Tim Mason, LSA:

1. In the MAG meeting last week you noted there would be no solar ELCC modeling in the IRP. In that case, what values should we default to for modeling solar value? 2019 CAISO monthly ELCC factors or something else?
    a. For RA compliance, use the 2019 CAISO monthly ELCC factors. There is no CPUC-adopted framework for counting capacity value to plan for meeting RA obligations beyond the year-ahead. The IRP proceeding has overseen some studies that indicate significant changes to ELCC as the online resource mix includes increasingly more intermittent renewables and storage. For example, as more solar is assumed online in the future resource mix, the average ELCC of solar as a resource class declines somewhat and the marginal ELCC of solar approaches zero. A description of ELCC studies related to the IRP proceeding is in Attachment A to the Sept. 24, 2018 ALJ ruling.

Deborah Behles, CEJA:

1. Where can we find a complete set of the GHG, NOx, and PM emissions factors that are assumed in the SERVM modeling? I also wonder where we can see the assumptions for startup time per generating unit and potentially for assumptions that may be used for estimating the amount of time that facilities are operating under partial load such as minimum operating/spinning reserves. The information given included ranges for startup and it was not clear what values were used for what assumptions. The values also did not include assumptions for biomass, shutdown emissions, and partial load. It is not clear if those emissions were included, but if they were, it would be great to know what was used.
    a. p. 53-55 of the Sept. 24, 2018 ALJ ruling Attachment B, IRP RSP 2017IEPR SERVM results. In the current analysis, staff used different emissions factors for hot/warm/cold starts, but constant factors for the range Pmin to Pmax. Staff used information in the CAISO Masterfile and the TEPPC Common Case to identify subclasses of plants and use the appropriate start and steady-state emissions factors for that subclass.
    b. Startup times for each generating unit are confidential. The variance in startup time for different units is substantial, so providing meaningful class averages is challenging. Time spent in partial load conditions for each plant or group of plants would require saving and post-processing large amounts of hourly dispatch data. Staff plans to more thoroughly develop this analysis during the next Reference System Plan process.

Farah Mandich, SCE:

Several of the questions below can be answered by the Sept. 24, 2018 ALJ ruling Attachment B, IRP RSP 2017IEPR SERVM results. We will refer to slide pages in the responses below.

1. What is the California hydro assumption applied in the SERVM conforming hybrid case, e.g. normal hydro year or dry hydro year? What is the total annual energy that the California hydro resources generate for the conforming hybrid case?

   a. SERVM models multiple weather years and matches with a hydro profile corresponding to historical hydro in that weather year. See slides 15, 16 for an overview of the weather years and weighting. See our hydro profiles here. We do not particularly model a dry or wet year because we model all of the 35 years we have in our dataset with equal weight. It would seem reasonable for SCE to choose either a normal or dry hydro year, given trends towards drier weather unless you wanted to model the entire group of weather years like we did.
   b. For total annual energy of hydro, you can take the hydro profiles data linked above and sum the "hydnrg" variable values across the months for each area and weather year - that represents the total energy that the model makes available in each weather year. For results from the runs we did on the Reference System Plan with the 2017 IEPR, see slide 35 which reports hydro for the CAISO area.
2. What are the California import and export transmission limits applied in the conforming hybrid case? What is the total annual energy of California imports and exports in the year 2030 for the conforming hybrid case?
   a. For simultaneous limits, see slide 23. For flow limits between regions in the SERVM model, see the SERVM model input data website. For total annual energy of CA imports and exports, we understand this to be an output so we do not have an answer. For results from the runs we did on the Reference System Plan with the 2017 IEPR, see slides 34, 40, 41.
3. What is the origin of the new resources named "Other_New_Solar" and "Other_New_Wind," and in what regions should parties assume this capacity resides?
   a. These are a mix of generic TBD wind or solar PPA and some generic ReMAT and RAM projected procurement. The summary dataset we provided shows in worksheet: *AdjLsePortByYear*: column A that the wind was placed in PGE_Bay and the solar was placed in PGE_Valley regions of the SERVM model.
4. How should parties use the "Global_hybrid_conforming.xlsx" dataset to determine which conventional generators were selected for 40-years retirement in the SERVM model?
   a. The *insvdt* variable gives the lifespan of the generator, from Commercial Operating Date (COD) to retirement date. One can use Excel to extract a numerical retirement date from the *insvdt* string and use that number to pivot/filter the data. The retirement date was extended to the end of any contract that was still in place at age 40.
5. Can staff please provide the carbon price file in SERVM's native format and clarify which carbon price scenario will be used in the SERVM PCM? The provided file is in the IEPR 2017 publication format.
   a. Staff is using the 2017 IEPR "Low Price (High Consumption Scenario)" of carbon price which projects $27.37 per metric ton CO2e in 2016$ in 2030. Using the 0.428 metric ton CO2e per MWh unspecified import emission factor, we calculate a $11.71 per MWh carbon adder to the hurdle rate in 2030. Staff has posted an updated workbook of flow limits between regions in the SERVM model as well as the hurdle rates including the carbon adder to the IRP SERVM model input data website. The updated workbook includes some minor corrections to the flow limits for a few lines.

6. Can staff please provide additional documentation comparable to data_dictionary.xlsx to describe the remaining posted datasets (i.e. the datasets located in the "SERVM input data for hybrid conforming aggregated LSE Portfolio" folder area are not yet documented)?
    a. Staff believes the text found on the webpage or in the files themselves are sufficient. However, staff sees the value of having a "data dictionary" that systematically and comprehensively describes the fields in all the datasets on this webpage. Staff will make website improvements during the next IRP cycle as time allows.
7. When will Staff complete its assessment of aggregated LSE plans for northwest hydro procurement? If it will not be completed before production cost modeling, how does Staff plan to approach any potential portfolio deficiencies discovered via this assessment?
    a. Staff is conducting its hydro assessment in parallel. The work is nearing completion, and staff has not identified any issues that would impact the PCM work.

Tyson Siegele, POC:

1. Will the modeling runs by stakeholders which are submitted to staff be posted on the CPUC website or included in MAG webinar materials?
    a. Yes – look for expected schedule details in an upcoming ruling.
2. In the Oct 31 webinar, Staff chose not to address DER questions. Will there be a DER specific MAG webinar? If not, how will updates be integrated into the hybrid portfolio?
    a. DER-specific questions, as they relate to modeling for the upcoming IRP 2019-20 process, were covered in MAG webinars on April 27th, May 30th, and June 29th. Those materials are available for download on the IRP MAG webpage. DER modeling improvements will continue to be addressed as part of the next Reference System Plan (RSP) development process, including MAG webinars. Staff expects to vet with parties a draft version of the RESOLVE Inputs and Assumptions for the next RSP development process soon.
3. When will energy storage inputs be updated beyond "as found" to account for projected utility and BTM installations through 2030?
    a. Storage inputs already include the assumed procurement to the CPUC storage target, the new storage in the LSE IRPs, and BTM installations assumed in the 2017 IEPR.
4. Will there be a MAG webinar specifically on storage?
    a. We do not currently have a storage-specific MAG webinar scheduled.
5. When will the load curves be updated to include the effect of battery/storage installation projections instead of just "as found"?
    a. Storage resources assumed in RESOLVE and SERVM are modeled as supply. We already assume some BTM storage effects by using the 2017 IEPR.
6. Will the hybrid portfolio be updated to include projected storage prior to submission for TPP?
    a. See response to POC Q3.
7. Will there be a process by which staff recommends to CAISO storage options which would be more cost effective than transmission?

   a. At the system level, RESOLVE selects storage options over new transmission when it is cost-effective. Staff is open to exploring questions like these through scenarios, and parties will have an opportunity to weigh in on staff's recommended scenarios in early 2019, to inform the next Reference System Plan development process.
8. Has a date been set for MAG review of solar, storage, and wind cost inputs so as to result in more accurate modeling outputs for the 2019-2020 IRP cycle? Will any updates to those inputs be included in the hybrid model before submission for TPP?
   a. The 2019 RESOLVE Inputs and Assumptions proposal, which will cover cost and potential sources across all resource types to be considered in RESOLVE modeling, is expected to be issued via ALJ ruling for party comment soon. It will be followed by a MAG webinar to discuss the proposal. Staff does not anticipate that these inputs will not be included in the Hybrid Conforming Portfolio for the TPP.

Ellen Wolfe, Resero:

1. Does the FCDS and EO distinction captured in the hybrid workbook influence in any way the SERVM PCM runs? Or is it provided for other purposes and is not relevant to the SERVM modeling?
   a. The FCDS/EO distinction is not relevant to SERVM modeling.
2. Regarding the staff's hybridization:
   2.1 At the Oct 31 workshop the staff discussed shifting resources to enforce limits and shifting resources to adjacent areas. Were factors such as cost or any other attributes from RESOLVE used in the choice of what areas had increased build outs when the staff needed to reduce the buildout in other areas?
      a. Staff considered the optimal build chosen by RESOLVE as a guide for whether certain regions or resource types tended to be cost effective by virtue of being selected by RESOLVE.
   2.2 For NW_Ext_Tx_WIND and SW_Ext_Tx_Wind areas the CPUC staff increased (over the LSE submitted amounts) wind in these areas to a great degree (700 MWs, 2030). What was the thinking to increase placement here verses other areas inside or outside of CA? Like why here over NM wind or other internal area wind? How are those areas represented in the SERVM topology (e.g., as radial lines, or…?)
      a. Staff moved wind to the NW_Ext_Tx_WIND and SW_Ext_Tx_Wind areas generally up to the amounts that were optimally selected in RESOLVE for these areas. This was done to preserve the desire for deliverable wind and to free up other in-state areas with constraints on wind potential or transmission capacity. Wind from these areas would be using part of the existing "pipes" between regions in the SERVM zonal model. See also Resero Q3 below.
   2.3 Among the OOS wind areas, why were these adjusted and what was the logic?
      a. Desire for AZ, NM, and WY wind was not changed. Moving wind build to NW_Ext_Tx_WIND and SW_Ext_Tx_Wind areas was explained above.

2.4 Greater Imperial Geothermal resources were adjusted down by 250 MWs in the hybrid plan relative to the LSE aggregated submitted numbers. Why was it all moved to Northern California Geothermal as opposed to Pacific_Northwest_Geothermal or Southern_Nevada_Geothermal?

a. RESOLVE chose Greater Imperial Geothermal as an area with appreciable cost effective potential. Staff moved the LSE-selected 250 MW of Northern CA Geothermal to Greater Imperial in order to free up Northern CA transmission capacity. LSE-selected Southern Nevada Geothermal (47 MW) was left alone.

2.5 The Read Me sheet of the hybrid plan workbook has a statement: "Rows 17:64 show the nameplate MW by candidate resource type and year. The adjusted aggregation of LSE new build in 2030 is used to proportionally adjust the candidate resource mix in earlier years." Could you please explain this last sentence a bit more; does it mean you derived the 2030 plan and then worked backwards to get the other year's plans based on ratios (of what?) in the 2030 plan? Is that what is described in the subsequent three rows of that sheet? If time permits perhaps you could explain this during the workshop.

a. On the *AdjLsePortByYear* worksheet, Column P indicates the relative proportion of for example "Solano_Solar" out of "all solar." Certain categories of solar are excluded from the prorating exercise since they were not adjusted in 2030, e.g. Distributed Solar, OOS solar, and Other New Solar. The ratio in column P is multiplied by the total amount of LSE-selected solar in earlier years (values in row 11), but again excluding the categories of solar that were not adjusted in 2030.

3. What is the candidate resource type Northern California Wind? (The hybrid plan seems to have increased the siting in that location, whereas RESOLVE assigned no resources to it.) How can other parties know what the definition of that zone within SERVM is in order to replicate that in other PCM tools? Is there a detailed zonal topology for the SERVM zones somewhere?
   a. See the CPUC staff Modeling Data webpage for a mapping of SERVM zones to balancing areas. In the *AdjLsePortByYear* worksheet, Column A shows the SERVM zone mapping to the RESOLVE resource types.
4. What is "Other_New_Wind"? Where will the Other_New_Wind resources be placed in the SERVM topology?
   a. See SCE Q3.
5. Can the staff explain, or otherwise point to documentation related to, how SERVM will dispatch batteries?
   a. SERVM is configured to minimize LOLE and curtailment. When SERVM dispatches storage to minimize LOLE, it will charge in excess energy conditions and discharge when energy is tight regardless of price. This coincidentally lines up with charging at low prices/curtailment conditions and discharging at higher prices though that is just coincidence. In minimizing curtailment and LOLE, higher renewables penetration creates more excess energy conditions and adding storage appears to help alleviate excess and allow more of the renewables to contribute to serving load across all hours of the year.

Shucheng Liu, CAISO:

1. What is the total amount of battery storage in the Hydrid Conforming dataset that will feed into the SERVM model? How is Lake Hodges accounted for?
    a. The total CAISO battery storage in the Hybrid Conforming dataset that will feed into SERVM is 120 MW from existing units (those with CAISO Resource IDs) plus 2360 MW from generic units labeled with the prefix "hyb_conf_" (green highlight in the summary workbook). The total is 2480 MW. Lake Hodges is not included in these numbers and is separately included in SERVM as an existing pumped storage unit.
2. Where is the capacity data for demand response resources assumed online in the Hybrid Conforming dataset in SERVM?
    a. Staff will post this data to the SERVM model input data website soon.