PN. ACC-869
98087

USAID

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

A report for the

Office of Energy, Environment, and Technology

Case Studies of the Effects of Power Sector Reform on Energy Efficiency

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Report No. 98-03
March 1998

Center for Environment
Bureau for Global Programs,
Field Support, and Research
S. Agency for International Development
Washington, D.C. 20523-1810

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CASE STUDIES OF THE EFFECTS OF POWER SECTOR REFORM ON ENERGY EFFICIENCY

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USAID/Office of Energy,
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March 1998

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ACKNOWLEDGMENTS

This report was prepared by Hagler Bailly Services, Inc., under the Energy Efficiency Project for the Center for Environment, Office of Energy, Environment, and Technology of the U.S. Agency for International Development (USAID). Preparation was overseen by Jeff Seabright, the director of the Agency's Office of Energy, Environment, and Technology, by the deputy director, Alberto Sabadell, by EEP Project Officer Carl Duisberg, and by Hagler Bailly Services director John R. Armstrong. Jeanne Clinton, Stefan Bokaemper, Brian Kick, Tracy Garcia, Carlos Allia, Julie Fitch, and Rob Schurhoff were the primary authors and researchers.

The authors gratefully acknowledge the extensive assistance and review provided by the following individuals:

Argentina
Ing. Omar Arza, Director, URE
Lic. Monica Servant, National Planning Director, Subsecretariat of Energy
Ing. Guillermo Gall Mendoza, Vice President, IDEE
Mr. Rafael Lobato, Siemens, S.A. Distribution Systems
Ing. Guillermo Spini, Philips Argentina

Chile
Miguel Jimenez, Endesa
Daniel Blasques, National Energy Commission
Sra. Loreto Villa Nueva, Chilean Energy Commission
Antonio Pardo, Fundación para la Energía
Stephen Hall, IIEC-Chile
Patricia Robles, Honeywell-Chile

New Zealand
Mr. Matthew Everett, Senior Analyst, Energy Efficiency and Conservation Authority
Ms. Molly Mellhuish, Power for Our Future

Norway
Mr. Birter Bergesen, NVE, Head of Energy Efficiency Department (Regulatory Agency)
Mr. Torfinn Jonassen, NVE, Energy Efficiency and Market Department
Mr. Are Thommessen, EnFO (Norwegian Association of Electric Utilities)
Mr. Per Skjoevelnd, Director of Oslo Energy Enok (Energy Efficiency Center)
Mr. Hans-Otto Haaland, Norwegian Research Council
Mr. Harald Wilhite, Ressoursconsult, Energy Efficiency Consultant/Researcher

Mr. Fritjof Uenander, Norwegian Institute for Energy Technology
Mr. Svein Brunborg, Ministry of Petroleum and Energy
Mr. Jon Iver Bakken, Scandpower

United Kingdom
Steve Fitzgerald, Midlands Electric, Powerline Energy Services Ltd.
Tim Curtis, Energy Saving Trust, Head of Programs
Chris Barkely, OFFER, Standards of Performance Program
Franka Vanetico, UK CHP Association / Energy Services Association
Andrew Warren, Association for the Conservation of Energy
Brenda Renn, Department of the Environment, Environment and Energy Awareness Division
Assistant to Mr. Nigel Foster, Department of the Environment, Head of the Public Sector Energy Services Team
George Henderson, Independent Consultant (formerly with ETSU)

United States
Ms. Theo MacGregor, Massachusetts Department of Public Utilities.
Mr. Mike Messenger, California Energy Commission
Ms. Andrea Gough, California Energy Commission
Mr. Sean Casey, California Public Utilities Commission
Dr. Don Schultz, California Public Utilities Commission
Mr. Scott Logan, California Public Utilities Commission
Ms. Terry Singer, National Association of Energy Service Companies
Ms. Mary Lee Berger-Hughes, National Association of Energy Service Companies
Mr. Peter Miller, Natural Resources Defense Council
Mr. Dan Violette, Hagler Bailly Consulting
Mr. Mike King, Hagler Bailly Consulting

This report is the second in a three-part set devoted to the topic of the impact of power sector reform on energy efficiency around the world:

1. *Bibliography: The Impact of Global Power Sector Restructuring on Energy Efficiency,* July 1997.

2. *Case Studies of the Effects of Power Sector Reform on Energy Efficiency,* September 1997.

3. *The Effects of Power Sector Reform on Energy Efficiency — A Guide Book for Energy Policy Officials,* September 1997.

Copies of these reports may be obtained by contacting the USAID Office of Energy, Environment, and Technology at (202) 712-4055.

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CHAPTER 1
INTRODUCTION

Many countries are undertaking or preparing for reform of their power sectors to introduce greater competition, increased efficiencies, and lower costs and prices for power. This reform often includes unbundling vertically integrated industries into distinct generation, transmission, distribution and retail supply organizations; introducing commercial principals to government-owned monopolies; and even transferring operation or ownership to privately-owned companies.

These changes have been accompanied by the elimination of price subsidies for selected classes of consumers and the introduction of greater consumer choice. Electricity users often have their choice of supplier and so, within limits, can decide what price they will pay for power and on what terms, and what other services they want provided, from improved billing and energy audits to the provision of other utilities (water, gas, etc.)

One of the greatest hopes, so far largely unrealized, has been that a power market without price subsidies would create the right economic conditions to stimulate power consumers to undertake energy efficiency actions on their own. It was hoped that consumers would investigate and adopt technology and operational measures available from manufacturers, product vendors, energy efficiency specialists and other service providers to improve the energy efficiency of buildings, equipment, and appliances and so reduce the overall cost of energy services.

There is worldwide interest in learning from the lessons of the countries that have already embarked upon the path of reform and a desire to understand what has worked best and why. The experience to date reveals that energy efficiency has been an afterthought at best and in many cases has simply been ignored in power reform efforts. The market response reveals that price competition has been paramount, pre-existing utility energy efficiency activities have largely diminished, hoped-for markets generally have failed to materialize, and only the largest commercial and industrial energy users seem to have attracted the attention of energy service companies (ESCOs) and other private energy services providers. Efforts to append efficiency mechanisms after reform structures and rules are underway are politically unpalatable, the options are limited, and implementation is difficult.

In analyzing the evidence on energy efficiency within the context of power sector reform, the questions of most interest are:

- How has efficiency fared under power sector reforms?

- Have market barriers to efficiency been reduced or changed?
- What kind of market infrastructure and capabilities are required to implement efficiency services?
- Is there a public policy reason to support efforts to implement energy efficiency?
- What specific mechanisms hold the most promise for increasing efficiency under reforms and in competitive markets?
- To what extent can power sector reforms include features to support policy goals for end use efficiency?
- Are there better mechanisms available for improving efficiency than those incorporated in the reform structure?
- When and how should efficiency be addressed in the political and technical deliberations on reform, regardless of whether efficiency will be a responsibility of the utilities?
- How should efficiency services that are in the public interest be paid for?

To answer these questions, this report presents the findings from an investigation of six countries where reforms are well underway. The countries were selected on the basis of being far enough along in implementing their reforms to provide ample evidence of utility and efficiency market responses. They also represent different models of reform with varying degrees of public intervention, as well as geographical diversity. The six countries are: the United Kingdom (the UK), Norway, Chile, Argentina, New Zealand, and the United States (the US).

The experience of each country is presented in this report as a case study. The case studies are followed by a general discussion of the findings and a discussion of the implications for other countries contemplating power sector reform.

The UK and Norway pioneered the current era of power sector reform. Both countries hoped that end use efficiency would occur naturally in a competitive market, both had previous experience with government or utility energy efficiency programs, and both could provide substantial information about the impact of reform on energy efficiency.

Chile and Argentina are examples of countries where power prices were higher, and there was no history of government or utility efficiency programs.

New Zealand represented a middle-ground situation where power prices were average by international standards, there had been some history of government and utility-sponsored

efficiency, and the reform plan specified both utility and government (funding) responsibilities for continued efficiency initiatives.

The US reform efforts are less well advanced, despite a history of active participation by both government and the utilities in energy efficiency activities. Utilities have considerable experience with integrated resource planning (IRP), demand-side management (DSM), and efficiency services, while the government has introduced efficiency programs through legislation and regulation. The US is an advanced marketplace for efficiency product and service providers; it is expected that many efficiency services can be incorporated into competitive market offerings. Because of an active government, environmental, and consumer constituency, reform plans are likely to contain provisions for the funding of public-benefit efficiency programs.

This report was prepared for the United States Agency for International Development (USAID) for use in guiding its energy sector strategies and assisting its client governments in developing countries and in restructuring economies to confront issues of power sector reform. None of the countries represented in the case studies is, of course, a developing country. The lessons they offer must be interpreted carefully when applied to countries where reforms may for the first time be introducing principles of commercialization, or where there is no infrastructure of energy efficiency product suppliers or service providers. Unfortunately, the reform efforts underway now in developing countries such as India, or reforming economies such as Ukraine, Russia, Brazil, and Central America, are not sufficiently progressed to offer much insight.

It is hoped that this case study report, along with its companion bibliography ("Bibliography: The Impact of Global Power Sector Restructuring on Energy Efficiency"), and guide book ("The Effects of Power Sector Reform on Energy Efficiency — A Guide Book for Energy Policy Officials"), will prove instructive to countries that are contemplating power sector reform and debating whether and how to address national goals for least-cost energy services, how market barriers might be overcome, and what local and global environmental benefits will result from such reforms.

CHAPTER 2
UNITED KINGDOM CASE STUDY

2.1 OVERVIEW OF POLITICAL AND ECONOMIC SITUATION

The United Kingdom of Great Britain and Northern Ireland (UK) is one of the world's leading industrial economies with a gross domestic product (GDP) of more than $1.1 trillion and a population of 58.5 million. Services, particularly banking, insurance, and business services, account for the largest portion of GDP while industry employs only 25% of the work force. The UK has large coal, natural gas, and oil reserves. Primary energy production accounts for 12% of GDP, one of the highest shares of any industrialized nation.

In the 1980s the ruling conservative party under Margaret Thatcher followed a policy of deregulation and privatization of state owned industries including telecommunication, natural gas, water and power. The Labor party which won the elections in May, 1997, will essentially continue the liberal economic policy of the conservatives, however the new government has stated its intention to put more emphasis on environmental issues including energy efficiency.

General Indicators

Population:	58.5 million; urban population is 90% of total population
Population growth:	0.3%/year (1990-1995)
GDP:	$1,106 billion
GDP per capita:	$18,900
Inflation rate:	3.5% (consumer price index)
Structure of the economy:	2% Agriculture, 32% Industry, 66% Services
Major economic sectors:	banking, insurance, business services, energy production
Export of goods and services:	28% of GDP
Life expectancy at birth:	77 years
Type of government:	democratic (constitutional monarchy)

Sources: World Development Indicators CD-ROM, World Bank, February 1997; CIA World Fact Book; all data for 1995.

2.2 STRUCTURE OF THE POWER SECTOR

2.2.1 Pre-Reform Situation

Prior to the reforms, the UK electric system, known as the Central Electricity Generating Board (CEGB), was wholly government-owned and vertically integrated, with a national grid for

transmission dispatch, 12 area distribution boards in England and Wales, and vertically integrated utilities in Scotland and Northern Ireland. In 1988 the government issued a white paper that provided the framework for liberalization plans. Subsequently, the 1989 Electricity Act provided for a complete restructuring of the industry into separate generation, transmission, distribution and supply businesses, followed by privatization of most assets.

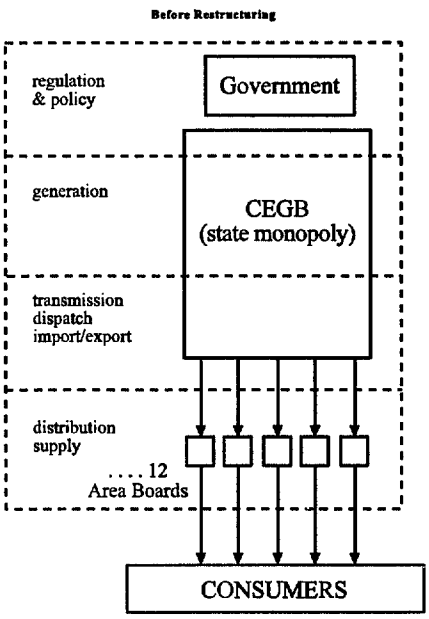
Power Sector Data

Installed generation capacity:	68.1 GW (in 1995)
Capacity connected to the grid:	60.7 GW (in 1996)[1]
Capacity of industrial autoproducers:	6.3 GW (in 1995)
Cogeneration Capacity:	3.6 GW (end of 1996)[2]
Peak Demand:	50.3 GW (at the Grid, January 1997)
Electricity Production:	307 TWh (plus 17 TWh imported electricity; 1995)
Electricity Consumption:	302 TWh (1995; 34% residential, 27% commercial and public service, 38% industrial, 1% agricultural, in 1995)
Per Capita Electricity Consumption:	5,200 kWh/person/year
Growth rate for total consumption:	forecasted to grow 1.4%/year from 1997 to 2004
Growth rate for peak demand:	forecasted to grow by 1.2%/year from 1997 to 2004
Average Pool Selling Price:	£25/MWh (4 cents/kWh; at the end of April 1997)[3]
Residential electric prices:	9.5 pence/kWh (15.2 cents/kWh; 2,500 kWh/year) 4.6 pence/kWh (7.4 cents/kWh; 20,000 kWh/year)[4]
Time of use tariffs available?	Yes, for all customer classes[5]
Technical T&D losses:	7% for distribution and 1.9% for transmission[6]

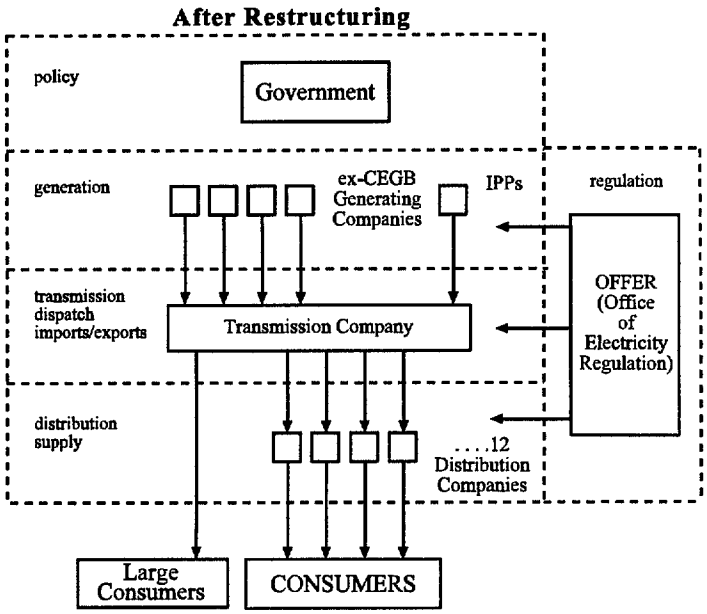
Sources: DTI Energy Report 1996, OFFER Annual Report 1996, Power in Europe (various issues), DOE/ EIA, IEA.
Notes:
1) Includes 2.1 GW pumped storage and 2 GW from EDF / France via cable.
2) At maximum electric output; about 3 GW are industrial cogeneration; the UK government has a policy target of 5 GW cogeneration by the year 2000.
3) In January 1997 (during the winter peak) the average pool selling price was £38/MWh (6.1 cents/kWh; with peaks above £100/MWh in the late afternoon); overall, pool prices are expected to remain flat in the next few years.
4) Prices are for December 1995 in London and include standing charges and VAT; second price is based on "Economy 7" time-of-use tariff assuming 15,000 kWh of night consumption.
5) Load profiles will be used for residential customers under retail competition to reduce metering costs.
6) Source: OFFER.

2.2.2 Objectives of Reform

The main policy objective of reform was to reduce the role of government by fostering private ownership and management and competition, all of which were expected to lead to increased operating efficiencies. Another objective was to maximize tax revenues through a successful privatization.



Power Sector Ownership: Public



Power Sector Ownership: Public & Private

2.2.3 Post-Reform Structure

Generation. Since restructuring, there has been a "dash for gas" with about 13,000 MW of newly constructed power plant capacity on-line (almost all efficient natural gas-fired combined cycle power plants) and up to 10,000 MW additional capacity projected for the next seven years. Coal subsidies have been phased out and older, uncompetitive coal plants have been shut down. Nuclear power and renewable energy sources to some degree have been subsidized through the non-fossil fuel obligation, although the nuclear subsidies were recently phased out.

Restructuring, combined with low natural gas prices, has led to a strong increase in industrial and other cogeneration projects. The generation market is generally competitive with free entry and exit. Until 1996, however, the power pool was dominated by two privatized generation companies (PowerGen and NationalPower), who together accounted for more than half of the total generation. In 1996 they were forced to divest some of their generation plants. In the fourth quarter of 1996 the generation market shares were: 23% for National Power and 22.5% for PowerGen (both fossil power plants), 17% for British Energy (in 1996, a privatized operator of nuclear power plants), 7% for Magnox Electric (a government-owned company operating older nuclear power plants), 7.5% for Eastern (a regional electric company that has expanded into generation), 13% for other new market entrants that have appeared since privatization, and 10% for the interconnectors and other existing generation (e.g., industrial).

Transmission. The National Grid Company is responsible for operating the power pool, dispatching power plants, planning for transmission, and constructing transmission lines. All generators must declare capacity availability and bid-prices at half-hour intervals. They are paid the pool's highest accepted bid price to serve each specific half-hour period. All generators providing power for the same half-hour period are paid the same price, regardless of their operating costs or their bid price.

Currently the cost of transmission losses is spread across all customers of the pool by a surcharge on all demand-charges, although the losses from electricity transport from power plants in the north of England to the south of the country (where most demand is located) can be significant. A new zonal system of transmission loss factors is currently proposed in order to better assign transmission losses to specific generators.

Distribution. Distribution in England and Wales is conducted by 12 regional electricity companies (RECs). There are two distribution utilities in Scotland and one in Northern Ireland. Since the government gave up its right to veto ownership changes in 1995, 11 out of 12 RECs have been bought by other utilities (including several US and European utilities as well as two water companies).

End-user supply. The supply function (electricity retailing) is separated from distribution and is competitive. Since 1990 about 5,000 customers whose use exceeds 1 MW have been able to buy electricity without going through their local distribution company. These customers can choose to buy from the generators, the pool, the RECs, or the independent suppliers. Choice of supplier was extended to 45,000 customers with electric demand higher than 100 kW in 1994. Full retail competition for all 22 million customers will be phased in over the period from April to September, 1998.

Total turnover for the <100 kW market in England and Wales is £9.5 billion ($15.2 billion). Supply to residential customers is currently provided solely by the supply business units of the RECs and is regulated separately from the distribution system. Even after introduction of retail competition for all customers in 1998, there will be supply price controls for at least two more years.

Regulatory oversight authority. Companies in the electric utility sector are subject to license conditions, general competition law, and specific power sector regulations. These regulations are implemented and enforced by the power sector regulator (the Office of Electricity Regulation, OFFER), the Director General of Fair Trading, the Monopolies and Mergers Commission and the Secretary of State. OFFER's main mandate is to promote competition and to protect the interests of consumers. (The new labor government is currently contemplating reversing this order).

Pricing rules. Whereas the generation function is competitive, the transmission and distribution networks as well as the "franchise" supply market (customers with demand less than 100 kW) are

overseen by OFFER under a system of performance-based regulation. Prices are set according to the "RPI minus X" formula, in which RPI is the real price index and X a productivity factor. X is determined by the regulator based on the estimated productivity increases in the industry and fixed for a period of five years. The regulatory process was designed to give companies an assured period between regulatory reviews in which to look for cost savings greater than the X factors.

Electricity prices are generally not subsidized, but in 1996 the Northern Ireland distribution company received a £15 million ($24 million) direct subsidy to hold down electricity prices, which are over 20% higher than those on the UK mainland.

The X factors for the transmission and distribution price controls have been modified over time. They have been subject to repeated controversy arising because of what many consider the excessive profits enjoyed by the RECs. In April, 1995, and April, 1996, the distribution price allowances for the RECs were cut by 10%-17% each and in April, 1997, the transmission price allowance was cut by 20%. The formula for 1998 to 2001 is set at RPI-4%.

The new Labor government has instituted a one-time "windfall tax" of several billion pounds on the profits of all privatized industries. Furthermore, the government is currently conducting a review of the regulatory mechanisms of all privatized industries.

2.3 MARKET RESPONSE TO REFORMS

2.3.1 Power Distributor/Supplier Behavior

Since being privatized, the transmission company and the RECs have reduced costs significantly, in part by cutting jobs and reducing research and development (R&D) spending. Furthermore, several RECs moved into the generation business by investing in IPP projects that are usually based on long-term power purchase agreements with these RECs. In preparation for retail competition many RECs recently started to try selling long-term supply contracts to customers with demand smaller than 100 kW. A large number of suppliers are active in the deregulated market, including oil, gas and water companies. Furthermore, all RECs have natural gas affiliates that are active in the deregulated gas market.

In 1995-96, 33% of the electricity for customers with demand larger than 1 MW was supplied by their host REC, 16% was supplied by other RECs, and 51% was supplied by generators or independent suppliers. For customers with demand between 100 kW and 1 MW these percentages were 59%, 30% and 11% respectively. Only very few large end-users buy directly from the pool (due to the volatility of pool prices). The majority of contracts are for long-term guaranteed prices and are only formally settled through the pool.

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2.3.2 Retail Prices

Since the reform of the power sector, there has been a significant drop in real (inflation adjusted) energy prices. Besides competition other important factors have been the new availability of cheap natural gas from the North Sea and a general decline in world energy prices since their peak in 1985 (see Table 2-1 below). Excluding value-added tax (VAT), real prices for a "standard" domestic customer with 3,300 kWh consumption per year have been falling by about 15% since 1990. For customers with a time-of-use "Economy 7" tariff with 3,000 kWh consumption during the day and 3,600 kWh during the night, prices were about 14% lower. Prices for commercial and industrial customers have been falling 15% to 21% on average.[1]

Table 2-1
Electricity Prices in England and Wales for Standard Domestic Customers with 3,300 kWh Consumption per Year (Excl. Vat)

Year	Nominal price (p/kWh)	Real price (in 1989/90 p/kWh)	Real price change compared to 1989/90
1989/90	7.22	7.22	-
1990/91	7.95	7.26	0.6
1991/92	8.81	7.56	4.7
1992/93	8.92	7.36	1.9
1993/94	8.60	6.99	-3.2
1994/95	8.49	6.73	-6.8
1995/96	8.45	6.48	-10.2
1996/97	8.17	6.12	-15.2

Source: OFFER Annual Report 1996

The UK Department of Trade and Industry (DTI) reports that the real price of domestic electricity (excluding 8% VAT, which was applied in 1994 for the first time) is now at the lowest level since 1974. Prices have been steadily falling since 1992, creating the expectation of further price decreases. Real industrial prices of electricity are at the lowest level since official DTI records began in 1970 and have been decreasing since 1993. Further price decreases are expected for 1997 due to the cuts in the transmission price control.

Table 2-2 shows the cost breakdown of a bill for a residential customer. The table shows that the generation and distribution businesses account for the largest share of the costs while the costs of the transmission and supply function are fairly low.

[1] Electricity consumption per household is much lower in the UK than in the US as there is little air-conditioning. Appliances, especially refrigerators, also tend to be bigger in the US than in Europe.

Table 2-2
Cost Breakdown for Franchise Customer's Electricity Bills in 1995/96

Function	% of total cost in England/Wales	% of total cost in Scotland
Generation	52%	65%
Transmission	4%	4%
Distribution	29%	25%
Supply	6%	6%
Non Fossil Fuel Levy	9%	0.1%
Total	100%	100%

Note: In April 1997 NFFL in England/Wales has been reduced to 2.2% and in Scotland it has been increased to 0.7%
Source: OFFER, Sept. 1996 (cited in *Power in Europe,* March 28, 1997, p.10)

2.3.3 Retail and Service Competition

The details of the rules affecting sales to domestic end-users are currently under discussion and the computer systems to administrate competition are still being developed. OFFER plans to impose supply price restraints (i.e., a price limit for domestic customers who don't switch their supplier) for the first two years of retail competition. The RECs are expecting a slump in profits due to higher advertising and customer service costs as well as increased competitive pressures. Electricity supply (electricity retailing) for industrial and commercial customers is already a competitive business with low margins of 1% to 3% (on the sales price).

Some electric utilities are preparing to offer comprehensive bundles of services once the market for domestic customers is opened up. These bundles could include communication and water services besides electricity. The most active companies are said to be Scottish Power, Scottish Hydro and Eastern Generation. The rationale for this strategy is that energy prices are not expected to fall much more and so comprehensive service offerings are being developed by utilities to help sell long-term (10-15 years) power supply contracts. However, the bundling of utility services (water, gas and electricity) is restricted by rulings of the individual regulators who have stated that the customer has to be able to terminate the purchase of each of these services individually. So far most energy services projects seem to consist of replacing boiler systems with cogeneration facilities under heat service contracts. The rise in cogeneration is also facilitated by a general trend towards outsourcing in some sectors, such as hospitals, where heat service contracts are favored.

Furthermore, many companies are forming alliances to prepare for retail competition. For example, there have been reports of an alliance between United Utilities and British Telecom

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(BT) to allow the marketing of energy to BT's customers. The generation company Scottish Hydro-Electric has joined with a Scottish insurance company in a trial arrangement whereby each offers the products of the other at discounted prices. Also, the Trade Union Congress has started a power marketing company called Union Energy to arrange for favorable deals for its members once retail competition begins. On the other hand, the two biggest supermarket chains in the UK, TESCO and Sainsbury, have abandoned a move into gas and electricity retailing apparently because of fears that their brand might be damaged by problems in the start-up and because of the low expected sales margins.

2.4 END-USE ENERGY EFFICIENCY

2.4.1 Pre-Reform Situation

Compared to the US, there was little utility sponsored energy-efficiency activity in the UK prior to the restructuring of the power sector. The UK utilities lack the extensive energy efficiency infrastructure and experience of the US utilities. Also, government activities supporting energy efficiency actually declined in the U.K. during the 1980s, until the climate debate asserted itself in the early 1990s.

2.4.2 Integration of Energy Efficiency in Reforms

Policy. Energy efficiency has not been explicitly addressed in the UK power sector reform legislation except through the provision that "standards of performance" could be prescribed for electricity service (which includes energy efficiency). The legislative provisions concerning energy efficiency are broad, leaving the power sector regulator with wide discretion on how to implement them. The general mindset of the Thatcher government in the late 1980s was that the market will take care of energy efficiency and that there is no need for government policy intervention through legislation or regulation.

Regulation. *Regulation of power sector energy efficiency activities.* Soon after the restructuring, OFFER recognized that utilities were not being provided with incentives to pursue energy efficiency programs. It conducted a review as part of the process to reset the X parameter for the non-competitive "franchise" electricity supply business (i.e., customers with demand smaller than 100 kW).

In its review, OFFER found significant energy efficiency potential in England and Scotland. It considered adding an "E" factor in the regulatory formula for the franchise supply business of the RECs, to raise funds to support energy efficiency programs. This approach was eventually rejected, however, because OFFER felt that such a mechanism would exceed its mandate. OFFER was particularly concerned that a large-scale energy efficiency charge would distort the

market because the benefits were unlikely to be distributed in accordance with the costs. Instead, OFFER included a £1 ($1.60) annual allowance per account for the period from 1994 to 1998 in the *supply* price control mechanism for the franchise market. The allowance equates to about 0.25% of REC revenues, compared to a US average for DSM expenditures of between 1% and 2% of utility revenues.

The annual £1 allowance per account will be collected at least until March 1998 and will generate £102 million ($165 million). OFFER oversees the use of these funds and has established "standards of performance" requiring RECs to achieve certain energy savings through a variety of DSM and low-income programs. OFFER is assisted by the Energy Saving Trust (EST), which oversees the program design and its implementation by the RECs. The EST is a non-profit organization established by the government in 1992 with participation of the UK energy companies, as a means to stabilize the UK's CO_2 emissions. Monitoring and verification of energy savings is conducted by independent consultants and by agencies such as the Energy Action Grants Agency, which is administering the low-income programs.

During the first two years of its operation, £40 million have been spent under the "standards of performance" program, resulting in estimated lifetime savings of 3,000 GWh. A 1996 evaluation by the EST estimated the program costs per kWh saved as 1.35p/kWh (2.2 cents/kWh); the costs to all parties (including additional costs by the program participants) are 1.68 p/kWh (2.7 cents/kWh). This is significantly lower than the price paid by the RECs for electricity, approximately 3.8 p/kWh (6.2 cents/kWh).

OFFER considers the program a success, but acknowledges the difficulty of realizing continued energy savings in the future. It is currently considering extending the program and the funding mechanism until the year 2000 as part of the planned introduction of supply price restraints in the domestic sector.

The price control mechanisms for transmission, distribution, and supply to franchise customers initially related the maximum allowed revenue directly to the number of kWh sold by setting a limit on the revenue per kWh sold (kW of actual demand for the transmission company). As part of subsequent regulatory reviews in 1993, OFFER introduced fixed elements into these formulas to decrease the incentive for the utilities to sell more electricity. Both the distribution and the supply formulas now include a revenue component that is related to the number of customers and a component related to the number of kWh sold. The weight of these two components is about 50% each.

The revised formula for the transmission company is based in part on a fixed demand forecast instead of the actual demand. Furthermore, there is a term for distribution losses in the distribution price control formula that determines permissible distribution losses. The formula allows RECs to capture part of the energy cost savings if they reduce their losses below the target value and penalizes RECs with losses above the target value.

A similar mechanism is in place for the transmission company. (The annual target for the National Grid Company is 5.6 GWh of transmission losses or about 1.9% of total electricity consumption.) In justifying these regulations, OFFER estimated that the long-term effect of the changes in the distribution formula could be a reduction of distribution losses from 7% to 6% over 15 years, resulting in cumulative savings of 9,000 GWh over this period. In addition, OFFER estimated the reduced volume incentive for distribution companies would reduce total electricity consumption growth by one twentieth of one percent, contributing to total discounted savings of about 6,000 GWh over 15 years. Although this is in line with the savings expected through the "standards of performance" program, OFFER is cautious about the validity of the estimates since no commitment has been made by the RECs.

Codes and standards. Appliance efficiency standards and building codes have not been directly affected by the power sector reform. Generally, the UK government prefers information and demonstration programs to mandatory regulations; nevertheless a number of regulations and programs were introduced for new and existing buildings, appliances, and industry.

For new buildings, revised codes were implemented in England and Wales in 1995 that stiffened the requirements for insulation and heating system controls and introduced a "Standard Assessment Procedure" (SAP) for all new homes. SAP ratings give information about the energy efficiency of space and water heating and are intended to improve purchasing decisions by home buyers. Also, for new commercial buildings there are minimum standards for the energy performance of electric light sources and lighting controls. Overall, the UK building codes are less stringent than the Scandinavian ones, but comparable to continental European codes. Local authorities are asked to take energy efficiency into account in their own housing strategies.

The Home Energy Efficiency Scheme (HEES) is a house renovation grant system available to low income households. About £100 million ($160 million) was spent in 1996 on this program. It is considered to have had a significant impact on energy efficiency. Furthermore, the Home Energy Conservation Act (HECA) of 1995 requires local authorities to prepare energy conservation reports identifying measures for all existing residential accommodations (privately and publicly owned) in their areas. The Act directs authorities to identify savings targeted at 30% but it does not require implementation.

Many local authorities are active in providing energy efficiency information, in arranging for bulk discounts for efficient equipment and appliances, and in negotiating purchasing agreements on behalf of a large number of smaller customers. Moreover, the government has been spending about £20 million ($32 million) annually in the last several years on the "Best Practice Program," an information and education program which reportedly has been very successful in spreading awareness of the advantages of energy efficiency in many industry sectors and among social housing programs. The program uses input from industry and government to develop "Good Practice Guides" and case studies, as well as "Energy Consumption Guides."

European Union ecolabeling and appliance labeling schemes as well as minimum efficiency standards for refrigerators and new central heating boilers are in effect in the UK. However, the conservative UK government was reluctant to accept the introduction of these standards, which were mostly backed by the Netherlands and the Scandinavian countries. (This attitude may change under the new Labor government.)

Related policies and regulations. Since 1994 the UK has had a climate change action plan in place that calls for a stabilization of CO_2 emissions by 2000 at 1990 levels. The UK is likely to exceed this goal, largely due to the massive shift from coal to natural gas. Furthermore, although the UK vigorously opposed the proposed EU energy/CO_2 tax, which it saw as an infringement on national sovereignty, the new Labor government elected in May, 1997, has stated that it will make energy conservation a priority issue and has committed itself to a goal of 20% CO_2 reductions by 2010.

As part of the ongoing regulatory review, it is expected that the government will put more emphasis on energy efficiency activities. One option being considered is the implementation of a levy, a fixed percentage added to the distribution costs, with the proceeds to be disseminated through a bidding mechanism similar to the one used for renewable energies under the Non Fossil Fuel Levy. This would allow companies (utilities, ESCOs, engineering firms) to bid with programs that would achieve a certain amount of savings for a fixed price. Another model under consideration is to prescribe energy savings targets for each distribution utility but to leave it to the utilities to decide how they will reach these goals.

2.4.3 Activities Promoting Energy Efficiency

Power sector. In the competitive market customers using more than 100 kW appear to choose their supplier mostly based on price; energy service offerings play a marginal role in their selection. In a situation of falling prices, these customers are mostly concerned with negotiating the best deal.

OFFER did not find sufficient reason to intervene in the non-franchise market, preferring to allow a competitive energy services industry sufficient time to develop. The degree to which energy efficiency measures will be offered by suppliers or included in an energy supply package is currently unclear. The supply subsidiary of Midlands Electric is planning to offer some energy efficiency services such as loft insulation and draft-proofing services, energy audits and consulting, and financing of efficient appliances. Scottish Power has announced it is planning to sell "lifestyle products" that might include energy efficiency offerings.

Liberalization of the power sector has led to more flexibility in the design of tariff structures and to increased load management activities. Interruptible/curtailable tariff options have been developed between suppliers and large end users. If the end users have a fixed price contract,

suppliers try to mitigate their pool price risk by integrating load management features into their contracts.

A demand side bidding pilot project has been operated in England and Wales for several years. Large customers indicate the amount of power they would purchase from the pool depending on the pool input price offered. The National Grid Company reconciles both the bids of the suppliers and the quantities demanded by buyers to come up with a pool price that better reflects the interactions between supply and demand. If large amounts of load can be dropped in a very short period of time, this load relief may be capable of replacing spinning reserves (power plant capacity held on reserve to substitute for the sudden loss of another plant or transmission line). There have been problems with operating the program as some industrial customers declared loads they were willing to drop that were higher then their actual load. The further development of the program is being reviewed.

Government. Besides overseeing OFFER's "standards of performance" programs, the EST is also implementing information and market transformation programs. In addition to the mandated energy efficiency programs, the British government, through the Department of the Environment, is funding the EST with £70 million ($113 million) for the period 1996 to 1999. Activities under this program include the creation of 35 local energy advice centers, school energy efficiency programs, ESCO promotion/pilot projects, small scale cogeneration, a nationwide marketing campaign for energy efficiency, promotion of alternative- fuel vehicles and several energy efficiency rebate programs.

In 1997 the EST started two ESCO pilot projects that are targeted at residential customers. The "Energy Club" provides power supply services combined with energy audits and low-cost financing for residential end users. The "Total Oil ESCO" program tries to persuade low-income consumers who still heat with solid fuels to switch to oil heating. Although customer interest in these programs was high initially, participation has been disappointing so far. One reason might be that residential end users are skeptical about the intentions of an organization that sells energy as well as energy efficiency services. The EST is also working on a feasibility study of ESCO services for local authority housing and for small and medium enterprises.

The Energy Action Grants Agency (which administers the UK government's home energy efficiency scheme) is planning to sell power to several thousand people on social security, with their bills to be paid directly by the benefits agency. Certain energy efficiency measures would also be made available to these people, to help reduce their bills.

Besides the activities of local authorities, the government set itself a 15% energy savings target to be achieved over the five years ending in 1996. Furthermore, in 1990 new guidelines for Third-Party-Financing were issued allowing ESCOs to make investments of up to $375,000 under performance contracts without Treasury approval. Under the "public-private partnership initiative" (formerly called "private sector financing initiative") the Environmental and Energy Management Directorate of the Department of Environment is trying to improve the market for

performance contracting in public buildings. These activities are part of a broader effort to utilize private sector financing for public agencies. Progress with performance contracting in the public sector so far is reported to be fairly slow due to complex procurement procedures and tax regulations.

For several years there has been a campaign by equipment suppliers and environmental groups to reduce the VAT on energy saving materials. This was initially supported by the Labor party but in its recent budget the Labor government decided not to implement the tax break for fiscal reasons. It remains on the agenda.

Private sector. Several ESCOs (called Contract Energy Management Companies in the UK) offer energy performance contracting in the large industrial and commercial markets. Contract energy management has been in use in the UK since the 1980s, focusing mostly on large-scale thermal measures at the sites of industrial consumers (boiler retrofit, cogeneration plants, steam and compressed air system improvements). According to a report for the World Bank, the industry's annual revenue in 1994 was estimated at $300 to $500 million with about 20 active ESCOs. The history of the industry has been "lumpy" with periods of rapid growth followed by slumps. The fortunes of the industry are closely related to the general business cycle, the development of energy prices, and the cost of capital. As in the US, many of these ESCOs are backed by energy supply companies who see ESCOs as a means to secure long-term supply contracts with potential customers.

Since restructuring, many contract energy management companies are reported to have focused on offering mainly energy purchasing services, because of better opportunities and low energy prices. Furthermore, electric and gas utilities that own ESCOs have no wish to implement measures that will reduce demand for their own product; they see ESCOs as a strategic weapon for retaining customers or gaining access to new customers who are looking for an integrated energy solution.

On the other hand, energy management companies benefit from the general trend among industrial and commercial customers towards outsourcing of non-core functions such as energy management. This has led to more comprehensive service offerings by contract energy management companies. A complete services package occasionally might include environmental services, training, project management, facility management, maintenance and security services.

Energy efficiency technologies. In the UK energy-efficient technologies and knowledge are widely available. However, energy efficiency "is not very important to energy suppliers or consumers" in the markets, according to Eoin Lees, chief executive of the EST. In order to improve the image of "energy efficiency" and to help consumers to identify products and services that are energy efficient, EST started a TV and press advertising campaign in January, 1997. The £4 million ($6.4 million) campaign highlights an energy efficiency logo to be used to identify efficient heating controls, boilers, glazing, lighting, appliances as well as certified installers of

heating, insulation and glazing. The campaign is intended in the long run to foster a cultural change in consumers' attitudes towards energy efficiency. (Currently energy efficiency usually connotes having to give up something). Unlike earlier campaigns, this one is being run in close cooperation with manufacturers and retailers who organize and finance some of the activities and use the logo in their own advertising.

Extent of implementation. Almost all end-use sectors and technologies are covered by at least one energy efficiency program in the UK. The EST focuses on residential and small commercial customers and covers all associated technologies such as refrigerators; lighting; heating, ventilation, and air conditioning (HVAC); insulation; and so on. "Standards of performance" programs are quite comprehensive in covering commercial and industrial applications of energy efficiency and all of the related technologies in those sectors.

The programs and success rates are generally much smaller than had been anticipated. Pressures were alleviated once the government realized that target CO_2 reduction would be met simply through switching from coal to gas fuel in generation.

2.4.4 Constituencies

Organizations lobbying for energy efficiency-related policy and regulations include:

- Combined Heat and Power Association (CHPA): an industry association of CHP operators;
- Energy Services Association (recently established as part of CHP association): promotes the interests of utilities;
- British Energy Efficiency Federation: promotes interests of equipment manufacturers;
- Energy Systems Trade Association: promotes interests of equipment suppliers;
- Association for the Conservation of Energy: promotes energy efficiency for environmental and energy security reasons;
- Friends of the Earth: a major environmental non-governmental organization (NGO) in the UK that lobbies for many environmental issues; and
- UK Round Table on Sustainable Development: a high level committee that advises the government on sustainable development.

2.4.5 Prospects for the Future

Expected legal and regulatory changes. Changes in laws and regulations will depend largely on the outcome of the Labor government's regulatory review of the power sector and on any steps the government might undertake to implement a climate protection policy. Most observers don't expect drastic changes in the coming years.

Greatest remaining barriers. The greatest barrier to more energy efficiency is the low price of energy, combined with a general perception of continuously falling prices. Another barrier, not found in most of Scandinavia and in central European countries, is the public's low level of environmental awareness. Energy efficiency efforts are hindered by the perception that they are of concern primarily to environmentalists. The EST is attempting to change this attitude, but expects it will take a long time.

Key actions needed. Current policy issues include: the intended extension of the "standards of performance" energy efficiency programs by two more years; the details of the rules and regulations that will govern the power sector under retail competition; the ongoing regulatory review of the power sector by the new labor government (including options to support energy efficiency); and any possible policy changes prompted by the climate change conference in Kyoto (Japan) in December, 1997.

Greatest opportunities. The main opportunities for supporting energy efficiency in the UK include the setting of CO_2 reduction targets as part of the climate change debate, the strengthening of market transformation and information activities of the EST and others, and the introduction of an energy tax.

2.5 CONCLUSIONS

2.5.1 Motivations for Energy Efficiency

End users. The power sector reforms in the UK have led to the removal of subsidies and the new structure largely ensures that the correct price signals are given to the end-users. (The major exception is the absence of energy taxes to internalize the external costs of energy consumption.) The absence of subsidies is generally good for end-use energy efficiency and the time-of-use pricing has encouraged load management schemes that should lead to a more even load curve and avoid the need for additional peak plant capacity.

However, productivity gains in the power sector and the new availability of cheap natural gas since the early 1990s have caused significant price decreases that have reduced end-user incentive to invest in energy efficiency measures. Appliance standards and building codes as well

as information on energy efficient technologies and management practices will remain important for stimulating end-user investments.

Utilities. The motivation of the deregulated and privatized utility companies to invest into energy efficiency measures is either regulatory or profit driven. It depends mainly on three factors:

- the existence of mandated energy efficiency programs (for investments in end-use efficiency),
- the form of the transmission and distribution price control formulas (for investments in transmission and distribution efficiency measures), and
- the intensity of competition combined with the general level of energy prices (for investments motivated by utilities' need to differentiate themselves through expanding services offerings).

Commercial energy efficiency services. So far no large commercial market for energy efficiency services has developed in the UK besides the consulting and contract energy management services market already in existence before power sector reform. The increasing trend towards outsourcing in the commercial and industrial sectors and with the streamlining of government regulations for purchasing energy services should enlarge the role played by contract energy management.

2.5.2 Growth Potential

The growth potential of commercial energy efficiency services in the UK is currently unclear. It appears that several RECs are planning to offer some energy efficiency-related services on a commercial basis. Furthermore, the trend towards outsourcing in the commercial sector as well as activities in the public sector are working in favor of contract energy management companies. However, given the current level of energy prices, energy efficiency services are unlikely to experience dramatic growth. Where they are available, they will usually be offered not as a self-standing product but as part of larger packages such as modernization of government facilities and fuel-switching from oil or electricity to natural gas.

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Warren, Andrew. "Energy - the Price Is Wrong; Free Markets and Energy Efficiency". *New Statesman & Society*, Vol. 9; No. 394; p.25. March 15, 1996. (Note: British Gas abandoned an initially planned nationwide initiative to sell energy-savings services with payments through saving on future bills – with a target of 200,000 homes to be insulated – after reevaluating the effect of the program on its gas business.)

Internet Resources

CIA World Fact Book Web Page (http://www.odci.gov/cia/publications/nsolo/Fact book)
US Energy Information Administration Web Page about the UK (http://www.eia.doe.gov)

CHAPTER 3
NORWAY CASE STUDY

3.1 OVERVIEW OF POLITICAL AND ECONOMIC SITUATION

Norway is an affluent industrialized country with a mixed economy involving a combination of private sector activity and government intervention. The government controls key areas, such as the vital petroleum sector (through large-scale state enterprises), and subsidizes agriculture, fishing, and areas with sparse resources. Norway also maintains an extensive welfare system that helps propel public sector expenditures to more than 50% of GDP and results in one of the highest average tax burdens in the world (46%).

A small country with a high dependence on international trade, Norway is basically an exporter of raw materials and semi-processed goods. It has an abundance of small and medium sized firms, and is ranked among the major shipping nations. Norway opted to stay out of the European Union (EU) during a referendum in November, 1994. The country is richly endowed with natural resources — petroleum, hydropower, fish, forests, and minerals — and is a major producer and exporter of oil and natural gas.

Norway's energy demand is largely met by oil (42% in 1993) and electricity (48%; of which 99% is hydropower). Since the early 1990s Norway has started to liberalize its economy and introduce competition into formerly monopolistic industries such as electric power.

General Indicators

Population:	4.4 million (July 1996)
GDP:	$146 billion
GDP per capita:	$33,302
Inflation rate:	2.5%
Urban population:	73%
Major economic sectors:	Fisheries, oil, forest products, shipping
Structure of the Economy (1985):	2.8% Agriculture; 37.6% Industry; 59.6% Services
Final Energy Consumption:	19.1 Mtoe
Power sector capacity:	27.3 GW
Per capita electricity use:	26,200 kWh (1994)
Type of government:	Constitutional monarchy (democracy)

Sources: World Development Indicators CD-ROM, World Bank, February 1997; CIA World Fact book; 1995 data.

Notes: Norway has the highest per capita consumption of electricity in the world due to a large number of power intensive industries such as aluminum and ferro alloy and very low prices. This results in extensive use of electricity for industrial process heating applications and a high penetration of residential electric heating (75% of all homes are heated electrically); the average household uses about 16,000 kWh per year.

3.2 STRUCTURE OF THE POWER SECTOR

Power Sector Data

Installed Capacity:	27.5 GW (27.3 GW hydropower; in 1995)
Forecast for Capacity in 2000:	28.2 GW[1]
Peak Demand:	19.4 GW (in 1993)
Annual Electricity Consumption:	113 TWh in 1996, 34% household & agriculture, 48% industrial, 18% other
Consumption growth rate:	1.6%/yr (1990-1993); IEA forecast for 1994-2000: 0.5%/yr[2]
Residential Electric Prices:	vary widely (average is 7.1 cents/kWh)[3]
Pool Prices:	1.9 cents/kWh in spring 1997[4]
Taxation:	generally very high[5]
Time of use tariff?	generally available[6]
Industrial autogeneration:	about 12 TWh per year (about 10% of total generation)
Transmission/Distribution losses:	About 9%[7]

Notes:
1) Power in Europe, September 20, 1996; source of data: UNIPEDE.
2) Growth rate varies depending on electricity price; "high" prices (by Norwegian standards) cause substitution of electricity used for industrial process heating by oil.
3) e.g., in January 1997 Drammen Kraft (near Oslo) charged 0.298/kWh Norwegian Krona (NOK; 4.3 cents/kWh) while Oslo Energi charged NOK 0.6263/kWh (8.9 cents/kWh); demand charges depend on the tariff chosen, no demand charge if electricity is purchased from the spot market, there are demand related elements in the calculation of transmission and distribution tariffs; prices are "very hard to compare" according to NVE.
4) Pool prices vary widely depending on weather patterns and import/export activity; average prices have been around NOK 0.25 / kWh in 1996; Note: in addition to the pool prices there is a transmission charge and taxation.
5) 23% VAT; NOK 0.053/kWh (0.8 cents/kWh) electricity tax for non-industrial consumers (1995); electricity production tax on hydropower of NOK 0.0155 / kWh (in 1996); various tax exemptions, e.g., for communally owned generation.
6) was in place before reform (for electric heating); spot pricing is generally available, even for some residential customers
7) 7% calculated based on DOE/EIA data, 9.5% calculated based on data from Statistics Norway.

3.2.1 Pre-Reform Situation

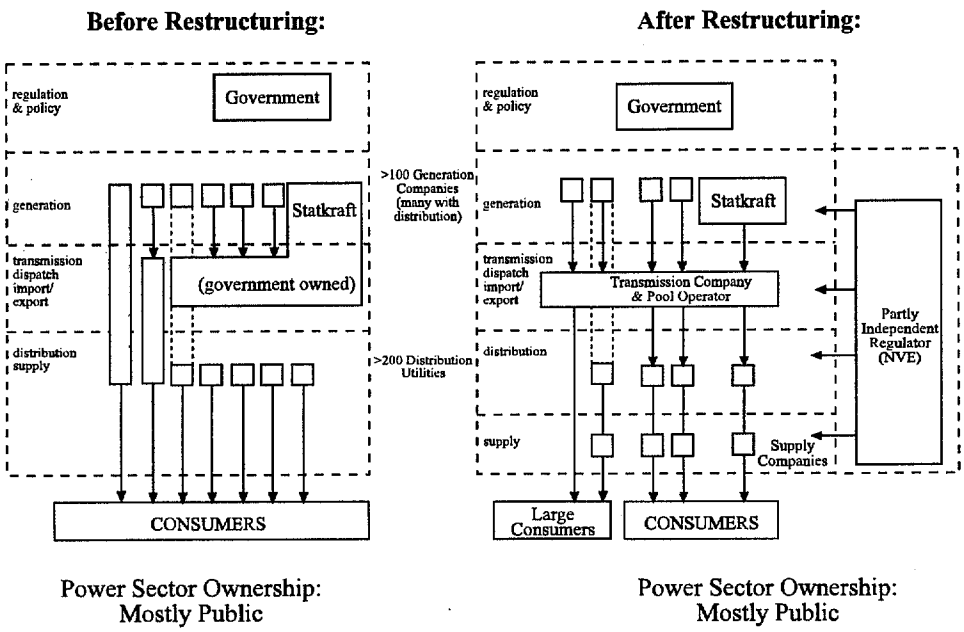
Historically, the Norwegian government played a major role in electrification through the development of the national transmission network, the subsidized supply of energy to energy-intensive industries, and as suppliers of last resort and (through local initiatives) for the electrification of most communities. The major government utility, Statkraft, owned about 30% of generation capacity and 80% of the transmission grid. Most of the hydropower plants were owned by small public distribution companies, and about 15% of production capacity was private (industrial auto-generation and a few utilities). In total there were more than 200 distribution companies ranging in size from fewer than 1,000 customers to more than 100,000. Some uneconomic investments made for political reasons (mostly by municipal distribution utilities) resulted in a capacity surplus in the late 1980s.

The 1990 Energy Act (which came into force in 1991) provided for a clear separation between monopolistic activities (transmission and distribution) and competitive activities (generation and supply). It opened access to the network on all levels. (The power pool, which had been in place for generators and large industrial customers since 1971, was not open to distribution utilities and end-users until then.) The law allowed customers to purchase electricity from the supplier of their choice, it created an organized market for buyers and sellers, and it provided for transmission and distribution pricing principles. The utility regulator, NVE (Norwegian Water Resources and Energy Administration), was awarded new responsibilities for overseeing the pricing mechanism in the monopoly segments and ensuring competition in generation and supply.

3.2.2 Objectives of Reform

The objectives of the reform were to reduce regional differences in the price of electricity, to reduce cross-subsidies favoring residential customers, to direct investment towards the least-cost source (small municipal utilities had preferred to build their own, expensive hydro plants instead of purchasing power), and to encourage efficient utility operations. Many of the small municipal distribution utilities were considered inefficient and expensive. In sum, the objective of the reforms was to improve economic efficiency via the introduction of competition. It should be noted, however, that privatization of public functions was not an objective.

3.2.3 Post-Reform Structure



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Generation. The generation market is highly competitive and consists almost entirely of hydropower plants. Therefore, short-term marginal costs are almost zero while market prices are highly dependent on the rainfall pattern. There were no significant changes in ownership following restructuring; 85% of the capacity is still publicly owned. Additional capacity is provided by interconnections with Sweden (2,800 MW), Finland (100 MW), Denmark (1,000 MW) and Russia (50 MW); capacity will be enhanced in the coming years (via subsea cables) by new connections to the Netherlands and Germany (and possibly also to the UK).

Since restructuring, investments in the operational efficiency of the existing hydropower plants have increased significantly. Attracted by the possibility of exporting electricity, the government-owned energy companies Statkraft, StatOil and NorskHydro developed plans for two 350 MW natural gas combined-cycle power plants. These were approved by NVE in 1996. The plants are scheduled to go online in 1999-2000. It is hoped that they will reduce electricity price volatility by allowing the Norwegian power system to become less dependent on weather patterns.

The plants are controversial with the public because of the CO_2 emissions involved. The official government position is that none of the electricity will be used in Norway and that the plants are intended to substitute for coal-fired baseload plants. Heavy industry is pressuring the government to change this position, threatening to move their production out of Norway if they cannot have access to cheap electricity. They claim that the electricity from the natural gas plants is essential to keeping prices down.

Transmission. The responsibility for the national transmission network has been separated from Statkraft and vested into a separate, state owned company, Statnett. Eighty percent of the network is owned by Statnett and the other 20% is leased from its municipal and county owners and operated by Statnett. The national control center of Statnett acts as system operator and supervises system stability and the technical balance between demand and supply. A subsidiary company, Statnett Marked, operated the power pool until it was reorganized in early 1996 into the Swedish-Norwegian energy bourse (called Nord Pool), which is jointly owned by Statnett and the Swedish Grid Company. There are three organized markets: a "day-ahead market", a "regulating power market," and a financial (futures) market ("week market").

Unlike the one-sided market in the UK, in the "day ahead market" the bid price is established by generation bids as well as purchase offers. The price is set hourly at the intersection of a demand and a supply curve. The "regulating power market" is used to price discrepancies between actual demand and actual generation through bids of prices at which participants are prepared to increase or decrease their generation or demand. In addition, there are arrangements for ancillary services (such as spinning reserve and reactive power output). The "week market" is a purely financial market for futures on delivery weeks ahead of time through standardized tradeable contracts.

Most of the power sales in Norway are still conducted through long-term (1 to 5 years) bilateral contracts. However, the importance of the organized markets has been increasing and the share of long-term transactions has fallen from over 90% to a recent level below 70%. Following the adoption of new energy laws in Sweden and Finland in 1996, the Norwegian power market was merged with the Swedish one in January, 1996. Finland is scheduled to join in 1997 or 1998 and Denmark in 2000, creating a common Scandinavian power market. The joint power market as well as two new subsea cables to Germany (600 MW each, in operation in 2002 and 2003) and one to the Netherlands (600 MW, in operation in 2001) are controversial in Norway. It is believed they will put upward pressure on Norway's traditionally low power prices, especially if Sweden should start to phase out its nuclear power plants as is intended.

Distribution. There are more than 200 distribution utilities, including regional, local and vertically integrated companies, that distribute about 58% of total generation. (The rest is sold directly to industry or produced by industry for its own use.) Most of these utilities are owned by municipalities or counties and about half of them own some generation. The average distribution company is very small, supplying fewer than 10,000 customers.

Until 1996, distribution companies had been regulated through the license conditions set by NVE under a system of rate-of-return regulation. Under this system, NVE allowed the utilities to earn a maximum rate of return equal to the government bond rate plus a risk premium of 1% (the maximum rate was 7.5% in 1996). However, many companies earned significantly more due to variations in demand because of weather variations and due to unclear separation of distribution and supply accounts. Subsequently NVE demanded that a total of NOK 1.2 billion ($170 million) be refunded to consumers through lower distribution charges.

On the grounds that productivity improvement in the transmission and distribution businesses has been unsatisfactory, NVE changed the regulatory system in 1996 to an incentive based system (rate-cap system) similar to the regulatory system in the UK. The allowable total income is now being set in advance (subject to a number of adjustments by indexation); profit is the difference between allowed income and actual cost. This creates a strong incentive for the utilities to reduce costs. At the same time, NVE is setting up service quality standards and penalties for service interruptions to avoid any motivation for utilities to cut maintenance and new investments to unsustainable levels.[1]

As in the UK, the allowable revenue for the distribution business is determined on the basis of the RPI-X formula. NVE is requiring the power companies to achieve uniform 2% costcuts and/or productivity improvements in 1996 and 1997. For 1998 NVE plans to distinguish between efficient and inefficient utilities by varying the X parameter between -2% and -6% based on results from productivity studies.

[1] While the distribution business of a utility is regulated, the supply business of the same utility is unregulated and treated as a competitive undertaking.

The target rate of return on invested capital (depreciated historic cost) is set at government bond rate plus 2% risk premium (8.3% for 1997), with the actual return being capped within a bandwidth of 7% (i.e., maximum allowable rate is 15.3% and minimum "guaranteed" rate is 1.3%) to avoid excessive profits or companies going bankrupt. The allowable revenue for the following year is calculated by adjusting for inflation, the productivity factor, and by 50% of the annual change in energy delivered. This last factor is intended to allow the utilities to recover the higher distribution costs of increased electricity demand; however, because of anticipated economies of scale it allows only a 1% increase in revenue for each 2% increase in electricity distributed.

This ratio has the effect of reducing the incentive for utilities to increase electricity sales. However, for an individual utility, the incentive depends upon actual distribution costs associated with additional sales. (This relationship is currently unknown but is being studied by NVE.) NVE hopes that this approach, together with quality and safety standards, will produce enough incentive for utilities to invest in necessary distribution and safety upgrades without leading to excessive profits.

End-user supply. End-users are free to purchase electricity from any generator, distribution company, electricity trader or broker. There are about 20 registered traders in Norway, some of them small independent companies (mostly owned by former utility employees) and some subsidiaries of foreign utilities (such as Sweden's Vattenfall). Large industrial end-users can also buy power directly from the pool. There is little regulatory framework for the supply market as it is seen as being competitive; nevertheless, all electric suppliers need a license from NVE. The main challenge so far has been to provide for clear accounting rules to avoid cross subsidies between the distribution and the supply businesses of local utilities.

Regulatory oversight authority. NVE has a general responsibility for regulating the monopolistic sectors (transmission and distribution) as well as for supervising the competitive sectors (generation and supply), with the aim of promoting economic efficiency in all sectors. NVE shares authority with the Norwegian competition authority, which oversees mergers and acquisitions as well as investigations into anti-competitive behavior such as price fixing. NVE controls the general tariff structure in the transmission and distribution sectors through licenses, but the Ministry of Petroleum and Energy acts as "court of appeal" and has the final say in regulatory matters. Nevertheless, NVE has an independent role in day-to-day regulatory affairs. Recently, NVE has used its powers to disallow mergers that would lead to vertical integration, while it has stated that it intends to foster horizontal integration.

Pricing rules. Transmission pricing is based on a "point tariff system" that accounts for local network constraints as well as transmission losses and is geographically differentiated depending on the connection point of the user. The transmission tariff includes two fixed charges (a "connection charge" to reflect grid reliability costs and a so-called "power charge" to reflect the user's contribution to peak demand). There are also two variable components (an "energy

charge" based on marginal transmission losses and point of connection and a "capacity charge" to account for transmission bottlenecks). In 1993 the average tariff for the main transmission grid was NOK 0.017/kWh (0.26 cents/kWh). In 1995 Sweden adopted the same pricing system as Norway.

Distribution charges are applied according to the voltage level at which the customer is supplied. Initially there were problems in setting these charges as they varied regionally from NOK 0.04/kWh to NOK 0.30/kWh with some utilities trying to cross-subsidize their supply operation or increase their rate base. An average low-voltage customer pays about NOK 0.15 / kWh in distribution charges and an additional NOK 0.02 / kWh in transmission charges. For residential customers the transmission and distribution charge consists of a fixed component as well as a variable (i.e., per kWh) component.

Power-intensive industries produce about 12 TWh themselves and purchase a further 17 TWh from Statkraft under subsidized long-term contracts set by the parliament (NOK 0.1/kWh as compared to NOK 0.22/kWh for commercial long-term contracts in early 1997). These subsidies have been criticized recently and politicians are demanding explanations and justifications from the industries.

3.3 MARKET RESPONSE TO REFORMS

3.3.1 Power Distributor/Supplier Behavior

Since introduction of competition, the local distribution utilities have become more cost conscious. They evaluate their investment budgets more carefully than before and they have reduced staff significantly.

A move towards consolidation and the development of nationwide alliances has begun with several power companies being sold, merging, or creating common power marketing and trading companies. However, with more than 200 companies, the distribution sector is still highly fragmented and most merged companies are still in public ownership. Observers expect the concentration process on the distribution side to continue, as significant economies of scale could be achieved.

At the same time, most utilities likely will remain in public ownership, as there is significant resistance by several political parties to privatization of community-owned companies. The generation sector, with its approximately 100 hydropower-based generation companies, is expected to remain fragmented with a diverse ownership structure. NVE is preventing vertical integration between generators and distribution companies. NVE encourages horizontal mergers in order to reduce the number of distribution companies as a matter of policy as well as through

the design of its regulations. (Companies are allowed to keep most of the profit resulting from merger-related synergy effects and productivity improvements.)

3.3.2 Retail Prices

Pool prices have fluctuated widely in the past, mostly reflecting changes in weather conditions. Average annual pool prices in the 1980s varied between NOK 0.02/kWh and NOK 0.13/kWh. Since deregulation, average annual prices have been as low as NOK 0.03/kWh in 1990 and 1991 (due to mild winters, abundant water in reservoirs, and overcapacity) and have achieved a record high in 1996 at around NOK 0.25/kWh (due to little precipitation and high demand for electric heating in a cold winter). Prices fell to NOK 0.13/kWh in spring, 1997, but are expected to stay relatively high in the future due to generally higher electricity prices in Sweden and the possible upward pressure on prices by the planned phaseout of nuclear generation in Sweden.

The pool price is generally used as a reference price for bilateral long- and short-term contracts struck outside the pool as well as for generation investment planning by market participants. Residential prices have varied widely because residential customers can choose between long or medium term fixed prices and contracts that will be coordinated with spot market prices. In addition, some utilities have been slow to make price adjustments in order to keep customers, whereas others have adjusted prices as fast as possible. In January, 1997, Drammen Kraft (near Oslo) charged NOK 0.30/kWh (4.3 cents/kWh) while Oslo Energi charged NOK 0.63/kWh (8.9 cents/kWh). In general, prices for residential customers have been roughly constant since power sector restructuring, while prices for commercial and industrial customers have been reduced. National average residential electricity prices were only NOK 0.49/ kWh (7.1 cents/kWh) in 1995, which was the second lowest, after Canada, of all countries involved in the Organization of Economic Coordination and Development (OECD).

3.3.3 Retail and Service Competition

Unlike the UK, no distinction has been made between a franchise and a non-franchise market and there was no phased introduction of competition. In theory every end-user has been able to switch suppliers since 1991. Until 1997, however, competition was limited mostly to industrial and commercial customers, because of high transaction costs of up to NOK 5,000 (about $715) and one month advance notice being required to change suppliers. Furthermore, many details, such as metering and settlement, were addressed only after legislation was in place. Hourly meter reading is mandatory only for end-users with an annual power consumption higher than 400,000 kWh. For smaller end-users, settling of purchases can be based on the network owner's system load profile. Since the introduction of these metering rules by NVE in January, 1995, transaction costs for switching suppliers have been forced down to NOK 200. In January 1997, NVE abolished this charge completely.

Starting in 1992 nationwide hotel and grocery chains, smaller distribution utilities with high-priced delivery contracts, and other big end-users such as the telephone companies and the military were the first to switch suppliers. Much of the competition was coming from newly established electricity traders and brokers who competed for the large end-users of the distribution utilities. Initially, the distribution utilities appeared to be very inflexible in dealing with the competitive threat, but over time the customer orientation of the distribution utilities improved (e.g., the utilities started offering flexible pricing and payment options).

The large majority of residential end-users (more than 90%) are still supplied by their local distribution utilities due to the complexity of comparing prices, little awareness of competition, and marketing inertia by distribution and supply companies that have focused mostly on commercial customers so far. In the early 1990s distribution companies also hedged against mass switching by keeping prices very similar to their competitors causing NVE and the Competition Authority to investigate possible price fixing.

Another problem has been that many residential customers are not aware of their electricity costs since they receive a bill only once a year. Many residential customers are sent quarterly invoices for 25% of their estimated yearly costs but actual consumption is shown (and any cost correction made) only once a year. An evaluation by the Norwegian Competition Authority revealed that 25% of the invoices sent out by the distribution and supply companies in 1996 did not itemize costs properly, making cost comparisons even more difficult.

The market has become more competitive since NVE abolished all charges for switching suppliers in January, 1997. Housing cooperatives are aggressively looking for better suppliers. Norway's largest association of industrials has formed an electric supply company to supply members with electricity. Spot market activity is increasing and utilities are gradually developing into a "normal" business. Change of power supplier is possible at present only once every quarter, but there are plans to change this to once every week at the end of the year. Nevertheless, only 0.25% of all household customers of the country's largest 40 utilities switched supplier between January and March, 1997 (the quarter following the abolition of charges for switching suppliers).

3.4 END-USE ENERGY EFFICIENCY

3.4.1 Pre-Reform Situation

Increasing electricity demand, coupled with environmental restrictions on building new hydropower plants and increasing national attention to resource conservation issues, led to voluntary demand-side management efforts by the larger utilities during the 1980s. In addition, the government put pressure on the utilities to develop "energy plans" that included strategies for encouraging energy conservation. The government also had a strategy of fostering vertical

integration to reduce utility fragmentation and to create incentives for utilities to develop programs to reduce demand rather than to build new hydropower plants.

In 1988 a government report estimated the technical energy savings potential in Norway at 19%. By 1990 about 300-person years (about 2% of the total utility staff) were devoted to DSM in Norwegian utilities. Since the early 1980s the government has also provided financial support for energy efficiency measures (mostly through grant programs to end-users) whose volume increased gradually from about $7 million in 1986 to a peak of about $62 million in 1993. In addition there were extensive R&D programs to support energy efficiency.

3.4.2 Integration of Energy Efficiency in Reforms

Policy. In the early stages of the climate debate in 1987 a United Nations Committee chaired by the Norwegian Prime Minister, Gro Harlem Brundtland, published an influential environmental report, "Our Common Future" (popularly called the "Brundtland Report"). The report called for drastic reductions in energy use in the developed countries to avoid a global climate disaster.

Soon after, the Norwegian government accepted the challenge advanced by its own leader. The new energy law of 1990 mandated integrated resource planning (IRP), removed price controls, and introduced competition in generation and supply. Utilities were required to draw up DSM plans every four years comparing energy conservation options with generation options.

This plan had to be submitted to the regulator, but implementation was not legally required and the problems of DSM program cost recovery, lost revenue recovery, and financial incentives for utilities to pursue DSM were not clearly addressed. Furthermore, many distribution utilities lacked the manpower and knowledge to implement energy efficiency plans. At the same time the government abandoned its goal of vertical integration and began to foster horizontal integration of utilities instead, which ran counter to the notion of integrated planning. Independent brokers started to compete for the big customers of the established utilities. Within a year after the act was in place, government officials were sending signals that IRP was no longer seen as compatible with a deregulated electricity market. In 1994 the requirement for utility IRP was removed and the clauses pertaining to DSM were weakened. Since 1994 NVE has been the entity responsible for administering the government efforts in the field of energy efficiency.

Regulation. *Regulation of power sector energy efficiency activities.* In general, the regulation of the power sector has been evolving since the energy act went into force in 1991 and is only now becoming comprehensive and consistent. The main goal of the regulatory authority NVE has been to make the market more competitive and to improve market transparency.

Since the changes to the energy law in 1994 and the weakening of the DSM clauses, the utilities have been required only to "encourage effective utilization of energy resources through neutral information and advice on energy conservation to customers in its service area." This is being

interpreted as meaning that the utility should be prepared to provide an energy audit, an overview on available energy conservation programs, and energy use information when it is requested by the customer. Utilities are no longer required to include DSM in their strategic planning or implement large efficiency programs.

Since 1993 the utilities have been allowed to include expenses for energy efficiency information in their distribution tariff through a small surcharge of NOK 0.002 / kWh (0.03 cents/kWh), providing for an annual amount of NOK 140 million ($20 million). This money is intended for energy efficiency information programs for all customer groups except large industrial companies. However, because NVE is not staffed to monitor the more than 200 distribution utilities and because many utilities are too small to justify assigning one full-time employee to energy efficiency activities, the utilities tended to use these funds for marketing and load building purposes instead.

To avoid misuse of funds and to provide for more qualified personnel and advice, the government fostered the establishment of regional energy efficiency centers to perform the mandatory energy efficiency information functions on behalf of the utilities. These energy efficiency centers are jointly owned and funded by regional utilities (and in a few cases by third parties such as oil companies) and they are operated by six operating agents selected by NVE. Centers have been established in 17 out of 19 administrative districts. The activities of the centers are very uneven and in some areas there are no energy efficiency activities at all. In many regions consumers are not aware of the existence of the centers. Finally, there are underlying tensions between the centers and the distribution utilities as the utilities perceive the centers as being detrimental to their business.

One of the most active centers is Oslo Energi Enok, the energy efficiency center of Oslo Energi, the municipal utility of the Norwegian capital. Besides providing general information and individual advice, the center performs free energy audits in commercial buildings such as hospitals. For these activities the center usually hires one of the approximately 20 local consultants specializing in energy efficiency and energy audits. In addition, the city of Oslo has set up a local energy efficiency fund totaling $100 million, the interest of which is used for efficiency related grants to end-users (about $5 million per year).

In certain other regions utilities have resisted giving up control of their energy efficiency expenses. Some do not even spend the total of their allowed amount and only an estimated 50% of total expenses is channeled through the energy efficiency centers. NVE cannot force the utilities to participate in the centers and NVE does not have the staff to supervise spending of the energy efficiency allowance by so many widely dispersed distribution utilities. Furthermore, there is a lack of evaluation of the effectiveness of the various information programs.

In 1996 the allowable surcharge was increased by 50% to NOK 0.003 / kWh, with the additional amount being earmarked for the regional energy efficiency centers. Only NOK 20 million out of the possible additional NOK 70 million were actually transferred to the centers by the utilities.

(Other utilities choose not to collect the money.) NVE receives some additional funding from the government for energy efficiency projects and it acts as the national coordinator of the energy efficiency centers but does not have a clear legal foundation. For example, NVE has established a common logo for energy efficiency and for the energy efficiency centers, but some centers refuse to use the logo. Proposals to change the energy law to give NVE more influence over the use of the energy efficiency surcharge are currently being discussed.

Codes and standards. Although Norway is not a member of the European Union, in 1995 it adopted the EU labeling scheme for refrigerators, indicating energy efficiency on a scale from A to G. Norway is likely to follow other labeling and standards activities of the EU explicitly or implicitly because of its close economic ties with EU countries. On January 1, 1997, new Norwegian building codes came into force requiring a 25% reduction of energy use in new buildings (from levels established in preexisting codes that were already fairly strong).

Related policies and regulations. Norway introduced CO_2 taxes on fossil fuels and on oil and gas activities in 1991 that vary widely by product. Some energy and industrial sectors are exempted from the tax; it has no effect on the electricity system which is based almost entirely on hydropower. In 1996, the Norwegian parliament adopted a "preliminary target" to stabilize CO_2 emissions at the 1989 level by 2000. However, projections indicate that Norway's CO_2 emissions will rise 16% above 1989 level by 2000, with the offshore oil and gas sector accounting for 13% of this increase. Currently the government is focusing on implementing voluntary measures among industries that are exempted from the CO_2 tax. An increase in the CO_2 tax is unlikely due to concerns about the competitiveness of Norwegian industry.

In June, 1997, the Ministry of Environment laid out its "Environmental Policy for Sustainable Development." The policy states that "the government aims to curb growth of energy consumption in Norway" and that "work to foster socially profitable efficiency measures will be strengthened." To date, the planned measures have been limited to encouraging a shift from electric heating to heating with biomass, evaluating the CO_2 tax structure, and negotiating with industry for voluntary agreements on reducing emissions.

3.4.3 Activities Promoting Energy Efficiency

Power sector. With the advent of competition, utilities moved most of the personnel from their old DSM departments into marketing and customer service functions. In the early 1990s, many utilities predicted that energy efficiency services such as energy audits and energy efficiency consulting would play an important role in helping them to compete. However, there currently are almost no utility-led energy efficiency activities other than the utility-sponsored energy efficiency centers (see above) and the occasional information program offered by an individual company. A number of utilities started up new information campaigns in the fall of 1996 in reaction to a steep increase in spot electricity prices.

One short-lived campaign financed from an energy efficiency fund set up by the city of Oslo helped Oslo Energi to provide residential customers with information booklets on energy efficiency, start a rebate program for Compact Fluorescent Lamps, and distribute packs of five free thermometers, each inscribed with the "correct" temperature in the room in which it should be installed. These programs are short-lived, observers think, because there is so little competition in the residential sector that there is no need for a utility to differentiate itself by offering expanded services. Furthermore, utilities have a general understanding that energy efficiency is being taken care of by the surcharge.

Government. In a 1993 review of its extensive energy efficiency grant programs for residential, commercial and industrial customers, the government estimated that 50-70% of customers who implemented the recommended changes would have done so anyway, without the financial assistance. Although this estimate was disputed by some other researchers, all grant programs were discontinued, the budget for energy efficiency was reduced, and subsequent efforts were limited to information and education. The 1994 state budget for energy efficiency was scaled back significantly to NOK 56 million (approx. $7.8 million) from NOK 352 million in 1992 with further cuts in 1995. (Energy efficiency R&D is in a separate budget.)

In October 1996 (during the so called "electricity crisis") the Norwegian government announced NOK 15 million ($2.3 million) would be spent for "an extraordinary information campaign to curb the consumption of electricity between then and summer 1997". The money was allocated to NVE for use in newspaper, radio and TV commercials. Furthermore, an increase in the maximum allowable energy efficiency surcharge from NOK 0.002/kWh to NOK 0.003/kWh was instituted.

A pilot project in Oslo revealed that end-users' attitudes about energy use can be changed in part by improved billing design. In that study, end-users who received more frequent bills as well as a graphical representation of their electricity use tended to use less energy. In response to these results the Oil and Energy Ministry directed NVE to develop guidelines for a billing format similar to the one tested. Draft guidelines were published in August, 1997, for review by utilities and other interested parties. The bill would be sent quarterly and would report actual, not estimated, use; it would display trends in consumption over the past two years; and it would list the current distribution and supply companies. The final law is expected to be published by the end of 1997, with implementation by Jan 1, 1999.

On the local level there is some interest in energy efficiency by the municipalities, but in effect politicians have been reluctant to push their locally owned utilities to support energy efficiency activities. Driven by environmental and climate protection concerns, the government currently appears intent on increasing support of energy efficiency measures. The Department of the Environment has released a white paper setting goals for the introduction of improved electricity bills and for increasing energy audits.

Private Sector. There has been fairly little commercial energy efficiency activity since the government and utility rebate programs of 1992 and 1993. Most end users and consulting companies are focusing on finding the least expensive supplier rather than improving their energy efficiency.

One exception occurred during the price peaks in fall and winter, 1996, when temperature-adjusted electricity consumption figures fell because industrial users switched from electrical process heating to oil heating. Currently, two large facility management companies are undertaking a systematic evaluation of the energy efficiency of their premises as they coordinate their energy purchasing.

In the past, NVE conducted some studies of energy performance contracting in the public sector and several consulting companies started performance contracting with public buildings. These efforts were abandoned, however, because of problems with the public procurement rules and perceived high risks. Currently, no performance contracting activities are known in Norway.

Energy efficient technologies. Efficient technologies are widely available in Norway and there are no significant barriers to their production or importation. However, there is not much interest on the part of the manufacturers in marketing energy-efficient models, nor is there consumer interest in purchasing these models due to the low electricity prices, and, in the case of residential users, the characterization of the electricity bill as a fixed expense. For example, the mandatory EU labels on energy efficiency of refrigerators have not been promoted by the energy efficiency centers, nor are they being used by retailers in advertising.

Extent of implementation. Most of the energy efficiency activity in Norway consists of information and market transformation efforts undertaken by the energy efficiency centers and a few others. Very little direct service is being offered to customers because both utilities and the government consider that these functions are being provided for by the energy efficiency centers, at least for residential customers. In reality, there is very little demand for such end-user energy efficiency activities, because electricity is generally inexpensive in Norway and consumers view their electricity costs as fixed.

3.4.4 Constituencies

Besides government and research institutions there are several other organizations interested in energy efficiency:

- The industrial trade group network is an industry-controlled, NVE-financed program that provides information on industrial energy efficiency; membership consists of 12 trade groups that represent about 80% of industrial on-shore energy consumption.

- EnFO (the Norwegian Association of electric utilities) has conducted energy efficiency research in the past, which was funded from membership fees; more recently EnFO has shifted its emphasis towards general market research.

- Bellona, Norway's largest environmental organization, is lobbying for energy efficiency on climate protection and environmental grounds.

3.4.5 Prospects for the Future

Expected legal and regulatory changes. If the parliament grants NVE more influence over the use of the energy efficiency surcharge, regional energy efficiency centers may become better coordinated and more independent of the utilities, freeing them to undertake additional activities.

Greatest remaining barriers. Overall, the government has been reluctant to support energy efficiency in part because of the ubiquitous availability of inexpensive energy. Not many of the typical barriers exist in Norway; the main problem is a lack of incentives.

Key actions needed. In the residential sector, the most urgent need is for more frequent billing. This would heighten customer awareness of electricity costs and allow closer monitoring, alerting customers to the possibility that they could reduce this expense by making adjustments in their electricity use.

If NVE is given more discretion in the use of funds collected through the energy efficiency surcharge, it may be able to achieve better coordination among the programs offered by regional energy efficiency centers.

Greatest opportunities. The regional energy efficiency centers already provide a mechanism for promoting energy efficiency. If the regulatory environment were to be changed to allow for greater independence from utilities and expansion into non-information activities, these centers would be an obvious focal point for energy efficiency activities. The emphasis in Norway on climate change issues will also provide an opportunity to bring attention to the issue.

In addition, in April, 1997, the Norwegian government appointed a committee to conduct a year-long far-reaching review of energy consumption trends that will form the basis of a white paper on energy policy in 1998. The review includes energy efficiency and the future potential for renewable energies. Because of Norway's intention to stabilize its CO_2 emissions, the report is expected to include some additional support for energy efficiency.

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3.5 CONCLUSIONS

3.5.1 Motivations for Energy Efficiency

Since restructuring of the power sector, utilities have abandoned most energy efficiency efforts due to a lack of incentives. Electricity is inexpensive in Norway and generation is nearly entirely hydroelectric. Competition for end-users is mostly limited to price, and commercial energy efficiency services by utilities have not been developed.

So far, the energy efficiency centers have not served to compensate for the reduction in utility activity and government energy efficiency funding, as they often lack the financial support of the local utilities. The centers are, by statute, limited to providing information programs. These programs are of uncertain effectiveness; there is little national coordination and no evaluation of the programs. Furthermore, the centers are not fully independent from the utilities, which further hinders their activities. In general, the Norwegian energy efficiency information programs could be better targeted and more centrally coordinated to improve their effectiveness.

In the residential sector, consumer motivation to modify energy use patterns will likely increase as a consequence of more frequent and more informative billing practices. Furthermore, there could be an opportunity for the government to start an energy services market by improving its purchasing and bidding requirements for energy equipment and services along the lines of the UK's private financing initiative or the US Federal Energy Management Program.

3.5.2 Growth Potential

The government investigation of energy consumption initiated this year and the subsequent white paper in 1998 should provide an estimate of further energy savings possible in Norway. There are no data available regarding how much energy efficiency was lost, if any, when utility DSM programs were discontinued after the restructuring of the power sector.

Though many of the prerequisites for success are in place, such as appliance efficiency standards and labeling, an energy efficiency surcharge, and regional energy efficiency centers, there appears to be little concern about energy efficiency because of the relatively low cost of electricity. The further development of Norwegian climate change policy is likely to provide the major influence on how energy efficiency activities will develop in the near future.

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CHAPTER 4
CHILE CASE STUDY

4.1 OVERVIEW OF POLITICAL AND ECONOMIC SITUATION

Chile extends 4,345 km along South America's western coast and has a GDP of $113.2 billion and a population of 14.3 million. Over the past decade, Chile has successfully maintained steady economic growth rates of 6 to 10% by promoting foreign investment, cutting taxes, and reducing import subsidies and tariffs to around 11%. Chile does not restrict foreign ownership of companies and permits invested capital to be repatriated after only one year. In 1996, Chile's economy grew by 7.1% while maintaining an inflation rate of 7.4%, remarkably low for South America. That same year, Chile became an associate member of Mercosur, the Southern Cone Common Market, of which Argentina, Brazil, Paraguay and Uruguay are full members.

Businesses in Chile are predominantly privately owned and controlled, with the notable exception of the mining sector, which is the single largest industry and the largest consumer of energy in the country. Codelco, the state-owned copper corporation, is Chile's largest company and the world's largest copper company. Chile is also the world's leading producer of copper.

General Indicators

Population:	14,333,258 (1996)
GDP:	$113.2 billion (1995)
Per capita GDP:	$8,000 (1995)
Inflation rate (consumer prices):	7.4% (1996)
Major economic sectors:	
▸ *services:*	56.2% (1995)
▸ *industry:*	36.4% (1995)
▸ *agriculture:*	7.4% (1995)
Total energy production:	24 billion kWh (1996)
Power sector capacity:	5,946 MW (1996)
Per capita electricity use:	1,656 kWh (1996)
Type of government:	republic
Literacy rate:	95.2% (1995)

Source: CIA World Factbook.

4.2 STRUCTURE OF POWER SECTOR

Power Sector Data

	Total	Industrial	Commercial	Domestic	Other
Installed Capacity (MW)	5,946				
Peak Demand (MW)	3,267				
Electricity Consumption (GWh)	23,531	61%	9%	15%	15%
Per Capita Electricity Consumption (kWh)	1,656				
Growth Rate for Electrical Demand	8.5%				
Retail Electric Price ($/kWh)	.10	.10	.10	.11	n.d.
Time of use of tariff	yes	yes	yes	yes	yes
Total Losses	9%				

Sources: Energy Information Agency database; *Market Assessment of Chile,* Export Council for Energy Efficiency, 1997 (data for 1996); *Saving Energy in Chile,* IIEC and NRDC, 1993.

4.2.1 Pre-Reform Situation

Energy demand has grown at an average rate of 7% since 1986, and grew 10% in 1995.[11] According to estimates by the Comisión Nacional de Energía (CNE), Chile's electricity demand will grow at a rate of 8.5% over the next ten years. In order to meet this demand, CNE has estimated that Chile will have to double its current capacity. In addition, President Eduardo Frei has called for complete electrification of Chile by 2000.

Prior to reform, the electricity sector was characterized by state owned enterprises; the Chilean government controlled 90 percent of generation, all transmission, and 80 percent of distribution capacity. Government subsidies to the energy sector completely distorted the prices of oil, coal, gas, and electricity. In addition, cross subsidies produced an inefficient use of resources, unnecessary investment, and diversion of capital from other social needs.

The Chilean government believed that the state electric company exercised more influence than the regulating agencies charged with its oversight, such that it had become an entity that went its own way, regardless of the public interest. It was also felt that the government's regulatory and business roles, quite generally, were in conflict.

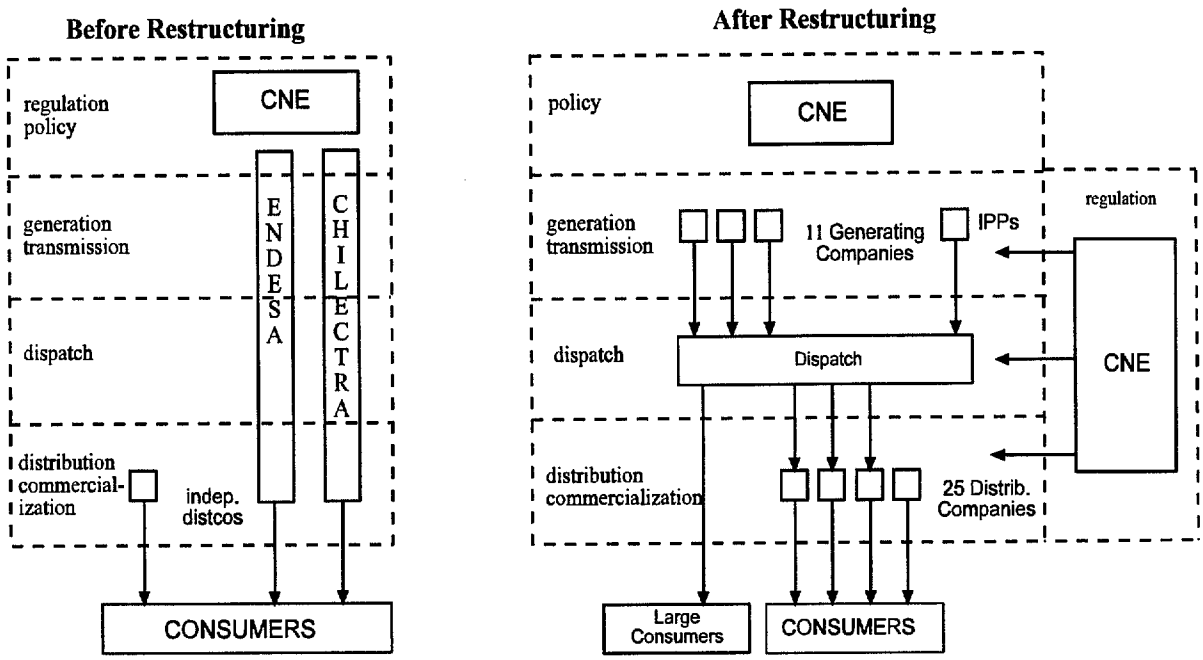
4.2.2 Objectives of Reform

In the early stages of the reform, the main objective was to establish a set pricing system in the energy sector as a whole. A key element of the reform was that decentralized decisions by energy

[1] Rudnik, Hugh. "Pioneering Electricity Reform in South America." *IEEE Spectrum,* August 1996.

consumers and producers had to yield economic efficiencies. The implication was that prices of the different energy products had to reflect their true economic value, so that individual decisions coincided with the least cost for the country. That understanding led first to legal and institutional changes to deregulate prices of liquid and solid fuels. (See Section 2.3 for a detailed explanation of the changes.)

It was also thought that the government should be limited to a supporting role in the energy sector; it should perform entrepreneurial activities only when such activities could not or would



not be carried out by the private sector. Its main job should be to regulate activities that are monopolistic. In keeping with this new hands-off approach, the government also discontinued electricity price subsidies in all sectors, alleviating some financial and budget pressure on the government.

4.2.3 Post-Reform Structure

In 1982, Chile formalized its power sector reform and passed a law that same year that defined basic regulations. Utilities were privatized between 1986 and 1989, an action which was preceded by financial and corporate restructuring. At the end of 1988, Chile had five generating companies, two distribution companies, and a competitive, economically-based dispatch system. An independent pricing mechanism is now in place as well, which sets prices based on a model

efficient company rather than a cost-plus system, so that there are always incentives for producers to strive for greater economic efficiency. All price subsidies to the energy sector in Chile were discontinued.

Chile instituted market mechanisms to encourage competition. First, it allowed large consumers to purchase power from any generator or distribution company, giving suppliers an incentive to lower costs in order to capture more of the market. Second, it linked the regulated price to the market price, so that small consumers would share in the efficiencies resulting from competition. Third, it relied upon the unregulated price as a signal for investment, so that supply expansion decisions would reflect market prices.

Today all transmission and distribution is privately held, while the small fraction of generation in the hands of the state will soon be privatized. The "Southern Cone" model, as the Chilean model is referred to, unbundles the industry into generation, transmission, dispatch, and distribution, and deregulates the utility systems at both the wholesale and retail levels. The following is a description of the branches that make up the energy sector in Chile.

Generation. No licenses are required for generation. Independent generators can sell energy to large consumers at negotiated contract prices and to distribution companies at regulated prices. The wholesale portion of the model relies on open competition in generation. The model's retail portion ensures direct access to generators for medium-size and large users under freely negotiated contracts, and regulated prices for smaller consumers.

Today, Chileans get 90% of their electricity from three large utilities: privately owned Empresa Nacional de Electricidad SA (Endesa), privately owned Compania Chilena de Generación Electrica SA (CHILGENER),[2] and Colbun Machicura SA (Colbun), partially privatized in early 1997. Empresa Electrica del Norte Grande (EDELNOR) provides services to Chile's fast-growing mining region in the north.

In 1981, the government decided to breakup the state-owned utility Compania Chilena de Electricidad SA (CHILECTRA) and formed CHILGENER, as a generation subsidiary. Then in 1986, the government decided to dissolve CHILECTRA and transferred ownership to Corporación de Fomento de la Produción (CORFO) and CHILGENER. By 1988, CHILECTRA was fully private.

Endesa was created in 1943 as a subsidiary of CORFO, which remained its majority share holder until 1988. Endesa remains the largest electric and generation company in the country. Chile has a total installed capacity of 5,946 MW. Hydroelectric plants account for 3,180 MW, steam-

[2] Chilean multinationals such as CHILGENER and Endesa own more installed generation capacity outside Chile than inside. In addition to Santiago, Buenos Aires and Lima are also being supplied by CHILECTRA, which serves a total of 39% of the Chilean population and 17% of the Argentinean and Peruvian populations, respectively.

electric plants total 1,900 MW, oil-fired gas turbines provide 530 MW, and diesels account for the remainder. At the end of 1995, Endesa had 2,513 MW of capacity, 48% of the country's total, and it generated 11.8 TWh during the year, 47% of the total.

Transmission. Now fully privatized, transmission companies must provide open access to all generators, but may not sell energy independently. They deliver power from the generators to distribution companies, or directly to large customers. Because transmission is considered a natural monopoly and therefore subject to government regulation, transmission companies receive payments from generators adequate to cover the costs that would be incurred by an ideally efficient transmission company of comparable size. These costs are based on the replacement value of assets plus the operating expenses of a "model" company.

Most of Chile's utility capacity feeds Endesa's Sistema Interconectado del Norte Central (SIC), which comprises more than 7,500 km of transmission lines spanning 2,000 km from north central to southern Chile.[3] In the far north — Norte Grande — is a separate grid known as the Sistema Interconectado del Norte Grande (SING) serving mainly mining auto-producers, while in southern Chile there are several isolated systems with an installed capacity of 46 MW.

Pooling and dispatch. Each of the two principal integrated systems (SIC and SING) has a coordinating committee (Centro de Despacho Económico de Carga, or CDEC) responsible for system operation (ensuring security of supply and optimizing generation). The coordinating committee is limited to representatives of the largest generators. The committee members have the ability, and perhaps the incentive, to "interpret" data and results in favor of the generation company shareholders. The asymmetry of information may have benefited the large generators, which are able to use their superior access to market information, and to the market itself, to the detriment of smaller competitors.

Distribution. Enersis is a holding company that owns 17.3% of Endesa and 73% of Distribuidora CHILECTRA Metropolitana (CHILECTRA), the country's largest electricity distributor serving Santiago. The second biggest distribution company is Chilquinta, which serves 1.3 million customers. The rest of the 25 distribution companies in Chile primarily offer local service.

End user supply. CHILECTRA is the largest distributor in Chile. Transmission companies are prohibited from selling energy for their own interest, though they can deliver power directly to large customers.

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[3] In 1996, Chile suffered a severe drought which reduced its hydroelectric output from 86% of the SIC total in 1995 to 73% in 1996. In response to this shortage of electricity, CHILGENER ran its thermal plants flat-out and moved up commissioning of a new coal-fired unit. Although it would seem logical that such an event would stimulate power sector interest in energy efficiency, or at least load management, in reality this did not appear to occur and was simply treated as a temporary shortage.

Regulatory oversight authority. The Ministry of Economy authorizes licenses and approves and publishes tariffs. CNE provides some regulatory functions for the energy sector including providing implementation rules, proposing policies, and overseeing market functioning and quality of service areas. The Superintendency of Electricity and Fuels oversees the technical and financial performance of sector entities, and maintains a technical statistical database for measurable data.

The government regulates electricity but does not subsidize the sector. In general, the government adheres to a policy of non-intervention in energy markets. The agencies responsible for regulating the energy sector have no commercial interests.

Pricing rules. The CDEC, the agency responsible for the power pool, also oversees the price of electric power sales from generating companies. Small consumers, with demand of less than 2 MW, pay for their electricity according to a regulated tariff based on the marginal costs of electricity generation. Large consumers (>2 MW) are free to negotiate price contracts directly with generating companies. Sale prices are regulated by a tariff system established in 1982 whereby marginal energy costs are determined in relation to the optimal operation of the various generators on the system. Since 1992, marginal costs have been calculated hourly. Sales prices charged to distributors are based on "node prices" or spot-market prices that are determined by CNE. Additional pricing factors are then applied for specific facilities to reflect changing operational conditions.

4.3 MARKET RESPONSE TO REFORMS

4.3.1 Power Distributor/Supplier Behavior

As a whole, the Chilean energy sector has improved its economic efficiency and has experienced minimal transition problems while undertaking privatization and power sector reform. The quality of supply has improved and the average response time to electrical outages has shortened. Between 1989 and 1995, productivity at Chile's largest electricity company, Endesa, more than doubled in terms of GWh generated per employee. During the same period, the average response time for providing distribution emergency service was cut by more than half at CHILECTRA. Distribution losses, including energy theft, were halved in seven years. The number of customers per distribution worker more than doubled in 10 years.

Sociedad Electrica Santiago SA (ESSA), a subsidiary of CHILGENER, has developed an energy efficient plant called the Nueva Renca Plant. The plant, with a capacity of 370 MW, will be the first combined-cycle plant in the country that will generate electricity from natural gas, with high efficiency, low costs, and minimal environmental impact. Nueva Renca claims a maximum generation efficiency of 54.4 percent, the highest available today. This percentage is in stark

contrast to the 38 percent maximum efficiency from steam-coal type plants, which are common in Chile.

4.3.2 Retail Prices

Though the price of power has dropped in real terms, electricity prices in Chile still remain high and prices vary widely depending on the origin of supply and the type of fuel used to generate the electricity. In the north, where thermal sources are plentiful, electricity costs range between US$0.10/kWh and $0.12/kWh. In the south, where there are substantial hydropower resources, prices average $0.08/kWh. In remote locations, served only by diesel or gas, costs can be 2 to 3 times those charged for electric service elsewhere. A contract to import natural gas from Argentina is expected to drive down the price for energy.

4.3.3 Retail and Service Competition

The predominance of one generator, the SIC, has caused problems in converting to a competitive market structure. At the time of privatization, there were no legal restrictions on cross-ownership of assets in different segments, and the bulk of the generating capacity and all of the transmission capacity serving the SIC were acquired by one private company. A controlling interest in this company was later purchased by an investment group that also had a controlling share in the largest distribution company. The shareholders of the transmission entity, TRANSELEC, are also the same as the Endesa shareholders. Thus, one investment group controls most of the system's generating capacity, the largest distribution company, and the transmission assets.

In effect, the Chilean policy of allowing cross-ownership of assets has allowed a monopoly to develop. According to a number of individuals interviewed for this study, cross-ownership and consequent conflicts of interest have hindered the development of a more competitive generation market in Chile.

4.4 END-USE ENERGY EFFICIENCY

4.4.1 Pre-Reform Situation

Prior to reform there was virtually no energy efficiency activity in Chile. Government activity was limited to public information campaigns focused on encouraging such energy saving practices as turning off lights. These campaigns reinforced an ethic of "conservation sacrifice" among the population. Subsidized power prices gave little incentive for energy efficiency in the commercial and industrial sectors, except to help utilities forego generation investment. In the

private sector, very little energy-efficient equipment and no energy-efficient services were available.

CNE's Energy Efficiency Program estimates that improved energy efficiency in the industrial sector could reduce its electricity demand by 4,924 GWh by the year 2002. Realization of this potential would reduce Chile's total projected demand in 2002 by 13% and industrial demand by 23%. In addition, the International Institute for Energy Conservation (IIEC) has published a study with the University of Chile and the Natural Resources Defense Council on Energy Efficiency in Chile entitled *Saving Energy in Chile*. The study concludes that the economic potential to save electricity is 3,400 MW by the year 2020.

Motors are by far the largest end-use, consuming 61% of the country's electricity. Sales of motors have been growing at 15% per year. Lighting accounts for 18% of power use.

IIEC and the US Export Council for Energy Efficiency recently conducted a study on Chile's energy sector and concluded that Chile's top-consuming industries could reduce electricity consumption by almost 30% through increased energy efficiency. The savings would total 2,614 GWh per year and would equal over 10% of the national electricity consumption.

Table 4-1
Energy Savings Potential by Industry

Industry	Consumption (GWh)	Potential Savings (GWh)	Potential Savings (percent)
Copper and Mining	5,065	1,524	30%
Pulp and Paper	1,621	410	25%
Iron and Steel Mining	642	163	25%
Cement	346	155	45%
Food Processing	583	102	18%
Others	1,150	260	23%
Total	*9,407*	*2,614*	*28%*

Source: "Potencial de Ahorro de Energía Eléctrica: Gran Industria y Minería" Comisión Nacional de Energía, 1993.

The foremost consumer of electricity in Chile is the mining sector, for which the minimum annual growth in energy consumption is projected at 14.6 percent. The Codelco copper mining company recently examined the energy efficiency potential at the world's largest open pit mine. It identified potential savings of 77 GWh per year, mostly from the installation of new energy-efficient motors. Since motors are the greatest end users of energy, this would be a very good

way to begin implementing energy efficiency programs. However, industries in Chile generally prefer to rewind old motors rather than to replace them with new, energy-efficient ones.

4.4.2 Integration of Energy Efficiency in Reforms

Policy. Energy efficiency was not made part of the power sector reform program in Chile. The official government position on the subject was that restructuring the market to ensure competition in supply would automatically provide incentives for energy efficiency. Economic efficiency was the only efficiency considered. The assumption was that the market would cause utilities, end-users, or energy service companies to undertake energy efficiency projects if they made economic sense.

More recently, the government has made public statements calling for a 10% reduction in energy consumption over the next ten years. Presumably, this will require a more systematic effort than simply reminding residents to conserve electricity. There has also been discussion in policy circles of the need to introduce restrictions on cross-functional ownership to discourage monopolistic behavior in generation, transmission, and distribution utilities. This could have indirect consequences for energy efficiency.

Regulation. *Regulation of power sector energy efficiency activities.* Current regulations in the energy sector stipulate that a supplier must provide energy to the end-user at least cost. There are no power sector regulations that specifically address energy efficiency issues. Demand-side management or integrated resource planning are not required of any generators or transmission utilities wishing to make new investments.

Those investments that are made do not reflect the true societal cost of the choices made. This is of particular concern in Santiago, where ambient air quality is already low and there is concern that investments in new power plants only worsen this situation.

Codes and standards. The only appliance efficiency standard in operation in Chile is a voluntary standard for refrigerators. Refrigerators make up less than 4 percent of energy consumption in the country. Furthermore, since the standard is voluntary, manufacturers have very little incentive to meet its requirements. IIEC is working with the US Lawrence Berkeley National Laboratories to coordinate the development of Latin American regional energy efficiency standards. IIEC is currently answering inquiries from Latin American agencies on how to establish efficiency testing capabilities.[4]

Related policies and regulations. In March 1994, Chile passed its first environmental law which sets standards for various air and water emissions and directs industry and government to

[4] http://www.iiec.org/about/synapse/la.html

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complete environmental impact assessments on projects over a certain size. The law does not set standards for energy efficiency but the air emission standards may have an indirect impact on energy efficiency.

4.4.3 Activities Promoting Energy Efficiency

Power sector. Several utilities do have load management initiatives in place, such as time-of-use tariffs, in order to discourage energy use at certain peak periods. Currently, this is the extent of power sector involvement in energy-saving initiatives.

Government. The national government in Chile has sponsored several information campaigns, including television and radio broadcasts, encouraging energy savings. The focus of these campaigns has been mostly lighting. The federal government in Chile seems to view its role in any energy efficiency initiatives as a purely informational one.

CNE has had a more active role. It has produced feasibility studies for energy efficiency investments, as well as an extensive list of universities involved in the renewable energy and energy efficiency fields. In addition, CNE in Chile and the European Union are developing the Conservation and Rational Use of Energy Program (CUREN — Conservación y Uso Racional de Energía), which is focused on energy efficiency. This activity, the details of which have not yet been determined, is being coordinated by Fundación de la Energía (FE).

A number of municipal governments are also taking a more active role in energy efficiency than the federal government. For example, some municipalities have tax incentives in place to encourage the installation of insulation in new buildings. The focus in the municipalities, however, has been overwhelmingly on lighting.

The town of Antofagasta is one illustration. This municipality replaced over 7,000 streetlights in the city with energy efficient streetlights at a cost of US$ 675,000. The CNE forecast monthly savings of US$25,000 from the reduced electricity consumption. However, this forecast failed to take into account the additional savings in reduced maintenance costs. The new lights did not require maintenance for two years. Instead of taking 27 months to pay back the initial investment, the Antofagasta project took only 17 months.

The project has saved the municipality $US 650 million in just under 4 years, funds which have been used for other infrastructural improvements. Other benefits included reduced maintenance costs, a notable reduction in CO_2 levels resulting from the generation of electrical energy from

thermoelectric plants, and a reduction of public waste. This energy efficient street lighting program has served as a model for over 150 municipalities that are implementing similar projects.

Private sector. FE is a private Chilean foundation supported mainly by technical consultants, which serves as a liaison between government organizations, private industries, and foreign companies involved in financing and program development of all energy-related projects. FE also assists in conducting feasibility studies and developing contracts with the energy sector.

There is some demand for energy service company services (ESCO) in Chile. The country's energy intensive industries, such as copper mining and textiles, are interested in energy efficiency. High electricity prices ($0.11/kWh in Santiago) and good energy efficiency potential coupled with a dynamic private sector provide a receptive setting for the entry of ESCOs.

CFLs in Santiago

The market for compact fluorescent lamps (CFL) in Santiago provides a good example of the barriers that energy-efficient technologies face. CFLs use one-fourth to one-fifth the electricity of incandescent bulbs to produce the same light. Yet they cost about 10 times as much. Despite the fact that a CFL more than repays this extra cost over its much longer lifetime, CFL sales in Santiago - like those around the world - are low. Why? Most customers don't know about them. When they do, they typically lack the cash to buy them or they deeply discount future energy savings. The concept of life-cycle costs is only beginning to take root in Chile. High first cost is still an enormous barrier. CFLs also present a technical problem in Santiago where voltage fluctuations may shorten their expected lives.

Source: *Saving Energy in Chile,* International Institute of Energy Conservation, May 1993.

The IIEC has provided four US ESCOs with introductions to potential customers in the Chilean market. One ESCO is close to signing a contract to implement an energy efficiency retrofit project. This project was funded by the Committee on Energy Efficiency Commerce and Trade of the US Department of Energy.

Honeywell-Chile has recently completed a lighting retrofit project in an air force hospital near Santiago, which was implemented through a performance-contracting mechanism. Support for such energy efficiency retrofit work is generally coming from the public sector and from universities on a project-by-project basis. Utilities and the government are not funding such activities in Chile.

The IIEC Chile office is also providing private sector technical support to the Centre for the Promotion of Chilean Copper (Procobre) in the establishment of an Energy Efficiency Office for the industrial sector of Chile. A representative of both the IIEC and Procobre traveled to the US to tour all the major technical research centers including the Electric Motors Information Clearinghouse, Industrial Electro-technology Laboratory and EPRI Motor and Drive Centre. IIEC designed a needs assessment survey for end-users, established a technical library and is currently

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producing technical fact sheets on industrial motors and transformers. IIEC is also developing a briefing paper on industrial motor standards for Latin America.

NGOs. IIEC is the main NGO operating in Chile in energy efficiency. In addition to publishing several studies on energy efficiency and the rational use of energy in Chile, IIEC is in the process of launching a project focused on the application of integrated resource planning in the power sector. The US Department of State is funding this initiative. IIEC has also sponsored, with funding from the US Environmental Protection Agency, two building technology demonstrations in Santiago. The hope is to interest the mayor of Santiago and bring some high-profile attention to this subject. IIEC is also active in many transportation-related projects in Chile.

International donor community. The International Finance Corporation (IFC) is currently developing a renewable energy and energy efficiency fund in cooperation with CNE. Energy efficiency projects are usually too small to be able to access IFC funding through its current mechanisms. Energy efficiency projects usually contribute to the reduction of greenhouse gas emissions by reducing the demand for fossil-fuel energy. As such, these projects can qualify for Global Environment Facility (GEF) funds aimed at reducing global greenhouse gas emissions. A current GEF project to increase the energy efficiency of motors in Chile's copper mining industry will highlight ESCOs.

Energy efficient technologies. Most energy-efficient equipment available in Chile is imported, and therefore more costly than locally manufactured models. Because Chileans tend to make investment decisions based on lowest first-cost, local manufacturers have very little incentive to invest time or resources in developing more efficient models. Lack of demand is causing a lack of supply. Since motors are an important consumer of electricity in Chile, the motor market provides a benchmark: only about 1% of motors sold in Chile are both high performance and energy-efficient.

Extent of implementation. Most energy efficiency measures being adopted currently in Chile are in the municipal and public sectors. Municipalities are capitalizing on the fast payback of efficient street lighting projects, while public sector institutions such as hospitals and schools are implementing fluorescent lighting retrofit projects, with the help of ESCOs.

Industrial sector. In the industrial sector, most energy efficiency potential is in motors and motor systems. In the copper industry, which contributes 40% of Chile's export earnings, motors are especially important, because they consume 95% of the energy used by the industry. Industrial process controls are another area commanding increasing attention.

Residential sector. In the residential sector, lighting and refrigeration are the largest end uses, representing 30% and 25% of residential consumption, respectively. The only energy efficiency activity in existence for these end uses is the voluntary refrigerator standard mentioned previously. Because first-cost is the determining factor in most residential customers' purchasing

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decisions, CFLs have been slow to penetrate the residential market. Building insulation, on the other hand, is receiving increased attention in some areas.

Commercial sector. Lighting is an important end use in the commercial sector as well. Although Chile has no formal building energy efficiency codes, codes do exist that categorize buildings according to their purpose and the quality of the materials used in construction. A team of Chilean building experts is convening a panel with counterparts from several other South American nations to work on the development of a regional building efficiency code.

4.4.4 Constituencies

Government. CNE has created a new division to promote energy efficient programs. This division represents the main constituency for energy efficiency within the national government.

Comisión Nacional del Medio Ambiente (CONOMA) is a federal agency responsible for the coordination of all environment-related activities being carried out by Chile's ministries. Energy efficiency falls under the Climate Change division of CONOMA, whose main objective is to reduce carbon dioxide emissions. CONOMA is joining with CNE to implement a project funded by the GEF to improve energy efficiency in the mining sector through the use of high-performance motors.

In addition, as discussed earlier, several municipalities are interested in energy efficiency, especially of street lighting.

Private sector. Codelco is the largest copper mining company in Chile. It currently pays high prices for energy and would like to lower costs. In just one Codelco mine, the annual energy expenditure is approximately US$50 million, in a company with 37,000 employees and total annual sales of US$3.2 billion.[5] Energy efficiency, especially of electric motors, could produce substantial savings in an operation of this size. There are signs that Codelco, as well as other mining companies, are becoming increasingly interested in energy efficiency in general, and ESCOs and performance contracting in particular. As Chile's largest industry, the mining companies could represent a powerful lobby against the power sector's disinterest in energy efficiency.

Non-governmental organizations. As mentioned earlier, IIEC-Latin America has been located in Chile for a number of years and is active in energy efficiency advocacy. A number of its projects are concerned with transportation-related energy issues, as well as end-use energy efficiency. This organization has facilitated the entry of some foreign-owned ESCO subsidiaries into the Chilean market and conducted studies and technology demonstrations.

[5] *Market Assessment of Chile,* Export Council for Energy Efficiency, 1997.

4.4.5 Prospects for the Future

Expected legal and regulatory changes. The most significant change expected in Chile is the institution of rules and the prohibition against cross-ownership of generation, transmission, and distribution assets. It should be recognized, however, that current majority stockholders represent a significant obstacle to the redistribution of these assets and could derail any attempts to reduce their influence.

Greatest remaining barriers.

Regulatory constraints. Chile does not have energy performance standards or demand-side management incentives. Generation, transmission, and distribution utilities have little incentive to implement demand-side management programs because their profits grow with the sales of electricity. Chilean utilities are not required to conduct integrated resource planning either. The CNE has been considering these issues.

Lack of awareness. End users are generally unaware of the benefits of efficient technologies, in part because these are not widely available. Raising public awareness and overcoming this barrier to energy efficiency is the role that the national government has taken for itself.

Access to capital. Most end users in Chile lack the capital to finance energy efficiency investments. This is especially true of residential end-users, who must often make investment decisions based on the lowest first-cost, discounting future costs entirely.

High capital costs of efficient equipment. Motors are a good example. Standard motors make up roughly 80% of the Chilean motor market with high-performance motors making up the other 20%. Energy efficient motors cost 25% to 40% more than standard motors in Chile. High-performance, energy efficient models represent less than 1% of the total motor market at present.[6]

Preference for reusing old motors. Another barrier to the growth in sales of energy efficient motors, in particular, is a preference among the copper mines to rewind failed motors instead of purchasing new ones.

Limited product availability. Not many energy efficient technologies are available in Chile. In the motor market, there is no domestic manufacturing capability for energy efficient models, and multinational corporations have shown little interest in marketing efficient models in Chile, partly because of high import tariffs and partly because of limited demand for these products.

Key actions needed. As a first step, clear rules regarding ownership within the power sector (and a prohibition against cross-ownership) need to be legislated. This will promote competition

[6] *Market Assessment of Chile,* Export Council for Energy Efficiency, 1997.

among distribution utilities, as was originally intended by the policy makers who instituted the reforms. Real retail competition will allow distribution utilities to compete on several aspects of their business, of which energy efficiency and related services may be two.

The government's position that the market will "take care" of energy efficiency is only practical if the market and competition are operating freely in reality. Even then, competition is not by itself a sufficient condition for energy efficiency to occur. To combat other barriers to implementation of energy efficiency measures, government needs to undertake more market transformation programs. There is also an opportunity for industry to influence government policies through lobbying efforts. This is particularly true of the copper industry, which stands to benefit significantly from energy savings.

Greatest opportunities. Industry clearly has the best opportunity to make changes that will achieve energy savings in Chile. A significant cost savings could be achieved through the installation of energy-efficient technologies and measures, particularly motors. Government efforts to promote awareness of the benefits of energy efficiency, coupled with technical assistance by donor agencies and government agencies, could be helpful in bringing industrial decision-makers to adopt energy efficiency measures that will bring them enormous benefits.

Another area of opportunity is created when energy efficiency is connected with environmental issues. Chile has a population that is generally aware of environmental issues because of the air pollution problem in Santiago. Market transformation efforts that seek to draw the connection between environmental issues and energy efficiency could help promote awareness of energy efficient technologies and their benefits. In the medium-term this will help energy efficiency to become a factor in investment decisions in all sectors, and may begin to overcome the first-cost barrier to the adoption of efficiency measures.

4.5 CONCLUSIONS

4.5.1 Motivations for Energy Efficiency

High electricity prices. Part of the power sector reform in Chile consisted of the national government diminishing its role in the energy sector. In doing so, the government completely discontinued all energy subsidies. Consequently, electricity prices in Chile are high, providing a strong incentive for customers to use electricity efficiently. High prices are particularly important in industry, where small energy efficiencies can mean thousands of dollars worth of savings. Industry is also the segment of the market most likely to have capital available for energy efficiency investments. The industrial sector in Chile is only beginning to take an interest in energy efficiency, however. So far, most of those participating in energy efficiency have been individual champions of the cause, such as municipalities, hospital administrators, and university professors.

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High foreign investment. There has been an influx of foreign investment into Chile due in part to the privatization of several industrial sectors. There should be sufficient foreign capital available to finance the import of efficient equipment.

High technical education. Chile maintains a high level of technical education. With a pool of well trained people to draw from, the country's engineers have available the human resources needed to identify, install, and maintain any energy efficiency measures they prescribe.

4.5.2 Growth Potential

At present, Chile is achieving very little of its high potential for energy efficiency. There are two main reasons for this. First, the government's official attitude to allow the market to decide on the investment in energy efficiency, without providing the regulatory incentives needed to overcome barriers present in the market, has tended to de-emphasize the need for energy efficiency. Second, the existing patterns of ownership within the power sector have resulted in the creation of what amounts to an unregulated monopoly, which presents a strong obstacle to the institution of any measures to introduce energy efficiency.

Generators and distributors also oppose energy efficiency because it reduces their revenues. In Chile, the utilities lobby not only against regulatory requirements for utility energy efficiency programs, but also against government support of energy efficiency activities. The utilities themselves are not required, by law or regulations, to incorporate the full societal cost of the energy they produce into their energy prices. Because integrated resource planning is not a requirement either, generators can make the least-cost investment decision in order to keep their prices low, without regard for any possible health or environmental effects.

The power sector represents a very strong political lobby in Chile. Until its influence can be curtailed, most likely by the opposition of increasingly strong mining interests, there is likely to remain a large gap between potential and actual achievement in energy efficiencies. The copper industry may provide the best balance for power sector interests; with so much to gain from energy savings, this industry could make a big impact upon conservation efforts if it were to throw its weight behind the energy efficiency cause.

Support for energy efficiency is currently found only in isolated spots in the economy, such as municipalities, hospitals, and small federal agencies.

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CHAPTER 5
ARGENTINA CASE STUDY

5.1 OVERVIEW OF POLITICAL AND ECONOMIC SITUATION

Argentina is considered a stable democracy and therefore a low risk for investment. A democratic government was reestablished in 1983. Since then, there have been four national votes, the most recent of which elected the current government of Carlos Menem. The next presidential election is scheduled for 1999. Over this same period, the government has improved political relations with its former adversaries including Chile, Brazil, and the UK.

A consensus exists among the major political parties on the course of economic reform, which has been under way for more than a decade. Between the mid-1970s and 1989, the country suffered from low savings and investment rates. During this period, the country underwent four successive stabilization programs, all of which failed. By July, 1989, Argentina's hyperinflation had reached 200 percent annually. In 1991, a convertibility plan was implemented which guaranteed a one to one conversion ratio of pesos to dollars. This had the effect of limiting the government's ability to finance its deficit through inflation.[1]

In the years following implementation of the convertibility plan, Argentina's economy has grown an average of 7.7 percent a year. Unemployment, however, continues to plague the economy at a rate of 17.1 percent. Nonetheless, as a full member of Mercosur, the common market with Brazil, Paraguay, and Uruguay (with Chile as an associate member), Argentina has been able to make improvements in its economic performance. Because it conducts 20 percent of its trade with Brazil, Argentina's fiscal success is very dependent upon the steady growth of Brazil's economy.

[1] Country Overview: Argentina, http://www.worldbank.org/, 1996.

General Indicators

Population:	34,672,997 (1996)	
GDP:	$278.5 billion (1995)	
Per capita GDP:	$8,100 (1995)	
Inflation rate (consumer prices):	1.7% (1995)	
Major economic sectors: (1985 est.)		
▸ *services:*	57% (1985)*industry:*	31% (1985)
▸ *agriculture:*	12% (1985)	
Total energy production:	54.8 billion kWh	
Power sector capacity:	17,330 MW	
Per capita energy use (total energy & electricity):	1,610 kWh (1993)	
Type of government:	republic	
Literacy rate:	96.2% (1995)	

5.2 STRUCTURE OF POWER SECTOR

Power Sector Data

	Total	Industrial	Commercial	Domestic	Other
Installed Capacity (MW)1996	20,207				
Peak Demand (MW) 1994	10,400				
Electricity Consumption GWh	55,065	43%	10%	32%	15%
Per capita Electricity Consumption	1,592 kWh				
Growth rate for electrical demand	5%				
Average Retail Electric Price	(cents/kWh)	5.6 MT	9 (2000 kWh/m)	6.6 (400 kWh/m)	
Wholesale Electric Price	$23/MWh				
Demand Charge (Equivalent)	$17/MWh				
Time of use tariff ?		yes (over 50 kW)		yes (over 50 kW)	no yes
Distribution losses	12% (Buenos Aires Province)				
Payment / collections rate	98 % (Buenos Aires Province)				

5.2.1 Pre-Reform Situation

Prior to the reform, the Argentine power sector was comprised of state-owned utilities and vertically integrated monopolies, including: SEGBA (Great Buenos Aires Area); AyE (thermal power plants at federal level); HIDRONOR (hydro power plants at federal level); and CNEA (atomic power plants at national level)]. The power sector consisted of four national utilities, two international hydro plants, nineteen provincial utilities, and several cooperatives. Tariffs were regulated by the government in an effort to control inflation.

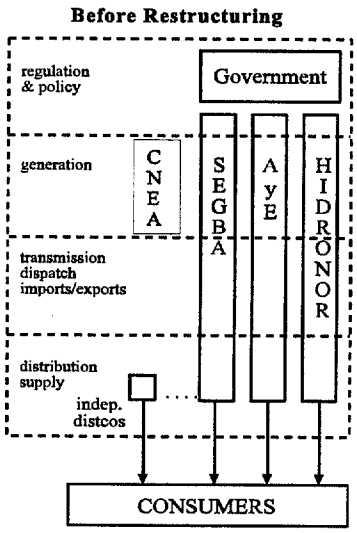
The sector was plagued by gross inefficiencies such that generation efficiency in thermal plants was below 50% and technical and non-technical distribution losses reached as high as 30% in the

Buenos Aires Province area. Maintenance practices were so poor in the capital that regular repairs were taking over 90 days.[2] The sector was sent into an energy crisis in 1988 when a severe drought significantly diminished the country's power availability at the same time that operation and maintenance problems were hampering supply.[3]

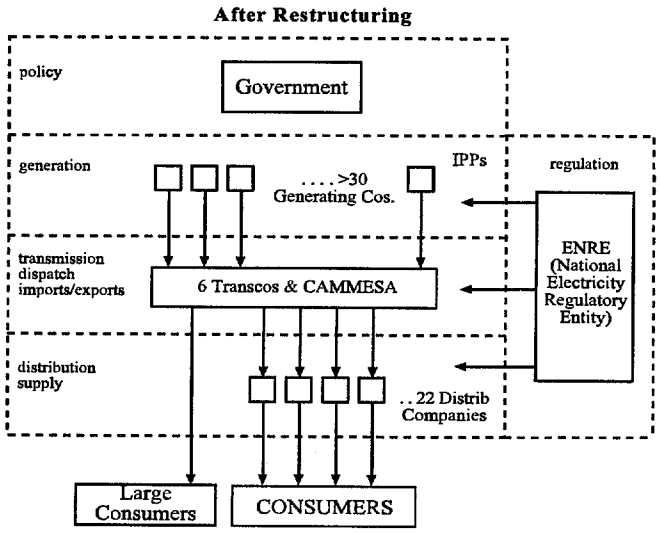
5.2.2 Objectives of Reform

The primary objectives for restructuring the electricity sector were to improve economic efficiency and reliability of service and to attract investment needed to upgrade the system to meet future demand. In addition, the Menem government wanted to limit the role of the government in the economy and provide fair and reasonable rates and protections for end-users. Another objective was to maximize revenue for public finances through a successful privatization program.

5.2.3 Post-Reform Structure



Power Sector Ownership: Public



Power Sector Ownership: Public, Private, Employees

[2] Rudnik, Hugh. "Pioneering Electricity Reform in South America," *IEEE Spectrum,* August 1996.

[3] Ibid.

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In 1992, Argentina began to restructure its power sector by providing open access to the wholesale capacity and energy pool for generating facilities, and least-cost centralized dispatch. Argentina required a mandatory separation of dispatch and transmission from generation and distribution by establishing an independent dispatch agency. This basic model divided the industry into separate functions of generation, transmission, and distribution. It also deregulated the utility systems at both the wholesale and retail levels with the creation of a wholesale spot market, called the Mercado Eléctrico Mayorista (MEM). The wholesale portion of the model, fully unregulated, relies on the open competition in generation. The model's retail portion insures direct access to generators for medium-sized and large users under freely negotiated contracts, and regulated prices for consumers using less than 100 kW, who are supplied only by the distributors.

The Argentinean restructuring was based on the Chilean model, except that cross-ownership of generation, transmission, and distribution assets was not permitted. The 1992 energy law explicitly states that no generator is allowed to control more than 10 percent of the system's capacity, and restrictions on reintegration and cross-ownership are enforced.

Three of the federally owned utilities were privatized and unbundled. The fourth is the power generation branch of the CNEA, the national atomic energy agency, which remains in state hands.

Generation. Three state-owned companies (AyE, SEGBA and HIDRONOR) have been replaced by over 30 competing private generators. Specifically for AyE and HIDRONOR, of the thirty-three units with about 16 GW of capacity, twenty-six units were sold to the private sector and seven remain under national or provincial ownership. Fifteen North American utilities, four European utilities and four Chilean utilities are among the purchasers.[4] Endesa, Chile's largest electric generation company, maintains 2,580 MW of capacity and 700 employees in Argentina. Its generation in Argentina was 8,750 GWh in 1994.

There is a short-term or spot market that establishes energy prices hourly and a long-term or term market, made up of contracts freely agreed upon between generators and distributors (not belonging to the state) and large users (over 100 KW). Generators are able to buy energy on the spot market to meet their term contracts. Utilities are also allowed to negotiate supply contracts with distribution companies and large end users (peak-demand greater than 100 kW)

Transmission. The transmission subsector consists of six transmission companies and Compania Administradora del Mercado Mayorista Eléctrico S.A. (CHEMISE), the agency which administrates the pool. Transener, previously the main transmission company, has been privatized along with four of the five regional transmission companies. Transmission companies

[4] Country of the Week: Argentina, published on the web site of the Utility Data Institute, 2/20/97, www.udidata.inter.net

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are obligated to provide open access to all generators and may sell energy directly only to large customers.

In general, the transmission companies deliver power from the generators to distribution companies. Transmission is considered a natural monopoly and is therefore subject to government regulation and is entitled to payments from generators adequate to cover the predetermined reasonable costs. Transmission charges are capped, but a transmission company that exceeds the benchmark performance can retain all the profits for its stockholders. Transmission facilities cannot be owned by distribution companies, power producers, private power companies, or industrial enterprises.

Transmission companies do not have an obligation to invest in new transmission capacity. In 1992, licensing agreements for transmission and distribution were granted under 15-year agreements with ten year extension periods (except for provincial distribution companies, which were not privatized). Although provincial transmission and distribution companies are considered natural monopolies for the areas they serve, some regulatory mechanisms have been put in place to ensure competition.

Electric utilities are free to sign supply deals with distribution companies and large end users (peak-demand greater than 100 kW) but they are subject to certain rules. For example, contracts must be made public.

Distribution. The distribution subsector consists of 22 regional distribution companies, most of which fall under provincial/regional jurisdiction and some of which have been privatized. Most are the same entities as in the pre-reform era, but are owned by private stock holders instead of the government. In addition, the three distribution successors of SEGBA (Edesur, Edenor, and Edelap) have been partly privatized. Together, these three companies serve about half of Argentina's electricity customers. Argentina is 95% electrified with a 70% rate of electrification in rural areas. Distribution companies are obligated to provide service to all those requesting it at the set tariff. They are penalized for non-compliance with set service quality standards.

National distribution tariffs (Capital Federal City area with Edenor and Edesur as distribution utilities) are set by the national regulatory entity (ENRE), while provincial distribution tariffs (Buenos Aires Province, Cordoba Province, etc) are set by provincial regulators. This makes careful coordination between the national and provincial regulatory entities highly desirable, but this often does not occur. Distribution tariffs are regulated through a price cap mechanism and do not distinguish between dispatch wires and supply. Increases in electricity costs and transmission tariffs are reflected in periodic reviews. Cost savings produced by increased productivity benefit the investors in terms of greater returns.

Pooling and dispatch. CHEMISE, the independent ("sociedad anonima") dispatch entity, is owned in equal parts by the generation, transmission, and distribution sectors, as well as by large

consumers and the government. Generators bid to supply power to the pool on a hourly basis. The approximately 30 generators are similar in size and cost structure, which keeps competition strong. The hourly pricing allows immediate price adjustments in response to changes in the generator's costs. The bidding system is quite complex and is impractical for smaller power systems.

End user supply. The Chilean model's retail portion ensures that medium-sized and large users have direct access to generators under freely negotiated contracts. Prices are regulated for consumers using less than 100 KW, who are supplied exclusively by the distributors.

Regulatory oversight authority. ENRE was established as an independent regulatory body to oversee distribution company tariffs, award licenses, protect consumers and oversee CHEMISE. ENRE is the "police" of the electrical system. There are several regulatory entities which provide similar functions in the provinces.

Pricing rules. Regulators cap the rates that distribution companies can charge customers while allowing them to keep a large amount of what they save below the cap. This system creates an incentive to cut costs and improve productivity.

Edenor, Edesur, and Edelap's retail tariffs were established, using the price cap mechanism, by indexed rate formulas in their licensing contracts, which were signed in 1992 for an initial ten-year period. The retail tariffs were set to cover the cost of purchased power, distribution system operating costs, taxes, and amortization. Penalties are applied for failure to meet established quality of distribution service criteria. ENRE oversees these tariffs, and will apply new tariff formulas based on defined criteria in 2002 after the current ten-year period is up.

Provincial regulatory entities set tariffs for distribution utilities in their jurisdictions according to economic criteria determined by sector reforms at this level. The method for calculating transmission tariffs and tolls is set by ENRE and implemented by CHEMISE. These cover CHEMISE's costs for operation and maintenance of the system.

Under the Ministry of Economy, Public Works and Services (MEyOSP), the Secretariat of Energy and the Subsecretariat of Energy (SE), make national energy policies and define dispatch criteria for the bulk power market (MEM).

5.3 MARKET RESPONSE TO REFORMS

5.3.1 Power Distributor/Supplier Behavior

The efficiency and distribution of supply has greatly improved since the 1992 power sector reform. Technical and non-technical energy distribution losses, for instance, were halved in three

years between 1992 and 1995. During the same period, investment in the generation-transmission-distribution chain dropped from $6,000/kW of installed capacity to approximately $2,000/kW, indicating a tripling of the productivity of money put into the system. In addition, the availability of thermal generation plant has increased from a historic low of 47% in 1992 to 70% in 1995. Part of the success of restructuring is attributed to the competitive nature of the sector after reform.

Three state-owned companies have been replaced by 30 competing private generators which are similar in size and cost structure, a situation which favors effective competition. This competition has helped avoid implicit collusion and gaming in the system. In large privatized power systems (such as Argentina and the United Kingdom), repeated bidding, in which the generators bid to supply power on an hourly basis, allows competition to be effective. If costs can be cut, prices can immediately reflect this, forcing higher-priced competition out of the way. This bidding system is complex; for most smaller power systems and for economies at lower levels of development, a contract system is often used instead.

Electricity prices generally reflect cost structures (except in subsidized rural areas) associated with supplying a particular class of end users and are comparable to prices in the United States. The wholesale spot price has dropped considerably with the introduction of a wholesale market (from 4.2 cents/kWh in late 1992 to 2.2 cents/kWh in 1995) due to overcapacity and good availability of hydropower plants. In addition, average monthly electricity prices in the wholesale market dropped from US$50-$60/MWh to $22/MWh after deregulation and privatization.

5.3.2 Retail Prices

As was noted in section 2 on the power sector, final prices billed to residential end users are much higher than the spot market prices because demand charges, transmission/distribution costs, and distribution company revenue must all be added. The average distribution cost to the industrial, commercial, and residential customers of privatized distribution companies in the Great Buenos Aires area is 4 cents/kWh.[5] (Of course the population density in the Buenos Aires area is higher than in the rural areas.)

[5] Ernesto Badaraco and Luis Scholand: "Deregulation and Privatization of the Argentine Power Generation Market," paper presented at the Hemispheric Energy Symposium, October 20-31, 1995, Miami.

Table 5-1
Post-Privatization Performance - Selected Indicators

Year	Generation		Distribution Losses (%)	Transmission Forced Outages (hours)
	Spot Price (US$/MWh)	Thermal Availability (%)		
1992	41.85	48.2	21	1,000
1993	32.12	59.8	20	900
1994	24.99	61.3	18	650
1995	22.30	69.9	12	300

Source: CHEMISE, ENRE and company annual reports.

Power price subsidies have been reduced since the beginning of reforms and where they have been kept they are now transparent. On the federal level there are two types of explicit subsidies: one applies to lower-income Edenor, Edesur and Edelap pensioners, equivalent to 50% of the normal tariff and paid by treasury funds; the second applies to electricity-intensive industries (with more than 100 MW end-use with certain other characteristics). In addition, there is a fixed tax of 0.24 cents/kWh (National Energy Fund) on the wholesale level that is used for transmission investments as well as to compensate for tariff differences in isolated areas.

A key improvement of the reform in the area of pricing is that the tariff regime is now largely based on marginal costs. Critics claim that there are still some distortions (e.g., in Buenos Aires the medium tension industrial tariff is still relatively high when compared to the residential tariff). However, before power sector reform the tariffs were based on political decisions that often had no basis in the underlying costs of electricity supply.

5.3.3 Retail Competition and Services

There is no retail competition for residential, industrial, and commercial end users with an electricity demand of less than 100 kW. Liberalization is planned for these customers, but when this will take place is not known. Some electric utilities such as Enron and CMS are analyzing plans to offer comprehensive energy services to customers once the residential and small commercial market is opened to retail competition.

Current energy services projects focus on cogeneration in the industrial sector as well as other energy services (lighting, air conditioner, boilers, processes improvements, etc.) offered by small local ESCOs to industrial customers. Some equipment suppliers, such as Philips and Siemens, are trying to offer energy services for energy efficiency replacement projects (lighting fixtures, electric motors, power substations) using performance contracting and leasing approaches.

5.4 END-USE ENERGY EFFICIENCY

5.4.1 Pre-Reform Situation

There was almost no utility-sponsored end-user energy efficiency activity in Argentina prior to the restructuring of the power sector. Before the restructuring process, the subsidies and the uncertainty in short- and medium-term electricity prices meant that there were no incentives for utilities or end users to pursue energy efficiency activities. Between 1985 and 1989, however, there was a national energy efficiency program that focused on developing renewable energy sources.

5.4.2 Integration of Energy Efficiency in Reforms

Policy. Energy efficiency was not explicitly addressed in the Argentina power sector reform legislation, except by reference to licensing contracts for distributors to offer energy efficiency services. This is not mandatory, and is therefore ineffective. The legislative provisions concerning energy efficiency are broad, leaving the utilities with wide discretion on how to proceed. The general mind set of the Menem government in the early nineties, through the Subsecretariat of Energy, was that the market will take care of energy efficiency and that there is no need for government intervention.

Regulation. *Regulation of power sector energy efficiency activities.* After restructuring, the Subsecretariat of Energy (SE) recognized that utilities were not being provided with incentives to pursue energy efficiency programs. SE is currently analyzing some measures that would provide an energy efficiency incentive to distributors and generators. One proposal would allow distributors to collect 100% of electricity bills in order to assure they are repaid for any energy efficiency programs they implement (e.g., public lighting, compact fluorescent lamps).

Through seminars and publicity campaigns SE is also promoting the creation of ESCOs. SE staff are working toward approval of regulations to allow use of part of the "Fondo Nacional de Energía" (FNE) to fund energy efficiency projects and activities. This fund, administrated by SE, was created several years ago and provides around $300 million a year in income through a surcharge of $0.24/kWh to all MEM participants. Prior to 1989, a decree allowed a portion of these funds (usually $15-17 million) to be used for energy efficiency and renewable energy projects, but that decree has not been renewed.

Codes and standards. There are no mandatory appliance or building efficiency standards in Argentina. Energy efficiency standards could theoretically be prepared and approved by the federal Institute for the Rational Use of Materials (IRAM), but none currently exist. The local universities and institutions such as the Economic Energy Institute (IDEE) and the Association for the Rational Use of Energy (AAPURE) are working together with the IRAM in the

preparation of energy efficiency regulations for appliances, electric motors and building codes, but at the moment these are not mandatory. Representatives of the Agency for Rational Energy Use (URE) and IDEE both feel that local governments should promote the development of adequate energy efficiency regulations, especially given the new Mercosur integration. Their current project involves implementing freezer standards for all Mercosur countries.

Related policies and regulations. Before liberalization of the power sector, there were almost no legal requirements for environmental performance in the power sector and thus also no mechanisms for control and measurement of emissions. One exception was the environmental management manual for hydropower projects published in 1987.

As part of the liberalization process, some specific environmental standards and procedures for the power sector have been introduced. Also, companies that invested in Argentine utilities with World Bank support had to prepare environmental impact statements and comply with World Bank environmental standards. In addition, utilities are required to comply with regional environmental regulations where they exist.

Starting in 1991 environmental issues have been integrated in the laws and decrees that govern the energy sector's deregulation process as well as the privatization process. The law governing the power sector privatization explicitly addresses air and water emissions related to the power sector. It charges the power regulator, ENRE, with overseeing the "protection of safety, environment, and public safety [issues] in the construction and operation of generation, transport and distribution systems of electricity" including the right to inspections and investigations.

In Argentina there is no strong climate change action plan in place that calls for a stabilization of CO_2 emissions in 2000 as there is in many other countries. However, the massive fuel switching from coal to natural gas has inadvertently contributed to reduced emissions. The Subsecretariat of Energy has stated that CO_2 reductions by 2010 is not a priority for Argentina. The SE is working with the Secretary of the Environment to pursue joint implementation of industrial pilot projects. However, the SE appears not to be interested in considering implementation of a carbon tax.

5.4.3 Activities Promoting Energy Efficiency

Power sector. The utility Edenor is a private distribution and commercialization company backed by French and Argentine capital. It has 92 licenses to supply the northern part of the Capital Federal City and part of the Province of Buenos Aires. In order to decrease peak energy demand and postpone substantial investments in power substations and distribution lines, the utility is trying to implement a pilot street lighting program in the Carlos Paz municipality of Buenos Aires Province. Depending on the results of this project, Edenor may be interested in implementing a similar program in other municipalities, as well as a CFL programs in some residential and commercial areas.

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The utility Edesur is a private distribution and commercialization company backed by Spanish and Argentine capital. It has a license to supply the southern part of the Federal Capital City and part of the province of Buenos Aires. Currently, it has implemented energy efficiency programs for public schools, small and medium-sized companies (for installation and maintenance of energy efficiency measures), and household appliances. With the possibility of new energy efficiency regulations approved by the Subsecretariat of Energy (SE), Edesur, Edenor, and other utilities have expressed interest in implementing street lighting projects and eventually CFL programs.

Some distribution utilities are also pushing SE for legislation to allow them to provide other energy services to end users and include the charges for those services on periodic electricity bills. The law is silent on the question of whether other services can be included in charges on electric bills. Utilities are pushing the government to send the right signals to consumers, by allowing customers to buy efficient appliances or equipment through their service providers and pay for them in installments on electric bills.

One further effort that a number of distribution utilities are involved in is the establishment of mandatory codes and standards for energy efficiency. The current focus is on freezer standards, because of the problem they pose for power factor for the distributors. Efficient freezers use higher quality motors which create less interference and an average of 75% less decrease in power factor.

Government. The SE is the most important state institution supporting programs for energy efficiency and renewable energy. Its main function is to propose and push legislation in support of energy efficiency. Before the power sector restructuring, government-sponsored tariff subsidies prevented consumers from paying the actual cost of energy and created no incentive to save energy. Since restructuring, the subsidies have been discontinued. Consequently, privatized electric companies are now searching for ways to save energy in order to remain competitive and to reduce rising costs.

SE wants to promote energy efficiency programs in many municipalities, especially in the areas of street lighting and peak load management. Peak load will become a more serious problem for Argentina by the year 2000. Current legislation encourages voluntary energy efficiency, but does not make it obligatory. The Secretary of Energy is advocating the development of legislation in support of energy efficiency, focused on market transformation programs.

Under the auspices of the Secretary of Energy and the Ministry of Economy, the SE investigates, plans, and regulates energy sector policies at the national and provincial level. They are in the process of developing a national strategy for energy efficiency and renewable energy. In addition, SE conducts feasibility studies and has developed programs with the Inter-American Development Bank (IDB), the Department of Energy (DOE), the European Community (EC), and the World Bank. SE reports directly to the Secretary of Energy.

Pending projects include market sector studies, identification of the barriers that impede the development of the market, an evaluation of project costs, evaluation of regulatory changes, development of regulations that favor the creation of ESCOs, and changes in new licensing requirements and contracts.

The Agency for Rational Energy Use (URE) is an energy efficiency agency under the auspices of SE and the Secretary of Energy. URE is currently implementing 13 energy efficiency programs in cooperation with the EC, in the areas of industrial efficiency, transportation, cogeneration, and public lighting. URE is creating an Internet web page about energy efficiency and has conducted two large-scale audits in the industrial sector. It is also working on proposing legislation to remove existing barriers to cogeneration.

URE is also working with the Gualeguay Municipality in Entre Rios Province to implement a pilot street lighting project which is funded by the municipality (70%) and the EC (30%). The project will be used as an example of market transformation. AZT of Germany will provide technical assistance to the project. The program's success will depend on a combination of financial support (loans), EC technical assistance, and legislative change to help transform the market.

Private sector. As mentioned before, some equipment suppliers such as Philips and Siemens are trying to offer energy services for energy efficiency replacement projects (lighting fixtures, electric motors, power substations), using performance contracting and leasing approaches. The main barriers to the implementation of these projects are the cost of credit, lack of repayment guarantees, and lack of knowledge by the end users and local banks about performance contracting procedures. Philips is interested in using available IFC funds (see "international donor community" section below) through local banks to develop more energy efficiency related activities.

There are very few ESCOs in Argentina. Herrera PGA S.A. is typical of the ones that do exist. Privately owned and employing 20 people, it conducts energy audits and does some performance contracting through the implementation of energy efficiency projects in the industrial, institutional, and commercial sectors in both Argentina and Spain.

Local consulting engineering companies such as ATEC are forming joint ventures with international companies in order to assess the possibility of working as an ESCO in Argentina. In 1996 ATEC signed an agreement with Duke Engineering of the United States to form an ESCO.

Another example is the joint venture between Hagler Bailly, Inc. of the United States and Estudio Q of Argentina, forming HBQ. HBQ performs energy studies which include the topics of tariffs, energy audits, regulatory framework, and privatization in the energy, gas, and telecommunications sectors. HBQ is also offering energy services, in association with local generators, to big industrial end users in the areas of power substation. HBQ's clients include the

principal private generators and distributors of energy. HBQ is also working on energy efficiency and DSM programs in the newly restructured energy markets of Guatemala and El Salvador.

Herrera PGA, ATEC, and HBQ are three examples of private sector involvement in energy efficiency. There are approximately five small companies, with no more than three or four employees each, working on energy efficiency issues in Argentina. Most of these companies have some experience with energy auditing, but relatively little knowledge or experience with performance contracting.

NGOs. The Economic Energy Institute (IDEE) investigates issues related to energy efficiency, provides technical assistance, and develops policies on the rational use of energy. It receives its financing from the federal government and the European Community. IDEE would like to promote market-based energy efficiency programs through the private sector. It believes that the changes in the economy have increased the pressure on users to save energy and remain competitive.

The Association for the Rational Use of Energy (AAPURE) is an organization similar to IDEE with a great deal of experience organizing seminars and conferences on energy efficiency.

Universities. Several universities in Argentina are involved in energy efficiency and have conducted energy audits and surveys in all sectors. The audits are generally paid for through the university budget, which ultimately comes from the government. Prior to 1989, the audits were funded by the FNE money, which is no longer authorized to be used on energy efficiency initiatives.

The University of Buenos Aires (UBA) is the principal university of Argentina. Its staff has conducted energy audits and surveys in the industrial, residential, commercial, and public sectors. The University has also developed a postgraduate program in energy efficiency. Currently it is conducting a study called "Analysis of the Rational Use of Electrical Energy in Argentina." The authors believe that great potential benefits for energy efficiency exist in the areas of transportation, motors, refrigerators, and lighting.

The National Technology University has also worked on energy efficiency projects since 1982 in the industrial, public, transportation, and renewable energy sectors. It has conducted over 850 audits in several industries all around the country, with the cooperation of other universities and institutions and with the support of government funding. The University maintains an organization of 25 groups covering the entire country for investigation and development in the area of energy efficiency. The University works with other regional organizations in energy efficiency programs.

International donor community. The regional office of the World Bank provides loans for energy efficiency projects. Specifically, the IFC sees it as its priority to find a sponsor for street

lighting projects. Over the past two years the IFC has granted US$15 million worth of credit for energy efficiency projects through private banks in Argentina (Banco Rio de la Plata and Banco Frances). In these two years, few entities were interested in utilizing these loans, mostly due to the lack of publicity and high interest rates (13-14 %, because of the local bank intermediation costs). Practically all the utilities that were privatized can find cheaper loans in the international market, at interest rates of 6 to 7%.

The Global Environment Facility (GEF) also has a grant program available (maximum of US$75,000) to be used for technical assistance. It is intended that an Argentine sponsor would obtain a loan from the line of credit offered by the IFC and then provide technical assistance for the implementation of an efficiency project. No projects have yet been implemented using this mechanism.

The Inter-American Development Bank (IDB), in cooperation with SE, is analyzing the possibility of developing a program in Argentina called "Sustainable Markets for Sustainable Energy," with the goal of promoting energy efficiency programs in a market-driven environment. The main purpose of this program is to provide technical/financial assistance for the implementation and evaluation of pilot projects in a variety of areas (cogeneration, public lighting, CFLs, ESCOs, etc.) that would serve as a basis for a market transformation.

Using funds provided by the IDB, various universities and individual consultants have studied the quality and energy efficiency of household appliances, cogeneration in the industrial sector, and rational use of energy in the residential sector, street lighting, water pumping, and grain drying.

Argentina has developed several cooperative and technical assistance programs with the European Union aimed at promoting energy efficiency, such as the Three-Year Program on the Rational Use of Energy (Programa Trienal de Cooperación sobre el Uso Racional de Energía). This program is funded by Argentina and the European Union and includes studies and technical feasibility pilot projects on the following topics: rational use of energy diagnostics in the industrial and transportation sectors, cogeneration in the industrial sector of Province of Buenos Aires, cogeneration in the hotel and hospital sector, optimization of fuel, and industrial processes.

End users. The end use getting the most attention in Argentina currently is street lighting. CFLs are another popular technology, especially in the public sector (including hospitals and schools). In both cases, these are chiefly retrofit markets. Most other projects until now have been feasibility studies or pilot projects, which have not yet been fully implemented. Distribution utilities have shown interest in the residential sector as an area for expansion of energy services, especially if they can obtain legislation which will allow billing for efficient appliances, audits, or other services on the customer's regular electricity bill. Such changes would have application in the industrial sector as well.

Energy efficient technologies. Argentina has low import taxes on all equipment. Combined with the absence of appliance efficiency standards, this has created an influx of inexpensive inefficient equipment. Bosch, a German freezer manufacturer, would like to begin importing high-efficiency freezers into Argentina and is lobbying for a program whereby consumers could buy the freezers through their distribution utilities (as a way to help with the power factor problem discussed earlier). This would require SE to propose legislation to allow distributors to offer these services in association with equipment suppliers.

A similar initiative has been proposed for use with CFL purchasing in Argentina. This is of interest to the distribution utilities because of the CFLs' contribution to peak load reduction. At present, however, there is very little energy efficient equipment available in Argentina.

Extent of implementation. As mentioned earlier, CFLs and efficient street lighting are the two main end uses that are receiving attention currently in Argentina. A great deal of unrealized energy savings potential exists in the transition to efficient appliances. Large energy savings are possible through the use of efficient motors in industry and as components of other equipment such as air conditioners and refrigerators.

5.4.4 Constituencies

Organizations lobbying for energy efficiency policy and regulations include:

- Subsecretariat of Energy, Secretary of Energy, Ministry of Economy: investigate, plan, and implement energy regulations at the federal and provincial level;
- URE, Federal Energy Efficiency Institute under the Subsecretariat of Energy: develop projects in energy efficiency;
- IDEE (NGO): investigates issues related to energy efficiency and provides technical assistance;
- AAPURE (NGO): investigates issues related to energy efficiency and provides technical assistance;
- Universities.

5.4.5 Prospects for the Future

Expected legal or regulatory changes. Changes in laws and regulations will depend largely on the success of SE's current legislative initiatives and on future steps the government might

undertake to implement a climate change protection policy. (The government is currently not interested in this issue.) Most observers don't expect drastic changes in the coming years.

Greatest remaining barriers. The greatest barriers to more energy efficiency in Argentina are the low energy prices combined with a general perception that prices will continue to fall. Unlike the situation in most European countries, the public is not very concerned about environmental issues. This disinterest hinders energy efficiency efforts which are generally considered to be an environmental concern.

Key actions needed. The success of energy efficiency programs in Argentina will depend mostly on legislative changes to allow SE to use a portion of the National Energy Fund to promote energy efficiency. In addition, once it is known whether distribution utilities will be allowed to bill customers for services other than electricity, it may be easier to offer energy services to end users.

Greatest opportunities. The best options for promoting energy efficiency at the present time are the high-profile municipal street lighting projects, where the barriers are relatively low and paybacks are swift. The success of these programs will create a stronger constituency for energy efficiency domestically. In addition, the attention the international donor agencies give to efficiency issues will help to develop champions for energy efficiency, especially in the commercial and industrial sectors.

5.5 CONCLUSIONS

5.5.1 Motivations

The most important motivation for privatized distribution utilities to address energy efficiency is that it could make unnecessary the expansion or construction of new power substation and/or power transmission lines in "hot spots." In areas or municipalities with peak demand problems, public lighting and CFL programs might be good investments for these utilities. On the other hand, distributors are not interested in undertaking massive campaigns that could decrease the demand in areas that do not have a peak demand problem.

For the municipalities, motivations take the form of cost savings and fast payback, especially for public lighting programs. In government, URE is the organization most motivated to pursue energy efficiency. Given its position in the fourth level of the government hierarchy, URE has trouble attracting attention to the issue.

5.5.2 Growth Potential

So far, only pilot projects have been implemented by the European Community and with assistance from multilateral banks. Not much real savings has been reported for these projects. In most cases, evaluation has not yet occurred. The future growth potential of commercial energy efficiency services in Argentina is unclear. It appears that some utilities are planning to offer some energy efficiency services on a commercial basis. However, given the current level of energy prices, these services are unlikely to be introduced on a large scale or, except for public lighting, to be offered as free-standing products.

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CHAPTER 6
NEW ZEALAND CASE STUDY

6.1 POLITICAL AND ECONOMIC OVERVIEW

Since 1984 the New Zealand government has embarked on a dramatic program of market liberalization and structural reform. Prior to 1984, the economy was highly regulated and had a high level of social spending. In 1984, the exchange rate was floated, subsidies and import controls were removed, a number of government departments were converted into commercially-run enterprises, and cross subsidies were eliminated.

The government has hoped that dynamic growth would boost real incomes, broaden and deepen the technological capabilities of the industrial sector, reduce inflationary pressures, and permit the expansion of welfare benefits. The initial results were mixed: inflation is down from double-digit levels, but growth was sluggish in 1988-91. In 1992-93, growth picked up to 3% annually, a sign that the new economic approach was beginning to pay off. Business confidence strengthened in 1994, and export demand picked up in the Asia-Pacific region, resulting in 6.2% growth. Growth continued strong in 1995, and the inflation rate remains among the lowest in the industrial world.

The government announced its first budget surplus in 16 years in FY94/95 and forecasts a surplus of $5.0 billion in FY97/98. The government intends to use the surplus to reduce the debt, increase social spending, and cut taxes - by $1.35 billion over two years beginning in 1996. Per capita GDP now is up to the levels of the big West European economies.[1]

[1] Source: *CIA World Factbook*: http://www.odci.gov/cia/publications/nsolo/factbook/nz.htm#Economy.

General Indicators

Population:	3,547,983 (1996)
GDP:	US $62.3 billion (1995)
Per capita GDP:	US $18,300 (1995)
Inflation rate (consumer prices):	2.0% (1996)
Major economic sectors:	
▸ *services:*	66.8% (1990)
▸ *industry:*	25.9% (1990)
▸ *agriculture:*	7.3% (1990)
Total energy production:	35.2 billion kWh (1995)
Power sector capacity:	7,750 MW (1995)
Annual per capita energy use (total energy & electricity):	8,401 kWh (1990)
Type of government:	parliamentary democracy
Literacy rate:	99% (1980)

6.2 STRUCTURE OF POWER SECTOR

Power Sector Data

	Total	Industrial	Commercial	Domestic
Installed Capacity (MW)	7,750			
Peak Demand (MW)	5,604			
1996 Electricity Consumption (TWh)	30.52	22%	n.d.	21%
Growth rate for electrical demand	2.4%			
Retail Electric Price (NZ $/kWh)		$0.06	$0.11	$0.11
Demand Charge ($/kW/yr)				
Time of use tariff?		yes	yes	yes
Losses (technical and non-technical)	7%			

6.2.1 Pre-Reform Situation

Prior to 1987, wholesale generation and transmission was owned and operated by the government through the New Zealand Electricity Department. Investment in generation capacity was governed not only by demand for power, but also by consideration of the contribution the electricity sector could make to other governmental objectives unrelated to the power sector, such as reducing unemployment and limiting dependence on imported oil.

Distribution and retail sales were handled by a collection of more than 60 Energy Supply Authorities (ESAs). ESAs were owned by consumer-elected electric power boards and Municipal Electricity Departments (MEDs). This industry structure did not provide strong incentives for

efficient operations and tended to result in over investment in supply infrastructure, particularly with respect to hydropower.

6.2.2 Objectives of Reform

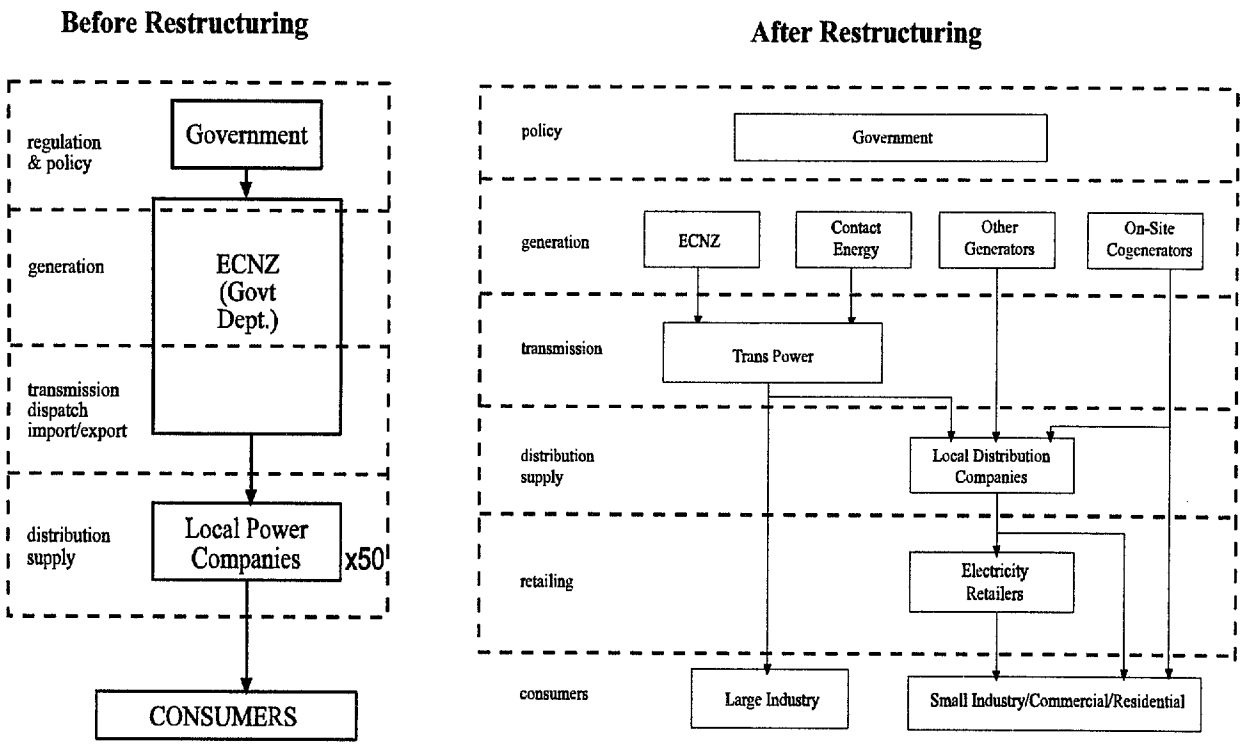
Restructuring was precipitated by the perception that government was too involved in the power sector and had been responsible for several ill-advised investment decisions. Restructuring was viewed as a means to limit government involvement and improve economic efficiency through introduction of both wholesale and retail competition. Restructuring included creating a power pool, spot and contract trading markets, and open access to the transmission grid. The major objectives for reform included the following:

- corporatization of the generation and transmission operations
- elimination of the state monopoly on generation and its obligation to serve
- separation of the transmission from the generation function
- corporatization and privatization of retail power companies
- full competition in the retail sector, enabling end users to choose their suppliers.

Given the lack of competition within the generation subsector, there is only limited price-based retail competition. Retailers do compete to some extent on price through use of risk management techniques and financial instruments such as options and futures that allow retailers to lock in future prices. Still, the primary emphasis on retail competition has involved service offerings rather than price-based competition.

6.2.3 Post-Reform Structure

Generation and transmission. In the post-reform structure, transmission and distribution functions have been unbundled from generation functions. The industry presently consists of one dominant generator, the Electricity Corporation of New Zealand (ECNZ) which accounted for approximately 75 percent of national production in 1995, a smaller generation company (Contract Energy), a single transmission company (Trans Power), and 42 distribution companies. The transmission company and generators are state-owned and the distribution companies are comprised of a mix of private and municipal ownership. ECNZ and Trans Power were corporatized in 1987, and the distribution companies were corporatized in 1993. Wholesale power supply and transmission charges are formally separated.



Distribution. Distribution networks are regarded as natural monopolies and are regulated as such. Comprehensive information disclosure is required of these companies. Network owners are also required to provide performance measures and methodologies used to determine network charges. Basically, information disclosure is intended to establish benchmarks to discourage anti-competitive and monopolistic behavior. The threat of tighter regulation keeps this system functioning. When reforms were instituted, the Minister of Energy was given the authority to intervene if prices became excessive, but this executive power has since expired. However, the government can choose to introduce more heavy-handed regulation at any time.

End user supply. The focus of the reforms was on creating a competitive retail sector, before establishing a competitive generation or wholesale sector. This has focused more resources and attention on retail customers. The figure above illustrates the conceptual structure of the post-reform period, but in reality the ownership is a bit more complicated. Distribution utilities, energy traders, and power supply companies have been amalgamated. There has also been a rapid

rise of joint holdings between power companies, between power and gas companies, and between power companies and new corporations on the scene.[2]

Regulatory oversight authority. The industry reform provided for little regulatory oversight. Regulation is light-handed and based on general commercial law and requirements for information disclosure. One important change brought about by restructuring is a emphasis on public disclosure and access to market information. The rules of the private sector Electricity Market Company (EMCO), which administers the New Zealand wholesale electricity market require that all discussions of the market's governing body become matters of public record and may be reviewed by any interested parties. This increased level of transparency has helped to expose previous practices that resulted in inefficiency.

Pricing rules. Wholesale prices are determined based on generators' bids to meet forecasted demand on an hourly basis. A hedging facility is also available, which allows purchasers to fix prices a year or more in advance. The combination allows buyers to choose certainty or volatility. Since 75% of New Zealand's electricity supply is made up of hydro generation, and the remainder is made up of thermal or geothermal generation, supply (and hence price) is highly dependent on rainfall patterns.[3]

The buying and selling of wholesale electricity has now become a 24-hour, 7-day-a-week operation involving competing generators and bulk electricity purchasers. EMCO, an independent organization, operates the market. Price is determined based on generators' offers to sell in relation to consumer demand for power. Electricity prices are set at the "spot" price, which is the highest offer from plants that must be dispatched to satisfy demand for each hour period. The price of wholesale power will change every half-hour with supply, demand and transmission conditions. With formal market rules in place, transparency of processes - particularly those of service providers - has improved dramatically. This is aided by an active market surveillance committee and compliance procedures. The market provides much information and market participants are now recognizing its commercial value.

The market was originally designed with ex-ante pricing which would have effectively allowed demand reduction to bid into the market. Under ex-ante pricing, energy service companies (ESCOs) could have either participated in the market directly or contracted with electricity purchasers to enable their energy savings to be much more responsive to price. The final market rules, however, introduced ex-post pricing in which prices are determined in relation to actual demand. The shift toward ex-post pricing is largely attributed to the influence of the power generators.

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[2] R.J. Lough, "Transition to a Competitive Market and its Impact on Energy Efficiency," *Presentation to the Third International Energy Efficiency and DSM Conference,* 1994.

[3] Ibid.

6.3 MARKET RESPONSE TO REFORMS

6.3.1 Power Distributor/Supplier Behavior

Distribution utilities carry out energy-saving marketing programs without any expectations of regulatory incentives for program cost recovery or reimbursement for lost energy sales. Some industry observers claim that the competitive market has caused both the wholesale and retail sectors to develop value-added services to achieve differentiation from competitors in particular market segments. Others claim that the relative lack of emphasis on end-use energy efficiency results from power suppliers' focus on a competitive pricing strategy rather than development of value-added energy efficiency services to attract and retain customers.

At present there are approximately a dozen distribution utilities managed by public trusts, however the absolute number of trusts is somewhat fluid due to recent and ongoing mergers and acquisition among energy retailers. The types of value-added services distribution utilities offer, and whether or not these programs emphasize energy efficiency, tend to be related to the ownership structure of the utility: in general, utilities owned by public trusts tend to be more involved in the end-use promotion of energy efficiency than privately-owned utilities.

6.3.2 Retail Prices

There is a general perception, but by no means a consensus, that electricity prices have fallen in real terms for commercial and industrial customers in the post restructuring period. Residential customers, on the other hand, have seen price increases due to the lessening or elimination of subsidies previously offered to them. Some groups, such as the Electricity Supply Association of New Zealand, argue that retail prices have dropped in the post-reform period and say that cross subsidies between customer classes have been minimized.[4] Others claim that prices have remained relatively constant (in real terms). Prices vary within and among customer classes based on geographic region or customer industry classification. The table below shows nominal retail prices for the period 1992 - 1996.

[4] Gunn, C., "Energy Efficiency Versus Economic Efficiency?," *Energy Policy*, Vol. 25, No. 2, pp. 247, 1997.

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Table 6-1
Nominal Retail Electricity Prices: 1992 - 1996
NZ cents/kWh (and US$ equivalent)

Customer Class	1992	1993	1994	1995	1996	1996 (US $)
Residential	8.873	9.214	9.7	10.24	10.97	0.073
Commercial	10.5 - 15.3	9.9 - 14.3	11.4	10.86	11.46	0.076
Industrial	3.3 - 15.1	3.4 - 14.5	5.99	5.84	6.39	0.042
Average	8.041	8.264	8.26	8.32	8.93	0.059

Source: Annual Statistics in Relation to the Electric Power Industry in New Zealand, Ministry of Commerce

Residential consumers use a significant proportion of electricity. In the year ended March 1995, the residential sector accounted for approximately 35% of total electricity deliveries, and electricity constituted 70% of delivered residential energy use. Available statistics show that the average annual domestic electricity consumption per household decreased from 7,888 kWh in 1991/92 to 7,594 kWh in 1992/93, remained at 7,592 kWh in 1993/94, and fell to 7,588 kWh in 1994/95. Further, the income elasticity of electricity demand is estimated to be 2.2, meaning that demand has grown more than twice as quickly as the economy as a whole.[5] In 1993/94, a household spent, on average, $734.40 on electricity. The corresponding figures for 1992/93 and 1991/92 were $699.68 and $701.59 respectively.

One of the most significant effects of reform on retail prices was the rapid hike in fixed charges of local power companies, and corresponding reduction in night-rate unit charges. There was widespread public criticism of the high fixed charges on the basis that these charges make energy efficiency less economic. Savings realized through energy efficiency would not be large enough relative to the fixed charge to reduce consumer power bills. Households with alternative heating or water heating fuels often find the fixed charge is close to half the total power bill. Ministerial pressure led to a reduction of fixed charges from as high as around $1.40/day to a typical maximum of around $1/day, and as low as $0.30/day.

6.3.3 Retail and Service Competition

Restructuring has created a strong incentive for distribution companies and electricity traders to maximize electricity sales. Distributors compete for large customers, while the generation market is dominated by two large entities, limiting competition. Thus, distributors differentiate themselves based primarily on price, but also on non-price factors, such as customer service, reliability, and marketing initiatives.

[5] *Energy Policies of IEA Countries, New Zealand 1997 Review*, OECD, Paris, 1997.

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6.4 END-USE ENERGY EFFICIENCY

6.4.1 Pre-Reform Situation

Prior to the deregulation of the power sector in New Zealand, there was little energy efficiency activity. There were no regulatory requirements and wholesalers and retailers had little incentive to undertake these activities because of characteristics specific to New Zealand's situation:

- low energy prices
- lack of vertical integration in the industry, which precluded distribution utilities from justifying expenditures on energy efficiency as a means of avoiding the cost of new generation (there was a clear split between the wholesale and retail levels)
- little political pressure for change
- no competition for customers[6]

Information dissemination and the processing of home insulation loans were the main energy efficiency activities prior to reform. At the retail level, load management objectives were met through extensive use of load control on water heating to reduce the cost of wholesale supply. Prior to 1967, residential tariffs did not include a kilowatt hour charge and were based exclusively on a demand charge. After 1967, a kilowatt hour charge was gradually phased in.

During the pre-reform period some government agencies were involved in improving building standards and conducting energy research activities. Energy efficiency was, in general, approached as a "public good."[7]

In 1986, prior to industry reform, the Ministry of Energy's Energy Management Division sponsored some regionally-focused information campaigns. In addition, many utilities had been promoting residential sector water heater insulation programs in an effort to reduce peak demand. At the same time, ECNZ launched a campaign promoting electricity use and expanded electrification. ECNZ faced strong public criticism for this campaign and eventually decided to end it. ECNZ also ran a program called HERO (Home Energy Rating Options), which was designed to provide information on energy efficiency to prospective home owners. However, not many power companies marketed the program, and ECNZ soon curtailed it.

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[6] R.J. Lough, "Transition to a Competitive Market and its Impact on Energy Efficiency," *Presentation to the Third International Energy Efficiency and DSM Conference,* 1994.

[7] Ibid.

6.4.2 Integration of Energy Efficiency in Reforms

Policy. The reformed market structure offers strong incentives for suppliers to maximize energy sales and there is little opportunity for suppliers to bid demand-side resources such as load shifting or energy efficiency to effect demand. Given the market structure, and the government's belief that market barriers are suppressing private sector energy efficiency, the government provided funding for the creation of the Energy Efficiency and Conservation Agency (EECA) to promote energy efficiency. Unlike the U.S. and the U.K., where funding for publicly-supported energy efficiency agencies is derived primarily from charges to electricity consumers, New Zealand allocates funding for EECA directly from the government's budget. Funding for 1996 was approximately NZ $ 5.5 million (US $3.5), which is roughly 0.2% of total 1996 electricity sales.[8]

Some observers claim that the reforms so far have inhibited energy efficiency and point out that a new government agency, the Energy Efficiency and Conservation Authority (EECA), was created specifically to offset this effect.

Regulation. *Regulation of power sector energy efficiency activities.* Two main laws during the transition period changed the incentives for energy efficiency in New Zealand:

- The Energy Companies Act of 1992 (which deregulated the industry with the goal of improving economic efficiency and market incentives for energy efficiency): imposes energy efficiency requirements on power companies that are more than 50 percent publicly-owned. Firms that are comprised of a 51 percent private ownership or more do not face these requirements.

- The Resource Management Act of 1991 (which requires a permit for any activity expected to have an adverse effect on the environment): creates an incentive for end users to engage in energy conservation to reduce site emissions.

Codes and standards. EECA has undertaken studies to analyze both the existing building codes in New Zealand and the creation of minimum energy performance standards for appliances. The goal is for eventual harmonization of efficiency standards between Australia and New Zealand, in order to create more economies of scale for energy efficient equipment in the region. Neither appliance nor building efficiency standards are a high priority on the government's legislative agenda, however. See section 4.3 below for more details.

Related environmental policy or regulation. The government of New Zealand has committed to reducing CO_2 emissions to 1990 levels by 2000, with a further reduction of 20% below 1990

[8] Based on 1996 total retail sales of NZ $ 2,771 million (30, 528 GWh at an average rate of NZ $ 0.089). Source: Ministry of Commerce.

levels the ultimate target. However, given the dominance of hydropower in New Zealand (70% in 1995), the impact of this goal on the power sector will likely be small.

The environmental movement in New Zealand is arguing that energy efficiency and renewable energy won't survive in the market economy until energy production and utilization are made to pay their full social costs. The costs of greenhouse emissions and local pollution, for example, are not currently captured in energy prices.

6.4.3 Energy Efficiency Activities

Since deregulation, several factors have changed the incentives for energy efficiency activities:

- residential electricity prices are rising, attracting new entrants to the competitive generation market
- some suppliers are developing value-added services, to increase their competitive advantage
- environmental pressure brings scrutiny and possible criticism of additions to generating capacity

Power sector. Energy efficiency activities have varied widely among retail power companies. In general, electricity suppliers owned and managed by public Trusts tend to promote end-use energy efficiency more aggressively than privatized energy suppliers. The following is a sample of power company activity related to promotion of energy efficiency within their service franchise territories:

- establishment of account managers for key customers and sectors
- development of energy audit programs for residential and commercial customers
- provision of information and advisory services
- joint partnership arrangements with wholesale power suppliers to use technologies such as heat sensors, solar/heat pump water heaters, and small scale generation (including cogeneration and land fill gas generation)
- partnerships with overseas consulting firms to gain energy services expertise.

In the post-restructuring environment, there is a much stronger emphasis on providing customers with information to enable selection of energy efficient options. Power companies are doing this largely for public positioning, differentiation from competitors, and desire for customer retention.

Both the retail and wholesale sectors are now disclosing spot prices and a variety of other indicators which will lead to more informed decision-making by customers.

Southpower, a large distribution company, identifies sustainable use of natural resources as one of its central business philosophies and offers several programs designed to reduce electricity consumption. One of its largest marketing efforts involves the promotion of the "Lightwise" technology, a cost effective device that reduces the energy cost of fluorescent lighting. Lightwise is an effective energy efficiency technology which is ideally suited for any area where there are large areas of fluorescent lighting, as in shopping centers, car parks, and office buildings. In addition, Southpower supports the Community Energy Action group, a community-based movement located in Christchurch, that promotes energy efficiency and environmental awareness and protection.

During the post-reform period, ECNZ, the dominant power generator, has become involved in developing and promoting energy services in the retail sector, including the following subsectors:

- Cogeneration. Activity has increased due to removal of obligation to supply
- Industrial. In New Zealand, a large percentage of industrial energy usage is for motors and drives. Thus, software to assist in selection of motors has been developed and distributed to power companies.
- Commercial. Monitoring and targeting and building design are major issues of concern.
- Residential. An energy performance rating scheme has been developed for homes, including recommendations for how the rating can be increased. A new design in hot water cylinders could also provide efficiency gains in the residential area.

Government.[9] As mentioned previously, the Energy Efficiency and Conservation Authority (EECA) is the national organization in New Zealand responsible for energy efficiency issues. EECA is governed by an independent board of directors and is responsible directly to the Minister of Energy. Its major activities over the past two years have included the following:

Development of Minimum Energy Performance Standards (MEPS).[10] EECA undertook a study, which was upheld by the Government, that showed that MEPS would produce a substantial economic benefit and significant reductions in CO_2 emissions. It is expected that these efforts will eventually lead to the harmonization of standards between Australia and New Zealand, creating a single market for a wide range of energy-using equipment. However, the legislation to

[9] Source of all government information is the *EECA Annual report,* 1995/96.

[10] Standards NZS4243 and NZS 4218.

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introduce MEPS does not currently appear to enjoy a high priority on the Government's legislative agenda.

Revision of New Zealand Building Code to include energy efficiency provisions. Over a three-year period, EECA undertook a detailed analysis of proposals for revising the building code to include pragmatic solutions that are easy to implement. Three new standards have been introduced, for small buildings, large buildings, and residential hot water systems. The standards address building insulation levels, window glazing, lighting energy consumption targets in commercial buildings, and domestic hot water heat loss reduction. As with MEPS, there is no target date for legislative implementation of mandatory building standards.

Energy Saver Fund (ESF). EECA has established and administers a five-year, $18 million pool of funds to be awarded as grants to assist with residential energy efficiency improvements. In 1995, operating procedures and criteria were developed for the fund. The first projects funded in 1996 include retrofits, market development for new technologies, and cooperative activities between power companies, contractors, and community organizations. Approved projects were required to meet the following criteria: provide large energy savings at low cost; develop effective methods to market and deliver efficiency after funds are gone; target sectors where barriers are high; have a good likelihood of success; and involve activities that would not have occurred without ESF funding. Critics of the fund claim that it focuses almost exclusively on technology installation and retrofit projects and pays scant attention to public information projects. One reason for the emphasis on technology-based projects is that the fund needs to estimate the energy savings of the projects it supports and it has no mechanism to attribute energy savings to information campaigns in its project proposal evaluation criteria.

Energy efficiency in business. To support this effort, EECA is involved in several activities, including running an Energy-Wise Companies Campaign, which includes over 700 companies; developing and reviewing 21 voluntary CO_2 agreements with major industry companies; assisting with energy management practices through training and publications; and running technology and behavioral change programs in the high opportunity areas of commercial and industrial lighting, office equipment, and motor drives.

Seminars. EECA's Marketing and Communications department conducts periodic seminars designed to raise awareness of energy efficiency and provide training in energy management in industry, energy management in buildings, energy efficiency refrigeration, energy efficiency and industrial services, and process heat.

Consumer promotions. EECA designs and implements promotional programs, including programs aimed at promoting energy efficient appliances and water heating systems.

Private sector. A number of energy efficiency firms and consulting groups operate in New Zealand. The majority of these firms operate on a relatively small scale, and many rely heavily on publicly funded energy efficiency programs targeted toward the residential sector. One of the

purposes of the public funding, described later in greater detail, is to "kickstart" the implementation of energy efficiency measures.

Funding is not explicitly intended to create a commercially sustainable energy efficiency industry but focuses instead on the cost-effectiveness of projected energy savings. Although it has helped form such an industry, it may be unrealistic to expect substantial private sector energy efficiency activities to continue, at least in the residential sector, absent public funding. While much of the public funding is awarded to power companies, particularly trust-owned power companies, the public monies are also allocated to private entities such as the Community Energy Action group (based in Christchurch), Negawatt Resources, and the Energy Fitness Company.

Since the retail market activity has been all about price-competitiveness, ESCOs tend to be understood by local power companies in terms of their nuisance value, not their potential for making demand responsive to cost.

Energy efficiency itself does not have a large appeal for businesses in New Zealand. This is primarily because of the low cost of energy relative to total production costs. However, because of the introduction of the Resource Management Act, companies are under increasing pressure to reduce all forms of emissions, and so are looking at energy efficiency as an alternative to accomplish that goal. Thus, the major impetus aside from cost considerations in the private sector in New Zealand is coming from an emphasis on emissions reduction.

Price is also playing a role in encouraging energy efficiency. For example, during a water shortage in 1992 and subsequent electricity shortage (due to reliance on hydro), energy savings of 20% were achieved in the face of electricity prices seven times their seasonal average. Customers responded to the higher prices by adjusting electricity consumption patterns and investing in energy efficiency.

Energy efficient technologies. In general, the availability of energy efficient technologies does not serve as a major constraint to energy efficiency in New Zealand. Energy efficient technologies are readily available for many end-uses and product labeling programs are in place to better inform consumers about the energy use characteristics of a given technology. It is the incremental cost of energy efficient technologies relative to technologies with baseline efficiency levels that tends to constrain demand for these products.

Extent of implementation. As a result of the Energy Saver Fund, a great deal of attention has been given to efficiency improvements in the residential sectors, including water heater insulation, lighting retrofits, and home energy audits. Relatively little effort has been put into public information programs that target behavioral changes. These programs have tended to languish relative to end-use programs aimed at installation of energy efficient technologies.

6.4.4 Constituencies

There is a small but vocal constituency for energy efficiency in New Zealand comprised primarily of environmental and consumer interest groups as well as industry and government agencies involved in the power sector.

Power sector. The Electricity Supply Association of New Zealand (ESANZ) is the trade organization for New Zealand's retail electricity traders and regional electricity distribution network companies. ESANZ has been a leading and very active participant in the restructuring of New Zealand's electricity industry and is a founding shareholder in the Electricity Market Company (EMCO) which has been identified by the government as the new market operator. Since 1990 ESANZ has been sponsoring annual energy efficiency award programs. These programs have resulted in an excellent collection of case studies which are summarized in booklets and videos.

Government. The major organization responsible for promoting energy efficiency policy and programs in New Zealand is the EECA. EECA was established in 1992 and has the following objectives:

- to develop, implement, and promote strategies for energy conservation.
- to advise the Government and the New Zealand energy industry on matters relating to the development, implementation and promotion of those conservation strategies, and
- to monitor known energy sources, their use, and the investigation of potential sources and applications, together with the economic, social and environmental impacts, in both the short and long term.[11]

In addition, EECA contributes to the efficient use of New Zealand's energy resources through improved energy management and the application of energy efficiency technologies that take into account environmental and social impacts. The strategies employed will improve long term energy security and economic growth, and reduce greenhouse gas emissions.

A Demand-Side Working Group has recently been established within EMCO to ensure that demand-side considerations be addressed in the interpretation and implementation of the wholesale electricity market rules.

NGOs. Greenpeace NZ, the Forest and Bird Protection Society, and the Sustainable Energy Forum are major advocates for energy efficiency on the basis of its positive environmental effects. There is no organized voluntary consumer movement in New Zealand, but Power for Our

[11] "Overview," *EECA Annual Report,* 1995/96.

Future (an informal network formed in 1991 to oppose the purchase of New Zealand's largest hydro station by an aluminum smelting company, Comalco) has continued to represent consumer interests. This group has been successful in linking consumer advocacy with environmental issues and has advised many communities which have opposed privatization of their local power companies.

The Energy Management Association has been formed as a technical group of the Institution of Professional Engineers New Zealand (IPENZ). The Energy Management Association will work towards ensuring that a continuing high standard of expertise in energy management and energy efficiency related services is available to industry, commerce and the public of New Zealand. The Association's aims are to promote the highest standards of energy management skills and competence and facilitate the integration of sound energy management practices into all sectors of the New Zealand economy.

The Association's *Energy Fitness Bureau* is an energy efficiency and energy management information service which aims to provide a wide range of information on products and services relevant to the efficient use of energy within New Zealand. The information service, which includes a toll free phone line, is operated by the Central Institute of Technology (CIT) and its initial development has been supported by the ECNZ and the power companies.

Private sector. Private consulting and engineering firms and ESCOs that rely on publicly-funded energy efficiency projects are a growing constituency.

6.4.5 Looking Forward: Issues, Concerns, Barriers

Expected legal and regulatory changes. The most significant legal and regulatory developments affecting energy efficiency pertain to the continued development of market rules for the wholesale electricity market. Changes to the original conception of the market have already resulted in muted incentives for bidding of so-called demand-side resources and load management activities. The likelihood of potential amendments to legislation governing the power sector, most notably The Energy Companies Act of 1992 and The Resource Management Act of 1991, is unclear at this time.

Greatest remaining barriers. While restructuring has resulted in improved price signals and limited government interventions have helped address some of the main barriers to consumer adoption of end-use energy-efficient technologies, several barriers remain, including:

Lack of capital for energy efficiency investment. There is currently a large discrepancy between the rate of return requirements for supply side investments (lower) and the requirements on the demand side (higher). ECNZ is considering establishing an investment fund for industrial and commercial sectors designed to stimulate investment in energy efficiency.

Low price energy traders. To the extent that customers assume that the only difference among suppliers is price, the development of value-added services by providers will be delayed.

Insufficient attention to residential customers. Because most residential customers have little opportunity to achieve savings through energy efficiency, because of high fixed charges, these captive customers are receiving less attention than those in the industrial and commercial sectors. This also has political ramifications.

Fixed line charges. Some networks currently have high fixed line charges, which then result in low energy costs (and thus, low incentive for energy efficiency). These network operators are under considerable political pressure to revise their charges.

Key actions needed. At this point the future of energy efficiency is heavily dependent on government intervention through EECA and continued support from the Energy Saver Fund. Private sector activities to promote energy efficiency are underway but, according to most observers, are still in a developmental phase. Further, energy efficiency advocates claim that market barriers still suppress the market for energy efficiency and justify continued government intervention.

Greatest opportunities to promote energy efficiency. Energy retailers represent one of the greatest opportunities for (and current obstacles to) energy efficiency. Since retailers all purchase their power from a single pool, they have only a limited ability to differentiate themselves from their competitors based on price. They may, however, choose to promote energy efficiency as a value-added strategy to attract and retain customers. Other important opportunities for energy efficiency include efficient market pricing, greater incorporation of energy efficiency provisions into building codes and product standards, and continuation of the Energy Saver Fund.

6.5 CONCLUSIONS

6.5.1 Motivations

Prior to reform, consumers in New Zealand were accustomed to subsidized prices and entitlements for public sector services such as electricity. Affordable electricity was considered a natural right. The situation changed dramatically as a result of corporatization of the sector, which rationalized investment decisions and tariff structures. A clear lesson for developing countries is that corporatization of state-owned power sector enterprises has a potential to result in economic efficiency improvements.

While restructuring and corporatization helped minimize waste and improve efficiency, privatization of the sector has had mixed effects on distribution utility promotion of energy efficiency. Privatized distribution utilities in New Zealand typically seek to maximize profit

through increased energy sales. They are commercial entities accountable to investors. Privatized distribution utilities will pursue energy efficiency activities only to the extent that these activities have a positive impact on profitability.

Distribution utilities that are not governed exclusively by commercial objectives will usually be more willing to promote energy efficiency even when there are no direct financial benefits to be received. Distribution utilities governed by public trusts are likely to make investment decisions in accordance with the wishes of their constituencies, who frequently express interest in energy efficiency. Numerous trust-managed utilities, including Horowhenua, King Country, Northpower, ScanPower and Tasman Energy, are actively engaged in promoting and funding energy efficiency projects within their service territories.

6.5.2 Growth Potential

Although no definitive analysis has been done to quantify energy savings attributable to efficiencies achieved since reform, there is a growing body of evaluation research to suggest that such savings have occurred. Factors that have contributed to making these savings possible include: EECA programs, energy efficiency codes and standards, and higher electricity prices in the residential sector. In particular, the Energy Savings Fund is responsible for significant savings in the residential sector. Curtailment of the fund will likely result in diminished future energy savings in the residential sector.

Several studies on energy efficiency potential were carried out in the late 1980s. These studies produced a range of between 10 and 40% as the estimate of achievable energy savings. Rather than trying to refine this estimate further, EECA considers that there is adequate prima facie evidence that energy savings potential exists in a number of sectors and in a number of technological applications. Its limited resources are allocated to programs that will improve energy management skills and practices, which eventually will produce the hoped-for savings.

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CHAPTER 7
UNITED STATES CASE STUDY

7.1 OVERVIEW OF POLITICAL AND ECONOMIC SITUATION

The US has one of the most diverse and technologically advanced economies in the world, with a per capita GDP of $27,500 (one of the highest among the industrial nations). In this market-oriented economy, private individuals and business firms make most of the decisions, and government purchases of goods and services are made predominantly in the marketplace. Most US business firms enjoy greater flexibility than their counterparts in Western Europe and Japan in decisions to expand capital plant, lay off surplus workers, and develop new products.

US firms are at or near the forefront in many technology areas, especially computers, medical equipment, and aerospace, although there have been ebbs and flows in the relative status of specific technology sectors since World War II. The onrush of technology in the US has contributed to the gradual development of a "two-tier labor market," divided between those who have the educational and professional/technical skills needed to succeed in this environment, and those who do not.

The years 1994-95 witnessed moderate gains in real output, low inflation rates, and a drop in unemployment to below 6 percent. The capture of both houses of Congress by the Republicans in the elections of November, 1994, (with a Democratic President) has intensified the debate over how the US should address its economic issues. These issues include inadequate investment in economic infrastructure, rapidly rising medical costs of an aging population, sizable budget and trade deficits, and stagnation of family income in the lower economic groups. The outlook for 1998 is for moderate to strong growth, low inflation, and low unemployment.[1]

[1] Source: CIA World Factbook: http://www.odci.gov/cia/publications/nsolo/factbook/us.htm#Economy

General Indicators

Population:	266,476,278 (July 1996)
GDP:	$7.248 trillion (1995)
Per capita GDP:	$27,500 (1995)
Inflation rate (consumer prices):	2.5% (1995)
Major economic sectors:	
▸ *services:*	75% (1995)
▸ *industry:*	23% (1995)
▸ *agriculture:*	2% (1995)
Type of government:	federal republic (democracy)
Literacy rate:	97% (1979)

7.2 STRUCTURE OF POWER SECTOR

Power Sector Data

	Total	Industrial	Commercial	Domestic	Other
Installed Capacity (1996)	724,728 MW				
Peak Demand (Summer, 1996)	616,790 MW				
Annual Consumption, 1995 (MWh)	3,013,411	1,012,597	862,841	1,042,565	95,407
Growth rate for electrical demand	2.7%	0.5%	5.2%	3.4%	-2.5%
Retail Electric Price* ($/kWh)	0.0689	0.0466 0.0769	0.084	0.0688	
Time of use tariff?		yes	yes (by size)	yes (optional)	—
Total losses	3% EIA estimate				
Payment / collections rate	99% EIA				

* Note: These figures include both energy and demand charges. A demand charge is frequently applied to large industrial and commercial customers.

7.2.1 Pre-Reform Situation

Most of the power sector in the US is privately owned by investor-owned utilities and independent power producers. In addition, a large number of utilities are owned by federal government agencies, municipalities, and rural cooperatives.

Historically, investor-owned utilities have accounted for more than 70 percent of the country's generating capacity and the major portion of its transmission and distribution infrastructure. Throughout much of the century, the investor-owned portion of the industry has operated as a collection of geographically independent regulated monopolies. Utilities were granted vertically integrated monopoly service franchises — generation, transmission, and distribution — in order to take advantage of economies of scale.

Until recently, this monopoly structure was thought to be more economically efficient than a structure based on competition. Regulation of the industry, with prices based on the cost of

providing the service plus a reasonable return on investment, served to guard the public against abuse of monopoly power. Regulated utilities faced an "obligation to serve" all customers located within their service franchise and to make all necessary investments in order to meet customer demand.

Regulation of investor-owned utilities occurs primarily at the state level through state public utility commissions. Interstate transactions are regulated by the Federal Energy Regulatory Commission (FERC). In addition, utilities must comply with a host of state and federal energy and environmental laws.

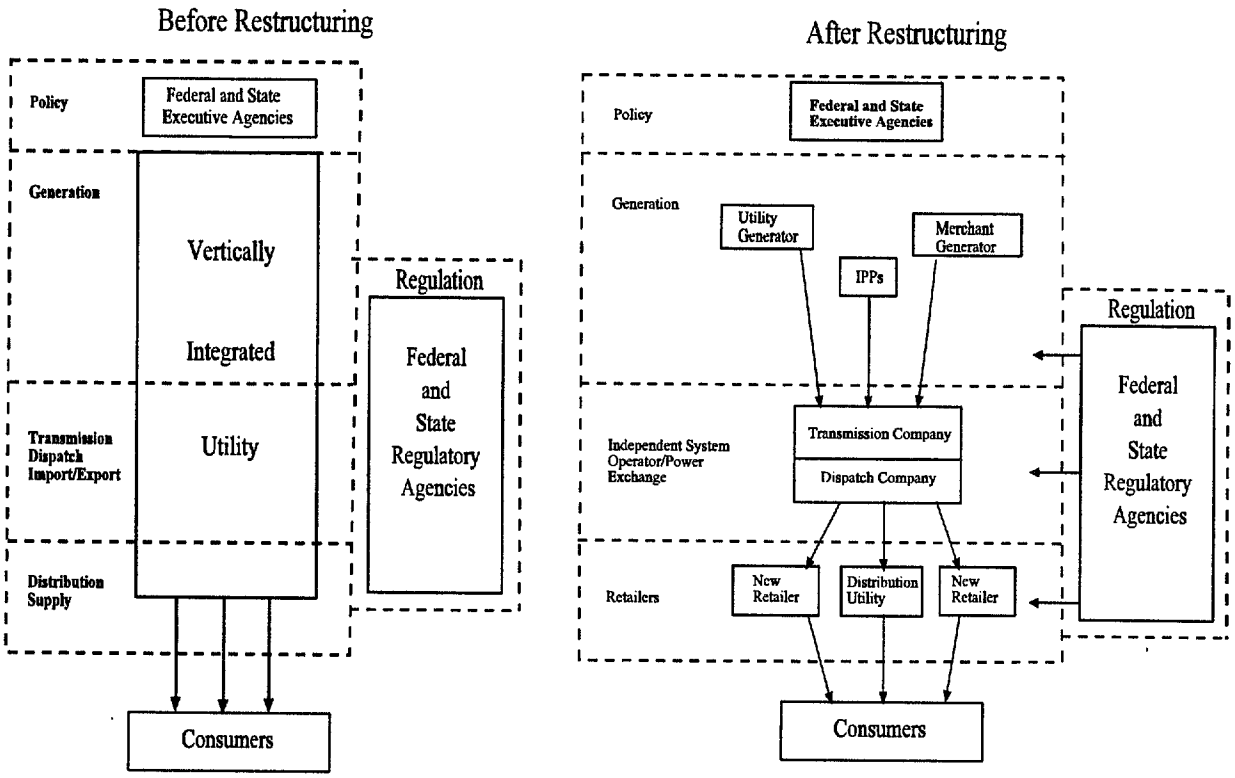
The economics of the industry began to change in the late 1970s when opportunities for further economies of scale in generation were exhausted. The 1970s ushered in an era of slower growth in demand for power. The decade also saw more stringent air pollution regulations, a jump in oil prices associated with the oil crisis of 1973-74, high inflation and high interest on debt, the accident at the Three Mile Island nuclear plant, and regulatory delays related to nuclear power. All of these factors contributed to higher costs and increased interest in both energy conservation activities and renewable energy sources.

Most recently, economies of scale in generation have been dramatically diminished because of the availability of new combined-cycle gas turbines which can be installed in modular units at much lower capital costs than plants could be built even a few years ago. These new combined-cycle plants possess extremely favorable heat rates and now can economically compete with existing coal-fired units. Some utilities are considering retiring existing coal plants and replacing them with new gas plants. This change in technology, along with low prices for natural gas, has largely eliminated the economies of scale that were prevalent on the generation-side of the electric industry before 1980.

The changing economics affecting the utility sector prompted policymakers to reexamine the utility industry structure and consider ways to reduce costs. Deregulation of other regulated industries such as the natural gas, airline, and trucking industries resulted, in general, in lower prices for consumers and helped to establish the precedent for power sector reform. The Public Utility Regulatory Policies Act (PURPA), passed in 1978, took one of the first steps to increase competition within the sector by requiring utilities to purchase power from certain nonutility producers. The 1992 Energy Policy Act (EPACT) further facilitated electricity deregulation by mandating open access to the transmission grid to allow third party wheeling of power to wholesale customers.

The excess generating capacity and the higher than expected capital and operating costs of many of these coal-fired plants led many regulators and utilities to decide to defer building new generating stations. Conservation or DSM efforts were adopted in a number of states, while other states and utilities bid out any expected future capacity needs to independent power producers. During the 1980s, there was the expectation that electricity prices would continue to rise and the economics of DSM were generally favorable. This resulted in a number of states working with

utilities to develop aggressive DSM program efforts with load management and energy efficiency programs being offered to all customer classes. For nearly ten years, DSM was one of the focal points of resource planning for utilities and regulators in the US.



7.2.2 Objectives of Reform

The overarching objectives of power sector restructuring in the US are to allow the forces of market competition to improve economic efficiency and thus lower the cost of electric service. Factors driving competition within the sector include retail price disparities across utility service territories, regional capacity surpluses that result in depressed wholesale power prices, and technology advances that result in low-cost, highly efficient generation technologies. All of these factors feed the belief that competition will minimize prices.

7.2.3 Post-Reform Structure

Electric industry restructuring is currently being considered in virtually every state, but full retail competition has yet to be implemented in any state. The creation of competitive generation markets and provision of customer choice of supplier is the primary focus of most restructuring

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proceedings. For example, one of the largest electricity markets in the US, the California market, will open for retail competition in January, 1998. A majority of customers in New England can expect retail choice by 1998-1999. Other regions that are right behind California and New England include Pennsylvania, New Jersey, New York, and Oklahoma. Legislation directly addressing retail choice and electric utility restructuring is currently under consideration in a majority of the remaining states.

State restructuring proceedings have focused on the unbundling of utility services into the component parts of generation, transmission, distribution, and retail sales, and on introducing competition into these subsectors wherever possible. Within the generation subsector, most states are considering a mixed market which includes: the creation of a power pool into which generators will bid their prices to deliver power; and a bilateral market where generators submit a schedule to an independent system operator (ISO) responsible for ensuring system reliability and resolving conflicts among pool participants. Generators will compete and be dispatched based on either their bid prices into the pool or on a schedule submitted to the ISO. In either case, customers will be given a choice of generation service supplier.

The ISO will be responsible for estimating hourly demand, managing power pool auctions, dispatching and scheduling generators, carrying out financial settlements, and ensuring system reliability. An ISO may assume other functions as well, but it will not have an ownership stake in any transmission or generation facilities, will not directly set energy or transmission prices, and will typically be indifferent to power market transactions except to the extent that they may burden the transmission system.

This arrangement will act to prevent the potential for market power abuse that exists in the current regulated monopoly structure. It should be noted, however, that some regions of the US are considering an ISO that sets market prices and thus would require significant regulation. Issues related to market power and concern over arm's length transactions between generation companies (GENCOs), transmission companies (TRANSCOs), and distribution companies (DISCOs) that formerly were one vertically integrated organization, have led regulators to require some utilities to divest portions of the generating capacity. Even when not required to, a number of utilities are voluntarily divesting themselves of generation for business reasons. As a consequence, a large number of electric generating plants have gone up for sale in the past year.

Regulatory Oversight Authority

In most states, the role of the state regulatory commission will change. The state regulatory agencies will no longer regulate generation (except where it remains in utility hands and in cases where there is market power). In addition, state regulators will no longer directly determine how much customers pay for generation services, which will be related to the market price for power.

Regulatory agencies will continue to set rates for transmission and distribution services and will likely do so through incentive regulation rather than the traditional cost-of-service regulation in order to encourage efficient provision of these services. Most parties agree that utilities should be

able recover their stranded costs[2] through the use of non-bypassable transition charges that would be applied to all customers during the transition period. Regulatory agencies will also set the level of these transition charges, which may depress the savings customers would otherwise have realized following the introduction of competition. These agencies will also decide on other customer-related fees, including funding for public purpose programs such as public information campaigns or subsidies for low-income customers.

Power marketers, companies that buy and sell power and ancillary services, and power brokers who arrange such deals, are becoming increasingly active in wholesale power markets and are positioning themselves to operate in retail markets once these are opened to competition. Restructuring has also resulted in increased power trading and the "commoditization" of electricity. In March, 1996, NYMEX introduced an electricity futures contract, a financial instrument that helps both suppliers and customers manage the risk in electricity trading.

Another trend has been the consolidation of the utility industry. Dozens of US utilities have merged or been acquired over the past three years. However, there have been some notable failures, and mergers between power companies do not look as promising as they did a few years ago. Mergers between what is predominately an electric company and what is predominately a gas company are now most common.

Industry analysts are predicting fewer electric/electric mergers in the near term, but they are still predicting that there will be considerable industry consolidation. However, the first step is likely to be vertically integrated utilities breaking up into GENCOs, TRANSCOs, DISCOs and retail companies (RETAILCOs); then these entities will consolidate. Some analysts predict that 10 GENCOs will account for 60 percent of US generation in five years, a considerable consolidation given the fact that there are now over 200-investor owned utilities and over 2,000 public entities.

US utilities are also actively pursuing overseas investments. Utilities such as the Southern Company and Pacificorp are acquiring generation and distribution utility assets in competitive international power markets such as England, Wales, and Australia. These US-based utilities are eager to gain experience in competitive markets which they can apply in US regional markets once these are opened to competition and which will also help them position themselves as global electric service providers.

The FERC has issued a number of rules in recent years to help facilitate wholesale competition. In 1995, it issued a rule on the treatment of stranded costs in its Notice of Proposed Rulemaking. In April, 1996, FERC released Order 888, which requires utilities to allow third-party use of their transmission lines (so called "open access" provisions), and Order 889, which establishes

[2] Stranded costs can generally be defined as the difference between the actual cost of a long term asset (e.g., a power plant or power purchase agreement) and the current market value of those assets. Source: SEL Energy Watch, April 25, 1997.

guidelines for utilities on electronic systems to share information about available transmission capacity.

Key restructuring issues that are being addressed by the states include recovery of stranded costs, divestiture of transmission assets, increased mergers, renewable energy incentives, energy efficiency investments, reliability, and the timing of retail competition.

Incentive regulation, which rewards monopoly service providers for improving efficiency and minimizes incentives for excessive capital expenditures (frequently incurred under cost-of-service regulation), is becoming the regulatory model of choice in the US and should merit serious consideration within the developing world. In addition, the regulatory function needs to ensure that the competitive power market operates according to market rules in order to guard against price fixing.

7.3 MARKET RESPONSE TO REFORMS

7.3.1 Power Distributor/Supplier Behavior

In the emerging regional power markets, state regulatory agencies may allow utilities to discontinue their DSM programs. Competition is creating pressure for utilities to cut costs. While DSM programs often reduced customers' electricity bills, these programs tended to reduce utilities' revenues as well. Sometimes electricity rates increased too, due to adjustments for lost revenues and recovery of expenses associated with the programs.

According to the Energy Information Administration, utilities project annual energy savings of more than 71 billion kWh and potential peak load reductions of more than 51 GW by 1999. This represents an 8.0 percent average annual rate of growth in energy savings, and a 5.4 percent average annual rate of growth in potential peak load reductions from reported 1995 levels. These projections are lower than previous projections made by the same utilities. A 13 percent reduction in expenditures on energy efficiency programs is also projected for the period 1995-1999.

The reasons for the decrease in utilities' spending for energy efficiency programs are several: First, the price of electricity has not risen to the extent forecasters predicted when DSM was a mainstay of many states' resource planning process. The cost cutting by utilities in preparation for restructuring is being driven by a desire to level and reduce electricity prices. Second, the restructuring efforts underway are redefining the utility. Functional unbundling of previously integrated utilities changes the economics of avoided costs to reduce incentives for investment in energy efficiency. Third, many of the market failures that served as justification for utility DSM may be reduced as a result of restructuring. Fourth, in many instances, utilities have found the rate impacts of energy efficiency programs to be detrimental to repositioning themselves for a competitive generation services market.

In general, there is a strong trend away from utility sponsorship of customer rebates and financial incentive programs for purchase of energy efficient products, and toward so-called market transformation[3] programs, which tend to be less costly and reach a broader audience than do rebate programs. A final reason for the decline in DSM spending by regulated utilities may be the conflict between integrated utilities' financial interests as suppliers of competitively priced generation and the potential of DSM programs to reduce load and market prices for generation.

While regulated utilities are spending less on DSM, the focus on electricity engendered by all of the restructuring activity has spurred some latent interest in electricity and energy costs at the consumer level. Consumers are increasingly using DSM-type measures to lower their energy bills.

7.3.2 Retail Prices

According to the Energy Information Administration, in 1995 utilities' average revenue per kilowatt-hour was 8.4 cents in the residential sector, 7.69 cents in the commercial sector, and 4.66 cents in the industrial sector. Retail prices within each customer class vary significantly across utility service territories. Average revenue per kilowatt-hour decreased in 1995 for publicly and federally owned utilities and increased modestly for investor-owned utilities.

In response to increased competition, utilities are reducing costs and modifying their fuel acquisition practices. This new emphasis on competitiveness has driven down utility operations and maintenance costs (in 1995 dollars) from about 4.5 cents per kilowatt-hour in 1986 to 3.5 cents per kilowatt-hour in 1995.

Nationwide, the prospect of competition has also caused utilities to cut rates in the industrial sector. With the imminent emergence of competitive markets, high-cost utilities are freezing and in some case lowering rates for customers as a preemptive measure to protect market share. Likewise, some regulatory agencies are taking steps to ensure that the benefits of competition be shared among all customer classes, not just customers that are profitable to serve, and have mandated rate reductions as a precursor to competition.

Market research has shown that up to 20 percent of residential customers may switch suppliers if given a 10 percent rate discount. Commercial and industrial customers tend to be even more responsive to pricing. Industry observers expect to see intense competition for commercial and industrial customers and for residential customers that are aggregated into groups based on geography or market behavior. For example, an apartment complex or entire substation might be billed collectively. Further, industry analysts expect to witness growth in the use of innovative

[3] Market transformation programs seek to reduce market barriers through a market intervention whose effects last after the intervention has been reduced or withdrawn. Market effects refer primarily to changes in product design and decision making among product suppliers and purchasers.

energy management services and time-of-use pricing options designed to optimize consumption patterns. During the transition to a competitive market, changes in the price elasticity of demand and supply are likely to be small. In the longer term, competition may increase the price elasticity of both demand and supply as a result of increased substitute goods available to consumers.[4]

7.3.3 Retail and Service Competition

New retailing activities are developing as markets open. Electric distribution utilities are having to prepare for competition from a host of new service providers. These providers are offering not only new products and services, but bundled packages of services. These packages can be tailored to meet individual customer needs, and may include financial services, energy management services, or integrated electricity, telephone, cable and internet service options.

Demand-side services will be competitively marketed by some energy suppliers, and by other service businesses, as a means of helping consumers manage their energy bills. These services may include automated energy management linked to a communications system that provides consumers and their energy management systems access to changing hourly electricity prices.

Currently, energy retailers (those entities that will retail generation services as well as gas) are designing and delivering product offerings which incorporate energy efficiency. Many of these retailers have purchased ESCOs in the last two years; others have formed joint ventures with ESCOs. Given the market premiums paid for ESCOs, it is clear that retailers see energy efficiency as a key component of their retail strategy.

In addition to the "traditional" ESCO and the retail portions of electric utilities, other entities are seriously looking at providing energy services for industrial and commercial customers. Organizations like Dupont are establishing subsidiaries for power marketing and energy services so they can share their experiences with other large end-users of energy. EVANTAGE, a Virginia Power subsidiary, has successfully established energy outsourcing relationships with large customers whereby they have responsibility for all fuels procurement and operations of energy-related equipment.

These aggressive actions by retail subsidiaries of utilities, customers, manufacturers, and ESCOs may produce an innovative and successful energy services industry that is geared to providing total energy solutions to customers. If so, it is not clear whether this portion of the energy industry will undergo as much consolidation as will the generation industry. The need for field personnel and direct customer contact may assure there will be a number of regional and niche players in the energy services industry.

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[4] Stevens, Brandt, Lerner, Lionel, "Testimony on the Effect of Restructuring on Price Elasticities of Demand and Supply," prepared for the August 14, 1996 CEC Electricity Report 96 Committee Hearing, July 17, 1996.

7.4 END-USE ENERGY EFFICIENCY

Numerous economic and institutional factors unique to the US power sector limit the relevance of the US experience as a model for developing countries. The intention in examining the US is not to suggest that its approach to providing energy efficiency should or could be replicated in developing markets. The US experience is being presented simply to show how energy efficiency is being addressed within a particular context, so that policymakers in developing countries have the opportunity to consider the strengths and limitations of a number of approaches and can develop policies tailored to their own specific market needs.

7.4.1 Pre-Reform Situation

Energy efficiency programs have come about largely because of the backing of environmental groups and some state governments that have sought to avoid costly new power sector investments. Energy efficiency efforts began in the mid- and late-1970s in response to the international oil crisis. During this period, regions of the US that use oil as a heating fuel participated in various efforts to reduce energy costs at the residential, commercial and industrial levels. Some utilities that relied heavily on oil for thermal generation were hurt during the oil price shocks if they did not have fuel adjustment clauses that allowed them to obtain timely rate relief.

In the 1970s and early 1980s, the passage of PURPA encouraged the use of time-of-use pricing and load management as ways to avoid costly investments in new power sector facilities. During this same period, the federal government required electric and gas utilities to conduct Residential Conservation Service and Commercial and Apartment Conversation Service programs which provided assistance to customers in the form of energy audits and energy efficiency measures.

In the mid-1980s, state utility regulatory commissions began to mandate DSM programs and IRP as tactics to limit expansion in the generation subsector. The historic justification for utility DSM in the US was predicated on the belief that provision of electric services was best carried out through vertically-integrated monopoly utilities which faced a regulatory obligation to serve all customers within their service territories. Federal and state regulatory authorities saw that the costs of demand-side management activities were often less than the avoided cost of new supply-side resources. Utility energy-efficiency programs were carried out under (1) a state and/or regulatory mandate that required them to undertake all cost-effective DSM measures, or (2) an IRP framework in which the utility considered the costs and benefits of DSM relative to investment in new generation, transmission and distribution facilities to arrive at a balanced portfolio of resources. While some utilities willingly offered energy efficiency programs, state regulatory commissions also mandated these programs for many other utilities.

In the past, the majority of state public utility commissions (under the traditional cost-plus/allowed rate-of-return price regulation) approved mechanisms to neutralize the various

financial incentives that rewarded utilities for maximizing energy sales. These mechanisms allowed utilities to not only recover DSM program expenses and be "made whole" for lost energy sales associated with DSM, but also in some cases earn additional profit for exemplary energy and capacity savings from DSM. As a result of these regulatory incentives, utility DSM programs have realized significant energy and capacity savings over the past decade. Now, in the mid-1990s, these savings are beginning to level in response to reduced utility involvement in DSM.

According to the Energy Information Administration, 1995 power savings associated with utility DSM were estimated at 52,831 million kWh, 0.7 percent above the annual energy savings reported for 1994. Annual 1995 potential peak load reductions were estimated to decline by 2.6 percent from 1994 levels to 41,784 MW. The leveling off in 1995 is in marked contrast to the steady growth reported in prior years. Annual energy savings from energy-efficiency programs are projected to continue growing, although at a slower rate, from 49,720 million kWh per year in 1994 to 51,221 million kWh in 1995.

Approximately one-third of the electric utilities in the United States have offered DSM programs. Overall, DSM costs decreased from $2.71 billion in 1994 to $2.42 billion in 1995, representing the second consecutive year that DSM costs have decreased from a high of $2.74 billion in 1993. Additional information on government-sponsored energy efficiency activities prior to reform can be found in of Section 4.3.

7.4.2 Integration of Energy Efficiency in Reforms

At present, it is not possible to know the full effect that restructuring will have on energy efficiency. Restructuring proceedings are only beginning to move to an implementation phase and there have been only limited efforts to evaluate the effect on new energy efficiency programs.

Energy efficiency advocates assert that there should be concern about the effect of restructuring on energy efficiency; they cite the recent decline in utility expenditures on DSM as evidence. They say that restructuring could pose a serious threat to new investment in energy efficiency by causing utilities and regulators to abandon DSM programs and the incentives that made those programs profitable to utilities, replacing them with more market-based alternatives. Without government intervention, advocates argue, highly polluting power plants are likely to be used more intensively and annual emissions could increase significantly. At the same time, air quality standards imposed locally by air quality management districts and nationally by the Environmental Protection Agency (EPA) are likely to result in increased incentives for power generators to reduce coal use and increase natural gas use.

There is evidence that many cost-effective energy-efficiency improvements are not adopted in the marketplace. According to a 1990 study by the Electric Power Research Institute, 20 percent of total US electricity consumption could be saved through adoption of energy-efficiency measures

costing less than 3.5 cents per kWh saved.[5] Based on this and other studies, energy efficiency advocates argue that consumers do not adopt many commercially available and cost-effective efficiency measures due to the presence of market barriers. Market barriers cited include customers' lack of information about energy efficiency, lack of financing options, the inability of low-income customers to purchase energy efficiency measures, and differing motivations of landlords and tenants.

Energy efficiency advocates have been successful in framing the debate and shifting the justification for continued ratepayer funding for DSM away from the "avoided cost" rationale. They argue that market barriers exist that suppress private sector development of energy efficiency resources and that public funding should be provided during a transition period in order to overcome these barriers and "jump start" increased private sector involvement. This issue was discussed in the Massachusetts restructuring proceeding. The commission said in its market rules proposal that in a fully competitive generation environment, energy efficiency services should be provided by the market; "however, some of the market barriers that currently exist for these services are likely to continue even after a competitive market has developed. Continued regulatory support is one method of mitigating the effect of these barriers."[6]

There is growing consensus for the use of a non-bypassable, non-discriminatory "system benefits charge" (or "wires charge") to fund energy efficiency activities that have broad public benefits. Under this approach, a volumetric charge (related to customer class and calculated as a percentage of the customer's energy bill) would be imposed on all customers and monies collected would be used to fund public purpose energy efficiency activities. Now that many utilities will be forced to cut all extraneous costs as a result of competition, the public benefits charge could be used to extend and re-shape the utility's DSM programs that were previously funded by a portion of their sales revenues. Most states that are considering ratepayer funding for energy efficiency programs view this funding as necessary only through a transition period until the private market for these services is more fully competitive and existing market barriers are reduced.

Many of the proposals regarding mandatory ratepayer funding for energy efficiency that are currently under consideration in various states include schedules for ramping down or eliminating mandatory funding over a three to five year period. While proposals vary with respect to the magnitude of the funding, most states considering this approach envision funding levels of less than one tenth of a cent on a per kWh basis (equivalent to approximately 1 to 2 percent of sales). Often, the proposed funding is significantly smaller on a per kWh basis than mandatory "competition transition charges" imposed to compensate utilities for stranded assets.

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[5] Of course, the new market structure will likely result in retail prices that more closely track the marginal cost of generation. At the time the EPRI study was completed, retail prices were more likely to be based on average costs, resulting in market distortions.

[6] Massachusetts D.P.U. 96-100 Model Rules and Legislative Proposal, pp. 175-176, December, 1996.

In addition to system benefits charges imposed at the state level, there are numerous proposals for a charge to be levied by the federal government as well. Monies raised through this charge would fund a national energy conservation trust, which would support state-funded energy efficiency projects through matching grants and other forms of funding allocation.

While there is growing consensus among many states on the need for a system benefits charge to fund energy efficiency activities during the transition to a fully competitive market, there are vast differences of opinion about how energy efficiency programs should be implemented. There are numerous options. Activities could be implemented by the private sector entities such as ESCOs, by energy marketing companies, or by distribution utilities that are selected through a competitive bidding process managed either by an independent agency or the existing regulatory body. Some states such as Massachusetts prefer that these programs be primarily administered by distribution utilities, given their close contact with customers and history of experience with managing energy efficiency programs. It has been common for distribution companies to contract out many elements of their energy efficiency programs and to work extensively with trade allies in implementing these programs. This is expected to continue.

There are also numerous disagreements about the scope and nature of publicly funded energy efficiency programs. Many retailers of generation services are designing and offering integrated products that incorporate energy efficiency offerings in the bundle (e.g., Evantage, ERI Services, Enron Energy Services, Xenergy, Duke Solutions, Edison Source, etc.). Utility-sponsored energy efficiency programs, funded through utility rates or a public goods charge, can have the effect of crowding out some of these offerings from the market. Hence, some of the debate has focused on the role of these programs vis a vis the role of developing a private market that values energy efficiency services.

In California, a working group comprised of industry, consumer, and environmental advocates has been set up that is responsible for policy formulation related to energy efficiency in the restructured California market. This group determined that energy efficiency programs that convey widespread public benefits (such as public education campaigns or market transformation programs) and would not otherwise be provided by the private market should be funded through a non-bypassable wires charge. The working group suggested that this charge be placed as a separate line item on customer bills.

An Advisory Board to the California Public Utilities Commission has been created to offer recommendations to the Commission on allocation of the energy efficiency fund and awarding of projects to energy efficiency service providers on a competitive bidding basis.[7] Much of debate over energy efficiency in California focuses on provision of energy efficiency services carried out by the private sector, absent any mandatory ratepayer funding. In order to realize this vision, a

[7] California IOUs will continue to be the entities primarily responsible for administering energy efficiency and low-income assistance programs for an interim period, with the goal of awarding these services on a competitive bidding basis.

two-track approach has been adopted, including: 1) promotion of an energy efficiency services industry through ratepayer-funded energy efficiency projects awarded on a competitive basis; and 2) implementation of market transformation programs that will create consumer demand for energy efficient products and services.

7.4.3 Activities Promoting Energy Efficiency

Government. While utility DSM programs have historically accounted for significant energy savings, other means of realizing energy efficiency such as state and federal initiatives and private sector activities have also played a central role. At the federal level, the DOE and the US EPA manage a variety of programs designed to promote end-use energy efficiency. The DOE has implemented national energy standards for gas and electric industrial and residential equipment and building codes that govern minimum efficiency standards. For example, existing appliance standards will save consumers $22 billion and more than one quadrillion (10^{15}) Btu of energy by the year 2000.[8] Other DOE programs include product energy usage labeling, public information campaigns to promote energy efficiency, research, development and demonstration projects for energy efficient technologies, and public/private partnerships to develop and market energy efficient products.

The federal government is the single largest energy consumer in the US, accounting for 1.2 quadrillion Btu (more than one percent of total national energy consumption) in fiscal year 1994. The Department of Energy's Federal Energy Management Program (FEMP) is responsible for helping government reduce its consumption of energy and nonrenewable resources. The Energy Policy Act of 1992 and related Executive Orders require that the federal government achieve a 30 percent reduction in energy consumption by fiscal year 2005.[9] The accumulated savings from FEMP related energy improvements in federal buildings and facilities was $9.8 billion through fiscal year 1994. Successful accomplishment of the goals will result in enough energy savings to produce a net $15 billion in energy cost savings through 2015.

Since the 1970s, federal government procurement policies have employed a "life cycle cost" approach. This technique looks at the total cost of a piece of equipment over its operating life and identifies competing technologies that have the lowest per-year cost over the useful life of the technology.

More recently, FEMP introduced its "Procurement Challenge," a voluntary, government-wide commitment that uses the buying power of the federal government to support and expand markets for today's "best practice" energy-efficient products. Best practice products – including

[8] Dollar savings were reported by DOE; energy savings are estimates of the Lawrence Berkeley National Laboratory and American Council for an Energy Efficient Economy.

[9] Http://www.eren.doe.gov/femp/bsbmtc.html

compact fluorescent lights and efficient electronic ballasts, efficient appliances, solar heat pumps, passive cooling systems, multi-paned windows, and many others – can often produce energy cost savings of 25 percent or more. For example, while a high efficiency 25-horsepower motor may cost about $230 more than a standard model, this difference is typically repaid by energy savings in only 18 months. For some products, such as fluorescent lamp ballasts, high-volume buying of energy-efficient products will reduce energy costs with little or no increase in purchase price. In addition to the "Procurement Challenge" program, FEMP has launched the "You Have the Power" information campaign designed to improve energy awareness among federal government employees.

Another highly successful governmental energy efficiency campaign is managed by the US Environmental Protection Agency. In June 1992, EPA announced its Energy Star Program which was designed to promote the development of energy-efficient office equipment. The program is based on creating voluntary partnerships between EPA and industry by identifying energy-using equipment that meets specifications set by EPA with the Energy Star label. In 1993, an Executive Order was issued requiring all US federal government agencies to purchase Energy Star computers, monitors and printers. Since then the program has been expanded to include several electricity end-uses such as lighting and space conditioning, and now involves hundreds of manufacturers of thousands of energy-using products.

The Green Lights Program is one of the most successful elements of the Energy Star Program. The Green Lights Program is a voluntary, non-regulatory program aimed at promoting energy efficiency through investment in energy-saving lighting. The program saves money for businesses and organizations, and it creates a cleaner environment by reducing pollutants released into the environment. Lighting accounts for 20 percent of all electricity sold in the United States. Green Lights participants realize average rates of return on their initial investment of 30 percent or more while improving lighting quality and reducing their lighting electricity bill by more than half. If Green Lights were fully implemented in all facility space in the United States, it would save over 150 billion kilowatt hours of electricity annually, reducing the combined electric bill by $12 billion per year.[10]

At the state level, end-use electric energy efficiency is addressed not only through regulation of the power sector (as previously discussed) but also through state energy agencies charged with promoting end-use energy efficiency. For example, the California Energy Commission offers numerous resources on energy efficiency, including a database on cost and consumption characteristics of energy efficient technologies and a wealth of literature on design and evaluation of energy efficiency programs. Likewise, other state agencies address energy efficiency through programs and initiatives that include reducing energy consumption in state buildings, public information campaigns on energy use, regulation of energy performance standards for buildings and equipment, and funding of energy related research, development, and demonstration projects.

[10] Source: http://www.epa.gov/appdstar/green/glb-home.html

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Private sector. Throughout the time period when regulated utilities were offering DSM programs, there have always been private sector energy efficiency activities. Certain architects and engineers have specialized in designing and constructing energy efficient buildings. In addition, companies like Honeywell and Johnson Controls have been active in promoting energy efficiency. Also, the rise in utility-sponsored DSM programs helped a new set of companies evolve and grow. ESCOs often would administer a utility's DSM program or set of programs on an outsourced basis. In addition, these ESCOs would independently approach customers in regions of the country where DSM programs were not as actively pursued. Using their experience from the utility programs as a foundation, a number of ESCOs were able to launch new activities and develop other projects with private companies.

Today, an ESCO is a business that develops, installs, and finances projects designed to improve the energy efficiency and maintenance costs for facilities over a seven to 10 year time period. ESCOs generally act as project developers for a wide range of tasks and assume the technical and performance risk associated with the project. When an ESCO undertakes a project, the company's compensation, and often the project's financing, are directly linked to the amount of energy that is actually saved.

Energy efficient technologies. Energy efficient technologies are available for the vast majority of end-use applications in the US. There is strong competition among multiple suppliers marketing energy-efficient technologies in numerous product categories. Appliance and equipment labeling programs that specify a product's energy consumption characteristics, manufacturer rebate programs, and public information campaigns all help to stimulate the market for energy efficient technologies.

Extent of implementation. The rate of adoption of energy efficient technologies is closely related to the cost effectiveness of the technology in question: the more cost-effective the technology, the higher the rate of adoption. In the residential sector, efficient lighting applications such as compact fluorescent lamps tend to have high rates of adoption. Efficient lighting measures also tend to be the primary focus in the commercial sector, whereas efficient motors and variable speed drives tend to be readily adopted in the industrial sector.

7.4.4 Constituencies

The constituency for energy efficiency consists of several national organizations and scores of state-specific groups and advocates. These groups' activities often include lobbying and public information and outreach campaigns in support of initiatives for the development and market adoption of energy efficient products and services.

Some of the more well known nationally oriented groups representing energy efficiency interests include: the Environmental Defense Fund (EDF); the Natural Resources Defense Council (NRDC); the Sierra Club; the Audubon Society; the International Institute for Energy

Conservation (IIEC); the Conservation Law Foundation (CLF); the Rocky Mountain Institute; the American Council for an Energy Efficient Economy (ACEEE); the Alliance to Save Energy; the Izaak Walton League; the National Association of Energy Service Companies (NAESCO); the Tellus Institute; and the Union of Concerned Scientists. There are numerous regionally based consumer and environmental interest groups as well. In addition, various federal and state government agencies and non governmental organizations such as the National Association of Regulatory Utility Commissioners (NARUC) are active in the promotion of energy efficiency.

7.4.5 Prospects for the Future

Despite regulatory support for a systems benefits charge to fund energy efficiency, many energy efficiency advocates contend that until market barriers are eliminated, the economic potential of energy efficiency will not be fully realized. Further, they fear that restructuring will offer little opportunity to establish price levels that capture the full social cost of production. As a result, promotion of energy efficiency will be more dependent on private sector initiatives, tightening of federal minimum energy efficiency standards, and governmental efforts to promote market transformation and procure and showcase energy efficient technologies.

Expected legal and regulatory changes. Over the next two to three years, most industry analysts expect state initiatives on power sector restructuring to move forward. As states consider restructuring, the impact on energy efficiency will most likely be included in the host of issues under discussion. There is growing support for some form of public funding such as a non-bypassable wires charges to support energy efficiency at the state level. Various parties have suggested mandating public funding for energy efficiency at the federal level; however these proposals have not received sufficient support to be considered by Congress in the near term.

Greatest remaining barriers. After restructuring, the disparity between the discount rate for a regulated utility's investments in supply infrastructure and the (high) discount rate for private customers investing in energy efficiency should be minimized. A closely related concept is the long payback period associated with utility investment in plant versus the short payback period required by customers to invest in energy efficiency. Theoretically, if a competitive market works efficiently and power is priced at the long run marginal cost, the payback gap and the difference in discount rates (two significant barriers) should be minimized. These are the greatest barriers to energy efficiency in the US under the regulated system.

Key actions needed. Key actions to support energy efficiency during the transition to fully competitive power markets include: public funding for broad-based energy efficiency programs such as market transformation; government intervention through public information and education activities; procurement initiatives; energy use codes and standards; and product labeling. In the future, when market barriers to energy efficiency have been minimized as a result of restructuring, government intervention will need to be re-evaluated in order to allow private sector activities to develop independently.

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Greatest opportunities to promote energy efficiency. The creation of competitive power markets that result in efficient price signals represents the greatest opportunity for energy efficiency. To the extent that retail prices capture the external (social) costs of power production and consumption, incentives for energy efficiency will be strengthened. Beyond efficient pricing, energy codes and standards hold tremendous promise for improving baseline energy efficiency levels, and market transformation programs have the potential to stimulate consumer demand for the most highly efficient technologies.

7.5 CONCLUSIONS

7.5.1 Motivations

Both well-established utilities and newer third party energy brokers and commodity providers are under pressure, in competitive markets, to minimize costs, reduce prices, and help customers reduce energy bills. For the most part, programs that adversely affect energy rates run counter to these objectives. To the extent that provision of energy efficiency services reduces electricity sales, energy suppliers will not have an economic incentive to market energy efficiency, unless: customers value these services and are willing to pay for them (either at a cost rolled into the energy supplier's price, or in a separate charge); or the energy efficiency service is a necessary part of a package (with the commodity) that secures customers because it produces a lower total energy bill.

Market segmentation and development of niche services targeted toward profitable customer classes will continue to grow in importance as retail competition intensifies. New retailing activities are emerging with the advent of competition. Utilities and other market entrants are devoting substantial resources to marketing and advertising activities in order to maintain and increase market share. Service providers are offering a host of new products and services tailored to customer needs, including services that resemble DSM such as financial services, energy management, innovative rates and billing options, energy information services, automated energy management, and other services designed to expand the ability of customers to respond to changing price signals.

So called "green power" — electricity produced from environmentally friendly generation sources — is one example of a new product that appeals to a select group of customers. Numerous utilities such as Green Mountain Power and the Sacramento Municipal Utility District and power marketers such as Enron Power Marketing are marketing "green power," mostly to residential customers, who are typically willing to pay an eight to ten percent rate premium for the service. The key difference between the competitive market and the pre-reform situation is that now the service provider will fund these activities and bears all the financial risk and reward of customer participation.

7.5.2 Expected Impact of Restructuring

Restructuring has prompted a dramatic change in the type and focus of energy efficiency and a reassessment of energy savings to be expected from energy efficiency programs. As mentioned previously, there is a strong trend toward market transformation programs, but these programs are relatively new and have not yet undergone extensive evaluation. It is therefore premature to speculate on the magnitude of energy savings attributable to these programs.

It is also difficult to gauge the impact of competitive markets on energy efficiency. Many observers expect prices to decrease, which will tend to reduce the consumer's incentive to invest in energy efficiency. There may be an increase in load shifting away from peak price periods, which may convey benefits in terms of reducing the need for new capacity, but load shifting will not affect the absolute level of electric consumption. It is too soon to know how manufacturers of energy efficiency equipment, service businesses, and architectural and engineering firms will respond to the market-based incentives brought about by power sector restructuring.

Minimum energy efficiency standards have proved to be a cost-effective approach to raising baseline efficiency levels. In addition, collaborative public and private funding schemes such as the Super Efficient Refrigerator Program (SERP) have been very successful at increasing market penetration of highly efficient technologies. Energy efficient technologies with the shortest payback periods tend to have higher rates of market penetration than technologies with longer payback periods. This was true prior to industry restructuring and continues to be true throughout the transition period.

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CHAPTER 8
OBSERVATIONS ON REFORM EXPERIENCE

8.1 OVERALL TRENDS

8.1.1 Change in Retail Prices

In almost all countries the effects of power sector reform have been to decrease the real prices paid for power by most, if not all, customer classes. Price decreases resulting from supply efficiencies and increased competition have amounted to as much as 15% in several instances. In Chile prices have dropped, but are still relatively high compared to international averages. Nevertheless, there is the perception among electric customers that power is less expensive than before.

The few exceptions to declining prices are for customer classes that had been heavily subsidized. Prices for Norway's residential customers have held constant; for New Zealand's residential customers prices have increased. In several instances, subsidies have been maintained for selected customer groups, such Argentina's discounts for low-income pensioners and large electric-intensive industries. There has also been increased implementation of time-of-use rates by both suppliers and distributors, to reflect the investment costs of expanding system resources to meet peak demands and to encourage users to buy power during off-peak periods. These rates are made more affordable because of improvements and cost reductions in metering and monitoring technologies.

In general, countries do not have data to characterize changes in consumption that have resulted because of reform-prompted price effects. One exception is New Zealand, where price increases for residential customers appear to have caused average consumption to decline by about 4%. Most other countries report that under reform it is harder to encourage customers to care about efficiency. Most consumers given a choice of retailers are selecting suppliers primarily based on price considerations, and not because of possible energy efficiency services. All of this would suggest that, except for classes where significant subsidies have been removed, reforms have not increased motivation to decrease consumption. In most cases, there appears to be less motivation.

In countries contemplating reforms where substantial subsidies currently exist for residential, agricultural, or large industrial consumers, reforms would be expected to increase the price of electricity and to produce some level of reduced consumption, depending on the elasticity of demand and the availability of alternative means of reducing power use.

8.1.2 Utilities' Interest in Energy Efficiency Services

In instances where competition is introduced primarily at the *generation* level, there is virtually no interest in efficiency services by either generators or distributing utilities. This is certainly the case for Norway, Chile, and Argentina. Utilities in this situation place great emphasis on cutting costs to minimize prices – reducing labor levels, improving operating efficiencies, reducing system losses, and increasing generation utilization ratios. The one exception may be Argentina where utilities have expressed interest in entering in joint ventures with manufacturers to offer energy efficiency technologies, with lease payments incorporated into the electric bill. The utilities are awaiting clarification of the legality of such business lines. They view this as an opportunity to offer a service to consumers, make a profit, and minimize risk.

In other cases, distribution utilities were required — either at the outset of reforms (New Zealand) or subsequently (UK, Norway) — to provide specified efficiency services. Some are simply information services, provided only upon request. To the extent the requirement is uniformly imposed, all distributing utilities face the same rules. The tendencies are for the utilities to minimize the costs spent on these compulsory services, or to derail them (as in Norway) into customer service and marketing activities that may have no relation to efficiency. In the UK, an independent organization (the Energy Savings Trust) was assigned responsibility to oversee the effectiveness of the mandatory efficiency services offered by the distribution utilities. So far there has been little rigorous evaluation of the actual energy efficiency impacts being achieved.

Faced with retail competition in a fairly sophisticated consumer market, New Zealand power suppliers are voluntarily offering technology promotion, advisory services, and other efficiency services for customer segments subject to retail competition. Alliances are being made between energy efficiency providers and generators and distributors, or between energy efficiency distributors and product manufacturers. US utilities appear headed on a similar path, with greater emphasis on packages of related services. According to some industry observers, one or two UK energy suppliers and distributors are planning to experiment with energy services as a way to offer customers a lower total bill, and there may be joint ventures with ESCOs.

For all three countries, there is an emerging recognition that some customers (mostly industrial, commercial, and institutional) are interested in more than simply obtaining power at the lowest price. These customers may also want suppliers to provide energy management software, more informative billing, technical advisory services, and related financial services.

The impact of reform on utilities' interest in delivering energy efficiency services varies for each country, depending on the before and after conditions. The most immediate drop in utility-run efficiency activities was experienced in Norway and the US. This trend could continue in the US once retail competition is fully in place. In the UK and New Zealand, efficiency also appears to be on the decline, except for programs funded through the UK's four-year wires surcharge on electricity sales and those funded by the government of New Zealand, which makes large awards

to utilities for implementing innovative programs. Chile and Argentina exhibit no change so far; very little was happening before and very little is happening now.

8.1.3 Opportunities for Non-Utilities to Provide Energy Efficiency Services

Except in the US, there is very little evidence of large-scale operation of commercial energy efficiency services, whether offered by ESCOs, energy efficiency companies, or local contractors. In the UK some ESCO activity is occurring on a limited scale for industrial facilities with cogeneration potential and for large commercial and industrial users. Estimates are that 20 ESCOs may generate $300-$500 million in annual revenue.

In Norway some private services are succeeding with large commercial customers. This has not happened in the public sector, where procurement rules work against performance contracting. In Chile, ESCOs have succeeded on a very small scale with savvy public sector institutions (municipalities, universities, hospitals). They are optimistic that some large industries will become clients. Argentina has seen private services on a small scale, such as local companies offering technical audits, or manufacturers offering leasing and contract programs for lighting and motors. There is discussion about forming ESCOs, but no activity. In New Zealand these services are offered on a very limited scale, either on a contract basis to the government to deliver residential services, or to help local businesses reduce emissions from energy consumption in order to meet local air quality regulations.

Perhaps the most surprising finding is the absence in most countries of vendor-supported promotional and leasing programs targeted directly at consumers. The few exceptions occur in the US and in New Zealand and Argentina where utilities and manufacturers are cooperating in joint ventures. The most plausible explanation for this is that the price reductions produced by reform have made energy efficiency less of a priority for customers.

8.1.4 Government and Publicly Supported Programs

Every country in this study has government-supported agencies to address energy efficiency policies and conduct research studies. Most have some activities that venture further toward producing actual efficiency improvements. The degree of government involvement in such programs is highest in the US, followed by New Zealand and the UK, and then Norway, with Chile and Argentina far behind.

Information programs are emphasized by all these countries except Argentina and Chile. (Chile's public information campaigns emphasize non-use of electricity rather than efficiency.) The US has extensive sources of information, technical assistance, and training. The UK has promoted efficiency technologies and has reluctantly accepted EU efficiency labeling of major appliances. Norway has voluntarily accepted the EU labels.

Codes and standards for buildings and appliances are commonplace in the US and Norway, are used to a limited extent in New Zealand, and are under consideration in Argentina. The UK has adopted accepted EU standards programs for refrigerators and boilers. Chile has only a voluntary standard for refrigerators. Labeling and standards programs are useful for setting a benchmark for additional efficiencies to be achieved through market transformation programs.

Market transformation activities are most evident in the UK; they are under discussion in Argentina and the US. New Zealand's government-supported programs are funding efficiency services that might not otherwise happen, but there is no deliberate strategy to create a self-sustaining market. Reform discussions in the two states investigated for the US study quite clearly indicate a commitment on the part of government to undertake activities to achieve some degree of market transformation. To spur the market along, the US and UK have set targets for efficiency improvement of 30% and 15%, respectively, in government facilities.

8.1.5 Improvements in Energy Efficiency

Efficiency. The opportunities for efficiency gain are substantial. The US has achieved impressive levels of efficiency over the past twenty years from a variety of utility, government, and private sector programs and services. US utilities project annual energy savings of more than 71 billion kWh and peak load reductions of more than 51 GW by 1999. Norway estimated the potential for efficiency improvements in 1988 as 19%, but has no data on progress to date. There is a general agreement that more progress was made in the early 1990s, and that achievements have slackened since. Chile has estimated a 10-13% potential, with no significant progress toward achieving this. Most evidence of efficiency in the UK comes from the programs run by the government or mandated upon distribution utilities. These are producing savings at one-third the retail cost of power. The programs are directed at residential consumers primarily, rather than commercial and industrial enterprises. New Zealand is achieving efficiency improvements primarily in the residential sector through its government grants program. Argentina is making virtually no efficiency improvements, due to significant market barriers and the lack of government support.

Load Management. In almost all countries, power suppliers and distributors are promoting customer load management where there is a clear economic rationale for suppliers or distributors to avoid peak production or delivery costs. Time-of-use rates are being promoted, as well as contracts for reduced usage during identified peak periods.

Sector Leaders. In the UK, most efficiency gains have come from industrial cogeneration. Chile estimates most of its potential exists in the industrial sector. New Zealand has targeted the residential sector, where reforms have eliminated subsidies that once made efficiency investments by consumers unattractive. US activity has addressed all consumer sectors.

8.2 REFORM FRAMEWORK AND MARKET RESPONSE

8.2.1 Framework

Policy. From a policy perspective, the US and New Zealand have taken the strongest stances toward efficiency. New Zealand found that efficiency activities were being hindered by market barriers not caused by the utilities and made the commitment to use national budget funds to promote energy efficiency. The decision was unrelated to the country's climate change policy, which has little impact upon the primarily hydro-based power sector.

The US establishes most of its utility policies at state levels. The majority of states considering power sector reform have identified the need for publicly supported efficiency programs to be operated throughout the 3-5 year transition period, to allow many remaining market barriers to be reduced. These programs will target activities that have not yet succeeded in a market environment.

Norway mandated utility IRP and strongly supported DSM through the period 1990-94, based on its global and national sustainable development policy. Since 1994, these requirements have been dropped; the only remaining requirement is a modest surcharge to fund consumer information services. Efficiency activities have declined noticeably.

Argentina has no policy on efficiency or global climate change, but has given distribution utilities broad authority to offer efficiency services of their choosing. So far, utilities have shown little interest and private energy services have taken only small steps to fill the market void.

The UK and Chile did not address efficiency in their initial power sector reforms, believing that market forces would be sufficient to stimulate cost-effective efficiency activities. The UK realized this was not occurring and subsequently changed its policies to add a surcharge and to require distribution utilities to operate efficiency services for an interim period of four years, 1994-98. Chilean policymakers still assume that market forces will suffice.

Legal/Regulatory Framework. In both Chile and Argentina there is no legal or regulatory framework to address efficiency in the context of reform. In Chile, there is an active political lobby by the utilities to prevent the government from promoting efficiency. In Argentina two government agencies with responsibility for efficiency issues are limited to performing research and conducting studies. Not surprisingly, there is little organized government action or effective outside constituency to promote efficiency policy in these countries.

Norway's limited regulatory resources mean that it is virtually impossible to oversee the efficiency activities of the over 200 distribution utilities, many of which are owned by municipalities with their own elected governing bodies. In New Zealand, where publicly-owned utilities (but not privately-owned utilities) are required to offer efficiency services and where

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reforms have led to an increase in residential electricity rates, there is a strong desire on the part of public utilities to offer profit-oriented energy services. The government supports the non-profitable services with direct budget funds.

The UK created the OFFER to oversee the reform structure, which in turn contracted with the Energy Saving Trust to oversee utility efficiency services. When it was determined that utilities initially were not offering efficiency services, a debate ensued as to whether to modify the reform structure and requirements, or to patch-on a temporary surcharge and regulatory directive to the distribution utilities. The latter course of action was chosen since there was no leverage or political will to change the rules of the reform process once it was underway. OFFER also began tinkering with the pricing formula for distribution utilities to reduce the incentive to increase sales. OFFER's existence created the opportunity for some fine-tuning, but the agency's work has been temporary and has not been a part of the reform structure itself.

The US has well-established regulatory oversight bodies at state levels to define and oversee the reform process. In California, a new organization has been created to oversee the allocation of public benefits charges (collected from all electricity sales) to support designated efficiency activities. It is anticipated that these funds will be awarded on a competitive basis, with energy suppliers, distributors, ESCOs, non-profit organizations, and private firms eligible to compete for funding.

Institutional. The extent to which a country addresses efficiency in its policies and its legal and regulatory framework is a direct reflection of the authority of the government body charged with responsibility for these matters as well as the strength and capabilities of outside constituencies. The US has both experienced government organizations and highly effective consumer, industrial, environmental and efficiency industry organizations. The presence of strong outside constituencies helps to ensure that efficiency is addressed "at the table" with other aspects of power sector reform. In Massachusetts, much of the responsibility for efficiency services will most likely be assigned to the utilities, whereas in California, an independent organization will administer the public benefit funds, which may or may not be awarded to utilities.

In New Zealand, an extensive and active constituency of consumer, environmental, industry and government organizations has worked together to support the government-centered public programs for efficiency. The constituency has been less successful, however, in gaining the active interest of the legislature to support the adoption of stronger regional building and appliance standards that would be in harmony with those of Australia. To the extent that the non-governmental constituency mirrors public and business sentiment, it would appear this has prompted some of the public utilities to offer profit-oriented efficiency services.

In the UK, institutions exist to address the policy, implementation, and technology issues, as well as to support implementation of government-supported and market-based services. There does not appear to have been an organized and effective constituency participating in the actual deliberations on the reform structure and on the industry rules affecting efficiency objectives. By

default, OFFER and the Energy Savings Trust have had to "pick up the pieces" after the fact. The early and middle stages of power sector policy and regulation took place under a Conservative party government; the new Labor government may introduce policy and regulatory changes.

In both Norway and Argentina, existing government regulatory and policy organizations are seeking greater authority to oversee power sector reforms and efficiency activities. Until they gain such authority, they have limited power to effect changes or undertake new initiatives. In Chile the national energy commission performs studies; no other effective organization exists to promote a change in policy or legislative direction. The power sector is a formidable lobby; the best hope is that the copper industry, with much to gain from energy savings, will recognize that it is in its interest to promote policies and regulations that create a favorable climate for efficiency services (presumably to be offered outside the power sector).

Financial resources. Funding levels are also indicative of a country's commitment to energy efficiency objectives. For the two states that were studied in the US, the public benefits charge for market transformation activities is expected to amount to 1-2% of electric revenues. This is slightly less than the 2-3% of utility revenues spent by some utilities (an average of 1-2% for all utilities) on DSM programs prior to reforms. However, in view of the fact that many energy services are expected to be offered through retail competition and private services without any public funding, overall funding levels for efficiency should remain robust for the next few years.

New Zealand commits national budget resources to efficiency that are the equivalent of 0.2% of electric revenues. The UK one pound surcharge on electric sales amounts to 0.25% of retail revenues, before counting government funds committed to government facility efficiency improvements or to low-income housing efficiency programs.

Norway's required surcharge for information programs amounts to 0.4% of electric revenues, with individual municipalities, such as Oslo, spending local government funds for additional programs. As was stated earlier, there is little oversight to ensure Norway's utilities are spending these funds on efficiency activities.

Argentina offers no government funding for efficiency services, and in 1989 made efficiency activities ineligible for funding from a government energy fund that is supported by a surcharge on electric sales. This fund is now reserved for renewable energy projects. The Secretariat of Energy supports renewal of a decree to make efficiency eligible for use of the fund. Chile has no explicit government funding or power sales surcharges to support efficiency services and programs.

8.2.2 Market Response

Market infrastructure. Whether or not a country has sufficient infrastructure to support efficiency products and services in the immediate post-reform period is heavily dependent upon the pre-reform situation. It is not surprising that reform has produced more activity in countries where these services were developed in the private sector during the pre-reform period, or were developed within utilities whose personnel have now migrated to private companies. Indicators of the adequacy of market infrastructure include: product availability; existing service suppliers, knowledge and capabilities of individuals who could create energy services businesses; financing mechanisms; and skill at marketing and delivering these kinds of services.

The UK had developed this basic infrastructure during the 1970s and 1980s when efficiency services were supported by government programs. The weaknesses in the post-reform era are that most marketing is directed by government rather than by product manufacturers or service providers, and that residential consumers are skeptical of the performance contracts that residential ESCOs have been offering to help manage energy costs. Also, many former government energy conservation staff and contractors have moved to Eastern Europe, Asia, and the Middle East to help support national energy efficiency and DSM programs in those areas.

Norway, like the UK, has a fairly strong knowledge base and good product availability. Financing does not appear to be an issue, with the exception of public sector facilities whose procurement regulations are not favorable to life cycle costing and performance contracts. The biggest apparent weakness is the lack of marketing and delivery capabilities by product manufacturers and energy management experts in the face of no apparent demand for these products and services. The once-a-year power bill for actual (not estimated) use means that residential customers are not regularly reminded of energy consumption and are not motivated to undertake efficiency actions.

New Zealand has good availability of products with required labeling of energy use of new appliances. There is some weakness in the efficiency service supplier business, where only a small number of firms exist. These firms are primarily supported by government funding for services that are unlikely to be successful on a commercial basis. The profit potential does not appear sufficiently high to attract more businesses to the efficiency market. Under impending retail power competition, it is expected that power suppliers and distributors will increase their service offerings to the commercial and industrial markets, but will continue to ignore the unprofitable residential market. In the meantime, most marketing activity is limited to government-paid promotion to the residential sector. The greatest need in the residential market is for financing mechanisms to overcome the incremental cost of energy efficient products and appliances.

In the US the market infrastructure is both extensive and competitive. Services are abundant and efficiency knowledge is well-established. Much of the early experience was gained by employees and contractors working on utility and government-funded programs. Utilities evolved from

using engineering-based staff to draw upon more marketing skills. Government-mandated product labeling for energy efficiency is well established. Marketing of efficiency products and services by retailers and manufacturers is common, though less evident than during the 1970s and 1980s. The single weakness may be problems with availability of small-scale financing for some consumers, especially low income families and small businesses.

The situation in Chile and Argentina is not as solid as in these other countries. In Chile there are few product and service suppliers and limited knowledge of technologies to deliver efficiency. On the positive side, there is a promising talent pool that could respond well to training and the emergence of market demand. There is little evidence of marketing ability, however. Financing is a significant barrier since most consumers take a first-cost approach to buying equipment and appliances. The IFC is in the process of setting up an efficiency and renewable investment fund that could help improve this situation.

In Argentina product availability is limited. Efficiency products are limited to efficient streetlighting and CFLs. A combination of no efficiency standards and low import taxes means that cheap, inefficient imports flood the Argentinean market. Service providers and technical knowledge are available to some degree, but there is limited evidence of marketing and delivery capabilities. The greatest barrier is the lack of affordable loans for small and medium enterprises. Businesses with expressed interest in offering efficiency services in Argentina will need to find solutions to problems with credit arrangements and loan guarantees.

Customer segments. Three countries (UK, New Zealand, and US) exhibit market-based efficiency responses from commercial and industrial sectors, especially larger companies with access to capital. New Zealand's residential sector is dissuaded by the higher first costs of efficient technology; these customers respond only when aided by government grants programs. In the US, homeowners are more likely than renters to consider efficiency measures; most owners are responsible for the building structure, heating and cooling equipment, and often the refrigerators, while tenants pay the utility bills. In Norway there is little market response at all, as consumers perceive electricity to be cheap and readily available from a renewable source (hydro). In Chile and Argentina the primary efficiency action is occurring with public facilities, presumably because power bills are large and budgets are constrained. Unlike private businesses, the public facilities cannot raise their prices to recover operating costs.

Technology markets. In all the countries studied, lighting is the best-accepted and most frequently adopted efficiency technology. Lighting systems are simple to install and have fairly fast paybacks. In Argentina there is some problem with CFL operation under fluctuating voltage conditions, a situation that will occur in most developing countries as well. In New Zealand there has been a demand for efficient electric water heaters, likely driven by the high cost of operating electric water heaters with high residential tariffs. In the UK, space-heating boilers and cogeneration equipment enjoy good market acceptance. The US technology markets are heavily influenced by minimum efficiency standards. Commercial and industrial customers will accept

efficiencies that are better than what is required by the standards if the simple pay backs have a maximum of 1-2 years. Decisions by residential customers are influenced by offers of utility or manufacturer rebates. Norway shows little signs of a market at all, beyond the level required to comply with the EU's minimum efficiency standards.

8.3 OUTLOOK FOR THE FUTURE

Influence of prices and power supplier/service competition. A basic analysis shows that these factors will not be enough to stimulate energy efficiency because energy users make short-term buying decisions and demand fast returns on investment in efficiency. This means that market response will fall far short of economic potential defined against power supply costs. Price will not be sufficient to overcome market barriers at least for residential users and small and medium commercial and industrial facilities. Among large commercial and industrial organizations, their greater total cost for power services is sufficient to capture attention to pursue efficiency measures with fast pay backs (under 1 or 2 years). This may occur through ESCO and product manufacturer marketing initiatives, or through efficiency services acquired in total energy management contracts in competitive retail power markets. The outcome in competitive markets for C/I measures with longer pay backs remains to be seen.

In countries *where power prices are perceived to be expensive* (not cheap), the key needs are for greater promotion of efficiency technologies and financing mechanisms to mitigate the deterrent of the higher first cost of efficient models. Both the UK and US hope that market transformation programs will make it possible in the next 3-5 years to reduce public funding for activities aimed at eliminating market barriers. New Zealand perceives that market barriers for the residential sector will be more long-lasting. The US experience reveals that market barriers such as access to technical advice and financing mechanisms that existed 20 years ago and prior to mandatory utility programs, appear to endure as utility DSM programs decline.

In countries *where power prices are perceived to be inexpensive* efficiency will depend on legislative adoption of standards and codes, or regulations that either create power sales surcharges to pay for publicly directed efficiency programs or require distribution utilities to offer some prescribed degree of efficiency activities.

All of the countries examined revealed the importance in achieving efficiency goals of mandatory codes and standards for at least new buildings, and in many cases, also for new appliances and equipment. In some countries the political will is not yet evident to adopt new or strengthened codes and standards.

Market potential for energy service businesses. Energy service businesses are expected to emerge where power is expensive and where retail competition takes root. There must be a perceived demand, services must be able to be offered at a profit, and business laws and

regulations must allow performance contracting, leasing, and other time-based forms of equipment and maintenance transactions. In the long run, most reformed power sectors can expect these services will target the commercial and industrial sectors. Some ESCO and other efficiency businesses may combine their services with power supply arrangements. At first, there may be an emphasis on getting the lowest-priced commodity, to be followed later by other options to optimize on total power expenditures.

In a few countries the energy efficiency business must await parallel reforms in legal and financial business conditions, to ensure the availability of credit, loan guarantees, and contract enforcement and collection. Until that happens, the financial returns may not be sufficient to attract management skills and capital to efficiency businesses.

To the extent that efficiency services will be paid for by private transactions, and not through ratepayer funds or government funds, the market will focus on the most profitable sectors, and move to other sectors as the prospects for profit manifest.

Market segments and technologies likely to be neglected. The market is least likely to serve residential customers and small and medium commercial and industrial enterprises. Simple technologies (such as lighting, motors, and refrigerators) will have more success than technologies that are more complex or are part of process systems. New appliances, equipment, and buildings will be best targeted through minimum efficiency standards, and not left to individual decisions.

8.4 OPPORTUNITIES FOR IMPROVEMENT

United Kingdom. It would appear there is a substantial amount of efficiency not being achieved, and a latent economic benefit awaiting consumers. There is no immediate environmental policy motivation to support greater efficiency actions. Thus the choice of action strategy depends on assessing the magnitude of potential consumer benefit. Less important is the specific choice of strategy: market transformation; government-directed services that target customer segments ignored by the market ("public benefit" services); or mandates directing distribution utilities to provide some level of performance-based efficiency services. Each would have different costs and different impacts. Some, such as government-directed activities, would affect broad groups of consumers; others would have moderate impact (transformation) or quite modest impact (those to be carried out by distribution utilities, which will be torn between fulfilling a mandate and selling more power).

There is a need for a longer-term plan for financing efficiency to replace the temporary account charge put in place for 1994-98. Before deciding upon the strategy and required financing arrangements, there should be a review of the merits of an expanded mandatory codes and

standards effort to target minimum efficiency levels for new buildings, appliances, and equipment, consistent with EU directions.

Norway. The most immediate need is to proceed with a plan to give consumers actual bills for consumption more frequently than annually. The current plan to do this on a quarterly basis is a good start, but may need to become every one or two months to provide sufficient reminders on consumption levels. The second need is to give the Norwegian Water Resources and Energy Administration greater authority to address efficiency needs. The third need is to authorize the regional energy efficiency information centers to become more independent of their current utility ownership, offer more than just information services, and receive their utility sales surcharge funding through an independent institution of the national government, rather than through the distribution utilities themselves. Finally, efficiency could be linked in a long-term perspective to Norway's climate change policy.

New Zealand. Two needs emerge. First, the robust constituency for efficiency could pursue greater legislative support for strengthened efficiency policy and standards for buildings and equipment, in harmony with Australia. Second, there could be investigation of the additional business, financial, or legal requirements that would be needed for the private sector to support more efficiency services to residential consumers. This might entail government-supported business advisory services to attract more providers, or special business investment funds to support small businesses to expand into efficiency service lines on their own, or in conjunction with efficient product manufacturers.

United States. In view of the extensive knowledge and services already available, the two most important issues for government policy are to continue and update regulations for product labeling on energy efficiency, and to test creative and lower-cost mechanisms to secure efficiency with residential and small/medium businesses and institutions.

Chile. Four steps appear advisable. The first is for the few emerging constituencies for efficiency to combine efforts to advocate that the government support, at a minimum, a policy for market transformation activities, to be implemented *outside* the power sector, which could lead to an eventual market-based efficiency system. The second need is to develop financing mechanisms to help residential and small business consumers to manage the higher first cost of energy efficient appliances and equipment. A third initiative should be to marshal the resources, knowledge, and self-interest of energy efficient equipment manufacturers and suppliers to promote the merits of efficient technologies, and to feature the availability of financing mechanisms to facilitate these purchases. Finally, in localities with severe air quality problems, such as Santiago, initiatives should be considered by local government pollution management authorities and major pollution sources to fund pilot programs for efficiency as a possible mitigation strategy for improving air quality.

Argentina. Overall, the greatest need appears to be a higher profile public policy on energy efficiency that can be carried out initially in a market-based environment, with modest government support to launch this. A case for the latent consumer and economic benefits of efficiency investments needs to be made. Utilities, small businesses, potential ESCOs and others have expressed interest in offering efficiency services if they perceive these services would be legal or encouraged by government policy. A significant step in this direction could be a government decree to allow the National Energy Fund to be used once again to support energy efficiency activities that would stimulate a private market for energy efficiency. A companion activity should be to increase the authority of government organizations such as the Secretariat for Energy and URE (the Agency for Rational Energy Use) to undertake initiatives to stimulate an expanded efficiency market, including policy development, research and analysis, and demonstration programs. Finally there appears to be a need for minimum energy efficiency standards for new buildings and appliances, especially in joint action with other countries in South America.

CHAPTER 9
LESSONS FOR OTHER COUNTRIES

This case study investigation offers many useful lessons for countries contemplating reform and needing to decide whether and how to incorporate energy efficiency in their reforms. The lessons are presented in two parts. The first part (Section 9.1) addresses threshold issues; the second (Section 9.2) addresses implementation issues. Both sections are organized as a series of questions policymakers must ask themselves, each question being followed by a discussion of relevant experience from the case study countries.

9.1 THRESHOLD ISSUES

1. Will there be retail competition under the reforms?

If so, and if power suppliers or distributors are free to enter the energy efficiency services business, it is likely that competition will cause suppliers to offer market-driven efficiency services to large industrial and commercial customers. The threshold for profitable delivery of these services is probably an energy consumption level of 100 kW or more. Evidence in the US, UK, and New Zealand bear this out.

Efficiency services will not necessarily be packaged with commodity sales and heavily marketed right away. There may be a time delay in offering the full package. Also, these services may be made available only to individual customers or customer segments that want total energy management or technical assistance and whose contract for power supplies cannot otherwise be secured. To deliver the services, the power supplier may create an ESCO subsidiary, form a joint venture with an ESCO or series of equipment manufacturers, or create a marketing alliance with other providers.

The particular approach that makes the most sense in a given situation depends on the perceived size of the market for efficiency services, the core competencies of the power entity, and the laws and regulations affecting activities that the power supply entity can undertake. If a country wants to encourage power organizations to offer efficiency services directly, then it is imperative to ensure that legislation and regulations will permit these business initiatives.

It is unlikely that efficiency services can be profitably offered to smaller consumers, i.e., all residential customers and small and medium-size commercial and industrial enterprises. The options remaining for them will be the traditional commercial outlets and services for energy

efficiency. In view of the typical market barriers found in virtually all countries, market forces alone are not likely to stimulate much selling of energy efficiency services in these customer segments.

If there will *not* be a competitive retail power market, then most assuredly power suppliers and distributors will focus on maximizing profits from power sales. Government policy should address the details of pricing rules affecting power supplier and distributor behavior, the adequacy of independent organizations (government, private, or non-profit) to deliver efficiency services, and the likely customer response to these independent service providers.

Whether a power supplier decides to maximize sales or to maximize profits, or whether he participates in offering efficiency services to end users or grudgingly watches as others do it, will largely depend on the retail pricing rules for distribution utilities. Different rules can decrease or even eliminate the incentive to maximize sales. Price caps (which provide incentives to seek operational efficiencies) as well as price formulae that make fixed charges a large component of revenue can make sales growth less attractive. To ensure a reliable distribution system, the UK changed its price formula to allow distribution utilities 100% recovery of capital investment expenditures, but only 50% of the variable costs associated with incremental power sales.

It is reasonable to assume that the power supplier will not have an incentive to promote energy efficiency. Thus the degree to which efficiency actions will emerge under reform will depend in part on the availability and adequacy of energy service providers, whether these are private companies, non-profit groups, or government organizations. Where such providers exist, they will probably attract at least some segments of power customer markets.

The market response to efficiency services will depend on several factors: customer awareness of energy efficiency technologies, power price levels and household income elasticity, the promotional efforts of manufacturers and retail outlets, and consumer purchase arrangements.

The evidence from the case study countries suggests that if service provider availability and market conditions (customer awareness, sufficiently high power prices) are conducive to the sale of efficiency services, then large commercial and industrial facilities are a natural market. The same favorable conditions may support middle and upper income residential consumers' purchases of major electric home appliances if 1) efficient models are heavily promoted by manufacturers or retail outlets, and 2) financing or credit terms are easily available to help manage the higher first costs of efficient models.

Low income households and small and medium-sized enterprises and government institutions are less likely to participate in an independent market for efficiency.

2. With limited natural market demand for efficiency, is there a compelling reason for governments to promote energy efficiency?

To answer this question, policymakers must consider these additional issues:

- From a national economic perspective, is there a rationale for encouraging energy efficiency rather than creation of new supplies? (E.g., what are the costs per kWh for energy generated, transmitted, and distributed compared to the costs per kWh for energy saved; how does the ratio of national energy costs to GDP compare with that ratio in other countries; what percent of household income is spent on energy purchases?)

- How significant are the market barriers, and do they apply to all consumers or just to select groups?

- How much efficiency opportunity is being "stranded" due to these barriers?

These questions are typically assigned to a national energy policy or research organization to address. In the case of UK, Norway, New Zealand, and the US, the answers were affirmative: a sizeable and valuable amount of efficiency savings were not being realized because of insufficient incentives and/or market barriers. Chile and Argentina have yet to finally make these determinations.

3. Do local and global environmental policies need to be considered when deciding whether to adopt policies to achieve end-use electricity efficiency?

The most frequently discussed environmental rationale for improved energy efficiency is a country's climate change policy and action plan. In advanced economies, an action plan may address compliance questions. In developing countries, a plan may mean establishing a climate change policy, carrying out projects under the Global Environment Facility's Operational Programme 5 (Reduction of Barriers to Energy Efficiency), or hosting projects proposed by advanced economies under the rules for Actions Implemented Jointly (AIJ). Of the countries in this study, three see no need for power sector reform plans to consider climate change mitigation (Norway, UK, New Zealand), two do not have a climate change action plan (Chile and Argentina), and one has yet to present a detailed action plan (the US), although its national energy and environmental policies[1] are tied to initiatives to reduce emissions.

End-use efficiency can improve local air pollution management, producing reduced emissions both from on-site energy use and from local generation of power. Some cities and states have identified energy efficiency from a new or expanding industrial plant as a way to address local

[1] Norway and New Zealand have power sectors based largely on hydro resources, while the UK's "dash to gas from coal" has conveniently achieved substantial reductions in carbon emissions.

environmental permit requirements (New Zealand), while others are investigating the merits of an overall strategy on reducing emissions from power generation in a regional area (Chile).

Another environmental rationale is based on public perceptions that energy efficiency is reducing the use of polluting (coal or petroleum) or dangerous (nuclear)fuels. The extent to which this is occurring depends on each country or region's fuel mix. In the US, pilot programs have shown that a small market segment will pay a premium for "green power" from renewable energy or gas. These same consumer segments may support efficiency initiatives. In Norway and New Zealand where generation is largely hydro-based, consumers perceive electricity to be "clean" energy already and not a target for conservation. In the UK, the rapid transition from coal to gas has produced a cleaner image of power, as well.

4. Which strategies for implementing efficiency should be used?

Power sector reform has produced two common strategies:

- Imposing energy efficiency requirements on all power distributors through regulation, with the costs of services being the responsibility of each distributor. This is best suited to a market without retail competition.

- Assessing a "wires charge," surcharge, or "public benefits charge" on all power sales, with funds to be used for certain energy efficiency activities. These funds may be reserved for the exclusive use of the distributing utility (Norway) to conduct specified services, may go to the national government for its allocation (UK), or may be directed to a regulatory body or independent organization for competitive award to service providers, including utilities (some US states). This strategy can work under either competitive or non-competitive retail structures.

A third strategy could expand opportunities for energy efficiency and load management to participate in competitive wholesale power markets:

- Allowing energy efficiency and load management to be bid into the power pool on a competitive basis with other resources. "DSM bidding" and "all-source bidding" were administered in the US under regulatory mandates prior to reforms, but these greatly complicated both the resource acquisition analysis and subsequent verification of "delivery". DSM bidding was discussed at the beginning of reform discussions in New Zealand as part of the "ex-ante" pricing formula, but was dropped when the pricing system chosen was based on "ex-post" pricing. (See the New Zealand case study.) There is continuing discussion in New Zealand about possible amendments to the pool pricing system that would allow DSM to compete. The two key issues for wholesale power pool operations are whether to allow some resources that are considered as long contracts, rather than hourly pricing, and how to verify the persistence of the efficiency measures over the term of the contract.

Energy efficiency can also be pursued as a public benefit outside the reform framework. Two government-directed strategies are:

- Supporting efficiency programs with general government funds, as in New Zealand, or with funds from an energy tax (a tax on all energy, not just electricity), as in Thailand. In the US, federal funds and some state-level funds have been committed to energy efficiency activities. (See Question 6 for a discussion of the kinds of services most commonly needed.)

- Instituting (mandatory or voluntary) energy efficiency codes & standards for new building construction, equipment, and appliances. This approach has been taken in Norway, New Zealand and the US quite independently of the reform process.

5. Who would participate in deliberations about utility responsibilities and about whether and how end use efficiency should be incorporated in any reforms?

The choice of strategy clearly depends on many factors, including: the perceived importance of increasing energy efficiency; a country's experience with efficiency services; the political will to impose a public-purpose policy for efficiency rather than letting the market find its own course; the capabilities of constituent groups supporting or opposing efficiency; the intellectual commitment to debate and find solutions among the many alternatives available for addressing efficiency; and the fundamental willingness to give efficiency a "seat at the table" when the power reform system is being reframed. All of these are in part influenced by the following institutional situations:

- Do national or state government energy policy, research, or regulatory organizations have sufficient authority, funding, and experience to participate meaningfully in power sector discussions? Can they make a case for efficiency and its alternative strategies? This appears to be a problem in Norway and Argentina.

- Is there a private sector efficiency infrastructure (manufacturers, ESCOs, energy service companies) that sees efficiency as an important business objective and is sufficiently organized and willing to advocate the adoption of efficiency policy and implementation arrangements? This is the case in the US.

- Do any pricing rules of the reform structure so narrow the profitability options that power supply and power distribution organizations will oppose any initiatives that could diminish sales? This appears to be the case in Chile.

- Is there a constituency with both the ability and the political access to advocate for efficiency? This is the case in New Zealand and the US. Chile has an emerging constituency, but it does not appear to have the necessary political access to overcome the opposition of the power sector.

- Is there either an advocacy or technical assistance role offered by the international donor and NGO community to supplement local efforts? Chile, for example, has access to an international NGO and a newly developing IMF fund for renewable energy and efficiency investment projects. Many developing countries and restructuring economies have access to technical assistance of the multilateral development banks and bilateral aid programs. This assistance helps bring new information, voices, and options to the discussion table.

9.2 IMPLEMENTING END-USE EFFICIENCY STRATEGIES

9.2.1 What kinds of services are needed?

A wide range of activities have been successfully employed to achieve efficiency goals. These can be grouped into: 1) voluntary programs that make services available to be accepted or rejected by consumers, 2) market transformation programs which aim to permanently alter the efficiency market to achieve more extensive adoption of efficiency measures, 3) government provision of services to certain "difficult" customer segments where market or institutional barriers are particularly intractable, and 4) government-adopted mandatory codes and standards that set minimum levels of energy efficiency for new buildings, equipment, and/or appliances.

Voluntary programs. Voluntary programs have been created to address a number of persistent market barriers that prevent consumer adoption of efficiency measures. The common barriers world-wide are a lack of awareness, information, and financing mechanisms, and the difficulty of making purchase or installation arrangements.

Information and awareness needs are commonly addressed by:

- advertising and public relations campaigns to publicize energy costs, efficiency options, and organizations that can guide consumers in managing or reducing these costs
- promotion of specific efficiency technologies
- tagging of appliances and equipment with labels showing energy consumption, operating costs, or relative efficiency

Financial services can include:

- special loan funds (at or below market interest rates) for residential consumers and small/medium enterprises
- leasing or finance programs offered by the vendors and manufacturers of efficient equipment

- encouragement and explanation of the benefits of performance contracting
- changes in government procurement rules to permit life-cycle cost analysis and use of performance contracts, to encourage customers to compare long-term operational savings against higher first cost of efficient equipment purchases and facility improvements

Market transformation programs. Many services offered through these programs address the same needs as the voluntary programs, but this is done with a primary objective of permanently changing the market for efficiency by either institutionalizing certain financing mechanisms, or shifting the market toward "best practice" efficiency products and services. Examples of these activities include:

Institutionalizing financing mechanisms by:

- creating revolving loan funds dedicated to efficiency measures
- modifying real estate mortgage rules to allow higher value loans when efficiency improvements will be made to a property being purchased (and labeling houses as energy efficient in order to command a premium on resale)
- active promotion of leasing and performance contracting mechanisms

Shifting the market toward "best practice" by:

- using government procurement to buy "best practice" technology as a means to stimulate manufacturers to raise their technical standard for efficiency
- creating bulk or volume-purchase arrangements (by government, municipalities, consumer clubs, business associations) to obtain lower prices
- using cooperative advertising between energy efficiency organizations (government or non-profit) and manufacturers and retailers to shift consumer demand in support of efficient products or services

The differentiating trait of market transformation services is that there is a cooperative arrangement between efficiency advocates in government or non-profit organizations on the one hand, and private sector manufacturers, retailers, service providers, and lenders on the other to make a permanent shift in the products and arrangements that are routinely called upon to adopt greater levels of efficiency.

Government-supported services to difficult market segments. Certain segments of consumer and technology markets are unlikely ever to respond to market incentives to invest in efficiency,

for economic or inherent structural reasons. For these segments, government policy may favor more direct intervention. On the consumer side, for example, low-income households in private housing may lack both cash and access to credit, and so cannot take advantage of equipment leasing programs; government-owned facilities and public housing may lack both capital and sufficient operating funds even to adopt fast-payback efficiency measures; and senior or pensioner households may not be inclined to invest in costly or long-term measures because of higher priorities for their meager funds. Government policymakers may choose to allocate government funds or "public benefits" energy surcharge proceeds to sponsor efficiency services for these customer markets.

On the technology side, because of the gap in investment horizons and return on investment requirements, customers may shun technologies that have 4-5 year pay backs. Yet many of these technologies have useful lives of 15-20 years and are excellent investment opportunities from the perspective of energy supply investments, social benefits, and environmental effects. In such cases, government policy may favor some form of public financial contribution to the cost of the longer-payback efficiency measures. Public financial contributions can come in the form of tax incentives, rebates on purchases, or direct government grants for purchase of efficient and desirable "public benefit" measures – whether for building insulation, solar water heating, or industrial process efficiency improvements.

Mandatory codes & standards. Many governments have achieved extremely cost-effective efficiency gains by instituting mandatory building codes or equipment and appliance standards that set minimum efficiency levels for new construction and equipment purchases. These codes have been able to improve efficiency by 10-15% or more at a very reasonable cost. The combination of "guaranteed" compliance from an entire class of new power uses, and relatively low costs for administering certification and compliance requirements, means that the cost of efficiency is relatively low. By contrast, the promotional and marketing programs that would be needed to encourage so many buyers to adopt efficiency measures voluntarily would be very costly.

Another type of standard has been tried by some local governments in the US. This is the so-called "retrofit ordinance" or "conservation at time of sale," which requires a certain minimum level of efficiency measures to be carried out at the time a home or commercial building is sold. The rationale behind these ordinances is that the cost of efficiency improvements can be included in the sales price and covered by the building's new mortgage.

Mandatory standards typically do not achieve the highest possible degree of efficiency, but because they apply to all buildings or appliance sales in a specified category, market penetration becomes virtually 100% over a period of years. Voluntary programs and market transformation services can still be used to augment mandatory standards, for even higher levels of efficiency.

7. Should power suppliers administer efficiency programs?

In the case studies there have been both positive and negative experiences when utilities have administered efficiency services. Some utilities lobby outright against government policy for efficiency, others are simply disinterested; some apply mandated expenditures for both appropriate and inappropriate activities, others compete for public funds based on effective program designs; some use these services as a good customer relations tool or as a critical weapon in competitive retail markets, and others create subsidiary companies to handle these services.

There is no one right answer to the question. It is also too early to judge the extent to which power suppliers will offer and profit from efficiency activities under retail competition. The lessons that can be drawn now are best limited to the situation where an energy surcharge or government expenditure will be utilized for efficiency services.

- If there is no other organization (public, private, or non-profit) with the ability to operate efficiency services, then any public policy in favor of efficiency may have no choice but to mandate a minimum level of efficiency services as an obligation of distribution utilities (as in the UK) or to create new organizations to deliver services (e.g., the regional efficiency centers in Norway). For these services to be effective, they must be monitored, include good accounting of expenditures, and require evaluation and reporting of program effectiveness. An independent oversight organization must be charged with reviewing the utility experience and with reporting any problems to a regulatory or power sector oversight body. Examples are the Energy Savings Trust of the UK and the California Board for Energy Efficiency in the US.

- If there are multiple organizations with the abilities to deliver services, then energy surcharge funds or government funds can be awarded on a competitive basis. Some situations may dictate that utilities not be allowed to compete for these funds, as when there is no retail competition and/or a distributor is incented to maximize sales. In these situations utilities may be suspect in the sincerity or effectiveness of their efficiency activities. In situations where distribution utilities or competitive retail suppliers have other motivations than simply maximizing sales – such as building good customer relations, differentiating their services and identities, or potentially operating efficiency programs at a profit – there is no reason to exclude power sector entities from competition for efficiency funding. In a least one jurisdiction the state regulator has indicated that utilities may be best positioned to offer the "public benefits" funds because they have historically had a close relationship with the end-use customers.

- Regardless of how funds are awarded and to whom, it is advisable to establish an oversight organization to manage the awards, set monitoring and reporting requirements, ensure independent program evaluation occurs, and to use this information in assessing the effectiveness of programs and merits of continuing funding awards to specific

organizations, for certain kinds of programs, and/or certifying that mandated utility expenditures on efficiency are prudent and useful.

- If there is a desire for power suppliers or distribution utilities to participate in the delivery of efficiency services, then is it also critical to make sure national or state laws and regulations permit the utilities to undertake such activities as: leasing equipment, selling equipment, promoting specific brands or models of equipment, offering maintenance/management/repair services, and other types of business services which are essential components of full scale efficiency service delivery.

8. Should efficiency strategies be integrated into power system reform, or can these be added later? How will either approach affect the achievement of efficiency?

Experience suggests there is no one right answer to this question either. One thing is clear: if public policy is counting on utilities to incorporate efficiency as a feature in a package of total services offered to customers in competitive retail markets, this expectation must be announced as part of the reform deliberations.

If power sector reform includes retail competition from the start, then government policy might want to limit the role of public benefits programs and services. Activities could include some of the voluntary services and/or programs for "difficult" markets. Efforts could start small as long as explicit authority is designated, allowing future adjustments to be made in activities and funding when and if these adjustments are needed.

Where there is little market incentive for utilities to administer efficiency programs, there could be a different course of action, especially if retail prices are not high, and/or the manufacturer/ retailer/ service provider market is not well developed or organized. In this case the government must expect that some form of energy surcharge and/or government funding will be required. The options become whether to pursue an extensive set of critical voluntary programs designed to overcome market barriers, or to embark upon a more aggressive market transformation strategy. These choices were discussed in Question 6. The more detailed choices entail selecting the level of expenditures, program activities, and funding source(s) that can support this agenda. These were discussed in the individual case studies.

In looking at the lessons framing most of these decisions, the discussion comes back to one of institutions and capabilities, as was introduced in response to Question 5.

Politics. Each country needs to assess the political motivations for addressing power sector reform in the first place. If it is to deal with long-standing problems of inefficiency in ownership or operation of the power sector, it might be best to address efficiency outside the power sector framework and to do so on a schedule dictated by the three considerations discussed immediately below. The politics of government majority parties may also enter into the decision. In the UK, reform was initiated under the Conservative party when the clear political desire was to pursue

only free-market policies and strategies. A change in government may permit these issues to be revisited, and with more information in hand from the experience to date.

Constituencies. Outside constituencies that might support policy initiatives for reform must assess their strength and ability to wield leverage and maintain an audible voice during the reform deliberations themselves. If they are strong and well-organized, it may be possible to address efficiency issues as integral parts of the reform deliberations, regardless of whether efficiency is handled in the power sector framework or outside of it. This appears to be the case in the US, and was partly so in New Zealand. In the latter case the constituencies do not seem sufficiently influential with national legislative leaders to gain strengthened government codes and standards provisions for efficient buildings and equipment. The lesson may be that some countries have to gauge the timing question based on when their constituencies will be best organized and have their most leverage – in the face of the core debate, or later when it will be easier to point to the deficiencies of whatever system reform was established.

Capabilities for policy dialogue and implementation. To be effective in the policy dialogue, government and non-government representatives need to be well-armed with assessments of the local situation, able to identify strengths and weaknesses of the market infrastructure for efficiency services, and prepared to cite the experiences and lessons from other countries. The capability for the policy dialogue must reside in government agencies with stature and authority, supported by outside constituencies. If these agencies lack stature or authority, it may be difficult to bring attention to the efficiency issue. If there appears to be no organized efficiency services infrastructure, then leaders of the power reform deliberations may be less willing to consider integrating the issue of efficiency into the debate.

Practicalities. There is no uniformity in the consequences of deferring action on efficiency until a later time. Argentinean observers believe they lost a critical opportunity to make efficiency part of the debate and will have a much harder time now trying to re-open the question of how the power sector structure and system should relate to efficiency. There is little perceived likelihood of being able to tinker with the reform system now that is it underway. The UK provides an alternate experience, where it succeeded in putting efficiency back onto the agenda several years into the reform process, albeit with a patched-on obligation for distribution utilities prior to the introduction of retail competition and only temporary funding. The primary difference may be that the UK had two capable and reputable organizations in OFFER, assisted by the Energy Savings Trust, that also had the authority to initiate additional measures when it realized that efficiency was being ignored.

9. What special considerations exist for developing countries or restructuring economies?

Developing countries will have some circumstances and institutional considerations that are quite different from the situations experienced in the case study countries. For example:

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- Government-owned utilities have a limited history of customer relations and will have their hands full learning to operate on a commercial basis. Many have never seen their job as including a responsibility to help customers solve problems. As a result, it may be totally impractical to think that these reformed systems would either see it as a priority, or have the abilities, to administer efficiency programs. These utilities might be able to manage limited scale load management activities at a later date once technical operations and communications systems are able to handle more modern metering and telemetry equipment. Efficiency responsibilities and opportunities may be better placed outside the power system in these cases

- If the reformed system persists in requiring power suppliers or distributors to serve some customer classes at subsidized retail rates, then there will be a financial motivation for the power suppliers to invest in efficiency measures targeted at these subsidized groups. If there is unserved energy demand in the region, the utility would be better off to spend its own funds on the most inexpensive efficiency measures for subsidized customers, and to sell the saved energy to customers willing to pay higher rates. In this case the utility might be willing to pay up to the revenue differential between the subsidized customer and the higher rate customers. If there is no unserved energy, the utility should be willing to undertake efficiency at a cost up to the variable costs to secure the energy supply and distribute the power, or the amount of the subsidy, whichever is less.

- It may be the case that private energy service providers or even equipment manufacturers and retail representatives are limited in their legal authority to undertake certain business services, such as loans, leasing, access to customer power consumption records, or third-party handling of utility bill payments. These potential barriers to non-utility efficiency service provision would need to be removed in order for a separate market in efficiency to emerge.

- Where power tariffs have been historically low, or utility revenue collection has been difficult, the lack of past economic motivation for efficient power use may mean there are no or few efficiency suppliers ready to serve local markets. In this case government strategies may be advised to promote the business opportunities available for efficiency. There should be substantial opportunities for improving efficiency among previously subsidized customer groups.

- Building codes and equipment standards are only as effective as their implementation. In some countries where the system for certification or inspection is not fully professional, bribes may be the cheapest and fastest guarantee of "compliance". Thus the opportunity for mandatory codes and standards will depend on professional willingness to adopt the efficiency standards, owner or manufacturer willingness to incur the costs of improved design or materials, and the capabilities and honesty of the enforcement mechanisms employed.

10. How can more policy and legislative attention be attracted to the issue of end-use efficiency during deliberations on power sector reform?

It is clear from the findings of the case studies that a certain level of knowledge and experience among participants in power reform deliberations is helpful in giving end use efficiency "a seat at the table." Informed participants can help in determining an appropriate policy position and necessary execution strategies for efficiency. The following steps may be helpful to consider. They are listed in order, from those requiring the greatest amount of local initiative to those requiring international expertise and policy experience.

- Assign explicit authority to government or independent organizations to conduct policy studies and gain constituent input to identify the "stranded" potential for efficiency, degree of market barriers, and preparation of the local market infrastructure to carry out efficiency services. If desired, undertake public workshops, seminars, and other supporting forums to help inform key participants in the power reform debate of the issues and options available for addressing efficiency.

- Investigate the merits of integrating local air pollution emissions policies and strategies with logical points of overlap with end use efficiency policies and strategies.

- Seek technical assistance and development of new financing vehicles that can help inform the alternative strategies and implementation mechanisms for both the power reform system and determining an efficiency policy and set of strategies. For developing countries, seek this assistance from bilateral aid donors and the multi-lateral development banks.

- Integrate energy efficiency with a country's climate change policy and strategies for reducing carbon emissions.

- Accept stated principles of power reform, efficiency policy, and climate change policy as possible conditions of receiving loans and other forms of financing for the power sector from multilateral development banks and individual donor countries export/import banks and associated trade institutions.

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APPENDIX A
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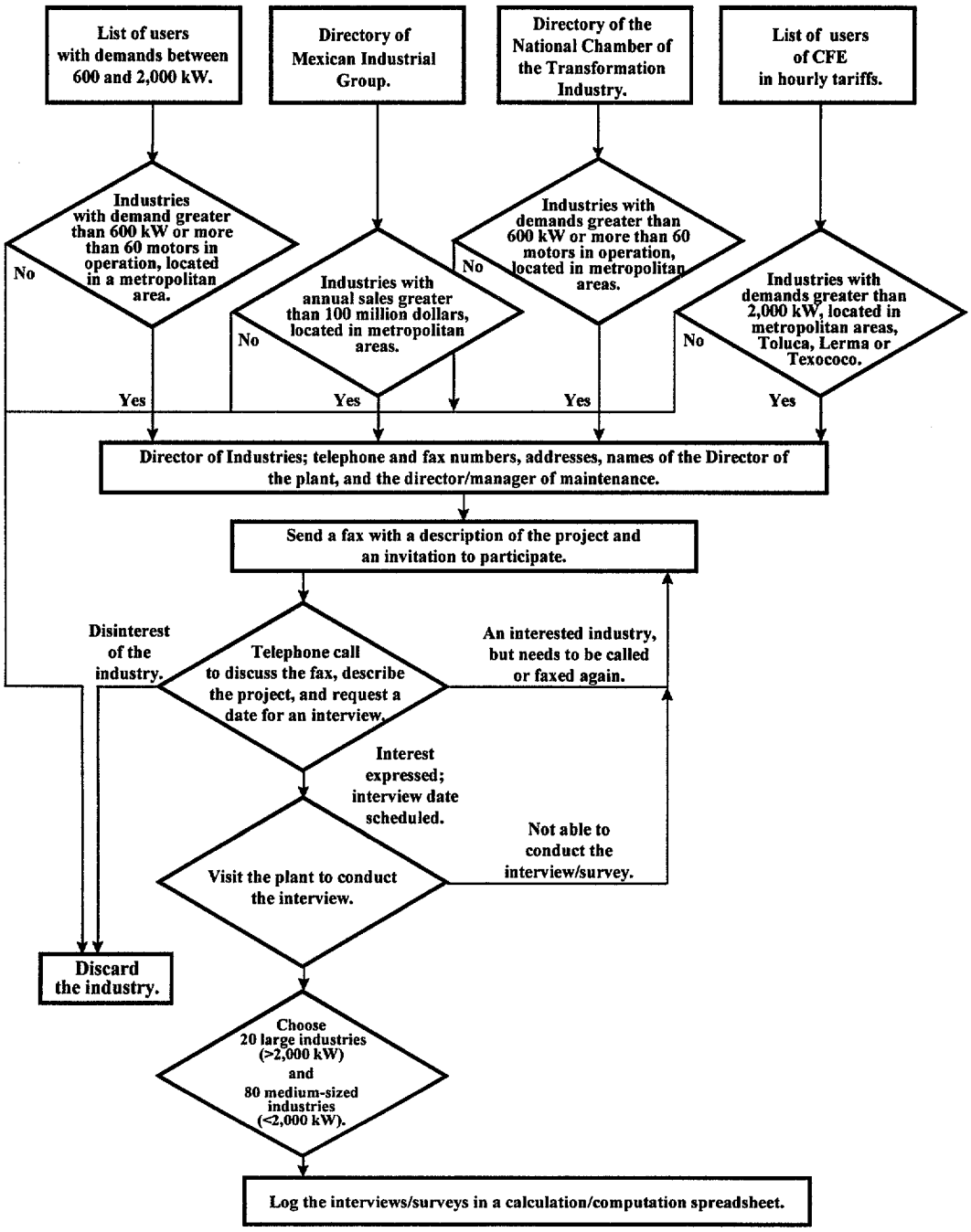

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U.S. Agency for International Development
Bureau for Global Programs, Field Support, and Research
Center for Environment
Office of Energy, Environment, and Technology

The Center for Environment of the Bureau for Global Programs, Field Support, and Research houses the environmental programs of the U.S. Agency for International Development (USAID). One of five *Centers of Excellence* within the Agency, the Center for Environment, provides field support to U.S. bilateral assistance efforts, manages global environmental program activities, oversees USAID's environmental research efforts, and is USAID's principal liaison on technical environmental issues to the rest of the U.S. Government, non-governmental organizations and universities, and other bilateral and multilateral donors.

The Office of Energy, Environment, and Technology is a part of the Center for Environment and helps developing countries and emerging economies find market-oriented solutions to their energy and environment problems. The Office helps set the energy policy direction for the Agency and responds to the short-term needs of USAID's field offices in assisted countries.

A lack of energy is seriously curtailing economic growth in developing countries and countries in transition. Expansion of energy supplies imposes a huge financial burden while increasing environmental threats in these countries. In addition, many countries lack the institutional capability and appropriate technology to operate and manage energy systems efficiently. These factors contribute to the role energy development plays as a leading contributor to global climate change and regional and local environmental problems.

To address these problems, the Office of Energy, Environment, and Technology leverages the financial resources of multilateral development banks, such as The World Bank and the InterAmerican Development Bank, the private sector, and other bilateral donors to increase energy efficiency and expand energy supplies, enhance the role of private power, and implement novel approaches through research and adaptation. These approaches include improving power sector investment planning ("integrated resources planning") and encouraging the application of cleaner technologies that use both conventional fossil fuels and renewable energy sources. The Office's promotion of greater private sector participation in the power sector and a wide-ranging training program also help to build the institutional infrastructure necessary to sustain cost-effective growth.

Further information regarding Center for Environment and Office of Energy, Environment, and Technology activities can be requested by contacting the Office of Energy, Environment, and Technology at the following address.

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