

Attendees: TAC 2, Tuesday, November 27, 2018 at Avista Headquarters in Spokane, Washington:

John Lyons, Avista; Jennifer Snyder, Washington UTC; Amy Wheelless, NW Energy Coalition; Steve Johnson, Washington UTC; Michael Eldred, Idaho Public Utilities Commission; Matt Nykiel, Idaho Conservation League; Shelby Herber, Idaho Conservation League; Dave Van Hersett, Avista residential customer; John Barber, Rockwood Retirement Community; Brian Parker, 350.org; Jørgen Rasmussen, Solar Acres Farm; Kirsten Wilson, DES Energy Program; Garrett Brown Avista; Clint Kalich, Avista; Barry Kathrens, 350.org; Pauline Druffel, 350 Spokane; Thomas Dempsey, Avista; Terrence Browne, Avista; Darrell Soyars, Avista; Scott Kinney, Avista; Mary Tyrie, Avista; Tom Lienhard, Avista; Tom Pardee, Avista; Kaylene Schultz, Avista; Amber Gifford, Avista; Rachelle Farnsworth, Idaho Public Utilities Commission; James Gall, Avista; and Gerry Snow, PERA.

Phone Participants:

Doug Howell, Sierra Club; Sarah Laycock, Washington State Attorney General's Office; Mike Starrett, Power Council; Nancy Estep, NW Energy Coalition.

These notes follow the progression of the meeting. The notes include summaries of the questions and comments from participants, Avista responses are in italics, and significant points raised by presenters that are not shown on the slides are also included.

TAC Expectations and Process Overview, John Lyons

Matt Nykiel: On the topics, what is available and when, and what will not be available?

Avista is developing a matrix of the data to indicate timing and availability of data.

Doug Howell: Why are there less meetings (5 instead of 6) for this IRP? *We are having fuller agendas in five meetings rather than spreading out to six.*

2019 IRP Modeling Process Overview, James Gall

Matt Nykiel: Which of these are going to be available publically? *For the February TAC meeting – market price results high level inputs, annual fuel, demand and resources today. Existing publically available data, transmission, and the load forecast provided in the last TAC meeting. Resource position will be next TAC meeting, Demand Side Management and Demand Response information will be at a later meeting. High level or detail level would be available in FERC level data.*

(See separate data matrix file sent with these meeting notes)

Steve Johnson: Simple list of items, where they are found and when they will be released.

Doug Howell: PSE has distinct scenarios for load, gas and fuel prices. How is Avista different in the process? *We will hit this later today.*

Brian Parker: Will proprietary data be included in the list? Why is it proprietary? *Often contractual and market intelligence data is proprietary, such as the natural gas price forecast we purchase.*

Doug Howell: Across the country we now have non-disclosure agreements in eight different states. Hoping to have them soon in Louisiana with the same owners as PSE (Puget Sound Energy). So we can have a consultant run the model, we want the data under a nondisclosure agreement. We hope to have one with PSE too.

Doug Howell: Are known and expected resource retirements included? *Includes publically announced retirements. If plants are uneconomic when modeled, but not announced, Aurora would shut those plants down too.*

James Gall: For the OWI (Oregon, Washington and Idaho) region, which Avista has modeled as one bubble in Aurora, we will try to split this region up by state to accommodate state-level resource policy decisions.

Amy Wheelless: What about resource shuffling? *This will be covered later.*

Matt Nykiel: Do we have a guideline for what will be modeled stochastically versus deterministically? *Avista tries to run as many studies as we can stochastically, but each study takes about a week to complete. We generally default to deterministic studies as we run out of modeling time which is limited.*

PRiSM Section

Doug Howell: What is the rationale for splitting up the region? [OWI being modeled as separate areas instead of one area] *Splitting up the region allows us to account for a situation where a state or city wants a unique policy that differs from the rest of the region, such as a 100% renewable energy requirement for a city.*

Mike Starrett: How are we going to do this for prudence? What if the city and state are not aligned like PGE and the City of Spokane. *Would probably develop a green tariff.*

Clint Kalich: This is an exercise for information. What costs might be if this type of policy occurred. The IRP doesn't promote tariffs, but informs the development of them.

Steve Johnson: Boutique resource portfolios for new resources from PSE. Shows cost differentials for core and unique customers.

Matt Nykiel: How practically can we identify them?

James Gall: More of an accounting mechanism. We know generation, but need to account for overages and surplus.

Brian Parker: What will we be able to share from the study?

James Gall: We would be able to share what is selected by PRiSM and the least cost results. We will talk about Spokane later.

Doug Howell: I have heartburn about long-term impacts, like coal ash having horribly wrong cost estimates, and how to reconcile them. Also low balling cost estimates of wind and solar. And climate cost estimates resulting in obsolete resources in the future.

Slide 10 – 11

James Gall: We are taking market risk. Others in scenario risk.

Amy Wheelless: Risks? *Market load, hydro and wind variability, not other risks.*

Clint Kalich: Qualitative choices.

John Lyons: Scenarios are used for fundamentally different futures with second order change, like a future with a new low-cost efficient car battery that changes the market for electric cars.

Amy Wheelless: BPA used an efficient frontier with how they picked DSM.

James Gall: We look at all 5,000 plus DSM measures, so conservation lowers risk, cost, and reduces summer/winter peak.

Generation Resource Options, James Gall

Steve Johnson: So actual runs will have the transmission cost where applicable later on.

Matt Nykiel: When will gas prices be locked in? *Probably after the February meeting.*

Steve Johnson: Price excursions with the British Columbia pipeline. *Will discuss later since Tom Pardee (Natural Gas IRP Manager) is not in the room.*

John Barber: What is the hybrid technology? *LMS 100 is a mix of frame and aero derivative. The compressor section compresses, cools and reinjects the air. It is more efficient than a peaker, but not as efficient as a combined-cycle plant.*

Steve Johnson: Does Avista model oil backup? *No, we have been able to rely on the pipelines not being fully subscribed. Now that they are fully subscribed, we will need to decide if we need to model oil, LNG or purchase gas as a backup.*

Jennifer Snyder: Ask PSE (Puget Sound Energy) if they got any traction in offshore wind.

Steve Johnson: Where does Avista get its updated data for expected capacity factors? How does Avista compare unknowns? Wind vs. solar. *Avista has gotten data from renewable RFPs with wind at a 38% capacity factor, but our actual experience has been much lower. We only pay by the megawatt-hour for actual generation under a contract.*

Wind on Avista's system is in the high 30s and high 40s for wind projects in Montana. Solar capacity factors are also for RFPs, as well as generation from the solar projects at Lind and Boulder Park. There is also solar data from NOAA, which is being used by bidders.

John Barber: Just lithium ion? *Yes, in conjunction with solar and all types of battery storage for other projects.*

Steve Johnson: Ramping costs, shut off, curtailment. *Yes, we can shut it off wind, but still have to pay for it.*

James Gall: Modeling on an hourly basis. Some may have PPAs with certain hours or ramping.

Amy Wheelless: Biomass seems pretty big. *Yes, we have the opportunity to do one biomass project that big. Is nuclear included? Yes, small nuclear is being modeled.*

John Barber: Doesn't biomass operate as a baseload plant and not as a peaker. *Usually true, this project would operate more as a peaking biomass facility in the winter.*

Pauline Druffel: Doesn't biomass produce greenhouse gases? *Yes, but biomass is carbon neutral under Washington law.*

Page 5 – Other Clean Resource Options

Amy Wheelless: Are hydro PPA's going to be included? *Yes, on a later slide (Slide #13)*

Slide #6 - Storage Technologies

Thomas Dempsey: Liquid air is a long-term energy storage using solar and wind generation to compress and liquefy the air. When using this system, the plant does not have to compress air, so we would get full use of the generating resource.

Steve Johnson: What are the efficiencies? *60 – 70% round trip efficiency. Hydrolysis is only 25% efficient.*

James Gall: We are using the Lazard Study, and a new version should be available next month, so we will use the most up-to-date costs available.

Steve Johnson: For hydro and Post Falls. PSE costs for rebuilding Snoqualmie Falls were much higher than expected. Make sure you are modeling these hydro rebuilding costs really carefully. The project economics didn't work out.

Steve Johnson: Power purchase options. Design a model to capture the value of an asset's value of these contracts. Green value. Very important to know it would serve load with the value of different kinds of resources. And articulate why, how, and ways resources are driving costs meeting loads with market options.

Resource Option Spreadsheet

Amy Wheelless: What is the deadline for comments on the resource spreadsheet? *By the middle to end of January.*

Steve Johnson: With the 20-year timeframe, are we adding more noise than necessary? Would retrofitting be cheaper? *Avista models retrofitting options if we know about the potentials.*

Home Heating Technologies Overview, Tom Lienhard

Garrett Brown: What is the payback on slide 11 [First cost of technologies]? *In floor radiant heat uses less than half the energy. Good if staying in the house for 20 years. Need to work to overcome the first costs. When they do a good job.*

Barry Kathrens: Comfort is another benefit. My woodshop has radiant floor heat and adds like an extra dollar a day.

Tom Lienhard: Maybe we need an Air B&B for people to be able to try out a good efficient house in the winter.

Kirsten Wilson: We were able to remove and replace the old heating system for an additional \$15,000 in an existing structure. But we are both engineers.

Jørgen Rasmussen: How does a CO2 heat pump compare. *COP of 3, equal or better than 96%, and is about \$5,000 for the unit.*

Brian Parker: I came here from California where they were more sophisticated about these matters. I've had trouble finding HVAC contractors who could do certain efficiency calculations. Either they wouldn't show up or they didn't come back. *Yes, it is a design issue and requires meeting with the right HVAC installers to make these things happen.*

Tom Lienhard: 10% humidity when cold in continental climate works the same way. 72 degrees feels like 64 degrees since heat can't transfer. At 45% relative humidity, 72 degrees feels like 72 degrees. This also affects heat pumps here where there is general not as much humidity.

Tom Lienhard: The RTF uses zones 1, 2 and 3. Avista is in zones 2 and 3. The map in slide #15 calls these zones 4, 5 and 6.

Slide 19 is referring to RTF zones 2 and 3.

Steve Johnson: So a BTU of natural gas is about one third the cost of a BTU of electricity? Yes.

Jørgen Rasmussen: But are they CO2 equivalent? Doesn't Kendall Yards [Spokane housing development near downtown] have all heat pumps? *Not all. There are one or two heat pumps per condo and the rest are resistance heat.*

Pauline Drury: Sounds like CO2 heat pumps are something for reducing heat. Is this for the source of electricity because I have a personal feeling that we should be reducing carbon? *These are CO2 heat pumps that use CO2 in the system.*

Jørgen Rasmussen: Greenhouse gas free because CO2 is less potent than other refrigerants.

Gerry Snow: More penetration of renewables makes the power budget (E&G) move to electrification, like British Columbia, and even more extreme as hydrogen in natural gas pipes. Where is the trade off? If it's a capacity issue, more storage is better.

Resource Adequacy and Effective Load Carrying Capability, James Gall

Steve Johnson: Balancing area has performance standards. Different kind of things. Obligations to meet load within the house. NPCC quote.

Steve Johnson: You don't model natural gas fuel disruptions? *No, we don't assume pipeline or storage disruptions. This study is not cost, just availability.*

Steve Johnson: Power Council, couldn't you just get something from another. *We have a winter problem.*

Amy Wheelless: Becoming more summer peaking regionally. *Yes and no. Summer is more consistent than winter.*

Steve Johnson: Don't have a good way of moving up summer or winter temperatures to set "benefits" of global warming for resource adequacy. *The means are changing, but the extremes not so much.*

James Gall: Wind improves reliability, but not by as much as thought. There is lots of variation site-to-site so more work is needed to pick the right number to use for reliable wind capacity – 5 to 10% range is probably right.

Clint Kalich: Does the Power Council still use 5% for wind?

Mike Starrett: Northwest capacity contribution for Columbia Gorge wind is 3% on its own, 9.5% when integrated with hydro. Solar is 3% and higher when integrated.

Steve Johnson: Their model accounts for energy at night allowing more daytime hydro. *Avista's model does too.*

James Gall: Need to consider correlation with very low temperatures in Montana compared to us. So we need more studies. Solar helps a little bit at 2.2% by moving hydro and if we peak in February. We had one of our last peaks with zero wind and solar for a week. This study considers demand response at 10 times per year now, ELCC (Effective Load Carrying Capability) would go up if there were more times per year.

Steve Johnson: Is the curve used to develop the LOLP (loss of load probability) accurate? *Yes, if want to use renewables to back up LOLP, need to add multiples of the renewable resources to get a better chance they are available when needed. Learned from the past model.*

Amy Wheelless: Why not reduce gas more?

James Gall: Storage moves and loses energy. The losses vary by the type of storage like lithium ion or hydrogen. Storage needs to be paired with something to charge it.

Matt Nykiel: Does this include carbon (cost)? *No, but about 5 times more expensive.*

Clint Kalich: About 6 times. This is for peaking capacity, so only runs about 5 percent of the time for reliability or low hydro conditions.

Mike Starrett: I have some questions about the numbers in the slides that can't be shown online.

Steve Johnson: Diversity – Avista could build a whole bunch and pay full cost while helping everyone else. It's great to think of one big utility, but we don't share the fixed costs.

Clint Kalich: Today, we are already long as a region. This is an additional surplus needed to charge these batteries. At a certain point, it doesn't help more. Is this incremental energy? This is how much wind and storage is needed to help.

Mike Starrett: More midday curtailment. Policy changes a little bit later. In Aurora, are those resources being curtailed so that adding more renewables lowers the value of them?

2019 Electric IRP Key Case Assumptions

Steve Johnson: Fully electric percentage? (Slide #9, Electric Vehicles) *We don't have the all-electric percentages broken out. Rendall Farley might. There is less separation between all-electric EVs and plug-in hybrids.*

Steve Johnson: Looking at the causal effect, if all these things are different, volatility may be different for loads, uses, etc.

Steve Johnson: Not a normal distribution? *No, it isn't.*

Jennifer Snyder: BPA has a forward looking study for hydro conditions (due to climate change). *Briefly, Avista expects the same amount of water for hydro, but the timing of it moves from the spring to the winter based on the studies we have reviewed.*

Garret Brown: Was the last hydro year good? *Hydro was really good the first six months and worse the rest of the year. About 5% lower regionally, but Avista did better than the regional average.*

Matt Nykiel: What is the time frame for coal prices deadline to comment? *Proposals in February, comment deadline a week or so after the next TAC meeting [February 6] and scenarios could be a few weeks later.*

Steve Johnson: Not sure of not doing a risk analysis for climate changes to hydro.

Mike Starrett: BPA came in and did a presentation last meeting (Power Council) and in person to the council. Is it a sensitivity or not? More winter rain, so a shortage from winter to summer.

Steve Johnson: You have examples of what it looks like when it warms. You could do a scenario or something like a single year look at it.

Rachelle Farnsworth: How do you include the risk associated with Colstrip? *We have a slide for that.*

Steve Johnson: There will be a different value for renewables before and after greenhouse gas prices. *The shadow price is not going down much.*

Clint Kalich: But people who waited and bought after I-937 paid less.

Matt Nykiel: No one wants to pay \$20 per dekatherm, but there is a cost.

Futures and Scenarios, James Gall and John Lyons

Jennifer Snyder: I would be more comfortable using 2020 instead of 2025 (for the start date of carbon pricing).

Steve Johnson: Another approach setting an objective function with an objective function.

Steve Johnson: We should probably set up a meeting with Brad (Cebulko) and others to go through this.

Matt Nykiel: Why only Washington? *It was for a WUTC request. A later slide shows a scenario for all of Avista's service territory.*

Steve Johnson: Look at the Northwest Natural IRP for their natural gas price for any divergent numbers.

Steve Johnson: Will you include the updated forced outage rates for Colstrip? *Yes, we will use the most recent forced outage rates.*

Matt Nykiel: Changes in ownership structure in Colstrip Units 3 and 4.

Steve Johnson: If not operating, an exit provision.

Steve Johnson: You should make sure to have a letter shielding any employees with knowledge of what would be paid in the future for the ownership interest in Lancaster. *Avista Corporation sold its ownership interest in Lancaster in 2006.*

Public Counsel (phone): Is the social cost of carbon included in its own case? *It is one of three futures, treated at the same time.*

Amy Wheelless: Spreadsheet available by the end of the week or early next week? *Yes.*

Matt Nykiel: Will there be a breakdown of basic assumptions for Colstrip? *Costs and when they are expected to occur.*

Matt Nykiel: What happens if someone walks away (from Colstrip), can you show how costs get reapportioned? *Would need to check on what could happen.*