Comments by James Adcock on Docket UE-210220 ELCC
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Commenting party's name: James Adcock, Electrical Engineer
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Comments Related To Puget Sound Energy's Effective Load Carrying Capability Estimates And Use In The Company's All-Source Request For Proposals, Docket UE-210220

9/14/2021

Comments by James Adcock, Electrical Engineer, MIT, decades-long participant in PSE's public Integrated Resource Planning Process, and a leading critic of PSE's modeling efforts. James has spent his entire career engaging in statistical analysis, including at three Fortune 500 companies.

Summary:

I strongly disagree with PSE modeling analysis and methods, which I find to be highly biased towards finding that PSE needs new Peaker plants, in part by PSE's continued insistence on using archaic 100-year-old weather data – even after telling IRP participants that they would no longer do so.

In comparison, I find that I have strong agreement with the criticisms of PSE's modeling efforts by E3, in particular E3's criticism of PSE's use of ancient weather data in their analysis, leading to literally a 10X exaggeration of LOLP by PSE – a problem that I have been strongly criticising PSE about for over a decade!

I do not necessarily agree in detail to the relative-severity that E3 assigns to each of PSE's modeling errors.

Context:

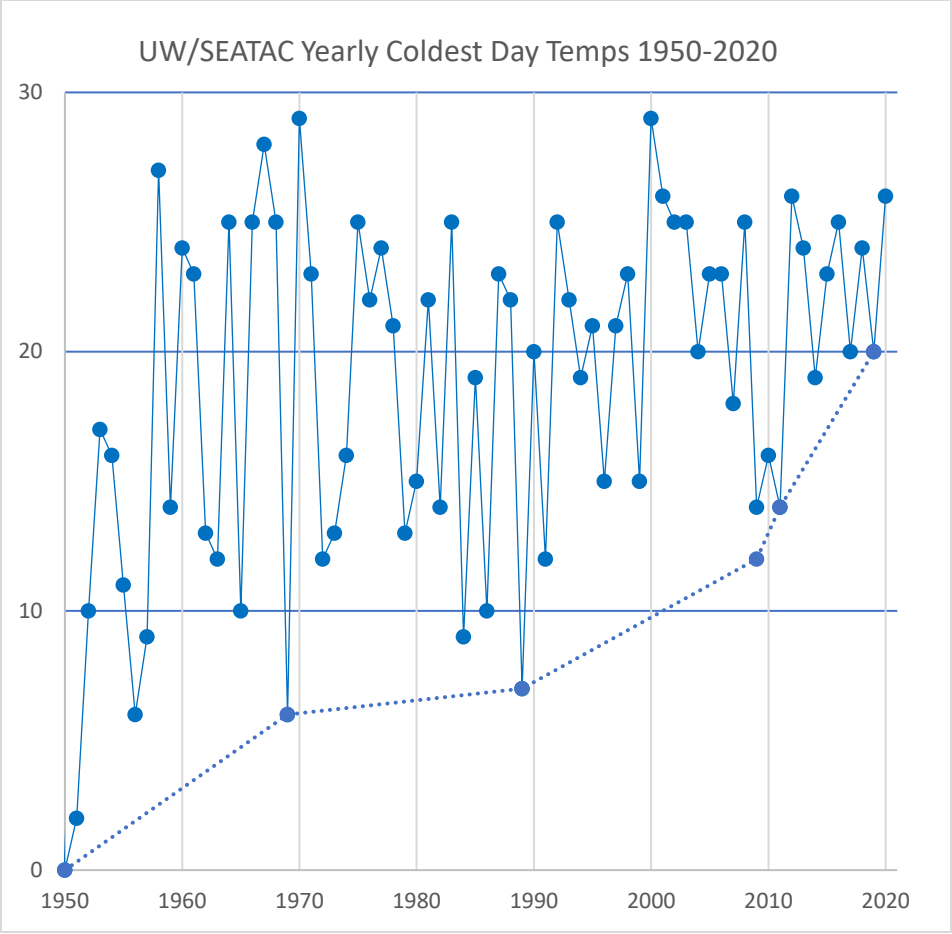
PSE is fundamentally a Natural Gas Company. While more revenue is generated on the Electrical Side, what electrical generation PSE does perform is overwhelmingly by Natural Gas, especially after the predicted closure of the use of Coal in serving Washington Load after 2025. We should not be surprised then, that PSE, when finding any [real or imagined] shortfall in generating capacity should believe that "More Natural Gas Generation!" is always the answer. Clearly such Natural Gas generation conflicts with any real commitment by PSE to actually be emissions-free by 2045. Any such new Natural Gas generating plants only increase the problem.

PSE has suggested, I believe without any real commitment, that the new Natural Gas Peaker Plants they want to build will not be run on Natural Gas, but rather will be run on perhaps Hydrogen, or perhaps Biodiesel. I suggest that this is simply the well-known "Camel's Nose under the Tent" approach to new polluting resources. UTC is familiar with this from some decade+ ago now, when a proposed Coal Power Plant suggested that they would somehow "magically" convert to non-CO2-emitting at some indefinite

time in the future, without any real plans and without any real technology to do so. PSE similarly has shown no real intent to actually run new Peaker plants off of Hydrogen or Biodiesel – they have shown no technology to do so. And biodiesel would have local air pollution problems that PSE would have to contend with – and PSE has shown no technology or consideration to do so. Further PSE has suggested that these plants would only run on an "emergency basis" – only for a very few hours to the year – when there is a peak capacity shortfall. But again, PSE has shown no actual commitment to limit operation to such restricted hours, nor how such a "limited use" commitment would be enforced.

I suggest on the contrary: If PSE builds new Peakers they WILL operate off of Natural Gas, and they WILL NOT be restricted to run just to meet rare extreme peak loads. That further they WILL NOT be restricted to run just to meet PSE ratepayer needs. Rather PSE ratepayers will pay to build these plants, but they WILL run off Natural Gas, and they WILL RUN to meet Californian load – even though it is PSE ratepayers who are paying to build these plants.

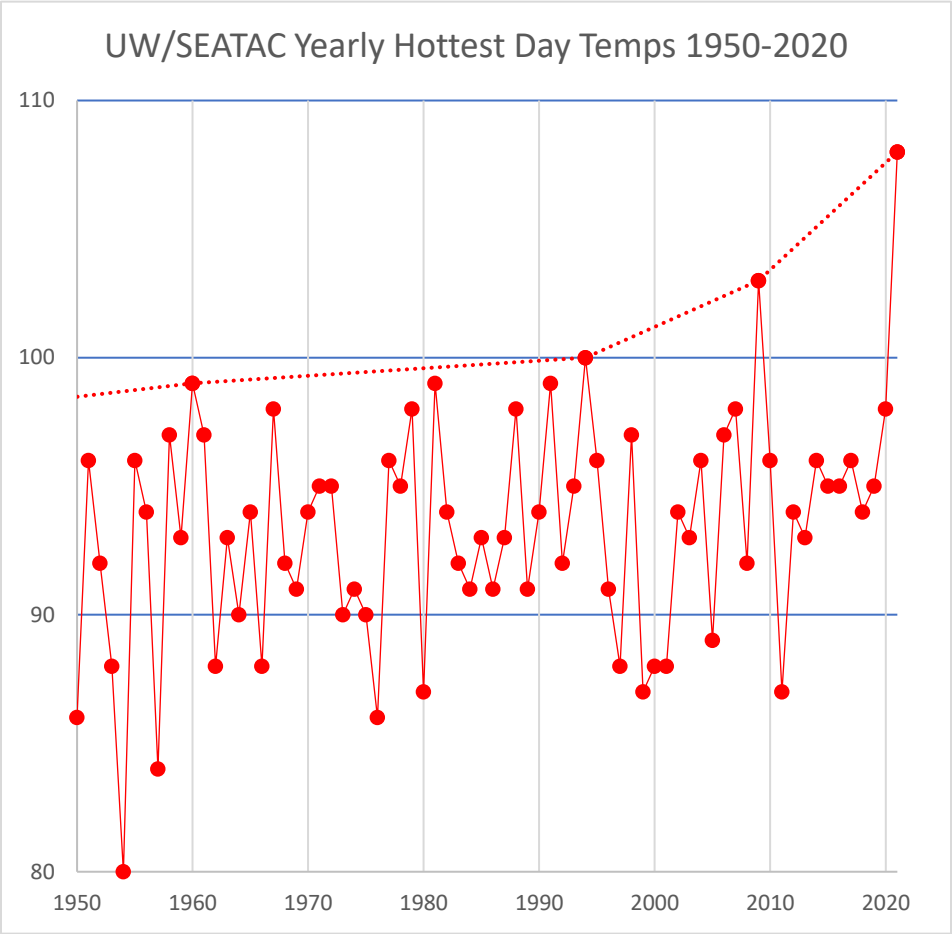
But are these new Peaker plants even necessary? E3 finds that they are not necessary – i.e., that PSE is exaggerating their LOLP by literally 10X by using fake analysis – by using extremely cold winter day historical data from the first part of the previous century – up to 100 years before the period of analysis! [More discussion to Follow] These extremely cold winter days no longer exist. They have gone away due to Climate Change, as the following chart demonstrates:




Where each dot shows the coldest temperature in Fahrenheit of the coldest day of each year, and the dotted line connects the "Coldest of the Cold" temperatures in each running 20-year period corresponding to a 5% LOLP – "Once in 20 Years" calculation. PSE's modeled "Loss of Load" clearly is strongly related to such extremely cold days, which is why E3 finds that 94% of PSE's modeled "Loss of Load" occurred due weather conditions which existed in the early half of the previous century, and only 6% in more recent decades after Climate Change has made coldest winter days much more mild.

One can clearly see that extremely cold days have "gone extinct" with Climate Change – "Coldest Winter Days" used to be as cold as zero degrees F., now the "Coldest Winter Days" have become a much more mild 20 degrees F. This in turn represents a reduction in "Heating Degree Load" of 20/65 – a more than 30% reduction in winter load due to cold temperatures! Yet PSE continues to use weather data even prior to 1950 – back to the early 1930s!

Conversely, Hottest Summer days have become increasing hot increasingly faster, due to Climate Change:




PSE needs to acknowledge that Peak Capacity Shortfalls are now driven by Summer needs, not Winter needs – PSE's recent actual "emergency" shortfall conditions have happened in the Summer. And PSE needs to get rid of any continuing "Seasonal Swap" contracts – where PSE sells Summer Capacity to another utility in exchange for receiving Winter Capacity. Such "Seasonal Swaps" no longer make any sense, nor does it make any sense to build additional Peakers to continue to support such Seasonal Swaps.

How is ELCC calculated? The following NREL paper discusses these issues in the context of Wind:

https://www.nrel.gov/docs/fy08osti/43433.pdf

"Determining the Capacity Value of Wind: An Updated Survey of Methods and Implementation"

By M. Milligan, National Renewable Energy Laboratory and K. Porter, Exeter Associates, Inc.

There are many ways of calculating ELCC. It is not standardized. However this paper points out that correct derivation of ELCC requires correct modeling of LOLP, something that PSE clearly fails to do.

In particular, in that paper Page 11 the authors find that ELCC should be close in value to the simple availability of Wind during periods of peak load. For example, in the not-uncommon case of Wind having 30-40% average availability, then the ELCC should be a value similar to that, but perhaps 10% lower, perhaps 27%-36% ELCC.

Is this what PSE found? Not at all. Why not? In part because PSE assumes that new Wind Generation in Washington State is "perfectly correlated" to existing PSE Wind – i.e., that new Wind Generation Farms are built exactly on top of existing Wind Generation Farms. Then, if PSE has a generating shortfall, if the wind is blowing at that wind farm location, PSE already has Wind Generation happening at that existing location, in which case Existing Wind Generation *already* "Saves the Bacon", so that addition new Wind Generation – at exactly that same location – doesn't contribute much to "Saving the Bacon" – because Existing Wind Generation has *already* "Saved the Bacon"! It isn't the case that Wind makes no meaningful contribution to Peak Capacity [ELCC] but rather one can't just build all of one's Wind Farms "on top of each other" – all at the exact same location – and then assume that those new Wind Farms are going to make a meaningful ELCC contribution. Wind Diversity – of location – IS IMPORTANT – which is why Stakeholders have been pressing PSE for many years to seriously explore Wind in Montana.

Batteries: PSE's modeled findings that Batteries do not make a meaningful contribution to ELCC doesn' t make any sense to me. At least SOME amount of batteries should contribute to "peak shaving" and "valley filling" leading to reduce LOLP. The notion that whenever PSE has a shortfall that shortfall always exists continuously for multiple days at a time is simply false. Almost always there are going to be "off peak" hours during which PSE can recharge batteries, and almost always peak conditions are going to last four hours or less, in which case four-hour batteries can make a meaningful contribution.

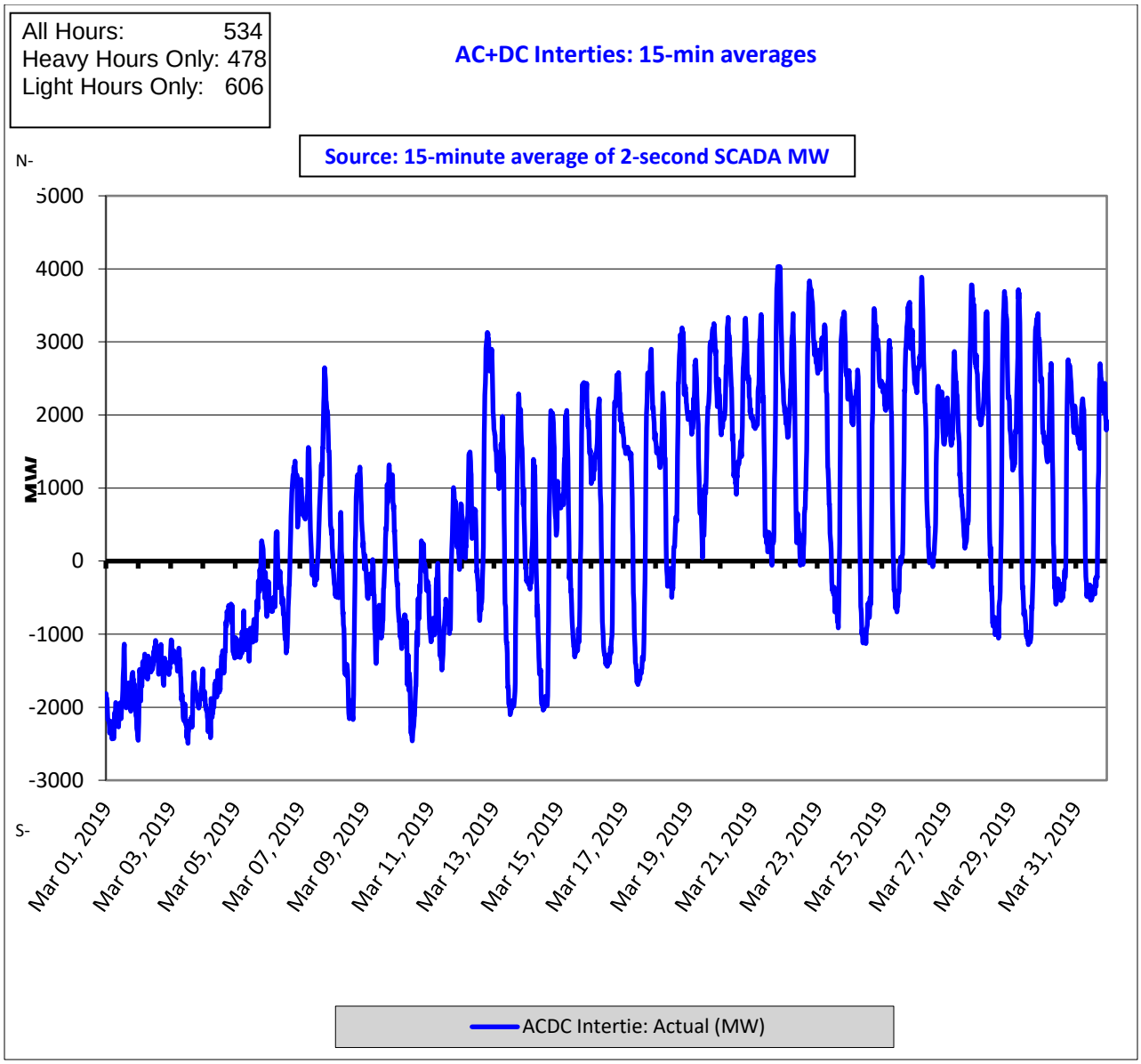
The following chart from BPA, which shows Californian Exports/Imports [from Mid-C] during a recent *Rare* cold snap shows these patterns. Positive numbers represent Exports from the PNW to California. Negative numbers represent *Rare* imports from California to the PNW – a condition which almost never exists – 99% of the time "we" – the Pacific Northwest – are exporting power to California – huge amounts of power, averaging 7000-9000 Megawatts. IE the PNW almost always has huge excesses of power! This plot demonstrates the *extreme rare* opposite to the rule – where the PNW is importing a few thousand Megawatts from California. And in turn the first couple days of the year do show *the rare condition* where power was being imported continuously from California. Even on this rare very-cold month all the other days show the typical daily pattern of fluctuation – with twice daily peaks of capacity need in the morning and early evening – a daily pattern of fluctuation where Batteries can indeed in reality contribute to ELCC by (as previously suggested) being used to shave peaks and fill valleys. And as is well-known in the Electrical Utility business, smoothing out load in this manner is extremely effective in using existing resources – including Transmission – more effectively. Which in turn is why Commercial

and Industrial customers have traditionally been charged a large premium based on their patterns of peak usage. In summary, batteries *do* make a meaningful contribution to ELCC *except* during those extremely rare periods of time when energy is being imported *continuously* for several days from California.

In addition, this plot shows the falsity of assumed limitations on imports into the PNW, where PSE has adopted NWCouncil/RAAC false assumptions of very limited availability of imports. On the contrary, California has huge excess generating capacity in the winter available for import to the PNW, as this plot shows, where 2500 Megawatts are being imported from California – no muss no fuss – contrary to the NWCouncil/RAAC / PSE assumptions of limited availability of imports to the PNW.

Pumped Storage: Comments for Batteries are equally applicable to Pumped Storage. Pumped Storage even has the potential ability of more hours of peak shaving and valley filling.

Hydro Integration: Similar to Batteries or Pumped Storage, Hydro Operations (primarily BPA) has the ability to generate "Synthetic Storage" by modulating existing Hydro Flow. Examples of this already being performed are called "Wind Integrations" or "Solar Integration." Also Hydro natural largely automatically modulations production to "get out of the way" of Wind and Solar generation for a very simple reason: It is not profitable for BPA to generate during periods of high Wind and Solar, so it is better for BPA (if possible) to store water behind their dams during such periods, and use that water later. Choosing to use water later is called "Energy Storage" and effectively performs the same function as Battery Storage or Pumped Storage. PSE should be exploring ALL POSSIBLE contracts with BPA for Hydro Power in all forms of contracts, including "Wind Integration" and "Solar Integration" as well as all other forms of hydro power tranches.




Reviewing E3's Findings about PSE's ELCC modeling efforts. As presented at the August 31, 2021 ELCC Workshop.

The first thing to note is that PSE *did* [in general] answer E3's questions and *did* provide E3 with support. This is in sharp contrast to how PSE has been treating its IRP/RFP/CEIP stakeholders, where PSE *does not* meaningfully answer our questions and *does not* provide meaningful support. Examples of this include:

I "raise my hand" at PSE meetings and PSE simply refuses to acknowledge my raised hand.

I asked PSE where in Washington their Wind Data corresponds to – choice of location may result in Wind

Availability varying from 30% to 40% -- and PSE's answer was to point me at 1 Terabyte of Federal Wind Data corresponding to the entire United States and say "Go Fish" – i.e. "You try to figure out what data we might have used." I suggest that this stonewalling behaviour on the part of PSE indicates that there are indeed problems with PSE's choice of Wind Data location. And at the same time PSE represented to UTC Staff and Stakeholders that PSE had answered my question. No they hadn't, actually.

In addition over the years PSE has acted to explicitly try to exclude me from public participation, and at other times has merely suggested that I should no longer publicly participate. I ask that UTC make it clear that such efforts to "pick and choose" who belongs or doesn't belong in the public participation process are inappropriate – of course given the choice PSE would choose stakeholders who are less critical of their actions!

Page 7 of E3's presentation:

E3 strongly disagrees with PSE's modeling of Batteries in regards to Mid-C.

E3 strongly disagrees with PSE's modeling of Battery Characteristics.

E3 disagrees with PSE's modeling of correlations between resources.

E3 disagrees with PSE's use of ancient weather data [In comparison I *strongly* disagree with PSE's use of ancient weather data since by E3's own analysis it inflates PSE LOLP by literally 10X]

E3 disagrees with PSE's modeling of Hydro Data. [Hydro generation is generally displaced by Wind and Solar, resulting in more stored water behind the dams which can be used to generate addition power in the hours and days in the future.]

Even E3 has not received enough information from PSE to be able to evaluate whether PSE's modeling of Battery Dispatch is sensible or not. [The great value of Batteries is that they need not only be used for one purpose (say peak shaving) but can also be used for other purposes, such as short-term dynamic load balancing +/- , and to help fill in sudden power shortages, such as a sudden loss of wind, loss of a Coal or Natural Gas plant, or afternoon "Duck Curve" rapid ramp rates.] I do not believe PSE correctly modeled all the possible usages, and the financial contribution Batteries would make when used in these manners.

Page 10: E3 points out how contrary to industry standards PSE is understating Battery storage capacity.

Page 11: E3 points out that PSE does not correctly model correlations between weather and renewables.

Page 12: E3 points out that 94% of PSE's modeled Loss of Load correspond to weather conditions which existed prior to 1972 – more than 50 years ago [the first half of PSE's weather data used in modeling] – and only 6% of PSE's modeled Loss of Load correspond to weather conditions which exist since 1972 [the more recent half of PSE's weather data used in modeling] IE if even weather data just corresponding to the most recent 50 years were to be used in PSE's modeling efforts, then PSE's Loss of Load would only be 12% of what PSE is currently claiming [due to PSE's use of extremely old weather data.] If PSE's use of weather data were to be further reduced, even to say generously use the most

recent 40 years of weather data, then PSE's modeled Loss of Load would be further reduced to only about 10% of PSE's currently modeled Loss of Load!

It is high time that UTC stops this PSE modeling nonsense! UTC *must* direct PSE to stop using weather data more than 40 years old! Does UTC want PSE to make reasonable modeling efforts that fairly informs what PSE builds or buys -- or not? PSE current continued use of ancient weather data *does not* reasonably inform what PSE needs to build or buy!

Page 13: E3 points out that PSE incorrectly models Hydro as a completely inflexible source of power that does not perform [explicitly or implicitly] any "integration" [i.e. "accommodation"] of Renewables. We know this is not true. BPA through their publicly available Operations Data clearly shows the Hydro operations *DO* modulate to "accommodate" Renewable – when Wind or Solar generate then Hydro "automatically" reduces its generation to accommodate those "cheaper" resources – i.e. Wind and Solar are at the bottom of the dispatch stack, they are the cheapest resources, they are "must run" resources, so all other resources, including Natural Gas and Hydro "get out of their way" – because Natural Gas and Hydro are higher [more marginal] on the dispatch stack. As is well known – because we have all heard BPA scream – in the spring time there can be *brief* periods of time when more Wind, Solar, and Hydro all want to run than Load to consume that desire – because running Hydro is less damaging to fish than spilling Hydro, and then much to BPA's chagrin they have to pay renewables to not run. All other times BPA Hydro *can* accommodate Wind and Solar, does "get out of their way" without Spilling, i.e. storing that water as Energy Storage [just like Batteries or Pumped Hydro] to be used when needed in a future hour or a future day.

Water behind a Hydro Dam IS ENERGY STORAGE!

Page 14: E3 points out that in only 2% of PSE's modeled cases do the modeled Batteries even do *anything*! IE PSE's "model" of battery use is that they have these batteries sitting around DOING NOTHING! This is clearly false modeling. Reasonable modeling would show that almost 100% of modeled days Batteries ARE "doing something" – peak shaving, valley filling, load balancing, duck curve ramp rate limiting, short-term filling of sudden loss of Wind Power, or sudden tripping off-line of Coal or NG resources, etc.

Page 16: Additional Problems E3 Finds:

PSE consistently finds lower ELCCs than other utilities.

PSE makes questionable operating data assumptions.

PSE makes questionable load shape assumptions.

PSE makes unreasonable limitations on Pumped Hydro storage utilization.

PSE makes unreasonable limitations on "Hybrid" Renewable + Battery operations.

PSE makes unreasonable limitations on the assumption of PNW regional imports from Mid-C ["market availability"]

PSE makes unreasonable limitations on the assumption of off-hour regional imports to Mid-C – which could be used to recharge Batteries or Pumped Hydro.

PSE makes unreasonable limitations on the assumption of available transmission [AC+DC transmission line capacity] from California to PNW [South-to-North direction]

PSE unreasonably assumes two-hour Battery capacity rather than industry-standard four-hour Battery capacity.

PSE unreasonably assumes that Batteries cannot be fully discharged, as compared to the industry-standard assumption that Batteries can be fully discharged.

PSE without explanation just suddenly reduced the assumed ELCC of storage technologies. What? If PSE doesn't like an answer, then PSE just suddenly changes it without explanation? This isn't "modeling" – rather it is "marketing" masquerading as "modeling" !

Page 17:

E3 asks that PSE fixes how they model regional additions in the context of ELCC calculations.

E3 asks that PSE follow industry standards about how they model Battery storage capacity, rather than making up their own special PSE-specific rules.

E3 asks that PSE fix their modeling to correctly model correlations between Weather and Wind and Solar

E3 asks that PSE fix their modeling to correctly model future Weather data, rather than relying on ancient weather data.

E3 asks that PSE fix their modeling to correctly model the fact that Hydro is a dispatchable, not a fixed resource – which can generally well-integrate with Wind and Solar, to the benefit of all.

In summary, if one strips away the "Consultant Niceties" of what E3 is saying – E3 is basically saying that PSE's modeling efforts are a disaster! And do not accurately reflect what capacity additions nor what technology is should be used for those additions.

PSE's modeling effort have been a disaster for more than a decade now. UTC needs to step in to fix this problem before CEIP is defeated by PSE's nonsensical modeling! Start by directing PSE to stop using weather data more than 40 years old. Require PSE to fix these innumerous problems and rerun their modeling effort BEFORE purchasing any new Peaker capacity. Conversely we know from PSE prior IRP cycles that in current CEIP conditions -- previously known as the "Green World" scenario -- PSE need to purchase tremendous quantities of new additional Wind Power. GET ON WITH IT! Build or Buy that Wind Power NOW and Stop Making Excuses!

Thank you for your consideration, James Adcock, Electrical Engineer