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REPORT ON POWER POOL OPTIONS

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Prepared by

Hagler Bailly
1530 Wilson Boulevard
Suite 400
Arlington, VA 22209-2406
(703) 351-0300

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POWER POOLS IN NORTH AMERICA

The term "power pool" describes an association of electric power utility companies which gain business advantages by joining together into a cooperative relationship Most participating utility companies are usually vertically-integrated, meaning that they own generation assets, operate networks of transmission and distribution lines, and sell electricity to retail and wholesale customers These utility companies form pools to purchase energy and capacity at lower costs than they would incur by using their own assets, to trade in capacity reserves, to jointly operate and plan additions to transmission assets, to plan generation unit additions, etc In itself, the term power pool only indicates that there is some sort of association among utilities, but does not define exactly how they operate The operating rules of the pool are contained within a pool agreement, and no two pools operate alike

Utilities engage in pooling and other types of coordination to obtain the economies possible for large systems Pooling requires the utilities involved to agree to numerous operational and financial relationships Members of tight pools, for example, must agree on such topics as transmission access rights and capacity obligations of pool members, compensation arrangements for use of transmission facilities owned by individual pool members, economy exchanges of power and compensation for those exchanges, generating unit commitment, and compensation for that commitment Inability to agree on these types of issues can result in the breakup of the pool

A power pool may be as little as an informal agreement among a group of utilities to establish principles and criteria to facilitate the coordination of planning or operations The principles could cover a variety of coordination activities, and compliance with them would be voluntary Alternatively, a pool may be a formal contractual agreement in which two or more systems coordinate the planning and/or operation of their bulk power facilities and in which the responsibilities of the individual systems are stated explicitly Power pools may be classified as either tight or loose

Tight Pools

In a tight pool extensive requirements are made of the member utilities These include capacity payments, central dispatch of generating plants as a single system, and coordinated scheduling of maintenance and unit commitment Penalties may be used to enforce the requirements

The tight pool operates a single control center, which effectively controls the operation of all available generators and transmission facilities owned by pool members Essentially, the pool operates as a single system, lumping all generation and all load together without regard to the service areas of the individual utilities In particular, generation is scheduled and dispatched for all utilities in the pool according to economic dispatch This is accomplished in the same way that a single utility schedules its dispatch, by controlling tie-line flows and system frequency Hence, a tight pool operates almost as a single system, as individual utilities surrender much of their autonomy to the pool

Like individual utilities, however, tight pools are forced to operate within constraints set by their internal transmission networks There will be times when pools will be forced to use high-cost generators, even though more efficient generators are available, because of limitations in the transmission capabilities between the generator sites and the load centers

Moreover, utilities within tight pools retain considerable control over their own operations Each utility decides daily which generators are to be committed to the pool's operations While most decisions to keep a generator are based on maintenance or internal system reliability requirements (related to protecting the transmission system from reactive loads), generators can be taken out of pool control because of capacity sales both to other pool members and to nonmembers In addition, pool members can purchase energy, both under capacity contracts and economy energy contracts, from sellers outside the pool

For example, the New England Power Pool coordinates virtually all of the six-state New England area's energy demand through its 93 members of investor-owned electric utilities, municipally-owned retail companies, and independent power producers NEPOOL's operations control center near Springfield, Massachusetts monitors the status of transmission lines throughout the six-state area, as well as conditions in the neighboring New York Power Pool, the Pennsylvania - New Jersey - Maryland Interconnection, the Maritime Pool (New Brunswick and Nova Scotia), Hydro-Quebec and Ontario Hydro

Loose Pools

A loose pool is less restrictive than a tight pool to its members in that it allows the members to control their own generating units and flows on their interconnecting transmission lines In a loose pool members coordinate their planning and operation, but central dispatch is not required Members continue to operate their own generation and transmission systems while the pool plans for long-term expansion of these facilities and sets standards for reliability and uniform operating procedures Penalties are not usually employed to enforce the agreement A loose formal pool is thus a middle position between the highly coordinated tight formal pool and the informal pool that operates with no contracts at all

The Mid-America Power Pool (MAPP) is a good example of a loose pool Five states in the upper mid-western part of the United States and two central provinces of Canada have formed this pool with the purpose of coordinating and cooperating in the operation of their electrical systems to minimize costs while maintaining reliability, to fully recover the costs of operation, and to share equitably in the resulting benefits Each individual member of the pool operates its own control area, there is no pool-wide dispatch center The pool does, however, maintain a Coordination Center, which monitors transactions, provides an energy accounting function, performs operational planning studies, and investigates disturbances

MAPP defines and sets pricing guidelines for energy and capacity transactions among the members The members themselves prepare and administer billings for their transactions, based on data kept by themselves and backed up by the Coordination Center

Multilateral Agreements

Multilateral agreements are a means by which utilities can try to achieve benefits for themselves through voluntary coordination while avoiding the requirements of more formal contractual arrangements such as tight power pools These arrangements are concerned mainly with the exchange of power and not with long-term capacity planning They differ from a pool in several ways perhaps most significantly each utility (rather than a central control point) is responsible for system reliability

The Florida Brokering System, which coordinates economy energy transactions among its members, is an example of a multilateral arrangement The utilities involved include the Florida Power and Light Company, the Florida Power Corporation, and the Florida Public Utilities Company Several other investor-owned, municipal, and cooperative utilities also participate

Each member submits buy/sell quotations hourly to the System's computer The quotation states the price at which the utility is willing to buy power, the price at which it will sell power, and the quantities of power involved The quotations are based on each potential seller's incremental cost of generating power and each potential buyer's decremental cost (i e , the amount of own generation cost that the buyer would save by buying instead of generating power) Transmission costs, including third-party transmission, are also included in the quotations and are taken from existing agreements and price schedules

The computer matches the buyer having the highest decremental cost with the seller having the lowest incremental cost The next highest decremental cost is matched with the next lowest incremental cost, and so on The matching concludes when a preset cost difference is reached Sales are voluntary and are based on existing bilateral contracts and transmission agreements among the utilities

Potential Problems in Pooling

Potential problems facing pooling include large utilities not deriving as much benefit from pooling as small utilities, or vice versa Large systems may thus not be interested in pooling unless they can share in the benefits that the small systems receive In addition, changing economic conditions may necessitate frequent renegotiation of the pooling agreement, endangering its stability Pools are sometimes constrained by their members' transmission networks, as noted above Other problems hindering pooling include the imposition of additional risks on a pool's members by the obligations of the membership in the pool and the diverse interests of the pool's members interfering with collective decision making The table below lists US power pools and coordination groups as identified by the National Regulatory Research Institute

Power Pools in the United States

Central Area Power Coordination Group (CAPCO)
Michigan Electric Coordinated Systems
Mid-Continent Area Power Pool (MAPP)
Missouri Basin Systems Group, Inc (MSG)
MOKAN (Missouri-Kansas) Pool
New England Power Pool (NEPOOL)
New Mexico Power Pool
New York Power Pool (NYPP)
Northwest Power Pool Coordinating Group
Pennsylvania-New Jersey-Maryland Interconnection (PJM)
Southern California Utility Power Pool
Wisconsin Power Pool

Trends in power pools

In the United States, the Federal Energy Regulatory Commission (FERC), a government regulator with jurisdiction over inter-state transmission of electricity, has ordered that electric utility companies must give transit access to the transmission systems on a non-discriminatory basis to all participants in the wholesale electricity market, including traditional electric utility companies, independent power producers, and power marketers Later, this access will be extended to retail customers as well The only limitations to access are the physical limitations of the transmission network itself This FERC order has affected the way power pools operate in the US They now must show that they are organized and operate in a manner that guarantees this non-discriminatory access to all potential users of the grid Power pools have responded by transforming their pool dispatch centers into "Independent System Operators", which are service organizations that have no financial or governance ties to the owners of the transmission networks Additionally, the transmission grid owners must develop and gain FERC approval for transit tariffs for use of their facilities, and must publish these rates at locations accessible to any potential users In the US, this publication is done using the World Wide Web

The impact of the FERC order is that first wholesale customers, and then later retail customers will have the option of shopping for their electricity supplier, and no longer will be required to purchase from the electric utility company to whose lines they are connected The choice of supplier will be made on the economics of selling price and any applicable transit charges (depending on the number of systems between the seller and the buyer), limited only by any transmission constraints Under constrained transmission, access is usually given on a first come, first served basis

Examples of Various Types of Power Pools

New England Power Pool (NEPOOL) - a tight power pool

General

NEPOOL serves six states (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut) in the northeastern part of the United States, with a peak load (summer) of approximately 23,000 MW and capacity of 28,000 MW It operates under reliability criteria established by the North American Electric Reliability Council and the Northeast Power Coordinating Council There are over 90 members of NEPOOL electric utilities, wholesale buyers, and wholesale sellers

Governance

Each of the 90+ members has a seat on the Management Committee, the highest governing body of NEPOOL Their individual voting power is equal to their company's peak load Actions of the Management Committee require 75% of the total number of votes Meetings of the Management Committee are held annually plus other times as decided by the group They are responsible for administration of the pool agreement, setting of budgets, appointing and setting compensation for NEPOOL staff (presently 115 people), establishing reliability standards, etc

Because of the size of the Management Committee, a separate Executive Committee is formed with ten members, chosen from and selected by the Management Committee The Executive Committee meets between meetings of the Management Committee, and, with certain exceptions, has all of the Management Committee's powers

A Policy Planning Committee is chosen from the larger member companies Their responsibilities include load forecasting, recommendations for reliability standards, recommending the pool's required capacity annually, studying and evaluating alternative sources for energy and capacity, etc

An Operations Committee is chosen also from the larger member companies Their responsibilities include the operation of the dispatch center for bulk power supply (generation and transmission) facilities, establishing and approving maintenance schedules for generation and transmission facilities, determining each participant's capacity responsibility, calculating and apportioning losses, determining each generating unit's incremental and decremental costs, etc

Pool Operation

- Each member may enter into bilateral contracts with other pool members or with entities outside of NEPOOL

- NEPOOL operates all generating units 5 MVA or larger based on incremental/decremental costs, regardless of ownership Each day, owners of generators submit limitations and constraints to NEPOOL for the following day
- The entire six-state area is operated as a single control area

Classifications of Energy Services

- Economy Service
- Scheduled Outage Service
- Unscheduled Outage Service
- Deficiency Service

Settlements

- Generation is dispatched on a pool-wide basis, regardless of ownership
- An after-the-fact computer simulation is made to determine each member's hypothetical dispatch and costs using only their own assets (real and contractual) A comparison is then made between the actual dispatch of each asset and its own-load dispatch in that hour If an actual dispatch exceeds the own-load dispatch, that is considered a delivery to the Pool If own-load exceeds actual dispatch, it is considered a receipt from the Pool
- The hour-by-hour deliveries and receipts between the Participants and the Pool are priced according to the generation asset's incremental cost of deliveries and Decremental cost of receipts Unit-by-unit energy transactions and costs are accumulated for each Participant Total Pool savings are then determined, being equal to the difference between the accumulated cost of the aggregate Participants' own-load dispatches and the actual dispatch (including the net amount of NEPOOL purchases/sales with external pools)
- One-half of NEPOOL expenses are drawn from the Savings (The other half of the Pool's expenses are billed to Participants according to their Adjusted Annual Peak loads) The remaining Savings are distributed according to proportional shares earned by Participants

Capacity Responsibility (Reserves)

- The Operating Committee assigns each participant a share of the pool's total required seasonal capability, one value for winter months, and another for summer months
- If a participant's actual capacity capability falls below its assigned share in any month, it can be charged a penalty, based on the capacity cost of a new combustion turbine

Generation Additions

- Members are free to plan, construct, and operate generation additions
- Pool-planned generation additions receive preferential treatment by the pool via the sharing of reserves
- Participants are encouraged to jointly undertake the construction and ownership of pool-planned units in order to take advantage of economies of scale, and to minimize the risks to individual utility owners

Maintenance Scheduling

- Transmission - All transmission lines 69 kV and higher are controlled by NEPOOL's dispatch (except for safety issues)
- Generation - All units 5 MVA and higher are controlled by NEPOOL dispatch and must have routine maintenance outages scheduled through the pool Units on scheduled outages receive preferential rates from the pool for replacement energy and capacity

Use of Transmission Facilities and Payments Therefor

- Each participant is entitled to use pool transmission facilities for Economy Service, Scheduled Outage Service, Unscheduled Outage Service or Deficiency Service at no transit cost
- Pool-wide transit tariff is set for use of pool transmission facilities for transfer of ownership interest or contractual entitlements
- NEPOOL, through the Management Committee, may require any participant to construct any transmission facilities which it deems necessary to maintain the reliability and stability of the network The costs of such additions, however, are borne by those participants which receive benefits from the addition

Key Features of Tight Power Pool

- Operate essentially with a single control center
- Operate as a single control area
- Pool planning for generation and transmission additions
- Penalties for capacity deficiencies

Mid-America Power Pool - A loose power pool

General

The Mid-America Power Pool (MAPP) covers the electric utility companies in the north-central part of the United States and Canada, and include the States of Minnesota, North and South Dakota, Nebraska, and Iowa, plus the Provinces of Manitoba and Saskatchewan The population of the pool area and the electrical load served are comparable to those in the New England Power Pool MAPP operates under reliability criteria established by the North American Electric Reliability Council and MAPP's Reliability Council There are 28 full members of MAPP and 16 associate members

Governance

Full members are those which own generating units, are interconnected with other MAPP members, operate a dispatch center, and maintain reserves An associate member is any electric utility which either chooses not to be a full member, or which does not meet all of the membership criteria Full members are entitled to a seat on the Management Committee with voting rights given by a weighting formula based on annual demand The Management Committee meets annually or as needed

Because of the size of the Management Committee, a separate Executive Committee is formed with nine members of the Management Committee The Executive Committee meets between meetings of the Management Committee, and has all of the Management Committee's powers, except for the adoption of budgets

The Engineering Committee contains one voting participant from each member company It is responsible for reliability issues, reserve capacity obligations, and long-range planning

The Operating Committee also contains one voting participant from each member company It is responsible for operations issues and for energy accounting of the members' electricity transactions

In addition to the above committees, the Management Committee also appoints members to a Design Review Committee, an Environmental Committee, and an Area Relations Committee

Pool Operation

Each member of MAPP controls its generation and operates its own separate control area Members may enter into bilateral contracts with other utility companies either within or outside of the pool

One pool member acts as host for a Pool Coordination Center, the funds for which are provided by each pool member based on load served The Coordination Center maintains records for the pool, analyzes disturbances and outages, reports to and prepares filings with regulatory bodies, etc

Classifications of Energy Services

- Participation Power
- Seasonal Participation Power
- System Participation Power
- Peaking Power
- Short Term Power
- Emergency Energy
- Scheduled Outage Energy
- Economy Energy
- Interruptible Load Replacement Energy
- Operational Control Energy
- General Purpose Energy

Settlements

- All wholesale transactions are bilateral, bills are presented monthly by the supplying member to the purchasing member
- All payments to be made in currency
- Each member keeps metering data as basis for billings

Capacity Responsibility (Reserves)

- Management Committee sets reserve obligation for each member, based upon size of each member's largest generating unit and each member's annual system peak demand

Generation Additions

- Planned, built and operated by individual pool members, although pool is kept informed of plans and may offer advice
- No concept of "pool-planned units" as in a tight power pool

Use of Transmission Facilities and Payments Therefor

- Postage-stamp tariff for transit, paid by the purchasing member to the member providing transit services

Key Features of Loose Power Pool

- No central dispatch center
- Each member controls its own control area
- Few, if any, penalties for failure to follow pool agreement
- No central planning of generation additions

Pools Using Spot-Pricing of Wholesale Electricity and Capacity

Traditionally, power pools have based the wholesale price of electrical energy on the marginal costs to produce energy Recent trends, however, are to "unbundle" the component costs of electrical power The resulting components, which vary somewhat in definition, consist of such items as energy, frequency regulation service, dispatch and system control services, near-term reserves, long-term reserves, reactive supply and voltage control, and wheeling (transit) services In a spot-priced market, the prices for each monopolistic service are regulated by tariffs, while bids are solicited for those services which can be competitively supplied

The best-known spot-priced wholesale electricity market is that of England and Wales, which has been in operation since the early 1990s In that system, operators of generating stations submit, on a day-ahead basis, offer prices for energy for each half-hour period of the following day The pool operator, National Grid Company (NGC), then ranks each generating unit in order of increasing offer prices, creating a "merit order" of generating assets NGC next derives an operating regime based on the merit order, the declared availability's of the units, and the demand forecast, assuming that transmission constraints do not exist In each half-hour of the day, the offer price of the most expensive generating unit required to operate to meet the unconstrained schedule becomes the "system marginal price" To this is added an "uplift", related to required reserves and other ancillary services Finally, adjustments are made to accommodate the actual, constrained dispatch of the system After all such transactions and adjustments have been made, the price to wholesale consumers is calculated as the sum of net payments to generators divided by the total amount actually generated during the day in question

Although the power pool of England and Wales was the first to adopt such an offer price based market, many other pools have either put into operation or are working toward such systems, including Australia, Norway, Kazakhstan Ukraine, Russia, and many of the US power pools, including NEPOOL