

2019 Integrated Resource Plan Technical Advisory Group Meeting #8
Hilton Bellevue
Salon D
300 NE 112 Avenue Southeast, Bellevue, WA 98004
September 19, 2019
10:00 a.m. – 5:00 p.m.

Attendees

Members

- James Adcock, TAG member at large
- Daren Anderson, NESCO Group
- Joni Bosh, NW Energy Coalition
- Charlie Black, Invenergy
- Rachel Brombaugh, King County
- Rob Briggs, Vashon Climate Action Group
- Brad Cebulko, Washington Utilities and Transportation Commission (WUTC)
- Carla Colamonici, Public Counsel*
- Kyle Frankiewicz, WUTC*
- Brian Grunkenmeyer, Flex Charging
- Kelly Hall, Climate Solutions
- Warren Halverson, Coalition of Eastside Neighborhoods for Sensible Energy (CENSE)
- Fred Heutte, NW Energy Coalition
- David Howarth, National Grid*
- Dan Kirschner, Northwest Gas Association
- Virginia Lohr, Citizens' Climate Lobby
- Don Marsh, CENSE
- Kate Maracas, Western Grid Group*
- Court Olson, Optimum Building Consultants
- Bill Pascoe, Orion Renewable Energy Group and Absaroka Energy*
- Noah Roselander, Vashon Climate Action Group
- Kathi Scanlan, WUTC
- Bill Westre, Union of Concerned Scientists

Public Observers

- Lori Ellsworth, citizen
- Max Green, Renewable Northwest*
- Randy Hardy, consultant
- Bill Lemon, Stone Bridge Securities
- David Perk, 350 Seattle
- Jim Woodward, WUTC

Project Team

- Elizabeth Hossner, Puget Sound Energy (PSE)
- Elise Johnson, EnviroIssues
- Michele Kvam, PSE
- Jennifer Magat, PSE
- Irena Netik, PSE
- Phillip Popoff, PSE
- Gurvinder Singh, PSE
- Angie Thomson, EnviroIssues
- Allan Vann, EnviroIssues

* Indicates remote attendance

Meeting objectives

- PSE presents an overview of the gas modeling process.
- PSE presents electric power price scenario results.
- PSE presents an overview of the electric modeling process.

Welcome and introductions

Facilitator Angie Thomson of EnviroIssues opened the meeting at 10:00 a.m. by welcoming attendees and providing safety information. Members of the TAG and PSE project team introduced themselves. Angie reviewed expectations for respectful meeting dialogue, provided an overview of the meeting and reminded attendees of the guidelines for the public comment period following the TAG meeting.

Irena Netik, PSE director of energy supply planning and analytics, provided a brief update on staff changes at PSE. The company developed an internal team to identify implementation and coordination tasks related to the passing of the Clean Energy Transformation Act (CETA). Phillip Popoff is now on special assignment with this CETA team, and Elizabeth Hossner is serving as interim IRP manager on the IRP team.

Irena then reviewed the meeting objectives and agenda for the TAG meeting. James Adcock expressed frustration with a letter written by PSE counsel to the WUTC, noting he felt it to be disrespectful to CENSE. Virginia Lohr also expressed frustration with the meeting objectives outlined by PSE and requested future meeting objectives to include receiving feedback from TAG members rather than only presenting information.

Irena Netik gave updates on action items from previous IRP meetings. For details, refer to the *Open action items from previous IRPAG and TAG meetings* as distributed in the meeting packet (also available on slides 5 to 9 of the meeting materials posted at www.pse.com/irp). Irena noted several tracked action items will need to be listed as open until they are completed in the IRP book, meaning several will stay open through the IRP process until the 2019 IRP is filed. These action items were provided in an appendix at the end of the meeting materials (available on slides 58 to 60 of the meeting materials posted at www.pse.com/irp). The TAG discussed the action item list, making the following key points:

- Noah Roselander asked the PSE IRP team what they heard at the IRPAG listening session in May, and what changes will be made as a result of feedback received at the session. Irena replied PSE took detailed notes during the listening session and received written comments as well. A large volume of comments centered around reducing carbon dioxide emissions in PSE's energy portfolio, and the assumptions included in IRP modeling reflect PSE's intent to develop a renewable energy resource plan. Noah responded many commenters made specific recommendations at the IRPAG listening session and shared that the Vashon Climate Action Group is looking for a written response on how those recommendations will be incorporated in the IRP process. Noah requested PSE take this as an action item. Irena noted PSE did not make a commitment to providing written responses to all comments received at the listening session, as this would be an enormous task in addition to completing the 2019 IRP, and that much of the feedback received from commenters would be incorporated into the resource plan. Noah replied PSE would have done this without the listening session, as CETA requires PSE to develop a future renewable energy portfolio and noted the listening session would have no purpose if specific feedback went unaddressed. Irena replied that Noah's requests will be taken into consideration by the PSE team.
- Warren Halverson noted he appreciated the listening session and thought it was well-run. Warren also noted he spent hours of time attending the listening session to provide comment, spent time providing written comments, and expressed the need for PSE to provide better transparency regarding the incorporation of feedback. This feedback would help him feel his time participating was well spent. Warren also requested written responses to comments received at the listening

session. Irena replied that Warren's requests, along with Noah's, will be taken into consideration by the PSE team.

- Irena noted the PSE IRP webpage has an online public input form where anyone can provide comments, and PSE has respond to those comments and published the comments and responses online. This input form was a direct result of feedback received from Virginia Lohr. Virginia expressed appreciation for this and asked when the form was added to the website. Irena explained this was developed and posted just before the May TAG meeting. Virginia asked where responses to comments have been posted, and Irena replied they have been posted in the webpage section under "IRP public input reports and PSE responses." Concerning PSE posting additional communications with the TAG, Virginia requested this section be updated to be titled "action items and key communications" to make comments and responses easier to find. Michele Kvam responded PSE would make this change.
- Irena explained the August TAG meeting, which was focused on the Energize Eastside project, was canceled due to the ongoing appeals process for the permitting of the project. The PSE IRP team received direction from the PSE legal team to not hold a meeting on Energize Eastside until the appeals process for the project comes to an end. Kathi Scanlan replied WUTC staff is aware of ongoing letter correspondence on Energize Eastside received from both PSE and CENSE, and WUTC staff is actively considering those letters and will issue a response soon.
- Don Marsh thanked the WUTC for considering the correspondence from CENSE and PSE. Don noted the PSE letter claims that he and CENSE distributed incorrect materials and expressed his surprise at that assertion. Don also expressed his intent to provide accurate data and distributed two graphs to TAG members and PSE to review. The first graph uses data from Federal Energy Regulatory Commission (FERC) Form 1 prepared by PSE and compares system peaks for PSE in winter and summer. Don requested PSE either explain how the data shown in this graph is inaccurate or provide an apology for their assertion in their letter to WUTC staff. The second graph compared system peaks between PSE and Seattle City Light. Don requested PSE explain why the system performance is so different between PSE and Seattle City Light (see Appendix A). James Adcock commented PSE engaged in discussion with Sierra Club TAG members in previous IRPs while the Sierra Club was actively engaged in legal action with PSE regarding using coal as an energy source. James then expressed frustration that PSE could not continue engaging with CENSE in TAG discussions on Energize Eastside while CENSE was engaged in legal appeals of the permitting process. James then requested greater clarity from PSE on their modeling efforts, particularly regarding winter and summer peaks.
- Charlie Black noted he made a request at a previous TAG meeting for PSE to address predicted capacity shortages in the wholesale power market, and the action items listed by PSE do not address this request. Irena replied the IRP team responded to Charlie's feedback by reworking one of the sensitivities on market reliance to analyze financial risk, and this change will be addressed in a presentation by Elizabeth Hossner later in the meeting. Phillip Popoff also noted Charlie's request has been on PSE's list of sensitivities to analyze for a long time and apologized for not including it explicitly on the action item list.
- Rob Briggs asked PSE about the status of a long-standing action item where he requested PSE to provide the leakage assumption as a percentage of gas delivered so the rate could be compared to scientific literature. Rob used data to develop an upstream leakage rate for PSE's assumptions, then sent a letter to Irena the day before the TAG #8 meeting asking if PSE's technical team can review the rate to see if Rob's calculations are accurate. Rob noted the rate he found raised concerns for him regarding the appropriateness of PSE's IRP assumptions. Rob then made two requests: for PSE to put the action item in the open action items category until PSE can review Rob's letter; and to include Rob's letter as an attachment to the meeting notes for the meeting (see Appendix B). Irena replied she read Rob's letter and was surprised to see it, as Michele had made efforts to reach out to Rob the week before to ensure he had adequate answers to his question and received no response. Irena also noted the upstream emissions shared with the TAG at previous meetings will need to remain the value used for the 2019 IRP.
- Warren Halverson commented he thinks it is unsatisfactory that PSE canceled the Energize Eastside TAG meeting. Warren noted some TAG members worked for years to discuss transmission planning for Energize Eastside related to the IRP and were disappointed when the

discussion was then canceled. Warren requested the removed action item to hold an Energize Eastside TAG meeting be replaced with a new action item to discuss Energize Eastside transmission planning issues not related to the appeals process. Warren also requested Don Marsh's requested action items be included in addressed action items for the IRP. Irena replied Warren's comments will be included as part of the notes, and the IRP team is currently following the instructions of PSE's legal team on how to proceed with Energize Eastside discussions.

- Court Olson expressed frustration with the cancellation of his presentation on energy efficiency (scheduled for the cancelled August meeting) and thanked Irena for reaching out to him about the possibility of including it on the September TAG meeting agenda. Court explained his opinion that previous IRPs have not fully explored energy efficiency as a potential resource, and noted he put hours of work into developing a presentation which will now not likely be included as part of the 2019 IRP due to a lack of time to incorporate his feedback.
- Virginia Lohr commented TAG members are often told there is not time available to fully discuss issues of concern to TAG members, when PSE chose to cancel meetings to discuss those topics.

Clean Energy Transformation Act rule makings overview

Kathi Scanlan, WUTC conservation and energy planning staff, provided the TAG with an update on rulemaking associated with the Clean Energy Transformation Act (CETA). After holding a workshop and receiving public feedback, the WUTC published a rulemaking implementation plan on August 27. This plan is available in Docket 190485 and on the WUTC website.

The implementation plan organizes rulemaking efforts into three phases. Phase 0 is the development of the implementation plan, which is now complete. Phase 1 will continue through January 2021 and includes discussions and workshops on various rulemaking components. The WUTC is preparing workshops for the following rulemakings:

- Electric IRP rulemaking to update the IRP structure and public involvement process – completion by the fourth quarter of 2020.
- Resource acquisition rulemaking – to begin fourth quarter of 2020.
- Energy Independence Act rulemaking and statutory requirements – to begin by the end of September 2019.
- Clean Energy Implementation Plan rulemaking – to begin in the first quarter of 2020.

The WUTC also intends to hold a renewable natural gas workshop in the third quarter of 2019 to review renewable gas proposals. Phase 2 of the rulemaking process will address the following three rulemakings beyond 2021:

- Natural gas rulemaking.
- Cumulative gas analysis rulemaking.
- Carbon and electricity rulemaking.

Overview of gas portfolio modeling process

Gurvinder Singh, PSE senior energy resource planning analyst, provided a presentation on the gas portfolio modeling process being used for the 2019 IRP. Gurvinder shared gas portfolio modeling inputs, outputs, and methodology. For details, see the *Overview of gas portfolio modeling process* presentation as distributed in the meeting packet (available on slides 8 through 17 of the meeting materials posted at www.pse.com/irp).

Scenarios and sensitivities

Gurvinder explained the scenarios being used for gas portfolio modeling. The IRP team used a base scenario, a low growth scenario with low demand and low gas prices, and a high growth scenario with high demand and high gas prices. Gurvinder also shared the sensitivities used for modeling, which included an alternative where the Tacoma Liquefied Natural Gas (LNG) facility does not go into service, two demand-side related sensitivities (alternative discount rate on the residential savings and extended DSR) and an alternative where the social cost of carbon (SCC) included upstream natural gas greenhouse gas (GHG) emissions and a carbon tax of \$15/ton.

Joni Bosh asked how the hybrid gas price prediction was developed for gas portfolio scenarios. Gurvinder explained it was developed using both Wood MacKenzie long-term price forecasts and a forward marks five-year forecast of gas prices for the short term. Fred Heutte noted extending a forward marks forecast beyond two years uses a lot of assumptions, and it may be prudent to have a high sensitivity for those forecasts to see what will happen if prices increase and stay high for a long period.

Charlie Black asked how SCC is being incorporated into the gas portfolio sensitivities. Gurvinder explained the SCC is built into the gas prices as a cost for resource acquisition. This cost would not be passed on to customers and is subtracted through forecasting customer bills and deducting the SCC adder. Charlie then asked if PSE is analyzing the underlying no-carbon penalty price for natural gas modeling and how it would affect rates. Phillip replied that PSE on the natural gas side has a Purchase Gas Adjustment (PGA) rate forecast which does not include the SCC. Charlie noted this could have an implication for the demand forecast, as demand would likely be lower if the SCC were included. Charlie asked if PSE is analyzing a scenario like that in the City of Seattle where new gas hookups are prevented or restricted. Gurvinder noted PSE is considering this, but not within the 2019 IRP.

Brad Cebulko asked what the Demand Side Resource (DSR) discount rate is, and Gurvinder replied it is 6.97%. Brad asked why an alternative DSR discount rate of 6.5% for residential was included in the scenario when the differences between these rates is so small. Gurvinder noted the Power Council differentiates between residential and industrial customers and uses different rates for each.

Rob Briggs noted the Final Supplemental Environmental Impact Statement (FEIS) for the Tacoma LNG project states that peak shaving is expected to occur for no more than 10 years of facility life, then asked Gurvinder why, given that the sensitivity of the Tacoma LNG facility not going into service was included in the IRP, a sensitivity assuming 10-years of peak-shaving operation, consistent with the FEIS was not. Gurvinder replied he is not familiar with the supplemental EIS document.

Load resource balance

Gurvinder described the load resource balance graph, which shows how the portfolio model will select the new cost-effective conservation for gas resources. Court Olson commented he does not think the demand increase for gas shown in the graph is realistic, noting he foresees gas demand decreasing instead of rising over the next 20 years. Gurvinder reminded TAG members the graph does not include new conservation, which the model will incorporate later, and which may impact demand forecasts.

Joni Bosh asked if PSE is including demand reductions in their definition of new conservation. If so, PSE could contract a request for proposals (RFP) for peak reduction programs. Gurvinder replied demand reductions come from PSE's energy programs, as PSE does not yet have a demand response program for natural gas. All conservation incorporated in IRP planning has a peak component to it which is built into the load shape. Don Marsh asked if gas-based demand-response water heaters have less of an effect than electric demand-response water heaters. Gurvinder noted natural gas planning looks at larger time increments, using peak days rather than peak hours. PSE is conducting pilots around demand-demand response gas heating, and possibly such peak measures can be included in the future.

Rob Briggs asked WUTC staff about rulemaking on House Bill (HB) 1257 and requested confirmation that monitoring greenhouse gas emissions is a WUTC responsibility. Brad replied the WUTC will put together

a report, which will ask for information from utilities. Rob also asked PSE if GHG reduction goals are part of the gas planning process. Phillip replied the 2019 IRP is including SCC and upstream emissions, but there is not time to include GHG targets in this IRP.

Supply side resources and DSR bundles

Gurvinder described the gas transportation map for PSE supply side resource and displayed a graph of projected DSR bundles over a 20-year timeline. Rob Briggs noted PSE can receive gas flowing from the San Juan basin, which has some of the highest methane emission rates in the country and asked how PSE incorporates this into their sensitivities. Gurvinder responded PSE is using two different emissions values for natural gas sources – a higher one for U.S. source gas and a lower one for Canadian gas.

Bill Westre asked if PSE could provide some information on what is included in each DSR bundle. Gurvinder noted this was explained in the December 6, 2018 TAG presentation (TAG #3), which he can share the link or redistribute.

Cost of gas: commodity and SCC adder

Gurvinder presented the cost of natural gas, comparing the difference between Canadian sourced gas and domestic sourced gas when the SCC adder and upstream carbon costs are added. Kelly Hall expressed an appreciation for this graph and asked if PSE will analyze the impact these prices could have for switching from gas to electricity for customers. Gurvinder replied PSE will likely do this for future IRPs but not for the 2019 IRP.

Don Marsh asked about a possible example of how the SCC is incorporated on the customer side: If a customer burns \$50 of natural gas in a month, would the customer have caused \$100 of damage as a result? Phillip encouraged Don to be careful in making these extensions to the customer side but noted the customer bill should be approximately one third of the damage. Phillip later clarified this number, saying half of a customer bill is associated with gas delivery rather than gas commodity, so half of the bill is one third of the damage. A \$50 customer bill would be associated with \$75 of damage.

During the discussion about the carbon tax sensitivity, Fred Heutte asked if the carbon tax would be subtracted from the SCC, or if PSE were planning to make it additive. Phillip replied that PSE was planning on adding the carbon tax on top of the SCC. There was some discussion about whether it was more appropriate from an environmental economic perspective to consider the tax a portion of the SCC or if it should be additive. PSE was initially not sure if this was the case, because the specific tax policy being considered was not adopted, and it was not clear if the policy would be additive. Phillip noted PSE would prefer to have this sensitivity data even if it ends up not being necessary. Brad Cebulko noted he thinks the SCC cost adder would incorporate the carbon tax but could imagine a scenario where the costs would be stacked instead, as PSE shows in their graph.

Virginia Lohr expressed appreciation for PSE considering the SCC adder and carbon tax separately, noting it followed the intent.

Clarification by PSE: On the gas side, PSE is modeling \$74/ton SCC in the base, low and high scenarios (converted to \$/MMBtu). There is a sensitivity to test an additional \$15/ton on top of the \$74/ton.

Cost of gas comparison between 2017 IRP and 2019 IRP

Gurvinder displayed a graph comparing the 2017 and 2019 costs of gas across low, base and high scenarios. Charlie Black requested PSE distribute by email the gas price scenarios PSE is using in 2019, year by year, and compare those prices to those used for the 2017 IRP. Elizabeth Hossner responded the gas prices are purchased from Wood MacKenzie and the contract with Wood Mackenzie specifies PSE cannot share their annual gas prices due to a confidentiality clause. PSE can share the 20-year levelized cost which is displayed on the graph.

Charlie expressed concern regarding the transparency of these gas prices and requested PSE only use gas price scenarios available to the public. Gurvinder replied Wood MacKenzie uses regional information to develop gas prices and use specific information relevant to PSE which makes their input valuable. Phillip also noted there are few things in the IRP process which are confidential, and these gas prices are one of them. Phillip replied the confidential gas prices have not been an issue for the past thirteen years, and PSE will not have time to use other gas prices for the 2019 IRP. Charlie asked if PSE could characterize if the front-end prices are higher or lower than the 2017 IRP, which would help TAG members understand what is driving PSE modeling. Phillip explained that in the last 14 years, PSE's IRP filings have not included annual natural gas prices, and no stakeholder has ever commented on it or requested annual prices, so we have been assuming the levelized gas prices have provided stakeholders with an acceptable degree of transparency. Phillip offered that PSE can show the levelized price for the first five years, and Charlie agreed that would help.

Brad Cebulko noted other utilities tend to take multiple price forecasts and make a composite, so they can show the year-by-year prices used for their IRPs. Brad noted he heard Charlie's comment regarding the transparency of gas prices, and that the year-by-year gas prices are an important part of the IRP process. James Adcock also commented on the transparency of year-by-year gas prices, noting TAG members have requested data which PSE then says is confidential. James requested PSE consider their public process and use public data when possible. Joni asked if the data under contract with Wood MacKenzie could become available if interested parties filed for confidentiality. Gurvinder replied the data could become available to those parties through a commission process that includes protections for confidential information, such as a general rate case filing. James disagreed and requested PSE use public data outright instead.

Kathi Scanlan looked up the portfolios of gas costs from the 2017 IRP. Charlie thanked Kathi for reminding the TAG what was included in the 2017 IRP forecast. Charlie then asked PSE to produce a similar product for the 2019 forecast to give TAG members the ability to do a comparison. Gurvinder will follow up with Charlie to identify what PSE can provide.

Social cost of carbon

Elizabeth Hossner, PSE interim manager of resource planning, provided information on how the SCC is applied as a cost adder in the 2019 IRP process and how this differs from applying the SCC as a carbon tax. Elizabeth provided excerpts from CETA referring to adding the SCC into electric planning, how PSE is using the SCC as a cost adder in resource acquisition and retirement scenarios, and how this choice to use SCC as a cost adder rather than as a carbon tax leads to a greater overall reduction in GHG emissions. For details, see the *Social Cost of Carbon* presentation as distributed in the meeting packet (available on slides 19 through 22 of the meeting materials posted at www.pse.com/irp).

Joni Bosh asked if, when using SCC as a cost adder, PSE is assuming a plant is running constantly. Elizabeth replied using SCC as a cost adder means a plant is running normally rather than limiting dispatch due to a tax, but the cost adder is considered when acquiring and retiring resources. Applying the SCC as a carbon tax instead means the dispatch would be limited to optimize the economics of the plant.

Charlie Black expressed confusion with the methodology used, noting the application of SCC as a cost adder is counterintuitive to him. Charlie requested PSE provide a more detailed explanation of the methodology prior to the development of the final IRP report. Charlie also noted the intent of the interagency working group when developing the SCC was to reflect the incremental impact of additional tons of carbon, which would be reflected when dispatching a resource on an hourly basis. Irena replied the CETA law specifically calls out applying the SCC when selecting intermediate and long-term resources, rather than hourly dispatch of resources. Applying SCC as a cost adder allows it to be incorporated in longer term planning decisions and in the IRP.

James Adcock agreed with Charlie and stated his opinion that the SCC should be applied as a carbon tax on dispatch. James also expressed concern that the current methodology may cause PSE to build too many gas plants, leading to stranded assets in the future. James also expressed his opinion that SCC should be variable and not a fixed cost. Elizabeth replied that after a carbon tax analysis, the combined cycle plants were most cost effective after applying the SCC because the plant shifts to optimize the cost of natural gas. Through applying the SCC as a cost adder, thermal resources are less cost effective than renewable resources, leading to removing thermal resources from the portfolio.

Kathi Scanlan asked if PSE considered completing a scenario for the IRP that used SCC as a carbon tax. Irena replied PSE considered completing the scenario, but because it was completed for two previous IRPs the team determined to not complete it for the 2019 IRP. Kathi asked if PSE would consider holding a webinar on their methodology for SCC.

Kelly Hall expressed appreciation for PSE's SCC methodology, noting SCC is a cost which cannot be passed onto customers. Kelly asked how the SCC would apply to existing resources. Elizabeth replied the SCC is considered in both decisions to build new resources and decisions to retire existing resources. The SCC is included in the cost of keeping existing plants when compared to building or acquiring other resources which may be non-emitting and therefore lower cost. Kelly suggested PSE conduct a sensitivity on if Washington state implemented a carbon tax which affects economic dispatch as well, which would have the SCC included separately.

Brad Cebulko asked PSE to explain the relationship between dispatch and retirement of resources. Elizabeth explained the decision to retire a resource is based on the full cost of the plant, which includes the life of the plant, year after year costs, capital expenditures, maintenance, dispatch costs and other variables like depreciation of the asset. This cost of continuing a plant is compared to building and maintaining a new plant. When the SCC is included in these decisions, thermal plants become more expensive and non-emitting plants become a more economic option.

Court Olson asked why PSE is not using SCC in both retirement decisions and dispatch calculations. Charlie Black also asked if PSE is modeling a carbon neutral portfolio by 2030, as required by CETA. Elizabeth responded PSE is modeling that portfolio. Charlie mentioned that while including SCC in hourly resource dispatch decisions is not necessarily required by law at this point, they may eventually be required. Charlie requested PSE develop a comparison between what resource additions PSE would select by resource type when using SCC in modeling dispatch, and what resource additions PSE would select by resource type when using SCC as a cost adder.

Phillip Popoff replied previous scenarios where PSE incorporated SCC as a tax in dispatch, a combined cycle gas plant is most cost effective because the carbon emissions understate the true pollution costs. Charlie stated he has not seen data to lead him to believe Phillip's assertion. Charlie asked if the combined cycle gas plant, when dispatched, would serve PSE's load or if it would serve the wholesale market. Phillip replied it would dispatch to the wholesale market. Charlie requested this be addressed in the IRP and in rulemaking, so utilities specify resource dispatch serving their own load and resource dispatch serving the wholesale market.

Joni did not agree with PSE's approach, noting the intention of the bill is to change generation resources, not allow plants to continue to operate and sell their power out of state. Joni stated that she desired more time to consider PSE's approach and pointed out the SCC was intended to apply to existing resources as well as new resources. Joni asked PSE if they could show their methodology for when they consider plants for retirement in the IRP. *Clarification post-meeting: PSE will include a description of the methodology in the 2019 IRP.*

Virginia Lohr noted in her reading of the 2017 IRP, PSE used a carbon cost instead of an SCC, and the carbon cost was based on a proposed law which exempted gas plants. Elizabeth replied the 2017 IRP ran multiple scenarios based on proposed laws, and scenario 14 included a carbon tax to all gas plants

and thermal plants. This scenario showed a shift to combined cycle gas plants, rather than a shift to renewable resources. Virginia asked what number was used for the carbon tax, and Elizabeth replied she would look it up and respond to her. *Clarification post-meeting: In the 2017 IRP, the Clean Power Plan carbon cost of \$19 per ton in 2022 was utilized, rising to \$51 per ton in 2037 (see 2017 IRP, Chapter 4, pages 4 to 17). Additionally, in the 2017 IRP, a carbon price or tax was used, but an actual SCC was not. The 2017 IRP includes a section describing why PSE decided to model carbon price regulation instead of the social cost of carbon (see 2017 IRP, Chapter 4, page 16).*

Daren Anderson asked if the application of SCC as a cost adder will have a large impact on future resource mixes. Elizabeth replied it likely will, but the IRP team has not yet completed resource modeling work. This will be a component of November and December 2019 IRP meetings. Daren asked if PSE will use SCC as a cost adder in determining Request for Proposal (RFPs) for resource acquisition. Elizabeth replied PSE will. Daren also asked if this methodology applies to energy imports. Elizabeth replied it does, and PSE is applying the SCC cost adder to market purchases as well.

Noah Roselander noted the Rocky Mountain Institute released a report which shows new natural gas infrastructure built after 2019 will likely become stranded assets due to decreased gas use (see also related Appendix C). Noah requested the WUTC work to protect ratepayers from the economic burden of stranded gas assets from their utilities.

Fred Heutte echoed requests from Kathi and Charlie to provide further information on the application of SCC as a cost adder before the next TAG meeting to provide more clarity on the methodology. Fred also commented that he would appreciate additional examples of applying SCC as a cost adder. When one thermal plant is removed due to the cost adder, another emitting plant may dispatch more frequently, leading to continued carbon outputs into the atmosphere. Fred would like to have a greater understanding of how all the pieces work together when applying the SCC cost adder for long-term planning.

Bill Westre asked if electric resources costs presented and finalized earlier in the 2019 IRP process will be updated after the passing of CETA, noting gas peaker plants will no longer have 30 years of life if PSE needs to reach zero emissions by that time. Elizabeth responded they are using the same resource report from HDR but will be running sensitivities to decrease renewable resource cost.

Kelly Hall asked if SCC cost adders are being applied to all resources coming into the system, regardless of state or location. Elizabeth replied the resources are challenging to parse out, but in the portfolio model PSE is adding the SCC to all thermal plants, both new and existing, regardless of location.

Brad echoed requests for a webinar on the SCC topic, noting he is still unsure what the best methodology is for incorporating SCC into the IRP process. Brad recommended PSE include different methods of incorporating SCC as alternate scenarios, even if the only one used for resource acquisition is SCC as a cost adder. Irena replied the team may not have time to include this in the 2019 IRP but looks forward to WUTC rulemaking on the SCC methodology.

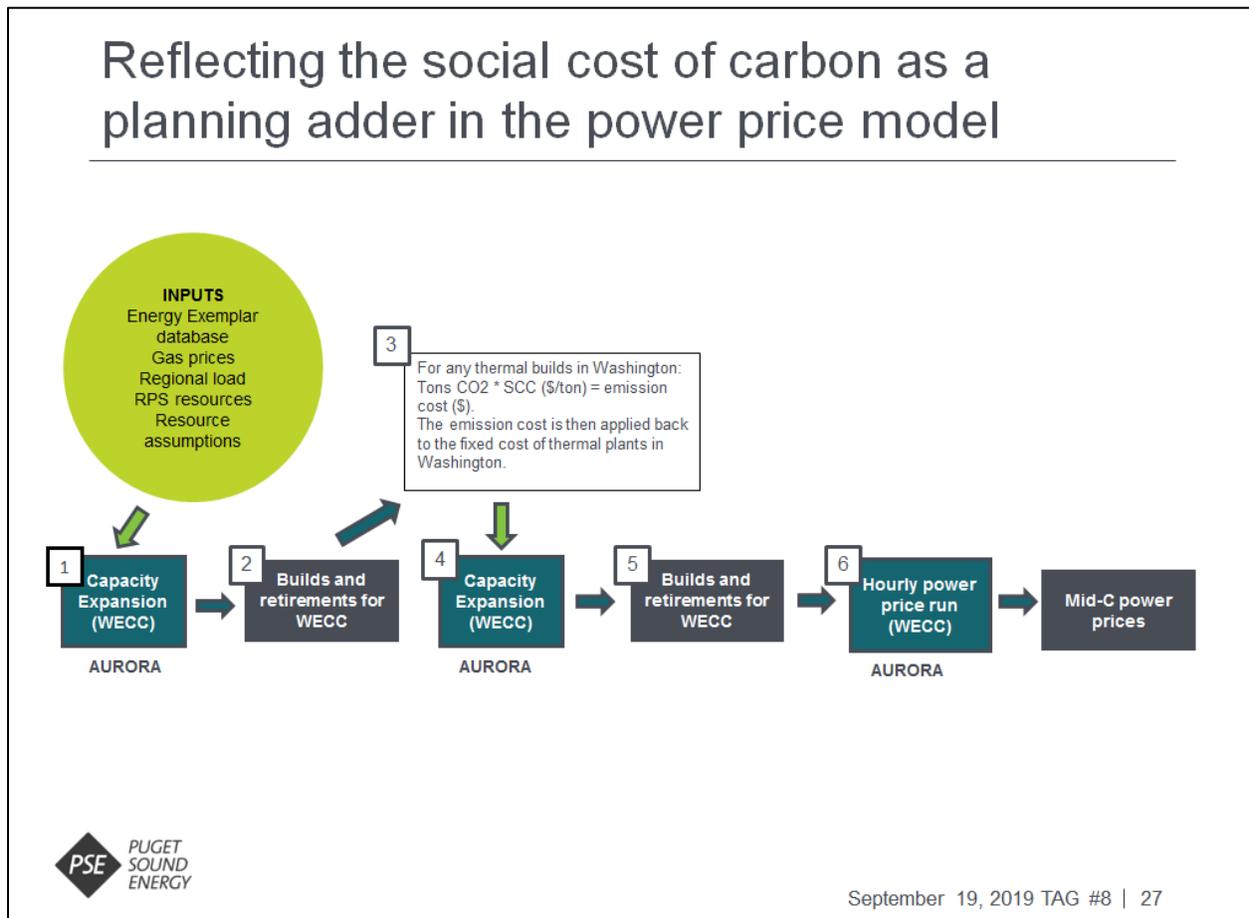
Scenario electric power price forecast

Jennifer Magat, PSE senior resource planning analyst, presented electric power price scenario results. Jennifer reviewed the price forecast model, previous power price forecasts presented earlier in the 2019 IRP process, updates made to the model reflecting the SCC as a cost adder, and the resulting hourly Mid-C price shape by month. For details, see the *Scenario electric power price forecast* presentation as distributed in the meeting packet (available on slides 23 through 33 of the meeting materials posted to www.pse.com/irp).

Reflecting the social cost of carbon as a planning adder

Jennifer illustrated how the SCC as a planning adder is incorporated into the power price model. Joni asked which step in the power price model the SCC is included. Joni also asked if PSE could provide a text description of this as the steps were not immediately clear from the provided flow chart.

[Note that the description below has been updated with references to the diagram on slide 27 in response to Joni's comment].



Jennifer specified PSE completes a capacity expansion model run first, so the model determines any new resources or planned retirements for the WECC. The initial run is the basis of the dispatch of new thermal plants in Washington state (*Step 1 in the diagram*). PSE then looks at the tons of CO₂ emitted by those new plants and applies the SCC to calculate the emissions costs. That information is then translated into a fixed cost and added back to the new thermal plants in Washington state (*Steps 2 and 3 in the diagram*). PSE runs the model to determine if new thermal plants in Washington state will be selected during the second capacity expansion run with the addition of the planning adder (*Steps 4 and 5 in the diagram*).

The resulting build and retirement decisions for the WECC (*Step 5 in the diagram*) and the existing resources in the database are the basis of the Hourly power price run (*Step 6 in the diagram*). The Mid-C power price forecast is used as an input to PSE's portfolio modeling.

Reflecting the social cost of carbon as a planning adder

Jennifer illustrated how the SCC as a planning adder is incorporated into the power price model. Joni asked which step in the power price model the SCC is included. Jennifer specified PSE completes a capacity expansion model run first, so the model determines any new resources or planned retirements. PSE then looks at new thermal plants in Washington state and applies the SCC. That information is then translated into a fixed cost where PSE looks back into those new resources as a planning adder, then PSE runs the model to determine if PSE would select that resource. Joni asked if PSE could provide a text description of this, as the steps were not immediately clear from the provided flow chart.

2039 hourly Mid-C price shape by month

James noted the chart reflects higher power prices in September, not December or January, and stated PSE is becoming a late-summer peaking utility due to limited hydro. Elizabeth clarified the projected high prices in September 2039 are not due to demand load peaks, but lower cost backup resources like hydro are reduced.

Brian Grunkenmeyer asked if PSE modeled limits on ramp rates to prevent power price problems during evening hours. Elizabeth explained that the Aurora model includes physical operational constraints on hourly ramp rates, and explained that PSE has not yet fully modeled this at a sub-hourly level, but noted their techniques will improve as PSE continues to work on this new modeling system.

Fred Heutte noted the 2039 hourly price projections might not be incorporating future battery storage to be added to the system to allow for more flexible energy dispatch. This may keep the projected dramatic price swings more level across the day.

Electric Mid-C price forecast scenarios

Charlie Black noted he is concerned there will be future capacity shortage events if there are several dry hydro years in succession. Charlie requested a risk analysis of spike events over one to two years, given PSE will frequently purchase power from the open market and may need to buy more frequently from a market with a potential for low hydropower availability. Elizabeth replied the forecast scenarios currently being used are under normal hydro conditions, but the electric modeling process presentation will review the stochastic analysis and risks as well.

Electric portfolio modeling process

Elizabeth Hossner, the interim manager of resource planning at Puget Sound Energy, gave a presentation on the electric portfolio modeling process used for analyzing the resources in the 2019 IRP. Elizabeth provided an overview of the complete six-step process for analysis in the 2019 IRP. At the time of the meeting, PSE was in the process of completing three of the six steps in the modeling process. The remaining three steps will be discussed at the November 26 IRPAG meeting and the December 11, 2019 TAG meeting.

TAG members asked questions and discussed various topics throughout the presentation, making the following key points:

Overview of the electric portfolio modeling process

Elizabeth Hossner gave an overview of the various steps in the electric portfolio modeling process and the progress PSE has made on completing the steps. There are six steps in the electric modeling process.

1. Analyze and establish resource need
2. Determine planning assumptions and identify resource alternatives
3. Analyze scenarios and sensitivities using deterministic and stochastic risk analysis
4. Analyze results

5. Develop resource plan
6. 10-year Clean Energy Action Plan

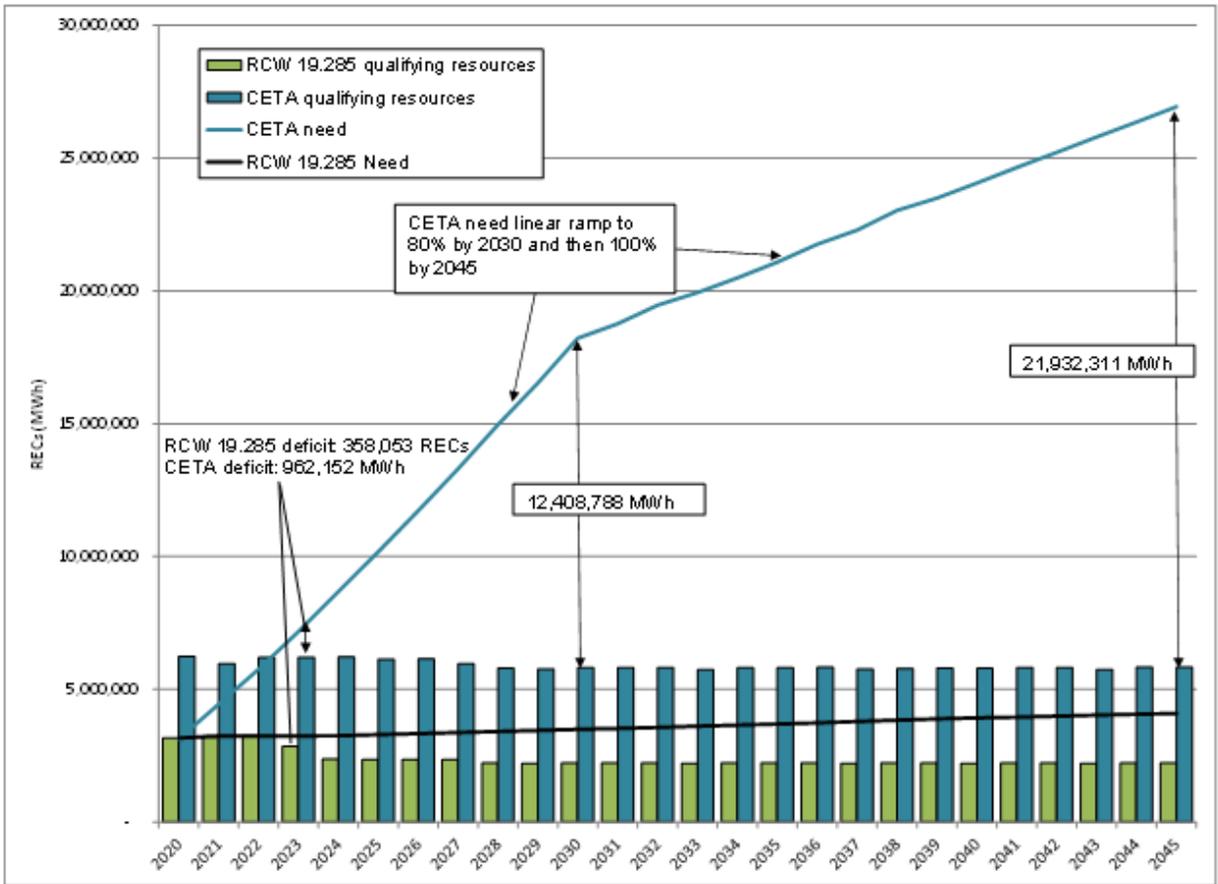
As of the IRP TAG #8 meeting, PSE was in the process of analyzing scenarios and sensitivities using deterministic and stochastic risk analysis, with plans to complete the remaining steps before the end of the 2019 IRP.

Establish resource needs

Elizabeth explained that there are three resources that needed to be identified: peak capacity need, renewable need and energy need. The peak capacity need was discussed in depth during the IRP TAG #5 in February 2019. A detailed graph with projections through 2039 for PSE's electric peak hour capacity resource need was discussed. The graph did not include new conservation and will be included later in the process once the cost effective bundle is selected through the portfolio model; new conservation can be a resource to help meet PSE's peak need. Elizabeth also discussed a graph for the resource need to meet RCW 19.285 and CETA.

James Adcock shared some concerns about the electric renewable need chart presented in slide 38 of PSE's meeting materials available at www.pse.com/irp. James suggested that the CETA needs linear ramp does not begin at the correct place, noting the ramp begins at 3,000,000 (MWh) RECs and should begin at 6,000,000 MWh RECs. In order to be meaningful linear progress, PSE needs to act now and not wait like the graph suggests. Joni Bosch agreed with James Adcock. The progress on the chart is linear for modeling purposes, but actualities may look very different. PSE could establish different resources earlier which may not fit the chart. Elizabeth agreed and responded that the chart shows the minimum requirements that PSE will need to meet according to CETA and RCW 19.285.

Clarification post meeting: Jim Adcock requested the meeting summary include a full record of his disagreement with PSE's approach concerning the start of the linear ramp and believes it is a mistake under CETA to show "CETA needs" starting in 2020 corresponding to existing RCW 19.285 qualifying existing resources. Jim contends that the CETA need start at the higher 2020 starting point. In addition, Jim asserts that the "CETA deficit 962,152 MWh" statement is incorrect, because CETA does not give PSE a "safe harbor" (2 percent) provision until 2030 – and then ONLY if PSE has maximized non-emitting acquisitions before then, which includes acquisitions during the current time-frame of 2019 to 2023. This is where in comparison slide 38 appears to be trying to show that PSE does not need to take action to acquire non-emitting resources prior to 2024 (in order to maintain access to the 2030 plus two percent safe harbor provision) – a statement that Jim views as incorrect under CETA. Note: Jim's feedback email concerning the draft notes listed the deficit as 962,1532 MWh RECs, capturing the typo on the slide. The correction was made in Jim's account and in the slide (provided on the next page and the correction has also been made on in the TAG 8 meeting materials posted at available at www.pse.com/irp



Brian Grunkenmeyer cautioned PSE to not assume that they can purchase renewable energy credits (RECs) from an external source. He mentioned that there will be potential for a clean fuel energy standard to be introduced in Washington in the next few years. The bill would allow the conversion of a REC into a clean fuel standard, which could be a separate market with separate prices. There will need to be mechanisms in place to complete that conversion, but if they exist, it could impact the availability of RECs. Elizabeth explained that PSE is assuming that the RECs will be new renewable builds to meet their needs.

Brad Cebulko asked for clarification on a chart in the presentation. The requirement is to be 100% GHG-neutral by January 1, 2030 which is not indicated on the chart. Elizabeth explained that PSE is looking at 80% renewable resources by 2030. The remaining 20% will need to be accounted for by offsets. 100% renewable resources will be analyzed as a sensitivity. Brad questioned why 100% renewable resources by 2030 was not used as the baseline if that is what the intent of the law states. Phillip Popoff responded that the chart is reflecting what the law requires. As Brian mentioned earlier, RECs may not be available in the future. The chart reflects that PSE must get to 80% at a minimum. The remaining 20% need to get to 100% is uncertain, which is why it's not reflected in the chart. Once PSE reaches 80%, there are other resources that can be explored for acquisition instead of building, such as energy transformation projects. The 100% renewable resource by 2030 sensitivity will be studied in this IRP.

Elizabeth discussed a chart showing the 2019 IRP electric demand forecast. The low represents P10 and the high represents P90. Joni asked for the specific numbers on the charts. Elizabeth explained the midline, which starts at around 2700 average megawatts and goes up to around 3500 average megawatts.

Planning assumptions and resource alternatives

Elizabeth moved on to step two of the electric portfolio modeling process. Step two includes an analysis of all the inputs PSE needs for the portfolio model, which includes resource alternatives as both supply and demand side resources, and scenarios such as gas prices, CO2 prices and electric demand. Elizabeth walked through three fully integrated scenarios that are being analyzed in the 2019 IRP, a graph showing the SCC and upstream CO2 emission for natural gas plants and emission rate for market purchases.

Fred Heutte asked for clarification during the discussion of alternative resource costs and Mid-C wholesale power prices. Fred's interpretation of the base versus base with no CETA lines meant the production costs on system are lower, thus market prices are decreasing as a result. Elizabeth explained the base scenario is showing there are a lot of renewable resources on the system. Those renewable resources become a marginal resource which causes a lower power price. If a marginal resource is a \$0 resource, then it will drop power prices to \$0. Base with no CETA does not include all the renewable resources, which has different marginal resources which is why the power prices are higher.

Elizabeth explained a chart showing the conservation bundles PSE will be using on the electric side. The chart shows the megawatt peak savings for various conservation bundles. The chart includes must-take codes and standards bundles that capture everything PSE knows will happen based on various laws, codes and building standards. The additional bundles show what PSE will be deciding as a cost-effective bundle to add beyond the codes and standards. Bill Westre asked for the makeup for the bundles. Gurvinder shared that the information was shared at the IRP TAG #3 meeting in December 2018. Fred asked for clarification on the 2017 IRP that went into the third bundle and how the SCC would be applied. Elizabeth explained that a much higher bundle would be reached once the SCC would be applied. Brad asked how PSE would expect to see more bundles/higher cost bundles due to CETA when the SCC is applied when the last IRP's scenario analysis did not show any effects. Elizabeth clarified that a carbon tax was applied in the previous IRP. By applying a carbon tax, the value of the resources and the dispatch of resources is changed. It makes a difference in the resources that will be dispatched in how you will apply a tax versus an adder. Once there are results, PSE will be able to understand a little bit more of what's happening.

Elizabeth explained the modeling process behind the sub-hourly system flexibility cost savings analysis using the PLEXOS model. For the sub-hourly cost analysis using PLEXOS, PSE first created a current portfolio case based on PSE's existing resources. Each resource was then tested in the portfolio and calculated the cost difference in the real-time re-dispatch from the current portfolio case. Fred appreciated the modeling since it showed a time differentiated value for resources. Fred is looking at promoting more conservation that occurs during peak periods and not just energy efficiency as a single option. Phillip added that CETA has requirements that go beyond the SCC – it doesn't necessarily matter what the SCC is, since PSE is still required to get to 80% clean energy by 2030, even if that would not be cost effective under the SCC. Conservation may offset the need to add renewables to meet that requirement.

In relation to the sub-hourly system flexibility cost savings chart, Fred asked why the figures for reciprocating engine ("recip") peakers were so high compared to frame peakers. Elizabeth explained that the ramp time for recip peakers is a full 20 minutes compared to five minutes for a frame peaker. Fred also asked for clarification on the difference between lithium ion batteries and flow batteries. His understanding is that the flow batteries are fast. Elizabeth explained that they have a lower roundtrip efficiency than lithium ion batteries at a full dispatch – that includes cold starts, resources that are already dispatched, etc.

Bill Pascoe asked if peak values are imported for PLEXOS into the portfolio model and a reset is run for flexibility purposes, then CO2 emissions then be captured in the sub-hourly timeframe that is modeled. Elizabeth explained that the only things captured will be what is dispatched for the hour, including CO2 emissions. CO2 emissions will not be captured at the five-minute mark. Bill also asked for clarification on the timeframe of running the PLEXOS model. Elizabeth explained that it only captured one year and not the entire planning horizon.

Bill suggested that the flexibility cost savings are modest and those could be considered operational savings. As PSE continues to add more non-dispatchable resources to their portfolio, it is no longer an operational consideration but a planning consideration. If there aren't enough flexible capacity resources now, then there could be a point where the next resources will have to be flexible. Elizabeth appreciated Bill's comments and acknowledged that the one-year model will not account for any future renewable resources that may come in and may have significant benefits to flexible capacity. A more robust analysis will need to be completed by PSE.

Bill recommended that PSE complete a sensitivity based on more flexibility analyses and savings. Elizabeth explained that completing additional sensitivities may be difficult before the November 15 due date for the draft IRP. *Clarification post meeting: Concerning the 2017 IRP, PSE used actual 5-minute demand data from 2016 for load, scaled to the demand forecast for 2022.*

James asked for clarification on the cost savings associated with pump storage and whether it was peak or off peak and if it models other constraints, such as buying shares instead of building new facilities. Elizabeth explained that the model assumes shares with some parameters on the number of megawatts the pump storage could ramp. PSE is assuming a 10-hour storage on the pump storage hydro. Specific details will be included in the IRP. James also asked if the model reflected the time for flow reversal. Elizabeth did not have an answer at the moment. *Clarification post meeting: this information will be provided with the draft 2019 IRP and final IRP.*

Kate Maracas mentioned research and modeling completed by Northern Tier Transmission Group (NTTG) and WECC to show roundtrip modeling that could be useful to PSE in modeling the value of flexibility. Elizabeth thanked Kate for the resource and noted that PSE will look into the modeling. Kate echoed Bill's previous point that PSE should continue looking into modeling flexibility as a sensitivity parameter. Brad expressed his disappointment there isn't enough time to incorporate the feedback that PSE is hearing from Bill and Kate due to the November 15 deadline. Brad stated PSE needs to ensure they have time to execute on ideas suggested by TAG members.

Daren Anderson had some clarifying questions and comments on the batteries shown in the flexibility cost savings chart. Daren shared with Fred and the group that roundtrip efficiency for flow batteries was 70%. He also wanted to know the flow battery specifications since the difference between flow and lithium ion savings were more drastic than he anticipated. Elizabeth noted she would have to review the assumptions that were put into the model and get back to Daren with details.

Fred noted that the specific values in the chart are not a big deal since the values can vary greatly amongst each of the individual resources. There is not enough experience and data yet to know the exact values to use. Fred also referenced the NTTG that Kate mentioned earlier. NTTG was able to complete a robust model analysis that included roundtrip capabilities. As utilities head towards resource mixing, there needs to be better coordination between utilities during IRPs to share modeling to ensure the grid remains strong. PSE should look into how to incorporate NTTG's work into the IRP.

Elizabeth then explained how PSE plans to analyze scenarios and sensitivities using deterministic and stochastic risk analysis. Elizabeth also showed a figure outlining all of PSE's existing resources, new resources in the model to meet their resource needs, the SCC into existing plants and new peaking or combined cycle peaker plants. At the end, there will be a portfolio dispatch and cost. Cost includes all expenses – the capital cost of building resources, the fixed capital cost of maintenance and upkeep of existing resources, the expenses related with the possibility of retiring existing resources, purchasing power using Mid-C power prices, the SCC, etc.

During the discussion of sensitivities, Phillip addressed Charlie Black regarding the reduced market reliance sensitivity. Phillip clarified that the questions PSE is asking is different than what Charlie had asked earlier in the day. The analysis is set up so instead of relying on 1500 MW for peak, PSE would rely on 300 MW at peak. The analysis would then try to understand how that would affect the portfolio, both in terms of cost and risk. Charlie asked earlier about the risk of the market reliance. Phillip

suggested that the best way to model that would be to completely remove the market exposure instead of reducing it to 300 MW. Charlie agreed that this approach seemed appropriate to limit one subset of the model to a hydro slice. Charlie assumed that PSE would let the model choose which resources can go into the remaining market reliance need. Elizabeth answered that a hydro slice would be added, and the remainder would be any new resources added to the portfolio.

Charlie clarified his question from earlier to look at an event risk-analysis, such as abnormally cool, dry winters in succession which would be like what was experienced in 2000-2001. That is a low probability, high consequence “shock” event. Charlie clarified that he was curious about the types of resources that would be resilient to “shock” events in the future.

Fred stated market reliance reduces the need for other new resources and that utilities would expect a certain amount of market to be available when you need it, which can reduce customer cost. The nature of the market is changing, and it is expected to be smaller. A changing market profile is important to look at in terms of resilience, in addition to cost. Charlie clarified he was talking about the Power Plan analyses in his previous comment, which addressed shock events. Fred commented shock events are studied over time since effects are recorded at quarterly timesteps. When regional portfolios are looked at and these factors are added, the loss of load probability looks at events that could last a year instead of a few days. Charlie mentioned that these shock events have effects on ratepayers. Ratepayers want to pay less over time. During “shock” events that affect rates, customers are unhappy. Rates need to be resilient to these “shock” events. James ended the discussion on this scenario by stating it is well-documented that more people die during hot weather events than cold weather events.

Elizabeth moved on and provided an overview of sensitivity C. The proposal for this alternative resource cost is to use the lower resource cost for wind and solar, which would be \$1500/kW on wind and \$1350/kW on solar. Fred recommended that PSE check out the Annual Technology Baseline report. The new release has some preliminary numbers for solar plus storage. Their analysis was showing \$1400/kW two years ago, so the numbers that utilities are seeing currently are too high. Fred shared that he is more concerned about the out-years, especially in the mid-2020s – those figures should be the baseline hour or the median since it is based in good methodology.

Stochastic Analysis

Elizabeth provided an overview of the stochastic analysis and where it would be applied. Fred wanted to highlight the stochastic analysis on gas prices. The stochastic variability will capture high gas prices but not in a very large fraction of the runs PSE is completing. Fred suggested that PSE run a high-gas run. The amount doesn't need to be large – however, it makes a huge difference to understand the price risk moving forward.

Elizabeth shared the results of the analyses, the electric and gas resource plans and the 10-year Clean Energy Action Plan will be discussed at the November 26 IRPAG meeting and the December 11 TAG meeting.

Next steps and action items

Irena reviewed the future planned meeting dates for the IRP process and the upcoming timeline for the distribution and finalization of meeting notes. PSE will distribute meeting notes on October 3. October 10 is the deadline for TAG attendees to provide comments on meeting notes to PSE. PSE will post the final meeting notes on the IRP website International Association of Public Participation on October 17. Irena then reviewed the action items for PSE captured throughout the meeting:

- Noah Roselander requested PSE provide a written response concerning recommendations shared by participants during the IRPAG listening session. *Update: PSE is considering this request and will share a response with the TAG before the next IRP meeting.*
- Virginia Lohr requested the “action item tab” on the PSE IRP page be updated to “action items and key communications” to identify that questions and answers between the TAG and PSE are included in this archive. *Update: On September 20, PSE made the update to the website and called Virginia to notify her the change was made.*
- Charlie Black requested PSE distribute by email the gas price scenarios PSE is using, year by year, with a comparison to those used in the 2017 IRP. Gurvinder agreed to touch base with Charlie regarding this topic, as the gas prices being used are private as dictated by the contract with Wood MacKenzie and will identify comparable gas prices to distribute. *Update: Gurvinder has reached out to Charlie to address this and will provide response to all TAG members, with a goal of resolving this by the publication of the final meeting notes on October 17. Note: this release was not made on October 17, but this will be accomplished by October 31 and the follow-up will be uploaded to www.pse.com/irp.*
- TAG members requested PSE develop a scenario where the SCC is applied as a tax. PSE will huddle as a team on how to address this request and will respond within two weeks. *Update: PSE will develop this scenario and will include it in the draft IRP.*
- TAG members requested PSE hold a webinar on how the SCC is applied in the electric modeling process. PSE will huddle as a team on how to address this request and will respond within two weeks. *Update: PSE will be providing additional information to TAG members on the SCC by October 31 and organize a follow-up call with TAG members for additional discussion.*
- Bill Westre and Court Olson requested PSE redistribute December 6, 2018 TAG (TAG #3) materials on conservation bundles. *Update: The materials have been redistributed to Bill and Court on September 26 and link on www.pse.com/irp also provided by email.*
- Rob Briggs requested PSE clarify information on the LNG plant, as the supplemental EIS stated the plant would only be used for peak shaving for 10 years. *Update: Upon reviewing the information Rob sent, the document in question was not prepared by PSE. PSE’s IRP is assuming that the Tacoma LNG peaker will be a resource through the entire planning horizon.*
- Rob Briggs requested PSE answer questions provided in his September 18 letter and PSE include it and the response in the meeting record. *Update: the letter is attached in the notes as Appendix B, and PSE provided a response and posted it to www.pse.com/irp on October 17 (and included it as Appendix F to the final TAG 8 meeting notes).*
- Don made two requests related to the graphs he distributed at the meeting:
 - Concerning the first graph, please verify the data in the graph is correct or not. If not, please provide why is it is not accurate (and this is curious since the source data is from PSE’s FERC Form 1). Also, if PSE is in error, Don would like an apology since he found the tone of the August 22 letter from PSE’s general counsel to the Commission very harsh in tone and Don was mentioned by name.
 - Concerning the second graph, please address why the shape of the peak load between PSE and Seattle City Light is so different. Can PSE explain the difference, is the nature of the load so different? Don presents this as an opportunity to learn and inform the planning process.
 - *Update: On September 26, 2019, WUTC’s Executive Director and Secretary, Mark Johnson, sent Mr. Marsh and other individual TAG members a letter concerning the 2019 IRP process and the Energize Eastside Project. The letter from Mr. Johnson was shared*

with the TAG with the draft distribution of these notes. PSE elects not to answer questions related to Energize Eastside in the IRP process.

Charlie reiterated his request for more analysis on spike/shock events, especially including hydro or natural gas after Colstrip 3 and Colstrip 4 are in the late-2020s. Elizabeth indicated that they will begin an analysis and try to complete it before November.

Several additional sensitivities were requested for additional analysis, including reduced market reliability and additional flexibility modeling. PSE would need to complete these analyses by November 15, 2019 in order to make it into the IRP. PSE will attempt to complete these sensitivities by this deadline.

James asked if there would be any discussion of transmission during the IRP, regardless of its relation to Energize Eastside. James would like to discuss transmission as a resource. Irena noted that an entire chapter of the IRP will be dedicated to transmission, but it will not be evaluated as a resource for this IRP with the understanding that it will be discussed at the next IRP. Phillip clarified that the earlier discussion on market reliance was about transmission and that transmission as a resource has been included in the IRP since 2005. It will continue to be included in future IRPs. James reiterated that he would like a technical discussion of transmission during the IRP.

Noah reiterated his previous point about the May 22, 2019 IRPAG meeting. He would like to see all of the public comments summarized and responded to as part of the IRP process. PSE will take these comments into consideration

Kate shared some information about the public involvement process in the IRP. Kate noted that there is an organization called the International Association of Public Participation (IAP2) that provides guidance on the various levels of stakeholder outreach and public participation. Some utilities have used IAP2 to create a two-way dialogue between utilities and the public to inform IRPs and influence decision. Kate would like to see PSE pursue some IAP2 practices in their own IRPs and would recommend that the IRP team reach out to several Community Projects Managers at PSE that are IAP2 certified for guidance. She would like to see that the IRP process is a sincere public participation process. Irena stated that Kate is welcome to send her resources to the IRP team for consideration. *Update: Kate kindly provided follow-up information to Irena and Michele on September 20, 2019.*

IRP comment period

No meeting attendees signed up for the comment period. After a final call for commenters, the meeting adjourned at 4:30 p.m.

Addendum to the notes dated October 31, 2019

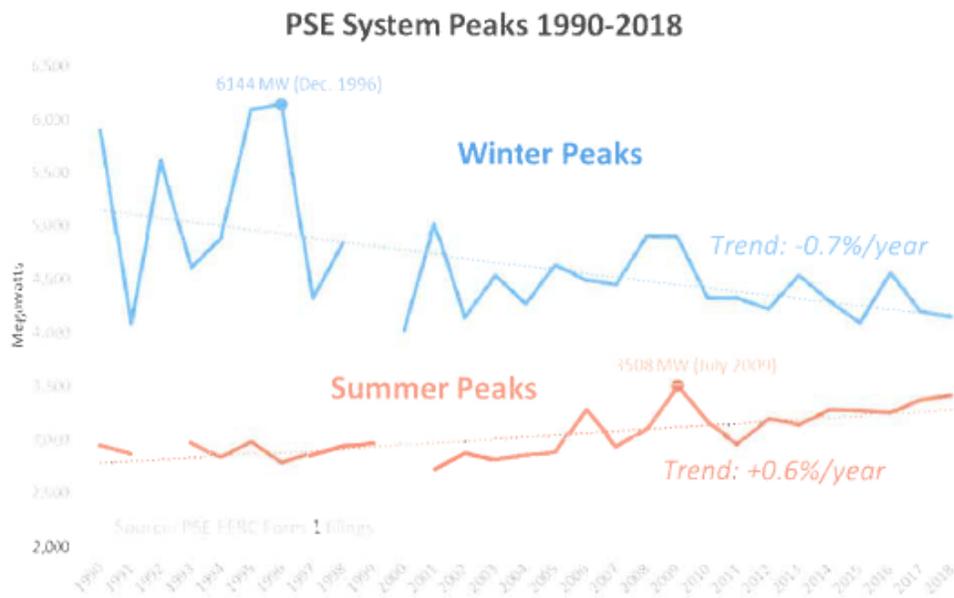
PSE has added Appendix G to the notes, the October 29 email notice concerning the cancellation of the November 26 IRPAG and December 11 TAG. Appendix H, 2019 IRP average gas costs has also been added.

Concerning the open action item TAG members requested PSE hold a webinar on how the SCC is applied in the electric modeling process. PSE will hold a webinar on December 11. PSE will be providing the 2019 TAG the webinar materials on December 4, along with the instructions on how to participate in the discussion.

Appendix A: System peak graphs as distributed by TAG member Don Marsh at the beginning of TAG #8.

System Peak Graphs

IRP TAG meeting #8, Sept. 19, 2019

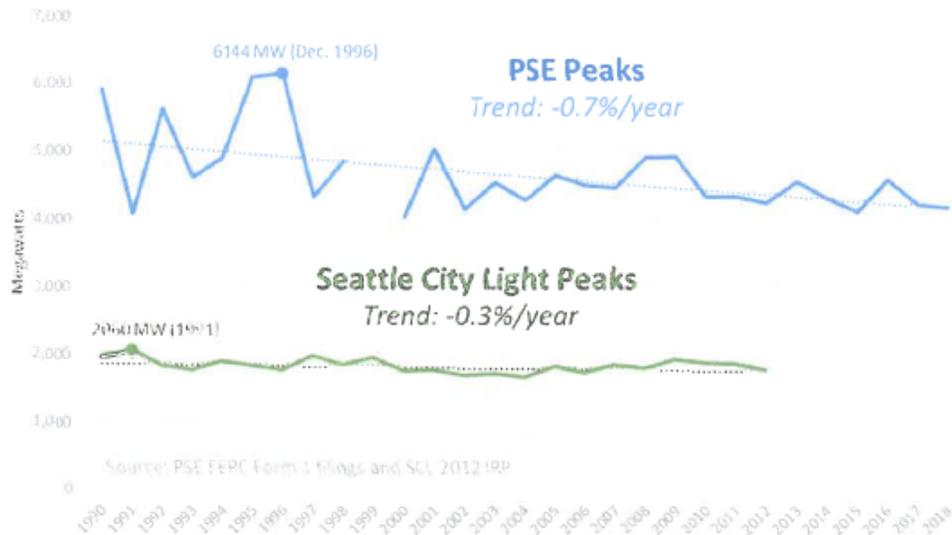


"... some of Mr. Marsh's, CENSE's, and CSEE's load forecast materials submitted in various forums – including the Bellevue public hearing – mixes and matches actual load data with weather normalized load forecasts and incorrect data from FERC Form 1, which manipulates and mischaracterizes the truth and has the potential to mislead those to whom it is presented. ... topics could be misconstrued in an IRP meeting and misrepresented in a local permitting setting, which would not benefit customers in the long term." (PSE letter to UTC, Aug. 22, 2019)

Historical demand and trends can clarify the challenges and opportunities considered by the TAG during development of the 2019 IRP.

We welcome any corrections or clarifications PSE would like to make in its FERC Form 1 submissions, or any proposal regarding a more authoritative source for this data.

PSE vs. Seattle City Light Peaks 1990-2018



Comparison with other area utilities can help identify opportunities and best practices to inform the 2019 IRP.

It appears that PSE's system peaks have been declining at twice the rate of Seattle City Light's.¹ If this is due to the company's aggressive conservation efforts, this result should be applauded. We don't know how the departure of Jefferson County and several large commercial clients might affect PSE's graph.

The large variations in PSE's graph, probably due to annual temperature variations, are more pronounced for PSE than SCL. Does this suggest an opportunity for more aggressive weatherization efforts in PSE's service area, or do more of PSE's customers rely on electricity for space heating? (16% of homes in Seattle are heated by electricity, what is the percentage in PSE's service area?)

Don Marsh
2019 IRP TAG member
don.m.marsh@hotmail.com

¹ http://www.seattle.gov/light/news/issues/irp/docs/SCL_2012_IRP.pdf, p. 13

Appendix B: Email dated September 18, 2019 from TAG member Rob Briggs concerning upstream gas assumptions in the PSE 2019 IRP. *Note: letter attachment was dated September 19.*

To: Irena Netik
From: Rob Briggs
Date: September 19, 2019
Subject: Upstream Gas Assumptions in PSE 2019 IRP

The purpose of this letter is to attempt to bring to closure questions and concerns I have expressed over proposed upstream methane emission assumptions proposed for use in PSE 2019 IRP.

I first made the request to know the assumed upstream methane leakage rate as a percentage of gas delivered on October 11, 2018 at TAG Meeting #2, and I asked to know the basis for PSE's assumptions. The presenter was unable to provide me that information, but PSE accepted as an action item for to the next TAG meeting to provide me that information. I have reiterated the same request at each subsequent TAG meeting and in writing.

I have concluded that the confusion and miscommunication on this issue may be due to the fact that the upstream emission rate that PSE inputs to their analysis software requires specific units and that PSE may not have ready access to the underlying data that would facilitate comparison of emission rates with those in the scientific literature.

However, the reason this issue remains timely and important is that measurement techniques for determining methane leakage rates throughout the production / transmission / distribution / end-use life-cycle have been improving dramatically over the past few years, and research efforts in this area have been greatly expanded. Industry reported leakage values are being replaced by third-party data gathered using aircraft, satellites, and sophisticated on-ground measurement equipment. A 2017 study by Atherton et al., which is probably the most robust study ever done on leakage from oil and gas production in B.C.'s Montney region—where PSE reportedly gets much of its gas—found fugitive methane emissions to be at least 2.5 times higher than stated by the B.C. government.^{1,2} Another major study by Alvarez et al. that incorporates improved research methods found methane leakage rates in the US oil and gas supply chain to be 60% higher than U.S. Environmental Protection Agency inventory estimate.³

The question that I have been attempting to answer is whether the values PSE proposes to use for PSE 2019 IRP are consistent with these recent findings.

The value provided for upstream emissions at TAG Meeting #2 was 0.009484 Metric tons/MMBtu. That value confounds upstream methane leakage rate (as a percentage of gas delivered) with CO2 emissions from energy consumed in production and transmission, with the chemical composition of the gas, its energy content, the assumed rating method (i.e., lower vs. higher heating value), and the assumed global warming potential (GWP) value. Without additional information, it is not possible to parse out the leakage rate that PSE is using for comparison with data in the scientific literature.

¹ David Suzuki Foundation, New science reveals climate pollution from B.C.'s oil and gas industry is more than double what government claims, April 26, 2017, <https://davidssuzuki.org/press/new-science-reveals-climate-pollution-b-c-s-oil-gas-industry-double-government-claims/>.

² Emmaline Atherton et al.; *Mobile measurement of methane emissions from natural gas developments in northeastern British Columbia*, Canada; *Atmos. Chem. Phys.*, 17, 12405–12420, 2017; <https://doi.org/10.5194/acp-17-12405-2017>.

³ Ramón A. Alvarez et al.; Assessment of methane emissions from the U.S. oil and gas supply chain; *Science*, 13 Jul 2018: Vol. 361, Issue 6398, pp. 186-188; <https://science.sciencemag.org/content/361/6398/186.full>

Requesting that PSE provide the leakage rate assumption as a percentage of gas delivered does not seem unreasonable given that it is consistent with the way PSE estimated the gas it leaks on its own watch in PSE 2017 IRP (0.5%) and the way leakage is presented in Table B.4 of the Final Supplemental Environmental Impact Statement (FSEIS) for PSE's Tacoma LNG project.

At TAG #6 on May 29, 2019, PSE presented similar upstream emission data on Slide 60, using essentially the same units, which present the same confounding-data problem as before.

TAG #6 slides p. 57 – 59 offer some help in understanding where PSE's values are coming from—GHGenius and GREET—but falls well short of providing proper references. GHGenius V4.0a (2016) is cited, but if you attempt to discover what data it uses, you encounter this message on the GHGenius web site: “The Government of Canada and S&T Squared no longer have an agreement to distribute the older versions of the model. If you need an old version please e-mail us and we can direct you to who to ask within the Government of Canada.”

This is a show-stopper for almost anyone trying to learn the underlying assumptions used in GHGenius V4.0a.

Tracking the basis for the GREET value, which is described on TAG #6, p. 59 as “Upper Sensitivity” is slightly easier, although doing so raises additional questions. The source listed on p. 59 is Puget Sound Clean Air Agency, Final Supplemental Environmental Impact Statement (March 29, 2019) (FSEIS). FSEIS, Table B.4 (p. 99) shows the leakage rates (expressed as % of gas delivered) from GREET1_2018 as 1.02% (for shale gas) and 1.00% (for conventional gas). Table B.4 also lists the total leakage rate from Alvarez et al. as 2.3%. Alvarez et al. is one of the most robust studies to date of methane leakage from the US oil and gas supply chain.

Interestingly, if you go to the GREET web site at Argonne National Laboratory, and look at the GREET Manual entitled Updated Natural Gas Pathways in the GREET1_2018, you encounter this: “...we added the option to use emissions data from Alvarez et al. (2018) for GREET1_2018. The data from Alvarez et al. (2018) is referred to as EDF 2018 in GREET.”⁴

Although neither the FSEIS nor PSE 2019 IRP, acknowledge the existence of this data set within GREET, it would in each case serve as a far more useful “upper sensitivity” than the GREET1_2018 value that PSE proposes to use in PSE 2019 IRP. Consider this passage from the GREET manual:

“From 2013 to 2018, a collaboration of the Environmental Defense Fund (EDF), universities, research institutions, and companies have completed 16 projects to collect data on methane emissions from the natural gas supply chain (EDF 2018). The EPA has incorporated data from these efforts, (e.g. updated emission factors for production, processing, transmission and distribution equipment) to improve its GHGI (Burnham et al. 2015). In 2018, EDF and many of its collaborators published an analysis synthesizing data collected across the 16 projects (Alvarez et al. 2018). The researchers, similar to Brandt et al. (2014) but with updated data, used a bottom-up analysis supplemented by a top-down analysis (covering 30% of U.S. gas production) to estimate national CH₄ emissions from natural gas and oil supply chains. Their facility-based estimate of 2015 NG and oil supply chain emissions is ~60% higher than the U.S. EPA GHGI estimate. Alvarez et al. (2018) facility-based methodology uses downwind measurements which, unlike solely relying on component-based calculations as done in the GHGI, can capture emissions released during abnormal operating conditions.”⁵

It appears that PSE has within the trusted GREET data source it references for the IRP, ready access to improved, up-to-date data on upstream fugitive emissions rates but has chosen not to use them.

⁴ Andrew Burnham, Updated Natural Gas Pathways in the GREET1_2018, October 2018, p. 2, pdf available here: Model https://greet.es.anl.gov/publication-update_ng_2018.

⁵ Ibid.

Questions

This leads me to several specific requests that may enable us to close out this upstream emissions action item.

1. Would you please have Keith Faretra or Bill Donahue verify (or correct) both my data input assumptions and the computational steps that I show below in converting the life-cycle emission rates that you show on Slide 59 of the May 29, 2019 TAG #6 Meeting Notes to gas leaked as a percentage of gas delivered.

Energy density of fossil gas = 49 MJ/kg
1 MJ = 948.45 Btu
Therefore, 1 MMBtu = $1,000,000 / (948.45 \times 49) = 21.52$ kg of fossil gas

From Slide 59:
Total upstream CH₄ emission rate (Baseline) = 0.15321 kg/MMBtu
Percentage of CH₄ leakage/CH₄ delivered = $0.15321 \text{ kg/MMBtu} / 21.52 \text{ kg/MMBtu} = 0.71\%$

Total upstream CH₄ emission rate (Upper Sensitivity) = 0.22105 kg/MMBtu
Percentage of CH₄ leakage/CH₄ delivered = $0.22105 \text{ kg/MMBtu} / 21.52 \text{ kg/MMBtu} = 1.03\%$

The Upper Sensitivity value appears to match closely with the GREET1_2018 value found for shale in FSEIS Table B.4 (1.03% vs. 1.02%), but the Baseline value (0.71) does not align with the 0.32% value for GHGenius 2016, BC value shown in Table B.4. Can you explain the discrepancy? Can you provide access to GHGenius v4.0a (2016) documentation? Can you explain why Atherton et al., which provides robust up-to-date leakage data for BC is not reflected in PSE's baseline assumption?

2. Would you please explain your rationale for not including the "EDF 2018 in GREET" data in the GREET1_2018 program as the baseline for the IRP, or at least in a sensitivity run.

Normally, when results are known to be highly sensitive to parameters on which there is high uncertainty, care is taken to ensure that the values used in sensitivity analyses effectively bracket the range of uncertainty. It appears that PSE is proposing to use values that range from less than one third (for the Baseline) to less than one half (for the Upper Sensitivity) of the best available estimate of the average leakage rate. A far more appropriate approach would be to use the GHGenius, BC value for a Lower Sensitivity, the "EDF 2018 in GREET" value for the Baseline, and a value reflecting high-emitting production fields like the San Juan Basin for the Upper Sensitivity. The map on Slide 58 of the TAG #2 clearly shows San Juan Basin gas flowing west through Stanfield, Oregon, so that very high emitting field clearly affects emissions in our Northwest regional market.

3. Would you please explain your rationale for not using GWP20 for methane?

My understanding is that PSE intends to use a GWP value of 25, representing the GWP100 value for methane from AR4. This seems oddly out of step with the more recent science from AR5, which puts the GWP100 value for methane at 34. Moreover, the use of GWP100 is widely recognized as an inappropriate basis for analyses related to greenhouse gases with short residence times in the atmosphere. Some argue for using both GWP20 and GWP100.⁶ The problem with using GWP100 for methane in an IRP with a 20-year time horizon is that it causes the costs of methane emissions during the analysis period to be understated by about 60%. That is doubly problematic and costly in the context of

⁶ Ilissa B. Ocko, Unmask temporal trade-offs in climate policy debates, *Science*, 5 May, 2017, Vol. 356, Issue 6337, <https://science.sciencemag.org/content/356/6337/492>.

the recent scientific pronouncement from the IPCC that we have just twelve years to cut carbon emissions in half if we intend to avert the most catastrophic climate impacts.⁷

I note that legislation was introduced in the Washington Legislature last session (HB 1597) that would standardize analyses like those planned for this IRP and require use of up-to-date science, regional methane leakage rates, and GWP values that make sense in the context of the current climate crisis. These issues are not going away. Should PSE decide to use a low methane leakage rate not supported by current research and a GWP value that is 2-1/2 time lower than makes public policy sense, it will dramatically underscore the need for such legislation.

I have stated at several TAG meetings and in written communications with PSE that I believe that PSE's proposed leakage factors underestimate the greenhouse gas impact of upstream fugitive methane leakage by a factor of between three and five. My analysis here would put that value at somewhat above five. Given the higher values that are required for social cost of carbon in this IRP and the magnitude of this leakage discrepancy, one would expect this underestimate to have a large impact on all IRP analyses that involve gas. I urge PSE to reconsider the values being used for leakage rate and GWP for methane. Failure to properly bracket the range of credible values will dramatically reduce the analytical power and value of the IRP analyses.

⁷ Intergovernmental Panel on Climate Change, *IPCC Special Report on Global Warming of 1.5 °C*, October 2018, <https://www.ipcc.ch/sr15/chapter/spm/>.

Appendix C: Email dated Sept. 23, 2019 from TAG member Court Olson concerning the predicted future use of gas in the U.S.

From: Court Olson

Sent: Monday, September 23, 2019 11:07 AM

To: IRP -- mail -- <IRP@pse.com>

Cc: Netik, Irena; Popoff, Phillip; Hossner, Elizabeth; Allan Vann; Elise Johnson; Angie Thomson

Subject: Sept 25th TAG gas discussion follow-up

Greetings fellow PSE TAG members.

Just wanted to share this link to a summary of new reports out from the Rocky Mountain Institute on the future of gas in the U.S. It lends credibility to my voiced assertion in the September 25th TAG meeting that use of gas will likely decline (not rise as PSE projects) during the 20 year forecast period of the current IRP.

<https://rmi.org/wp-content/uploads/2019/09/clean-energy-portfolio-two-pager.pdf>

While this RMI report focuses on electric utilities needing to move away from gas as a power generating source for cost reasons, it does point out that a consequence of this transition will likely be a rising cost of gas to end users:

" • This decline in utilization will lead to rising unit costs for delivered gas borne, in most cases, by captive utility customers "

I expect this potentially rising cost of gas to consumers due to potentially stranded utility gas assets will only add to the increasing interest of building owners (consumers) in moving away from gas and into clean energy appliances --e.g. away from gas furnaces, hot water heaters, and stoves toward clean and more healthy electric heat pumps, heat pump hot water heating, and electric induction stoves.

Court

Court Olson

MSCE, CCM, DBIA, LEED AP

Optimum Building Consultants, LLC

206-245-7176

www.optimumbldg.com

Appendix D: Email dated Sept. 30, 2019 from TAG member Rob Briggs concerning upstream gas emission

Fellow TAG Members,

Upstream methane emissions are an arcane and detailed facet of PSE's IRP analyses.

I'm providing the link below to my latest letter to PSE seeking clarification of the assumptions they are using and the basis for those assumptions:

https://oohpseirp.blob.core.windows.net/media/Default/19_Sept_TAG_8/Upstream_Gas_Assumptions_PSE_2019_IRP.pdf

While it's great that PSE has established a space for sharing communications on the IRP with the TAG and the public, it is difficult to locate things there, hence this note.

And while the issue may appear technical, even picayune, the impact is not. PSE presented a figure (TAG #8 - slide 15) showing that including the social cost of carbon adder more than triples the levelized cost of gas. If upstream methane leakage is modeled consistent with the studies I'm reading, it likely quadruples the cost. Particularly for optimization-based analyses, discrepancies of this magnitude without suitable sensitivities, pose major risk to the usefulness of analysis results. It seems to me like optimizing the business plan for your startup, while neglecting to include the payroll.

Rob Briggs

TAG Member representing Vashon Climate Action Group

Appendix E: PSE's email response dated October 11, 2019 to TAG member Don Marsh concerning his handout and October 6 email.

From: IRP -- mail -- <IRP@pse.com>

Sent: Friday, October 11, 2019 3:04 PM

To: Don Marsh <don.m.marsh@hotmail.com>; Netik, Irena <irena.netik@pse.com>; Popoff, Phillip <phillip.popoff@pse.com>; Hossner, Elizabeth <elizabeth.hossner@pse.com>

Cc: Elise Johnson (ejohnson@enviroissues.com) <ejohnson@enviroissues.com>; Diane Adams (dadams@enviroissues.com) <dadams@enviroissues.com>; Allan Vann (avann@enviroissues.com) <avann@enviroissues.com>; Angie Thomson (athomson@enviroissues.com) <athomson@enviroissues.com>

Subject: Don Marsh comments and PSE's reply : PSE 2019 IRP TAG #8 follow-up: Draft meeting notes distribution

Don,

Thank you for your feedback about the meeting notes. We'll update them accordingly.

PSE is focused on moving toward carbon neutrality in 2030, in accordance with the Clean Energy Transformation Act. At this time, we don't have resources to divert from this critical work. It's unclear what data you presented in your first graph since that is not from FERC Form 1. PSE presented the load forecast at the January 9, TAG meeting #4, and at this time the load forecast for the IRP has been finalized. Differences between PSE and SCL service territory are outside the scope of the IRP. Economic, demographic, building stock, and development plans of the two geographic areas are clearly different. It is complicated work to understand the differences between the two service territories.

Concerning the \$15/ton carbon tax related question below, we briefly discussed this when I called you on Friday, October 4. And as we discussed, PSE will clarify in the final meeting notes: On the gas side, PSE is modeling the \$74/ton SCC in the base, low and high scenarios (converted to \$/MMBtu). There is a sensitivity to test an additional \$15/ton on top of the \$74/ton.

Thank you for participating in our stakeholder process, we value your participation. Achieving carbon neutrality by 2030, in accordance with CETA, will be a challenge. I look forward to your continued participation as we transition to the new era.

This message will be shared with the TAG as an attachment to the September 19, TAG meeting #9 final meeting notes, and also uploaded on www.pse.com/irp, along with the handout you provided at TAG #9.

Thank you again and wishing you a good weekend!

Sent on behalf of Resource Planning & Analysis,

Michele Kvam

Michele Kvam

Resource Planning & Analysis

Puget Sound Energy, Inc.

P (425) 462-3137

Email michele.kvam@pse.com

From: Don Marsh <don.m.marsh@hotmail.com>

Sent: Thursday, October 3, 2019 4:30 PM

To: Kvam, Michele <michele.kvam@pse.com>; Netik, Irena <irena.netik@pse.com>; Popoff, Phillip <phillip.popoff@pse.com>; Hossner, Elizabeth <elizabeth.hossner@pse.com>

Cc: Elise Johnson (ejohnson@enviroissues.com) <ejohnson@enviroissues.com>; Diane Adams (dadams@enviroissues.com) <dadams@enviroissues.com>; Allan Vann (avann@enviroissues.com) <avann@enviroissues.com>; Angie Thomson (athomson@enviroissues.com) <athomson@enviroissues.com>

Subject: RE: PSE 2019 IRP TAG #8 follow-up: Draft meeting notes distribution

Michele,

I have reviewed the meeting notes and find them to be pretty good. I am satisfied with the summary of my question about peak demand and the letters to the UTC.

However, there is one ominous sentence: "PSE elects not to answer questions related to Energize Eastside in the IRP process." Given the close proximity of this sentence to the discussion about the two graphs I provided, does this mean that PSE will not answer questions about the graphs? It's possible these questions may relate to the peak demand scenario that PSE is trying to address with Energize Eastside. But the question of peak demand growth has much greater implications and applications than just that project.

I request that PSE clarify how and when it will answer these peak demand trend questions and the accuracy of these graphs. I would like assurances that PSE will be transparent about this and include correct graphs of these peak demand trends in the 2019 IRP. I note that PSE has not updated me on whether it will correct the graphs or issue an apology. I will inquire about this status during our next TAG meeting.

Also, I looked for a summary of my questions for Gurvinder about the social costs of natural gas, but I couldn't find it. As I remember the interaction, I asked Gurvinder whether the following interpretation of the SCC graph was correct: "If I burn \$50 of natural gas in a given month, is it true that I have caused \$100 worth of damage to society and the environment as a result of my energy consumption?" I believe Gurvinder replied, "I suppose you could look at it like that." A little while later, Phillip clarified that my \$50 bill would not be the actual cost of the gas, because about half of the amount would pay for transportation and infrastructure. In any case, the cost of the damage would still be \$100, and no one is directly paying for that damage at this time (at least neither the customers nor the company are paying).

Can you add that detail to the meeting notes? If you prefer to take it from your notes rather than my recollection, that would be fine.

Finally, I'm confused by the \$15/ton carbon tax referenced in the "Scenarios and sensitivities" section on page 5. Isn't the WUTC requiring PSE to incorporate costs of \$74/ton? Help me understand the discrepancy.

Thanks,

Don

From: Kvam, Michele <michele.kvam@pse.com>

Sent: Thursday, October 03, 2019 3:45 PM

To: Netik, Irena <irena.netik@pse.com>; Popoff, Phillip <phillip.popoff@pse.com>; Hossner, Elizabeth <elizabeth.hossner@pse.com>

Cc: Elise Johnson (<ejohnson@enviroissues.com> <ejohnson@enviroissues.com>); Diane Adams (<dadams@enviroissues.com> <dadams@enviroissues.com>); Allan Vann (<avann@enviroissues.com> <avann@enviroissues.com>); Angie Thomson (<athomson@enviroissues.com> <athomson@enviroissues.com>)

Subject: PSE 2019 IRP TAG #8 follow-up: Draft meeting notes distribution

To PSE's TAG Members,

Thank you to all who attended the TAG meeting on September 19, 2019.

I have attached the draft meeting summary for your review. Please provide any feedback on the notes to me on or before **October 10**. Final meeting notes will be published on **October 17**.

Key communications between PSE and TAG members related to this meeting have been included in the appendix to the notes, as well as posted under "action items and key communications" at www.pse.com/irp.

On September 26, 2019, Mark L. Johnson, Executive Director and Secretary of the WUTC sent a letter to certain TAG members concerning the 2019 IRP and Energize Eastside. I have attached it to this email.

Sent on behalf of PSE Resource Planning and Analysis,

Michele

Appendix F: PSE response dated October 17, 2019 to TAG member Rob Briggs concerning upstream gas assumptions in the PSE 2019 IRP.

To: Rob Briggs

From: PSE IRP mailbox

Date: October 17, 2019

Subject: Response to your Sept. 19 questions Re: Upstream gas assumptions in PSE's 2019 IRP

Keith Faretra responds to your questions as follows:

1. PSE uses the methane characteristics published by DOE/EIA for gas composition calculations:

Heating value of natural gas delivered = 1,078 Btu/ft³

Energy content of natural gas = 100,000 Btu/therm

Density of methane = 0.6785 kg/m³

Methane in natural gas = 95%

Unit Conversion = 35.3 ft³/m³

The underlying assumptions used to calculate methane emissions in each segment of the supply chain are published in the Final SEIS for the Tacoma LNG plant (including associated spreadsheets) made available by the Puget Sound Clean Air Agency (PSCAA).

2. PSE relied on the sensitivities published in the PSCAA SEIS analysis. Please also see on page 2 of the document you referenced in your September 19 email, Updated Natural Gas Pathways in the GREET1_2018, October 2018, where Andrew Burnham writes:
“We find the EPA GHGI to be the best data source that provides detailed process-level emissions needed to update GREET. As described below, Alvarez et al. (2018) has detailed NG sector emissions, however assumptions from the GHGI and other sources are needed to estimate process-level emissions.”
3. PSE is using the 100-year GWP from AR4 to remain consistent with current state and federal regulatory reporting requirements.

This message will be shared with the TAG as an attachment to the September 19, TAG meeting #9 final meeting notes, and also uploaded on www.pse.com/irp, along with the September 19 communication from you, already uploaded.

Respectfully sent on behalf of PSE Resource Planning & Analysis,

Michele

Appendix G (note, the attachments referenced are available at www.pse.com/irp under “action items and key communications”)

From: IRP -- mail -- <IRP@pse.com>

Sent: Tuesday, October 29, 2019 4:43 PM

To: Netik, Irena <irena.netik@pse.com>; Hossner, Elizabeth <elizabeth.hossner@pse.com>; Popoff, Phillip <phillip.popoff@pse.com>

Cc: Elise Johnson (ejohnson@enviroissues.com) <ejohnson@enviroissues.com>; Diane Adams (dadams@enviroissues.com) <dadams@enviroissues.com>; Allan Vann (avann@enviroissues.com) <avann@enviroissues.com>

Subject: Cancellation of November 26 IRPAG and December 11 TAG meetings

To PSE’s TAG Members,

PSE is cancelling the Integrated Resource Plan Advisory Group (IRPAG) meeting scheduled for November 26, 2019 and the Technical Advisory Group (TAG) meeting scheduled for December 11, 2019.

The cancellation is due to the October 28, 2019 WUTC Commission Staff petition for an exemption from WAC 480-100-238(4) and (5) and WAC 480-90-238(4) and (5) which require electric and natural gas utilities to file IRPs every two years. The petition also resets the next IRP due dates for January 4, 2021, for the draft IRP, and April 1, 2021, for the final IRP. Further details are available in the attached WUTC staff petition.

PSE supports WUTC staff’s petition and looks forward to working with the WUTC staff and stakeholders in the development of new rules guiding the development of integrated resource plans.

PSE appreciates the time, expertise and input of the TAG and IRPAG during the 2019 IRP process. Many of the suggestions made by TAG members were incorporated in the 2019 effort. We will work with care and deliberation to ensure that the applicable contributions and feedback of TAG members in the 2019 process is included in the 2021 IRP. We humbly thank you and sincerely regret any inconvenience concerning this change.

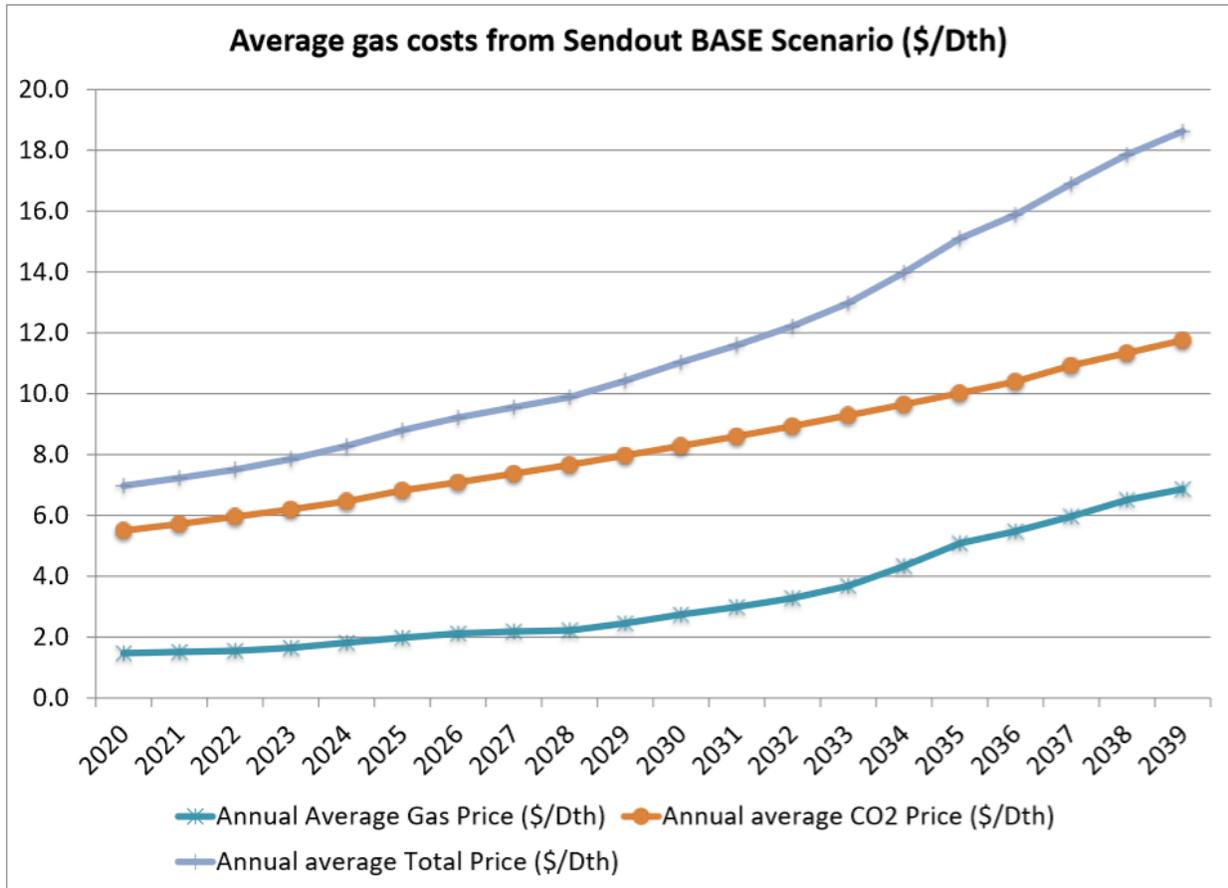
Although the formal 2019 IRP process is at an end and there will not be a 2019 IRP filing, PSE will be filing a progress report by November 15, 2019 and will be formally responding to the listening session.

PSE will continue to maintain and update the IRP resources at www.pse.com/irp, be available to answer questions via the email IRP@pse.com, and maintain and respond to public input via the IRP website.

Sent on behalf of Resource Planning and Analysis,

Michele

Appendix H (note, the attachments referenced are available at www.pse.com/irp under “action items and key communications”)



PSE 2019 IRP - Average gas costs
October 31, 2019