Technical Advisory Panel Meeting

Tuesday, May 7, 2019
8:00 am – 4:30 pm
King Street Auditorium

Attendees

Anderson Hoke, NREL
Martha Symko-Davies, NREL
Derek Stenclik, Telos Energy
Matt Richwine, Telos Energy
Elijah Pack, AEMO
Rick Rocheleau, HNEI
John Cole, HNEI
Terry Surles, HNEI
Sara Cerri, Consultant to HNEI
Julia Matevosjana, ERCOT
Naomi Stringer, University of New South Wales
Dana Cabbell, SCE
Jeff Smith, EPRI
Jeff Burke, APS
Paul De Martini, Newport Consulting
Colton Ching, HE
Earlynne Maile, HE
Marc Asano, HE
Alan Hirayama, HE
Dean Arakawa, HE
Lisa Giang, HE
Christopher Lau, HE
Christopher Kinoshita, HE
Vladimir Shvets, HE
Collin Au, HE
Sorapong Khongnawang, HE
Jon Shindo, HE
Peter Young, HE
Joanne Ide, HE
Robert Uyeunten, HE
Keith Asato, HE
Yoh Kawanami, HE
Nohea Hirahara, HE
Steven Sano, HE
Greg Shimokawa, HE
Henry Lee, HE
Kevin Saito, HE
Lisa Dangelmaier, HEL

Agenda

8:00 - 8:30 am	Continental Breakfast (to be delivered)
8:30 - 9:30 am	IGP Process Status Update Review of Workplan filed December 2018 and status of the various working groups.
9:30 - 10:30 am	Planning Criteria Discussion Part 1 – Robert Uyeunten "Capacity" Planning Criteria
10:30 - 10:45 am	Break
10:45 - 11:45 am	Planning Criteria Discussion Part 2 – Christopher Kinoshita Regulating and Ramping Requirements
11:45 - 12:30 pm	Lunch (to be delivered)
12:30 - 1:30 pm	Planning Criteria Discussion Part 3 – Dean Arakawa Transmission Planning Criteria
1:30 - 2:30 pm	Identifying System Needs – Chris Lau & Vladimir Shvets Discussion of grid services and needs assessment
3:00 - 3:15 pm	Break
3:15 - 4:15 pm	TAP insights • Insights on grid strength issues and experience on planning metric for short circuit ratio. • Insights on future technologies and policy for incorporating DER into long-term forecasts (i.e., is it PV and storage for the next 20-30 years?).
4:15 - 4:30 pm	Summary of Key Takeaways

Discussion

IGP Process Status Update

Please see the presentation materials for details on upcoming working group meetings and current activities.

Forecast Working Group (FAWG)

- Will the FAWG be focusing only on forecasting for load and distributed energy resources (DER) or are other things being considered? (For example, fuel)
    - Fuel forecasts are considered, but they are managed by a different group in the Company.

Competitive Procurement Working Group (CPWG)

- Regarding the Standardized Contract Working Group, the challenge has been that contracts go through a lot of negotiations. Therefore, the goal was to file a model grid service purchase agreement (GSPA) with the Commission.
- Is the CPWG only looking at grid-scale resources?
    - Procurements could be DER and other grid services. It doesn't only have to be for utility-scale resources.

Solution Evaluation Working Group (SEOWG)

- Expected outcomes: possible weighting and evaluation criteria for different resource types.
- Note that actual proposals and bids will not be discussed in this working group. There will also be clear separation with RFPs currently in process for Stage 2.
- If project developers are part of the SEOWG, and if this group is doing the evaluation of proposals, how can Hawaiian Electric ensure that the evaluation is fair?
    - This working group will look at an appropriate and reasonable process for evaluating bids but will not be part of the actual evaluation.

Resilience Working Group (RWG)

- FEMA did some work on resiliency, so they may have some information that can be used.
- Should also consider cyber threats and not just look at hardware.
- Will need NDAs and smaller, closed meetings when discussing confidential information.
- One of the difficulties with resiliency is asking customers to pay for what-if scenarios.
- In Australia, question being asked on how much customers value reliability.
    - Developing resiliency metrics.
    - Evaluating the cost of a long blackout versus a short blackout.
    - Developing explanations on why money is being spent on resiliency.
    - Reference the Australian Energy Market Operator (AEMO) South Blackout paper, which highlights resiliency challenges.

Distribution Planning Working Group (DPWG)

- In addition to reviewing the upcoming schedule of working group meetings, focused on efforts to date on the Soft Launch non-wires alternative (NWA) project.
- Not presupposing any technology to provide NWAs.
- Capacity needs to be reliable.
    - The local capacity need is priority before considering co-benefits or ancillary system benefits.
- Prioritization of needs? For example, load vs. DER growth, or which feeders to analyze first.
    - No real priority; needs are addressed as they arise.
    - Analysis of the distribution network is done on an annual basis. During this review, will look at which feeders have issues and which may be solved with an NWA.
    - Will need to come up with an NWA screen to identify criteria on which upgrades should be deferred with NWAs.
        - Long duration needs tend to be more difficult to solve with an NWA.
        - Some NWAs need three to five years to plan.
- How to balance sharing costs (of the wires solution) and getting cost effective solutions?
    - Providers may come right under the deferral cost without much competition.

Capacity Planning Criteria

- For Solar/Battery Energy Storage System (BESS) projects, are you assuming a capacity value for those systems?

    - We are testing out a couple methods to determine the capacity value of Solar/BESS systems in the loss of load probability (LOLP) analysis.
- Is there any forced outage rate (FOR) on the battery when using in determining planning criteria?
    - Since there are currently no grid-scale batteries on the system, they don't have any means of estimating the FOR. As a result, they are currently assuming that the battery operation will honor the PPA.
    - AEMO has a battery on their system and so far they haven't had any issues.
- Is there any planning being done for a large failure, similar to the Arizona battery fire?
    - We assume that the IPPs will honor their PPA including any failures.
- The Electric Power Research Institute (EPRI) did a study on looking at the capacity value of Wind/BESS systems. This year, they plan on looking at Solar/BESS systems.
- One of the biggest challenges of using these systems for capacity planning is communication with the systems.
    - When working with multiple batteries, will it be manual dispatch versus auto dispatch?
        - Ideally want the batteries managed and working in concert.
        - Will need to be integrated with an energy management system and be available for central optimization.

Regulating Reserve and Ramp Requirements

- May want to net out the sun rising and sun setting from historical ramp data.
- Data is based on what is available and is not attributed to geographic location. May want to do a sensitivity based on irradiance data.
- At the Electric Reliability Council of Texas (ERCOT), notice that wind, solar, and load tend to cancel each other and drive down regulation needs. This is being taken into consideration even with integrating more wind.
- Is 30-minute window appropriate?
    - This is to allow for Operator decision time.
- Do you look at DGPV and utility-scale separately?
    - AEMO looks at it separately.
    - For ERCOT, DER is embedded into the load. Load is estimated from the output of the thermal units.
- Do you look at DER from location specific data or at the aggregate level?
    - For AEMO, at the aggregate level.
- What are Operations doing today?
    - Will there be a MW/min ramp requirement?
    - How far out do the forecasts go out?
        - 15-minute updates for solar and wind.
        - Operations try to make decisions as close to real-time as possible, which makes it difficult to depend on MW average or day ahead forecasts. Need to account for forecast uncertainty.
- May want to consider split reserve windows, for example 5, 10, 15, 30-minute windows, with breakouts of what resources and how much contribute to each window.

- How will PV+BESS contribute to regulation requirements?
    - Assume that the battery will absorb the variability of the paired variable resource.
    - Allow the PV and BESS to contribute to regulation.
    - Will also need to consider any charging limits due to investment tax credit (ITC) and contractual restrictions.
    - DC-coupled vs. AC-coupled projects will react differently to amount of regulation it can provide.

Transmission Planning Criteria

- We should do system protection updates like how other parts of the system have annual planning reviews and updates.
- Is there a limit on the ratio of synchronous generation vs. non-synchronous generation that you can have on the system?
    - No. Instead focus on the operational and technical issues that arise from an inertia-less system.
    - No limits in Australia. However, working on a limit / ratio now. Will need to set the limit and explain why, with considerations like system strength and inertia.
        - Will take a stepped, iterative approach. Test when it reaches the limit, and then set a new limit moving forward.
    - Avoid naming a percentage ratio in ERCOT. Look instead at things like short circuit current and other power system characteristics.
        - Anticipating a minimum inertia constraint.
        - Setting faster response time for services to move down the inertia constraint.
- Discussion on modeling
    - For AEMO, build all generators in their PSCAD model. Require all new generators connecting to the system to submit a PSCAD model. This is usually a long process during negotiation, but it is important.
    - How do you represent the DER in the transmission model?
        - Will need an accurate distribution model in order to account for the loads and impedance leading up to the transmission system.
    - For batteries, these respond very quickly, so need to be mindful of this in protection schemes. May lead to false trips.

Identifying and Valuation of Grid Services

- Will grid services like inertia or VARS be looked at and valued?
    - Unsure how to incorporate these into a production simulation.
- How will you determine the value or a service if it is likely to vary by day or month? For example, the regulating reserve requirement will likely vary by hour.
    - The value will likely vary as the requirement varies. We will look at the typical day in the month.
    - A decision may be made in one hour because of a need in a different hour. For example, a unit may be started in one hour to provide regulation or ramping in a

different hour. If you look at the hourly cost and savings in this case, the cost/ savings in an hour may be due to a need in a different hour.

System Needs Assessment

- Does the unserved energy have to be zero?
    - In the PSIP, the unserved energy didn't go to zero. The E3 plan had large amounts of unserved energy due to the retirement of fossil generation. We then took that plan, and in the E3 plan with Generation Modernization (E3 Gen Mod) plan, added in new generation which helped to reduce unserved energy. Even in the E3 Gen Mod plan, however, it did not go to zero. This may be something that we should discuss in the IGP: what is the right amount of unserved energy that is allowable.
    - From AEMO perspective, do multiple runs, but could still have bad outages stacked on each other, which will result in some unserved energy.
- The process doesn't appear to be integrated. Historically, distribution planning has always been on its own, and the way its presented, it looks as though distribution planning will again be on its own. What the commission is likely looking for is how the solutions at the distribution level may be used to satisfy system level needs. This way you are folding in distribution planning into system planning.
    - Would like to hear more about how T&D and generation will be better linked. For example, how much of the system grid services can be procured at the edge of grid?
    - Need to lay out how the models and tools are converging, moving towards all-source procurements.
    - Overall, need to constantly think about how things are being integrated. Explicitly lay out the connections, tools, and work relationships.
- AEMO allows generation and transmission to compete. Starting to let DER compete as well but are not yet at the appropriate saturation level.
- How would we model / choose to build new network to connect new generation?
    - Instead of a pure technical analysis, we are doing a market-based approach because of the many external forces and non-technical considerations such as land use, zoning, neighboring communities, etc.
    - More deterministic once the market submits their proposals.

Insights Discussion

- What can really be done in the next five to ten years given only current technology?
- Defining scenarios – what drives investments?
    - AEMO
        - Low, medium, high load growth
        - Low cost of gas
        - High DER penetration
    - ERCOT
        - Load
        - Gas prices
        - DER high penetration

    - Extreme weather considered a separate study. Such as increasing temperatures (climate science). In California, consider drought scenarios which historically occur during cool temperatures, but are now trending towards hot weather times.
- Focus on future dispatchable technology.
    - Use excess solar and wind to drive chemical storage such as methane.
- Short circuit ratio (SCR) is a crude metric; may need to move beyond this. What other challenges appear on a low-inertia system?
    - Control, voltage and frequency stability.
    - Need for grid-forming inverters or other control schemes.
        - Need to set expectations on what this technology can actually do.
- What are alternatives to synchronous condensers?
    - The flipside of a low inertia system is you can push the frequency back up quicker if it falls.
    - Grid forming inverters still a nascent technology
    - Research questions still need to be answer regarding grid forming inverters and their interactions with each other
    - The cost of getting fault current from inverters likely cost prohibitive compared to synchronous condensers
- If we drift from 60 Hz, what are the implications?
    - Damage to synchronous generation, motor loads, transformers will over flux.
- Watch out for oscillatory behavior between controls. Quick responding sources may overreact.
- Considering rare low-solar events
    - Will synchronous generators still be ready and deployable? Or will they be demolished?
    - Come up with scenarios on how thermal generation will be managed.
        - Full retirement → overbuild renewables
        - Keep on cold standby and show start up costs (no fuel, but O&M costs for storage).
    - Does not have to be the most extreme case like the 40 days of rain. We get five days of low solar pretty regularly in Hawaii.
- PSCAD modeling
    - ERCOT provides a generic system model for developers with an explanation of expected behavior of their proposed generation. The developers are responsible for working with the manufacturer to get the model right.