IGP Stakeholder Technical Working Group Meeting

Wednesday, October 13, 2021
9:00am - 12:00pm
WebEx

Attendees

WebEx

Marc Asano, HE
Colton Ching, HE
Christopher Lau, HE
Eli Morris, AEG
Ken Walter, AEG
Fuong Nguyen, AEG
Andy Hoke, NREL
Aaron Schwartz, RMI
Alex de Roode, COM
Clarice Schafer, HPUC
David Parsons, HPUC
Dean Nishina, DCA
Derek Stenclik, Telos Energy
Genevieve Lillis, RMI
Jerry Sumida, Carlsmith Ball
Gina Yi, HPUC
Grace Relf, HPUC
Genevieve Lillis, RMI
Gord Stephen, UW
Henry Curtis, LOL
Jacqui Hoover, HIEDB
Jeremy Laundergan, EnerNex
Jessie Ciulla, RMI
Keith Yamanaka, DoD
Kevin Schneider, PNNL
Michael Schwing, HSEO
Kylie Wager Cruz, Earthjustice
Mac Wodicker, ASU
Marcey Chang, DCA
Murray Clay, Ulupono
Matthias Fripp, Ulupono
Noelani Kalipi, PHOW
Paul De Martini, Newport Consulting
Pete Polonsky, HPUC
Rene Kamita, DCA
Riley Saito, COH
Robert Harris, Sunrun
Samantha Ruiz, Ulupono
Sherilyn Hayashida, DCA
Stephen Mariani, HPUC
Steven Rymsha, Sunrun
Terry Surles, HNEI
Rod Aoki
Christopher Kinoshita, HE
Abel Siu Ho, HE
Collin Au, HE
Brian Lam, HE
Robert Uyeunten, HE
Anne Fuller, HE
Jeslyn Kawabata, HE
Alyssa Nada, HE
Kent Kurashima, HE
Kolter Kalberg, HE
Shuk Han Chan, HE
Jennifer Baker, HE
Victor Bolin, HE
Dean Oshiro, HE
Scott Lee, HE
Isaac Lum, HE
Dan Lum, HE
Kenton Suzuki, HE
Lisa Dangelmaier, HE
Brendan Pascua, HE
Richard Wang, HE

Agenda

- AEG Update on Supply Curves
- Overview of ERM Criteria
- Review of ERM Testing Analyses
- HNEI Presentation – ERM Calibration and Resource Adequacy

Discussion

AEG Update on Supply Curves

I. Stakeholder: Can you say which hours were considered peak again for supply curves?
    a. AEG: 5-7 PM weekdays

Review of ERM Testing Analyses

I. Stakeholder: What is the resolution of the full production profiles?
    a. HE: The production profiles and HDCs in REOSLVE and PLEXOS are hourly.
II. Stakeholder: Why did you start at 30% ERM?
    a. HE: For O'ahu, this roughly represented the energy provided by the loss of largest unit.
III. Stakeholder: Can you elaborate more on how DR is incorporated into the ERM calculation?
    a. HE: DR was previously embedded in the load and is now being modeled as a supply side resource. No derate though the HDC is applied. For the GSPA projects, we account for the number of events per year, timeframes, and durations in the modeling.
IV. Stakeholder: What is the regional resolution on the full production profiles?
    a. HE: Existing resources are based on their historical generation. Future resources are based on a profile developed by NREL through their resource potential study.
V. Stakeholder: So how does using the full production profile for renewables remove the hourly dependable assumption?
    a. HE: The HDC profiles derate the production profiles to determine their reliable capacity contribution. The production profiles give full credit to what the projects can produce.
VI. Stakeholder: How are DER included in the ERM/HDC? Are they treated as negative load, which reduces the need for ERM?
    a. HE: Yes, DER is a load layer.
VII. Stakeholder: Since RESOLVE isn't setup to consider N-1 contingencies directly, are you using a proxy for the largest plant you expect to be online (e.g., 150 MW), or is this just folded into the ERM percentage?
    a. HE: That's why we model the resource plans in PLEXOS, to capture the maintenance and forced outages.
VIII. Stakeholder: Is this modeled for 2030? Is it assuming all procured resources are online?

a. HE: To evaluate the ERM criteria and HDCs, we decided to model one year, 2030. By modeling one year, we were able to focus on resources added for capacity. When modeling multiple years, the model may choose to build resources earlier because its cost effective and any resource built would have some capacity credit through the HDCs, so it becomes more difficult to determine what was built specifically for capacity.

IX. Stakeholder: Does the HDC differ for hybrid projects like RE paired with storage?
   a. HE: No, the PV uses the same HDC regardless of if it's paired or not. The storage is not limited by an HDC.

X. Stakeholder: Would a new retirement schedule require this analysis to be redone? Or potentially pick a different date to model?
   a. HE: No, a different retirement schedule would not require this analysis to be redone. We assumed a base retirement schedule then removed additional units for the lower ERM target cases.

XI. Stakeholder: Can you comment again on the type of analysis you're doing?
   a. HE: This is a capacity expansion model plus hourly production simulation in PLEXOS.

XII. Stakeholder: Is this done via linear optimization? Does PLEXOS do the optimization?
   a. HE: RESOLVE is used for capacity expansion; it's a linear optimization model. We don't use PLEXOS for capacity expansion. We use it to verify hourly operations of the system.

XIII. Stakeholder: Did you look at alternative HDCs for the RESOLVE analysis under the different ERM criteria, besides the 30% ERM? Why not look at RESOLVE at 1 sigma?
   a. HE: Yes, we did look at it only for case 6 and not the rest of the cases.

XIV. Stakeholder: It seems that in the PLEXOS ERM evaluation, the run is derating production of renewables between 50% to 90%.

XV. Stakeholder: Could you explain what the y-axes on the HDC and PV production profiles represent?
   a. HE: Those are unitized for the generating unit capacities by taking the production profile and dividing by the project's capacity. It's on a per MW basis.

XVI. Stakeholder: You are assuming that no one will include hydro as a resource in ten years?
   a. HE: We've included hydro as a resource in RESOLVE. The ATB provided information on pumped storage hydro cost.

XVII. Stakeholder: Could you explain the relationship between the number of standard deviations and the likelihood of occurring? How does this relate to the low renewables sensitivity?
   a. HE: The number of standard deviations is how much the renewable production is derated to produce its reliable capacity. The resource plan would then have additional resources to meet the margin, in the event the renewables don't perform. It is separate from the low renewables sensitivity because we are trying to determine the appropriate ERM target and assumptions for HDC in this analysis.

XVIII. Stakeholder: Because of bad weather, what resource types would be added? Thermal capacity or storage?

a. HE: The resource plan build out is described in the later slides of the presentation.

XIX. Stakeholder: How much does two sigma reduce the PV generation? By what amount?
   a. HE: The PV HDC uses a normal distribution and takes the standard deviation on the mean for each hour of the year using historical data. One sigma is 68% and two sigma is 95%.

XX. Stakeholder: Does HECO have any kind of energy market mechanism to work on these things? Thinking about capacity markets, IPPs, ancillary services, etc.
   a. HE: We don't have a power or energy market here in Hawai'i, in an ISO or RTO sense. Resources and grid services come from IPP/aggregators with relatively long-term bilateral contracts, tariff programs, and utility projects.

XXI. Stakeholder: Is there another way to look at ERM where instead of applying the deration to a renewable resource like PV or wind in the HDCs, we could move the deration to the right-hand side of the equation? This might mix the deterministic type analyses with the probabilistic analyses. Is this reasonable to do?
   a. Stakeholder: This would blend the deterministic and probabilistic analyses. Would need to look at many weather years in lieu of using the HDCs.

XXII. Stakeholder: Does ERM account for damage/loss of availability of PV or wind from extreme weather events or is it just looking at windless/sunless days? If not, how will this be addressed?
   a. Stakeholder: ERM does not account for extreme weather events. More likely to put that on the resilience side, not on resource adequacy.

XXIII. Stakeholder: Did the Telos analyses look at other reliability metrics besides LOLE?
   a. Stakeholder: Yes, EUE and LOLH.

XXIV. Stakeholder: Did RESOLVE choose retirements based on economics or were those manual inputs into the RESOLVE cases?
   a. HE: We removed the same units in year 2030 that we proposed in our Inputs and Assumptions, up to year 2030. In the lower ERM cases, additional units were removed.

XXV. Stakeholder: Did the Company look into offshore wind with one or two interconnection points?
   a. HE: Only one interconnection point was assumed with no equipment outages assumed.

XXVI. HE: The issue we are seeing with paired PV+storage is more an energy issue than a capacity issue. The batteries are running out of energy to serve the peak period. Since we are applying the PV HDC to the PV part of the paired project, there is not enough energy to shift around to hours when it is needed.
   a. Stakeholder: The problem with HDC is that the output is a lot lower than what you would get on a real day. For example, for solar, it looks to be a lot lower than the minimum solar you will get on a real day.
      i. HE: The way the HDC is defined, it is using historical data to determine the reliable portion of the generation that we should consider for capacity planning.

b. Stakeholder: HDC is a capacity metric and you're trying to use it to solve an energy problem. If you're worried about days with unusually low energy from renewable resources, you should model days with unusually low energy rather than string together the individual hours with the lowest energy. By stringing individual hours with low energy, you will create a day that would not occur.
    i. HE: This is why we did these tests, looking at how to treat wind and solar, various ERM levels, comparing HDC to the renewable profiles.

XXVII. Stakeholder: When RESOLVE was choosing how much capacity to add, was it constrained by the HDC?
a. HE: In all cases except the production profile case, RESOLVE used the HDC for ERM purposes when building the plan. In the production profile case, we swapped out the HDC profiles.
b. HE: When we applied the full production profiles, RESOLVE is giving more credit to the variable renewables. You don't see the thermal capacity being built in the case where the production profile was used instead of the HDC.
    i. Stakeholder: Is that why RESOLVE adds so much capacity of variable renewable resources? Because RESOLVE is using the HDC and assuming it is only getting a small percentage of energy from the variable renewables than it actually would?
        1. HE: Yes, for the cases where we are using the HDC.

XXVIII. Stakeholder: How are batteries considered in ERM?
a. HE: Batteries are assumed to pass through their energy, i.e. have 100% HDC. It's the energy flowing into the battery that is derated by the HDC.

XXIX. Stakeholder: You mentioned removing thermal units that were added for energy.
a. HE: One of the challenges in this analysis was to determine how much resource was built for capacity versus for economics.
b. Stakeholder: If RESOLVE is adding energy resources, it's probably to avoid being energy short during low renewable days, so I'm not sure why you're removing them before doing a reliability analysis.
    i. HE: In a separate case that we tested, we didn't allow variable renewables to be built. In that case, the same thermal capacity was built compared to the cases where we allowed variable renewables to be built. That gave us confidence that the variable renewables were not being added for capacity.
    ii. HE: In discussions with HNEI, the thought was that in order to isolate the capacity issue, we should remove resources that appear to only be added for energy.
    iii. HE: When you take the three resource plans that were developed by RESOLVE (30% ERM, 30% ERM with production profile, and 30% ERM without thermal candidate resources), the results show a step function as you give more credit to the variable renewables.
        1. HE: From an unserved energy perspective, the results show that as you give more credit to the variable renewables, you get less unserved energy.

2. HE: Also noting these results are for the ERM test. In the production simulation where load is not increased by the ERM margin and the production profiles are used instead of HDCs, the unserved energy goes away.

XXX. Stakeholder: What is the historical unserved energy for the systems?
   a. HE: Not sure how many events we've had in the past. For planning, we use 1 in 4.5 years per our LOLP guideline.

XXXI. Stakeholder: Do you have a target unserved energy that you are looking at for this stage of the modeling?
   a. HE: We don't have a target for unserved energy. Traditionally, for Adequacy of Supply, we look at Rule 1 and LOLP.

XXXII. Stakeholder: What's the difference between the full production profiles case and the production simulation?
   a. HE: Both cases use the full production profile for the variable renewables. The full production profile case is meeting the load with the ERM adder while the production simulation is just the load. The production simulation also includes the forced outage monte carlo loops.
   b. HE: We don't know when we will have unplanned outages that will cause us to need more generation so the ERM adder is applied to the load in all hours.

XXXIII. Stakeholder: Were low weather days examined in this study?
   a. HE: We are intending to do that as part of the IGP process when we evaluate the resource plans. It wasn't included here.

XXXIV. Stakeholder: Do the outage loops also impact the weather profiles?
   a. HE: No, the monte carlo outages are only for the firm thermal generators.
   b. Stakeholder: Does it look at maintenance outages and forced outages for the thermal units?
      i. HE: Yes, those are included in the production simulation.

XXXV. Stakeholder: Outages are increasing and appear to be trending worse. A lot of this study is focused on credit to the variable resources, but we need to be realistic and take into consideration the reliability of the thermal fleet as well.

XXXVI. HE: When we get to the resource adequacy step of the IGP process, we'll try to incorporate some of the probabilistic type analyses or ask TAP/HNEI to evaluate some of the portfolios. This may be more useful for the near-term years, but as you get out further, 2045 or 2050, it may not be necessary.

XXXVII. HE: We still plan to use HDC but still deciding between 1 sigma or 2 sigma based on the results of the analyses.
   a. HE: This is especially important for the hybrid, PV+storage resources. We don't have much operating experience or data on how the resources will perform. As we get more experience, we may revisit how we are thinking about the capacity accreditation. We don't want to be in a situation where we overvalue them now, retire units on that basis, and are then caught short on poor weather days.

XXXVIII. HE: For HELCO, the resources that RESOLVE selected was constant. In the 40% case, however, there was some additional thermal capacity being built.
   a. Stakeholder: Does this include PGV and Hu Honua?

b. HE: Hu Honua was not included. PGV expansion was included.

XXXIX. HE: Want to note that PLEXOS includes a 1-day lookahead and dispatches over the course of a couple days.
   a. HE: One of the pros/cons of the planning tools is it does benefit from having perfect foresight, so it wouldn't be perfectly aligned with our operation decisions.
   b. HE: Are there thoughts on how the model's perfect foresight can be "turned off"?
      i. Stakeholder: Could be handled with spinning reserve margin. Then you try to run the system with that reserve margin which will help you with the ramps within the hour. Doesn't have to be spinning machines, but just fast response generators like batteries or DR.

XL. Stakeholder: It seems like at least partial foresight is needed since we won't have perfect foresight in reality but we will have some foresight through forecasts.

XLI. Stakeholder: You're not just carrying operating reserves in case load jumps by 30%? You're carrying the inflated load throughout the day that is soaking up energy?
   a. HE: Yes, it is to simulate an outage. The load could be the same but there could be an outage and no energy to charge the battery.

XLII. Stakeholder: Are you doing monte carlo outages on the ERM test?
   a. HE: Not in the ERM test since that will double count between the ERM and forced outage.

XLIII. Stakeholder: Do you have any generator that is expected to run all day and serve the 30% ERM?
   a. HE: It could be multiple units out, or one of our large units.
   b. HE: The ERM targets were based on the energy equivalent of the largest unit on each island.

XLIV. HE: For Maui, we weren't seeing additional thermal units for the higher ERM targets. That's one of the differences compared to Oʻahu and Hawaiʻi Island.

XLV. HE: For Molokaʻi and Lānaʻi, we took a slightly different approach and removed all the current thermal units as a starting point.
   a. HE: For Molokaʻi, we're seeing that we don't get to a 60% effective ERM when we evaluate the resource plans in PLEXOS. At most, we achieve 40% in the 2 sigma and production profile cases.
   b. HE: One of the challenges with the smaller systems is when RESOLVE builds thermal units, block size is a key variable in determining what the unserved energy will be for the resource plan.
      i. Stakeholder: If you had smaller thermal generators, would it change the results?
         1. HE: For the smaller islands, it may have. Particularly when you account for outages, having multiple smaller generators rather than one large generator increases the availability of the total firm capacity because it will be less likely that large amounts of capacity will be unavailable due to outages.

c. Stakeholder: Can you explain why for Lāna‘i and Moloka‘i, you started with all the current thermal units removed?
    i. HE: Due to the block size. We though it would give a better optimization problem for RESOLVE to see what it would build as replacement capacity using the 2.2 MW block size.

XLVI. Stakeholder: Can you speak to why PLEXOS can’t satisfy the ERM when RESOLVE thought it could when it designed the buildout?
a. HE: In RESOLVE, we model only 30 representative days so it doesn’t capture the variability that can be modeled in the full 8760 hours in PLEXOS.

XLVII. Stakeholder: Is the thinking that you would retire the difference between the current thermal capacity and new thermal capacity?
a. HE: We would need to address that more when we develop the full resource plans in the IGP process.

XLVIII. HE: Based on the analyses done so far, it appears for O‘ahu, Hawai‘i, and Maui, the 30% ERM and the HDC appear to be a reasonable metric to use in the planning analyses in IGP as a starting point.
a. HE: Through discussion with the resilience working group, if a higher level of reliability is needed or desired, that may result in a higher ERM target. The 30% ERM target was intended to cover loss of largest unit, as well as other events like outages and weather-related issues that may cause forecast uncertainty.
b. HE: We believe the HDC is a reasonable approach to mitigate the impact of low PV/wind output and to be able to provide enough energy to charge batteries on the system.
c. HE: A fuller reliability analysis will still be conducted in the resource adequacy step of the IGP.

Discussion Topics for TAP

Capacity Expansion

- Is it appropriate to use an ERM for long-term capacity expansion modeling?
- If so, what is the appropriate ERM %?
- Is it appropriate to use production profiles or an HDC for capacity expansion modeling?
- If HDCs are used, what value should be used? 1 sigma or 2 sigma?
- Applying ERM and HDC now, is there a risk of overbuilding/underbuilding? Does it leave sufficient flexibility for the future?
- Should the ERM or capacity expansion modeling account for the worst weather day? How is the worst weather day defined?
- Should the ERM account for more extreme weather than historically observed?

Resource Adequacy

- What methodology is appropriate for evaluation in the Resource Adequacy step?
- In the PLEXOS Resource Adequacy evaluation, what level of HDC is appropriate?
- If there are capacity shortfalls in the resource adequacy process step of IGP, is it appropriate to re-run RESOLVE with an increased ERM %?

Next Steps

- Stakeholders may provide feedback on today's discussion to IGP@hawaiianelectric.com