

**Meeting Summary**  
**NorthWestern Energy Electric Technical Advisory Committee**  
**Butte, Montana**  
**April 18, 2018**

**Attendance**

Those participating in or attending the Electric Technical Advisory Committee (ETAC) meeting in person or by teleconference included:

<b><u>ETAC Member Organization</u></b>	<b><u>Attendees</u></b>
Consumer at Large	Chris Pope
District XI Human Resource Council	Tom Power
Montana Department of Environmental Quality	Dan Lloyd
Montana Environmental Information Center	Brian Fadie
Montana Public Service Commission	Robin Arnold
Natural Resources Defense Council	Chuck Magraw
Northwest Power and Conservation Council	Brian Dekiep

  

<b><u>Organization</u></b>	<b><u>Attendees</u></b>
ETAC Facilitator	Beki Brandborg
HDR	Scott Leigh
NorthWestern Energy	Bleau LaFave
	Frank Bennett
	John Bushnell
	Joe Stimatz
	Mike Babineaux
	Todd Johnson
	Jim Williams
	Bill Thompson

## **Agenda:**

1. New Resource Additions
  - a. South Peak
  - b. Purchase of Two Dot Wind, LLC
2. Resource Definitions – HDR Engineering, Inc.
3. Timeline – Discussion

### Draft - June Agenda Items

- i. Feedback on Resource Definitions
  - ii. VER Integration Study
  - iii. Ascend Analytics
  - iv. Other
4. Future Meeting Dates
    - a. Thursday May 24, 2018
    - b. June \_\_, 2018

## **Discussion on the earlier public meeting**

Comment – I thought we had a really great public meeting; twenty-two different classifications of folks outside of ETAC members. I hope this helps demonstrate the significance and interest in public meetings.

Question - What about comment that the media and invitations weren't wide-spread enough?

Answer - NorthWestern looked at advertisements – too expensive for too little space. We looked at bill inserts but billing cycle did not align well with the meeting date; we'll work on that for the next public meeting.

## **Facilitator - What recommendations does ETAC have for the next public meeting?**

Comment: Several public participants expressed happiness as a customer with NorthWestern service. On the other hand, several talked about climate change, environmental, and health (air quality) issues. I would like to see the utility get in front of those conversations.

Comment: The MPSC Commissioners don't care about this in their realm, so we'd be up against a very steep wall.

Question - Does or will the NWPCC consider climate change in their plan this time around?

Answer – The NWPCC runs climate change scenarios. What it sees is that it creates some noise in the hydro system. With the storage in place, it takes out the seasonal variations. Modeling shows a small decrease in winter load and small increase in summer load.

Comment - NorthWestern has wrestled with carbon costs being included from the very beginning. Some people commented how this was included in the hydro acquisition discussions. In NorthWestern's hydro system, the climate change modeling doesn't indicate some major changes in the value of the hydros. It will change some of the timing of snow melt and run-off but not less moisture.

NorthWestern is using 10 years of rolling hydro data which will capture changes in hydrologic conditions.

ETAC - A broad discussion of climate and various reports were held between ETAC members in a general conversation.

Facilitator - What does NorthWestern think about having a draft plan meeting in November?

Comment – NorthWestern anticipates a final draft for public review will be available at that time. NorthWestern will present the Plan and there will probably be about two weeks to provide comments.

Question - Will the November public meeting be prior to submittal of the Plan to the commission? Will there be potential changes after that?

Answer - Yes, there could be changes based on feedback.

ETAC - General discussion about how to model Colstrip considering other partner retirements. NorthWestern believes this discussion is more appropriately handled within a general rate case. Also, it is important to remember the Plan is on two year cycles allowing other scenarios circulating to be firmed up rather than just being conceptual. NorthWestern also has to be mindful of SEC regulations about what it states.

Question – There were comments on the 2015 Plan having an EOP showing gas resources?

Answer - Those comments ignored the explanation of the RFP process that would eventually determine what resources would be offered from the market.

Question - Another part of the meeting that we didn't get to is the SPP or EIM markets, so maybe in the next public meeting we can talk about this?

Answer - NorthWestern had a presentation prepared for this but it ran out of time in consideration of public participants wanting to make comments.

Comment - People don't understand the difference between energy and capacity.

Comment - Perhaps, we could make a couple of slides and get them out ahead of time to help people understand this.

Question – When will the NWPCC have the studies on capacity in the region completed?

Answer - The NWPCC next report will come out around July.

Comment - The introduction and presentation were excellent and really a service to your customers. This was a great part of the meeting.

## **New Resource Additions**

South Peak Wind is a QF negotiated last fall. It is 80 MW and located close to Spion Kop. The energy rate is \$21.03 per MWh and capacity cost falls in the range of \$1.58/MWh annually but for on-peak hours it is about \$6.16 per MWh. This is a very affordable contract at 15 years and is good for NorthWestern's portfolio, but there is concern about the long-term viability of these contracts. The COD is December 1, 2019.

Question – Are there curtailments?

Answer – It is a take-or-pay contract. Curtailments are prohibitive and are restricted to emergencies. The penalties are stiff. Economically, prices would have to be negative \$40/MWh.

Question – Is the concern with PTCs?

Answer - When PTCs are gone you are left with increased costs in the out-years.

Question - There has to be some IPPs participating in the market that are wind or solar.

Answer - There are but not many. In the SPP, we see a lot of QF resources, but not IPP resources.

Question - That market will start to shake out. Won't there be some sort of balancing?

Answer - Yes, but this comes at a cost. There will be stranded assets.

Two Dot Wind Farm LLC will be purchased by NorthWestern. NorthWestern filed a FERC form 203. There were no intervenors. The timeframe for approval is expected to be about 20-60 days. This was an existing QF contract with 21 years remaining. It was cheaper for customers if NorthWestern owned it. It was determined that it will qualify as CREP. The final capacity will be 11.1 MW. The expectation currently in the market is for a 25-year depreciation, except some developers with newer turbines extend this. Some of the market failure rates are interesting.

Question – So this would not be a must-take?

Answer - For the next four years, to maximize PTCs, it would still be a must-take. After that, NorthWestern can curtail if it is economical to do so.

Question - Can you describe how long it took to get through these negotiations?

Answer - It will have been about 6-7 months when it was said and done.

## **Resource Definitions**

Scott Leigh of HDR gave a slide show presentation on new resource definitions that will be modeled in various portfolios for the 2018 Plan.

HDR's work was only for supply side resources (not demand-side management). The presentation represents generic plants, and are not technology or manufacturer specific. HDR is an architectural engineering firm that is employee-owned. 10,000+ employees in 225+ offices.

1,000 employees devoted to energy (wires, generation, etc.) planning, development, and implementation support.

HDR considered 15 plus resources with additional iterations such as dual fuel and duct firing.

HDR does not include substation, supply costs in the plant costs, so these include costs up to the interconnect point. HDR is using market data, supplier feedback, other IRPs. HDR is not partnered with any suppliers. Scott noted that the pace of change in electric generation is very rapid.

## **Resource list:**

### **Thermal Resources**

#### Simple Cycle combustion turbines (CTs)

These units will be in the 25 MW and 50 MW range – efficient and flexible. Larger sizes are not a good fit for NorthWestern. Heat rates are based on the higher heating value (HHV) and not on the lower heating value (LHV). Some equipment manufacturers quote heat rates using LHV which results in a lower heat rate but this is misleading and HHV is more representative of actual heat rates.

Costs will be firmed up in the final report, but general estimated ranges were discussed with ETAC.

Question – I have heard that GE instruments are getting out of this business?

Answer – They have surplus capacity and will probably reorganize.

#### RICE Resources

Reciprocating Internal Combustion Engines (RICE) are typically more efficient but are more expensive than CTs. RICE units are flexible, fast-starting, and can use multiple fuel types. NG is the primary fuel with diesel fuel typically used as an alternative fuel. We are looking at including LNG as an alternative fuel too.

Suppliers include Wartsila, Jennbacher, Caterpillar, and Mann.

Question - How would you get LNG to plant?

Answer - Would want to connect to a pipeline, especially if multiple units are planned.

#### CCCT Resources

Combined Cycle CTs (CCCTs) have two cycles, a combustion cycle followed by a steam cycle (like Colstrip). CA uses these to deal with duck-curve swings, not as flexible as simple cycle, and are used in an intermediate dispatch need (5-25% CF). CC get economic in the 30-50% capacity factor range.

Engines are peaking units not normally used like CCCTs for baseload. However, because engines are more efficient, they stay on longer than a pure peaker.

Question - Can you compare across all three technologies for the dispatch range?

Answer – Simple cycle CTs can turn down to about 50% of full load, some can go lower. As you go lower, emissions in PPM go up. Without emissions limits, these could turn down to 5%. Engines can turn down to 30-40%, some down to 20% and stay within emissions compliance. HR curve is flatter for engines than turbines. These make engines more flexible.

CCCTs are less flexible. Some can turn down quite a bit. HR does not get affected as much as you'd think. In a CCCT you capture waste heat from less efficient combustion at lower loads and so the efficiency is balanced better.

Question - Is there a minimum cost to follow load with the different thermals?

Answer - Typically, small aero-derivative CTs can ramp up and down a lot without penalty. CTs have a \$/start. Engines don't. CCCTs weren't built previously for cycling. Now they are because of the need to run them this way. Cycling causes heat in the units which can increase maintenance. Elevation also affects CTs more than engines.

Question - How does air temperature affect efficiency?

Answer - Hotter – less efficient. Recips react better (curve is flatter) across various temperatures. At cold temperatures, there are heaters that pre-heat the air.

Question - The Allen cycle is a relatively new technology, is this being looked at?

Answer - There are more knowledgeable people at HDR to discuss this, but from what we've seen this technology is not totally proven yet. We'll get back to you on this.

## **Wind Resources**

HDR is considering three proxy locations across the state (in coordination with NorthWestern). Billings, Anaconda, and Great Falls. HDR looked at NREL data (2-3 MW wind turbine), used Wind Toolkit to estimate wind generation. In general, capacity factors improve as you go east.

Question - Are you using data from NorthWestern?

Answer - We will do that as a general comparison. Technology has changed a bit. Wind Toolkit uses multiple data sources.

Question - So the process was to use NREL and Wind Toolkit to get data and then compare to NorthWestern?

Answer - Yes. HDR would be hesitant to make adjustments based on differences with existing wind generation (in NorthWestern's fleet) because technology has improved and is not represented in currently deployed farms here.

Fixed O&M are the main costs for wind resources. Not a lot of variable costs, just all-in costs.

There was a general discussion with ETAC on modeling and wind facilities.

## **Solar Resources**

HDR is reviewing 100 MW of solar in two locations, possibly three. Modeling did not see much difference in terms of generation. Used PVSyst from NREL, very similar net CF. Most costs are fixed costs. ITCs will be handled in NorthWestern's financial modeling. VOM costs for fixed axis (Fixed O&M is typically used to handle this).

Question - Does the model factor in snow load?

Answer - PVSyst includes some of this as shading.

There was a general discussion of solar facilities and modeling with ETAC.

Question - In the spirit of CCCT, do you ever look at solar and storage together?

Answer - Yes, This is present in a lot of bids received. We haven't looked at the combination separately. We [NorthWestern] allowed for that in the RFP. Any resource, wherever it's located, you have to look at how it operates within our system.

One example, a RECIP with a battery, where the battery provides the fastest response until the engine can warm up and ramp up. You have to consider the specific location/configuration.

We'll analyze the battery and try to get the most out of it. Our task is to be the lowest cost portfolio. If you put these resources together, you strap the project with higher capital costs.

Question - 100 MW for solar – how was that decided?

Answer - Scale of economies are realized at less than 100 MW for solar – these cut in before wind does, so this is a reasonable number.

## **Geothermal Resources**

HDR is looking at Geothermal – 20 MW Flash Steam plant, there are also dry steam and binary types (binary uses ammonia as a heat exchanger). Flash Steam is most common.

A thorough geothermal resources assessment has not been done; we're assuming that the resource exists. It assumes high capacity factor. This is similar cost in terms of power generation as thermals but on a smaller scale. The lead time for geothermal – 36 months. This excludes exploration. (We have schedules for all the resources from start to finish.) 60% of all geothermal are flash steam.

Question - Nationwide are you seeing much geothermal being installed?

Answer - No, we have only seen exploration. This is not a huge penetration in the market.

## **Pumped Hydro Storage Resources**

HDR looked at 400 MW with 9 hours of storage, single stage variable speed. Capex depends on location. These typically require a longer lead time. There is a premium for variable speed, and cost is on the higher end.

Question - Are you looking at multiple products coming out of this plant?

Answer - There are constraints on how much can go on at once, but we're looking at these.

### **Compressed Air Energy Storage (CAES) Resources**

This is similar to Pumped Storage. Compressing air into a cavern when efficient to do so. You skip the compressor side of the generation cycle for air going into CT. So more efficient during generation hours. There are 2 plants. 110 MW plant in Alabama (Macintosh). This technology is completely dependent on location and cavern availability.

Question - How do efficiencies of CAES compare to PSH?

Answer - IT depends, HDR modeled at around 4500 btu/kWh HR. Buying off the grid for a PSH system would be more economical. 100 MW, 8 Hours discharge considered. Assumes the cavern is there.

### **Battery Resources**

HDR looked at 3 types. ViZn has had financial difficulties so they have been removed from consideration. Li-Ion and Vanadium Redox-Flow technologies. 25 MW / 100 MWh (4 hrs) assumed. HDR felt 4 hours was reasonable. Some of the ISO's have used this for capacity accreditation. Modeling has to consider what the battery is used for. HDR Assumed 1 discharge cycle for a day. In some bid info from across the country, this is a base assumption. Very important to take into account degradation, and roundtrip efficiency. However, we've moved to exclusively thinking of batteries in terms of \$/MWh \$300-\$400/MWh for a 4-hr battery. \$/kW in batteries is very misleading. If you're looking at capacity then \$/kW is OK. If the battery only has 30 minutes of storage, then this number is not OK.

Question - Is there any difference in cycling capability between flow and Lithium?

Answer - Yes, flows have longer life under same cycling conditions.

You will see a drastic drop-off in terms of capacity for batteries. There are not many batteries that have operated for 10 years, so there is not much long term data.

Question - How big is footprint is a 100 MW site?

Answer - Large. A shipping container is about 1 MW.

### **Wrap-up**

HDR has provided templates to NorthWestern and Ascend for these definitions, but this is still in-process.

NorthWestern will deliver the final report from HDR to ETAC as soon as possible. A lot of the same resources are being used in NorthWestern's SD Plan.

For the June meeting NorthWestern anticipates feedback on resource definitions, review of the VER study, and an Ascend presentation on how we're setting up the model for Montana.

Regarding future meeting dates:

The May 24<sup>th</sup> meeting will be in the BGO-north auditorium.

Later dates will be communicated through email.

Question - I'm not sure we've talked through yet what case NorthWestern is going to make for how it's going to fill the gap, will it be tied to regional organizations and their analysis of resource adequacy?

Answer – NorthWestern will be looking at the same things this time (more coal closures, NWPCC assessment, and the VER study). The front end of the Plan proving up the need is very important. The back end of the Plan, determining resources, will be really done in the RFPs.

The difference with NorthWestern and the region is that most are going out to fill capacity needs that are relatively small. NorthWestern's deficit is large.

Beki will send out a Doodle for picking a June date.

Note: Committee members provide advice to NorthWestern as individual professionals; the advice they provide does not bind the agencies or organizations that the members represent.