PSE IRP Feedback Report
Webinar 1: Generic Resources Assumptions
May 28, 2020

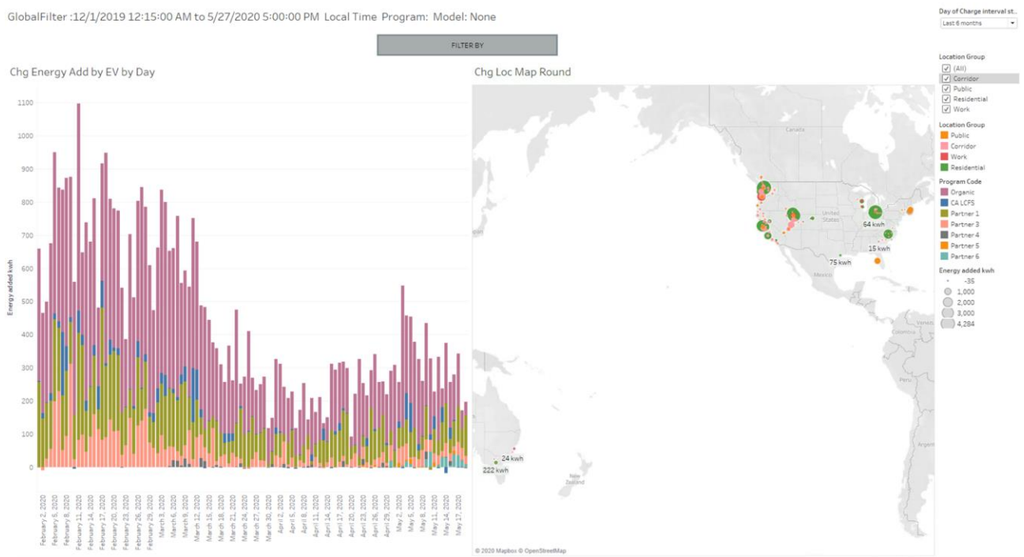
6/11/2020

The following stakeholder input was gathered through the online Feedback Form, from May 13 through June 4, 2020. PSE's response to the feedback can be found in the far-right column. To understand how PSE incorporated this feedback into the 2021 IRP, read the Consultation Update, which will be released on June 18, 2020.

2021 IRP Generic Resource Assumptions Workshop Feedback Report			
Feedback Form Date	**Stakeholder**	**Comment**	**PSE Response**
5/13/20	James Adcock	I am concerned that while I received an email "invite" to join the 2021 IRP process, when I tried to use the provided automated method of responding to that "invite" PSE's automated system instead logged an error message, rather than correctly "signing me up" for the IRP process. I then sent an email to PSE IRP leader Irena Netik, telling her about this problem, asking her to sign me up for the 2021 IRP, and asking her to acknowledge this email. She has not responded.	An acknowledgement email was sent on 5/13/20 at 2:20 pm. A copy of the message is included below: **From:** Netik, Irena **Sent:** Wednesday, May 13, 2020 2:20 PM **To:** 'jimad@msn.com' <jimad@msn.com> **Subject:** RE: Welcome to PSE's 2021 IRP Process Hello Jim, Thank you for your continued involvement and interest in the 2021 IRP process. I am confirming that we did in fact receive your response to the poll in the MailChimp email indicating that you do want to be engaged in the 2021 IRP process. Thank you for your feedback on the usability of that poll and we will work to make responding clearer. PSE is committed to engagement throughout the 2021 IRP process, and I appreciate interested stakeholders like yourself. I hope you are available to attend the first webinar on May 28, 2020 from 1:30 p.m. to 4:00 p.m. Thank you, Irena Netik Director, Resource Planning --- **From:** James Adcock <jimad@msn.com> **Sent:** Wednesday, May 13, 2020 6:15 AM **To:** IRP -- mail -- **Subject:** Re: Welcome to PSE's 2021 IRP Process **CAUTION - EXTERNAL EMAIL** Phishing? Click the PhishAlarm **"Report Phish"** button. For mobile - forward to **abuse@pse.com** Could you acknowledge this email please, so that I know you received it? Thank you,
5/21/20	James Adcock	This question relates to the May 28 2020 IRP Presentation, Page 25 -- -- "Operating characteristics" of Wind Resources. The source of this information is given as "NREL Database." Can you please give us a pointer to the exact "NREL Database" and information therein being used? IE a web address, etc.? As you know, in recent years the Wind Industry has advanced their technology, both in designing new windfoils with greater availability at lower wind speeds, which might benefit "Washington Wind Annual Average Capacity Factor" and also in improving power conversion, such that high wind generation limits have been lifted, so that more power can be generated in high-wind conditions. I want to make sure that your data source "NREL Database" is recent enough to capture these new Wind technological developments. Please answer the question asked so that we can determine whether or not your modeling assumptions include recent Wind Industry innovations that may affect resource costs, and relative resource costs, including affecting whether Wind resources are better built in Washington vs. Other States.	The NREL database refers to the 5-min wind speed data obtained from NREL's Wind Toolkit database: https://www.nrel.gov/grid/wind-toolkit.html. The NREL Wind Toolkit data contains mesoscale modeled data from 2007 to 2013. Only wind speed data was used from the NREL database, capacity factors were calculated by PSE analysts with experience in wind energy assessment in order to employ up-to-date wind technology and methods. The raw, 100m above ground level wind speed data was processed using industry-informed methods to calculate hourly net production shapes. Processing steps include: • Re-average 5-min wind speed data to hourly wind speed data • Calculate gross production using the air density adjusted, power curve for a GE3.03-140 as a model turbine • Apply loss factors including estimated wake impacts, stochastic availability losses, turbine performance losses, environmental losses (stochastic icing shutdown, high/low temperature shutdown) and electrical line losses to calculate a final net production shape. • Validate net production calculation against existing NREL Wind Tool Kit net capacity factor estimates and DNV GL production calculations for select sites.

			This process was repeated for 250 unique locations surrounding the point of interest, then the most representative shape was selected for the deterministic Portfolio model. The described process has only been performed for the wind resources added to the 2021 IRP (Wyoming and Idaho wind resources). 2019 IRP wind resource characteristics (Washington, Montana, Offshore) were obtained from HDR and DNV GL 3rd party analysis. The HDR report is available for review on the PSE IRP website (pse.com/irp). Documentation for the DNV GL wind shapes is not available at this time.
5/28/20	Brian Grunkemeyer, FlexCharging	When evaluating resources, do you apply a discount rate to the value of energy produced? This article below in Utility Dive makes an argument that the Levelized Cost of Energy hurts renewables because the math is wrong. The author observes that LCOE doesn't apply a discount rate to the value of energy produced in the out years. The claim is LCOE overprices wind & solar by 18% and 27% respectively compared to natural gas. The author is pushing a slightly corrected metric, the “present value of the cost of energy” instead of LCOE. https://www.utilitydive.com/news/lcoe-is-not-the-metric-you-think-it-is/578360/ It's possible PSE doesn't use LCOE at all in its resource evaluation. But it may be useful to understand whether discount rates apply to the value of energy produced as well as operating costs. This same thought process could apply to conservation as well, correct? Please inform the IRPAG about whether it is reasonable to apply a discount rate to the value of energy when valuing resources & conservation measures, and whether you do so.	Resources are evaluating on an annual basis for the life of the plant, we do not use the levelized cost of energy in the models. The discount rate is only applied at the end to levelize the costs for charts and tables that are used for comparison.
5/28/20	Virginia Lohr, Citizens' Climate Lobby	The emails I received before the May 28 meeting had links to this form and to a general PSE IRP page, but the link to the specific page where the materials for the webinar would be was not included. I had to send time searching through your IRP pages to find them. In the future, I suggest you send copies of the materials for a webinar to all people who have expressed interest in the IRP process. If that is not possible, then at least share the url of the actual web page where you are posting the materials.	Thank you for the suggestion. PSE will plan to send direct links to materials in future email updates.
5/28/20	James Adcock	This is feedback in regards to the chosen PSE "technology" for the meeting, namely "GoToWebinar" and the need to submit questions indirectly by keyboard as opposed to directly by microphone. I have participated in other large meetings including by Commerce and UTC which did successfully allow direct communication and interaction with the presenters by microphone. By using the "raise hand first" protocol this worked out very well in these other forums. But, in regards to today's "GoToWebinar" format where one has to type in questions via keyboard -- it really didn't work for me. What I see happening in practice over and over again is that Irena or Elizabeth interpret a question not as coming from an technological expert, but rather as-if it were coming from a kindergartener, and then give either a dismissive answer, or no-answer-at-all but rather an answer to a different question that the presenter made up in their mind. For example often a technology expert participant asks a question -- in context -- "But what about ABC?" and Elisabeth simply answers a different question "As I told you earlier, we are not doing ABC, we are doing XYZ." OK, but the participant didn't misunderstand what you were doing [which was XYZ], rather they asked you a specific question, which you chose to ignore by answering an entirely different question. And the problem with having to use a keyboard and chat -- as PSE knows perfectly well -- is that gives no opportunity for the technology expert participant to say "Wait a second -- that is not the question I asked you!" In summary "GoToWebinar" is simply yet-another PSE ploy, in a long series of PSE ploys, over a decade-plus of IRP meetings, to prevent real and meaningful public participation, allowing the public to actually ask real and meaningful technological questions, and receiving real and meaningful technological answers. The reason that these question are being asked is very simple: Participants want to be able to ensure that PSE is making the best resource acquisitions -- and retirements -- possible, at BOTH the lowest ratepayers costs AND the lowest environmental damage costs. And the reason the PSE continually avoids giving meaningful answers is that PSE does not want to be held accountable to actually making the best possible resource acquisitions -- meaning that PSE will be making resource acquisitions which are more expensive to ratepayers, AND more damaging to the environment.	For the June 10, 2020 meeting, PSE transferred the meeting platform from GoToWebinar to GoToMeeting in part due to your and other participants’ feedback. PSE will make best efforts to more clearly answer questions in all meetings.

		PSE, like Commerce and WUTC already do, needs to choose to use a "technological resource" that allows participants to ask questions of presenters by microphone "in more-or-less real time" after the participant "raises their hand". Further, PSE presenters should commit to giving real and meaningful answers to participant questions, which actually are responsive to the question, and not simply dismissive ploys just intended to "make the question go away." PSE needs to actually make a real commitment to PUBLIC PARTICIPATION in their IRP Process -- as required by law -- and not this continual PSE ploy of "We Talk and You Just Listen." PSE needs to design into meeting schedules enough time for participants to ask questions. I suggest that PSE design into their meetings the assumption that 1/2 of the time will be taken by PSE making presentations, and that 1/2 of the time will be used by participants asking questions and by PSE giving actual and real answers to those questions, rather than engaging in ploys to avoid given real answers.	
5/28/20	James Adcock	This is feedback you requested in terms of a more detailed understanding of what exact NREL Wind Data you are using, and what "generic 3 Meg 100 Meter" wind turbine you are assuming. My expressed concern is that your modeling may not include more recent Wind Turbine technological developments over recent years, where now wider blades are available making Wind Farms display better availability at lower wind speeds -- as may be more appropriate to Washington State Wind Farm modeling, and also higher output generators are now available which do not run into output upper limits until higher wind speeds -- which may be more appropriate for Montana Wind Farm modeling. Can you please tell me exactly what you are using in terms of Wind Turbine assumptions. What I see on the NREL site is the assumption of "Vestas V-90 3 MW" -- is this the wind turbine you are assuming for all your Wind Farm modeling? What I also see on the NREL site is various documentation and data creation dates from 2007 to 2015 -- meaning that any Wind Turbine technological developments in the last 5 to 13 years would not be included in your IRP modeling. Is this a correct assumption? Please clarify to me and other participants exactly what NREL wind data you are using and how, exactly that Wind Turbine(s) you are modeling, and from what calendar year your wind data, and wind turbine model(s) date from.	The NREL database refers to the 5-min wind speed data obtained from NREL's Wind Toolkit database: https://www.nrel.gov/grid/wind-toolkit.html. The NREL Wind Toolkit data contains mesoscale modeled data from 2007 to 2013. Only wind speed data was used from the NREL database, capacity factors were calculated by PSE analysts with experience in wind energy assessment in order to employ up-to-date wind technology and methods. The raw, 100m above ground level wind speed data was processed using industry-informed methods to calculate hourly net production shapes. Processing steps include: • Re-average 5-min wind speed data to hourly wind speed data • Calculate gross production using the air density adjusted, power curve for a GE3.03-140 as a model turbine • Apply loss factors including estimated wake impacts, stochastic availability losses, turbine performance losses, environmental losses (stochastic icing shutdown, high/low temperature shutdown) and electrical line losses to calculate a final net production shape. • Validate net production calculation against existing NREL Wind Tool Kit net capacity factor estimates and DNV GL production calculations for select sites. This process was repeated for 250 unique locations surrounding the point of interest, then the most representative shape was selected for the deterministic Portfolio model. The described process has only been performed for the wind resources added to the 2021 IRP (Wyoming and Idaho wind resources). 2019 IRP wind resource characteristics (Washington, Montana, Offshore) were obtained from HDR and DNV GL 3rd party analysis. The HDR report is available for review on the PSE IRP website. Documentation for the DNV GL wind shapes is not available at this time.
5/28/20	Nate Sandvig, National Grid Ventures	-This comment is in reference to slides 43 and 44- PSE IRP Team, Good webinar. Reviewing pumped storage slide/assumptions, would change Swan Lake COD to 2026. Would also add 1200-MW Goldendale and a COD of 2028. We have HDR as our quasi-owner's engineer for Goldendale, and they can follow-up with details (Carl Mannheim with HDR is copied). Presumably with scale in mind, Goldendale should be less capital cost on a $/kW basis. Also, by averaging data sources, Swan Lake (and Goldendale) is really at a disadvantage compared to batteries when that is not necessarily the case. As you've stated, pumped storage went up (2176→2515) and batteries went down (2427→1900). Just trying to keep a level playing field on cost for starters without getting into duration advantage, supply chain risk, degradation, recycling, waste, etc. that aren't factored into battery costs.	PSE is currently researching more information on pumped storage hydro and will have the results for the Consultation Update on June 18. PSE contacted Nate Sandvig on June 11 and discussed more detailed information on the Swan Lake and Goldendale projects. We look forward to receiving this information and incorporating it into the analysis.

		Thanks, Nate Sandvig	
5/28/20	Brian Grunkemeyer, FlexCharging	During today's IRPAG meeting, someone mentioned PSE was still working to understand demand changes after the impact of SARS-CoV-2. At FlexCharging, we do have a number of electric vehicles that we're monitoring, and we saw a ~75% drop in driving & charging. California issued a shelter-in-place order around March 15. WA high tech employers encouraged everyone to work from home around March 5th, then Gov. Inslee issued a stay-at-home order late the following week. This data is not limited to the US west coast. I've also included a map of the charging locations here. The number of charge sessions at public, workplace, and corridor chargers also dropped after the lockdowns. But it also looks like drivers got antsy in the first week of May. 	This information has been shared with PSE's load forecasting group and will be discussed further at the demand forecast meeting which will be scheduled in the next few weeks.
5/29/20	Don Marsh, CENSE	I participated in the Generic Resource Assumptions webinar on May 28. At a couple of points during the meeting, I asked questions about the Demand Forecast, but the answers were vague and unsatisfying. First, I asked when the Demand Forecast would be discussed. No specific date was given. PSE said the company was trying to evaluate the impacts of the COVID-19 crisis. Of course, we all understand the pandemic is having a significant negative effect on demand. However, PSE has a process for handling uncertain scenarios (like the future price of natural gas). The company can provide a range of outcomes (best case, worst case, and most likely), and then we can proceed cautiously with those scenarios in mind. Second, I asked how the public could participate in the development of the forecast. I was told that this part of the IRP would be "inform-only." This means that PSE will do all of its modeling in secret, and then "inform" us what the models predict. Without access to the data or the tools, we must trust PSE to come up with the right answers. However, this trust has been strained because PSE's forecasts have been significantly too high during the last decade, occasioning comment from the WUTC. For example, in previous IRPs, PSE has consistently projected substantial demand growth during the winter, but winter demand throughout PSE's service territory has actually declined since 2009. The Demand Forecast is at least as important to a successful IRP as the Generic Resource Assumptions. If the public doesn't have a good understanding of what customers' future needs will be, it's hard to know whether the IRP is a prudent plan to meet those needs. We should understand where there are likely to be "hot spots" of demand growth, and how vigorous that growth is expected to be. A forecast that covers PSE's entire service territory misses opportunities to target local needs with appropriate alternatives. For example,	The demand forecast for the 2021 IRP will be covered in an upcoming meeting. PSE is currently developing a schedule for the next set of meetings. We expect the website (pse.com/irp) to be updated and a schedule filed with the WUTC in the next few weeks.

		high growth in a small area might be an ideal scenario to deploy distributed resources and energy storage without over-building the entire grid. PSE's "Energize Eastside" project provides an instructive example. The company is using a five-year-old forecast of 2.4% annual demand growth to justify this project. Given the history of demand during the past decade, plus the realities of lower demand in the COVID age, this forecast is pure fantasy. Even before the outbreak of the virus, 2.4% growth seemed incongruous given falling winter demand throughout PSE's service area. PSE responded that the growth of the Eastside is unprecedented and is straining the Eastside grid. However, no proof has been provided that Eastside population and economic growth is actually producing increased demand, or that Eastside growth is significantly more vigorous than other areas served by the utility. Ratepayers worry that incorrect forecasts are used to justify unnecessary infrastructure investments that are costly to customers and harmful to the environment. We request four corrective steps be taken immediately: 1) Schedule a meeting specifically dedicated to the Demand Forecast. This meeting should occur as soon as possible, because the rest of the IRP is difficult to judge if participants don't have a clear understanding of the need PSE is trying to serve. 2) Provide individual summer and winter forecasts for each of the eight counties served by PSE (or finer geographic granularity, if warranted). 3) Provide full data and assumptions to IRP participants, and allow substantive feedback to shape the final forecasts. 4) To provide full context, demand forecasts should show at least ten years of peak demand history, including both actual and weather normalized trends. We also need to have a discussion about weather normalization procedures. There is no reason why this fundamental part of the IRP should remain secretive and obscure. To be legitimate, this IRP must demonstrate a significant improvement in the process and transparency of the Demand Forecast. Sincerely, Don Marsh	
6/1/20	Robert Briggs, Vashon Climate Action Group	There are two recent studies that show that renewable hydrogen can play an important role in enabling transitioning to 100% carbon-free energy at reduced cost. The two studies of great relevance to this IRP are: Path to 100% Renewables for California, WÄRTSILÄ®, https://www.wartsila.com/docs/default-source/power-plants-documents/downloads/white-papers/americas/path-to-100-renewables-for-california.pdf. And Hydrogen Opportunities in a Low-Carbon Future: An assessment of long-term market potential for hydrogen in the Western United States, Energy+Enviromental Economics, May 2020. [See Attached Executive Summary] It seems that it would be financially imprudent for PSE to add any thermal plants that are not designed to allow them to operate on 100% hydrogen, otherwise they will be at risk of being taken out of service before the end of their service life. Your comment?	Thank you for the reference material. We have reviewed through the Wartsila slides and are working on reviewing through the other documents that you have provided. The PSE IRP team has also scheduled a meeting with an industry expert to learn more about the commercial availability of renewable fuels for gas plants. PSE is currently researching more information on this topic and will have an update for the Consultation Update on June 18.
6/1/2020	Robert Briggs, Vashon Climate Action Group	Include electrolyzers and compressed hydrogen storage used in conjunction with H2-capable peaker plants as a measure in this IRP. Install a small (e.g., 5 MW) electrolyzer at one of your gas plants to evaluate its potential for long-term storage and the provision of other grid services.	The PSE IRP team has been in contact with the plant engineers to discuss this recommendation. The team is currently researching hydrogen as a fuel at the current gas plants and future gas plants and will have an update for the Consultation Update on June 18.
6/2/2020	Kevin Jones, Vashon Climate Action Group	REVISED: I participated in the 2021 PSE IRP Generic Resource Assumptions webinar on May 28, 2020. There are at least two concerns that I would like PSE to respond to.	Thank you for your questions. Responses below as you have numbered and labeled: 1. There are different risk factors when looking at new assets.

		1. It appears that PSE is not considering cost risk of potential assets being analyzed in the 2021 IRP. In some cases, the siting of offshore wind assets or the market cost of non-fossil based gas fuels, for example, these cost risks could be considerable. Yet it was clearly stated in the presentation that PSE does not consider asset cost risk in the IRP analysis. a. Why is cost risk not considered in the PSE IRP analysis? b. Where in the PSE portfolio analysis process is cost risk considered? c. Please also address how PSE's analysis process considers, or does not consider, asset acquisition schedule risk. 2. The IRP Draft WAC 480-100-620 states that "The utility must inform, consult and involve stakeholders in the development of its integrated resource plan and its two-year progress report" (emphasis added). When asked "What IAP2 level are you applying to this meeting?" Irena Netik responded "we are applying the consult level to this meeting" (ref time 31:33 in the meeting recording at https://register.gotowebinar.com/recording/3604364449812524812). When asked "Since WAC 480-100-620 uses "and", not "or", wouldn't it be more appropriate to apply the "involve" level of public participation to this meeting? If not, why not?" Irena Netik's answer was "PSE made the determination that we use involve as the appropriate level" (ref time 49:30 in the meeting recording at https://register.gotowebinar.com/recording/3604364449812524812) a. Please clarify PSE's position – will the May 28, 2020 meeting comply with the consult or involve IAP2 level? b. Please provide rationale for not conducting all 2021 PSE IRP meetings at the IAP2 "involve" level of public participation given the use of the word "and" in WAC 480-100-620 public participation directions. Please let me know where and when we can expect a reply. Please provide and post answers to the above questions on the PSE IRP website. Thank you, Kevin Jones kevinjonvash@gmail.com Vashon Climate Action Group	a. The risk of permitting. This is a factor used when assessing resources in the RFP, but not included in the IRP. b. The risk that resources will have different costs than projected. In the past PSE has not modeled this risk as part of the stochastic risk modeling, but we have discussed it several times and started developing information for the 2019 IRP. PSE will work to use a cost of resource as one of the variables to change in the stochastic analysis. The stochastic analysis work will begin later in the year. c. Asset acquisition schedule risk. This risk considers the operating start date for different resources. Since the 2021 IRP planning horizon starts in 2022, PSE considers the schedule for asset acquisition, permitting and building for the first year a resource is available. For example, a wind project can be built in 18 months, but you also have to consider permitting, acquisition of the turbines, and transportation to the side. This increases the process to 3 years lead time, so the first year available is 2024. 2. PSE reviewed stakeholder input from 2019 and considered the levels from the IAP2 spectrum that could be best supported. PSE determines the IAP2 spectrum for the public participation. The meeting on May 28 was at the "consult" level which is defined by IAP2 guidelines as "to obtain public feedback on analysis, alternatives and/or decision" and the promise is to "keep you informed, listen to and acknowledge concerns and aspirations, and provided feedback on how public input influenced the decision." Certain IRP subjects will be at the "involve" level but not all subjects meet that level of involvement.
6/3/2020	Willard (Bill) Westre, Union of Concerned Scientists	The Generic Resource Approach is no longer a reasonable method of analyzing generation costs for an IRP or a CEIP. It does not reflect the way PSE acquires resources so it cannot be accurate or transparent. Of the 97 responses to PSE's 2017 RFP's, the vast majority of generation resources proposed were Power Purchase Agreements (PPA). Of the 21 responses selected by PSE for further consideration 18 were PPA's for direct delivery of power at a defined price, only one was a PPA with a build-asset option and only two were PPA's with a buy-asset-option. The Generic Resource Approach data as presented leaves out the majority of generation resource costs – particularly finance cost, fuel cost, accurate performance data, national state and local subsidies, property and other ownership costs; local variations such as tax and labor rates, grandfathered requirements and other competitive advantages, construction transportation costs, etc. that are inherently included in PPA proposed costs. PPA proposals are a considerably more accurate source of data to use as the foundation for resource selection. Since PPA data is what PSE uses in resource selection, it is the data that should be used in the IRP including subsequent analysis processes such as resource adequacy. Adopt a Market Cost Approach using PPA data from previous solicitations. Confidential data can be protected in numerous ways e.g. presenting average data for 3 or more PPA proposals of the same type. This has been used by other utilities that have adopted this approach. PSE could begin by using data from the 2017 RFP responses received in 2018. The data is available already – just use it. Use of 6.97% as discount rates in General Resource Assumptions is unwarranted. The current Federal Fund Rate is 0.25% with the possibility of going negative. The current 30-year Corporate Bond Rate is 3.24%. It is not prudent for PSE to charge ratepayers any higher than market rates for asset purchases or use in determining capital costs for future assets. Secondly, use of high discount rates for cost estimates discriminates against renewable energy sources versus thermal resources - because renewable resources have high capital costs and zero fuel costs, whereas thermal resources have high fuel costs and lower capital costs.	The IRP models PSE-built resources as the generic resource, so a PPA is not directly comparable. PPAs are bids from third party developers and their financial structure is different from a utility, so they can offer prices that may be different from the cost for a utility to build and operate a generating resource. The generic resource cost webinar only presented the overnight costs. The Consultation Update will have the final costs that include the financing costs, PTC and ITC, taxes and insurance. PSE will continue to model generic resources as a PSE built and operated power plant. We can document the cost of materials and construction for a generic resources, but it is difficult to estimate future PPA costs, making it hard to model as a generic resource.

		Use the discount rate of 2% as suggested by the US Council of Economic Advisors in this policy brief: https://obamawhitehouse.archives.gov/sites/default/files/page/files/201701_cea_discounting_issue_brief.pdf Note: this does not apply to the discount rate specified for determination of the Social Cost of Carbon in the CETA regulation.	
6/4/2020	Bill Pascoe, Absaroka Energy and Pascoe Consulting	1. Pumped Storage Hydro (PSH) Nameplate Capacity (slide 24 from May 28, 2020 presentation) - The slide shows a 300 MW nameplate capacity. Please confirm that PSE will model shared ownership of a 300 MW PSH facility (PSE ownership share of less than 300 MW, say in 50 or 100 MW increments) in the IRP. 2. PSH Energy Storage Capability (slide 24) – The slide show an 8-hour discharge period, presumably at full (nameplate) capacity. Please confirm that this will be modeled in the IRP as 2,400 MWH of storage that can be called upon in various combinations of MW and hours (300 MW for 8 hours, 150 MW for 16 hours, 300 MW for 4 hours + 100 MW for 12 hours, etc.). 3. Energy Storage Recharge Parameters – What are the assumed recharge parameters for PSH and batteries? 4. PSH Operating Range (slide 24) – Gordon Butte PSH includes “quaternary” technology that allows the project to operate at any point from 0% to 100% generation and 0% to 100% pumping. This operating range should be modeled as a PSH option in the IRP. 5. Battery Degradation (slide 24) – The assumption that battery degradation is “near zero” is only reasonable if the capital costs on slide 44 include an allowance for future additions of new capacity to offset degradation of the initial installed capacity. If this is not the case, PSE should research and include a non-near-zero degradation rate for batteries. 6. Energy Storage Lives – What are the assumed lives for PSH and batteries?	PSE is currently researching more information on pumped storage hydro and will have the results for the Consultation Update on June 18.
6/4/2020	Stephanie Chase, Public Counsel Unit of the Washington State Attorney General’s Office	During the last webinar, PSE staff mentioned that there would not be a general public listening session for this IRP. In light of that, what efforts are you making to inform customers or stakeholders about the IRP process and ways that they may become involved or offer feedback, outside of the technical webinars?	For the 2021 IRP, PSE expanded its outreach efforts and contacted more than 1,400 potential stakeholders from across PSE’s service territory with an invitation to participate. As a result, new stakeholders have participated in the webinars. PSE continues to provide regular outreach and updates to the expanded stakeholder list. PSE is creating more stakeholder engagement opportunities through webinar recordings and feedback forms all through the process. Stakeholders can provide feedback to PSE at any point through the IRP process.
6/4/2020	Sarah Laycock, Public Counsel Unit of the Washington State Attorney General’s Office	There had been a question regarding renewable gas. As a follow up, just wondering if and how RNG will be modeled in this IRP. I saw that PSE contracted to obtain a certain (seemingly large?) amount from Klickitat PUD for about three years, if I recall correctly. So, just trying to figure out why RNG doesn’t appear to be listed as a renewable to model	PSE is currently researching more information on renewable fuels as an alternative fuel source and will have the results for the Consultation Update on June 18.
6/4/2020	Mike Hopkins, FortisBC	I think it would be useful to explore use of other fuels besides traditional natural gas in the thermal generation resource options - such as biofuels, renewable nat gas, hydrogen - to see if any would be viable in the future. While these fuels are likely more costly, they would reduce GHG emissions in valuable baseload or peaking plants. I think using the chat box to ask questions rather than having participants calling in was useful in keeping the meeting focused on the agenda topics and it was much easier to hear all the questions and answers.	PSE is currently researching more information on renewable fuels as an alternative fuel source and will have the results for the Consultation Update on June 18.
6/4/2020	Kathi Scanlan, WUTC, and WUTC staff	Commission Staff Feedback for Puget Sound Energy 2021 IRP: Webinar # 1 Generic Resource Assumptions (May 28, 2020) 1. This feedback, dated June 4, 2020, states the informal comments, questions, and recommendations of Washington Utilities and Transportation Commission Staff, Kathi Scanlan. Staff appreciates the continued work of PSE’s IRP Team and the opportunity to participate. Timely feedback is offered as technical assistance and is not intended as legal advice. Staff reserves the right to	1. Thank you and noted. 2. PSE will provide an updated table in the Consultation Update on June 18. 3. Transmission costs will be covered in the June 30 webinar.

		amend these opinions should circumstances change or additional information be brought to our attention and are not binding on the commission. 2. Capital Costs—Beyond slides 34 and 35, staff requests more information on definitions used by PSE, including definition of overnight capital costs, capital cost, or all-in capital costs to build plant. It is staff's understanding the Northwest Power and Conservation Council capital cost estimates include EPC + owners costs, including interconnection costs, development costs, legal, land, and overnight costs do not include interest that would be incurred during construction (AFUDC). Defining these new columns in the slides presented for the PSE recommended costs, including differentiating overnight capital, capital, capital-all-in, etc., for slides 36-45, and providing additional discussion and rationale is requested. 3. Conceptual cost estimates for transmission and delivery for each technology—the Clean Energy Transformation Act (CETA), including provisions in the IRP statute (RCW 19.280.030(1)(d)), which requires each utility to perform a comparative evaluation of renewable and nonrenewable generating resources, including transmission and distribution delivery costs. PSE indicated public sources do not identify different capital cost by region, so one cost will be used for each onshore wind option and transmission costs will vary depending on location. PSE responded that it may utilize the, "HDR Report flat 5-mile transmission and gas pipeline to get to system, plus flat $/mile applied to resources." Staff requests more follow-up information related to estimating costs for infrastructure outside the fence. PSE states, by June 18, PSE will decide what costs to use (slide 48). Staff requests clarification on transmission and distribution delivery costs, and when they will be discussed. 4. Regarding request for proposals (RFPs) and generic resource cost assumptions, staff asks: Can recent RFPs help PSE true-up resource costs in the IRP? The PSE's 2021 IRP resource cost inputs need to be the best available as they are a stand-in for potential new resources—there is a connection with the RFP. RFP data can inform generic resource costs, while maintaining confidentiality, where and when appropriate. How will PSE's RFP data inform generic resource costs? Staff agrees with comments posed by several other stakeholders on this discussion topic and requests PSE provide additional clarification of how its RFP data can inform cost data in its 2021 IRP. 5. Energy Storage—PSE asks stakeholders if the company should use the HDR Report for other battery options or only model the 4-hr Li-Ion in the IRP? Staff recommends PSE should include other battery options in its IRP analysis. By analyzing only one type, PSE is likely limiting its capacity for future resources from the outset and may not give PSE a broad enough analysis of how different resources can fit into PSE's needs. Energy storage is a key enabling technology for utilities to accomplish the goals of the state's clean energy transformation. In 2017, the Commission issued a report and policy statement on the treatment of energy storage technologies in the integrated resource planning process (see Docket U-161024, Service Date 10/11/17), which staff strongly encourages PSE revisit. Further, staff recommends PSE compare alternative data, including PNNL's Energy Storage Technology and Cost Characterization Report (July 2019): https://www.energy.gov/sites/prod/files/2019/07/f65/Storage%20Cost%20and%20Performance%20Characterization%20Report_Final.pdf This report defines and evaluates cost and performance parameters of six battery energy storage technologies (BESS) (lithium-ion batteries, lead-acid batteries, redox flow batteries, sodium-sulfur batteries, sodium metal halide batteries, and zinc-hybrid cathode batteries) and four non-BESS storage technologies (pumped storage hydropower, flywheels, compressed air energy storage, and ultracapacitors). Data for combustion turbines are also presented. Detailed cost and performance estimates were presented for 2018 and projected out to 2025. 6. Solar—According to a new LBNL utility scale PV benchmarking report (June 2020), solar useful life expectations have substantially increased to 30 years or more. The report includes relevant operation expenditure data: https://emp.lbl.gov/publications/benchmarking-utility-scale-pv. As reported by LBNL, solar project developers, sponsors, long-term owners, and consultants have increased project-life assumptions over time, from an average of ~21.5 years in 2007 to ~32.5 years in 2019. PSE's HDR Report (and workbook) provides data 5 to 10 years less than. Also, staff appreciates the additional consideration and data and analysis for distributed-generation residential solar (slide 39). Did PSE consider commercial distributed-generation solar as a type to model for its electric generic resource assumptions? 7. Existing and Refurbishment of Resources (remaining useful life)—Staff requests additional details regarding how PSE models existing resources and refurbishment costs and echoes similar questions raised in real time during the webinar on this topic. Please explain how PSE determines budgets for O&M inputs and economic retirement in the IRP modeling process. Further, how is PSE modeling PPAs—existing PURPA and other supply resources (expiration)? 8. For the 2021 IRP, PSE expanded its data sources and revised its generic resource assumptions based on feedback received from stakeholders from the last IRP cycle, which staff also appreciates. For the 2021 IRP, PSE states that it intends to utilize	4. For the 2021 IRP, PSE is following stakeholder recommendations to utilize publicly available cost information and will not utilize confidential bid information from the last RFP process. 5. PSE is researching the PNNL report and will have an update in the Consultation Update on June 18. 6. PSE is researching operating life and will have an update in the Consultative Update on June 18. 7. The operations and maintenance costs at PSE's existing resources are based on the most current budget and escalated at 1.5% per year. The PSE IRP team plans to use the 2020 budget for the 2021 IRP portfolio model. Since the IRP model allows for economic retirements, a decommissioning cost is used to adjust the remaining revenue requirement at the plant if it retires before the end of its economic life. All contracts are modeled with the contractual end date. The one exception is the Mid-C hydro contracts. The IRP has an assumption that the Mid-C contracts will get renegotiated and extended. The assumption for the Mid-C contracts in the 2021 IRP is under review. 8. The HDR report referenced in the webinar was incorrectly posted to the "Work Plan" area of the IRP website. The HDR report is now correctly posted with the Generic Resource Cost webinar materials. 9. A meeting for natural gas portfolio modeling has not yet been scheduled. PSE is currently developing a schedule for the next set of meetings. We expect the website (www.pse.com/irp) to be updated and a schedule filed with the WUTC in the next few weeks. 10. The GoToWebinar does not have the capability for attendees to make their questions visible to all GoToWebinar participants. Unfortunately, PSE learned about this limiting capability a few days before the webinar. The PSE team found a workaround to make all questions/comments visible to participants in real-time by copying and pasting the questions. PSE plans to us the GoToMeeting platform for the next webinar which has the desired functionality. 11. The demand forecast will be covered in an upcoming meeting. PSE is currently developing a schedule for the next set of meetings. We expect the website (www.pse.com/irp) to be updated and a schedule filed with the WUTC in the next few weeks. 12. PSE plans to share the appropriate model data as it is developed to support the IRP process. PSE is currently developing a schedule for the next set of meetings, which will include flexibility modeling and ELCC contributions. We expect the website (www.pse.com/irp) to be updated and a schedule filed with the WUTC in the next few weeks. PSE is researching efficiency gains for hybrid or co-located projects and will have an update in the Consultation Update. 13. PSE is tracking Northwest Power and Conservation Council's climate change analysis and at this time the IRP team is still assessing the appropriate methods to incorporate a climate sensitivity in the 2021 IRP.

		select information from the “Generic Resource Costs for Integrated Resource Planning, Revision 4” report authored by consultant HDR to supplement information. The generic resource costs will be derived from publicly available data sources and stakeholder feedback, where public data sources do not provide detailed operational characteristics necessary for robust power system modeling. The generic resource operational characteristics will continue to be sourced from the HDR Report. As such, staff questions why PSE’s Revision 4 Generic Resource Costs for IRPs (HDR Report), which was referenced numerous times in the webinar, was not initially posted under the first webinar and grouped with other Generic Resource Assumption Documents for review prior to the meeting. PSE’s website shows generic resource assumptions will be discussed on May 28, 2020 and lists four meeting documents: Webinar 1: Generic Resource Assumptions presentation REVISED [PDF, 1.6 MB] Webinar 1: Generic Resource Assumptions agenda [PDF, 120 KB] Generic Resource Assumptions Workbook Summary [Excel, 879 KB] Generic Resource Assumptions Webinar Q&A Log [PDF, 158 kb] PSE instead provides a link to its HDR Report under the subheading “Work Plan” in a completely different area of the IRP website https://pse-irp.participate.online/2021-IRP . To ensure transparency in the public process, staff recommends relevant documents be grouped or linked together with the relevant webinars to allow for timely stakeholder review before and after the meeting. 9. Slide 14—PSE made comments regarding the action plan not pertaining to the gas IRP (referring to step 6 of PSE’s 6-step process), please clarify if PSE intends to submit a short-term plan outlining the specific actions to be taken by the utility in implementing the gas long-range integrated resource plan? 10. Public Participation— Staff appreciates that PSE’s IRP webinar web recording is available for stakeholders and others who are not able to attend the webinar during work hours. Consultations with commission staff and public participation are essential to the development of an effective IRP. The PSE copy/paste delay of comments and questions in Webinar #1 was perplexing. Looking ahead, as PSE transitions to the new platform for Webinar #2, staff requests to see questions and comments from stakeholders in real-time during future webinars. 11. Upcoming Webinar #2—Staff found PSE’s comments regarding load forecasting as categorized as an “inform item” with no firm advisory group date around this topic surprising and requests further clarification and discussion. The demand forecast produced by PSE provides public insight into the future demand for power and gas in PSE’s service area. The demand forecast is influenced by economic and population trends in the Pacific Northwest. As a forecast, and an input for hourly demand for PSE, it is the most important factor in determining resource need. Again, staff believes ongoing feedback is essential to the development of an effective IRP. 12. Increasing Transparency in IRP Modeling—Staff appreciates PSE updates to the new website content, including delineating models used and inputs throughout the six-step IRP development process. The new generic resource assumptions workbook is a very helpful first addition to the library of data inputs and encourages PSE to share Aurora data input files and tables to increase transparency, including but not limited to Plexos Electric Portfolio Model, Electric Resource Adequacy Model (RAM), and Sendout Gas Portfolio, and other models. In terms of specific model questions, how does PSE account for efficiency gains for hybrids or co-located projects as inputs into the model(s)? Further, please specify the date PSE intends to discuss flexibility modeling and ELCC contribution? 13. Planning for tomorrow, the Northwest Power and Conservation Council is likely incorporating the impact of climate change in its next Power Plan. Reviewing regional and electricity data for 2018, the Council’s power planning staff reported in the fall of 2019 that the 2018 winter was warmer on average than the previous 91 winters. UTC staff requests additional information on how PSE intends to assess the climate sensitivity in future years of the utility’s load-resource balance and potential effects from changes in temperature/streamflow. Does PSE intend to use projected temperatures or streamflow distribution rather than historic distributions? Further, will PSE model unplanned outages linked to climate change in its IRP analysis, such as wildfires or other extremes like floods, snow pack shortage, or concurrent weather-related events?	
6/4/2020	Katie Ware, Renewables Northwest	*See attached PDF for comments (2020-06-04 RNW Feedback PSE Generic Resource Assumptions.pdf)*	1. Thank you. 2. PSE is researching pumped storage hydro and will have an update in the consultation update. 3. PSE is reviewing the data sources provided and will have an update in the consultation update. 4. PSE is modeling solar + battery and wind + battery in the 2021 IRP. The consultation update will include these resources along with research that PSE is doing on efficiency gains for having co-located resources.

6/4/2020	Joni Bosh and Fred Huette, NW Energy Coalition	*See attached PDF for comments (2020-06-04 resource-cost feedback NWEC.pdf)*	1. PSE is researching pumped storage hydro and will have an update in the consultation update. 2. For this IRP PSE will model offshore wind off the coast of Washington State, but we will continue to research offshore wind and monitor any developments in technology and location. 3. Thank you for the feedback and we apologize for the confusion. PSE develops 250 stochastic draws for each wind and solar resource. These draws are used as part of the resource adequacy model to develop the peak capacity credit or ELCC. The P50 single hourly profile is used the deterministic portfolio model along with the ELCC that was developed in the resource adequacy mode. 4. Thank you for feedback. 5. a) PSE is modeling solar + battery and wind + battery in the 2021 IRP. The consultation update will include these resources along with research that PSE is doing on efficiency gains for having co-located resources. b) PSE is researching pumped storage hydro and will have an update in the consultation update c) PSE will research the data sources and make sure that we are including the latest information in the capital cost. An update will be available as part of the consultation update. 6. PSE is looking into using the ATB cost curves instead of the AEO cost curves. An update will be available as part of the consultation update.
6/4/2020	Vlad Gutman-Britten, Climate Solutions	*See attached PDF for comments (PSE IRP feedback 6_4 Climate Solutions.pdf)*	1. PSE is researching owner's costs and AFUDC and will have an update as part of the consultation update. 2. PSE is looking into using the ATB cost curves instead of the AEO cost curves. An update will be available as part of the consultation update. 3. PSE is researching the outlier costs for both battery storage and biomass to see if there is a good reason for the higher costs. Without knowing the assumptions behind the costs it is hard to determine if it is a reasonable data point or not. PSE will have an update as part of the consultation update. 4. PSE is researching pumped storage hydro and will have an update in the consultation update. 5. PSE is modeling solar + battery and wind + battery in the 2021 IRP. The consultation update will include these resources along with research that PSE is doing on efficiency gains for having co-located resources.
05/28/2020 (question not answered during webinar)	Bill Pascoe, Absaroka Energy and Pascoe Consulting]	When and how will PSE look at flexible capacity needs in this IRP?	PSE is currently developing a schedule for the next set of meetings which will include flexibility modeling. We expect the website (www.pse.com/irp) to be updated and a schedule filed with the WUTC in the next few weeks.
05/28/2020 (question not answered during webinar)	Virginia Lohr, Citizens' Climate Lobby	Did David Nightingale (WUTC) ask for anonymous RFP data in one of the early 2019 IRP meetings?	PSE checked the meeting summaries for the 2019 IRP process and did not locate this reference.
05/28/2020 (question not	Kate Maracas,	Can PSE provide anonymized bid data in the form of median values by project type?	Due to RFP bidder confidentiality agreements, PSE will not make bid data public in any format.

answered during webinar)	Western Grid Group (WGG)		
05/28/2020 (question not answered during webinar)	Kate Maracas, Western Grid Group (WGG)	Will PSE consider using big data to inform future IRP's once they have been fully negotiated? Note that I'm not suggesting making the data public.	Once a project has been selected through the RFP process, negotiated, constructed and added to PSE's resource portfolio, then PSE will use those costs for that resource only. Since the costs are negotiated, it is difficult to use that as a prediction for future resource costs.

June 4, 2020

Puget Sound Energy
IRP Team

RE: Feedback of Renewable Northwest, Generic Resource Assumptions
Puget Sound Energy's May 28, 2020, Feedback Webinar Relating to Generic Resource Assumptions for PSE's 2021 Integrated Resource Plan.

I. INTRODUCTION

Renewable Northwest thanks Puget Sound Energy ("PSE") for this opportunity to provide feedback as a stakeholder in PSE's 2021 Integrated Resource Plan ("IRP"). This feedback is a response to PSE's May 28, 2020, Feedback Webinar regarding the Generic Resource Assumptions ("Assumptions") of the 2021 IRP.

Renewable Northwest participated in the first hour of the Feedback Webinar and subsequently joined Climate Solutions in a separate meeting with PSE to address questions on the webinar's content. Below, we provide feedback based on 1) the materials provided by PSE for the webinar, including the revised Generic Resource Assumptions Presentation and the Generic Resource Assumptions Workbook Summary, and 2) the public discussion heretofore on the Assumptions for PSE's 2021 IRP.

II. FEEDBACK

1. Renewable Northwest appreciates the addition of new proxy renewable resources to PSE's IRP modeling. Other utilities throughout the Northwest are identifying significant value in adding geographically and technologically diverse renewable resources to their systems, especially as these resources continue to fall in cost. We appreciate PSE's commitment to sharing more information about how the new proxy resources were selected and the intersection between these resources and available transmission capacity, and we look forward to additional engagement on these topics.

2. Renewable Northwest has identified possible discrepancies in PSE's determination of cost values for the proxy pumped hydro storage resource. Slide 43 of PSE's revised May 28, 2020 slide deck regarding generic resource assumptions breaks out the values that PSE averaged to determine the cost for its PSE 2021 IRP Reference Plant. Among those values, three stand out:

- Swan Lake, which is listed as a 393 MW/9 hour project with overnight capital costs of $2,093/kW;
- 2019 PAC Draft IRP which is listed as a 400 MW/9.5 hour project with overnight capital costs of $2,991/kW; and
- 2019 NWE Draft IRP (High), which is listed as a 500 MW/9 hour project with overnight capital costs of $3,479/kW.

Considering Swan Lake and the generic 2019 PAC Draft IRP resource together, Appendix A of PacifiCorp's 2018 Renewable Resources Study Report used in PacifiCorp's 2019 IRP lists Swan Lake as a 400 MW/9.5 hour project with EPC project costs of $2,070/kW.[1] These figures appear to be a mix of PSE's Swan Lake attributes and PSE's "2019 PAC Draft IRP" attributes.

On the other hand, the $2,991/kW figure appears to come from Table 6.1 of PacifiCorp's 2019 IRP, but in that table it is attributed to a 300 MW x 1,800 MWh proxy project located in Utah.[2]

As for the 2019 NWE Draft IRP (High) value of $3,479/kW, Renewable Northwest had significant concerns with many of the cost inputs NorthWestern Energy used in their 2019 ESRPP and discussed these concerns in our comments to the Montana Public Service Commission (although we did not address pumped hydro storage specifically).[3] Following this general trend of higher-than-expected costs for renewable and non-emitting resources in NorthWestern's ESRPP, we note that the 2019 NWE Draft IRP (High) value stands out as an outlier on PSE's slide 43.

For additional perspective on how these values may have affected PSE's proxy pumped hydro storage resource, we note that slide 47 shows approximately a 15% increase in pumped hydro storage costs between PSE's 2019 IRP and its 2021 IRP. We are unaware of any real-world circumstances that would support this increase, and removing the high PacifiCorp and NorthWestern figures would yield a value slightly higher than but generally consistent with PSE's 2019 value. All in all, we encourage PSE to take a second look at their pumped hydro storage cost inputs.

3. Renewable Northwest appreciates PSE's decision to use values from Lazard's Levelized Cost of Energy report as inputs to inform its proxy generating resource costs. Lazard's Levelized Cost of Storage report provides similar value in tracking price trends and providing up-to-date costs

[1] Available at https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2019-irp/2019-irp-support-and-studies/Renewable_Resources_Assessment_for_the_2019_Integrated_Resource_Plan.pdf.

[2] Available at https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2019_IRP_Volume_I.pdf.

[3] Renewable Northwest's January 15, 2020 Comments on NorthWestern Energy's 2019 ESRPP are available on the Montana Public Service Commission's EDDI website.

for storage resources. Version 5.0 of the Levelized Cost of Storage report, released in November 2019, shows a range of capital costs for 4-hour battery storage systems from $898/kW to $1,874/kW -- both lower than PSE's proposed cost for the proxy 4-hour battery system.[4] We encourage PSE to incorporate Lazard's values into its battery storage cost calculation.

4. Renewable Northwest encourages PSE to model hybrid resources as well as standalone renewable and storage resources. Hybrid resources can bring additional value and system benefits above the aggregate values of their component parts modeled as standalone resources, and the full benefits can be difficult to capture unless they are explored in a targeted manner. As an example, in developing its 2019 IRP, PacifiCorp identified significant cost savings when it modified its model to select solar-plus-storage rather than standalone solar.[5] This value was attributable to resource-adequacy benefits that PacifiCorp's initial model run was unable to capture when assessing resources separately. Meanwhile Portland General Electric's most recent Request for Proposals resulted in the selection of a hybrid wind-solar-storage project as a least-cost, least-risk resource to meet PGE's identified needs.[6]

III. CONCLUSION

Renewable Northwest thanks PSE for its consideration of this feedback. We look forward to continued engagement as a stakeholder in this 2021 IRP process.

Sincerely,

/s/ Katie Ware
Katie Ware
Washington Policy Manager
Renewable Northwest
katie@renewablenw.org

/s/ Max Greene
Max Greene
Regulatory & Policy Director
Renewable Northwest
max@renewablenw.org

[4] Available at https://www.lazard.com/media/451087/lazards-levelized-cost-of-storage-version-50-vf.pdf -- see slide 7 for capital cost information.

[5] See Slide 28 of PacifiCorp's 2019 Integrated Resource Plan (IRP) Public Input Meeting slide deck from September 5-6, 2019, available at https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/energy/integrated-resource-plan/2019-irp/2019-irp-presentations-and-schedule/2019-09-5-6%20-%20General%20Public%20Meeting.pdf.

[6] See Press Release, *Portland General Electric and NextEra Energy Resources to develop nation's first major energy facility co-locating wind, solar and battery storage* (Feb. 12, 2019), available at https://www.portlandgeneral.com/our-company/news-room/news-releases/2019/02-13-2019-portland-general-electric-and-nextera-energy-resources-to-develop-en.

NW Energy Coalition Comments on Costs for Generic Resources

June 4, 2020

1. **Pumped Storage [Slide 24]**

Please explain the operating range of 37.5-100% for pumped storage. Because this is hydro generation technology, it is our understanding that there is no minimum operating rate (Pmin) for pumped storage.

In addition, new technology is now improving the overall performance of pumped storage. The proposed Absaroka Gordon Butte project in Montana anticipates using a "quaternary" configuration, consisting of three pairs of 134 MW generators and pumps with a full operating range from -400 to +400 MW, that can switch from generation to pumping mode with very little interruption and very fast (20MW/sec) ramp rates, similar to the design of the KOPS II facility in Austria.

Further information:

https://gordonbuttepumpedstorage.com/wp-content/uploads/2020/03/3.04.2020_BriefingDoc_Final.pdf

https://nwcouncil.app.box.com/s/xfuiz4fzn0yw6zzmu61djsxc7pt5b3z7

2. **Offshore wind [Slide 25]**

Pacific offshore wind has a winter peaking seasonal profile that is very favorable to PSE winter peaking needs, as shown in slide 27. However, while the presentation indicates a 34.8% capacity factor for Washington offshore wind, much higher output is anticipated from potential offshore wind in southern Oregon and northern California, with capacity factors at the best southern Oregon sites of over 50%. See Musial et al., Oregon Offshore Wind Site Feasibility and Cost Study, 2019, nrel.gov/docs/fy20osti/74597.pdf. We urge PSE to constantly monitor technology improvements in offshore wind, as this resource may be particularly suited to meet westside winter needs in the future.

The Bureau of Ocean Energy Management is sponsoring ongoing technical workshops focusing on the southern Oregon region, including one scheduled for June 4, 2020.

3. **Resource adequacy – renewable resources (Slide 26)**

As we discussed during the workshop, the wording on Slide 26 is ambiguous. As we understand PSE's clarification, the resource adequacy assessment is stochastic using 250 draws to represent resource variability, and the P50 wind/solar values derived from that assessment are then used for the deterministic portfolio modeling. That should be clarified and explained on the slide.

4. **Ongoing and Capital Costs [Slides 29-47 and Generic Resource Cost Summary spreadsheet]**

We appreciate the well-structured breakout on new resource costs and the full detail provided in the accompanying spreadsheet. The derivation of the values is well documented and allows stakeholders to review the process and compare the results to other analyses. This is a major improvement for the 2021 IRP process.

5. **Current Capital Costs**

(a) Hybrid Solar+Storage and Wind+Storage. As discussed during the workshop, we understand that PSE will be modeling hybrid project costs taking into account the cost savings afforded by common site location, interconnection costs, etc., and not simply adding together the renewable and storage costs. We noted that the cost savings may also include additional factors such as financing structures that are attractive to investors. We encourage PSE to include the most current publicly available data and independent assessments, as cost trajectories are going down quickly during this formative period for hybrid resources. A recent California ISO presentation showed that in 2019, for new projects entering the CAISO transmission queue, 95% of solar projects are hybrids and 75% of wind projects.

(b) Pumped Storage. The Absaroka Gordon Butte project in Montana and the National Grid/Rye Development Goldendale project in Washington should be included in the resource list and cost assessment.

(c) As indicated in the Generic Resource Cost spreadsheet, we recommend using only the most recent cost estimates from any source to construct the average values for the years 2018 onward. Including older cost estimates will tend to bias the median and mean value per resource type upward as there has been consistent overestimation of future costs for resources undergoing rapid innovation and scale-up. In addition, as noted below, both the NREL ATB Low and Mid values should be included. For example, using the most recent cost estimates would change the Clean Solar-Utility sheet in the following way:

Line	Source
exclude	
9	NREL ATB 2018 Mid (AC)
15	PGE 2016 IRP Update (AC)
17	PSE 2017 IRP (AC)
19	Avista 2017 IRP (AC)
22	Pacificorp 2017 IRP (AC)
23	Pacificorp 2019 pre-IRP BMcD - 50 MW in ID (AC)
24	Pacificorp 2019 pre-IRP BMcD - 200 MW in ID (AC)
26	7P - Low Cost PV (AC)
27	Mid-Term, Low (AC)
28	Mid-Term, High (AC)

add NREL ATB 2019 Low (AC)
add PGE 2019 IRP
add PacifiCorp 2019 IRP
add NW Power and Conservation Council 2021 Plan initial inputs (GRAC)

Similar exclusions and additions should be applied to the "clean" worksheet for each resource category.

(d) In the Raw Resource sheets, the NREL ATB Constant values should be removed. The Constant scenarios set equal resource costs in all future years and are only used for NREL internal modeling purposes.

6. Future Capital Costs [Generic Resource Cost Summary spreadsheet]

We strongly disagree with the use of the Annual Energy Outlook (AEO) trajectories for future resource costs (Cost Curves tab of the spreadsheet). Instead, we recommend using the average of the NREL ATB Mid and Low estimates (which extend to 2050) to create the cost trajectories for each resource type. NREL does not have a High scenario, so the two provided basically equate to medium-low and medium-high values for future years. Our own independent estimates suggest the midpoint between those values is reasonable for assessing future resource cost trajectories.

For example, the AEO estimates solar utility PV (single axis tracker) costs as $1614/kW-ac in 2019 and $1309/kW-ac in 2030, a 19% decrease in 11 years. The midpoint of the ATB estimates are $1028/kW-dc in 2019 and $713/kW-dc in 2030; converting to ac values using an inverter loading ratio of 1.3, that is $1337/kW-ac in 2019 and $927/kW-ac in 2030, a 31% decrease.

The AEO uses an outmoded trending model and poorly documented methodology with stale data. The NREL ATB method includes more attributes with better balancing, much better documentation and a thorough assessment of the most current available data. While we do not agree with all of NREL's method, it is clearly the most authoritative national source of current resource cost data and future projections, so as noted, we support use of an averaged approach for the NREL ATB Mid and Low-cost scenarios for future cost trajectories in the PSE IRP.

We hope that in the future there will be a way for participants in the feedback sessions to speak directly; there were often confusing gaps between presentation, follow up questions and eventual responses.

Cordially,

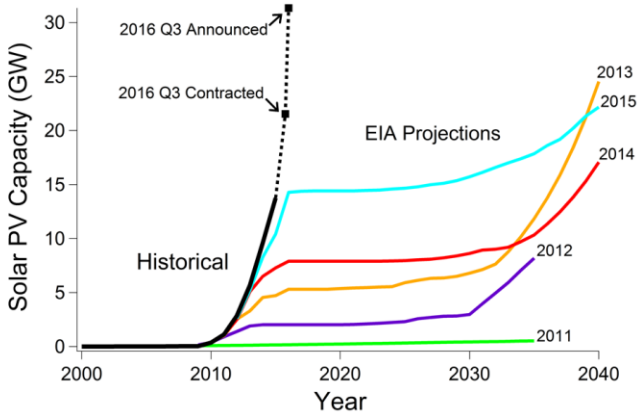
Joni Bosh, Senior Policy Associate
NW Energy Coalition

Fred Heutte, Senior Policy Associate
NW Energy Coalition

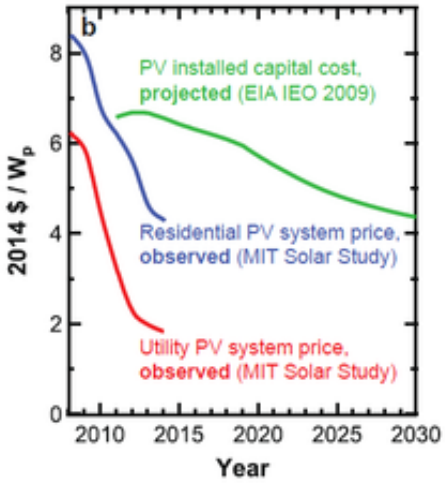
DATE: June 4, 2020
FROM: Climate Solutions
RE: Feedback on May 28 IRP Meeting

- **Owner's costs**
  - In the last IRP, PSE originally had 10% for RE and 30% for thermal, then ultimately used a blanket 30%.
  - We have requested from PSE a better understanding of what costs go into the owner's costs, and believe that those assumptions should be reflected in including owner's costs to the various resources.
- **EIA AEO learning curves**
  - AEO historically underestimates the installations of renewable energy capacity and therefore, the projected cost reductions of renewables.
  - We recommend using NREL's ATB instead of AEO.
  - A number of sources demonstrate EIA's poor track record projecting future deployment and costs:
    - Clean Technica - AEO Wildly Misses the Mark, Again

Figure 1. U.S. Utility-Scale Solar PV Capacity and EIA Projections



    - Clean Energy Action
    - Zenmo: PV growth



- **Averaging data for capital costs**
    - Averaging data for capital costs should not be based on so many utility IRP projections. Utility IRP projections also pull from data sources, so PSE should understand where the data comes from and use that data instead of utility IRPs.
    - Some of the IRPs that are being used are from 2016/2017, which is using information from outdated sources. PSE should only use the most up-to-date sources.
    - PSE should also be more consistent on where to average data from, and how many data sources they are using. For example, using the NREL report, which is already an average, and four IRP calculations will skew the average towards utility IRP projections.
- **Battery storage & biomass costs**
    - The batter storage and biomass costs are inflated by one single entry that is a substantial outlier from the others and we recommend deleting the outlier.
    - Storage costs should also incorporate Lazard's cost of storage.
- **Pumped hydro**
    - Pumped hydro costs appear to be high, and it appears in part due to Swan Lake being referenced twice from two different sources with different costs. PSE indicated that they are unaware of what is in PAC's pumped storage resource assumption, yet continues to use the assumption. We recommend only relying on reliable sources for these resource assumptions.
- **Support modeling hybrid resources**
    - The PSE spreadsheet includes a hybrid Solar + Storage resource, and we recommend incorporating this into the model. Additionally, we recommend looking at a hybrid Wind + Storage resource as well.