TECHNICAL CHALLENGES RESULTING FROM ELECTRIC UTILITY RESTRUCTURING

Reliability Enforcement and Accountability

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Executive Summary:

Retail and wholesale competition and electric utility restructuring elicit the need to establish mechanisms to ensure continued reliability in a restructured, competitive market. It is incumbent upon the reliability institutions: NERC, FERC, State Public Utility Commissions, and Regional Reliability Councils to develop internal tacks to parallel the challenges of a restructured, competitive market: establishing reliability protocols, compliance standards, reliability incentives, and non-compliance sanctions. A conservative reorganization cannot ensure reliability. The reliability institutions must supplant their current regimes with innovative and effective policies apposite to ensuring reliability.

Reliability Management

FERC must provide regulatory oversight of energy contracts, tariffs, and market licenses. FERC will also act as a regulatory backstop; hence, demanding legislation to expand FERC's reliability enforcement authority. NERC must provide policy insight. They will establish Reliability Policies, Standards, Principles, and Guides, develop a compliance plan, and have sanctioning authority. Regional Reliability Councils and Independent System Operators (ISOs) will monitor energy transactions and generation and enforce reliability compliance. Jointly, NERC, FERC, and ISOs will implement energy entities to comply with reliability protocols and ensure reliable operations. With many new entities joining the electricity market, reliability institutions must expound reliability protocols, compliance standards, incentives, and sanctions to fledgling and restructured entities.

Legislation

The reliability institutions must have legislative support to enforce their lucid reliability dicta. Legislators should not be interlopers in establishing reliability standards; they must encroach upon reliability institutions' authority. Legislators must abnegate to the idea reliability standards should be legislated; new legislation must accrue the governing and enforcement authorities of the reliability institutions, focusing on FERC. The issuance of redrawn regulatory authority obviates legislators from ensuring reliability.

To reverberate, reliability institutions must reconstitute their structures and responsibilities to meet the demands of a restructured, competitive electricity market. Reliability institutions must have augmented responsibilities and federal authority with enforcement via legislation. Proposed in this paper are the changes necessary to reliability institutions and legislation to allay ensured reliability in the future market.

Legislative Summary:
Reliability standards should not be legislated.

Bulk electric system reliability and proper transmission system operation will be the responsibility of the Independent System Operator (ISO) in coordination with NERC.

Reliability standards must be clear, transparent, nondiscriminatory, enforceable, and enforced. Compliance must be mandatory for all entities using the bulk power system and heavy sanctions imposed on noncompliant entities. [17]

It is very likely that any reliability rule, no matter how obvious, will be challenged by an entity with an economic incentive to do so. [20]

Competitors compete, not cooperate.

Regulatory oversight is necessary to ensure compliance with reliability policies and standards and to resolve disputes. [17]

Mandatory sanctions and business incentives should be used to enforce compliance. [35]

FERC needs to assure compliance with NERC reliability protocols.

Seven Critical Activities for a Reliable Power System	
Activity	Governance
Observe the network	ISO
Analyze and model the system	ISO in conjunction with State PUCs
Communicate with operators of other systems	ISO
Take control actions to maintain reliability	ISO with NERC then FERC backstops
Monitor and enforce compliance	ISO
Plan to expand and/or modify the system	ISO, State PUCs
Ensure incentive system for reliability	FERC, NERC

Legislation is needed to authorize DOE/FERC to monitor and enforce reliability compliance over the entire bulk electric system of the United States.

PART I

CURRENT REGIME

1.0. Deregulation Background

The electric utility industry is vital to the U.S. economy. It contributes over 5% of the Gross National Product which translates into a $250 billion/year industry. The electric utility industry directly employees over 500,000 workers and supports a $6 trillion product market. The electric utility industry is the largest regulated U.S. industry and overall, the 4th largest U.S. industry.

1.1. What is Deregulation

The electric power industry is comprised of vertically-integrated, monopoly utilities that perform every electric supply function from production to retail delivery (figure 1). Deregulation means splitting the generating facilities from the transmission and distribution. This allows consumers to select a generating facility on the basis of its product (i.e. nuclear, coal, natural gas, wind, solar, hydro). The term deregulation is misleading. The term restructuring should be used in lieu of deregulation. Deregulation connotes the regulation in place over the electric industry; thus, it will be dismissed and the industry will instill its own practices and standards without oversight. The electric industry will still be highly regulated in its generation, transmission, and distribution operations. Restructuring involves splitting all ties between power generation and power transmission and distribution. Restructuring, then, is a term used to represent the progression to make the electric utility industry a competitive market. 1.2. Why Restructure?

Restructuring the electric utility industry means that consumers could actually elect to shop for electricity the same manner by which they are accustomed to purchase clothes, cars, or long-distance phone services. Electric power companies would compete with each other to give consumers the 'best service'[1] at the lowest prices. If consumers are dissatisfied with MCI, for instance, they can switch to AT&T, Sprint, or local companies; if they think Chevys cost too much, then they buy a Ford; if they are tired of Target, they go to Walmart. But when it comes to electricity, however, it is illegal for a

Electricity deregulation makes sense. After all, consumers enjoy an almost unlimited power to choose in other areas of the economy.

[1] The electric grid will have the same reliability levels throughout. A company advertising the 'most reliability service', etc. will be talking about the grid in general. No company may claim better reliability over another company because the grid works as a whole and is affected by every action of every entity interacting with the grid.

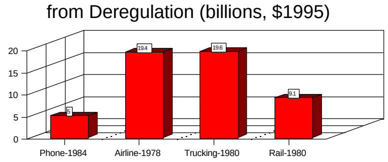
consumer to switch power companies. The power of individual choice is one of the major factors supporting and sustaining restructuring.

Clemson University economists produced a study on the savings resulting from restructuring. According to these findings, the typical customer's monthly electric bill will drop approximately 43%, from $69 to $39. This translates to $360 savings per year. Consumers then could directly save $107 billion a year; for contrast, a tax relief in current legislative debate would amount to only $17 billion a year savings. A mere 1-cent-per-kilowatt-hour drop on the average cost of 7 cents would save consumers $28 billion a year. The *Citizens for a Sound Economy* asserted in a recent report, recognized by Congress, that for each year without restructuring, the electric power industry costs the US economy over $190 billion in lost GDP, in addition to a $24.3 billion in lost disposable income every year.

Restructuring, in addition to affecting constituents, will reduce costs for commercial businesses, especially small businesses. The portion of overhead electricity accounts will then be reduced, having a domino effect on final costs of goods and services and company vitality. According to the Food Marketing Institute, in 1994 grocery stores spent approximately 4% of their net sales on electricity expenses. GM, furthermore, reports of every new vehicle they sell in the U.S., $700 of the sticker price is attributed to electricity expenses. In fact, the National School Board Association estimates schools can save up to 35% on the electric bills in competition. The money saved, then, can be spent on books, computers, and other learning tools. Once competition is effective, the corporate sector will shop for competitively priced electricity and will pass the savings on to the consumers. Consumers will benefit from all their purchases as competition arrives. Companies will have reduced costs and they will pass these savings along to consumers. The summation of savings for consumers will boost spending and expand markets. [1] Secretary of Energy Pena noted that manufacturers and other large consumers of electric power are virtually certain to benefit from industry restructuring, boosting the economy to the extent that their savings are passed on in the form of cheaper goods and services. He also added that he is committed to ensuring that American homeowners and small business also benefit. [4]

1.3. Does Restructuring Work ?

Since 1977, five major U.S. industries have been deregulated: trucking, railroads, natural gas, long distance phone service, and airlines[2]. All evidence suggests deregulation is beneficial to consumers. In every case, consumer prices fell: the average price drop in two years was between 4 and 15%; after 10 years it was between 25 and 50%. These are drastic figures. [1] The chart[3] below demonstrates how much each industry has saved consumers



since its initial deregulation. The trend reflects enormous consumer savings. The telephone industry has saved 5 billion; airlines $19.4 billion; trucking $19.6 billion; and rail roads $9.1 billion[7].

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[2] For further information on deregulated industries try:

1. Evans, D.S., Breaking up Bell, New York: Elsevier, 1983.
2. Winston, C. "Economic Deregulation: Days of Reckoning for Microeconomists," Journal of Economic Literature, 31, Sept. 1993, p. 1263-1289.
3. Richard Schuler, Ph.D., Professor of Economics and Civil and Environmental Engineering; Director, Cornell Institute for Public Affairs, Cornell University

[3] Source: Crandall and Ellig, Economic Deregulation and Customer Choice. Note: These figures reflect the benefits of the introduction of competition in long-distance telecommunications in 1984, airline deregulation in 1978, interstate trucking deregulation in 1980, and railroad deregulation in 1980. Natural gas is not included because no controlled studies have examined the impact of deregulation on gas prices or quality of service.

Reliability Institutions-DOE, FERC, State PUCs, NERC, System Operators

2.0 United States Department of Energy

2.1 DOE Authority with regard to transmission system reliability [12]

The DOE has limited authority over the reliability of the interstate transmission system. DOE has authority to order temporary interconnections and the generation and transmission of electricity in an emergency situation pursuant to section 202 of the Federal Power Act (FPA), Moreover, it also has the authority to define reliability regions and encourage interconnection and coordination within and between regions under section 202(a). In addition, it has the authority to gather information regarding reliability issues and to make recommendations pertaining to industry standards for reliability pursuant to section 209 of the Public Utility Regulatory Policies Act (PURPA).

DOE is responsible under section 202(a) of the FPA for encouraging the coordination and interconnection of facilities. This provision directs DOE to "divide the country into regional districts for the voluntary interconnection and coordination of facilities for the generation, transmission, and sale of electric energy," and, "to promote and encourage such interconnection and coordination within each such district and between such districts." 16 U.S.C. 824a(a).

DOE has limited authority to require utility action related to reliability under section 202 of the FPA[4]. DOE may order temporary interconnections and the generation or

[4] Section 202 16 U.S.C. 824a© provides as follows:

During the continuance of any war in which the US is engaged, or whenever the Commission determines that an emergency exists by reason of a sudden increase in the demand for electric energy, or a shortage of electric energy or of facilities for the generation or transmission of electric energy, or of fuel or water for generating facilities, or other causes, the Commission shall have authority, either upon its own motion or upon complaint, with or without notice, hearing, or report, to require by order such temporary connections of facilities and such generation, delivery, interchange, or transmission of electric energy as in its judgment will best meet the emergency and serve the public interest. If the parties affected by such order fail to agree upon the terms of any arrangement between them in carrying out such order, the Commission, after hearing held either before or after such order takes effect, may prescribe by transmission of electricity in times of emergency.

Authority under subsection 202(a) and © of the FPA was transferred from the Federal Power Commission to the Department of Energy by the Department of Energy Organization Act 42 U.S.C. 7151(b); 42 U.S.C. 7172(a)(1)(B) transfers authority to order interconnection in nonemergency situations from the Federal Power Commission to the Federal Energy Regulatory Commission.

Under section 209(b) of PURPA, the Secretary of Energy has the authority to request "the reliability council...or other appropriate persons (including Federal agencies) to examine and report to him concerning any electric utility reliability issue," 16 U.S.C. 824a-2(b). Section 209 provides the Secretary authority to recommend industry standards for reliability[5].

16 U.S.C. 824a-2© requires the Secretary to report to Congress on any recommendations made under this subsection, any recommendations concerning electric utility reliability problems made under any other provision of law, and any actions taken by electric utilities with respect to such recommendations. The Conference Report on PURPA H.R. Conf Rep. 1750, 95th Cong., 2nd Session at 63 states:

> The purpose of this section is to require the Secretary of Energy to study ways to improve the reliability of service to electrical consumers, to authorize the Secretary to request appropriate persons to examine and report to him on reliability issues, to authorize the Secretary to recommend to the electric utility industry standards for reliability, and to require that the Secretary, in his annual report, make recommendations concerning reliability of service to electrical consumers.

DOE's authority under section 209 of PURPA is limited to gathering information and to making recommendations, and does not extend to requiring a utility to perform any action.

3.0 Federal Energy Regulatory Commission (FERC) ORDERS 888 & 889 [10,11]

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supplemental order such terms as it finds to be just and reasonable, including the compensation or reimbursement which should be paid to or by any such party.

[5] The Secretary, in consultation with the Commission, and after opportunity for public comment, may recommend industry standards for reliability, to the electric utility industry, including standards with respect to equipment, operating procedures and training of personnel, and standards relating to the level or levels of reliability appropriate to adequately and reliably serve the needs of electric consumers.

3.0.1. Briefing

FERC is the federal agency with jurisdiction over the bulk power market, including interstate transmission systems. As part of these responsibilities, the FERC is implementing policies to assure that owners and operators of bulk power transmission facilities under the agency's jurisdiction provide non discriminatory service to all power suppliers in wholesale power markets. FERC has not had to involve itself with regulating reliability functions, though it possess the authority; NERC regulates reliability. FERC may begin to address reliability issues that intersect with the commercial needs of the industry as restructuring proceeds. [17]

The FERC Orders started wholesale competition and are the precursors for retail competition. Order No. 888 contains rules for open access (opens wholesale power sales to competition, through the use of open use of utility transmission lines) and stranded costs. Order No. 889 contains rules for Open Access Same-time Information System (OASIS) and standards of conduct. The FERC orders on wholesale competition are a model for retail competition to work from to develop a working and beneficial policy.

3.1.0 Mandatory Open Access

Opening wholesale power sales to competition requires public utilities owning, controlling, and/or operating transmission lines to file nondiscriminatory open access tariffs that offer others (any energy company) the same transmission service for the same price they provide themselves. This will: (1) bring lower cost power to consumers; (2) ensure continued grid reliability; and (3) provide for open and fair electric transmission services by public utilities. Any entity engaged in wholesale purchases or sales of energy or retail purchases is an eligible customer for the pro forma tariffs. Transactions violating the Federal Power Act's prohibition against wheeling are not eligible. Foreign entities that otherwise meet the eligibility criteria may obtain transmission services. However, they would be subject to all the terms and conditions of the applicable open access tariff, including the requirement that they provide reciprocal transmission service. If, though, a public utility voluntarily offers unbundled retail access in interstate commerce (hence giving FERC jurisdiction), the affected customer is an eligible customer and must obtain its unbundled transmission service under a transmission tariff on file with FERC.

3.1.1 Tariff Provision--Pricing

The open access tariffs (pro forma tariffs) include: minimum network, load based service, point-to-point[6] contract-based service, and ancillary services. The order says, "[It] is not intended to signal a preference for contract path/embedded cost for the future." There are no prescribed rates for network, point-to-point, or ancillary services. Public utilities may charge current rates or apply for new transmission rates. FERC wishes to encourage flow-based pricing as a specific example. The tariff also allows transmission providers to propose recovering opportunity costs and expansion costs.

3.1.2. Tariff Provision--Reservation Priority: Priority for obtaining services

Short term firm[7] point-to-point service (less than one year) will be conditional until one day before the commencement of daily service, one week before the commencement of weekly service, and one month before the commencement of monthly service. These conditional reservations may be displaced by competing requests for longer-term point-to-point service.

Network customers' economy purchases have a higher priority than nonfirm point-to-point transmission service. The final rule adopts a reservation priority for nonfirm point-to-point service based on duration of the nonfirm service with price as a tiebreaker for competing service requests of an equal duration. If there is insufficient transmission capacity

[6] Point-to-point transmission service means a generator puts power out at X and a customer takes in power at point Y. Network point-to-point transmission services includes point-to-point transmission and generation factors, load, ancillary services, the entire transmission package.

[7] Firm transmission service means some entity (independent power producer, transmission owner, marketer, etc.) has promised, through a contract, to deliver some amount of power and they must deliver it. Non firm transmission service means if there is available/excess power, then you are obligated to get it (also in a contract). A good example of a non firm contract is hydroelectric power. If excess there is excess rain, you have more power produced, and you can fulfil many non firm contracts.

to accommodate all nonfirm transmission requests, the reservation of longer duration will displace the reservation of shorter duration. A firm point-to-point customer's use of transmission service at secondary points of receipt or delivery will continue to have the lowest reservation priority.

3.1.3. Tariff Provisions--Reserving Transmission Capacity

Firm transmission customers will not lose their rights to firm capacity simply because they do not use that capacity for certain periods of time. In the absence of evidence of hoarding or other anti-competitive practices, FERC will not limit the amount of transmission capacity that a customer may reserve. A utility is free to schedule and sell any unscheduled firm point-to-point transmission capacity on a nonfirm basis to any entity eligible to receive such service under the utility's tariff. Public utilities may reserve existing transmission capacity needed for native load growth and network transmission customer load growth reasonably forecasted within the utility's current planning horizon. Any capacity that a public utility reserves for future growth that is not currently needed must be posted on OASIS and made available to others through the capacity reassignment requirements.

3.1.4. Tariff Provision--Curtailment

To relieve transmission constraints for reliability or economic reasons, a transmission provider can curtail--reject, redirect, reassign--service for firm or nonfirm service.

3.2. Reciprocity

The rule requires that those who own, control, or operate transmission facilities and receive open access service, must, in turn, provide open access service to the transmitting utility. This rule applies to all customers and their affiliates that own, control, or operate interstate transmission facilities and take service under the open access tariff.

Nonjurisdictional utilities can reap the benefits of the tariff by submitting to FERC an open access tariff that meets FERC's standards. On the other hand, jurisdictional utilities can exempt themselves from the tariff if providing reciprocal transmission service would jeopardize the tax-exempt status of the transmission customer's or its corporate affiliate's bonds used to finance transmission facilities.

3.3. Reassignment

Point-to-point transmission service, because it sets forth clearly defined capacity rights, must be reassignable. Network transmission service, which FERC decided has no specific capacity rights, is not reassignable. A public utility's tariff must explicitly permit the voluntary reassignment of all or part of a holder's firm transmission capacity rights to any eligible customer.

3.4. Ancillary Services

Ancillary services are the services provided by utilities to ensure safe, efficient, and reliable transmission of power. Excluding administrative fees (office work, etc) and the power itself, ancillary services include the systems that make the transfers possible. FERC included 6 ancillary services in the open-access tariff. These are[8]:

Ancillary Service	Service Description
1. Scheduling, System Control, and Dispatch	Provides for a) scheduling, b) confirming and implementing an interchange schedule with other Control Areas, including intermediary Control Areas providing transmission service, and c) ensuring operational security during the interchange transaction.
2. Reactive Supply and Voltage Control from Generation Sources	Provides reactive supply through changes to generator reactive output to maintain acceptable transmission system voltages and facilitate electricity transfers.
3. Regulation and Frequency Response	Provides for following the moment-to-moment variations in the demand or supply of a Control Area and maintaining scheduled interconnection frequency.
4. Energy Imbalances	Provides correction for any hourly mismatch between a Transmission customer's energy supply and the demand served.

[8]Ancillary Services Descriptions Outlined in FERC Order 888. See NERC's Interconnected Operations Services Working Group's final report: Defining Interconnected Operations Services Under Open Access. March 7, 1997.

5. Operating Reserve--Spinning	Provides additional capacity from electricity generators that are online, loaded to less than their maximum output, and available to serve customer demand immediately should a contingency occur.
6. Operating Reserve--Supplemental	Provides additional capacity from electric generators that can be used to respond to a contingency within a short period, usually ten minutes.

Transmission providers are not limited to these services but can voluntarily offer other ancillary services. Pricing for ancillary services will be considered on a case-by-case basis.

3.5. Power Pools

The order provides that power pools and similar organizations must remove transmission access and pricing provisions that favor members of the group or discriminate against outsiders.

3.6. Federal and State Jurisdiction

FERC asserts jurisdiction over the rates, terms, and conditions of unbundled retail transmission in interstate commerce by public utilities. In doing so, FERC asserts no control over retail transmission directly to an ultimate consumer. Nor does the jurisdictional determination change historical state franchises areas or interferer with state laws governing retail marketing areas of electric utilities. States have authority over local distribution and over the service of delivering electric energy to end users. The order will not affect or encroach upon state authority in such traditional areas as the authority over local service issues; including reliability of local services; administration of integrated resources planning and utility buy side and demand side decisions; authority over utility generation and resource portfolios; generation transmission siting; and authority to impose non-by-passable distribution or retail stranded cost charges. FERC has set up technical indicators to distinguish between transmission and distribution centers, and hence where their jurisdiction ends.[6] Overall, FERC has made it clear that it is wants to defer to recommendations by state regulatory authorities on where to draw jurisdictional lines, how to allocate costs for local distribution facilities, customized retail wheeling tariffs, etc.

3.7.0. Stranded Costs[9]

This paper cannot fully address the issue of recovery. For further, detailed information, view sources 5 and 6. EEI is a bias group but they present facts which support Kolbe and Tye's findings.

3.7.1. What are Stranded Costs

Stranded costs are primarily uneconomic physical assets (generation stations), which are uneconomic to run now and will be even more uneconomic in the competitive era, past investments, contracts associated with PURPA, and deferred recoveries of expenses, previously reviewed and approved (and in some cases, mandated) by regulators, that have not yet been fully recovered by the utility companies and that could not be recovered in a fully competitive market because competitors would bear no such burdens. Much is for the higher cost of high efficiency fossil generating units and low fuel cost nuclear units.

The three main categories of stranded costs are: (1) past investments-generation facilities (in utility-owned plants) whose total operating costs exceed market prices or future competitive prices; (2) long-term power purchase contracts from independent power producers under PURPA, which the utilities were forced to take (frequently mandated by regulatory authorities), based on projects of costs and prices that have turned out to be too high; and (3) regulatory assets (deferred taxes, post-retirement employee benefit costs, nuclear decommissioning costs, and other expenses capitalized for rate making purposes such as Demand Side Management systems) that regulators required be amortized and recovered over extended periods. [6,8]

3.7.2. Examples of Government Intervention to Abet Stranded Costs

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> It is simply not the case that utility investors have been compensated to any significant degree asymmetric risk and that they could not have been so compensated by the methods typically determine the allowed rate of return
>
> (Kolbe and Tye, 5)

3.7.2.1. The Fuel Use Act: Limiting the Use of Oil and Natural Gas

Prior to the 1970's, utilities used large amounts of natural gas to produce electricity. When shortages of natural gas arose in the late 1960's, the Federal Power Commission (predecessor agency of FERC) required interstate pipelines to curtail delivery of natural gas to electric utility boilers so that gas would be available for higher priority residential and small commercial use. Notable, these shortages were a direct consequence from the federal wellhead of natural gas price controls. During the 1970's, the curtailments severely limited electric utilities' ability to use natural gas to fuel generation of electricity. This policy was codified in 1978 when Congress passed the Power Plant and Industrial Fuel Use Act of 1978 ("Fuel Use Act"). The Fuel Use Act prohibited utilities from using oil and natural gas to generate electricity and ***required*** utilities to replace oil and gas units with alternative fuel sources. As a consequence of the Fuel Use Act, utilities were forced to shut down all their oil and gas units. Utilities had to turn to coal and nuclear energy as new fuel supplies. The Clean Air Act made it very costly to meet air pollution control requirements and the number of plants per region was limited by air quality standards. Hence, with the hindrances of the Clean Air Act, nuclear generation appeared to be a viable and prudent alternative in the 1970's.

3.7.2.2. PURPA: Requiring Utilities to Purchase Power from Non-Utility Generators at Prices that have Proven to be Significantly Above-Market

Along with the Fuel Use Act, the Public Utility Regulatory Policies Act of 1978 (PURPA)
was enacted into law. PURPA's goal is to encourage efficiency and the use of alternative sources of fuel such as coal and nuclear. To achieve this goal, PURPA ***required*** utilities to purchase power from non-utility generators at a rate that reflected the utilities "avoided cost" of having to build its own generation facilities or purchase from another source. At the option of the project developer, prices could be locked-in for the duration of the contract, often 25-30

years. Requiring utilities to enter into these long-term power purchase agreements with non-utility generators has proved to be costly. When many of these contracts were signed, projections for future energy prices were estimated to be much higher than they actually are. These government-mandated contracts have forced utilities to purchase power at prices that are significantly higher than what they would pay in today's market or any competitive market. In California, and parts of the Northeast, above market PURPA contracts are the largest single component of utility stranded costs. Having compelled utilities to enter these long term contracts at above-market prices, Congress has an obligation to ensure that these costs are recovered.

3.7.2.3. The Energy Policy Act of 1992: Accelerating the Transition to a Competitive Electric Market And the "Stranding" of Costs

The Energy Policy Act of 1992 (EPAct) gave FERC the authority to order wholesale transmission access and hence opened up the generation market to virtually all firms. By allowing utilities and other power generators to "wheel" (see Part I, 7.3) power across utilities' transmission facilities, EPAct increased competition in the wholesale electric market. Wholesale competition has been heightened by capacity surpluses resulting from lower than anticipated load growth due primarily to recession and government mandated encouragement of non-utility generation construction. The results of this competition, in turn, have resulted in state efforts to institute retail wheeling. (EPAct is the current basis for electricity competition. It mandates wholesale competition and encourages retail competition.)

3.7.3. Estimated Stranded Costs

Stranded costs have been estimated by independent observers such as Resource Data International, Moody's, and Oak Ridge National Labs at $100 to $200 billion nationwide. When compared with the equity for the entire electric industry -- about $175 billion -- the importance of how these costs are treated becomes overt. [3]

3.7.4. Recovering stranded costs

The Commission will permit a public utility or transmitting utility to seek recovery of wholesale stranded costs from departing customers by direct assignment. A departing customer will be required to pay costs incurred to serve it when it was a bundled customer. The order lays out the rules for recovery of costs associated with new and existing contracts, reform of existing contracts, and discusses jurisdictional allocation.

3.7.5. New Contracts

Stranded costs associated with new wholesale contracts (new contracts are effective after July 11, 1994) may be recovered only if the contract contains an explicit stranded cost provision that permits recovery. FERC defines 'explicitly stranded cost provisions' as a provision that identifies the specific amount of stranded cost liability of the customer and a specific method for calculating the stranded cost, charge, or rate.

3.7.6. Existing Contracts

Utilities may not recover stranded costs if recovery is explicitly prohibited by the contract or by any power sales or transmission tariff on file with FERC for existing wholesale contracts (existing contracts are effective on or before July 11, 1994). If an existing contract does not address stranded costs through an exit fee or other explicit stranded cost provisions, a utility may seek recovery of stranded cost provisions in three instances. Option one is for the contract parties to renegotiate the contract and file a mutually agreeable amendment dealing with stranded costs.

3.7.7. Reopening Contracts

Option two allows either one or both parities of an existing contract to seek amendments or early termination before it expires; this applies even when the Sierra-Mobile clause which bars the change is in the contract. FERC will address option two requests on a case-by-case basis. Option three allows a supplier to submit a request, before the contract expires, to recover stranded costs through a departing generation customer's transmission rates under the Federal Power Act.

3.7.8. Jurisdiction over stranded costs--State vs Federal

For customers who obtain retail wheeling, a public utility or transmitting utility may seek recovery through FERC jurisdictional rates only if the state regulatory authority had no authority under state law to address stranded costs when retail wheeling is required. On a case-by-case basis, FERC will address the need to amend a jurisdictional agreement to prevent retail stranded costs from being shifted to customers in other states. For a retail-turned-wholesale customer (municipality), a public utility or transmitting utility may file a request to recover stranded costs from the newly created wholesale customer through that customer's transmission rates under the FPA. Second guessing the states is a fear of the Commission. If a state has authority to address the issue the state's decision should not be second guessed by FERC. If the state lacks the authority, or has the authority but does not use it, FERC should act on requests for stranded cost recovery.

3.7.9. Stranded cost recovery will not skew competition in the emerging restructured industry

Stranded cost recovery will ensure that uneconomic bypass and construction of unneeded capacity is avoided. Competition will occur at the margin and prices will be set by the market, not by any of the competitors. With stranded cost recovery, both the utility and competing suppliers will have the same charge for fixed costs; but the supplier with the lowest marginal (operating) costs will win the right to serve. Thus, recovery of stranded cost assures that the economically efficient power producer wins the right to serve customers.

For example, if other generators are more efficient than the local utility, stranded cost recovery will not prevent them from obtaining the right to supply. If other generators are not more efficient than the local utility, stranded cost recovery will ensure that they do not win the right to supply. Stranded cost recovery guarantees that society will benefit from the most efficient use of resources. [9]

3.8. Open Access Same-Time Information System (OASIS)

OASIS is an electronic information system that allows users to instantly receive data on the current operating status and transmission capacity of a transmission provider. The OASIS rule applies to any public utility that offers open access transmission services under the open access pro forma tariff, including both wholesale and retail transmission customers that are able to receive unbundled retail transmission. Transmission providers are required to: (1) establish or participate in an OASIS that meets certain requirements and (2) comply with prescribed standards of conduct. Examples of the type of information on OASIS include: availability of transmission services, hourly transfer capacities between control areas, hourly amounts of firm and non-firm power scheduled at various points, current outage information, load flow data, current requests for transmission service, and secondary information regarding capacity rights that customers wish to resell.

3.9. Standards of Conduct

The standards of conduct are designed to prevent employees of a public utility or affiliate engaged in marketing functions from obtaining preferential access to OASIS related information or from engaging in unduly discriminatory business practices. Utilities are required to separate their transmission operations/reliability functions from their marketing/merchant functions. This prevents system operators providing merchant employees transmission related information not available.

3.10. Independent System Operators

Order 888 encourages the formation of Independent System Operators (ISO). ISOs will be discussed in Part III Section 2.

4.0 State Public Utility Commissions--StPUCs

PUCs assure rates, operations, and services are just and reasonable to both the utilities and to the consumers they serve. PUCs authorize the construction of new transmission lines and generating facilities. PUCs adopt and work with NERC Regional Councils to establish guidelines for reliability, safety, planning, and operation of the state’s bulk electric power system. The PUCs have jurisdictional control over all intrastate electricity transactions (intrastate wheeling) while FERC has jurisdiction over interstate wheeling.[15]

5.0 North American Electric Reliability Council--NERC

NERC is responsible for promoting the reliability of the interconnected bulk electric systems[10] in North America. Reliability is described as how well the utility succeeds in giving the customer the quality and continuity of service s/he desires, i.e the lights always go on when the switch is flipped. Having enough electricity and ways to get the electricity is called 'adequacy.' When the system is hit with some problem: lightning, over load, lines down, etc. and you continue to have electricity, it is called system 'security.' To meet reliability objectives from a planning perspective, NERC establishes Policies, Procedures, Principles, and Guides for planning reliable bulk electric systems and Policies for Interconnected systems operation (i.e. rules for planning and operation of the entire system). The regional reliability councils (regions), subregions, power pools, or individual systems have the primary responsibility for the reliability of bulk electric supply in their respective regions or areas. NERC's Planning, Policies, Procedures, and Principles and Guides provide a framework for these entities to develop their own detailed planning criteria or guides that reflect the diversity of individual system characteristics, geography, and demographics. [13] Each region submits a unique, tailored plan to accommodate its weather, conditions, terrain, population, etc. to NERC for review and acceptance.

6.0 System Operators

Today the country is served by approximately 150 separate control areas, each with its own system operator. The operators of these systems rely on communications with one other,

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Bulk power electric system--is a term describing the aggregate of electric generating plants, transmission lines, and appurtenant equipment. The term may refer to those facilities within one electric utility, or within a group of utilities in which the transmission lines are interconnected.
Reliability, in a bulk power electric system, is the degree to which the performance of the elements of that system results in power being delivered to consumers within accepted standards and in the amount desired. The degree of reliability may be measured by the frequency, duration, and magnitude of adverse effects on consumer service. Bulk power electric system reliability can be addressed by considering two basic and functional aspects of the bulk power system-adequacy and security.
Adequacy is the ability of the bulk power electric system to supply the aggregate electric power and energy requirements of the consumers at all times, taking into account scheduled and unscheduled outages of system components.
Security is the ability of the bulk power electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system components. [14]

access to essential system information, and real time monitoring and control of certain facilities to maintain system reliability. When an emergency occurs on the system, the control area operator takes action--both through communication and direct physical action--to ensure the integrity and security of the system. These people take and direct others to take the actions necessary to "keep the lights on" and to protect against damage to the entire system in the event of emergencies. [17]

7.0 The Transmission System

7.1 Basics

The transmission systems connect the generating plants to the distribution systems thus providing multiple paths from electricity suppliers to customers. The telephone network route signals from point to point; electricity cannot be directly routed over specific paths. Electricity follows all paths from source to destination based on the laws of physics; electricity flows in the path of least resistance. This means when you put electricity out into the grid from the generators, it will follow the available paths of least resistance (the electricity put out in Los Angeles could end up being used in San Francisco; who knows where it will go). This phenomenon (of taking the least resistive path), called "parallel flow[11]" sometimes results in overloading transmission facilities that are not part of the "contract" path, i.e. the electricity will flow into another region and overload that system and not flow to where the generator wants it to go--the purchasing customer.

A fundamental concept to understand is that there is no practical way to provide a specific, unique transmission path from a particular electric generator to a particular customer unless a radial (not part of the network) transmission line is built just for that connection. [7]

To ensure reliable and safe transmission systems, guidelines have been developed to

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[11]Loop flow occurs whenever a circulating power around a complete loop goes through a number of systems even while each system is supplying its own load from its own sources. It is not related to parallel path flow which results when power from one point in the system is transmitted to another and takes a number of parallel paths. Parallel path flow results from the delivery of power. [33]

keep the bulk electric system working as a whole entity. There are thousands of generating plants dumping electricity in the transmission system. Their electricity flows all over the place uncontrollably throughout the grid. All transmission system users must follow the same guidelines in order to keep the system from overloading and shutting down. We have seen blackouts through out the world because the transmission system becomes overloaded. If power companies followed these guidelines then the probability would be near zero for blackout occurrences.

Currently the North American Electric Reliability Council (NERC) sets the guidelines. In the past, blackouts have been rare because companies usually have followed NERC's guidelines. With competition and open access to the grid arriving, many concerns about reliability arise (Parts II & III).

7.2. Characteristics of Transmission Systems

1. Transmission systems must dependably connect the generating units to the distribution system.

2. Transmission systems must dependable connect the utility with neighboring utilities. These inter-utility ties are the key element of our highly reliable bulk electric systems. Evaluating how the system will respond to minor and major contingencies and bulk electric system component failures[12]. They must provide enough margin and flexibility to withstand major contingencies, hence providing system security.

3. Transmission systems must be flexible enough to allow a utility to fully utilize generating resources in the most economic manner. This involves unit commitment and economic dispatch.

4. Transmission systems must accommodate all known and planned long-term interchange contracts with neighboring utilities.

[12]In addition to major contingencies, the system must compensate for general maintenance of generation and transmission equipment, the forced outages of such equipment and a wide range of other system variable conditions such as construction delays, higher than expected customer demands, and generating unit fuel shortage.

5. Transmission systems must meet 1-4 while considering economics and environmental impacts. [7]

Transmission systems (1) reliably deliver electricity to the distribution systems and (2) connect utilities together to enhance reliability and (3) provide a means to exchange electricity. The complex network provides many electrical paths from a generator to key substations in its territory. The transmission substations connect to the distribution system which services customers with electricity. The substations also provide connections to other utilities. Connecting the generating units together through the transmission substations, a utility or ISO can: (1) "unit commitment"--selecting which generating units operate; (2) "economic dispatch"--optimize the economic electric generation among the operating units; (3) maintain Interconnection frequency; and (4) during sudden generator shutdowns they can quickly replace lost generating capacity. [7]

7.3 Wheeling--How Do you get Electricity from Ontario to Florida?

Wheeling involves moving power across a transmission or distribution system. Needed are a buyer, seller, and one or more utility in between to transmit-or wheel- the electricity. To ensure reliable electricity interchange, or wheeling, six rules must be followed.

1. The seller and buyer must have an interchange agreement

2. The time, price, and amount of electricity to be bought and sold should be agreed upon by seller and buyer

3. The ability to increase or decrease the output of generating units to cause the transaction to occur

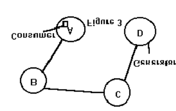
4. Transmission agreement must be made with any wheeling utility

5. There must be adequate transmission system capacity to accommodate the transaction and provide margins to handle contingencies

6. Agreements between the utilities to control the transactions on the network to maintain reliability [7]

7.4 Wheeling Example

A consumer in A (Figure 3) establishes a contract with the generating facility called D to provide 10 MW of power at 3:00 pm for $100. To get the power from D to A, interaction and wheeling contracts must be made with utilities B and C. Let us pretend the latter contracts have been established and utility D will be in charge of wheeling. [D will produce x excess energy for a period y and C will produce x less than D for a period y and the electricity will move from D to C because of the laws governing electricity; repeat until you get the electricity to the desired customer = wheeling] What happens is D will produce 10 MW more output than it normally does and utility C will produce 10 MW less than it normally does for a duration of time Q. Then, D will resume its normal output and C will output 10 MW above its normal output and B will decrease its normal output by 10 MW for a duration of X minutes. Finally, C will resume its normal output, B will output 10 MW above its normal generation, and the consumer in A will use the energy. After the wheeling, all the utilities return to normal operations. This model is very basic and does not reflex the complexity of a regular wheeling deal. Most often, the number of utilities involved are more than 4 aligned in a series network. The grid is set up to connect A to D to B and B to D and A, etc. The utilities are interconnected and do not have just one connection to the other utilities (grid). This complexity is the main reason technical challenges have arisen: the complexity of electricity transfer and generation.



PART II

HOW TO ENSURE RELIABILITY: RESTRUCTURING REGULATORY ISSUES

Many frameworks have been proposed to ensure reliability in a competitive market. Part II is my view on how the industry should be restructured.

1.0. Who Establishes Reliability Protocols (Reliability Policies, Standards, Principles, and

Guides)

The transmission grid must have rules protecting competition for all users, and there must be rules protecting the grid (reliability). Reliability should be clearly defined as: (1) generation adequacy; (2) transmission security; and (3) distribution outages and responsibility is different for each part. [28] With the transition of the electric industry to a competitive structure, it is critical to have a clear reliability management framework with focused responsibility and accountability. [35] Reliability is composed of four parts: (1) regulatory oversight; (2) policy; (3) oversight (monitoring and compliance enforcement); and (4) implementation. [34,35]

A broad based organization (like NERC) is the best option to define standards regarding the security of the bulk electric power system. [24] For 30 years, NERC and its member regions have overseen the reliability through the development of reliability protocols. Because NERC membership is made up of industry experts who understand the technically complicated interactions within the interconnected electric grids, NERC and its member regions should continue to be recognized as the preeminent authorities on reliability and should develop the mandatory protocols required to ensure reliability of the North American Electric systems. [35]

2.0. Quick Action to Change Reliability Standards, Policies, Principles, and Guides (Reliability Protocols) to Meet Changes in the Industry

Operating practices and policies will continue to change as new participants, structures, and contracts develop to meet specific customer demands. Procedures must evolve more rapidly to handle control area problems that surface in daily operations. NERC must streamline its ability to develop and implement new and revised policies that reflect the needs of the changing industry, while maintaining the reliability of the bulk electric systems. These policies provide the standards and rules necessary to keep the marketplace a reliable forum in which to conduct business. In general, the system of committees in NERC must be reviewed to provide more timely decision making. [30]

Former Secretary of Energy Hazel R. O'Leary wrote to President Clinton in the August 1997 Western Outages Report about how the institutions charged with maintaining reliability will have to evolve at a pace commensurate with the changes in the industry. The fluctuating competitive electric industry needs constantly updated standards and policies and this has been recognized by NERC, Industry, and Government. All segments, though, of the power supply and delivery industry--investor owned utilities, independent power producers, municipals and cooperative utilities, Federal Power Marketing Administrations, power marketers, and other emerging players--must also recognize that the benefits of a reliable system accrue to all participants. All users of the power grid must accept and operate under the planning and operating guidance developed by reliability entities (NERC) once they recognize the importance of a reliable interconnected grid.

As the industry changes during competition and markets grow larger from local to regional, entities responsible for reliability must identify, adapt, ameliorate, and plan for future changes in parallel to industry change. [31]

3.0. NERC Membership = Reliability Assurance

All entities engaged directly in the generation, transmission, or interchange of electricity (electric utilities, independent power producers, electric power marketers, control areas, etc.) that can affect the interconnected bulk electric system in North America must be members of the regional reliability councils (NERC member) in which they carry out their business or be otherwise recognized and certified by NERC as being accountable for compliance with applicable NERC reliability protocols. Membership contracts with NERC and NERC regional councils specifically state the intent of the organization and its members to comply with NERC and NERC regional reliability council protocols. [30]

4.0. Compliance Enforcement

NERC's compliance process will be based on:

a. Aggressive oversight, review and follow up on recommendations;

b. Active training, support, encouragement, and assistance to regional councils and their members;

c. Open, all-inclusive participation;

d. Use of alternative dispute resolution in lieu of sanctions, court actions, or referrals to regulatory bodies; and

e. A demand for excellence in the operation and planning of interconnected bulk systems, up to and including direct CEO involvement. [35]

4.1. Voluntary Compliance

As competition increases, fewer participants will be willing to do ‘more than their share’ for reliability. Compliance has not been perfect; there have been many cases on non-compliance. Some have been dealt with effectively through peer pressure, but quite a few have not. NERC Control Performance Criteria Survey reflects the numerous monthly NERC reliability protocol compliance violations. Voluntary compliance will not work in a competitive environment. Competitors do not cooperate, they compete. The existing cooperative and voluntary system for reliability management cannot survive in a competitive market. [35] Because overall network security depends on maintaining a continuous balance between supply and demand and having the ability to quickly adjust generation or load to relieve system security violations, it is paramount that effective compliance mechanisms be established. [30]

The North American Electric Reliability Council Board of Trustees voted unanimously on 6 January 1997 to obligate its regional and affiliate councils and their members to promote, support, and comply with all NERC reliability protocols. [36] Mandatory compliance obviate the need for government *prescriptive* intervention.

4.2.. Contractual Agreement. [30]

Parties may agree contractually to meet certain reliability protocols. Party A may require Party B to meet or exceed a standard as a requisite for doing business or for obtaining certification. Regional members may contractually agree to meet regional reliability protocols.

Consequences for non-compliance must be applied in a consistent, non-discriminatory manner.

4.3. Contractual agreements with regulatory mandate (FERC as a federal 'backstop') [35]

America has no fully self-regulating industry. Federally mandated regulators are found in industries concerning health and safety. Generally, however, regulation occurs as the result of a perception that a problem exists which will not be solved properly if left simply to market pressures.

Since the electric industry is and will continue to be a regulated industry, even contractual agreements carry with them an element of legislative backing in that such contracts require the approval of appropriate regulatory jurisdictions. Generally speaking, a regulatory body such as the FERC cannot delegate to NERC rule-making or rule-enforcing authority. However, FERC can approve contracts which stipulate performance requirements (compliance to NERC and regional reliability protocols) as a requisite to doing business.

4.4. Legal Mandate (legislation) [35]

Legally-mandated reliability protocols require the force and authority of the appropriate state, provincial, or federal body through the enactment of legislation. Legally-mandated sanctions may also include criminal fines and penalties. Under this form of enforcement, the appropriate body would adopt NERC reliability protocols as their own regulation. (The Securities and Exchange Commission adopts the rules developed and promulgated by the industry-run Financial Accounting Standards Board.)

5.0. Sanctions and Incentives for Reliability

NERC should develop and gain FERC approval for the incentives and sanctions that will be used to ensure compliance with reliability standards. [18] Incentives to ensure compliance usually take the form of certifications (market trade privileges or operators' licenses) to allow them to conduct business, or ratings that participants seek in order to reduce their costs. Such incentives are effective because they provide a financial incentive for the party to comply. For example, nuclear units that receive high ratings from the Institute for

Nuclear Power Operations (INPO) also experience lower costs in the form of lower insurance premiums. [35]

When business incentives cannot be developed or do not provide great benefit, sanctions in the form of fines or punitive prices must be enforced. A question which will readily occur is, what powers of enforcement would NERC command? Giving NERC 'power' to impose sanction would change it to a quasi-government bureaucracy, eventually as much concerned with measures of punishment as with measures of progress. [39] NERC regional reliability councils will monitor compliance with ISOs, State PUCs, and FERC for compliance. NERC will play a very active role in monitoring and giving input on compliance rules and standards. ISOs should try to work out noncompliance issues before recommending sanctions. If ISOs are not satisfied with the outcomes of their recommendations they should be able to defer to a government backstop for further assistance. FERC should be an objective, fair body to say what is fair and what the penalty should be with the powers to enforce the sanctions. For example, penalty-back financial decisions could be used to force customers off the system when necessary. After-the-fact assessments of very high costs for service (e.g. $90.000/kWh) are likely to be effective. [24] In noncompliance cases needing immediate sanctions, ISOs will use FERC guidelines on sanctions to implement immediate sanctions to preserve reliability.

6.0. Words

There is no simple implementation mechanism for a mandatory reliability management system covering the North American grid. FERC jurisdiction does not cover municipal utilities and federal power agencies. Federal legislation would not extend to the Canadian and Mexican portions of the North American grid. Hence, an industry initiative that leads to a mandatory system to which everyone subscribes through tariffs, interconnection agreements, and contracts with FERC backstop support of NERC reliability protocols may be the best solution or remedy.

FUTURE ROLES OF RELIABILITY INSTITUTIONS

7.0. United States Department of Energy

Congress has given DOE explicit but quite limited authority on reliability. [31] Legislation is required to clarify and define federal authorities. [24] DOE has explicit authority over reliability, and it is limited--recommend changes in proposed industry standards, change boundaries or regional reliability councils (RRCs), ask for reports on utility troubles. [34] The DOE should delegate reliability issues to FERC, an independent regulatory agency within the DOE.

8.0. Federal Energy Regulatory Commission (FERC) and other Regulators

FERC only exercises jurisdiction over 60-70 % of the power system. The system also involves Canada and Mexico -- clearly not under FERC jurisdiction. Legislation will be need to expand FERC's jurisdiction to cover municipals, Federal plants, and intrastate commerce intervention. [24]

FERC has economic regulatory responsibility for electric transmission. [18] Reliability has a cost. It includes the cost of personnel and equipment required to develop the rules and to monitor for compliance, as well as the cost incurred by participating entities to comply with the rules. The recovery of these prudently incurred costs to ensure reliable operation should be a function of federal, state, and local regulators. Maintaining the reliability of the bulk electric system requires economic principles, measurements, compensation, and sanctions. State and local regulators must support new approaches that are developed to ensure compliance with reliability rules, including financial penalties. [35]

FERC also has a responsibility to bulk system reliability on the grid. Chair Moler of FERC best put it when she recommended that Congress enact comprehensive electricity restructuring legislation and include provisions authorizing the Commission to enforce compliance with NERC reliability requirements. [37] FERC needs to assure compliance with NERC reliability protocols.

FERC's responsibilities:

1. Ensure all expenses of the reliability organizations, prudently incurred to meet

NERC reliability protocols, are fully recoverable from customers and market participants. [35]

2. Support, encourage, and approve ISOs as a means to have focused and independent reliability responsibility. [31, 35]

3. Issue sanctions for non-compliance, including being “economically disconnected” from the grid or otherwise prohibited from conducting business and aid in creating incentives for reliability protocol compliance. [35]

4. Provide a regulatory backstop by setting terms and conditions of transmission service: make mandatory reliability compliance part of transmission tariffs, interconnection agreements, conditions of marketing licenses, and agreements of ISOs and Power Exchanges. [31, 35]

5. Does not exist for generation, transmission, or distribution planning.

9.0. North American Electric Reliability Council

9.1. Responsive to Industry Needs and Changes

NERC must change to respond to the differences that competition will bring forth in the restructured industry. There will be many more players and a variety of types that will be participating in the new competitive market. [39] Restructuring involves a multitude of different groups and will require active support by these groups to achieve the goals of increased customer choice, reliability of service, and lower costs. [28] NERC is prepared for the change in industry by changing its by laws, having a new security coordinator, reducing the number of control areas, and requiring mandatory compliance. [39]

9.2. Reliability Protocols

NERC is the voluntary organization that has been the keeper of reliability for the past 35 years; it has set the standards by which the industry has functioned very well. [39] NERC must be recognized and supported by legislative and regulatory bodies (FERC) as the authoritative private-sector organization on the reliability of interconnected bulk electric systems. [18] NERC’s Task Force has a set of recommendations for NERC. They find and recommend [30]:

NERC will carry out its mission in the future by:
1. Establishing Reliability Policies, Standards, Principles, and Guides

2. Measure Performance Relative to NERC Policies, Standards, Principles, and Guides

3. Ensuring Conformance to and Compliance with NERC Policies, Standards, Principles, and Guides

To be effective in the changing electric industry environment, NERC must:

1. Be the leading in coordinating the reliable operation of interconnected bulk electric systems

2. Fairly represent the reliability interests of all participants in bulk electricity markets, whether or not they own transmission or generation

3. Be recognized and accepted by legislative and regulatory bodies as the authority on the reliability of interconnected bulk electric systems in North America

4. Establish, monitor, and enforce compliance with NERC reliability protocols, in a fair, non-discriminatory manner; resolve its own technical disputes; and work together with all industry participants to ensure the continued reliability of interconnected bulk electric systems in North America

5. Exercise initiative and independence with regard to performance measurement, reliability assessment, and compliance.

PART III

ENSURING RELIABILITY: TECHNICAL CHALLENGES = IMPLEMENTATION

1.0. Implementing Change

In addition to developing a restructured regulatory framework, it must be implemented. The challenge exists to create entities to manage the proposed framework. Changing regulatory policy to create ISOs is a policy challenge, while actually creating the ISO is a technical challenge.

1.1. Why worry about technical issues?

Competition, downsizing, restructuring, mergers, and curtailed spending are changing electric utilities and their attitudes toward the future. Utilities are changing their operations to prepare for competition. Not only are they reducing capital budgets, they are making substantial reductions in operating and maintenance budgets to become more competitive: this is where reliability and safety are affected.

Reduced budgets mean fewer linemen to build and maintain transmission and distribution facilities, fewer technicians to test and perform preventive maintenance on equipment, fewer spare parts, and an aging transportation fleet. A past chairman of one of NERC's regions said that increased competition is not compatible with improved reliability. He added that peer pressure, legislation and regulation will be ineffective in maintaining reliability when competition is the driving force.

The recent outages on the Western system raise new questions about reliability. In an era of increased competition and restructuring, the issue of reliability may be in opposition to the forces of cost cutting and marketing opportunities.

The recent outages on the Western system raise new questions about reliability. In an era of increased competition and restructuring, the issue of reliability may be in opposition to the forces of cost cutting and marketing opportunities. [16]

2.0 Independent System Operators (ISO)

2.1. Why do we need ISOs?

The US procedure for scheduling power interchanges (wheeling) is effectively turning from reliability and safety interests over much to commercial interests, whose primary objective is to maximize profits, not to minimize energy cost. These schedules are often being made without the knowledge or control of system operators, including operators of systems not directly involved in the purchase or sale. The need for operators to retain or regain control of bulk electric system transactions is pertinent to system reliability. This means that all scheduled interchanges must be reported to all the operators involved before being agreed to. The operator's role will then be to look at all of the schedules in combination and determine which ones are feasible, given the capability of the system.[21] Because overall network security depends on maintaining a continuous balance between supply and demand and having the ability to quickly adjust generation or load to relieve system security violations, it is paramount that an effective entity can be established to oversee these objectives. The design of ISOs will ameliorate most congestion and interchange problems. They are the best solution to which entity will enforce and oversee transmission issues in a restructured and competitive market.

2.2. ISO Analogy

The purpose of an ISO is to preserve and implement existing and future operational procedures and guidelines for ensuring the reliability of the interconnected grid in a transparent and non-discriminatory manner. Ralph Masiello describes an ISO as, "a non-profit, independent agency, above the fray, which determines how the transmission system is used--an air traffic controller of sorts." [26] An ISO would function like an air traffic controller. An air traffic controller has all flight information (planes departures and arrivals, number of passengers, routes, fuel supply, etc.) available in the flight tower. He uses all of the information to determine who lands and takes off. He tells planes when to leave, how long they must wait till departure, where to taxi, which runway to depart on, when to land, how long to circle, and which landing strip to use. The airplane follows what the controller says at all times because the controller has all the pertinent information needed to determine reliable and safe flights. The individual planes cannot coordinate the transactions to run an efficient flight industry. The controller does not own the planes, s/he just manages the system to keep it safe, reliable, and efficient.

An ISO has all generation, transmission, and distribution data (ATC, line loads, other ISO data, weather, etc.) available at the physical location of the ISO. S/he will use all of the data to schedule power transmission and other services. He tells power transmitters when, where, how long, and how much energy they can transmit. The power transmitters follow what the controller says at all times because the controller has all the pertinent information and experience needed to keep the ISO region interconnections safe and reliable. The controller does not own any part of the electric industry, he just manages the system to keep it safe, reliable, and efficient.

AIR TRAFFIC CONTROLLER ANALOGY	
All Flight Information:	**All Generation and Transmission Information**:
Plane departures and arrivals	Line Loads/Data
Number of Passengers	Weather
Fuel Supply	Supply/Demand Levels
Routes	Outages
Airport Conditions	Contingencies
Uses all Information to Tell Planes:	Uses all Information to Tell Transmitters:
When and where to leave and land	When, where, how long, and how much energy they can transmit

2.3. ISO Function

The mission of an ISO include:

1. Manage and have enforcement authority to conduct real-time operations of the interconnected grid for safety and reliability purposes (i.e. generation and transmission dispatch);

2. Coordination of transmission maintenance schedules;

3. Collection, analysis, and dissemination of information for system planning;

4. Developing and adopting tailored regional reliability standards, operational procedures and agreements, and safety procedures adapted for local conditions and specific application, in cooperation with NERC policies, criteria, and guidelines;

5. Implementation, monitoring, and enforcement of reliability standards and procedures to ensure that all bulk-power market participants comply fully with their reliability obligations;

6. Coordinate reliability issues with other ISOs-both real-time and forward-looking;

7. Planning to relieve transmission constraints;

8. Establish regional transmission tariffs (not just administer) with the approval of FERC;

9. Resolve disputes;

10. Conduct regional planning and establish a means to assure implementation of the plans (not just providing information and analysis for planning);

11. Facilitate (but not control) the market--Issue standards for market participation;

12. Ensure all market participants have equal and non discriminatory access to transmission services at just and reasonable rates approved by FERC. [18,19,22]

FERC Order 889 recommends the establishment, by industry cooperation, of ISOs. FERC supplies their own framework for ISO principles as follows:

1. The ISO's governance should be structured in a fair and nondiscriminatory manner.

2. An ISO and its employees should have no financial interest in the economic performance of any market power participant. An ISO should adopt and enforce strict conflict-of-interest standards.

3. An ISO should provide open access to the transmission system and all services under its control at non-pancaked rates pursuant to a single, unbundled, grid wide tariff that applies to all eligible users.

4. An ISO should have the primary responsibility in ensuring short-term reliability of grid operations. Its role should be well defined and comply with applicable standards set by NERC and the regional reliability council.

5. An ISO should have control over the operation of interconnected transmission facilities within its region.

6. An ISO should identify constraints on the system and be able to take operational actions to relieve those constraints within the trading rules established by the governing body. These rules should promote efficient trading.

7. An ISO should have appropriate incentives for efficient management and administration and should procure the services needed for such management and administration in an open competitive market.

8. An ISO's transmission and ancillary services pricing policies should promote the efficient use of, and investment in, generation, transmission, and consumption. An ISO or an RTG of which an ISO is a member should conduct such studies as may be necessary to identify operational problems or appropriate expansions.

9. An ISO should make transmission system information publicly available on a timely basis via OASIS.

10. An ISO should develop mechanisms to coordinate with neighboring control areas.

11. An ISO should establish an Alternative Dispute Resolution (ADR) process to resolve disputes in the first instance.

FERC's principles and the mission statement are have mostly parallel ideas. The latter has incorporated some of FERC Order 889's principles in addition to input and ideas from experts from the electric utility industry. ELCON [22] and other industry leaders have drafted models, guidelines, and operational guides for ISOs. ISO function and guidelines have not been set or confirmed by industry. The mission statement is a version of ISO principles extracted from various sources and ideas which I believe should be implemented.

2.3.1. Definition of how ISOs are "Independent"

ISOs must not have a commercial interest in the power market. The security function must be separated completely from commercial operation of the market to avoid conflict of interest. [24] This restriction will ensure that the ISO will have no bias in favor of or against generators who participate in the pool or as suppliers with direct access contracts. The ISO will own no generation, transmission, or distribution facilities, will have no affiliation with any companies that own those facilities, and will have no affiliations with any entity involved in energy generation, transmission, or distribution. [25]

2.3.2. ISO Dispute Resolution

The ISO must have its members agree to adhere to a dispute resolution procedure, otherwise a great deal of litigation may result. [26] Members are encouraged to resolve disputes through the ISO. If the ISO is unable to handle the dispute, FERC should step in as a 'backstop' to litigate the situation. FERC and ISOs want to avoiding lengthy and costly lawsuits in a competitive, vicious market.

2.3.3. Generation commitment enforcement by ISO

Framework is needed to ensure the ability of the system operator to commit and dispatch generating resources, which will be needed for reliably operating the transmission system and providing ancillary services. It is clear ISOs must control generation commitment, hence enforcement rules must be defined for ISOs.

2.4. ISO Information Exchange

Restructuring will result in bigger networks under real time supervision and control and stakeholders will want to be sure that all actions and answers are correct. Improved system simulations and information exchange capabilities are technological needs. Computer software can be written to deal with the former; the latter needs attention because many control centers use out-dated computers, use inadequate software, and have insufficient personnel training to handle 'high' technology software and computers. [26] These problems are easily ameliorated.

There must be continuous exchange of information to ISOs from all power entities to achieve reliability. However, much information transmitted today between companies may be considered commercially sensitive in a competitive generation market. The number of participants and quantity of information will be greatly increasing. Rules must be developed to assure the system operator will have the information available to operate the system reliably. [27] The policies, guidelines, and/or missions governing ISOs must have enforcement powers. (See enforcement: Part II, Section 5.0 Sanctions and Incentives)

2.5. ISO oversight of Ancillary Services

Ancillary services are any service provided in support of the transmission grid to transport electricity. Some ancillary services such as reactive power support and frequency regulation are required to regulate the power system. Others such as operating reserves are required to provide reserve capabilities to help sustain the power system in the event of a major system disturbance or loss of critical facilities. Both regulation and reserve type ancillary services can typically be supplied by generators. FERC has defined six classes of ancillary services in Order 888 (see table in Part I, Section 3.4). NERC has developed a broader class of services called interconnected operations services (IOS). FERC's ancillary services are those NERC IOS services which FERC requires transmission providers to include in their open-access tariffs. FERC believes that the other IOS services--e.g. losses, dynamic scheduling, and backup generation services--are more appropriately provided for in a separate service agreement or other contractual arrangement. FERC's non operating reserve ancillary services must be provided at the control area under the direct supervision of the ISO.

2.6. A Fledgling ISO

The Electric Reliability Council of Texas (ERCOT) began an ISO operation in September 1996. The Texas Legislature allowed the formation of an ISO for Texas (Most of Texas is covered by ERCOT so it is easy to establish an ISO; other reliability councils are composed of many states and hence many state public utility commissions. It is difficult to coordinate the agreement between many states for the formation of an ISO.). The ERCOT ISO responsibilities and authority include:

1. Real time system monitoring such as control area load, spinning reserve, ACE, scheduled and actual net interchange, critical transmission component loading and system frequency;

2. Longer term system monitoring such as control area daily and next day planning, transmission clearance requests and generation overhaul schedules;

3. Response to system contingencies such as line loading relief, load shedding, schedule curtailment, redispatch, and ordering emergency energy schedules;

4. Administration of the ERCOT OASIS including calculation, posting, and update of ATC;

5. Transmission tariff administration, transmission reservation approval, ancillary service verification, and energy transaction scheduling;

6. Transaction accounting; and

7. Coordination of Regional transmission planning for future planned transactions. [23]

ERCOT and the Texas Public Utility Commission are currently revising ISO responsibilities and authority after its initial evaluation. Though, the adjustments are minor, the evaluation by ERCOT and the TxPUC shows current ISO theory principles work in application. Each region needs tailored rules, but ISO principles will transcend throughout each ISO region. As California enters a competitive market and other states begin to form ISOs, Power Exchanges, etc., the principles for ISOs will become apparent: hence allowing for standards to be set.

2.7. ISO wrap-up

Again, ISOs are in the process of being defined. They are not required and do not have set rules at this time. Industry is aware of the need for ISOs in the emerging era of retail and wholesale competition. The challenge is to devise an ISO which meets industry needs. I have attempted to recommend an ISO structure to be used in the restructured, competitive market. As industry restructures and ISOs are implemented, ISO operating principles will be refined to fit industry needs.

3.0. ISO Alternatives

ISOs are not the only mechanism for an organization for transmission. The following two examples are summations of alternatives to ISOs. Though most of industry agrees ISOs are the best way to handle the new market, other ideas are present and need addressing. ISOs are the best way to regulate and operate the bulk electric system in North America. These are just other theories, and they are executable; I prefer the implementation of ISOs to handle the reliability management of the future bulk electric system.

3.1. Wide Open Load Following (WOLF)[13]

WOLF is a new automatic market-based pricing mechanism that mimics the actions of a competitive marketplace. Shortages of electricity, as measured by substandard frequency (any imbalance between supply and demand changes the frequency of the system), automatically and continuously increase the price of electricity. Similarly, surpluses of electricity automatically decrease the price of electricity. The result is a series of real-time, market clearing prices. This mechanism is best used when many buyers and sellers of

[13] Mark Lively's WOLF system for Real-time reliability based electricity pricing paper will be presented at The International Symposium on Product Quality and Integrity, January 19-22, 1998 in Anaheim, California USA.

electricity are willing to react to a market price. [32]

3.2. Son Of WOLF (SOW)

SOW is a variant of WOLF that is applicable when there are a limited number of participants in the marketplace. The utility defines a price function in terms of a market fuel and frequency. The current fuel price and the average frequency during each time period uniquely determine the price paid for electricity during the time period. SOW can be interpreted as defining a utility's input/output curve, relating fuel cost to electricity prices. [32]

4.0. Poolco vs Direct Access [28]

There is a convergence on ISO functions. System reliability and proper transmission system operation is the responsibility of the ISO. The debate, though, rivets on how to increase competition and consumer choice: Poolco (Power Exchange) vs. Direct Access.

4.1. Poolco

Poolco greatly expands ISO authority to create and operate the primary energy market. Under the Poolco structure, ISOs set energy prices for each 30 minute period at each location, require that all energy suppliers sell to and customers buy from Poolco, and then assesses transmission charges for each transaction. This allows generation costs to be minimized and eliminates transmission congestion. To achieve this goal, Poolco will collect cost data for each generator and demand data for each load.

4.2. Direct Access

Direct access restricts ISOs' role to system stability and security. Producers and customers make direct contracts and communicate energy transactions to ISOs with no pricing information. The ISO approves the transaction if there is no transmission congestion: changes in transactions are negotiated in case of congestion. ISO assesses transmission charges according to formula. To achieve these goals, the ISO does not need cost or demand data. [28] Table 1 compares the two.

POOLCO	DIRECT ACCESS
Modeled on UK system	Modeled on US commodity markets
Central authority over generation and transmission pricing	Market creates necessary institution; ISO prevents transmission congestion
Consumer buys only from Poolco, hedges risk via financial derivatives	Consumer contracts directly with producers for prices and other terms
Separate treatment for wheeling	Wheeling like other transactions
Requires private cost, benefit data	Requires no dat on cost or benefit
Standardization on energy commodity ; limits innovation	Direct trades; encourage innovation

4.3. Options

CUB has been adopted by Texas and Florida PUCs. Purchasing utilities determine the capital, operating, and fuel costs it would expect to incur over the life of its next committed unit. These costs are converted into a series of capacity and energy payments that would be payable over the life of the committed unit. Contracts contain these prices. CUB is a pricing mechanism for utility contracts with independent producers. It develops annual shadow prices which are the financial equivalent of the utility owning its own generator; it also financially equivalent to publicly owned generation but without the burdens of raising public financing for generating projects. [32] CUB is used in conjunction with the ERCOT ISO. CUB is similar to Poolco in that it is a pricing mechanism.

4.4. Conclusion

In 1998, California will function with a Poolco/ISO structure. The benefits and costs of the Poolco/ISO structure will be quickly observed. Direct access has been used within ERCOT and the Direct Access(CUB)/ISO structure in ERCOT seems to function. The Poolco/ISO structure in California may prove more cost effective in competition and will alter perspectives on direct access. The outcomes are awaited.

5.0. Generation

Generation technology in combined cycles, nuclear-standard and reprocessing, distributed technologies, and "green power" (of which there are several choices, and they are expensive choices) are not issues in restructuring; the technology is updated and not lacking. [29]

6.0. Metering Problems

Customer metering and billing problems that will arise under retail access will be more of the form involving procedures, administration, verification, tracking, and customer "churning," rather than equipment technology. [29] Residential meters currently used cost about $20 and last forever. They are simple gear driven mechanical devices which do not need replacement. New residential electronic 'smart' meters will cost $150 and no one knows how long they will last. Electronics break and deteriorate over time, unlike simple gear mechanisms. [40]

Metering functions will change under real time pricing. If the price of power changes every hour, payment should be made for how much is used and when it is used--need electronic 'smart' meters and communication systems to collect this information. [26] 'Smart' meter technology is available and newer models are easy to design. The meter technology is not an issue; the verification of customer billing creates technical problems. [40]

Current utility accounting and billing practices cannot be transferred as such to work in a restructured industry. [26] Currently electric bills are estimated. Utility companies read meter dials to see how many kWh are used per month and then they use an estimated price to devise a bill. Individuals can read their own meters in the backyard to see if the electric companies are charging them correctly; there is no question of the amount of consumption per month.

The issue in a restructured market is how do energy companies verify electricity consumption at specific times, prices, amounts, and locations. Energy companies can produce bills, and they must also be able to defend their bills. Meters monitor energy consumption at their times, prices, locations, and demand/peak times. The energy company can then download the information to their computers for analysis and bill production. The problem arises not in meter technology or downloading/communications capability but in storing and sorting data. If energy prices change ever hour, then meters record data in the area of 24 (hours) x 30 (days) x 6 (months). Storing this amount of reproducible data is a technical task for energy distribution companies. The 24x30x6 is for each household; think about for the entire nation. Billing verification is a product of competitive industry and needs to be handled outside of regulatory intervention. The market will ameliorate the problem. [40]

7.0. Putting it all together = Reliability Management

Figure 4 puts together reliability management in a clear diagram. [30]

RELIABILITY MANAGEMENT

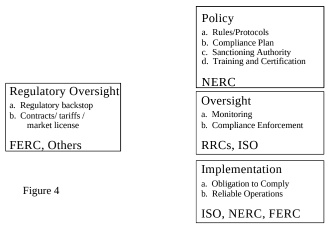


Figure 4

Part IV

POLICY ALTERNATIVES/LEGISLATION [41]

1.0. H.R. 338 (Stearns)

Prospectively repeals Section 210 of the Public Utilities Regulatory Policy Act of 1978 (PURPA), the mandatory purchase requirement provisions, as of January 7, 1997. Introduced January 7, 1997; referred to Committee on Commerce.

2.0. H.R. 655 (Schaefer)

Comprehensive restructuring of the electric utility industry, focusing on development of retail wheeling and competitive markets. Requires states and nonregulated utilities to allow retail wheeling by December 15, 2000, with FERC takeover of authority if not achieved by then. Also provides exemptions from PUHCA (Public Utilities Holding Compact Act of 1935: enacted to eliminate unfair practices and other abuses by electricity and gas holding companies by requiring federal control and regulation of interstate public utility holding companies) and section 210 of PURPA for utilities that states determine provide retail services on a neutral and non-discriminatory basis. Introduced February 10, 1997; referred to Committee on Commerce.

3.0. H.R. 1230 (DeLay)

Comprehensive restructuring of the electric utility industry, focusing on development of retail wheeling and competitive markets. Requires retail competition by January 1, 1999, with FERC enforcing the mandate. Also provides exemptions from PUHCA and section 210 of PURPA for utilities that states determine provide retail services on a competitive basis. Introduced April 8, 1997; referred to Committee on Commerce.

4.0. S. 237 (Bumpers)

Comprehensive restructuring of the electric utility industry, focusing on development of retail wheeling, competitive markets, and full stranded cost recovery. Requires retail wheeling by December 15, 2003, with federal judicial remedies available for aggrieved parties. Also reforms PUHCA effective one year after enactment, and section 210 of PURPA effective on December 15, 2003. Introduced January 30, 1997; referred to Committee on Energy and Natural Resources.

5.0. S. 621 (D'Amato)

Repeals PUHCA and replaces it with the Public Utility Holding Company Act of 1997. State regulators would maintain limited access to specific utility books and records. Introduced April 22, 1997; referred to Banking, Housing, and Urban Affairs Committee. Hearings held April 29, 1997.

6.0 S. 687 (Jeffords)

Encourages state programs for renewable sources, universal and affordable electric services, energy conservation, research and development; repeals PURPA and replaces it with a renewable resource portfolio program; and, mandates nationwide sulfur dioxide, nitrogen oxides, and carbon dioxide emission standards for electric generation facility. Introduced May 1, 1997; referred to Committee on Energy and Natural Resources.

7.0. S. 722 (Thomas)

Empowers states to initiate retail competition programs by clarifying state-federal jurisdictions. Also provides for reciprocity between states that have retail competition and those that do not. Other provisions include the repealing and replacing of PUHCA 18 months after enactment and the amending of section 210 of PURPA for future contracts as of enactment. Introduced May 8, 1997; referred to Committee on Energy and Natural Resources.

8.0. State Legislation

Edison Electric Institute distributes a newsletter monthly on the status of restructuring within each state. The report is called: "Current Status Summary, The States: Leaders in Electric Power Industry Restructuring." Monthly and quarterly updates are available from Edison Electric Institute. For more information contact Alice Travis at 202.508.5691. [42]

PAPER CONCLUSION

Restructuring provides increased choice of suppliers and distributors, promotes competition among generators and distributors, will compensate in varying degrees utilities for stranded costs, however, system reliability must be maintained and transmission congestion and contingencies need to be avoided and manageable. While the traditional reliability institutions and processes have served us well in the past, these institutions and processes need to be modified to assure that reliability occurs in a competitively neutral fashion, without favoring one or another set of market participants. To attempt to accommodate these new reliability issues that arise with competitive markets, today's existing reliability institutions must undertake new initiatives secure reliability. Outlined in figure 4 and throughout the essay sum up my projections and recommendations for the reliability management for the restructured industry.

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Acronyms:

ADR--Alternative Dispute Resolution

AFCE--Alliance for Competitive Electricity

ATC--Available Transfer Capability

CUB--Committed Unit Basis

DOE--United States Department of Energy

EEI--Edison Electric Institute

ELCON--Electricity Consumers Resource Council

EPAct--Energy Policy Act of 1992

ERCOT--Electric Reliability Council of Texas

FERC--Federal Energy Regulatory Commission

FPA--Federal Power Act

IEEE--The Institute of Electrical and Electronics Engineers

IOS--Interconnected Operations Services

ISO--Independent System Operator

kWh--kilowatt hours

MW--Megawatt

NERC--North American Electric Reliability Council

NOPR--Notice of Proposed Rulemaking

OASIS--Open Access Security Information System

Poolco--Power Exchange

PUC--Public Utility Commission

PURPA--Public Utility Regulatory Policy Act of 1978

RRC--Regional Reliability Council

SOW--Son of WOLF

StPUC--State Public Utility Commission

U.S.C.--United States Code

USDOE--United States Department of Energy

WOLF--Wide Open Load Following