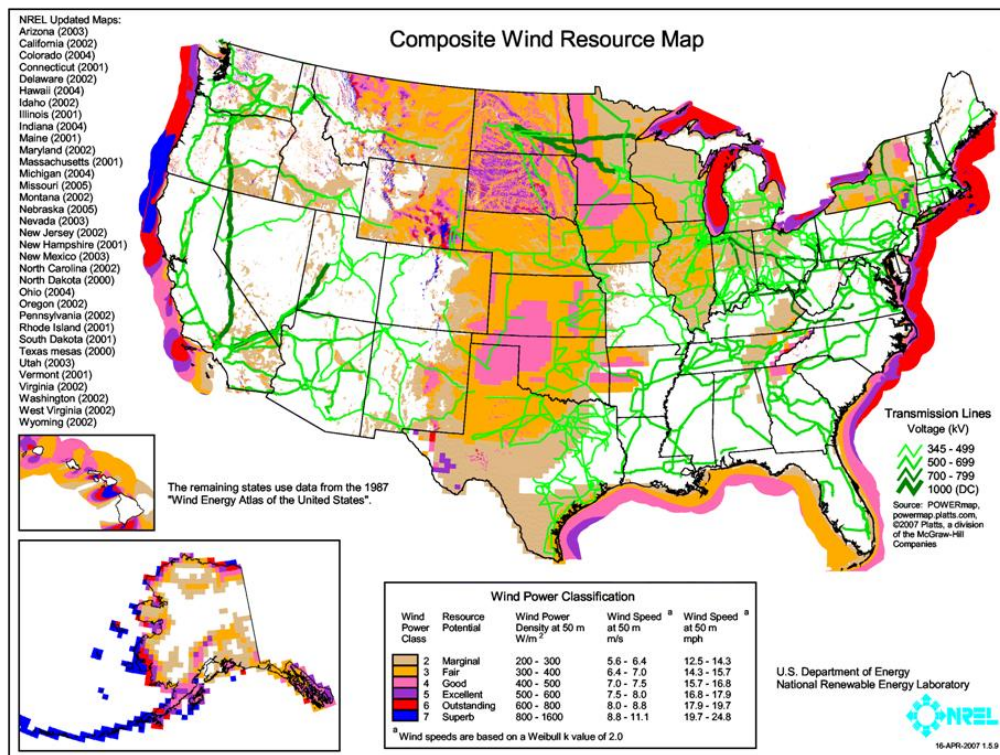


An Overview of Current Initiatives to Expand Transmission Infrastructure to Accommodate Utility Interconnection and Integration of Wind Power

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Over the past few years, wind power has been recognized as a significant emerging source of electricity. According to the American Wind Energy Association (AWEA), in the United States alone, during 2006, 2,454 megawatts (MW) of nameplate capacity was installed, bringing total capacity to 11,603 MW. There are several key drivers for this expansion, including many states adopting rules requiring a certain percentage of electricity to be generated from renewable resources, effective tax incentives for building wind plants, and increased concern about the production of greenhouse gases from fossil generation. Late last year, AWEA and the U.S. Department of Energy (DOE) introduced a 20% by 2030 Vision Scenario for Wind.

One major obstacle for achieving that goal is the inadequacy of the national transmission system as it currently exists. Put simply: where wind is, transmission generally isn't. The chief contributor to this is the fact that the areas with the best wind resource are remotely located from load centers. Construction and/or expansion of transmission systems is a complicated and expensive undertaking, with costs running into the millions or billions of dollars and the process including siting, permitting, acquisition of right of way, environmental impact assessments, and numerous other steps. On top of all of this is the fact that there is a clear "Not In My Backyard (NIMBY)" mindset when it comes to opposition to siting and construction of transmission lines.



Source: National Renewable Energy Laboratory

This paper provides a snapshot of policy initiatives underway to either facilitate or undertake the construction and/or expansion of transmission infrastructure in the “lower 48” portion of the United States. While enabling the interconnection of wind power plants is not the sole focus of all of these efforts, it is clear that wind generation will benefit from the success of these initiatives. It should be noted that this paper was authored well in advance of the TransTech conference, so current events may supersede the information in this paper. The slide presentation made at the conference and available for download in Adobe Acrobat format on the Utility Wind Integration Group web site (<http://www.uwig.org>) will provide a more up-to-date overview of these and even newer initiatives.

Transmission as a National Issue – National Interest Electric Transmission Corridors

The Energy Policy Act of 2005 directed the U.S. Department of Energy to conduct periodic national electric transmission congestion studies and to designate National Interest Electric Transmission Corridors if deemed appropriate. Under the Energy Policy Act of 2005, the Federal Energy Regulatory Commission (FERC) can issue, under certain circumstances, permits for new transmission facilities within a National Corridor. If an applicant has not received approval from a state regulatory body to site a proposed new transmission project within a year of application, FERC may consider whether to issue a permit and to authorize construction of the project.¹ In May of last year, DOE announced two draft corridors– the Mid-Atlantic Area National Interest Electric Transmission Corridor consisting of portions of Ohio, West Virginia, Pennsylvania, New York, Maryland, Virginia, and all of New Jersey, Delaware, and the District of Columbia – and the Southwest Area National Interest Electric Transmission Corridor including portions of California and Arizona. The initial draft of the Southwest National Corridor also included a part of Nevada, which was excluded in the final version.

DOE, after a comment period and a series of public meetings, finalized the designation of the two corridors. This process and the end result were not without controversy, with condemnation of the action by a number of politicians in the impacted states. A key argument made by many has centered on Federal intervention into matters dealt with traditionally by state governments, as well as NIMBY concerns. As of the writing of this paper, it is uncertain what the ultimate end result of this exercise will be – several transmission projects have been proposed in both of the corridor footprints. These projects are now going through state-level permitting processes. FERC issued regulations in 2006 stipulating that only those transmission projects within a corridor that would significantly reduce congestion into or within the congestion area would be eligible for a FERC permit. The location of additional conditional congestion corridors has been identified in the DOE report. The statutory language indicates that mitigation of transmission congestion – not access to renewable generation – will be the key criteria in designating a corridor.

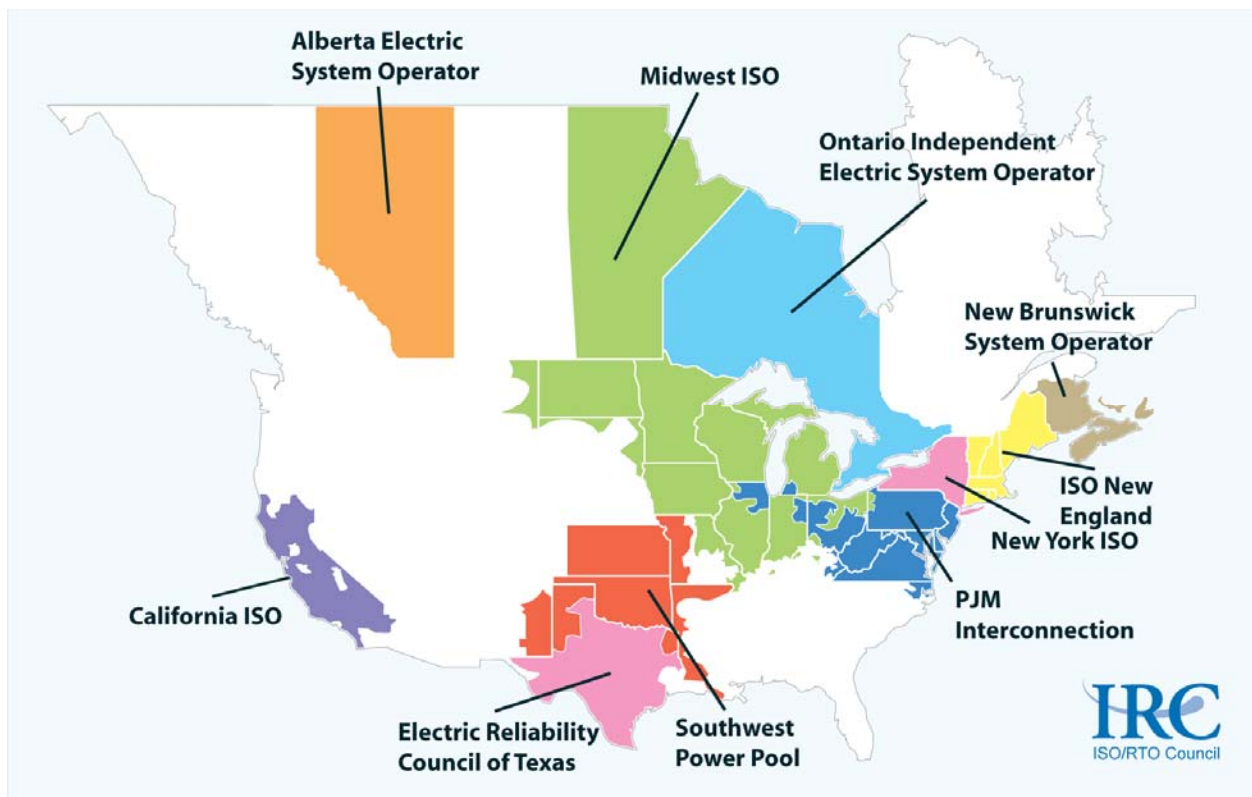
Along with this initiative, the Federal Energy Regulatory Commission, through its Order No. 890, Final Rule: Preventing Undue Discrimination and Preference in Transmission Service, set in place additional guidelines and clarifications for use of the grid. This rule amended FERC’s regulations and the pro forma Open Access Transmission Tariff (OATT) adopted in Order Nos. 888 and 889 to remedy opportunities for undue discrimination and address deficiencies in OATT. The key provisions in Order No. 890 include:

- Greater consistency and transparency in calculation of Available Transfer Capability

¹ More information on this can be found online at <http://nietc.evs.anl.gov/>

- Open, coordinated, and transparent planning on local and regional levels
- Reform of energy and generator imbalance penalties
- Adoption of a “conditional firm” component to long-term point-to-point service and reform of existing requirements for redispatch
- Reform of rollover rights
- Clarification of provisions in the tariff
- Increased transparency and customer access to information

Order No. 890 applies to all public utility transmission providers, including Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs). This rule is playing a significant role in how these entities conduct transmission planning and provide transmission service which affects renewable generation.²



Map Showing Many of the Transmission System Operators Referenced in this Paper
Source: ISO/RTO Council

Solving the California Transmission Conundrum

California has a significant amount – 2,361 megawatts (MW) at the end of 2006 – of wind capacity on line. More than 4,000 MW of new renewable generation has been proposed, which will go a long way toward meeting the state’s Renewable Portfolio Standard (RPS), calling for 20 percent of the state’s energy to come from renewable sources by 2010. California is blessed with significant wind resources; however; much as with many other portions of the United

² More information on this can be found at <http://www.ferc.gov/>

States, the resources are located in remote areas where the infrastructure to transmit the energy to where it is needed does not exist.

A significant concern with construction or expansion of transmission systems is how to finance it. As stated before, construction costs can run into the billions of dollars and as always, someone has to pay for it. Under the system utilized by the California Independent System Operator (CAISO), charged with managing the flow of electricity along the state's open-market wholesale power grid, transmission construction costs are treated in two ways. With transmission for interconnection to generation, known as gen-ties, the costs for network expansion or upgrades are paid up front by the owner of the generator, with the money reimbursed over a five-year period once the facilities are energized. The other transmission category – network upgrades – are controlled by CAISO and costs reimbursed by ratepayers. This two-tier mechanism has proven problematic for developers of renewable generation facilities as they tend to be smaller in size than conventional generators. And as noted previously, they tend to be located in remote areas away from the transmission system and the costs add up. Recognizing this to be a barrier to meeting the RPS goal, as well as preventing the efficient and cost-effective development of transmission infrastructure, CAISO has worked on an alternate means of financing transmission for interconnecting renewable generation.

CAISO filed a petition for a declaratory order with the Federal Energy Regulatory Commission (FERC) in January 2007 requesting approval of a third category of transmission. Targeted towards accommodating renewable generation, CAISO proposed a hybrid financing model where the upfront costs for building transmission would be born by utilities that will be reimbursed at a later date after the renewable projects are online and generating revenue. In order to be eligible for the third category, a transmission project had to meet a set of criteria:

- Transmission is needed to interconnect an area that has significant potential for renewable generation.
- The capacity of the individual interconnecting generation projects would be smaller than the optimal transfer size of the transmission facilities.
- The transmission would not be considered network facilities and the upfront funding required from the generator would be considered a barrier to the generation project being built.
- Demonstration of commercial interest by load serving entities in renewable energy projects in the area.
- The proposed transmission facility could be turned over to the grid operator.
- The proposed transmission would not increase CAISO's Transmission Access Charge (assessed across all users) by more than 5 percent on average over 10 years.

CAISO opted to file the petition for a declaratory order with FERC prior to moving forward with a filing to make tariff changes. This stemmed from a 2005 FERC decision rejecting Southern California Edison's request for a similar category in relation to its Antelope transmission project for connection of three wind projects in the Tehachapi area.

In April 2007, FERC granted CAISO the declaratory order approving the third transmission category in concept. It acknowledged that there is a significant and quantifiable difference between the sites and transmission needs of renewable generation as compared to conventional generation.

FERC announced that it found CAISO's proposal struck a reasonable balance that addresses the barriers impeding the development of location-constrained resources while providing protection to ratepayers through a rate impact cap and the commercial interest provision. The Commission noted that renewable generation is considered location restrained because it must be built where the resource – wind, geothermal, etc. is located.

FERC noted that the CAISO proposals would initially roll in the cost of the facilities to all users of the system through the transmission revenue requirement of the participating transmission owner constructing the facility, reflected in the CAISO Transmission Access Charge. Each generator that interconnects would be responsible for paying their pro rate share of the going-forward costs of the line. All users of the transmission grid (the ratepayers) would pay the costs of any unsubscribed part of the line through the Transmission Access Charge until the line is fully subscribed. To be eligible, the line must be approved by CAISO as providing needed system benefits and any generator, regardless of fuel type, would be eligible to interconnect and contract for capacity.

The CAISO Board of Governors approved making changes to its federal tariff in October 2007. This process incorporated extensive stakeholder input, as per FERC's request, and as of the writing of this paper, the tariff was to be filed with FERC very shortly.

In addition to this activity, the state of California has formed a public-private partnership to consider the feasibility of building new transmission lines to access renewable generation. This effort, called the Renewable Energy Transmission Initiative (RETI), will serve as a way to facilitate the development of renewable generation to help meet the state RPS. The goal of RETI is to put in place the infrastructure to deliver energy from renewable generation located in remote parts of the state or in adjoining states. The effort is being spearheaded by the California Public Utilities Commission, CAISO, California Energy Commission and representatives from publicly-owned utilities in the state. RETI plans to identify major renewable zones to be developed throughout the state and to rank all renewable resource areas in the state to establish an order for the development of transmission lines. The organization held its first formal meeting prior to the writing of this paper – an update will be provided in the presentation.³

Building Transmission for Renewables – A Texas Tale

Texas, which overtook California in 2006 in the American Wind Energy Association's rankings as the state with the most wind capacity, is implementing a plan to facilitate the development of transmission connecting renewable generation to the grid. In 2005, the Texas legislature passed a bill increasing the state's Renewable Portfolio Standard to 5000 MW by 2015. Realizing that the key component for meeting this objective consists of electricity generated in the wind-rich western part of the state, necessitating upgrades to the transmission system, the legislature called for the designation of Competitive Renewable Energy Zones (CREZ). The CREZ concept flips the existing transmission planning process around by planning ahead for transmission in wind-rich areas so that when new generation is ready to connect to the grid, the lines are already there.

There is plenty of activity related to wind power project development underway in Texas, and more is to come. According to the Electric Reliability Council of Texas (ERCOT), there is 2,992 MW of wind generation currently in operation on their system, with an additional 1,701 MW

³ More information can be found at <http://www.energy.ca.gov/reti/index.html>

planned through 2008. This does not include that part of the grid that is not under ERCOT's control, but under the jurisdiction of the Southwest Power Pool (SPP).

On paper, each CREZ is expected to support roughly 1000 MW of generation and the costs for transmission would be paid for by ratepayers. The CREZ enabling legislation covers all transmission in Texas, but transmission to support CREZ areas in SPP territory would be subject to SPP tariffs, over which the Public Utility Commission of Texas (PUCT) has no jurisdiction.

According to the enabling legislation:

- The PUCT will require generation to meet the RPS
- The PUCT will consider financial commitment of generators
- An expedited Certificate of Convenience and Necessity process that will take six months
- Long-term transmission and capacity planning will be met for conventional generation as well as renewables
- Transmission supporting meeting the RPS will be recoverable in electric rates
- Transmission will be planned for the zones and built using special provisions

The PUCT established that 10 percent of the CREZ transmission cost be posted by renewable generators within approximately 12-18 months of following the CREZ designation. A timeline provision was also established mandating that generators commence commercial operation within 12 months of the transmission being built.

A number of companies and organizations expressed interest in the CREZ process, requesting hearings or filing petitions to nominate CREZs. In addition, several companies partnered together to form ventures to build merchant transmission for the CREZs. Electric Transmission Texas LLC (ETT), a proposed joint venture between subsidiaries of American Electric Power and MidAmerican Energy Holdings Company, filed in February 2007 a transmission proposal with the PUCT for the construction of approximately 1,000 miles of transmission lines to support CREZ development. At the same time, ETT proposed for consideration by the PUCT and ERCOT an additional approximately 900-mile, high-voltage, high-capacity backbone transmission system.

On October 3, PUCT issued an Interim Final Order designating five CREZs in West Texas and the Texas Panhandle and authorizing development of transmission lines to deliver electricity out of those areas to customers throughout Texas. A final order, transmission plan, and budget are still pending and expected to be finalized in early 2008.

ERCOT has initiated a transmission optimization study to develop options for delivering wind power from the five CREZs to customers throughout the ERCOT system. The CREZ model is being studied closely by a number of states, and is actually being implemented in Colorado. It has also been proposed as a national transmission development mechanism in legislation proposed by Senate Majority Leader Harry Reid (D-Nev.).

Transmission Development to Support Renewables: A Western Roundup

Outside of California, quite a bit of activity is ongoing regarding transmission development to support movement of electricity among the Western United States.⁴ Several Western states – Wyoming, Colorado, and New Mexico – have established state offices or organizations to

⁴ The National Wind Coordinating Collaborative has a lot of information on this at <http://www.nationalwind.org>

facilitate and fund development of transmission infrastructure. The Wyoming Infrastructure Authority (WIA), Colorado Clean Energy Development Authority and New Mexico Renewable Energy Transmission Authority all have authority to issue bonds to fund transmission projects in their states. The WIA's mission was expanded in 2006 to include infrastructure to support clean coal projects. Montana established an Energy Infrastructure Promotion and Development Division within the state Department of Commerce to help develop transmission within the state. The Montana office does not have the authority to issue bonds.

There are several key transmission development initiatives underway in the Western U.S including TOT-3 Wyoming/Colorado InterTie, Wyoming-West Project, TransWest Express, and the High Plains Express project. The TOT-3 Wyoming/Colorado InterTie is a 345 kV project running from northeast Wyoming to the Colorado Front Range and is intended to deliver roughly 800 MW of capacity to Xcel Energy/Public Service Colorado. The target date to be online is 2011 or 2012. The Wyoming-West Project would carry electricity from southwest Wyoming to Utah and is being studied with a 345 kV or 500 kV configuration. This project also has a projected completion timeframe of 2011 or 2012. It would provide a means to move power from Wyoming to California via a DC line. The TransWest Express line would go from the Wyoming Powder River Basin to Arizona via Colorado or Utah and facilitate moving power from coal plants in the area to the Southwest. Led by the WIA and National Grid, this effort also has participation from Arizona Public Service, Salt River Project, Southern California Edison, and Tucson Electric. Currently in the feasibility analysis phase, the High Plains Express is a transmission backbone that would run through the eastern plains of Wyoming and Colorado to central Arizona, linking many of the aforementioned projects and providing access to renewable generation. The High Plains Express would either be a 345 or 500 kV line connecting the TOT 3 project, the TransWest Express project, the Eastern Plains Express proposed by Tri-State Generation and Transmission, and several other projects. The project backers, led by Xcel Energy, hope to coordinate the effort with the National Interest Electric Transmission Corridor process and have the line complete by 2017.

The state of Colorado has gone a step beyond in terms of transmission expansion. In Spring 2007, the Colorado legislature passed a bill, which was signed by the governor; requiring utilities to identify "energy resource zones" where transmission constraints hinder the delivery of electricity to consumers or the development of new electric generation facilities to serve the state's consumers. The bill requires utilities to undertake biennial reviews to designate areas in which transmission capacity lags behind generating capacity; for such areas, utilities would submit proposed plans for development of additional transmission facilities. The Colorado Public Utilities Commission would be required to grant or deny any necessary certificates for such development within 180 days.

The legislation would allow utilities to recover costs during construction of new or expanded transmission facilities through a rate adjustment clause. The approach undertaken by this legislation mirrors that of the Texas CREZ initiative.

Around the Country – What's Going on in Other Areas

A significant amount of activity is going on in other parts of the United States, particularly with the Independent System Operators/Regional Transmission Organizations as well as independent transmission companies. This section provides a roundup of significant developments.

Midwest Independent System Operator (MISO). MISO has a significant number of wind generation projects in its interconnection queue. MISO has undertaken a series of transmission expansion plans and in its most recent effort, is taking steps to optimize the coordination of long term transmission needs with new generation. The plan under consideration at the time of this writing – Midwest Transmission Expansion Plan 2007 (MTEP 07) – addresses factors such as Renewable Portfolio Standards, FERC Order No. 890 and seeks to change the fundamental way that MISO approaches transmission planning. MISO wants to move from the traditional approach of transmission planning to ensure system reliability to one that optimizes the value of expansion. According to MTEP 07, with the right assumptions, transmission investment will be better aligned to generation needs.

MISO has suggested several changes. One is an “open season” generation interconnection, “wherein the transmission expansions to accommodate generation interconnections are sized to conform with the long range plan, which in turn has been developed considering the likely future generation interconnections,” it stated in the draft MTEP 07 plan. “As the interconnections materialize, the transmission costs are apportioned between the generators and the loads, but the transmission is sized for the long haul.”

A second change is to network upgrades, and involves a new category of upgrades now called “regionally planned generation interconnection projects.” The ISO defines these as upgrades “consisting of one or more transmission facilities that are needed to interconnect large concentrations of location-constrained resources, and that are sized to accommodate anticipated interconnections that will be using the upgrades based on current queued requests, long-term portfolio standard requirements and assessment of other drivers of future capacity needs.”

The interconnection project would be made available to all generators in the area, with costs shared on a pro rata basis, according to MISO, which will be refined by stakeholders and will be proposed as a revision to the ISO tariff.⁵

Southwest Power Pool (SPP). There is a good amount of activity under way in the SPP area, part of which is impacted by the Texas CREZ designations. SPP approved a 2006 – 2016 Transmission Expansion Plan in January 2007 that budgeted \$1.4 billion in projects to maintain reliability. SPP established as priorities facilitating wind development in the Central and South Plains and supporting renewable and overall energy objectives in Oklahoma and Kansas, as well as addressing the CREZs. A key development relating to transmission development in the region is an Extra High Voltage Overlay effort, which is a 20 year plus visionary blueprint to shape near term planning. This project, which would allow for 13,000 MW of wind, provides a strategic assessment of how to meet SPP’s future reliability and capacity needs through the use of a 500 and 765 kV transmission system overlaying the existing SPP footprint and integrating with the existing EHV systems of Entergy, MISO, and PJM. An EHV Overlay would:

- Enhance reliability by providing a stronger transmission system for the communities within SPP’s footprint
- Provide greater access to transmission service customers seeking to deliver environmentally-friendly, renewable energy from existing and potential wind farms in the South Central portion of the U.S.

⁵ More information on this can be found at <http://www.midwestiso.org/page/Expansion+Planning>

- Position SPP to become part of an enhanced transmission system extending across the Eastern Interconnection, increasing access for U.S. electricity customers

SPP's project team conducted a study considering the challenges of operating the electric system up to the year 2026 and identified an optimized package of projects designed to satisfy the needs of SPP and its member systems. The team used an innovative screening methodology to test many different system configurations and performed detailed analysis on six leading alternatives. The top-performing alternative, which has a cost estimate of almost \$5 billion, is a 765 kV loop in the Central part of SPP's footprint with connections extending to MISO/PJM, SERC, and ERCOT. The study identified strong performance of a 765 kV interconnection from SPP to MISO (near St. Louis) and continuing into PJM (near Chicago). The plan also includes an extensive 500kV expansion in Arkansas, Missouri, and Texas, which would integrate into existing Entergy and SPP systems. SPP is working with stakeholders to share strategic plans, consider FERC Order No. 890 rules, perform benefits analysis, and finalize the agreements and cost allocations necessary to move forward. The completion of this effort is being delayed a bit due to the decision issued by the Public Utility Commission of Texas regarding CREZ designations in the ERCOT and SPP footprint.⁶

Inside the territory, Oklahoma Gas & Electric is moving forward on construction of a 345 kV line from north-central Oklahoma to Wichita. In addition, the Kansas Electric Transmission Authority and ITC Great Plains, an affiliate of independent transmission company ITC Holdings, have proposed to construct transmission lines. The state of Oklahoma has created the Oklahoma Electric Power Transmission Task Force to coordinate development of renewable energy in the state.

ISO-New England. ISO-New England is slated to receive proposals at the end of 2007 for long-distance transmission lines to bring wind and hydropower from northern New England and Canada's eastern provinces into load centers. This is critical as many of the states within the ISO-New England footprint have aggressive RPS goals. Work is underway to refine and implement the New England East-West Solution, or NEEWS. This effort, slated for presentation to regulators in early 2008, would link southeastern Massachusetts and Rhode Island with Connecticut. Northeast Utilities and National Grid USA are taking the point on this effort.

Independent Transmission Companies. Independent transmission companies, or TransCos for short, are for profit companies that own or lease transmission facilities. They differ from Independent System Operators, which are not-for-profit entities organized to maintain system reliability and provide coordination of the transmission system. Chief among these are American Transmission Company, which owns and operates infrastructure in Wisconsin, Michigan, Minnesota, and Illinois; and ITC Holdings, which owns and operates infrastructure in Michigan and is acquiring transmission lines in Iowa, Illinois, Minnesota, and Missouri. ITC Holdings established ITC Great Plains, which is a transmission company certified as a utility in the state of Kansas. ITC Great Plains has notified SPP of its commitment to construct, own, operate and maintain the northern portion of SPP's "X Plan." The 180-mile long transmission project calls for the installation of a transmission line commencing northeast of Dodge City, Kansas running southeast to Comanche County, Kansas. The line will then run from Comanche County northeast toward Wichita. ITC Great Plains anticipates that the project will be completed by 2010. The company has also filed with the Oklahoma Corporation Commission to be considered as a utility,

⁶ More information on this can be found at <http://www.spp.org> under "Engineering and Planning"

thus giving it eminent domain authority to build lines. It is in discussions with utilities in the state to partner on transmission construction projects.

Getting More Transmission for Wind: Putting it All Together

As can be seen, there is a tremendous amount of activity, both on national and regional levels, to build or expand transmission infrastructure to get electricity generated from wind plants to customers. Key trends that have been identified, and that should be followed, include:

- Progress of the National Interest Electric Transmission Corridor Initiative
- Implementation and compliance with FERC Order No. 890
- Identification and implementation of mechanisms for financing transmission to support renewable generation
- Progress of the implementation of CREZs within Texas and in other areas following a similar model
- Transmission coordination and construction activities on the parts of states, ISO/RTOs, and organizations such as the Western Governors Association
- The growing role of independent transmission companies

One of the key lessons to be drawn from observing all of this is that transmission construction or expansion projects are increasingly being scoped to accommodate wind plants that have yet to be built. Historically, transmission planning has been conducted with system reliability and least cost considerations in mind. The trend of expanding and enhancing infrastructure to interconnect generation resources that are all too frequently in remote areas reflects a “build it and they will come” mindset that indicates a sea change in how the electric power industry views renewables. The bottom line – stay tuned.