Attendees: TAC 4, Tuesday, August 6, 2019 at Avista Headquarters in Spokane, Washington:

John Lyons, Avista; Thomas Dempsey, Avista; Steve Johnson, Washington UTC; Brian Parker, 350.org; Barry Kathrens, 350.org; Gerry Snow, Pacific Energy Research Associates; Michael Eldred, Idaho Public Utilities Commission; Terrence Browne, Avista; Greg Rahn, Avista; Ryan Ericksen, Avista; Mike Dillon, Avista; Ryan Finesilver, Avista; Jared Akins, Avista; Tom Pardee, Avista; Garrett Brown, Avista; Jaime Majure, Avista; Clint Kalich, Avista; Scott Kinney, Avista; Jennifer Snyder, Washington Utilities and Transportation Commission; Chris Zentz, National Grid; Kevin Davis, Inland Empire Paper; John Barber, Rockwood Retirement Communities; Dave Van Hersett, Residential Customer; Steve Wenke, Avista; Dennis Cakert, National Hydropower Association; Jose Phillips Rangel, Avista; Annie Gannon, Avista; and James Gall, Avista.

Phone Participants:

Kevin Keyt, Idaho Public Utilities Commission; Idaho Office of Energy; Shelby Herber, Idaho Conservation League; Tina Jayaweera, Northwest Power and Conservation Council ; Mike Starrett, Northwest Power and Conservation Council; Fred Heutte, Northwest Energy Coalition, and others who did not identify themselves.

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.

Introductions and TAC 3 Recap and Washington SB 5116 and IRP Updates, John Lyons

Steve Johnson: Is this the specific avoided cost for peak summer hours. *Yes, avoided cost of energy and capacity or summer; i.e., $1 per kWh month.*

Clint Kalich: PRiSM technology allows us to calculate capacity values.

Steve Johnson: As we dispatch gas less, per unit increases so capacity value becomes more. Attract more developers to the Northwest by showing them a price.

James Gall: Duration problem, 6-hour vs. 2-hour peak contribution.

Steve Johnson: Hours and frequency.

Clint Kalich: Disincent new energy and incent capacity.

Jennifer Snyder: Really like to see an actual target in Demand Response (DR) in this IRP. *James Gall: We expect this, but things that provide energy and capacity might push DR out.*

Energy and Peak Load Forecast Update, Grant Forsyth

Dave Van Hersett: Is slide #6 a percentage scale. *Yes, now 8-9% above where we were in 2007.*

Steve Johnson: Does the model capture recession events? *Not really, timing is difficult and we haven't really beat the business cycle.*

Steve Johnson: Load forecasts have consistently been high. Action Item to keep in mind is to be responsive to economic downturns. Not saying that you need to change models, but consider the impact of these actions. *I now run the forecast twice a year to more quickly see changes in the forecast.*

Grant Forsyth: Slide #7 population growth is a proxy for customer growth. About 2011, the natural birth/death rate with very little in-migration.

Dave Van Hersett: Where are they coming from? *Mix of everywhere, but a lot from California based on driver's license surrenders. Also relocating business operations from the west side of the state.*

Greg Rahn: Does the blue bar [slide 7] imply more exposure to recessions. *Yes.*

Linda Gervais: How has DSM influenced summer/winter peak? *Still winter peaking, but summer peak is growing at a faster rate than winter because of a better economy, warmer summers and adopting more air conditioning.*

Steve Johnson: Data going back to 1890, is there some other explanation for the last 20 years? *May inform gas dispatch for the four-year plan and reshape hydro. There are not very good models for local temperature change. Imperfectly calculated risk.*

Clint Kalich: Can the data even be loaded from those models? Are other utilities looking at shorter periods [of weather data]? *It is hard to explain the oscillation of weather using historic data.*

James Gall: There is a risk if we exclude past peaks from shorter time periods. Bigger risk of missing a peak. Energy – short. Peak – capacity.

John Barber: New climate studies. Are they ready? *Starting to "downscale" global models, but no commonly accepted methodology to do this exists. Which study do you choose? Which downscaling method to you use? We don't know, but the University of Washington and Oregon State University are working on this issue. We went to 20-year average, but I'm still not comfortable enough with them yet to shift away from the moving average.*

Grant Forsyth: Slide 11 – actual, not weather normalized pre 2019.

James Gall: We plan for the tail events to maintain adequate supply.

Gerry Snow: Winter tail? *Summer looks more like a bell curve. Long tail at low temperatures, this is what we are worried about for capacity.*

James Gall: There is greater winter than summer variation.

Steve Johnson: There is a smaller area under the curve, so there may be fewer cold events. *NASA analysis for the 1950-1981 period for the temperature difference from average, shows a bigger summer than a winter shift.*

Steve Johnson: With EVs [electric vehicles], do you think you need more resources in the next five years or later? *No, our needs from resource retirements and contracts ending are a greater impact than EVs.*

Slide #15 – medium term forecast is now done twice yearly.

John Barber: Southerly parts of the country – looking at fleeing to places like here. May be looking at climate refugees. *Climate Council is looking at how climate and water is changing, but there is still a substantial investment in these areas so what will be spent on mitigation, so hard to work into the forecast.*

Barry Kathrens: Won't these impact us too? *May impact other areas. They would be impacted, but not as much. A lot of coastal regions are going to be going somewhere.*

Slide 19 – PV is rooftop solar.

John Barber (Slide 19): About a 2% penetration rate? *A generous forecast, but not unreasonable.*

Slide 20: About 13% electric vehicle penetration rate for residential.

Gerry Snow: Spokane transit may be the first big commercial EV customer.

Steve Johnson: Graph timing of EV. *Tough to calculate because small changes up front make huge changes later.*

Steve Johnson (Slide 21): Don't the wealthy buy most of the cars anyways? *Yes, but we also need a robust used market of EVs***.** *Besides income, density is another predictor, probably because of range issues. This curtails regional uptake of EVs.*

Slide 22: Could have significant transportation emission savings. Still a net benefit per year with the switch to EVs.

Steve Johnson (Slide 26): I'm confused, difference in UPC winter vs. summer. *My guess is a disproportional effect on UPC on summer because of heating.*

Natural slowing of gas because of penetration, but not a specific cause.

Jim Le Tellier: Must be going to different meetings, because that is the next big thing for environmental groups.

James Gall: It's a very large cost for a small benefit with the extra cost of wiring.

Jim Le Tellier: Not an argument, just observing.

Steve Johnson: Price of gas falls, but price of electricity is going up.

Gerry Snow: It might be cheaper to decarbonize gas, rather than getting rid of it.

Steve Johnson: If the cost per unit is high, plus low greenhouse gas benefits, there may be a lot of pushback.

Steve Johnson: Strong enough population growth is overcoming no load growth.

Clint Kalich: Red bump on slide #25 (2023 to 2024), need to check why it is increasing.

Steve Johnson: Would like to leave feeling like he [Grant] can stand by the forecast. *Big forecasters still fundamentally different now. This is the best guess I've got now. All sorts of weird stuff can happen.*

Clint Kalich: We have low load growth and no immediate needs.

Steve Johnson: Lot of end use incentives. People want the service, not the thing. They want cold milk, not electricity. Would like to see more focus on the service. More DSM deployed and recognized. Tech geek out on the conservation side.

Jenifer Snyder: (Slide 26) 2020-2021 jump. Intermediate term probably enough correction process going from further out. Pushes more to the long term. *Price elasticity assumption – price not statistically significant anymore using academic studies. Longer term – no longer assume real price is constant, now increasing.*

Steve Johnson: Colstrip remediation costs also impacting

Dave Van Hersett: Small in comparison.

Steve Johnson: Can be significant. We'll see.

Substituting rising price for conservation in the long run.

Steve Johnson (Slide 29): Conservation adopted this year or actual effects. *This is the amount DSM said they got per month.*

Jennifer Snyder: Savings in that year. Grant cumulatively builds them in. *Persistence? Assumes going forward in time.*

Dave Van Hersett (slide 29): Is the 12% per year of 1%?

James Gall: More like 1% per year, the average of those.

Slide 30: Preliminary about 60% of black line.

Tina Jayaweera: How do codes and standards fit in?

James Gall: Transfers from programs to standards. Grant builds in a trend, pushed forward, but there is no specific variable to change.

Tina Jayaweera: About 2012, standards really increased. *Hard because of the timing.* We have some estimates that can be shared. *Yes, please.* Masood has these.

Natural Gas Price Forecast, Tom Pardee

Gerry Snow (Slide 3): Is Jackson Prairie a geologic formation. *Yes, an old aquifer. There are no salt domes available regionally.*

John Barber: Dth? *Dekatherm, million BTU or 10 therms.*

Fred Huette (slide 7): Numbers may be off a bit: 4.5 Bcf British Columbia and 10.5 Bcf Alberta. *The slide actually came from the Canadian government. We have all learned more about gas north of the boarder.*

Clint Kalich: Do you have statistics on the relative amounts of LNG vs. coal to China? *No.*

Fred Huette: If LNG is at 3.5 Bcf, any sense of price impacts? *Yes, in a few slides. Basically, their own pipeline, so will take away capacity potentially, but new filled so it lessens the impact to the AECO trading hub.*

Slide #11: 90 Bcf yesterday. About half to electric generation. 120 Bcf /day by 2050.

Slide #12: "Proved" reserves – fairly economic and could be extracted if need be.

Fred Huette: Not sure I would agree with reserves. Definitely a lot less, maybe better if we communicate offline about this. *On EIA as well, about 400 Tcf, about 360 Tcf last update.*

Steve Johnson: What if solar gets really cheap, cost per mmBtu for gas products? *Depends by area.* What does the curve look like? *Actually negative in the Permian where they are drilling for oil and natural gas is a byproduct. Marcellus is more of a dry gas with a higher marginal cost to extract.*

Jim Le Tellier: Could be a lot higher. Like solar curtailment, got to get rid of it. *Yes.* What is the long term production cost if they have to pay back Wall Street? *Typically, no free cash flow. Typically a hockey stick with high initial production in the first year, followed by less production, so they have to keep drilling. Now five days on average. Oil projects are long-term and large capital, not so much with [natural] gas only producers.*

Clint Kalich: Social policy might be more of a driver than investment.

Fred Huette: I have a somewhat different view. 80 years based on resources, not proved reserves. 464 Tcf, about 30 Tcf consumption. *We should probably get together on this offline.*

Grant Forsyth (Slide 15): Gas-fired generation in Canada? Or east?

Steve Johnson: What is driving increasing prices?

Fred Huette: What is your opinion or view of the differential between AECO and Henry Hub? Will it persist or is it temporary? *Never expect it to persist, but producers are trying to think about curtailing production to get closer to Henry Hub prices. Not sure why they can't, will seek normal returns.*

Clint Kalich: Oil is a bigger driver.

Steve Johnson: 2011 with falling prices, suppliers still want to do shorter contracts instead of long term. Is it because of fracked gas? *A lot of them do hedge 3 to 5 years, or less, to lock in margin.*

Barry Kathrens: Can't help thinking it might be a little low at 1 – 3%.

Gerry Snow: Is this based on CO2 equivalent? *Yes, so different if flaring or leaking with a 28 times multiplier for leaking.*

Fred Huette: Interested again offline. It's a difficult question with a lot of information coming in. GWP [global warming potential] for 100 years is 33 or 36 times CO2, 20-year is about 85. Atmospheric is 10 – 15 years, CO2 is much longer.

Steve Johnson: Has Avista examined the methodologies? *No, haven't seen if methodology is available. It is set by the Canadian government and there is a tendency towards less reporting.*

Clint Kalich: So now we need to second guess federal studies?

Steve Johnson: The key is if you buy a product, you need to know it. Get a sense of risk if they are off. It may be hard to calculate and may not be very willing to report it. Not asking you to reinvent, but do you put a brand on it. Informing customers of what product they are getting. Could just say it in the IRP. If the methodology is self-reporting – it's a red flag. If spot measurement, that's better. Risk of non-cost effective conservation.

Jim Le Tellier: How did they build that [CO2 reports]?

Clint Kalich: What do we do?

Tom Pardee: We have the date and documents. Should have a description of how they developed the numbers.

Fred Huette: I know a fair bit about this issue. Five years ago, it was based on a lot of engineering data. EDF managed a large research project on this issue and others, so more data is folding into it and the numbers are getting better. *Flaring is not a big issue in the northwest, but probably a little bit. Probably Bakken and Permian oil dominated by less gas infrastructure. Very little of this is coming to the Pacific Northwest. Data is reported to the states and to the feds. The industry has an incentive to reduce flaring, but the low prices don't incent it.*

Fred Huette (Slide 21): Able to cover almost all times in non-firm in the past when there was spare capacity, now no firm gas is left. *Jackson Prairie rights are on the LDC [local distribution company] side, so there is no interaction with it and generation.*

Gerry Snow: Have you investigated into renewables to hydrogen? *Yes, we also looked at hydrogen at the same time. Renewable about $40/Dth to hydrogen to a fuel cell in this IRP. It's very good for long-term storage. There is also methanization, but at a higher cost.*

Fred Huette: Unsure with pumped storage. Very big and limited places.

Electric Price Forecast, James Gall

Dave Van Hersett (Slide 7): At night, use something else than solar. *Every day's price and standard deviation of price (volatility).*

Slide 7: Implied market heat rate equation.

Steve Johnson: What is causing higher 2018-2019 prices? *Start up for fewer hours per day, etc.*

Fred Huette: In California last year, they are all out of range. Scarcity pricing for Aliso Canyon storage and pipeline issues. Persistently high prices. Will these continue? Much work is being done to calm down prices as things are fixed.

Fred Huette: Kevin Harris at Columbia Grid has studied the startup issue.

Fred Huette: High hydro, low gas burn, but fairly stable online.

Fred Huette: Will see higher emissions this year. Pretty stable market.

Clint Kalich (Slide 16): How do you reconcile resource need with the Council?

Jennifer Snyder (Slide 17): Does load growth include conservation? *Yes, low level of conservation assumed by the consultant.*

Thomas Dempsey: What is the 2045 percentage clean? *Over 80%, Northwest is 110%. Western Interconnect excludes Canada and Mexico. Assumes Colstrip out of Washington by 2025, but we assume there will likely be some generation out of Colstrip still for other areas.*

Fred Huette (Slide 17) Aurora inputs?

1. *Future resource cost projections from a consultant, can't tell you who, plus incentives; and the vendor of Aurora. NREL annual technology report just released 2019 update.*
2. *Solar, wind, storage. We can send out the cost assumptions. Solar plus storage.*

3. *Carbon pricing in model for future and existing resources. Washington uses the social cost of carbon. Other states/provinces include their own requirements – California, British Columbia, and Alberta.*
4. *Hydro modeling in Aurora is good, but not great. How do we modify it? 80-year energy input plus how flexible (Power Council factors) for hydro.*

Fred Huette (Slide 18): Are you doing anything to shock or perturb gas prices for unexpected conditions? *Yes, different hydro, load, gas prices, etc. for each of the 500 runs.*

Dave Van Hersett: Do rising gas prices raise electric prices? *Market prices are relatively flat in real terms.*

Fred Huette: What is the stochastic range? *Using randomized draws.*

Fred Huette (Slide 20): High load hours with 2026 being higher makes total sense. *I've actually studied the market in California. It is lower in the day than at night. The theory is that gas plants are bidding in the evening and recovering their costs then. May not shift total market revenue. Solar plus storage first reduces curtailment and then helps with the ramp.*

Steve Johnson: 8 to 16-hour is not relevant anymore.

Mike Dillon: Lot of seasonality, summer 20-21 hours for EIM buyers spike and it spikes aggressively. The value of flexibility and instant capacity is more.

Clint Kalich (Slide 22): Gas has collapsed showing most of this.

Steve Johnson: Price spike volatility in gas prices. Smaller gas exposure diminishes impact. *More impactful for winter than summer.*

Jim Le Tellier: This doesn't agree with the articles in the paper making statements about general shift of renewables blowing out bills.

Steve Johnson: The differential has collapsed, but capacity supply will explode in the other direction.

Clint Kalich: So suppose we now have 5 cents for energy and 2 cents for capacity, we will have 2 cents for energy and 5 cents for capacity in the future.

Steve Johnson (Slide 25): Why is March so high? *Probably because of the ramp spiking prices. Need to look at this. It is a penalty to turn back on. Not as much with higher loads.*

Fred Huette: A few slides ago, 2030/35/40. It is really great to see shifting prices and resource availability.

John Barber (Sldie 31) EUE? *Average load unserved.*

Clint Kalich: Energy that would have to be curtailed in the market.

Clint Kalich: PV [present value] of portfolios to run. *Didn't have to do the math or a levelized cost, wholesale prices are down and retail price up.*

Fred Huette: How did you apply the Social Cost of Carbon? *Applied the Social Cost of Carbon in dispatch for the entire Western Interconnect generation fleet.*

Phone: Is the 2020 and 2035 levelized cost for deterministic with California and British Columbia. *Yes, in Expected Case. Social Cost of Carbon case overrides.*

Existing Resource Overview, John Lyons

Gerry Snow: Limestone wet scrubbers? *Yes.*

Steve Johnson: There is a lot of water you can't get rid of if the plant is off. *The majority of the water leaves through the stack and evaporation. The remedy and closure plan gets to a net zero point about 30 years out on the current model.*

Jim Le Tellier: Sometimes the preliminary estimates are off. Article in the Billings Gazette was $700 million of cleanup costs [for contaminated water]. *That number is for all four units added together.*

Gerry Snow: If you stop bringing in more water? *About 470 million gallons on site now, it was about 700 million gallons.*

Fred Huette: What about the new [coal] contract? *It will be an all-party contract.*

Jennifer Snyder: Is Coyote Springs 2 getting a major redesign? *GSU [generation step up] transformer is the problem. Looking at breaking into individual phases outside of the IRP, but using the IRP to help evaluate because of losses to winter capacity. Already submitted a business case, but haven't made a decision yet.*

Final Resource Needs Assessment, John Lyons

Fred Huette: Tenth percentile for hydro? *We look at the tenth percentile, enough in nine out of 10 years. Others use critical water. One consistent month – 1937 was a bad winter, but an average summer.*