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What is Happening with Independent System Operators?

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What Is Happening With Independent System Operators?

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I. Introduction

Emerging ISOs appear to have many advantages for the wind power industry. This paper compares some past research on wind and transmission issues with some of the developments in ISO design and implementation.

Independent system operators (ISOs) are created when a transmission-owning utility, or group of transmission-owning utilities, transfer some or all operating control (but not ownership) over designated transmission facilities to an independent, nonprofit, or not-for-profit organization. ISOs may or may not operate a control area; dispatch transmission; run a power exchange or spot market; administer an ancillary services market and deliver ancillary services; conduct transmission planning; and, with transmission owners, expand transmission capacity.

ISOs became an industry topic in 1995 when a bitter standoff in California between advocates of a central pool ("poolco") and advocates of direct contracts between parties agreed to a separate power exchange and a separate system operator (the ISO, in this case). Since then, another nine ISOs are in various stages of discussion, negotiation, formation, and operation as of early 1998 (see Table 1).[1] This includes the Texas ISO that is operating in the Electric Reliability Council of Texas (ERCOT) and is not under jurisdiction of the Federal Energy Regulatory Commission (FERC). This amount of ISO activity suggests that the electric power industry has moved from an open access transmission world that is focused on individual utilities, to an ISO world in which efforts are devoted to developing a regional transmission tariff and an institution to support the emergence of regional power markets.

ISOs offer the potential for combining the now balkanized transmission system into several regional networks, perhaps with consolidated control areas and a single regional transmission tariff with little or no “pancaking” of transmission rates. Pancaking of transmission rates occurs when power is shipped over more than one transmitting utility’s system, and the transmission customer pays for the capacity shipped over each utility’s system. In other words, a transmission customer who transmits 100 MW over three transmission systems pays for 300 MW of service. ISOs may also provide at least an interim solution for those that prefer divestiture of transmission by avoiding some of the legal difficulties of divesting transmission facilities that have been constructed with public and/or tax-exempt financing, and it allows policymakers to move ahead with restructuring initiatives.

Even so, attempts to form some ISOs have resulted in considerable difficulty. In December 1997, a group of utilities led by FirstEnergy broke away from the planned Midwestern ISO to explore forming a smaller, “sliver” ISO that would lie between the Midwestern ISO and the New England ISO (NE-ISO) and Pennsylvania-New Jersey-Maryland (PJM) ISO in the eastern United States.[2] More recently, negotiations to form the Indego ISO, encompassing the Pacific Northwest, were suspended when the Bonneville Power Administration indicated it would not join, prompting many other utilities in the region to withdraw as well.[3]

Table 1: Summaries of ISO Proposals

Name	Planned Operation Date	Proposal Status	States Included	Power Exchange (PX)?	Control Areas	ISO Grid*	Congestion Pricing	Trans-mission Tariff
ISO-NE	Began Operating In July 1997	Condition-ally Approved	CT, MA, ME, NH, RI, VT	ISO is PX	Single	69kV and up	Out-of-merit when capacity available	Postage stamp
NY ISO	Q4 1998?	Before FERC	NY, part of NJ	Separate PX	Single	115kV and up	LBMP	Zonal
PJM Inter-connection	4/1/97	Approved	DC, DE, NJ, PA, MD, VA	ISO is PX	Single	69 kV and up	LBMP; fixed transmission rights for firm transmission service	Zonal
CA ISO	3/31/98	Approved	CA	Separate PX	Single	60 kV and up	User pays through adjustment bids	Zonal
ERCOT ISO	12/96	TX PUC approved	TX	No PX	Multi	69 kV and up	Re-dispatch; all users share costs	Postage stamp w/dist.
IndeGO	N.A.	Negotia-tions suspended	CO, ID, MT, NV, OR,UT, WA,WY	No PX	Multi	230 kV and up	Bids to reverse flow	Zonal
Midwest ISO	1999	Before FERC	IL, OH, KY, IN, WI, IA, MI, MN	No PX	Multi	100 kV and up	Re-dispatch, all load share costs	Zonal
Desert Star	2002	In planning	AZ, NM, TX, NV	No PX	Multi	230 kV and up	Bids to reverse flow or by auction	Zonal
MAPP ISO	Late 1999	FERC filing in fall 1998	IA, MN, NE, ND, MT, WI., SD, IL	Under Investiga-Tion. May be part of ISO or separate.	Multi	Filing for utility facilities to be in ISO in prepara-tion.	Redispatch all users share costs. Rate 110% of costs or $100/MWh	Zonal, flow-based pricing
Alliance ISO	N.A.	In planning. FERC filing expected in 1998	MD, MI, OH, PA, WV, VA	Initially, ISO is PX. May be separated.	Multi	100 kV and up	LBMP	Zonal

* General characterization of ISO-controlled facilities; many higher and lower rated facilities may be included or excluded.

Source: See note to Table 1 at the end of the paper. Information on the Desert Star, MAPP, and Alliance ISOs should be viewed with caution, as negotiations over their formation are ongoing, and provisions may change.

A primary reason for some transmission owners' reluctance to join ISOs is the difference in transmission rates among transmission owners, which can differ by as much as a factor of seven. As a result, transmission owners express concern that costs may be shifted from transmission owners with lower rates to transmission owners with higher rates. Therefore, although ISOs offer the potential of single tariffs and rates, almost all ISOs must go through a transition period before getting to this state. Generally, this involves creating transmission zones corresponding to the service territories of transmission owners; transmission customers pay the rate corresponding to the zone where the load is located. Even with this transition period, some transmission owners fear they may not recover their costs if they join an ISO.[4]

Furthermore, some transmission owners, or other market participants, may be reluctant or unwilling to join an ISO because of concerns that the tax-exempt financing used for these facilities may be jeopardized if for-profit market participants use them. Though investor-owned utilities control more than 70% of the nation's transmission, the reluctance of municipal utilities and/or rural cooperatives to participate in an ISO may have important regional implications. For example, concerns about tax issues have been at least one of the reasons why the Los Angeles Department of Water and Power, holder of 28% of the state's transmission, has not joined the California ISO.[5] In addition, Bonneville Power Administration, controller of most of the transmission in the Pacific Northwest, believes congressional legislation may be required before it can join an ISO.

Consequently, there are concerns that ISOs may be too small, and/or that there may be "holes" in an ISO caused by parties that choose not to join. This issue may effectively minimize or even nullify the potential of one-stop shopping for transmission. Also, pancaked rates may not entirely disappear if there are many small ISOs, rather than a small group of large ISOs, although pancaked transmission rates may arise in a different way. Pancaked transmission rates may occur in transactions between ISOs or between ISO and non-ISO members. Therefore, the goals of avoiding pancaked transmission rates and developing regional, efficient electric markets or transmission markets may not be reached if ISOs are too small.

These developments have prompted re-examination of several issues. Are ISOs a permanent institution or merely a stepping stone to an independent tariff administrator or transmission-only companies? Can the electric power industry form ISOs voluntarily or must it be coerced into doing so? Should FERC intervene, and does it have the regulatory authority to do so? Should possible national restructuring legislation include ISO provisions that specify minimally acceptable ISOs and require utilities to join or commit to an ISO? FERC recently held a 2-day technical conference in Washington, D.C., addressing these and other ISO-related questions.

II. Transmission Issues of Interest to Wind

In 1996, FERC issued Order 888 that, among other things, directed electric utilities under its jurisdiction to file new transmission tariffs allowing open transmission access to wholesale entities. Also about that time, the first filings towards establishing the California ISO were filed at FERC. The American Wind Energy Association (AWEA) filed comments in Order 888, in the environmental impact statement to Order 888, and in the California ISO.[6] In addition, the National Wind Coordinating Committee (NWCC) has sponsored research that examines transmission issues and wind energy technologies.[7]

Among other things, the AWEA and NWCC documents suggest the following issues are important for wind:

- Development of flexible transmission services
- Consequences of schedule deviations or delivery imbalances
- Requirements for ancillary services
- Congestion management and pricing.

This paper compares some of the findings in these documents with ISO proposals and tariffs and discusses some of the provisions relevant to wind power. In general, more attention was paid in this paper to transmission provisions of the ISO rather than how the ISO is structured or voting and governance rights of members and directors of the ISO. Also, wind companies may consider certain strategic business elements, such as selling wind output to a third party that may market the power into a power exchange; matching output with a gas generator; or using various financial risk management tools. These elements were not addressed in this paper so that the issue of how wind would fare under certain ISO proposals could be assessed.

III. ISO Provisions of Interest to Wind

Availability of Transmission Services

In its Order 888 comments, AWEA called not only for the availability of firm and non-firm, point-to-point transmission service, but also monthly or seasonal options to better reflect the seasonal nature of the wind resource. However, FERC was reluctant to adopt proposed changes in transmission services such as AWEA's flexible transmission proposal when it adopted Order 888 in 1996. FERC stated it was introducing enough change and complexity by requiring every utility under its jurisdiction to file open access transmission tariffs without adopting additional changes in industry practice or policy.

At this time, wind companies face a difficult choice when deciding what transmission service to pursue. A wind company can purchase firm transmission service and be guaranteed service around the clock, subject to emergency curtailments or system congestion. However, because wind is a relatively low-capacity factor technology, a wind company may not be able to use firm transmission service at all times. In theory, a wind company can sell the transmission capacity it does not use, but a secondary market in transmission capacity has been slow to develop. Therefore, a wind company runs the risk of paying for transmission capacity it cannot use when the wind resource is unavailable.

In contrast, non-firm transmission service is more economical than firm transmission service, can be scheduled with short notice and for shorter terms of service, and is perhaps more suited to hourly variations in wind output. However, non-firm service is subject to curtailment and interruption, often with little or no notice by transmitting utilities, leaving the possibility of wind generation but with unavailable transmission.

It appears that by forming ISOs the electric industry may introduce new varieties of transmission service beyond the usual firm, non-firm, and network-transmission service. Though it may not exactly match the flexibility of service by month or by season that AWEA called for, it comes reasonably close. For example, the MAPP ISO will offer non-firm transmission service and allow service to continue during times of transmission constraint but will impose a congestion charge of up to $5 per megawatt-hour (MWh). The MAPP transmission tariff is still being developed, but

presumably a generator may opt to go off line rather than pay the congestion rate. However, a generator that offers reverse power flows to relieve congestion may pay little or no congestion charges. Furthermore, while Order 888 requires that firm transmission service be made available for periods as short as one day, at least one ISO—the NE ISO—is offering firm transmission service for periods as short as one hour.

Nevertheless, greater conditions may be imposed on non-firm transmission service than in the past. The proposed Desert Star ISO may require users of non-firm transmission service to have reserve capacity available as back up, which is unusual for non-firm service. Such restrictions may indicate the level of discomfort transmission owners are experiencing as they move into a market structure with more players and non-traditional entities. It also may indicate that such a rule is designed for conventional firm generation without taking into account the characteristics of wind generation.

In addition, the NE-ISO may impose non-usage charges for firm and non-firm transmission capacity holders that do not use their capacity. The NE-ISO wants to encourage the maximum utilization of the region's transmission system and prevent parties from hoarding transmission capacity. The NE-ISO also has proposed allowing transmission users to bid for transmission capacity if there is more demand for transmission capacity than supply.

Finally, if there is more demand for transmission capacity then is available supply, generally all of the ISOs allow for firm transmission service to displace non-firm transmission, and for longer-term firm transmission service to displace shorter-term firm transmission service. Holders of non-firm or short-term firm transmission capacity may be offered the opportunity to upgrade their service if they are going to be displaced otherwise. Therefore, wind companies deciding to use non-firm or short-term firm transmission service need to be aware that they are subject to displacement.

Scheduling and Deviation Penalties

AWEA and others have suggested that the intermittency and unpredictability of wind makes it optimal for wind companies to submit bids to a power exchange as close to the time of delivery as possible. Even so, Order 888 allows transmission owners to levy deviation penalties if power delivered varies by 1.5% above or below scheduled amounts. If wind companies were required to bid a day ahead of actual delivery, then they would have to balance the risk of scheduling and deviation penalties for not being able to deliver as scheduled. Indeed, a wind company may not bid at all if confidence in the wind resource is marginal, meaning that the market may lose wind resources if the resource is available but a bid was not submitted.

So far, however, all of the ISOs with power exchanges have proposed requiring the submission of load and demand schedules a day in advance, with the hour-ahead schedules used for settling accounts and providing emergency energy. While wind may be best suited for bidding into an hour-ahead or real-time market, the complexity of creating a power exchange, installing the necessary software and hardware, and running the exchange may make ISO administrators reluctant to make the hour-ahead market as vibrant as the day-ahead market. For example, about $300 million has been spent on developing the California ISO and PX, yet certain provisions will be gradually phased in over 2 years.[8] Two exceptions are the New York Power Pool ISO (NY ISO), which will allow generators to change their bids or to submit new bids, and the PJM ISO, which allows parties to request new, non-firm service in the hour-ahead market.

This means, in most cases and at least for some transition period, that wind companies will have to bid into the day-ahead market if they wish to bid into a power exchange. There is good news,

however. The ISOs with power exchanges plan to either pay or charge some portion or all of the prevailing spot market rate for energy deliveries that are either over or under schedule. Failing the development of a spot market that goes beyond account settlement and reliability, this may be the best the wind community can hope for, at least with the current crop of ISOs. This could also mean that ISOs without a power exchange may be more likely to follow Order 888 requirements in imposing deviation penalties, although it is difficult to predict with precision because non-PX ISOs are still forming or awaiting a FERC order and are not operating.

Another possibility for wind may be private market power exchanges, which may arrange transmission service from an ISO but may offer terms and conditions that are more conducive to wind. The Automated Power Exchange (APX) in California, for example, has a green power market segment that can automatically match buyers and sellers of renewable energy through a spot market. The APX accepts orders starting a week ahead of deliveries and stays open continuously until the ISO's deadline for submitting schedules. This allows sellers and buyers to schedule deliveries and purchases in advance of renewable energy production, which helps to reduce price uncertainty.

The emergence of individual, and even multiple, private market power exchanges are an interesting contrast to the initial ISOs that featured a power exchange integral to the ISO, i.e., the California, NE-ISO, and PJM ISOs. Indeed, the newer, proposed ISOs have specifically cited the cost and complexity in developing a power exchange, and the interest of market participants in forming their own power exchanges, as reasons for not including a power exchange with an ISO.[9]

Changes in Types of Transmission Service

While the idea of offering more flexible transmission service has had some momentum, there also has been a counter-movement to collapse the types of firm and non-firm transmission service into one kind of transmission service available for all transmission customers and owners. With Order 888, FERC released a proposal to create a single transmission service called the capacity reservation tariff, or CRT. However, industry concerns about complying with Order 888 prompted FERC to put the CRT notice on hold.

With the advent of open access, transmission owners have expressed concern that transmission users may take advantage of point-to-point or flexible point-to-point service and occupy transmission capacity at peak times at low cost. For this reason, momentum has built among transmission owners to try to convert transmission users to a single transmission service, generally network service. Network service may offer wind an advantage by granting access to the entire ISO transmission system at a single rate.

However, network service is generally a premium service and priced as such, meaning a wind company may get more service than it really needs. In addition, wind companies may run into the same take-or-pay issues with point-to-point transmission service. Finally, collapsing transmission service into a single service may conflict with the desire of some wind interests to have as flexible a transmission service as possible. This implies that more types of transmission service are probably better than one.

Ancillary Services

In Order 888, FERC directed transmission owners to offer customers six ancillary services, with two provided only by the control area operator. Several analysts have expressed concern about the possible impact of ancillary service charges on wind because of these FERC requirements.[10]

So far, there appear to be two ISO models for ancillary services. One is a daily competitive market auction for ancillary services, conducted or facilitated by the ISO. This is the approach commonly used by ISOs with power exchanges, such as the PJM and NY ISOs. The second model is one in which transmission customers or owners provide ancillary services, with the ISO acting as a provider of last resort. The California ISO and PX plan a competitive auction for ancillary services, but the California ISO also has some must-run contracts with generators, both to protect reliability and to ensure ancillary services are provided.

In Order 888, FERC expressed concern that there may be only a few ancillary service providers and required that ancillary service tariffs be filed at FERC at "just and reasonable" rates until further notice. AWEA, in its Order 888 comments, expressed similar views. Recently, FERC said it is open to proposals for market-based pricing of ancillary services.[11]

It may be time for the wind industry to consider supporting market-based pricing of ancillary services. Recent work at Oak Ridge National Laboratory suggests pricing for ancillary services could differ significantly under a market-based pricing as compared to embedded-cost pricing.[12] It is also possible that ancillary service providers may become more creative and provide packages tailored to wind's needs, such as "on-call" services or ancillary services made available on an hourly basis. Dynamic scheduling (the electronic transfer of a generator or load from one control area to another) may also help wind in accessing more favorable market conditions or to combine wind resources to secure a more favorable performance profile.[13]

Congestion Management and Transmission Pricing

Congestion can occur if the sum of energy bids or transmission transactions is greater than available transmission capacity; some form of mitigation is required. So far, ISOs have proposed two approaches: (1) to assume any difference in energy costs between two locations is attributable to congestion (LBMP), or (2) to do out-of-merit dispatch and to assign the costs to all transmission customers or the customer that is contributing to transmission congestion.

LBMP measures the price of energy at two different points, based on the idea that there should be no difference in energy costs between two points other than for transmission constraints. If there were a difference, lower-cost energy would be transmitted to the higher-cost point, driving the cost of energy down to where the costs at those two points would be the same. Constrained transmission would cause the price at the two points to differ, because lower-cost energy could not get to other parts of the transmission system. The difference in prices between the two points is attributed to congestion, and parties with bilateral contracts using the congested lines must pay congestion charges if their transactions are to go forward. If transmission constraints become severe and congestion charges are correspondingly high, some believe that transmission customers would move to expand transmission capacity in some way. FERC has approved the LBMP in the PJM ISO, and LBMP is proposed for the NY ISO and is under consideration in the Alliance ISO.

The California ISO also relies on the difference in energy costs between two points to determine whether there is congestion or not. However, for the California ISO, congestion triggers a series of

communications between the ISO and the affected scheduling coordinators to try to resolve the transmission constraint. The ISO sends the affected scheduling coordinators an adjusted bid schedule to alleviate the constraint. The scheduling coordinators may send back an alternative schedule or accept the ISO's schedule. If the constraint exists even with readjusted schedules, the scheduling coordinator must pay the congestion charges.

The NE-ISO and the proposed Midwest and MAPP ISOs plan to redispatch or do out-of-merit dispatch if there is transmission congestion. They will either assign additional congestion charges to all users of the relevant ISO or to the customer that causes the congestion. Some believe that having all users pay for congestion charges, rather than the customer that causes it, may not send the correct economic signals. However, this method is administratively simple and may work well if congestion is infrequent. The MAPP and Desert Star ISOs are also considering whether to solicit reverse power flows to relieve congestion.

Besides congestion pricing, attention is also being paid to developing transmission congestion contracts (TCCs). These are financial instruments that direct parties to pay some sum in advance in exchange for avoiding congestion charges for a certain amount of capacity. In addition, some ISOs are proposing transmission capacity rights (TCRs), which are considered defined rights to a certain amount of transmission capacity.

The wind industry may wish to carefully follow the debate in congestion, although it is not clear what the impact of congestion charges on wind may be. Transmission congestion may not occur at times of peak wind output, so wind may not be assessed congestion charges at all or only at certain times. In addition, the California and PJM ISOs have had little or no congestion so far, although neither has gone through the summer peak yet. Therefore, wind companies need to carefully consider whether output from the wind resource will coincide with times of transmission congestion and whether they may be exposed to significant levels of congestion charges.

Some ISOs are considering whether to move away from traditional, postage-stamp transmission pricing. The proposed MAPP ISO, for example, is considering flow-based pricing, which would create four transmission zones. The power flows in a transaction would be tracked, and the transmission customer would be charged a proportion of each zone's transmission rate based on the amount of power flows in each zone. How this affects wind depends on the number of zones set up, the flow of wind power, and the price of transmission per zone.

Other ISO Provisions

Some believe the wind industry may be able to enter into direct bilateral contracts with customers, which could allow longer transmission contracts and perhaps avert the need to bid into a power exchange. However, most ISOs require parties engaged in bilateral contracts to notify the ISO and to let the ISO know whether they will pay congestion costs or not. As the essential guarantors of regional reliability, transmission owners assert that the ISO must be aware of all transactions in a region. The proposed MAPP ISO would go further by requiring all parties, including qualifying facilities (QFs), independent power producers, marketers, and exempt wholesale generators, to commit to the regional ISO. Furthermore, it would require QFs to give up their rights under the Public Utility Regulatory Policies Act when bidding into the power exchange.

ISOs also typically encompass transmission facilities of 100 kV or more or may encompass a smaller set of larger transmission facilities rated at 230 kV or more. Transactions involving facilities not in the ISO would be covered under the transmission owner's own open access transmission tariff.

However, which facilities are in an ISO and which are not can change, depending on use. A significant element of Order 888 is the "unbundling" of generation and transmission in a retail, competitive market. That is, customers will use competition among power generators to select their power supply, then use a utility's transmission system to deliver the power. In essence, the former bundled transaction of generation and transmission has changed to unbundled transactions of generation and transmission.

In Order 888, FERC determined it has jurisdiction over unbundled transmission. Therefore, if more regions in an ISO go to retail competition, more transactions may take place over transmission and distribution facilities and these facilities may become part of the ISO. The MAPP ISO proposal foresees this possibility and allows the ISO to control distribution facilities in individual cases at the transmission owner's consent. The NY ISO also allows for participation by generators wishing to transmit directly to retail loads if the load or supply exceeds 1 MW. Other ISOs will allow transmission to retail loads only if there is a filed retail transmission tariff, or if the transmission owner voluntarily provides the service.

The California ISO and the proposed MAPP ISO exempt facilities with less than 10 MW capacity; those facilities sell straight to local distribution companies. Wind companies seeking to avoid an ISO or power exchange may wish to keep their facilities small or use lower voltage transmission lines.

IV. Copyright

V. Note to Table 1

Table 1 is adapted from *Independent Transmission System Operators and Their Role in Maintaining Reliability in a Restructured Electric Power Industry*, ICF Resources Inc. Prepared for U.S. Department of Energy, January 1998, and "ISOs: A Grid-by-Grid Comparison," Public Utilities Fortnightly, January 1, 1998, pp. 44-45. Updated by the author of this paper.

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