Q: Was V2G included in the emerging technology review?

A: No - It is a separate topic that we cover today.-

_____

Q: Will there be any effort to validate Lazard cost of storage with actual battery contracts that have been signed by the IOUs?

A: Yes. we typically validate Lazard cost (and other resource costs) against actual contracts. I can get more details on this from my team if that's helpful.

_____

Q: Why are you only using Morro Bay OSW and not including Humboldt?

A: We are doing both. Morro Bay is presented in the slides in the interest of keeping the slides readable.-

_____

Q: (Cal Advocates): Did that process/schedule slide say that both sets of comments will be informal?

A: That's correct.

_____

Q: Did this cost analysis reflect the increased incentives in the IRA?

A: Not in the slides you are seeing right now. We discuss those in later slides and are in the process for the draft I&A document-

_____

Q: Are you still using single point costs for the various technologies in the database, or are we going to use supply curves? Why aren't biomass and biogas included in the chart?

A: Yes. we use supply curves. The costs we showed are general technology costs, which will be adjusted for location-specific resources using supply curves in the Resource Costs & Build workbook that will be published in Q4 this year. We have results for biomass/biogas - those will be included in the Resource Costs & Build workbook as well.

_____

Q: Was there any consideration of variable O&M costs for gas generators? Was there any ground-truthing with the actual costs for contracting these resources in California?

A: Our variable O+M costs for gas generators come from CAISO MasterFile listings which are used in the CAISO market.

_____

Q: Will the resource cost assumptions be used in any of the CPUC modeling, or are they solely provided as inputs for LSE modeling? Specifically, without developing a Reference System Portfolio, are there any other uses for these cost inputs?

A: The I&A updates discussed today may be considered for multiple use cases, including development of the 2023 IRP Preferred System Plan; portfolios for the 2024-25 TPP process; or other modeling that may have to be done to support planning-

_____

Q: (Cal Advocates): the IRA also has a nuclear PTC. Will that be applied to the SMR candidate resource? At what level (the nuclear PTC phases out as the plant's receipts increase)?

A: This would be in scope for the updates to the Zero Carbon Tech report.

_____

Q: Do assumed capital costs increase for full/bonus ITC, due to higher labor costs etc.?

A: We have held the labor / capital costs constant across ITC scenarios. Our understanding is that the labor requirements under the IRA are not as stringent as what is already required to build in California; consequently, those costs could be seen as already "baked-in" to the model.-

_____

Q: When will the Zero Carbon Tech report be updated to include IRA?

A: For the draft I&A ducument to be released in Nov-

_____

Q: Is the CCS applied to CTs or CCGTs? Were they retrofits on existing plants or entirely new builds?

A: The costs are new build, and are from the NREL ATB or literature reviews. But the CCS technology can be applied to both. And the report evaluated CCS applied to CTs and CCGTs. TCCS applying to CTs or CCGTs, they were assigned to CCGTs and were assigned to new builds.

_____

Q: (Cal Advocates): should we expect a RESOLVE candidate resource for "CCS" and "zero-carbon firm" as larger categories (like the CEC SB 100 report), or candidates for the sub-category options (Allam Cycle, SMR, EGS)? (apologies if John answered - he is coming in and out)

A: Christian: These are resource types that we're going to consider to add to RESOLVE. Whether/how to add them is what we aim to engage with stakeholders on over the coming months.-

_____

Q: With new storage candidate resources, can the model endogenously optimize duration in addition to size?

A: Currently in RESOLVE the costs for new storage resource have decoupled the capacity and the energy costs. As such the RESOLVE model endogenously optimizes the duration of the storage resource by determining how much energy it selects per capacity selected. -

_____

Q: Can you comment on the duration difference between H2 and SNG?

A: Re: the duration difference between H2 and SNG, we chose illustrative durations to show here. RESOLVE can endogenously choose the desired duration. That said, the lowest cost storage costs of all technologies surveyed are for SNG because of its ability to be stored in natural gas storage reservoirs, and its higher volumetric energy density than hydrogen. -

_____

Q: Is the idea that small modular nuclear reactors would be built outside of California and electricity would be imported? My understanding is that currently, there's effectively a ban on new nuclear in CA, or is there an assumption that's not a problem?

A: The report states that out-of state construction of nuclear power plants would potentially be an option, and could provide zero-carbon firm capacity at sites where firm transmission capacity exists. The viability of SMR development in California would require the federal government to develop a safe, long-term solution for the disposal of spent nuclear fuel or a change to state law-

_____

Q: Can you comment on the lack of a flow battery candidate resource? Has it been removed or is just not included in the materials so far?

A: Re: the lack of flow battery as a candidate resource, I recall that we found that Li-Ion batteries had lower projected total capital costs than flow batteries, even at very long durations and into the future. We are happy to further explain our reasoning via email if desired. To clarify, flow batteries are currently included as a candidate resource in RESOLVE.

_____

Q: Is there a reason costs for CCS were only evaluated for new builds, or are you open to including a retrofit on existing plants resource, similar to what was done for the most recent CARB Scoping Plan modeling?

A: Re: allowing CCS retrofit costs, we did not have a resource that exactly outlined which generators could and could not be retrofitted to CCS, thus we chose to rely on new builds as a means to ensure we didn't under-state the costs of CCS retrofits in the IRP.

_____

Q: (Cal Advocates): If implementing SMRs and EGS as candidate resources, can we get a RESOLVE dashboard toggle for SMRs and EGS to limit them to OOS? The state has a law on the books tying new in-state nuclear to CEC findings about a federal nuclear waste repository. On EGS the induced seismicity concern is acute in some CA areas, and there may be uncertainty about how the 2021 EO on no new fracking permits would apply to EGS (or not). There may be a related need to segregate the ATB's EGS-driven costs

A: We are able to model the SMR resources as OOS resources. Like is the case with some other OOS resources, particularly the ones not on dedicated existing transmission lines, there will likely be cost adders associated with getting the nuclear resource delivered to the CAISO boundary. -

_____

Q: Will the model be able to endogenously optimize tax credits included in the IRA? Will the addres be modeled?

A: The tax credits will be modeled upstream of RESOLVE, in the Resource Costs & Build workbook to be published in Q4 this year. Any cost adders will also be included in the same workbook. -

_____

Q: Have ED and E3 considered PNNL's storage cost and performance report to add other emerging storage technologies like thermal and gravitational?

A: Re: Including thermal and gravitational storage, this report did not provide an exhaustive review of all technologies. We may consider these technologies in the future. -

_____

Q: (Cal Advocates): will candidate conventional geothermal remain "must-run" in RESOLVE?

A: That is correct. We will continue to model it as a must-run resource.

_____

Q: DR is limited to 8% by the policy is that imposed in the modeling?

A: Yes the 8% cap would be imposed in the modeling. I believe the 8% cap would apply to the sum of Shed DR and Shift DR-

_____

Q: There are a few storage cost analyses. CAISO TPP is using 2020 Grid Energy Storage Tech Cost and Performance Assessment. We recommended updating the costs back in Q1 2021. We did look at lazard too.. Since then NREL also put out a cost projection for utility scale BESS in June 2021. One of the challenges is these make assumptions on life cycle, DOD, plus others that the results are sensitive too.

Do you think we could have a deeper conversation about the storage cost assumptions not just comments?

A: Thanks Cathleen. After digesting comments we'll be open to having deeper conversations on specific topics where needed. Please be as specific as you can in your comments where you think we may be missing something, and let's follow up after.-

_____

Q: The above does not explain why H2 would have a lower min duration than SNG. Please clarify.

A: Re: H2 and SNG, there is not a minimum duration enforced in the model, these plots are just illustrative.

_____

Q: (Cal Advocates): between the draft 2022 Scoping Plan, the Governor's direction to CARB with proposed changes, SB 905, and AB 1757, there is a lot of interest in CDR options. Are there technical issues that would prevent implementing a CDR candidate resource(s)?

A: CDR itself isn't a generation resource. I believe E3 has implemented a characterization of certain CDRs (like DAC) in other studies via PATHWAYS. If you have ideas, though, please let us know in the comments. You can also find some discussion of CDR in the Zero Carbon Emerging Tech report because while CDR can't be directly modeled in RESOLVE, CDR infrastructure could be relevant for the availability of certain resource types such as CCS and SNG-

_____

Q: Has the increase in smart thermostats been considered in the shift DR? Or is considered somewhere else?

A: The increase in smart thermostat adoption would impact the technical potential and corresponding costs for residential HVAC for both Shift DR and Shed DR. For example, if someone already has a smart thermostat, that would reduce the cost of enabling DR potential for that person's load. I believe that impact is already considered in LBNL's supply curves, but would need to confirm with the LBNL team -

_____

Q: How are you defining shift DR?

A: Shift DR in this case is load that can be shifted on a regular basis (ex. no limit on calls per year), while maintaining energy services (ex. thermal comfort, enough hot water, daily water pumping needs, etc). LBNL's DR Potential Phase 3 Study has more detailed explanations: https://eta-publications.lbl.gov/sites/default/files/ca_dr_potential_study_-_phase_3_-_shift_-_final_report.pdf-

_____

Q: How will the Zero Carbon Tech report funnel into the forthcoming I&A document?

A: these are resource types that we're considering adding to RESOLVE. Whether/how to add them is what we aim to engage with stakeholders on over the coming months. Stakeholders comment by Oct 6 is part of that-

_____

Q: Apologies but I missed the difference explained for V1G and V2G - what is the difference between 1 or 2?

A: V1G is one-way managed charging, V2G is bidirectional managed charging-

_____

Q: (Cal Advocates): follow-up for Femi - can you clarify the extent of the OOS cost adder? I assume costs = new OOS transmission up to but not including potential intertie upgrades? And the intertie upgrade cost is considered via busbar mapping consideration of partial upgrades that RESOLVE selects? OOS resources known to have existing Tx rights would not get the adder (e.g. SMR replaces a coal plant with Tx rights)?

A: That's generally correct. However, from a transmission perspective we currently do not consider "replacement capacity" for new candidate resources, although like you have implied, that is a valid consideration for cost reduction. -

_____

Q: Please cc: myself if you send any information on cost comparisons between Lazard battery storage costs and IOU procurement - we are both witnesses in GRC 2 and ACC/IDER proceedings where this is relevant.

A: Jan, Not all data we use for benchmarking is public. If public data is available, we can consider including more details on the benchmarking the draft I&A document. re: your request to be CC'd, please just make sure you're on the IRP service list to track this sort of activity

_____

Q: Just want to confirm: The results here imply V1G capacity contritbution is 2% of a L2 charger (7kW) so 0.14kW while V2G is 20% of (charge capacity and discharge capacity (14kW)) so 2.8kW

A: Yes, that's mostly accurate. It's 2% of the weighted average L2 charger (around 5kW) which is 0.1kW and 20% of 5kW for V2G, which is 2kW. And to keep in mind that this is only reflecting the value for residential V1G and V2G. For workplace locations, because it has higher utilization rate, the capacity contribution will be higher. -

_____

Q: the workshop notice stated that staff will not record the Q&A. Can you please reconsider, save, and publish the Q&A?

Priority: N/A-

A: Yes. As noted, we will post the Q&A. But would not consider those as submitted comments.

_____

-Paul Nelson CLECA (paul@barkovichandyap.com) - 10:21 AM

Q: Re a comparison between Lazard Battery storage cost and IOU procurement - If such analysis is performed it should be sent to the service list.

A: We'd have to consider confidentiality concerns with any such analysis and whether/how to circulate it.

_____

Q: will any of the new offshore wind candidate types be assumed as specified imports? IIRC the CAISO's sensitivity had suggested importing Del Norte wind as an option, maybe in conjunction with OR offshore wind.

A: Not at this stage, until the possible tx pathways for Del Norte become more defined. But pls share your comments about that, incl pros and cons.-

_____

Q: I think the shed DR curve is CUMULATIVE, which is the confusion.

A: when reading that Shed DR "supply curve" chart, the load impact (y-axis) for any given price (from x-axis) should be assumed to include the load impacts of prices to the left of it, as well.

_____

Q: Is there any update on the locational optimization functionality that is being developed? Are there any screens that have been developed related to air quality/DACs?

A: So these more granular datasets are difficult to incorporate into RESOLVE zones since the resource areas in RESOLVE cover a much larger geographic area than DACs and non-attainment zones. Those factors typically are taken into account only able to be taken into account in the level of granularity that our busbar mapping process focuses on.-

_____

Q: CELCA's consultants are willing to sign an NDA, as cost of storage issue is very important in the GRC and Avoided Cost Calculator proceedings.

A: Noted.

_____

Q: Follow-up re: inability to directly model CDR in RESOLVE, is that a technical limit (please elaborate) or is there a way to have a "CDR adder" for emitting resources that accomplishes the same goal? Maybe a representative cost for a thermal resource to subscribe to a CDR resource? The result might be a partial resource selection, but that seems like a similar problem as with the partial selection of transmission upgrades.

A: Christian, what I meant was that RESOLVE is an electric sector capacity expansion model that optimizes decision-making to serve load while meeting electric sector GHG and other constraints. It does not model broader economy-wide decarbonization pathways like CDR. Because CDR does not explicitly generate energy or serve load, it generally falls outside the scope of RESOLVE's decision-making. If you have ideas though on adders or other ways that CDR should be incorporated in IRP, please share in comments.-

_____

Q: Will the Disadvantaged Communities (DACs) in SB535 be included in the land use screens?

A: So these land-use screens are still being developed (the CEC will be leading a workshop on them on 10/10). They currently do not include DACs given these are more state area-based screens and DACs have a much higher granularity-

_____

Q: Regarding making available the comparison between Lazard storage costs and actual storage contract costs, could staff consider aggregating the actual storage contract cost data in order to avoid confidentiality concerns?

A: If we're able to do such a study, we'll also explore aggregating the info in ways that protect confidentiality and allow for broader dissemination of any results-

_____

Q: Geothermal considerations for potential seem very different than those of solar and wind which are more land use related. The US Geological Survey has done a lot of work on this, as have some other independent organizations. What is necessary – process-wise - to get these potentials into the IRP I&As?

A: Please submit the comparison in your comments and we will look into this.

_____

Q: Why isn't solar and storage included in the table of First Year Assumptions?

A: The first available year constraint is typically applied to resources that have a longer development timeline, a.k.a long-lead time resources like offshore wind, OOS wind requiring new transmission, geothermal resources, and pumped hydro resources. Solar and battery storage resources are generally not considered as long-lead time resources. Based on our analyses of historical annual build rates and the amount of solar and battery resources in the CAISO queue, and the in-development and planned resources, we believe it is reasonable to assume that these resources can be developed without the long runway-

_____

Q: Does the scatter points match where existing generators are? Or are they in close proximity?

A: For existing renewable generation profiles, the exact coordinates are used. For candidate renewable generation profiles, a relatively random scatter within the land-use screened regions is used. Because

the Wind Toolkit Sites don't often have a precise match to existing resource locations, the closest Wind Toolkit Site is used to represent the site. If the location is significantly far from the nearest Wind Toolkit Site such that it would be considered unreasonable, it is ultimately not used to develop the normalized profile.

_____

Q: Could you specify which version of SAM (PVWATTS) was used to calculate the capacity factor profiles for solar?

A: We stay up-to-date with the latest SAM version whenever we produce generation profiles. The version that we will use for the solar generation profile refresh is 2.2.4-

_____

Q: Q going back to emerging technologies: Have there been any updates to the RESOLVE model that enable a more accurate valuation of long-duration storage? My understanding was that the ~40 representative days (that weren't connected to each other temporally) may have led to the undervaluation of long-duration storage.

A: re: the valuation of Long Duration storage in RESOLVE with 40 representative days, we are working on updates to RESOLVE to enable better treatment of this technology, recognizing the issues you mentioned. We endeavor to have something later this fall for stakeholders re: the 37 days as part of this broader I&A conversation.

_____

Q: Have you modeled hybridizing existing thermal peakers to lower emissions and maintain reliability? apologies if it's a duplicate question, my last send seemed to have only been to the host.

A: We're currently not explicitly modeling hybrid resources in RESOLVE. In our update of the modeling to incorporate paired solar and storage, we will consider the feasibility of additional storage pairing options.

_____

Q: is there room in the schedule to incorporate the preliminary 2022 IEPR forecast? The IEPR scope has the draft 2022 IEPR Update scheduled for October (then, final in January and adoption in February).

A: Are there particular elements of the new IEPR you're referring to/concerned about? We expect that to be vetted within CEC's processes, as per usual.

Q: Our concern is that we're coming off 3 successive IEPRs with large jumps in mid- and long-term peak load (plus the move to High EV in D2202004). In combination with the new 2035 90% zero-carbon target in SB 1020, if the 2022 IEPR takes another jump, we'd be concerned about having enough resources in the portfolios for transmission to the TPP. We hope for more stability in the IEPR forecast year-over-year but continued policy change makes us think we should anticipate the possibility of more jumps.

_____

Q: IRA removes requirement to link renewables to storage to get the ITC / PTC for batteries. Perhaps developers could opine on whether they will now be separating especially solar and storage projects in future given the new incentive landscape

A: We will take this into consideration in future modeling.

_____

Q: Does the paired and hybrid generation configuration model mirror the CEC's RPS requirements?

A: I have not stayed current with the CEC's RPS requirements. Please forward to CPUC staff any documentation on those requirements that is relevent to paired and hybrid resources. -

_____

Q: If the storage - to transmission capability interactions are different from the last RESOLVE release is there a way that we can get the details of the RESOLVE logic that incorporates this more dynamic consideration of storage and transmission as you discussed on slide 85?

A: So the transmission capability interactions are the same that was used in the most recent PSP and TPP work. These slides are just a refresher on the changes that were implemented then and are updates since the last I&A. -

_____

Q: Can you confirm that the IRP proceeding will continue to assume DCPP will retire by 2025?

A: The new IRP statutory language that was recently added to PUC 454.52 through SB 846 on this topic. -

(1) The commission shall not include the energy, capacity, or any attribute from Diablo Canyon Unit 1 beyond November 1, 2024, or Unit 2 beyond August 26, 2025, in the adopted integrated resource plan portfolios, resource stacks, or preferred system plans.

(2) The commission shall disallow a load-serving entity from including in their adopted integrated resource plan any energy, capacity, or any attribute from the Diablo Canyon Unit 1 beyond November 1, 2024, or Unit 2 beyond August 26, 2025.

Our default assumption for analysis is that DCPP retires at its previously assumed dates. You're probably aware that recent legislation basically requires us to characterize it as such in our modeling. That does beg the question, though, of how to do things such as reliability studies with a big resource like that turned off, despite the resource potentially being around for the years that you're looking at in real life. We're open to ideas if you have them on that.

_____

Q: The proposed fuel price update is entirely inadequate.. Has staff l;looked at what actual natural gas prices are today? The Henry Hub market recently exceeded $9 per MMBtu, and burnertip CAISO gas prices have regularly exceeded $10 per MMBtu this summer. Forward markets indicate natural gas commodity prices in excess of $5 per MMBtu for the foreseeable future. This is well above the range shown by staff. Why are you not doing a new forecast to reflect the realities of today's natural gas markets?

A: We rely on IERP and CEC work for the assumption but please provide these inputs in your comments so we can work/review as part of this I&A process.

_____

Q: Question on transmission slides - for out-of-state transmission updates - has the MAG team conferred with other balancing authority areas and transmission developers to refine transmission cost hurdles in resolve? Has there been coordination with the CEC SB 100 modeling efforts and some of their recent work under SB 100?

A: We are working to upgrade hurdles and wheeling costs and specific transmission upgrade costs for OOS resources, both of which have changed significantly in some areas since the last I&A. From a transmission standpoint CPUC and CEC coordinate also with the CAISO for the work we're doing on the various modeling efforts.

_____

Q: Question on Offshore Wind LCOE - has CPUC staff conferred with DOE and the windshot work and data on potential changes in cost over time: https://www.energy.gov/eere/wind/floating-offshore-wind-shot

A: Appreciate if you can help call out takeaways with respect to the NREL-sourced curves we have presented today, in your comments.

_____

Q: Slide 85: If a paired configuration is added as a candidate resource, how will that impact your ability to model the interactions between solar/storage and transmission? You mentioned how the modeling of these interactions are trying to mimic a paired resource, but I thought you were adding a paired resource that would alleviate the need to mimic.

A: So the ISO has specific transmission factors to apply to coupled hybrids that are separate to the interplay of the solar transmission factors and storage transmission factors. -

_____

Q: Are you investigating expanding SERVM to model entire WECC?

A: Yes investigating modeling all of WECC - we used to do that, but the external areas needed some calibration. If that is not successful in time for the TPP work, we may continue to use the import shapes that we used for the PSP.

_____

Q: If BTM solar is now modeled as a load modifier, does that mean BTM solar is no longer a candidate resource?

A: There are two types of distributed solar in RESOLVE. One is "customer PV" that represents mostly behind-the-meter residential solar that benefits from NEM, with capacity consistent with IEPR forecasts, and it is not a candidate resource. The other is a "distributed solar" resource that is a candidate resource - this largely represents commercial rooftop solar. We plan to include some clarification on this in the I&A document.

_____

Q: Question reliability modeling strategy - Can you explain how ELCC factors into the integration of reliability modeling between Resolve and LOLP used in Slice of Day. It was my understanding from the last RA workshop that exceedance was used to calculate the reliability contributions of wind and solar. Does ELCC in IRP and exceedance in RA create inconsistencies?

A: If the LOLE modeling results in a portfolio that achieves 0.1 LOLE standard, then we would need to translate that portfolio into an NQC set that we use for RA. The translation will be challenging but the LOLE study will primarily supply the portfolio, not necessarily how it is quantified for NQC..

_____

Q: do the changes on slide 100 obviate the 4.3% "calibration adder" in RESOLVE?

A: Yes. Per slide 94 in the 19-21 IRP cycle we had a PRM in RESOLVE to reflect various adders. That falls away with the proposed improvements for this IRP cycle.-

_____

Q: can you clarify how marginal elcc for existing resources work as counting under PCAP?

A: In general, when using marginal ELCCs, they are applied to all resources, existing and new. As noted in the footnote on slide 103, The SERVM runs to create ELCCs for existing resources were sequenced to avoid double counting interactive effects: "To avoid double counting interactive effects, ELCC calculations in SERVM were sequenced: firm resources first, hydro second, existing pumped storage third, existing demand response fourth, then candidate resource options."

_____

Q: If using marginal ELCC for existing resources, don't we end up adding way more ICAP to achieve the same level of reliability vs avg ELCC?

A: No, because when using marginal ELCCs, we must use marginal reliability need (MRN) rather than total reliability need. MRN is defined as the sum of the ELCC MW of every resource in a 0.1 LOLE tuned portfolio.

_____

Q: Can you confirm: the IEPR load modifiers for res and non-res BTM storage will be modeled separately from teh ELCC surface, but candidate shed DR is effectively BTM storage that will be implemented on the storage dimension of the surface?

A: Confirmed that the proposal for IEPR BTM Storage is to model as a load modifier, separate from the ELCC surface. Confirmed that the proposal is to model candidate shed DR on the storage dimension of the surface.-

_____

Q: Do you have a feel for how the added sophistication in hybrid resources and perfect capacity will affect the RESOLVE run time?

A: I don't have a guess as to how adding hybrid / paired resources will impact model runtime. In the event, that runtime becomes unacceptable after adding hybrid / paired resources we will explore simplifications.

_____

Q: Does E3 have the full battery and solar ELCC tables on Slide112 filled out? The slide only shows one column and one row.

A: Yes we do – CPUC staff coordinate on sharing those values.

_____

Q: For demand response (DR) programs that are available 24/7 such as the base interruptible program (BIP), does the model optimize DR's dispatch based upon reliability need hours or is BIP being restricted to being available in a limited set of hours such as 4-9pm? How is the model address that has the hours of most reliability need changes over time, the availability and design of DR programs will also change?

A: SERVM dispatches the DR program as needed. for reliability given their program constraints. When DR programs evolve, their constraints are updated in SERVM. We will explain the RESOLVE treatment more in the I+A doc forthcoming.

_____

Q: Will you remove Hoover from the conventional hydro ELCC when it gets to minimum generation pool elevation?

A: Stakeholder should comment on whether the proposed ELCC % reflects Hoover's perfect capacity contribution.

_____

Q: What should modelers assume for the retirement of thermal resources from 2023-2035, including combined cycle, combustion turbines, and the once-through cooling resources? Is there a "40-year rule" that stakeholders should consider, similar to what was implemented in the "High Need" scenario of the MTR decision?

A: We are working to update our I&A based on known retirements and CHP contract roll-offs. Please submit comments if you have thoughts on the continuation of the 40-year retirement assumption as well as other updates to thermal retirement assumptions.-

_____

Q: When are you seeking party proposals on the hybrid configuration?

A: comments by Oct 6.

_____