

## NEBRASKA STATEWIDE WIND INTEGRATION STUDY

### SUMMARY of Technical Review Committee Meeting #3

March 19, 2009 – 10:00 AM to 4:00 PM (Central Time)-Omaha – Gallup Headquarters Building

**Reference Documents** - Email to TRC and Observers dated 03.13.09 from Doug Kallesen (for Clint Johannes) containing four attachments: the meeting Agenda, TRC Meeting #2 Summary (revised final), Task Table Detail, and Roster, some of them having been updated from previous distributions. The EnerNex and Ventyx presentation files were provided shortly before the meeting and then updated with the final versions used in the meeting by an email from Doug Kallesen on 03.23.09. Background material for the CO2 pricing consideration was sent by email from Doug Kallesen on 03.24.09, as decided in the meeting.

#### TRC Members Participating [(p) means by phone]:

Utility- Clint Johannes, Doug Kallesen, David Ried, Marc Nichols, Jon Iverson, Bruce Merrill, Billy Cutsor, Dave Mazour.

Consultants- Bob Zavadil, Tom Mousseau, Gary Moland, Rick Hunt.

Technical Experts and Stakeholders- Michael Milligan, Matt Schuerger(p), Ed DeMeo, Laverne Kyriss(p), Mike Radecki(p), Jay Caspary, Sohrab Asgarpoor, Neil Moseman, Bruce Hauschild(p), Sarah Hurt(p), John Hansen, Tim Texel, Michael Goggin, Steve Eveans.

#### Observers Participating:

Utility- Randy Lindstrom, Rocky Plettner, Mike Matheson(p), Frank Thompson, Brian Wilcox, Ron Steinbach, Max VanSkiver, Eric Hixson.

Technical Experts and Stakeholders – Mark Ahlstrom.

#### Overview of Meeting and Summary:

The complete agenda was covered and the general purposes achieved, that being to review wind generation site selections, discuss methodology for estimating operating reserve requirements, review data, approach, and assumptions for production modeling, discuss results of first base case run, and preview work for next two months.

This summary is intended to document key points of the discussion. *Questions and comments from the audience are usually identified in italics* and plain type is intended to indicate statements by the presenter at the time. Usually the person involved will be clear, but not always.

Afterthoughts and suggestions can be emailed at any time to Doug Kallesen, [drkalle@nppd.com](mailto:drkalle@nppd.com), 402-563-5274, and they will get “logged” into the study process, or to Clint Johannes, Chair of the TRC, [cjohannes@neb.rr.com](mailto:cjohannes@neb.rr.com), 402-910-1856.

#### Key Points of the Discussion:

1. Clint Johannes, Chair of the Technical Review Committee (TRC) and Chair of the NPA Joint Planning Subcommittee (JPS):
  - a. Welcomed all, took roll call, and provided an overview of the meeting purpose.

- b. Asked for any additional comments to the TRC 2 Meeting Summary distributed a third time (revision dated March 12, 2009). No comments offered.
  
2. Bob Zavadil, study technical manager, EnerNex, proceeded into the EnerNex presentation with some more background on meeting objectives and general work status. Zavadil related that the EWITS study work had identified that the standard **“proxy resource” definition** used in these types of studies was not going to work for the high EWITS wind penetration scenarios. Proxy resource is the reference block of energy that shows little variation and no uncertainty for unit commitment and load following that becomes a case run to compare the wind resource to. To now, the proxy unit has been the amount of wind generation during a day divided equally during all hours of the day, in a “flat” manner with transitions from one day’s level to the next occurring at midnight. With the high penetrations being studied in EWITS, and involving the whole eastern interconnection, they encountered the need in the proxy resource defined in this way to ramp 25 GW – an unattainable ramp level in a short time. The same can happen in the NPA study going to 20% and 40%, although to a lesser degree measured in GW. EnerNex and others on the EWITS are working on alternative definitions of the proxy resource that will be shared with the NPA study effort for consideration and use here.
  
3. Tom Mousseau, EnerNex, continued with the wind generation siting slides in the EnerNex presentation (slides 8-26) making the following points:
  - a. The slides have MISO wind selections at 10%, 20%, and 40% levels, instead of being “set at” the EWITS reference case (EWITS reference case is similar to the JCSP reference case, only the magnitude of wind generation is slightly different and is based on the NREL data base, although basically located similarly as in the JCSP case). Discussion held (at this point in meeting and continued later in the meeting) and concluded that the MISO area can and should be held at the EWITS Reference case level (that satisfies current RPS requirements in the MISO area in the 2018 time frame) because that is what the generation and transmission designs for that area are set up for. We are not really able to fully develop all the areas external to SPP to match up with the 40% case especially. *Some concern raised then about these areas of the country to the east absorbing the wind energy and then not showing the true integration effects (and costs) associated with the high wind penetrations (if not shown high correspondingly to the east).* Consultants felt that the lack of transmission in the reference case should prevent most of this from happening. But it would be good to monitor what amount of energy gets transferred into the eastern interconnection.
  
  - b. The adherence to the use of full site capability (rather than taking pieces of an NREL site) was mentioned as a bit of complication for the study resulting in the scenarios having a bit more wind generation selected than targeted because most of the NREL sites are large. This was done to avoid “compromising” the subhourly characteristics of the sites. *Question from Mark Ahlstrom concerning the applicability and suitability of the large sites.* Zavadil explained that the large site data were developed by smaller 2-km calculations that were aggregated for an integrated composite data set, and felt this was a suitable process. A 2-km grid usually represents more than 30 MW, and that the EWITS study (for which the NREL data was primarily developed) needed lots of MW,

hence the larger sizes. A 1,100 MW site would represent 36 – 2 km grids so there would be inherent in the data, diversity, and time lags for weather fronts. The data could be disaggregated to smaller capacities, but at a cost by the consultant supplier (AWS Truewind). *Michael Goggin indicated that this aggregation process was the same process in the western interconnection.*

- c. *Jay Caspary asked about the sites out in far western Nebraska – connected which way?* The sites shown in the EnerNex slides are to be connected east, and only show up in the 40% case when the EHV overlay would be present.
- d. SPP sites are created from considering the SPP maps provided by Jay Caspary for the Overlay and queue information. NREL sites were taken in similar areas. These selections do not have the ultimate diversity (few sites in western Kansas), but discussion concluded they were reasonable at this time for the transmission modeled. Bruce Rew – SPP staff is looking over the SPP selections.
- e. *Matt Scheuriger indicated that 23 GW of wind in MISO corresponds to about 10% penetration and indicated concern about selecting sites too different from the EWITS/JCSP reference case for which the transmission system was designed.* Acknowledged that it will be best to align closely with the EWITS/JCSP Reference case in the MISO area.
- f. *David Ried inquired why the TVA region had constant values for all scenarios when all the other areas varied.* Reply that TVA had few good wind generation sites.
- g. *Ed DeMeo asked why MAPP had so little wind generation sites added.* Reply that most of North Dakota and Iowa was considered as part of MISO category.
- h. Tom Mousseau clarified that for slides 24-26, the seasons are defined as winter (Jan-Mar), spring (Apr-Jun), summer (Jul-Sep), and fall (Oct-Dec). *Doug Kallesen remarked that the slide 24 seems to indicate summer wind generation for the NPA area exceeds spring in most hours. This seems somewhat surprising.* EnerNex agreed to prepare a data report on the wind and load data that would include monthly reporting, correlation of wind and load, and provide some access to the data. They have a template report that they have done before and will prepare a first cut of this document for review. *A suggestion on data like slides 24-26 to use different scales for load and wind generation in order to help the smaller wind generation values to show more separation between seasons.*
- i. *Steve Eveans inquired about the flyway consideration in the selection of sitings.* Reply clarified that the flyway was only one of the considerations – that we did not want to have a predominance of sites directly in the flyway (even though it is one of the better capacity factor areas) because we wanted some diversity and to give some consideration to environmental factors.

4. Bob Zavadil continued with the EnerNex presentation at slide 27 (Intra-Hourly Analysis & Results).
  - a. “Real-time” energy market is usually set up to make adjustments every 5 minutes looking out 15 minutes, and is done from a central point (a centralized, coordinated market). Base assumption in this study will have NPA immersed in an SPP fully-developed, centralized market.
  - b. NPA did not have 10-minute load data for the three historical years, so EnerNex needed to do some “proxy work” in that regard.
  - c. At this point PROMOD can only enforce spinning and non-spinning reserve requirements; hence why EnerNex analyzes the subhourly wind data and proxied load data to compute additional operating reserves for input to PROMOD. This process of statistical evaluation is described theoretically in the EnerNex presentation, slides 29-55.
  - d. Zavadil will include findings on additional reserve requirements in the EnerNex portion of the data report to NPA/NREL.
5. Ron Steinbach-TriState and Billy Cutsor-MEAN, described the evaluation being done by WAPA for various transmission requirements to add various levels of wind generation connected to the Nebraska system in the western interconnection and staying on that side. This is not an integration study from the generation impact standpoint, but rather from the transmission requirements standpoint. Also, this is not a thorough interconnection study but rather a rough estimate for additions up to 300MW. Ron and Billy will have a more detailed report ready for the next meeting.
6. Bob Zavadil continued with the EnerNex presentation:
  - a. Zavadil indicated that the proxy resource methodology can be described as part of the Assumptions document he is maintaining.
  - b. *Randy Lindstrom asked about the GGS East Flow Stability limit, as to whether it is being modeled in PROMOD, being concerned especially about the western Nebraska wind generation that appears to be needing connection to the Missouri Basin Power Project 345kV lines. Gary Moland indicated that they have the constraint modeled in PROMOD.*
  - c. Bob Zavadil indicated that the far Western Nebraska wind addition does not take place until the 40% case (which will have additional transmission, in concept). Initially they are hooking up the wind generation without constraints to see where the power wants to go as an aid to sketching out transmission needs and estimating a cost.
  - d. *John Hansen reiterated his concern for addressing wind generation in the west – that he feels there are people there concerned about their role in the wind development opportunities and that the advantages from their wind resource be given proper consideration. We have the 40% wind generation scenario that shows wind generation*

additions in the west connected to the eastern interconnection. Until more transmission is installed out west, no more can come east. WAPA is doing some study for the western interconnection as described by Steinbach and Cutsor. We do not claim to be doing “the optimum end-all siting”, but merely a sample. Other processes will need to play out determining the ultimate wind and transmission expansion developments.

7. Gary Moland-Ventyx went through the Ventyx presentation, with the following as highlights:
  - a. *Question was raised on dollar basis.* Reiterated previous decision to analyze in nominal (2018\$) – the typical utility way. But since others (typically economists and governmental/academic organizations express in current year dollars), we will be clear in our documents and present it both ways for key values (2009 and 2018).
  - b. Ventyx work so far has been using the 2004 data set at 10% penetration. This run needs more work, plus later they will be doing 2005 and 2006 as well to determine effects of weather.
  - c. *Question asked by Ed DeMeo concerning assumptions for demand response, real time pricing, and hybrid car charging as there potential developments will affect load shape.* Reply that Ventyx is using what the utilities supplied for 2018 (2004-2006 load shapes adjusted to 2018 monthly demands and energies) – so whatever utilities supplied is in there in the best manner possible. Especially some demand response is included but not much of the other. However, it was noted that these options, if more significantly developed, should make things better for integrating wind. *DeMeo indicated that he would still like to keep alive the possibility of running a sensitivity case with a suitably “flattened” daily load profile to reflect prospective load leveling from these resource options that may be significantly utilized on the demand side.* The TRC can later discuss the merits of this evaluation in comparison to the other “nominations” for yet undefined sensitivity cases once we have in hand some results from the identified cases.
  - d. Gary Moland indicated that Ventyx will resend the NPA generator spreadsheet with summer/winter capacity data being used in PROMOD for the utilities to review, as only max provided previously, which is normally considered for winter.
  - e. Gary Moland will send a list of the small (muni) units for clarifying bus assignment (actually, since most of these units carry town names, Ventyx will first try to assign them to available buses based on the names available and a state map).
  - f. Ventyx can (needs to yet) back the thermal units in the EWITS case down from 2024 to match 2018 conditions and the wind capabilities. That is, the regional expansion was done before the wind units were added. These units are incremental above projects in construction or advanced permitting. Wind generation was given 15% capacity value in the EWITS for capacity expansion planning purposes. Interestingly, these additions were mostly coal, some nuclear, some CTs but no combined cycles (slide 9).

- g. There was a good discussion of gas price forecast assumption, resulting in continuing to use the Ventyx forecast as displayed in the Ventyx presentation file (slide 10). *Michael Goggin offered a suggestion to consider using the latest DOE forecast. This was seen as offering merit as an outside source, but it was discovered to have inherent the assumption of zero carbon dioxide price. So it was decided to stick with the Ventyx forecast (which was approximately \$1/mmBtu higher than DOE's forecast, but had included a carbon pricing assumption in the neighborhood of our base assumption. Ventyx assumption is \$8/ton in 2012, and \$20/ton in 2020, both real 2009\$. So the CO2 pricing value should be about \$20/ton nominal in 2018, assuming steady exponential changes.*
  - h. Moland displayed the list of transmission additions (slide 12). *Randy Lindstrom confirmed these as required for the study. Question was asked about the 345kV line from Kansas (not on the list) to Nebraska and Lindstrom indicated that this was an economic addition associated with the overlay, and not expected before that plan. Gary Moland indicated that Ventyx will include the overlay information from Randy Lindstrom and Jay Caspary in the appropriate cases. [This information was transmitted to Ventyx and EnerNex as an email from Doug Kallesen dated March 2, 2009, with subject "RE: NPA-NREL Transmission Ideas for Nebraska".]*
  - i. Moland described their work to date trying to determine a satisfactory method for "equivalencing" the eastern/southeastern part of the PROMOD model without having significant effect back in the Midwest yet creating a savings in run time. Ventyx has concluded it is best to keep the whole model even though case run time increases considerably. *TRC agreed to this plan but a question was raised concerning the eastern extremes of the interconnection absorbing the wind integration effects while not reflecting back into the results the cost of integration.* Discussion indicated that the hurdle rates would be important constraints in keeping the wind issues in the SPP general area. Another method could be to limit the amount of energy that could be exported.
  - j. The tariffs (hurdle rates) on slide 13 were agreed to by the TRC.
8. Bob Zavadil led the next portion dealing generally with "next steps".
- a. Options for the proxy resource were described as (a) knowing the exact shape, (b) leveling the energy over seven days, and (c) leveling the energy over thirty days. *Question about why not consider the proxy resource to have dispatchability and operate proportional to load.* Zavadil indicated that industry thinking has been to limit the proxy to energy characteristics, and not capacity characteristics. *Mark Ahlstrom asked if this integration cost definition amounted to the delta to add to determine competition with a gas resource.* Reply - Not directly in that the proxy resource does not include full capacity characteristics. Conclusion on next step-small group will review and likely accept decision of EWITS process unless a big problem with that is identified – TRC accepted this approach.

- b. Gary Moland will inquire of utilities concerning outages affecting LMP's (feels \$115/MWh on peak result is reasonable and \$70/MWh off peak is reasonable).
  - c. Question whether to allow wind generation curtailment or not needs to be addressed (current result of 29% in SPS and in WAPA of 19% seems too high and is unrealistic – i.e., likely wouldn't something would be done to solve such problems? Curtailment could be reduced by showing at cost of minus \$40/MWh. *Caution, however, that we would expect congestion at high penetrations.*
  - d. *"Ownership" assignments associated with the results (slide 19 of Ventyx presentation) need to be checked and corrected. E.g., the table shows 7,398 GWh of Potential Energy for NPPD, but Potential Energy for NPA in total is supposed to be 4,523 GWh (slide 9 of EnerNex presentation) for 10% penetration.*
  - e. *Alongside the "allowed" generation that "ignores" congestion we will need to roughly estimate the transmission requirement to overcome the congestion.*
  - f. Input data needs to be vetted. To do this the input details for NPA will need to be provided to the utilities (before we get too far into the runs so there is time to tune up the data).
  - g. Bob Zavadil will send out the PJM CO2 study report. After TRC input the small group will make decision on modeling assumption for the high case and the zero CO2 (potential) case.
  - h. Forecast error sensitivity studies may not require the full range included in the scope of work – if so, this work scope can be dedicated to other issues.
  - i. Market sensitivity case is not fully set yet either in definition (issues need to be identified).
9. Clint Johannes closed the meeting and verified the schedule for the next meeting: May 13 in Omaha at 10 AM – 4 PM Central. Agreed by the TRC.

By Doug Kallesen, NPPD (for NPA)