PN-ACE-796
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UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

and

BECHTEL CONSULTING

PRESENT THE SECOND CENTREL ROUNDTABLE FORUM ON COMPETITIVE POWER MARKETS

BACKGROUND MATERIALS

RENAISSANCE PRAGUE HOTEL, CZECH REPUBLIC

JANUARY 20 ~ 22, 1998

Vol I
22934-010-003

Bechtel National, Inc

PN-ACE 796

RENEWABLE ENERGY SOURCES AND DIRECTIVE 96/92

1 INTRODUCTION

The promotion of renewable energies is a high priority for the EU, contributing to both energy and environmental goals, in particular the EU's target for CO_2 emission reductions At the present time the Commission is preparing a White Paper on Renewable Energies which will present a Strategy and Action Plan to substantially increase the use of renewables to the year 2010 The progressive introduction of renewable energy sources in the production of electricity in the EU is therefore a high priority

At least for the medium-term, it appears likely that electricity produced from renewable sources (excepting large scale hydro) may be more expensive to produce than electricity from competing fuels

Thus, the issue arises how to ensure the introduction and development of renewable technologies in the context of a single market for Electricity The ability of eligible customers to purchase throughout the EU raises two basic problems in this respect

The first concerns mechanisms introduced to ensure the purchase and financing of renewables, the second - a subsidiary question to the first one - the possibility for customers obliged to purchase a certain proportion of their electricity requirements from renewable sources to acquire these supplies from abroad

2 MECHANISMS TO ENSURE THE PURCHASE AND FINANCING OF RENEWABLES

The Directive provides only one explicit mechanism for the favorable treatment of electricity from renewable energy sources, Article 8(3)

"A Member State may require the system operator, when dispatching generating installations, to give priority to generating installations using renewable energy sources or waste or producing combined heat and power"

This provides an exception from the basic rule, established in Article 8(2), that in normal circumstances the "dispatching of generating installations and the use of interconnectors shall be determined on the basis of criteria (which) take into account the economic precedence of electricity from available generating installations "

This mechanism is, in fact, one followed by most Member States prior to liberalisation the transmission system operator (TSO) purchases renewable energy sourced electricity (usually at

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advantageous prices), and passes this on to its captive customers, spreading the cost of this over the total captive consumer base

It should be noted, however, that the Directive limits itself to favourable dispatching It does not cover schemes providing direct or indirect subsidies to renewable energy sources, and it does not *in se* permit Member States to authorise the TSO to oblige eligible customers to purchase "their" share of renewable energy - either directly, or via the imposition of levies or green certificates

In reality, therefore, the mechanism provided in the Directive appears to be of limited use - in the absence of accompanying measures not explicitly authorised by the Directive - in permitting Member States to develop or maintain a significant policy for promoting renewables

This is because of the following reason Electricity from renewable sources may cost more to produce than "conventional" (fossil/nuclear) sources Where renewables account for a significant proportion of total domestic electricity production, this may result in a significant increase in the overall average cost of producing electricity in a Member State, compared to a neighbouring country without a developed renewables policy, or an IPP producing from fossil fuels Specific measures should ensure that all consumers, eligible or not, participate in the financial support of such a renewable policy Otherwise, eligible customers, would, if free to do so, normally choose not to pay for this "renewables surplus", purchasing therefore abroad, or from IPPs As a consequence, the overall customer base at the TSO in question would reduce, meaning the additional cost of renewables per customer would increase, leading to higher domestic prices, thus prompting further, less price-elastic eligible customers, to seek supplies elsewhere In this way a "viscious circle" could develop, forcing increasing numbers of eligible customers out of the domestic system - not due to inefficient or uncompetitive "conventional" electricity production - but simply due to a significant pro-renewables policy

Evidently, the likelihood and/or extent of such an effect will depend on a number of factors, the additional cost of renewables, the percentage of renewables purchased over total purchases etc Nonetheless, this effect is an inbuilt consequence of the mechanism provided in the Directive

Member States have, therefore, been reflecting on how to deal with this issue, as can be seen from the annexes, giving a Member State by Member State analysis, the following different types of schemes Note, that certain of the elements figuring below are (or can be) used in combination with one another

The schemes - or elements of schemes - fall into two basic categories First, aid schemes - intended to pay for the cost of these schemes and second, schemes intended to finance the aid

1 Aid schemes

A large number of different aid schemes (often state aid) exist, including the following

- guaranteed purchase obligation at a guaranteed price - often on an avoided cost basis, or on the basis of a regulatory-based calculation as to the necessary suggested level required to generate the desired level of renewable electricity production ,

- tax exemptions, in particular from energy and CO2 taxes, but equally from non-energy taxes ,

- subsidy per kWh produced ,

- other subsidies , support for R&D, capital investment, etc These aids may be granted either at Member State, or Community level.

2 Schemes intended to finance as complement aid.

Again, a number of variations have been - or are in the process of being - developed

- Levy on all consumers of electricity within a given Member State, characterised as a "renewable", "green" or "non-fossil fuel" levy All consumers must pay, irrespective of whether they actually purchase the electricity in the Member State in question (but see below, imports and exports) The levy may be a fixed payment per kWh consumed, or a transparent separate fee added to the transmission tariff.

  The levy is fixed by the Member State in question or the regulator, and varies depending on the level of support the Member State in question feels is necessary to generate the requisite level of renewables production

- System of Green certificates

  In this system the Member State simply decides the level of renewable electricity that it desires to be produced (or consumed - see below, imports and exports) within its electricity system. It then simply requires all consumers to purchase x % of their electricity requirements from renewable sources Evidently, given the impossibility of separating "green" from "conventional" produced electrons, it is not possible for all consumers to actually be supplied x % of the electricity that really originates from renewable sources To overcome this, consumers are obliged to purchase "green certificates" representing the x % of their overall requirements Green certificates are issued by renewable producers, under the control of the appropriate Member State authorities

  In practice, therefore, renewable electricity producers sell their electricity to the TSO at normal market prices The additional cost of producing renewable electricity is covered by the price that all, final consumers, eligible and captive, pay for the green certificates Thus, a secondary market develops for green certificates, which will be priced at a function of the difference between the market price for electricity and the (average) cost of producing renewable electricity that is additional to that market price

- Compensation payments into a renewable fund

  Distributors are legally obliged to dispatch x % of their electricity requirements from renewable sources If they do not fulfil this obligations they, alternatively, have to make a

compensation payment into a renewable fund This fund is used selectively to grant investment support, e g through a tender for renewable based plants

- Obligation to purchase

  Consumers in a Member State may be obliged to actually purchase "their" share of the renewable electricity that the government decides should be acquired by the TSO They would be obliged to purchase this at a supra-market price, reflecting the additional cost of producing renewable electricity This item would be billed separately, such that the additional cost involved is transparent

- Other non-financial measures
  General possibility for the TSO to refuse access to eligible customers to the network for TPA/transit requirements in the event that it became difficult for it to pass the renewable sourced electricity that it has been obliged to purchase by the government on to consumers

3 ANALYSIS OF THESE DIFFERENT APPROACHES COMPATIBILITY OF COMMUNITY LAW

1 State aid.

The state aid issue is dealt with separately from the issue of compatibility with the Directive and the Treaty articles on which the Directive is based It is not proposed to discuss this issue in the context of this analysis However, it should be noted that very close collaboration takes places between the relevant services of the Commission (DG IV and DG XVII) to ensure a co-ordinated approach whenever possible

2. Competitivity of renewables

Already at this stage it may be stated that schemes which introduce competition between producers of renewables are likely to require less support, and are more likely to become fully competitive with "conventionally" produced electricity There are two methods that such competition might be introduced First a regulator or other body may periodically review the level of support, with the intention of existing downwards pressure reflecting technological advances Second, the system of green certificates by its very nature introduces competition for renewable electricity production The secondary market for green certificates will set the level for the price of renewables New, more efficient, lower cost producers will enter the market if they can produce below the "market price" for green certificates

Whilst it is of course too early to state which of these two mechanisms are most likely to produce the most rapid reduction in the cost of renewables, it does appear at this stage that if the system of green certificates works effectively in practice, it is likely to exercise a constant and important downwards effect on the price for renewables

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Furthermore, whilst again it is too early to state whether the introduction of a scheme with no mechanism to encourage efficiency and price reductions whatsoever would be compatible with the Directive, it appears reasonable at this stage to assume that the introduction of such a mechanism would be more likely to ensure compatibility with the relevant EU rules

3. Schemes intended to finance aid schemes.

The Directive, pursuant to Article 8(3), covers only priority dispatching at TSO level for renewables *In se* it covers none of the above schemes

In such circumstances recourse to two other provisions of the Directive becomes relevant Article 3(2) - public/environmental service obligations, and theoretically Article 24 (transitional regimes) It is on the basis of these provisions that compatibility of measures set out above will need to be examined.

In reality, however, it is suggested that almost all schemes adopted in this context will need to be examined in the light of the environmental service obligation provisions of Article 3(2) Article 24, transitional regimes, are temporary support schemes, which will cease to exist in the foreseeable future and seem therefore not suitable for renewables On the contrary, these renewable schemes are envisaged to be operational for the foreseeable future

When examining whether any of the abovementioned schemes are compatible with Article 3(2) of the Directive, it is necessary to take account of the principles laid down by the European Court of Justice in interpreting Article 90 of the EU Treaty, in combination with the free movement and competition provisions of the Treaty Whilst an exhaustive discussion of this jurisprudence is not within the scope of the present examination, it is clear that the following basic principles will guide the Commission's analysis of any environmental service obligation such as those considered above

First, the imposition of any such obligation will always lead to measures that will act contrary to the free movement and competition provisions of the Treaty As such, they will be examined carefully by the Commission and a strict interpretation and approach maintained

Second, the Commission will always commence its examination by asking whether the underlying objective pursued by the Member State in question is legitimate - i.e that it could permit derogation from the normal competition/free movement rules In this context it should be noted that environmental protection has been recognised by the Commission and Court of Justice as an objective that might permit derogation from the basic free market rules pursuant to Article 36[1] and an objective that may permit the exemption - pursuant to Article 85(3) - of an agreement restrictive of competition[2] Thus, in general, it is concluded that this first test will be met by such schemes

Third, the Commission will examine whether the measures in question are reasonable and proportionate in order to meet the objectives pursued by the Member States Obviously, each scheme must be examined on its own merits However, it is clear that one element that is fundamental in considering this question is the contemporaneous examination of comparable schemes all seeking the same objectives In determining the proportionality of one scheme it is

[1] Case 302/86 Commission V Denmark (1988) ECR
[2] See 2nd competition report I at paragraph 77

necessary to examine whether alternatives exist, which are less disruptive of competition and trade between Member States, which nonetheless equally meet the objectives in question

Evidently, this aspect of the analysis is of limited importance at present the various schemes are either in their infancy or are presently being conceived In the future, once they have entered into force, this will become increasingly relevant

4 IMPORTS AND EXPORTS

1 - Legal aspects

All of the above schemes raise the question of imports and exports of electricity produced from renewable sources Green certificates can, for example, be issued by renewable producers outside the territory in question Domestic companies with the obligation to pay a levy or which are submitted to a purchase obligation, could be exempted from this levy if they demonstrated that their imports were sourced from producers with at least the same minimum level of renewables as that required by domestic legislation Whilst certain administrative measures would need to be taken to prevent avoidance of the relevant renewable purchase obligation, it would be possible to permit renewable obligations to be made up through imports if desired

However, the decision whether or not to permit imports to fulfil this role is not simple The cost of producing renewable electricity varies according to the geographic area in question - this is particularly relevant regarding large hydro, the marginal cost of which is very low during summer months In such circumstances, at least with respect to certain countries, over time, an as yet undetermined proportion of the renewable electricity for which their citizens would be paying through higher prices would be sourced abroad The direct benefits of the renewable production would, however, accrue abroad (although the actual benefits of reduced CO_2 are wider than a limited geographic area) In any event, it is unclear whether the consequent CO_2 reduction would accrue to the paying country, or the producing country, when the question of meeting CO_2 reduction objectives are considered

On the other hand, the prohibition of imports in this respect would contravene the most basic provisions of the EU Treaty regarding free moment of goods Equally, in terms of overall EU energy policy, it makes considerable sense for renewable energy to be produced at its most cost-effective location within Europe

2 - Practical aspects

– Impact of levies on the transport of electricity

As mentioned above, if a levy is imposed it may be imposed either at the production level, the transmission level, or, most usually, at consumption level. Whilst the Commission has reached no final conclusion regarding the relative merits of these different approaches, it does appear that a number of significant advantages attach to the imposition of a levy at consumer level. Such a levy is directly related to the amount of electricity actually used, and is highly transparent If a levy would be imposed at transmission level, however, a number of difficulties would arise First, the payment would not relate directly to the amount of

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electricity consumed (the relationship between the distance electricity travels and the amount consumed not being a constant), and second, this would represent an inevitable handicap to Community trade in electricity This handicap would be increased where electricity is traded across borders, as two "transport levies" would be imposed The situation is still worse in case of transit
Furthermore, the different levels or methods of imposing a levy may also lead to trade distortions

- Import / Export of renewable based electricity

As mentioned above, the question of the import and export of renewable electricity raises a number of difficult legal issues Equally, in the event that imports of renewable produced electricity are viewed as the equivalent of domestic produced electricity for the purpose of meeting purchase obligations on paying levies, the question arises how can one Member State ensure that the electricity actually imported does really come from renewable sources?

Again, the existence of different methods of supporting renewables in different Member States could lead to trade distortions Assume example, that country X paid significant state aid to renewable producers, but country Y operated a system of green certificates If producers from X were permitted by country Y to issue and sell green certificates in Y, they may receive double support Producers in Y selling in X would, on the other hand, receive no support whatsoever

The Commission services have reached no conclusions on these issues at present

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Combined heat and Power

1 The economic and environmental benefits of CHP are widely documented and supported It is Community policy to promote the wide introduction of CHP, a policy recently confirmed in a Commission Communication[1] to promote CHP and to dismantle barriers to its development This policy is also followed in most Member States

2 This is reflected in Article 8 (3) of the Directive, which provides that

"A Member state may require the system operator, when dispatching generating installations, to give priority to generating installations using renewable energy sources or waste or producing combined heat and power

3 Where Member States have recourse to this provision, and support is limited to such mechanism, no issue as to the compatibility of any given support scheme with the Directive arises

4 However, for reasons explained in detail in the paper regarding renewables[2] in competitive markets support schemes limited to those covered by Article 8 (3) are unlikely to be sufficient to effectively support non - competitive methods of electricity generation

5 Annexed hereto is a paper detailing the Danish support system for CHP supplying heat to domestic consumers, and DG XVII's analysis as to its compatibility with the Directive The essential conclusion is that

[1] COM (97) 514

[2] A summary of these reasons is as follows if a TSO gives priority to non-competitive energy sources it has to pay a premium compared to the situation where it would simply purchase the cheapest electricity It must pass these costs onto its customers. Where the customers are captive this is no problem, but once liberalized, the eligible customers will go elsewhere purchasing from electricity producers not burdened by the obligation to source from "non-competitive" producers and in particular IPP S Thus in such circumstances, measures may be necessary in addition to those envisaged by 8 3 to provide effective support.

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a in most circumstances the production of electricity by CHP plants must and will be competitive,

b however, with respect to electricity produced by CHP plants supplying heat to domestic consumers, Member States may decide to set up some support mechanism, a form of "safety net" This is because, in the event that the electricity produced as a co-product of heat generated for sale to domestic consumers would not be competitive (and could thus not be sold without loss), the CHP plant would quickly become unviable and, without support, would be forced to close It being unacceptable for heat supplies to domestic consumers to be cut, such a closure is equally unacceptable Thus the need for some form of "safety net"

c The result, however, of any such "safety net" is to *de facto* close the national market in question to imports (for the amount of electricity, produced as a co-product of heat generation see annex for detailed reasoning in this respect)

d With respect to CHP supplies to <u>domestic consumers</u>, DG XVII considers that a support mechanism, in the form of a "safety net" mechanism, can be viewed as acceptable, providing that it is set up in the manner least likely to distort competition and trade between Member States whilst achieving the objectives in question

6 Regarding industrial CHP, the situation is rather different

<u>First</u>, the major investments in heat infrastructure necessary to set up a domestic network is not required for industrial CHP Thus, the investments that might limit the competitiveness of electricity produced from municipal CHP are not applicable with respect to industrial CHP

<u>Second</u>, industrial CHP is usually installed because it is economically attractive - i.e competitive

In these circumstances, DG XVII sees less justification for support mechanisms going beyond Article 8(3) with respect to industrial CHP In particular, DG XVII doubts it will be necessary for a Member State to resort to actual or even potential refusal of network access to stimulate industrial CHP as mentioned above, such installations should be highly competitive and in these circumstances the priority dispatch mechanism of Article 8(3) should be adequate or even unnecessary

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7 This does not mean that DG XVII excludes the possibility of any form of support for industrial CHP Member State may legitimately wish to provide certain incentives to stimulate the wide introduction of industrial CHP, through direct or indirect state aid schemes, such as can be found in Finland (aid to investment and tax rebates)

8 Such support measures must be examined under the Community's State aid provisions, on a case - by - case basis They must also be examined , depending on the nature of scheme, pursuant to the Directive, either Article 3(2) or Article 24

9 In conclusion therefore, with respect to support schemes for industrial CHP, DG XVII notes that each case must be examined on its own merits support, if necessary, should be limited to that least necessary to achieve the objectives in question, and be applied in the manner least reasonably likely to distort competition and trade in the EU

"Towards competitive markets for energy in Europe"

Christopher Jones
Head, Internal market and energy liberalisation
Directorate-General for energy
European Commission

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Introduction

1 Remember when Directive adopted - great critical acclaim. Unfortunately, by and large, all the acclaim was critical.

- Not go far enough

- MS will sidestep Find backdoors

- I mean, look at single buyer
  Terms single buyer + competitive market oxymoron

- It will fail to deliver lower prices, or only benefit large consumers, indeed prices to citizens go up to pay for industrial price cuts

2 But something strange has happened One doesn't hear this so much, or at least with less conviction, even by the most doubting Thomas

In fact, reverse is true
when visit Ministries, electricity companies, regulators, you even have the faintest, most tentative whispers
- it might even exceed our initial expectations
- that the Directive, far more than a de-minimis market opening piece of legislation - catalyst for more fundamental change
- that process of liberalisation like rolling a ball off a hill - not a question of whether you reach the bottom, but how long it will take, and how bumby will be the ride

3 In many respects, these comments are true

4 There has been a sea change since adoption of Directive

- Most aware of Follows-up Group (explain)
  In addition, large series of bilateral contacts each ms, to ensure full and effective implementation
- now reaching its critical phase (deadline 2/99)
- MS and Commission remarked clear determination of all MS to make objectives of Directive a reality
- This is reflected by
  - the structure being adopted (generally competitive in nature)
  - level of liberalisation chosen - clear majority exceeding minimum 24 %

Thus, take this opportunity to look at these issue, + dispel
- some of the myths that have arisen regarding the Dir
- at least some which developed during its negotiation, and are only dispersing slowly

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MYTH N° 1 The Directive only requires a -± market opening of 22 - 24%
Thus, why bother

POINT 1 Directive only an initial step
- one year after entry into force 28 %
- 3 years later (2003) 33%
- Review clause (2005)
- All liberalisation exercises went this way
- Telecoms terminal equipment Dir 1988 - Decade
- UK electricity began 1990 27%
  1994 42 %
- Such a running- in period normal and necessary
- Permit monopoles to adapt to competitive market
- to permit structural change (alliances, mergers, de-mergers)
- to determine exactly what is necessary at EU level
  - what %
  - accompanying measures

POINT 2 Majority of M S already commented to going further

1 In 10 M S more-or-less clear the initial market opening for exceed 22-24 % minimum
-Finland
-Norway
-Sweden
-UK
-100 %

On basis of these 10, and under most pessimistic scenario (other 5 limit to 22-24 %), 60% of EU electricity market will be open to competition by 2000

2 Also not Production already 100% liberalised authorisation or tendering
This, in many respects, lead to largest savings, but in medium-long term.

3 In any event, 33% market opening of 2003 will lead to all large/medium size EU industry open to global competition energy liberalised
Not to say EU not interested in citizens - on the contrary - but a question for later

MYTH N° 2

In a competitive market, public service will be eliminated The large companies will benefit, the weak and small will suffer

1 There is nothing incompatible between public service obligations and a competitive market

2 Directive specifically provides for protection of public service obligations, Article 3

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M S way adopt whatever measures necessary to achieve the following objectives

- security, including security of supply
- regularity
- quality and price of supplies
- environmental protection

If necessary to achieve these objectives, MS may even take measures limiting the scope of the market opening provisions of the Dir

3 And this is not just a theoretical possibility, it can, and does, work in practice

Nothing, for example, prevents a M S from obliging all electricity companies operating on its territory, or in any given region, from charging the same tariff to all citizens, or an obligation to connect everyone who so desires

4 Sweden, for example, is likely to impose just such an obligation of this type

5 Indeed during the follow-up group meetings, a non-issue

MYTH N° 3

MS will therefore use public service obligations to sidestep the market opening provisions

1 Not possible, Article 3 not a "carte blanche"

- list of public service obligations exhaustive
  - security, including security of supplies
  - regularity
  - quality and price
  - environment

- obligations, where used, "clearly defined, transparent, non-discriminatory and verifiable, notified to Commission and published"

- subject to the control of the Commission, pursuant to article 90 + competition + free movement rules

- In other words
  - actions in question must be strictly necessary to achieve objectives in question
  - in deciding on this, always take the least restrictive measures reasonably necessary to achieve objectives
  - always examine approach in other Member States in this respect
  - refusal of access a last resort

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- Commission will be most vigilant in applying this test
    - in reality, to-date, unnecessary
    - MS taking this restrictive approach anyway (positive attitude)
    - use of follow-up group to discuss + cross fertilise experience

MYTH 4

Network access not work.

- no obligation to legally unbundle transmission from other activities,
- even with accounting separation, in-built tendency to cross-subsidise

1 No secret that original Commission proposal - legal separation

2 Majority MS not agree to this - Dir Accounting unbunding + vertically integrated company magement unbunding

3 But, actually, appears highly likely that a majority of MS in any event will legally unbundle

4 Futhermore, further tendency, where not legally unbundling, MS appear to be moving to regulated TPA rather than negotiated TPA Inherently more easily supervised - prices to subsidiary companies same as to competitors

5 Finally, Commission + M S determined to ensure strict control on basis of accounting separation
- independent regulators (from Elec Company not Government)

6 Remains perhaps most difficult

MYTH N° 5 Environmental protection

- not possible in a liberalised market
- eligible customers will (almost) always choose the cheapest, irrespective of pollution

1 Not true

Article 8 (2) MS may require TSO to give priority dispatch to renewable/CHP produced electricity

May not be enough not answer the question who pays?

2 M S may therefore decide to go further, imposing environmental service obligations, which would then be subject to examination under Article 3 of the Directive

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3 Such schemes might include

- state aid (German Energy feed law wind power)
- levies and green certificates obliging consumers to pay
- even, if necessary, and as final solution, refusal of access to network if no other way to sell renewable

4 Again not carte blanche

- again, commission control
- least restrictive scheme necesary to achieve objective
- experience elsewhere
- not mean all have identical schemes, markets different

5 Such schemes are

- inevitable
- necessary
- laudable

if our kyoto Co2 reduction proposals are to be taken seriously

6 Example green certificates

require all consumers to purchase x% renewables
5 %

- but cannot purchase green electrons

- thus oblige customers to purchase green certificates equivalent to x % consumption (citizens certificates by distribution Co)

- certificates issued by renewable producer, under strict regl control

- renewables paid at market price (pool), but priority dispatch

- Difference between market price + cost of producing renewables, made up by sale of certificate

- can give state aid to developing photo etc

- Thus, type of secondary market for renewables develops, competition without heavy regulation

- not necessarily prevent trade Non- MS producer can receive authorization to sell green certificates, providing electricity actually delivered to NL, + produced + sold

- compatible with Dir whilst promoting efficient use of renewables, and minimising competition/trade distortions

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Conclusions at this stage of implementation

1 Feb 1992 Deadline

2 Highly promising

- all MS will make deadline

- higher than expected liberalisation Directive being overtaken by events

- limited "opt-out" - least restrictive approach, not prevent competition development

- we do not know where 2005 revision will take us, but at present, every reason to be optimistic

GAS

1 Expect common position in october

2 Dir will differ in many respects from Elec Dir
- not production (hydrocarbons licensing Dir)

4 Many respects similar

1) gradual market opening

- final decision on thresholds for ministers

- clear will be significant, covering at least all those industrial purchases substitued to global competition

- will be in a band quantitative figure (xm3) leads to vastly different openings

- 25 - 35 %

5 Not time for exhaustive discussion, focus on most important outstanding issues

6 Take - or - Pay

1 Such contracts entered into traditionaly to
- secure supplies from producers geographically distant, political unknown
- pay for infrastructure investment

2 In some cases are and will remain necessary overly simple to see issue from producer country perspective, not from dependent one

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3 Where such top contracts exist, liberalisation produces danger If prices drop radically, then companies cannot sell, must take, must pay

4 Thus, some protection necessary and justified

5 Will be true for the past and future

6 Whilst diminishing tendency
- in context of competitive market, risk assessment different, will remain

7 But not a carte blanche

8 Commission only too well aware that incumbent monopolist way sign T-O-P not for legitimate security/business reasons, but also, at least partly, to close off the market

9 Thus, key, effective control over any refusal of access on grounds of T-O-P

10 Thus, Commission's view that, whatever procedure for examining such situations, the Commission must have the final word on any access refusal due to the existence of T-O-P contracts

11 Particularly for future T-O-P, this control must be effective and strict cases will arise where ex-monopolist attempts to close market via TOP

12 No doubt that final Dir will provide for such control, and that it will be effective

13 Many will doubt political ability of the Commission to effectively exercise such conrol. Believe it can - see merger regulation

7 OTHER MAIN ISSUES

- emergent regions

- areas of EU where no infrastructure
- where a company (not neccessary incumbent monopolitst) develops network, normal that it has a period of exclusivity
- Principle agreed Definition of emergent region to be finalised

- Off-shore pipelines

Both technical issues, and will be resolved

1) If energy liberalisation is like a ball rolling down a hill

- the ball has surely been pushed
- it is surely rolling
- and it is rolling faster than anyone expected

2) Whether it willget to the bottom of the hill
- or how long it will take,
- or whether it even needs to reach the end of the vallery

3) We shall all, just have to, wait and see

Speech by Mr Christos Papoutsis
Member of the European Commission
with responsibility for
Energy, Enterprise Policy and Tourism

"Milestones on the way to Energy Liberalisation
A Commitment to Europe's citizens"

At the Conference

"Energy and Gas Liberalisation:
A win-win position for Europe"

Brussels, 9 October 1997

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Ladies and gentlemen,

The liberalisation of the energy markets is not a goal in itself. It is, however, a very important tool, contributing to the development of the European economy towards its goals of efficiency and competitiveness

Today, the most important problem facing Europe is unemployment This is of concern to us all. 18 million European citizens, or about 11% of the work force, is now out of work This is not acceptable All governments, and the Community institutions, must concentrate their efforts to reverse this trend

The Single Market has contributed to growth, competitiveness and employment It has been responsible for an increase in EU income of between 1 1% and 1 5%, and for the creation of between 300 000 and 900 000 jobs But its full potential has not yet been realised Barriers still remain Europe needs a better Single Market for more growth, more innovation and more jobs

The Action Plan for the Single Market, which was adopted by the Commission this spring, and endorsed by the European Council in Amsterdam, points out a number of targets and actions to be taken One target is to remove the remaining sectoral obstacles to market integration, and the realisation of the internal market for electricity and natural gas These objectives are viewed by the Commission as amongst the most important steps in order to develop a true Single Market

Comparisons of the price of European electricity with our main competitors show the present disadvantage Electricity bought in Germany is approximately 25% more expensive than in the United States In Australia the price of electricity is less than half of the price in Germany

Today, most companies are exposed to international competition The rapid changes in information and process technology imply for many industries that they have to compete in an ever-expanding global market place Reasonable and affordable energy

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prices are therefore very important The competitiveness of the European industry needs to be improved, and one important tool is to liberalise the energy markets This will strengthen the competitiveness of the energy consuming industries, as it will force the energy producing industries to be as efficient and competitive as possible

Industry is, however, not the only one to gain Even if the efficiency gain is mainly transferred into lower industry energy prices, small consumers will gain Better energy prices for industry imply better prices of final goods

Due to the improved competitiveness of its industry, Europe can expect that new jobs will be created, and existing jobs will be retained, the incentive to move production to third countries diminishes Such job creation increases consumer income and restores confidence to the European economy

I understand that Professor Schulz, from the University of Cologne, will present later today the results of a study on the impact of increased competition for electricity and gas on energy prices and on consumers' disposable income

Improved competitiveness is not the only consequence of the opening of the energy markets The security of supply will also increase In the case of electricity, the individual Member State will be less dependent on its own generation capacity, because it can, to a much greater degree than at present, rely on other Member States Supply shortages and price changes on specific fuels will therefore be less dramatic, due to the increased inter-connections between the systems

We are now closer than ever to liberalised energy markets The Electricity Directive was adopted by the Council of Ministers last December and the Member States are now busy transposing the Directive into national legislation They have two years to do this, with the exception of Belgium and Ireland, which have three years, and Greece which has four years

The negotiations on the gas directive are at present very intense and I hope and expect that we will reach a conclusion in the very near future But as you probably all know, this is the result of a long process The Commission anticipated this, and therefore suggested a step-by-step approach to progressive completion of the internal energy market

Let me point out some of the milestones in this process The first milestones were in 1990 and 1991, when the energy ministers adopted two Directives on electricity and gas transit, and another Directive on price transparency for gas and electricity prices

A further step was taken during 1994 when the ministers adopted a Directive which liberalised the market for the exploration and production of hydrocarbons This, together with the Directives on public procurement in the excluded sectors, brought the upstream part of the natural gas market within the scope of the internal market

The negotiations on the internal market for electricity and gas started back in 1992 when the Commission presented its proposals These proposals introduced the concept of mandatory third party access to energy networks This would enable consumers and producers to enter into direct contractual relationships with each other throughout the European Union

In 1993, the proposals were amended after receiving many modifications from the European Parliament, which was concerned about the mandatory nature of the third party access The Commission therefore re-centered its proposal, permitting equally a system of negotiated Third Party Access It was decided to postpone the discussion on gas until agreement had been reached on electricity

The negotiations on the amended proposal started in January 1994 It took nearly three years before the Directive was finally adopted by the Council of Ministers on 19 December 1996 The result reflects a broad degree of consensus and compromise between the Member States and the institutions of the European Union

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The Directive sets out the basic principles for an internal market, which the Member States will have to include, and follow in their national systems But the Directive does not create one uniform system throughout Europe It provides subsidiarity and flexibility for Member States, when applying these rules to their particular national situation This is clearly reflected in the number of options and models Member States can choose

The environmental dimension has also been strengthened The Directive gives Member States the possibility of requiring the operator of the transmission system to give priority to electricity from renewable energy sources, and from combined heat and power generation We hope they will indeed give this priority

Our policy is to support renewables and the use of combined heat and power If the right accompanying measures are taken, a more open electricity market will provide more opportunity for renewables It will also be possible to impose public service obligations related directly to the protection of the environment

I am certain that all these possibilities will be used But we have to insist that this is done in a transparent and non-discriminatory way, so as not to frustrate the market opening objectives of the Directive

Public service obligations must not be used as an excuse for closing the market to foreign-produced electricity On the other hand, the Directive should not be the reason to undermine the growth of promising, environmentally friendly energy services, such as renewables

Member States have flexibility in applying the Directive but they must respect the degree of gradual market opening, based on a minimum percentage for the whole European Union On 19 February 1999, approximately 22% of the market will be liberalised This market opening will progressively increase to 33% in 2003 This degree of market opening is a minimum level, but Member States are, of course, allowed to go further on a national basis if they so wish

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I will not go into detail with the transposition of the Directive, as Mr Jones will give a presentation on the state of play right after my speech I will, however, add that the feedback we get from Member States is very encouraging I am confident that in many Member States we will see that more than 22% of the electricity market is liberalised in February 1999

Let me now turn to the negotiations on the gas proposal. We are,at the moment, at an advanced phase As a result of the experience from the electricity Directive, discussions have proceeded more rapidly Important progress has been made since negotiations resumed about a year ago

In July this year, the Luxembourg Presidency tabled a new compromise proposal which has been the subject of intense and constructive negotiations over the last month

The European gas sector is characterised by a large degree of diversity - more than in the case of electricity This will of course have to be respected when opening the gas markets I am confident, however, that the proposed gradual but significant market opening can be achieved to the benefit of all.

Sufficient protection of take-or-pay contracts is built into the proposed gas Directive The proposed Directive will satisfy security of supply, and protect against possible serious economic problems of gas companies, when opening the market

However, strict criteria will be applied by Member States and the Commission, in order to ensure that take-or-pay contracts are not being used as an unjustified reason for refusing third party access

As you all know, the Presidency has called an extraordinary meeting of the Energy Ministers on 27 October in Luxembourg, with a view to solving the outstanding issues, and arriving at a common position

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There are still differences of view on some points, but there is also a strong will to reach a compromise agreement Based on the recent progress made, and the will to come to an agreement, I am very optimistic about the outlook for a breakthrough in Luxembourg

The agreement on a common position by the Council does not, however, constitute the final adoption of the Directive The European Parliament will have another reading on the proposal. Only after this, assuming that the Council and the Parliament are in agreement with each other, the Directive can be finally and fully adopted It could then come into force in 1998

The electricity Directive already adopted by the Council of Ministers and, hopefully, an agreement on the gas proposal in the near future do not, however, imply that we can sit back, self-satisfied, with the feeling that we have reached our ultimate goal. The markets are still only partly liberalised It is possible and perhaps even necessary to go further The experience from Norway, New Zealand and the United Kingdom points in this direction

The electricity Directive contains a review clause, which requires the Commission to re-consider the application of the Directive in the light of the experience gained To consider new proposals for further market opening The gas Directive will probably contain a similar review clause The experience from Member States and other countries, who are planning a more thorough liberalisation, will be very valuable in this context

Ladies and Gentlemen,

I would like to re-emphasize that a more open market within the Union, for energy as well as for other products and services, should be seen as an important tool for improving competitiveness, employment and quality of services Our commitment is not to the concept of liberalisation for its own sake, but to the improvement of the quality of life of Europe's citizens

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I would like to wish you all an interesting and instructive conference Thank you for your attention

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Paper presented at NARUC annual meetings
Boston MA Nov 11 1997 The views expressed
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University

MARKET CONCENTRATION AND THE SUSTAINABILITY OF MARKET POWER IN PUBLIC UTILITY INDUSTRIES

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INTRODUCTION

Two fundamental questions must be addressed in any program that places major emphasis on marketization and deregulation of electricity, gas, and telecommunications first, will workable competition emerge with deregulation, and second, will interim regulatory policies facilitate the transition to competition and assure attainment of public policy goals? This presentation will address question (1) and the first part of question (2)

WILL COMPETITION EMERGE?

At the outset an acceptable definition of what constitutes competition in a deregulated environment must be established At least three approaches should be considered The first is the industrial organization-structural approach This is premised on the belief that market concentration, or market share, promotes market power Market power, in turn, permits the firm to earn high profits and support both profits and prices above competitive levels A major issue for public policy involves dealing with concentration and barriers to entry

A second approach involves the so-called "new learning", as proposed by the Chicago School and public choice theorists The deregulated firm, if efficient, will earn

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high profits This will encourage new entry and the incumbent's market share will soon be eroded Furthermore, the firm will not be able to sustain a unilateral price increase This becomes a major test of market power rather than concentration Absolutely no government intervention is warranted or condoned

A third approach involves a type of competition described by Joseph Schumpeter and the neo-Schumpeterian historians Technological advance is the principal source of growth, and change is associated with large firms aggressively innovating to capture markets The process of change is turbulent as new firms continually challenge incumbents Market share is largely meaningless and any market power that exists will be eroded over time There are examples of Schumpeterian change in telecommunications For example, the conflict between promoters of the Asymmetric Digital Subscriber Line (ADSL) (regional Bell operating companies, France Telecom, Deutsche Telekom, and Northern Telecom) on the one hand, and the promoters of cable (cable companies and Microsoft) on the other, would appear to represent Schumpeter's creative destruction -- especially if one system eventually triumphs over the other Other examples might include confrontations between wireless and wireline networks, or the rivalry between the Internet and established telcos There are significant deficiencies in the Schumpeterian approach because it dismisses the strategies by which firms seek to achieve dominance, foreclose entry, and shift costs and risks between customer classes as part of the process of exploiting new technology

We will adopt the industrial organization-structural approach in the discussion that follows A generally accepted definition of competition holds that no firm has more than 40% of the market, that there are 5-6 comparably sized firms, that no overt collusion exists, that market demand is highly elastic, that substitutes are available, and that barriers to entry are

minimal Conversely, market dominance exists when one firm has 40-100% of the market and barriers to entry are high Tight oligopoly exists when the four leading firms combined, have 60-100% of the market and barriers to entry persist Despite the fact that there are supposedly 450 firms in the interexchange market 100 potential entrants into the California electricity market and 30 potential entrants in the Philadelphia electric market it is still clear that major public utilities can be characterized as dominant firms or as tight oligopolies Even the domestic long distance market, 20 years after open access was given to MCI in the Execunet decisions, still finds AT&T with 60% of the market, MCI with 20%, Sprint with 10%, and WorldCom with 7% Of course, it can be argued that open access conditions have not been fully satisfied, and that concentration measures at this point exaggerate the incumbent's market power But it is more relevant to look at the major structural and behavioral determinants that will both promote and reinforce market concentration over time

STRUCTURAL AND BEHAVIORAL DETERMINANTS PROMOTING CONCENTRATION

There are three major structural determinants that promote concentration These include (1) inherent network economies, (2) network coordination, and (3) monopoly focal points The network economies include joint production, scope and scale economies, pool reserves, software enhanced functionality, and the low incremental cost of adding services Coordination involves matching a capital-intensive supply network with a demand network of customers having diverse patterns of usage so that effective coordination results in high load, diversity, and capacity factors The monopoly focal points involve access to the EHV grid, local loop, local switching, and local distribution network

There are other structural features that may or may not promote concentration or serve as barriers to entry These include substantial sunk costs that limit potential entry, a highly leveraged capital structure, potential excess capacity, and the long gestation period required to achieve going-concern status These factors may change over time For example, a comparison of the relatively long gestation period for MCI as compared to that of WorldCom strongly suggests that the length of time needed to achieve going concern status has diminished significantly, yet the industry still fits the definition of tight oligopoly

Behavioral determinants refer to the strategies of firms as management moves to adapt to a more deregulated environment A new management philosophy appears to have emerged which is driven by a recognition of oligopolistic interdependence and a set of values derived from behavior in the computer industry, and an implicit belief in increasing returns to scale As a result, management places a premium on closely following the actions of rivals, selecting the right market to target, striking early and hard, achieving the requisite size of enterprise to be a successful player, and capturing profits or facing a slow demise The new generation of utility management will employ pricing, marketing, and investment strategies to achieve these goals

Pricing in a deregulated environment will be employed to retain or achieve market dominance and promote industry stability Low limit-entry pricing, as in the case of special contracts for large electric customers, will be used to foreclose entry and retain preferred customers High access pricing will be used to foreclose rivals or make the cost of market entry prohibitively high This is shown in high access charges for entry into the local exchange, and a 74-81% average increase in transmission rates imposed by 18 major electric utilities, after FERC Order 888, on those transporting power for resale As a consequence of

such strategies market concentration will remain high and pervasive competition will evolve slowly if at all

At the same time pricing designed to recognize oligopolistic interdependence is clearly in evidence in patterns of price leadership and conscious parallelism in interstate and intrastate long distance rates Such pricing behavior is reinforced by the need to maintain acceptable levels of profitability, a fear of retaliation, information about the actions of rivals, and the possibility of umbrella pricing by a dominant firm Price leadership may be eroded by cheating, secret dealing, and the oligopsony power of large buyers This type of pricing could eventually be expected to prevail in sales to tariffed retail markets in electricity and gas, while direct sales to large buyers would be determined by relative bargaining power

With respect to marketing and investment strategies under tight oligopoly, three patterns appear to emerge

The first is the preemptive strike Examples of preemptive strikes include the entry of U S electric utilities into regional power distribution in the U K , U S utilities moving to establish a major position in response to privatization in both industrialized and developing nations, and the jockeying of WorldCom and GTE for the acquisition of MCI to establish a dominant role in an integrated local, long distance, and Internet market Preemptive strikes appear to be most successful when they draw heavily on the utility network Conglomerate diversification appears to be far less successful As examples of the latter, one could cite regional Bell holding company (RBHC) entry into real estate, telco entry into cable on the assumption of some type of synergistic convergence, and AT&T's entry into retail computer sales and the acquisition of NCR

Emulative behavior occurs when one oligopolist feels compelled to follow the pattern of

another in order to avoid being left out Examples include the entry of electrics into deregulated generation, and the entry bv Sprint TCI, Comcast, and Cox into wireless service following AT&T's acquisition of McCaw Cellular Sprint s effort was also followed by PCS Primeco (reflecting the joint effort by Bell Atlantic US West, and Air Touch)

Collaborative behavior has probably drawn the most attention in recent years It may take the form of alliances, joint ventures, acquisitions, or mergers The goal is to minimize the risk of new technology, to share the risk of new markets, to dominate or preempt new networks, to exclude entry through standards or other barriers, to facilitate provision of rebundled retail services through one-stop shopping, and to foreclose rivalry among incumbents While alliances have figured significantly in collaborative behavior, they are not all equally successful The strongest alliances appear to match two dominant firms in the provision of a new service with a clear understanding that neither will invade the other's basic service markets The best example is France Telecom/German Telekom's "Atlas", which is a value-added set of services for large corporate customers within France and Germany, and across Europe Both carriers currently control 100% of their national voice and data network offerings -- although open entry will come in 1998 The weakest alliances appear to be associated with rapid change, an uncertain sharing of benefits, and ease of entry or departure AT&T's World Partners is an example -- Telecom Italia joined World Partners, but Spanish Telefonica dropped out to join the BT-MCI Concert alliance Yet World Partners still includes, besides AT&T and Italy, Netherlands, Sweden, Switzerland, Singapore, and KDD as equity partners As non-equity partners it includes PTTS in Korea, Thailand, Taiwan, Indonesia, Malaysia, the Phillippines, Hong Kong, and Telecom NZ The introduction of alliances appears to have moved global communications toward a triopoly (FT/DT/Sprint, BT/MCI, and

AT&T World Partners)

Acquisitions and mergers may be vertical (e g , Chevron and NGC), or they may cross industry lines (e g , Duke Power s acquisition of Panhandle Pipeline) Finally, the sequence of strategies is by no means clear or readily defined For example, World Com seeks to preempt BT's offer for 80% of MCI, but it enthusiastically welcomes a collaborative effort with BT's Concert in global markets

EFFECTS OF TIGHT OLIGOPOLY

There are at least eight adverse effects associated with tight oligopoly The first is the emergence of collaborative behavior which increases overall industry concentration and, in turn, tends to reinforce oligopoly behavior on the part of the individual firm Second, prices will not track costs (as they should under competition), instead, prices will tend to reflect corporate strategies and the bargaining power of individual players Third, profit levels will be higher than those that would prevail under competition There will also be a tendency for aggregate profits to be maximized whenever possible through collaborative behavior Fourth, network technology and design will be driven by the demands of the largest users Fifth, asymmetric deregulation will provide an incentive to fragment the network by transferring assets to nonregulated activities thereby capturing economic rents inherent in these assets Sixth, there will be an inducement to disinvest in the network whenever alternative profits appear to be higher This situation could arise when profits anticipated from privatization fail to measure foreign risk accurately Any network disinvestment could result in both a denigration of infrastructure and quality of service Seventh, oligopoly pricing can lead to price rigidity for tariffed services when cost of service falls so that consumers of these services would be burdened -- especially if demand is perceived to be inelastic or if there is a recession

Eighth the gains from network economies will not necessarily be distributed to those classes of customers who served to bring them about That is each class of customer will not participate in network benefits in proportion to its contribution to the success of the network

The broader consequence of oligopoly will be to adversely affect the infrastructure as a platform for supporting productivity growth throughout the economy Any decline in productivity, in turn, will ultimately culminate in a decline in real income However, it must be noted that oligopoly may have some consequences that could be viewed more favorably These include a greater responsiveness to demand (especially of oligopsony buyers), a stronger incentive to promote X efficiency, and a willingness to look beyond the confines of the firm for solutions Under oligopoly, the self-contained role of the old AT&T would not be sustainable

THE ADEQUACY OF INTERIM REGULATORY POLICIES

The move toward marketization and deregulation has been accompanied by the acceptance of "light" regulation as a transitional safeguard There are two essential features of light regulation The first is price cap regulation and the second is a market structure policy designed to facilitate competitive entry and greater initiative on the part of carriers and utilities

Price cap regulation suffers from a number of serious deficiencies First, PCR cannot come to grips with oligopoly pricing strategies An indexed ceiling price is an admittedly feeble constraint on cross subsidization and price discrimination, but more importantly, it is largely ineffectual in constraining limit entry pricing, price leadership, tie-in sales, umbrella pricing, predation, and vertical price squeeze tactics

Second, price cap regulation severs the traditional relationship between profits and

prices that prevailed under rate base/rate-of-return regulation The old relationship between profits as a return on net rate base and prices tied to cost of service is gone Under tight oligopoly, however, profits are a measure of the reasonableness of prices over time but the interrelationship between market concentration price, and profits cannot be determined through PCR

Third, any attempt to recapture oligopoly profits once PCR has been put in place will be subject to the recontracting argument This states that recapturing, whether through an excess profits tax or an arbitrary increase in the X factor will be viewed as a clear disincentive for efficiency This conveniently overlooks the fact that any system of incentive allowances can also become a means for camouflaging oligopoly profits

Finally, PCR will still be subject to all of the well-known problems of measurement, the disincentive to experiment with lower prices in inelastic markets, and the cumulative effects of compounding which aggravate the spread between ceiling prices and actual costs

Market structure policy under light regulation focuses on open access, interconnection, and the provision of incentives for competitive entry Merger policy appears to be tied to such entry rather than to the control of concentration At the public policy level, the centerpiece for open entry has been the EPAct of 1992 and the Telecom Act of 1996

The argument for the new structure policy was succinctly made by Reed Hundt on September 4, 1996, in a speech before the Royal Institute of International Affairs in London Hundt argued that with minimum-procompetitive rules (mandatory interconnection, unbundled elements available to resellers, and the auctioning of the spectrum) there would be no need to fix retail prices -- telecommunications would become comparable to "soap, shoes or software " The FCC issued its Order on Access Charges on August 8, 1996 It is interesting to speculate

why open access has proceeded at such a slow pace In part, this may be due to the RBHCs' appeal of FCC pricing rules for local competition to the Eighth Circuit Court of Appeals, but it may also reflect the deeper failure of bilateral negotiations to produce interconnection arrangements that are acceptable to all parties The government of New Zealand placed great faith in a "rule of reciprocity", which argued that all parties to an interconnection agreement would benefit by not imposing restrictions on inter-network traffic Yet, eight years later, full interconnection between New Zealand Telecom (the incumbent) and Clear Communications has not come to pass This may be attributable to Clear's unwillingness to pay an access fee based on the efficient component pricing rule, but a better explanation is that New Zealand Telecom fears that interconnection represents a loss of market share and a threat to its dominance In the U S , a different situation exists Both the Bells, on the one hand, and the IXCs (AT&T, MCI, Sprint, and WorldCom) on the other, have comparative strengths, and full interconnection could result in either side losing a significant market share before it has an opportunity to establish a major position by exploiting pricing, alliance, joint venture, and merger strategies designed to promote a position of potential dominance The goal of such a position would be to create a consolidated entity that is best suited to provide bundled telecommunications services and one-stop shopping This playing out of strategies underlies the negotiations between GTE, WorldCom, BT, and MCI, as well as AT&T, and potential merger talks with RBHCs and other major entities In short, the interconnection impasse is little more than one facet of the struggle to achieve dominance Interestingly, the long delay in implementing the 1996 Telecom Act must have prompted Reed Hundt to observe, "We can hope for competition all we want, but that doesn't mean it's going to happen " (*New York Times*, December 23, 1996)

FERC's open access policy has been implemented through conditioning mergers (such as Utah P&L and Pacific Corp), issuing comparability orders, and most recently in Orders 888 and 889 (1996) The latter addresses matters such as functional separation and unbundling, pool participation and suggested guidelines for ISO organization However, it is too early to determine what problems will be encountered Little work has been done on the economic costs of access associated with a power exchange and a host of related pricing issues Equally important is the strong financial incentive created for RTG members to cartelize the network -- especially when generating capacity exceeds available transmission capacity

Paralleling access pricing is the question of appropriate merger criteria as oligopoly forms maneuver to establish significant market positions With respect to the antitrust laws, W G Shepherd observes that "tight oligopoly has scarcely been touched "[1/] The FCC has declared AT&T to be a nondominant carrier and has approved the mergers of Bell Atlantic and NYNEX as well as SBC and Pacific Telesis What criteria will be used in the future remains to be seen European criteria for alliance and merger approval appears to be less than stringent For example, the European Commission has approved the BT/MCI and the France Telecom/Deutsche Telekom/Sprint alliances, but it did take a stand against a vertical joint venture composed of German Telekom and program producers aimed at providing digital pay TV Similarly, the U K has prohibited vertical integration by its power generators into the retail distribution of electricity

As part of its merger guidelines, FERC has required that applicants utilize an analytic screen based upon the Herfindahl-Hirschman Index to measure concentration When the HHI is high, it permits the applicants to qualify submissions by showing that access restrictions are removed, ISO's will be created, or provisions will be added to protect customers against price

increases FERC endorses functional separation of networks and deregulated services, but it does not require full structural separation or holding company divestiture Furthermore, FERC does not require an analysis to show that the same network benefits could be achieved without mergers It does not require transparent regulation of RTGs, and it limits concentration measures to the same product in the same market, thereby dismissing aggregate concentration Finally, the agency does not require the Landis Posner Index, which is a much preferred measure of market power

A PROPOSAL TO NEGATE OLIGOPOLY, MAXIMIZE CUSTOMER OPTIONS, AND STRENGTHEN INFRASTRUCTURE

Many of the domestic issues of market power associated with tight oligopoly could be addressed directly by introducing a full, mandatory separation of the network from all services deemed to be competitive that utilize the network With structural separation, the network would have common carrier status with an obligation to serve all comers It would be subject to appropriate state and federal regulation, and it would not be protected from the threat of bypass

An independent network would have independent financing and its own board of directors There would be no inherent reason to limit the scope of the network to properties affiliated with an existing vertically integrated public utility Indeed, there would be substantial benefit from bringing together the largest number of potential buyers and sellers consistent with some economic criterion such as the application of FERC's delivery price test Increasing traffic on a network should serve to exploit all inherent network and coordination economies

Structural separation should be clearly distinguished from functional separation, the creation of an ISO, and- the FCC's Computer II decision There will, of course, be offsetting costs associated with any loss in vertical economies from restructuring John Kwoka estimates

the loss from vertical deintegration at 13-14% for the average size electric utility [2/] But there should be substantial offsetting gains that support the case for network independence and the expansion of such networks

The first category of benefits would include greater opportunities to achieve network efficiencies and the creation of strong incentives to realize the gains It would expand to meet demand and aggressively promote usage and new network services to achieve a high load, diversity, and capacity factors Gains would arise because

1) The incremental cost of adding new services would fall as the size of the network increased
2) Reserve capability would be enhanced through access to greater standby capacity and alternative routings
3) Electric "must-run" requirements would be handled more efficiently
4) An expanded network would tend to expand available transmission capacity and minimize potential network bottlenecks that would require allocating ATC among generating entities
5) Network functionality would increase as network size increases -- particularly in telecommunications
6) Network expansion would increase opportunities for more market centers and hubs in natural gas supply
7) Potential conflicts between bidding and direct contracting could be diminished by a growth in total transactions on the bulk power market
8) Price volatility in secondary markets could potentially be minimized because an expanded network could provide greater opportunities for arbitrage

A second category of benefits would involve the diminution of market power held by buyers and sellers using the network

1) As the size of the network increases, the ability of oligopsony buyers to extract price concessions or dictate network design will diminish because sellers will have other options
2) As the size of the network increases, the market power of individual sellers will decrease because buyers will have access to more sources This will diminish the attractiveness of alliances, mergers, and joint ventures when the gains from collaborative behavior do not increase as fast as the network creates new supply options It would also constrain the payment of exorbitant fees for the purchase of assets (such as generation) that are exempt from regulation
3) As buyer options increase, the number of captive customers should decrease Rebundling at the retail level will continue but as the number of sellers increase it should diminish in significance In addition, aggregators would be better able to target the needs of specific customer classes

A third category of benefits relates to a diminished opportunity to exploit the network as part of a joint offering of network and unregulated services

1) Structural separations would minimize the opportunity to cross subsidize between both types of activities or combine them through tie-in sales via supposedly separate marketing affiliates
2) It would minimize the incentive and opportunity to fragment the network by shifting portions of the network to nonregulated status or to disinvest in the network
3) Since the network had independent financing, any anticompetitive gains from a

leveraged capital structure associated with holding company financing would be eliminated

4) An independent network would be free from RTG dominance of the ISO and it would be free from member company control of the ISO It would also be free from constraints on expansion when such expansion was dependent upon the consent of the members that owned proportionate shares of the network Closely related to this is the need to free the network from what could be called the Argentinean constraints [3/]

An independent network would be free to practice proper pricing that should minimize uneconomic bypass The test would be whether the stand-alone cost of nonparticipation in the network was greater or less than the direct cost of using the network and an allocated share of network overhead If the Glaeser model[4/] were used to price the network, then this allocated overhead would simply reflect the difference between the stand-alone cost and the direct cost of providing the service

There are, of course, still questions to be resolved regarding structural separation These include

(1) Analytical refinements in defining the boundaries of the network

(2) The proper costing and pricing model to be applied to the network The Glaeser model would appear to be ideal for such a situation, and it is made particularly attractive since it would require only the calculation of total cost, stand-alone cost, and direct cost, while avoiding the complexities of assigning common costs among particular services

(3) A determination whether the network should provide so-called default service

(4) An exploration of whether a "bright line" can be drawn that divides a network

between long-haul and local distribution functions

(5) A decision whether the network should be assigned responsibility for assuring universal service, energy conservation, and oversight of potential collusion among buyers and sellers

(6) In the case of electricity, a decision whether generating plants that are substantially paid for by customers should be retained by the network as a barrier to inefficient entry This would also apply to hydro and geothermal facilities

The opportunities for structural separation along the lines indicated appear to be greatest in electricity and natural gas However, delays will cause other institutional arrangements to be put in place that will constitute a barrier to such reform In telecommunications political and institutional resistance to restructuring could be substantial from existing firms and potential entrants Yet, it should be noted that without formal separation, changes are taking place in telecommunications as the carriers recognize that there are major gains to be made in voluntary restructuring This is evidenced in AT&T's 1995 restructuring plan, Rochester Telephone's 1995 restructuring, and US West's 1997 restructuring A major advance could be made by suggesting that the regional Bell companies be permitted to establish a common carrier network incorporating structural separations implemented through strict financial and organizational separations that would effectively limit a parent holding company's ability to commingle network and user related services In this case, the promotion of a common carrier network could represent a major step toward assuring universal service

If effective network separation cannot be achieved in public utility industries, then regulators will be confronted with the need to try to negate tight oligopoly pricing patterns

through attempts at bellwether pricing, and by tightening up considerably on PCR through periodic cost reviews, monitoring oligopoly strategies, and tying prices and profits together, thereby reinstituting RB/ROR The prospects for success in such efforts are doubtful, especially when there will be constant pressure to minimize or eliminate regulatory agencies as they exist today

FOOTNOTES

1/ W G Shepherd, *The Economics of Industrial Organization* Prentice Hall, 1990, p 473

2/ J Kwoka, "Vertical Integration and Its Strategies for Achieving Cost Efficiency in Electricity Supply " Economics Discussion Paper, George Washington University, March 1996

3/ The Argentinean network has no obligation to expand transmission capacity Capacity expansion is kept separate from operation of the network and it must be approved by a national regulatory agency with financing coming from a voluntary agreement among major users (generators, distributors, large customers)

4/ Martin G Glaeser, "Those TVA Joint Costs", *Public Utilities Fortnightly*, August 31, 1939, at p 259

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ANTITRUST POLICY IN THE NEW ELECTRICITY INDUSTRY

Richard J Pierce, Jr *

I. The Old Regulatory and Operating Environment

For over a century, the U S electricity industry consisted primarily of over one hundred vertically-integrated investor-owned utilities (IOUs) [1] Each IOU was subject to pervasive cost-of-service regulation by a combination of one or more state public utility commissions (PUCs) and the Federal Energy Regulatory Commission (FERC) [2] Agencies and courts have applied antitrust principles to IOUs in a variety of contexts for several decades [3] The antitrust analysis of the industry's structure and of the conduct of the participants in the electricity market has been greatly influenced, however, by the existence of pervasive cost-of-service regulation of IOUs and by the widespread belief that large economies of scale left little room for competition to play a beneficial role in governing the electricity market.

Most analysts have long believed that the industry is unduly fragmented and that substantial consolidation of IOUs would enhance the efficiency of the industry's performance [4] The industry structure varies greatly by state and region. In some regions, *e.g*, parts of the Midwest, a single large IOU serves millions of consumers in several states In other regions, *e.g*, parts of New England, several tiny IOUs serve portions of a single small state The regulatory environment has been inhospitable to mergers and acquisitions involving IOUs, however Such a consolidation requires at a minimum the approval of the Boards of both IOUs, the FERC, and one or more state PUCs. The FERC has encouraged efficiency-enhancing consolidations of IOUs. It has proven difficult for the parties to negotiate terms that would satisfy the disparate interests of the Boards of both IOUs and of state PUCs, however [5] Thus, the level of consolidation among IOUs has fallen far short of the level previously predicted by financial analysts and urged by economic analysts. The situation seems to be changing rapidly, however Thirteen large IOUs proposed consolidations in 1995 and

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1 *See* Paul Joskow & Richard Schmalensee, Markets for Power 11-16 (1983)

2 *See id.* The FERC was named the Federal Power Commission until 1977

3 *See, e.g*, Conway Corp v FPC, 426 U.S. 271 (1976) United States v Otter Tail Power Co., 410 U.S 366 (1973), City of Huntsburg v FPC, 498 F.2d 778 (D C. Cir 1974)

4 *See e.g*, Joskow & Schmalensee, *supra* note 1, at 66· Richard Pierce *A Proposal to Deregulate the Market for Bulk Power* 72 Va. L. Rev 1183 1192-97 (1986), Stephen Breyer & Paul MacAvoy Energy Regulation by the Federal Power Commission 91 107 (1974)

5 *See* Pierce *supra* note 4 at 1195-96.

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rumors abound with respect to scores of other consolidations under consideration by IOUs [6]

This dramatic change in the prospects for consolidation among IOUs may be attributable to the arrival of a new source of impetus to engage in efficiency-enhancing behavior All IOUs now believe that they will soon experience the transition from the safe, quiet life of a regulated monopoly to the perilous, volatile life of a participant in a vigorously competitive market. Inefficient firms will not survive that transition Thus, achieving an efficient size is no longer a discretionary goal that an IOU is free to pursue at its leisure or to decline to pursue at all Instead, it is one of a dozen or more essential predicates to survival. A desire to enhance efficiency is only one of several plausible motives for the rash of proposed mega-mergers, however Other less attractive candidates include (1) a desire to increase a firm's political clout in an effort to provide it increased leverage to negotiate with regulators for a more favorable transition to competition, and (2) a desire to increase a firm's market power in order to earn monopoly profits in the new environment.

Whatever factor or factors account for the sudden increase in proposed utility mergers, the dramatic changes in the electricity market require agencies and courts to take a fresh look at the application of antitrust law and policy to the electricity industry [7] The FERC has the leading role in that process [8] It has fulfilled that role in several ways in the past. In the consolidation context, the FERC originally focused its attention on horizontal issues, with particular emphasis on expected cost savings [9] Since there was little potential for meaningful competition among IOUs, the FERC approved virtually any proposed consolidation that was accompanied by a claim of expected cost savings [10]

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6 *See* Jeff Bailey *Electric Utilities in Midwest Plan 3-Way Merger* WALL ST J., Nov 13 1995 at A2, Benjamin Holden, *Merger of Baltimore G & E, Potomac Electric Planned*, WALL ST J., Sept. 26 1995 at A4 Douglas Hawes, *Electric Utility Mergers and Acquisitions Seen in a Larger Perspective* ELEC. J., Oct. 1995 at 11 James Pierobin, *Merging for Critical Mass* PUB UTILS. FORT., Oct. 15 1995 at 16

7 *See Midwest Power Sys., Inc. and Iowa-Ill. Gas & Elec. Co* 71 F.E.R.C. ¶ 61,386 (1995) (Comm rs Massey and Hoecker concurring)

8. The FERC must approve a proposed consolidation if it finds that the proposal will be consistent with the public interest. 16 U.S.C. § 824b(a) (1994) The Department of Justice (DOJ) has the power to disapprove a consolidation that the FERC approves. 15 U.S.C. § 18a (1994) So far the DOJ has chosen not to exercise this power It is entirely possible, however that the DOJ will determine that a proposed consolidation that satisfies the FERC's public interest standard is inconsistent with the more rigorous standards in the Clayton Act.

9 *See* John S. Moot, *The Changing Focus of Electric Utility Merger Proceedings* 15 ENERGY L.J 1 (1994)

10. *See* GEORGE HALL, AMERICAN BAR ASS'N ANTITRUST POLICY AS REFLECTED IN THE FERC'S REGULATION OF THE ELECTRIC POWER INDUSTRY (forthcoming in REGULATION OF THE ELECTRICITY INDUSTRY) Douglas Green & J.A. Bouknight, Jr., *Electric Utility Antitrust Issues in an Era of Bulk Power Marketing Competition*, NAT RESOURCES & ENV'T Winter 1994 at 20 John Williams, *Wheeling & Dealing: FERC's Evolving Approach to Electric Utility Mergers* ELEC. J Aug./Sept. 1989 at 16

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The FERC modified its approach to consolidations in the 1980s [11] By then, the FERC had determined that the potential existed for socially-beneficial competition among IOUs with respect to the generation and wholesale of electricity That potential was not being realized, however, because of vertical constraints on competition The IOUs were unwilling to allow potential competitors access to their markets They could preclude competitive access to their sales markets by declining to allow competitors equal access to their transmission lines [12] In recognition of this new reality, the FERC changed its primary focus to vertical constraints on competition It would approve a proposed consolidation if, but only if (1) the consolidation would yield expected cost savings, and (2) the parties to the transaction agreed to provide competitors equal access to their transmission lines [13] Since the FERC found that each of the consolidations it considered would produce cost savings, the FERC's new merger policy focused primarily on vertical constraints [14] The FERC considered horizontal issues but in ways that were greatly influenced by its preoccupation with vertical issues Thus, for instance, the FERC often found that a proposed consolidation of IOUs would *decrease* concentration in the wholesale market by increasing the number of firms with access to the relevant market,[15] and it defined the relevant wholesale market primarily with reference to the presence or absence of vertical constraints [16] This approach made sense at the time The vertical constraints were formidable obstacles to competition in the generation and wholesale markets, and the FERC had no other effective means of inducing IOUs to eliminate the vertical constraints [17]

II MAJOR CHANGES DURING THE PERIOD 1992 THROUGH 1995

Between 1992 and 1995, the environment relevant to the application of antitrust principles to the electricity market changed again. The new changes require the FERC to reassess its methods of applying antitrust principles to the industry None of the approaches the FERC has used in the past are appropriate to the new market conditions In 1992, Congress enacted the Energy Policy Act (EPAct) [18] That statute empowers the FERC to require any IOU to provide third parties access to its transmis-

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11 *See supra* notes 9-10

12 *See* Pierce *supra* note 4 at 1215 18.

13 *See e.g Utah Power & Light Co* 45 F E.R.C. ¶ 61,095 (1988) *See also* Richard Pierce *Using the Gas Industry as a Guide to Reconstructing the Electricity Industry* 13 RES. IN L. & ECON 7 32 34 (1991)

14 *See supra* notes 9-10.

15 *See e.g Midwest Power Sys. Inc. and Iowa-Ill. Gas & Elec. Co* 71 F E.R.C. ¶ 61,386 (1995) *Entergy Servs. Inc. and Gulf States Utils. Co* 62 F E.R.C. ¶ 61 073 (1993) *See generally* Hall, *supra* note 10

16 *See supra* note 15 The FERC defines the relevant market to include all first tier' suppliers—*i.e.* those connected by open access transmission tariffs.

17 *See* Pierce, *supra* note 13 at 24-40

18 Energy Policy Act of 1992, Pub L. No 102-486 106 Stat. 2776 2905 (1992)

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sion lines [19] In 1994, the FERC issued a Notice of Proposed Rulemaking (NOPR) in which it relied on the text of the Federal Power Act of 1935 (FPA) and the spirit of the EPAct as the bases for proposing major changes in the structure, and methods of governing the industry [20] The FERC intends to compel each IOU to file an equal access tariff and to require each IOU to implement functional unbundling, *i.e.*, to separate its transmission, distribution, and generation functions and to perform each function as if it were being performed by a separate firm.

These changes in regulatory environment have two major implications for the FERC's methods of applying antitrust principles to the electricity market. First, for antitrust purposes, the FERC can now ignore the vertical constraints on competition that were the primary focus of the FERC's antitrust activities during the 1980s As amended by the EPAct, the FPA now gives the FERC regulatory tools that allow it to address those vertical constraints effectively, and the FERC's NOPR evidences its ability and willingness to use those tools to good effect. Second, the FERC needs to refocus its antitrust attention on horizontal market power issues as they arise in the functionally unbundled environment prescribed in its NOPR. The FERC, along with virtually all market participants and analysts, anticipates that each vertically-integrated IOU will be divided into three separate subfirms or operating divisions—a transmission company (transco), a distribution company (disco), and a generation company (genco) [21] Indeed, many market participants and observers expect functional unbundling to evolve into corporate de-integration—IOUs will spin off their transcos, discos, and gencos into three separate corporations [22] In either case—functional unbundling or corporate de-integration—it no longer makes sense for the FERC to apply antitrust principles as if the relevant product market were provision of bundled electricity service by vertically-integrated firms Instead, the FERC needs to devise antitrust policies appropriate to the dramatically different characteristics of the separate markets for transmission, distribution, and generation. In the new environment, transmission and distribution will remain regulated monopolies By contrast, the FERC's goal in implementing the EPAct is to create a fully-competitive wholesale electricity market that will subject gencos to the powerful discipline of a competitive market.

The FERC must apply antitrust principles in at least three different decision-making contexts First, of course, it must decide whether to

19 *See* Richard Pierce *The State of the Transition to Competitive Markets in Natural Gas and Electricity* 15 ENERGY L.J 323 (1994), Jeffrey Watkiss & Douglas Smith, *The Energy Policy Act of 1992. A Watershed for Competition in the Wholesale Power Market*, 10 YALE J ON REG. 447 (1993) Bernard Black & Richard Pierce, *The Choice Between Markets and Central Planning in Regulating the U.S. Electricity Industry*, 93 COLUM. L. REV 1339 (1993)

20. Notice of Proposed Rulemaking, *Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities*, IV F.E.R.C. STATS. & REGS. ¶ 32,514 60 Fed. 17 662 (1995) (1994) [hereinafter referred to as *NOPR*]

21 *Id.* at 17 664

22. *See* Richard Pierce *The Advantages of De-Integrating the Electricity Industry* ELEC. J Nov 1994 at 16

approve proposed consolidations of IOUs beginning with the six major consolidations that have been proposed this year In all six cases vertically-integrated IOUs propose to consolidate all of their functions The FERC has the discretion, however, to authorize only a partial consolidation In some circumstances, it might find it appropriate to authorize consolidation of the firms' transmission and distribution assets but to refuse to authorize consolidation of their generation assets Second, the FERC must decide whether a particular geographic market for electricity is sufficiently competitive to justify a decision to allow unregulated wholesales by some or all of the participants in that market.[23] The FERC's goal is to create a fully-competitive unregulated wholesale electricity market in all parts of the country[24] It recognizes, however, that it may not be able to fulfill that goal if, and to the extent that, some geographic markets are unduly concentrated[25] Third, the FERC has the power to condition its approval of a proposed transaction or method of operation on an IOU's willingness to restructure in ways that would render the proposed transaction or method of operation consistent with the "public interest" and the resulting prices "just and reasonable "[26] Thus the FERC may find it appropriate to condition its approval of either a proposed consolidation or a proposal to make wholesales at unregulated prices on an IOU's willingness to divest a portion of its generating assets if the FERC concludes that the relevant wholesale market is, or would be, unduly concentrated in the absence of partial divestiture of generating assets

In its NOPR, the FERC indicated that it is considering whether, and to what extent, to employ such structural remedies for market power in the wholesale electricity market.[27] In some circumstances, other institutions also may have the power to employ structural remedies A state PUC might condition its approval of a proposed consolidation on divestiture of a portion of the IOU's generating assets even if the FERC approves the transaction without such a condition. Some state PUCs may have broader authority to impose structural remedies in some circumstances The California Public Utilities Commission (CPUC) has stated that it "almost certainly" will require some California IOUs to divest a portion of their generating assets as part of the CPUC's plan to create a competitive retail electricity market in California.[28] Each of these decision-making contexts raises somewhat different considerations, so it may be desirable to apply different antitrust criteria to each, *e g*, a geographic market for electricity might not be so concentrated as to justify divestiture or imposition of price controls, yet the same market might be too concentrated to justify approval

23 *See e.g Entergy Servs. Inc.*, 58 F E.R.C. ¶ 61,234 (1992)

24 *See generally NOPR supra* note 20

25 *NOPR* at 17,674-75

26. *See* 16 U.S C. §§ 824b(b) d, e (1994)

27 *NOPR* at 17 674-75

28. California Pub Util. Comm n. Proposed Policy Decision Adopting a Preferred Industry Structure 7 (1995)

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of a proposed consolidation of IOUs absent partial divestiture of generating assets

III THE NEW REGULATORY AND OPERATING ENVIRONMENT

Antitrust criteria should be applied to a market in a manner consistent with the expected future characteristics of that market. This principle is problematic in the context of the electricity market, however, because we can be certain of only one characteristic of that market in the near future—it will bear little resemblance to the electricity market of the past The FERC must predicate its new antitrust policies on some set of expected future market and regulatory conditions, however For this purpose, the FERC should assume that the electricity market will have the following characteristics within the next few years

First, the industry will be functionally unbundled, *i.e.*, IOUs will reorganize internally so that the functions of transmission, distribution, and generation are performed by separate units that are required to deal with the other units of the firm as if they are independent firms This is a central component of the FERC NOPR [29] Its implications for antitrust policy are clear The FERC should apply different antitrust policies to each of the unbundled markets It also should consider structural issues on an unbundled basis, *e g*, if a proposed consolidation would yield cost savings and no increase in market power with respect to the transmission and distribution functions, but the proposed transaction would yield no significant cost savings and an undesirable increase in market concentration with respect to the generation function, the FERC should condition the approval of the consolidation on the firms' willingness to divest a portion of their generating assets The FERC should reject the arguments of vertically-integrated IOUs that a proposed consolidation should be approved because an otherwise undesirable increase in the market concentration in the wholesale market will be more than offset by expected cost savings with respect to the transmission and distribution functions Arguments of that type should be rejected in a functionally unbundled operating environment because they are based on the implicit assumption that vertical integration yields nontrivial benefits attributable to economies of scope and coordination. Functional unbundling undermines that assumption.

Second, the FERC will be successful in implementing a system of equal access to transmission. Again, this is a core component of the FERC's NOPR.[30] The FERC is likely to make some mistakes and false starts in accomplishing this daunting task, but the availability of powerful regulatory tools to eliminate vertical constraints on competition has clear implications for the antitrust policies the FERC should adopt. It should ignore all vertical constraints in establishing and implementing its antitrust policies on the assumption that it ultimately will be successful in using its powerful regulatory tools to eliminate those constraints

29 *NOPR* at 17 681-82.
30 *Id.* at 17 679-80

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Third, transmission will be subject to pervasive and exclusive regulation by the FERC Transmission is a classic natural monopoly that is within the FERC's exclusive regulatory jurisdiction Competition may supplant or supplement regulation of this function at some time, but this can occur only through creation of a secondary market in transmission capacity It would be futile and counter-productive to attempt to create a competitive transmission market by limiting the degree of concentration in the market This also has clear implications for the FERC's antitrust policies The FERC should approve, indeed it should encourage maximum consolidation of transmission assets in each region All such transactions are likely to yield substantial gains in efficiency, and none can harm competition

Fourth, distribution will be subject to pervasive and exclusive regulation by state PUCs Like transmission, distribution remains a classic natural monopoly A state can create a competitive retail electricity market by requiring discos to provide equal access to their distribution systems but the potential for retail competition is unaffected by the pattern of ownership of distribution assets Thus a proposed consolidation of discos raises no concerns with respect to potential creation or increase of market power by any seller

The only competitive concern that might be raised by such a proposal is its potential adverse effect on monopsony power A particular proposal might raise non-trivial monopsony concerns if it would have the effect of creating a highly concentrated wholesale market on the buyer's side [31] Three factors complicate the FERC's efforts to devise an appropriate set of antitrust policies applicable to proposed consolidations of discos First, it will experience difficulty determining the geographic scope of the relevant market. I will discuss this problem in detail in Section IV A Second, it is difficult to verify, refute, or quantify claimed cost savings attributable to a proposed consolidation of large discos We know little about the extent of the economies of scale potentially available in performing the distribution function We can conclude with confidence that the consolidation of two small discos would enhance efficiency, but we do not know whether the potentially available economies of scale continue beyond a size equivalent to ten, twenty, fifty, or even ninety percent of a wholesale market. Third, state PUCs have discretion to adopt regulatory policies that can eliminate the only potential source of antitrust concern raised by a proposed consolidation of discos If state PUCs require discos to provide equal access to all consumers, or even to a class of consumers that accounts for a high proportion of total electricity consumption in the relevant market, the concern with respect to potential disco monopsony power disappears

Given the high degree of uncertainty with respect to the variables that should shape the FERC's policies with respect to the appropriate structure of the distribution sector, and the power of states to affect those variables, the FERC should accord near dispositive deference to the positions of states on proposed consolidations (or divestitures) of discos in the new

31 *See* IV PHILLIP AREEDA & DONALD TURNER, ANTITRUST LAW §§ 963 65 (1992)

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unbundled environment The FERC cannot approve a proposed consolidation of discos over the opposition of a state PUC in any event If functional unbundling evolves into corporate de-integration, the FERC may also lack the jurisdictional power to disapprove a consolidation that is approved by the PUCs of the affected states Even if it retains that power, the FERC should defer to PUCs in exercising that power It should approve any proposed disco consolidation that is supported by the PUCs of the affected states

Fifth, the FERC will continue its efforts to substitute competition for regulation as the primary means of governing the wholesale electricity market. This assumption seems safe The FERC has pursued policies designed to displace regulation with competition to the maximum extent possible in all contexts for over a decade [32] Enactment of the EPAct of 1992, and issuance of the 1994 NOPR eliminate any remaining doubts about the FERC's continuing pursuit of this policy agenda. The broad antitrust implications of this element of the new environment are clear The FERC must analyze with care the present structure of the generating sector It must develop a comprehensive set of antitrust policies applicable to proposed consolidations of gencos and to the other decision-making contexts to which structural issues are relevant, *e.g*, proposals to make wholesales at unregulated (or lightly regulated) prices and proposals to require partial divestiture of generating assets I will discuss this difficult task in the remaining sections of this paper

Sixth, the FERC will devise and implement an efficient method of pricing transmission services This assumption is predicated on a more fragile foundation than the first five assumptions The present state of transmission pricing is confused and inefficient Many transactions are governed by complicated agreements among large numbers of IOUs in which a substantial portion of the consideration for the service consists of implicit barter, *e.g*, utility A provides services for utilities B through J in return for those utilities' provision of services for utility A.[33] To the extent that transmission service is provided in return for a purely monetized price, the most frequent pricing approach relies on "postage stamp rates," *i.e.*, the IOU charges the same price per unit of service provided without regard to differences in distance or costs [34] The FERC has encouraged IOUs to switch to a methodology called "or" pricing, in which the unit price of transmission service is determined with reference to the IOU's average fully allocated embedded cost if the service can be provided without expanding the existing transmission capacity, "or," with reference to opportunity cost, if transmission capacity constraints create a situation in which provision of service to one party would displace service to another

32. *See generally* Pierce, *supra* note 19

33 *See* JOSKOW & SCHMALENSEE, *supra* note 1 at 71-77

34 Policy Statement, Inquiry Concerning the Commission s Pricing Policy for Transmission Services Provided by Public Utilities Under the Federal Power Act, 59 Fed. Reg. 55 031 (1994) [hereinafter *Transmission Pricing Policy Statement*]

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party[35] The FERC's "or" methodology would be a major improvement over the status quo ante—barter and postage stamp rates—if the FERC can devise a practicable way of implementing its preferred methodology So far however, the FERC has not been able to overcome the formidable obstacles to implementing opportunity cost pricing on a dynamic and complicated transmission grid.

Notwithstanding the large gap that exists between the present methods of pricing transmission service and an efficient pricing policy, I will analyze the antitrust issues on the assumption that the FERC will adopt and implement a more efficient transmission pricing policy in the near future I indulge this assumption for five reasons First, the FERC is striving to attain that goal.[36] Second, the goal is attainable Third, many market participants share the FERC's interests in attaining that goal. Fourth the goal must be attained, since continuation of the present pricing methods would produce a variety of serious adverse effects in the new unbundled environment[37] Fifth, it is impossible to make a rational determination of the geographic scope of a wholesale electricity market consistent with the alternative assumption, *i.e.*, that the present inefficient pricing methods will persist in an unbundled environment Determining the geographic scope of a market is a critical step in determining whether any particular market structure is likely to have adverse effects on consumer welfare Yet, determining the geographic scope of a wholesale electricity market is critically dependent on adoption of a more efficient transmission pricing policy

An efficient transmission pricing regime should include several features First, it should be a two-part rate, or it should have characteristics analogous to such a rate The first part should be designed primarily to allow a transco to recover its investment in transmission assets This part should be billed on some basis other than per unit of service provided in order to minimize its potential distortive effect on decisions whether to purchase a unit of transmission service Devising and implementing the first part of the rate is a daunting task that requires the FERC to choose among imperfect alternatives[38] The second part of the rate should be billed per unit of service provided It should be calculated solely with reference to the short-term marginal cost of providing a unit of transmission service That marginal cost has two components variable out-of-pocket costs and opportunity costs The variable out-of-pocket costs consist primarily of line loss, *i.e.*, the value of the electricity lost in the process of transmitting a unit of electricity over a particular route This varies primarily as a function of the distance transmitted and the characteristics of the relevant transmission lines, *e.g.*, a 765 KV line experiences less line loss

35 *See* Northeast Utils. Serv Co., 58 F.E.R.C. ¶ 61,070 (1992)

36. *See generally Transmission Pricing Policy Statement*, *supra* note 34

37 *See* Pierce *supra* note 13 at 40-47

38. *See* RICHARD PIERCE, ECONOMIC REGULATION 142 55 (1994) *See generally* FEDERAL ENERGY REGULATORY COMM'N THE TRANSMISSION TASK FORCE S REPORT TO THE COMMISSION (1989) Charles Stalon, *The Significance of the FERC s Transmission Task Force Report in the Evolution of the Electric Industry* 13 J RES. IN L. & ECON 105 (1991) KEVIN KELLEY ET AL., SOME ECONOMIC PRINCIPLES FOR PRICING WHEELED POWER (1987)

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than a 230 KV line The line loss per mile on a modern, ultra high voltage line is very small Thus, if line loss were the only component of the marginal cost of transmission, the FERC could conclude with confidence that U S wholesale electricity markets are very large The relevant market would have a radius of at least five hundred miles Indeed, in this situation the relevant market might consist of the entire continent of North America

The marginal cost of transmission also should include opportunity costs, however [39] If a transmission line (or path) is capacity-constrained at a particular time, the opportunity cost of transmitting an additional unit of electricity to accommodate one wholesale transaction consists of the cost of foregoing the transmission of other units of electricity associated with different wholesale transactions, *i.e.*, the output of some generators must be reduced to permit the transmission of electricity produced by another generator [40] In this situation, the opportunity cost of transmitting a unit of electricity is the cost of substituting units of higher cost electricity for units of lower cost electricity Since the marginal cost of generating electricity ranges from eight dollars per megawatt hour (MWH) to 155 dollars per MWH,[41] this opportunity cost can be very large In conditions of constrained capacity, the opportunity cost of transmission, often referred to as the congestion cost, usually dwarfs the variable out-of-pocket costs of transmission The existence of transmission capacity constraints at some locations during some periods of time, and the existence of the associated congestion costs, greatly complicates the FERC's task of devising and implementing antitrust policies appropriate to the wholesale electricity market. Transmission capacity constraints and congestion costs reduce to some uncertain extent the geographic scope of the wholesale market relevant to a particular proposed transaction

Seventh, the FERC will implement its pro-competitive regulatory agenda through adoption of the "Poolco" model This assumption is controversial and contestable The participants in the ongoing debate about the preferred future of the electricity market are about evenly divided between the proponents of the Poolco model and the proponents of a bilateral trade model. This is not the place to rehearse that complicated debate [42] I will attempt only a brief, simplified summary for the benefit of

39 *See* Pierce *supra* note 13 at 40-47 I am excluding from this discussion what the FERC refers to as "ancillary services." This generic label includes several distinct services, *e.g.*, dispatch, load following, and reactive power Each of these services must be analyzed carefully and subjected to an appropriate governance regime. Some services can be provided through competitive market mechanisms, while others should be provided by regulated entities, either owners of transmission lines or Poolco.

40. *See* William Hogan, *Electric Transmission. A New Model for Old Principles* ELEC. J Mar 1993 at 18.

41 *See* William Hogan, Poolco What s the Trick? 13 (July 18 1995) (paper presented at the Electric Generation Ass n Summer Meeting)

42. For a sample of the debate, *compare* Donald Garber et al., *An Efficient Electricity Market Using a Pool to Support Real Competition*, ELEC. J Sept. 1994 at 48, *with* California Pub Util. Comm n, Customer Choice Through Direct Access: Proposal and Recommendations of Commissioner Jessie J Knight, Jr (May 24 1995)

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those who have chosen not to immerse themselves in the details of this important debate

Both groups recognize that each regional transmission grid must be subject to operational control by a single entity often called the independent system operator (ISO) Both also recognize that transmission grids are complicated, interactive and dynamic If the grid is characterized by non-trivial capacity constraints the addition of a load or a source at one point on the grid can impose large costs on numerous third parties by reducing the capacity available on other portions of the grid, thereby forcing curtailment of the output of one or more generators Both groups agree that the method of organizing wholesale trade in electricity must account for these complicated relationships

Proponents of a bilateral trade model believe that it can perform this function if the contracts between generators and purchasers are well-drafted, and if the FERC implements an efficient system of transmission pricing that incorporates congestion costs Some combination of arbitrage and multi-party contracts might yield acceptable results in this situation If a bilateral contract purported to require a particular generator to sell electricity to a particular purchaser in circumstances in which the associated transmission would require curtailment of a lower cost generator, the transaction would not actually take place because of the high cost of the associated transmission service If the generator under contract had to bear the high transmission cost it would have an economic incentive to purchase electricity from another generator with an uncongested transmission path to the buyer and to substitute that electricity for its own to meet its contractual obligations If the buyer under the contract had to bear the high transmission cost, it also would have an incentive to substitute electricity from a generator with an uncongested transmission path and to use a portion of its saved transmission costs to compensate the generator under contract for its lost profits on the sale The proponents of bilateral trade believe that arbitrage and multi-party contracts of this type would avoid the adverse effects of the complicated interactions within a transmission grid

Proponents of Poolco are skeptical of this belief on at least two grounds First, they believe that the FERC would not be able to implement an efficient transmission pricing policy in a bilateral trade environment Second, they believe that arbitrage and multi-party contracts would not be sufficient to avoid the high social costs attendant to the network effects that exist on a capacity-constrained transmission grid. Both sources of skepticism have the same root. The nature, location, and magnitude of the network effects on a capacity-constrained grid are complicated, non-linear, and dynamic. They could be accommodated only by some combination of extremely complicated contracts, *e g*, a contract with ten parties and scores of contingencies, and/or hundreds of arbitrage transactions each day Moreover, the FERC would have to implement an extremely complicated and dynamic transmission pricing policy in which the cost of transmission on many paths would vary within a large range continuously throughout

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each day The proponents of Poolco doubt that the FERC would be able to implement such a system in the context of a bilateral trade market

The Poolco proponents have designed their alternative method of moving to a competitive wholesale market on the basis of the systems that are already in effect in many other places *e g*, Great Britain Norway, Alberta, New Zealand, Argentina, and Chile, and the power pools that many U S IOUs have long used to reduce the cost of electricity in a region [43] Poolco refers to a new independent institution that would have two complementary roles daily operation of a regional transmission grid and implementation of a bidding system that would determine which generators provide power to the grid at what prices at each point in time Poolco would use existing algorithms that reflect the characteristics of the grid, including the capacity constraints and network interactions that exist in varying generation and load conditions, to implement a dual bidding system Each half hour, each purchaser would submit a bid that consists of the quantity of electricity it is willing to purchase at each node on the grid at various prices, and each generator would submit a bid that consists of the quantity of electricity it is willing to sell at each node at various prices Poolco would then input the bids and run the algorithm. The output would include the quantity of electricity that flows in and out of the grid at each node during that half hour, the price paid and received at each node, and the per unit cost of transmission on each path Thus Poolco would automatically implement an efficient transmission pricing policy The marginal cost of transmission from one node to any other node would be the difference between the time-specific prices of electricity at the two nodes The Antitrust Division of the Department of Justice (DOJ) has aptly analogized Poolco's role to that of a stock exchange [44] The FERC would have to regulate Poolco, since it would be a classic natural monopoly that dispatches electricity in interstate commerce That task would be relatively easy, however, since both the Poolco algorithm and its transaction records would be highly transparent. Poolco would be unlikely to abuse its monopoly power because any such abuse would be easy for transacting parties or the FERC to detect.

In my analysis of antitrust issues, I will assume that the FERC adopts the Poolco model as the basic mechanism to create a competitive electricity market. This assumption has several effects on the analysis, but the net effect is only to reduce the potential for abuse of market power The potential for gencos to exercise market power exists under either model, but the Poolco model has features that reduce the potential for undetected abuse of market power to some uncertain extent.[45] Thus, adoption of the alternative assumption—that the FERC chooses a bilateral trade method

43 *See generally* Hugh Rudnick et al., Evaluation of Alternatives for Power System Coordination and Pooling in a Competitive Environment, IEEE Transactions on Power Systems (1995)

44 *See generally* ANTITRUST DIV., U S DEPT OF JUSTICE, COMMENTS IN RESPONSE TO THE FERC NOPR (1995)

45 *See infra* notes 81 86.

of implementation—would not materially affect the results of my antitrust analysis

IV ANTITRUST POLICIES APPLICABLE TO GENCOS

In the new functionally unbundled environment the wholesale electricity market will share the basic features of any other competitive market Thus the starting point for devising policies to govern the permissible structure of the genco segment of the industry should be the DOJ Merger Guidelines [46] The Guidelines use the Herfindahl-Hirschman Index (HHI) to identify proposed consolidations that raise potential anticompetitive concerns sufficient to justify detailed analysis of the likely effects of the proposed transaction The HHI is calculated by summing the squares of the market shares of the participants in the relevant market A consolidation that would increase the HHI in the relevant market by fifty points triggers antitrust scrutiny if the pre-existing HHI exceeds 1800 while a consolidation that would increase the HHI by 100 points triggers scrutiny if the pre-existing HHI is between 1000 and 1800 The Guidelines suggest that a high proportion of proposed consolidations of gencos might well warrant serious antitrust scrutiny Indeed, the Guidelines suggest the distinct possibility that the present pattern of ownership of generating assets should be a subject of serious antitrust concern If the relevant geographic market is each state, or that portion of a state that is served by one of the ten regional transmission grids, ninety-one percent of U S electricity markets have HHIs in excess of 2500, and scores of markets have HHIs in excess of 5000 [47]

Studies of the electricity markets in Great Britain and Sweden reinforce the belief that market concentration among gencos is a subject worthy of serious concern The British genco sector has an HHI of approximately 3460 [48] Numerous studies of the British market have produced evidence of abuse of market power by gencos [49] Richard Green and David Newbery estimated that prices were approximately seventy-nine percent higher, and that output was approximately thirteen percent lower than would be the case if the genco sector were structurally competitive [50] Green and Newbery predicted that the abuse of market power by the British gencos would decline dramatically if the genco sector were restructured to consist of five equally-sized firms, yielding an HHI of 2000 Such a structure would produce an average price only seventeen percent higher, and

46 *See* 57 Fed. Reg. 41,552 (1992)

47 William Hogan, Background for Plenary Session on Market Power *in* WORKING PAPERS OF THE HARVARD ELECTRICITY POLICY GROUP 5-6 (1995)

48 *See* Stephen Littlechild, *Competition in Progress* PUB. UTILS. FORT., Nov 15 1994 at 26

49 *See id. See also* Alex Henney *The Mega NOPR. A Brit Crosses the Pond to Explain What's Happening at FERC*, PUB. UTILS. FORT., July 1 1995 at 29 *See generally U K s National Power Powergen Must Sell Off Up to 6000 MW Lower Rates* ELEC. UTIL. WK., Feb 21 1994 Richard Green, *Britain s Unregulated Electricity Pool in* FROM REGULATION TO COMPETITION (M Einhorn ed 1994) Richard Green & David Newbery *Competition in the British Electricity Spot Market* 100 J POL. ECON 929 (1992)

50 Green & Newbery *supra* note 49 at 943-46

59

output only three percent lower, than the results of a hypothetical fully-competitive market[51]

Studies of the British market have also detected another phenomenon that should be of concern to U S policy makers Some portions of the British grid are capacity-constrained during some load conditions At those times and locations the price bid and received is far above the price that would be produced by a competitive market[52] This finding demonstrates that the effects of capacity constraints can include creation of local genco monopolies with very large resulting reductions in consumer welfare

Studies of the Swedish market have produced similar estimates and predictions The Swedish market has an HHI of 3200[53] Lars Bergman and Bo Andersson estimated that the level of market concentration is such that the market price in Sweden would be thirty-six percent higher and the output would be nineteen percent lower than the results produced by a hypothetical, structurally-competitive market.[54] Bergman and Andersson also estimated that modest restructuring—increasing the number of gencos from four to six—would virtually eliminate the adverse effects of potential exercise of market power by Swedish gencos[55] On the basis of these studies, and scores of studies of other markets, Paul Joskow has developed a few simple rules of thumb with respect to criteria applicable to concentration levels in the U S electricity market. two gencos are too few; ten are ample, five are probably sufficient, and, four equally-sized firms represents the presumptive balance point.[56]

These guidelines and studies provide a useful starting point for an antitrust analysis of the electricity market but they are not sufficient alone to form the basis for a detailed set of policies that can be implemented for that market That task is complicated by three factors First, it will be difficult to determine the scope of the geographic market relevant to a proposed consolidation The major determinative variables are the existence, location, extent, and effects of capacity constraints on transmission grids In the absence of capacity constraints, it might be defensible to divide the U S into two geographic markets east and west of the intertie that connects the two halves of the national grid. If those were the relevant markets, the present structure of the market, with an HHI well under 1000, would provide no reason for concern, and the FERC could approve all of the consolidations that have been proposed to date and a great many others without having to engage in close scrutiny of the likely antitrust effects of the consolidations At the other extreme, if capacity constraints

51 Green & Newbery *supra* note 49 at 947

52. Green & Newbery *supra* note 49 at 951

53 *See generally* LARS BERGMAN & BO ANDERSSON STOCKHOLM SCH. OF ECON MARKET STRUCTURE AND THE PRICE OF ELECTRICITY AN EX ANTE ANALYSIS OF THE DEREGULATED SWEDISH ELECTRICITY MARKET (1994)

54 *Id.* at 9

55 *Id.* at 11

56 *See generally* Paul Joskow *Market Power Friend or Foe?* *in* WORKING PAPERS OF THE HARVARD ELECTRICITY POLICY GROUP (1995)

59

limit the scope of geographic markets to each state or each portion of a state that is served by a particular regional grid almost all U S electricity markets are already characterized by a degree of concentration that is likely to yield bad results and the FERC should disapprove virtually all proposed genco consolidations except those between two tiny gencos If as seems likely, the relevant geographic markets are larger than a state and smaller than half the nation the FERC must adopt a detailed set of policies that will allow it to distinguish among transactions and markets In any event, it is impossible to apply any set of policies without first deciding how to determine the relevant geographic market and hence the degree of concentration in each market I will return to this complicating factor in section A

The second complicating factor is the existence of unique institutional features of the new electricity market. Antitrust analysts view measures of market concentration as no more than presumptive indicators that a particular market structure or proposed consolidation is or is not, worthy of detailed analysis There are myriad other factors that can appropriately induce an agency to conclude either that a different set of guidelines and thresholds for scrutiny should apply to a particular type of market, or that a proposed consolidation should be approved even though it poses a risk of creating a degree of market power that would be considered unacceptable in other circumstances This is the point at which the assumed adoption of the Poolco model becomes relevant to the analysis The factors that should be considered in a detailed analysis of the permissible or desirable structure of a market include ease of entry, existence of excess capacity, proportion of costs that are fixed degree of homogeneity of product structure of the buyer side of the market, extent of sellers' knowledge of each other s costs and prices, degree of transparency of any exercise of market power and, most importantly extent of potentially available economies of scale [57] The last four of these factors are affected to some uncertain extent by the assumption that the FERC will adopt the Poolco model I will address each of these considerations in sections B and C

The third complicating factor is lack of relevant historical experience The manner in which a market has evolved, and the manner in which a market has performed in the past, are valuable sources of data for an antitrust analysis of the market. Most of the variables relevant to establishing antitrust policies applicable to a market are difficult to estimate [58] Historical data can be very helpful in verifying or refuting a preliminary estimate of an important variable [59] Two examples illustrate this phenomenon First, an analyst might conclude preliminarily that the relevant geographic market probably is small area X, in which case the HHI is 3200, indicative

57 *See* IIA PHILLIP AREEDA ET AL., ANTITRUST LAW §§ 404 408 420-22 (1995) AREEDA & TURNER, *supra* note 31 at §§ 916-23 939-62, PHILLIP AREEDA & HERBERT HOVENKAMP SUPPLEMENT TO ANTITRUST LAW §§ 917-20 939-40 (1994)

58. *See* AREEDA ET AL., *supra* note 57 at §§ 530d 531a, AREEDA & TURNER, *supra* note 31 at §§ 921 923 AREEDA & HOVENKAMP *supra* note 57 at § 921

59 *See* AREEDA ET AL. *supra* note 57 at §§ 422d, 515-25 550 552d.

of a highly concentrated market In many circumstances, however, it is difficult for the analyst to be confident that she is right. If a retrospective study of the market's performance produces a finding that prices have approximated marginal cost, the analyst has good reason to believe that her preliminary determination of the geographic scope of the market is wrong On reconsideration in light of the historical performance of the market, the analyst may conclude that the relevant geographic market probably is large area 4X in which case the HHI is 768, indicative of an unconcentrated market Second an analyst might conclude preliminarily that a market is characterized by low economies of scale Again, however, the analyst cannot be confident that she is right. If a retrospective study of the market's performance indicates that many small firms have become unprofitable and have gone out of business, while large firms have grown and become more prosperous, the analyst has reason to believe that her preliminary determination was wrong On reconsideration, she may conclude that economies of scale are much larger than she previously believed and hence, that we should tolerate a relatively concentrated market in order to take advantage of the available economies of scale

The problem is that we have no historical experience with a competitive electricity market in the U S This has major implications for devising antitrust policies appropriate for the new market For instance, we cannot draw meaningful inferences from the fact that many of the most successful gencos are large because they did not reach their present size as participants in a competitive market The size and profitability of a franchised monopolist has no necessary relationship to the firm's efficiency[60] Some of the largest, most prosperous IOUs are also among the least efficient[61] Similarly, we have no record of performance of a fully competitive wholesale electricity market that will help us draw inferences with respect to the geographic scope of the new markets

A. *Determining the Geographic Scope of an Electricity Market*

Transmission capacity constraints limit the geographic scope of many U S electricity markets at some locations and at some times Bill Hogan has documented the existence and the powerful effects of capacity constraints in many locations[62] The FERC has not previously considered the effects of capacity constraints on the scope of the geographic market relevant to a proposed consolidation of gencos That policy may have been defensible in the prior regulatory environment, but it is no longer defensible in the new environment. The FERC confronts four major problems, however, in its efforts to determine the geographic scope of U S electricity markets (1) inadequate data with respect to the locations of constraints,

60 *See* Charles Studness *Estimating the Financial Cost of Utility Regulation* PUB UTILS FORT Nov 1 1993 at 48 Charles Studness, *Regulation and Local Rate Differences* PUB. UTILS. FORT Aug 15 1992, at 28

61 *See id.*

62. *See e.g* William Hogan *Electricity Transmission and Emerging Competition* PUB UTILS FORT July 1 1995 at 24

(2) inadequate data with respect to the scope and effects of constraints (3) the practical inability to store electricity; and (4) uncertainty with respect to the likelihood that present constraints will dissipate in the near future or conversely, that new constraints will evolve in the near future

The roots of these problems lie in the principles of physical law that govern the flow of electricity in an interconnected grid The capacity of a transmission line or more accurately of a transmission path from point A to point B can vary dramatically, depending on the combination of generators and loads that are on the grid at a particular point in time Bill Hogan has illustrated this phenomenon in several specific contexts [63] In Southern California, for instance, two transmission paths have maximum capacities of 5700 MW and 16 974 MW respectively but their capacities are interrelated in complicated ways If the first path is operating at its maximum capacity of 5700, the capacity of the second path is reduced by fifty percent from 16,976 to approximately 8400 If the second path is operating at maximum capacity, the capacity of the first path is reduced dramatically—from 5700 to 700

These capacity constraints have three dimensions—geographic temporal and quantitative In most operating conditions *e g* ninety percent of the time a grid may be unconstrained over a particular path, but that path may be severely constrained ten percent of the time In the context of markets for most goods an antitrust analyst could safely ignore the existence of temporary transportation capacity constraints If transportation constraints preclude movement of refrigerators into Detroit ten percent of the time, for instance the constraints would have no effect on the geographic scope of the refrigerator market Refrigerator dealers in Detroit would simply maintain an inventory of refrigerators in Detroit sufficient to meet demand during the periods covered by any short-term transportation capacity constraints Thus temporary transportation capacity constraints are worthy of serious consideration only with respect to their potential effects on markets for perishable commodities *e g*, if peaches last for only one week after they are harvested, a one-week constraint on the number of peaches that can be transported into a particular area during the peach harvesting season may properly induce an analyst to conclude that the geographic market for peaches consists only of that area.

Electricity is the ultimate perishable commodity It cannot be economically stored for even a minute Thus at least arguably, even short-term capacity constraints across transmission paths should induce the FERC to conclude that the constraints constitute boundaries of the relevant geographic markets for wholesale electricity To complicate the analysis further, some capacity constraints are effective twenty or thirty percent of the time, rather than a mere ten percent of the time

An analyst also could defend a decision to ignore a transportation capacity constraint if she has reason to believe that capacity is likely to be expanded to eliminate the constraint in the near future The natural gas

63 *Id.*

62

market illustrates this point particularly well During the period 1985 through 1992 the FERC implemented a series of reforms of the gas market that are broadly analogous to the electricity reforms it is now implementing, *e.g.*, equal access to transmission lines combined with functional unbundling of transmission distribution, and wholesales[64] Initially these reforms produced numerous local and regional wholesale gas markets because gas transportation constraints limited the scope of geographic arbitrage In just a few years however the wholesale gas market evolved into two large markets—the eastern and western halves of North America within which a single, national market in which geographic arbitrage precludes any seller from exercising market power in any local or regional market.[65] It would be nice if the FERC could safely assume that the electricity market will evolve in a similar manner The relevant market would then be one-half of the continental United States (or even North America), and the FERC could ignore as implausible any potential concern about the present or future structure of the genco market

There are three reasons, however, for skepticism with respect to any assumption that the electricity market will evolve in the same manner as the gas market.[66] First, gas can be economically stored Major changes in the patterns of ownership, location and operation of gas storage facilities have reduced significantly the potential for temporary gas transportation constraints to limit the geographic scope of the gas market. By contrast electricity simply cannot be stored economically

Second the private incentives to install new pipeline capacity to reduce constraints are strong and straight-forward. If the pre-existing capacity into an area is effectively constrained both incumbent owners of capacity and potential new entrants confront a strong economic incentive to install new capacity The party who installs needed capacity can realistically expect to earn a competitive return on its investment. By contrast the incentives of private parties to invest in needed expansions of an electricity grid are extraordinarily complicated[67] No single firm is likely to have a sufficient economic incentive to invest in a socially beneficial expansion of the grid All participants in grid transactions are potentially affected by any potential expansion. Each is affected to a different extent and sometimes even in different directions Some parties are harmed by some grid expansions In this environment, we can be confident that socially beneficial grid expansions will be proposed only if all participants

64 *See generally* Pierce *supra* note 19 Richard Pierce, *Reconstructing the Natural Gas Market from Wellhead to Burnertip* 9 ENERGY L.J 1 (1988)

65 *See generally* Robert Michaels & Arthur DeVany *Market Based Rates for Interstate Pipelines The Relevant Market and the Real Market*, 16 ENERGY L.J 299 (1995) *See also Canada Gas Market Mimics U.S. In East West Price Difference* NAT GAS WK. Jan. 15 1996 at 10 *NEB Calls Gas Price Split Not North-South, but East West*, NAT GAS. WK., Jan. 8 1996 at 1

66. *See e.g* John Herbert, *Improving Competitive Position with Natural Gas Storage* PUB UTILS FORT Oct. 15 1995 at 24 *Storage Benefits from Technology Competition*, NAT GAS WK Apr 18 1994 at 6

67 *See* William Hogan, Electricity Transmission Policy and Promoting Wholesale Competition 110-13 (Aug. 7 1995) (unpublished manuscript, on file with the author)

in grid transactions agree to form a coalition to support each grid expansion. A socially beneficial grid expansion is unlikely to be proposed unless a high proportion, perhaps even all, of the scores of grid participants reach agreement.[68] This type of decision-making environment creates a high potential for collective action problems that can preclude many socially beneficial capacity expansions from reaching the stage of a viable proposal.[69]

Third, the regulatory barriers to pipeline capacity expansions are low. The FERC has exclusive authority to approve or disapprove a proposed expansion project. Most proposals elicit no opposition, and the FERC almost invariably approves the rare contested projects expeditiously. The FERC approved hundreds of pipeline capacity expansion projects between 1985 and 1992.[70] By contrast, the regulatory barriers to grid expansions are formidable.[71] Any project must be approved by all affected states; many also must be approved by all affected units of local government. Virtually all projects are opposed vigorously. Many socially beneficial expansions are never approved; others are approved only after many years or costly regulatory delay. Thus, the FERC cannot afford to indulge the assumption that the present capacity constraints will dissipate over time. Instead, changes in the patterns of generators and loads spawned by the dramatic changes in the electricity industry's operating environment are likely to create new capacity constraints.

In this situation, the FERC should adopt a merger policy in which it resolves uncertainties with respect to the geographic scope of the relevant market in favor of the smallest plausible market. Such a policy may well yield disapproval of some genco consolidations that would be socially beneficial. That is a risk worth taking, however, given both the present level of uncertainty with respect to the magnitude and effects of transmission constraints and the likelihood that this uncertainty will diminish significantly over time. After a few years of experience with competitive wholesale markets, the FERC will have access to data that will allow it to determine with confidence the magnitude and significance of all capacity constraints. The record of prices at each node on the grid for each half-hour will provide the FERC with all the data required to determine the geographic scope of each market. If that data demonstrates that the market relevant to a proposed genco consolidation is larger than the FERC originally estimated, the FERC can reconsider its prior decision declining to approve the consolidation in light of the new data. By contrast, if the FERC were to approve a consolidation based on its belief that the relevant market is large, and the data produced by the actual performance of wholesale mar-

68. *See id.*

69. *See generally* MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS (1971).

70. *See Factors Affecting the Time it Takes to Approve Construction of Natural Gas Pipelines: Hearings on Before the Subcomm. Env't, Energy, and Natural Resources of the Senate Comm. on Government Operations*, 102d Cong., 1st Sess. 7 (1991) (testimony of Victor Rezendes, GAO).

71. *See* Pierce, *supra* note 19, at 333-35.

kets demonstrates that the relevant market is smaller the FERC would confront major problems in any attempt to eliminate the adverse affects of its prior order approving the consolidation

It does not follow that the FERC (or state PUCs) should resolve all doubts in favor of the smallest plausible market for other antitrust purposes *e g*, in deciding whether to order partial divestiture of generating assets or in deciding whether to allow a genco to make sales at unregulated prices For those purposes an erroneous determination that a market is larger than it turns out to be is less costly The FERC can induce partial divestiture or reimpose price controls if it later determines that it overestimated the geographic scope of the relevant market.

Of course, Congress could render the FERC's task much easier, eliminate virtually all concerns about the structure of the wholesale electricity market, and ensure the creation of a fully-competitive national wholesale market simply by amending the Federal Power Act to create a jurisdictional environment identical to that created by the Natural Gas Act If the FERC had exclusive jurisdiction to approve grid expansion proposals the FERC could safely assume that it would approve all socially beneficial proposals and that a national electricity market would evolve within a few years Once the competitive wholesale markets begin to produce data that document the high social costs of transmission capacity constraints Congress may develop the will to take this step Until that time however the FERC must apply antitrust policies that are based on the assumption that high regulatory barriers will preclude many socially beneficial grid expansions

B Beyond the Threshold Issue

Determining the geographic scope of the relevant market is a necessary but insufficient condition for devising and implementing antitrust policies appropriate to the new electricity market. Defining the relevant market allows an analyst to measure the degree of concentration in the market, *e.g*, an HHI of 1700 or 2600 That measure is useful as a threshold criterion for deciding whether a particular existing market structure or proposed consolidation warrants detailed analysis, but an analyst should consider several other characteristics of a market before she concludes that a level of concentration that exceeds a specified threshold is, or is not acceptable Moreover, generic consideration of those characteristics of a market may suggest the desirability of choosing threshold concentration levels applicable to the electricity market that differ from the threshold criteria the DOJ applies to other markets

At least eight characteristics of a market, in addition to its degree of concentration, have an effect on sellers' ability to exercise market power: (1) ease of entry, (2) degree of excess capacity; (3) proportion of fixed costs, (4) degree of product homogeneity; (5) buyer-side structure, (6) extent of sellers' knowledge of each other's prices and costs, (7) degree of transparency of any exercise of market power; and (8) extent of potentially

available economies of scale.[72] The new electricity market will have some characteristics that suggest diminished concern about potential exercises of market power and other characteristics that suggest heightened concern. To further complicate the policy making task, we do not know much about the characteristic of the market that is most important—the extent of potentially available firm-level economies of scale.

Entry into the wholesale market has become easier over the last two decades.[73] Generating unit-level economies of scale have declined significantly to the point at which a unit with a capacity of 200 to 400 MW exhausts virtually all of the available unit-level economies of scale.[74] Moreover, the time required to enter the market has declined from ten years to about three years over the same period of time. This characteristic of the market suggests that the FERC should have less concern about potential exercises of market power by incumbents today than would have been the case twenty years ago. It is hard to know how much significance to attach to this characteristic, however, for four reasons. First, entry still requires a large investment and approximately three years lead time. Second, viable sites for new generating units are scarce in some areas. Thus, the FERC will have to examine each market with care to determine the extent to which site scarcity poses a barrier to entry in each particular market. Moreover, the FERC will have to combine its site availability study with the available data with respect to transmission capacity. A site should not be considered viable if generation added at that site would be inaccessible to most of the grid because of transmission capacity constraints. Third, the existence of significant excess generating capacity at present raises questions about the extent to which incumbents will charge lower prices because of their concerns about potential market entry. A market with large excess capacity is not a particularly good candidate for entry. Fourth, Richard Green and David Newbery have shown that it is costly and hazardous to rely solely on entry or threat of entry, to limit the exercise of market power by incumbents in a highly concentrated electricity market. In their words:

> In the short run the strategies followed by [the incumbents] will have little effect on the level of entry, and in this period they have very considerable market power, which they can exercise without collusion by offering a supply schedule that is considerably above marginal operating cost. They have additional methods of market manipulation that exploit the constraints on the grid's transmission capacity, since their market power in some regional submarkets is considerably greater than in the country as a whole.[75]

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72. *See supra* note 57.

73. Ease of entry reduces the potential for the exercise of market power. *See* AREEDA ET AL., *supra* note 57, at §§ 420-22; AREEDA & TURNER, *supra* note 31, at § 917; AREEDA & HOVENKAMP, *supra* note 57, at § 917. For the FERC's analysis of entry barriers, see *Kansas City Power & Light Co.*, 67 F.E.R.C. ¶ 61,183 (1994).

74. *See* Paul Joskow & Nancy Rose, *The Effects of Technological Change, Experience, and Environmental Regulation on the Construction of Coal Burning Units*, 16 RAND J. ECON. 1 (1985).

75. Green & Newbery, *supra* note 49, at 951.

Green and Newbery conclude that Great Britain's adoption of a strategy in which potential entry is assumed to temper incumbents' exercise of market power is imposing a large deadweight loss on the British economy [76]

Of course, the present excess capacity is itself a characteristic of the U S electricity market that suggests diminished concern with respect to the potential for exercise of market power Excess capacity can render it more difficult for incumbents to sustain supra-competitive prices [77] Again however, it is difficult to know how much significance to attach to this characteristic of the market, particularly when the excess capacity also reduces the likelihood of market entry or credible threats of entry

The capital investment required to create a unit of generating capacity has declined over the last two decades, but electricity generation remains a capital intensive activity Fixed costs constitute a high proportion of total generating costs [78] This market characteristic suggests heightened concern about potential exercise of market power, but its relative significance is highly uncertain [79]

It is hard to imagine a product or service that is characterized by greater homogeneity than electricity Purchasers neither know nor care about the source of a unit of electricity High product homogeneity increases concern about potential exercises of market power because it eliminates the availability of marketing strategies, such as product differentiation, that impede attempts to exercise market power [80]

It is difficult to know what significance if any, to attach to the structure of the buyer side of the wholesale market. Ordinarily, a highly concentrated buyer market reduces concerns about potential exercises of market power by sellers because buyers then have strategies available that render exercise of market power more difficult.[81] The FERC cannot predict with confidence the structure of the buyer side of the market, however If states implement retail wheeling, there will be many buyers If not the buyer side of the market will be highly concentrated. Even in that situation, however it is not at all clear that buyer concentration will have its usual effect in the context of the Poolco model. Buyers will be purchasing through a market-clearing institution, Poolco, which is required to act in accordance with a pre-determined least cost dispatch strategy that is designed to yield a single market-clearing price at each node for each time period [82] That institutional mechanism seems inherently inconsistent with adoption of the types of purchasing strategies that can confer on buyers

76. Green & Newbery *supra* note 49 at 944-52.

77 *See* AREEDA ET AL., *supra* note 57 at § 404e2, AREEDA & HOVENKAMP *supra* note 57 at § 920 1b6.

78 *See generally* Joskow & Rose, *supra* note 74

79 *See* AREEDA ET AL., *supra* note 57 at § 202c5 AREEDA & TURNER, *supra* note 31 at § 920b

80 *See* AREEDA ET AL., *supra* note 57 at § 404c3 AREEDA & TURNER, *supra* note 31 at § 919 AREEDA & HOVENKAMP *supra* note 57 at § 919

81 *See* AREEDA ET AL., *supra* note 57 at § 404c7 AREEDA & TURNER, *supra* note 31 at § 918 AREEDA & HOVENKAMP *supra* note 57 at § 918.

82. *See supra* notes 43-45

some ability to limit sellers ability to exercise market power when both the seller and the buyer sides of a market are concentrated.[83]

Electricity wholesalers in the new market will have ready access to data that will allow them to draw accurate inferences with respect to each other's pricing strategies and cost structures. The supply schedules submitted by each genco to Poolco each half hour will yield a series of market-clearing nodal prices that each genco can use to make accurate estimates of the pricing strategy and cost structure of every other genco.[84] This market characteristic increases substantially the risk of exercise of market power in a concentrated market.[85] It provides each seller with the data that is most useful to it for purposes of explicit or implicit collusive pricing.

The ability of each genco to learn every other genco's pricing strategies and cost structures is attributable primarily to an important characteristic of the new market. It will be highly transparent to everyone. That increases the risk of exercise of market power by providing valuable data to each genco, but it also reduces the potential for exercise of market power in other ways. The market will be highly transparent to buyers, consumer groups, journalists, politicians, the public and the FERC.[86] Anyone will be able to detect with ease the extent to which gencos are exercising market power. That characteristic of the market supports two permissible and closely related inferences. First, the FERC can respond to the easily-detected exercise of market power in various ways, *e.g.*, by reimposing price controls or by coercing partial divestiture of generating assets. Second, the FERC's ability to detect exercises of market power combined with its ability to respond to such exercises in ways that would displease gencos, reduce the likelihood that gencos will exercise market power. This market characteristic may be an important consideration in some of the FERC's decision-making, *e.g.*, with respect to otherwise close decisions whether to coerce divestiture of generating assets and with respect to otherwise close decisions whether to authorize wholesales at unregulated prices.

The FERC should not attach significance to this characteristic however when it is required to decide whether to approve a proposed consolidation of gencos. It would be unrealistic for the FERC to approve such a consolidation based on the assumption that it could reimpose price controls on the new entity, or order its divestiture, if the FERC later concluded that the new entity was exercising significant market power. Forced divestiture is a remedy that is extremely difficult and costly to implement. The FERC may need to attempt to induce divestiture in some circumstances, but it is unlikely to be successful except in extreme circumstances, and then only after it conducts long, expensive proceedings. Reimposition of price con-

83 *See supra* AREEDA ET AL., *supra* note 57, § 404c; AREEDA & TURNER, *supra* note 31, § 918; AREEDA & HOVENKAMP, *supra* note 57, § 918.

84 *See supra* notes 43–44, 81–86.

85 *See* AREEDA ET AL., *supra* note 57, at §§ 404b, c3, c8; AREEDA & HOVENKAMP, *supra* note 57, at § 920.1.

86 *See supra* notes 43–44, 81–86.

trols is a highly undesirable remedy for market power Creation of a structurally competitive deregulated market will produce much better results than acquiescence in a market so concentrated that it must be subjected to price controls

C Cost Savings

We have now reached the single most important characteristic of the new generating market—the extent of the potentially available firm-level economies of scale Most antitrust analysts including most who have shaped U S antitrust policy over the past fifteen years, believe that it is worth tolerating some degree of exercise of market power if that is necessary to allow firms to reduce their unit costs significantly by reaching a size sufficient to take advantage of potentially available large economies of scale [37] Large cost reductions can more than offset the effects of exercises of market power on prices in some circumstances Thus, the DOJ and the courts have acquiesced in numerous consolidations that increased market concentrations above the initial thresholds that trigger close antitrust scrutiny where the proponents of the consolidations produced convincing evidence that large cost savings would result from the consolidations [38]

The FERC has also attached great significance to potential cost savings in the policies it has previously applied to proposed consolidations in the electricity industry [39] The FERC routinely accepted as valid the sometimes questionable claims of the proponents of a consolidation that it would produce large cost savings In the prior regulatory environment, that practice made sense for three reasons (1) claims of that type were logically plausible (2) the consolidation was unlikely to yield significant competitive harm because competition played a limited role in governing the market, and (3) the FERC could use the process of approving the consolidation to improve competitive conditions by conditioning its approval on the new firm's willingness to eliminate vertical restraints on competition. In the dramatically new conditions that are evolving today, the FERC should take a far more skeptical approach to claims that a consolidation of gencos that increases market power above some pre-defined threshold will yield significant cost savings

A significant proportion of the savings claimed for past IOU consolidations were attributable to the transmission and distribution functions The FERC should ignore cost savings with respect to those functions for purposes of deciding whether to approve a proposed consolidation of generating assets In an unbundled environment, the FERC should apply its antitrust policies independently to each of the functions performed by IOUs It should approve a proposed consolidation conditioned on divestiture of generating assets if application of its antitrust policies yields that result.

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87 *See* AREEDA ET AL *supra* note 57 at § 408 AREEDA & TURNER, *supra* note 31 at §§ 912e 939-62, AREEDA & HOVENKAMP *supra* note 57 at §§ 939-40

88 See cases discussed in AREEDA & HOVENKAMP *supra* note 57 at § 917 1

89 *See supra* notes 9 10

69

We know with considerable confidence the magnitude of the present generating unit-level economies of scale. They are completely exhausted by a unit with a capacity of 400 MW.[90] Economies available through construction and operation of multiple units at a single site might yield further savings up to a maximum capacity of 1600 MW.[91] If those are the only economies relevant to a proposed consolidation of gencos, the FERC can ignore cost savings completely in devising and implementing antitrust policies applicable to gencos. It is hard to imagine a proposed consolidation of gencos that would yield a firm with only 1600 MW of capacity and that would also raise serious concerns with respect to market concentration. The consolidations proposed at present involve IOUs with much larger generating capacities, *e.g.*, an IOU with 5660 MW of capacity has proposed to merge with an IOU with 6038 MW of capacity.[92] If the FERC approves a consolidation of gencos of this size in circumstances where the consolidation would exceed the market concentration threshold, its action must be predicated on the existence of large firm-level economies of scale.

It is difficult to estimate the firm-level economies of scale that will exist in the generating sector of the new electricity market.[93] There is no historical experience that can provide data that is directly relevant to this task. The best we can do is to examine the studies of firm-level economies of scale that were done in the old environment and then to try to adjust the findings in those studies to fit the new environment. I will use as my starting point the comprehensive study by Stephen Breyer and Paul MacAvoy in 1974.[94] They found that consolidation of generating assets would yield large savings attributable to potentially available firm-level economies of scope and coordination. The cost savings fell into four categories: (1) demand diversity savings; (2) savings attributable to least cost dispatch of generating units; (3) savings attributable to the need to maintain smaller reserve margins; and (4) savings measured with reference to environmental costs attributable to the consolidated firm's access to a broader range of sites for generating units.[95]

If Breyer and MacAvoy's findings apply to the new environment in which gencos will operate, they suggest strongly that the FERC should be willing to tolerate a highly concentrated wholesale market in order to allow gencos to take full advantage of the potentially available economies of scope and coordination. Breyer and MacAvoy found that large cost savings might be obtained by acquiescing in consolidations up to the point at which each genco had the capacity to serve twenty-five percent of the national market.[96] That would yield a wholesale market with a barely tolerable HHI of 2500 if the relevant market is the entire country. As discussed

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90 *See generally* Joskow & Rose, *supra* note 74.

91 *See* Joskow & Rose, *supra* note 74. *See also* JOSKOW & SCHMALENSEE, *supra* note 1, at 48-54.

92 *See* Potomac Elec. Power Co. and Baltimore Gas & Elec. Co., FERC Form 1, at 401 (1994).

93 *See* JOSKOW & SCHMALENSEE, *supra* note 1, at 54-58.

94 BREYER & MACAVOY, *supra* note 4, at 91-97.

95 Breyer & MacAvoy, *supra* note 4, at 91-97. *See also* JOSKOW & SCHMALENSEE, *supra* note 1, at 166-67.

96 BREYER & MACAVOY, *supra* note 4, at 95.

earlier, however, transmission capacity constraints limit the geographic scope of the market relevant to a proposed genco consolidation to areas smaller, perhaps much smaller than the whole country.[97] Given the likely size of the relevant markets, consolidation on the scale suggested by the Brever and MacAvoy study would yield markets with HHIs in the range of 5000 to 10,000. Markets that concentrated would perform miserably.

As Brever and MacAvoy recognized, however, virtually all of the firm-level economies they found are potentially available through changes in the institutional environment of the electricity industry without the need to acquiesce in a highly concentrated generating sector.[98] At this point, the characteristics of the Poolco model become relevant to an antitrust analysis of the wholesale electricity market. Use of the Poolco model will allow society to take advantage of *all* of the economies of scope and coordination documented by Brever and MacAvoy, even if the market were to consist of hundreds of gencos, each with a capacity of only 400 to 1600 MW. Of course, proponents of the bilateral trade model contend that it would have the same effects. If the FERC believes that contention, its antitrust policies should be the same whether it embraces the Poolco model or the bilateral trade model. If it does not believe those contentions, it should reject the bilateral trade model. Either way, the FERC should not credit a proposed consolidation with cost savings that will be produced by the transition to a competitive market even in the absence of the consolidation.

Are there potentially available firm-level economies other than those found by Brever and MacAvoy? Proponents of consolidations claim that they will produce large savings attributable to managerial functions, *e.g.*, accounting, personnel, and supervision, and to expertise, *e.g.*, a larger genco may be able to recruit and organize a better engineering staff that can perform its functions at a lower cost per unit of output. The FERC should view claims of that type with skepticism for three reasons. First, the empirical support for large economies of scale at the firm level is weak in the context of most markets.[99] Second, most of the savings attributed to proposed consolidations of large gencos are likely to be realized as a result of the transition to a competitive market even in the absence of the consolidations. The transition from regulated monopoly to unregulated competition *always* requires market participants to reduce their bloated staffs and costs.[100] Third, any potentially available firm-level economies may be attainable consistent with a geographic pattern of ownership of generating assets that raises no market concentration concerns. A genco might have a total capacity of 10,000 MW, for instance, and yet own no more than 2000 MW of capacity in any relevant wholesale market.

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97 *See supra* notes 62-70; Pierce, *supra* note 19, at 333-35.

98 *See* BREYER & MACAVOY, *supra* note 4, at 91-107.

99 *See* AREEDA ET AL., *supra* note 57, at § 408; AREEDA & TURNER, *supra* note 31, at §§ 948-61. *See also* JOSKOW & SCHMALENSEE, *supra* note 1, at 54-58.

100 *See* John Meyer & William Tye, *Toward Achieving Workable Competition in Industries Undergoing a Transition to Deregulation: A Contractual Equilibrium Approach*, 5 YALE J. ON REG. 272, 277-79 (1988).

Proponents of genco consolidations undoubtedly will claim that their proposed transaction would produce cost savings attributable to other sources At least some of these claims may well prove to be true but the FERC will not be in a position to verify or refute claims of this type in the near future The data required to perform this critical task will not be available until we have several years of experience operating in the new environment Until the FERC has the historical data required to evaluate claims of savings attributable to a proposed consolidation of generating assets that would produce a market concentration above the threshold of antitrust concern it should consider all such claims skeptically

D Policy Implications

My evaluation of the antitrust issues raised by the transition to the new method of providing electricity service supports the following recommended policies First the FERC should be prepared to approve and indeed to encourage virtually any conceivable consolidation of transmission assets All such transactions are likely to yield large cost savings and no adverse effects on competition Second the FERC should accord near dispositive deference to the views of state PUCs when it is confronted with a proposal to consolidate distribution assets Many such transactions are likely to yield cost savings while the effects of such transactions on market performance are both highly uncertain and largely within the control of state PUCs Third, the FERC should adopt a conservative initial set of policies with respect to proposed changes in the structure of the generation market The conservatism I urge in that context has several elements that require elaboration

First the FERC should adopt and apply the threshold market concentration criteria the DOJ uses to determine whether a proposed consolidation in an unregulated market raises antitrust concerns While the new electricity market has several unusual characteristics that may have effects on the relationship between market concentration and potential exercise of market power, it is impossible to predict with confidence the net effects of those characteristics Second, the FERC should resolve all uncertainties with respect to the geographic scope of a wholesale market in favor of the smallest plausible market The magnitude, temporal scope, and effects of transmission capacity constraints are highly uncertain at present Third the FERC should adopt a posture of skepticism toward any claims that a proposed consolidation that exceeds the market concentration threshold would yield savings sufficient to justify approval of the consolidation Again, the existence of economies of that magnitude is highly uncertain at present.

These are two alternatives to this approach to proposed consolidations that might be appealing in some circumstances First if a market would be large enough to be compatible with a proposed consolidation but for the existence of a transmission capacity constraint with limited geographic and temporal dimensions, *e g*, a path from two generating plants that is constrained ten percent of the time, the FERC might be able to devise a condi-

tion to approval of the proposed consolidation that is narrowly-tailored to avoid the potential problems created by the capacity constraint The FERC might require, for instance, that the plants affected by the capacity constraint be bid at a price equal to the short-term marginal cost during the periods in which the path is constrained

Second, the FERC could approve a proposed genco consolidation in conditions in which the geographic scope of the relevant market is uncertain if the parties to the transaction were willing to commit to divest all or a portion of their generating assets in the future if the FERC then determines that the market is unduly concentrated Some utilities might prefer this alternative for two reasons (1) they would be able to retain all their generating assets if the performance of the market rebuts any inference of exercise of market power; and (2) even if they are required to divest generating assets, they would not have to complete all of the arduous legal and financial tasks attendant to a divestiture at the same time their resources and personnel are severely stressed by performance of the many tasks attendant to a merger This alternative is critically dependent on the parties' unequivocal acceptance of the FERC's power to order a subsequent divestiture, however The FERC lacks the power to order a divestiture of assets absent an IOU's voluntary acquiescence in the FERC's assertion of such a contingent power as a condition to an order approving a consolidation The FERC has indirect means of inducing involuntary divestiture in some circumstances, but those means are too blunt and costly to warrant an assumption that they would be fully effective in eliminating the adverse effects of the FERC's approval of consolidation of generating assets that has the effect of inflating the price of electricity by allowing sellers to exercise market power

I want to emphasize that I propose these conservative merger policies only as initial, interim policies A single change in the relevant law would have a dramatic effect on the analysis and on the policy prescriptions If Congress were to amend the FPA to confer on the FERC exclusive power to approve or disapprove any proposed expansion of transmission capacity the FERC could approve virtually any proposed consolidation of generating assets without any concern that it might have an adverse effect on the performance of the market.[101] In that changed situation, the FERC could safely assume that the electricity market would evolve in a manner generally analogous to the gas market. The wholesale electricity market relevant to a proposed consolidation would consist of at least an entire region and perhaps even the entire continent. Such a market would perform well even if it consisted of only five or six extremely large gencos

Absent such a statutory amendment, any of several potential changes in our understanding of the characteristics and performance of the new wholesale electricity market could suggest the need for a change in policy that is more hospitable to proposed consolidations of gencos These include (1) evidence that the relevant markets are larger than we initially

101 *See supra* notes 62 70 Pierce *supra* note 19 at 333-35

assumed because transmission capacity constraints have fewer effects than we initially assumed (2) evidence that relatively concentrated wholesale electricity markets do not give rise to significant exercises of market power and/or (3) evidence that economies of scale in the generation and wholesale of electricity are larger than we initially assumed A few years experience with competitive wholesale markets will provide solid data relevant to each of those issues

The same wide range of uncertainty that should induce the FERC to take a cautious and skeptical approach toward proposed consolidations should induce it to take a similar approach to any potential coerced divestiture of generating assets in any context except as a condition to the approval of a proposed consolidation of vertically-integrated IOUs The FERC (or a state PUC) could well regret any divestiture ordered in today's conditions of uncertainty once it has access to vastly superior data relevant to the relationship between market structure and market performance in the new environment. In the context of deciding whether to attempt to coerce partial divestiture of generating assets the FERC should resolve all uncertainties in favor of (1) the largest plausible geographic market (2) the weakest plausible relationship between market concentration and exercise of significant market power and (3) the largest plausible economies of scale in performing the generation and wholesale functions After just a few years experience with competitive wholesale markets the FERC will have good data that will either confirm or refute any present beliefs that the pre-existing market structure requires divestiture

This leaves just one crucial issue to be addressed What criteria should the FERC use to decide whether to authorize unregulated (or loosely regulated) sales in a particular wholesale market? In this context the FERC should apply the permissive criteria applicable to potential divestitures rather than the restrictive criteria applicable to proposed consolidations for three reasons First price controls are so destructive that the FERC's goal should be to create an unregulated, structurally competitive wholesale market. Even a flawed market structure that produces significant exercises of market power is likely to perform better than a market that is subject to price controls Second, maximizing the scope of unregulated wholesales will maximize the amount and value of the data that will be available to the FERC to devise well-supported long-term policies applicable to the structure of the wholesale market. After a few years experience with several unregulated wholesale markets with widely varying characteristics, the FERC will have a solid data base that will allow it to address the crucial issues of geographic scope, relationship between market concentration and market performance, and existence and scope of economies of scale If the FERC instead retains price controls on wholesales in all markets that are arguably unduly concentrated, it will experience great difficulty in its efforts to address those issues because it will lack the data required to perform that task Third, the FERC should not conceive of imposition or retention of price controls as an end in itself Rather, the FERC should use its power to impose price controls as one of its primary sources of leverage

in its efforts to obtain a sufficiently competitive market structure Any order imposing or retaining price controls on a participant in the wholesale market should be predicated on a finding that the relevant market is unduly concentrated and should be coupled with a commitment to eliminate the price controls if the market participant acts in ways that yield an acceptable market structure *i e*, by divesting part of its generating assets In other words, the FERC should conceive of its power to impose retain relax or eliminate price controls as one of its most potent tools to induce any structural changes in wholesale markets it ultimately finds necessary to create a structurally competitive market It follows that the FERC should eliminate price controls in all markets that are even arguably structurally competitive today In any context in which there is doubt about that issue, however the FERC should eliminate the price controls on a temporary, experimental basis *e g* for three to five years By the time the experiments end the FERC should have the data necessary to address the critical issues of geographic scope, relationship between market concentration and exercise of market power and magnitude of economies of scale

V Conclusion

To summarize, the FERC should encourage all potential consolidations of transmission assets It should defer to the positions of state PUCs with respect to all proposed consolidations of distribution assets It should take a conservative initial attitude toward all proposed changes in the structure of the wholesale market, both proposed consolidations and potential coerced divestitures It should eliminate price controls on virtually all wholesales on an experimental basis and use the data made available by that experiment as the basis for a more refined set of policies applicable to the structure of the wholesale market in the dramatically new environment that it is in the process of creating

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A Generation Market Structure to Promote Price Competition

Prepared for

Advisory Committee on Competition in Ontario's Electricity System

Final Report

May 1, 1996

Her Majesty the Queen in Right of Ontario as represented by the Minister of Environment & Energy (Advisory Committee on Competition in Ontario's Electricity System)

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I. Introduction

A Overview

The Advisory Committee on Competition in Ontario's Electricity System (Advisory Committee) has engaged Reed Consulting Group (RCG) to provide it with advice on the configuration of generating assets in the Province of Ontario to support price competition in a restructured electric generation market This report presents RCG's findings and conclusions regarding a market structure for the Ontario electric generation market that will promote price competition

RCG's findings are based on theoretical considerations regarding market structure, empirical evidence gathered from electric restructuring initiatives that have been undertaken by other jurisdictions, and the specific facts and infrastructure in place in Ontario Consistent with our charge, we have provided advice on how to structure a generation market that will promote price competition RCG has also considered the implications of this market structure on the overall economic efficiency of the market While we recognize that the primary objective of a competitive generation market is to promote robust price competition, it is also important that the market structure promote overall economic efficiency In an efficient market, prices are such that the allocation of goods and services is optimal and the production of those goods is accomplished at minimum cost The latter is referred to as productive efficiency, the former is allocative efficiency Our objective has been to recommend a market structure which is conducive to both types of efficiency This has caused us to balance our objective of recommending a market structure that will promote price competition with a concern for ensuring that the resulting configuration of generation assets is efficient and, to the degree possible, able to realize the economies of scale that are available to generation companies (Gencos) [1, 2]

A Genco is a company that owns generation assets and is not vertically integrated, *i e* owns no transmission or distribution facilities A Genco may have other lines of business outside the electric utility industry

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II. Theoretical Considerations to Developing a Market Structure

A. Overview of Considerations

RCG's approach to proposing a market structure for the Ontario electric generation market that would promote price competition has been to outline the characteristics of a market structure that would result in a "workably competitive" market In an industry such as electric generation in which potential economies of scale exist, a significant efficiency loss would occur in most geographic markets if firms were of a size necessary for the structural attributes of perfect competition to be realized [3] Therefore, it is generally acknowledged that perfect competition, from a purely structural standpoint, is not a reasonable standard for most electric generation markets given current electric generation technology As noted above, a more common standard when evaluating the acceptability of an industry's market structure is to assess whether the market is workably competitive, *i e* , that the level of competition within the market is sufficient to prevent any one market participant or group of participants acting in concert, from being able to exercise market power

Market power is defined as the ability of a market participant to profitably maintain prices above competitive levels for a significant period of time (U S Department of Justice and Federal Trade Commission, *Horizontal Merger Guidelines*, April 2, 1992) Market power is of concern because it can, if exercised, impose costs on society In those markets where market power is exercised, the output is restricted to less than the "efficient" level and, as a result, prices are increased above their competitive levels This causes a misallocation of resources and a net welfare loss for society Therefore, in a market where a market participant, or group of market participants acting in concert, is able and chooses to exercise market power, economic efficiency will not be

[3] A market is considered perfectly competitive if the following conditions are satisfied (1) there are a large number of firms with an insubstantial share of the market; (2) these firms produce a homogenous product using identical production processes (3) market participants possess perfect

fully realized In short, allocative inefficiencies arise from the exercise of market power because goods are not allocated to those who value them the highest In addition, productive inefficiencies may result because of weaker pressures to keep costs down Finally, dynamic inefficiencies may be caused since there will likely be less incentive for product innovation and development

A firm's ability to effectively exercise market power is determined by the options available to customers (*i e* the customers' demand response relative to an increase in price or price elasticity of demand),[5] and the firm's ability to restrict the supply of the particular product or service For example, if the demand for a product is highly elastic, *i e* the percentage change in demand is greater than the percentage change in price, then if a market participant were to increase its price, the reduction in demand would likely make that increase in price unprofitable

B Structural Analysis

1 *Introduction*

In the context of identifying a market structure that would result in a "workably competitive" market an analysis assessing the current structure of the market in question and the interaction and influence of the participants in that market is necessary

Evaluating the structure of a market involves identifying the attributes of the market and comparing them to the extremes (*i e*, perfectly competitive or purely monopolistic markets) On a very basic level, a structural analysis can be understood in terms of a

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information, and (4) entry and exit to the market is free Implicit within this definition is the assumption that the demand curve facing each firm is horizontal such that the firm is a price taker

[5] Economic efficiency can be measured by three criteria (1) productive efficiency under which firms have strong and direct incentives to minimize the costs of producing goods and services demanded (2) allocative efficiency under which market prices are used to allocate products to those market participants that value the products the most and (3) dynamic efficiency under which competitive forces promote the introduction and adoption of new technologies and products to better serve society's demands

continuum of competitiveness On the left of the continuum are markets that are purely competitive on the right are markets that are purely monopolistic Perfectly competitive markets are described as having innumerable sellers all producing as much output as possible at prevailing prices Purely monopolistic markets, on the other hand, contain only one seller who is able to establish the market price by restricting its output As an illustrative tool, the continuum highlights the link between market concentration (structure) and competitiveness (performance) Most markets, including the electric generation market, do not mirror either of these extremes, but rather fall somewhere in the middle of the continuum Therefore, the focus of much market power analysis, and the present analysis in particular, is in determining where on the spectrum the market lies, comparing it with the known textbook extremes, and drawing inferences about the level of competition in the market

Structure is only one indicator of the competitiveness of a market This fact is illustrated by the myriad of real-life examples of industries that run counter to the structure-performance paradigm that underlies the continuum (*e g*, unconcentrated industries with relatively mild degrees of competition or concentrated industries with robust competition) The results of a structural assessment, therefore, should be used in combination with other analytical tools to determine the appropriate market structure [6] RCG has also evaluated the ease of and barriers to market entry in its analysis of the appropriate market structure for Ontario's electric generation market

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[5] The price elasticity of demand for a specific product is measured by the percentage change in demand for the product divided by the percentage change in price of the product.

[6] RCG notes that to be as comprehensive as possible a specific assessment of the behavioral attributes of a market should be performed in an analysis of market power Analysis of the behavioral attributes of a market could include various quantitative evaluations (*e g*, estimating demand elasticities, cross price elasticities transportation and production costs and information costs) as well as the interaction of firms in a market Due to data limitations however the breadth of a behavioral analysis can be limited In this case, due to quantitative information limitations our analysis of the behavioral features of Ontario's electric generation market is limited to the contestability of that market and a consideration of production costs

Following the discussion of the desirable structural features of the market, RCG will discuss market entry considerations, namely the contestability of the market, that must be reflected in any policy decision used as a basis to institute structural changes in the market

2 *The Application of Structural Analysis*

At the core of a firm s ability to exercise market power is its ability to restrict its output from the market It is, however not simply the ability to withhold output from the market It is the ability to withhold output from the market, thereby reducing the overall aggregate supply by a magnitude sufficient to elicit a price response For example, if a firm withdraws capacity from the market in an effort to raise prices only to have competitors replace its sales to the market, then it would not have market power Furthermore, if the increase in the market price from the exercise of market power caused others to enter the market within a short period, then this firm would not have market power [7]

As previously discussed, both structural and behavioral issues must be addressed before one can definitively conclude that a firm has the potential to exercise market power However, as a starting point, the analyst should consider the market share of each firm in the market Although not conclusive as an indicator, market share (and ultimately overall market concentration) is important because it sheds light on how the market might operate in a static and dynamic sense and provides a useful analytical tool

For a seller to be able to profitably raise its price unilaterally it must have a large market share since its share of the benefits from the output restriction that causes the price increase is determined by its market share In other words, market share is important

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Some delay in the supply response of rivals is expected because it takes time to acquire information about market conditions and in some instance may require the rival to construct new generating capacity (See Section II E for a discussion of timeliness of entry)

since the profitability of any output restriction depends on the amount of production remaining after the restriction [8]

However, an individual firm s market share should be viewed in the context of the market shares of other competing firms such that if the market is dominated by relatively few firms, *i e* , is highly concentrated firms should be subjected to scrutiny at lower market share thresholds than in an unconcentrated industry [9] Furthermore, because the Advisory Committee is concerned with the overall market structure of the Ontario electric generation market rather than with a particular market participant, a cumulative assessment of the relative market shares of all industry participants is more meaningful than attempting to identify what is likely to be the threshold market share that would allow a firm to exercise market power

Market concentration is significant when attempting to establish a market structure that will promote price competition because an individual firm's ability to behave uncompetitively is determined largely by competitive interactions with competing suppliers If there is a relatively limited number of competitors, and these competitors all have relatively high market shares, then each is likely to benefit more from accepting the higher market price than from engaging in a competitive response, *e g* , an increase in output, to a price increase If there is a large number of sellers in a market, then coordination between market participants would likely be necessary to effect a price increase, and such coordination becomes more difficult since there is an increased incentive for individual market participants to undercut the established price in an effort to secure a greater market share

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[8] For example in a bid-based pool, if a Genco with a large market share bid high in an effort to increase the market-clearing price, it would lose only a proportion of its market share whereas a Genco with only one unit would risk losing its whole market share if it bid above the market-clearing price

[9] For example when assessing whether a firm should be granted authority to charge market-based rates Joskow recommended that if the firm were in a highly concentrated market a market share greater than 20% should cause the firm to be subjected to greater scrutiny while if the market were not highly concentrated a market share greater than 35% would cause the firm to be subjected to greater scrutiny (Paul L Joskow *Horizontal Market Power in Wholesale Power Markets* August 1995)

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3 *Regulatory Standards for Assessing Market Power*

When assessing whether a market is concentrated and whether a market participant is likely to have market power regulatory agencies commonly use two measures of market concentration (1) the four-firm concentration ratio, which, as its name suggests, measures the market share of the four largest firms in the market, and (2) the Herfindahl-Hirschman Index (HHI) which is calculated by summing the squares of the individual market shares of all participants [10] RCG believes that the HHI offers two primary advantages relative to the four-firm concentration ratio (1) it gives proportionately greater weight to the market shares of the larger firms, in accord with their relative importance in market transactions, and (2) it takes account of all the firms in the market

In Canada, market power concerns stemming from mergers are assessed by the Director of Investigation and Research's (Director's), *Competition Act* The Director has established *Merger Enforcement Guidelines* that are used to assess when a merger is likely to have an anticompetitive effect and when government intervention is likely to be necessary The *Merger Enforcement Guidelines* indicate that the Director will generally not challenge a merger where the post-merger market share of (1) the merged entity would be less than 35%,[11] or (2) the four largest firms in the market would be less than 65% (p 21)

In the U S , the U S DOJ and Federal Trade Commission (FTC) typically police market power concerns and have developed standards for increases in the HHI as a result of a merger For example, in their *Horizontal Merger Guidelines*, the DOJ and FTC indicate that a market with an HHI of 1800 is considered highly concentrated and mergers of firms in these markets that result in an increase in the HHI of more than 50 points

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[10] Therefore if there were four firms in a market each with a 25% market share the HHI would be 2500 ($25\%^2 \times 4$)

[11] The U S Department of Justice (DOJ) employed a similar leading firm standard in their 1984 *Horizontal Merger Guidelines* under which it indicated that it was likely to challenge the merger of

potentially raise significant competitive concerns However when assessing the appropriate regulatory regime for oil pipelines, the DOJ employs a different threshold In its report on *Oil Pipeline Deregulation* the DOJ found that an HHI of 2500 is 'a reasonable threshold above which pipelines should be presumed to require continued regulation ' (May 1986, p 30) The DOJ supported the higher HHI threshold because "when the continued regulation of an industry rather than a merger is the issue the benefits of preventing anticompetitive behavior, which regulation presumably confers must be weighted against the direct and indirect costs of regulation " (pp 29-30) This distinction between when the two thresholds should be applied is significant RCG believes that everything else remaining equal, the HHI of 1800 is probably the most relevant threshold when attempting to determine a market structure that will promote price competition [12] However, the use of an HHI as an assessment of the competitiveness of the market should also consider the potential for entry by competitors, the shape of the industry supply curve as discussed below and short-run demand elasticities for electricity

4 ***Empirical Evidence***

Research performed by Green and Newbery on the British and Welsh pool in the United Kingdom which, at the time of the study, was best characterized as a duopoly,[13] indicated that the uncompetitive pricing by the two dominant firms resulted in an efficiency loss, *i e* , a reduced consumer surplus of approximately 6% of the total industry revenue (Richard J Green and David M Newbery, "Competition in the British Electricity Spot Market," *Journal of Political Economy*, October, 1992, pp 929-953) Green & Newbery found that if the market were composed of five equally sized firms the electric generation market would be workably competitive However, a more recent study of this same market found that "prices are much closer to marginal costs than

any firm with a market share of at least one percent with the leading firm in the market, provided the leading firm has a market share that is at least 35% " (June 14, 1984, p 16)

[12] An HHI of 1800 implies that there would be at least six firms in the market which would have roughly equal market shares

[13] A duopoly is a market that is dominated by two major firms

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even theories of non-collusive supply predict,' thereby suggesting that efficiency losses are smaller than estimated by Green and Newbery and that the resulting efficiency loss from fewer than five firms may be lower than estimated (Catherine D Wolfram, "Measuring Duopoly Power in the British Electricity Spot Market,' November 1995) An analysis of the Swedish electricity market performed by Anderson and Bergman confirmed the results of Green and Newbery Specifically Andersson and Bergman found that "if the electricity market consists of at least five electricity producing firms of equal size their possibility to influence the market price is reduced significantly" (Bo Andersson and Lars Bergman, "Market Structure and the Price of Electricity An Ex Ante Analysis of the Deregulated Swedish Electricity Market," *The Energy Journal*, Vol 16, No 2, p 107)

5. ***Conclusions: Structural Considerations to Promote a Competitive Market***

Based on the standards applied by Canadian regulators, *i e* , a four-firm concentration ratio of 65%, and American regulators which suggests that approximately six equally sized firms are needed to provide a competitive market, and Green and Newbery's, Andersson and Bergman's findings that five equally size firms are likely to provide a competitive generation market RCG believes that, based solely on structural considerations and without consideration of the possible implications on economies of scale of the resulting Gencos, that a minimum of five Gencos would likely provide a market structure that promotes price competition As discussed, RCG believes that consideration should also be given to the shape and composition of the industry supply curve and the ease of entry since this will be essential if the market is to remain competitive

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C Assessment of Economies of Scale

1 *Review of the Theory of Economies of Scale*

As acknowledged above developing a market structure for the Ontario electric generation market that achieves the highest possible level of economic efficiency requires balancing the objectives of price competition and economies of scale Empirical evidence regarding economies of scale in electric generation is reviewed below to suggest a range of estimates of minimum efficient scale (MES) which can be used in evaluating the appropriate market structure for Ontario

The optimal number of firms in any market is determined, at least in part, by the economies of scale and scope of the firms in the market Firm level economies of scale and scope are in turn determined by production technology Economies of scale refer to the reduction in average unit costs from increasing the volume of outputs Economies of scope refer to the reduction in average unit costs from producing a mix of output Economies of scale and scope influence the number of firms in a market by dictating the size of those firms With a fixed level of demand, the optimum number of firms can be estimated by dividing market demand by the optimal size of the firm In this context, the optimal size of the firm refers to that size which minimizes average unit costs, *i e* , the MES

2. *Empirical Research on Economies of Scale in the Electric Generation Sector*

Economies of scale can be realized at three different levels of aggregation (1) the individual generating unit, (2) the generating station which is comprised of several generating units, and (3) the enterprise Because our focus is on market structure, the MES at the enterprise level is of the most relevance However, the MES at the generating unit level is discussed because it has a bearing on the risks associated with market entry and the implication of MES on the ease of entry is discussed below in Section II-E

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Evidence suggests that the most significant economies of scale are realized at the level of the individual generating unit in terms of capital cost savings and the higher efficiencies that are offered by larger units [14] However, the MES at the generating unit level has decreased dramatically since the 1980s with the widespread application of combined cycles which are based on aero-derivative engines which are able to achieve high efficiencies and low capital costs with an MES of 250 MW, compared to 500 MW, which represented the MES in the 1970s

It is more difficult to assess the MES at the enterprise level A relatively wide range of estimates of the MES for generation companies exist In a study performed for the government of New South Wales (Australia), Egan noted that a "benchmarking analysis of 153 generation utilities with 477 plants in 11 countries indicates that the minimum efficient size for generation businesses is in the region of 1000 MW to 5000 MW while the average size of generators displaying constant returns to scale is 3100 MW" (M Egan, *Electricity Reform Statement*, 1995 p 10 cited in "Does Pacific Power Have Market Power?", Industry Commission August 14, 1995, p 122) This study focused primarily on coal-fired facilities

Another study undertaken for the New South Wales Treasury reviewed the results of several studies and concluded that for steam-based electricity generation technologies

- previous studies have shown that the minimum economic size of a generation business is likely to be in the range of 1500 MW to 4000 MW
- data envelopment analysis (DEA) shows that the average size of plant operating at an optimal scale (at which constant returns to scale are achieved) is around 3000 MW However, there are firms operating at constant returns to scale between 60 MW and 28000 MW, and
- the DEA Modeling also shows that decreasing returns to scale appear in generation firms that are 6000 MW and over (London Economics, 1994d

[14] These economies of scale are realized during design and construction such that once the unit is installed typically there are only limited opportunities for lowering the unit's variable operating costs

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cited in "Does Pacific Power Have Market Power?", Industry Commission August 14, 1995 p 145)

This study focused only on generators that relied on coal for 90% or more of their fuel requirements and, as such, did not consider the economies of scale for a generator with a full range of generation technologies However, the findings cited are largely consistent with those reported by others For example, research using 1970 data found no significant scale effects for outputs between 19 8 TWh and 67 1 TWh representing a capacity rating of approximately 4,000 MW to 14,000 MW, thereby suggesting that the MES for electric generation was achieved at 4,000 MW (Laurits R Christensen, and William H Greene "Economies of Scale in U S Electric Power Generation," *Journal of Political Economy*, Vol 84 No 4 pt1 (August 1976) 655-76) Others have suggested that if there is a tight power pool, the minimum efficient scale for a vertically integrated electric utility is much smaller, 10 TWh to 35 TWh or 2,000 MW to 7,500 MW, and that the integrated operation economies achieved through greater number of units could be captured through a power pool or alternatively an independent system operator (Raymond Hartman "The Efficiency Effects of Electric Utility Mergers Lessons from the Statistical Cost Analysis," Working Paper No 90-14, School of Law, Boalt Hall, University of California, Berkeley) Hartman's findings are consistent with those of Moorhouse who found that "Interconnection power pooling, and coordination among independent utilities reduces system economies of scale from the 8,000 - 10,000 MW level to 1 600 - 3,800 MW level (J Moorhouse, The Uncertain Future of the Electric Power Industry, in *Electric Power Deregulation and the Public Interest* J Moorehouse, ed 1986 cited in D Hatcher, "Were Joskow and Schmalensee Wrong?', *The Electricity Journal*, Vol 4 No 7, September 1991, p 30)

3 ***Strategic Assessment of Economies of Scale***

a Factors contributing to Economies of Scale

Several strategic factors should be considered to ensure that the resulting industry structure is best able to achieve any economies of scale that may be present First of

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all units at individual generating stations should be owned and operated by the same entity so that any plant efficiencies from shared fuel storage facilities, staffing, and spare parts can be realized Secondly, hydro facilities located on the same river systems should be owned and operated by the same entity to better allow coordination of flows and unit output [15] [16]

b Evaluation of Claimed Strategic Economies of Scale

In Ontario Hydro Management's Submission to the Advisory Committee, Hydro claimed that "[t]he efficiency of operating Hydro's fossil fueled generating stations is enhanced by integrating fuel supply, inventory management and utilization as well as coordination in the planning and execution of plant maintenance It is unlikely that these efficiencies could be duplicated by operating the fossil plants as independent entities" (Appendices, January 25, 1996, p A-2) RCG recognizes that there are likely to be economies of scale associated with each of these functions However, we believe that our proposal to ensure that all units at each generating station are under a common ownership would enable Gencos to continue to achieve the majority of these economies

Hydro claims that competitive leverage, particularly in coal supply and bulk transportation markets, would suffer in disaggregated operations However, three of

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[15] OH has indicated that the "inefficiencies of uncoordinated water utilization are estimated to be as high as 1 TWh based on different storage management objectives, differing station sizes and storage capability on a river and poor outage coordination all resulting in spill The value of this energy is estimated between $25 and $50 million annually" ("Ontario Hydro Management's Submission to the Advisory Committee on Competition in Ontario's Electricity System" Appendices, p A-3)

[16] However, a number of utilities throughout North America coordinate the operation of their hydro facilities to achieve the greatest value from these resources RCG notes that OH has agreements with the New York Power Authority that allow water to be dispatched to units owned by either utility to optimize economics, maintenance practices, and ice management Furthermore, in the Pacific Northwest area of the United States and in British Columbia Canada, thermal and hydroelectric generation is coordinated through the Columbia River Treaty between the two countries and the Pacific Northwest Coordination Agreement which specifies water storage and transfer "rights" and "obligations" among the Bonneville Power Administration the U S Corps of Engineers, various investor-owned and publicly-owned utilities and one large industrial power user The Coordination Agreement formalizes bilateral transactions to ensure that surpluses and deficits are shared to ensure meeting region-wide load requirements

Hydro s five coal-fired generating stations representing 7 055 MW, burn bituminous coal from the U S and the remaining two coal-fired units representing 535 MW, burn lignite from Western Canada RCG has not compared Hydro s delivered coal costs to those cf other electric utilities and s unable to offer an opinion regarding the degree to which it has been able to realize these economies of scale However, RCG notes that for Hydro to fully realize these economies it would have to contract with only one coal supplier in each of the two coal supply basins from which it purchases coal and that this would appear to significantly increase fuel supply risks A more prudent coal purchasing policy that in fact is employed by Hydro is to spread purchases over several suppliers however, this diminishes the economies of scale that can be realized

Hydro also indicates that there are 'considerable economies of scale from the coordinated planning and execution of maintenance for generating plants with the same technology ' (Ontario Hydro Management's Submission to the Advisory Committee on Competition in Ontario's Electricity System, January 25, 1996, Appendices, p A-2) RCG recognizes that because some maintenance work is intermittent and unpredictable maintenance teams can be most effectively utilized if they are spread over many stations and, therefore, the most effective means of realizing these economies may be to have one owner and operator for all of these units Nonetheless, RCG believes that to the extent that the ownership and operation of these units is spread among several Gencos, much of these economies could be realized by contracting for these services from third parties, *i e* , it may be cheaper to contract for these services then to have each Genco maintain a staff to provide the services internally

This question has been addressed by others The state of Victoria (Australia) addressed this issue when assessing the appropriate market structure for its electric generation market, claiming that "it is more efficient to outsource maintenance services, materials supply and storage to the private sector on a competitive tender basis where the private sector can capture the economies of scale and pass these through in

competitive pricing " (State of Victoria Office of State Owned Enterprises 1995b, cited in "Does Pacific Power Have Market Power?", Industry Commission, August 14, 1995, p 146)

Alternatively a number of utilities in the Northwestern United States have even entered into cooperative arrangements to share services where economies could be realized by providing the services over a wider basis These utilities in the Pacific Northwest region share equipment inventories (*e g* , transformers, poles, etc) on an emergency basis and are considering formalizing a system, using information networks (such as the Real-Time Information Network) for not only posting purchase and sales opportunities but also inquiries for generation transmission and distribution spare parts and equipment available for sale RCG believes that Ontario's Gencos could employ such a strategy to minimize the loss of any economies of scale

Hydro indicates that some of these savings stem from applying "processes for maintenance and operation across plants with the same characteristics and design features " ("Ontario Hydro Management's Submission to the Advisory Committee on Competition in Ontario's Electricity System", Appendices p A-2) RCG's proposal of keeping units at individual generating stations under a common owner and operator would allow much of these economies to be realized given that units at a particular generating station typically share the same characteristics and design features

RCG recognizes that there are economies of scale from the integrated operation of generating stations and that typically these economies are more tangible than the cost savings that will be produced by increased competitive pressures However, there is dramatic evidence of the savings yielded by increased competition For example, in Victoria, five state-owned generating stations representing a total of 7,838 MW were disaggregated by generating station, and each generating station was separately managed Even though the average size of each generator less than 1 600 MW, was

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well below the estimated MES of 3 410 MW identified above, the cost savings realized were dramatic

> Direct controllable expenses fell by 10% in 1994/95 with forecasts for a further 13 5% improvement in such costs by 1997/98 This improvement can be attributed to
>
> - labour costs falling 7% in 1994/95 with expectations of further falls of 25% by 1997/98 and
>
> - material contracts and miscellaneous costs falling 12% in 1994/95 with expectations for future falls of 7% by 1997/98 (Victorian Electricity Supply Industry Reform Unit Submission 41, p 2, cited in "Does Pacific Power have Market Power?' Industry Commission, August 14, 1995, p 120)

4 *Conclusions: Minimum Efficient Scale for Generation Company*

Table 1 summarizes the findings of the five studies that reviewed the MES for electric generation companies The mean MES for the five studies cited was 3,410 MW As indicated, two of the studies were primarily for generation companies that relied heavily on coal-fired generation As indicated below, Hydro's mix of fossil units is largely based on coal-fired generation, however, nuclear units account for approximately 46% of Ontario's generation capacity Given the infrastructural and operations and maintenance support requirements for nuclear units, RCG believes that this MES may be too low for a Genco with nuclear units The Christensen and Greene study was for a diverse mix of generation companies, but was based on 1970 data and, as such, does not fully reflect the impact of nuclear units on the MES for a Genco As noted, both the Hartman and Moorhouse studies recognized that some economies could be achieved through interconnections and power pooling with adjoining generators In sum, RCG believes that this mean MES of 3 410 MW represents a reasonable estimate of the MES for a fossil-fuel based Genco, but may be too low for a Genco with nuclear units RCG believes that while the MES for a Genco with nuclear units is probably larger than this estimate of 3,410 MW, the MES can probably be achieved by keeping generating stations under one owner and operator and spinning off support functions to an

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independent entity who could provide these services to the Gencos and other market participants on a competitive basis

Table 1

Summary of Research on the Minimum Efficient Scale for Electric Generation Companies

Study (1)	Minimum Efficient Scale(2) (MW)	Comments
Egan (1995)	3,100	Focused on Coal-fired Facilities
London Economics (1994)	3 000	Focused on Coal-fired Facilities
Christensen and Greene (1978)	4 000	Based on 1970 data
Hartman (1990)	4 250	Range of 2 000 MW to 7 500 suggested
Moorhouse (1986)	2,700	Range of 1 600 MW to 3 800 suggested
Average	3,410	

(1) The year indicated for the study is the year the study was published
(2) Where a range is cited the mid point is presented

D Shape and Composition of the Supply Curve

1 *Theoretical Considerations*

In competitive markets the market price is established by the marginal costs of the highest marginal cost unit necessary to satisfy industry demand Therefore, as discussed below in Section III in the market structure being proposed by RCG, all generators that nominated prices below that of the highest-priced generator needed to clear the market would receive the price paid to this marginal unit In a market where all participants receive the market-clearing price, if there are a sufficient number of competitors in general there will be an incentive for all firms to price the output of their units at their short-run marginal costs In this market, if the firm which owns the last unit to be dispatched in a particular hour also owns several other units with lower short-run marginal costs all of which have been dispatched, and the next unit in the dispatch order has a significantly higher short-run marginal cost, then there would be an incentive for this firm to price the output of its marginal unit just below that of the next unit assuming that it is able to anticipate its competitor s bid price Under these

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conditions, this firm would receive the higher market-clearing price for all of its lower short-run marginal cost units that have been dispatched Since it would have only received the marginal operating cost for the unit that it used to bid-up the market-clearing price, it would not forgo any fixed cost contribution from this unit if it were not in fact dispatched Clearly, there is an incentive for market participants to bid up their price to just below that of the next lowest cost competitor in an effort to obtain a higher market-clearing price

A market participant's ability to behave in this manner will be determined largely by the number of intermediate and baseload units that it owns as well as the shape of the supply curve Specifically, the greater the difference between the marginal operating costs for the unit that would otherwise supply the final unit of demand and the next unit in the dispatch order that was not dispatched, the greater the ability to bid up prices The steepness of the merit order is significant since it is an indication of the ability of generators to profitably bid up prices

This discussion suggests that a firm's market power is influenced by the expected amount of time that its units will be establishing the market-clearing price and the increase in marginal costs represented by the next unit in the dispatch order owned by a competitor If a firm is to be able to exercise market power successfully by increasing the bid prices for its marginal units or not offering their capacity to the market, then it must be able to accurately bid prices that will be nominated by competitors and the unit availabilities for its units and those of competitors [17] The difficulty of accurately forecasting these variables suggests that unless the market participant controls a significant portion of the industry supply curve it would be difficult for the market participant to be able to successfully exercise market power for any significant portion of time

[17] Forecasting the bid prices of competitors is made more difficult by the fact that unit's marginal costs typically vary over the unit s output level

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2 *Consideration of Ontario's Supply Curve*

Figure 1 presents a graphical representation of Ontario's generation supply curve Given the commercial sensitivity of the information needed to construct such a supply curve RCG has relied upon publicly available information such as industry fuel prices, and generic variable operations and maintenance estimates for the specific types of units owned by Hydro [18] In addition RCG has assumed that Hydro s contracts with NUGs are reformulated or bought out so that these units would be dispatched based on their variable operating costs

Figure 1 indicates that Ontario has a significant amount of baseload capacity available relative to system load As expected, Ontario's run-of-river hydro and nuclear units are base loaded The next set of units in the dispatch order would be the NUG combined-cycle units, which are in turn followed by the coal units and finally Hydro's one oil unit, the Lennox generating station

Other than for Hydro's Lennox generating station, which based on the amount of available capacity relative to load in the Province, rarely operates, there is only one area in which there is a significant discontinuity, or step, in the supply curve As discussed above, this is the critical issue with the supply curve since this step would provide Gencos with the ability to bid up the market-clearing price It is significant that Ontario's baseload capacity represents approximately 17,500 MW and that Ontario's minimum load is considerably below this level Based on the unit dispatch order, this suggests that nuclear units might be the marginal units during portions of the year RCG has not been able to definitively answer this question because we have not attempted to determine a maintenance schedule for Ontario's units,[19] and we did not have data on seasonal water flows that would allow RCG to estimate seasonal hydro

[18] Hydro indicated in its January 25 1996 filing with the Advisory Committee that the running costs for its hydro units are about $1/MWh and for its nuclear units are about $2/MWh (Ontario Hydro Management's Submission to the Advisory Committee on Competition in Ontario's Electricity System Appendices p B-1)

[19] To the degree possible maintenance is scheduled during off-peak periods

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output In general we believe that this is an important issue that should be addressed before a market structure for Ontario is established Specifically, as discussed in greater detail below these nuclear units are likely to be bid up to just below the estimated bid price for the NUG combined-cycle units which represent the next resource in the dispatch order The only consideration which would cause these nuclear unit owners to refrain from this behavior would be if they believed that bidding up would cause their units not to be dispatched While RCG believes that the owners of these nuclear units would be able to bid up their units, this is likely to result in a higher market price for only a relatively limited number of hours Furthermore, as system load grows and the minimum load increases, this is likely to occur less frequently

In addition to assessing whether there are any steps in the supply curve, it is necessary to assess whether any one generating station represents a significant segment of the supply curve and the next generating station has a marginal operating cost that is significantly higher It is necessary to evaluate whether one or more generating stations represent a significant segment of the supply curve because RCG is proposing that generating stations be owned and operated by one entity to maintain economies of scale at the generating station A review of Table 2, which lists the generating units by rank order of operating costs, indicates that the eight units at the Naticoke generating station 3,924 MW (net), represent about 70% of the capacity of a 5,600 MW segment of the intermediate section of the Ontario supply curve and that the next major unit in the dispatch order after this segment has a variable operating cost 5 mills above that of the highest-cost Naticoke unit [20] Therefore, there would be a risk of the Genco that controls the Naticoke generating station bidding up when it calculated that the approximately 3,900 MW of generation capacity that it controls would be setting the

[20] The fossil unit ratings presented in Table 2 are from Hydro s March 26 1996 submission to the Advisory Committee The hydro unit ratings reflect the average annual output from these units under normal water conditions The aggregate capacity totals for Hydro discussed elsewhere in this report are from "Ontario Hydro Management's Submission to the Advisory Committee on Competition in Ontario's Electricity System" dated January 25, 1996

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market-clearing price However for several of the fossil generating stations with units in this intermediate section of the supply curve there are additional units that are currently mothballed that could be returned to service to reduce the market share of the owner of the Nanticoke generating station for this segment of the supply curve For example, there are four Lakeview units representing approximately 1 100 MW that have been mothballed which if returned to service may be on the supply curve in the segment represented by the Nanticoke units RCG is not able to make a more definitive statement regarding where these units would likely be positioned on the supply curve because we not have received any data regarding the heat rate, *i e*, the energy conversion efficiency of these mothballed units However, the four operating Lakeview units are within the segment of the supply curve in which the Nanticoke units fall If these Lakeview units were included within this segment of the supply curve then the capacity represented by the Nanticoke units would represent approximately 58% of this segment of the supply curve Furthermore, RCG's analysis has focused only on generating units located within Ontario and conversely assumed that all of the generating units located within Ontario would always be dedicated to the Ontario market However, during some periods Ontario Gencos are likely to find that it is more profitable for them to offer a portion of the output from their units to adjacent markets and Gencos in adjacent markets are likely to find that Ontario represents a more profitable market If this Ontario supply curve were expanded to reflect increased competition from adjacent regions, the Nanticoke units would likely represent a much smaller portion of the intermediate section of the supply curve Therefore, RCG believes that there is a relatively limited risk of the owner of the Nanticoke units being able to exercise market power

E. The Theory of Contestable Markets

The structural analysis presented above while providing meaningful information about the potential level of competition in the Ontario market is only part of the analytical picture As stated in the previous sections, a rigorous market analysis must also encompass behavioral features Studying the behavioral interactions of the firms in a

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market provides insight not only into how we can expect the market to operate today but also what can be expected prospectively Thus, by embodying behavior, the analysis takes on a necessary dynamic dimension

1 *Theory*

The theory of contestable markets postulates that a market can behave competitively regardless of its structure (concentration) if the threat of entry is sufficient A market is said to be contestable if existing firms are compelled to meet customer demand efficiently or risk losing business to potential entrants By comparison, traditional economic theory suggests that if left on their own, firms possessing market power would restrict their output such that the marginal costs of the last unit produced was exactly equal to the marginal revenue received In other words, firms with market power would restrict output in such a way as to achieve the highest price consistent with their cost structure Contestability theory suggests that "monopoly" pricing is not the necessary outcome if the threat of entry is present

There are degrees of contestability as there are degrees of competition A market is said to be perfectly contestable if incumbent firms are vulnerable to "hit and run' entry Hit and run entry can occur if potential entrants can enter a market, collect gains and then leave without costs For a market to be perfectly contestable certain conditions must hold Among them, all firms (existing or potential) must have access to the same production methods and hence cost functions Entry must also not involve any "sunk" costs That is, a firm can enter and exit the market without making irrecoverable expenditures The oft cited example of a perfectly contestable market is airline routes Should an incumbent airline be making supernormal profits, other parties can acquire aircraft via short-term leases, enter the market, undercut the incumbent, and leave, without sunk costs, once prices are depressed back to their competitive levels A monopolist is extremely reluctant to raise his price if this type of entry is possible because at the first sign of monopoly pricing or profits, a competitor would enter the

market undercut the monopolist and leave before the incumbent firm has an opportunity to retaliate

Outside of airline routes, there are few markets where perfect contestability holds However this does not diminish the threat of entry as a constraining factor to the exercise of market power The threat of market entry can be an effective deterrent to the exercise of market power and, as such, induce market participants to price their services competitively and promote innovation There are varying degrees of contestability that act to provide varying degrees of market discipline The degree of contestability and thus market discipline will depend to a large extent on the barriers to entry Markets with sufficiently high barriers to entry can safely be analyzed using traditional economic theory As the barriers to entry fall, theory of contestability becomes a more accurate representation of market behavior

2. *Ease of Entry*

According to economic theory, for the threat of market entry to be an effective deterrent to the exercise of market power, entry into the market must be "easy" Entry is considered easy if it would be (1) timely, *i e*, within a sufficiently short period to limit the profits of the firm exercising market power, (2) likely, *i e*, profitable to the firm entering the market and thereby making such entry likely, and (3) sufficient, *i e*, of a sufficient magnitude of competing product to make the uncompetitive behavior unprofitable [21]

- The U S Federal Energy Regulatory Commission (FERC) has assessed whether existing market participants are likely to be able to exercise market power in the long-run bulk power market by ascertaining whether they are able to erect barriers to entry Specifically, the FERC has focused on the following barriers to entry (1) sites for new capacity development (2) transportation of key inputs *e g* fuel and (3) key inputs to generation In a 1994 case regarding market-based rates for sales from new capacity the FERC found that "for sales from new (un-built) generating capacity there is no need for the Commission to focus on whether the seller has market power in generation as long as the seller has demonstrated that it and its affiliates (1) do not have transportation market power in the relevant market or have adequately mitigated any such market power; and (2) do not own or control other barriers to entry" (Kansas City Power & Light Company 67 FERC ¶ 61 183 pp 61, 552-3)

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3 *Analysis of Barriers to Entry*

Traditional barriers to entry include access to scarce resources, cost advantage of incumbent firms economies of scale, product differentiation and the amount of sunk investment in production costs and strategic behavior on the part of incumbent firms to influence entry In addition to these traditional barriers to entry the following barriers should also be considered regulatory barriers, constraints on transmission capacity, and degree of vertical integration In later sections of this report, RCG outlines the essential structural requirements for a competitive generation market The issues associated with regulatory barriers, transmission constraints, and the degree of vertical integration are addressed there The role of more traditional barriers in the electric generation market is addressed below

In electric generation, access to resources is not of paramount concern to potential entrants The technology is widely known and available to all on equal terms In addition, an incumbent firm attempting to restrict entry can also attempt to restrict access over preferred generation sites, key inputs to generation, and transportation of those inputs to generation facilities In most cases where the relevant geographical market is large it is unlikely that any firm, or group of firms, could effectively exercise control over potential generating sites given the significant availability of these sites Key inputs to electric generation in addition to the supply of electric generation equipment and suitable sites include the supply of generation fuels Again, in broadly defined markets it is unlikely that any entity could control the supply of generation fuels, particularly with respect to fuel oil, natural gas, and coal which are likely to be the fuels utilized by new projects All of these markets are very competitive and served by numerous suppliers Similarly, given the availability of a wide range of transportation alternatives, it is highly improbable that any firm or group of firms could restrict access to transportation services in the oil market And given that natural gas transportation services in North America are provided by open-access pipelines, natural gas transportation services cannot be used to restrict entry Finally, given the availability of a number of different coal transportation alternatives, including the highly competitive

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water-borne transportation market, coal transportation cannot be used to restrict entry Thus, incumbent firms cannot preclude entry through control of key resources

Similarly, incumbents can't effectively forestall entry as a result of a cost advantage With a system peak demand of approximately 25,000 MW and projected annual load growth in excess of 1 5%, the additional electric generation capacity required by the Ontario market each year is significantly greater than the MES for new generating units [22] Therefore, new entrants are able to realize the MES are not required to accept a cost disadvantage relative to incumbents In fact, given the low capital costs and high efficiencies of natural gas-fired combined-cycle projects which are likely to be the electric generation technology employed by market entrants, these entrants will be well-positioned to compete with incumbents As just described, the mere presence of economies of scale is not a barrier to entry It is the combination of economies of scale and the "sunk" nature of the investment in electric generation that presents a potential barrier to entry

Sunk costs are unavoidable costs that once incurred cannot be recovered Except for simple-cycle gas turbines which can be moved to a new site once constructed, an electric generation plant has few alternative uses They cannot be dismantled (without significant cost) and redeployed elsewhere Thus, once the investment is made, it is, for all intents and purposes, sunk Since the investor cannot employ this resource in alternative uses, he must strive to maximize its utilization in an attempt to recover his capital investment The size of the investment will dictate how long it takes to recover the sunk costs If sunk costs can be recovered in a relatively short time frame they do not represent a significant barrier to entry However, as the cost of the investment grows so does the recovery period, sometimes to extremely long periods In these cases entry is especially risky because the potential entrant is faced with substantial uncertainty concerning post-entry prices

[22] As discussed in Section II C 2 the MES for new generating units is approximately 250 MW

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A potential entrant can put downward pressure on market prices in addition to that pressure already being applied by competing incumbent firms In the extreme, prices could fall to such a level after entry has occurred to make recovery of the sunk costs impossible Thus, in those instances where sunk costs are sizable, entrants must be concerned with the impact of their entry on post-entry market prices If the uncertainty about post-entry market prices is too great, entry will be unlikely

While the presence of extremely large sunk costs can prove to be a barrier to entry it is unlikely to be a barrier in today's generation market given the comparatively low capital costs of combined-cycle units and their high efficiencies Given the technological evolution of the industry along with the reliability driven desire to spread risk over much smaller plants, the sunk costs necessary to preclude entry are unlikely to be observed In most cases, we observe entry occurring on a scale that is relatively small when compared to market demand Furthermore, entrants are able to minimize the risks associated with the uncertainty of the post-entry prices by executing fixed price contracts with purchasers Thus, uncertainty of post-entry prices and the impact of strategic behavior on the part of incumbent firms is a limited concern

Strategic behavior to make entry unprofitable or at least appear unprofitable is another potential barrier to entry Outside of control over upstream resources, another strategic behavior that can be employed as a means to hinder entry is predatory pricing Predatory pricing occurs when an incumbent firm sets a price so low as to undercut a rival's costs, thus making the production of the product unprofitable The incumbent firm can send signals to potential entrants that entry will be followed with a pricing strategy that will ultimately prove unprofitable for the entrant The degree to which this strategy is credible and thus successful depends on the financial position and cost structure of the incumbent firm If the incumbent firm enjoys a cost advantage, it can use predatory pricing as a means to prevent entry However, here as well, RCG believes that the high thermal efficiencies of combined-cycles and the competitiveness of natural gas prices ensures that market entrants' variable operating costs will be

below those of other fossil-fuel units that will typically be establishing market-clearing prices This will limit the ability of incumbents to engage in predatory pricing Finally, probably the greatest constraint on predatory pricing by an incumbent will be the amount of capacity that it owns If an incumbent bids down in an effort to forestall entry the prices that it receives for its existing units will be reduced Therefore, given the market shares of incumbents relative to the market entrant, such predatory pricing is likely to be unprofitable

The final form of predatory pricing that incumbents may engage in is to attempt to make prices more volatile in an effort to create uncertainty for potential entrants and for purchasers This behavior was thought to have been observed in the British market, with spot price volatility increasing just before major contracts were to be signed However, RCG believes that this spot price volatility is likely to increase the attractiveness of contracts for differences for purchasers, thereby making it easier for potential entrants to negotiate a contract for difference which in itself makes entry easier

It is clear that the MES for electric generating facilities has decreased dramatically over the last fifteen years It is because of this evolution as well as the other market and regulatory developments described above that the electric market has become vulnerable to entry and is contestable

B. Focus of this Report

As discussed, the focus of RCG's evaluation was the generation market RCG believes that the structure of the retail electricity market need not have a significant bearing on the competitiveness of the generation market Therefore, RCG has not offered an opinion on the appropriate structure of the Ontario retail market However, we recognize that there are institutions and rules that are essential to achieving a competitive generation market and consequently we have offered recommendations regarding their necessary forms

RCG also recognizes that in addition to achieving economic efficiency, other public policy considerations are associated with the structure of the generation market However, we have not attempted to address these other public policy issues

C Contents of this Report

This report contains six sections This Introduction is the first section The second section reviews the theoretical considerations associated with the development of a market structure for the electric generation market and then applies this theory to the specific circumstances of the Ontario electric generation market Section III outlines the specific structural requirements for a competitive generation market Section IV reviews Ontario's existing generation mix and develops recommendations on how the generation market can be structured to achieve Ontario's objective of a competitive generation market Section V reviews potential strategies for mitigating any market power possessed by the Ontario Gencos Section VI summarizes RCG's conclusions and recommendations

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As discussed in an upcoming section economies of scale have a direct bearing on the cost of production

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MITIGATION OF MARKET POWER IN COMPETITIVE ELECTRIC POWER MARKETS[1]

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Introduction

Methods for measuring market power in competitive electric power markets and options for its mitigation are areas that are areas that are receiving a lot of attention in the literature. Measurement methods rely on measuring concentration indices such as the Hirschman-Herfindahl Index (HHI), i.e., to measure the concentration of generating firms in geographic markets and therefore identify whether any firm (or group of firms) might tend to exercise market power. Options for its mitigation such as increasing supply, reducing demand, or imposing a regulatory solution to the problem however, are often considered in a piecemeal manner, i.e., a systematic and consistent basis for selecting between individual or packages of measures that mitigate market power at least cost to society is often missing.

We propose a 5-step process, termed ADDAS (**Assess** the Situation, i.e., constraint, **Define** the objective, **Develop** a preferred package of mitigation measures, **Analyze** for contingencies, and **Select** for implementation) intended to help regulators and planners maximize the net benefit to consumers of market power mitigation in constrained electric power markets, in a systematic and consistent manner.

Central to ADDAS is the use of a supply curve to evaluate individual market power mitigation options. Following the evaluation, such individual options are combined into portfolios, taking into account factors such as lumpiness or continuousness of individual mitigation options, and ranked on the basis of their net consumer benefit, i.e., the difference between the consumer benefit from mitigation less consumer payments to cover (or more than cover) the cost to put in place the portfolio. The theory underlying ADDAS is that by ranking mitigation portfolios on the basis of net consumer benefit, a regulator or planner can identify and therefore chose for implementation one which maximizes the net consumer benefit of mitigating market power.

Market Power

Market Power is generally defined as the ability of a firm (or group of firms acting jointly) to raise prices above competitive levels and/or restrict output below competitive levels for a sustained period of time, for the purpose of increasing its profit (described generally in Landes & Posner, 1981, Joskow, 1995, Hogan, 1995, Market Power Analysis of

Pacific Gas & Electric Company 1996 New York State Public Service Commission Staff Report on Load Pockets and Market Power 1996) The problem of market power might arise in a competitive electric power market on account of physical constraints a good example of which might be a geographic area of load that, because of transmission limitations, must have resources internal to the area so as to ensure that the area's load is served reliably (Referred to as "Load Pockets" in the Staff Report on Load Pockets and Market Power, 1996, resources internal to the area are sometimes referred to as "must-run" generation, see Market Power Analysis of Pacific Gas & Electric Company 1996)[2] An owner of such resources in the constrained geographic area might be in a position to raise prices or withhold output in order to maximize earnings [3]

There is currently an active debate concerning how electric power markets and products should be defined in order to assess whether suppliers might (or might not) exert market power in constrained electric power markets, and why and over what duration such markets might be constrained (see Werden, 1996, Brand, 1996)[4] Despite the market power debate however, voices seems to be converging on the notion that its importance lies in its potential consequence customers located in constrained markets that have no realistic option but to buy from a monopolist located in the market might see an increase in the prices that they pay for electricity! It is this consequence of market power, i e , its impact on retail prices

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2 The phrase "Transmission limitations" as used in this research imply a limitation on the Total Transfer Capability (TTC) between two load areas after assuming that the grid is operating normally and is stable. (Glossary of Terms Task Force of the North American Reliability Council (NERC) August 1996)

3 The straightforward solution to the market power problem in a constrained electric power market might be to divest generation and/or set the stage for new supply to locate in the constrained market, but it is important to keep in mind that in some instances the size of the constrained market might not be large enough to allow effective competition among generation owners due to economies of scale.

4 Before articulating some of the consequences of market power in electric power markets it is important to recognize that the definition of the phrase market power has, embedded in it, several key words that make difficult its straightforward application to competitive electric power markets. First, a distinctive feature of electric power markets is that, even in the absence of market power prices vary significantly by hour, week, month, season and over the course of a year a supplier "raising prices above competitive levels" therefore might not be easy to discern. Second, it is important to recognize the limitations inherent of the phrase sustained period of time" Suppliers located in constrained markets generally tend to have an incentive to raise prices or withhold output if a significant profit can be made from exercising market power to date, neither the definition of what constitutes a sustained period of time or significant profit have been clearly articulated. There tends to be agreement though that both are a function of location, type of product, and the amount of time that it would take for new entrants to arrive in the constrained market in expectation of capturing some of the profit of the incumbent supplier in the constrained market.

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that consumers located in constrained markets might have to pay for electric power products and services markets relative to the price of such products and services outside of the constrained market, that drives the need to identify cost-effective mitigation of the problem.[5]

Discussed in the literature are market power mitigation options that center around categories such as increasing supply, e.g., via transmission and distribution reinforcements to eliminate the constraint affecting the market, reducing demand in the constrained market, e.g., by pursuing customer energy efficiency, fuel switching, and demand response mechanisms such as real-time pricing, or regulating how suppliers located in constrained markets can (or cannot) behave during times at which the market is constrained (Staff Report on Load Pockets and Market Power, 1996, Werden, 1996)

Table 1 Options for mitigating market power in constrained electric power markets

	Indirect Intervention	Direct Intervention
Expansion of Supply i.e. generation and/or transmission	Government Mandate on the private market. Tax Incentives. Preferential allocation of the use of the expanded capacity	Investment in Power Generation or T&D reinforcements by a regulated Distributor, i.e., Grid Company
Demand Reduction	Incentives for customer financed Fuel Switching, Institutional rules to facilitate real time demand response, On Site (Private) Generation and/or load management and energy efficiency tax incentives	Publicly financed, e.g., by the regulated grid company fuel switching and/or load management and energy efficiency
Pricing, Supplier Behavior and Entry	Divestiture of ownership of existing generation in the constrained market	Continued regulation of generators via • Pricing, e.g. price caps revenue net of fuel caps etc. • Capacity Availability e.g. by mandating long term contracts, or via contractual arrangements between the unregulated supplier and regulated distributor (call options)

Using these as examples, Table 1 attempts to classify options for mitigating

5 The provision of reliable service to customers requires the supply of a spectrum of products to the grid. Included in this spectrum are installed reserves (capacity), energy, operating reserves (including spinning and supplemental reserve services), VAR support, Load Following (Scheduling, System Control and Dispatch, Regulation and Frequency Response, and Energy Imbalance services) and, finally Blackstart capability. Going by its definition therefore, i.e. transmission limitations, suppliers located in constrained markets might be able to exercise market power in the provision of any or all of these services a function of several factors to the detriment of consumers located within the market for the duration over which the market is constrained.

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market power in electric power markets using the proposed taxonomy of direct and indirect government intervention Hybrids of direct and indirect intervention are nothing but the result of combining the two

Given the definition of the factors that give rise to the potential exercise of market power in constrained electric power markets, i e , raising prices and/or withholding output, intervention options, be they indirect or direct in nature as far as government is concerned, center around increasing supply, reducing demand, and/or continued regulation of suppliers in constrained markets Examples of increasing supply include investment in transmission and distribution reinforcements to increase power transfer capability into the constrained market or establishing conditions favorable for a competing supplier to locate in the constrained market Demand reduction, on the other hand, might be achieved by real time pricing or investments in fuel switching, i e , customers switching from electricity to natural gas Continued regulation of suppliers in constrained markets centers around the regulation of prices that suppliers located in such markets can charge over the duration that the market is constrained or quantities that the supplier should provide, or a combination of price and quantity regulation Additionally, if it is thought that the constrained market was large enough to accomodate competition among a number of generation entities, intervention might take the form of a government initiated strategy of mandated divestiture of the ownership of generation within the constrained market to "dilute" the market power of the incumbent generator Finally, depending on the magnitude of the constraint (or some residual thereof), an option for government that is neither direct nor indirect, is the "do nothing" option Assumed in such an option is that demand response in the marketplace will respond effectively over time to an initial occurrence of high prices during constrained periods. New entry by suppliers and/or innovative demand response activities evolve such that market power diminishes and ceases to be excessive

Rather than choosing one of the above alternatives, the best solution may be reliance on a portfolio, which is created by combining individual options Examples of such combinations might include increasing the total transfer capability (TTC) of the transmission system into the constrained market by a regulated T&D company together with the institution of hourly real time pricing for large numbers of customers Another might

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included mandated (or incentive driven) divestiture of the ownership of electric plants located in constrained markets combined with government investment in increasing the TTC, and encouraging, via tax incentives, customer financed fuel switching away from electric use. Yet another portfolio might include government mandated energy efficiency and load management and tax incentives for private investment in grid expansion or the location of new generation in constrained markets, and incentives provided to the incumbent supplier to divest ownership of sources of supply located in the constrained market.[6]

ADDAS - A Planning Tool

ADDAS (Assess, Define, Develop, Analyze, and Select) is a 5-step algorithm intended to help regulators and planners identify the composition and optimal quantity of a broad range of electric power resources that could be acquired to meet the demand for such resources in transmission and distribution constrained markets in a manner that maximizes net consumer benefit. The key strength of ADDAS is its requirement that a broad range of individual resources or resource portfolios be considered before comparing them on a consistent basis, following which one can be selected for implementation purposes An illustration of ADDAS and its constituent 5-steps is provided in Figure 1

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6 It is important to keep in mind that what might complicate a planner's mission of combining individual mitigation options to develop a portfolio is that some options are lumpy, i.e. transmission and distribution reinforcements whereas others might be continuous, e.g real time responses to demand. Thus, in creating a portfolio of mitigation options the planner might be limited somewhat. Suppose for example, 50 MW of mitigation is required and that transmission reinforcements are "sized" in 100 MW increments whereas demand responses can be sized in 1 MW increments. A portfolio of 45 MW of transmission and 5 MW of demand response is thus not feasible as a mitigation portfolio the planner in this instance, has to select between all transmission or all demand response.

Step 1 - ASSESSMENT of the magnitude of the transmission constraint

ADDAS begins by requiring the planner interested in mitigating market power to assess the degree to which a market is constrained, i e , an assessment of the extent to which and the period of time over which the market is reliant on internal generation because of limits on the total transfer capability of the transmission and distribution system linking the constrained market to the outside world To perform this assessment, the planner would first need to calculate the total transfer capability of the T&D system that allows power to flow into the territory assuming that the system is operating normally and is stable This calculation would assume that in-market generation is out of service and unavailable This is then compared to the demand (load) in a planning period, i e , over a period, season, or year, to determine the percent (%) of time that the market would be constrained. An illustration of the method that should be used in this step is provided in Figure 2

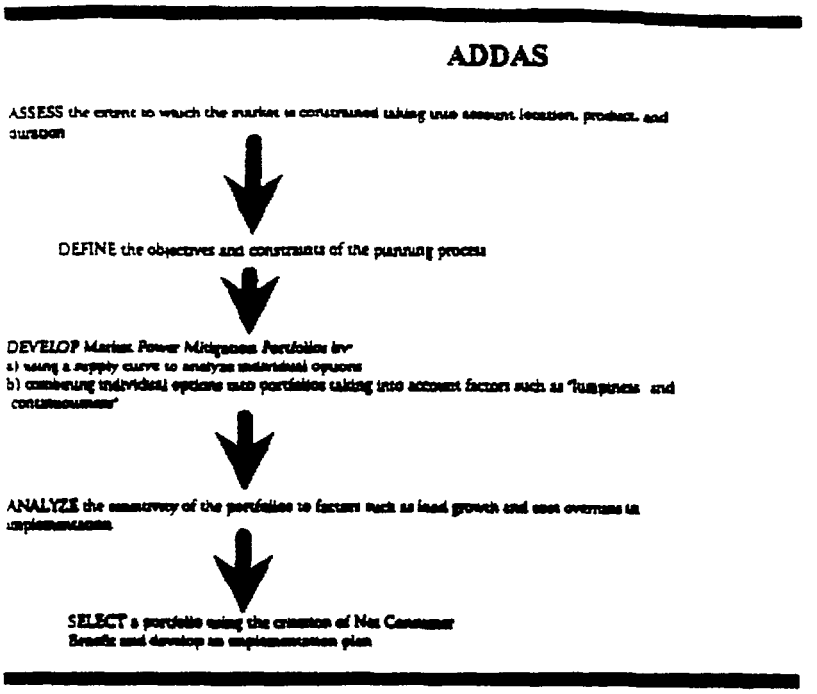

Figure 1

To illustrate how Figure 2 might be used,

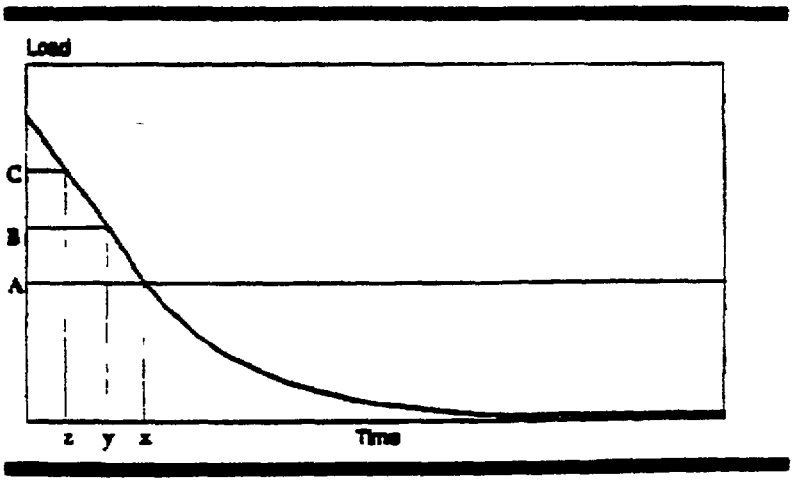

Figure 2

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suppose with all sources of supply (generators) in the constrained market assumed as out of service the total transfer capability into the constrained market is A megawatts, the market is therefore constrained for x% of the number of hours in the planning period in the sense that it is reliant on generation internal to the market to supply the needs of consumers located in the market

Step 2 DEFINITION of the Objective and Constraints governing the planning process

Having assessed whether or not the market under examination is constrained, and having made a determination of the significance of the constraint (e g , it might not be worth examining in precise detail how to mitigate market power in a market that is constrained for less than 1% of the hours in a planning period), ADDAS requires the planner interested in mitigating market power to define the goals objectives, and constraints that would guide the planning process The objective would typically be to assess whether a market is constrained on account of power transfer limitations and, if so, implement a portfolio of mitigation measures that maximize the net consumer benefit of market power mitigation in such a constrained market subject to a set of constraints Constraints would generally include the following a) maintenance of system reliability, both bulk system and at the customer level, b) environmental constraints, and, c) suppliers must, at a minimum, break even

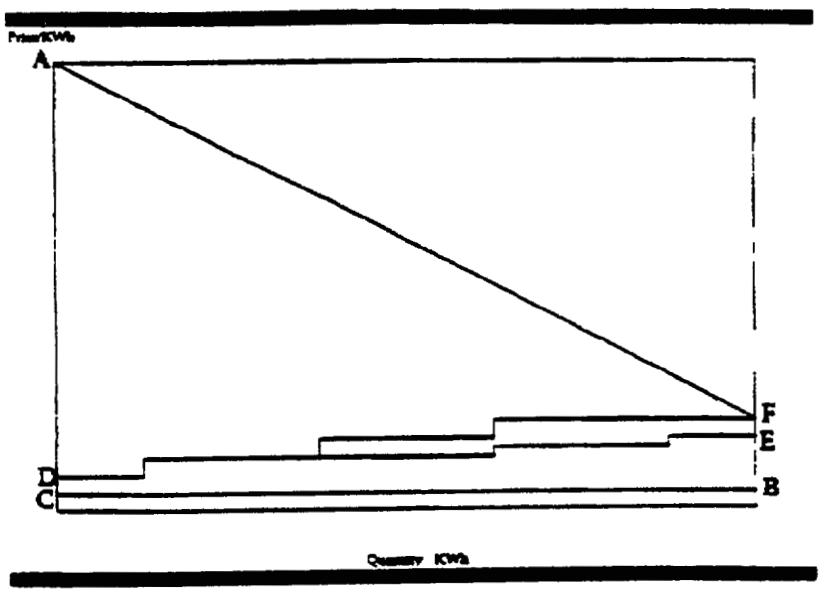

Figure 3

In the context of market power mitigation, the term "Net Consumer Benefit" is best illustrated by using a simple demand curve approach illustrated in Figure 3

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Assume in figure 3, that. a) AF = Consumer demand in the constrained market, b) BC = price of electricity outside the constrained market, c) DE = Cost of Implementing Market Power Mitigation Option 1, and, d) DF = Cost of Implementing Market Power Mitigation Option 2 Then, absent a constraint Net Consumer Benefit can be represented by area under the polygon AFBC

Assume now that the market is constrained and that the decision-maker can use either Mitigation Options 1 or 2 to eliminate the constraint and thereby address the problem of market power in the constrained market Assume further that the cost of both options 1 and 2 is stepwise in nature as illustrated in Figure 3 If Option 1 is selected, the resulting net consumer benefit can be represented by the area under the polygon AFDE, if option 2 is selected, the net consumer benefit can now be represented by area under the polygon AFD From its geometry, it is clear that the area of the polygon AFDE is greater than that of AFD, thus, consumers would stand to gain an incremental net consumer benefit of (AFDE - AFD) Thus, all else held equal, it would seem that the decision maker would selection option 1 for implementation on the basis that Option 1 *maximizes* the net consumer benefit relative to Option 2

Step 3 DEVELOPMENT of Market Power Mitigation Portfolios

If step 1 indicates that the market is constrained for x% of the time in the planning period and if a determination is made that such a constraint is significant, the purpose of Step 3 is to develop market power mitigation portfolios that address the objectives and constraints defined in step 2.

The first sub-step so to speak, in step 3 is to develop a list of individual mitigation options within the two broad categories of direct and indirect intervention by government into constrained markets such as those illustrated in Table 1

The next sub-step is to take into account whether the mitigation options are "lumpy" or "continuous" in nature in order to develop a supply curve for each individual option Transmission reinforcements, on account of the physics of the electric power grid, require a basket of technologies that often provide value to the grid in "lumps" of incremental power transfer capability This feature is illustrated in Figure 2 which indicates that, absent

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generation internal to the constrained market, the transmission system can transport A megawatts into the constrained market from the outside Thus, the market is constrained for x% of the hours in the planning period An incremental investment would need to be available to allow, for example, an incremental (B-A) megawatts of power transfer capability to eliminate the constraint for an incremental (y-x)% of time in the planning period A further increment would need to be available to completely eliminate the constraint What is generally true is that each "incremental" increment of transmission tends to cost more to put in place relative to the prior increment. Figure 4, attempts to capture this lumpiness for the transmission only option by using a step-function to illustrate the cost function of a transmission-only mitigation option

Though demand responses, e g , to real time prices, tend to be more continuous (or less lumpy) in nature relative to the transmission option, after a certain point each successive increment of demand response tends to be far more expensive than the prior one Figure 4 attempts to capture this feature of the demand response option to market power mitigation in terms of a curve with a steep slope.

An Example of a Mitigation Supply Curve for individual Market Power Mitigation Options

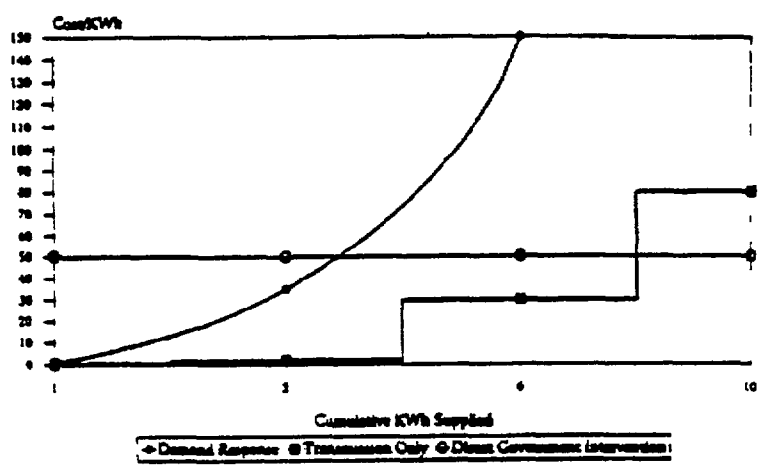

Figure 4

Finally, given that direct government intervention, e.g , via the form of a price cap or call option on generators located in constrained markets, would probably apply for the full duration of the constrained market, such intervention is displayed in Figure 4 as a flat line parallel to the X-axis

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Having developed the supply curve for each individual market power mitigation option, the next sub-step is to use the information provided by the supply curves in developing mitigation portfolios A way of doing so is to sequentially combine one mitigation option with another and develop a list of "candidate" portfolios recognizing a) the lumpiness of transmission investments, b) the "continuousness" of demand responses to pricing signals, e g , real time pricing, and, c) the flexibility of direct government intervention in the form of regulating the price or mandating the quantity that should be provided by the generator located in the constrained market.

To illustrate how combining might be undertaken, suppose the load duration curve displayed in Figure 2 indicates that, with generators of 300MW, 120MW, and 80MW in the constrained market assumed as out-of-service, the difference between peak demand in a period, season, or year and power transfer capability is 500MW Suppose further that this difference between peak demand and power transfer capability can be met via transmission reinforcements in three stages thereby eliminating the market power of the generators located in the constrained market, the first stage provides for 300MW (i.e , from A to B in Figure 2), the second stage provides 150MW (from B to C in Figure 2), and the last stage provides 50MW (i e , from C to the peak demand in Figure 2) Suppose the cost associated with all three stages are known are relate inversely with the amount of resources they are capable of providing to the system, i e , the last lump of transmission is the most expensive Taken together, the three stages represent a transmission-only plan

Given the nature of the cost of transmission reinforcements, the transmission only mitigation option is represented in Figure 4 as a step function. Then, each stage of the transmission only plan is compared with alternatives such as demand responses to pricing signals, direct (or indirect) government intervention, or the "do nothing" option on the basis of its cost. An example of how this sequential comparison might be performed is provided in Table 2 below

Table 2 - Developing Portfolios

#	Block 1 300MW	Block 2 150MW	Block 3 50MW	Net Consumer Benefit
1	Transmission	Transmission	Transmission	NB1
2	Demand Side Response	Demand Side Response	Demand Side Response	NB2
3	Direct Government Intervention	Direct Government Intervention	Direct Government Intervention	NB3
4	Transmission	Transmission	Demand Side Response	NB4
5	Transmission	Transmission	Direct Government Intervention	NB5
6	Transmission	Direct Government Intervention	Indirect Government Intervention, e.g., by providing the signal for new suppliers to locate in the market	NB6
7	Transmission	Transmission	"Do Nothing" - Let the market Innovate	NB7

To develop portfolios alternative to the transmission only option, factors such as the constraints listed in step 2 of ADDAS, i e., reliability and environmental constraints, together with technical constraints such as lumpiness are considered. Since demand-side responses are continuous and in theory, reliable and environmentally benign, the entire 500MW could theoretically be supplied by demand-side responses (i e , portfolio 2 in Table 2) While portfolio 2, might be technically feasible, it is likely to be cost-prohibitive, given the nature of the demand response cost curve illustrated in Figure 3

Portfolio 3 is the option of direct government intervention and could be, for example, regulating the 300MW, 120MW, and 80MW generators located in the constrained market. Such regulation might take the form of pricing, e g., price caps or call options, or mandating the generators located in the constrained market to supply capacity during constrained times [7]

Finally, portfolios 4-7 involve mixes of transmission, demand responses to

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[7] Note that strategies such as price caps must ensure that the targeted generator or generators receive an annual revenue stream that is sufficient to provide them with a financial incentive to remain in operation. Obviously the plan falls apart if subsequent to the establishment of such a price cap plan, the generator shuts down.

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pricing signals, direct and indirect government intervention concerning pricing, supplier behavior and entry, and finally, the 'do nothing' option. Development of such portfolios would have to take into consideration the lumpiness of the transmission option when deciding how much of each option to "mix" with another.[8]

It is interesting to observe that the portfolio that maximizes net consumer benefit (i.e. the area under the demand curve in Figure 3) may not be the one that also eliminates market power completely. In Table 2 for example, portfolio 4 maybe better than portfolio 1, even though under portfolio 4 generators in the constrained market might exercise some degree of market power and obtain pleasing profits. But, if this is less costly to consumers than expensive transmission reinforcements, it may be the best choice. Regulators will need to grapple with the notion that not regulating may be best, even in the face of limited amounts of market power.

The final sub-step in step 3 is to rank the set of portfolios using the criterion of net consumer benefit. An illustration of a hypothetical ranking is provided in Figure 5.[9] Based on the ranking, and not account for the

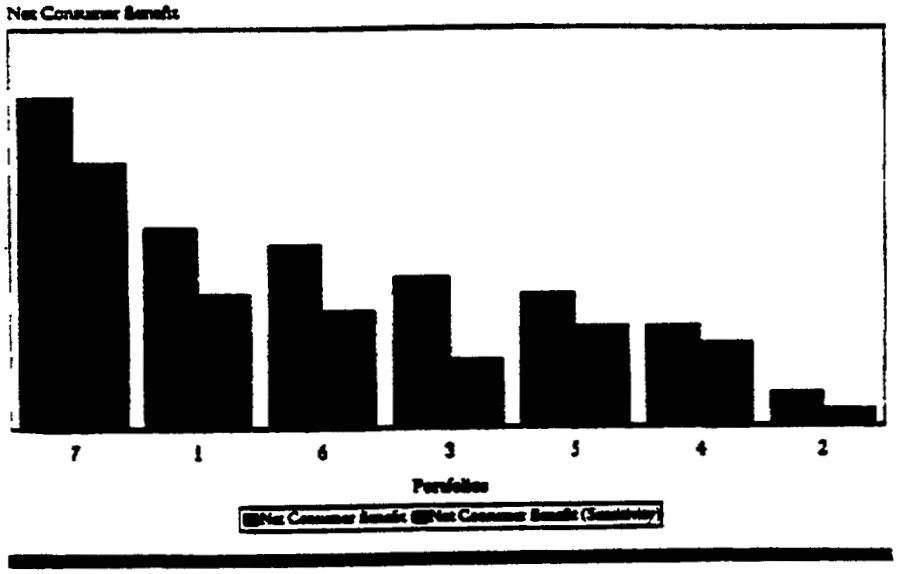

Figure 5

[8] The development of portfolios in and of itself represents an interesting problem since, an infinite number of combinations are theoretically possible. One could define the parameters that limit combinations, i.e. reliability, environmental constraints, lumpiness and continuousness and use an automated process to develop a list of workable combinations such as that displayed in Table 2.

[9] Note that figure 5, for illustrative purposes, assumes that NB7 > NB 1 > NB6 > NB3 > NB5 > NB4 > NB2. This might not be the case when actual data on a constrained market is used.

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sensitivity analysis suggested in the next step it would seem appropriate to select portfolio 7 for implementation [10]

Step 4 ANALYZE the rigorousness" (i e , sensitivity) of the portfolios to external (i e , uncontrollable) factors such as load growth and controllable factors such as cost overruns,

Having developed a set of portfolios and ranked them on the basis of net consumer benefit the next step in ADDAS is to analyze how the transmission-only and each alternate portfolio would respond to external factors such as load growth in the constrained market, cost overruns that might occur in implementing an investment-oriented portfolio, or both

Estimates of the net consumer benefit used in the ranking in step 3 would need to be revised here and a re-ranking of the portfolios would be performed. Key in this analysis of the rigorousness of the portfolios is to observe the directionality of how net consumer benefit changes when uncontrollable and controllable factors are introduced in the operating environment Unlike the instance illustrated in Figure 5, in some instances the directionality of the change might be significant enough to warrant rejection of the "best" portfolio identified in step 3.

Step 5 SELECTION for implementation

Based on the information developed in steps 1-4, the final step involves the selection of a portfolio for the purpose of implementation. Factors that should be considered here include the objectives and constraints stated upfront and the rigorousness of the transmission-only portfolio and each competing portfolio to uncontrollable and controllable events such as load growth and cost overruns Taking these into account, an implementation plan would have to be developed. This implementation plan would have to articulate: a) to the extent that resources might have to be acquired from the market, details regarding the acquisition process, e g , competitive bidding, and, b) how the provider of such resources

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10 Just for illustrative purposes, figure 5 indicates that even with a sensitivity analysis, the planner might still select portfolio 7 for implementation.

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would be reimbursed, e g , flat fee staggered payments etc c) (if necessary) a public outreach and education effort to the extent that market power mitigation in the form of portfolio implementation involves demand responses

Conclusions and Next Steps

What we have proposed here is a generic process via which a broad range of options contained in set of portfolios might be considered by utility planners and/or regulators for implementation to mitigate market power for a given level of constraint The answer, in terms of the portfolio that maximizes net consumer benefit however will vary as a function of the degree to which the market is constrained, the location of the market, and, in certain instances, the type of product under consideration in the constrained market that is being analyzed.

We suggest that a process such as ADDAS be taken a step further and used to develop a supply curve that provides a market planner or regulator with an understanding of the "optimal" portfolio, i e , maximizes net consumer benefit, for different levels of constraint affecting a market. Data for the development of such a generic supply curve might be gathered from a laboratory experiment involving actual sellers located in a constrained market. The net consumer benefit can be derived by examining how suppliers react when informed that certain mitigation portfolios were to be put in place. We believe that the results of such a laboratory experiment would lend further credence to both ADDAS and those who might opt to use it to address the problem of market power in constrained electric power markets

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Identifying Market Power in Electric Power Generation

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Presented at

Competitive Positioning Strategies for
Achieving and Surviving Competitive Generation

Washington, D C.
November 29, 1995

*The views expressed herein are not purported to be those of the U S Department of Justice

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A central issue in the debate over reform in the electric power industry is extent to which market forces, rather than regulatory controls, should be relied upon to determine wholesale prices FERC placed this issue on the table by seeking comments on whether opening up the transmission system would eliminate the need for anything like traditional rate regulation The answer given by the Department of Justice and other commenters is "not necessarily," and surely this is the correct answer Transmission constraints and other factors can combine to produce pockets of substantial market power The purpose of my remarks is to shed some light on the process for identifying these pockets of substantial market power

The Meaning of "Market Power"

I begin with the definition of the term "market power " Market power on the part of sellers is the ability profitably to maintain prices above competitive levels by restricting output below competitive levels This definition is applied both to the unilateral market power of a single seller, and to the collective market power of a group of sellers [1]

Since market power is defined by reference to the competitive price, it is important to indicate what that would be The general prediction of economic theory is that the equilibrium price in a competitive market is the marginal cost of the highest-marginal-cost unit necessary to satisfy industry demand

Which costs are marginal depends on the time frame of a transaction For a short-term sale of energy, fuel costs would be the principal marginal cost; for the long-term sale of capacity, all costs would be marginal Short-run marginal costs vary according to the type of generating unit, from gas turbine and diesels units at the high end, to nuclear and hydro units at the low end

[1] In the case of price-regulated industries, market power might manifest itself in other ways if regulation constrains prices to competitive levels A proviso sometimes inserted in the definition of market power is the absence of price regulation Thus, as a matter of definition, regulation can effect the ability to exercise market power, but not the existence of market power

Determinants of a Firm's Market Power

Since market power is the ability to profitably restrict output below the competitive level, the degree of market power is determined by factors affecting the costs and benefits of restricting output Of the greatest importance is industry demand, which economists characterize by its "elasticity" The elasticity of demand indicates how responsive quantity is to a change in price Thus, elasticity of demand also indicates how responsive price is to a change in output, if output is restricted to drive up price

If demand is very elastic, the benefit from a given output reduction is, relatively, quite small, and no firm or group of firms can possess significant market power What makes demand for a product very elastic is the availability of good substitutes for it For example, the demand for red bowling balls is probably very elastic indeed, because blue and black bowling balls are very good substitutes As a general matter *No firm or group of firms can possess substantial market power if the industry demand for the product they sell is highly elastic due to the availability of good substitutes*

The demand for electric power surely is not so elastic that no group of firms could collectively exercise significant market power, so we should proceed to consider the factors affecting the market power of a particular firm, when all firms, acting collectively, could exercise substantial market power To facilitate the discussion, I postulate an industry in which there are seven generating units, each with a constant marginal cost over its entire range of possible output, and no two units having the same marginal cost The marginal cost schedule for the industry would be something like what I have depicted in Figure 1

Figure 2 adds an industry demand curve and illustrates the competitive equilibrium The competitive price and quantity are determined by the intersection of the industry demand curve with the industry marginal cost schedule The competitive equilibrium serves as a baseline from which to consider the exercise of market power

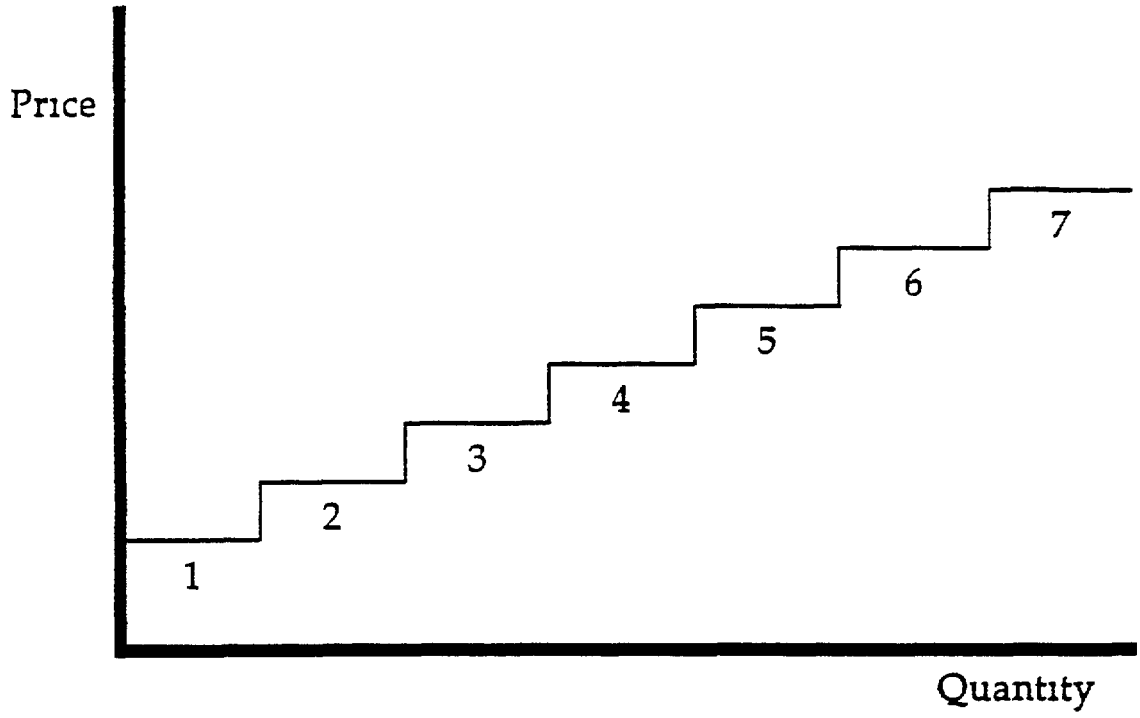

Figure 1 Industry Supply Schedule

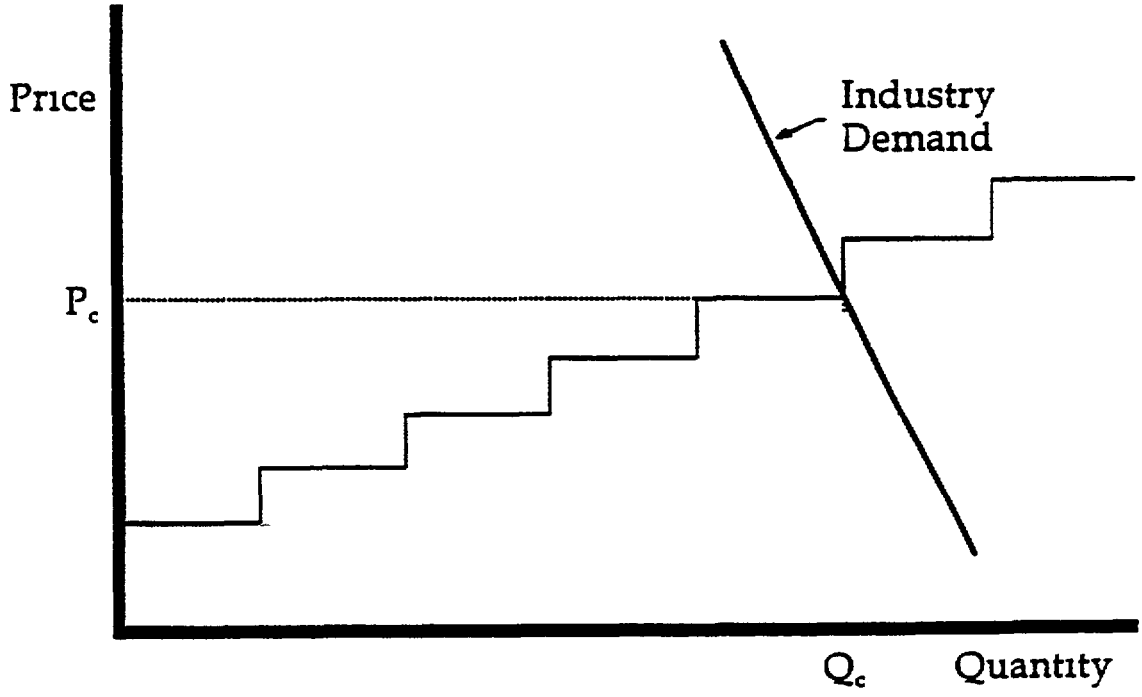

Figure 2 Competitive Equilibrium

A brief consideration of the cost-benefit trade-off associated with restricting output yields several important insights into the factors affecting the existence and extent of market power Given the industry demand elasticity, two factors determine the benefit side of the market power trade-off for a particular firm They are how much of industry output that firm accounts for, and how responsive to a price increase is supply from other firms

As one firm restricts output and drives up price, the higher price confers benefits on all firms in the industry that make sales A given firm's conduct, however, is motivated by its *share* of those benefits, which is indicated by its share of the remaining industry output This simple point explains why market share is a central focus of market power inquiries As a general matter *The market power of a particular competitor is greater the greater is its share of output in the competitive equilibrium, because that share determines its share of the benefits from its output restriction*

As any one firm restricts output, its rivals typically find it profitable to increase their output If they would make up for the output restriction using resources with the same marginal cost as those from which supply was restricted, then the firm restricting output would have no market power, because the output restriction would not drive up price If Figures 1 and 2 were modified so that all units had the same marginal cost, then the owner of even several units would have no market power As Figures 1 and 2 are drawn, however, the owner of a single unit can have significant market power because an output restriction could not be made up for by a unit with a marginal cost very close to the competitive price As a general matter *The market power of a particular competitor is greater the less responsive to a price increase is the supply by its rivals in the neighborhood of the competitive price*

An important footnote to the foregoing is that no market power is conferred by the ownership of a resource that is not used in equilibrium The owners of units 6 or 7 alone would have no market power, since they sell nothing in the competitive equilibrium and thus cannot restrict output below the competitive level This does not mean, however, that units 6 and 7 are irrelevant to the issue of market power If a firm owned both units 5 and 6, it

would possess more market power than if it owned unit 5 alone, because unit 6 would be the next-best source of supply once output from unit 5 was restricted As a general matter *Ownership of resources not used in competitive equilibrium may enhance market power if those resources would become economical when market power was exercised*

A second footnote is that the industry demand may be greater at certain times than it is at the time illustrated by Figure 2 If so, then ownership of units 6 and 7 could confer market power at such times As a general matter *The market power of a particular firm may vary over time as demand conditions vary*

On the cost side of the market power trade-off is the profit that must be foregone if output is restricted, and that is indicated by the difference between price and marginal cost for each unit of output restricted There is no difference between the two for unit 5, and owning that unit alone would certainly confer significant market power By contrast, the difference between price and marginal cost is quite large for unit 1, and owning unit 1 alone might not confer significant market power As a general matter *The market power conferred by ownership of a particular resource is greater the smaller is the difference between the price and the marginal cost associated with that resource, provided that the resource is used in the competitive equilibrium*

Determinants of the Collective Market Power of Several Firms

What I have said thus far was addressed to the market power of a single firm, but it also applies to the collective market power of several firms Collective market power also raises additional issues relating to the competitive interaction among the firms. A great deal could be said about these issues, but time permits only a brief overview of the subject

Both experience and a variety of economic models suggest that number and size distribution of competitors has important effects on equilibrium price and output These models can be usefully divided into two classes on the basis of the nature of the interaction among competitors One class features an interaction in which competitors act noncooperatively, by making their strategic decisions independently and based on consideration of just their own profits

The other features an interaction in which competitors coordinate their strategic decisions, or "collude" in some sense of the word

The vast majority of economists believe that collusion in one form or another is a significant concern when the number of competitors is very small, but collusion models do not permit specific predictions about the relationship between the size distribution of firms and industry performance

Noncooperative models permit specific predictions and those predictions appear to be reliable enough so that the models should be taken seriously One very interesting model of this sort is that by Richard Green and David Newbery[2] They consider a noncooperative interaction among generating companies using supply schedules as competitive strategies These schedules indicate how much they are willing to sell at each price The model is designed to predict performance in the British-Welsh pool, which has only two substantial competitors

Green and Newbery find performance is not nearly competitive with only two sellers, and a host of commentators have argued that actual performance in the British-Welsh pool is quite inadequate On the other hand, Green and Newbery also find that the number of sellers does not have to be very large in order to achieve virtually all the benefits of competition, five equal-sized firms should do it These results are comparable to those from other models and are reasonably representative of general economic thinking on the subject

Costs and Benefits of Regulation

As I indicated at the outset, my remarks are directed to the desirability of market-based pricing, as opposed to regulatory pricing, for wholesale electric power In assessing the desirability of regulation, it is essential to consider not only the potential benefits of the regulation in preventing the exercise of market power, but also the likelihood of achieving those benefits and the likely costs of trying to do so

[2] Richard J Green & David M Newbery, Competition in the British Electricity Spot Market, 100 JOURNAL OF POLITICAL ECONOMY 929 (1992)

There is some degree of market power in most markets—often quite a bit Prices typically are not very close to marginal cost But price regulation has never been seriously considered for most industries with significant market power There are surely a variety of political and historical reasons for this, but, over the last few decades, some form of cost-benefit analysis has been a major factor, and we have become acutely aware that a regulatory cure can be worse that the market-power disease

In some cases, the direct administrative costs of regulation may be large in relation to the potential social welfare gains from a regulation In many more cases, the more important social costs of price regulation are those arising from the distortions in the economy caused by the use of improper price signals I have seen estimates a high a $100 billion per year for the potential direct gains from efficient pricing of electric power[3] I have some doubts about such calculations, but I have no doubt that the potential savings from eliminating all regulatory distortions could be very large indeed

Because of the inherent costs of regulation, the existence of significant market power is not now seen as a sufficient rationale for price regulation in any industry If we did not already have wholesale price regulation in the electric power industry, I very much doubt that we would get it now But we do have it, and FERC does not have the power to ignore the mandate of the Federal Power Act Exactly how the Federal Power Act constrains FERC is an interesting question I leave for others

What I am prepared to say is that results like those of Green and Newbery are a starting point for the development of a sensible policy If five (roughly equal-sized) firms are sufficient to reasonably assure competitive performance, then some smaller number is sufficient to justify the use of market forces to set prices While economists certainly differ in their views as to how many firms are necessary for adequate competition, I suspect that most would agree with this proposition

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[3] *See* Tabors Caramanis & Assoc, Unbundling the US Electric Power Industry A Blueprint for Change 44–51 (March 1995)

Delineation of the Product Dimensions of Relevant Markets

Given that policy is likely to be based on some measure of the number of competitors, it is immediately apparent that it is necessary to delineate particular products and areas within which to count competitors The theory of market delineation for competitive analysis is well developed within the antitrust context [4]

The basic idea is simply that a group of products and area constitute a market if, and only if, it would be possible for a monopolist over them to exercise significant market power As I explained earlier, the market power of a monopolist would be largely determined by the elasticity of demand it faces, thus, market delineation is largely a process of measuring—or, if that is infeasible, intuiting—the elasticity of demand for groups of products and areas The process is applied to groups of products and areas of increasing scope until one is found in which a monopolist would have significant market power [5]

The best perspective from which to address both market delineation and other issues probably is that of a wholesale customer shopping for power By considering its alternatives, one can understand how market power might be exercised and by whom One aspect of this process is identifying what it is that the wholesale customers is buying In the electric power industry, a host of different products are traded, and competitive conditions might differ significantly from one product to the next Potentially important product distinctions include energy vs capacity, firm vs non-firm, peak vs off-peak, long-term vs short-term, and present time vs future time

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[4] *See* Gregory J Werden, Market Delineation under the Merger Guidelines A Tenth Anniversary Retrospective, 38 ANTITRUST BULLETIN 517 (1993), Gregory J Werden, The History of Antitrust Market Delineation, 76 MARQUETTE LAW REVIEW 123 (1992), Gregory J Werden, Market Delineation under the Justice Department's Merger Guidelines, 1983 DUKE LAW JOURNAL 514

[5] Significant market power is generally defined in this context in terms of the price increase that a monopolist would impose In the merger antitrust context, a 5% price increase typically is used The social costs of regulation suggest the use of a significantly larger threshold in the context of determining whether to engage in price regulation

Since electricity is not stored to any great extent, it is theoretically appropriate to delineate at least 8760 separate, hourly markets for short-term power within a year From a practical perspective, however, it likely would be unnecessary to delineate more than a few, since competitive conditions are not likely to vary systematically from one hour to the next, although they might vary significantly seasonally, or from on-peak to off-peak

In light of current market institutions and possibilities for substitution among various types of supply arrangements, it might be reasonable to delineate three major products—short-term energy or capacity, intermediate-term capacity, and long-term capacity The distinction between the latter two is the lead time for the transaction The long run entails sufficient lead time so that newly constructed capacity can compete The distinction between the former two is the duration of the transaction and, hence, its role in system planning

The process of market delineation naturally depends on existing market institutions The use of a PoolCo would vastly reduce the number of products that must be considered, leaving only short-term energy

Delineation of the Geographic Dimensions of Relevant Markets

The geographic dimensions of relevant markets probably present the most important issues If markets are sufficiently large geographically, there are likely to be a large number of competitors, and if they are very small, there may be very few competitors In principle, the geographic scope of market should be defined on the basis of the sources of supply that could possibly be reached, the likely prices at those sources, and the likely transmission costs that would have to be paid by a wholesale customer This presents many difficulties, not the least of which is the fact that transmission pricing is in a state of flux, so we cannot readily determine what transmission costs would be

A good start on the problem would be to examine existing trading patterns and to identify significant transmission bottlenecks in light of existing trading patterns This should be quite easy to do, and it should provide rough approximation to geographic market boundaries However, markets based on

this exercise likely would understate the scope of markets for two reasons Existing patterns of trade are not premised on open access transmission, and the attempt to exercise market power could induce substitution to much more distant sources of supply that are currently relied upon

A far more refined analysis could be done by combining existing transmission models with information on loads, generating capacities, and unit marginal cost schedules, at all relevant points within the transmission network All of this information should be readily available, and it could be used within a computer program that minimizes the cost of satisfying the specified loads, given generation capacity and costs, as well transmission costs and constraints

The process of delineating markets would involve restricting output from the generating units in a region and determining the effect on prices and profits in the region If power from other regions makes a significant price increase either impossible or unprofitable, then the selected region is too small to constitute a market and a larger region should be tested Some years ago, the Justice Department used such a model to delineate markets for coal, and the results were highly satisfactory [6]

What I have just described would, no doubt, entail a significant investment of resources, but it might be well worth the expense Such an approach has two tremendous advantages over any other approach First, it is almost entirely objective, and therefore not inherently suspect Second, it would be quite simple with this approach to investigate how, if at all, markets might change with additions of transmission or generating capacity, or with changes in transmission pricing

Groups of utilities interested in market-based pricing on a regional basis should consider cooperating in such an analysis They should also consider what they can do to make the process appear objective They might, for example, make the analysis as visible as possible to the outside world and invite comments on modelling procedures and assumptions

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[6] Antitrust Division, U S Department of Justice, COMPETITION IN THE COAL INDUSTRY 20–47 (December 1982)

Assignment of Market Shares

Having delineated markets, the next task is to assign market shares For long-term capacity, however, there is little need to assign shares, all those capable of building plants should be considered competitors in markets for long-term capacity, and this generally should assure that markets are dramatically unconcentrated For short-term energy and intermediate-term capacity, shares should be assigned on the basis of existing generating capacity

In assigning shares based on existing capacity, the use of total capacity is problematic because some utilities are net buyers, while others are net sellers Excluding capacity effectively committed to serve native load addresses this problem Under present market institutions, it is also reasonable to treat capacity committed to serve native load as being off the market, and in any event, additional output from such capacity would not be able to prevent an exercise of market power Thus, shares of excess capacity are much better indicators of the likelihood of a significant exercise of market power than are shares of total capacity This conclusion, however, is premised on present market institutions, and would not apply if all generation were sold through a PoolCo

The proper treatment of long-term sales contracts presents a similar issue The share attributable to the contracted capacity should be assigned to the buyer under the contract However, if the buyer under such a contract is a distribution utility or end user, it probably is best in the end not to count the contracted capacity in assigning market shares, just as capacity committed to serve native load is not counted.

There is also the question of how best to treat out-of-region capacity the sale of which is significantly constrained by the lack of transmission capacity The simplest way, and quite possibly the best way, to treat such capacity is not to count it at all in assigning market shares Capacity constrained in such a way cannot take up any of the slack in the event of an output restriction, and cannot significantly constrain the exercise of market power

As the earlier examples illustrated, the most important resources are those low enough in cost to be used in competitive equilibrium, yet high enough in costs to have relatively small differences between price and marginal cost It is these resources from which it is most profitable to restrict supply This suggests attributing special weight to such resources in assigning market shares I would not do this, however All low-cost capacity is relevant to the benefit side of the market power trade-off, and most high-cost capacity is marginal at some times Moreover, any weighting scheme would be arbitrary

An alternative to a weighting scheme that does appeal to me is to compute a second set of market shares for mid-marginal cost capacity, consisting of fossil-fueled units with relatively high average load factors These shares would not be used instead of the market shares computed for all capacity, but rather would be one of many other factors that could provide additional perspective on the likelihood that market power could be exercised

Measuring Market Concentration and Concentration Screens

Having assigned market shares, it is highly useful to summarize those shares with an index of market concentration The most popular index today is the Herfindahl-Hirschman Index or HHI It is computed by squaring each market share, then adding up the squared shares For example, with three firms having shares of 20%, 30%, and 50%, the HHI would be 400 + 900 + 2,500 = 3,800 The HHI approaches zero if there are a very large number of very small firms, and equals 10,000 if there is just one firm

Five equal-sized firms yields an HHI of 2,000 Thus, an HHI of 2,000 or less can be expected to yield a reasonably competitive outcome in the electric power industry Market power sufficient to warrant price regulation would entail even greater concentration, in light of the social costs of regulation

In the context of oil pipelines, the Department of Justice has suggested that markets be presumed sufficiently competitive for market-based pricing if the

HHI is less than 2,500[7] Paul Joskow recently proposed the same rule for electric power generation,[8] and I would be inclined to use this rule as well[9]

The way it should be phrased is that as showing that the HHI is below 2,500 establishes a rebuttable presumption that market-based pricing would result in just and reasonable rates This would permit an intervenor to make the case that there is a substantial market power problem despite the HHI[10]

Even if the market HHI is high, a small individual firm would not likely be able to exercise market power if larger firms were subject to price regulation Thus, a presumption of no market power could arise from a demonstration that a firm's market share is no more than, say, 20%

However it might be done, I would strongly urge that FERC establish some market share and/or market concentration screens that could be used to establish a presumption in favor of market-based pricing

Even without a presumption in favor of market-based pricing, utilities can, of course, make a case for market based pricing, and there can be situations in which it would be easy to make such a case For example, if there were enormous excess capacity relative to industry demand, the distribution of excess capacity among firms would not be terribly important, so the fact that a single firm controlled a great deal of it would be of little consequence, even though it caused the HHI to be quite large.

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[7] Antitrust Division, U S Department of Justice, OIL PIPELINE DEREGULATION 29–30 (May 1986)

[8] Paul L. Joskow, Horizontal Market Power in Wholesale Power Markets, Appendix A to Initial Comments of Edison Electric Institute, Dkt Nos RM94-7-001, RM95-8-000 (August 1995)

[9] One very large firm could be in a position to exercise significant market power, even if the market HHI was below 2,500 Thus, it might be appropriate to add an additional proviso that no firm have a share of more than, say, 35% This would be appropriate, however, only if the supply from other firms were not very elastic

[10] In antitrust cases and prior adjudications before FERC, the focus typically has been on market delineation However, the elaborate market delineation analysis I sketched out earlier could short circuit fruitless battles of experts on market delineation If so, I would expect that the presumption would rarely, if ever, be overcome

Mitigation of Market Power

The creation of presumptions based on market share or market concentration screens permits utilities so inclined to take steps to assure that they pass through the screens I would be very reluctant to force any utility to take such steps, but making clear what steps would have to be taken can only have positive effects And I would have no qualms about utilities getting together, and agreeing among themselves that they will take such steps, so all can secure the blessings of market-based pricing Concerted conduct with respect to these sorts of steps would not seem to create any significant antitrust exposure

The most obvious step a utility could take to assure that it can pass through a market share or market concentration screen is to sell one or more generating units outright, to firms will little or no capacity Short of outright sale of a unit, a utility could enter into long-term contracts that effectively transfer the rights to operate a unit and to sell the power that it generates Similarly, a utility could enter into long-term, fixed-price contracts with distribution companies If a utility with market power presells large fraction of its competitive output, its market power is drastically reduced [11]

All of the forgoing steps are designed to reduce a firm's market share, given the market A utility, or more likely a group of utilities, might also take steps to enlarge the market This could be done by strengthening interconnections to permit out-of-region power to compete better

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[11] *See* Richard Green, Britain's Unregulated Electricity Pool, in Michael A Einhorn, FROM REGULATION TO COMPETITION NEW FRONTIERS IN ELECTRICITY MARKETS ch 4 (1994)

APPENDIX A

HORIZONTAL MARKET POWER IN WHOLESALE POWER MARKETS

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August 1995

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HORIZONTAL MARKET POWER IN WHOLESALE POWER MARKETS

Paul L Joskow[1]

INTRODUCTION AND SUMMARY

This paper focuses on the questions posed by the Federal Energy Regulatory Commission ("Commission") regarding horizontal market power in the supply of various generation services and how its current policies toward such market power problems will be changed by the proposed rule [2] Horizontal market power is of potential concern to the Commission as it considers when it can replace cost-based regulation of wholesale power transactions with market-based pricing. This is the case because when firms have and can exercise significant market power, the resulting prices may be too high and the quantities supplied to the market too low In order to approve applications from firms for market-based pricing authority, the Commission must be reasonably confident that the benefits obtained exceed the costs of imperfect and costly price regulation.

Horizontal market power problems can arise at any horizontal level of the production chain from inputs to final output as a consequence of, for example, there being a very small number of competing sellers and significant entry barriers at that horizontal level. Market power problems may also arise at one horizontal level of the production chain as a consequence of market power problems at another horizontal level. This might be a problem when there are "vertical" control relationships between producers at two or more horizontal levels For example, the Commission's proposed open access rule is built upon the assumption that suppliers of transmission and certain related network services necessarily have significant potential market power because the supply of transmission and certain ancillary services are perceived to have natural monopoly characteristics It assumes further that absent appropriate regulations, transmitting utilities would be able to exercise this market power in two ways One is that transmitting utilities would charge excessive prices for transmission service if these prices were not regulated, thereby increasing the

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[2]"Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities," Docket No RM95-8-000 and "Recovery of Stranded Costs by Public Utilities and Transmitting Utilities," Docket No RM94-7-001

"downstream" delivered price of electricity by increasing the combined price for delivered bulk power (transmission plus generation) They might also use their control over transmission facilities to distort competition "upstream" at the generation supply level if unconstrained by regulation and antitrust sanctions The particular concern underlying this Rulemaking is that firms that own and control both "natural monopoly" transmission and network facilities that are needed by competing suppliers of generation to compete effectively, and also have an ownership interest in competing generators that use these facilities, will have the incentive and ability to favor their own generators and otherwise to raise their rival generators' costs to increase the profitability of sales made by their own generators, absent effective regulation.

In what follows, I am interpreting the questions about horizontal market power raised in the NOPR in the following way The NOPR focuses on fixing "vertical control" problems arising from the common ownership and control of (presumed to be natural monopoly) transmission networks and (potentially competitive) generation suppliers by adopting open access and comparable service rules applicable to transmitting utilities Assuming that these rules solve these vertical control problems I interpret the NOPR as asking the following kinds of questions (a) Are there still additional potential horizontal market power problems in the supply of generation services that will require the Commission's attention in response to utility requests for market-based pricing? (b) How should the Commission go about identifying such horizontal market power problems? (c) What criteria should the Commission use for determining when market power is sufficiently benign that it can allow suppliers to engage in market-based pricing free from traditional price regulations? and (d) If horizontal market power is a serious problem, what should the Commission do about it? The following is a summary of my comments on these questions and the issues they raise

1 The primary purpose for expanding access to transmission networks under reasonable terms and conditions is to support competitive wholesale power markets that are free from costly and burdensome price and entry regulation. It would be unfortunate if the Commission's efforts to expand access to transmission services were not followed quickly by the removal or relaxation of regulations governing prices for wholesale power transactions Unlike the electric power sectors in countries such as England before restructuring and privatization, we have many utilities and independent suppliers providing generation services in all regions of the country They already compete aggressively in wholesale markets, subject of course to Commission regulations that de facto provide for considerable price flexibility While it is certainly necessary for the Commission

to consider horizontal market power issues in an open access regime as it expands market-based pricing for wholesale power transactions, it should seek to specify criteria that recognize the broad superiority of resource allocation in unregulated markets compared to the allocation of resources that results from necessarily imperfect regulation. The concepts and criteria discussed in this paper can and should be readily integrated with current Commission policies for granting market-based pricing in a way that protects wholesale customers from abuse while rapidly expanding market-based pricing opportunities

2 As the Commission considers the methods that it will use to examine horizontal market power issues and the criteria that it will apply to determine whether market-based pricing can replace cost-based regulation, there is one important set of considerations that should guide its decisions At the present time, wholesale power transactions are generally subject to some form of cost-based regulation. These regulations are rationalized by the perceived need to protect buyers from prices that would otherwise be too high as a result of the exercise of market power The question that the Commission should be trying to answer is under what circumstances is there "enough" competition to replace administrative regulation of prices with market-based pricing? The answer to this question must reflect <u>both</u> the consideration of market imperfections that can lead to departures from the attributes of a textbook competitive market model <u>and</u> that continued regulation is costly and imperfect as well Accordingly, it would be wrong to conceptualize the choice as being between costless, perfect regulation and perfect competition. Rather the choice should be conceptualized as being between two imperfect institutional arrangements Thus, in developing criteria for drawing lines between markets where there is adequate competition and those where there is not adequate competition, the Commission must ultimately balance the costs of imperfect markets against the costs of imperfect regulation to determine whether a market is "workably competitive " The analytical methods that it selects must be focused on this balancing issue, not on satisfying a rigid set of structural or behavioral indicia of market power

3 The Commission asks whether it can eliminate its generation dominance standard based on before-the-fact predictions of changes occurring as a consequence of the implementation of the proposed rules My analysis leads me to conclude that it would be unwise at this time to eliminate completely case specific factual analysis of horizontal market power for purposes of granting

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market-based pricing for sales of generation service at wholesale However, there are several ways in which the Commission can refine its present approach to assessing market power in market-based pricing cases

4 If we had data for all of the relevant demand elasticities, cross elasticities, production costs, transportation costs, information costs, the distribution of information, market structure and the nature of the competitive interactions between suppliers in a market, we could specify an associated market model and determine directly the extent of market power, and how it is affected by changes in transmission institutions, trading institutions, market structure, input costs, technological change, etc However, as a practical matter the information necessary to perform such a modelling exercise so as to yield definitive conclusions about market power is rarely available to the analyst. Instead, the analysis of market power generally relies primarily on more indirect indicia of market power to draw inferences about the likely importance of oligopolistic interactions between suppliers and how they affect market performance — the exercise of market power — given available but generally imperfect information on demand and cost parameters, firm and market structure, behavior and performance

5 The answer to the question of whether competition in a market is too imperfect or a particular supplier is so dominant in a market that it can exercise unilateral market power is fact specific However, the *analytical framework* that should be applied to diagnose market power need not and should not vary on a case by case basis The basic analytical framework embodied in the 1992 Horizontal Merger Guidelines adopted by the Antitrust Division of the U S Department of Justice and the Federal Trade Commission ("the Merger Guidelines") provides a useful framework for examining market power issues associated with the liberalization of the regulation of prices charged by competing suppliers of wholesale generation services However, I believe somewhat different structural screening criteria should be used to evaluate market-based pricing applications than are specified in the Merger Guidelines for the evaluation of horizontal mergers This is because the issues that the Commission must address in evaluating market-based pricing proposals are different from the issues that must be addressed by the enforcement agencies in evaluating horizontal mergers

6 The Commission has previously concluded that the market for sales from new generating capacity is competitive and that pricing arrangements for sales from new generating capacity acquired from unaffiliated companies can be market-based rather than being subject to cost-based regulation. The proposed rules governing the terms and conditions of access to jurisdictional transmission systems does not alter this conclusion. Indeed, if the rules are successful in facilitating access to transmission and ancillary services that otherwise would not have been available based on reasonable terms and conditions, they will expand competitive opportunities associated with new generating capacity even further Moreover, market-based pricing of long term capacity and energy contracts from *existing* capacity that compete with sales from new capacity should be subject to the same regulatory treatment as sales from new capacity That is, there should be a rebuttable presumption that market power is not of sufficient concern to justify continuing price regulation in these cases

7 The Commission seeks comment on how the relevant markets should be defined in an open access transmission regime My analysis leads me to conclude that the appropriate definition of the relevant product and geographic markets for purposes of assessing market power in the sale of wholesale generation services will be fact specific and is unlikely to be susceptible to a simple mechanical rule While the existence of power pools, RTGs, and reliability councils may have important implications for the appropriate definition of the relevant geographic market, the existence of these institutions per se will not necessarily define the boundaries between relevant geographic markets A variety of physical, institutional and economic factors will affect the appropriate definition of the relevant geographic markets Institutional, physical and economic factors will also affect the appropriate definition of the relevant product markets

8 The definition of the relevant product and geographic markets must be conducted from the perspective of the consumers of electricity, in this case wholesale customers Wholesale customers have needs for various types of generation services (e g capacity and energy, firm and non-firm, contracts of varying durations) to meet the needs of their retail customers economically and reliably These generation services are, to varying degrees, substitutes for one another Relevant product markets should aggregate good substitutes together and consider products that are not good substitutes as being in separate relevant product markets

9 The special characteristics of wholesale electricity supply, demand, trading and reliability institutions makes a "delivered bulk power market" or "destination market" perspective particularly useful [3] This approach looks at markets from the perspective of particular wholesale customers or groups of wholesale customers and examines which geographically dispersed suppliers, and the associated competitive significance of each supplier in the market, these customers would find it economical to turn to if wholesale prices were to rise by a small but significant amount. Wholesale customers can turn to generation suppliers dispersed over wide geographic areas in an open transmission access regime They can turn to generators located within their control areas (including own-generation), in directly connected control areas, and in more remote control areas in an open access regime Suppliers at different geographic locations provide competitive constraints on one another as they compete to supply particular wholesale customers In an open access regime these competitive supply forces are limited only by transmission costs, physical/reliability transmission constraints, and the competitive generating capacity available at different locations The expanse of the relevant geographic markets will be defined primarily by transmission costs and constraints and how they are reflected in transmission prices

10 Properly defining the relevant product and geographic markets is an important step to evaluate properly the likely intensity of competition in an open access world with market-based pricing because it allows us to calculate structural and behavioral indicia for these relevant markets that may be meaningful for assessing the intensity of competition. Market shares and seller concentration ratios calculated for properly defined relevant product and geographic markets are convenient, but highly imperfect indicia of market power They can be useful components of an analysis of market power if they are used properly and carefully, within the context of properly defined relevant markets and taking full account of the market, contractual and regulatory institutions that characterize wholesale trade in electricity Market share and seller concentration ratios may be completely meaningless outside of the context of properly defined relevant markets and the market and regulatory institutions that govern firm behavior

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[3]The United States Department of Justice has used this perspective to analyze market power and deregulation for oil pipelines *Oil Pipeline Deregulation*, Report of the U S Department of Justice, May 1986, pages 23-32,

11 If there are market power problems in a relevant wholesale power market, they are likely to be associated with shorter term transactions and to be transitory This is because at current and expected fuel prices and with state-of-the-art generating technology, entry of new generating capacity is relatively easy and can be supplied by numerous potential suppliers Thus, competitive entry necessarily places a cap on prices at a level that reflects the cost of new entrants This in turn defines the long run competitive price of electricity To assess the importance and duration of these potential short term market power problems I recommend that the Commission adopt a two-step process First, the Commission should specify a set of market structure "screens" for distinguishing firms and markets which have a "low risk" of significant short run market power from firms and markets where there may be a "high risk" of significant short run market power Market-based pricing authority should be granted without further analysis in the "low-risk" situations Where these screens indicate that there may be a "high risk" of significant market power, the Commission should then proceed to a second step in which further analysis of additional structural and behavioral indicia for the relevant markets is conducted to come to a final determination of whether market power is a significant problem. If this second step of the analysis indicates that market-based pricing would lead to market outcomes that are too imperfect, the Commission should proceed to consider alternative mitigation strategies, including continued cost-based regulation.

12 I suggest the following structural screens for the first step of the analysis aimed at distinguishing firms and markets that are at "low risk" for excessive market power, and where market-based pricing can proceed without more detailed analysis, from those where the market structure screens suggest that a more detailed inquiry is required

a. A *market* should be considered to be "low risk" if the Herfindahl-Hirschman Indices (HHI)[4] calculated for properly defined relevant product and geographic markets, and using generating capacity or energy that is actually available or likely to be available to compete in the relevant markets, are less than or equal to 2500 This is the equivalent of four equal

[4]The HHI is equal to the sum of the squared market shares of all of the suppliers in the relevant market. For example, if there are two equal-sized firms in the relevant market the HHI would be 5000 If there are four equal-sized firms in the relevant market the HHI is 2500

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sized firms This criterion was used by the U S Department of Justice in its 1986 report on deregulation of oil pipelines [5] In markets where the HHIs are below this threshold, the presumption should be that "collective market power" is not a problem. Market-based pricing would be available to all suppliers in such a market, except for any individual suppliers which other screening criteria (see (c) below) indicate may be a high risk of exercising *unilateral* market power

b An *individual firm* should be considered to be "low risk" of exercising unilateral market power (i e possessing "market dominance" or "unilateral market power") if its market share in properly defined relevant markets and using generating capacity and energy that is actually available or likely to be available to compete in the relevant market is less than or equal to 20% *regardless* of the HHI for the relevant market. This market share criterion, though not necessarily the relevant markets to which it is applied, is consistent with the Commission's current policies in market-based pricing cases This criterion provides a safe harbor for firms which are clearly not dominant suppliers regardless of the overall structure of the market. This approach is consistent with the FCC's treatment of interstate long distance telephone carriers other than AT&T

c An *individual firm* should be considered to be "low risk" for exercising unilateral market power if its market share in properly defined relevant markets and using generating capacity and energy that is actually available or likely to be available to compete in the market is less than or equal to 35% *and* the HHI in the relevant market is less than or equal to 2500 This criterion provides a threshold for closer examination of unilateral market power possessed by one or more suppliers in markets that are otherwise structurally competitive This criterion would increase the threshold market share presently used by the Commission for market dominance from 20% to 35% *if* the overall market is structurally competitive The 35% screening threshold for unilateral market power is significantly below the market share threshold that is typically required to demonstrate that a firm has monopoly power under Section 2 of the Sherman Act.

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[5] *Oil Pipeline Deregulation*, Report of the U S Department of Justice, May 1986, pages 23-32

There should be a presumption that firms and markets that meet these first step screening criteria have a "low risk" of market power and market-based pricing should be permitted without further analysis of market conditions Thus, in these cases, the burden of proof would shift to those who would argue that despite meeting these structural criteria, market power is still a sufficiently significant problem that continued regulation or other mitigation strategies are required. Firms or markets that fail to meet these first step structural criteria are designated as being of *potentially* "high risk" of exercising market power and are subject to further analysis of other structural and behavioral indicia mentioned in this paper to come to a final judgement about whether or not there is excessive market power in the relevant markets and that market-based pricing would adversely affect consumers. So, after further analysis the Commission might conclude either that a supplier with a 40% market share does not have sufficient market power to withhold market-based pricing authority or that it does have excessive market power, depending on the broader facts developed in step two for the particular situation being analyzed.

13 The Commission seeks comment on whether it can rely on rules of conduct and monitoring of behavior to mitigate remaining horizontal market power problems If the Commission concludes that horizontal market power in one or more relevant markets is so significant that it cannot grant a utility's request for market-based pricing authority, the default is to continue to regulate wholesale transactions as it does now However, the Commission should allow firms to propose alternative mitigation strategies that would be substitutes for continuing to rely on prevailing regulatory rules. These mitigation strategies should maximize opportunities for flexible market-based prices, be fair to the regulated firms from a cost recovery perspective, and provide benefits to customers compared to continuing with business as usual They should reflect both the significance and duration of the expected market power problem. Among the mitigation strategies that should be considered are the use of price caps that would allow flexible pricing below a cap for all suppliers in the relevant market (as in the WSPP), the application of price caps only to truly dominant firms in the relevant market (as has been applied by the FCC to AT&T's interstate telephone services), the development of performance-based regulatory arrangements applicable to a utility's generating plans which provide incentives for the utility to expand output, to make offers at competitive prices and provide disincentives to restricting output — that is incentives to behave competitively and disincentives to exercising market power; investments in transmission

capacity that will relieve constraints and expand the size of the relevant geographic market, and the separation of sufficient generating capacity to reduce excessively high levels of concentration. If utilities do not come forward with satisfactory mitigation strategies then the Commission can continue to regulate wholesale rates as it does now, i.e , cost-based pricing.

14 The Commission also seeks comment on whether it should rely on structural reform as a means to curb horizontal market power My analysis leads me to conclude that the Commission should rely on mandatory structural remedies (e g., divestiture)[6] as a last resort and only under the following circumstances the market power problems are severe and actual or potential entry of competing generators is not expected adequately to constrain it for several years, light-handed incentive regulation and related transition mechanisms are unavailable, investments to remove transmission constraints and market growth are unlikely to ameliorate the problems relatively quickly; and the Commission's open access rules are not successful in ameliorating market power problems that arise from vertical control of both generation and transmission facilities in the same area. Mandatory divestitures of generating assets are likely to be a costly and time consuming process that will raise difficult organizational, financial, legal and jurisdictional issues It would only make sense to proceed with such a mitigation strategy if the market power problems are likely to be severe and sustained for a long period of time Otherwise, it would be unwise to delay expanding market-based pricing opportunities until difficult structural reforms are accomplished

15 The Commission seeks comments on whether it should entertain requests for market- based pricing by all wholesale suppliers within a relevant geographic market or any smaller area within a properly defined relevant geographic market. My analysis leads me to conclude that this would represent a very desirable reform of the Commission's current approach to analyzing horizontal market power since market power problems are often associated with the behavioral interactions between firms in a market rather than with unilateral market power associated with a single firm in the market. A full market analysis would allow the Commission to develop criteria for assessing the competitive attributes of the market as a whole and would facilitate expanding market-based pricing to all suppliers in markets which are adequately competitive If this approach is adopted,

[6] I offer no opinion about whether the Commission has the authority to order firms to restructure if they are willing to continue to make wholesale transactions subject to cost-based regulation.

the Commission could avoid the costs and delay associated with performing market power analyses for each firm applying for market-based pricing authority

MARKET POWER: WHAT IS IT AND WHERE DOES IT COME FROM?

Market power refers to the ability that a single firm or a group of competing firms in a market have *profitably* to raise prices above competitive levels and restrict output below competitive levels for a sustained period of time. Market power is normally analyzed by examining competitive conditions at one or more horizontal levels of the production chain from inputs to final outputs (e g. fuel, equipment, delivered energy and capacity) In the perfectly competitive market of elementary textbooks each competitor ignores the actions of its rivals, assumes that market prices are not affected by its own actions, and produces as much output as it can profitably produce at prevailing price levels When all firms in a market behave this way supply and demand are balanced at a price that is just high enough to bring forth the resources necessary to satisfy customer demands at that equilibrium price

Very few firms or markets have the attributes associated with textbook perfect competition. Firms often recognize that their decisions about how much to produce can affect the price that they receive for their products They also recognize that if they raise their prices they will not instantly lose all of their customers to rivals Finally, individual firms may come to recognize that the ultimate outcome of the market process depends not only on their own actions, but on the interactions between their behavior and those of their rivals Their pricing and output decisions will be affected by their recognition of these interdependencies Overall, firms are rarely pure price takers as is assumed in textbook perfect competition. Thus, most markets have attributes that lead to departures from the perfectly competitive ideal and in this sense most markets are "imperfectly competitive" and exhibit at least some market power [7]

In the U S , we don't generally subject firms in markets that are imperfectly competitive to price regulation or antitrust sanction, just because they depart from a textbook model of perfect competition. Rather, we generally accept a considerable degree of market power before public policy actions seek to intervene into the unfettered operation of markets This is because price regulation and antitrust sanctions are necessarily imperfect and potentially costly as well [8] Price and entry regulation, antitrust sanctions and

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[7]See generally, Jean Tirole, *The Theory of Industrial Organization*, MIT Press, 1988

[8]See e g Paul L Joskow and Alvin K. Klevorick, "A Framework for Analyzing Predatory Pricing Policy," *Yale Law Journal*, December, 1979

other forms of government intervention into firm and market structure and behavior are properly applied only when the imperfections of the market can be ameliorated without incurring excessive regulatory costs These costs go well beyond the administrative costs of regulation, and most importantly include the costs of static and dynamic inefficiencies that can be caused by regulation. Market power is not something that a firm or market "has" or "doesn't have" like some disease It is a question of degree and importance Thus, it is necessary to develop market power indicia and associated "workable competition" criteria for diagnosing the presence of market power, its significance, and when it is appropriate for government to intervene -- through price regulation, other behavioral restrictions, or structural reforms -- to mitigate market power when it is too extreme

If we had data for all of the relevant demand elasticities, cross elasticities, production costs, transportation costs, information costs, the distribution of information, market structure and the nature of the competitive interactions between suppliers in a market, we could specify an associated market model and determine directly the extent of market power, and how it is affected by changes in transmission institutions, trading institutions, market structure, input costs, technological change, etc However, as a practical matter the information necessary to perform such a modelling exercise so as to yield definitive conclusions about market power is rarely available to the analyst. Instead, the analysis of market power generally relies primarily on more indirect indicia of market power to draw inferences about the likely importance of oligopolistic interactions between suppliers and how they affect market performance — the exercise of market power — given available but generally imperfect information on demand and cost parameters, firm and market structure, behavior and performance

Thus there is no simple formula, model or set of structural, behavioral or performance indicia that make it possible to diagnose and measure with mathematical precision the presence and significance of market power across all markets However, there is a reasonably well accepted set of economic factors that the antitrust enforcement agencies and, in particular, economic analysts skilled in market power analysis, rely on which provides considerable guidance regarding the kinds of firm, product, and market characteristics that are likely to lead to significant market power problems For example, the number and size distribution of firms is thought to be an important determinant of market power, at least in the short run when rapid and significant entry does not provide an exogenous constraint on efforts to raise prices above competitive levels The fewer are the number of firms, the more likely are individual firms to recognize that their individual behavior can affect market prices and to take account of important oligopolistic interrelationships between their decisions and those of their rivals

The conditions of entry into the market also have important implications for the viability and significance of market power Market power can only be a problem if unilateral or collective actions of suppliers can cause prices profitably to rise above the levels necessary to cover the costs of the additional resources required to expand output at such prices and associated quantities (i e prices must exceed the relevant short run or long run marginal costs) If prices were to rise above the costs that new entrants would have to incur, competitive entry would place a competitive cap on prices equal to the costs of new entry The more rapid entry can occur, the lower the minimum efficient scale of potential entrants, and the less important are sunk costs in the total costs of production, the more likely is it that actual or potential entry will constrain prices at competitive levels that reflect the long run, "zero economic profit," competitive price level.

Several other structural and behavioral factors also can have implications for assessing the significance of market power These include the nature of the products being sold in the market (homogeneous or heterogeneous), customer switching and information costs, the nature of the market mechanisms through which trade takes place (e g. open auctions, bilateral contracts, etc.), information asymmetries among competing suppliers and between suppliers and customers, existing contractual arrangements between buyers and sellers, and other factors However, the market power implications of these market characteristics are less well understood, both theoretically and empirically, than are the other structural indicia.

Market power problems may also arise at one horizontal level of the production chain as a consequence of market power problems at another horizontal level This might be a problem when there are "vertical" control relationships between producers at two or more horizontal levels of the production chain. For example, the Commission's proposed open access rule is built upon the assumption that suppliers of transmission and certain related network services necessarily have significant potential market power because the supply of transmission and certain ancillary services are perceived to have natural monopoly characteristics It assumes further that in the absence of appropriate regulation, transmitting utilities have or can exercise this market power in two related ways [9] One is that transmitting utilities would

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[9]In my discussion I will assume that these assumptions are in fact correct since my analysis does not focus on market power problems arising from vertical control relationships between transmission and generation. However, I am far from being convinced that all of the Commission's assumptions about the problems that have been created in wholesale power markets up until now as a consequence of vertical control by utilities of generating and transmission capacity under existing regulatory rules and ownership arrangements are in fact valid Many utilities offer transmission service under reasonable terms and

charge excessive prices for transmission service if these prices were not regulated, thereby increasing the "downstream" delivered price of electricity by increasing the combined price for bulk power (transmission plus generation) They might also use their control over transmission facilities to distort competition "upstream" at the generation supply level if unconstrained by regulation and antitrust sanctions The particular concern underlying this Rulemaking is that firms that own and control both "natural monopoly" transmission and network facilities that are needed by competing suppliers of generation to compete effectively, and also have an ownership interest in competing generators that use these facilities, will have the incentive and ability to favor their own generators and otherwise to raise their rival generators costs to increase the profitability of sales made by their own generators, absent effective regulation.

In what follows, I am interpreting the questions about horizontal market power raised in the NOPR in the following way The NOPR focuses on fixing "vertical control" problems arising from the common ownership and control of (presumed to be natural monopoly) transmission networks and (potentially competitive) generation suppliers by adopting open access and comparable service rules applicable to transmitting utilities Assuming that these rules solve these vertical control problems I interpret the NOPR as asking the following kinds of questions (a) Are their still additional potential horizontal market power problems in the supply of generation services that will require the Commission's attention in response to utility requests for market-based pricing? (b) How should the Commission go about identifying such

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conditions and wholesale markets have expanded significantly over the last two decades I am not aware of any systematic empirical evidence which demonstrates that discriminatory access to transmission service that supports wholesale trades has been a major source of market distortions that pervades the entire industry rather than being limited to a few special cases State regulations governing capacity procurement, cost of service regulatory policies, and the historical public policy preference for vertical integration, have all been much more significant factors affecting the development of fully competitive generation markets with large numbers of independent suppliers than has been discriminatory access to transmission systems to support wholesale trade See Paul L Joskow, "Regulatory Failure, Regulatory Reform and Structural Change in the Electric Power Industry," *Brookings Papers on Economic Activity Microeconomics*, 1989 I believe that the framework established by the proposed rules is a good one for supporting an industry that is being transformed into one that will look very different from the one that a century of legislative and regulatory policies have given us That is, it's good public policy looking out into a future that will rely much more on competition in the supply of generation services and a much expanded role for independent generation suppliers than has been the case historically The need to create the necessary competitive market platform to support a vision of a future competitive industry should be the primary justification for the proposed transmission access and pricing rules, not allegations of pervasive discrimination or anticompetitive behavior in the past. Nor do I believe that the ancillary services identified in the NOPR either are necessarily natural monopolies or that utilities should necessarily be required to provide these services at regulated rates For example, the provision of reactive power, losses, balancing service, spinning reserves, etc are likely to be available from competing suppliers

horizontal market power problems? (c) What criteria should the Commission use for determining when market power is sufficiently benign that it can allow suppliers to engage in market-based pricing free from traditional price regulations? and (d) If horizontal market power is a serious problem what should the Commission do about it?

BASIC POLICY APPROACH TO ASSESSING MARKET POWER IN WHOLESALE POWER MARKETS

The Commission has recognized that market power problems can emerge as a consequence of common ownership and control of "bottleneck" transmission facilities and generating facilities that make use of these facilities to compete at wholesale It has also recognized that the combination of exclusive retail service territories and imperfect cost of service regulation may make it possible for vertically integrated utilities to favor affiliated suppliers when they make generation procurement decisions (abusive self-dealing) or engage in cross-subsidization of services supplied in unregulated competitive markets by shifting costs to regulated rates and customers [10]

Accordingly, in a series of decisions, the Commission has made suitable open access transmission tariffs a necessary condition for permitting market-based pricing of power by utilities that own both transmission facilities and generating facilities that make direct use of these transmission facilities when they compete to make sales at wholesale In addition, the Commission has required generators affiliated with regulated utilities to demonstrate that they have not engaged in cross-subsidization of unregulated generation services by shifting costs to services subject to cost of service regulation. Finally, the Commission has not, to my knowledge, approved market-based rates for generation service transactions between a regulated utility and an affiliated generator[11] without an arms-length market benchmark.[12]

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[10] See generally, Tennenbaum, Bernard and Stephen Henderson, "The History of Market-Based Pricing," *The Electricity Journal*, December 1991 My discussion here relies on my interpretation of *Public Service of Colorado*, 58 ¶61,322, *Entergy Services Inc*, 58 FERC ¶61,234, *Public Service Company of Indiana*, 51 FERC ¶61,367, *Kansas City Power & Light Company*, 67 FERC ¶61,183, and *Ocean State Power*, 44 FERC ¶61,261

[11]There is nothing wrong in principle with allowing a utility to transact with an affiliate at market based rates as long as there is an external market price proxy against which the affiliate transactions can be judged Indeed, there may be considerable merit in requiring affiliate transactions to be priced based on a market price yardstick. Of course a regulatory rule that allowed recovery of only the lower of market price or accounting cost of service would be confiscatory and inappropriate

[12]*Ocean State Power* at 61,984

The Commission has never, however, considered the mitigation of market power associated with the ownership and control of transmission assets, as well as the mitigation of abusive self-dealing and cross subsidization, to be both necessary *and* sufficient to mitigate potential horizontal market power problems that may arise in the supply of wholesale power services While access to transmission networks based on reasonable terms and conditions may be a *necessary* condition to mitigate market power that may be associated with the control of transmission facilities, the Commission's policy has been that it is not a *sufficient* condition for mitigating horizontal market power that may arise independently at the generation level. The appropriateness of this view will be unchanged by the implementation of the proposed rules Accordingly, an independent requirement for obtaining Commission approval for market-based pricing of wholesale power should continue to be a separate analysis of horizontal market power in the supply of wholesale generation services, at least until further experience with these markets in an open access regime can support a generic conclusion that significant horizontal market power problems at the generation level arise sufficiently infrequently that they can be handled on an after the fact complaint basis only

However, the Commission has concluded, properly I believe, that market power is not a problem for sales from new generating capacity to meet the longer term capacity needs of distribution utilities The Commission has concluded further that such sales are properly subject to market-based pricing [13] Likewise, if existing capacity actually or potentially competes with new capacity to satisfy customer needs, such sales from existing capacity should be permitted market-based pricing authority as well More generally, if there are any market power problems in the supply of wholesale power services they must be associated with the use of existing generating facilities to make short and medium term sales of energy and capacity whose prices, absent the exercise of market power, would otherwise be below the cost of new entry

There is nothing in the open access NOPR that leads me to believe that this basic view of the Commission's obligations to assess horizontal market power as part of its evaluation of market-based pricing applications should be changed as a consequence of implementing the proposed open access rules The proposed rules deal with potential market power problems associated with the control of transmission facilities Generation market power remains a distinct *potential* problem in the short run regardless of whether access conditions for all transmission systems are now improved to mitigate any market power associated with control of these facilities Nor should the NOPR lead to any significant change in the broad

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[13] *Kansas City Power & Light Company*, 67 FERC ¶61,183 at page 61,557

distinctions previously adopted by the Commission between competition involving rivalry between suppliers of new and existing generating capacity to meet buyers' long term capacity needs and competition involving rivalry only between existing generators to meet shorter term needs when investment in new capacity is not a good competitive alternative This narrows significantly the circumstances under which market power in the supply of wholesale generation services is likely to be a problem. That is, it becomes largely a short term problem that is likely to be transitory

All things considered, I cannot agree with those who argue that the open access rules contained in the NOPR can be *assumed* to mitigate adequately horizontal market power associated with sales of wholesale generation service in all situations An independent case by case (or perhaps region by region) analysis of short term horizontal market power risks should still be required to meet the Commission's obligation to ensure that market-based (unregulated) wholesale rates for generation services are just and reasonable

ANALYTICAL FRAMEWORK AND MARKET POWER INDICIA

A Overview

The answer to the question of whether competition in a market is too imperfect or a particular supplier is so dominant in the market that it can exercise unilateral market power is fact specific However, the *analytical framework* that should be applied to diagnose market power need not and should not vary on a case by case basis As I have already discussed, this analysis cannot be reduced to a simple formula or model that can measure market power with mathematical precision. The basic analytical framework (but not necessarily all of the market structure criteria relevant to distinguishing acceptable from unacceptable horizontal mergers — a subject that I will return to presently below) embodied in the 1992 Horizontal Merger Guidelines adopted by the Antitrust Division of the U S Department of Justice and the Federal Trade Commission ("the Merger Guidelines") provides a useful framework for examining market power issues associated with the liberalization of the regulation of prices charged by competing suppliers of generation services

The basic framework starts by defining the relevant markets at issue The relevant markets have both a product dimension and a geographic dimension. The definition of the relevant product and geographic markets must be conducted from the perspective of the consumers of electricity, in this case wholesale customers Wholesale customers have needs for various types of generation services (e g. capacity and energy, firm and non-firm, contracts of varying durations) to meet the needs of their customers

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economically and reliably These services are, to varying degrees, substitutes for one another Relevant product markets should aggregate good substitutes together and consider products that are not good substitutes as being in separate relevant product markets

The special characteristics of wholesale electricity supply, demand, trading and reliability institutions makes a "delivered bulk power market" or "destination market" perspective particularly useful.[14] This approach looks at markets from the perspective of particular wholesale customers or groups of wholesale customers and examines which geographically dispersed suppliers, and the competitive significance of these suppliers, these customers would find it economical to turn to if wholesale prices were to rise by a small but significant amount. That is, wholesale customers may be able to turn to generation suppliers dispersed over wide geographic areas in an open transmission access regime These include generators located within their control areas (including owned-generation), in directly connected control areas, and in more remote control areas in an open access regime Suppliers at different geographic locations provide competitive constraints on one another as they compete to supply particular wholesale customers In an open access regime these competitive supply forces are limited only by transmission costs, physical transmission constraints and the generating capacity available at different locations to compete The expanse of the relevant geographic markets will be defined primarily by these transmission costs and constraints and how they are reflected in transmission prices Indeed, one way of looking at the effects of the open access NOPR on horizontal competition is that it promises to expand the relevant geographic market and increases the number of effective competitors available to deliver power to any particular geographic location.

Defining precisely which products and which geographically dispersed suppliers are "in" the market and which are "out" of the market is often impossible, as clear gaps in the chain of substitutes may not exist. Moreover, existing contractual or regulatory commitments can affect the appropriate consideration of the competitive significance of different suppliers As a result, it may be necessary to examine market power indicia using alternative definitions of the relevant market to understand better how sensitive the analysis is to small changes in definitions of relevant markets

Once the relevant markets are defined, the framework goes on to examine a variety of structural and behavioral indicia that are generally thought to be related to either unilateral or "collective" market

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[14]The United States Department of Justice has used this perspective to analyze market power and deregulation for oil pipelines *Oil Pipeline Regulation*, Report of the U S Department of Justice, May 1986

power in particular market settings The indicia include the number and size distribution of suppliers, associated market shares and seller concentration levels, entry conditions, institutional factors that affect opportunities to compete and the nature of competitive trade, the nature and distribution of information, and other factors identified in the Merger Guidelines These indicia are all potentially useful but imperfect predictors of the existence and magnitude of market power problems in particular market settings, however They must be used carefully with other relevant information about market institutions, firm behavior and market performance to lead to an informed judgement about the intensity of competition in specific relevant markets and how it is likely to change as demand and supply conditions evolve over time In short, there are no simple mechanical formulas that make it possible to distinguish markets with varying degrees of market power with mathematical precision. We can, however, often use simple indicia to identify firms and markets in which market power is *unlikely* to be a serious risk if market-based pricing is permitted Developing "safe harbors" based on such indicia can speed the expansion of competitive opportunities and reduce the distortions caused by regulation.

Finally, if this analysis leads to the conclusion that the structural, behavioral and performance attributes of the market would, absent continuing regulation, lead to a market environment characterized by excessive market power in one or more relevant markets, the Commission should allow firms to propose alternative mitigation strategies that would be substitutes for continuing to rely on prevailing regulatory rules These mitigation strategies should maximize opportunities for flexible market-based prices, be fair to the regulated firms from a cost recovery perspective, and provide benefits to customers compared to continuing business as usual. They should reflect both the significance and duration of the expected market power problem. Among the mitigation strategies that should be considered are the use of price caps that would allow flexible pricing below a cap for all suppliers in the relevant market (as in the WSPP), the application of price caps only to truly dominant firms in the relevant market (as has been applied by the FCC to AT&T's interstate telephone services), the development of performance-based regulatory arrangements applicable to a utility's generating plans which provide incentives for the utility to expand output, to make offers at competitive prices and provide disincentives to restricting output — that is incentives to behave competitively and disincentives to exercising market power; investments in transmission capacity that will relieve constraints and expand the size of the relevant geographic market, and the separation of sufficient generating capacity to reduce excessively high levels of concentration. If utilities do not come forward with satisfactory mitigation strategies then the Commission can continue to regulate wholesale rates as it does now, i e cost-based pricing

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b Relevant Product Markets

An analysis of market power must begin by defining the relevant product and geographic markets where competition takes place and identifying the suppliers and the associated supplies that actually or potentially could compete with one another to supply customers in these relevant markets if prices were to rise by a small but significant amount. The substitutes available include supplies from geographically dispersed third parties as well as own-generation. The relevant product markets of interest here all involve the sale of electricity produced by competing owners of generating facilities In principle, the relevant product market should be defined by aggregating products that are close but not necessarily perfect substitutes for one another into the same product market and including products that are not good substitutes for one another in separate relevant product markets If there were clear gaps in the chain of substitutes separating groups of close substitutes from one another, the task of defining relevant product markets would be easy Unfortunately, this happy circumstance rarely emerges in practice

The definition of the relevant product markets of interest in evaluating market power in wholesale power markets will depend on a variety of physical, economic and institutional attributes that are particular to electricity and the way the industry is structured and regulated As a result, under prevailing institutional arrangements, it will not generally be appropriate simply to define "electricity" or "generating capacity" as the relevant product market. Nor will it necessarily make sense to calculate "market shares" and seller concentration ratios simply by adding up all of the generating capacity and associated energy in an area and assigning them to the firms that control the associated capacity and energy Some of this capacity and energy may compete on the supply side in the relevant market. Some may compete on the demand side (for vertically integrated firms), acting as competitive substitutes for those utilities that are buyers rather than sellers in wholesale markets And some may not compete at all in certain relevant product markets because of pre-existing regulatory or contractual commitments or the economic attributes of particular supply technologies Moreover, some of the relevant institutional factors may change over time and the definition of the relevant product markets and/or who competes in them may change as well. For example in the Independent System Operator/Poolco model proposed in California, the traditional distinction between firm and non-firm capacity transactions and energy transactions would no longer exist. Physical trades and financial contracts of certain kinds would be separated rather than bundled together Finally, transition arrangements for existing generating capacity could affect the behavior of incumbent suppliers in the market

Among the factors that must be taken into account to define the relevant market, the associated suppliers who compete in it, and their respective significance as competitive forces are

a. Utilities enter into a wide array of contractual arrangements for purchases of electricity at wholesale. The transactions range from hourly non-firm energy transactions to firm capacity and energy contracts that last twenty years or more Indeed, there is a continuum of contracts that varies by duration, firmness, and price adjustment provisions Moreover, as the electric utility industry is structured today — built around over 140 control areas and an associated "capacity capability/responsibility" paradigm — firm and non-firm *energy* transactions typically play a different role from firm *capacity* or capacity and energy transactions A utility must have either owned capacity or capacity under contract to meet its capability/responsibility Energy contracts cannot be used to meet capacity requirements and "gaming" that endeavors to do so necessarily involves inefficient free riding on utilities with control area responsibilities and ultimately threatens reliability Further, short term capacity transactions play a different role from long term capacity transactions Firm and non-firm energy transactions are typically good substitutes for one another and are used by utilities as substitutes for running their own generating plants or calling on energy available in connection with capacity contracts Short term capacity contracts that are used to meet a utility's capability/responsibility at any given point in time often make it possible for a utility temporarily to turn off a generating unit or even retire a generating unit that is costly to run, and may make it possible to defer acquisition of additional long term capacity resources They may also be good substitutes for short term energy transactions, especially when there is excess capacity in a region. Longer term capacity transactions have typically been used as a substitute for building or taking an ownership interest in incremental generating facilities required to meet a utility's capability/responsibility criteria. In general, energy contracts of varying durations are good substitutes for one another and capacity contracts of varying durations are good substitutes for one another Substitution possibilities decline as the difference in the duration of the contractual commitments increases and as the flexibility of associated pricing provisions decreases As the duration of contractual commitments grows, sales from new capacity are likely to become a good substitute for sales from existing capacity

This suggests that under prevailing institutional arrangements there are at least three relevant product markets that are likely to be worth considering -- a short term energy and capacity market (up to two years or so), a medium term capacity contract market involving capacity and associated energy sales from "excess capacity" from existing facilities (two to five years or so)[15], and a long term capacity market where sales from new capacity and long term contracts for sales from existing capacity compete. For the reasons already discussed, the presumption should be that market power is not a problem in the latter market so that the analysis of competition and market power can focus on the first two product markets identified above This approach seems broadly consistent with the Commission's current approach to defining relevant products, though not necessarily with its approach for identifying the competing suppliers in the market or their competitive significance

b Under current institutional arrangements, the native load customers of a utility have first call on the generating facilities that produce the cheapest energy at any particular point in time Moreover, a utility cannot sell capacity it relies on at a particular point in time twice If capacity is being used to meet a utility's capability/responsibility it cannot (or at least it should not) be sold to meet another utility's capability/responsibility Thus, under prevailing institutional arrangements what a vertically integrated utility has to put on the market is the "residual" energy and capacity that is not already committed pursuant to its obligation to serve its native load customers or previous long term commitments to third parties It is these residual energy and capacity sales opportunities that should generally represent a supplier's competitive presence in short and medium term wholesale markets A large vertically integrated utility with a lot of capacity to serve its native load customers but little capacity or energy to sell to third parties may not be a significant competitive force on the supply side of the market while a small vertically integrated utility with a lot of excess capacity to sell may be a big player in the market.[16] Long term contracts with independent

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[15]Precise definition of the time frame depends on lead times for the entry of new generating capacity into the relevant geographic market and the expected supply and demand balance in the relevant geographic market in the future

[16]For this reason I cannot agree with the Commission's general conclusion in *Entergy* that "The distribution of installed generating capacity is a general indicator of a utility's size and, therefore, of its ability to dominate electricity supply in a region, including the short-run market. " Footnote 75 to this sentence, properly qualifies this conclusion, however, and is more consistent with my views "Because this indicator includes capacity required to serve native load, however, it overstates the amount of capacity a

suppliers or incentive regulatory mechanisms (PBR) that specify maximum prices and minimum supply obligations to serve retail customers can have similar implications for specifying properly the capacity that is actually available to compete in wholesale markets during a specific time frame

c. With some exceptions (e g , pumped storage) electricity cannot be stored economically As a result, energy and capacity that may be available to the wholesale market at one hour when demand is low may not be available to the wholesale market when demand is high because it is already being used to satisfy long-term regulatory and contractual commitments This suggests that the relevant product markets may theoretically be further disaggregated based on time of the day or year and associated supply and demand conditions (As discussed presently, the relevant geographic market may also vary over time due to variations in supply and demand conditions) However, it is unlikely to be either necessary or practical to define a large number of time differentiated product markets One reason is that demand and supply characteristics are likely to be similar for broad groupings of hours during a year Also, while electricity cannot be easily stored, generators can reschedule maintenance downtimes in response to variations in market prices, a form of supply-side substitutability Moreover, competition through firm energy contracts that cover sales over all hours of the year can constrain prices during "non-competitive" hours Firm energy contracts that give buyers flexibility as to when they take the energy they have contracted for can provide a particularly potent constraint.

d. Economic institutions may change in the future and this in turn may alter the way electricity is traded For example, in the England and Wales pool-based system there is no meaningful distinction between "firm" and "non-firm" physical transactions or between "energy" and "capacity" transactions. Rather, physical sales and purchases of power through the pool each 30 minutes have been separated from financial contracts that allow firms to hedge price volatility, lock in fixed prices for a specified period of time, or make prices contingent on how much the customer consumes The potential suppliers of these financial contracts can be generators, unaffiliated retailers and/or a variety of financial intermediaries The associated market for these financial contracts should be very competitive Nor is there contract path wheeling in the England/Wales

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utility can withhold or offer in the short-run bulk power market." *Entergy Services, Inc* 58 FERC ¶61,234 at 61,758

pool. All buyers and sellers have access to an integrated network and make physical purchases and sales to and from a common pool of all generating resources making sales over the network without the need for specific contract wheeling paths There is no capability/responsibility placed on distribution companies as in the U S or on retail customers that have direct access to the pool. They can buy as much electricity as they like at any particular point in time as long as they are willing to pay the market price at that time, which could be quite high when supplies are tight.

Thus, for purposes of evaluating horizontal market power associated with the physical supply of useful electric energy to customers, the relevant product in the England/Wales pool is simply "energy" available in the pool, perhaps differentiated by time to reflect variations in transmission constraints (see the discussion of relevant geographic markets below) Moreover, experience in the England/Wales pool suggests that the capacity that sets the price in the market is the mid-merit order fossil capacity rather than the low marginal cost nuclear capacity or the low-cost energy that comes over constrained ties with France and Scotland [17] This in turn suggests that in a market environment such as the one that exists in England and Wales it may be more appropriate to focus attention on the supply attributes of the capacity that is reasonably likely to be competing to set the price in the market rather than focusing on total capacity and energy available to the market.[18]

The Commission's current procedures for defining the relevant generation product markets for the purposes of evaluating market-based pricing proposals reflects many of these considerations [19] In

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[17]Richard Green and David Newbery, "Competition in the British Electricity Spot Market," Journal of Political Economy, 929, 1992 and David Newbery, "Power Markets and Market Power," mimeo, April 1, 1995

[18]A full assessment of market power in a pool-based system should consider the effects of the market for contracts for differences and related financial instruments as well. To the extent that generators are also participants in the markets for these heterogeneous financial instruments, competition to write financial contracts with customers may serve to undermine oligopoly behavior in the pool. This is because "cheating" on an oligopoly price will be harder to detect or punish in a heterogeneous financial contracts market and, therefore, more likely to promote competition. Generators may participate in the financial contracts market in a variety of different ways

[19]The discussion that follows is my simple interpretation of Commission policies as they have evolved in *Public Service of Colorado*, 58 ¶61,322, *Entergy Services, Inc*, 58 FERC ¶61,234, *Public Service Company of Indiana*, 51 FERC ¶61,367, and *Kansas City Power & Light Company*, 67 FERC ¶61,183

particular, it reflects a recognition that there are differences between short term and long term transactions and that competition in short term markets comes primarily from existing capacity that is surplus to the owner's native load and long term contractual commitments However, there remain some potential problems associated with identifying the capacity and energy available to compete in the market and in measuring the associated competitive significant of competing suppliers of energy For example, in *Entergy*, the analysis of market power in short run markets relied in part on "market shares" calculated for the total installed generating capacity in the relevant geographic market and in part on "market shares" for surplus generating capacity The resulting market shares could be misleading in some circumstances Assume, for example, that half of the vertically integrated suppliers in the relevant market are generally *sellers* of short term energy and capacity and half of the vertically integrated suppliers in the market are generally *buyers* of short term power in the wholesale market. Calculating market shares for all vertically integrated utilities in a relevant geographic market and treating them all as if they are competing suppliers selling to still other buyers would not make good sense in this case [20] A large utility may have a lot of capacity because it serves a large retail load, but it could easily be a buyer rather than a seller in wholesale markets It's share of the generating capacity would tell us nothing about its ability to exercise market power as a seller, but a lot about the ability of other sellers to charge it, as a buyer, excessive prices As a general matter, the Commission should use information about the economic and contractual attributes of the generating capacity available in a region, and how it is used, to define market shares and concentration ratios that are meaningful indicia of seller market power

Similar complications may emerge in interpreting "market shares" for surplus capacity and associated short or medium term firm power sales Assume that a geographic area has very little surplus capacity overall and that the bulk of the capacity needs of buyers are expected to be met with new capacity Indeed, assume that only one of the ten suppliers in the market has any excess capacity at all. By definition this supplier has 100% of the "surplus capacity" However, this "market share" is of no competitive significance if the seller with the surplus capacity is competing against suppliers of new capacity Alternatively, consider a market which has a great deal of excess capacity, let's say 10,000 Mw, and that uncovered load is expected to grow at only 1,000 Mw per year Assume that one supplier has control of

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[20]On the other hand, the fact that the buyers are also vertically integrated utilities with capacity they can run if wholesale prices for energy rise suggests that their capacity does have potentially important competitive significance The problem is that simple market share and concentration ratios may be especially poor indicia of market power in the electric power industry because of vertical integration and long term contractual and regulatory commitments

5,000 Mw and five suppliers each have control of 1,000 Mw of surplus capacity While the large supplier may have 50% of the surplus capacity, *each* of the other suppliers can fully meet additional demand for capacity projected for the coming year It is unlikely that the largest supplier could have any effect on competition by withholding supplies from the market since each of its competitors can fully meet the relevant demand. The 50% market share figure will vastly overstate the competitive significance of the largest potential supplier

Finally, the Commission has chosen to evaluate one potential way that market power can be exercised. That is, *unilateral* market power that may be possessed by an applicant for market-based pricing. However, as I discussed above, a market may be characterized by significant *collective* market power which would be very difficult to identify by looking only at the market share of a single firm. Thus, it would be worthwhile for the Commission to consider a broader and more comprehensive analysis of the entire market when an individual firm cannot meet that threshold or when there is a multilateral filing for market-based pricing

In light of these considerations, I believe that the Commission should be receptive to alternative approaches to defining the relevant product markets and measuring the competitive significance of the suppliers in them if they better capture the nature of competition in these markets

c Relevant Geographic Markets

The second key step in evaluating competitive conditions in bulk power markets is to define the geographic expanse of the market in which generators compete with one another Generators located at different points should be aggregated together when customers do or could economically turn to them as competing suppliers for their needs if prices were to rise by a small but significant amount. If transmission were costless, there were no line losses, and there were no physical or institutional constraints limiting transactions between regions, the relevant geographic market would be the entire U S , Canada and parts of Mexico If this were the case we would not have to worry about horizontal market power problems in generation because there are so many suppliers in the U S and Canada and no individual supplier has more than a small share of the generating capacity available to compete to sell the relevant products Unfortunately, transmission is not free, line losses increase with distance, and there are physical and institutional constraints that limit trade between regions As a result, the relevant geographic markets used to evaluate short run market power will be significantly smaller than the entire area encompassed by the U S and Canada.

The primary factors affecting the boundaries of the relevant geographic market are transmission costs (including line losses), binding transmission constraints that "separate" wholesale prices in different geographic areas, and institutional arrangements that may facilitate trade (e g. power pooling arrangements) or create barriers to trade between suppliers [21]

Evidence regarding actual trading patterns of the relevant products during the pre-open access regime can provide useful information for defining the *smallest* reasonable relevant geographic market. Although all utilities do not now have open access tariffs in place, there has been extensive trade in energy and capacity in wholesale markets for decades A good set of open access rules can only help to expand the boundaries of the relevant geographic market.[22] As a result, the definition of the relevant geographic markets informed primarily by historical trading patterns will tend to lead to relevant geographic markets that are unrepresentative, indeed generally too small, of what will emerge in an open access regime So, in addition to an examination of historical trading patterns, it will be useful to examine information that can help to inform the Commission about how geographic trading patterns are likely to change in an open access regime Additional information that will be useful for defining the relevant geographic market are data on transmission costs and transmission constraints, the response of wholesale prices to demand and supply shocks in different areas,[23] and the attributes of power pooling and multilateral coordination and transmission arrangements that emerge as the open access regime evolves Overall, I expect that open access will expand the geographic expanse of trade and that relevant geographic markets defined based on pre-open access attributes will be too small for evaluating properly competition and market power post-open access, other things equal

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[21]Neither price differences between locations nor significant transmission costs necessarily imply that the locations are in different relevant markets Even if transportation costs are high and prices differ significantly, supply sources in a high cost area may still provide binding competitive constraints on prices in a low cost area (and vice versa) if an increase in price in the low cost area is unprofitable because it induces a countervailing supply increase in the high cost area. If such "arbitrage constraints" are binding, the locations are in the same relevant geographic market even if the delivered prices in the two locations are significantly different. Only when the arbitrage constraints are not binding and prices in the two areas do not respond together to supply and demand shocks would the two locations be in separate relevant geographic markets See the discussion of this issue in Pablo Spiller and Cliff Huang, "On the Extent of the Market. Wholesale Gasoline in the Northeastern United States," *The Journal of Industrial Economics*, Volume XXXV, December 1986, page 131

[22]This assumes that transmission services are priced properly

[23]As discussed earlier, neither transportation costs nor geographic price differences necessarily lead to the conclusion that the associated locations are in different relevant geographic markets

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Because the utilization of the transmission grid varies widely over time, the relevant geographic market may vary over time as well When demand is relatively low and transmission lines are not fully loaded, the relevant geographic market can be very large, encompassing large regions of the country This is because in the absence of transmission constraints and with low line losses, the arbitrage constraints that operate to link prices at different locations on the grid will be binding over a wider geographic area. When demand is very high and transmission lines are constrained, the relevant geographic market may be much smaller because the transmission constraints can have the effect of "separating" price formation in different regions by eliminating arbitrage opportunities when prices rise at a particular location that is inside of a constraint boundary The Commission's current policy for defining relevant geographic markets may be a useful "rough and ready" approach for defining market dominance when a single applicant for market-based pricing files a conforming open access tariff The Commission examines the supplier alternatives available to each wholesale customers which is interconnected with the applicant ("first tier" utilities) If the applicant has no open access tariff in place, the relevant geographic market in which these first tier utilities can turn to alternatives is defined by the generation suppliers to which each of them is directly interconnected This approach assumes either that no interconnected utility provides wheeling service to first tier utilities to allow them to gain access to additional generation suppliers or that the terms and conditions of transmission service that is available make such transactions uneconomical The first assumption will not be correct in an open access regime and the second assumption may not be consistent with the actual costs and constraints associated with transmission service The associated market share calculations also assume that all of the capacity or surplus capacity available from these interconnected suppliers are available to compete to serve the first tier utilities However, assuming that this capacity is potentially available to compete, transmission constraints may limit its competitive significance On the other hand, even in the presence of an open access tariff, current Commission policy assumes that a "second wheel" through utilities beyond the applicant is either unavailable or uneconomical In an open access world, buyers and sellers will have access to as many "wheels" as they are willing to pay for Moreover, changes in transmission pricing, the development of RTGs, pooling and other multilateral arrangements may facilitate economical trade over wider geographic areas than would be consistent with a rigid "one wheel" rule for defining relevant geographic markets

The approach that the Commission has taken to date to define relevant geographic markets and to evaluate market dominance in market-based pricing cases is fairly simple, pragmatic and does not appear to have led to results that have produced large numbers of complaints of abuse by the utilities that have

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been given market-based pricing authority On the other hand, it is clear that the approach to geographic market definition that has been used can lead to relevant geographic markets that are either too broad or too narrow It can also lead to "market shares" that do not accurately reflect the competitive significance of individual suppliers or the intensity of competition in the market. At the very least, I believe that the Commission should allow parties to make use of the best data and analytical techniques available to define relevant geographic markets more precisely

d. Indicia of Market Power: Overview

There are a variety of structural and behavioral indicia that are generally useful for making assessments of horizontal market power in the context of properly defined relevant product and geographic markets and the proper identification of the suppliers and the competitive supply capabilities that they have These indicia include market share and seller concentration ratios, entry conditions, trading institutions, price dispersion, evidence of cooperative behavior or unilateral restrictions on output, price/marginal cost ratios, and related behavioral information. As I have already discussed, these indicia are generally indirect and imperfect measures of market power and cannot be plugged into a simple formula that yields answers regarding the presence or absence of market power with mathematical precision.

Specifically, it is widely recognized that market shares and seller concentration ratios are only imperfect indicia of the extent of market power in properly defined relevant markets Despite these imperfections, however, market shares and seller concentration ratios can and are used productively as initial screening devices to distinguish firms and markets where there is a "low risk" of significant market power from firms and markets where there may be a "high risk" of significant market power, and therefore require closer scrutiny Thus, market shares and seller concentration ratios can be used productively in a "two-step" market power evaluation process

In the first step, the Commission would define the relevant markets, identify the suppliers and associated capacity and energy available or expected to be available to compete and then use a set of market share "screens" to distinguish firms and markets where there is a "low risk" of significant market power from firms and markets where there may be a "high risk" of significant market power being exercised Firms and markets that are determined to be "low risk" are then presumed to be eligible for market based pricing without further analysis Further review would only be triggered by complaints and persuasive evidence, based on observations drawn from actual market behavior and performance in a market-based pricing regime, that market power is a serious problem. If the market share and seller

concentration ratio screens indicate that firms or markets may be at "high risk" of creating significant market power problems when market-based pricing is available, a more detailed analysis of market indicia would take place before an ultimate decision regarding the availability of market-based pricing is made

This is the basic approach taken in the Merger Guidelines and by the Department of Justice in its evaluation of deregulation of oil pipelines [24] I suggest that the Commission adopt this type of screening approach in its evaluation of horizontal market power in an open access regime

Implementing this approach requires identifying which suppliers and which generating capacity and associated output they control are properly in the relevant product and geographic markets As discussed earlier, capacity and any associated energy that has a long term commitment to a distributor by ownership or contract and not available to compete in the relevant product market generally should be excluded from the market (in both the denominator and the numerator of the market share calculations) The Commission should consider refinements in its present policy that allow these factors to be taken into account.

In addition to examining individual market shares to infer market dominance, the Commission should also make use of the Herfindahl-Hirschman Index (HHI)[25] for measuring seller concentration, because the HHI neither excludes smaller suppliers from consideration (as would, for example a four-firm concentration ratio) nor assumes that all suppliers place an equivalent competitive constraint on the market without regard to size (as would a simple count of the number of competing suppliers) As I will discuss further below, the Commission's evaluation of market-based pricing requests should be based on an evaluation of both the significance of market power in the market as a whole as well as the possibility that a single dominant firm has significant unilateral market power This would involve expanding the approach presently utilized by the Commission which involves looking only at the market shares of the firm seeking market-based pricing authority to include a broader analysis of competitive conditions in the market.

The Commission's current view that entry into the new capacity market is sufficiently easy, that there are numerous suppliers who can easily enter to supply new capacity and, as a result, that it is "no longer necessary to examine generation dominance when considering market-based proposals for sales from new (as opposed to existing) generation units"[26] is correct and should continue to be applied in an

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[24] *Oil Pipeline Deregulation*, Report of the U S Department of Justice, May 1986, pages 23-32

[25] The HHI is equal to the sum of the squared market shares of all of the suppliers in the relevant market. The HHI is 10,000 when there is a pure monopoly and 2500 when there are 4 firms each with a 25% market share (25 x 25 x 4 = 2500)

[26] *Kansas City Power & Light Company*, 67 FERC ¶61,183 at page 61,557

open access regime It is consistent with the evidence from competitive bidding programs and the opportunities for entry created by low gas prices and technological changes that have led to smaller economical supply increments and shorter lead times

These attributes of the competitive markets for new capacity also have a number of implications for the significance of *short term* horizontal market power problems associated with wholesale sales from *existing* capacity as well.

First, because of constraints created by actual or potential entry, significant opportunities to exercise short run market power are most likely to exist only when there is significant excess capacity *in the relevant markets* and the marginal cost (measured over the appropriate time period) at which demand and supply are balanced is significantly below the long run entry cost of new capacity For example, in such a situation a monopolist could profitably set price significantly above the short run competitive price implied by the excess capacity available to the market as long as the resulting price is kept just below the competitive long run entry cost. This price is above competitive levels only because the competitive price in the short run is below this long run competitive equilibrium level due to excess capacity This appears to be "the problem" in the pool covering England and Wales which has only two suppliers setting prices in almost all hours (See Newbery (1995), *op cit*) [27] If there is no excess capacity, the short run marginal costs that balance supply and demand (measured over an appropriate time period) will be equal to the long run entry cost. If efforts to exercise market power resulted in a significantly higher price it would induce further entry and the price increase would be unprofitable to sustain. Thus, even if control over existing generation is highly concentrated, if there is little excess capacity in the relevant market, the ability profitably to raise prices above competitive levels for a sustained period of time will be constrained by actual or potential entry of new capacity

Second, under the current capability/responsibility paradigm that the industry relies upon to maintain reliability and guard against free riding, suppliers of new capacity may compete both with each other *and* with longer term firm capacity contracts from existing capacity that is surplus to its owner's needs In the presence of satisfactory transmission access and pricing arrangements, market transactions that are organized around competitive bidding for both long term contracts for sales from existing capacity and new capacity should be presumed to be adequately competitive to allow market-based pricing for long

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[27] An incumbent monopolist could profitably set an even higher price if entry is slow or the minimum efficient scale of an entrant is high and requires a significant commitment of sunk costs Jean Tirole, op cit., Chapters 8 and 9

term contracts for supplies from existing capacity as well as from new capacity In general, the Commission should operate under the presumption that capacity contracts with durations that exceed five years or so compete with sales from new capacity and that market power is not a problem with regard to such transactions Evidence regarding the overall extent of excess capacity in the market and its expected duration can help to refine further the extent of competition between capacity contracts for sales from existing capacity and new capacity

Thus, to the extent that horizontal market power is a problem in wholesale power markets in an open access regime, it is likely to be a transitory phenomenon that will be of most concern when there is excess capacity

Applicants for market-based pricing for which the market share and HHI screens indicate there may be a "high risk" of market power problems should then have the opportunity to perform further analyses of other structural and behavioral indicia that are useful for properly interpreting the competitive significance of market share and concentration indicia and to use this analysis to provide a more detailed assessment of competitive conditions in the relevant markets The indicia that the Commission should consider are outlined briefly at the end of the next section of the paper

MARKET SHARE AND CONCENTRATION SCREENING CRITERIA

According to the two-step evaluation process I have proposed, once the relevant markets have been defined and the various indicia of market power developed, this information must first be used to come to a judgement regarding whether the firms and markets at issue are at "low risk" of having excessive market power so that market-based pricing can proceed without further analysis, or may be "high risk" so that further analysis of competitive conditions is required Let me first address two conceptual issues and then suggest a set of numerical criteria for market share and concentration indicia that can be used as a simple structural "screen" for making an initial determination about whether or not there is adequate competition in the market to proceed with market-based pricing.

The most important thing to keep in mind in the question that we are trying to answer is under what circumstances is there "enough" competition to replace administrative regulation of prices with market-based pricing? The answer to this question must reflect *both* the consideration of market imperfections that can lead to departures from the attributes of a textbook competitive market model *and* that regulation is costly and imperfect as well. The potential social costs resulting from the exercise of market power are

well known.[28] However, regulators cannot reasonably expect that they can use their control over prices, entry and exit decisions to replicate perfectly the results that would emerge in textbook, perfectly competitive markets. Price regulation inevitably leads to price distortions and dulls incentives for efficient operating and investment decisions So, the Commission should not conceptualize the choice as being between costless, perfect regulation and perfect competition. Rather the choice should be thought of as being between two imperfect institutional arrangements In developing criteria for drawing lines between markets where there is adequate competition and those where there is not adequate competition the Commission should balance the costs of imperfect markets against the costs of imperfect regulation and apply a reasonable "workable competition" standard

In this regard, it is important to recognize that there are many industries in the U S in which individual firms have high market shares and the aggregate level of seller concentration on a national or local basis is quite high compared, for example, to the market share and HHI thresholds contained in the Merger Guidelines Yet as a matter of public policy we do not generally subject the firms in such markets to price regulation. This is because imperfect price regulation is likely to lead to worse results than imperfect competition unless the imperfections associated with particular unregulated markets are extremely costly from a social perspective It seems to me that there should be some symmetry between the public policies that guide decisions to regulate prices in the first place and decisions to deregulate those prices that takes account of the costs and imperfections of price regulation. In an open access regime, the Commission should be wary of continuing to regulate the prices for competitive supplies of generation services when the relevant markets have structural and behavioral characteristics similar to those of markets in our economy that we do not typically subject to price regulation.

The Commission also indicated that it is interested in comments on whether it should entertain applications for market-based pricing for an entire market, just for individual firms or for both. Market power problems generally arise as a consequence of the nature of competitive interactions between firms all of which behave as imperfect competitors (that is, they are not price takers and do not ignore the impacts of their output and pricing decisions on market prices as a whole) Thus, an appropriate analysis would typically look at the entire market and not just at individual firms in the market. It is also possible that only one or two dominant firms in a market exhibit imperfectly competitive behavior (they are not price takers and make output and pricing decisions accordingly) while the remaining "fringe suppliers" are

[28]Prices that are too high, inefficient operating and investment decisions, etc

price takers and act competitively given the price levels established by the dominant firm. This model of oligopolistic interaction is most likely to be a realistic characterization of the workings of a real market when one or two firms have very large market shares and the remaining firms are each relatively small suppliers

As a result, I believe that the Commission should examine the structural indicia for the entire market and not just for individual firms that happen to be applying for market-based pricing It should also entertain applications for market-based pricing both from individual firms and for the market as a whole (all suppliers) However, it would be unwise to withhold market-based pricing authority pending applications from all of the firms in a market because this could unduly delay the diffusion of market-based pricing

These considerations along with my evaluation of the empirical evidence that relates market share and concentration indicia to market power,[29] leads me to conclude that the Commission should adopt the following screens for distinguishing firms and markets which have a "low risk" of significant market power from firms and markets where there may be a "high risk" of significant market power Market-based pricing should be allowed in the "low-risk" situations and further analysis of competitive conditions and mitigation strategies should be conducted for the potential "high risk" firms and markets The market structure screens I suggest are

a. A *market* should be considered to be "low risk" if the Herfindahl-Hirschman Indices (HHI) calculated for properly defined relevant product and geographic markets and using generating capacity or energy that is actually available or likely to be available to compete in the relevant markets are less than or equal to 2500 This is the equivalent of four equal sized firms This criterion was used by the U S Department of Justice in its 1986 report on deregulation of oil pipelines [30] In markets where the HHIs are below this threshold, the presumption should be that "collective market power" is not a problem. Market-based pricing would be available to all suppliers in such a market, except for any individual suppliers which other screening criteria (see (c) below) indicate may be a high risk of exercising *unilateral* market power

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[29]See e g. *Handbook of Industrial Organization*, Volume II, Chapter 16, R. Schmalensee and R. Willig, eds , North-Holland, 1989

[30]*Oil Pipeline Deregulation*, Report of the U S Department of Justice, May 1986, pages 23-32

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b An *individual firm* should be considered to be "low risk" of exercising unilateral market power (i.e possessing "market dominance" or "unilateral market power") if its market share in properly defined relevant markets and using generating capacity and energy that is actually available or likely to be available to compete in the relevant market is less than or equal to 20% *regardless* of the HHI for the relevant market. This market share criterion, though not necessarily the relevant markets to which it is applied, is consistent with the Commission's current policies in market-based pricing cases This criterion provides a safe harbor for firms which are clearly not dominant suppliers regardless of the overall structure of the market. This approach is consistent with the FCC's treatment of interstate long distance telephone carriers other than AT&T

c An *individual firm* should be considered to be "low risk" for exercising unilateral market power if its market share in properly defined relevant markets and using generating capacity and energy that is actually available or likely to be available to compete in the market is less than or equal to 35% *and* the HHI in the relevant market is less than or equal to 2500 This criterion provides a threshold for closer examination of unilateral market power possessed by one or more suppliers in markets that are otherwise structurally competitive This criterion would increase the threshold market share presently used by the Commission for market dominance from 20% to 35% *if* the overall market is structurally competitive The 35% screening threshold for unilateral market power is significantly below the market share threshold that is typically required to demonstrate that a firm has monopoly power under Section 2 of the Sherman Act.

These market share screens are different from those that appear in the Merger Guidelines I believe that these differences are appropriate because the question that the Merger Guidelines is seeking to answer is different from the question the Commission is seeking to answer when it considers applications for market-based pricing. The Merger Guidelines are generally applied to horizontal mergers in markets which are not regulated. The question is whether or not the proposed merger is likely to increase market power and lead to higher prices Neither the pre-merger market nor the post-merger market is affected by the imperfections associated with price and entry regulation. The Commission, on the other hand, is asking whether or not it is appropriate to replace costly and burdensome price regulation with market-based pricing The expectation should be that even an imperfectly competitive market will yield some performance results that are superior to those that emerge under regulation Indeed, this is the presumption

upon which our economic system and the role of government in it are based Accordingly, I believe that the numerical market structure screening criteria that I propose are appropriate for answering the question to which the Commission is seeking answers [31]

This is the basic view adopted by the Department of Justice in its evaluation of oil pipeline deregulation.

> "When continued regulation of an industry rather than a merger is the issue, the benefits of preventing anticompetitive behavior, which regulation presumably confers, must be weighed against the direct and indirect costs of regulation. (footnote omitted) As a matter of practical implementation, though, even the direct costs of regulation are difficult to measure They include resources both public and private, committed to the determination, implementation, and maintenance of tariffs Indirect costs in the form of resource misallocation are much more difficult to appraise In the case of the impossibility of actually measuring the costs of regulation, the Department believes that an HHI of 2500 is a reasonable threshold above which pipelines should be presumed to require continued regulation. (footnote omitted)"[32]

There are some who will argue that the market share screens that I have proposed are too stringent. After all, there are many firms and markets in the U S economy which have market shares and/or HHIs that exceed these values Yet we do not typically subject them to price regulation. Indeed, under U S antitrust law, monopoly power itself is not illegal To run into trouble under Section 2 of the Sherman Act a firm must both have monopoly power in the relevant market (or a dangerous probability of obtaining it) *and* engage in predatory or exclusionary behavior that maintains or creates such monopoly power Furthermore, the market shares that the courts generally looked for to make a finding that a firm has monopoly power have generally far exceeded the 35% market share (e g. 60% or more) that I have proposed as a screening criterion. (I would expect, however, that after further analysis the Commission

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[31]It should be noted as well that over the last decade there appear to have been numerous horizontal mergers that "fail" the HHI screens in the Merger Guidelines which were not ultimately challenged by the Department of Justice (DOJ) Furthermore, the courts have rejected DOJ challenges to horizontal mergers that far exceed the HHI screens in light of other structural and behavior factors that suggest that the market share and HHI numbers are poor indicators of market power in those specific circumstances

[32]*Oil Pipeline Deregulation op cit* at 29-30

will ultimately determine that some suppliers which have market shares that exceed the 35% step one market share screen do not in fact have significant enough unilateral market power to deny them market-based pricing authority in an otherwise structurally competitive market.[33])

From this perspective, an alternative approach to the one that I have proposed would be to use "Section 2" criteria and ex post complaint procedures to govern the availability of market-based prices in wholesale power markets Under such an approach, the Commission might grant market-based pricing as long as a firm has no more than say a 60% share of the relevant market and then rely on a complaint process to demonstrate that firms are engaging in behavior that would be illegal under Section 2 of the Sherman Act.[34]

While I have some sympathy for this approach, I cannot recommend it to the Commission at this time In unregulated markets, the size distribution of firms at any particular point in time reflects the operation of market forces over many years Firms that obtain large shares of the relevant products have often done so as a result of providing superior products or better service and having lower costs than have their competitors. Indeed, unless firms with monopoly power engage in predatory or exclusionary behavior this is the implicit assumption that underlies U S antitrust law since monopoly pricing itself is not illegal.

However, it would be very difficult to make the case that the existing size distribution of electric generation suppliers reflects the historical results of market forces and that large suppliers have become large because they have been more efficient than their competitors State regulatory policies which define retail service territories, the historical preference for vertical integration, and related regulatory factors have played a very important role in determining the present size distribution of suppliers of generation. Accordingly, when price regulations are relaxed, I believe that policymakers must be more concerned about excessive prices resulting from the exercise of market power than they would be in an industry whose structure has not been so heavily influenced by regulatory policies rather than market forces

The market share and HHI screens that I have proposed seem to me to be a reasonable compromise between the standards that are used to screen mergers and those that are used to impose antitrust sanctions for monopolization which give appropriate recognition to the costs of imperfect regulation and the opportunity to mitigate these costs by relying more on market forces

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[33]Similarly, further analysis in step two may indicate that market-based pricing can go forward in markets with an HHI that exceeds 2500

[34]Note, however, the monopoly pricing itself is not illegal under the Sherman Act.

POTENTIALLY "HIGH RISK" FIRMS AND MARKETS

Firms and markets that meet the market share and seller concentration screening criteria enumerated above should be presumed to be at "low risk" of exercising market power and market- based pricing authority can be granted without further analysis [35] If the initial screening process using market share and seller concentration indicia suggest that there may be a "high risk" of significant market power, then the two step process that I have proposed requires the Commission to allow applicants to attempt to show that other structural or behavioral attributes of the markets at issue diminish the significance that might otherwise be attached to simple market share and concentration values and demonstrate that there is more intense competition than would be suggested by looking only at these indicia.

Relevant information that could be included in such an analysis would be the actual magnitudes of the market shares and HHI values and how much greater they are than the threshold values identified above, how sensitive the market share and HHI values are to modest changes in the definition of the relevant product and geographic markets, the effects of incentive regulation mechanisms and contractual arrangements on the incentives suppliers have to exercise market power by withholding output, the attributes of trading institutions that govern wholesale trade, planned transmission expansions that may relieve constraints and expand the geographic market, expected entry into the market, and direct evidence about the behavior of the firms in the market, in particular whether there is evidence that they are withholding supplies that should be profitable to place on the market at prevailing prices

Applicants should also be permitted to present additional evidence on the direct and indirect costs imposed on society by continuing regulation and to present a detailed analysis which directly balances the costs of imperfect regulation against the costs of imperfect competition.

MITIGATION STRATEGIES

The above analysis will allow the Commission to determine whether or not there is adequate competition to rely on the market, rather than cost-based regulation, to determine wholesale electricity prices If the Commission determines that there is not adequate competition then the default is to continue

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[35]Consumers who believe that significant market power remains a problem despite meeting these screening criteria always have the opportunity to file complaints with the Commission. However, if the screening criteria are satisfied, market-based pricing should be granted and the burden of proof should shift to those who wish to complain that there are unilateral or multilateral market power problems Such complaints should be supported by evidence based on actual observations of behavior and performance in a market-based pricing regime

to regulate wholesale transactions as it does now However, I believe that the Commission should invite utilities to propose alternative "light handed" regulatory mechanisms as alternative mitigation strategies that will continue to constrain suppliers from charging prices that are higher than they would be under cost-based regulation due to the exercise of market power while maximizing opportunities for replicating many of the benefits of flexible market-based pricing. Potential regulatory and other mitigation mechanisms that utilities might offer in response to a determination that there is excessive market power in the market as a whole or associated with particular firms include

1 The use of price caps to specify a set of maximum prices or a maximum average price calculated over some period of time (e g each year) The price cap could be set at a level that reflects the costs of the highest cost competitors in the market (since they would determine equilibrium prices in a competitive market) or, if lower, to a level equal to the prices that could have been charged under cost-based regulation. All suppliers would have complete flexibility to make power transactions at prices below the cap A variation on this approach has been used in the WSPP Price caps may be an especially useful strategy in this industry because of the conditions of entry and the associated likelihood that any market power problems are transitory

2 If the market power problem arises from the presence of one or two dominant firms, price caps could be applied to the dominant firms and the other firms supplying electricity in the relevant markets could be allowed to rely solely on market-based pricing without a cap This is the approach was taken by the FCC in its regulation of AT&T's interstate toll services When the telephone industry was restructured, AT&T faced competition from MCI, Sprint and a number of smaller regional competitors in interstate toll markets However, AT&T initially had a very large share of the sales (70 - 80%) for many of these services The FCC created three bundles of interstate toll services and required AT&T to keep its weighted average price for the services within a cap which changed over time using a CPI-X+Z formula.[36] As competition has expanded

[36]CPI is the consumer price index, X is a productivity growth factor applied by the FCC and reflects primarily historical productivity growth, and Z is an adjustment for changes in regulated access charges paid by long distance carriers to the local exchange operators to connect calls to the local exchanges they control Upper and lower bounds for price changes for individual services within each bundle were also applied, although the mechanism gave AT&T significant price flexibility for individual services within each bundle

the price caps have been removed. The FCC did not regulate the prices charged by non-dominant carriers, which was every supplier except AT&T

3 Incentive regulation and contractual arrangements may be designed to mitigate the incentives dominant firms have to exercise market power In general these arrangements would be designed to make it in the firm's financial interest to supply at least as much electricity as it would have supplied under regulation from the facilities that it controls at a price that is capped at a level that reflects the firm's regulated supply costs This is the relevant cap because it defines what the prices would have been under regulation. If voluntary requests for market-based pricing of wholesale transactions by utilities leads to prices that are less than this level consumers will be better off and the suppliers presumably expect to be better off as well or they would not have made the market-based pricing proposal in the first place Such contracts would penalize a firm for producing less than it would have under regulation and rewards it for producing more Such arrangements ensure that even dominant firms will increase the supplies they provide to the market at market-based prices and mitigate their incentive to exercise market power by withholding supplies from the market. The initial vesting contracts in the England and Wales Pool had these attributes, and significant short term market power problems did not emerge there until these contracts began to expire

4 Opportunities may exist to make investments that will remove transmission constraints, expand the relevant geographic markets, and reduce market shares and concentration ratios sufficiently, given other relevant structural and behavioral indicia, to reduce market power concerns and to proceed with market-based pricing

5 Of course, utilities should be permitted to mitigate horizontal market power in the relevant generation markets by voluntarily selling off or spinning off enough generating capacity to independent third parties to bring the relevant structural and behavioral indicia within an acceptable range

If the applicants for market-based pricing who exhibit an unacceptable risk of exercising significant market power and the Commission cannot come to an agreement on a suitable mitigation strategy then the

default is continued cost-based regulation of wholesale power transactions using prevailing regulatory procedures

CONCLUSION

The primary purpose for expanding access to transmission networks under reasonable terms and conditions is to support competitive wholesale power markets free from costly and burdensome price and entry regulation. It would be unfortunate if the Commission's efforts to expand access to transmission service were not followed quickly by the removal or relaxation of regulations governing the prices for wholesale power transactions Unlike the electric power sectors in countries like England which had only one generation supplier prior to restructuring and privatization, we have many utilities and independent suppliers providing generation services in all areas of the country They already compete aggressively in wholesale markets subject to Commission regulations that de facto provide for considerable price flexibility While it is certainly necessary for the Commission to consider horizontal market power issues in an open access regime as it expands market-based pricing for wholesale power transactions, it should develop and apply reasonable criteria that recognize the broad superiority of unregulated market allocation of resources compared to the allocation of resources that results from necessarily imperfect regulation. The concepts and criteria discussed in this paper can and should be readily integrated with current Commission criteria for granting market-based pricing in a way that protects wholesale customers from abuse while expanding rapidly market-based pricing opportunities

LBL-37508
UC-1320

Lawrence Berkeley Laboratory

UNIVERSITY OF CALIFORNIA

ENERGY & ENVIRONMENT DIVISION

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Prepared for the U S Department of Energy under Contract Number DE-AC03-76SF00098

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The work described in this study was funded by the Assistant Secretary of Energy Efficiency and Renewable Energy Office of Utility Technologies Office of Energy Management Division of the U S Department of Energy under Contract No DE-AC03-76SF00098

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Acknowledgments

We would like to express our appreciation to the following people who provided valuable review comments on an earlier draft

Theresa Flaim
Niagara Mohawk Power Corporation

Charles Goldman
Lawrence Berkeley National Laboratory

Eric Hirst
Oak Ridge National Laboratory

Ben Hobbs
Johns Hopkins University

William Hogan
Harvard University

Val Jensen
U S Department of Energy

Kevin Porter
National Renewable Energy Laboratory

Kathy Treleven and Jim Davidson
Pacific Gas and Electric Company

The work described in this study was funded by the Assistant Secretary of Energy Efficiency and Renewable Energy, Office of Utility Technologies, Office of Energy Management Division of the U S Department of Energy under Contract No DE-AC03-76SF00098

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Acronyms and Abbreviations

ACE	Area control error
ADOE	Alberta Department of Energy
BRPU	Biennial Resource Plan Update
CCGT	Combined cycle gas turbine
COB	California-Oregon border
CPUC	California Public Utilities Commission
FERC	Federal Energy Regulatory Commission
GAPP	General Agreement on Parallel Paths
IPP	Independent Power Producer
ISO	Independent system operator
NERC	National Electric Reliability Council
NUG	Non-utility generation
NYMEX	New York Mercantile Exchange
NYPP	New York Power Pool
OFFER	Office of Electricity Regulation
PJM	Pennsylvania New Jersey Maryland Interconnection
PUC	Public Utility Commission
PURPA	Public Utilities Regulatory Policy Act
PSI	Public Service of Indiana
QF	Qualifying Facilities
REE	Red Electrica de Espana
RTG	Regional Transmission Group
SCD	Security constrained dispatch
SDG&E	San Diego Gas and Electric Company
WSCC	Western System Coordinating Council

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Executive Summary

Introduction

The electricity industry in the U S today is at a crossroads The restructuring debate going on in most regions has made it clear that the traditional model of vertically integrated firms serving defined franchise areas and regulated by state commissions may not be the pattern for the future The demands of large customers seeking direct access to power markets, the entry of new participants, and proposed reforms of the regulatory process all signify a momentum for fundamental change in the organization of the industry This paper addresses electricity restructuring from the perspective of bulk power markets We focus attention on the organization of electricity trade and the various ways it has been and might be conducted

Our approach concentrates on conceptual models and empirical case studies not on specific proposals made by particular utilities or commissions We review a large literature in economics and power system engineering that is relevant to the major questions Our objective is to provide conceptual background to industry participants, e g utility staff, regulatory staff, new entrants who are working on specific proposals While we formulate many questions, we do not provide definitive answers on most issues We attempt to put the industry restructuring dialogue in a neutral setting, translating the language of economists for engineers and vice versa Towards this end we begin with a review of the basic economic institutions in the U S bulk power markets and a summary of the engineering practices that dominate trade today

International Experience with Restructuring

Electricity restructuring is a worldwide phenomenon Because of this, the experiences of other countries may provide some useful perspective for the U S debate We survey this experience

The restructuring process in electricity can be divided into three general elements First, vertically integrated firms are reorganized to separate generation from the transmission and distribution assets We call this functional restructuring It includes both divestiture of generation and a re-orientation of the transmission function to facilitate increased competition Because the organization of the competitive process can be so varied, we refer to generation competition as a separate stage Finally, there has frequently been a privatization element associated with electricity restructuring In most countries outside of the U S , electricity industry reform originates from a situation of public ownership

Table ES-1 summarizes the restructuring process in a number of countries It shows both the varying extent of implementation and the substantially different starting point of the U S Because of private ownership in the U S , functional restructuring is linked to stranded cost recovery Once the possibility of expanded competition arises, private investors need assurance of cost recovery for assets that would become economically obsolete, if they are going to cooperate with such a transition The cases of Spain and Alberta (Canada), where private ownership has a long history, involve recent functional restructuring but limited competition to date

Table ES-1 How You Proceed Depends Upon Where You Start

Country	Functional Restructuring	Generation Competition	Privatization
UK, Chile, Argentina, Victoria (Australia)	→	→	→
Norway	→	→	
NSW (Australia) **New Zealand**	→	→ ?	
Ontario (Canada)	? →		
U.S		←	←
Spain, Alberta (Canada)	→		←

International restructuring experience offers few major lessons for the US, because none of these situations involves both the pervasive private ownership and the highly fractionated nature of the US electricity industry The importance of private ownership is that it makes functional restructuring more complex than where government enterprises are involved exclusively Where restructuring involves writing down the value of uneconomic assets, governments accomplish this is more easily than if private investors must be compensated The large number of relatively small utilities in the US power network means that the formation of pools would also involve complicated financial compensation procedures In Chile, Argentina and the UK, a centralized pool operates the wholesale market, with all trade

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going through the pool These pooling institutions were formed from pre-existing national utilities A bilateral trading regime dominates the Norwegian market, but it depends upon an uncongested transmission network, and is facilitated by a pre-existing framework of pooling and marketing institutions Australian interstate trading experiments promise greater market decentralization than the pool cases, made simpler by the presence of few market centers

Constraints may limit electricity restructuring Where technology involves environmental or economic externalities, such as hydro or nuclear generation, there is likely to be public ownership, because private markets cannot easily internalize all of the associated externalities These cases may pose potential barriers to privatization In Norway, a competitive regime has not included privatization of the generation, 98% of which is hydro Other important constraints include the nature of local fuel markets and the strength of the transmission network Competitive electric markets are facilitated by competitive fuel markets Where coal mines are vertically integrated with generation plants, the competitive situation may be complicated This situation arises in Spain Australia and Alberta In many countries, natural gas plays an important role facilitating competition by lowering the barriers to entry Gas-fired combined cycle plants are relatively simple to build and operate have low capital costs and very high thermal efficiency Where a well developed natural gas infrastructure exists, competition will be more robust The transmission network is the vehicle through which electricity competition occurs The stronger this network is, the smaller the limitations of network congestion When the network is congested, markets are geographically separated, limiting competition

Market Power Concerns Are Important

We can distinguish three sources of market power in the electricity industry market concentration in generation, vertical integration that may limit access for competitors, and the ability to block transmission pathways

Market concentration is the typical source of market power and will probably prove to be the most decisive factor in bulk power markets as well We show that forward contract markets tend to ameliorate the effects of market concentration, while network congestion increases the level of market concentration Our analysis also suggests that a limited amount of market power derived from concentration is found to play a helpful role in maintaining system reliability

Perhaps the central question concerning the organization of U S bulk power markets is whether vertical re-organization of the entire industry will be required We analyze various forms of market power engendered by collusion between the DistCo and GenCo halves of vertically integrated firms Specifically, we discuss the potential for this collusion to inhibit entry by other GenCos and the possibility that an Independent System Operator (ISO) can control this type of behavior

A particular kind of access limitation that is peculiar to electricity is the possibility for strategically located Gencos to block transmission access for other suppliers We illustrate how this can be achieved in an electric network and observe that such practices seem to have occurred in other countries

Ensuring "Open Access" Will Likely Require an Independent System Operator

Achieving open access in electricity markets is the objective of the FERC's Mega-NOPR We argue that FERC's open access objectives simply cannot be met successfully without the use of an ISO, and that even with one, the pre-determined transmission prices envisioned by FERC impede the implementation of an efficient access rule

Both major models of electricity competition the bilateral and the spot-market approaches, rely on an Independent System Operator (ISO) to provide non-discriminatory access FERC attempts to achieve non-discriminatory access without the benefit of an ISO Open access must solve the problem of excess demand for transmission to preserve reliability, and the FERC's Mega-NOPR allows this only through a predetermined tariff and non-price rationing Because of the complexities of transmission, non-price rationing cannot be accomplished in a non-discriminatory fashion by an interested party This leaves the predetermined tariff as the only tool for preventing excess demand But for this to be almost perfectly effective, as is required by reliability, the tariff must be so high as to prevent even moderately efficient use of the grid

Summary of the Bilateral vs Spot Market Debate

A few broad principles have emerged from recent debates and experience both in the US and other markets These include

(1) a general agreement that price transparency is desirable,
(2) a broad (but not universal) consensus that an independent system operator (ISO) is necessary to facilitate increased trade,
(3) an increased skepticism about vertical economies, and
(4) a consensus that market distortions should be minimized

The two main competing market models, spot market pools versus bilateral trade, would implement these principles differently Table ES-2 summarizes the differences

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Table ES-2 Market Model Summary

	Pool	Bilateral
ISO Function	Grid Merchant	Information Broker
Price Transparency	SRMC	Index
Vertical Economies	less important	more important
Contract Performance	Financial	Physical

The ISO function involves a broader range of actions in the Pool model than in the bilateral model The reason is that the Pool ISO is dispatching the power system based on sellers' prices, whereas the bilateral ISO is an information broker who facilitates the trading decisions of others The different conceptions of the ISO are reflected in all of the other market model attributes in Table ES-2

Price transparency facilitates competition by making the value of power clear to participants but the notion means different things in the two models because price formation differs in each When the Grid Merchant is the central clearinghouse the resulting prices at any network node are the short-run marginal cost (SRMC) at that node Where no congestion exists, there is effectively a single market clearing price for any given period of time In the Pool model, price variance results from the time differentiation of SRMC, not from any variance at a given time The bilateral trade model is more compatible with price indices, which are typically derived from market information with inherently longer time horizons than hourly bids from generators used to estimate SRMC in the Pool model These indices are averages of many bilateral contract prices The potential biases in price reporting will also differ in each model In the Pool model, there is some arbitrariness in SRMC determination In the bilateral model, sampling error may distort price indices

The question of vertical economies is quite unsettled Both competitive models inherently question the role of vertical economies In neither case, however, is it clear that divestiture of generation will be required for unbiased functioning of bulk power trade There appears to be less emphasis on vertical economies in the Pool model, if only because of the international precedents, where electricity restructuring along pool lines has been accompanied by vertical separation The bilateral model also seems more consistent with a vertical structure, because it is closer to current U S industry structure and practice The increasing occurrence of utility mergers may end up raising market power questions in either of these models The traditional arguments for vertical economies in a monopoly structure may turn out to look like access barriers in a competitive model

Finally, contract performance standards differ in the two models Given that the Pool ISO is a Grid Merchant through whom all physical transactions clear, the only role for contracts is financial Indeed, a physical performance standard, where seller must physically deliver to buyer, is incompatible with the Grid Merchant concept In the bilateral model, on the other

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hand, physical performance is the essence of commercial relations It embodies the mutual commitment of the parties to trade Physical performance as the cornerstone of a bilateral trade market may impose some complexity on the ISO, but proponents argue that this is feasible

Future Research

The FERC Mega-NOPR lays out the clear objective of achieving open access, but it is less persuasive on the means of achieving it The major conceptual models of electricity competition are incompatible with the Mega-NOPR framework in a number of ways The choices concerning the future organization of bulk power markets will be influenced by a number of factors These include the magnitude of the transactions costs involved, the impact on reliability of increased competition, and the potential for abuse of market power Of all these issues, it is probably market power which will be the most decisive If market power problems are found to be excessive, it is likely that vertical separation will be required Whether this turns out to be the case is the major structural uncertainty in bulk power markets in the U S

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1 Introduction and Overview

There is a significant demand for increased electricity trade in the U S today The principal signs of this demand are the recent appearances of electricity marketers who hope to profit from trade opportunities and the demand for retail access by large industrial consumers The regulatory response to these market developments at the federal level began with the Energy Policy Act of 1992 and continues with Federal Energy Regulatory Commission (FERC) actions, the latest of which is the Mega-NOPR of March 1995 At the state level numerous initiatives to experiment with retail access have been initiated, the best publicized of which is the California Public Utilities Commission (CPUC) Blue Book proposal of April, 1994 (CPUC 1994) All of this activity, in one way or another calls into question the current functioning of the bulk electricity market Responding to the demand for increased trade implies major restructuring of the electricity industry It is the purpose of this concept paper to address the bulk power market issues raised in the debate about the organization of the electricity industry

Increased electricity trade means that the electricity industry will become more competitive, and hopefully more efficient A large part of the controversy over these developments involves uncertainties about the potential magnitude of the efficiency gains, their origin, and the practical feasibility of achieving them It is entirely possible that the pursuit of these gains may sacrifice other benefits of the current structure The questions raised by restructuring, therefore, are quite fundamental In this paper, we will attempt to formulate these questions as precisely as possible, and review the controversies that have been generated in the discussions to date Many of the other important issues associated with restructuring, such as stranded cost compensation and the fate of social programs lie outside the bounds of this discussion

The paper is organized in the following fashion Chapter 2 reviews the basic economic institutions in the electricity industry and formulates the problem of the optimal industry structure as a trade-off between competition and coordination Electricity involves managing significant technical constraints, we summarize current engineering practices used to address these constraints Chapter 3 addresses international experience with electricity restructuring The forces driving restructuring are world wide, and there may be valuable lessons from the experience of other countries Chapter 4 looks more closely at current practices in the U S and focuses on significant decentralizing forces that are operating in the existing bulk power market These include the role of non-utility generation, developments in the direction of greater price transparency in the wholesale market, and assessments of the institutions that currently organize electricity trade In Chapters 5 and 6, we analyze proposals to increase competition and assess the problems raised by a competitive organization of bulk power markets Chapter 5 discusses various proposals to facilitate increased trade in bulk power markets We contrast the market model organized around the concept of nodal spot prices (usually implemented in a pool), with various kinds of bilateral trading models In Chapter

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6 we address several key problems posed by the presence of market power We examine both traditional issues in market concentration and those specific electricity issues that may mitigate or exacerbate market power We also consider limits on access associated with vertical integration We conclude that an independent system operator (ISO) will be necessary for an effective open access trading regime Chapter 7 discusses transmission capacity expansion and presents several ways to handle this issue in a competitive setting, including the possibility of allowing private investment in new lines Conclusions and suggestions for future research are presented in Chapter 8

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2 Economic Institutions and Engineering Practices: The Basics

This chapter reviews the basic elements of bulk power markets from the economic and engineering perspectives First, we summarize the economic literature on U S institutions that organize the buying and selling of electricity We focus on that element of the economic literature which addresses broad questions concerning the organization of electricity markets rather than the substantially larger literature addressing particular sub-markets We then describe the engineering practices used in the U S to produce and deliver electricity This discussion will establish the general questions posed by the demand for increased electricity competition and trade, and characterize the technical constraints affecting the electricity marketplace

2.1 Economic Institutions

Economists have looked closely at many particular aspects of the U S electric power industry, but there have been relatively few studies which directly address the optimal industry structure We survey a small number of these more general studies to highlight the major issues that are posed by restructuring

2 1 1 *Markets for Power*

The book, *Markets for Power*, by Joskow and Schmalensee (1983) is the *locus classicus* of electricity deregulation analysis It was written before the wave of international experimentation with electricity restructuring began, but it nonetheless reflects many of the basic issues that neither theory nor experience have resolved about the optimal structure of the electricity industry Rather than recapitulate the specific industry models that Joskow and Schmalensee (JS) use to frame their analysis, it is more useful to identify the main characteristics of the industry on which they focus, to outline the criteria they use to assess deregulation, and to review their predictions in light of subsequent developments

According to JS, increasing competition and trade in the electricity industry poses a trade-off between the potential efficiency benefits (in both the short and long run), and the increased transactions costs and the potential abuse of market power JS pay substantial attention to the transactions costs associated with achieving in a competitive setting those coordination economies, such as efficient investment and dispatch, that are currently accomplished through allocations that are internal to the vertically integrated utility Because many complex contingencies must be taken into account in a contracting regime, there may be rigidities and inefficiencies that result from these arrangements JS focus attention on the key role played by transmission in the integration of supply and demand in any organization of the industry Given the externalities involved in electric networks, where actions at one point have effects

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elsewhere, coordination economies currently achieved may be difficult to duplicate in a competitive setting Congestion in transmission networks may also confer substantial market power on generating companies in a less regulated electricity industry JS make only the most approximate estimate of market concentration, but find that it is likely to be a concern

Many of these points have been confirmed by subsequent experience We address all of them in one way or another in this study Since JS original analysis, perhaps the main changes in the climate of opinion concerning electricity competition are (1) decreased confidence about investment efficiency under vertical integration and (2) increased confidence in dispatch coordination among a large number of independent entities The first factor is due both to the failures of the nuclear power industry and the emergence of an independent power industry based largely on highly efficient gas-fired combined cycle generation The second factor is due to the enormous productivity gains in computation and control technology

The crucial role of the transmission system and the difficulties associated with providing transmission access remain the most important themes in the dialogue about the organization of electricity trade These subjects have begun to attract the interest of economic theorists

2 1 2 *Optimal Industry Structure*

Recent economic theory on the problem of optimal industry structure poses the issues as a regulatory choice In this formulation, the regulator both chooses an industry structure and then enforces those rules or incentive schemes that are made necessary by the institutional framework While this is a somewhat expansive view of the powers that any actual regulatory body may have, it allows a comprehensive treatment In this section, we discuss briefly two recent studies that use this approach in order to characterize the problem formulation and to describe the kinds of results that are obtained Vickers (1995) gives a general account of the trade-offs involved in regulating monopoly versus allowing competitive entry in vertically related markets Gilbert and Riordan (1992) formulate the same general problem To obtain tractable models, these authors must abstract significantly from the details of industry practice and technology In the case where entry is allowed, both studies focus attention on the difficulties posed by the access problem The vertically integrated firm must provide access to competitors This is an inherently conflict-ridden role with the potential for inefficiency or abuse of market power

Both studies adopt the modern approach to regulatory issues, which emphasizes the fundamental information asymmetry facing the regulator (Laffont and Tirole, 1993) Starting from this premise, the papers rediscover the basic trade-off between a vertically integrated structure and an industry structure which allows for competition in the segment where it is feasible Vertical integration offers economies of scope across the upstream and downstream functions, but the information monopoly of the firm allows it to extract some rent from the regulator to achieve these economies Allowing entry may sacrifice these vertical economies,

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but offers lower costs in the competitive segment The loss of vertical economies shows up in the Vickers framework through excessive entry Gilbert and Riordan emphasize the inefficient coordination across the upstream and downstream functions due to the inability of either the regulator or the disaggregated industry to operate the two functions efficiently on a separated basis

2 1 3 *Estimating Vertical Economies*

A central question in the restructuring debate involves whether it will be necessary (or desirable) to divest the vertically integrated firm of its generation assets to achieve a workably competitive generation market and what the costs of such divestiture might be Given the basic trade-off between vertical economies and gains from competition, it is an important empirical question to develop some estimate of the magnitudes of these effects Kaserman and Mayo (1991) address the issue of vertical economies It is quite remarkable that these questions have been largely ignored in recent policy discussions

Kaserman and Mayo (KM) formulate the problem by estimating cost functions for a sample of electric utilities, relying on accounting data adjusted where possible to reflect economic costs rather than regulatory conventions KM estimate a cost function for 1981 data, on a sample of 74 investor-owned utilities operating only in the electricity business The argument for excluding firms operating in either the gas or water business along with electricity is that accounting allocations between these other businesses may introduce noise The choice of 1981 data is based on the perception that earlier periods would be confounded by dis-equilibrium effects of rapid demand and input price changes The sample includes 50 firms operating in both generation and distribution, 10 only in generation, and 14 only in distribution The characterization of vertical economies involves testing whether firms that operate in both the generation and distribution segments have lower costs, all other things equal, than firms which operate in only one of these segments

The statistical model that KM use (with several variations on the basic functional form) has the following general structure

$$TC = a_1 + a_2 GEN + a_3 DIST + a_4 GEN^2 + a_5 DIST^2 + a_6 GEN\ DIST + b\ X \quad \textbf{(1)}$$

The dependent variable TC is the total dollar cost of electricity sales GEN and DIST are the physical volumes of generation and distribution respectively X represents a set of "control" variables which are composed of various utility characteristics These include fuel mix, labor costs, capital costs, customer mix regional characteristics and wholesale trading arrangements The point of including these control variables is to "hold other things constant " There inclusion prevents the variables of interest, *GEN* and *DIST*, from picking up extraneous effects and allows us to state that "other things held constant", *GEN* and *DIST* have a certain affect on *TC*

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The variable of central interest in this model is the "interaction variable *GEN DIST* The coefficient on this variable answers the question Does a firm with both generation and distribution produce more cheaply than a firm with just one or the other? If a firm has just one or the other, this variable is zero while if it has both it is positive Thus if $a_6 < 0$, the vertically integrated firm has been shown to have a lower cost than the separated firm

The first four variables model the basic production process The first two variables (GEN and DIST) model the fact that total cost increases roughly in proportion to the firm's size The second two variables (GEN^2 and $DIST^2$) model the fact that marginal costs are increasing as output expands In all of the models tested, the coefficients $a_2 - a_5$ are positive and significant This indicates that marginal cost is positive and increasing, which is not unexpected but which does contradict the assumption of a natural monopoly in generation [1] But, like X, these variables only play a supporting role They are included to pick up the basic properties of the production process just described and thereby keeping the interaction term free of contamination with these affects Most importantly the coefficient a_6 on the interaction term between generation and distribution is negative and significant at the 0 01 level in every model, which indicates the presence of cost complementarities between the vertical stages This result is the principal basis for finding economies of vertical integration [2]

Interpreting the statistical results, KM conclude that for a vertically integrated firm operating at the sample mean of generation and distribution (9,000 GWh and 7,200 GWh respectively), the costs of vertical disintegration are about 12% more than those of vertically integrated production One key question is whether these results would stand up to further examination As previously noted, the data are old (1981) and it is unclear if more recent data would change the results significantly Perhaps more importantly, the KM study provides no clear indication regarding the source of these vertical economies If these effects are large, it would be important to understand more completely where they originate

The policy implications of these results are significant The KM study strongly suggests that competitive restructuring may impose costs on electricity consumers If the vertical economies are lost due to increased competition, then there should be efficiency gains of at least comparable magnitude in order for the change to be worthwhile Alternatively, it may be desirable to retain the vertical structure, if possible, while enhancing competitive processes (see Chapter 6 for more detailed discussion)

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1 The assumption of a natural monopoly for distribution does not rely on economies of scale as measured by the total amount of power sold but rather as measured by the amount of electricity sold per geographic area That hypothesis has not been tested Note however that both of these results run counter to the notion that mergers are economic These results indicate that the recent merger trend may have more to do with market power than with economies of scale

2 It is also interesting that no other variables show up as statistically significant with any consistency across the various alternate model specifications

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2 2 Engineering Practice

In this section we describe the typical engineering practices that characterize the operation of the bulk power markets in the U S today Historically this activity has not been organized with commercial purposes i e , trade as the predominant objective Reliability issues, broadly construed, are the major consideration in engineering practice, particularly in the relations among utilities Economic factors however are also significant determinants of engineering practice Utilities seek to minimize costs within a framework of reliable operation One way to think about the restructuring of bulk power markets is that it represents a shift in the balance between traditional reliability practices and economic objectives Most of the reliability conventions adopted in the power industry arose out of informal practice, and not as an explicit optimization of reliability value [3] To understand how these practices may be adjusted to allow for more commercial activity we need to characterize current procedures

2 2 1 *Reliability Councils*

Regional reliability councils were established in the U S following the Northeast blackout of 1965 to coordinate the reliability practices of utilities so that major disturbances could be avoided or their impact minimized in the future The reliability councils are voluntary organizations which engage in essentially two different kinds of activities First, they establish minimum standards for operating procedures including issues such as the appropriate level of operating reserves, which includes both "spinning" and fast-start reserves Reporting the performance of utilities with regard to meeting quality of service standards also comes under the area of operating standards One important service standard is area control error (ACE) ACE measures the deviation between net power flow in or out of a utility control area and the net scheduled flow The National Electric Reliability Council (NERC), the umbrella organization of all the regional reliability councils, requires that ACE be computed at least once every four seconds Minimizing ACE is important for maintaining the standard frequency (60 cycles per second) of power supply By encouraging utilities to meet the ACE standard the reliability councils are limiting the extent to which one company is "leaning" on the grid to support network standards, rather than meeting these obligations themselves

The reliability councils also engage in transmission planning activities, because these almost always have a regional aspect to them The reliability councils have evolved into an arrangement of more or less permanent study groups that typically delegate to special subgroups the task of examining the regional and interregional implications of proposed new transmission projects (Fitzgerald and Hemphill 1993) An example of the results of these studies is the recently completed line ratings study for the new Mead-Adelanto-Phoenix 500

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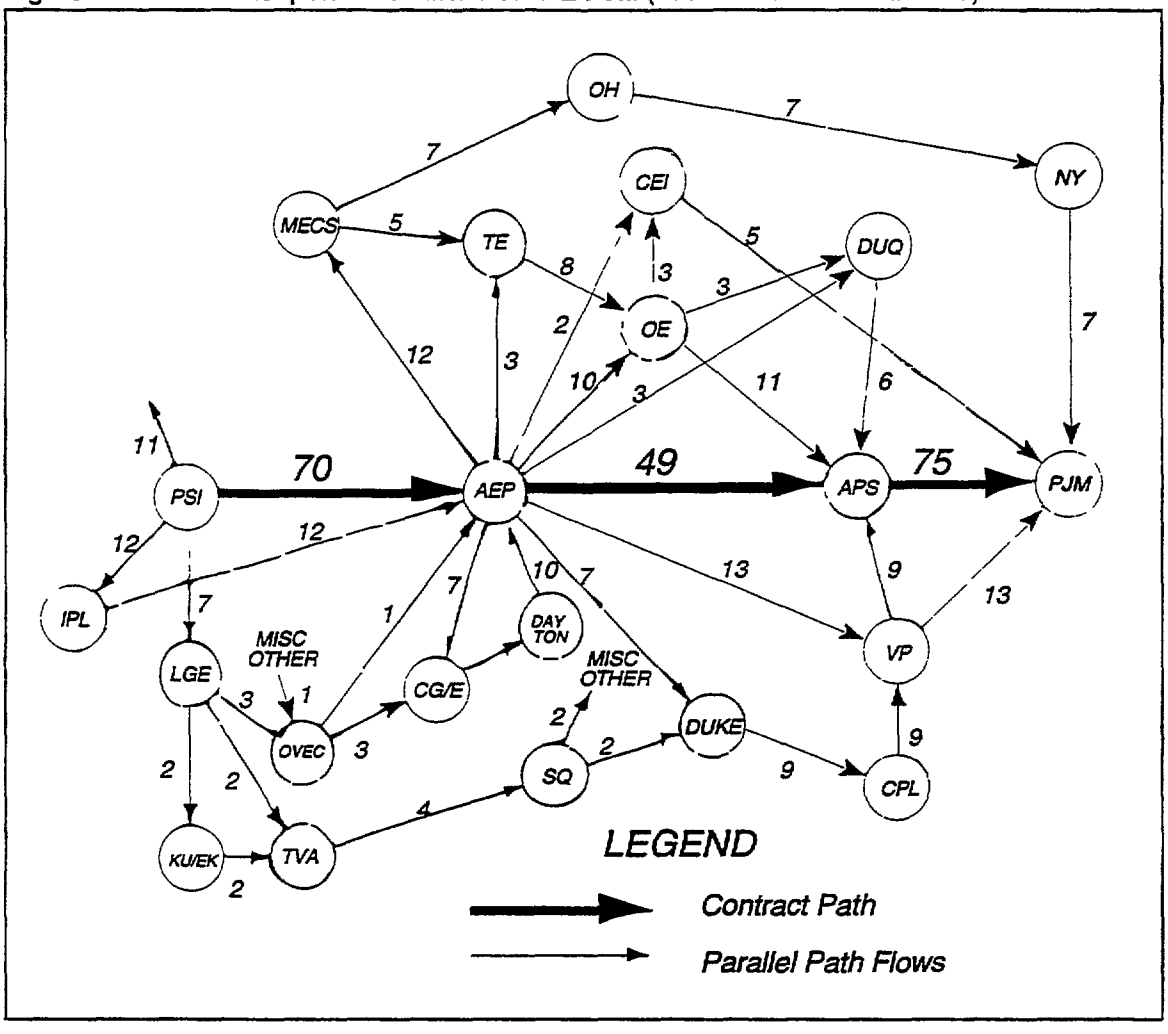
[3] One example of the changing environment is the formulation of generation planning reserve targets on an economic basis as in Southern Company Services (1991)

kV transmission project scheduled to enter service in December, 1995 Line ratings are limits to the level of power flow that operators agree to maintain so that potential reliability impacts on the interconnected system are acceptable Lee *et al* (1995) describes the results of the study process leading to establishing the line rating for this project

More recently, the reliability councils have gotten involved in pricing issues that involve network externalities In electric transmission networks, actions in one location frequently have effects elsewhere When the locations involved are under different ownership these interactions are economic externalities Baldick and Kahn (1993b) give several simple examples of these in a planning context In the operating context, the most common network externality is loop flow (sometimes called "parallel flow')

Figure 1, from Mistr (1992), illustrates the phenomenon In this figure, a hypothetical 100 MW transaction is being simulated from PSI (now CINergy) to the eastern portion of the Pennsylvania New Jersey Maryland Interconnection (PJM) As this figure shows the amount of power flowing over the assumed "contract path " from PSI to PJM, is only 50-75% of the 100 MW total The rest flows on the systems of other utilities, not involved in the transaction This loop flow phenomenon is common both in the eastern and western U S Utilities in both regions, through the reliability councils, and in special groups are attempting to develop compensation mechanisms to deal with this problem Examples include the Western System Coordinating Council (WSCC 1994) coordinated phase shifter agreement filed with FERC and the General Agreement on Parallel Paths (GAPP) organized among utilities in the eastern interconnected grid These examples represent the first time that explicitly economic issues have been addressed by the reliability councils

Figure 1 Transfer Response 100 MW PSI to E PJM (1991 Summer Conditions)



2 2 2 *Operational Procedures at the Utility Level*

Electric utilities can be separated into those which physically control their own resources, and those which delegate that task to a larger regional neighbor Of the nearly 3,000 electric utilities in the U S only about 160 operate their own control areas (FERC 1989, p 11) [4] This number of control areas is large by the standards of other countries, since it implies that the average amount of capacity controlled is about 4,000 MW The control function can be separated into three broad categories (1) unit commitment, (2) transactions scheduling, and (3) security constrained dispatch This typology is not the only way to conceptualize the

[4] There can be some ambiguity in the use of the term 'control area In some cases it may be used to denote less than the complete set of functions described in this section We have made no independent assessment of the assertion cited regarding the number of control areas

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control function (see Kirby *et al* 1995) for a more disaggregated view), but it will suffice for the purposes of this discussion We briefly describe each of these activities

Unit commitment refers to the operator s decision regarding the choice of generating units to turn on and off This decision is usually made weekly although in some cases it may be more frequent Because there are significant thermal lags limiting the responsiveness of generating units the start-up and shut-down schedule must be planned in advance The factors affecting the determination of the optimal schedule include the forecast loads over the time horizon, the availability of units and the operational constraints on those units The unit constraints include minimum operating capacity, minimum up time and down time, ramping limits, and fuel limits Using this information the utility typically runs a computer program to decide what commitment schedule will minimize total costs There is a great variety of algorithms available to solve this problem (Sheble and Fahd 1994) A good conceptual discussion with simple illustrative examples is given in Stoll (1989, pp 410-419)

Figure 2 shows the unit commitment for Southern California Edison during a summer week in the mid-1980s This figure shows only the utility's oil and gas units which serve the intermediate and peaking segment operating in addition to baseload coal and nuclear units

The top line in Figure 2 represents the total nameplate capacity of oil and gas generation that is running and capable of serving load over this week The line indicated by the open circles shows the actual generation from these units Load fluctuates by approximately 6,000 MW from its highest to its lowest level during this week The amount of capacity capable of operating (i e , that is committed) fluctuates much less and much less frequently During the weekdays (hours 1-108) the amount of capacity committed varies by about 1,500 MW On the weekends, much more capacity is shut down

Figure 2 shows that substantial amounts of thermal capacity are committed but will operate at low output levels during low load periods The efficiency of oil and gas-fired steam units at low output levels is poor Nonetheless, it is more economic to incur this efficiency penalty than to start and stop units frequently [5]

The unit commitment decision is made separately by each utility control center One of the key questions involved in organizing bulk power markets to facilitate increased trade is whether there are coordination economies across control areas in the unit commitment function and if so, how they might be achieved This question will be explored in more detail in Section 5 2

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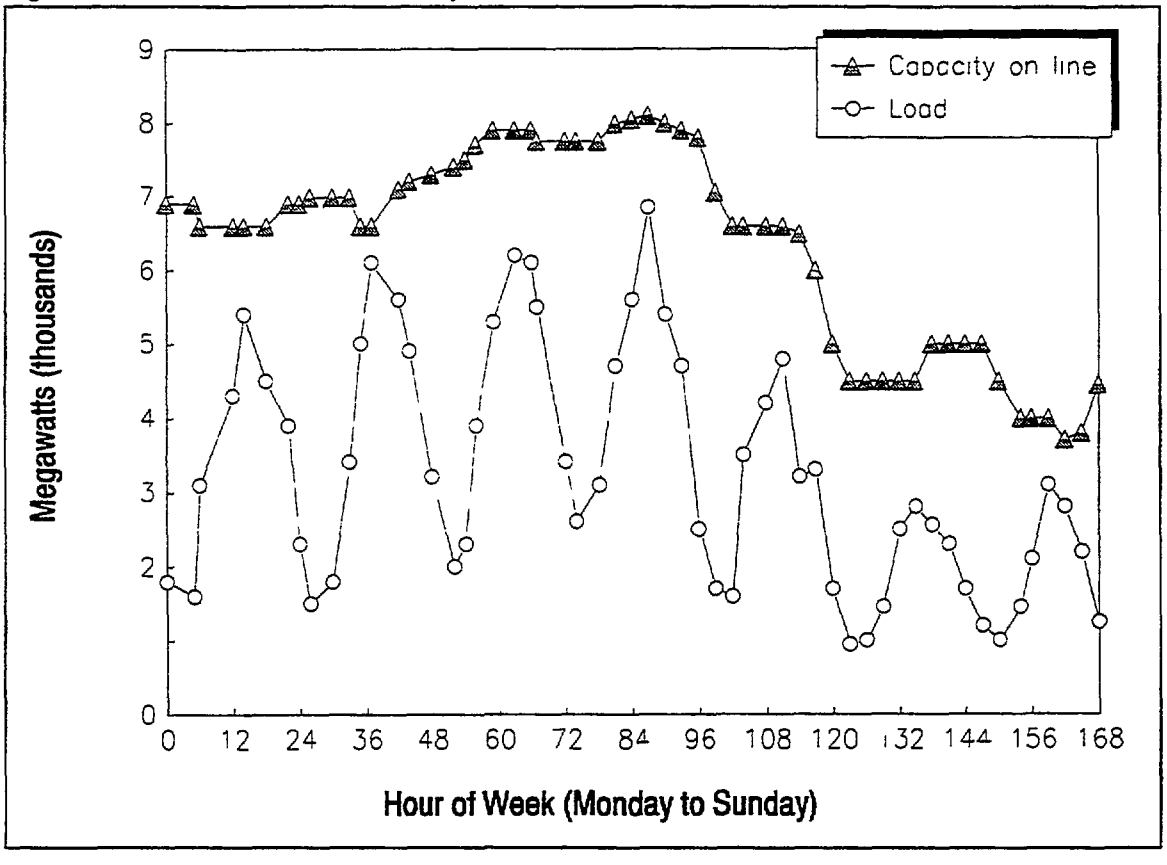
[5] Among the costs of frequent start-ups are increased maintenance costs due to stresses on equipment

Figure 2 Unit Commitment and Dispatch



Transactions scheduling involves trade between utilities in different control areas There are typically two kinds of transactions, firm and non-firm A firm trade means that the supplier is responsible for meeting reliability requirements and cannot interrupt delivery unless his own system is in jeopardy Firm transactions are accounted for in unit commitment decisions and security constrained dispatch. Non-firm transactions are scheduled over shorter time horizons and do not affect the unit commitment Dispatchers may schedule non-firm transactions on a daily or hourly basis

Security constrained dispatch (SCD) takes the available set of operating generation units as given and determines what the loading on each of them should be to meet the system loads This decision is made within the bounds of reliability criteria established by the utility itself and the reliability council in which it operates The reliability criteria include maintaining appropriate transmission line loadings, providing sufficient reactive power to meet voltage constraints, operating within stability requirements, etc Once the reliability criteria are met, SCD chooses the generator loadings that minimize costs In practice, the SCD is run at the utility control center every five minutes

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3 International Experience

Electricity restructuring has become a world wide phenomenon in the past decade A broad range of new practices have been introduced in those countries that have reorganized the electricity industry It is common to distinguish cases where liberalized entry has been allowed typically in the form of independent power producers (IPPs) from more thorough reforms (Tenenbaum Lock and Barker 1992 Smith and Klein 1994) Where institutional changes have involved reorganization of electricity trade there may be some lessons for the U S We concentrate on these cases In Section 3 1, we address the general issues affecting restructuring and identify those factors which distinguish the process in various countries We emphasize the role of initial conditions Section 3 2 reviews briefly the experience of individual countries and includes extensive references to the growing literature In each country, the particular reforms strongly reflect the initial conditions We do not draw out these dependencies in any detail although common themes are identified

3.1 Restructuring Processes

The restructuring process in electricity, as it has been implemented internationally, encompasses three general elements First, vertically integrated firms are reorganized so that generation assets are separated from the transmission and distribution assets We refer to this process as *functional restructuring* It ultimately involves more than simply the divestiture of generation assets Some kind of re-orientation of the transmission function is typically also required to facilitate increased competition among generating units and entities Because the organization of the competitive process in generation can be so varied, it is convenient to refer to *generation competition* as a separate stage Finally, electricity restructuring has frequently been accompanied by *privatization* of ownership It is important to note that electricity industry reform originates from a situation of public ownership in most countries outside of the U S

Using this typology, Table 1 summarizes the restructuring process in a number of countries The table highlights the fact that the entire process has been completed to varying degrees in various countries and that the U S industry starts from a substantially different point Because of private ownership in the U S , functional restructuring is linked to stranded cost recovery Once the possibility of expanded competition arises, private investors need assurance of cost recovery for assets that would become economically obsolete if they are going to cooperate with such a transition In the case of government ownership, losses are more easily absorbed The cases of Spain and Alberta (Canada), where private ownership has a long history, involve recent functional restructuring (or serious discussion thereof) but limited competition to date These cases are discussed in more detail in Section 6 2

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Table 1 How You Proceed Depends Upon Where You Start

Country	Functional Restructuring	Generation Competition	Privatization
UK, Chile, Argentina, Victoria (Australia)	→	→	→
Norway	→	→	
NSW (Australia) **New Zealand**	→	→ ?	
Ontario (Canada)	? →		
U S		←	←
Spain, Alberta (Canada)	→		←

It is useful to recognize that different kinds of constraints may limit electricity restructuring Jaccard (1994) provides an interesting discussion, in the context of varying conditions in the Canadian provinces, of the role played by technological endowments, particularly the dominant generation fuels He distinguishes between "public goods" technologies, primarily nuclear and hydroelectric, and fossil fuel generation technologies, which are fundamentally private sector goods Hydro resources clearly involve public lands and natural resource endowments for which there is a public interest Balancing that interest with private concerns requires some government attention Nuclear technology involves a number of externalities, both environmental and economic,[6] which are viewed positively in some countries (i e , France) and negatively by at least some groups in other countries Jaccard's point about the "public goods" technologies is that where they are predominant, there is likely to be public ownership, because private markets cannot easily internalize all of the associated externalities Alternatively, reliance on public goods technologies may pose potential barriers to privatization

6 The environmental externalities includes waste disposal problems safety risks and potential weapons proliferation The economic externalities include the impact of developing a technological base that may create export opportunities

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Other important constraints on restructuring include the nature of local fuel markets, the strength of the transmission network, and the reliability performance of the industry We discuss each of these issues briefly

Competitive electric markets are facilitated by competitive fuel markets To the extent that coal mines are vertically integrated with generation plants, the competitive situation may be complicated Natural gas plays an important role in facilitating competition in many countries by lowering barriers to entry Gas-fired combined cycle technology is relatively simple to build and operate and has low capital costs and very high thermal efficiency Thus, where a well-developed natural gas infrastructure exists competition will be more robust

The transmission network is the vehicle through which electricity competition occurs The stronger this network is the smaller the limitations of network congestion When the network is congested competitive markets are geographically separated This can be a problem for the efficient functioning of electricity competition We discuss the role of transmission network constraints in Chapters 5-7

Finally, reliability performance is an important dimension of the restructuring process As a practical matter no government would undertake electricity restructuring if it thought that the process would result in deteriorating reliability In the developed countries surveyed below, it was always the case that the system was over built in generation In the less developed countries, reliability performance was poor before restructuring Improved productivity in these cases resulted in improved reliability None of these situations, however, represent anything like a long run equilibrium Whether competition produces adequate reliability in the long run remains unclear

3.2 Individual Countries Experiences with Electricity Restructuring

The details of restructuring in different countries depends strongly on the initial endowment of generation resources, the political and economic culture, and the government policies that restructuring is designed to implement The interplay of these factors is best understood through case studies (see Gilbert and Kahn, to appear)

3 2 1 *United Kingdom*

Newbery and Green (to appear) and Armstrong, Cowan and Vickers (1994) give comprehensive and balanced assessments of the restructuring history in the UK and its effects to date The main limit on the extent of electricity privatization efforts in the UK was the nuclear assets The financial markets would only accept these assets if the government was willing to provide broad guarantees that would have eliminated most risk and liability The government refused to do this As a result nuclear generation remains in public ownership

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To implement generation competition the UK has instituted a centralized spot market pool through which all electricity must be traded There is a uniform price for all trades based on the bid price of the marginal unit The level of capacity required is determined centrally by the pool s load forecast with no demand-side bidding The generation market is dominated by two large generating companies who have the ability to influence marginal price in the pool Green and Newbery (1992) argued that the monopoly assets would have had to been divided up into at least five companies to produce effective competition The large incumbent generators, National Power and Power Gen dominate the market They have engaged in a number of anticompetitive practices that have been documented in the reports of the Director General of the Office of Electricity Regulation (OFFER 1991 1992a, 1992b, 1992d, 1993b, 1994) Among the more important of these practices has been manipulation of the pool price The incumbent generators have also been able to manipulate transmission constraints in various ways, shifting costs onto all users through a pool surcharge called the uplift which is added on to the pool price

In addition to the spot market pool, there is a contract market operating between generators and users (large customers or distribution companies) This is strictly a financial market, we discuss its economic effects in some detail in Section 6 2

Despite the lack of effective competition in the spot market, other aspects of the UK restructuring have had positive impacts These include improved labor productivity, increased market share and profitability by Nuclear Electric, thereby improving the productivity of those assets and the entry of new gas-fired combined cycle gas turbine (CCGT) technology (Yarrow 1994) There have been disputes regarding the extent to which this new entry was economic Evaluating the need for new capacity in the UK is complicated because even though there was sufficient capacity even before the new CCGTs were added, impending environmental constraints would make much of it uneconomic (Newbery 1994) Most of the productivity benefits produced by the new system in the UK, however, have accrued to producers, rather than consumers, end-user prices have not declined

3 2 2 *Norway*

The Norwegian system is 98% hydroelectric The market was reorganized in 1991 by breaking up the vertical relationships, forming a separate transmission company, and instituting a trading regime Electricity trade is dominated by physical bilateral contracts between buyer and seller that are dispatched by the central pool This market is supplemented by a daily pool for all power that is not sold under contract The pool price is set on a market clearing basis In addition there are two other markets to meet technical and commercial requirements The "regulation" market provides generation for the very short term balancing of supply and demand fluctuations There is also a limited system of forward markets which can be used for price hedging (Knivsfla and Rud 1994)

The transmission network is sufficiently over-built so that on average no constraints limit trade (Hjalmarrson 1994) Nonetheless transmission pricing accounts for potential congestion by charging a bottleneck fee" based on the difference in spot prices on each side of a constrained interface (Moen 1995) This is the approach proposed in the spot market theory discussed in Section 5 1 The restructuring of the Norwegian industry involved separating the transmission network from the generating companies but involved no privatization of generation assets government ownership is still dominant There had been a pool operation in Norway since the 1960s and a market-making operation since the early 1970s (Weideswang 1993) so the restructuring did not require creating completely new wholesale market institutions The performance of the highly fractionated distribution segment of the industry is still believed to need improvement (Hjalmarrson 1994, Yarrow 1994)

3 2 3 *Chile*

The electricity system in Chile is a mix of hydro and thermal resources The political and economic turmoil in Chile during the 1970s resulted in poor performance in the electricity sector and motivated the government to restructure A systematic procedure of reorganization began with separating the state's commercial role from its policy-making and regulatory function Next, a competitive wholesale market was established, and the vertically integrated monopolies were functionally separated A regulatory system was established which included substantial pricing reform Finally, the Chilean electricity industry was privatized A substantial fraction of the assets are now under foreign ownership The political background and details of the institutional development are described in Covarubbias and Maia (1994b)

The bulk power market operates through a centralized pool based on supply bids from generators that were spun off from the former monopolies and new entrants Buyers are distribution companies and large customers Bernstein (1988) describes the bulk power market institutions including the role of the central dispatch pool and the pricing of transmission constraints Galal (1994) gives a careful and positive assessment of the productivity performance of one generating company and one distributor following privatization The Chilean system has the longest history of operation under a competitive regime, and was the conceptual model for the better known UK market

3 2 4 *Argentina*

Covarubbias and Maia (1994a) characterize the productivity problems motivating the restructuring in Argentina, describe the institutional reform process, and provide some early results The government proceeded with asset sales of both hydro and thermal generating stations in 1992 and 1993, but retained nuclear power under government ownership

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The generation mix in Argentina resembles Chile, except that the hydro resources are more decentralized and represent a larger share of total generation The transmission network is more complex, and distances between generation and load centers are also greater than in Chile Perez Arriaga (1994) describes the details of the new industry and regulatory structure The dispatch operator who runs the pool depends upon decentralized hydro scheduling decisions made by project owners, whereas the pool controls the main hydro reservoir in Chile Transmission capacity expansion decisions are also decentralized to some degree

The pool structure in Argentina differs from Chile and the UK in two important regulatory dimensions (Perez Arriaga 1994) First, generators are not free to bid any price that they like They are required to bid variable cost, which is subject to audit by the regulator This feature may have been specified in light of concerns arising from experience with excessive bid prices in the UK pool Second, the distribution companies purchase through the pool with a substantial lag There is a "stabilization fund" which smooths out the price fluctuations that result from marginal cost pricing This will limit the short term price responsiveness of distribution level demand Large customers are directly transacting in the pool, however, and should be more price responsive

3 2 5 *Australia*

The Australian power system is characterized by vertically integrated state-owned companies that serve each of the regional states In the state of Victoria, whose capital is Melbourne, the industry has been vertically restructured and privatized along the lines of the UK There is currently a wholesale pool operating in Victoria New South Wales, whose capital is Sydney, is not as far along in the restructuring process Some efforts have begun to increase the commercial orientation of the electricity generating company and the distributors, by removing them from direct government supervision and emphasizing profitability (GPT 1993) There may be a break up of Pacific Power, the generating company in preparation for a more competitive market

There have been experiments in interstate trade that were undertaken under the guidance of a federal agency (NGMC 1993a, NGMC 1993b) Due to the large distances between load centers and generating stations, the only practical trading regime would involve the states of Victoria, New South Wales, and South Australia The trading rules currently under discussion will attempt to implement a decentralized market using the principles of spot pricing (Schweppe et al 1988, also see Section 5 1), supplemented by forward market institutions (NGMC 1995) The purpose of developing forward markets is to improve the quality of the trading environment by helping to manage risk and improve the transparency of the market (Outhred and Kaye 1994) In Section 5 5 we discuss the current NGMC market rules in the context of unit commitment coordination economies

The significance of the NGMC initiatives for the U S lies in their "bottom up ' nature The federal authority over the companies in each state is limited, so that industry consensus is required for significant change to occur The decentralization of the industry parallels the current organization of the electricity industry in the U S This institutional setting contrasts strongly with the situation in most other countries where ' top down restructuring has been the rule

3.3 Summary

In Chile Argentina and the UK a centralized pool operates the wholesale market, with all trade going through the pool A bilateral regime dominates the Norwegian market, but it depends upon some unusual conditions First there are very limited transmission constraints in the network so that many possible dispatch arrangements are feasible Secondly, before restructuring, there had already been a framework of pooling and marketing institutions which facilitated a smooth transition to a competitive wholesale structure The UK, Chile and Argentina all formed their pooling institutions from the single area control function performed by a central utility operator The Australian NGMC experiment promises greater market decentralization than the other cases This will be facilitated by having relatively few market centers involved in the trading regime

Our analysis suggests that, overall, the electricity restructuring processes in other countries offer few major lessons for the U S because of pervasive private ownership and the highly fractionated nature of the U S electricity industry Private ownership is important because it makes the process of reorganization of functions more complex compared to situations that involve government enterprises exclusively If restructuring requires writing down the value of uneconomic assets this is more easily accomplished by governments than if private investors must be compensated The large number of relatively small utilities in the U S power network means that the formation of pools would also involve complicated financial compensation procedures

For the current institutional framework of the electricity industry in the U S , there may be insights from the Australian NGMC experiments where decentralized trade coordination will be tested The other country experiments offer potential lessons in pool economies, operation and transaction costs Both Argentina and Chile are trying to decentralize transmission system expansion which should also provide valuable lessons

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4 Current Structure of the Bulk Power Market

The economics literature reviewed in Section 2 1, insofar as it addressed empirical issues, is significantly out of date with regard to important features of current bulk power markets in the U S In this chapter, we focus on issues that affect the prospects for efficient trade In particular we address the role of non-utility generation (NUGs), market price formation and the performance of existing bulk power market institutions

NUG issues are addressed in Section 4 1 The emergence of non-utility generators reflects the success of PURPA s policies to facilitate entry However, in many areas of the U S , entry by non-utility generators has also reduced operational flexibility for utility system operators, which results in increased operating costs Understanding the current role of most non-utility generation in the existing bulk power market is important because it highlights the point that ease of entry for new participants does not necessarily or inevitably lead to a more efficient electricity industry overall

In Section 4 2, we discuss the importance of price transparency in the development of competitive markets We then examine obstacles to price transparency, specifically some of the practices of existing U S institutions, such as power pools, which are responsible for coordinating and facilitating trade in bulk power markets We also highlight the efforts of various market participants to develop and produce wholesale market price indices in response to the increasing demand for price transparency

In Section 4 3, we survey the performance of U S bulk power market institutions, focusing on power pools Our review indicates that power pools have produced demonstrable benefits for utilities by reducing excess capacity, thus leading to reduced reserve margins However, the studies also suggest that there are not significant efficiencies in dispatch for utilities in power pools vs companies that are not in pools and engage in bilateral trade Based on current practices in the U S , there is not definitive evidence regarding the superiority of voluntary bilateral trade vs pooling arrangements

4.1 Non-Utility Generation

There is a fundamental asymmetry between utility responsibilities and NUG access rights in the bulk power market Because PURPA mandates that utilities must take power from Qualifying Facilities (QFs) under almost all circumstances, the burden of making operational adjustments to accommodate changes in the supply/demand balance falls entirely on utility-owned generators In regions such as California and the Northeast, these are important factors Ilic *et al* (1993) describe procedures used to manage random fluctuations in supply and demand in this setting The burden of cycling generator output under expected conditions is equally, if not more important As the output from a generator varies, and as the number

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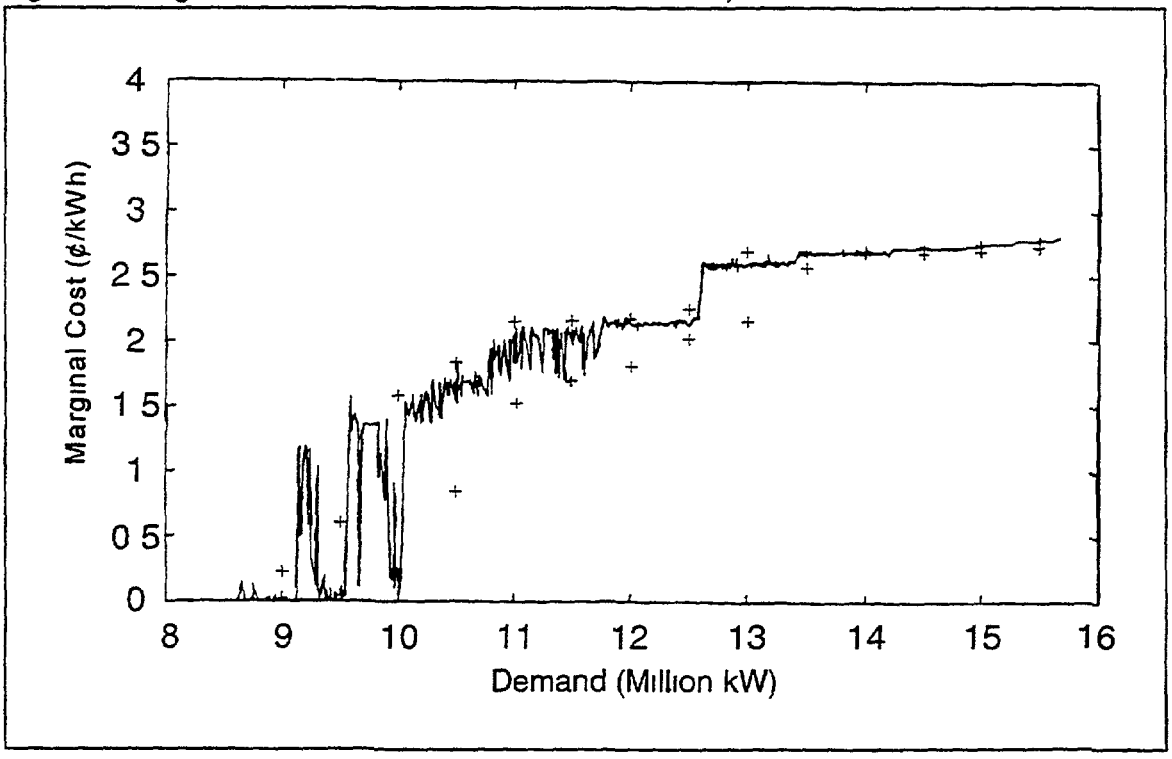
of start-ups increases, there is additional wear and tear that requires O&M expenses Due to the growing perception of these issues, NUGs acquired competitively in recent years are obliged to provide operating flexibility and are being evaluated along that dimension (Kahn Marnay and Berman 1992) NUG contracts in Virginia, for example, exhibit substantial operating flexibility, which has resulted in much more adaptation to unexpected conditions than is typical elsewhere But the competitive segment is still small compared to the much larger population of non-dispatchable NUGs Data on the recent performance of dispatchable projects and the relative size of this segment is given in Comnes Belden and Kahn (1995)

There are no general estimates of the costs associated with the asymmetry in operational obligations, but there is reason to believe that these costs are significant Some of the costs are monetary These are primarily opportunity costs resulting from must-run PURPA production Utilities must purchase high priced QF output when cheaper alternatives are available Other costs involve reduced reliability, such as a lessened ability to meet Area Control Error standards Figure 3, from White (1994), shows the minimum load problems of Southern California Edison in the form of extreme marginal cost instability during periods of low demand The price spikes at the low end of the cost curve show cases where generators start up and operate at their minimum stable levels, but these levels are sufficiently large that they may exceed demand, or at least reduce opportunity cost to extremely low levels It is quite likely that these cost instabilities at low demand result in lower performance

Figure 3 Marginal Cost Curve for SCE Based on Summer, 1992 Conditions



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on Area Control Error but NERC does not make data on this question publicly available Other examples where supply inflexibilities result in operating problems associated with generator cycling are discussed qualitatively in Le *et al* (1990)

One approach to quantifying the cost impacts of QF must-run operation more generally would be to examine regions such as California, New England or New York, where the NUG impact is large and examine what the savings in operating costs would be if the QFs were dispatched The difficulty with such an approach would be getting reliable estimates of the true QF variable costs Alternatively, a lower bound would involve comparing the outage rates of utility generators with those of NUGs, as well as the change in utility outage rates as NUG penetration has increased The implicit argument of such comparisons is that the adjustment costs of increased cycling requirements show up as reduced reliability of utility generators It would be much more difficult to estimate the costs of the control area reliability case discussed in connection with Figure 3

Some reform of the NUG market is currently being debated by federal and state policymakers Changes in this regime need to simultaneously respect NUG contract rights, but also encourage re-negotiation to increase operating flexibility

4.2 Price Transparency

Transparency of various kinds has become an increasingly important regulatory objective as the process of infrastructure deregulation has developed Transparency is one aspect of the larger question of information management and disclosure which is a subtle problem in regulation The fundamental proposition of the modern theory of regulation is that the monopoly firm has an important information advantage over the regulator (Laffont and Tirole 1993) Competition tends to erode the information advantage of the monopolist This occurs both by the functional restructuring process, which requires information about cost, and by competitive processes which tend to produce information about price At the same time, however, that deregulation increases pressure for information transparency, there are pressures for information protection Competitive advantage for individual firms is frequently involved If a competitor must disclose all relevant market information, then there are no returns to developing it

As a working definition of the transparency concept, we use the simple criterion that something is transparent if it can be known to any interested party at nominal cost We can speak about transparency of prices, of costs and of processes Price transparency may be the simplest of these notions The reason that price transparency is desirable is to facilitate competition by making apparent the transaction price for various products In countries where such prices are either secret, or at least difficult to obtain, regulatory reform may begin with requirements for price transparency This appears to be the case in much of Europe (De Paoli and Finon 1993)

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Transparency of process is more complex, if for no other reason than that processes are complex, whereas prices are inherently more simple Decision-making is frequently obscure in state-owned infrastructure industries Often, no one has to explain why a particular decision was made and therefore no one can be held accountable This is in marked contrast to systems (even government owned) in which a regulatory agency must give an account of its decisions Increasing the transparency of government processes is a common objective of deregulation (Smith and Klein 1994) Firms frequently employ complex processes to optimize their own operations in either monopolistic or competitive markets The need for transparency here is much less, since firms are accountable Only in cases where complex processes affect the competitive position of other participants can a case be made for the public value of process transparency in the individual firm

Finally, cost transparency has several dimensions In a competitive market, prices approximate costs closely In the case of regulated firms with dominant market positions the situation is more opaque Regulators can observe costs through auditing This may be expensive, but it is feasible Where costs are jointly incurred to produce more than one service or product, the separation is basically arbitrary In this case cost observation is essentially infeasible The marginal costs of some products produced by dominant firms are difficult to observe because they result from complex (i e non-transparent) processes

Price transparency is an important element of the competitive process because it reveals the value of products that might not otherwise be known either by market participants or by regulators trying to facilitate the transition to a competitive market structure

In the following sections, we survey various current practices that are obstacles to price transparency as well as procedures that may facilitate it First, we examine power pool operations organized along central dispatch lines through a case study of the New York Power Pool (NYPP) The translation of the engineering rules used to operate central pools into commercial terms can be difficult Next, we examine the recent development of market indices, which characterize transaction prices at various locations in the U S power network

4 2 1 *Power Pool Practices and Price Transparency NYPP Case Study*

In the U S , there are three "tight" power pools, which are located in the northeast the New England Power Pool (NEPOOL), the Pennsylvania-New Jersey-Maryland (PJM) Pool and the New York Power Pool (NYPP) Utilities in other regions of the U S have entered into "looser" pooling arrangements, none of which involve central dispatch To illustrate current practices of power pools as they relate to price transparency issues, we focus on the New York Power Pool, because its operation has been particularly well-documented in several studies (Ruganis 1986)

The NYPP, like other centrally dispatched power pools in the U S , operates on a "split-savings" pricing rule This means that the marginal costs are not charged to buyers and paid to sellers, but rather that an intermediate price is used for transactions which reflects what the buyer would have paid This pricing policy introduces an extra level of complexity into conventional U S pool pricing and contributes to making the pricing more opaque The opacity stems both from the specific nature of the price for every buyer for every transaction and from the lack of a mechanism to make this information available broadly Needless to say, it would be quite difficult to audit or verify In contrast, pools implemented in other countries rely on marginal cost pricing (see Section 3 2)

Ruganis (1986) is a very careful and interesting, if somewhat dated, study of the operating cost structure of the New York Power Pool (NYPP) Ruganis has available to him the operating records of the NYPP, and seeks to construct a characterization of the hourly marginal costs While his purpose is to develop data that can be used for benchmarking a multi-area production simulation model his study has implications beyond that purpose Among other lessons, this study illustrates the difficulties of using engineering data to characterize the commercial aspects of electricity trade In formal pools, such as the NYPP the transactions price between parties has frequently been based on the "split savings' concept This requires a separate calculation of the hypothetical cost of buyers, which has many of the same conceptual problems as marginal costs, but does not have the property of being observable in principle Thus, the very fact that retrospective marginal cost studies are necessary indicates the basic point that centralized dispatch may not produce readily transparent transaction prices We summarize this study to illustrate the gap between power system operations and electricity trade

System operations in the NYPP are governed by a security-constrained dispatch (SCD) model that allocates minute by minute fluctuations in load to the generators on the system which are operating Ruganis characterizes the principal objective of SCD models as maintaining system stability, economic optimization is secondary to that primary objective SCD models yield shadow prices that can be interpreted as marginal costs Ruganis shows, however, that these values are too finely grained to be usable for estimates of the "market price" of electricity That is, the SCD shadow prices can fluctuate substantially over short time intervals, and their values are quite sensitive to the length of the time interval over which they are measured Further, SCD shadow prices only measure very small marginal changes, and so can neglect the impact of units that provided "most" of the adjustment to a load change observed over a somewhat longer time horizon As a result there may be "noise" in SCD estimates of marginal costs It is not clear if this implies a biased estimate It is clear, however, that the microstructure of marginal cost is less significant for commercial purposes than the larger view based on discrete transactions

The NYPP uses available hydro resources along with its predominantly thermal generators The scheduling and valuation of storage hydro resources presents another major problem in the translation of engineering to commercial practice The economic principle on which the

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valuation of storage hydro resources is typically done is by estimating the opportunity costs associated with its use This means that its value is the cost of the resources that it would have displaced at some future date, had in not been used today The problem is quite complicated when formulated over a multi-year horizon The complexity involves deciding how to allocate water storage and use over these time cycles [7] Hjalmarrson (1995), for example, describes this problem in the Norwegian setting The competing generators, all of whose resources are hydro based, use stochastic dynamic programming models of the power system to design bidding strategies in light of hydrologic conditions, a demand forecast, and their assessment of the behavior of competitors For such analysis to be even feasible, there must be common models of the hydrology, the power system, and demand characteristics This is certainly not a transparent process, but there is no reason for it to be All that matters is that the pool price which emerges from competition is transparent to users There is neither a transparent marginal cost nor a transparent transaction price in the U S "split savings" power pools

Even in systems where hydro plays a much smaller role, the basic problem remains that over any time horizon longer than a month, the estimation of storage hydro value is quite uncertain Therefore any hydro scheduling plan is quite likely to be suboptimal after the fact, and any forecast of marginal costs is highly dependent on the storage hydro schedule This means that marginal cost depends upon the administrative decisions of the hydro scheduling program, and this is a non-transparent process

4 2 2 *Wholesale Market Indices*

Although there is a very large volume of wholesale electricity trade, the transaction prices are not easily available Firm transactions have typically been regulated on a cost of service basis by FERC They are reported in the annual filings of investor-owned utilities to FERC Short term non-firm transactions are also reported on an annual basis, but at a level of aggregation that does not reveal the structure of transaction prices The FERC reports of non-firm trade simply add up all the transactions between two parties that occur over a year and report them as one sale or purchase

Recently, market participants and private information service providers have begun to cooperate in efforts to produce more transparent indicators of wholesale transaction prices All of these efforts are designed to produce price indices that reflect market activity in different products at particularly active trading locations in the electricity network One of these indices is being developed by Dow Jones/Telerate reflecting activity at the California-Oregon border (COB) The COB market index will cover four different electricity products

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7 The problem resembles the operator s decision to invoke the limited curtailment rights obtained from customers analyzed by Oren and Smith (1992) In both cases, a fixed quantity of a valuable resource must be allocated over a future period where the occurrence of the periods of maximum value is uncertain

firm and non-firm energy delivered during peak and off-peak hours (Speckman and Schleimer 1995) Other providers of market price information include newsletters such as *Power Markets Week* and *California Energy Markets*

It is not clear exactly how these indices are computed or what their accuracy may be We can illustrate the index construction issues with a simple example Table 2 gives four hypothetical trades characterized by a price and a quantity The two obvious ways to construct a price index is to compute a simple average price or a quantity-weighted average For this example, the simple average is 31 and the quantity weighted average is 31 8 In this case, therefore the choice of averaging method turns out to make only a small difference More generally, this would not be true Clearly, the quantity-weighting method is conceptually preferable

Table 2 Hypothetical Trade Data

Trade	Quantity	Price
A	5	20
B	10	40
C	20	35
D	30	29

The potentially larger problem with indices is sampling bias The data used in the index may represent a biased sample of the underlying market because the data collection is not based on a random process Some market participants may not provide their data, thus introducing a potential distortion in the reported index price Using Table 2 data, suppose the transaction sample only included A and D Then the simple average price would be 24 5 and the weighted average would be 27 7 In this case, sampling error introduces a large bias, although the error is less with the quantity-weighted index

Another important issue involves the question of what product is being described The current indices appear to be focused on very short-term products, typically one day ahead schedules However useful such products may be, they may not be the main products transacted Electricity production planning over longer time cycles is much more important than daily planning Unit commitment schedules typically involve a one week plan Fuel purchasing typically involves a minimum of one month planning Therefore, electricity price indices for transactions representing these longer time horizons may be more economically meaningful than the day ahead products

Price indices are useful measures of economic value At their current state of development, it is likely that the indices have sampling bias problems As the wholesale market develops, these problems will probably be diminished Competing information providers will have an incentive to demonstrate the quality of their products by trying to assure more complete

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sampling It remains to be seen whether price indices develop for electricity products traded over longer time horizons than the day ahead schedule

4.3 Performance of Market Institutions

Empirical studies of market performance have seldom yielded conclusive results A subject of traditional interest is the relative performance of public vs private ownership Pollitt (1994) is a recent study of this kind We focus on the performance of trading institutions Studies of these institutions have been typically conducted at a fairly high level of aggregation because it is necessary to observe many trades to arrive at any conclusion about the functioning of commercial practices Qualitative studies also play an important role in isolating particular practices that may limit performance Such studies also can be fairly far removed from engineering practices

The performance of U S power pools has been examined recently from a number of different perspectives Pechman (1993) and the staff of the New York Public Service Commission (NYPSC 1991) examine the functioning of the New York Power Pool from organizational and information perspectives Both identify serious impediments to improved efficiency in the NYPP due to the unanimity rule governing changes in procedures One area where efficiency could be improved involves the operation of the single pumped storage unit in the state Each member utility has certain scheduling rights for this unit The result of decentralized decision-making is less optimal use of the facility as a whole compared to pool-wide operation More beneficial arbitrage is limited in favor of schedules that improve the position of only one company Another example of a coordination economy that the NYPP does not capture is single area unit commitment Unlike other centrally dispatched pools, the NYPP does not coordinate the commitment of units among the utilities

Gilbert Kahn and White (1993) examine data on power pools to determine if there are observable efficiencies associated with pooling They examine the level of operation of baseload units owned by utilities that participate in pools compared to those that do not In principle, pooling should increase the output of low cost baseload units by "flattening" the load curve that these units serve This means that there should be a better utilization of their capacity than for non-pooled units Data for 1989 suggests that this is, in fact, the case Closer inspection, however, suggests that the observed differences are due primarily to differences in installed capacity Utilities that do not pool typically had greater excess capacity at this time than those that pooled Once the operational data is adjusted for the differences in capacity, there is no longer any observable difference in performance These results, while they fail to support the claims of operational superiority of pooling, do support the other main coordination claim of pooling, namely that it results in better planning

Finally, White (1995) studies the potential for increased pooling in California He takes a detailed look at the benefits of dispatching hydro resources located primarily in the North,

across the entire state His simulation concentrates only on the peak month, so that operational benefits such as joint unit commitment or coordinated maintenance scheduling are excluded He also ignores transmission costs and constraints The result is an estimated benefit of about 4% of total costs, due principally to lower costs of peak load production The net benefit, once transmission effects are taken into account would be less These results are consistent with the belief that wholesale markets in the Western U S , operating under the currently accepted set of constraints, are not grossly inefficient It remains to be seen, however, whether larger efficiency gains are possible if some of the current constraints and trading practices were changed

The implications of these results for competitive markets are not entirely clear If competition results in the reduction or elimination of barriers to trade, then operational efficiency should increase It would appear that the opportunities for increased trading efficiency would lie in the interaction of non-pooled utilities either with one another or with existing pools In the short run, competition will probably induce increased trade based on under-utilized assets In the longer run, competitive pressure may or may not facilitate efficient investment The pools seem to have achieved less excess capacity than non-pooled utilities It is reasonable to expect that competition will reduce excess capacity in the intermediate term Long-run investment in a competitive market may not be adequate (see Section 6 1 3 for discussion of this issue)

5 Trading in a Competitive Power Market

As activity in the wholesale market has increased and state regulatory commissions have begun seriosly discussing deregulation of the bulk power market, a variety of views have been offered on the best way to structure this market Most of these views propose a fully competitive structure but these views divide into two quite distinct categories The nodal pricing models would require all trades to be made with a central market maker, the ISO In contrast, the bilateral models specify that trades should be made between private parties Both sides recognize that an ISO is necessary to control the externalities associated with trading over a common network, and both sides claim that their proposals will best approximate the workings of a competitive market

In this chapter, we do not attempt to resolve this debate, which is occurring in many regions and countries and will undoubtedly persist for years Instead we describe the basic nodal pricing model and three variations of the bilateral approach and explain some of the central arguments for and against the two generic approaches

Section 5 1 presents the influential nodal spot market theory stripped of its mathematical complexity Section 5 2 shows how nodal spot prices provide a basis for several long-term contracts that can be used to eliminate some of the risks associated with spot markets [8] Section 5 3 considers a criticism of the nodal approach that claims trading only with the ISO is too restrictive, while Section 5 4 asks whether we need a mandatory pool at all, or if the market can self-organize efficiently without the ISO being directly involved in economic dispatch This section also summarizes three academic versions of the "bilateral" approach Section 5 5 discusses forward contracting in a bilateral regime Finally, Section 5 6 examines the coordination economies of a centrally dispatched pool

5 1 Spot Market Theory

The technological characteristics of electricity networks have led to the development of a pricing and trade theory based on a particular concept of spot markets Originally articulated by Schweppe (1978), and fully developed in Schweppe *et al* (1988), this approach has been revived more recently by a number of authors in their proposals to restructure bulk power markets Accounting for network properties is a fundamental requirement of any electricity trading regime The spot market theory gives particularly strong emphasis to network properties Because this theory has been thoroughly studied, it can be more clearly defined than the more recent bilateral proposals

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[8] In Section 6 1 2 we examine whether the full structure of both spot and contract markets might mitigate the market power of dominant participants

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5 1 1 *Spot Market Definition*

Spot market theory defines the optimal spot price at each node in a very simple and natural way, although one often finds that definition replaced by one based on complex procedures for calculating that price We will not concern ourselves with the details of calculation, and will only give the underlying economic definition

Definition The optimal spot price (per kWh) at a node is the minimum system cost of supplying one more kWh at that node when the system is optimally dispatched

The optimal nodal spot price is a very useful concept because it measures the true cost of supply and as a consequence provides the conceptually correct price to charge a demander If demanders are presented with this price, they will consume up to the point where their marginal value of power is equal to the spot price Thus the optimal nodal price will also equal the value of supplying a marginal kWh at the node in question

In defining optimal nodal spot price we also introduced the concept of "optimal dispatch," which we now define

Definition The optimal dispatch maximizes system net benefit, i e the difference between the total benefit to customers and the total cost of generation

Among power system planners, this is often referred to as the "optimal power flow," or OPF However in calculating an OPF, planners typically assume that demand is fixed, which simplifies the demand side of the problem. OPF is easy to define but hard to calculate In fact one of the central controversies surrounding nodal spot pricing proposals is the difficulty of computing the OPF Recent experience reported by PG&E highlights this issue (Papalexopoulos *et al* 1994) OPFs are generally very sensitive to both the precise specification of system constraints and to slight differences in the marginal cost of generation Thus, there are typically a set of power flows that dispatch very different generation sets than the OPF, but that are nonetheless extremely close to optimal in terms of system net benefit This makes it possible for the system operator to favor one generator over another without being readily detected For this reason, independence of the system operator is desirable This property of OPFs has been cited by Wu and Varaiya (1995) as a critique of the spot pricing model. We discuss their arguments in Section 5 3 2 The importance of this issue has not been settled conclusively

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5 1 2 *Properties of the Spot Market*

To gain a deeper intuitive understanding of optimal nodal spot prices, we now discuss several of their properties Spot prices are partly determined by the supply and demand for power but they are also affected by two properties of the transmission grid itself losses and constraints Our first property describes how prices would be set if these two properties were not constraining In other words we assume a grid without losses or congestion

Property 1 In a loss less and uncongested grid, the optimal nodal spot price will be the same at all nodes, and will equal every generators short-run marginal cost and every demanders short-run marginal benefit

In this case the entire system forms a single perfectly competitive spot market While there are many times when a grid is uncongested, there are always losses, so we consider that case next

In the spot-price regime, the independent system operator (ISO) is the buyer to every seller and the seller to every buyer all trades are made with the ISO When considering this aspect of the ISO's role, we generally refer to the ISO as a grid merchant, and refer to the grid merchant's net gains from trade as the "merchandizing surplus " Property 2 considers the part of the merchandizing surplus that arises from the spot price differences that correspond to losses

Property 2 In an uncongested but lossy grid, the optimal nodal spot price is lower at generation nodes and higher at demand nodes These differences are great enough to earn the grid merchant a merchandizing surplus, which is approximately equal to the value of lost power

This property is somewhat surprising One might have expected that if 10% of the power is lost when shipping from node A to B, then the price at B would be 10% higher This would imply that the system operator would just break even However, power losses are proportional to the square of the power shipped, so the marginal loss is twice the average loss Consequently, the price at B, which reflected the marginal loss, will be 20% higher than the price at A, and the grid merchant will make a profit of 10%

We now turn to the even more subtle effect of congestion on spot prices To simplify this discussion we again assume a loss less network This assumption is not problematic, because the nodal spot price differences caused by losses and those caused by congestion are simply additive in the complete model

Property 3 In a loss less grid with one congested line, the optimal spot price will be higher at the end receiving power by an amount that measures the value of increasing the line's capacity

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If the line from node A to B is congested then it is not possible to increase consumption at B simply by increasing generation at A, for this would cause the power flow on line A-B to exceed its rating For that reason the cost of supplying power to B will be greater than the cost of generating it at A thus the difference in nodal spot prices

Beyond this point the effects of congestion become quite complex To give the reader some idea of the nature of these complexities we state two more properties that demonstrate the counter-intuitive nature of real power flows

Property 4 With only one congested line, it is possible that for some other line in the network the spot price at the demanding end will be lower than at the generating end

This appears counter-intuitive because we generally expect that electric power will only be bought at node A and sold at node B if it is cheaper at A than at B Because of the apparent backwardness of this transaction the corresponding power flow is often called an "uphill flow "[9] This possibility has been most closely analyzed by Wu *et al* (1994)

Possibly even more disconcerting than the standard uphill flow described in property 4 and by Wu *et al* is the possibility of an uphill flow on a congested line, which we describe in our final property

Property 5 In a grid with more than one congested line, the optimal nodal price at the receiving end of a congested line may be higher, lower, or equal to the optimal nodal price at the transmitting end

In spite of these complications the optimal spot price differences between nodes do send the correct economic signals to both generators and demanders Both are properly discouraged from contributing to system losses and from contributing to congestion Thus, if they can be computed by the system operator and utilized by traders, they will play exactly the role one would hope for them to play, counter-intuitive properties not withstanding These commendable properties are simply the result of optimal prices being defined as the shadow

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9 Figure 7b in Section 6 3 shows an example of an uphill' power flow In this example line 1-2 is congested and is preventing node 1 from transmitting additional power to node 3 But if as happens in Figure 7c node 2 transmits additional power to node 3 this causes a counter flow on the congested line and makes it possible for node 1 to inject more power If we assume the prices at node 1 and node 3 are 5¢ and 10¢ respectively we can find the optimal nodal spot price at node 2 as follows

The optimal price at node 2 is the net system benefit of an additional kWh Every kWh injected at node 2 has a direct benefit of 10¢ to node 3 But every kWh injected at node 2 also has an indirect net benefit of 5¢ because it allows node 1 to ship an additional kWh to node 3 Thus the value and price at node 2 is 15¢/kWh and the flow from node 2 to node 3 is an uphill flow it takes power from an expensive node to a cheap node

prices of generation at each node In other words optimal spot prices, by design, take into account all system costs and benefits

5 1 3 *Spot Market Implementation*

This conceptual discussion of spot market theory is sufficiently abstract that it requires further institutional specification before a trade regime can be defined coherently The spot market model can be implemented to varying degrees of approximation One particularly important question involves the issue of system dispatch Who will operate the network to produce the flows that link the prices at different nodes? The early formulations of this question were somewhat vague For example, Hogan (1992) assumes that there need be no change in operations from existing institutional arrangements to implement spot market prices for use as transmission prices

> ' transmission prices can be estimated ex post The ex post method allows the current dispatch operations to remain in place and calculates prices consistent with the actual usage by applying the marginal tests of economic dispatch " (p 224)

This approach requires "accepting the actual system dispatch as an optimal balance of the underlying economics and constraints " (p 223) For a regime of limited trade among vertically integrated utilities, this approximation *might* be acceptable In a regime of more expanded trade where marketers and perhaps end-use customers are transacting, this approximation will not suffice, because the dispatcher has incentives to favor trades that benefit his own units and not those of competitors In any particular situation, many dispatch patterns are feasible, although they affect access opportunities differentially Therefore, the dispatcher can discriminate in response to network constraints

More recent discussion of spot market theory has situated it institutionally in a centralized pool setting (Garber, Hogan, and Ruff 1994) In this implementation, concerns about biased dispatch are mitigated to a considerable degree, although not eliminated (see Wu and Varaiya 1994)

5.2 Spot and Contract Markets

The spot market provides for the real-time matching of supply and demand, which is a unique requirement of the electricity industry However, spot markets alone are not likely to meet other requirements of an efficient market By its nature, spot prices generate a risky income stream, which can be problematic as a basis for long-term investment By design, the spot market can provide opportunities for manipulation of the process, and therefore of the resulting spot price or prices These problems (i e , risky income stream and opportunities

to manipulate prices) can create barriers to entry which in the long run undermine the competitiveness of the market [10] These problems can be mitigated by long-term financial contracts which are the subject of this section

To motivate our discussion on the use and value of long-term contracts we develop a stylized example that involves a pair of traders who wish to make a long-term trade at a fixed price This example allows us to introduce three basic types of long-term contracts which can be overlaid on a spot market a contract for differences (CFD), a transmission congestion contract (TCC), and a forward contract (FC)

The first and simplest step for the supplier and demander is to write a CFD This can be done without any support from a long-term contract market it is entirely private in nature A CFD eliminates the temporal risks associated with the spot market but not spatial risks, as it does not account for the price difference between nodes A second step is needed to completely eliminate risk from the long term contract and this step is taken by purchasing a TCC This requires a market in TCCs for there is no way for the traders to originate such a contract on their own Having both a CFD and TCC completely eliminates long-term risk As Table 3 illustrates part of the TCC cancels in a mathematical sense part of the CFD and the result is equivalent to a forward contract (FC) This allows us to conclude that a forward contract could be used in place of both CFDs and TCCs

In Table 3, we illustrate these relationships more concretely with a supplier at node I and a demander at node J that decide to trade a quantity of power q, at the fixed contract price P_c In a true spot-market regime this trade could not be made directly, but instead each must trade with the ISO, the payment from this transaction is shown in row 1 of the table

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10 When there is a competitive fringe interacting with vertically integrated dispatcher there are incentives to find an equilibrium that damages competitors (Kahn 1995a) As the experience in the UK amply illustrates an independent system operator is no guarantee of efficient dispatch

Table 3 Using Long-Term Contracts to Eliminate Nominal Price Risk

	Contract or Market	Payment	
		Supplier at Node *i*	Demander at Node *j*
1	Spot Market	$P_i q$	$-P_j q$
2	CFD for q at P_c	$(P_c - P_j) q$	$-(P_c - P_j) q$
3	Total	$P_c q - (P_i - P_j) q$	$-P_c q$
4	TCC for q from i to j	$(P - P_j) q$	---
5	Total	$P_c q$	$-P_c q$
6	FC sold at i, bought at j	$-P_i q$	$P_j q$

The easiest step in moving from the spot market to a long-term fixed price contract is to implement a contract for differences as described by row 2 This contract can reference either node's spot price or even the average of the two We have chosen one typical and convenient implementation for our example, and have defined the CFD to require the demander to pay the supplier the difference between the contract price, P_c, and the spot price at node *j* As can be seen from row 3, if the two spot prices are the same, this contract exactly transforms a series of spot transactions at uncertain future prices into a single long-term transaction at a fixed price, thereby eliminating all price risk of nominal price fluctuations for both parties If the parties are equally risk averse, this elimination of risk is accomplished without the payment of a risk premium by either party, something that cannot be accomplished by a forward market involving outside speculators If one party is more risk averse than the other, that party should still pay less for risk reduction than in a futures market because the other party can provide that reduction at no cost

Because a nodal spot price market does have nodal spot price differences whenever intervening lines are congested, the complete elimination of price uncertainty requires the use of another type of long-term contract For this purpose Hogan (1992) invented the transmission congestion contract (TCC) [11] As shown in row 4, a TCC pays its bearer the spot price difference between the specified nodes times a fixed contract quantity Hogan has proposed that the investors who build the grid should be rewarded with a TCC, which is issued and backed by the ISO This again has the advantage of eliminating risk without the need to pay any party a risk premium, but it would still be possible for an outside financial institution to make a market in TCCs

[11] Nodal prices also differ because of losses The standard definition of a TCC ignored this complication and we will continue in that tradition but the interested reader who consults Bushnell and Stoft (1995b) will find that TCCs can be extended to lossy networks with only minor modifications The principle one being that they must be broken into two parts and consequently come to look exactly like a pair of forward contracts

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As can be seen from row 5, which sums rows 3 and 4, the addition of the TCC completes the process of transforming a series of spot trades into a fixed price long-term contract This is seen by the fact that the payment shown in row 5 is fixed, it does not depend on any spot price The last line in the table shows the payments from forward contracts at the two nodes a short contract at I, and a long contract at j These contracts exactly cancel the spot-market transactions shown in row 1 Thus if the demander buys a forward contract at j and the supplier sells a forward contract at I they have accomplished the same thing as is accomplished with a TCC and CFD This point is made by Oren *et al* (1995)

This concludes our brief overview of the mechanics of various types of long-term contracts, the role of long-term contracts in addressing the shortcomings of spot markets is discused in more detail in Section 6 1 2

5 3 Will a Mandatory Pool Restrict Bilateral Contracts?

A concern of those who favor "physical" bilateral contracts is that the obligation to trade with the Pool prohibits the implementation of useful "physical" bilateral contracts, thereby reducing market efficiency PoolCo advocates point out that those engaged in a bilateral contracts can easily insure that their generator will be dispatched and their load will be fully served simply by manipulating their bid prices Because a contract for differences (CFD) insulates them from spot price fluctuations, and because they will trade at the spot price and not at their bid prices, the outcome of their trade with PoolCo is exactly the same both physically and financially as if PoolCo had been absent from the transaction

Bilateral advocates claim that there are exceptions to this equivalence One example that has been pointed to in discussions is the case of a contract between a hydro generator and a load that wants to contract for a fixed amount of energy without specifying the delivery time Although it is admitted that a CFD would be equivalent to a physical bilateral contract in the absence of congestion, it is claimed that congestion will drive a wedge between the two outcomes Although it is true that CFDs do not eliminate the risk of locational variations in the spot price, it is also true that parties with a physical bilateral contract should have to pay these same congestion charges The claim that trading with a PoolCo is more restrictive than bilateral trading certainly deserves more attention, although so far the argument has not been fully articulated and supporting evidence is limited

5 4 Do We Need A Mandatory Pool to Compete?

Various types of bilateral trading models represent the major alternative to the nodal spot market implementation of a competitive bulk power market, sometimes referred to simply as the Poolco approach These bilateral trading models can be distinguished from PoolCo proposals in three ways

(1) The ISO does not take title to the power during a trade i e the ISO is not the buyer to every seller and the seller to every buyer

(2) The ISO does not have control over the dispatch except to the extent needed to maintain system integrity

(3) There are no nodal prices spot prices are always prices for bilateral trades, which may sometimes be spot (short-term) prices but which are not associated with a single node

In California several bilateral trading models have been put forward by various parties in response to the California Public Utilities Commission's (CPUC) "Blue Book" proposal We will not try to recapitulate the specific proposals put forth in California, many of which have evolved through the workshop and political negotiation process For discussion purposes, we focus on three academic models that span a large part of the spectrum of "bilateralist" positions The three academic models are relatively simple to summarize and are internally consistent, if perhaps less practical, than the ones put forward in the regulatory arena

The three models are Wu and Varaiya's "coordinated multilateral trading" (CMT) approach (1995), Chao and Peck's transmission-bidding approach, and McGuire's transmission-charge approach All three models are quite recent, appearing for the first time in 1995, each model has some areas that have still not been well-defined It also must be noted that Chao and Peck's model is not simply bilateral but envisions the possibility that bilateral trades taking place along side spot-price trades with a PoolCo Nonetheless, it does show one way a competitive bilateral/multilateral market could be organized, and we will focus only on the bilateral trading mechanism

5 4 1 *Chao and Peck*

Both the CMT approach (Wu and Variaya), and the transmission bidding approach (Chao and Peck), remove the ISO not only from the energy market, but also from the market for transmission services This does not mean that the ISO has no roles in these markets, only that the ISO does not buy or sell transmission services In both approaches, the ISO gives information to the traders on the extent of losses that are attributable to their transactions on the network This includes not only the power lost in their own shipments but also any losses

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that they impose on other trades The traders are then responsible for covering the losses they cause, either through generation of their own or through purchases Of course, it may happen that a trader fails in this responsibility, but at that point, we are discussing imbalances rather than losses Imbalances are handled by the ISO by procedures that are not intrinsic to the systems under discussion Other ancillary services are also handled by the ISO based on pre-specified procedures

The most interesting and definitive aspects of these two models lie in their treatment of congestion In the transmission-bidding approach, transmission rights to lines are owned privately, and must be acquired before a trading party can use the line The ISO has a major role to play in this regard Since the path of power flow through a network is determined by the laws of physics and not by the traders or even by the ISO (barring the use of control devices such as phase shifters) a given trade will typically flow over a large number of lines, in fact it is not technically incorrect to say that to some extent it flows on every line in the entire system The ISO computes these flows for the trading parties and the trading parties are then required to secure the appropriate level of rights on all the affected lines As Chao and Peck readily admit, this is a daunting task at best requiring state of the art telecommunications and computing equipment

It is also important to note that the market for transmission rights *must* include a rule that forces the ownership of each line to be spread among many parties If not, and the rights to even one line were owned by a single party, that party could stop all trade on the network by refusing to sell that right to the traders that need it Of course such stark monopoly power would earn the owner a handsome income From this example we see that moving to a bilateral trading system does not necessarily remove all problems of market power

5 4 2 *Wu and Varaiya*

In contrast to Chao and Peck, Wu and Varaiya have gone to great length with their CMT approach to reduce the computational burden needed to "coordinate ' their multilateral trading market Their ISO provides traders with very simple formulas that embody the system losses and system security limits with respect to any set of traders Traders are required to cover the losses they cause and are not required to obtain rights to use network lines Traders are simply required to respect the system limits

In situations in which a number of non-cooperating traders each want to use a single line and their total usage would exceed the lines' security limit (based on the system contingency analysis), the ISO must then resolve this conflict Wu and Varaiya acknowledge that the ISO's method for resolving this conflict is "arbitrary "[12] By this, they appear to mean only

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[12] Private correspondence from Felix Wu to Steven Stoft (7/22/95)

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that their lemmas and theorems apply irrespective of the curtailment rule used by the ISO However the curtailment rule does matter to the traders

To understand the potential impact on traders we must consider the concept of optimal congestion In each model (i e bilateral multilateral, and PoolCo), when the system works as planned by the authors there are market forces that induce traders to optimally adjust their trades to the congestion of the system This means that in all of these systems, each trader must experience through some market mechanism the negative external impact on other traders caused by his own trades contribution to system congestion How does this happen in the CMT approach? When trades are initially proposed for any half hour time slot, the ISO curtails any group of trades that exceed system limits This means that the ISO arbitrarily divides up the rights to the congested lines and gives them to the traders who submitted bids for those lines Being scarce, these rights are valuable and may well be sold to parties who can make better use of them. If they are sold that imposes the correct congestion cost on the buyer If they are not sold that imposes the correct congestion cost on the owner in the form of an opportunity cost

It is interesting to note that in a lossless network, the value of the curtailment rights that are "arbitrarily" handed out by the ISO are exactly equal to the "merchandising surplus" collected by the ISO in a PoolCo regime This is a consequence of the fact that the Wu-Varaiya system constrains the merchandising surplus to zero, yet to, achieve efficiency, must in effect distribute these rights to the traders If these rights are curtailed in a way that reflects energy use or sales, then we believe that curtailment will introduce a distortionary incentive for either use or generation thereby causing inefficiency Wu and Varaiya deny this claim

5 4 3 *McGuire's Transmission Charge Approach*

We review briefly a bilateral proposal that has been developed by McGuire (1995), which is less well-known, but is formulated in very practical and down-to-earth terms McGuire (1995) asks the question "Is power really so special?" and answers it with a firm no As a consequence, McGuire thinks it should be traded like any other commodity two traders make a deal, then they go to the shipping company, pay for shipping, and complete their transaction He admits that it is more difficult to compute the cost of shipping electricity than other goods, but still finds this only a small problem He also admits that the shipping (transmission) company has a natural monopoly, and so he proposes a way for them to compute transmission charges that will make it easy to regulate them Having done that he proposes to leave the business of trading to the traders as we do in every other market

McGuire's system is simple in its structure Traders submit proposed trades, i e 10 MW from node I to node j, to the ISO The ISO provides information on curtailments and transmission prices Trades are now allowed to take place But if traders want to, they can revise their trades based on the transmission prices they have received, and the ISO will

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reschedule and return new transmission prices If the traders persist in resubmitting, then McGuire's rules for the ISO will lead to an equilibrium in which no trader finds his trade curtailed by the ISO, and no trader wants to propose a different trade The challenge in this system is in specifying the rule by which the ISO adjusts the price of transmission Since this rule is specified by the regulator, and the ISO has no choice as to how it is applied, the ISO cannot impose unfair transmission charges The primary difficulty of the system is technical For each one hour dispatch a set of iterations between the traders and the ISO is required At this time a good estimate of the number of iterations required is not available The costs of the iteration process may be prohibitive

5 4 4 *Comparison of Bilateral Trading Models*

Our provisional assessments of these three schemes may be summarized as follows The Chao-Peck scheme requires such a complex auction that it is probably far beyond the realm of workability Their approach also presents serious market power problems with respect to transmission rights that have not yet been addressed theoretically and may well be unsolvable Wu and Varaiya's scheme appears workable and it may do more to help traders arrive at an efficient set of trades than McGuire's does, but it also seems to have potential problems with the allocation of transmission rights McGuire's system seem superior to Wu and Varaiya's because it does not allocate transmission rights arbitrarily, but instead sets a price for it and allows any that are willing to pay that price to have access This would seem to prevent the gaming and arbitrariness that would be an inevitable part of the Wu-Varaiya system

Table 4 Comparison of Three Bilateral Trading Models

	Chao & Peck	Wu & Varaiya	McGuire
Role of ISO in Trades	Report actual power flows on all lines as result of proposed trade	Arbitrarily curtails trades in excess of rated line capacities	
		Provides information about loss and congestion	Imposes transmission charges on traders
Energy Trade Prices	Strictly confidential between trading partners		
Energy-Trade Quantities	Reported to ISO		
Transmission Rights	Privately owned Auctioned off every period	Allocated arbitrarily by ISO in each trading period	Owned by ISO who charges traders for losses & congestion
Losses	Computed by ISO, covered by traders		
Imbalances	Handled by ISO		

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5 5 Forward Markets for Bilateral Traders

As discussed in Section 5 2 forward markets can be useful for hedging the risks of nodal spot prices but their role in bilateral markets has somewhat different dimensions The most fundamental difference is that the bilateral models assume that forward contracts close with physical delivery of the product They are not only financial instruments, but entail what contract lawyers call "specific performance ' Because of the specific performance feature, it has been argued that a PoolCo is not such a good idea because it would be hard to establish a forward market in such a setting These ideas have been articulated most completely by Levin (1995a, 1995b)

Levin brings a unique perspective to the discussion of electricity trade because he represents the New York Mercantile Exchange (NYMEX) which is the leading futures exchange for energy products NYMEX developed a highly successful futures market for natural gas which matured along with the deregulation of that industry NYMEX has recently submitted proposed electricity futures contracts for approval by the Commodity Futures Trading Commission The issues associated with an electricity futures market are addressed in Belden and Kahn (1995) Here we concentrate on Levin's views of the economic role played by forward markets

Levin observes that forward markets are in fact the dominant form of exchange for most commerce Buyers and sellers benefit from planning their business activities in advance, and therefore predominantly contract for future delivery The role of spot markets is primarily to allocate supply in light of planning errors and random shocks on the supply or demand side This is necessarily a smaller segment of total market activity than that which is represented by forward markets As a result, Levin argues that the prices in forward markets will typically be lower than those in spot markets for the same good This basic relationship is the reason that Levin believes that using spot market pools as the required medium of all electricity trade is inefficient

In a spot market pool, where all electricity trade must clear, forward markets are reduced to financial instruments While pool proponents assert that this will provide adequate risk hedging opportunities for participants who do not wish to rely on spot prices exclusively, Levin argues the contrary position The key difference that Levin perceives between forward market trading with physical delivery responsibility and the strictly financial forward contract is that the former will be lower cost than the latter A seller in a mandatory pool environment would have no incentive to contract forward at a price that is less than the expected spot price A seller's incentive in a market structure without such a pool is to gain customers This incentive is lacking where all demand clears through the pool

In addition to his analysis of forward contract inefficiencies in a mandatory pool Levin also provides an interesting analysis of potential regulatory distortions that might arise in a mandatory pool Since a mandatory pool will have enormous influence over the structure of

the electricity market there will be an interest in regulating the behavior of participants For example, in Argentina, bidders are required to bid their true variable cost to the pool, not just a price that they choose strategically, they are subject to audit on this (Perez Arriaga 1994) The goal of this requirements is to avoid some of the distortions in the UK pool The result of such a requirement, however, is potentially to limit the fuel pricing flexibility of sellers Levin (1995a) lists six different fuel pricing conventions that might be mandated in a regulated 'merit order dispatch" regime [13] In a decentralized trading regime, individual agents would decide on whatever fuel pricing they deemed was appropriate and take the corresponding risks

Levin's discussion abstracts completely from the technological constraints in electricity markets, which are the foundation of spot market theory His positive view of forward market contracting is consistent with the kind of decentralized trading discussed in Section 5 3, but does not really address how the appropriate level of multilateral coordination might be achieved Finally, he does not take the possibility of transmission manipulation to be a serious issue neither this nor any other form of market power enters his discussion In Chapter 6, we examine a few of the ways in which electric networks give rise to opportunities for exercising market power

5.6 Coordination Economies

Spot markets may be implemented through pooling institutions or in a more decentralized fashion The central dispatch argument for pooling emphasizes very short run coordination economies With improved communication and control technologies, it is unclear whether centrally dispatched pools will achieve any significant improvement over decentralized trade A more significant potential source of coordination economy involves intermediate term reserve sharing, specifically unit commitment and maintenance scheduling Short term trading among wholesale market participants is based on hourly or perhaps day ahead costs The intermediate term scheduling of maintenance, unit commitment and reserves operates over time horizons of one week to one year Here the coordination problem is more difficult because it may be difficult to get decentralized agents to contract with a high level of certainty to achieve the benefits, or to devise compensation schemes that will share the benefits

The magnitude of coordination economies in the intermediate term is difficult to estimate One recent study which addresses unit commitment benefits is Lee and Feng (1992) We discuss this study in some detail Lee and Feng consider three utilities connected by transmission links of varying capacity The greater the transmission capacity connecting them

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[13] These include (1) swing gas delivered the next day (2) swing gas delivered the next week (3) 'spot gas delivered the next month (4) the average price of gas imputed from a twelve month commodity swap (5) the opportunity cost of re-selling gas in the cash market, and (6) any of various definitions of historic purchase costs

the more they can share capacity (no attention is paid to network effects) There are two impacts of increased coordination First, fewer units (or more efficient units) need to be committed The benefit of that is reduced inefficient operation at minimum load With fewer units operating, however, there are fewer opportunities to trade among the utilities We report the net effect of these two different impacts in Table 5 and disaggregate the net impact in Figure 4

Table 5 Multi Area Unit Commitment Economies

Transmission Capacity		Case A Coordinated Unit Commitment ($000)	Case B Coordinated Dispatch Only ($000)	B-A	
MW	% Area Peak			($000)	(B-A)/B
0	0	3002	3002	0	0
50	3 8	2918	2960	42	0 014
100	7 7	2818	2938	120	0 04
150	11 5	2761	2927	166	0 056
200	15 4	2691	2924	233	0 079
250	19 2	2649	2924	275	0 094
300	23 1	2626	2924	298	0 101
350	26 9	2615	2924	309	0 105
400	30 8	2612	2924	312	0 106
450	34 6	2611	2924	313	0 107

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Figure 4 Commitment Economies vs Lost Trade Opportunities

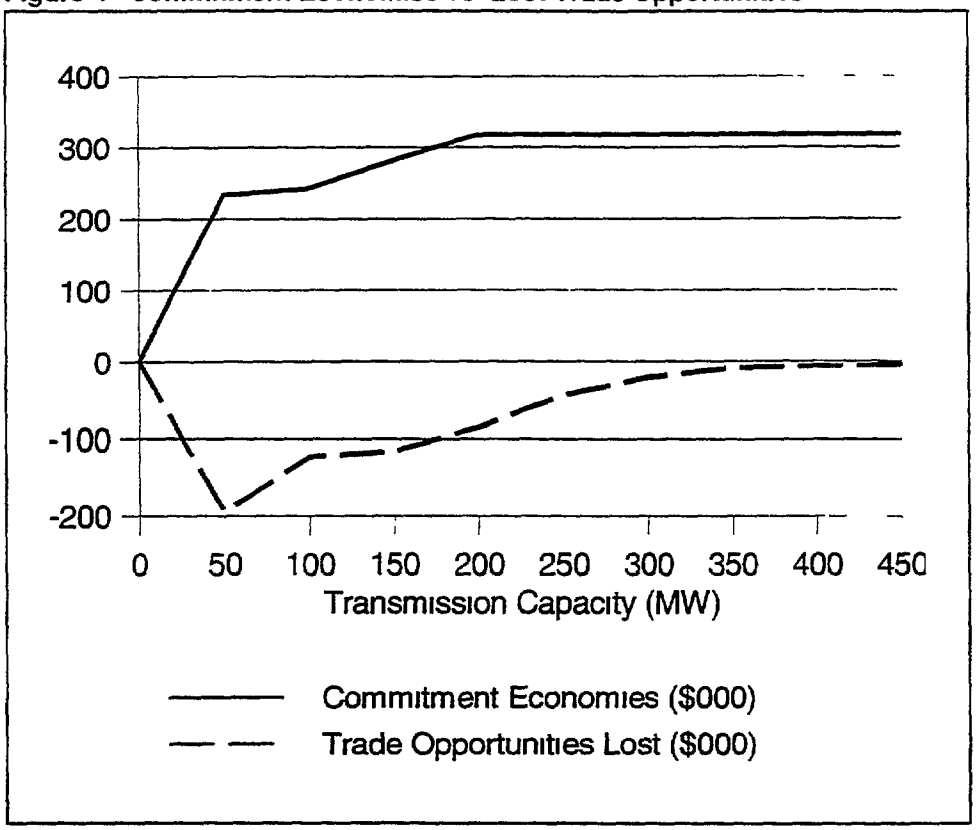

Table 5 summarizes the simulation results as presented by the authors Case A represents the situation where unit commitment is coordinated among the three areas and they are jointly dispatched In Case B, each area commits units separately and then there is joint dispatch The sensitivity of results to the magnitude of transmission interconnections is illustrated in the table Transmission capacity is listed in MW interconnections between any two of the utilities To give a better idea of total transmission requirements for these cases, we also express the total transmission capacity as a fraction of the total peak demand for all three utilities

Presented in this fashion, however, the underlying trade-offs are not apparent To illustrate those, we disaggregate the simulation results into the benefits of joint commitment, which is reduced inefficient operation at minimum load, and the reduced trade opportunities that result when fewer units are committed To make this separation we first identified the units from the EIA *Inventory of Power Plants* and estimated their unit price for fuel from the EIA *Cost and Quality of Fuels* report Data on the unit input/output functions and minimum generation levels is provided in the study Figure 4 summarizes the trade-off between unit commitment economies and diminished trade This figure shows that the avoided cost benefits of coordinated commitment saturate more quickly than the trading opportunities are achieved

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The reason that multi-area commitment is beneficial is that the minimum operating levels of the units are highly inefficient The average heat rate for this data is about 12,000 Btu/kWh for the baseload units, while their full load heat rates range between 9,500-10,000 Btu/kWh

This study does not address the optimal level of transmission capacity, but from the results in Table 5, it appears that marginal benefits beyond the level of 250 MW interconnection among all participants are rather small

It is an open question whether pooling institutions will be required to achieve coordination economies of this kind, or whether a more decentralized market structure can achieve the same result The NGMC experiment in Australia is the most serious effort internationally to implement decentralized trading The NGMC Code of Conduct (1995) specifies that it will be the responsibility of individual generators to decide when and whether to commit their units These decisions are subject to advance notice requirements and various measures of system reliability A short term forward market will be set up with the intention of providing generators with an opportunity to minimize the risks associated with a commitment decision by locking up a price for at least their minimum output, or perhaps for more than that This forward market is intended to be a purely financial market

6 The Problems of Market Power

When competition is imperfect, firms may be able to exercise market power, thereby distorting trade and potentially reducing efficiency The sources of market power vary from industry to industry In this chapter we examine key factors and/or situations that may create market power in electricity market concentration vertical integration and the ability to block transmission pathways

Market concentration is the typical source of market power and will probably prove to be the most decisive factor in bulk power markets as well In Section 6 1 we address the question of concentration and explore several related concepts We show that forward contract markets tend to ameliorate the effects of market concentration while congestion increases the level of market concentration Our analysis also suggests that a limited amount of market power derived from concentration is found to play a helpful role in maintaining reliability Perhaps the central question concerning the organization of U S bulk power markets is whether vertical re-organization of the entire industry will be required Section 6 2 addresses the problem of market power engendered by collusion between the DistCo and GenCo halves of vertically integrated firms Specifically, we discuss the potential for this collusion to inhibit entry by other GenCos and the possibility that an ISO can control this type of behavior In Section 6 3, we examine the possibilities for Gencos to block transmission access for strategic purposes In Section 6 4 we discuss and critique recent transmission access policies put forth by FERC in its Mega-NOPR We argue that FERC's open access objectives simply cannot be met successfully without the use of an ISO, and that even with one, the pre-determined transmission prices envisioned by FERC impede the implementation of an efficient access rule

6 1 Market Concentration in Generation

In this section we review briefly techniques used by economists to analyze market concentration as applied to bulk power markets We then focus on two areas that are, if not completely unique to electricity, at least quite unusual and generally not well understood the effect of congestion on market size and the effect of competition on reliability

6 1 1 *Standard Issues in Market Concentration*

Considering generation first, the central question is whether one firm will have a large enough share of the market to profitably raise the market price significantly This question can be approached via the standard Cournot oligopoly analysis, which tells us that the answer will depend on the elasticity of demand and the market share of the generating firms Specifically the markup of a firm with share-of-market s and elasticity ϵ, will be given by

$$\frac{p-c}{p} = \frac{s}{\epsilon} \tag{2}$$

On the left we have the fraction by which price exceeds marginal cost As an example, assume that a certain firm has 20% of the market and the long-run elasticity of demand is 0 8 which is quite elastic In that case we would expect a markup of 0 2/0 8 = 0 25, which means that 25% of customer payments go to covering markup, while 75% cover marginal costs This is quite a substantial markup More recently, contestability theory has been used to argue that the firm will price lower than this in order to prevent the entry of competitors An even more pertinent correction to the Cournot model has been pointed to by a number of authors who argue that bilateral contracts will dramatically reduce markups in the spot market This is discussed at some length in the following subsection

Market concentration may also be a problem in the distribution market the demand side of the market We do not analyze buyer market power, which is referred to as "oligopsony power " in detail but offer several reasons why we think it is not likely to be too important Most importantly, although a Disco may have a large market share it cannot make a centralized decision to curtail demand the way a large generating company can decide to curtail generation This is because the Disco typically serves many customers who would find it impossible to collude on their consumption decisions A second limit on oligopsony power is the elasticity of the supply curve Just as the market power of an oligopolist is limited by the elasticity of the demand curve, so an oligopsonist's market power is limited by the elasticity of the supply curve Because entry costs in generation are low and because gas-combined cycle technology exhibits relatively few economies of scale, the long-run supply curve appears to be quite flat i.e extremely elastic Because of this, reducing demand won't lower price very much

6 1 2 *The Usefulness of Forward Contracts*

Forward contracts replace the uncertainty of the spot market with the certainty of a fixed price contract, which is highly desirable for an investor in the long-lived physical assets of a power plant Forward contracts help assure investors that a generation project will be able to sell its product at a reasonable price over a sufficient time frame for investors to recoup their investment From a financier's viewpoint this makes the project safe, from the investor's viewpoint, this makes his project "bankable " Thus forward contracts facilitate entry into the generation market In the long-run, this will limit the market power of the current players, and in the short run it will dissuade them from exercising some of the market power they have, because they do not want to encourage entry There are other ways in which forward contracts can mitigate market power which also deserve attention

A number of writers have identified a second potential benefit of forward markets This is as an important mitigant of market power in the spot markets to which the forward markets are

linked (Allaz and Vila 1993 Green 1993, Powell 1993, Newbery 1995) In the context of market power an important conclusion of these papers is that forward contracts reduce the exercise of market power in the spot market After presenting the basic argument for this position we raise some of our concerns regarding its validity

Allaz and Vila (1993) show that forward contracting causes sellers to increase their output compared to a spot only market structure In a duopoly setting, both sellers want to do this resulting in increased total output and lower price compared to a spot market only structure, thus their market power is mitigated Powell (1993) examines the behavior of sellers who may try to collude in both the spot and forward markets Even in this case, the existence of a forward market puts downward pressure on the expected future spot price, so buyers will want to contract in the forward market because that will drive down spot market prices, even if buyers suspect collusion on the part of sellers Thus once again we find that the forward market acts to put downward pressure on a spot price that is supported by market power Green (1993) argues that price competition in the forward market will push price in that market and the spot market down to marginal cost This would indicate a complete elimination of market power To the extent however, that forward market contracting is incomplete prices in both markets will exceed marginal cost Risk aversion on the part of buyers will increase the demand for forward contracts Risk aversion on the part of sellers will increase their desire to sell forward contracts Thus risk aversion propels both parties towards forward contracts, which, when signed, cause a mitigation of market power When Green introduces asymmetric information, the balance of power shifts back to the sellers, who want to raise price in the spot market to influence expectations about price in the forward market In this case, which is probably the most realistic one of those analyzed, the equilibrium level of forward contracting is less than complete, so that price will never fall to marginal cost But to the extent forward contracts are adopted, their effect is still to mitigate market power

None of these papers examine the effect of the threat of entry on these dynamics Newbery (1995) adds this element to the analysis His principal observation is that the low cost of new entry limits the extent to which spot and short-term contract prices can rise

For policymakers, the important question is whether the potential for contract markets to limit market power in the spot market is adequate to produce "workable competition " This requires a definition of "workable competition, ' which is difficult to formulate

To understand the mechanism through which forward contracts work to reduce market power, it is necessary to examine Cournot competition Cournot competition occurs when a small number of firms compete by setting quantities instead of prices This can be done in a number of ways, but in a spot market it would be done through bidding a very steep supply function in the spot price auction It is not hard to show that steep supply functions are

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strategically desirable [14] Since in the limit, a vertical supply function amounts to bidding a fixed quantity[15] a Cournot model may provide a useful tool for gaining a qualitative understanding market power in the electricity spot market

In a Cournot equilibrium, each firm takes the other firms strategies as given (just like in a Nash equilibrium) and then optimizes its own supply quantity In doing so, it recognizes that if it increases supply it will lower price Thus, its profit function is

$$\pi = p(\bar{Q} + q)\ q - C(q) \tag{3}$$

Notice that price is a function of the output of all other firms, $\bar{Q}$, (assumed constant) plus the output of the firm in question If demand has an elasticity of ϵ, and if the firm's share of the market, $q/(\bar{Q} + q)$, is denoted by s, then maximizing profit results in a markup give by equation (2)

To understand forward contracts, we introduce into the above Cournot model a CFD covering quantity d Such a contract pays the supplier $(p_0 - p)\ d$, where p_0 is the contract price This gives us a new profit equation

$$\pi = p(\bar{Q} + q)\ q + (p_0 - p)\ d - C(q) \tag{4}$$

With this new profit equation, maximizing profit results in a markup is given by

$$\frac{p - c}{p} = \frac{s - d}{\epsilon} \tag{5}$$

As the coverage of supply by CFDs becomes more complete, the markup decreases until, at full coverage, markup becomes zero

This argument does not consider repeated rounds of contracting Although the lower markup applies only to the spot market, it undermines the price of future CFDs Taking this into account may substantially change equation (5) Consequently it is not entirely clear whether the mitigating effect of contracts on market power in the spot market will hold None of the models examined consider this complication Therefore we cannot be sure whether to rely on this mechanism, or to what extent it will operate This remains a subject for further research

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14 By bidding a very steep, possibly vertical supply function firm A assures the others that if they raise the market price (by cutting back on their supply) it (firm A) will not respond be stealing some of their market share This makes it safe for other firms to cooperate in the Cournot equilibrium by cutting their quantities and raising price to the Cournot level Thus we should expect firms to bid steep supply functions in a spot market with few suppliers

15 A vertical supply function ' is actually horizontal at zero price up to some limiting quantity Q_o at which point it becomes vertical Consequently the supplier is offering to sell up to Qo at any positive price but refusing to sell more at any price This is equivalent to bidding Q_o

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6 1 3 *The Effect of Losses on Market Size*

Transmission network losses can be viewed approximately as normal transportation costs, even though they are proportional to the square of the power flow We believe that network losses are generally small enough that when they are the only barrier to trade the market is generally quite competitive For instance, when the Western Regional Transmission System is constrained only be losses two-thousand mile trades between northern and southern regions are commonplace Moderate market power problems may arise when these trades are blocked by congestion effectively isolating Washington and Oregon from cheap power in the Southwest Extreme market powe problems could arise after deregulation due to local congestion, such as occurs on the path into San Francisco which is limited, for reliability reasons to a flow that is approximately half the city's peak consumption level The remaining power is currently being supplied by local generation, which is owned entirely by PG&E Because losses represent a relatively benign source of market power, their effects have not yet been investigated When it is, the large literature on spatial price competition, which focuses on the insulating effects of distance and transport costs will become highly relevant Because we believe losses play a less important role, we focus mainly on the effects of congestion

6 1 4 *The Effect of Congestion on Market Size*

Because market power depends crucially on the size of a firm's market share, the geographical extent of a firm's market is also of crucial importance Unfortunately, the geography of bulk power markets is determined by congestion and this fluctuates on an hourly basis Although there is no limit to the complexity of geographical separations that can be caused by congestion the effects of a congested line on market power can be broken into the following two distinct cases

(1) Flow on the congested line simply acts as a shift in demand at each end of the line
(2) Suppliers at each end actually "feel" competition from suppliers at the other end

We will consider each in turn, and represent each by the simplest possible example Each example has only two nodes and a single connecting line that is congested or is in danger of being congested The first example has market power at only one end, while the second has market power at both

The two cases might correspond, in the California setting, for example, to congested lines that enter the state from the North and East, and which connect it to large external markets that are essentially competitive (case 1), and to congested lines under peak load conditions that are internal to California and connect regions that have a limited numbers of suppliers, and thus exhibit market power at both ends of the lines (case 2)

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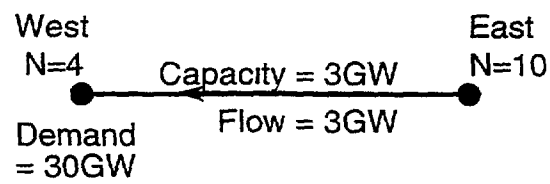
Case 1

Figure 5 Congestion Supports Market Power



Because of the transmission capacity limit, market power in the west is effected very little by the 10 competitive firms in the east

We begin with case (1), the most elementary congested-line problem This example illustrates the most basic point about congestion and market power In this case, the inflow of power on the congested line effectively shifts the demand function at both ends of the line At the transmitting end, demand is increased, and at the receiving end demand is reduced If, as in our example, there is a monopolist at the receiving end, it will mark up prices less, but it will still act as a monopolist

In this example, illustrated by Figure 5, we call the two nodes East and West, with the East node being assumed to be competitive (10 firms) The West node represents California, and is assumed to be subject to market power on the part of suppliers (4 firms) To simplify the analysis, we represent this market power as a monopolistic supplier We also assume for simplicity that both the monopolist and the competitive suppliers to the East have the same marginal cost

The first step is to notice that price at the East node will equal marginal cost, while the monopolist in the West will always find it profitable to restrict demand until price exceeds marginal cost Consequently, with price higher in the West, the line will certainly be congested with power flow from East to West (An optimal dispatch requires this whenever there is a price difference in such a simple network) Now the monopolist knows that there can be no response from the East to a change of supply, so the western monopolist continues to act as a monopolist facing this shifted demand Because demand is lower, the monopolist may set a lower price, so in this sense its market power may be curbed But the monopolist does not need to take into account any competitive behavior of firms to the East

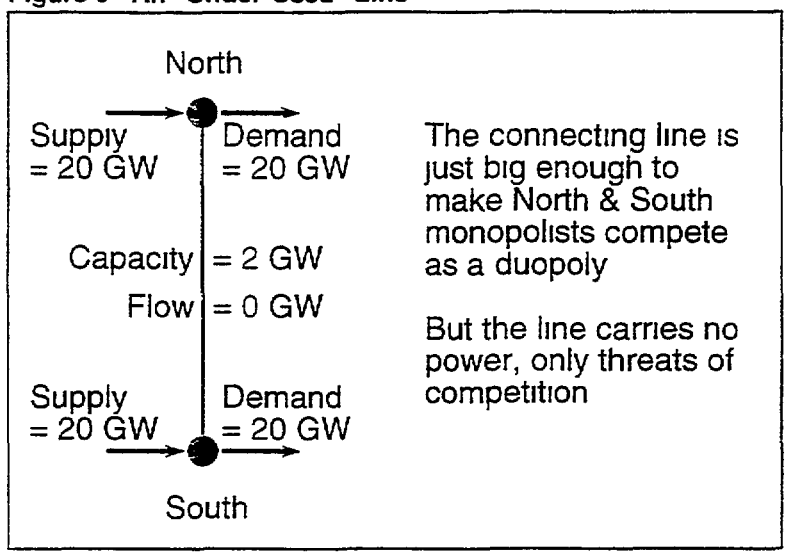
Case 2

The simplest example of case 2, closely mimics one of the main constraints in a potential California power pool This is the constraint which occurs when transmitting power from Northern to Southern California (the so-called "south of Tesla constraint")

This north-south constraint, illustrated in Figure 6, is particularly simple because, to some reasonable degree of approximation, it breaks the market into two regions We will make the

simplifying assumption that the two regions, north and south are identical in every respect and that there is a monopoly supplier in each

Figure 6 An "Under-Used" Line



If these two regions were completely separate, there would be identical monopolistic solutions in the two regions If we connected them with a very strong line, so that both suppliers could sell as much as they wanted in the other s market, there would be a duopolistic solution with lower prices Although this result is obvious, it has one very surprising property *No power flows on the connecting line* This is a consequence of the complete symmetry of the problem. This means that although the line is *not* used, it is still very useful because it keeps prices low The threat of competition is all that is really needed, and the line (if it is big enough) provides that threat

- **If a connecting line is of sufficient capacity to reduce market power as much as possible, it will appear to be over built and under used**

This raises the obvious question how big a line is needed to induce duopolistic, instead of monopolistic, behavior? Ironically, the answer has nothing to do with actual power flow on the line, and everything to do with the threat of competition The line sizing question is very difficult to answer and the best we can do currently is to solve one very simple example In this example the answer was found to be that a line big enough to carry 1/10 of the power sold at one node would be sufficient (see Borenstein, Bushnell, Kahn, and Stoft 1995 for discussion of this example) Note that this solution again depends on the unproven assumption of Cournot competition

Probably, the most interesting problem involves a transmission line that is too small to bring about the duopolistic solution Clearly a very weak line would provide such an example If we imagine the two nodes connected by an extremely weak line, then both suppliers would almost ignore each other, because both would know the other could affect them very little Thus we should have something close to the two-monopoly solution But because of the symmetry of the problem, the line should be uncongested and this adds a duopolistic character to the solution The actual solution is quite complex, but it involve randomness and congestion in both directions This example allows the following conclusion

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- **A line that is on-average uncongested may still be too small to reduce market power at both ends as much as a larger line would**

This reinforces our previous conclusion as can be seen as follows This conclusion tells us that even if a line is seen to be uncongested on average, it may be to small to produce the maximum possible market-power-reducing effect In order to eliminate its residual contribution to market power its capacity will need to be expanded When capacity has been expanded sufficiently to eliminate any contribution to market power it will appear to be even more over built than previously

The implication of our analysis is that in situations where generation market power is a problem, there may well be value in building a more robust transmission system than can be justified on the basis of the economics of power flows alone Of course there are costs to overbuilding the network, so a cost-benefit analysis will be necessary

6 1 5 *The Effect of Competition and Market Power on Reliability*

Competition will force prices down close to marginal costs How, then, will generators cover their fixed costs? If they cannot, how will adequate capacity margins be maintained? It is useful to analyze this issue by generation market segment, distinguishing between baseload, mid-range, and peak-load capacity Our analysis of reliability (as well as market power) indicates that the design and operation of the market during times of peak demand, or unexpected loss of supply, needs much more attention The Staff of the Public Service Commission of Wisconsin makes a similar point in its assessment of restructuring (PSCW 1995) A preliminary back-of-the-envelope calculation indicates that a spot price as high as 50¢/kWh may be needed at peak load in order to induce the correct level of investment in peaking generators [16]

We begin with the issue of base and mid-range capacity First, it is true that when only base-load capacity is required, price will fall to the marginal cost of base-load generation, which can be quite low Thus, revenues collected during these times will make no contribution to the fixed cost of base-load capacity However it is also true that when mid-range or peaking capacity is required, price will exceed base-load marginal cost (and this price will be paid for all generation) so base load will, during these periods, collect revenues contributing to their fixed costs In Appendix A, we present a detailed argument which shows that if the system has the optimal mix of base-load capacity, then the base-load capacity will earn exactly what is required during high demand hours, to cover all costs and earn a normal rate of return on

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[16] This value (50¢/kWh) corresponds to an estimate presented by Michael Schnitzer at the Harvard Electricity Policy Group seminar (9/27/95) as an estimate of the energy charge that would just cover the cost of peakers in the current system It is also the value arrived at theoretically based on an elasticity of demand of 0 2 and a fairly reasonable load-duration curve This question deserves much more attention

investment Moreover, if the system has too much or too little base-load capacity, the market price will induce low or high profit levels (respectively) that will cause investors to adjust the level of base-load capacity towards the optimum ratio

Mid-range capacity of any variety, from just above base load to just below the last peaker in the loading order will be treated similarly by the market Each variety of capacity can only earn enough revenue to help it cover marginal costs when capacity that is higher on the loading order is called into service But during this time, it will earn enough to ensure that the proper amount of that type of generation is in the mix of generation technologies

This brings us to the second issue, how will the peaking technology cover its fixed costs Whenever this technology runs it is by definition the marginal technology, and so one would expect a competitive market to drive price down to its marginal cost, thus preventing it from covering fixed costs However, once the last peaking unit has been brought on line the market no longer behaves competitively, because we are in a condition of short supply At this point, any increase in demand will raise price above marginal cost

The behavior of the market in this condition is very delicate Price must be raised to clear the market but for this to work, demand must respond to price If demand is totally unresponsive, the market will fail to clear, which in a power market means rolling blackouts, not a happy turn of events If demand is merely very insensitive to price, then the market will clear but at a very high price In general this is to be considered the desired outcome, as a very high price is needed to cover the fixed costs of capacity that runs only a few hundred hours per year Very preliminary calculations indicate that a price as high as 50¢/kWh may not be unreasonable during the annual demand peak

This analysis highlights several problems that deserve serious attention before a competitive market is launched These include, how to insure that the market will clear, how high a price should be considered a healthy outcome of competition, and how best to induce a large demand response to price The good news is that if demand is, or can be made to be quite price responsive, this response can take the place of a large amount of peaking capacity which will result in substantial savings for consumers

6.2 Conflicts of Interest in the Vertically Integrated Firm

There are a variety of ways in which the vertically integrated firm can exercise its control over the transmission network to frustrate competition This can occur in both the short-run trading market and the long-run capacity expansion market In Section 6 2 1 we address the problem of long-run access We examine whether the introduction of an independent system operator can mitigate access problems in Section 6 2 2

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6 2 1 *Long-Run Wholesale Access*

A recent competitive bid in Southern California illustrates the long-run problem of competitive wholesale access under vertical integration In this 1993 case San Diego Gas and Electric (SDG&E) was seeking approval from the California Public Utilities Commission (CPUC) to repower its South Bay Unit 3 from steam generation to a combined cycle configuration After initial indications that the CPUC would approve of this project, independent generators complained As a result the CPUC ordered SDG&E to seek competitive bids as a ' market test ' of the project economics All the independent projects which were bid were located on the periphery of the SDG&E system, relatively far from the load center and required transmission upgrades The South Bay 3 unit is located at the load center and would provide reactive power support To evaluate the bids, SDG&E hired a consultant Absent the location factors, the South Bay 3 bid was not superior To evaluate the locational effects (costs and benefits), the consultant relied on the utility's own estimates With locational effects estimated in this way, South Bay 3 was deemed the preferred alternative The CPUC ordered that the consultant's evaluation be made public (RCG/Hagler Bailly 1993) This was unexpected by SDG&E and the bidders, each of whom was upset, but for different reasons The bidders were unhappy because details of their offers were discussed The utility was subjected to criticism concerning the independence of its consultant In the end, the utility dropped the project, citing a reluctance to make any long-term commitments in the face of increasing competition

This set of events illustrates the information asymmetry inherent in assessing transmission costs and benefits It is possible that SDG&E could have contracted with a consultant who had substantial expertise in transmission issues and who would have been in a position to make a truly independent assessment Given the outcome, i.e , the extent to which the utility's competitive advantage appeared to lay in their favorable location, the utility would have a disincentive to seek out advice that may have gone against its interest On the other hand, it isn't clear that the utility could have known in advance that locational effects would be the fundamental determinant of bid ranking The motivation of the CPUC in forcing the disclosure of the bid evaluation report is unclear The effect of the disclosure was to reveal the inconsistency between the treatment of locational effects in this setting with what the CPUC was requiring in the statewide competitive bid known as the Biennial Resource Plan Update (BRPU) The BRPU policy on transmission costs was intended to provide bidders with information in advance on the upgrade costs associated with siting at different points in the network This policy would remove much of the information asymmetry between the utility and non-utility bidders in a competitive procurement Since it focuses only on costs and does not address benefits,[17] the BRPU policy does not give optimal siting signals, although it is a considerable advance compared to previous methods

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[17] No approach based solely on upgrade costs can incorporate the benefits of siting to relieve congestion

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6 2 2 *Independent System Operator*

The potential development of competition in retail markets has elevated sensitivity to the conflict of interest problem in short-term markets Nowhere has this discussion been more intense than in California where the CPUC investigation of retail access (CPUC 1994) has stimulated substantial discussion One important area of agreement to emerge from the California debate over retail access has been consensus on the need for an independent system operator (ISO) under anv of the plans being discussed (Stalon and Woychik 1995)

There are several countries in which the ISO concept has been implemented or is under active discussion, and where complete vertical divestiture has not been or is not intended to be implemented These cases are interesting because they raise the possibility of introducing more trade and competition without vertical ownership changes The country with the longest experience of this kind is Spain (Kahn 1995) In 1985, the vertically integrated utilities sold their high voltage transmission lines to a government entity, Red Electrica de Espana (REE), which became the operator of the grid and which centrally dispatches the entire system as an integrated national pool Utilities, both private- and government-owned retain generation assets and distribution assets Until quite recently, REE was effectively unregulated, and operated under ministerial control The Spanish government created a regulatory commission in 1995, which will exercise oversight on REE, among other responsibilities

Similar arrangements are being proposed in Alberta, Canada (ADOE 1994) In this case, there are also both private and government owned utilities They already transact all electricity, except for self generation, through a centralized pool The government and industry have agreed to open up this market to more competition by providing for access to the pool, initially for existing self-generation plants and, in the long run, to any new generator Implementing open access will involve setting up an oversight function for the pool and grid operations that will involve all industry participants Ownership transfers of transmission assets are not anticipated nor will there be any vertical divestiture Because Alberta already bases transactions on pool operation, the incentive for generators to sell to their affiliated distributors has already been attenuated

Although an ISO could be expected to increase market transparency, there have been barriers to this, at least in the case of Spain REE, as the agent of government electricity policy, dispatches the system to meet certain national objectives regarding the use of expensive locally produced coal Preferential treatment for local coal production is a ubiquitous practice in Europe, even though it is opposed by the European Union (De Paoli and Finon 1993) The result in the Spanish case is that REE must constantly be adjusting its implicit dispatch rules to meet the coal target, given the other conditions on the system (i e , expected hydroelectric and nuclear production, demand levels, maintenance schedules)

The arrangements in Spain and those proposed in Alberta mitigate conflicts of interest in vertically integrated utilities by interposing a strong market-making institution The separation

of ownership of transmission lines in Spain provides stronger assurances that there will be no manipulation of access than the proposed sharing arrangement in Alberta On the other hand the governance structure in Alberta may be able to exercise better control of the pooling and access functions than in Spain if only because preferential access is not reserved to a special class of suppliers

In the U S context, the discussions of the ISO concept have focused on the issue of its commercial role Various pooling proposals address the conflict of interest problem by assigning the commercial function of matching supply and demand to the ISO along the lines of central pooling institutions around the world The argument against assigning this commercial role to the ISO is that it creates a difficult regulatory problem and that there is an arbitrariness to such dispatching that need not produce efficient outcomes (Wu *et al* 1994) Alternative visions of an ISO have been discussed in Section 5 3 With an ISO that does not play the role of grid merchant there may still be a problem due to vertical relations To achieve the benefits of decentralized trade there should not be incentives for commercial relations that are dictated by vertical ties Thus in the California debate for example, the proposal for direct access and no central pooling requires that utilities spin-off their generating assets (Knight 1995)

Ultimately, vertical issues must be addressed either by structural or regulatory controls While spot market institutions, particularly a mandatory pool, may ameliorate preferential trading with affiliated entities, there may still be a problem in the contract market Even in the UK, the regulator has had to review affiliate relations involving the investments of distribution companies in IPP projects from which they also purchase (OFFER 1992c, OFFER 1993a)

6.3 Blocking Behavior

Network topology has a strong influence on the potential for trade It is a fact emphasized by the technologists that electrical networks do not function the way ordinary "transportation" networks function, and therefore analogies from other network industries are approximate at best There are several ways in which particularly situated agents can block the transactions of others Hobbs and Kelly (1992) illustrate straight-forward examples based on the network topology in New York state An example with an international cast is given in Bjortvan and Tjotta (1993), where the position of Sweden in the Scandinavian countries effectively limits the ability of Norway to export throughout the region The blockades examined in both cases are quite transparent The only path for exchange lies across the territory controlled by the blocking agent In both of these studies, the authors conclude that pricing policies which allocate a large share of the benefits of trade to the blocking agent are required to reach efficient trade levels

Electrical properties of the network can also be used to affect trade blockades This is usually due to the presence of weak lines in the network which limit flows Generators located near

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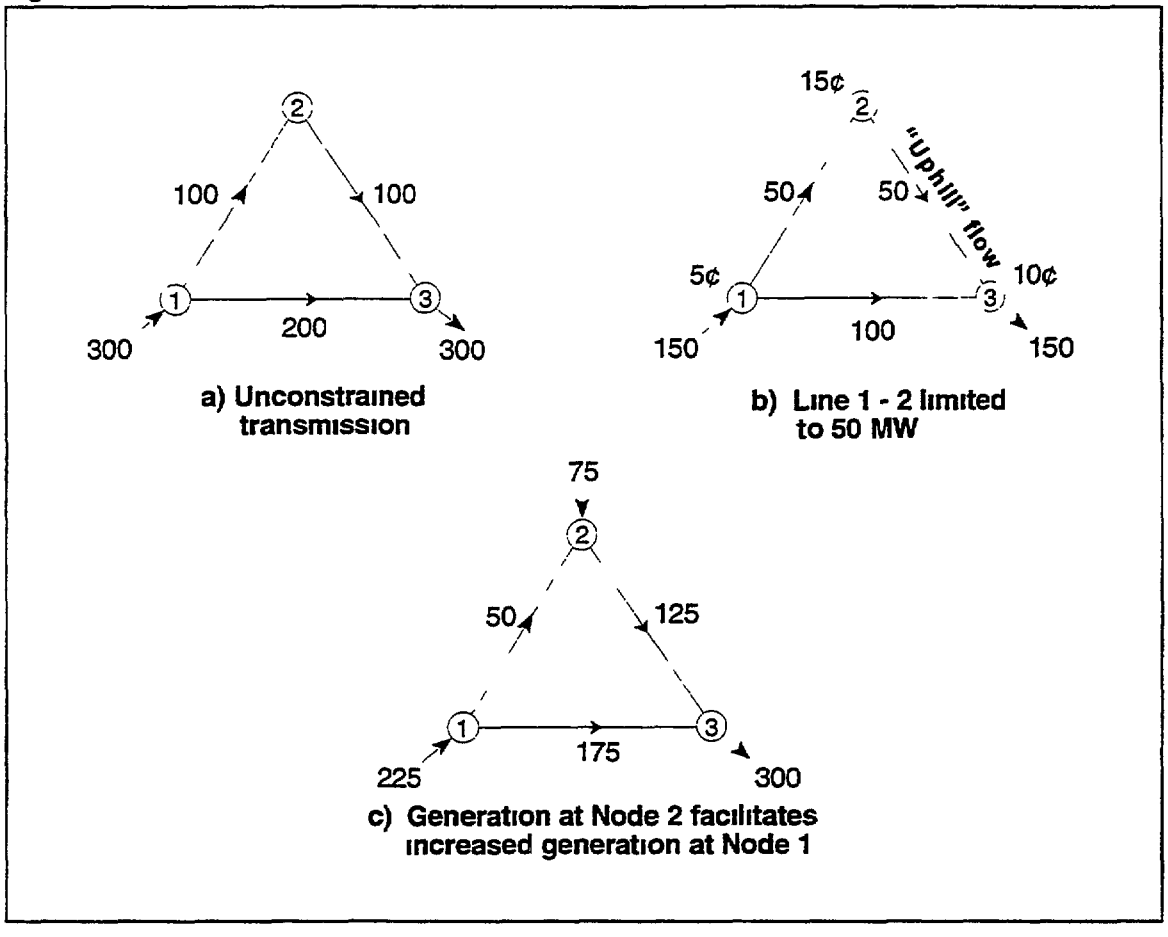
Figure 7 Line Constraints Produce Market Power



these lines are in a position to facilitate or block the output of other generators Chao and Peck (1995) give a useful simple example of this phenomenon, which we reproduce below as Figure 7 They adopt the standard pedagogic convention for illustrating network constraints, namely a three node network with two supply nodes and one demand node, linked by lines of equal impedance [18] Figure 7a shows the case where the generator at Node 1 injects 300 MW, and the generator at Node 2 does not produce at all The powerflow equations determine that the injection at Node 1 is divided in the ratio of 2 to 1, corresponding to the relative impedances of the short path from Node 2 to the demand at Node 3 and the long path that goes from Node 1 via Node 2 to the load Since the lines are of equal impedance the long path has twice the impedance of the short path Figure 7b shows the effect of a 50 MW transfer limit on the line from Node 1 to Node 2 With only the generator at Node 1 producing, this line limit reduces the total supply to only 150 MW

[18] Impedance is the measure of the ease with which power flows on the lines of a network

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Figure 7c shows that producing power at Node 2 will allow additional production at Node 1, while still respecting the limit on the line from Node 1 to Node 2 The flows from Node 2 will offset incremental flow from Node 1 to keep the net flow at 50 MW, as long as every incremental MW at Node 1 is matched by an incremental MW at Node 2 This gives the generator at Node 2 substantial influence over the market His output determines how much above 150 MW the generator at Node 1 can produce Depending on the demand elasticity at Node 3 the Node 2 generator can charge a high price for this service If the price offered is not high enough, the generator at Node 2 can simply withdraw from the market and force production and demand back to 150 MW

Notice also that the congestion on line 1-2, produces an "uphill flow " By this we mean that if the nodal price at nodes 1 and 3 are 5¢ and 10¢, respectively, then the optimal nodal spot price at node 2 is 15¢ The optimal price at node 2 is the net system benefit of an additional kWh Every kWh injected at node 2 has a direct benefit of 10¢ to node 3 But every kWh injected at node 2 also has an indirect net benefit of 5¢ because it allows node 1 to ship an additional kWh to node 3 Thus, the value and price at node 2 is 15¢/kWh, and the flow from node 2 to node 3 is an 'uphill" flow it takes power from an expensive node to a cheap node Any price above 15¢ at node 2 would involve the exercise of market power, i e be above the social value of power injected at that node

This example uses the simplest possible characterization of electricity networks Only the DC powerflow is taken into account, even line losses are neglected In reality other network constraints also allow generators to exploit local geographic position for market power Kahn and Baldick (1994) give an example, also in the three node, two generator, equal line impedance style, where voltage constraints coupled with one seller's refusal to support network requirements become a tool for market share gains These examples resemble some of the documented abuses of market power by the large generators in the UK (OFFER 1992d, OFFER 1993b)

6.4 Will Comparable Service Standards Work?

In light of the potential abuses of market power that may occur, it is reasonable to ask whether these can be sufficiently mitigated by the regulatory approach currently being adopted by the FERC Mega-NOPR (FERC 1995) If not, more significant steps will need to be taken The independent system operator concept, common to the competition models analyzed in Section 5 and also discussed in Section 6 2 2, is a more significant reform of bulk power institutions than the comparable service standards currently being implemented by FERC, which only require that the vertically integrated firm offer service to others on a nondiscriminatory basis

The main critique of the comparable service standard approach lies in the difficulty of enforcement The staff of the Federal Trade Commission (FTC 1995), for example, argues

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that the time sensitivity of electricity transactions would make compliance monitoring extremely difficult Regulation would be required "virtually transaction by transaction " This is simply not feasible

The counter-argument relies on reputation effects Since regulatory oversight is necessarily incomplete, it is rational for attention to be concentrated on firms that have developed a reputation for non-compliance Such reputations are developed by complaints from affected parties As long as the gains from individual episodes of the exercise of market power are small a utility might feel that the costs in terms of future oversight would be large if they were to engage in market manipulation Only time will tell if these effects are strong

To illustrate the enforcement problem it is useful to examine the kinds of litigation that may develop in an open access regime We summarize a relevant case in the next section and then discuss its implications

6 4 1 *The Cleveland Electric/ Cleveland Public Power Dispute*

The dispute between Cleveland Electric Illuminating (CEI) and Cleveland Public Power (CPP) over an emergency incident illustrates what may be an extreme, but nonetheless quite relevant, example of enforcement issues arising in a competitive regime This dispute is discussed at length by Porter (1995), who summarizes the FERC litigation We borrow from that review here

CPP is a small (200 MW peak) transmission dependent municipal utility that competes with CEI for retail load in the city of Cleveland This type of retail competition is unusual in the U S It is facilitated legally by the particular nature of the franchise laws in Ohio Not only do the two utilities compete at the retail level, but CEI is required to provide transmission service to CPP Under the terms of an anti-trust settlement associated with nuclear power plant licenses granted to CEI and its joint venturers, CEI must provide CPP with superior transmission service, not simply comparable service

On June 16, 1994 an emergency condition occurred in the Cleveland area due to heavy summer loads and scheduled maintenance on several of CEI's plants As a result of heavy import loadings on CEI's lines (more than 60% of area demand), voltages on the CEI-CPP interconnections declined CEI requested that CPP reduce its reactive power demand, which would have helped restore voltage This did not occur Next, CEI ceased service to its own interruptible customers, and curtailed non-firm transmission service to CPP There was still no change in deliveries to CPP When voltage at the interconnection declined below 95% of the rated level, CEI began rolling blackouts to 38,000 of its own retail customers After repeated requests, CPP reduced its own real power demand and voltage increased Within two hours service was restored Subsequent to these events, the parties filed complaints against each other at FERC

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Although the relationship between CEI and CPP is governed by contracts there was still considerable disagreement about whether each side had met its respective responsibilities CEI complained that CPP did not have firm transmission contracts for all of its demand and had failed to meet its long standing obligation to install capacitors or otherwise take responsibility for controlling its reactive demand On its side, CPP argued that CEI was irresponsible for having so much capacity unavailable during the summer period, that CEI interrupted deliveries, and that CEI should have complied with requested changes in CPP schedules The two sides also dispute the precise factual sequence of events and the voltage standards that ought to be applicable

This case raises questions about the enforcement of contracts when situations are complex the parties have conflicting economic interests, and one party depends upon the other for critical services FERC was called upon to intervene as this situation developed, but its advice did not appear to affect the course of events significantly It is quite likely that the litigation costs arising out of this situation will exceed the direct damages caused by the emergency It is also unclear that there is really a situation of market power abuse involved in these circumstances There does clearly seem to be an atmosphere of mutual mistrust between the parties that is not conducive to longer term assurances that similar problems would not arise in the future

The issues of the appropriate voltage standard and the extent to which either party was out of compliance with responsibilities do not seem to be appropriately adjudicated by FERC It would be preferable for an industry-based organization of some kind that was closer to the facts than FERC to make such determinations This kind of role would be more consistent with an independent system operator enforcing network standards than a federal regulator The best treatment of problems of this kind is before the fact rather than after Therefore, if it is the responsibility of wholesale customers to be responsible for their voltage demands, this should be enforced as a routine matter of grid management, rather than arising ex post as part of a contract dispute

Increasing competition in the bulk power market will inevitably lead some participants to "lean on the grid" in one way or another When such behavior arises, there are likely to be contract disputes, if not worse consequences The FERC standard of comparable service implicitly assumes that these events will be very infrequent and minor If they in fact interfere with the functioning of a competitive market, then a more substantial reform of wholesale market institutions will be necessary

6 4 2 *The General Argument for an ISO*

The Cleveland dispute provides a telling example of the type of problem that can arise in a competitive environment where "open access" has been implemented without the benefit of an ISO But one example of an open-access system with serious problems does not argue that the design of a successful open access system without an ISO will be flawed generally We now attempt to construct a general argument to that effect

We require three properties of a successful system

(1) that it maintain reliability,
(2) that it allow reasonably efficient use of the grid, and
(3) that it provide nondiscriminatory access

To meet the first of these requirements the system must ensure that demand does not exceed supply This is a simple problem and it has three solutions

(1) A high tariff price set ex ante
(2) non-price rationing of demand or
(3) a market clearing price

The first (high price) solution would be easy to implement, but would waste grid resources To avoid completely the need for rationing, the predetermined transmission tariff would need to be high enough to prevent excess demand under all possible market conditions But such a high price would severely discourage the use of the grid during the rest of the year, during most of which time the marginal cost of using the grid is practically zero (no congestion and very small losses) Thus while solution 1 flawlessly solves the problems of non-discriminatory access and reliability, it fails to allow reasonably efficient use of the grid

The rationing solution is the one that failed in Cleveland In general, if the posted tariff is set at any level that encourages at least moderately efficient use of the grid, there will be many times when the demand for grid services exceeds the capacity of the grid to supply In this case demand *must be rationed* to avoid catastrophic failure of the system Again this is demonstrated vividly in the Cleveland example **But the decisive problem is not the need for rationing, but the unavailability of a disinterested party to perform that rationing** Without an ISO, rationing must be conducted by the owners of the grid, and in all cases these owners are also users of the grid When rationing is needed, they cannot be expected to be unbiased and even if they were no one would believe it The inevitable consequence is frequent and costly litigation

The third solution the use of a market clearing price for transmission services, requires a market in those services Such a market can only be conducted by an ISO Any attempt by the owning utility to conduct a market for the use of its lines, with itself being one of the principle purchasers would rightly never pass the FERC guidelines for non-discriminatory tariffs

The inescapable conclusion would seem to be that the FERC's guidelines simply cannot be met successfully without the use of an ISO Further, it would seem apparent that although an ISO might be capable of implementing a moderate pre-determined price and non-discriminatory rationing, that this would be less than ideal Rationing is rarely a desirable solution to the problem of allocating scarce resources, and it would seem to have little to recommend it in the present circumstances Simplicity is its only virtue, and since the implementation of rules for non-discriminatory rationing are probably just as complex as those for pricing, rationing in this context will not be particularly simple Consequently a *market* for transmission services run by an ISO would seem to be the obvious first choice for solving the open access problem. This is of course what is proposed both by bilateralist and by those advocating the nodal-pricing form of restructuring

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7 Transmission Capacity Expansion

This chapter focuses on incentive and institutional mechanisms that have been proposed to encourage transmission capacity expansion in a restructured and more competitive electricity industry Currently transmission capacity expansion problems are almost entirely left in the control of vertically integrated utilities who are providing for their own transmission needs Consequently, these utilities are well informed about their needs and have good reason to satisfy them economically Aside from the standard problems of rate-of-return regulation, transmission within a vertically integrated utility presents no special problems But as soon as trade between utilities becomes important, the provision of transmission capacity becomes problematic In a restructured power market where the grid is a common resource to be share equally by all players the problem is considerable

Three broad approaches have been proposed to solving the transmission capacity expansion problem in a restructured industry (1) rely on a regulated monopoly, (2) rely on regional transmission groups, and (3) rely on private investment guided by an artificial market mechanism such as awarding transmission congestion rights to investors All three approaches show some potential, but also present serious unanswered questions For the monopoly approach to work, the regulator must be able to specify clearly and objectively the criteria for evaluating transmission investments This has not been done For regional transmission groups to work effectively, they need a decision process that leads to optimal outcomes Unfortunately, both majority rule and unanimity seem to have very serious drawbacks In the next sections, we focus on the third approach in more detail

There are two important sets of questions associated with transmission capacity expansion cost recovery and investment incentives The first involves the design of efficient prices that cover costs Since transmission is a technology characterized by significant scale economies, marginal cost pricing will not recover total costs There is a growing literature, originating principally in those countries that have restructured the electricity industry, about various ways to recover fixed investment costs (Rudnick 1994, Perez Arriaga *et al* 1995) Of equal importance are the questions concerning the control over investments in grid expansion Who can propose expansion projects, who can veto them, and who will pay for them?

7.1 Transmission Pricing and Network Fixed Costs

As we have seen, under one prominent version of a nodal pricing regime, the grid merchant will collect revenue roughly equal to losses plus revenue that is directly linked to the amount of congestion on the grid Both of these sources of revenue are roughly proportional to the marginal value of improving the grid, which if the grid has been optimally designed will equal the marginal cost of improving the grid But if the cost of providing grid services has a large fixed component, marginal costs will be far less than average cost and revenue will fall far

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short of covering the total cost of the grid If the grid has been over built, then the marginal value of expansion will be even lower than marginal cost and revenues will fall short of total cost by an even greater margin In a bilateral or multilateral regime the situation can be even worse For instance in the multilateral trading system described by Wu and Varaiya, the ISO collects no revenues whatsoever

Open access controlled by an ISO poses an economic efficiency problem If neither utilities nor IPPs have control over the network, they will not be inclined to expand it, so that network expansion and maintenance will need to be funded by the ISO For this to happen the ISO needs a larger source of revenue than it can obtain from charges for loss and congestion Therefore the ISO will need to impose some transmission charge in addition to the optimal loss and congestion charges This additional transmission charge (perhaps similar to the "uplift" in the UK) may discourage trade, but that may be the price that has to be paid for neutrality of grid operation Other possibilities for funding and motivating grid expansion are discussed in the next section

7.2 The Control and Motivation of Grid Investment

In the long run expanded trade will require expansion of the transmission network This might be expected sooner rather than later, because the grid in the U S was not built with trade as its principal objective With the highly decentralized nature of the U S transmission network, any new transmission system expansion necessarily involves the interests of many utilities Traditional methods of dealing with these interactions were based on study groups of transmission-owning utilities More recently, with encouragement from FERC, cooperative institutions, known as Regional Transmission Groups (RTGs), have been encouraged to develop Although there is still relatively little experience with RTGs, the basic organizational goal is to broaden the range of economic interests participating in transmission capacity expansion discussions and decisions (Kahn 1994) This means primarily that independent power producers and transmission dependent utilities (mostly government owned) will be active members

The problem of optimal transmission capacity expansion is quite complex First, there are a variety of ways to expand the network to satisfy demand for access at a given point Second, transmission capacity is subject to a number of indivisibilities Third, the optimal expansion depends upon the future pattern of demand for access, which is difficult at best to forecast Baldick and Kahn (1993a) give an example, based on access litigation in California, illustrating all of these features

In any institutional structure designed to facilitate transmission capacity expansion, a critical problem is getting those parties who would benefit from additional capacity to propose projects that are both beneficial to themselves and do not damage others Although these have been the goals of cooperative planning groups in the past, these principles have never been

formalized explicitly in an economic framework Bushnell and Stoft (1995) investigate this problem in the framework of "transmission congestion contracts" (TCCs) This notion formalizes the ideas put forward in Hogan (1992)

7 2 1 *Private Investment in a Public Network*

Even if the network were run independently to both limit market power and preserve reliability, this does not necessarily mean that investment decisions cannot be made privately To motivate appropriate private investment two objectives must be satisfied (1) the investor must be rewarded with the benefits of the investment and (2) the investor must suffer any costs imposed on the system To date in our opinion, no one has proposed a system that perfectly satisfies these two requirements However two models may come reasonably close Hogan's "contract network" model and the Chao and Peck pool-based transmission bidding model discussed in Section 5 3 1

Before examining these proposals, it is useful to look at a more straight-forward system We begin by noting that one of the main rewards of expanding the network is simply to make use of it for expanded trade In fact in the case of a vertically integrated utility, this is the only reward for network expansion and it is sufficient In a pool, the reward is still sufficient in the case of a radial line to a single IPP In this case leaving network expansion to the private investor works perfectly The IPP will build the optimal line because it bears all costs and receives all benefits However, expansion of shared portions of the grid is problematic In this case, because the ISO controls use of the grid, an expander has no way to be sure of getting full use of the expansion it pays for

Since the investor is not given control over his investment he must be rewarded in some comparable way To the extent that he cannot use his investment as planned it must be congested and used by others In this case, the other parties are being charged for the use of this congested, and thus obviously valuable resource Thus, one possible rule for compensating an investor for his loss of use is to pay him the congestion charges that are being paid by those who are getting use of his expansion This concept has been referred to as "link based rights" by Oren *et al* (1995) Unfortunately, this seemingly straight-forward rule has very perverse incentive properties

Under a system of link-based rights, it would be possible for an investor to build a weak line that creates congestion, and being congested it would of course be well utilized For example in Figure 7a if line 1-2 did not exist, it might be possible to transmit 300 MW from node 1 to node 3 If someone then builds the weak, 50 MW, line shown in Figure 7b, this will limit transmission to 150 MW as shown So it is a detrimental line Nonetheless, the weak line would earn 10¢/kWh for its entire 50 MW capacity The problem is that in a power grid, even though grid users would prefer not to ship their power on the new weak line, they

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cannot avoid it Thus link-based rights while sometimes rewarding those who make beneficial investments can also reward those who make detrimental investments

7 2 2 *The Investment Incentive Properties of TCCs*

A completely different system has been proposed by Hogan for his contract network " He has proposed granting 'transmission congestion contracts " (TCCs) to investors in the network These have been introduced briefly in Section 5 2 1 above The details of the rule for allocating TCCs to investors have been spelled out by Bushnell and Stoft (1995a) and will be summarized here

To begin with, a TCC can be defined between any pair of nodes whether or not they are physically connected and is defined in a particular direction and for a particular quantity of power flow Specifically, the TCC for q units of power from node *I* to node *j* pays its holder ($P_j - P_i$), where P_j and P_i are the nodal spot prices The ISO pays this to the contract holder regardless of the amount of power flowing on any particular link in the network (Note that this definition is for a loss less network [19]) This definition by itself tells us nothing about the incentive properties of TCCs It is the rule for allocating TCCs to investors that determines their effect on the investment incentive

When an investor modifies the grid, that modification can effect many parts of the grid, and can effect parts that are remote from the site of modification Because of this we need an allocation rule that takes into account the impact of the modification on the entire network The allocation rule does this by considering the entire network's transfer capability before and after the modification The details of this process are complex, but we outline the most crucial facts of the allocation process

Before the investor modifies the grid, there is an existing set of TCCs that have been previously allocated by the ISO Since TCCs are defined by power flows between nodes, a set of TCCs corresponds to a particular dispatch of the system By the rules of TCC allocation, this existing set of TCCs must correspond to a feasible dispatch of the grid (generation is not considered in the allocation process) Call that dispatch D0 Now if the modification is useful it will make possible a "greater" feasible dispatch In fact, it will make possible many different feasible dispatches that are in some sense greater than D0 We can now define the allocation rule for TCCs

Definition An investor in the grid is rewarded with a set of TCCs corresponding to the difference between D1 and D0, where D0 is the dispatch corresponding to the set of

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[19] Bushnell and Stoft (1995b) have extended the definition of TCCs to lossy networks and have shown that all their important incentive properties transfer to the more realistic setting

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previously allocated TCCs and D1 is a dispatch of the investor s choosing, that is feasible after his modification of the grid

We illustrate this rule with a simple but informative example Assume the initial network consists of a single 1 MW line from A to B, and that someone owns a 1 MW TCC from A to B Thus dispatch (D0) corresponding to the initial set of TCCs is 1 MW injected at A and 1 MW withdrawn at B Now assume that an investor upgrades this line to a capacity of 2 MWs To what will he be entitled under the allocation rule? One feasible dispatch is 2 MW from A to B Choosing this for D1 will entitle him to a 1 MW TCC from A to B But another feasible dispatch is 2 MW from B to A Choosing this for D1 will entitle him to a 3 MW TCC from B to A This is because when 3 from B to A is added to 1 from A to B, the result is 2 from B to A, which is the second feasible dispatch D1 Of course, there are an infinite number of alternative dispatches for the investor to choose from

Despite the indeterminism of this allocation rule, it has been proven that no matter what allocation is chosen by the investor the ISO will always have sufficient revenue from transactions at the optimal nodal spot prices to cover the resulting allocation of TCCs (Hogan 1992) [20] One may wonder what an investor faced with such a array of seemingly arbitrary choices should do But the practical reality is not so confusing as it may at first appear If the investor does not attempt to make money off the blunders of others, but instead assumes they will act intelligently, then an optimal strategy for selecting D1 is simply to choose the dispatch that he expects will actually occur after his network expansion is complete This is a clear rule, and the uncertainty it holds is just the normal uncertainty faced by entrepreneurs in normal competitive markets

7 2 3 *WSCC's Rated-System-Path Method*

The WSCC has implemented a set of rules for grid expansion that has some similarities with the TCC scheme (Walton 1993) Both systems have tradeable transmission rights, and both award these rights to investors based on the extent to which they improve the grid

One difference between the two systems is that the WSCC only examines the effect of the investment on a limited portion of the grid, which they term the "rated system path" However, when Walton describes the philosophy of the WSCC mechanism, he says "Transmission capacity rights are determined by a project's net addition to total system capability" Because the power grid in the West is so loosely connected, the procedure of

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[20] Remember that the ISO makes money from the trade of electricity in a nodal-spot-pool system because of the nodal price differentials caused by congestion and losses The ISO s income is referred to as the merchandising surplus and has been shown to always be sufficient to cover the payments to holders of TCCs provided they are allocated as specified and the system is optimally dispatched

looking only at the most affected "system path" is often a good approximation to looking at the entire system

The principle difference between the two mechanisms is that the transmission rights awarded by the WSCC are physical rather than financial But because they can be sold, the effect will often be the same If the line is not congested neither WSCC rights nor TCCs have any value or effect If the line is congested the WSCC rights can be sold for the value of the corresponding TCC right However there are two crucial differences First, current ratemaking practices limit transmission charges to embedded cost, which may be less than congestion rents Second, the current system does not provide any way to award a physical right of negative value Because of this the WSCC specifies that "The project sponsor must demonstrate that the harm to any party has been mitigated to the satisfaction of those affected " This is a very unsatisfactory rule for two reasons First, there is no fair mechanism for determining the extent of harm to another party Second not all examples of "harm" should be compensated In the normal process of competition it is necessary and desirable for competitors to undercut each other s market power In this sense they are constantly harming each other This harm has a real and computable financial cost to the party that loses market power, but it is the way in which competition generates its socially desirable effect It is not desirable to require compensation for this type of harm, but the WSCC mechanism provides no way to distinguish this from true negative externalities

The advantage of the TCC mechanism is that it does have an economically sensible method for evaluating and punishing negative externalities as well as system improvement It seems possible that the WSCC method of assigning physical rights could be improved to account for negative externalities and to include effects on the whole network If this were done, it would probably be quite similar to the TCC mechanism In this case the decision as to which approach to use might depend on which system imposed lower transaction costs on the trading parties and was more easily enforced by the regulator

7.3 Conclusion

Motivating optimal investment in a transmission grid appears to be a very difficult problem, whether that investment is to be undertaken by a regulated monopoly or by private investors The problem is complicated both by the complex externalities produced by grid modification, and by the lumpiness of investment decisions Currently, only two mechanisms have been proposed that show any real promise of solving the problem in a decentralized fashion, and no attractive mechanisms have been proposed for regulating a monopoly The contract network method, which rewards investors with TCCs, is currently the most complete and sophisticated system But even this method fails to compensate investors fully for positive externalities that their network improvements may generate Beyond that, there is the question of to what extent the distribution of TCCs will match the actual dispatch of generators who own the TCCs If the match is not close there may still be significant

problems with negative externalities being insufficiently discouraged The WSCC approach, while definitely a move in the right direction, is probably only workable in the Western U S , as it is currently practiced Improvements in the system might well move it towards that TCC approach, which could make it more practical in a highly meshed setting

Although a decentralized approach to transmission investment is attractive for its potential competitiveness and for its information properties, it may face insurmountable legal barriers Local siting resistance to new lines, which may be far worse than for point facilities like power plants, will be very difficult for entrepreneurs to overcome A regulator may be needed to define "need" in order to issue the certificate of convenience and necessity needed to obtain eminent domain power

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8 Summary and Future Directions

In this chaper we synthesize and summarize the previous discussion Section 8 1 argues that an ISO will be necessary for a successful open access regime Section 8 2 identifies key questions arising in the debate over models for organizing the bulk power market Future directions are discussed in Section 8 3

8 1 Ensuring "Open Access" Will Likely Require an ISO

Achieving open access in electricity markets is the objective of the FERC's Mega-NOPR But fully competitive market models, both in the bilateral and the spot-market form, rely on an ISO to accomplish this effect, while the FERC attempts to achieve it without the benefit of an ISO In Section 6 4 we argue that an ISO is necessary for effective competition Open access must solve the problem of excess demand for transmission to preserve reliability, the FERC in its Mega-NOPR allows this only through a predetermined tariff and non-price rationing Because of the complexities of transmission, non-price rationing cannot be accomplished in a non-discriminatory fashion by an interested party This leaves the predetermined tariff as the only tool for preventing excess demand But for this to be almost perfectly effective, as is required by reliability, the tariff must be so high as to prevent even moderately efficient use of the grid

A crucial part of this argument is the assertion that the allocation and expansion of transmission is a complex problem Such complexities were discussed in Section 5 1, "Spot Market Theory," Section 6 1 2, "The Effect of Congestion on Market Size," and Section 7, "Transmission Capacity Expansion "

Although both the bilateral and nodal spot pricing approaches differ fundamentally from the FERC approach because of the reliance on an ISO, it is interesting to ask which more closely resembles FERC's current approach As is made clear in Section 5 3, the essence of the bilateral approach is to attempt to separate the market for power from the market for transmission This is done most successfully by McGuire's approach, in which the ISO assigns a transmission charge to each bilateral trade, but has no knowledge of the energy price involved This does not constitute a predetermined tariff because it is reset every hour based on market conditions, although it does meet FERC's requirement for a nondiscriminatory tariff and open access

Nodal spot pricing, as described in Section 5 1, takes a different approach to open access It recognizes that power injected at any one node affects the flow of power on every line in the entire grid Instead of trying to track these flows and calculate n (n-1) transmission prices, one for every pair of nodes, the nodal spot price simply measures the net benefit of energy injected and announces a single price at each node This price includes transmission

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charges that are correct according to the actual flow over the entire grid of power injected at a single node Thus, the nodal spot price incorporates both the energy price and the transmission price and does so optimally But in doing this, the nodal approach completely obscures the transmission charge Thus nodal spot pricing achieves open access and non-discrimination, but does away, once and for all with transmission tariffs

8.2 Summary of the Bilateral vs. Spot Market Debate

The variety of ways in which bulk power markets can be organized, coupled with limited restructuring experience, makes it difficult to reach definitive conclusions However, based on our review, several broad principles seem to have emerged from the recent discussions and the experience both in the U S and other markets These include

(1) a general agreement that price transparency is desirable
(2) a broad (but not universal) consensus that an independent system operator (ISO) is necessary to facilitate increased trade,
(3) an increased skepticism about vertical economies and
(4) a consensus that market distortions should be minimized

But stated at this broad general level, these principles are too ambiguous to provide much guidance concerning the choices lying ahead for the organization of bulk power markets To provide a more structured assessment of the choices, we outline a stylized version of the pool versus bilateral market structure debate to examine exactly how these general principles are reflected in the different market models

Table 6 summarizes this comparison It shows that depending upon the market model, even general principles have different meanings, and different implications We summarize each of the categories listed in the table below

Table 6 Market Model Summary

	Pool	Bilateral
ISO Function	Grid Merchant	Information Broker
Price Transparency	SRMC	Index
Vertical Economies	Less Important	More Important
QF Must-Run	Distorts Pool Price	Forecloses Access for Other Transactions
Contract Performance	Financial	Physical

The ISO function involves a much broader range of actions in the Pool model than in the bilateral model The reason is that the Pool ISO is dispatching the power system based on sellers' prices whereas the bilateral ISO is an information broker who facilitates the trading decisions of others This distinction has been discussed more fully in Sections 5 1 and 5 3 The different conceptions of the ISO are reflected in all of the other market model attributes in Table 6

Price transparency means different things in the two models because price formation differs in each When the Grid Merchant is the central clearinghouse for dispatch of the system, the resulting prices at any network node are the short-run marginal cost (SRMC) at that node In the case where no congestion exists, there is effectively only one node and a single market clearing price for any given period of time In the Pool model, price variance results from the time differentiation of SRMC not from any variance at a given time The bilateral contract model is more compatible with price indices averaged over inherently longer time horizons than the Pool model These indices are averages of many bilateral contract prices The potential biases in price reporting will also differ in each model In the Pool model, there is some arbitrariness in SRMC determination In the bilateral model, sampling error may distort price indices

The question of vertical economies is quite unsettled Both competitive models inherently question the role of vertical economies In neither case, however, is it clear that divestiture of generation will be required for unbiased functioning of bulk power trade There appears to be less emphasis on vertical economies in the Pool model, if only because of the precedents set in other countries, where electricity restructuring along pool lines has been accompanied by vertical separation The bilateral model also seems more consistent with a vertical structure, if only because it is closer to current U S industry structure and practice The current industry trend toward utility mergers may end up raising market power questions in either of these models The traditional arguments for vertical economies in a monopoly structure may turn out to look like access barriers in a competitive model

While everyone opposes market distortions in principle, in practice, none of the restructuring models has addressed the inefficiencies associated with the QF "must-run" entitlement This distortion is present in both models, but its effect is somewhat different In the Pool model, the QF entitlement distorts the Pool price by effectively lowering it This occurs because low cost resources that might have been inframarginal in a less constrained market are more likely to determine marginal cost when they must compete for residual demand after the QF output has been dispatched on a priority basis In the bilateral model, while there may be price effects there may be more noticeable effects on access Since the QF resources have dispatch priority, they potentially foreclose access for other transactions This may not be directly visible from today's perspective, since such foreclosure is already occurring As the market process becomes increasingly transparent, these effects will inevitably be noticed In either model the magnitude of these effects depends upon the relative size of the QF share of the market

Finally, contract performance standards differ in the two models Given that the Pool ISO is a Grid Merchant through whom all physical transactions clear, the only role for contracts is financial Indeed, a physical performance standard, where seller must physically deliver to buyer, is incompatible with the Grid Merchant concept In the bilateral model, on the other hand, physical performance is the essence of commercial relations It embodies the mutual commitment of the parties to trade Physical performance as the cornerstone of a bilateral trade market may impose some complexity on the ISO, but proponents argue that this is feasible

This descriptive assessment does not address normative or implementation questions associated with each of the models These are formulated in the next section as subjects for future research

8.3 Future Directions

In this section we list a few of the more important questions raised by the prospects for a more competitive bulk power market This list is not complete, but rather it is indicative of issues that will need resolution in the future In each case we comment briefly on the questions, indicating some of the directions for future study

8 3 1 *Which Model Is Most Compatible with the FERC Mega-NOPR?*

The FERC Mega-NOPR represents an important transformation of the regulation of bulk power markets, principally by addressing equal access questions and to an extent by transcending the contract path approach to transmission pricing (To the extent that "network service" tariffs avoid the fiction of contract paths within a utility franchise area, contract paths are transcended Since there will still be loop flow among utilities, the limitations of the contract path will persist) Despite these significant steps, however, FERC's basic approach still relies on the traditional cost of service paradigm, which is inconsistent with the degree of pricing flexibility inherent in the Pool model

In the short run, compatibility with existing FERC practice may represent an implementation advantage for a particular market model But given the distortions due to cost of service pricing and the contract path, in the long run isn't such compatibility a barrier to economic efficiency?

8 3 2 *Which Model Has the Largest Transactions Costs?*

The models involve different kinds of transactions costs In particular we can distinguish the start-up costs from the ongoing transactions costs The Pool model may have low transactions costs once implemented, but its implementation may have high start-up costs The opposite appears to be the case for the bilateral model

A broad view of transactions cost would extend to the costs of managing risk This is a large set of questions many of which involve the prospective role of an electricity futures market This issue will get increased attention as the New York Mercantile Exchange pursues its initiative to set up such a market

Transactions costs are important but public policy should not seek to minimize them at the cost of other inefficiencies

8 3 3 *How Will Reliability Be Affected by Increased Competition?*

There is some reason to believe that reliability practices, if not the actual level of reliability will have to change under increased competition The discussion of these issues in Section 6 1 3 indicates quite a different path toward reliability than current industry practice summarized in Section 2 2 Short run operational practices could differ in the market models, with the Pool model offering a more centralized approach to reliability management While centralization has traditionally been used to manage reliability in the electricity industry, it is not clear what the potential is for managing these problems in a more decentralized fashion High prices during peak periods will be required to ration demand if a strictly market solution is desired This will create problems both because such pricing is unprecedented, and because it will be difficult to distinguish it from the exercise of market power, which is itself a major concern

8 3 4 *Which Model Has the Greater Potential for Abuse of Market Power?*

The discussion in Sections 6 1 1 and 6 1 2 addresses the origin and exercise of market power in electricity generally, but not at the level of comparing the Pool and bilateral models The recent accelerated merger movement in the electric utility industry may raise a whole new set of market power questions Open access may mitigate seller market power depending upon the degree of network congestion Mergers may increase buyer market power, again depending upon the degree of network congestion

It is not clear which of the market models contains greater risks from the exercise of market power This will be an increasingly important issue in the discussion over the organization of bulk power markets

8 3 5 *Is Vertical Separation Necessary?*

It may be that the culture and information links in the vertically integrated firm will lead to inevitable distortions of wholesale trade and investment In this case, vertical separation will be required Such separation has been the dominant pattern internationally (see Section 3) What would trigger a policy decision of this kind in the U S ? Would separation be more difficult in our electricity industry than it has been elsewhere?

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Appendix: The Effect of Competition and Market Power on Reliability

There is an important concern that full competition may compete away excess profit and with it the reserve margins that provide us with reliability If such concern is well founded then perhaps market power is a necessary evil in a competitive system, for market power could provide the profits needed to finance adequate reserve margins Perhaps this is the case in the present marketplace, but it is not the necessary outcome of competition, and will be seen once we examine the underlying mechanisms

We will formulate the reliability problem using the standard concepts of short-run and long-run marginal costs and long-run average costs and attempt to illuminate the roles they will play in a competitive generation market

First let us acknowledge that setting prices equal to short-run marginal costs will not come close to covering long-run average cost [21] This occurs because long-run average cost includes both short-run marginal cost and the fixed cost of constructing the generating facility Since without market power firms are generally forced to set price equal to marginal cost, it would seem the market power would be necessary for their survival In a very narrow sense this will turn out to be true If this were broadly true then with current excess capacity, price would fall to marginal costs, and stay there until enough firms went out of business to confer on the remaining firms the market power needed to lift price high enough to cover long-run average cost This would result in the elimination of all reserve margin In fact, by today's measurement procedures, reserve margin would certainly become negative This would force the system into a state of shortage, which is the only state in which generators can exercise market power, for enough of the year for them to recover their fixed costs This is not the hoped for competitive scenario

This competition-reliability conundrum is not particular to nodal pricing regimes or bilateral trading regimes Each of these regimes, if they function as their advocates claim, reach the same set of perfectly competitive prices Fortunately the broadest part of the solution to the paradox lies not in any particular market structure or regulation, but in the very nature of the generation industry itself

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21 We will not need to concern ourselves with the distinction between short- and long-run marginal costs and the reader will be well served to imagine simply the short-run whenever we mention marginal costs In equilibrium short-run marginal cost equals long-run marginal cost, unless the equilibrium involves holding excess capacity for strategic reasons With excess capacity short-run marginal costs are lower and with capacity below the equilibrium level short-run marginal costs are higher than long-run marginal costs

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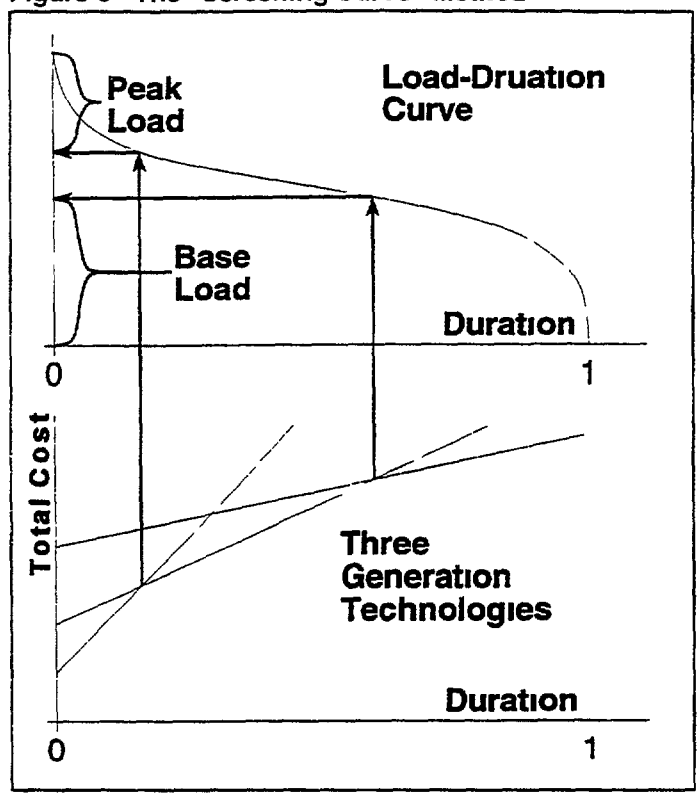
To see this we must first broaden the problem Reliability, properly considered, is simply one end of a spectrum of similar problems Regarding generation, reliability is the problem of putting in place the correct number of peaking units After that comes the problem of putting in place the correct number of mid-range units, and finally of base-load units

Figure 8 The "Screening Curve" Method



This is an old problem, formerly solved in its simplest form by use of the "screening curve diagram" (shown in Figure 8) Of course this solution is still correct in the new competitive marketplace, but there is no longer any organization with the authority to implement this outcome Instead a rather disorganized and dispersed market must somehow reproduce this outcome simply by relying on each firm's profit motive Let us examine how this would work

We start at the opposite end of the spectrum from where we first encountered our problem, and consider the plight of the base-load plant As is well known base-load plants have the highest ratio of capital cost to output capacity, and as a consequence the lowest short-run marginal cost of operation Thus when competition drives price down to short-run marginal cost, they will suffer most If all plants were base-load plants, they would indeed be in serious trouble and would soon begin going out of business This would be the first step towards re-establishing the correct generation mix, for their replacements would be mid-range or peaking facilities, but we are getting ahead of the story In fact base-load plants will not fare so badly because much of the generating capacity has higher short-run marginal costs

When demand increases beyond the ability of base-load generation, then the loading order moves on to higher-cost plants, and these now set the competitive price Now the mid-range plants are barely covering operating costs, but the base-load plants are doing somewhat better and beginning to cover their fixed costs As demand increases further, so does price, and base-load earns even higher profits Yet each new price level is being set at exactly the marginal cost of the last plant called into service If the profits earned by base-load plants

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during the non-base-load hours exactly cover the costs of the base load plants, then the generation mix, as it applies to the base, is exactly right This is not obvious but it can be shown by comparing the screening curve procedure with the conditions for market equilibrium While these calculations are not inherently difficult they are, nonetheless beyond the scope of this report

Mid-range plants are similar They make nothing when only base-load is running They make nothing (above cost) when only they are running, but when peakers are running they come out ahead During this period they must cover their fixed costs If they do not, then some will go out of business, and this will lengthen the duration of use of peakers and make all remaining mid-range plants more profitable When equilibrium is established we will have the optimal number of mid-range plants

This logic continues through, the upper mid-range, and the lower peakers, and the standard peakers, until we get to the ultimate peaker the last plant in the loading order This is the one and only plant (or there may be a very few identical plants) to which our original conundrum applies How is this penultimate peaker to earn any money in a perfectly competitive market? Whenever it runs, which is rarely, it is paid only marginal cost So its fixed costs small as they may be, are never covered The answer here finally seems to be market power This penultimate plant has a monopoly during the few hours a year that it is needed, and during this time it can charge what it wants, well almost

Beyond our penultimate peaker lies the real supplier of last resort load shedding In a market system, shed load should be purchased Notice that, appropriate to its spot in the loading order, it has the highest short-run marginal cost and the lowest capital cost of all generation facilities

From the above discussion it is clear that a competitive market can in fact provide the optimal level of reliability There is nothing inherent in the process of bringing price down to the level of marginal cost that will prevent investment in sufficient generation capacity However, that fact that no theoretical barrier to market-provided reliability exists does not prove that real-world markets will be capable of theoretical levels of performance For the market to function correctly, prices must be set correctly, and customers must be able to respond to those prices within the require time frames

The sticking point with regard to electricity pricing, is the ability of customers to receive and respond to prices quickly enough to handle system failures and anomalous demand spikes Both occur quickly enough that some automatic load-shedding arrangements are required If these cannot be implemented widely enough, then the cost of load-shedding will be higher than necessary and peakers will be able to exercise too much monopoly power Alternatively, there may be system outages exactly when the price of power should be highest, which is when the peakers should be covering their fixed costs This is a market failure that could result in insufficient reliability Thus, both with regard to market power

and to reliability, the design and operation of the market during times of peak demand, or unexpected loss of supply, needs much more attention This point has been made by the Staff of the Public Service Commission of Wisconsin in its assessment of restructuring (PSCW, 1995) A preliminary back-of-the-envelope calculation indicates that a spot price as high as 50¢/kWh may be needed at peak load in order to induce the correct level of investment in peaking generators [22]

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[22] This value (50¢/kWh) corresponds to an estimate presented by Michael Schnitzer at the Harvard Electricity Policy Group seminar (9/27/95) as an estimate of the energy charge that would just cover the cost of peakers in the current system It is also the value arrived at theoretically based on an elasticity of demand of 0 2 and fairly reasonable load-duration curve This question deserves much more attention

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UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

and

BECHTEL CONSULTING

WELCOMES YOU

TO THE SECOND CENTREL ROUNDTABLE FORUM ON COMPETITIVE POWER MARKETS

RENAISSANCE PRAGUE HOTEL, CZECH REPUBLIC

JANUARY 20 ~ 22, 1998

Bechtel National, Inc

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22934-010-003

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CENTREL Regional Roundtable Forum

Competitive Power Markets

RENAISSANCE PRAGUE HOTEL
V Celnici 7
Prague, Czech Republic
January 20-22, 1998

AGENDA

MONDAY, JANUARY 19, 1998

7 00 p m	**Registration and welcoming reception**	*Lobby Hollar*
8 00 p m	**Buffet dinner**	*Pavilion Restaurant*

TUESDAY, JANUARY 20, 1998

8 30 a m	**Registration**	*Lobby Hollar*
9 00 a m	**OPENING SESSION**	*Conference Room Brandl*
9 00 a m	**Welcoming Remarks** -- Peter Amato, USAID/Warsaw Miroslav Tvrznik, Deputy Minister Ministry of Industry and Trade of the Czech Republic	
9 10 a m	**Roundtable Overview** -- Roger Griffin, Bechtel	
9 20 a m	**Self-introduction of all attendees**	
9 45 a m	**NATIONAL PLANS FOR COMPETITIVE POWER MARKET DEVELOPMENT**	
9 45 a m	**Czech Republic** -- Miroslav Tvrznik, Ministry of Industry and Trade	
10 00 a m	**Poland** -- Leszek Juchniewicz, Energy Regulatory Authority	
10 15 a m	**Slovakia** -- Peter Prochazka, Ministry of Economy	
10 30 a m	**Hungary** -- Gabor Szorenyi, Hungarian Energy Office	
10 45 a m	**Questions and Answers**	
11 00 a m	**BREAK**	*Lobby Hollar*
11 15 a m	**PRINCIPLES OF COMPETITION IN POWER MARKETS - I**	*Brandl*
11 15 a m	**Basic Concepts** -- Karl McDermott, Illinois Commerce Commission	
12 15 p m	**Questions and Answers**	
12 30 p m	**LUNCH**	*Potomac Restaurant*

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1 30 p m	**PRINCIPLES OF COMPETITION IN POWER MARKETS - II**	*Brandl*
1 30 p m	**Application to CENTREL Countries** -- John Gulliver, Pierce Atwood	
2 15 p m	**Responses and discussion**	
3 00 p m	**BREAK**	*Lobby Hollar*
3 30 p m	**EU HARMONIZATION AND COMPETITIVE POWER MARKETS - I**	*Brandl*
3 30 p m	**EU Directive 96/92 Requirements** -- Christopher Jones, DG XVII (Energy), EC	
4 30 p m	**Questions and Answers**	
5 00 p m	**DAY 1 ADJOURNS**	

WEDNESDAY, JANUARY 21,1998

9 00 a m	**EU HARMONIZATION AND COMPETITIVE POWER MARKETS - II**	*Brandl*
9 00 a m	**Application to CENTREL Countries** -- John Gulliver, Pierce Atwood	
9 30 a m	**Responses and discussion**	
10 30 a m	**BREAK**	*Lobby Hollar*
10 45 a m	**PROVIDING FOR PUBLIC BENEFITS AND SOCIAL NEEDS IN A COMPETITIVE POWER MARKET**	
10 45 a m	**Summary of Issues and Approaches** -- Karl McDermott, Illinois Commerce Commission	
11 30 a m	**Discussion**	
12 30 p m	**LUNCH**	*Potomac Restaurant*
1 30 p m	**ATTRACTION OF CAPITAL**	*Brandl*
1 30 p m	**Necessary Conditions to Attract Foreign Private Investment in the Power Sector in a Competitive Global Capital Market** -- Michael Hogan, InterGen	
2 15 p m	**Hungary's Experience** -- Gabor Szorenyi, Hungarian Energy Office Zoltan Tihanyi, MVM Rt	
2 30 p m	**Questions and Answers**	
3 00 p m	**BREAK**	*Lobby Hollar*
3 15 p m	**ROLE OF CENTREL IN COMPETITIVE POWER MARKETS - I**	
3 15 p m	**International Power Pool Issues** -- Roger Kearsley, Svenska Kraftnat/NordPool	
4 15 p m	**Discussion**	
5 00 p m	**DAY 2 ADJOURNS**	

THURSDAY, JANUARY 22, 1998

9 00 a m	**ROLE OF CENTREL IN COMPETITIVE POWER MARKETS - II**	*Brandl*
9 00 a m	**CENTREL Issues** -- Erik Schmidt, CEZ, Chairman of CENTREL Working Group on Electricity Market Harmonization	
9 30 a m	**Discussion**	
10 15 a m	**BREAK**	*Lobby Hollar*
10 30 a m	**GENERAL DISCUSSION OF KEY ISSUES**	
	Panel Discussion 1 -- Chris Turner, Bechtel, Facilitator	
	Panel Discussion 2 -- Russ Brown, Bechtel, Facilitator	
12 30 p m	**LUNCH**	*Potomac Restaurant*
1 30 p m	**ROUNDTABLE ADJOURNS**	
2 00 to 4 00 p m	**REGULATORS MEETING**	*Brandl*

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CENTREL Regional Roundtable Forum

on

Competitive Power Markets

January 20 - 22, 1998

SPEAKERS

From the United States:

John W. Gulliver

Mr Gulliver is a partner in the Pierce, Atwood firm and a graduate of Yale University (B A , 1974) summa cum laude, and of Yale Law School (J D , 1977) He was an Assistant in Instruction at the Yale Law School from 1976-1977 and a Law Clerk to the U S District Court Judge Edmund T Gignoux

For many years, Mr Gulliver worked with a variety of clients before the Federal Energy Regulatory Commission, the U S Department of Energy, and state public utility commissions He assisted in establishing policies and regulations related to restructuring and competition in the electric industry, the IPP industry, transmission access and wheeling, and other proceedings pertaining to the generation, transmission, importation, distribution and pricing of electric energy

Mr Gulliver has been involved in all aspects of energy project development, including financing, power contract negotiations, permitting and licensing activities He participated in approximately 100 non-utility power projects and associated power purchase agreements Mr Gulliver acted as an arbitrator in IPP-utility power purchase agreement disputes, and served as lead counsel in connection with the restructuring and refinancing of several large independent power projects

Mr Gulliver is actively involved in restructuring U S utilities and with large industrial customers, to prepare for a more competitive electric sector Currently, Mr Gulliver is involved in overseas projects, including Latin America and Central and Eastern Europe He heads the legal team as part of a major USAID consulting program to restructure, refinance and privatize the energy sectors in approximately ten Central and East European and Baltic countries

Mr Gulliver is the author of several articles and papers on electric power restructuring and regulation and is a member of the American Bar Association, the Edison Electric Institute Legal Committee, the Federal Energy Bar Association and other professional organizations for energy and utility practitioners Most recently he authored "Central and Eastern Europe -- Restructuring

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Electric Utilities The Issues Facing Investors," with DePinto, D , Petroleum Economist, World Power Yearbook, 1996 Mr Gulliver is listed in The Best Lawyers in America and has achieved the highest professional rating awarded by Martindale-Hubbell Law Directory He is fluent in English and French

Karl A. McDermott

Mr McDermott is a Commissioner with the Illinois Commerce Commission

He was appointed to the Illinois Commerce Commission by Governor Edgar on April 1, 1992 Commissioner McDermott serves on the Commission's Telecommunications, Electric, Natural Gas, and Transportation Policy Committees Also, he is Chairman of the Environmental Subcommittee of the National Association of Regulatory Utility Commissioners (NARUC) Energy Resources and Environmental Committee

Prior to joining the Commission, Mr McDermott was the President and Chairman of the Board of the Center for Regulatory Studies (CRS) Currently, he serves as a board member at the Institute for Regulatory Policy Studies (formerly CRS) During his tenure at the CRS, Mr McDermott was also a lecturer at Illinois State University and a Research Scientist with Argonne National Laboratory He was a consultant to the Governor's Sunset Task Force on Utility Regulatory Reform for the Illinois Department of Energy and Natural Resources Prior to this assignment, Mr McDermott was employed by the Illinois Commerce Commission in the Policy Analysis and Research Division Early in his career, he was a Senior Research Associate at the National Regulatory Research Institute

Mr McDermott has a B A in Economics from Indiana University of Pennsylvania, an M A in Public Utility Economics from the University of Wyoming, and a Ph D in Economics from the University of Illinois

FROM EUROPE

Michael Hogan

Senior vice-president of International Generating company Ltd ("InterGen2") and is based in London as Managing Director of InterGen (UK) Ltd Mr Hogan oversees all the Intergen's business activities in Europe, Africa, the Middle East and South Asia InterGen is a joint venture of Bechtel Enterprises, the investment arm of Bechtel Group

Prior to assuming his current post in March, 1995 Mr Hogan was Senior vice President of J Makowski Associates, Inc , responsible for all of Makowski's international development activity Mr Hogan joined Makowski in 1988 as a power project development senior associate Between 1989 and 1992, Mr Hogan was responsible for the successful development of Selkirk Phase 1 and Selkirk Phase II, a 360 MW gas-fired cogeneration facility at the GE Plastics plant

in Selkirk, New York During that time Mr Hogan also oversaw a number of early-stage development activities

Prior to Makowski Mr Hogan's professional experience included six years as a marketing professional with General Electric's Power Systems business, most of the time being spent in International Marketing positions

Mr Hogan holds a Bachelor of Science degree in Aerospace Engineering and a Bachelor of Arts degree in Philosophy from the University of Notre Dame du Lac in South Bend, Indiana and a Master of Business Administration degree from Harvard University in Cambridge, Massachusetts

Christopher Jones

Mr Jones is the Head of Unit responsible for Internal Market issues in DGXVII, the European Commission's Directorate-General for Energy Prior to this, he spent some 12 years dealing with competition issues in the Commission, inter alia being one of the team responsible for setting up the Merger Task Force, personal advisor on competition issues to Sir Leon Brittan, then Commissioner for competition, and then moving on to become the Assistant to the Director General for competition

Mr Jones is co-author of two books on competition policy, The EC Merger Regulation, and the Eec Competition Law Handbook, now in its 7th edition He is also author of numerous articles on EU law

Roger Kearsley

Since 1992, when Svenska Kraftnat (Swedish National Grid) was formed, Roger Kearsley has worked as a senior advisor specializing in various aspects of the Swedish and Nordic electricity market reform His main tasks have involved how firstly a Swedish, and later a Nordic, trading exchange for electricity could be set up He has also worked with network-tariffs and is currently investigating how to harmonize these and other infrastructure aspects of the common (so-far Nordic) electricity market

Roger Kearsley is an electrical engineer graduate of Nottingham University in England with post-graduate studies at Chalmers University of Technology in Gothenburg, Sweden He started work in electricity distribution (Norweb) in England, but moved to Sweden in 1970 In Sweden, until 1991, he had several appointments, chiefly with the power company Vattenfall, in the fields of electrotechnical development of power-system components, maintenance, power-system operations and system planning He has participated in various national and international working groups (Cigre, UNIPEDE, IEEE, Nordel, etc)

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CENTREL Regional Roundtable Forum

RENAISSANCE PRAGUE HOTEL
Prague, Czech Republic
January 20-22, 1998

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CENTREL REGIONAL ROUNDTABLE MEETING, PRAGUE, JAN. 20-22

ELECTROTEC AND USEA

ON BEHALF OF USAID I WOULD LIKE TO THANK BECHTEL INTERNATIONAL, INC. AND FOR ORGANIZING THIS CENTREL ROUNDTABLE FORUM ON COMPETITIVE POWER MARKETS. I APPRECIATE HAVING THIS OPPORTUNITY TO ADDRESS THIS THE 2ND CENTREL REGIONAL ROUNDTABLE HELD HERE IN PRAGUE.

OUR LAST CENTREL MEETING HELD IN WARSAW IN SEPTEMBER OF LAST YEAR FOCUSED ON ONE OF THE THREE PRIMARY AREAS OF INTEREST IN THE CENTREL GROUP OF COUNTRIES, THE TECHNICAL REQUIREMENTS, NAMELY, HOW TO MAKE ELECTRICITY SUPPLY SAFE, SECURE, AND SUFFICIENT, HOW TO CAPITALIZE ON OPPORTUNITIES TO MAKE COORDINATED CENTREL OPERATIONS MORE EFFICIENT THAN THE INDIVIDUAL COUNTRIES CAN DO ON THEIR OWN.

THIS ROUNDTABLE MEETING IN PRAGUE SHOULD BE CONSIDERED AN IMPORTANT AND NECESSARY FOLLOW-UP TO THE WARSAW MEETING IT WILL FOCUS ON TWO OTHER COMPONENTS, THE ECONOMIC AND INSTITUTIONAL COMPONENTS, WHICH TOGETHER WITH THE TECHNICAL COMPONENT ARE THE PRIMARY AREAS OF INTEREST TO THE CENTREL GROUP OF COUNTRIES

THE ECONOMIC COMPONENT DEALS WITH ESTABLISHING ELECTRICITY MARKETS THAT PERMIT (OR EMULATE) COMPETITION WHEREVER FEASIBLE, THAT LINK ELECTRICITY PRICES TO THEIR UNDERLYING COSTS, AND THAT PROVIDE THE NECESSARY RESOURCES FOR RENEWAL AND EXPANSION OF THE SYSTEMS IN RESPONSE TO CUSTOMERS, DEMANDS

THE INSTITUTIONAL COMPONENT FOCUSES ON PROVIDING FOR INDEPENDENT REGULATION OF ENTERPRISES WHERE NECESSARY, AND IMPLEMENTING THE INDUSTRY RESPONSES TO THE REQUIREMENTS FOR INTEGRATION WITH WESTERN EUROPEAN SYSTEMS, IN CONTEMPLATION OF ACCESSION TO THE EUROPEAN UNION.

AND LET ME SUGGEST THAT THESE THREE AREAS ARE OF [redacted]H CONCERN AND IMPORTANCE TO THE CENTREL GROUP OF COUNTRIES BECAUSE THEIR IS A CLEAR RECOGNITION THAT ONLY THROUGH A COORDINATED EFFORT ON ALL THREE FRONTS CAN REGIONAL-LEVEL VALUE BE ADDED TO THE INDIVIDUAL COUNTRIES' TRANSFORMATIONS. IT IS UNDERSTOOD THAT EACH COUNTRY MAY HAVE ITS OWN APPROACH TO EACH OF THESE COMPONENTS AND AS ~~THE~~ WARSAW PROVIDED A GOOD FORUM TO DISCUSS VARIOUS TECHNICAL APPROACHES, THIS ROUNDTABLE WILL PROVIDE THE SAME OPPORTUNITY TO EXPLORE VARIOUS ECONOMIC AND INSTITUTIONAL COMPONENTS NEVERTHELESS WE DO NEED TO KEEP IN MIND THAT THREE OF THE FOUR COUNTRIES REPRESENTED HERE TODAY ARE IN LINE TO JOIN THE EUROPEAN UNION, AND THAT ACCESSION TO THE EU WILL ADD CONSIDERABLY TO THE NEED FOR CHANGES IN SOME OF THE CURRENT APPROACHES TO PRICING AND REGULATIONS

NOW I WOULD LIKE TO BRIEFLY MENTION WHAT HAS USAID'S ROLE BEEN IN THIS PROCESS. WHAT HAS IT ADDED? IT IS FAIR TO SAY THAT USAID HAS ASSISTED THE CENTREL COUNTRIES IN A VARIETY OF WAYS

--USAID BROKERED THE UTILITY PARTNERSHIP PROGRAM WHICH HAS BROUGHT TECHNICAL EXPERTISE TO GENERATING AND TRANSMISSION COMPANIES IN AIL FOUR COUNTRIES SOON AFTER THE BREAKUP OF THE SOVIET UNION,

--USAID HAS HAD EXTENSIVE INVOLVEMENT IN EFFORTS TO INTRODUCE INSTITUTIONAL MODERNIZATION, INCLUDING ENERGY LEGISLATION AND IMPLEMENTATION OF NEW LAWS AND REGULATIONS IN HUNGARY AND POLAND,

--USAID HAS HELPED WITH PROJECTS THAT FOCUS ON BOTH THE ELECTRICITY SUPPLY SIDE, SUCH AS THIS CENTREL WORK; AND ON THE DEMAND SIDE, WHERE ENERGY EFFICIENCY IMPROVEMENTS RESULT FROM INSTALLATION OF EFFICIENCY MEASURES AT CUSTOMER LOCATIONS AND FROM EFFORTS TO GIVE PROPER PRICE AND CHOICE SIGNALS TO CUSTOMERS,

--AND USAID HAS PROVIDED ASSISTANCE FOR PRIVATIZATION INITIATIVES, BOTH AT THE GOVERNMENTAL LEVEL AND WITH "PILOT" ENTERPRISES THAT CAN SERVE AS EXAMPLES FOR OTHERS IN THE SECTOR IN TERMS OF THE NECESSARY PROCESSES AND INTERNAL RESTRUCTURING TO PREPARE FOR THE TRANSITION AWAY FROM CENTRAL OWNERSHIP AND PLANNING.

JUST AS THE INDIVIDUAL CENTREL COUNTRIES DIFFER IN THEIR NEEDS AND PRIORITIES, USAID MISSIONS HAVE RECOGNIZED THAT ASSISTANCE RESULTS FROM THE NEEDS OF THE COUNTRIES, AND THAT NO SINGLE SET OF SOLUTIONS IS POSSIBLE. IN POLAND, FOR EXAMPLE, WE ARE HEAVILY INVOLVED IN MOVING THE NEW ENERGY LAW FROM THE CONCEPT TO THE EXECUTION PHASE, WITH A PARTNERSHIP OF POLISH EXPERTISE THAT WORKS ALONGSIDE THE AMERICAN ADVISORS AND THAT HAS THE "TRACK RECORD" TO COMMAND SERIOUS ATTENTION.

ALSO, USAID/POLAND HAS RECENTLY EMBARKED ON A PROJECT TO HELP THE NEW ENERGY REGULATORY OFFICE IMPLEMENT INFORMATION MANAGEMENT SYSTEMS THAT WILL PERMIT THE LICENSING OF SOME 800 ENTERPRISES TO COMMENCE THIS YEAR AND WILL PROVIDE AN INFORMATION BASIS FOR THE TRANSFER OF PRICING AUTHORITY TO THE REGULATOR IN ABOUT TWO YEARS THE INFORMATION PROJECT BUILDS DIRECTLY ON USAID-SPONSORED WORK CARRIED OUT AT THE HUNGARIAN ENERGY OFFICE IN 1996 AND 1997 EARLIER, OUR FOCUS WAS ON PRIVATIZATION PREPARATION FOR THE GENERATING AND DISTRIBUTION COMPANIES, A PROCESS THAT HAS NOT YET BEEN ACHIEVED BUT IS BECOMING MORE URGENT AND WE ARE OPTIMISTIC THAT OVER TIME WILL MATERIALIZE

AS YOU KNOW, USAID'S TIME IS LIMITED WITHIN THE CENTREL COUNTRIES, AND IT IS INCUMBENT UPON US TO DO ALL WE CAN WHILE WE ARE HERE ALREADY, THE AID MISSION TO THE CZECH REPUBLIC HAS CLOSED, AND THE MISSIONS IN HUNGARY, SLOVAKIA AND POLAND ARE PREPARING GRADUATION PLANS AND WILL CEASE OPERATIONS OVER THE NEXT FEW YEARS.

ONE VITAL TEST OF THE SUCCESS OF THE AID EFFORTS WILL BE THE CONTINUITY OF IMPROVEMENTS ONCE THE AID PRESENCE HAS ENDED IN ALL COUNTRIES, WE SEEK SUSTAINABLE DEVELOPMENT, NOT SIMPLY EXPEDIENT "FIXES" THAT GO AWAY ONCE THE CRISIS OF THE MOMENT ENDS. CENTREL HAS AN IMPORTANT ROLE TO PLAY, NOW AND IN YEARS TO COME, AS THE EMPHASIS MOVES FROM INDIVIDUAL COUNTRY PROJECTS TO COORDINATED EFFORTS TO BUILD UPON THE SUCCESSES OF THE LAST EIGHT YEARS FORUMS LIKE THIS ONE ADD TO THE OVERALL VALUE OF THE CENTREL ASSOCIATION, AND GIVE HOPE FOR EVEN GREATER SUCCESSES IN THE FUTURE

I WOULD THUS LIKE TO END MY BRIEF PRESENTATION TO YOU THIS MORNING BY POSING WHAT I CONSIDER IS A VERY IMPORTANT QUESTION THAT NEEDS TO BE ADDRESSED. AND THAT IS " WHAT ARE YOUR PLANS AFTER AID ENDS ITS FORMAL COUNTRY INVOLVEMENT IN THIS REGION? WHAT ARE CENTREL'S PLANS FOR CONTINUITY? I WOULD HOPE THAT MEETINGS OF THIS SORT MAY PROVIDE ITS MEMBERS SOME DISCUSSIONS AS TO THE FUTURE OF YOUR VERY VITAL WORK HOW DO YOU KEEP CENTREL ALIVE AND WELL?

THAT YOU AND I WISH YOU WELL IN ALL YOUR DELIBERATIONS OVER THE COMING DAYS.

DR PETER W AMATO
DIRECTOR PRIVATE AND FINANCIAL OFFICE
USAID WARSAW, POLAND

National Plans for Competitive Power Market Development

A contribution by Mr Miroslav Tvrznik
Deputy Minister, the Ministry of Industry and Trade
of the Czech Republic

Prepared Changes in the Energy Sector of the Czech Republic

1 Amendments to Energy legislation

Changes which occurred in the economic environment of the Czech Republic called for a need to create a new energy legislative framework, which in the context of the new drafted general legislation should regulate specific features of the energy market while safeguarding the fundamental interests of the State especially from the viewpoint of security and stability of supplies from energy resources

As a basis for the energy legislation, there was adopted Act No 222/1994 Coll (On Business Conditions and State Administration Execution in the Energy Sectors and On State Energy Inspection) The Act, in direct relation to the Commercial Code, pricing and tax legislation, formulates fundamental conditions necessary for regulation of these entrepreneurial activities The mentioned Act has already been amended by eleven executive regulations of the Ministry of Industry and Trade Another legislation of key importance is represented by Act no 18/1997 Coll "On Peaceful Utilisation of Nuclear Energy and Ionising Radiation" (Nuclear Act) and on changes and amendments to some of the acts A series of executive regulations amending this act has also been adopted.

During the validity of Act no 222/1994 Coll a number of problems appeared in connection with its enforcement Therefore, at the end of 1998 at the latest, an amendment to this act will be prepared as a response to these problems It will be mainly concerned with giving a more precise definition of the position and powers for a regulatory body and related problems Subsequently, a secondary legislation will also be adjusted (e g individual regulations of the Ministry of Industry and Trade) This amendment will also include some aspects of conservation and efficient use of energy which will eventually be the subject of a separate act

Another basic legislation tool in the course of energy policy implementation in the near future will be the Act on obligatory oil and oil products stocks

In connection with the progressing coal mining phase-out and especially with preparation of this branch to enter into the EU, it will be necessary from the Government's level to adopt a decision, which would link up to conclusions of the Government of the Czech Republic already in force, regarding the finalization of phase-out programmes destined for coal mines and quarries and which would comply with EU Decision no 3632 from 28 12 1993, determining the rules for the State

subsidy in the coal mining industry for the period up to 23 07 2002 Before the expiration of this term, it will be necessary to judge comprehensively the problems once more in their full scope and consider them with the EU

2 The further process of energy companies privatisation

As seen from a short-term perspective, only some parts of the refinery industry will not be privatised in the energy sphere (oil and oil products transport and storage), nuclear power stations, Czech gas manufacturing industry Transgas, and Diamo in the town of Straž pod Ralskem Also, it is not expected that the State's share in the high voltage transfer system, which is currently in the possession of čEZ, will not decrease At present we are considering in detail the privatisation of the OKD coal mines in Ostrava The main problem in this case is represented by commitments resulting from past extraction and by the phase-out programme carried out so far The remaining energy companies will successively undergo privatisation without principal restricting conditions

Concerning the completion of privitisation of the energy distribution stock companies, the Ministry of Industry and Trade prefers to sell the whole package of shares owned by the National Property Fund to a strategic partner chosen on the basis of public tender and then approved by the government

3 Creation of the market's model in relation to conditions existing in the Czech Republic

A decisive factor of the energy sector's further development can be seen in the change of the branch structure, which to a great extent depends on the decision made by the State Currently, the market structure of coal and oil products has already become a competitive one In the heating supplies sphere, the Government has adopted and realised a programme of successive price deregulation On the contrary, the uranium products market continues to remain under the State's control for economical reasons during the entire period of termination of uranium ore extraction However, it appears necessary to make changes in the electricity and gas market structure

In the electricity energy branch it is necessary to change the present state, when a transfer system proprietor is at the same time the major energy producer These two activities, production and grid operation, should be separated In the case of the Czech Republic, access to the successive creation of a new electricity market structure will evidently be directed from the present state to a transitive single buyer's model with the successive creation of conditions (both legislative and regulatory ones) in order to achieve a possible implementation of the agreed access of third parties, first with customers having the greatest electricity consumption Seen from the perspective of 5-10 years, this model will successively become a completely competitive one offering possibilities for suppliers and smaller consumers, in accordance with EU requirements

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The gas sector has set a goal to extend as much as possible competitors participation and to set up such a model of the gas market as to respect the EU Directive concerning rules for the internal market in natural gas which is being completed at present In view of the strategic character of gas import it would be necessary to maintain the monopoly of Transgas for 2-3 years The State-defined environment will successively enable the creation of free competition between the suppliers of one kind of energy as well as competition between different energy sources The State will also enable the creation of conditions necessary for safety of deliveries and protection of the environment We consider that the basis of relations in the Czech gas industry should consist of long-term contracts which secure a safe supply of gas to all consumers in the Czech Republic

4 Pricing policy in the energy sector

The correction of prices is being carried out by the Ministry of Industry and Trade, which would enable the creation of a prices structure which reflects the costs to a maximal possible extent This correction especially enables the reduction of wasted energy, and it also permits energy companies to proceed in accordance with the standard market rules

Primarily, it deals with correction of electricity energy and natural gas prices for households Since 1 5 1994 coal prices are no longer regulated, the regulation of objectively directed fuel prices was abolished up to 1 1 1997 In October 1996, the Government adopted a decision relating to heat energy prices correction, which is currently being made The maximum limit for these prices was abolished and beginning January 1, 1998, the new price was fixed.

It is claimed that the Government, within the shortest possible time, should adopt a binding scenario according to which it would be possible to determine the regulated prices development in such a way that from the year 2000 at the latest all consumer groups would pay prices corresponding to costs based on their consumption This price correction entails elaboration of a new tariff system, which should come in force in 1999 at the latest Price correction will progress under the strict supervision of a regulatory body, ensuring accuracy of the process At the same time, the State must perform a detailed analysis with respect to social impacts, and corresponding social provisions should be prepared

In accordance with the Resolution of the Czech government, the basic costs analysis of the electric and gas energy sectors were finished by the end of 1997

The outcome of this analysis creates the necessary conditions for the decision of the government in the sphere of electricity and gas prices and also determines the basic limits under which these changes can take place, if the financial stability of the entire energy sector should be reached in the short-term

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In accordance with the above mentioned analysis, it is possible to propose the termination of the correction of electricity and gas prices for households to a level which reflects all required supply costs It should represent the entire increase, at a minimum of 80%, in such a way that the price increase would be above 40% by July 1, 1998, and by July 1, 1999 this increase will be repeated approximately on the same level At the same time, the increase will be corrected on the basis of continued cost analyses, and after determination of adequate profit, throughout the whole process from production to final consumption of electricity and gas

Concerning the mentioned correction of electricity and gas prices for households, only the most serious problems currently existing in the electricity energy and gas manufacture sector will be removed. In order to create a standard market environment it will be necessary to undertake further steps It especially will be necessary to bring to a final solution the problems relating to prices and tariffs structure, including the complete elimination of cost redistribution, to create such a system of electricity and gas prices which respects local conditions prevailing in individual regions and to introduce energy and environmental taxes in accordance with the current situation in this field existing in EU countries, etc

5 A procedure for the formation of a regulatory framework in the energy sector

Currently, according to the legislation in force, a decisive activity during exercising, regulation and control of products prices, performances, works and services is being executed by the Ministry of Finance The Ministry of Industry and Trade disposes of any competencies at all relating to prices in the energy sector and only submits to the Ministry of Finance suggestions relating to electricity, gas and heat prices amendments

The Ministry of Industry and Trade proposes the realisation of a set of regulation tools and methods, in which measures for consumer protection, protection against discrimination of subjects entering into the market, and protection against company discrimination caused by established monopolies are included, as well as tools intended for monopoly companies to motivate them to decrease costs, including the determining of such activities which in the long-term would assist them in retaining their natural monopoly This suggested regulatory body would also monitor the quality of services, in which technical standards are included, giving a definition of the product delivered, delivery safety agreed upon with respect to prices, and standard services for consumers On the other side, such regulated companies would enjoy a preference by primarily securing demand and price stability within the declared regulated extent and even protection against the entry of a speculative offer

To initiate the realisation of this concept, a new body within the Ministry of Industry and Trade was created on January 1, 1998, the Energy Regulatory Administration, which reports directly to the Minister

The main responsibility of this body is to make state regulations (according to section 11, law no 222/1994)

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In connection with the mentioned suggestions it can be assumed that the amendment to Act no 222/1994 Coll will strengthen the independence of a regulatory body Therefore, it will be drafted in such a way that a regulatory body would be as much as possible detached from the sphere of the Ministries Powers and execution of activities to regulate the energy sector should be transferred to this office It will be necessary to link up all regulatory powers, price policy and authorisation, as well as other control powers, which are now divided between the Ministry of Industry and Trade and the Ministry of Finance, to a single regulatory body The act must for a regulatory body enable the regulation of all entities participating in energy production, its sale, transfer, import, export and distribution in the country

The objective of the elaborators of proposed modifications to Act no 222/1994 Coll is that the prepared amendment enters into force at the end of 1998 I hope during next year's meeting I will be able to inform you all that this has definitely been accomplished

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REGULATION IN POLAND

This is a great pleasure for me to attend this forum intended to discuss the issues of introduction and operation of competitive forces in the power sector Taking this opportunity I would like to thank the organizers for inviting me to participate in this important event As the President of a newly established body - the Energy Regulatory Office- let me first brief you on the Polish energy regulatory regime and the role of my office in its implemention In this context, I would like to make some comments on the Regulator's role in developing competitive electricity market in Poland

In December last year, six months after its promulgation, the new Energy Law came into force This Law sets general legal and regulatory framework for three network - basic energy subsectors electricity, gas and heating The new legal and regulatory framework is to achieve three goals

•ensure the energy security,

•increase efficiency in the whole energy sector through the introduction of competition, wherever possible, and regulated markets where necessary,

• creating equal conditions for all kinds of energy companies no matter what their ownership status is

From this perspective, the main components of the new legal and regulatory environment are as follows

•The first component is the establishment of independent regulatory office with the task of administering a regulatory framework The Law includes a clear statement that my task is to promote competition and that the basic principle of my activity as a regulator has to be balancing interests of consumers and energy companies

•The second component is an obligation imposed on network enterprises to provide transmission services which is commonly known as the TPA principle It is worth to add here that in the result of a very hot discussion in the polish parliament this principle will be implemented with two important restrictions the access will be allowed only for energy genarated in Poland and there will be a transition period of 8 years when gradually different categories of customers will be granted an access to grids

•The third component of the new regulatory framework is the principle that energy prices are to reflect full economic costs of production and supply, the costs however must be prudent and reasonable

•The fourth component regards the introduction of licensing system for basic energy - related activities like generation, storage, transmission, distribution and trade I have to stress that the licensing rules are designed not to raise additional entry barriers but first of all to check the credibility of the potential applicants and to determine detailed, individual conditions of each licensed activity which are important mainly to assure proper servicing of customers

Adoption of the Energy Law was the first step in the process of creating the energy regulatory regime The next steps involve the following stages

•First, development of the general rules into detailed regulations mainly by drafting secondary legislation According to the Law this stage should be completed by May 5-th this year

• Second, setting up the Energy Regulatory Office which includes designing its organizational structure, hiring and training the regulatory staff and developing the regulatory tools and procedures

•The last stage is an issuance of licenses for all already operating companies or energy enterprises under construction The deadline for that set by the Law is December 4-th this year At the

same time the office is obliged to process all applications for licenses from newcomers

Currently, most of above mentioned elements of the regulatory regime are still under preparation *Referring to the works on establishment of the ERO, I should mention three important conditions which so far have determined the pace of our preparations They regard the issuance of two ordinances one on the Statute of the Office and the second on remuneration for the office staff Though both ordinances were formally approved in October last year, there was still third condition regarding providing the budget for the office that has been very recently fulfilled This enables us now to speed up the process of preparations for making the office ready to take on the regulatory duties*

Let me now say some words on the duties and responsibilities of the Energy Regulator in Poland The Energy Law specifies a long list of what these duties and responsibilities are Among them, the most important are those related to

- licensing the energy activities which includes issuance, refusal, change and withdrawal of licenses,
- price regulation which involves approval and control tariffs with respect to their compliance with the principles determined in the secondary legislation,
- agreeing development plans submitting by the network companies,
- controlling quality customer standards which are to be set by an ordinance,
- resolving disputes with respect to providing transmission services, refusal of connection to the grid and to sign sale contracts, and unjustified suspensions of supplies,
- imposing financial fines on companies and managers,who do not observe the tariff and license obligations

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The Energy Law also provides some very important provisions with a view to ensure stability of performing properly regulatory duties and by this to minimize the regulatory risk This is, in turn, a very important condition first, for making possible the private participation in the Polish energy sector, and second,for development of competitive and regulated markets In this recpect, two issues are worth to be mentioned The first one regards balancing autonomy and accountability of the regulator and the second one, providing him with sufficient regulatory resources

To ensure the autonomy of the President of the ERO three measures are included in the Law First, the President is appointed by the Prime Minister what by itself strengthens his position Second, the appointment is for a fixed period of five years Third, the law sets limitations on the procedure of president's dismissal before the end of the term On the other hand, the Law provides some measures to make the Regulator more accountable, objective and fair in implementing regulations *The most important of them may be listed as follows*

•First, the President is obliged to report annually to the Prime Minister on his activities and to publish in the ERO Bulletin his decisions together with justification in the matters related to licensing, price regulation and solving disputes

•Second, the Law establishes a Consultative Council to cooperate with the President of the ERO The Council will be appointed by the Prime Minister from the candidates proposed by the energy sector and institutions representating consumer interests The Council will have the right to express its opinion on all regulatory matters handled by the ERO

•Third, the Law introduces appealing procedure, that means that all my decision may be taken to the Antimonopoly Court and abolished

As far as providing sufficient regulatory resources, two Energy Law provisions seems to be very important One regards remuneration rules for the ERO staff and second funding the regulatory body

•To facilitate recruitment and retention of the highly qualified staff, the Law exempts remuneration rules of the ERO staff from the civil salary rules The Law states that these rules should consider the wages in the energy sector,

• In turn, the funding of the ERO provides the state budget However, the funds will come from annual fees paid by the licensed companies and they will be calculated on the basis of costs of the regulation The draft ordinance on license fee calculation is ready to be presented for formal approval of the Council of Ministers It assumes that a license fee will be calculated as a percentage of the company revenues from licensed activity Depending on the kind of activity the percentage is fairly small and will amount from 0 01 to 0 07 %

Responding to the main topic of this forum that refers to the development of competitive power markets I would like to focus my comments on the possible role of the polish energy regulator in this area First of all, one general point should be made to understand the concept of the Polish energy regulatory system It consists of two levels of regulation

- The first one involves designing and setting regulatory rules through primary and secondary legislation and this is a responsibility of the Parliament and the government with the key role of the Ministry of Economy in issuing the most important ordinances
- The second level of regulation consists of implementing the regulatory framework through individual decisions made by the regulator in the areas already mentioned under the heading of the duties and responsibilities of the President of the ERO

This clarification is necessary to stress the important difference between the role of the Polish regulator and the role of regulatory bodies in other countries with respect to the development of competitive energy markets Contrary to other regulators which are deeply involved or even responsible for designing, creating and administering the energy markets, the Regulator in Poland does not have such formal powers The main role in this area plays the Ministry of Economy responsible for issuance of key ordinances which will determine the pace of introduction and the shape of the future competitive markets First of all, these are the ordinances on establishing detailed terms of

- gas, electricity and heat trade,
- providing transmission services,
- connection to the grids,
- the ordinance on setting a schedule for a period of 8 years, for introduction of access to the grids, completes a set of the most important regulations for bringing competition to the energy sector

However, it does not mean that the regulator is to be passive in respect of the development of competition As I mentioned before the Energy Law obligates me to promote competition and this task should guide my regulatory decisions *Moreover, the primary legislation enables me to be very active and in fact effective in supporting the process of introduction and strengthening competitive forces in the energy markets On my side, I declare my strong determination in using all the regulatory powers to facilitate this process*

The Regulator's role in encouraging competition consists of mainly lowering and wherever possible removing the barriers to the market entries There are at least two areas where I can make entry as easy as it is possible and allowing the energy enterprises to operate effectively

•The first area regards the complex issue of the access to the grids The Energy Law provides two measures I may use to facilitate or make possible to sign contracts for transmission services and by this to open grids for other parties The first one concerns my power in the regulation of prices for transmission services and the second one my power to solve disputes concerning the conditions for rendering these services

- The second area is licensing energy activities The licensing system adopted in the Energy Law allows me to take very liberal approach in processing the applications for licenses for two reasons First of all, the Law sets no legal monopoly, even in transmission and distribution business The Law provides the *following* list of requirements each applicant has to meet in order to get a license
- *registered office or place of residence in Poland,*
- *possession of the sufficient funds or ability to acquire such funds to perform properly licensed activity,*
- *possession of technical capability which will ensure the proper performance of activity,*
- *ability to hire staff with proper qualifications*
- *having registration with respect of so-called Terms of Development of the Area*

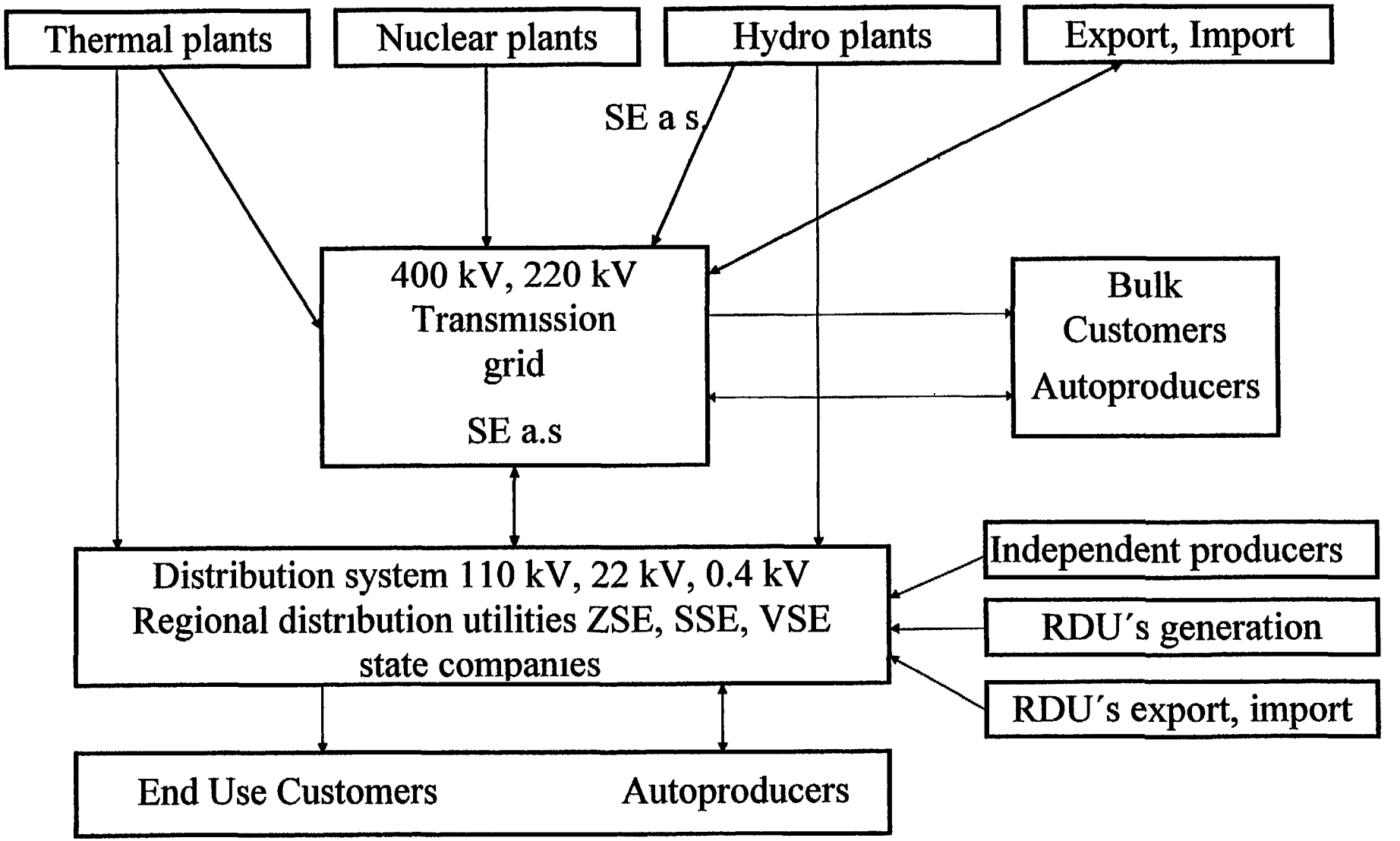
My intention is to use licensing procedures only in the way which makes possible to keep markets open for new entrants and by this to strengthen competition in the market and increase their contestability

Let me finish with making more general remark Though, that was not my intention to talk about Polish plans for competitive power development, I would like to stress strong will of the Polish

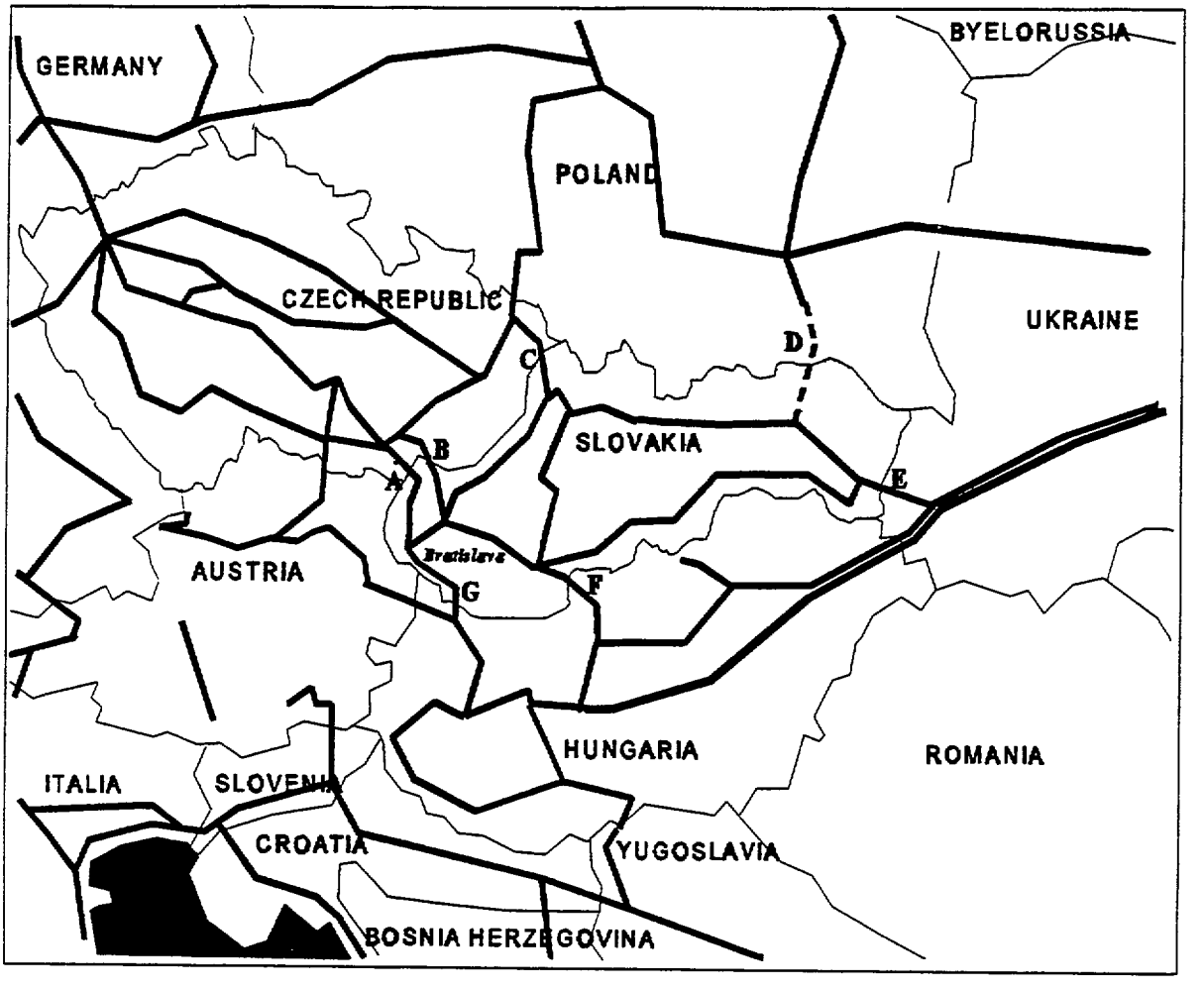
Government to continue the reforms aimed at liberalizing the energy sector This was strongly expressed in two official documents The Energy Policy Guidelines for Poland until 2010 and in Demonopolization and Privatization of the Polish Power Sector Both documents set an important policy background for my activity as the energy regulator

Thank you for your attention and I wish all of us interesting and useful debate

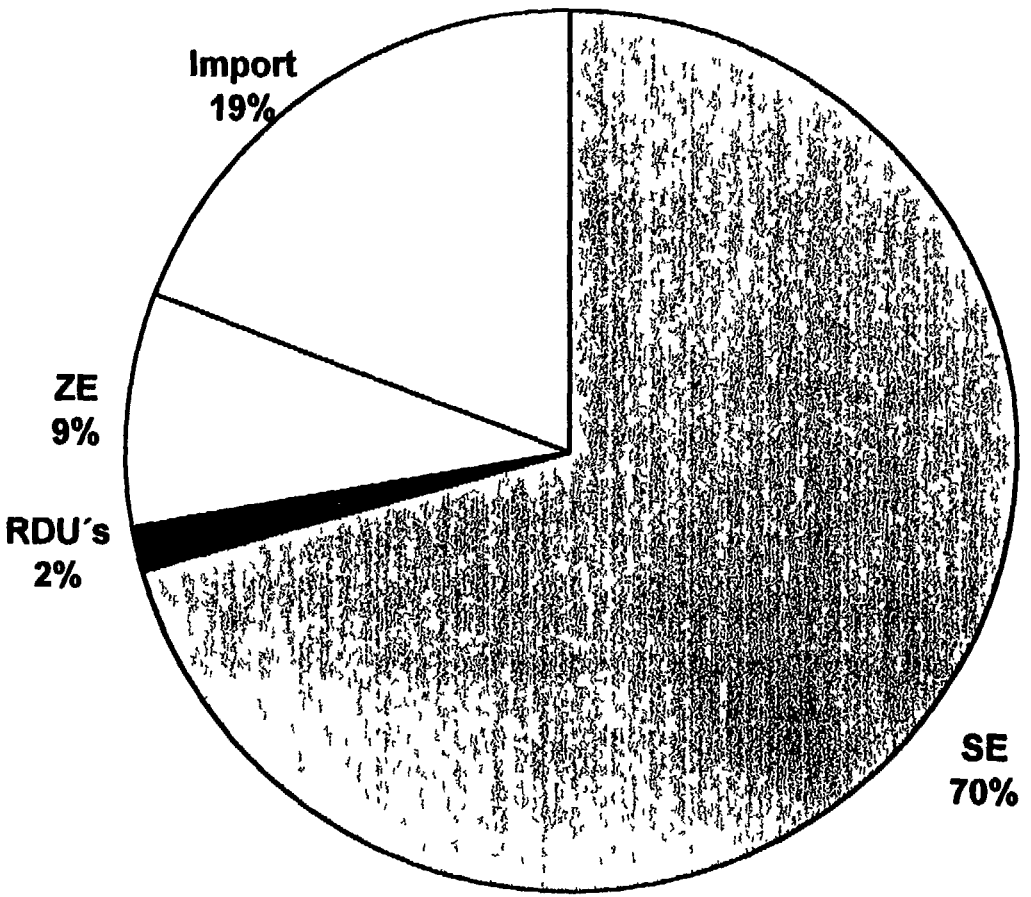
Slovak Energy Industry Structure



2.8. Medzinárodné prepojenia



Generated and purchased electricity



Energy Act

⇒ approved by the Government in September 1997

⇒ expected to be approved by the parliament in the beginning of 1998

⇒ principally in compliance with EU legislation

⇒ equal conditions for licensing for all subjects - market is open for generation

⇒ obligation to purchase energy from cogeneration and renewables

⇒ regulation by the Ministry of Economy (conditions) and the Ministry of Finance (tariffs)

⇒ TPA is not required

Energy policy till the year 2005

⇒ approved by Government in October 1997

⇒ create conditions for integration to European structures

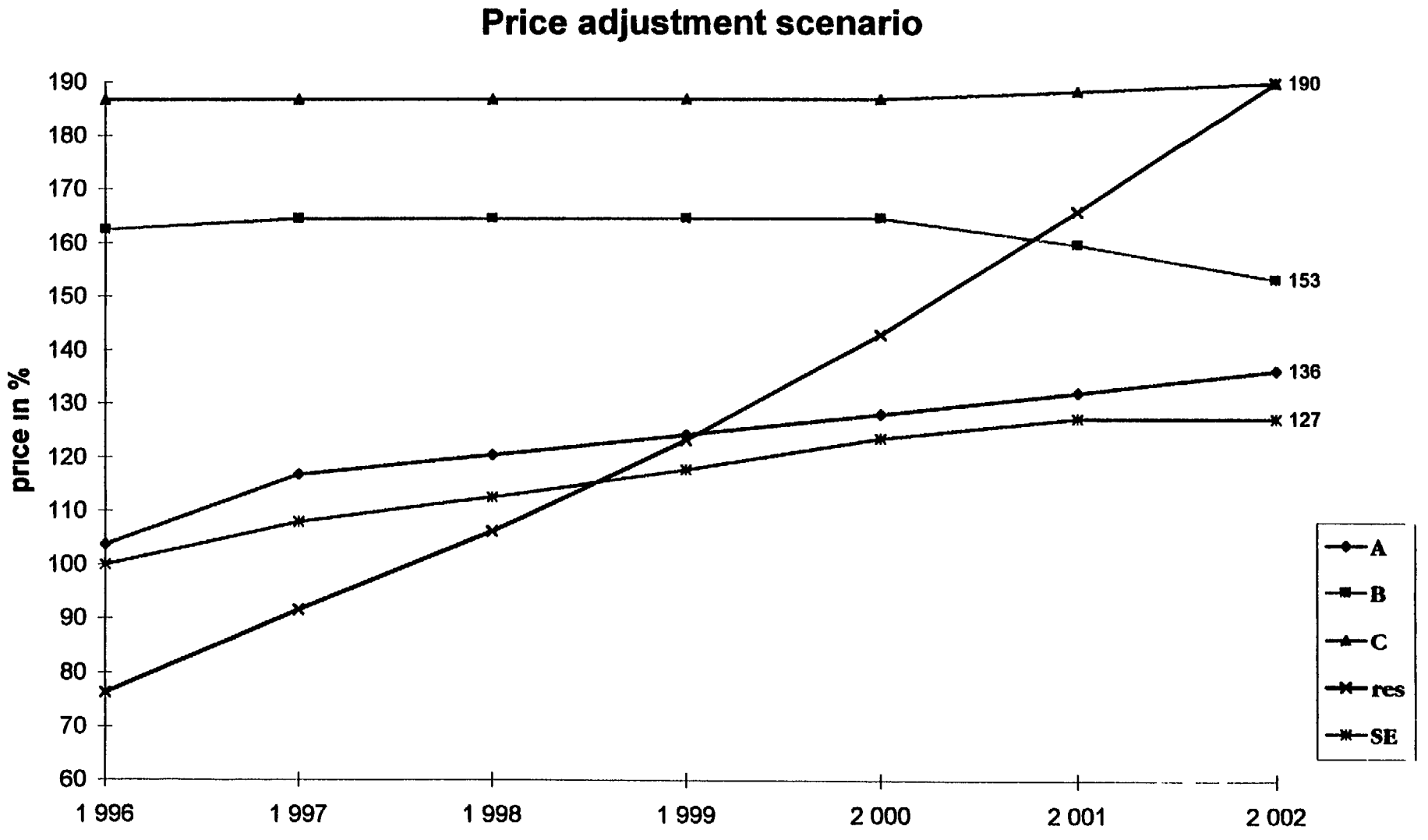
⇒ development of appropriate legal framework

⇒ create equal conditions for all subjects on the market

⇒ to the year 2002 tariffs for all customer categories have to cover costs and reasonable profit

⇒ transparent prices

⇒ after removing the cross subsidizing open the market for competition


Price adjustment scenario
price in %
190
180
170
160
150
140
130
120
110
100
90
80
70
60
1 996
1 997
1 998
1 999
2 000
2 001
2 002
190
153
136
127
A
B
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res
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Energy efficiency law

⇒ expected to be adopted in 1998

⇒ obligation to built cogeneration with all thermal sources with higher capacity than 5 MW

⇒ great potential for new capacity from independent producers

ENERGY POLICY, REGULATION OF NATURAL MONOPOLIES AND MARKETS IN SLOVAK REPUBLIC

Dr HIJJ Jan, Dr DUBNIČKA Milan
Ministry of the Economy, Slovak Republic

1 Introduction

Since 1 th January 1993 the Slovak Republic is the sovereign state New Civil Services had been created by new state with policy and economy strategy The main direction of the creating is democracy state with market economy and as access into Europe structures and NATO

2 Energy Objectives

Transformation of the Slovak economy from the centrally planned to market economy is associated with a need for the newly defined relation of the state to electrical power engineering The reason for that results from some significant specific features of this branch (public benefits, of product, continual development of supply, prompt changes in the operation, the system and monopolistic nature) constraining or eliminating some of general positive features of the market economy

As regards the current state of natural monopolies in the energy sector, there are four key companies in electrical power engineering Slovenske elektrarne a s (Slovakian Power Plants, Corp) - a dominant electricity generator, owner and operator of the transmission system, and distribution companies Western Slovakian Utilities Bratislava, Central Slovakian Utilities Žilina and Eastern Slovakian Utilities Košice

The Slovakian Power Plants (SE) is the joint stock company with 93,7% of shares owned by the National Property Fund and 2,9% owned by the Restitution Investment Fund The Slovakian Power Plants company was established in November 1994 by transforming the former state-owned company SEP (the Slovak Utility) into the joint stock company SE owns 86% of installed capacity of Slovakia s power plants and covers 90% of domestic consumption

Three distribution companies are owned by the state

Since October 1995 the Power system of Slovakia integrated within CENTREL (made by the Czech Republic, Slovakia, Hungary and Poland) has been interconnected with UCPTE and is so far running without any difficulties

As regards gas the Slovak Gas Industry managing transit, transmission and distribution networks in the Slovak Republic occupies the monopoly position

The extraction of 50% of brown coal is conducted by three mining companies - joint stock companies The remaining part of brown coal as well as all black coal is imported from abroad

The exploitation of crude oil in Slovakia is carried out by Nafta Gbely Corp Import of crude oil amounting over to 98% of total consumption is provided through the Friendship crude oil pipeline

The essential paper of energy planning stating the basic objectives and starting points of energy policy of the state, the status of the energy sector and strategies for providing the national economy with fuels and energy is the Energy Concept

The Government of the Slovak Republic accepted the Energy Concept of Slovakia by 2005,30 th September 1997

The updated version of the Energy Concept with perspective by 2010 sets out the strategic intentions of the energy sector in the following areas

- providing the national economy with fuels and energy
- increase in operational safety of plants, meeting internationally binding criteria
- increase in efficiency of energy conversions
- reduction of negative effects of the energy sector on the environment
- stability of the power, gas and oil systems
- energy conservation and utilisation of renewable energy sources

- economisation of the energy sectorprerequisite for meeting both long-term and short-term objectives of the energy policy is development of the legislative framework that in compliance with the newly designed general legislation will define the energy related environment and provide the regulatory performance of the state

The base of energy legislation will be the Act on conditions for doing business and performance of the state authorities in energy related branches (the Act on business activities in the energy sector) The Act would replace the out of date acts (related to power gas, heat, the Act on energy inspection) The objective of the Act is to make equal business conditions in the energy sector, modify rights and obligations for both natural and legal persons performing business activities in energy related branches and define necessary scope of the state intervention The paragraph version of the Act also covers the section "the state supervisory" designating the activities of the State Energy Inspection The bill takes into account the current legal status of the energy sector in the EU countries The only exception will be the provision on the third party access into grids (Directive on internal electricity market 96/92/EC), approximation to which will require the time delay, until energy prices do not reflect all the cost, while respecting differences between groups of consumers

The Act on energy management is also under preparation It deals with final energy use, focusing on energy intensity, energy conservation and introduction of mechanisms supporting the reasonable energy management The Act applies provisions and recommendations of EU, IEA and Energy Charter Treaty on energy efficiency and related ecological aspects

One of the tools for reaching the strategic intentions of the Energy Concept of Slovakia is also the regulation of natural monopolies Natural energy monopolies will retain their significant portion of natural monopolistic position in the future The reason for that is a need to provide continual, high quality and reliable network and the protection of strategic state interest

The purpose of regulation in the energy sector is to oversee the fulfilment of the energy policy, check out monopolies (especially due to the prevention from taking advantage of the monopolistic market position) in power generation, transmission and distribution, gas

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and heat supplies, in releasing licences for new entrees in the energy sector and checking out the fulfilment of conditions imposed by the licence

The objective of regulation in the energy sector is to crease the sound competitive environment and balanced conditions for both investors requiring return on investment and consumers who cannot be merely guided by the market principles and select the most suitable supplier

In the Slovak Republic, the Ministry of Finance has been authorised to regulate the pricing policy, tariffs and related conditions for the individual energy forms, to evaluate and provide Government guarantees for investment and reconstruction of key energy sources The Ministry of Economy provides the Ministry of Finance with proposals concerning prices, tariffs and related conditions for the individual energy forms, including changes

The Decree No 18/96 on prices endorses the rules regarding contracts, application, regulation and checking out of prices of output, labour, services, rent, and real estate Details on pricing, price regulation procedures, price registration and calculation are set out by the Decree of the Ministry of Finance No 87/96 Based on these legal provisions, justified cost supported with accounting sheets or tax and customs papers are applied in the price regulation The following types of price regulation are being applied official determination, time based direction or price moratorium The legislation defines the product price regulation in natural monopolies (especially in power, heat and gas production, transit and supply) as pricing, allocation of tariff and related conditions, binding rules for the production, supply and purchase, allocation of justified cost and adequate profit, including the amount of investment to be calculated within the cost and tariffs

The Antitrust Authority SR performs the regulation of contractual relations posing threat to competition or the competitive environment

Under the bill on energy management, the Ministry of Economy will be in charge of regulation in other fields such as justified cost, product and service quality, etc Regulation will be applied by

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- supervising whether the official cost of supplied energy reflects the incurred cost and adequate profit (under the Act No I 8/96 Col on prices, par 5)
- guiding the activities of licensees to keep the energy network functional and safe, efficient use of its capacity, reproduction and development for the macroeconomic needs, including the essential investment needs having impact on objectives set by the Energy Concept of Slovakia
- approving the construction of the plant in compliance with the state energy policy
- proposal of prices, tariffs and related conditions for the individual energy forms, and activities funded by Government guarantee loans to the Ministry of Finance

As the regulator, the Ministry of Economy will

- publicise information on its regulatory activities
- analyse and calculate background material submitted by the individual companies
- influence changes in the organisation and structure of the individual energy branches
- review cost of the licensed activities in long run in light of the power system operation
- influence investment activities of the regulated companies according to the energy policy and demand forecasts, including comparisons of the investment and non-investment alternatives (DSM)
- influence the authorised activities in form of rules and legitimate powers thus minimising the State intervention

check out meeting the conditions preventing from possible discrimination of individual customers (consumers, articles of demand - supply chain) and excluding the preferential treatment of some participants of this chain

- support the application of the pricing policy respecting the allocation of cost related to the production, transmission and trade activities protect customers (energy consumers) against the pressure imposed by natural monopolies, thus replacing the economic pressure otherwise generated
- set the minimum standard customer service and oversee compliance with it
- based on analysis propose changes in tariffs for the individual energy forms to the Ministry of Finance

The legal relations requiring specific legislation related to more detailed regulation conditions are set out in the act on energy related business and executive provision related to this area

Based on this Act, the Ministry of Economy will

- issue licenses accordingly
- propose prices, tariff, cost, trading terms and conditions modifications according to regulation rules
- enforce correction measures and set deadlines for their implementation
- request regulated companies to supply background material and information essential for its activities
- release its binding decisions concerning the subject of regulation and rules in the "Commercial Newsletter"

The regulated company may

- request a license
- approve adequate change of price, tariffs, cost, or trading terms and conditions
- quit or interrupt energy supply in line with the conditions set in the Act on energy management
- apply for exemption from regulation

The regulated company shall

- provide energy supply and meet the conditions set out in the license in compliance with approved changes of prices, tariffs, cost, and trading terms and conditions enable the access to the network to other business entities according to the conditions endorsed in the Act on energy management
- in the accounting documents include information on means of handling complaints provide a body of the State regulation with the requested documents and background material, allow its staff to enter the facilities, buildings and land

- keep separate accounts for the regulated operations according to the requirements of the State regulatory body

The Ministry of Economy shall control the conduct of trusts especially to prevent the abuse of their monopolistic market position in the field of production, transit and supply of energy, gas and heat The first phase will principally involve compilation of relevant and transparent information to support relevant regulation In the next phase, the regulatory body will solely focus on "the natural monopolistic nucleus" of the branch, or on limited control of other branches according to competitive elements

Regulation of the selected branches will involve especially

- price control
- cost control
- control of products and contractual relations on the energy market

The formation of regulation will be a dynamic process, emphasising the communication between the regulating body and the regulated companies The energy policy for Slovakia puts the stress on the objective to achieve the economic pricing and introduce separate regulation accounts as a source of information for the regulatory decision making process

The set of regulatory tools and methods will contain consumer's protection, prevention from discrimination of small businesses entering the market or independent firms by the established trusts, motivation of trusts to lower cost, including the allocation of activities that will remain regulated in a long term perspective

The development of the regulatory framework and the essential scope of regulation will gradually approach to the deregulation trend in the EU to make up conditions for the equal access to the energy markets with transparent prices and investment, equal access to transmission networks, and connection to the joint dispatching system

In order to impose the efficient regulation of energy related branches, we will have to resolve some issues and proposals regarding the legislative specification of the regulatory framework

- the amendment of the act will have to clearly define the functions of the regulatory body, its rights and obligations, key principles associated with the decision making process, the relation to other state authorities (e g the Ministry of Finance in case of the price regulation and the supervision of its activities) clearly define activities that are subject to regulation, or conditions for involvement or exemption from the regulatory actions All holders of licences are subject to regulation under the law However, not all holders of licences are monopolies A question related to this issue is legally set authority to modify the licensing terms, including the specification of economic claims for business activities in authorised activities
- clearly define rights and obligations of regulated entities, their mutual relations to non-regulated companies and regulatory institutions
- define how to settle disputes concerning regulation

Finally, the Act on doing business in the energy sector, once passed, will establish the necessary legislative base for efficient regulation of natural monopolies in the Slovak Republic

The enforcement of legislation necessary for regulation is accompanied with detailed monitoring of the development in regulatory methods applied in Western European countries as well as in the U S and Canada so that positive experience might be applied in the Slovak Republic in the future

As an example of utilising the experience in this area is the co-operation with Bechtel Corporation. Based on the Contract EUR 0030 - C 2055 -00 USAID the Office for Europe - the Energy and Infrastructure Division - The project of Eastern European energy efficiency - electrical power engineering, in 1995 Bechtel Corporation along with sub-contractors Arthur 9 Anderson & Co and the Power Research Institute in association with the Ministry of Economy SR, Ministry of Finance SR, Slovakian Power Plants and three regional utilities elaborated the study on prices and tariffs for Slovakia s power engineering, whose results appear to be very useful in setting the future energy prices

3 Conclusion

The market mechanism and it is effectiveness depends proportionally on the competitive environment

„Perfect" competitive environment to grant maximum of the benefits and services In that environment no subject (company) of the competition cannot „controlled" for example the prise of the goods

Deficiencies of the market is mechanism must be compensated by government which according to a legislation and it is self activities regulated or simulated the market environment

Slovak Republic (likewise that state of middle and east Europe) is transforming from central management to market management The transformation process in the Slovak Republic is now under progress a lot of problems concerning energy policy, regulation of natural monopoly and market are relevant to the present status

Lucia Ca
23 10 1997

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CENTREL REGIONAL ROUNDTABLE FORUM COMPETITIVE POWER MARKETS

January 20-22, 1998
PRAGUE, CZECH REPUBLIC

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NATIONAL PLANS FOR COMPETITIVE POWER MARKET DEVELOPMENT

- SCHEDULE FOR PREPARATION OF EU LEGAL HARMONISATION, LED BY THE MITT

- PREPARATION FOR MORE COMPETITION BY THE HEO

- SUGGESTION

SCHEDULE FOR PREPARATION OF EU LEGAL HARMONISATION, LED BY THE MITT

- *PHASE 1.* ANALYSIS OF PRIMARY AND SECONDARY LEGISLATION OF THE EC

  DECEMBER, 1996 – SEPTEMBER, 1997

- *PHASE 2.* PREPARATION OF NEW ELECTRICITY LEGISLATION HARMONISED TO THE DIRECTIVE AND OTHER LEGISLATION OF EC

  DECEMBER, 1997 – DECEMBER, 1998

PHASE 1. ANALYSIS OF PRIMARY AND SECONDARY LEGISLATION OF THE EC (NECESSARY LEGAL HARMONISATION)

DECEMBER, 1996

- INTER-MINISTERIAL CO-ORDINATION
- TASK FORCE №8. ENERGY

JANUARY – MAY, 1997

- ANALYSIS OF THE TREATY, REGULATION, DECISIONS, DIRECTIVES, RECOMMENDATIONS OF THE EC RELATING TO ENERGY

- COLLECTION OF EC-LEGISLATION REQUIRE IMPLEMENTATION INTO THE HUNGARIAN LEGISLATION

Schedule for preparation 8/2

JULY – SEPTEMBER, 1997

- ANALYSIS OF AGENDA 2000 (Commission Opinion on Hungary's Application for membership of the European Union)

- PROPOSAL FOR THE HUNGARIAN NEGOTIATING PARTY

- SUGGESTION FOR THE GOVERNMENT ON THE FUTURE WORK

Schedule for preparation 8/3

PHASE 2. PREPARATION OF NEW ELECTRICITY LEGISLATION HARMONISED TO THE DIRECTIVE AND OTHER LEGISLATION OF EC

DECEMBER, 1997

- SET UP OF DIRECTING COMMITTEE (MITT, MIN. OF FOREIGN AFFAIRS, MIN. OF FINANCE, COMPETITION OFFICE, HEO, STATE PROPERTY AGENCY, MVM RT.)

- SET UP OF TASK COMMITTEE

- APPROVED TIME SCHEDULE:

31 JANUARY:	POTENTIAL MODELS
15 FEBRUARY:	EXISTING LEGAL FRAMEWORK – POTENTIAL MODELS
28 FEBRUARY:	SUGGESTED MODEL(S)
30 APRIL:	CONDITIONS OF SUGGESTED MODEL(S)

PHASE 2. PREPARATION OF NEW ELECTRICITY LEGISLATION HARMONISED TO THE DIRECTIVE AND OTHER LEGISLATION OF EC

31 MAY:	CONSEQUENCES OF THE IMPLEMENTATION OF SUGGESTED MODEL(S)
30 JUNE:	PRICING QUESTIONS
30 SEPTEMBER:	DISCUSSION WITH THE INTERESTED PARTIES (LICENSEES, CUSTOMERS)
15 OCTOBER:	FINALISATION OF THE SUGGESTED MODEL(S)
15 DECEMBER:	PREPARATION OF THE AMENDMENT ON THE HUNGARIAN LEGAL FRAMEWORK

SOME OF THE KEY QUESTIONS

- **HOW TO OPEN THE MARKET?**

  - *AS FROM FEBRUARY 1999 ALL MEMBER STATES MUST OPEN AT LEAST 25,37% OF THE MARKET TO FREE COMPETITION.*

  - *IN 2000 THE MARKET SHARE WILL BE CALCULATED ON THE BASIS OF 20 GWh, RESULTING IN APPROX. 28%.*

  - IN HUNGARY.

Over 40 GWh/year	41 end-user;	18,9%
Over 20 GWh/year	95 end-user;	24,3%
Over 9 GWh/year	200 end-user,	29,2%

  - **POTENTIAL DEROGATION'S;**
    - **at the start?**
    - **at the level of 9 GWh?**

SOME OF THE KEY QUESTIONS

- TENDERING PROCESS? (AUTO-PRODUCERS, INDEPENDENT PRODUCERS) (IRELAND ONLY)
- HOW IS ENSURED THE NON-DISCRIMINATORY MANNER OF DISPATCHING THE GENERATORS?
- WHAT TO DO IN THE TRANSIENT PERIOD? (NEW PPAs, STRANDED COST ACCEPTATION AND ALLOCATION)
- POTENTIAL MODELS
- TRANSMISSION, DISTRIBUTION, ANCILLARY SERVICES, PRICING
- SERVICE PUBLIC
- METERING
- ELIGIBLE CUSTOMERS (AGGREGATION?)

Schedule for preparation 8/7

SOME OF THE KEY QUESTIONS

- IMPORT FROM NON MEMBER STATES
- OWNERSHIP CONCENTRATION
  (avoid dominant position)
- LOW PRICE OF THE NPP

Schedule for preparation 8/8

PREPARATION FOR MORE COMPETITION BY THE HEO

DIRECTIVE 96/92/EC

ARTICLE 20., SECTION 3.:

"Member States shall designate a competent authority, which must be independent of the parties... settle disputes..."

ARTICLE 22:

" Member States shall create appropriate and efficient mechanisms for regulation, control and transparency..."

- **ANALYSIS OF THE DIRECTIVE**
- **ANALYSIS OF DIFFERENT MODELS IMPLEMENTED COMPETITION**
- **IMPLEMENTING REGULATORY METHODS, PRACTICE USED BY OTHER REGULATORS**
- **PAY ATTENTION ON THE PREPARATION, PRACTICE OF OTHER STATES**
- **STRATEGY OF THE HEO BASED ON THE EXISTING LEGAL FRAMEWORK**

ANALYSIS OF THE DIRECTIVE

- TRANSLATION, EXPLANATORY REMARKS
- DISTRIBUTION OF NEW IDEAS
- EUROPEAN COMMISSION DG XVII. (ENERGY) VISIT, DISCUSSION
- DG XVII. HOME PAGE

  http: //europa.en.int/en/comm/dg17/elechome.htm

  - explanatory memorandum
  - frequently asked questions
  - country reports

ANALYSIS OF DIFFERENT MODELS IMPLEMENTED COMPETITION

- DISCUSSION, CO-OPERATION WITH OTHER REGULATORS AND PARTIES OF THE ELECTRICITY INDUSTRY (ENGLAND-WALES, ARGENTINA, SPAIN, GERMANY, AUSTRALIA, CALIFORNIA, NEW ENGLAND)

- ANALYSIS OF THE KEY QUESTIONS WITH THE USAID-TEAM (supporting the HEO);

  - POTENTIAL BENEFIT ON THE SIDE OF THE CONSUMERS, ECONOMY
  - NECESSARY LEGAL HARMONISATION TO THE DIRECTIVE
  - POTENTIAL METHODS DETERMINING AND ALLOCATING THE STRANDED COST
  - TECHNICAL QUESTION (GRID CODE, ANCILLARY SERVICES, METERING, ECONOMY OF SCALE – OWNERSHIP CONCENTRATION)
  - POTENTIAL MODELS
  - NEW TASKS, RESPONSIBILITIES, NECESSARY AUTONOMY OF THE HEO

IMPLEMENTING REGULATORY METHODS, PRACTICE USED BY OTHER REGULATORS

- OFFER /Know How Fund/;
  - QUARANTEED SERVICES
  - MEASURE OF SERVICE LEVEL
  - ANALYSIS OF OUTAGES

- CEC, CPUC (USAID);
  - MEASURE OF CUSTOMER SATISFACTION
  - DATA AND INFORMATION BASE, LAN
  - LICENCE CONDITIONS – COMPLIANCE MONITORING SYSTEM

- VICTORIA (Australia);
  - BENCHMARKING PERFORMANCES OF LICENSEES

- PUC OF MAIN (USA);
  - STABILITY, CONTINUITY AND PREDICTABILITY IN DECISIONS
  - GUIDELINES
  - PUBLIC HEARINGS

PAY ATTENTION ON THE PREPARATION, PRACTICE OF OTHER STATES

- VISIT SOME MEMBER STATES (ENGLAND, IRELAND, SPAIN, GERMANY)

- TAKE PART ON CONFERENCES

- INVITE FOREIGN EXPERTS FOR ROUND-TABLE DISCUSSIONS;
  - OFFER
  - KARTELLAMT (Antimonopoly office in Germany)
  - IEA
  - RWE
  - EC DG XVII (GAS + ELECTRICITY)

- CENTREL MEETINGS

STRATEGY OF THE HEO BASED ON THE EXISTING LEGAL FRAMEWORK

- LICENCE FOR "AUTO-PRODUCERS" (SELF-USERS), "INDEPENDENT PRODUCERS"
- LICENSE FOR DIRECT SUPPLY (create competition)
- GUIDELINE ON NEW CAPACITY TENDERING
- POSITION TAKEN UP IN THE CASE OF NEW PPAs
- PREPARATION FOR THE NEW TASKS, RESPONSIBILITIES, NECESSARY AUTONOMY OF THE HEO (Distributed questioner to Regulators in Member States)

SUGGESTION FOR THE GOVERNMENTS IN THE CENTREL STATES

- ROUNDTABLE MEETINGS
- EXCHANGE OF IDEAS
- CO-OPERATION IN THE PREPARATION OF NEW REGULATION
- POSSIBILITY OF CENTREL-POOL;
  - TRANSMISSION PRICING
  - ANCILLARY SERVICES (COST SEPARATION, PRICING)

I. Principles of Competition in Electric Power Markets

A. Markets are a "regulatory" structure designed to allocate resources

1. Market success, as an institution, depends on its design.
    a. incentive structure
    b. feedback mechanisms
2. Some imperfections in markets are tolerable, don't let the perfect be the enemy of the good!

B. What are the parameters of a competitive structure?

1. Many self-interested buyers and sellers acting independently.
2. Free entry and exit of infinitely divisible resources.
3. Production of discreet, homogeneous, nondurable goods.
4. A complete set of transaction markets - spot, forward, futures, etc.
5. A high degree of (perfect) information or perfect foresight.

C. Transaction process characteristics

1. Discreet, simultaneous transactions
2. Anonymous exchange - no long term relationships
3. Very low or zero transaction costs
4. Little or not ex-post obligation

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D. What institutional structures operationalize these characteristics and parameters?

1. Auctions
2. Market places
3. Pool Co

E. Competition can take many forms

1. Wholesale markets
2. Bidding for specific projects
3. Spot markets

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F. Regulatory classification

1. Competitive model - structure - conduct - performance
    a. competition/regulation are designed to modify behavior of participants
    b. structure - conduct - performance paradigm
        1. competitive market structure
        2. leads to competitive conduct
        3 which produces competitive performance (e.g. efficient allocation of resources)

F. Regulatory classification (cont'd.)

2. Regulatory or control option - command and control or markets
   a. remember markets are a form of regulation

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F. Regulatory classification (cont'd.)

3.

	Structure	Conduct	Performance
CAC	Strong Power Pool	IRP	Cost-based regulation
MKT	Pool Co Spot Mkt	Competitive Bidding	Performance-based regulation

↑ Bilateral Contracts

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G. For each market-oriented strategy buyers, whether they are customers or purchasing distribution/retail firms, need access to multiple suppliers

1. Traditionally, if a supplier controls more than 60% of market, market power is believed to exist.

2. Minimum number is 5 to 6 equal size firms to foster, but not guarantee competition.

H. Competition has generally been limited to the generation sector where the economies of scale have been eroded by technical change

1. Central station - efficient size is being reduced

2. Cogeneration - economies of scope

3. Distributed generation - response to bottlenecks in transmission and distribution

I. Bilateral contracts vs spot markets

1. Problem of discrimination and market segmentation.
    a. spot markets treat all players equally
    b. equal treatment creates incentives to avoid equal treatment
        - contracts for differences

I. Bilateral contracts vs spot markets (cont'd.)

2. Are there cost differences - differentiated markets - that should be segregated?

   a. idea of natural market segmentation by load factor, total consumption etc.

I. Bilateral contracts vs spot markets (cont'd.)

3. Nature of market differs based on customers capabilities.
   a. if you are residential your options are limited
   b. if industrial you can cost effectively purchase back-up or stand-by services
   c. result is quality of service differentiation which affects prices

J. The effects of competition will depend on the way in which competition is implemented

1. Markets may naturally segment if bilateral contracts are used.
2. Spot markets may create incentives for customers to self-implement alternative power sources.
3. Prices will be forced to the "true" underlying costs of providing services.
4. If certain classes of customers cannot afford these prices, explicit - not implicit - subsidies should be employed.
5. Remember markets abhor implicit subsidies and will subvert them.

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K. Enforcing competition

1. By creating clear market structures/processes that are monitored by regulators, the ability to circumscribe the market is limited.

   a. government organized auctions
   b. pool cos
   c. computerized spot markets

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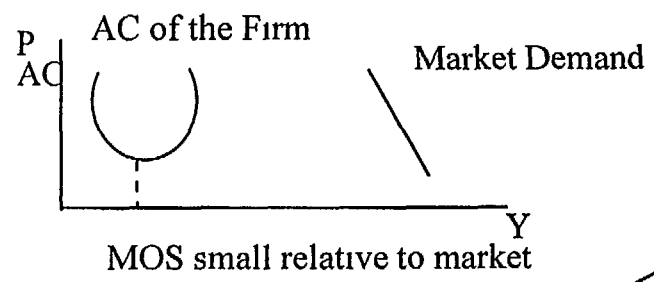


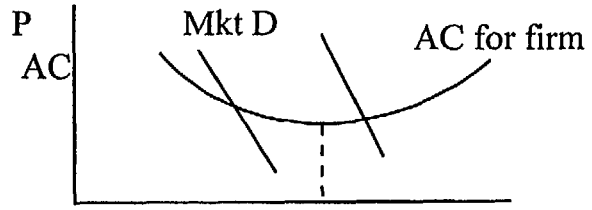
MOS small relative to market

Is there a "natural monopoly"? (Is MOS large relative to D, so that competition is WITHIN the market is not possible?

NO

Don't regulate achieve first best

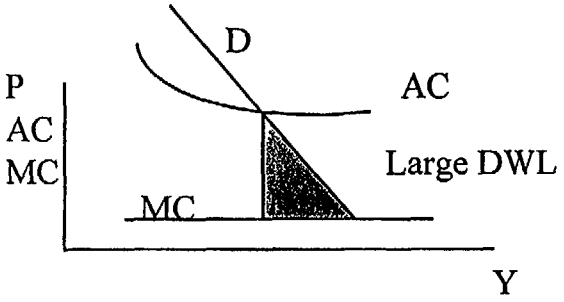
Example
Motor Carriers, Water Carriers

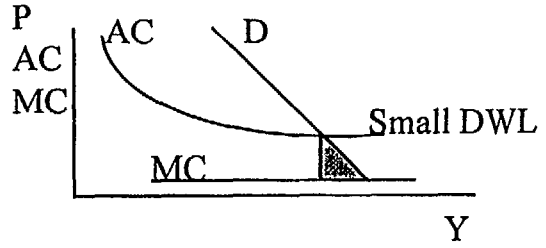


MOS large relative to Mkt

YES

Is Deadweight Loss at "Second Best" (relative to "First Best") "Tolerable"?





YES

Can there be competition FOR the market?---
(a) Demsetz Competition
(b) Contestable Market
(c) Monopolistic Competition

NO

Regulate to achieve "First Best" (or near "First Best") outome

Need external subsidy - or-
Price Discrimination - or-
Nonlinear tariffs
(to allow firm to avoid a deficit and price efficiently

NO

Regulate to achieve Second Best (or near Second Best) outcome

(May avoid external subsidy and nonlinear tariffs)

YES

Introduce Competition FOR the market

Examples RRs, Pipelines, Monopolistic or Demsetz Competition
Airlines Contestable

CENTREL REGIONAL ROUNDTABLE FORUM
COMPETITIVE POWER MARKETS

Competition and Power Markets -- CENTREL Countries

Prague, Czech Republic
20-22 January, 1998

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OVERVIEW

I. HALLMARKS OF COMPETITION

II. MARKET STRUCTURE

III. MARKET PLAYERS

IV. REGULATORY ENVIRONMENT

V. REGULATORY COMPETENCIES

VI. SPOT MARKET

VII. CONCLUSIONS

I. HALLMARKS OF COMPETITION

- MARKET STRUCTURE
- MARKET PLAYERS
- REGULATORY ENVIRONMENT
- REGULATORY COMPETENCIES

II. MARKET STRUCTURE

- COMPETITION IN GENERATION AND WHOLESALE MARKETS

- HUNGARY
  - » Active Market For Wholesale Competition
  - » Active Bidding on New Generation

- POLAND
  - » Potential For Active Wholesale Market

- CZECH REPUBLIC, SLOVAKIA
  - » Market Domination By Principal Generator

II. MARKET STRUCTURE

- **DE FACTO COMPETITION THROUGH**
  - » Self-Generation
  - » Fuel Switching
  - » Demand Side Management, Conservation

- **PRICING**
  - » Role in Fostering Competitive Markets
  - » Cost Based, Transparent, Non-Discriminatory, No Subsidies
  - » Price Structures in CENTREL

III. MARKET PLAYERS

- IF SUPPLIER CONTROLS 30-40% OF MARKET, MARKET POWER LIKELY EXISTS

- HUNGARY, POLAND
  - » Multiple Generators
  - » Multiple Sellers
  - » Framework for Effective Competition

- CZECH REPUBLIC – CEZ, 75% OF MARKET

III. MARKET PLAYERS

- SLOVAKIA – SE, 86% OF MARKET
- MARKET DOMINANCE?
- STEPS REQUIRED TO ALLOW COMPETITIVE WHOLESALE MARKET
- TRANSMISSION MARKET DOMINANCE

IV. REGULATORY ENVIRONMENT

- POLICY ENCOURAGING COMPETITIVE MODEL
- CZECH REPUBLIC
  - » Process for New Capacity
  - » Process for Load Forecasting
  - » Customer Choice?
    - ~ Distribution companies
    - ~ End users
- HUNGARY
  - » Traditional Generating Companies
  - » Self-Generators
  - » Direct Supply

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IV. REGULATORY ENVIRONMENT

- **POLAND**
  - » **Multiple Generators**
  - » **Self-Generation**
  - » **Can Distribution Companies Buy Directly or Only Through PSE?**

- **SLOVAKIA**
  - » **Does SE Dominate Sector?**
  - » **Will Draft Legislation Permit Regulatory Changes?**

V. REGULATORY COMPETENCIES

- COMPETITIVE MARKETS CHANGE TYPE OF REGULATION

- COMPETITION DOES NOT ELIMINATE REGULATION

- REGULATED MODEL FOCUSES ON:
  - » Engineering Skills
  - » Price Setting
  - » Rate Design

- COMPETITION REQUIRES DIFFERENT SKILLS

V. REGULATORY COMPETENCIES

- ANTI-MONOPOLY, ANTI-TRUST
  - » Shift From Assuring Fair Price Calculations By Monopoly Parties To Assuring Open Access To All Entrants
  - » Regulators Need Competency In Legal and Economic Basis For Anti-Trust And Competition Theory
  - » Anti-Monopoly, Anti-Trust Capabilities in CENTREL Member Companies?

V. REGULATORY COMPETENCIES

- **COORDINATION AMONG AGENCIES**
  - » Hungary
  - » Czech Republic
  - » Poland

- **OWNERSHIP LIMITATIONS, MARKET DOMINATION, AND SIZE**
  - » Direct and Indirect Ownership of Multiple Generating Companies, Distribution Companies – Hungary
  - » Market Activities in CENTREL Countries
  - » Fuel Supply

V. REGULATORY COMPETENCIES

- **POOLS/ISO/TRADING ARRANGEMENTS**
  - » **Regulators Must Assure Operation of Independent System Operator, Ancillary Services, Identification, Pricing**

- **EUROPEAN UNION DIRECTIVES**
  - » **Commercialization, Competition Will Require Understanding of EU Policies**
  - » **Specifically, Regarding Energy**
  - » **Generally, Regarding Trading and Competition**

V. REGULATORY COMPETENCIES

- LINKAGES BETWEEN COMPETITION, SECTOR DEVELOPMENT AND ENVIRONMENTAL SUSTAINABILITY

- WRITTEN STANDARDS ESSENTIAL
  - » Published Written Standards Governing Activities In General
  - » Hungarian Enforcement Decree
  - » Poland – Secondary Legislation

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V. REGULATORY COMPETENCIES

- **CUSTOM AND USAGE NO LONGER WILL SUFFICE**
  - » **New Entrants, Existing Parties, Customers -- Need Clear, Understandable, Generally Applicable, Transparent Procedures**
  - » **Multiple Market Participants Require Appeal Procedures**

VI. SPOT MARKET

- **THREE ESSENTIAL REQUIREMENTS**
  - » Transmission System Infrastructure
  - » Competitive Industry Structure
  - » Supportive Regulatory Environment

- **MULTIPLE PRODUCTS**
  - » Energy, Capacity, Reserves, Ancillary Services
  - » Day Ahead Scheduling, Immediate Scheduling
  - » Medium and Long Term Scheduling

VI. SPOT MARKET

- COMMERCIAL AND SETTLEMENT FUNCTIONS
  - » Ability to Hedge Future Price Changes
  - » Basic Legal Structure to Support Contracts
  - » Transaction Settlements Through Currency Payments or Energy Banking

- INTERNAL GOVERNANCE
  - » Who Operates Spot Market
  - » How Are Decisions Made
  - » Are They Appealable

- EXTERNAL REGULATION

VI. SPOT MARKET

- **WILL SPOT MARKET FACILITATE COMPETITION IN CENTREL?**
  - » **Is Commercial/Technical Infrastructure Adequate To Support Cross Border Spot Market**
  - » **Transmission Grid, Telecommunications, Software**
  - » **Internal Governance and External Regulation**

- **PARTICIPATION IN MARKET VOLUNTARY OR MANDATORY?**

VI. SPOT MARKET

- HOW SHOULD TRANSMISSION ACCESS BE ASSURED?
- HOW SHOULD TRANSMISSION SERVICES BE PRICED?
- DO ANY SPOT MARKETS EXIST WITHIN CENTREL CURRENTLY?
- DOES SPOT MARKET ROLE MAKE SENSE FOR CENTREL?

VII. CONCLUSIONS

- COMPETITION AND EUROPEAN UNION STANDARDS LINKED
- COMPETITION CAN EXTEND BEYOND EU STANDARDS
- EMERGING COMPETITION IN SOME CENTREL MEMBERS
- LIMITED END-USER CHOICE
- COMPETITION CURRENTLY UNEVEN, INCOMPLETE

VII. CONCLUSIONS

- COMPETITIVE EXAMPLES FROM PRIVATIZATION OF ECONOMY IN CENTREL COUNTRIES

- GOALS OF COMPETITION: REDUCE PRICE, INCREASE CHOICE, INCREASE EFFICIENCY, ATTRACT PRIVATE CAPITAL, AVOID CROSS-SUBSIDIES

- ULTIMATELY, STRENGTHEN ECONOMY, IMPROVE STANDARDS OF LIVING

DIRECTIVE 96/92/CE

INTERNAL MARKET FOR ELECTRICITY

The use of indigenous primary energy sources

Article 8(4) of the Directive States

A Member State may for reasons of security of supply direct that priority be given to the dispatch of generating installations using indigenous primary energy fuel sources to an extent not exceeding in any calendar year 15 % of the overall primary energy necessary to produce the electricity consumed in the Member State concerned "

The objective persued by this Article is to permit a Member State to give a certain priority to domestic energy sources It should be noted that electricity produced from hydroelectric and renewable energy sources (with the exception of biomass) are not included within this definition, because whilst they are "primary energy sources", they are not "fuels" Electricity produced from renewable energy sources are not therefore discussed in this document

It should also be noted that the measures adopted or envisaged by the Member States in this respect generally concern non-competitive fuels

Article 8(4) has therefore no apparent justification for indigenous fuels which are competitive, because market forces will in any event result in a sufficient usage of these fuels, which have therefore no need of protection mechanisms This concerns, for example, gas and petroleum products (United Kingdom, the Netherlands and Norway) Nuclear energy may also be viewed as an indigenous fuel, but, ceteris peribus, should be classified amongst competitive fuel sources

Systems envisaged for indigenous fuels likely to require support within the meaning of Article 8(4)

The support mechanisms and recourse to Article 8(4) concern, therefore, non-competitive fuels It should however be noted that the measures taken by Member States for the support of the coal industry are aimed, in particular, to make coal competitive Aids additional to those envisaged in the framework of the ECSC Treaty are not permitted

In Greece and the Eastern German Lander, lignite is the principal fuel (regarding Germany, accounting for some 70 % of electricity production in these Lander)

Greece Lignite

Greek lignite mines are owned by PPC, the national electricity producer The costs of production appear to be competitive with other energy sources The production of electricity from lignite does not at present benefit from any direct aid, nor from any other specific protection mechanism

Germany Lignite

In the Eastern Lander, major modernisation investments, in particular regarding emission reduction have taken place in the generating installations using lignite The depreciation of these investments increase production costs, which requires certain mechanisms giving priority to their production
The German government envisages to leave in place the priority for access to the network for electricity produced from lignite until 2003, and to leave to the Bundeskartellamt (BKA) the examination of any refusal of access to the network to other producer which might result This mechanism takes the form of a transitional regime (Article 24), and not one within the scope of Article 8(4) Article 8(4) envisages in effect the quantity of priority for dispatch for electricity produced from indigenous fuels, but under no circumstances envisages the refusal of access to the network for electricity produced from other fuel sources

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Spain Coal

The Spanish government envisages that 15 % of electricity produced will be from indigenous coal Whilst a levy on the transmission of electricity in favour of coal was initially envisaged, the present draft legislation now envisages, according to the information presently available to the Commission, a tax to cover the aids in question These aids are equally examined in the framework of the ECSC Treaty

Ireland Turf

Electricity produced from turf amounts presently to 12 % of domestic electricity production and benefits from priority of dispatch Aids provided to turf producers by the Electricity company ESB, will be financed by a levy, clearly identifiable, the "peat levy", which will be added to the electricity price

United Kingdom Coal

Even if the price of domestic coal may be slightly higher than existing world market price, UK coal is the most competitive produced in the EU More than 40 % of domestic electricity is still produced from coal, and aside from aid granted in the framework of the ECSC rules (the lowest in the EU) no support mechanism is envisaged.

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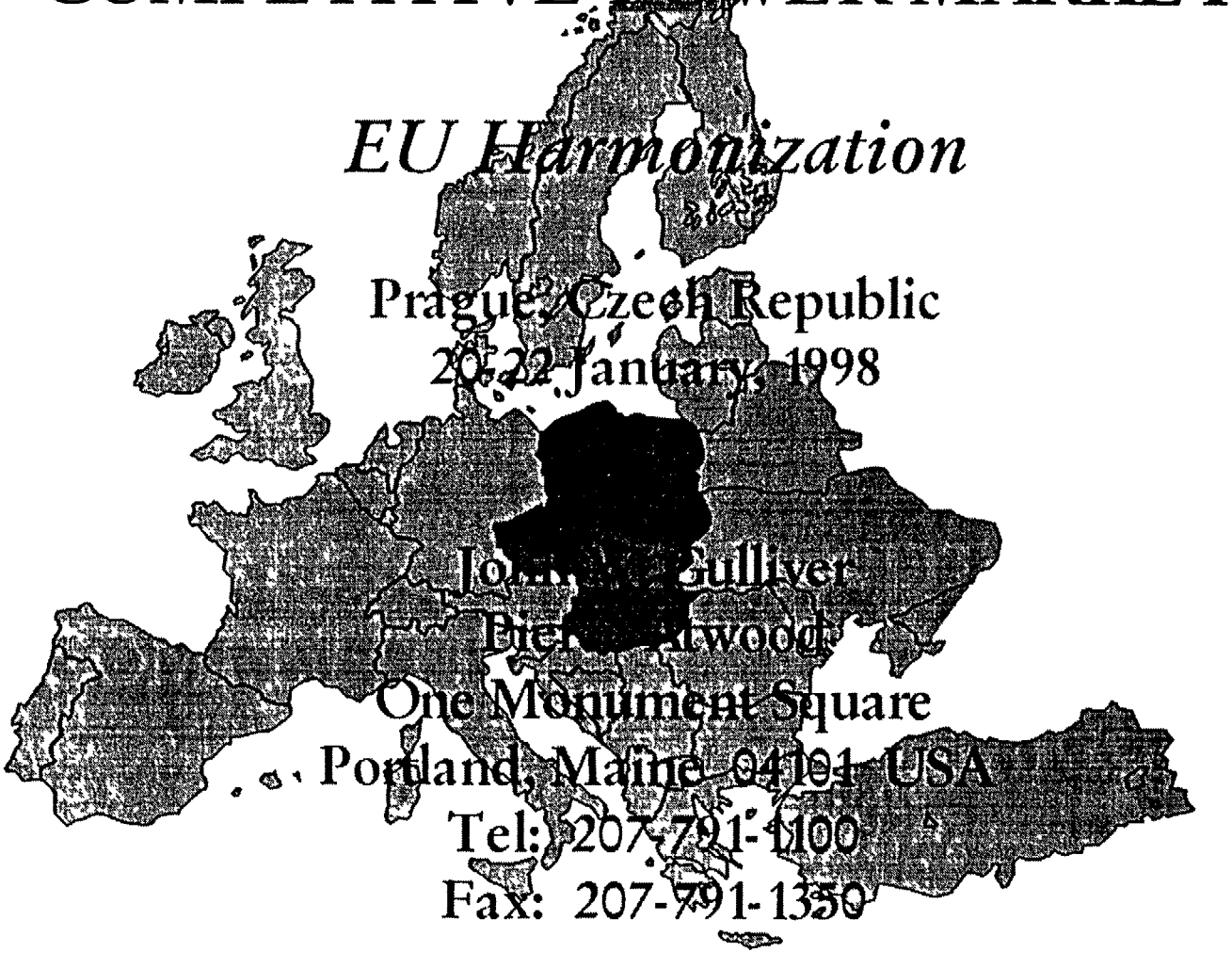
CENTREL REGIONAL ROUNDTABLE FORUM
COMPETITIVE POWER MARKETS



EU Harmonization

Prague, Czech Republic
20-22 January, 1998

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USAID - BECHTEL

OVERVIEW

I. OVERVIEW
II. CRITERIA TO EVALUATE NEW GENERATION
III. DECISION-MAKING CRITERIA, APPEALS
IV. NEW CAPACITY FORECASTS
V. DIRECT ACCESS FOR ELIGIBLE CUSTOMERS
VI. ANTI-COMPETITIVE EFFECT OF LONG TERM CONTRACTS
VII. FUNCTIONAL SEPARATION OF TRANSMISSION
VIII. PATH FORWARD FOR CENTREL MEMBERS

I. OVERVIEW

- SOME PROGRESS TOWARD HARMONIZATION IN CENTREL COUNTRIES
  - » Basic Energy Laws Drafted or Implemented
  - » Emerging Competitive Procurement of New Generation Capacity
  - » Disaggregation Incomplete, But Has Increased Over Time

- COMPARE EU CRITERIA WITH CENTREL MEMBER PROCEDURES

- SIGNIFICANT REMAINING ISSUES

II. CRITERIA TO EVALUATE PROPOSALS FOR NEW GENERATION

- **EU REQUIREMENT**
  - » Authorization or Tender Procedure
  - » Objective Criteria

- **CZECH REPUBLIC**
  - » ACT 222 Does Not Provide Specific Criteria
  - » Does CEZ Need To Obtain Government Approval To Acquire New Capacity?

II. CRITERIA TO EVALUATE PROPOSALS FOR NEW GENERATION

- HUNGARY
  - » MVM Now Obtains New Capacity Through Tender Process
  - » Detailed Bid Process and Requirements
  - » Role of HEO

- POLAND
  - » ERA Licenses All Participants In Energy Sector
  - » Secondary Legislation A Priority

II. CRITERIA TO EVALUATE PROPOSALS FOR NEW GENERATION

- SLOVAKIA
  - » Ministry of Economy Proposed New Energy Act To Govern Licensing
  - » Specific Provisions Dealing With New Capacity?

III. DECISION-MAKING CRITERIA, APPEALS

- **EU REQUIREMENT**
  - » **Decision-Maker Must Set Forth Reasons For Refusals, Appeal Rights**
  - » **Tender Procedure Must Be Managed By Entity *Not* Engaged in Transmission, Distribution or Generation**

- **CZECH REPUBLIC**
  - » **ACT 222 Does Not Specify Procedures For Approval or Appeal**
  - » **Amendment To Act or Secondary Legislation?**

III. DECISION-MAKING CRITERIA, APPEALS

- HUNGARY
  - » Limited Provisions on Approvals in Act
  - » Enforcement Decree, Other Regulations
  - » Specified Appeal Procedures
  - » Dunaferr – Dédasz Example
- POLAND
  - » ERA Licenses All Sector Participants
  - » Limited Criteria to Date
  - » All ERA Decisions Appealable
- SLOVAKIA
  - » Proposed Legislation?

IV. NEW CAPACITY FORECASTS

- **EU REQUIREMENT**
  - » If Tenders, Forecasts Based On Open, Public Procedures, No Less Than Every Two Years
- **CZECH REPUBLIC**
  - » Ministry Data Gathering
  - » Access
- **HUNGARY**
  - » MVM and Ministry of Industry and Trade Forecast Demand
  - » Forecasts Submitted To Parliament Every Two Years
  - » Operational Code, Establishment Plan

IV. NEW CAPACITY FORECASTS

- POLAND
  - » PSE and Distribution Companies Forecast Demand
  - » Subject to Review by ERA
- SLOVAKIA
  - » Proposed Legislation?

V. DIRECT ACCESS FOR ELIGIBLE CUSTOMERS

- **EU REQUIREMENT**
  - » Negotiated Access or Single Buyer
  - » Phased Opening of Markets Over 6 Years
  - » Must Include All Consumers Over 100 GWh

- **CZECH REPUBLIC**
  - » ACT 222 Does Not Provide For Direct Access
  - » Potential Legislative Change
  - » Market Operates, Notwithstanding
  - » Example of Subtransmission Sales

V. DIRECT ACCESS FOR ELIGIBLE CUSTOMERS

- HUNGARY
  - » Electricity Act Permits HEO to License Direct Supply For Certain Consumers
  - » Dunaferr, Csepel
- POLAND
  - » Energy Law Expressly Provides For Direct Access
  - » Phased Access 8 Years
  - » Large Customers First
  - » Limited to Domestic Suppliers
- SLOVAKIA
  - » Draft Law Silent?

VI. ANTI-COMPETITIVE EFFECT OF LONG TERM CONTRACTS

- EU REQUIREMENT (Treaty of Rome)
  - » Interpreted to Prohibit Contracts Restraining Competition

- WITHIN CENTREL, MANY LONG TERM CONTRACTS BETWEEN GENERATORS AND DISTRIBUTORS

- CZECH REPUBLIC
  - » Long Term Contracts Between CEZ and Distributors

VI. ANTI-COMPETITIVE EFFECT OF LONG TERM CONTRACTS

- HUNGARY
  - » Generators Have Long Term Contracts With MVM
  - » MVM Has Long Term Contracts With Distributors
- POLAND
  - » Long Term Contracts Among Sector Participants
- SLOVAKIA
  - » SE Contracts with Distributors Renewed Annually

VI. ANTI-COMPETITIVE EFFECT OF LONG TERM CONTRACTS

- LONG TERM CONTRACTS MAY
  - » Inhibit Competition
  - » Limit Customer Choice
  - » Inflate Prices

- BUT, GOVERNMENT INTERFERENCE WITH EXISTING CONTRACTS COULD
  - » Frustrate Investor Expectations
  - » Chill Privatization
  - » Limit Capital Flows

- ISSUE NOT UNIQUE TO CENTREL
  - » United States – High Priced IPP Contracts

VII. FUNCTIONAL SEPARATION OF TRANSMISSION

- **EU REQUIREMENT**
  - » **Functional Separation of Transmission From Generation and Distribution; Disaggregation Preferred, Not Required**

- **CZECH REPUBLIC**
  - » **CEZ Controls Transmission and 75% of Generation Capacity**
  - » **ACT 222 Does Not Require CEZ To Operate Transmission System Independently**

VII. FUNCTIONAL SEPARATION OF TRANSMISSION

- HUNGARY
  - » Partial Disaggregation During Privatization, Generators And Distributors
  - » MVM Transmission and Generation Functions Not Functionally Separate
  - » MVM Owns Certain Generation
  - » Distribution Companies Own Limited Generation
  - » Reaggregation Through Acquisitions

VII. FUNCTIONAL SEPARATION OF TRANSMISSION

- POLAND
  - » Sector Largely Disaggregated
  - » PSE – Transmission
  - » 33 Distribution Companies
  - » 34 Generation Companies

- SLOVAKIA
  - » SE Dominant Participant
  - » SE Controls Transmission Grid, 86% of Generation Capacity
  - » Regional Distribution Companies Also Own Generation

VIII. PATH FORWARD FOR CENTREL MEMBERS

- IDENTIFY ACTUAL HARMONIZATION
  - » Generation Competition Through Self-Generation
  - » Generation Competition Through Limited Direct Access
  - » Tenders

- IDENTIFY AREAS OF NON-COMPLIANCE

- NEW CAPACITY TENDERS INTERIM BRIDGE TO DIRECT ACCESS

- DIRECT ACCESS VERY LIMITED

VIII. PATH FORWARD FOR CENTREL MEMBERS

- FURTHER FUNCTIONAL SEPARATION OR DISAGGREGATION REQUIRED
- BASIC ENERGY LAWS NEED TO BE SUPPLEMENTED
- SECONDARY LEGISLATION MUST BE IMPLEMENTED
  - » Decision Criteria
  - » Administrative Procedures
  - » Appeals

VIII. PATH FORWARD FOR CENTREL MEMBERS

- FOUNDATION HAS BEEN SET, BUT MORE WORK REMAINS TO BE DONE

- ULTIMATE BENEFITS OF GREATER COMPETITION, LOWERED COST, GREATER CHOICE, ECONOMIC GROWTH

Providing for Public Benefits and Social Needs in a Competitive Market

A. If specific social needs have been identified (environmental, low income subsidies, energy efficiency), then the only competitively neutral approach is to assess a non-bypassable system benefits charge.

1. Wire use charge
   - a fixed monthly charge
   - b. may vary in size by usage characteristics
2. You want to employ a fixed charge so as not to distort the energy usage price away from its competitive (marginal cost) based signal.

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B. Reliability should be established as a system standard

1. Every supplier must be part of the standard setting group and violations of standards should ultimately be punished by exclusion from the marketplace, (e.g. revoke supplier certificate).

   a supplier certificates should simply look at managerial, technical and financial capability; they should not be used to restrict entry

C. You can try and promote innovative solutions to participate in the market

1. Low income buyers cooperatives

2. You can conduct an auction for the right to be the supplier of last resort

D. Stranded costs and employer of last resort

1. If you must collect stranded costs from customers, do it on a competitively neutral lump-sum/fixed monthly charge.

2. Since these costs are owed to the state in many cases, it would be easier to take care of this through the central government budget.
   a. if you privatize, stranded costs are equal to:

original cost - purchase price

This difference could be handled as a budget deficit item to avoid encumbering the regulatory process.

E. Promotion of energy efficiency

1. The first thing you can do to promote energy efficiency is price your electricity at cost.
    a. subsidized energy prices distort customer choices regarding efficient technology adoption.

2. Create low income and energy efficiency audit plans with rebates or discounts on energy efficient appliances, weatherization and other programs.
    a. These could be financed directly through a government subsidy. If you try and finance this through electric rates, you'll distort prices and defeat the purpose of the program.

F. Environmental compliance

1. This is a cost of doing business that should be flowed through in the price of electricity.

   a. adopt cap and trade programs
   b. gradual phase-in of meeting standards to avoid flash cut - plant shut downs

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Comments to CENTREL Roundtable Session

ATTRACTION OF CAPITAL:

Necessary Conditions to Attract Foreign Private Investment in the Power Sector in a Competitive Global Capital Market

Michael T. Hogan
Senior Vice President, InterGen Ltd., London

INTERGEN

Goals of the CENTREL countries?

- Reduce government spending and/or raise money for central treasury?
- Improve economic efficiency of the sector?
- Lower prices to consumers (or avert drastic increases in prices to consumers)?
- Improve quality of service to consumers?
- Satisfy conditions for entry to the EU?
- Improve environmental performance of sector?
- Retain access to sector as instrument for indirect taxation?
- Retain access to sector as instrument for industrial and/or environmental policy?

INTERGEN

Ranking of goals drives type of investors, targets for investment

- Types of investors
  - large institutional investors (domestic and/or international)
  - domestic small investors
  - multi-national utility investors
  - entrepreneurial developers
- Targets for investment
  - distribution
  - transmission
  - supply
  - generation
  - various combinations of the above
  - vertically integrated, monopoly "single buyer"

INTERGEN

Various models and their impacts

- United Kingdom
- Scandinavia
- Victoria/New South Wales (Australia)
- Hungary
- Chile
- Italy/Portugal
- Spain
- California

INTERGEN

Lessons Learned so far

- De-regulation vs. re-regulation
- Enforcement mechanisms
- Fuel supply security
- Limited re-integration
- Trading
- Capacity payments

Do European Power Markets Have Surplus Capacity?

Martin O. Giesen

and

Mark Somerset

of

International Generating Company Limited,

("InterGen"),

London

Martin O. Giesen and Mark Somerset
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Ladies and Gentlemen,

thank you for attending a session dealing with a topic which for many of us may appear to be depressing "surplus capacity" Let me begin with the good news

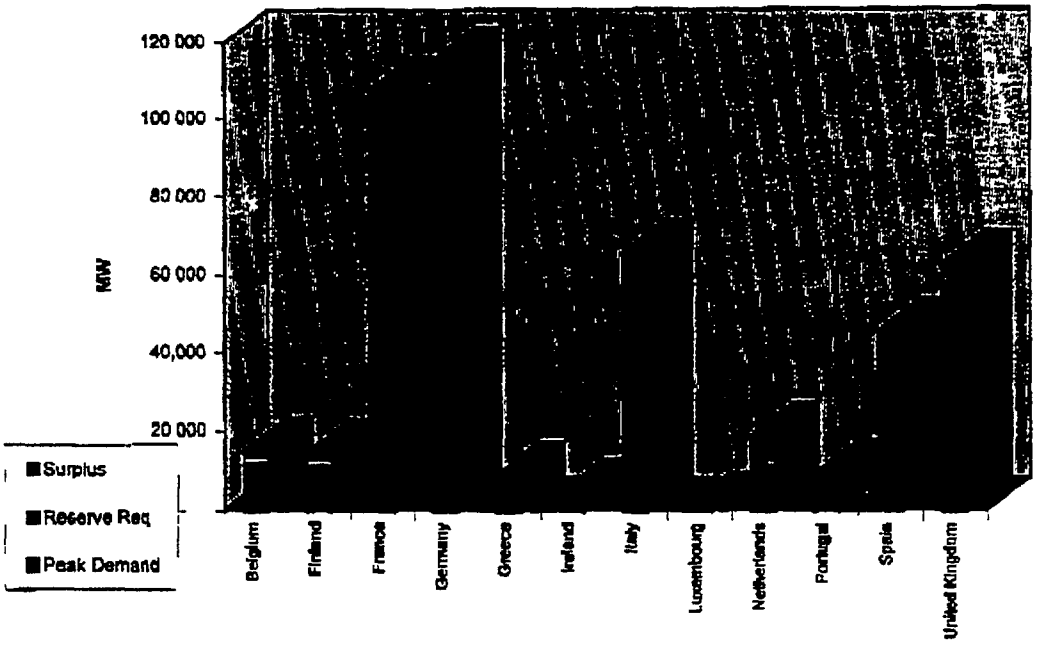
There really is no such thing as surplus capacity in an open market.

Surplus Capacity of Shoe Shops Quite a few of us in this room have probably at one time or another walked along a high street in one of Europe's major cities and wondered about the surprisingly large number of shoe shops There is simply no way in which all these shoes will ever find enough feet to wear them Europe - and I suspect the rest of the developed world as well - has a great problem with **overcapacity** of shoe shops And what do people do? They open yet more shops! The "Nation of Shopkeepers" has gone mad!

Surplus Capacity in British Power Generation When looking at the power generation industry, this view of the British is strongly confirmed In 1989 Britain had a peak power requirement of about 48,000 MW and an installed generation capacity of 68,000 MW 20,000 MW of overcapacity! Even if one assumes an operating margin of 25% over peak requirements, there were still 8,000 MW of surplus capacity But what do the British do? Over the last 6 years, they have installed another 15,000 MW of new generation capacity Fortunately, they also retired 12,000 MW of existing capacity, but still, surplus capacity grew What happens next? Companies such as InterGen with its 750 MW Rocksavage project coming on-line in 1997, initiate a "second dash for gas" and are on a very fast track to operate yet more generation capacity

What about Europe? Practically, all countries in Western Europe - and probably even more so in Eastern Europe - have a "technical surplus" of power generation capacity One look at the following Chart (**Chart 1**) shows that installed capacity exceeds peak demand by no less than 26 % in all EU markets and by more than 60 % in 6 out of 12 West European countries

Chart 1
Surplus Capacity in EU Power Generation



Even if one were to assume that a reserve margin of 15 % of peak demand is required - an assumption which seems much too high in view of the excellent interconnection of the European grid - a substantial "technical" surplus appears to exist in all these countries Many policy makers in Europe look at this "technical surplus" - the excess of installed capacity over peak requirements and conclude that this is a reason why very little new power generation capacity will be built in Europe over the next decade and why none **should** be built What I would like to demonstrate to you in the remainder of this talk is that this "technical overcapacity" becomes an entirely irrelevant concept when markets for electricity and fuel are liberalized My company - InterGen, an affiliate of Bechtel - believes that substantial new generation capacity is needed in Europe and that we are in an excellent position to develop, build, own and operate it

Return to the British Example - The First Dash for Gas Let us have another look at what really happened in the UK after 1989, the year in which Margaret Thatcher liberalized and privatized the electricity industry Where previously you had the Central Electricity Generating Board ("CEGB")

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which matched demand with supply, you now had generators (primarily National Power and PowerGen) selling to regional electricity companies and industrial customers via the Electricity Pool and the National Grid Company The generators were scrambling to lower their costs by shedding employees and shutting down power stations The RECs were competing for customers by lowering their power purchasing costs Generally they bought from the existing generators, but they purchased part of their requirements from new built IPPs, such as ENRON's 1850 MW Teeside developments The important questions for generators, IPPs and RECS alike was not whether there was a "technical surplus" of generating capacity, but whether power could be generated more cheaply from one source than another - from coal or from gas, from existing capacity or new-built - and whether such power could be sold to customers In Britain, two sets of circumstances led to the overwhelming rush to build new gas-fired combined cycle plants ("CCGTs")

(1) the gas industry was in a process of liberalization also, and more and more North Sea Gas was discovered, accordingly, gas prices stabilized and started falling

(2) British coal-fired power stations had not yet been equipped with FGD, but would need this in the future Correspondingly, even existing capacity would clearly require additional capital expenditure At the end, the balance of future costs of upgrading and operating existing coal fired power stations against new-built CCGTs was resolved in favor of the CCGTs and about 10,000 MW of new base-load generating capacity were added in the "first dash for gas" Meanwhile 11,000 MW of coal-fired capacity was shut down

The Second Dash for Gas Having indulged in this "feeding frenzy", a certain degree of calm ensued A few of the last CCGT projects were caught in a climate of declining appetite for yet more base-load capacity, and yet, IVO's Humber I project did eventually close, British Gas and Scottish Hydro closed 750 MW at Seabank and InterGen sponsored a new 750 MW CCGT at Runcorn, selling power to ICI, Scottish Hydro Electric and retaining a small amount of merchant capacity

Since then, more projects have closed - Destec with its oil-fired Indian Queens project with 160 MW, AES in Barry with a 230 MW CCGT, and the IVO consortium with it 500 MW Humber II CCGT And no end is in sight ENRON has announced its 800 MW Sutton Bridge project, BP and Entergy have announced their 1000 MW Saltend project and - once again - InterGen is in the final stages of permitting its 800 MW Spalding project - and this is only a sample

But the market for these projects is changing where initially projects such as ENRON's Teeside or Scottish Hydro's Keadby were selling base-load power under firm 15 year sales and purchase agreements, there are now projects in a variety of market segments some are designed for mid-merit generation (e g Rocksavage), some sell peaking and other ancillary services to the National Grid (e g Indian Queens), some sell tolling capacity to gas suppliers (e g Humber II) Technical surplus there may be, but market players are obviously identifying segments in the market where new capacity can be added or can replace existing capacity

Capacity in Liberalized Markets In the highly developed market economies of western Europe with relatively slow growth rates in electricity consumption and its large stock of existing generation infrastructure, there will practically always be a technical surplus of generation capacity But in a liberalized market where players are free to identify and exploit all opportunities, there may well be many segments where new capacity can economically replace existing capacity Competitiveness in such segments could be based on

- technological advantages, e g the very high efficiency of modern gas-fired combined-cycle units,
- operating cost advantages, e g the 40 or less people required to operate a modern 1000 MW CCGT, as opposed to the 120 people or more required to operate a similarly sized coal-fired plant,
- fuel purchasing cost advantages, where, for example, the delivered cost of gas in the UK can sometimes be below the delivered cost of coal (not taking into account the efficiency advantages of gas-fired CCGTs),
- better load-following characteristics of gas turbines, allowing seasonal and daily cycling
- environmental advantages, such as result from operation of CCGTs and, particularly, large scale cogeneration plants as opposed to traditional coal-fired plants, even if equipped with FGD
- siting advantages resulting from smaller size, less noise and lower cooling water requirements, and allowing CCGTs or cogeneration plants to be built near load centers where traditional coal fired plants had to be built near mines or port facilities

There are probably many more factors to be taken into account All of this is not to argue that there will never be new coal-fired or perhaps even nuclear capacity built in Europe All it tells me is that

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technological changes, changes in fuel supply and even political changes can and will materially change the economics of power generation. In a liberalized market, these changes are directly perceived by many players in the industry, and some or all of them will translate these changes into closure of older facilities and construction of new facilities

There can of course be situations where for one reason or another there is simply no opportunity to replace existing capacity, either because there is so much capacity with very low marginal production costs (e g nuclear capacity) or because access to competitive fuels is constrained Even if France were to fully liberalize its power generation industry, it may be difficult or impossible for new-built base-load CCGT to compete against existing nuclear capacity, particularly if the economics of decommissioning are twisted such that depreciation is effectively a negative number, with capacity One wonders why EDF is resisting liberalization. But perhaps EDF has done its homework and has found out that overcapacity in baseload generation does not mean that there is no room for new cogeneration, mid-merit or peaking capacity

Similarly in Italy or Spain, monopoly control over gas supplies may continue to keep gas prices above comparable market levels and may therefore constrain a shift to gas-fired generation which would otherwise occur But even the big gas monopolies are beginning to crack - as seen in Germany or Holland - and market forces will open the way for new capacity

Potential for New-Built Capacity in Europe I think it is perhaps time to have a look at some of the key European power markets to see where new capacity is most likely to be built It seems to me that there are three key factors determining the probability of new generation capacity additions in Europe

1 Openness of the market, i e are there physical or regulatory barriers which would prevent a potential generator from selling to a potential purchaser even if the two could agree on prices and other terms of such a sale In Germany, for example, uncertainty regarding transmission access at reasonable cost and availability of ancillary services at reasonable cost could still prove to be critical barriers to an open market.

2 Availability of fuel supplies on globally or at least regionally competitive terms For a large variety of reasons, the new technology of choice in Europe will continue to be gas-fired CCGTs Where gas is not available on competitive terms (and this includes price indexes suitable for power generation), for example in Italy, capacity replacement or additions will be held back

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3 Existence of generation capacity with low marginal costs In France, hydro and nuclear together account for almost 90% of total generation It will be very difficult or impossible to replace existing nuclear capacity with new CCGT capacity, except in certain narrow market segments However, in Germany or Spain, for example, there is still a very substantial stock of relatively small, coal-fired units of 150 MW or less capacity with high fuel costs due to inland locations and very high personnel costs I know facilities in Germany which employ more than 600 people to operate less than 600 MW of generation capacity

Anybody who wants to compete in the more liberal energy markets of Europe in the future will need to compare opportunities and threats with reference to these - and probably many other - factors I thought I might show you in very general terms where we see major opportunities **Table 1** shows some of our conclusions, even though they are obviously highly qualitative and quite often guesswork

Table 1

Opportunities for Generating Capacity Replacement / Addition in EU Countries

	Market Openness	Competitive Fuel Availability	High Marginal Cost Capacity in Operation
Belgium	↓	↑	↓
Denmark	→	→	→
France	↓	↓	↓
Germany	?	↑	↑
Greece	↓	↓	↑
Ireland	→	→	↑
Italy	?	↓	↑
Luxembourg	?	↑	→
Netherlands	↑	↑	→
Portugal	↑	?	→
Spain	?	?	↑
United Kingdom	↑	↑	→

↑ = favorable to new-built
→ = neutral
↓ = unfavorable to new-built
? = to be determined

No wonder that the UK is popular with independent power producers, Germany, Spain and Italy are at least worth a second look, and France is a kind of "no go" zone

A Shortage of Economic Generating Capacity Rather than having "surplus capacity", I would argue that there are markets in Europe such as Germany, Spain and Italy where there is an acute shortage of capacity - not a shortage of installed capacity, but a shortage of economically efficient capacity These are markets where production costs of traditional coal or oil fired facilities are

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much higher than in the UK, because of higher staffing levels, higher employment costs and higher costs of fuel than in the UK Correspondingly, the range of capacity which could potentially be replaced is much greater than in the UK. The fact that this has either not happened at all - yet - or has happened only sporadically has nothing to do with overcapacity, but all to do with **regulatory barriers and monopolized markets** in both gas and in electricity

This is a situation where everyone - except the entrenched utilities managements - loses

- retail prices can be kept artificially high,
- inefficient and polluting generating capacities are operated longer than they should be, and
- the rate of introduction and development of new technologies and operating methods is retarded

Even employment levels cannot be maintained this way in the long run - Germany's 4 5 million unemployed paying some of the highest electricity prices in the world bear witness to this

Just to circle back to the beginning of my talk, I want to tell you the true story of the now world-famous Italian shoe-designer Salvatore Ferregamo He was born in 1898 in the Southern Italian town of Bonito, near Naples Even as a child, Ferregamo had wanted to become a shoe-maker However, his parents knew that cobblers were among the poorest people in the country and therefore forbid him to even think of becoming a cobbler Fortunately, Ferregamo was an adventurous spirit He emigrated to the United States at the age of 16 and became the shoe designer for Hollywood's stars At the age of 29 he returned to Florence and opened the first large scale production facility for hand-made shoes in Italy, employing 60 shoe-makers In spite of the "technical surplus" of cobbling capacity, Ferregamo had the drive and the opportunity of turning his personal design and marketing skills into fame and fortune, in spite of a crowded market

I sincerely hope that European electricity consumers and producers will have the same opportunity When European power markets are liberalized, "surplus capacity" will disappear, not technically, but economically, new opportunities will be created and genuine cost savings will be realized in the economy - for the benefit of all

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PRIVATISATION

CENTREL REGIONAL ROUNDTABLE FORUM COMPETITIVE POWER MARKETS

January 20-22, 1998
PRAGUE, CZECH REPUBLIC

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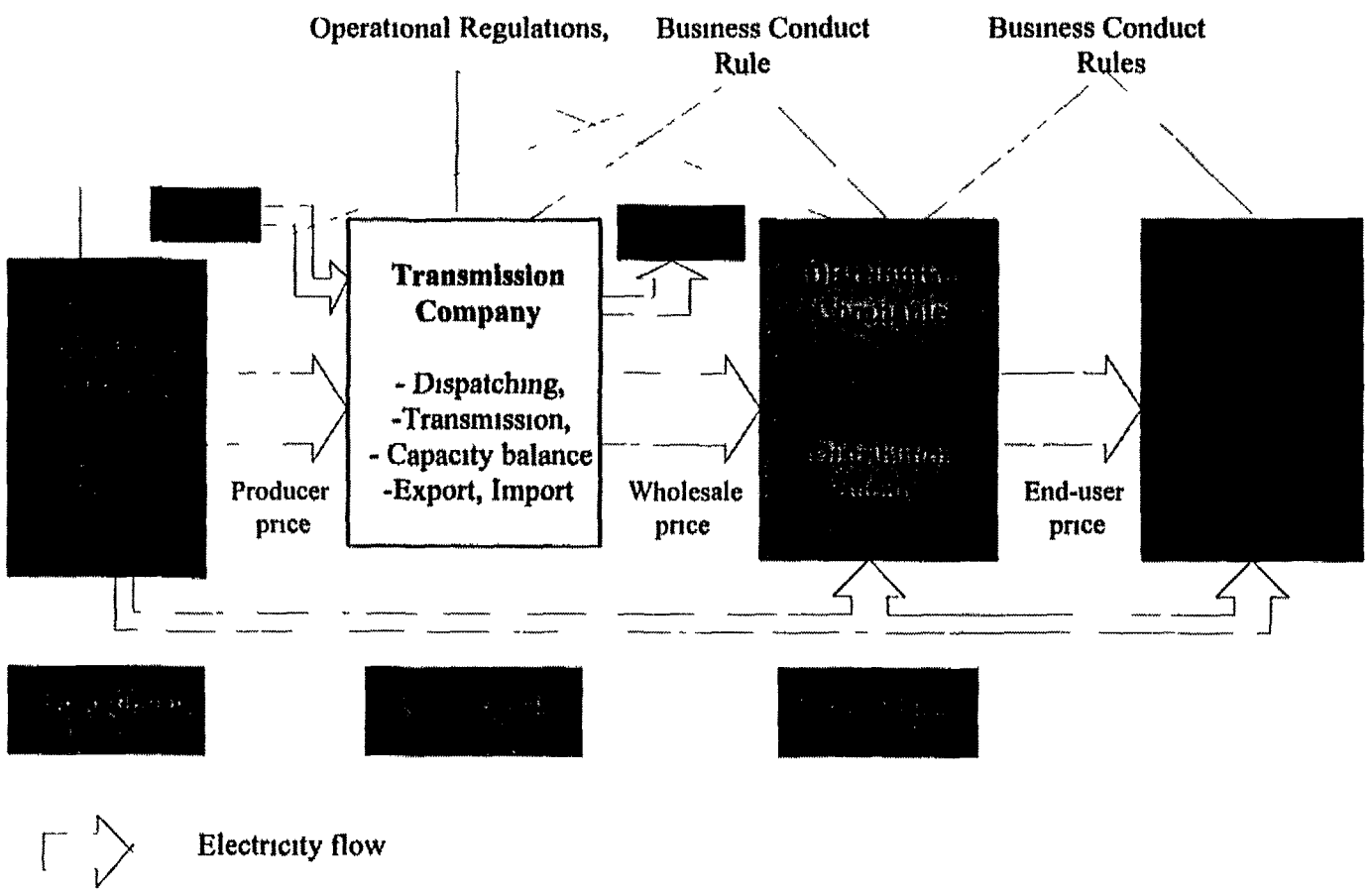
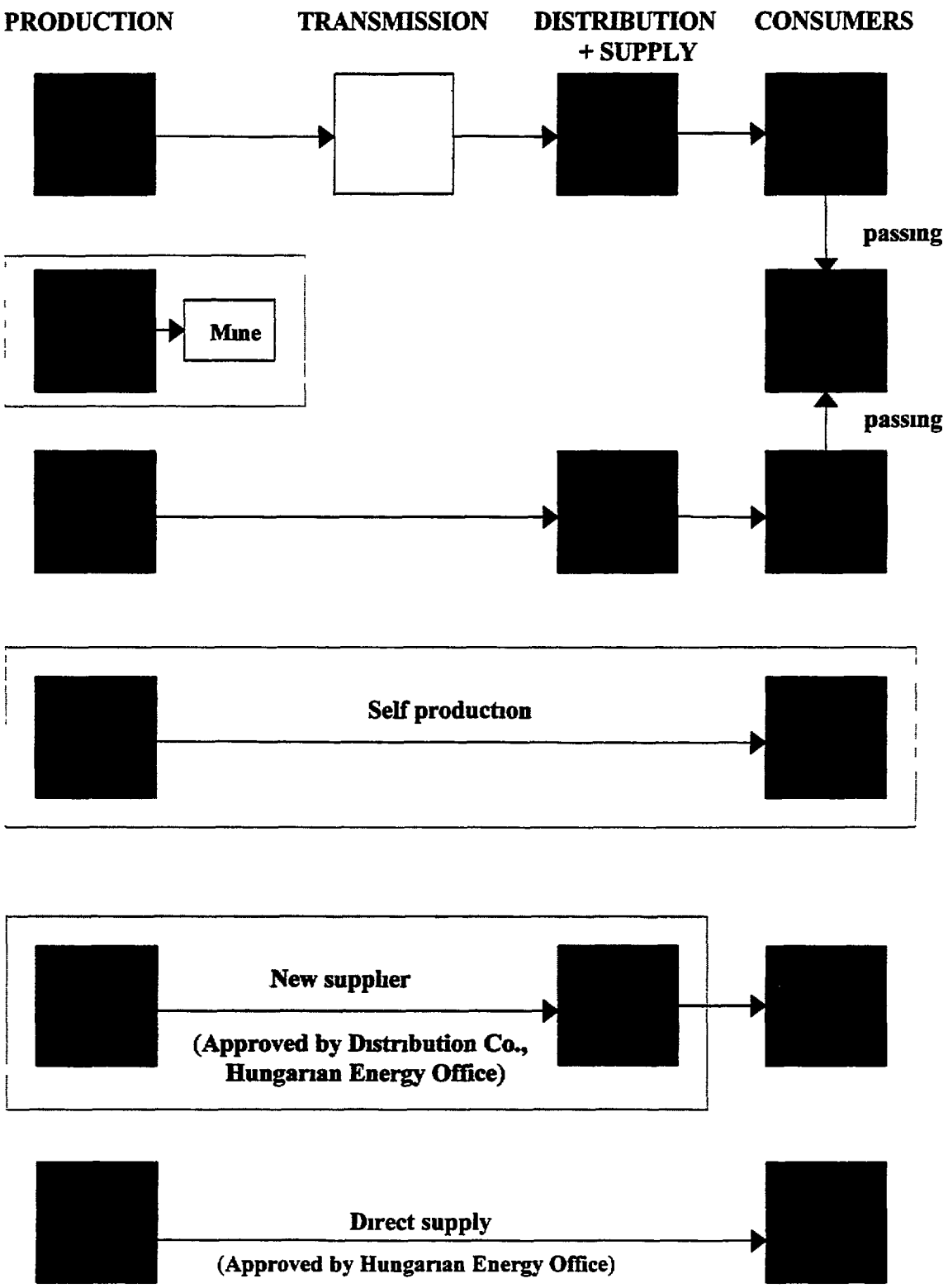
BASIC IDEA OF THE ELECTRICITY LAW
Operational model of the electricity system



ELECTRICITY SUPPLY
(different possibilities)



SITUATION IN WHICH GOVERNMENT DECIDED TO PRIVATISE ENERGY INDUSTRY:

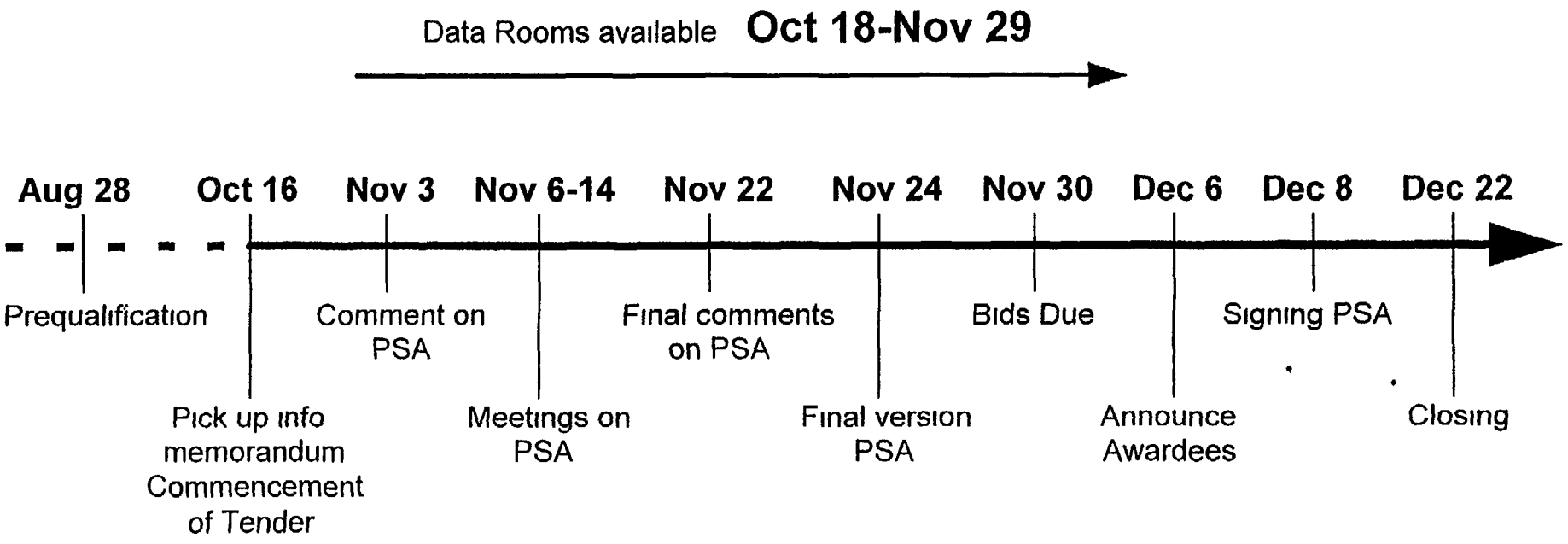
- HIGH DEBT SERVICE OF HUNGARY
- PROCESS IMPLEMENT MARKET ECONOMY
- OLD POWER PLANTS, DISTRIBUTION NETWORK - INVESTMENT NEED
- NEED FOR NEW CAPACITY

OBJECTIVES OF THE GOVERNMENT:

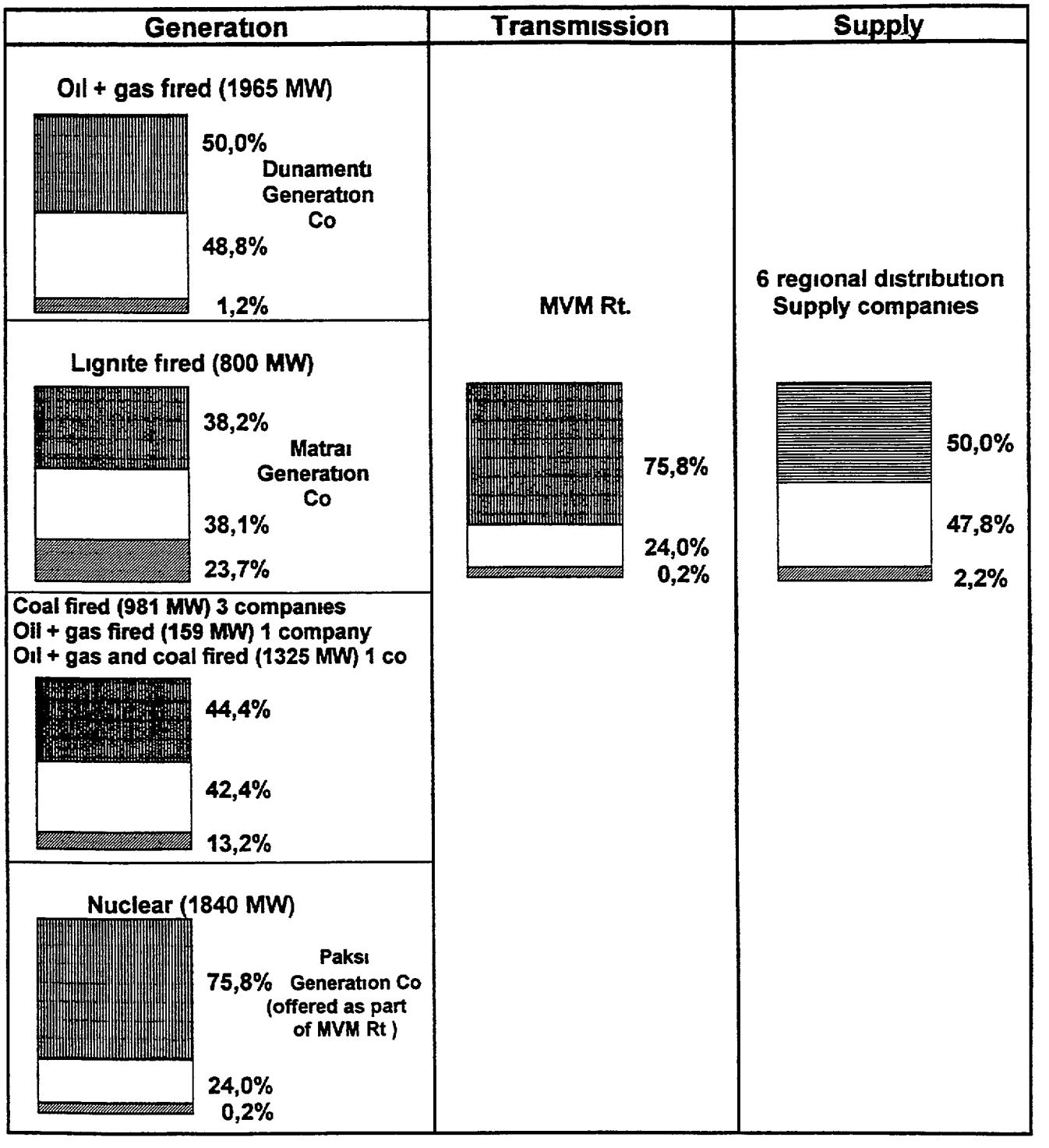
- IMPLEMENT MARKET CONDITONS INTO ENERGY INDUSTRY
- REDUCE RESPONSIBILITIES OF GOVERNMENT
- INVITE FOREIGN CAPITAL TO HUNGARY
- INCOME FOR THE BUDGET OF GOVERNMENT
- INCREASE EFFICIENCY, ENVIRONMENTAL PROTECTION OF ENERGY INDUSTRY
- FOLLOW INTERNATIONAL TREND (MORE COMPETITION IN ENERGY INDUSTRY)

III. Privatisation Process

Timeline



Offered Shares in 1995



Legend: MVM Rt; Offered shares (Direct & Indirect); Others; APV Rt. (State)

Offered Assets in 1995

(nominal value at 31st December 1995 of shares offered (@ HUF 130 USD1 00)
total **1898** M USD)

Generation	Transmission	Supply
Oil + gas fired (1965 MW) 126 M USD Dunamenti Generation Co Total 258 M USD	MVM Rt. 461 M USD Total 1920 M USD	6 regional distribution Supply companies 876 M USD Total 1839 M USD
Lignite fired (800 MW) 100 M USD Mátrai Generation Co Total 263 M USD		
Coal fired (981 MW) 3 companies Oil + gas fired (159 MW) 1 company Oil + gas and coal fired (1325 MW) 1 co 335 M USD Total 792 M USD		
Nuclear (1840 MW) 234 M USD Paksi Generation Co (offered as part of MVM Rt.) Total 974 M USD		

Legend MVM Rt | Offered assets (Direct & indirect) | Others | APV Rt. (State)

Sold Assets in 1995

(Total income 1.3 bn USD 118% of average nominal value at 31st December 1995 of shares sold)

Generation	Transmission	Supply
Oil + gas fired (1965 MW)		
Dunamenti Generation Co	MVM Rt	6 regional distribution Supply companies
Lignite fired (800 MW)		
Mátrai Generation Co		
Coal fired (981 MW) 3 companies Oil + gas fired (159 MW) 1 company Oil + gas and coal fired (1325 MW) 1 co		
Nuclear (1840 MW)		
Paksi Generation Co (offered as part of MVM Rt.)		

Legend: MVM Rt; Offered, not sold assets (Direct & Indirect); New Privat owner; Others; ÁPV Rt (State)

IV. "Lessons Learnt"

General Comments - Positive Aspects

- Strategic foot hold and opportunities for growth in the long term
- Framework established
  - energy law, regulations and regulatory authorities, PPA, pricing regulation, etc
- APV Rt/Government listened to investors, flexible changes made to PSA
  - golden share, environmental indemnification etc.
- General information provided informative (info memo's)
- Offer prices received and paid well above nominal value
- Guarantee of further investment of USD 3 billion
- Government's objectives mostly achieved
- Heightened Hungary's international reputation, privatisation step to integration with Western Europe
- Future efficiencies expected in future - impact on price for consumers

IV. "Lessons Learnt"

General Comments from Investors - Negative Aspects

- Process was too short (45 days)
- Full due diligence process not able to be performed
- "Too many" changes during process relative to perceived risk/uncertainity
- Coal mines integrated with power plants
- Paks in MVM ownership
- Pricing regulation and formula
  - understandability / complexity
  - uncertainity in future price increases, allocation
- Lack of new Environmental Protection(Emission) Limits
- Only 2 of the 7 Generation Companies successfully sold

IV. "Lesson Learnt"

General Comments - Suggestions

- Clear model (responsibilities, rights, duties)
- Taking into consideration domestic constrains (legal, economical, technical, political, etc.)
- Preparing feasibility studies (Impact; on prices, on new investment)
- Clear future role of the Government
- Privatisation income versus future prices
- Market dominance
- Regulatory power (Customer + Investor Confidence, Stability, Continuity, Predictability in Decisions, Fairness)
- No Hurry But Clear Signals, Exact Decisions
- Someone (Who want to and who can restructure / privatise) Take the Lead

IV. "Lessons Learnt"

Now what?

- PPA implementation
- Putting structure into practice
- Collaboration and partnership between investors, Hungarian Energy Office, Government, unions, municipalities
- Phase II of privatisation
  - remaining generation facilities
  - MVM Rt
- Positive momentum of Hungary in taking leadership role in Eastern European transition of the electricity industry to meet global competition

IV. "Lesson Learnt"

General Comments - Suggestions

- Clear model (responsibilities, rights, duties)
- Taking into consideration domestic constrains (legal, economical, technical, political, etc.)
- Preparing feasibility studies (Impact; on prices, on new investment)
- Clear future role of the Government
- Privatisation income versus future prices
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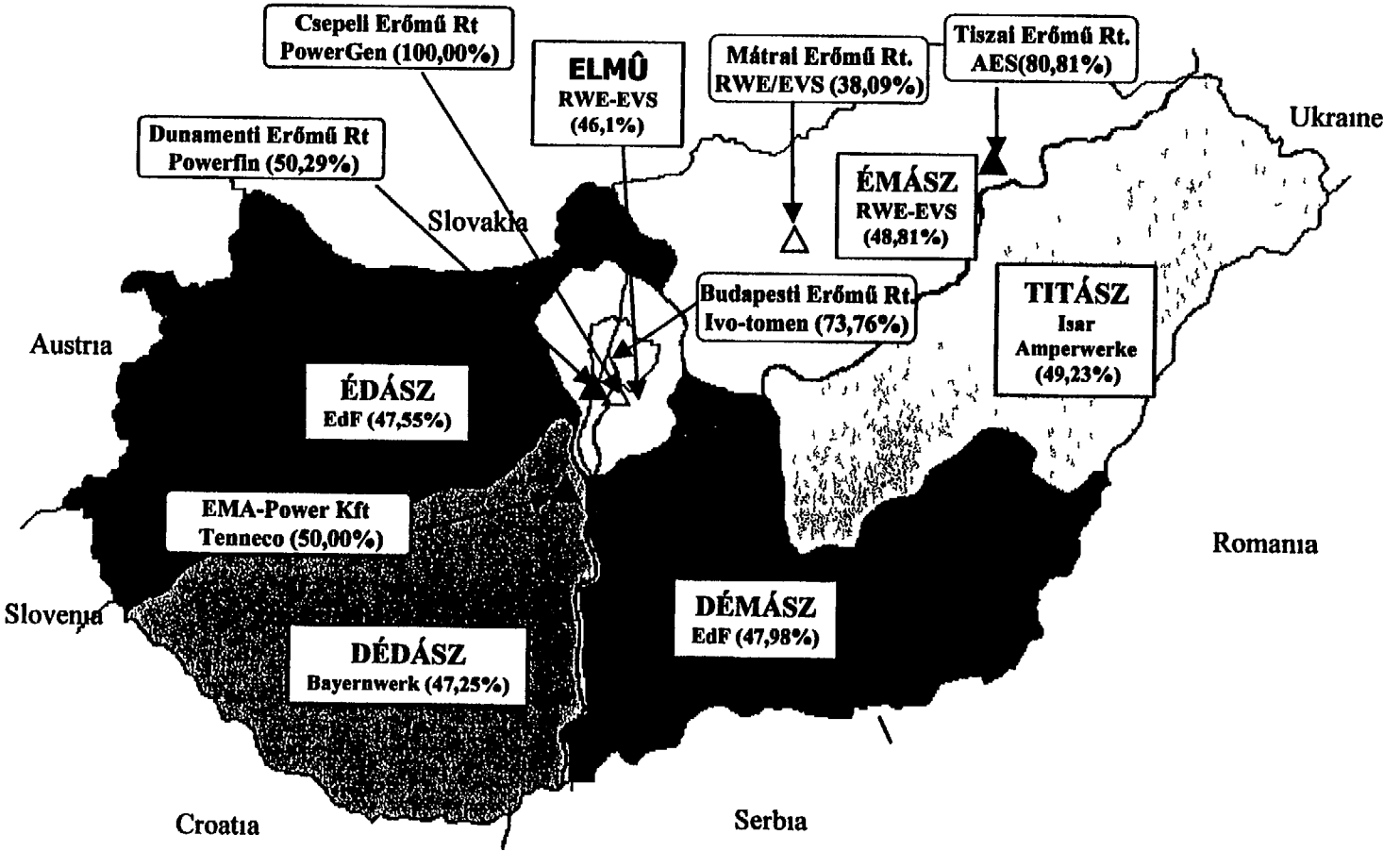
Foreign Joint Proprietors of Electricity Suppliers



French capital participation | German capital participation | German capital participation | German capital participation

Belgian capital participation | Powerstations | English capital participation | US capital participation

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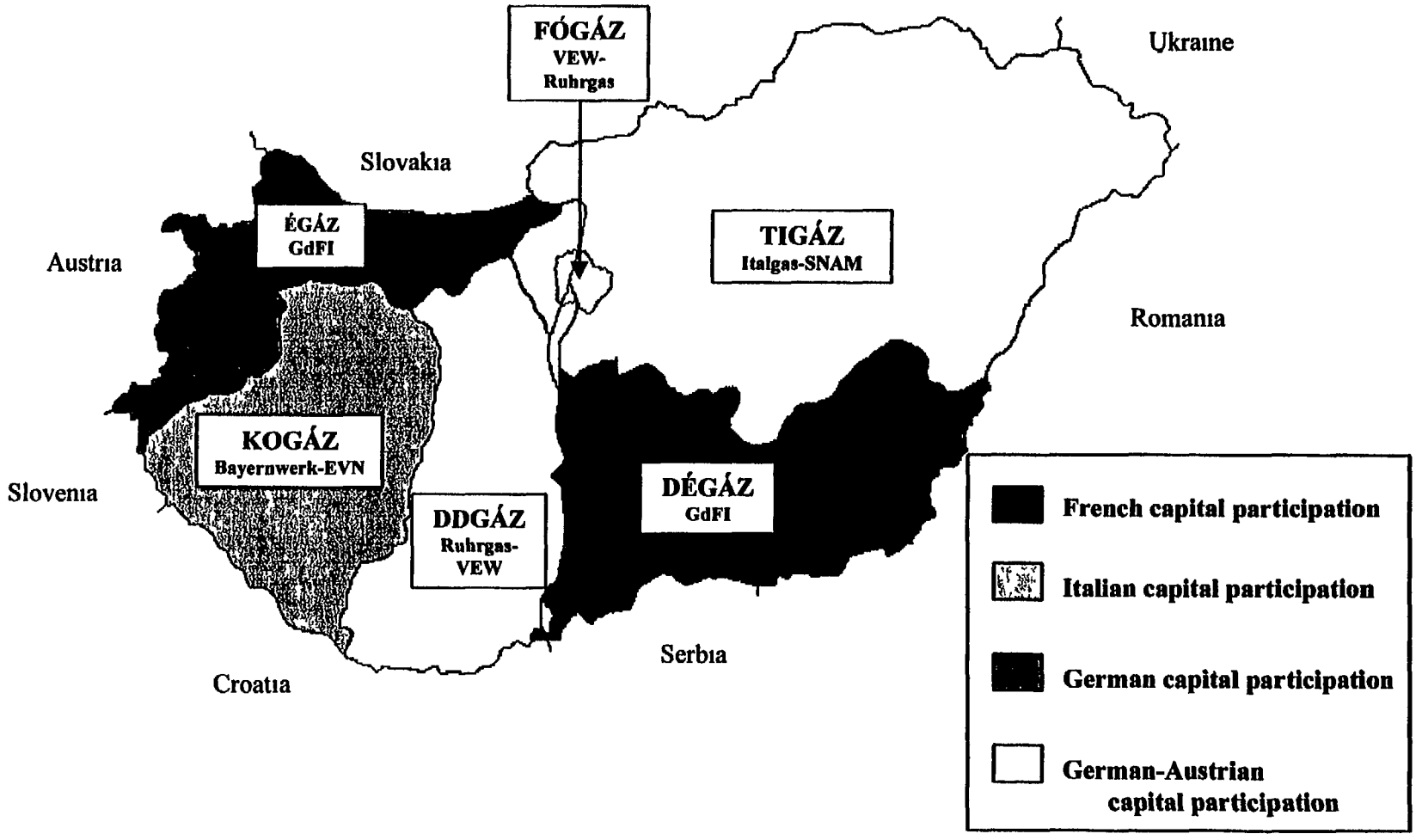
HUNGARIAN ENERGY OFFICE

Foreign Joint Proprietors of Gas Suppliers



ISSUED RESOLUTIONS BY THE HUNGARIAN ENERGY OFFICE
RELATED TO THE ELECTRICITY LICENSING

	1995	1996	1997
OPERATIONAL LICENSES			
– GENERATION:			
– PUBLIC	11	2	1
– AUTO GENERATION		1	
– TRANSMISSION	1		
– SUPPLY			
– REGIONAL	6		
– DIRECT SUPPLY	1	3	1
ESTABLISHMENT LICENSES			
– PRELIMINARY	4	2	1
– ESTABLISHMENT (CONSTRUCTION)	4		
– COMMISSIONING	2	1	
APPROVAL OF SHARE TRANSFER	16	9	4
APPROVAL OF DISPOSAL OF ASSETS		4	

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ISSUED RESOLUTIONS BY THE HUNGARIAN ENERGY OFFICE

RELATED TO THE ELECTRICITY LICENSING

	1995	1996	1997
AMENDMENT O OPERATIONAL LICENSE		22	8
AMENDMENT OF ESTABLISHMENT LICENSE		5	
APPROVAL OF OPERATIONAL CODE	1		
APPROVAL OF BUSINESS CONDUCT RULES	1+8		
AMENDMENT OF OPERATIONAL CODE		1	1
ISSUED GUIDELINES			1
– INFORMATION ON OUTAGES	18		
– SURVEY OF CONSUMER SATISFACTION		6	
– CONTENTS OF THE FEASIBILITY STUDIES		1	
– CONTROL OF THE BUSINESS PLAN		1	
ORDER OF RESTRICTION			
– SETTING		1	
– AMENDING			3

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LESSONS TO BE LEARNED IN THE LICENSING PROCEDURE

- PREPARE LEVEL PLAYFIELD FOR EACH LICENSEE HOLDERS

- USE LAWYERS

- TAKE CARE ON;
  - •• CONSUMER CONFIDENCE
  - •• INVESTOR CONFIDENCE
  - •• STABILITY, CONTINUITY AND PREDICTABILITY IN DECISIONS
  - •• FAIRNESS
  - •• PUBLIC RESPONSIBILITY FOR ACTIONS

- CLEAR REQUIREMENTS (CONDITIONS) – FIT TO MEDIUM TERM GOALS (→GIVE EXTENSION, POSTPONED DEADLINES)

LESSONS TO BE LEARNED IN THE LICENSING PROCEDURE

- CONSULT
  - OTHER REGULATORY BODIES ON METHODS OF REGULATION
  - LICENSE HOLDERS ON REALITY
  - CUSTOMERS ON THEIR EXPECTATION

- CLEAR RESPONSIBILITIES (GIVE FREEDOM FOR LICENSE HOLDERS)

- USE ADVISORS FAMILIAR WITH THE ELECTRICITY SYSTEM, INTERNATIONAL MARKET, TENDENCIES

POTENTIAL FIELD OF LICENSING RELATED CO-OPERATION

- MODEL QUESTIONS
- CONTENT OF LICENSES
- LICENSING PROCEDURES
- HOW TO MEASURE THE LEVEL OF SUPPLY
- COMPLIANCE MONITORING
  (REQUIRES DATA, INFORMATION + ANALYSIS)

CENTREL REGIONAL ROUNDTABLE FORUM

PRAGUE, JANUARY 20-22, 1998

HUNGARY'S EXPERIENCE WITH COMPETITION

CAPACITY TENDERS

ZOLTÁN TIHANYI, MVM RT.

STRUCTURE OF HUNGARIAN ELECTRIC POWER INDUSTRY

HUNGARIAN POWER COMPANIES LTD. (MVM RT.)

- SINGLE BUYER
- OWNER OF TRANSMISSION GRID
- OWNER OF GRID OPERATING CO. (OVIT)
- OWNER OF PAKS NUCLEAR POWER PLANT CO.

6 DISTRIBUTION COMPANIES

- REGIONAL MONOPOLIES ON 120 KV AND BELOW

7 PRIVATE GENERATING COMPANIES

- IPPs
- LONG-TERM CAPACITY AND ENERGY PURCHASE CONTRACTS WITH MVM RT.

SEVERAL SMALL IPPs

- COGENERATION
- RENEWABLES
- INDUSTRIAL POWER PLANTS
- CONTRACTED EITHER BY MVM RT. OR BY DISTRIBUTION CO-s

REGULATION

HUNGARIAN ENERGY OFFICE (MEH)

- LICENCES FOR OPERATION AND/OR BUILDING OF CAPACITIES
- SETTING PRICES OF BOTH POWER AND ENERGY
  - WHOLESALE
  - RETAIL

GOVERNMENT

MINISTRY FOR INDUSTRY, TRADE AND TOURISM
MINISTRY FOR ENVIRONMENTAL PROTECTION

PARLIAMENT

MUNICIPALITIES

OFFICE FOR COMPETITION IN ECONOMY

INVITING TENDERS FOR BUILDING NEW CAPACITIES

WHY MVM RT.?

- SINGLE BUYER WITH OBLIGATION TO SERVE ON GRID

BASED ON COUNTRY STRATEGY

- LONG-TERM CAPACITY PLANNING
  - ROLLING PLAN
  - ACCEPTED BY PARLIAMENT

- DEMAND ESTIMATION
- CAPACITY MANAGEMENT
- PRIMARY ENERGY SOURCES
- ENVIRONMENTAL ISSUES

TWO SEPARATE TWO-PHASE TENDERS

1. - NEW CAPACITIES BETWEEN 20-200 MW BY 2001-03
   - RETROFIT - 3 YEAR'S LONGER LIFE-TIME OR
     - 10 % INCREASE OF CAPACITY

   600-1000 MW

2. - NEW CAPACITIES MORE THAN 200 MW EACH BY 2005
   - NO NATURAL GAS!

   800-1400 MW

1ST PHASE: TECHNICAL PART

NEGOTIATIONS WITH MVM RT.

2ND PHASE. UPDATED TECHNICAL PART + BUSINESS INFO

WHO CAN COMPETE?

- ENTERPRISES LOCATED IN HUNGARY

    - HAVING PRELIMINARY OR FINAL LICENCE TO BUILD POWER PLANT OR
    - GENERATION/DISTRIBUTION CO-s

- ENTERPRISES, THE MAJOR OWNERS OF WHICH ARE

    - EXPERIENCED IN MANAGING, BUILDING, MANUFACTURING SIMILAR POWER GENERATING UNIT(S) (CAPACITY, FUEL, TYPE)

    - ABLE TO FINANCE SUCH PROJECT (OWN CAPITAL)

COMPETITORS SHOULD HAVE

- PRELIMINARY FEASIBILITY STUDY
- PRELIMINARY BUSINESS PLAN
- AUDITOR'S REPORT
- PRELIMINARY STUDY ON ENVIRONMENTAL IMPACTS
- STANDPOINT OF COMPETENT INSPECTORATE FOR ENVIRONMENTAL PROTECTION

WINNERS

CAN PRECONTRACT MVM RT. FOR PURCHASING THEIR CAPACITY AND ENERGY PRODUCED IN THE LONG RUN.

THIS IS NEEDED TO GET A LICENCE FROM MEH.

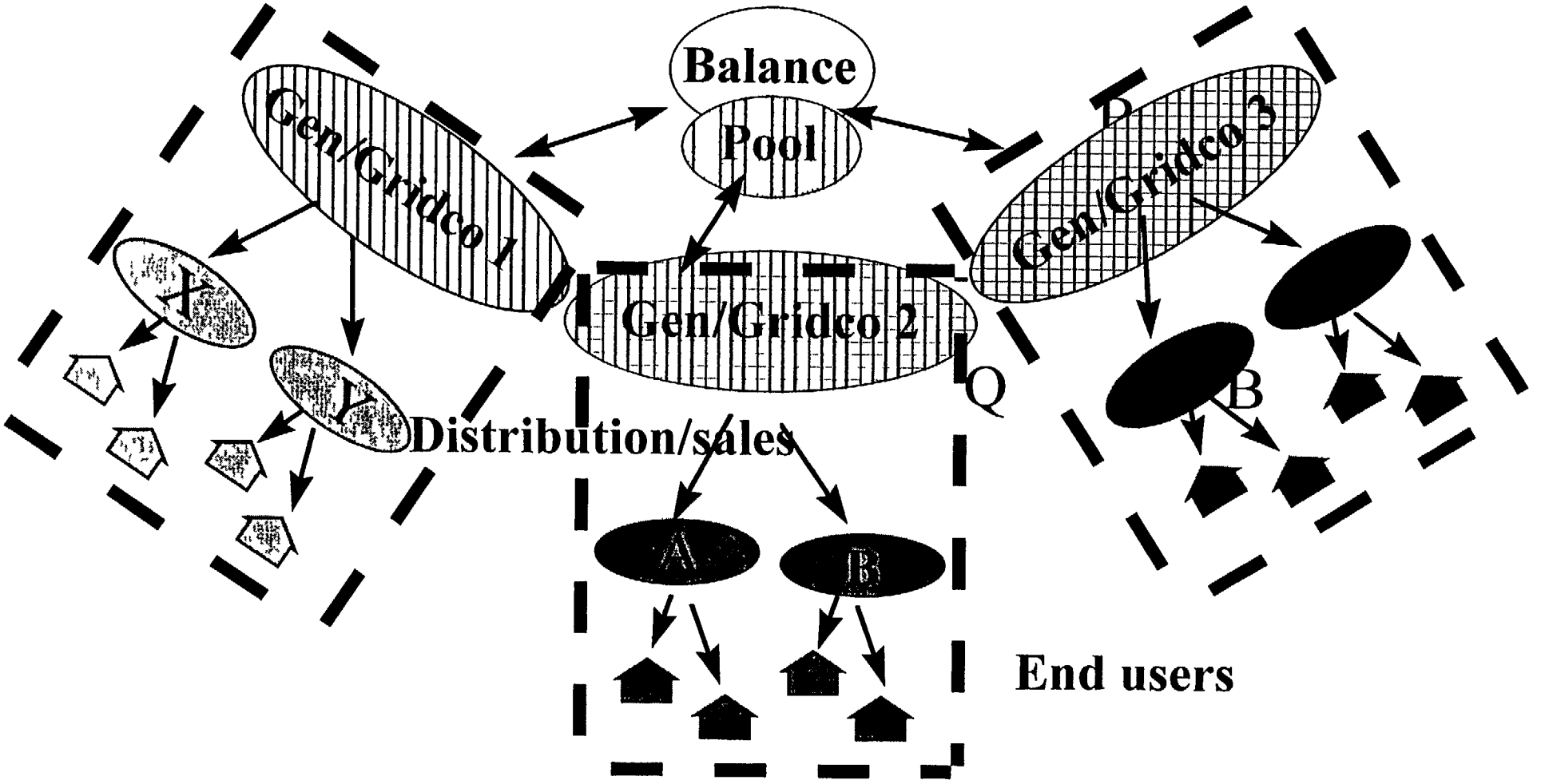
ROUGHLY 10 TIMES MORE TENDERS FOR 1ST PHASE.

2ND PHASE: APRIL-MAY, 1998

Nordic electricity market (pre 1992)

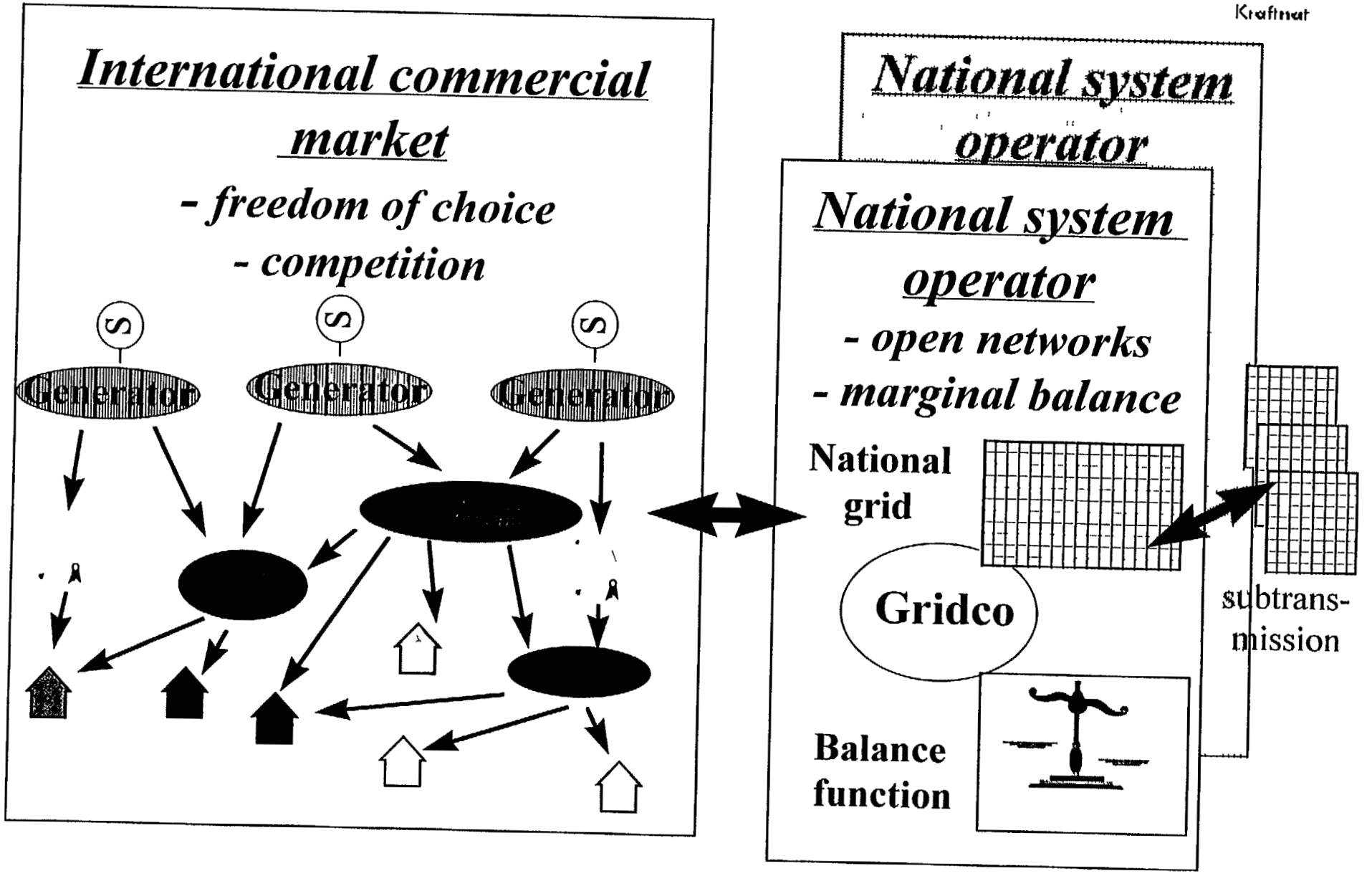
Svenska Kraftnat

- *monopolies and oligopolies (co-operation)*
- *no access to alternative market places*



Nordic electricity market (from 1996)

Svenska Kraftnat

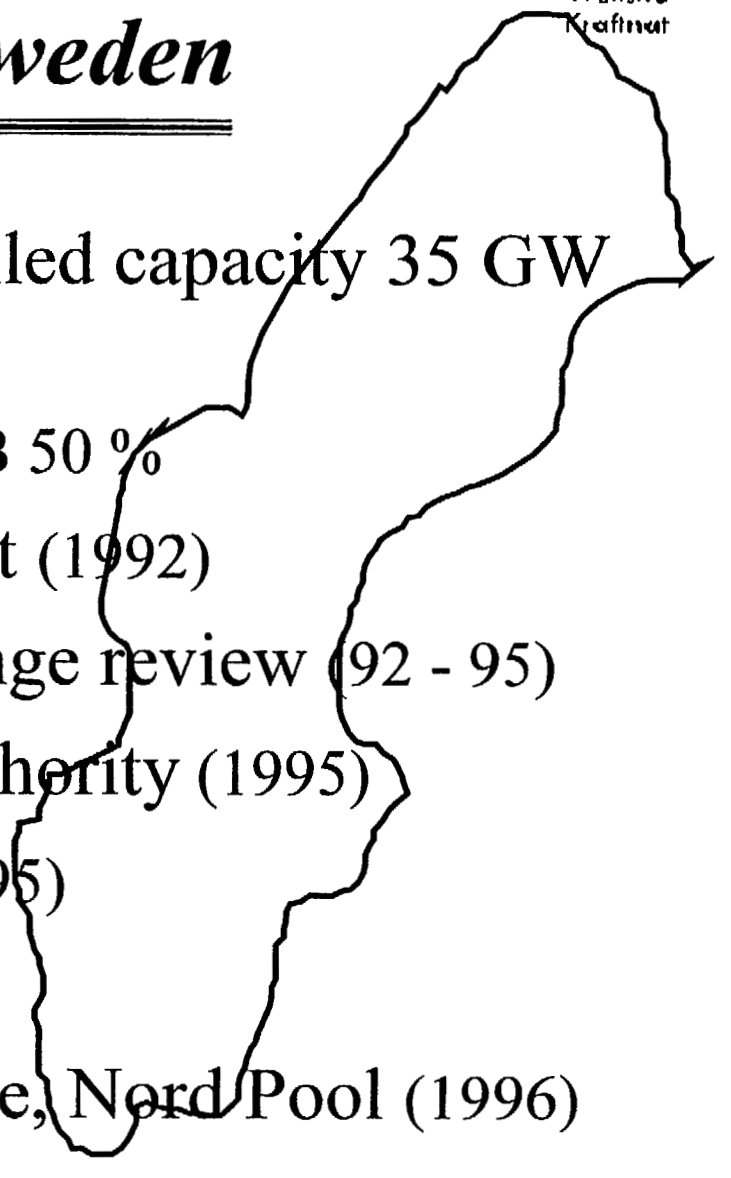


Svenska Kraftnat

Background - Norway

- Demand 110 TWh / year; Installed capacity 27 GW
  - all hydro
  - dominant generator, Statkraft 30 %
- New electricity law (Jan 1991)
- Grid company, Statnett - system authority (Jan 1992)
- Nodal tariff (May 1992)
- Trading exchange (Statnett Marked 1993, NordPool 1996)
- Statnett coordinates all foreign electricity trade

Background - Sweden



- Demand 140 TWh / year; Installed capacity 35 GW
  - hydro 50 %, nuclear 50 %
  - dominant generator, Vattenfall AB 50 %
- Grid company, Svenska Kraftnät (1992)
- Electricity law & trading exchange review (92 - 95)
- Modified law, SvK's system authority (1995)
- Nodal tariff on national grid (1995)
- New law - open networks,

  - joint trading exchange, Nord Pool (1996)

Background - Finland

Svenska Kraftnat

- Demand 60 TWh / year; Installed capacity 14.5 GW
  - hydro 35 %, nuclear (20%), other thermal (45 %)
  - dominant generator, IVO 45 %
- Electricity law & trading exchange review (92-95)
- New electricity law (June 95)
  - soft transition (Nov 95 > 500 kW, Jan 97 < 500 kW)
  - nodal tariff
- System authority complicated - still under review
  - 2 grid companies from 1992, merged 1997 (Fingrid)
  - foreign links owned by generator IVO (until July 96)
  - private balance company (97) - to Fingrid July 98?
- National Trading exchange, **EL-EX** (Aug 96) - to Fingrid Jan 98

Background - Denmark

Svenska Kraftnat

- Demand 35 TWh / year; Installed capacity 10 GW
  - all conventional thermal
  - ELSAM 55 %, ELKRAFT 45 %
- Vertical integration until 1996
- Emphasis on energy and environmental politics
  - combined heat and power schemes
  - wind power (about 375 MW)
- ELSAM split (Jan 97, separate grid company, ELTRA, Jan 98)
- New electricity law (Jan 1998)
  - Open access > 100 GWh / year
  - proposed May 1996, accepted by EU December 1997

Nordic electricity supply data

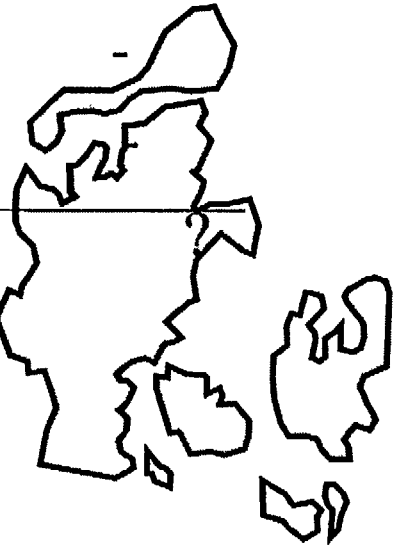
Svenska Kraftnat

	Norway	Denmark	Sweden	Finland
Demand (TWh/yr)	110	35	140	60
Installed (GW)	27	10	35	15
• hydro (%)	100	0	50	35
• nuclear (%)	0	0	30	20
• conv. thermal (%)	0	100	20	45
Dominant generator	Statkraft (30%)	ELSAM (55%) ELKRAFT (45%)	Vattenfall (50%)	IVO (45%)

Nordic electricity deregulation

Svenska Kraftnät

	Norway	Sweden	Finland	Denmark
New legislation	Jan 91	Jan 96	June 95	-Jan 98
Grid company	Statnett (Jan 92)	Svenska Kraftnät (Jan 92)	Fingrid (Sep 97)	Eltra (Jutland) (1998)
• nodal tariff	May 92	Jan 95	Nov 95	-
• balance authority	Jan 92	Jan 95	July 98	-
• trading exchange	Jan 93	Jan 96	April 98	
Joint market	Jan 96			
	April 98			



Svenska Kraftnat

New Electricity Acts - common features

- All networks open, nodal tariff
- Gridco has system operating responsibility (not finalized in Finland)
- Network services separated from generation & sales
- Regulator supervises network tariffs

Gridco perspective

Svenska Kraftnät

- Open networks - new solutions
  - nodal tariff
  - constraints
  - losses
- Independent system operations authority
  - balance service (close contact with spot market)
  - complex balance settlement
- Promoting competition
  - electricity trading exchange (spot and financial products)

Player perspective

Svenska Kraftnät

- 3 components for electricity
  - ***network access*** (tariff) - network company (monopoly - tariff)
  - ***energy*** (foreseen kWh) - sales company (competition - negotiated price)
  - ***balance power*** (unforeseen kWh) -Gridco (directly or indirectly)
- Free trade in energy (even internationally)
- Visible energy prices
  - via trading exchange (Nord Pool)

Problem areas

Svenska Kraftnät

- Physical network capacity
  - total / available
  - especially between countries
- Distorted competition
  - dominance of large generators
  - different rules within the involved countries
  - currency conversion
  - language difficulties
- Trading rules for non-TPA countries

Capacity for import / export

- physical (subscribed 98)

Svenska Kraftnat

Norway - Sweden

* Free access but old priority agreements (until 98)

1800 - 2400 MW

1800 - 2400 (400) MW)

Sweden - Finland

* No free access (until 99?)
* Extra tariff[1] (about 3 USD / MWh)

1500 MW

1700 (480) MW

1000 (1000)MW

1900 (400) MW

2100 (2100) MW

Sweden - Denmark

* No free access
* Extra tariff [1]

(about 10 USD / MWh ←
-"- 13 USD / MWh →)

1) Compare: *Spot prices (1997) about 7 - 50 USD / MWh*

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Different rules

Svenska Kraftnät

- Electricity market
  - different charges in nodal tariff
  - special border tariffs to Finland & Denmark (HVDC costly)
  - different principles for handling balance (not yet neutral in Finland and Denmark)
- Energy taxes and environmental charges
  - production & consumption charges in Norway & Sweden
  - only consumption charges in Finland and Denmark
  - different levels

Svenska Kraftnät

Advantages of a common (Nordic) market

- Better functioning trading exchange
  - larger volume - better liquidity
  - more competitive- large players less dominant
  - representative prices
- Traditional advantages with interconnection
  - increased diversification
  - shared reserves, etc

Thursday, January 22, 1998

10 30 AM--General Discussion of Key Issues

This session is divided into two panel discussions, each taking about one hour It is hoped that the panels can be composed as follows

Panel #1	**Panel #2**
Facilitator Howard Menaker, Bechtel	Facilitator Russell Brown, Bechtel
Participants Leszek Juchniewicz, Poland, ERO	Participants Pavel Brychta, Czech MoIT
Gabor Szorenyi, Hungary, HEO	Andras Kacso, Hungary, MVM
Dusan Slamka, Slovakia, SE	Peter Prochazka, Slovak MoE
Erik Schmidt or Miroslav Vrba, Czech CEZ	Marek Zerka, Poland, PSE

Please note that each panel has two regulatory representatives and two utility representatives, each from different countries It is felt that two panels are better than one as this will provide the opportunity for more people to participate, thereby presenting more views

Each participant will be asked to make a short presentation regarding the key issues considered most important to himself and his country, after which the session will be opened to comments, suggestions, and questions from all other attendees If you wish, your presentation can also include a critique of this second roundtable, i e , what was useful, what was not useful, and what should be amplified further in the future

Included herein is a preliminary list of key issues developed from the first roundtable (held in Warsaw in September 1997) and from this second roundtable, at least so far This list will be refined and finalized at the end of the day on Wednesday, January 23 Consequently, those of you on both panels are requested to remain at the end of todays session to assist in refining the issues list Then the key issues will be divided up between the two panels for detailed discussion on Thursday, January 22

The objective of these panel discussions is to address as many important issues as possible while here in Prague as a basis for (1) additional presentations and discussions at future roundtables, (2) ultimately, when all roundtables are completed, the finalization of a key issues listing, and, (3) most hopefully, ultimate resolution of as many issues as possible or, at the least, a plan or a course of action to come to some sort of closure on all unresolved issues

Preliminary Listing of Key Issues

[As a reminder, the thrust of the next roundtable to be held in the spring will be Contracts and Management of Risk]

1 Issues to be resolved regarding EU harmonization on an individual and a regional (CENTREL) basis Is new or revised energy legislation a requirement? Is the exchange of information among CENTREL countries desirable during the preparation of new legislation? How could this be accomplished?

2 The creation of competitive markets Plans and problems related to EU requirements for minimum competition first in February 1999 and again in 2000 Sub-issues would include such things as elimination of cross subsidization, transparency and separation
of costs, the creation of fair and equitable minimum standards for licensing of enterprises, and the like

3 Additional issues related to licensing such as ownership limits, affiliate limits, consumer minimum standards, authority/autonomy
of economic regulator, etc

4 Approach to the generation tendering process on individual or regional basis

5 How to ensure non-discriminatory dispatch of generation

6 Import and export within CENTREL, UCPTE, all of Europe, and non-member EU states

7 Pricing of transmission, distribution, and ancillary services Also, the need and/or desire for a CENTREL ISO

8 Possibility/desirability of a CENTREL "pool" Implications foi UCPTE membership Development of a spot market?

9 Miscellaneous Stranded costs, social/public service obligations, etc

The introduction of competition in the electricity market is a complex process involving the removal of a variety of seemingly unconnected barriers Strong historic, natural, cultural, socioeconomic factors, etc are in play

What were and are the main reasons for changes in the World

- to promote greater efficiency
- to attract new investment
- to enhance security of supply
- to lower prices
- to eliminate unacceptable price differences within countries
- to improve performance of industry
- to improve quality of service
- to enhance scope of service
- to eliminate monopoly power
- to remove subsidizing and cross-subsidizing
- to raise funds for the state budget
- to promote competitiveness of Europe in the global world economy
-

This is not a complete list of items

Requirements to ensure and protect security of supply, support the general economic interest, and in many cases further requirements contributing to the solution of social issues were and are present in our countries

Let me now, from my point of view, touch key issues listed by Howard

1 **The energy legislation**

Deputy Minister Mr Tvrznik mentioned on Tuesday morning the prepared amendment of our Energy Act It will be an improvement of the current law, but this amendment, focusing esp (or only ?) on regulatory issues, does not solve harmonization of Czech energy legislation with EU legislation

What I feel as most important Changes must be driven by a clear vision of the future, of the envisioned design of the competitive market in the Czech Republic I am afraid that, so far, there exists no clear and acceptable vision in the Czech Republic

2 **EU requirements for minimum competition**

Subsidies removing - the newly appointed government announced that deregulation will continue, in the case of electricity in two steps in this and next year, each time over 40% It is a result of a shilly-shally policy in the past And the question of social acceptance and political boosting is back again as a boomerang and unfortunately, in greater dimension

Unbundling - separation of functions - generation, transmission, distribution and trading- is not a target per se but a corner-stone of transparency which, per se, inhibits cross-subsidies and facilitates a fair competition It is not a tool for „divide and govern" purposes

3 **Issues related to limits** (such as ownership, affiliate, etc)

Well, I agree with DG XVII representative Mr Jones The first question must be „Why limits" and the second question „Is it the best, least restrictive way from the competition point of view Markets don't love limits, constrains, restrictions

Second part of this point No 3 is for me more interesting - authority and autonomy of regulator I am joyous of a significant shift of our regulator in the ministry organization chart from the underground to light and nearness to the Minister But what is essential ?
Allow me to help myself with an analogy in football When players are fouling or immature, the referee must be present and visible But the game is not very attractive for the audience in this case The game is great if the referee is present but invisible And when players play with endeavor, and fair

4 **New capacity issue**

If you remember our silent yesterday morning, when John asked us for response regarding this issue, you can guess, that this process is not under full control in the Czech Republic On the one side you can find that there are no significant restrictions for new comers, except common legal requirements for undertakings and also their „environmental behavior" On the other side, now only a contract with the network owner (not with final customers) can bring the money back But it is a theme for a long discussion Let me select one issue - security of supply We in CEZ feel very strongly that LOLP horror can come soon New capacities like co-generating units and their firm contracts directly with discos increase demand for regulation and reserves dramatically

5 **How to ensure non-discriminatory dispatch in our conditions**

Only two alternatives are possible cost-based per unit, and for all, or bid-price based for all again Even if one company runs only one unit and another 50 Each mix of cost and prices is a road to hell

Let me skip point number 6

7 and 8 **CENTREL ISO or Poolco**

Very briefly a good idea in wrong time We feel absence of common will among CENTREL companies due to the absence of commonly shared driving forces, combined with the internal problems of our countries and power industries But let's start with analysis of pros and cons, possibilities and barriers

9 **One example and question**

Does suppressed utilization of desulphurised units due to base load contracts with IPPs and/or imports of cheap but uncleaned electricity lead to stranded costs? I think, in our case, yes
Let me close my short presentation with ČEZ hopes concerning the future development of the electricity market in the Czech Republic and generally in Central Europe

- clear vision and unambiguous rules, predictable behavior of regulator - a level playing field and a competent referee
- on the other side, sanctions, if a player breaks the rules - no tolerance for free riders
- principle of reciprocity by opening closed markets
- respect for ownership - changes driven by empty budget or the „divide and govern" principle are simple but don't solve the problem
- respect for national differences
- broad acceptance of all stakeholders is half way to success

CENTREL REGIONAL ROUNDTABLE FORUM
Prague, January 20 - 22, 1998

Trans-European Energy Networks development as the element of creation of competitive electricity markets in Europe

Benefits of TENs initiative

- Improvement of the reliability of electricity supply and energy security
- Diversification of fuel sources
- Reduced dependence on dominant external suppliers of primary energy sources
- Development of competitive energy markets
- Limitation of isolation effects for less developed regions for enabling them the access to diversified sources of energy on competitive prices
    - increase of economic and social coherency

Responsibilities

- **Power Industry Companies:**

  - elaboration and financing of necessary analyses and feasibility studies
  - realisation of projects

- **Governmental authorities:**

  - elaboration and implementation of legal framework
  - administrative decision, construction permits

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EU Priorities for TENs development

- connections with isolated energy networks
- improvement of networks interconnections within EU member countries
- improvement of internal connections within national energy networks
- construction of new- or improvement of existing energy networks connections with third countries

List of common interest projects „D"

„Development of power exchange interconnections with third countries in Europe and in the Mediterranean Region for improvement of reliability and supply security within EU"

- d2 Germany - Poland reinforcing of interconnections between power systems (modernisation of lines Mikułowa-Hagenwerder, and Neuenhagen-Vierraden- - Krajnik)
- d14 Baltic Ring. - Germany, Poland, Russia, Estonia, Latvia, Lithuania, Sweden, Finland, Denmark, Byelorussia
  Reinforcing and development of interconnections between power systems of these countries by lines and/or cables
  Decision of DC submarine cable construction connecting Poland and Sweden have already been made as well as study related to the possibility of AC connection between Poland and Lithuania have been elaborated
- d16 UE, Byelorussia, Russia, Ukraine development of connection and back-to-back stations between extended UCPTE system and third countries systems in Europe.

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UE declaration related to creation of adequate conditions for TENs development

- promotion of technical Cooperation between operators responsible for management, monitoring and control of TENs
- promotion of Cooperation between UE member countries enabling procedures of construction permits obtaining
- possible financial support for common interest project within TENs budget

UE financial tools for TENs development

- separate TENs budget
- structural funds, (ERDF - European Regional Development Fund)
- special programme, PHARE, TACIS, MEDA
- EIB loans (European Investment Bank)
- ECSC loans (European Community of Steel and Coal)
- EIF guarantees (European Investment Fund)

CENTREL goals

- Improve the system quality
- Co-ordinate the UCPTE interconnection
- Co-ordinate the development of the power system
- Organise beneficial energy transaction
- Co-ordinate Cooperation with other power systems
- Exchange experiences on transformation, privatisation, and energy law

CENTREL
Preparing for the Future

- 400 kV line from Hungary to Croatia and Slovenia
- 220 kV and 400 kV lines from Hungary to Austria
- 400 kV line from Hungary to Slovakia
- 400 kV line(s) from Hungary to Romania
  (depends on availability of Mukachevo connection in Ukraine)
- 400 kV line from Poland to Slovakia
- 400 kV line from Poland to Lithuania
- DC submarine cable from Poland to Sweden

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CENTREL
Trading Partners

- **Poland**
  Germany, Austria, Switzerland, Czech Republic, Slovakia, Hungary

- **Czech Republic**
  Austria, Germany, Hungary, Slovakia, Poland

- **Slovakia**
  Czech Republic, Poland, Ukraine, Hungary

- **Hungary**
  Slovakia, Austria, Croatia, Yugoslavia, Romania, Ukraine

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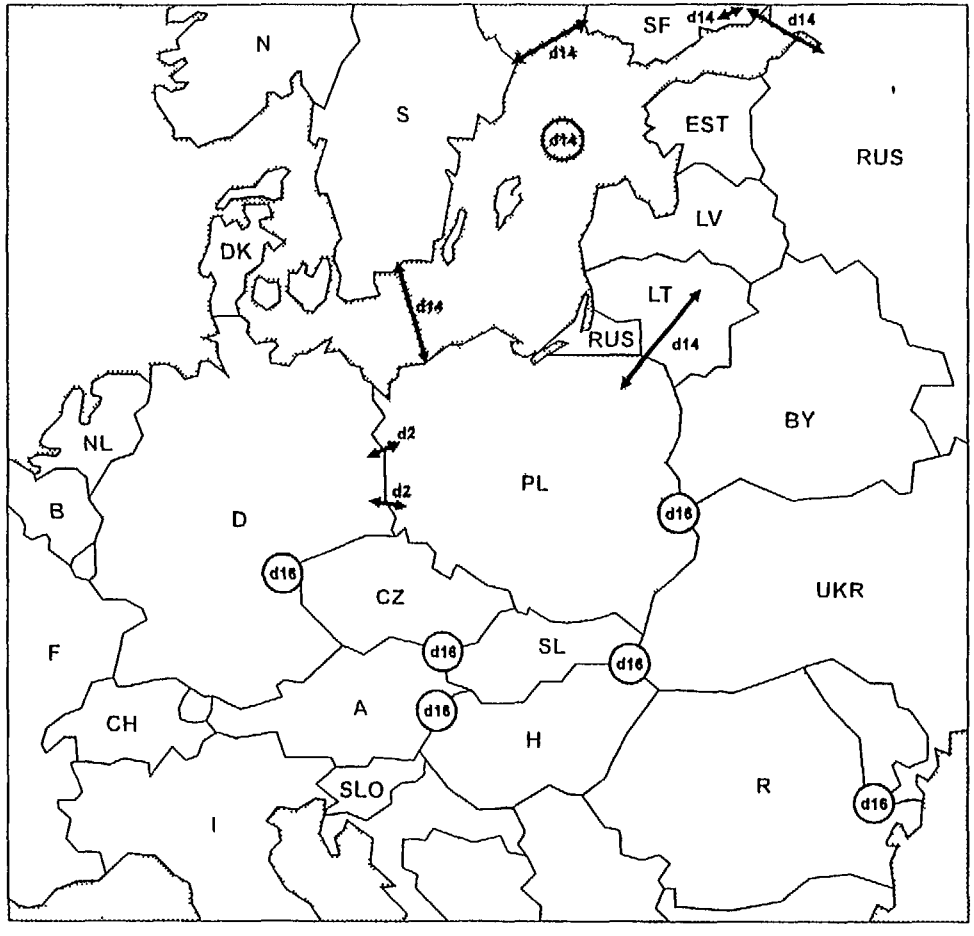
TENs initiative
Development of power exchange interconnections
List „D"



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VIEW OF HUNGARIAN REGULATOR

- ANALYSE THE NECESSARY AND RATIONAL STEPS TO HARMONISE THE LEGAL FRAMEWORK

- WHAT WE REALISED AS NECESSARY STEPS TO START DEVELOPING AS SOON AS POSSIBLE

- AVOID – IF POSSIBLE – TRANSIENT ACTIVITIES WHICH COULD DESTROY THE FUTURE COMPETITION

- TRANSIENT STEPS:
  - TRANSMISSION PRICING
  - MINIMISE NEW INVESTMENT OVER THE ESTIMATED FUTURE EU MARKET PRICE
  - MORE TRADE AMONG CENTREL

PRACTICAL STEPS

- CALCULATE THE OVER – CAPACITY IN CENTREL

- COMPARE THE ADVANTAGES OF TRADE TO NEW INVESTMENT (IMPORT PRICE – NEW CAPACITY PRICE)

IF THERE ARE ADVANTAGES;

- ASK GOVERNMENTS TO GIVE POLITICAL SIGNALS TO THE OTHER GOVERNMENTS

- CREATE TRANSPARENT TRANPORT PRICING METHOD

First!

February 4, 1998

Geir Ramleth Joins Uwi com Board of Directors, Internet and Telecommunications Visionary Key to Extending Internet Forms Company Market Leadership

VICTORIA, BC--(BUSINESS WIRE) via Individual Inc -- UWI Com -- The Internet Forms Company today announced the addition of Geir Ramleth, 39, to its Board of Directors

Ramleth joins the Board just a month after presiding over the sale of GENUITY, a Bechtel company he founded, to GTE Internetworking (NYSE GTE) As President and CEO, Ramleth grew GENUITY into a major Internet Service Provider (ISP) with over 200 employees and a fully redundant backbone network connecting data centers in 7 cities -- all in the course of a year and a half

"Geir's credentials are impressive for a relatively young executive and we are absolutely delighted to have him participate in our growth," UWI Com CEO Eric Jordan said "He's done it all -- from building networks at GENUITY and PageMart Wireless, to financial management at Bechtel, PageMart and PacTel Personal Communications, to managing major software implementations at Oracle and Bechtel, and finally growing an organization from scratch to over 200 employees " "I'm pleased to be a part of UWI Com and its Board of Directors," said Geir Ramleth "The most satisfying opportunities in my career have come in the area of strategic planning, especially for companies in their start-up and early stages, and I think that experience is in line with the needs and objectives of UWI Com I hope to be able to enhance the effectiveness of the Board by anticipating technological and market changes "

Before joining Genuity, Ramleth was Manager of Commercial Systems at Bechtel Corporation where he was responsible for consolidating all commercial systems activities, including their global financial and human resources systems Other management positions he has held at Bechtel include Manager of Controller Project Systems, Assistant Portfolio Analyst, and Treasury Analyst He served at Oracle Corporation (Nasdaq ORCL) as Director of Oracle Consulting where he directed organizational and systems projects for global Fortune 500 businesses, managed design and implementation of mission-critical applications, and was responsible for migration planning of legacy systems to open systems environments

Ramleth was also part founder of PageMart Wireless (Nasdaq PMWI) where he served as Vice President and CFO Prior to that he was Senior Financial Analyst at PacTel Personal Communications, which became AirTouch (NYSE ATI) Before immigrating to the United States in 1984 he was General Manager with TransAlp where he was responsible for a travel business in four European countries Ramleth is fluent in five languages and holds degrees from Menlo College and the University of Oslo (Norway)

"Geir's multi-faceted background and intricate understanding of the Internet will add an important dimension to our Board," said John Beaulieu, UWI Com's Chairman "We're on a fast track and Geir is no stranger to the challenges of establishing market leadership during the ramp-up "

About UWI Com (www uwi com)

UWI Com, developer of the first Internet forms software, is the leader in the Internet Forms market segment The company's InternetForms System helps businesses develop cost-effective Internet-based business forms to replace paper forms or cost-prohibitive proprietary electronic forms

Unlike many software publishers, UWI Com offers its forms language to the public as a common standard for business forms on the Internet Founded in 1993, UWI Com is based in Victoria, British Columbia, and is privately held with major investments from Maritime Capital Partners, L P , Seed Management, Innovation and Development Corporation (IDC) from the University of Victoria, and the Working Opportunity Fund Interested parties may learn more about UWI Com and its products through the company's web site at www UWI Com or by calling 888/517-2675

NOTE Trademarks UWI Com, The Internet Forms Company, and InternetForms System are trademarks of UWI Unisoft Wares Inc All other products named herein are trademarks of their respective manufacturers

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[02-03-98 at 09 04 EDT, Business Wire, File b0203091 302]

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