

# *Transmission Update*

February 2009

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## Summary

- ✓ Welcome to the Twenty First National Wind Coordinating Collaborative (NWCC) Transmission Update! Kevin Porter of Exeter Associates, Inc. led the February 27, 2009, Transmission Update conference call. As always, this written brief is being distributed after the call to conference call participants, other NWCC members and participants, and to interested NWCC observers.
- ✓ This update features the Western Electricity Coordinating Council (WECC) Transmission Expansion Planning Policy Committee's (TEPPC) recent analysis of the impact of increasing renewable energy, energy efficiency, and carbon reductions in the WECC region, and an update on developments with the Texas Competitive Renewable Energy Zones (CREZ) program.
- ✓ Bradley M. Nickell from WECC was on the call to talk about the TEPPC's 2008 Study Results, and Jess Totten from the Public Utility Commission of Texas gave an update on developments in Texas.

## Transmission Expansion Planning Policy Committee

### Background

The Transmission Expansion Planning Policy Committee (TEPPC) oversees modeling and analysis for the WECC. The purpose of the TEPPC is to guide, advise, and facilitate economic transmission planning and expansion in the Western Interconnection (WI). TEPPC develops and implements interconnection-wide expansion planning policies and processes in coordination with the WECC Planning Coordination Committee and sub-regional planning groups, and guides and improves the economic analysis and modeling of the WI. TEPPC's functions are intended to facilitate and serve WECC members, sub-regional planning groups, and stakeholders that have the responsibility for planning and implementing specific transmission expansion projects.

In 2008, the TEPPC undertook a modeling analysis of several cases that were selected under the TEPPC protocol from requests received during an open season, where any interested party was able to submit a WECC study request. The TEPPC study cases included 15 percent energy from renewable resources (as compared to the existing aggregate RPS requirement in the West of about 8.6 percent), 20 percent energy efficiency, and carbon reduction cases. WECC staff is working closely with TEPPC, its Technical Advisory Subcommittee, and multiple working groups to perform the studies. The 2008 TEPPC portfolio cases address two key

areas of concern: high renewable resource penetration and carbon constraints.

## 2008 Study

Mr. Nickell sent out a PowerPoint presentation in advance of the call and the following discussion on the cases and results draws from that presentation. The 2008 study consisted of three cases involving renewable energy, energy efficiency, and carbon prices projected out to 2017:

- 15% Renewables Case
- 15% Renewable plus 20% Energy Efficiency Case
- 15% Renewables plus 20% Energy Efficiency plus a \$20 per ton CO<sub>2</sub> Adder Case

The 2017 base case was built mainly from information provided by members on their forecasted loads and from WECC on planned transmission and generation additions. TEPPC then added sufficient renewable energy generation to meet the regional RPS requirement of approximately 8.6% by 2017 and then assumed the addition of local generation to fill any remaining gap between generation and demand. The TEPPC used a regionally dispatched hourly production cost model to conduct the analysis. One important thing to note is that the cases were additive, i.e., first 15% renewables were added, then 20% efficiency was imposed on that model, then the carbon adder was imposed on that model. Changing the order would most likely change some of the results.

### *2017 – 15% Renewables Case*

For this case, a mix of renewable resources were added to increase renewable generation to 15% of total WECC energy. The Western Interconnection Regional Advisory Body (WIRAB) provided guidance on the type and amount of renewable energy generation by state. A variety of data were used including meso-scale wind and solar data from the National Renewable Energy Laboratory (NREL) to determine where the renewable generation should be located. The meso-scale data was also used to create the hourly wind and solar profiles. The final renewable energy mix for the 15% renewable energy case was 45% wind, 16% solar, 32% geothermal, and 7% biomass, sited in areas throughout the WI footprint. Solar energy includes both photovoltaics and concentrating solar power with 6 hours of storage. The forecasted load was unchanged and no new transmission was added.

As compared to the base case, the key results are a 4.7% decrease in CO<sub>2</sub> emissions and an 18% decrease in natural gas generation. The states with the largest percentage drops in natural gas production are Colorado (41%), Montana (78%), New Mexico (35%), and Utah (22%). Other generation was relatively unchanged. Mr. Nickell pointed out that the analysis shows a good synergy between wind and solar generation, with solar rising when wind was dropping. Also, Mr. Nickell said a notable result is how inclusion of very good geothermal resources in some states led to a displacement of about 24,500 MW of wind on a WI-wide basis.

### *2017 – 15% Renewables plus 20% Energy Efficiency*

For this case, the projected 2017 load (both energy and peak demand) was reduced by 20%, consistent with the Western Governors Association/Clean and Diversified Energy Advisory Committee's goal of 20% energy efficiency by 2020. The generation and transmission in this case were the same as the 15% renewables case. Mr. Nickell said the 20% energy efficiency reduction was not uniformly applied to all states but adjusted based on where energy efficiency is already implemented, i.e., more efficiency measures were added to states that have had less investment in efficiency and visa versa for those that had already made greater investments in energy efficiency.

The key results as compared to the 15% Renewables Case are:

- CO<sub>2</sub> emissions decreased 16.5%
- Coal generation decreased 5%
- Natural gas generation decreased 44%
- Transmission congestion increased, especially on the energy pathways from the interior to the coastal areas

Mr. Nickell noted that the transmission congestion increase is at least partially dependent on where the energy efficiency is assumed to take place and the results might be different if it was levelized. He explained that the model chooses the least cost resources on a regional basis and therefore backs out the marginal ones. Natural gas is the marginal resource in the WI and therefore is the one most displaced. Additionally, the low-cost coal generation is in the interior, states of the WI, and transmission congestion arises from that low-cost coal trying to move west to replace the displaced natural gas generation. He re-emphasized that the model does not add new generation or transmission, so no new generation was added in the coastal states.

### *2017 – 15% Renewables plus 20% Energy Efficiency plus a \$20/ton CO<sub>2</sub> Adder*

For this case, a \$20/ton carbon price was added to the previous case as a surrogate for a carbon tax or a cap-and-trade scheme. The loads, generation, and transmission remained the same. Mr. Nickell said the team had also run the model with carbon prices at \$40/ton and at \$60/ton, but the extreme shifts in dispatch order that resulted were not realistic.

The key results as compared to the 15% Renewables plus 25% Energy Efficiency Case were:

- CO<sub>2</sub> emissions dropped 3.1%
- Natural gas generation increased 7.7%
- Coal generation dropped 4.5%

The addition of a price for carbon also resulted in a 50% increase in production costs.

When compared to the 2017 base case, the results are:

- CO<sub>2</sub> emissions dropped 22.9%
- Coal generation dropped 10%
- Natural gas generation dropped 51%

Mr. Nickell noted that a big driver here is energy efficiency, as this reduces load and reduces the need for generation.

Mr. Nickell said transmission congestion had been identified to some degree in all of the cases. As part of the analysis, power flows on selected transmission paths were examined, particularly on the ones that connect regions, and compared the results between cases. Congestion was especially prevalent along the following paths – IPP DC Line, Table Mountain to Vaca Dixon, Four Corners Transformer, TOT2C, and Montana-Northwest.

Mr. Nickell expects that TEPCC will approve the final draft on April 28<sup>th</sup>. He cautioned that the following should be taken into account when interpreting the results of this analysis:

- Natural gas and coal prices were held constant
- CO<sub>2</sub> reductions are heavily dependent on the order renewables, energy efficiency and a carbon adder are applied
- Transmission congestion is dependent on renewable site selections and gap generation
- In this model, the renewable resources are assumed to have a marginal cost of zero. No conclusions should be made regarding the capital costs associated with the various scenarios

## Discussion

A caller noted there was a large amount of geothermal energy in the final mix and wondered where it was coming from. Mr. Nickell said they had based some of the renewable energy development on the California Renewable Energy Transmission Initiative's Phase 1 report which examined cost-effective renewable energy in the WI footprint, including several areas with geothermal resource potential.

A caller asked why natural gas generation decreased so much, as it would probably be needed to provide ancillary services because of the large amounts of wind being added to the grid. Mr. Nickell said the natural gas capacity is still there; it is just not being utilized as much. Additionally, there are a lot of must-run units for voltage support at load centers, and that is reflected in the model. He noted they did see some excess energy being produced at times and also, since the model solves dispatch on an hourly basis, the model would not reflect any intra-hour

variability. Mr. Nickell said they hope to do some more work on high renewables penetration in the coming year.

A caller said the model is reducing gas generation but is it building gas capacity to shape the added wind capacity, i.e., does natural gas capacity increase even though energy production decreases. Mr. Nickell said the results are showing the cumulative effects from energy efficiency. He said they did carry the reserve requirement by regions through to 2017, but the only generation added was what the utilities have reported to WECC. The model itself solves the energy production algorithm; it does not add or remove capacity.

A caller asked whether the 51% decrease in natural gas generation lead to production costs being the same or higher. Mr. Nickell said that load was also reduced by 20%, pushing production costs lower. However, the model only calculates production costs; without including capital costs, it is difficult to compare the costs before and after.

A caller asked whether the increase in congestion was an indication that new transmission lines were needed. Mr. Nickell said that key areas do need additional transmission and there are already some projects in the works to address this.

Another caller pointed out that adding a price for carbon can result in increased production costs, as more expensive natural gas units may run more often than less expensive coal units (assuming that the cost of coal generation is lower than natural gas generation). However, revenues from either a carbon tax or from the sale of carbon allowances may either result in more energy efficiency or renewable energy generation, or the revenues may be rebated to electricity consumers. Therefore, the estimated costs of carbon regulation for consumers should be restricted to increases in production costs.

## **Texas Competitive Renewable Energy Zones Program Update**

**Background** Following a competitive transmission service provider proceeding, on January 29, 2009, the Public Utility Commission of Texas (PUCT) awarded the right to construct almost \$5 billion worth of CREZ transmission plan segments to six established transmission service providers, three new entrants, and three Texas cooperatives, as listed in order below:

- American Electric Power Texas, Sharyland Utilities, Oncor, Electric Transmission Texas, and the Lower Colorado River Authority.
- Cross Texas Transmission, Lone Star Transmission, and Wind Energy Transmission Texas.
- South Texas Electric Cooperative, Brazos Power Electric Cooperative, and Bandera Electric Cooperative.

## Update

Mr. Totten began by explaining that the PUCT had several separate proceedings addressing different stages or aspects of CREZ implementation. The first one was concerned with identifying the zones and the level of potential energy, choosing a development scenario, and adopting a transmission plan. The second proceeding, which is almost completed, involves designating companies to build the chosen transmission plan. The PUCT has opened a third proceeding that will examine a potential transmission priority system for CREZ developers.

### *First CREZ Case – CREZ Plan*

This case started in December 2006, when the PUCT issued an order directing ERCOT to examine and propose potential CREZs in Texas. Mr. Totten said that one party was unhappy with this order and has taken the matter to court. This court case is still ongoing and may eventually decide the original order was in error, which means the whole CREZ process will move back to square one. PUCT ended up looking at four scenarios and chose the mid-level scenario that would support up to 18 GW of renewable energy capacity, including existing renewable energy capacity. Mr. Totten noted that back in 2006 when the PUCT first started, Texas had 6,000 MW of wind power. Therefore, the approved transmission scenario would support a tripling of renewables development from what was in place in 2006. The transmission would consist of about 1700 miles of 345-kV double circuit transmission lines, 400 miles of single-circuit 345-kV transmission lines, and some lower-voltage transmission projects, for a total cost of about \$4.9 billion.

### *Second CREZ Case – Transmission Developer Selection*

Mr. Totten said the PUCT wanted to bring new developers with new ideas and designs to Texas and therefore opened this proceeding as a competitive process. The PUCT invited all interested parties to submit proposals. The chosen developers are a mix of established transmission service providers (TSP), new entrants (two of which are entirely new to the state), and publicly-owned utilities and rural electric cooperatives. Mr. Totten sent out a copy of the draft order, which is also available on the PUCT web site (see below). He said the draft will be discussed further, and the PUCT may modify certain aspects, but the companies and projects will remain the same.

### *Third CREZ Case – Transmission Rights*

Mr. Totten said that Texas has a history of wind developers putting up a project, building the transmission connection to the grid, and then having later projects come along and make that path congested. Wind developers are concerned this will happen again with the CREZs. This case will examine whether to grant priority on CREZs to wind developers. Mr. Totten said that wind developers are arguing for rules that will actually alter the ERCOT economic dispatch model. Other parties are arguing that economic dispatch in ERCOT should not be compromised. The PUCT will be examining other options and aim to find some

middle ground.

#### What's Ahead

Mr. Totten said some of the CREZ transmission upgrades do not need licensing and the transmission developers can start right away. Others will require PUCT permits, and the companies will need to start planning routing and environmental work. Mr. Totten noted that the windows for filing applications may need some tweaking so that the PUCT does not become a bottleneck with transmission applications all coming in at once. In Texas, the PUCT has only six months to complete processing a CREZ transmission application once it is filed. Therefore, the PUCT is looking at prioritizing the transmission projects and create a filing schedule.

#### Discussion

A caller asked about how, or if, the CREZ plan fit with Southwest Power Pool's system in the Texas Panhandle. Mr. Totten said that two of the chosen zones are outside of ERCOT's traditional footprint but the energy would be transmitted into ERCOT. The PUCT order does not preclude additional transmission development in those two areas by SPP. Jay Caspary from SPP said they were trying to coordinate with Texas on the CREZ projects in the SPP area. He noted some of the double-circuit lines for ERCOT could overlap with one or more 765-kV lines that SPP is planning.

A caller asked if there were any energy and fuel type figures available for the 18,000 MW capacity scenario. Following up later on this question, Mr. Totten passed along the information below:

Technology	Scenario 2			Start Case		
	MW	GWh	CF (%)	MW	GWh	CF (%)
CT	4,528	7,006	17.6	4,528	6,870	17.3
CC	34,486	149,276	49.3	34,486	169,576	56.0
Coal	20,854	139,822	76.3	20,054	154,372	87.6
Gas Steam	20,709	11,627	6.4	20,709	13,958	7.7
Hydro	469	957	23.2	469	958	23.2
Nuclear	5,007	36,983	84.0	5,007	38,346	87.2
Wind	18,538	63,931	39.3	18,538	25,590	15.7

Mr. Totten said that the ERCOT study showed for the scenario that the PUCT selected, 18% of the capacity in ERCOT would be wind, and 16% of the energy production would be wind. The additional transmission would allow for higher wind generation as evidenced by the projected increase in the capacity factor of wind from 15.7% to 39.3%.

A caller asked when the transmission developers would be submitting their filings. Mr. Totten said the goal was set for October 2009, but the PUCT cannot handle them all at once and is considering staggering the filings. He noted that projects

will probably start coming on line by 2011 or 2012. He noted that wind developers recognize the expected volume of transmission CPCN filings and are willing to consider different approaches to make the process go more smoothly.

## **Implications**

The TEPPC analysis is an initial examination of the potential grid impacts of incorporating higher levels of renewable energy generation (particularly wind and solar), along with energy efficiency and some form of carbon regulation. The results provide an initial view of the potential for reductions in carbon dioxide emissions from the addition of renewable energy, energy efficiency and the incorporation of a price on carbon. Transmission congestion, as to be expected, emerged as a concern. The limitations of the model did not allow for an assessment of ultra-hour variability; perhaps that can be addressed in future analyses.

Texas keeps moving ahead with its competitive renewable energy zones, having selected a variety of companies to participate in the development of nearly \$5 billion of transmission. Texas is now considering whether to allow some form of priority to wind generation on CREZ transmission lines, an issue that likely will be quite controversial and precedent setting, and worth monitoring as the PUCT proceeding progresses.

### **For more Information**

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TEPPC 2008 Annual Report – draft (March 5, 2009)

<http://www.wecc.biz/modules.php?op=modload&name=Downloads&file=index&req=viewswindowload&sid=172>

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PUCT CREZ Transmission Developers Draft Order

[http://interchange.puc.state.tx.us/WebApp/Interchange/application/dbapps/filings/pgSearch\\_Results.asp?TXT\\_CNTR\\_NO=35665&TXT\\_ITEM\\_NO=1295](http://interchange.puc.state.tx.us/WebApp/Interchange/application/dbapps/filings/pgSearch_Results.asp?TXT_CNTR_NO=35665&TXT_ITEM_NO=1295)