Regional Planning Group
Meeting Notes
October 20, 2015

Miscellaneous Updates

-Oil and gas workshop will be held on November 10
-SSR workshop will be held on December 4 [originally announced as potentially on November 20 but since updated]
-2016 LT Forecast will be presented at next SAWG meeting and at November RPG
-MISO update: approached ERCOT about doing coordinated study looking at potential DC ties.
-Woody Rickerson has been named the ERCOT VP of Grid Planning and Operations

Panhandle Review

Fred Huang presented the results of the Panhandle project review.

Q: Please explain why Rocky Mound is not in service in the study?
A: Item 600, Joint Notification of CREZ Project Update, in PUC Project No. 38517 in which ERCOT and Oncor Electric Delivery Company LLC (Oncor) notified the Commission that the Rocky Mound reactive compensation project is on-hold until further notice to permit additional study of SSO in ERCOT.

Q: Did you consider adding additional synchronous condensers to get closer to the 4,300?
A: No, we have not considered other options.
Jeff: We have talked about it, but we're not sure if the next best upgrade would be a synchronous condenser or a new line. The Lubbock study or the detailed Electranix study could provide better information to consider the next best upgrades for Panhandle.

Q: If this goes to TAC in November, does it go to Board in December?
A: Yes.

Q: Are we still saying the impact of the series capacitors is about 250 MW or was that part of the outcome?
A: The next presentation will cover how ERCOT plans to manage the Panhandle export in Operations.

Q: Could you provide actual production costs for each one of the scenarios?
A: It can be calculated based on the information available in the presentation.

Q: What percent of the time was the synchronous condenser required to be operational in the study?
A: They are modeled as available in the study cases. It should be noted that the synchronous condensers are needed for high wind output conditions to provide system support.
Q: Is this model a synchronous condenser or some type of reactor?
A: The synchronous condenser is a synchronous machine that produces reactive support only.

Panhandle GTC
Fred Huang presented on the Generic Transmission Constraint (GTC) in the Panhandle.

Q: What questions are the detailed Electranix Panhandle study going to answer?
A: The detailed Panhandle project will address 1) the adequacy of the typical dynamic stability analysis tool and models used in the ERCOT region for the Panhandle area, and 2) review the proposed Weighted Short Circuit Ration (WSCR) of 1.5 as the minimum system requirement for the Panhandle area.
Q: When you talk about stability, what stability problems have you noted in the Panhandle?
A: The current Panhandle GTC is based on voltage stability concern due to transmission outages. With more wind generation projects being operational in the near future, system strength can be a concern.

Q: In terms of operations, what mechanisms do you have to give visibility into the area of potential of oscillations as they may develop?
A: We currently have some PMUs installed in the Panhandle area to monitor the system responses with high resolution data. These PMUs will help to detect the abnormal system responses, including oscillations.
Q: Are there any plans to make the short circuit ratio Planning Guide criteria?
A: Currently, GTC is based on outage conditions, not based on system strength.
Jeff: We would consider adding the weighted SCR to Planning Guide, Section 4.

Q: Can you give update on models for wind generation in that area?
A: We modeled the wind generation projects based on the information provided by the developers and Resource Entities.

2015 RTP Update
Sun Wook Kang gave an update presentation on the 2015 RTP.

Q: Slide 3: What equipment are you defining as “long lead time?”
A: Any item that requires more than 12 months for delivery. Typically 345/138 kV transformers.

Q: Is it true that the projects are being reviewed by TOs or have already been reviewed and they agreed that these are needed?
A: When we develop these projects, we work with the TOs.

Q: For the Kiamichi reactor, are you modeling the need for the reactor at the actual substation spot in Oklahoma, or the interconnection spot in ERCOT?
A: Whether it is in Oklahoma or Texas, the Kiamichi substation is part of the BES in the ERCOT system. The reactor is needed at the substation.

Q: “Previously identified” means TOs haven’t added projects into the cases to address issues found in 2014?

A: Those projects were not added into the 2015 RTP cases. As an example, some projects may need an RPG review. We don't model those projects not approved by RPG [if RPG review is required].

Q: There are many constraint management plans needed, instead of addressing them with actual projects. Why are we not addressing them in Planning instead of leaving for Operations to handle?
A: Most of those CMPs are related to X-1+N-1 conditions. The ERCOT Planning Guide allows us to use an operational solution if acceptable. Some of the transmission projects require longer lead time. Until such projects can be in service, CMPs will be implemented.

Q: In 2016, you've got 38 CMPs, they're X-1+N-1. I see it drops off significantly in 2018. Does that mean there are projects, but they can't be constructed by 2016?
A: Yes, that is correct.
Q: Then for 2018, 2020, and 2021 there are still residual projects.
A: Those are related to X-1+N-1 conditions which our Planning Guide allows us to use operational solutions if acceptable.

Comment: The line upgrade—Slide 13—you don't know how many of those are in 2018, a project doesn't get added, so then it falls to 2017, then it falls to operations. Projects aren't being planned for these and then end up in operational world and you have to deal with it there.

Q: Could you look back historically and see the number of CMPs in past years?
A: Prabhu: criteria changed and now looking at TPL standards, so not sure how far we can go back.

Comment: Identify CMPs that are the result of a more stringent standard out of the new TPL requirements.

Q: With cascading analysis, do you anticipate recommending projects to address the issues?
A: If system issues are really severe, we'll work with TSP to identify any corrective actions needed.

Q: Is the only case the High Wind/Low Load?
A: Based on new TPL, one of the new sensitivity analyses we're running is a High Wind/Low Load condition for the 2018 case.
Q: And no sensitivity on solar?
A: No, we don't have that scenario.
C: There are several solar projects with signed IAs.
A: Solar was dispatched based on what we agreed on in the 2015 RTP scope.
Q: Are the base cases posted on MIS?
A: Yes. We will be bringing the 2016 RTP scope to the November RTP meeting so we can look at assumptions for next year.

Q: At what point can one consider new technologies as a transmission reliability fix? Is that something that can be incorporated into the 2016 RTP or is that PUC decision?
A: Capacitors are considered. Storage presents issues: is storage generation or transmission? That probably needs to be addressed by the PUC.

Q: For cascade analysis with the new software, is it the same type of methodology you used last year applied this year?
A: As far as methodology it's very similar to previous cascading analysis but we used trip settings this time such as transmission relay loadability limits, generation under/over voltage trip settings, and under-voltage load-shedding schemes.

Q: Is the generation under-voltage trip information gathered from the RARF?
A: Yes, that information was from the RARF.

Q: Did the tool you used allow you to trip off generation at a certain voltage level?
A: Yes and the name of the tool is POM/OPM/PCM.

Q: Does that do a stability analysis once it trips?
A: That is purely for steady-state analysis.

Regional Haze Analysis
Ying Li and Dana Lazarus gave an overview on the transmission impact of the proposed Regional Haze rule.

Q: ERCOT is not making a statement on what units you think would retire, you're just analyzing the scenarios?
A: Correct.

Q: Can you clarify what you mean by inside/outside study area?
A: We studied the impact by region or area. When we study the impact to East/Coast region, the East and Coast is inside the study area, while North/North Central, South/South Central, and West/Far West are outside of the study area. Similarly, when we study the impact to North/North Central region, the North and North Central is inside the study area, while East/Coast, South/South Central, and West/Far West are outside of the study area.

Q: Is the Appendix to the presentation a full list of generation that you used for scenarios?
A: Yes.

Q: Did the basecase you used include projects being recommended in the current 2015 plan?
A: Yes, we used the 2015 RTP case.

Q: Slide 8: why sum upgrade totals?
A: These are unique overloads.
Q: This is only the impact of the Haze, there's no CPP contribution, correct?
A: Correct.
Q: So we should expect a study that would include the CPP on top of this, correct?
A: We have not decided if we're going to do something like this with CPP and share it publicly. With Regional Haze, we are able to say which specific units are affected.
Jeff: Our point of doing the review was to show that there is a transmission impact, not just a generation impact.

Q: Are the underlying studies posted on the MIS?
A: We're just posting the PowerPoint, nothing else.
Q: Why?
A: This is an ERCOT study, primarily for our own information. We've given all the information if you would like to reproduce the study on your own. We used the RTP cases.

Q: Slide 5: scale load outside of the study area. How did you do that? Equally in all the weather zones until you matched the load and generation or was it done based on some coincident peak?
A: We proportionately scaled down load outside of study.

Q: Do these units still need to go through an RMR assessment?
A: Yes

<u>Clean Power Plan</u>
Dana Lazarus presented on ERCOT's analysis of the Clean Power Plan.

Q: How much were Texas CO_2 emissions (in tons) from power plants in 2012?
A: 241 million tons

Q: In the CO_2 limit scenario, how does the model treat the interaction between coal and gas dispatch?
A: The model dispatches generation resources based on their relative economics, so long as total CO_2 emissions remain below the limit. For example, the model may select to run coal-fired units, which emit higher amounts of CO_2, so long as total system emissions remain below the cap. The model breaks up the annual CO_2 constraint into amounts for different periods of the year. If, for a period, the CO_2 limit is reached, the model decreases the amount of generation allowed from higher-emitting sources.

Q: Did you assume compliance with the mass-based (tons) or rate-based (lb/MWh) form of the limits?
A: We modeled compliance with the mass-based form of the limits.

Q: In the energy efficiency scenario, is 7% the cumulative amount of energy efficiency savings? How is it phased in?
A: Yes, 7% is the cumulative amount of energy efficiency savings by 2030. We applied the approach that EPA used in the regulatory impact analysis of the final rule, using EPA's assumptions for start year and ramp up and expiration of savings.

Q: Do you apply the CO_2 limits on existing units or all units?
A: The CO_2 limit scenario applied the limits only to existing units that meet the criteria to be regulated under the Clean Power Plan.

Q: The report implied the CO_2 limit scenario is the most economically efficient method of compliance. How does that relate to the method used in the CO_2 price scenario?
A: In the CO_2 limit scenario, the model selects which units to run to result in the least-cost way for ERCOT to stay under the limits. This outcome may not be achievable in the current ERCOT market design, since it requires direct control of plant emissions, and in ERCOT resource owners determine how to operate their existing resources based on market forces. By contrast, the CO_2 price scenario uses a price on CO_2 that is incorporated into unit variable costs and results in a different dispatch compared to the CO_2 limit scenario.

Q: The presentation states that you used methods consistent with LTSA. Does the baseline equate to any scenarios under the 2016 LTSA?
A: It does use similar input assumptions, but does not directly correspond to any individual scenario in the 2016 LTSA scenarios.
Q: Would it not be fair to take the baseline and compare it to the previous LTSA results?
A: No, due to updated input assumptions it would not be appropriate to compare these results to the 2014 LTSA.

Q: How does the CO_2 price adder work?
A: There is a price placed on CO_2 that applies to all CO_2 emissions, and every unit that emits CO_2 is charged that price. The CO_2 cost is part of the incremental cost to determine which resource is the cheapest resource to meet next MW of load. The price changes each year to reflect the "glidepath" in the final rule.

Q: Did you try different levels of pricing to see what the results were?
A: We determined the level of prices necessary to put system-wide CO_2 emissions below the Clean Power Plan requirements. We did not conduct a sensitivity analysis looking at the impacts of different levels of CO_2 prices.

Q: When you estimate the reduction in CO_2 emissions, is it the reduction EPA is measuring or system-wide?
A: We count emissions from only those units that fall under the EPA criteria of having to comply with CPP when calculating the CO_2 emissions.

Q: In the CO_2 price scenario, is it correct that there were 5,500 MW total coal retirements, reflecting 1,500 MW in the baseline plus an additional 4,000 MW?
A: Yes.
Q: In the CO_2 Price & Regional Haze scenario, total retirements are 6,200 MW?
A: Yes.

Q: What exactly did you see in the model to determine when a coal plant would retire?
A: The model retires a unit when its revenues can no longer cover its operating costs and fixed O&M. In addition, in the two CO_2 price scenarios, we assumed that any coal unit operating below a 20% capacity factor would retire.

Q: Does that imply that you don't see additional retirements in the CO_2 price scenarios if you don't require that 20%?
A: There would be fewer retirements in the CO_2 price scenarios without that requirement.

Q: Where did the 20% capacity factor retirement criterion come from?
A: The 20% capacity factor criterion is an estimate based on professional judgment. The estimate of 20% is below the capacity factor that would correspond to a unit in seasonal mothball status (25%, assuming a unit operates during the three summer months of the year), and thus represents a unit operating at low capacity factors even during peak months. Taking into account the impacts of cycling on coal units and other operational and economic considerations, we considered it unlikely that coal-fired units operating at capacity factors below 20% would remain in operation.

Q: When you say the model considers fixed costs, you mean only new fixed costs?
A: The model assumes an annual fixed O&M charge.

Q: What model did you use for this analysis?
A: PLEXOS.

Q: Why didn't you apply the 20% retirement threshold to the CO_2 limit scenario?
A: The CO_2 limit scenario allows the model to select the least-cost method of complying with the Clean Power Plan limits. The least-cost solution may not reflect market design, operational, or economic considerations, including the impacts of coal unit operations at low capacity factors, because the model is allowed to select the least-cost method of compliance.

Q: Why did the model add a combined cycle in the CO_2 limit scenario, but only combustion turbines in the CO_2 price scenarios?
A: It is due to the relative costs of different technologies in different periods. Inclusion of a price on CO_2 may result in more renewable capacity being added earlier in the timeframe, which will impact the projected future revenues of combined cycle capacity additions. The CO_2 price itself may also impact projected revenues and result in a different expansion.

Q: Does your model assume any demand response as a resource in the market? Would that change some of these numbers?
A: The analysis considered current levels of demand response in ERCOT; it did not assume any increases above current levels. Increased deployment of demand response in ERCOT could impact the results.

Q: Did you look at storage and how that might change the outcome?
A: We did include CAES an expansion candidate, but beyond that did not look at deployment of other types of energy storage in this study.

Q: Are the increases in wind capacity as opposed to solar based on price?
A: It is due to a combination of the capital costs assumed for these technologies and other constraints within the model.

Q; The results show very little gas expansion compared to current interconnection queues. What is the model seeing that the current market is not?
A: We did include some additional natural gas units currently in the queue in the baseline capacity included in the model. The expansion is largely driven by the capital cost inputs to the model, which reflect declining capital costs for new wind and solar capacity.

Q: Did ERCOT model emissions from new units as counting against the cap in the CO_2 limit scenario?
A: No, emissions from new units were not counted against the system-wide emissions limit in the CO_2 limit scenario.

Q: Does the chart show the impact of energy efficiency?
A: No, the energy efficiency scenario is not included in the chart. The energy efficiency scenario retired the same amount of capacity as the baseline and CO_2 limit scenarios, but added fewer amounts of new capacity due to reductions in demand offsetting the need for new capacity. In the energy efficiency scenario, the model added 10,200 MW of solar, 2,200 MW of wind, and 900 MW of gas combustion turbines.

Q: Are you planning to present these results to other groups?
A: There are plans to present the results of this study to TAC on October 29th.

Q: Are you looking for comments on this?
A: The presentation is an overview of the results of our analysis, which was published on Friday, October 16th, 2015. We welcome any comments and feedback.

Q: How do these results relate to the LTSA CPP compliance scenario?
A: There will be an environmental mandate scenario in the 2016 LTSA. The scenario will have a CO_2 price assumption to mimic the CPP, and will include a couple of other restrictions. I don't think it will be exactly the same, but something somewhat similar.

Q: Does ERCOT have the ability to model demand response and/or storage to look at how it changes these results? Is this something that ERCOT could do as a follow up to this study?
A: This analysis based on what we know at this time and current market trends and requirements in the ERCOT Region.
Pete: We've concluded this study. Other studies are potentially on the table, but we're in a wait-and-see-mode until we know the status of other EPA rulings.

Other Business

Q: What is the Laredo GTC?
A: Laredo GTC was implemented about two months ago. This GTC is created to maintain adequate voltage stability for the Laredo region in the real time operations. A preliminary assessment indicates benefit of the new transmission line (Lobo-North Edinburg 345 kV line) that will improve the voltage stability for the Laredo region and eliminate the need for the GTC.