HECO IGP Technical Advisory Panel – Distribution Subcommittee
Summary and Feedback from November 16, 2022, Meeting

Distribution Grid Needs Assessment & Non-Wires Alternatives

This feedback and summary was delivered by the IGP Technical Advisory Panel (TAP) Distribution Subcommittee to Hawaiian Electric (HECO) based on HECO's slides and presentation on November 16, 2022, related to two presentations. The Distribution Grid Needs Assessment & Non-Wires Alternatives, and the Protection Roadmap.

TAP and distribution sub-committee members

- Kevin Schneider (PNNL, Chair distribution sub-committee)
- Dana Cabbell (SCE, member distribution sub-committee)
- Debbie Lew (ESIG, member distribution sub-committee)
- Aiden Tuohy (EPRI, member distribution sub-committee)
- Vishal Patel (SCE, member TAP)
- Andy Hoke (NREL, member TAP)
- Dave Narang (NREL, member TAP)

TAP feedback and comments are divided into four categories:

1. Informational, no action needed
2. Action required, expected in coming months
3. Concern or suggestion, for future discussion or consideration
4. Clarification needed

TAP summary of discussion and feedback

Two presentations were given to the sub-committee. Comments for each are as follows:

Distribution Grid Needs Assessment & Non-Wires Alternatives

- Overall, the proposed approach to NWA evaluation appears reasonable. Positive aspects include:
    - Consider looking at four net load growth scenarios to better consider uncertainty in load growth.
    - Consider allowing NWAs for needs as close as two years out.
    - The criteria for NWA evaluation appear reasonable. (Have the numbers on slide 10 been checked with potential NWA developers?)
- When evaluating the deployment of NWAs in lieu of traditional approaches, it would be appropriate to include an assessment of the "impact" if the NWA fails to perform. For example, an NWA that fails to reduce peak load on a single circuit might result in a low voltage condition, while an NWA that fails to reduce the peak load on an entire transformer could result in a transformer failure, with a potential failure to serve customer load. There would also be impact

to the end-use customers if there is a failure to perform that results in long term equipment damage. The key being that when assessing the cost/suitability of an NWA it would be appropriate to also assess the performance expectation of the selected NWA and the impacts of non-performance. This may help identify NWAs that are more suitable for a given scenario.

- Capacity and duration may not be perfect metrics for performance, but it gives commonality with existing process so that there can be an "apples to apples" comparison approach. Based on this it makes them very suitable.
- When considering Market Assessment, % overload is a useful metric, but the land use considerations should be considered as well. For example, a large battery deployment to defer a transformer upgrade may be cost effective based on equipment price but considering the cost of land for the multiple shipping containers a battery is housed in may change the outcome. Additionally, in some scenarios obtaining the land may not be possible under any viable situation.
- If NWAs become more common and include the deployment of additional DERs, this may need to be considered with respect to existing DER forecasts. Specifically, does the forecast include these additional DERs? It may not be necessary at lower levels but if this becomes more common there may be a connection.
- What is the basis for triggering a re-evaluation based on the four NWA assessment categories? It might make sense to develop metrics and differentials for each of the four categories that "trigger" a re-evaluation. Mapping this out in flow-chart type process map might help to conceptually show the process and thinking to stakeholders, and hopefully improve process transparency.
- One additional NWA screen that may be useful could be based on longer-term forecasts of growth: In areas where high net load growth is expected to be sustained well past the year when the grid need occurs, the NWA may only defer the grid need a few years, leading to limited benefit.
- Moving forward, tracking forecasts (or load, DER, EE, EV, etc) against real growth data can help tune future forecasts, if HECO is not already doing that. Likewise, it may be useful to track what percent of interconnection request for load, EV charging stations, etc., actually connect
- Are any transmission-level benefits of NWAs considered? Might there be any transmission-level benefits?

Protection Roadmap

- The TAP members present commented that HECO's protection roadmap does a very good job of summarizing the current and future challenges HECO sees with protection as the system transitions to higher average and peak levels of inverter-based resources (IBRs).
    - Note that the TAP members do not consider themselves protection experts. Rather than prescribing a certain path, we aim to flag issues HECO may want to look into.
- The TAP asked whether HECO has considered imposing requirements on the fault response of transmission-connected IBRs. HECO responded that they are looking into this but have no immediate plans.
    - The TAP noted that IEEE 2800 already requires tunable inverter fault response for transmission and subtransmission-connected plants. To take advantage of this, the

utility needs to define what fault response they want from the inverters. While it would certainly take some effort to define the desired IBR fault response, HECO may later regret not asking for specific fault responses now – if you don't ask for something specific, you will probably end up with a mixed bag, making protection more difficult. If possible, look at applying specific requirements even to plants in the queue. (For distribution-connected IBRs, it may not be feasible to obtain specific fault response behavior until standards are updated; these comments apply to larger plants.)

- The TAP cautioned against assuming that grid-forming (GFM) inverters will automatically help with protection issues. GFM inverters will hit current limits during low voltage conditions and may wholly or partially lose grid-forming characteristics. The response may be dependent on the pre-disturbance inverter operation point. Each inverter model's response may also be different. HECO's requirement for 1.6 per unit overcurrent capability should help, but you may also want to define the desired characteristics of the GFM fault response. At the same time, the TAP acknowledges this is not an easy task.
- The TAP commented that experts in other areas are moving away from K-factor style IBR fault responses and towards closed-loop voltage control with anti-windup for fault conditions.
- The TAP cautioned that even modern microprocessor-based relays can fail due to unexpected mixes of IBR sequential component current.
- HECO's move away from distance-based protection for transmission makes sense, but the TAP acknowledges that alternatives are communication-dependent and therefore can be costly, especially considering needs for communication redundancy.
- Like HECO, TAP members are starting to look at GFM supercapacitor systems, which may help with protection among other things

The TAP Chair will share HECO's protection roadmap slides with the transmission subcommittee as well, and we can continue this discussion during the December 1 TAP meeting.