



2019 Integrated Resource Plan Technical Advisory Group Meeting #3
Hilton Bellevue
King County Room
300 NE 112 Avenue Southeast, Bellevue, WA 98004
December 6, 2018
9:30 a.m. – 3:45 p.m.

Attendees

Members

- Daren Anderson, The NESCO Group
- Larry Becker, Northwest Power Consulting*
- Joni Bosh, NW Energy Coalition
- Rob Briggs, Vashon Climate Action Group
- Rachel Brombaugh, King County
- Nancy Esteb, Renewable Energy Coalition*
- Brian Grunkemeyer, FlexCharging, Inc.
- Kelly Hall, Climate Solutions
- Warren Halverson, Coalition of Eastside Neighborhoods for Sensible Energy (CENSE)
- Norm Hansen, Bridle Trails Neighborhood
- Doug Howell, Sierra Club
- Kevin Jones, Vashon Climate Action Group
- Virginia Lohr, Citizens' Climate Lobby
- Dan Kirschner, Northwest Gas Association*
- Don Marsh, Coalition of Eastside Neighborhoods for Sensible Energy (CENSE)
- Court Olson, Optimum Building Consultants
- Andrew Rector, Washington Utilities and Transportation Commission (WUTC)
- Kathi Scanlan, Washington Utilities and Transportation Commission (WUTC)
- Kevin Smit, Northwest Power and Conservation Council
- David Tomlinson, Solar Horizon
- Washington Utilities and Transportation Commission
- Bill Westre, Union of Concerned Scientists
- Amy Wheelless, NW Energy Coalition

Public Observers

- Lori Elworth
- David Morton
- David Perk, 350 Seattle

Project Team

- Nate Davern, Puget Sound Energy
- Samantha DeMars-Hanson, PRR
- Alice Hackbart, Puget Sound Energy
- Hossein Haeri, Cadmus
- Nate Hill, Puget Sound Energy
- Bill Hopkins, Puget Sound Energy
- Elizabeth Hossner, Puget Sound Energy
- Brett Houghton, PRR
- Michele Kvam, Puget Sound Energy
- Irena Netik, Puget Sound Energy
- Aaron Poor, PRR
- Phillip Popoff, Puget Sound Energy
- Gurvinder Singh, Puget Sound Energy
- Bob Stolarski, Puget Sound Energy
- Jamie Strausz-Clark, PRR
- Travis Walker, Cadmus

* Indicates remote attendance

Meeting objectives

- Puget Sound Energy (PSE) explains how the demand side resources (Conservation Potential Assessment (CPA)) are used in the Integrated Resource Plan (IRP).
- PSE provides Cadmus an opportunity to share information about demand side resources.

Welcome and introductions

Jamie Strausz-Clark, meeting facilitator, opened the meeting at 9:30 a.m. by welcoming attendees and providing safety information. Members of the Technical Advisory Group (TAG) and project team introduced themselves. Jamie reviewed the agenda, meeting objectives, and guidelines for the comment period following the TAG meeting.

One TAG member expressed disappointment with the meeting objectives and said an objective should include TAG members contributing feedback. One TAG member expressed frustration that the agenda did not allow for much time for discussion and said they would appreciate more time for dialogue. A few TAG members echoed this comment.

Irena Netik, Puget Sound Energy (PSE) director of energy supply planning and analytics, updated attendees on PSE's revised public process, including a shift in the approach to meeting notes and email correspondence practices. Meeting notes for future meetings will highlight meeting outcomes, main points, and action items, instead of describing every individual question and comment. All emails regarding the IRP process now come from the IRP mailbox. PSE will no longer post questions, comments, and third party documents/studies about the IRP from individuals to the PSE website or distribute such material via email. TAG members have the contact list and are free to share materials with each other. PSE does not have to be a bottleneck with respect to information you wish to share with each other. PSE will send out an updated meeting schedule by the end of 2018. They have not distributed the schedule yet because the meeting location for future meetings has not been confirmed.

A TAG member expressed concern that PSE would no longer post questions and comments about the IRP to the PSE website. She added that, in the interest of transparency, there needs to be some way for other TAG members and the public to see each other's questions and comments. She also asked that PSE maintain a public record of the comments and questions that had been posted online, so they would not be lost.

Irena gave updates on action items from previous IRP meetings. She provided an update on the listening session, saying a modified listening session will be held with PSE Senior Vice President of Policy and Energy Supply David Mills at the IRPAG meeting on March 18, 2019.

A TAG member indicated he believed action item three is not complete. He explained that some TAG members felt the objective of discussing the social cost of carbon had not been met. The TAG member asked for an opportunity to discuss it at a future meeting. Irena mentioned that there will be an additional opportunity to discuss the social cost of carbon with the review of portfolio sensitivities and results.

A few TAG members asked for the updated gas emission rate source in action item seven. Irena committed to sending out the gas emission rate as a percentage by the end of 2018.

Demand side resource overview

Gurvinder Singh, PSE senior analyst, presented how the demand side resource study fits into the IRP. He started by sharing PSE's energy efficiency investments over the last fifteen years. Gurvinder shared the history of PSE investing in energy efficiency and described the demand side resource methodology. Gurvinder highlighted that PSE has been a leader in the region concerning energy efficiency. For example, PSE's share of savings in the PNW region is close to 20% and PSE's load is only 13%, and total investments in electric and gas efficiency totaling over \$1.2 B.

The intent of the Cadmus demand side resource study is to determine spectrum of options, from lowest to highest cost. The results of the study are inputs in the model to find the lowest cost solution.

A TAG member asked PSE to consider re-thinking how they define lowest reasonable cost, given three recent reports on the effects that climate change will have on way of life and the U.S. economy.

A TAG member suggested PSE review the Seattle City Light MEETS (Metered Energy Efficiency Transaction Structure) program as they consider demand side response. Gurvinder explained PSE had done some investigation at a TAG member's suggestion during the 2017 IRP and the program was not successfully meeting its objectives, but he offered to provide additional information offline to any TAG member who would like it. PSE explained that this program is an implementation issue, not a planning issue, as all measures are covered in the Cadmus work. If vendors want to propose different delivery mechanisms (programs), they should respond to PSE's current Request for Information (RFI), issued from the Energy Efficiency team.

Electric demand side resources

Gurvinder welcomed Cadmus, the technical consulting company developing the demand side resource inputs for PSE's 2019 IRP. Hossein Haeri, senior vice president at Cadmus, provided information about Cadmus' experience and qualifications to perform this work. Hossein also shared an overview of the methodology and Cadmus' scope of work for the 2019 IRP. Put simply, Cadmus looks at how many products (or measures) can be put in how many residential, commercial, and industrial buildings to improve energy efficiency. Where possible, Cadmus uses northwest-specific and PSE-service-area specific data.

Travis Walker, senior associate at Cadmus, defined the different data sources Cadmus used in its work. Their methods are in line with the Northwest Power Council. First, Cadmus gathers available data including PSE's load and customer forecasts and Residential Building Stock Assessment (RBSA) II. PSE also recently conducted a Residential Characteristics Study (RCS) with over 20,000 customers, providing reliable and relevant data for Cadmus. From this data, Cadmus determined 5,562 inputs for the IRP modeling. Cadmus built forecasts from counts of customers currently using the most efficient products and those who will need to upgrade to more efficient units in the future. With this information, Cadmus calculates levelized costs using costs and benefits PSE incurs.

Cadmus uses these numbers to develop technical potential, a measure of all technically-feasible potential energy savings. Applying technical potential, Cadmus forecasts achievable potential, or the potential energy savings solutions PSE can reasonably expect residential, commercial, and industrial clients to adopt. PSE then selects the least-cost solutions from the achievable potential suggestions in the IRP. Cadmus concluded an achievable technical conservation potential of 20 percent of energy sales over the next 20 years, similar to conservation levels found in the 2017 report. Cadmus also reviewed measures residential, commercial and industrial clients could take to maximize conservation. A TAG member asked how closely historical forecast numbers have matched actual outcomes. PSE responded that their impact assessments generally align with forecasts. A TAG member asked about how the Residential Build Stock Assessment and Residential Characteristics Study compare in terms of level of detail and accuracy. Cadmus explained the Residential Characteristics Study provides a greater level of detail.

Electric conservation potential results

Cadmus determined 652 average megawatts (aMW) could be saved over 20 years across PSE's electric portfolio. Most efficiencies come from residential and commercial customers programs in the first 10 years of the 20 year forecast. Residential lighting potential is lower than 2017 potential levels by approximately 30 aMW. This potential is captured in Cadmus' codes and standards research, as current laws raised efficiencies statewide. Cadmus identified growing popularity of embedded data centers and indoor agriculture as future savings potential savings for commercial conservation. Industrial savings come from higher energy management programs. Graphs of electric conservation forecasts and electric supply curves highlighted residential, commercial, and industrial options sorted into levelized-cost bundles.

Top commercial measures for energy savings include LED lights, embedded data center (although these will take the full 20 years to recognize their potential) and increased commissioning (a process where auditors suggest improvements in energy management in building). Top industrial savings are energy

project management (having a dedicated staff member). Most industrial savings are already implemented through retrofits over the last 10 years. Cadmus reviewed Washington state and federally-enforced codes and standards. They determined about 200 aMW of saving from implementing current codes.

Discussion revolved around the potential for unrecognized technologies emerging beyond the first 10 years Cadmus assumed in their study. A TAG member also asked about modeling electric cars as a saving. Cadmus explained that there is not reliable data available to model savings from electric cars or distributed energy storage. These may be considered in the 2021 IRP. The group also discussed breaking up the cost bundles Cadmus used to specify cost per megawatt savings. Cadmus uses a fixed achievability factor.

PSE is piloting demand response for gas resources in Duvall, Washington. Gas is harder to monitor because gas delivery is not measured the same as the hourly demand for electric resources. Cadmus clarified the IRP model receives hourly capacity information, more detail than was shown in this presentation. Cadmus delved into their rationale for unique building types. Commercial buildings are classified into specific types, based on use (offices, warehouse and retail shops). These classifications are general enough to maintain reliable data sets. Discussion revolved around incentives for gas-to-electric conversions. Finally, Cadmus confirmed they use only current legal code, not potential future code.

It was clarified that the 2019 IRP will not include a natural gas demand response analysis or a gas to electric conversion analysis. [Further clarification – *PSE will consider or assess natural gas demand response potential in the next IRP or future IRPs, as appropriate*].

Demand response

Cadmus considered load reductions where large commercial and industrial customers reduced their energy use manually and automatically. They looked at peak pricing effects on residential and small commercial customers with and without smart thermostats. These customers are sent alerts when energy demand is high and power costs more. Finally, they looked at direct load control, where residential and small commercial customers reduce their energy use during peak events. These 12 solutions amounted to around 232.5 megawatts or 5 percent of PSE load.

Discussion revolved around products not previously mentioned such as dryers, air conditioners, and electric vehicles. Many of these products do not have enough reliable data to study or, in the case of air conditioning, are not used during winter peak. A TAG member requested time-of-use rates for different products saying this information could better incentivize customers to adjust their energy use away from peak periods. For example, incentivizing customers to charge electric cars overnight instead of immediately after work could better spread demand.

Discussion about water heaters included energy-storage potentials and using switches to turn off water heaters during certain times. Switches and timers have higher costs because PSE must pay licensed contractors to install them on customers' heaters. Cadmus indicated they will provide additional context for potential water heater savings for the conservation potential assessment report for the 2019 IRP. PSE explained that RFPs are used for demand response procurement. Cadmus explained their data is based on benchmark data from other utilities.

Finally, the group discussed the interaction between conservation measures and demand response measures.

Solar photovoltaic (PV) potential

After a one hour long lunch break, Travis reviewed the solar PV cost forecast. Cadmus used multiple metrics to determine residential and commercial savings from solar investments over the next 20 years. Commercial has a higher benefit than residential. Savings forecasts plateau with state and federal incentives running out. Cadmus noted incremental changes on top of the work PSE has already done.

Cadmus converted the nameplate capacity into megawatt-hours. Solar potential peak does not match PSE peak hours.

A TAG member suggested Cadmus pair batteries with solar panels and time-of-use data. The group also discussed how market penetration affects solar cost calculations.

Combined heat and power potential

Next, Travis reviewed combined heat and power potential (CHP). Cadmus studied nonrenewable technologies, renewable technologies, and applicability to residential customers and commercial and industrial clients. They identified much lower potential than the 2017 study showed. Cadmus restricted study to CHP and assumed a different scope.

A TAG member had questions about changes in assumptions from the 2017 to 2019 IRP. The Cadmus report will have a section that compares the two. A few TAG members asked PSE to provide a written CHP summary in advance of the draft IRP in May to explain the drop in CHP achievable energy efficiency potential between the 2017 IRP and the 2019 IRP

Distribution efficiency

Gurvinder reviewed distribution efficiency achievable potential. The PSE system planning team is observing what other projects have done. They are rolling out an advanced metering system, a control system that will accommodate some of these changes in the distribution system and prevent anything that might destabilize it. With the new control system, they will be able to enhance the conservation voltage reduction (CVR) to include Volt-VAR Optimization (VVR), which uses dynamic control to constantly adjust the set-point and increases savings.

Natural gas demand side resources

Travis presented results from their natural gas conservation potential analysis. He concluded that residential, commercial, and industrial customers could potentially conserve an additional 177 MMtherms of natural gas over the next 20 years. This is an increase of 13 MMtherms from the 2017 conservation potential analysis. Key factors include more efficient furnaces and weatherized windows.

Travis discussed measures residential, commercial and industrial clients could take to meet the maximum conservation targets. Efficient furnaces are the highest saving measure in both assessments. Notably, the furnace contributed to a jump in a lower cost bundle. Windows and wall insulation are two of the three highest opportunities for saving. The industrial sector is small compared to the commercial and residential sectors. He discussed some programs to achieve their projected solutions.

This section of the presentation concluded with natural gas codes and standards. Potential savings from codes and standards affecting natural gas were relatively small and are predominantly from the Washington state and Seattle energy codes, totaling 25 MMtherms.

Topics of discussion brought up by the group revolved around suggestions for improving the graphs in the slide deck, questions about bundle ranges, factors in promoting electric-to-gas incentives and data on gas or electric-fueled water heaters or furnaces.

Demand side resource sensitivities

Finally, Travis reviewed two sensitivities in their demand side resource analysis. Cadmus studied the benefits of retrofit improvement projects and higher discount rates for residential customers. Cadmus analyzed both electric and natural gas resources. A TAG member encouraged PSE to look at battery storage and time-of-use data.

Gurvinder reviewed next steps related to the Cadmus report. PSE will start working on their portfolio analysis and scenarios once they get the supply curve. Cadmus will put together a report for the studies

they did as a part of the draft IRP. The draft report will be available May 15, 2019. The final report will be released with the final IRP on July 15, 2019. A few TAG members said it would be helpful to receive the CPA report earlier if it is available.

Next steps and action items

Irena returned to outline the next steps from this meeting. The group brought up their desire and recommendations for increasing dialogue in these meetings. They also brought up a transition they see in the energy industry to address concerns about climate change.

Irena reviewed the action items PSE committed to:

- PSE will provide gas emission rate as a percentage by 12/31/18.
 - Update: This was provided to TAG members on 12/28/18 via email and also attached as Appendix A.
- PSE will publish a revised schedule with updates to the meeting scope and location by 12/31/18.
 - The revised schedule will show that the January 9 meeting includes load forecasting, portfolio sensitivities and system planning (transmission and distribution) topics.
 - Update: The revised schedule was provided to TAG members by email on 12/20/18, uploaded to pse.com, and filed with the WUTC on 12/19/18 as an update to the 2019 Integrated Resource Plan Work Plan pursuant to dockets UE-180607 and UG-180608. The updated schedule is also attached as Appendix B.
- PSE to provide a written CHP summary in advance of the draft IRP in May to explain the drop in CHP achievable energy efficiency potential between the 2017 IRP and the 2019 IRP.
- PSE will consider Virginia Lohr's request concerning re-posting questions and answers that were previously posted on pse.com for transparency.

PSE asked TAG members to send any questions they have concerning the material presented at this meeting to PSE by December 20, 2018 for inclusion in the final meeting notes. PSE will distribute meeting notes with action items outlined on December 20, 2018. December 27 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: www.pse.com/irp by January 3, 2019.

Questions submitted by December 20, 2018 and PSE responses are provided in Appendix C.

IRP comment period

The comment period began with Brett Houghton, comment period facilitator, reviewing the comment guidelines.

- David Morton: The IRP says that in estimating the lowest reasonable cost mix of resources it must consider the risk associated with environmental effects, including the risks of emissions of carbon dioxide. While it appears PSE has completed its analysis, a thorough analysis of PSE's methane emission is lacking. Methane easily escapes into the atmosphere. A June 2018 study published in the Journal of Science reports that the natural gas industry is leaking more methane than previously thought. The IRP ignores the recent improvements in the cost of renewable energy. The leakage of methane has been contributing and will continue to contribute to dangerous global warming. PSE contributes to renewable energy by burning natural gas. PSE knows their leaks contribute to dangerous global warming. Thank you.
- Kevin Jones: The current IRP legislation requires cost-effects of carbon pollution. We know the IRP is where that discussion occurs. We discuss how PSE includes carbon in their planning. For example, an action item from the May 30 IRPAG meeting was to identify a contact from PSE to talk about carbon reduction goals. It has been six months since that action item has taken, and it might be another three months until we speak to that contact. Many people thought it was incomplete. The concern I have is that three reports have come out since the last TAG meeting.

Changes are being exhibited to us on a very infrequent basis, but I am glad to see we are making progress. I hope we hold to our commitments so we can close those conversations and reach durable outcomes.

- Virginia Lohr: I spoke earlier in the meeting about the three reports Kevin just mentioned: the Fourth National Climate Assessment, the IPCC (Intergovernmental Panel on Climate Change) report, and the UN Environment Emissions Gap report. These are all very recent. They all talk about extremely dire consequences and short timelines. One says they must decline carbon dioxide emissions by 45% from 2010 levels to keep the chances of reaching the goal aligned. I want to add quotes to what I said at the meeting. "This will require deep emission reductions." Another one says "climate change, if left unchecked, could eventually cost the economy hundreds of billions of dollars per year and take thousands of lives." We need to do this now to put the world on a least cost pathway to limiting global warming. Many of us on the TAG have been aware of this and I'm sure PSE has been aware of this. But my hope is PSE will do everything they can do in their power to accelerate what they are doing.
- Don Marsh: I have so many things I could say but I want to comment on commenting. I want to bask in the fruitlessness of what I am doing right now. If I wanted my TAG members to hear what I had to say, they are mostly all gone. If I wanted to talk to the UTC, they are gone. Almost all of PSE is gone. I want to show that my comment can make a difference. I will give Irena the opportunity to make my comment matter. I want to open the TAG meeting with a comment period. This is absolutely insufficient.

Appendix A

From: Kvam, Michele

Sent: Friday, December 28, 2018 10:57 AM

To: Popoff, Phillip; Netik, Irena (*bcc to TAG membership list*)

Subject: PSE 2019 IRP TAG 3 follow-up: gas emission rate as a percentage

At the TAG meeting #3 on December 6, 2018, PSE agreed to provide the gas emission rate as a percentage by 12/31/2018. PSE is providing the rate as a percentage of the upstream or non-combustion related CO₂e (carbon dioxide equivalent) of the CO₂ from combustion of natural gas. This calculation is shown below:

A - Emissions from End Use Combustion:	0.0544 Tonne CO ₂ /MMBtu
B - Added Emissions (CO ₂ e) lifecycle production/transmission:	0.00948 Tonne CO ₂ /MMBtu
Rate - Ratio of Added Emissions to Combustion (B/A):	0.00948/.0544 = 17.4%

1. PSE determined emissions for natural gas production in British Columbia based on Province-specific data from the Canadian National Inventory Report (NIR) and British Columbia natural gas production data as reported by the Province in its Natural Gas & Oil Statistics data series.
2. Heating value of natural gas delivered to consumers in are Washington and taken from the U.S. Energy Information Administration Natural Gas Annual Report 2015, Table 16 (DOE/EIA 2015)
3. Methane characteristics : 95% in natural gas, density = 0.6785 kg/m³

Sent on behalf of Resource Planning and Analysis,

Michele

Michele Kvam

Resource Planning & Analysis

Puget Sound Energy, Inc.

Appendix B

2019 INTEGRATED RESOURCE PLAN

IRP Stakeholder Meeting Schedule

Updated December 18, 2018

Group	Meeting No.	Date	Topic	Location
IRPAG	1	May 30, 2018	IRP general process awareness	Olympia
TAG	1	July 26, 2018	Electric resource costs	Meydenbauer (Bellevue)
IRPAG	2	August 28, 2018	IRP Overview Electric resource costs Load forecasts and initial resource needs	Meydenbauer (Bellevue)
TAG	2	October 11, 2018	Scenarios including carbon prices, gas prices, power prices, portfolio sensitivities Gas resource alternatives	Meydenbauer (Bellevue)
TAG	3	December 6, 2019	Draft Conservation Resource Potential Assessment	Bellevue Hilton (Bellevue)
TAG	4	January 9, 2019	System planning (transmission and distribution) Portfolio sensitivities Load forecast	Bellevue Hilton (Bellevue)
TAG	5	February 7, 2019	Electric resource needs Effective peak capacity of intermittent resources Electric and gas planning standards	Bellevue Hilton (Bellevue)
IRPAG	3	March 18, 2019	Process update	Bellevue Hilton (Bellevue)
TAG	6	April 18, 2019	Overview of electric and gas portfolio model Results of electric and gas portfolio modeling	Bellevue Hilton (Bellevue)
Draft 2019 IRP available on pse.com May 15, 2019				
IRPAG	4	May 24, 2019	Draft 2019 IRP	Bellevue Hilton (Bellevue)
TAG	7	May 29, 2019	Draft 2019 IRP	Bellevue Hilton (Bellevue)
Final 2019 IRP available on pse.com July 15, 2019				

Appendix C

Questions provided by the December 20, 2018 deadline concerning the conversion potential assessment, and PSE response.

TAG questions in bold, PSE responses in italics

Daren Anderson, The NESCO Group:

Q1 from Daren Anderson: **Slide 70 regarding Distribution Efficiency Savings: In the CAISO market, “Regulation Up” and “Regulation Down” are the most valuable services provided by energy storage. Please quantify or otherwise address the value of energy storage to the distribution system for regulation and other ancillary services, if applicable for a battery in the PSE distribution system as it relates to DE. I note PSE previously calculated the deferral benefit of substation upgrades and other benefits but did not address making the distribution system more efficient through regulation services and other ancillary services. I would suggest one located at the future Westminster or Vernell Substation as they are in the fast growing Spring District and half way between the big 230kV substations at Sammamish and Talbot. Spring District loads is an issue PSE is planning to address. Please describe how the EIM market would make the battery energy storage facility utilized more often.**

PSE Response: PSE will be using the Plexos model to calculate a value for the sub-hourly flexibility that different kinds of resources create for the portfolio. Plexos does not determine a specific value for each individual ancillary service, such as a flex-up and flex-down, as the model works with the operational parameters of each resource and optimizes across all the ancillary services the resource can provide dynamically. Batteries will be one of the resources that are examined. The sub-hourly value from Plexos will be applied as a net reduction in the cost of each resource, in the same manner as was done in the last two IRPs. PSE will note your suggestions concerning potential locations of a battery in PSE’s system.

Q2 from Daren Anderson: Demand Response: **How do the PSE demand response contracts work? Are they all large scale and through RFPs or is there a way for residential customers to sign up for demand response and if so what is the response rate?**

PSE Response: In general, the IRP determines the amount of electric capacity (as measured in megawatts [MW]) of demand response that is cost effective in meeting future resource need. Third party contracts will be solicited thru a Request for Proposal (RFP) process, and the vendors propose how much capacity, which customer segments, type of end use, and years to ramp up aggregate capacity, costs, etc. The successful third party bidder will be responsible for aggregating customer loads and delivering total contracted dispatchable capacity, including frequency and duration of each demand response event.