BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

LC 72

In the Matter of AVISTA CORPORATION, dba AVISTA UTILITIES, 2018 2018 Integrated Resource Plan	Opening Comments

Introduction

The following are the Public Utility Commission of Oregon (OPUC or Commission) Staff's Initial Comments on the Avista Corporation's (Avista or Company) Natural Gas 2018 Integrated Resource Plan (IRP or Plan). These comments are organized according to topic as laid out in the Company's initial IRP filing and guided by the Commission's IRP guidelines.[1] Staff's initial comments are based on the Company's IRP, and Avista's responses to information requests (IRs) issued by Staff up to the time of the filing of these comments. Staff notes that it is still in the discovery stage of the IRP process and continues to work with Avista to obtain data necessary to evaluate the Company's IRP.

As noted by Avista in its IRP and recent presentation to the Commission, overall growth in Oregon is lower than in the previous IRP and Avista is not planning any major investments in Oregon over the Action Plan time horizon.[2]

Background of 2018 IRP

Avista filed its 2018 Natural Gas IRP with the Commission on August 31, 2018. The Citizens Utility Board (CUB) is currently the sole intervenor in this docket. A pre-hearing conference was held on October 11, 2018 for the purpose of convening stakeholders to set the schedule for the 2018 IRP. A schedule was agreed upon, and Avista gave an informational overview of its IRP at the October 23, 2018, Public Meeting in Salem, Oregon.

Since the initiation of the IRP process in August of 2018, over 20 information requests (IR) have been initiated by Staff.

Demand Forecasts

The Customer Forecast
As part of every IRP, Avista develops an "expected" forecast of customers, as well as high and low customer forecasts. The customer forecast is then used as an input in the various demand forecasts created for the IRP.

Avista models its customer growth forecasts based on two main driving factors. Customers are assumed to increase when the population of a demand area increases, and also when existing households convert to natural gas.

Specifically, Avista's residential, and commercial forecasts are a multi-step process involving several intermediate forecasts.[3] For industrial customer forecasts Avista simply averages the number of industrial customers over the last twelve months.

With respect to the residential, and commercial forecasts, these are based on the following:

[1] *See* UM 1056, Order Nos. 07-002 and 07-047.
[2] *See* LC 72 Avista 2018 IRP Initial Filing, Aug. 31, 2018, Chapter 9, pg.184; and, Avista presentation to the OPUC at the Public Meeting on Oct. 23, 2018.
[3] In the 2018 IRP, these MSAs are the Spokane-Spokane Valley, Coeur d'Alene, and Medford MSAs. Avista uses the Spokane and Coeur d'Alene population forecasts to forecast customers in Washington and Idaho, respectively.

1. **Medium-term employment forecast**: First, Avista utilizes a Gross Domestic Product (GDP) forecast and historical employment data as inputs into in a linear regression model forecasting employment over the next seven years.[4]
2. **Medium-term population forecast**: The resulting employment forecast is then used in combination with historical population data in a linear regression model forecasting regional population growth over the same seven year period.
3. **Long-term population forecast**: The resulting seven-year population forecast is then averaged with long-term population forecasts in Idaho and Oregon from the independent consulting firm IHS, and Washington's Office of Financial Management (OFM) forecast in Washington.
4. **Long-term customer forecast:** Finally, the resulting population forecast is used as an input to a linear regression model to develop Avista's customer forecasts. In Oregon, customer forecast models are developed for Medford, Roseburg, Klamath Falls, and La Grande.

In Oregon however, Avista's customer growth rate has been slower than the rate predicted in the 2016 IRP. For residential customer growth the increasing natural gas market saturation since 2009 has resulted in fewer conversions of residential customers than predicted.

In addition to lower residential customer growth, the industrial customer forecast in Avista's service territory has decreased since the 2016 IRP. Industrial growth has gone from flat to declining industrial customer forecast, based on Avista's methodology to average the number of industrial customers over the last twelve months. To this end, Staff suggested in Avista's 2016 IRP that the Company supplement its approach by exploring the use of economic drivers to forecast industrial customers, as has been done by other utilities, rather than averaging the last twelve months of customers.[5] Avista did not adopt Staff's recommended approach nor did the Company address why they did not do so in this 2018 IRP. Staff would like to better understand why Avista continues to choose to use an industrial customer forecast approach that would appear to be out of step with the other utilities in Oregon.

Avista forecasts customers for both its residential and commercial schedules in Washington, Idaho, and Oregon. The Washington and Idaho customer forecasts utilize population forecasts for Spokane and Coeur d'Alene, respectively. Avista performs separate Oregon customer forecasts for Medford, Roseburg, Klamath Falls, and La Grande. Avista utilizes these Oregon-specific forecasts as inputs into SENDOUT to inform any need for new resources in Oregon. The various forecasts of employment, population, and customers utilize variables and data intended to represent US GDP, seasonality in the data, the great recession, and other events which Avista believes help explain changes in customer growth.

After the customer forecast is developed, Avista develops low-growth and high-growth cases by assuming lower or higher than expected population growth:

[4] Avista 2018 Integrated Resource Plan. Page 30.
[5] LC 65. Staff's initial comments. Filed on November 8, 2016. Page 4.

Area	Low Growth	Base Growth	High Growth
WA-ID:			
WA-ID Customers	0.9%	1.3%	1.6%
WA Population	0.5%	0.8%	1.1%
ID Population	1.1%	1.6%	2.1%
OR:			
OR Customers	0.6%	0.9%	1.3%
OR Population	0.5%	0.8%	1.1%
System:			
System Customers	0.8%	1.2%	1.5%
System Population	0.5%	0.9%	1.2%

Avista's high and low forecasts of population and customers, as seen in the table above, are provided without an explanation for how these scenarios were calculated. Staff needs Avista to better explain how these growth cases were developed.

Staff Analysis of Avista's Customer Forecast and Requests for Avista
Staff is interested in learning more about why Avista performs its own near-term, county-level population forecast to blend with the long-term, county-level population forecast from IHS. Staff will submit Information Requests to the Company on this subject. Staff has some concerns with the specification of Avista's employment forecast for Medford.

The employment forecast for Medford uses an Autoregressive Moving Average (ARIMA) model without a differencing term. The purpose of a differencing term in an ARIMA model is to make the mean of time-series data (which fluctuates over time), stable. While ARIMA models are standard in IRP analysis, Avista does not explain the assumptions behind its model, or why it chose to not use a differencing term. Avista's employment forecast model is shown below:

[3] $$GEMP_{y,JACK+JOS} = \phi_0 + \phi_1 GGDP_{y,US} + \phi_2 GGDP_{y-1,US} + \phi_3 GGDP_{y-2,US} + \omega_{SC} D_{HB,2004-2005=1} + ARIMA\epsilon_{t,y}\,(1,0,0)(0,0,0)_{12}$$

The Demand Forecast for Annual Average and Peak Day Use per Customer
Avista's resource selection is based on a demand forecast over the next 20 years. The demand forecast is structured around eleven demand areas (4 of which are in Oregon) which correspond to the pipelines that provide service to Avista's service areas. The demand forecast is broken into two segments: a base forecast (July and August) and a weather-sensitive usage forecast (all other months).

Avista calculates demand coefficients for base demand and weather-sensitive demand to use as inputs to the demand forecast in SENDOUT. To obtain the base demand coefficient, Avista develops a use per customer coefficient by finding the average usage in July and August over the last three years and dividing by the average number of customers. To obtain the weather sensitive demand coefficient, Avista calculates linear regression coefficients for the same dataset, for but with data for July and August removed.

After developing demand coefficients to input into SENDOUT, Avista utilizes Heating Degree Day (HDD) data to predict average annual demand and peak day demand in each year of the forecast horizon. The annual average demand forecast utilizes daily averages of the last 20 years of NOAA data to forecast average annual demand. The peak day demand forecast

utilizes the coldest temperature on record for each service territory, as if the coldest day in each region were occurring simultaneously. Additionally, the peak day demand forecast replaces the data for several days immediately surrounding the system coldest-day-on-record with additional cold days, slightly warmer than the record coldest day.

Staff Comments on the Demand Forecast (Average Annual and Annual Peak Day Forecasts)
With respect to its modeling of population in its service territory, Avista's IRP describes the methodology for forecasting population for Medford County, but does not say what methodology was used to forecast population for Douglas County, Klamath County, or Union County in Oregon. Staff assumes they are the same but cannot perform its own analysis based on an assumption. Tying into population modeling is capacity need: Staff is concerned that assuming a simultaneous coldest day in recorded history, accompanied by additional near-coldest-days for each demand area is likely to overestimate capacity need. Additionally, Avista has noted that wind chill is a concern when planning to support peak day needs. Staff agrees and would recommend consideration of coldest historical day in future IRPs.

Developing a Reference Case
Avista developed a reference case demand forecast and compared it to 18 different demand sensitivities. The reference case assumed no elasticity of demand and no conservation.

1. **Customer Compound Annual Growth Rates**

Area	Residential	Commercial	Industrial
Washington/ Idaho	1.1%	0.6%	0.0%
Klamath Falls	1.3%	0.9%	0.0%
La Grande	0.6%	0.4%	0.1%
Medford	1.3%	1.0%	0.0%
Roseburg	1.1%	0.2%	0.0%

2. **Use-Per-Customer Coefficients**
   Flat Across All Classes
   3-year Average Use per Customer per HDD by Area/Class
3. **Weather**
   20-year Normal – NOAA (1998-2017)
4. **Elasticity**
   None
5. **Conservation**
   None

[6]

Avista then grouped the 18 sensitivities into groups intended to represent potential future scenarios.[7]

Staff notes that the assumptions of no price elasticity and no conservation assumed in the reference case are not realistic, given the discussion of significant conservation potential and estimated elasticity of -.01 within the 2018 IRP. The "reference case" for other utilities represents business as normal, i.e., most likely case, for things like load growth, prices and

[6] Avista 2018 Integrated Resource Plan. Page 38.
[7] Avista 2018 Integrated Resource Plan. Page 3.

policies. Avista however, assumes no customer elasticity of demand, no conservation, and flat usage-per-customer. This is not how Staff believes a reference case should be developed, as is reflected in Staff's recommendations

Price Elasticity
Avista utilizes an estimate of price elasticity in the demand forecasts and notes that price elasticity is limited for natural gas customers due to a variety of mechanisms that mute the impact to customers of changes in the cost of the underlying gas commodity. Price elasticity in the 2018 IRP is -0.01. Price elasticity in the 2016 IRP was -0.15.

Staff Comments on Price Elasticity
Price Elasticity in the 2018 IRP has changed to -.01 from -.15 in the 2016 IRP. Staff notes that this is a substantial change and would like to better understand the drivers behind the change.

Results
Avista predicts an average annual customer growth rate of 1.3 percent in Washington and Idaho, with demand growing at .36 percent. In Oregon, the customer increase rate is estimated to be .9 percent per year, with demand growing .7 percent per year.

Staff Recommendations for Demand Forecasts

- Staff proposes that the Company include in reply comments a thorough explanation of why Avista generates its own near-term population forecast when a population forecast from IHS is available.
- Staff recommends that Avista explain the terms and lack of differencing in its customer forecast model.
- Staff recommends Avista consider using auto-ARIMA process for the selection of its ARIMA terms.
- Staff would like to encourage Avista to evaluate the known penetration rate of new homes with natural gas service in its Oregon territory in future IRPs, and requests that Avista consider including a variable in its customer forecast in future IRPs to reflect policies to promote conversion to natural gas.
- Staff requests an explanation of how the high and low customer/population growth scenarios were calculated as well as any data files used to create the high and low forecasts.
- Staff requests Avista explain why it has not adopted Staff's recommendation from the 2016 IRP and looked into using economic drivers in its industrial forecast.
- Staff requests the Company clarify what method was used to forecast population for Douglas, Klamath, and Union Counties in Oregon.
- Staff suggests reducing the timeframe of historical weather data for peak day planning. Instead of planning to meet the coldest day on record for each demand area simultaneously, Staff recommends utilizing a planning standard that results in meeting peak day load in 99 percent of the coldest weather events over the last forty years on a rolling basis. This is similar to the methodology being considered by Cascade for its 2020 IRP and those proposed by NW Natural and recommended by Staff in NW Natural's 2018 IRP.[8,9] This planning standard is less likely to over-estimate needed capacity but still allows the Company to plan to meet load on a reliable basis.

[8] Cascade. LC 69. Amended Four Year Action Plan. Filed June 20, 2018. Page 10-5.
[9] NW Natural. LC 71. Staff's Opening Comments. Filed October 15, 2018. Page 9.

- Staff suggests Avista consider adding wind chill data to the predictive model for peak day in order to address this concern for future IRPs.
- Staff requests Avista provide an explanation of why its price elasticity and non-conservation assumptions are different in the reference case than the rest of the IRP, and whether the same assumptions are also made in each of the 18 demand sensitivity cases.
- Staff requests that Avista provide a reason for the substantial shift in estimated price elasticity between its 2016 and present IRP.
- Staff requests that Avista develop a "business as usual" reference case to more accurately reflect real world scenarios, and bring it in line with other utilities.

Energy Efficiency and Demand Side Resources

In its IRP, Avista presents the methodology used to estimate the potential for demand side resources. In Oregon, these supply curves are created by the Energy Trust of Oregon (Energy Trust). Staff only focuses on the analysis conducted by Energy Trust and the methodology described in Chapter 3 for Washington and Idaho.

Energy Trust's Conservation Supply in Avista's Territory
The process to create the conservation supply curve used in the IRP begins with Avista providing Energy Trust with its demand forecast, customer demographics, and avoided costs. Energy Trust processes these inputs and provides Avista with a 20-year, Demand Side Management (DSM) forecast to identify savings potential. This forecast is used in an IRP as the DSM resource potential and impacts the load forecast.

Energy Trust uses its DSM Resource Assessment modeling tool (RA Model) to identify 20-year cost-effective savings potential. Each stage of estimation filters the possible DSM investments until only the technically achievable, cost-effective measures that are likely to be adopted remain. The result is a twenty-year Final Program Savings Potential estimate, which is provided to Avista for use in its IRP modeling.

In the 2018 DSM forecast, the cost-effective, achievable potential for energy efficiency in Avista's territory in Oregon over the 20-year planning horizon is estimated at 17.2 million therms. In the 2016 IRP, when Avista administered its own energy efficiency programs, their Oregon achievable potential over the planning horizon was estimated at 6.26 million therms. This represents an increase of about 275 percent in cost-effective, achievable potential since Energy Trust began administering the program.

Staff Comments on Efficiency and Demand Side Resources
Staff has submitted information requests regarding the calculation of the inputs provided to Energy Trust by Avista and will provide a summary of its findings in reviewing the calculations in final comments. Staff would note that since Energy Trust began administering energy efficiency programs for Avista there has been a sizeable increase in acquired and forecasted energy savings.[10]

[10] For increases in acquired savings see Energy Trust 2017 Annual Report, April 13, 2018. https://www.energytrust.org/annualreport2017/. For increases in forecasted energy savings see Energy Trust 2019 Draft Budget https://www.energytrust.org/documents/2019-draft-budget-and-2019-2020-action-plan/.

Contribution of Emerging Technologies
Emerging technologies are assigned a risk factor to account for uncertainty in their ability to produce reliable future savings. Avista reports that emerging technologies only make up about 5 percent of total cost-effective potential in Energy Trust's analysis.[11]

Results: Final Savings Projection
Avista reports that Energy Trust's study shows it can save about 1.65 million therms across Avista's service territory in Oregon from 2018 to 2022. By 2037, Energy Trust expects to be able to save over 8.5 million therms for Avista customers in Oregon. This results in an average of about 0.5 percent incremental annual load reduction for Avista in Oregon. Staff would also note that savings forecast of 8.5 million therms is much less than the 17.2 million therms of cost-effective, achievable potential and plans to ask further questions of Avista and Energy Trust to better understand this difference.

Avista reports that the final projection for 20-year savings, while an improvement over past IRPs, is lower than the total estimated cost-effective achievable potential in part because Energy Trust is still getting established in Avista's service territory after beginning work with Avista in 2017.

Deployed Results – Peak Day Results
Avista reports that the OPUC has recommended all gas utilities review and consider the DSM capacity contribution analysis recently developed by NW Natural.[12] In response, Avista has collaborated with Energy Trust to develop estimates of peak day contributions from energy efficiency. Peak day coincident factors represent the percent of annual savings that occur on a peak day within a given year.

The Energy Trust currently still uses its own peak day factors, including residential and commercial space heating factors developed by NWN in 2016 and other factors sourced from the Northwest Power and Conservation Council (NWPCC). The factors are highest for space heating, which aligns with winter peaks of gas utilities. Avista plans to develop and utilize Avista-specific values for Avista's next IRP.

Table 3.17 - Peak Day Coincident Factors by Load Profile

Load Profile	Peak Day Factor	Source
Residential Space Heating	2.10%	NW Natural
Commercial Space Heating	1.80%	NW Natural
Water Heating	0.40%	NWPCC
Clothes Washer	0.20%	NWPCC
Process Load	0.30%	NWPCC

Each measure is assigned a load shape and the peak day factor is applied to the annual savings to calculate overall DSM contribution to peak day capacity.

[11] Avista 2018 Integrated Resource Plan. Page 78.
[12] Avista 2018 Integrated Resource Plan. Page 83.

Table 3.18: Cumulative Deployed Peak Day DSM Savings Contribution by Sector (Therms)

Sector	Cumulative Peak Day Savings (Therms)	% of Overall Sector Savings
Commercial	35,263	0.7%
Residential	73,749	2.2%
Industrial	1,538	0.7%
Total	110,551	1.3%

Conclusion
Avista's Oregon DSM residential (non low-income), commercial, and industrial customer programs have been administered by ETO beginning January 1, 2017. In the 2018 DSM forecast, cost-effective achievable potential in Oregon over the planning horizon is estimated at 17.2 million therms. In the 2016 IRP, the Oregon achievable potential over the planning horizon was estimated at only 6.26 million therms. This represents an increase of about 275 percent in the first year of Energy Trust administration. Additionally, Avista notes that it plans to work with the Northwest Energy Efficiency Alliance (NEEA) in the long term and that the potential for regional market transformation entity is a valuable tool in achieving cost-effective conservation opportunities.

Staff Recommendations for Energy Efficiency and Demand Side Resources

- When Avista develops peak day factors for a future IRP, Staff requests that Avista provide work papers demonstrating how its peak day factors are calculated.
- Provide Staff with an explanation of why Energy Trust and Avista believes only 8.5 million therms of energy efficiency savings by 2037 instead of the 17.2 million identified of cost-effective, achievable potential.

Supply Side Resources

Chapter 4 of the Company's IRP describes its modeling strategy and results for predicting a range of future supply scenarios.

Avista manages natural gas procurement and related activities on a system-wide basis with several regional supply options available to serve core customers. Supply options include:

- Firm and non-firm supplies;
- Firm and interruptible transportation on six interstate pipelines; and
- Storage.

The Company describes the various supply basins available to it across geographic regions, and explains that increasing domestic supplies are displacing Canadian natural gas supplies relative to 2005 numbers. The Company states that recent estimates from the EIA and the Natural Resources Canada reflect a large potential supply of North American natural gas of over 4,000 trillion cubic feet. For this reason, natural gas prices are considerably lower than projected

in prior IRPs. The Company also notes that as compared to prior years, the abundant supply of natural gas may also lead to an increased industrial demand. This scenario is addressed by the Company in its IRP analysis, and the supply side models produced by the Company do account for this potential scenario.

Avista also notes in the 2018 IRP that where a resource deficiency may be a possibility in the forecast, the Company will likely have sufficient lead time to carefully monitor, plan, and take action on potential resource additions as described in the Ongoing Activities section of the Action Plan. This plan includes the optimization of any underutilized resources to mitigate the costs incurred by customers, a long- and short-term resource management strategy that the Company states will provide the flexibility to meet firm customer demand in a reliable and cost-effective manner. Staff continues to review Avista's supply side resource planning assumptions and results.

Staff notes that in its supply side modeling, Avista modeled scenarios using existing resources, as well as a separate modeling of existing + expected resources. Existing resources include all currently owned and contracted Company resources, whereas expected resources include sources such as RNG, Hydrogen, and LNG. Staff appreciates this approach. It allows the Company to consider alternate fuel sources in its IRP analysis without prognostication on the certainty of the availability and economics of these alternatives. Staff believes this is a very solid approach for modeling alternative supplies which may or may not be available or viable in future years.

Avista has indicated in its IRP that it is proposing several projects in its service territory:

- FortisBC Southern Crossing Expansion
- TransCanada GTN/ Trail West N-Max
- Sumas Express
- Enbridge
- Pacific Connector
- NGTL – Path Expansion

The Company is not clear in its IRP as to the likelihood of these projects being completed, or the timeframe. Staff has initiated IRs to clarify these matters.

While Staff is appreciative of the general strategies employed by Avista, as well as its detailed explanation of the "bigger picture" scenarios involving the evolution of natural gas supply, Staff does have some questions and comments for the Company regarding the details of the models.

The Company uses software called SENDOUT to model natural gas supply and demand planning for their IRP. The model uses present value revenue requirement (PVRR) to perform least-cost optimization on the basis of daily, monthly, and seasonal assumptions related to factors such as customer growth and usage; existing and potential transportation and storage options; existing and potential natural gas supply availability; revenue requirements; climate; and energy conservation. Staff wishes to point out that the results of any model will be heavily influenced by the initial values and boundary conditions used in the model, as well as any implicit or explicit assumptions made in constructing the model. The data sources used in the model will influence these factors.

In modeling, supply side models such as those described by the company fall into a category known as “initial value problems”. In these types of problems, the initial conditions of an unknown function are specified at some time, and differential equations are solved given those initial conditions to predict how the system being modeled will evolve over time and/or space. Unlike most differential equations which have more than one solution, an initial value problem should have only one solution. And that single, unique solution, will be entirely dependent on the initial stated values. In mathematics, the proof of this is known as the Fundamental Theorem of Ordinary Differential Equations.

In the context of supply side resource modeling, this means that assumptions and initial values of the data any of the categories listed above can introduce considerable differences in the model’s output. It also means that careful consideration of the data sources used to justify the assumptions and to populate the initial values in the problem, is critical for evaluating the model results.

Although the Company provides certain data used in constructing its supply side models in its appendix, Staff has initiated several data requests to obtain the data in useable form (i.e., spreadsheet), and has also requested narrative explanations of the sources of the data, and the spatial and temporal granularity of the data. Staff has also issued IRs requesting clarification on why the Company chose to model only natural gas purchases under firm, physical, fixed-price contracts. Staff will work with the Company to better understand these factors and will then perform an independent evaluation of the Company’s modeling approach.

That said, the Company’s IRP explanation as is provides good context on the “real world” supply side issues, such as the proliferation of hydraulic fracturing domestically (as well as public concerns over its safety), availability; risk management strategies at the Company level, and environmental factors such as carbon intensity. Based on the Company’s supply side model, several pipeline projects have been proposed, as well as a few industrial plants being considered. Once the Company has responded to Staff’s IRs, and once Staff has fully evaluated the Company’s responses, Staff will be in a position to comment further on the Company’s proposals.

Staff Recommendations for Supply Side Resources

- Staff recommends that the Company include its proposed pipeline projects in the Action Plan.
- Staff continues to investigate Avista’s supply side resource planning and recommends that Avista provide Staff and stakeholders with updates regarding its discussions and analysis regarding possible regional pipeline projects that may move forward as part of future IRP processes.

Policy Considerations

Avista provides an overview of environmental policies that have emerged in the last few years. At the federal level, the Clean Power Plan is on hold and the lack of federal-level leadership has led to increased activity at the state level to consider climate change legislation.

Avista incorporates environmental costs into in analysis as required by Commission guideline 8 in its 2018 IRP. Carbon costs are now broken out in its service territories individually. In Oregon, as a potential proxy for environmental costs, Avista used the potential cost impacts of House Bill (HB) 4001 & Senate Bill (SB) 1507. While both of these bills did not pass in the 2018 session using them as a proxy for potential, future environmental costs represented an innovative

change in analysis between Avista's 2018 and 2016 IRP.[13] Staff appreciates Avista use of environmental cost data changes by potential policy changes in Oregon.

Avista also considers the challenges associated with policy differences between its service territories, and the range of potential changes that could impact its planning based on future divergent changes and policy priorities across those jurisdictions. One of the factors that complicates Avista's analysis is the range of potential legislation across the states in which it operates. Oregon, Washington, and Idaho may have different regulations for carbon reduction, greenhouse gas emissions, renewable natural gas standards, and demand-side management. In Oregon, HB 3543 was passed in 2007 and set greenhouse gas targets. Since then, different carbon cap-and-trade policies have been proposed. 2017's SB 334 creates and maintains an inventory of renewable natural gas sources in the state.

The amount of legislative activity in bills, initiatives, and orders in Oregon and Washington proves an ongoing interest in the region on carbon policy, emissions, and renewables in natural gas. The ongoing conversation on these topics adds some uncertainty to Avista's planning. The particular details of any successful legislation affecting carbon or renewable sources of gas could eventually result in impacts with a wide range impacts that cannot be foreseen as part of this IRP.

Staff Recommendations on Policy Considerations

- Staff has no specific recommendations related to this section.

Integrated Resource Portfolio

As provided in the IRP[14], the Company incorporates the following variables into the modeling of least cost solutions:

- Demand data, such as customer count forecasts and demand coefficients by customer type (e.g., residential, commercial and industrial);
- Weather data, including minimum, maximum and average temperatures;
- Existing and potential transportation data which describes the network for physical movement of natural gas and associated pipeline costs;
- Existing and potential supply options including supply basins, revenue requirements as the key cost metric for all asset additions and prices;
- Natural gas storage options with injection/withdrawal rates, capacities and costs; and
- Conservation potential.

While Staff is appreciative of Avista's comprehensive resource integration analysis, Staff does have some concerns relating to the Company's natural gas price forecasts.

Avista in its IRP describes how it relies on two outside consultants as well as New York Mercantile Exchange (NYMEX) futures to create its forecast of natural gas prices. In the short term Avista uses forward prices, and in the long term it use consultant estimates. The company blends these together, with less weight given to forward prices up to seven years.[15]

[13] In the 2016 IRP, Avista compared three carbon tax sensitivities and performed a statistical analysis.
[14] Avista 2018 Integrated Resource Plan. Page 121.
[15] Avista 2018 Integrated Resource Plan. Page 127.

Staff notes that this is a standard approach across utilities in the industry – while the particular years or consultants may vary, the general consensus is that markets know best in the short run, and forecasters make better predictions in the long run. However, future commodity prices, a.k.a., "futures," are not forecasts. Staff finds most utilities conflate these two terms and plans to seek a forum whereby Staff and all utilities can come to a better understanding of the development and definition of key terms used in future price forecasts.

Shifting from Avista's resource integration analysis to the Company's preliminary results, the Company provides graphic summaries of Average Case demand as compared to existing resources on a peak day in Figures 6.8 through 6.11[16]. Figures 6.12 through 6.15[17] summarize "Expected Case peak day demand" compared to existing resources, as well as demand comparisons to its 2016 IRP.[18] In both the average and expected case, current resources meet demand needs over the 20 year planning horizon. The Company notes that it has chosen to utilize the Expected Case for peak operational planning activities given experience, industry knowledge and understanding of future natural gas markets.[19]

Besides the decrease in the near years driven by falling commodity prices, the Company's avoided cost increased between its 2016 IRP and its 2018 IRP as shown in Figure 6.16[20] (Staff's Figure 1). This rise can be attributable to the Company's addition of a carbon adder starting in 2021 in its avoided cost for Oregon in this IRP. The price of carbon in Oregon is based on the California annual auction reserve price of the Cap-and-Trade Regulation. As avoided costs have a direct impact on what is considered cost-effective, an increase in avoided costs will cause more energy efficiency options to be considered cost-effective, increase energy efficiency targets, and allow higher incentives to be paid for an energy efficiency measure. To repeat from the previous section, while Staff appreciates Avista's inclusion of potential carbon emission prices to meet expected regulatory compliance costs as outlined in Commission IRP Guideline 8[21], it is not evident that a price on emissions is the likely outcome at this point.

[16] Avista 2018 Integrated Resource Plan. Pages 134-135.
[17] Avista 2018 Integrated Resource Plan. Page 136-138.
[18] Avista 2018 Integrated Resource Plan. Page 136-138.
[19] Avista 2018 Integrated Resource Plan. Page 149.
[20] Avista 2018 Integrated Resource Plan. Page 143.
[21] *See* UM 1056, Order No. 07-002.

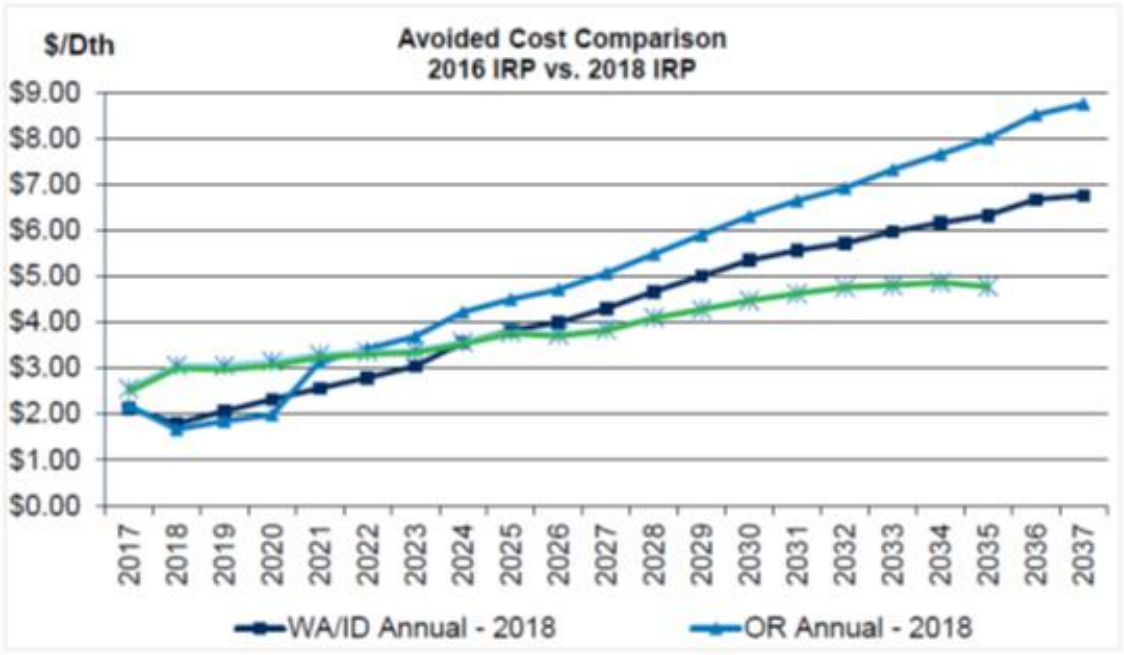

Figure 1 Avoided Costs. From IRP. Green line represents the Company's 2016 IRP projection which combined it's WA/ID and OR service territories.

Overall, Staff considers the portfolio selection methodology in the 2018 IRP to follow the primary goal of the Commission IRP guidelines, in that the IRP soundly presents the resources chosen as the best combination of expected costs and associated risks and uncertainties for the utility and its customers.[22] Staff notes that the Company analysis shows current resources meeting demand needs over the planning horizon, but Staff will continue to assess the underlying modeling assumptions used throughout the analysis.

Staff Recommendation Integrated Resource Portfolio

- Staff recommends that the Company work with Staff to develop a shared understanding of best practices and definitions for developing forward curves for forthcoming IRPs.

Alternate Scenarios, Portfolios, and Stochastic Analysis

As part of its IRP analysis, Avista developed a range of alternate supply and demand scenarios based on assumptions agreed to by stakeholders at the Company's Technical Advisory Committee (TAC) meetings. The modeling process performed by the Company contains two separate steps: First, a completely deterministic approach (i.e., an initial value problem, as discussed earlier in Staff's comments); and second, in accordance with Commission requirements for probabilistic modeling, a stochastic analysis to estimate probability distribution functions for potential outcomes. This is done in part by modeling random variation in weather and natural gas prices based on "base case" inputs. When the deterministic and stochastic approaches were combined, the Company used these model outputs to evaluate risk related to each scenario, based on the models' probable outcomes of weather and climate fluctuations.

As noted earlier in the comments, Staff appreciates Avista's modeling treatment whereby it models existing resources (which the Company owns or contracts at present), and existing and

[22] *See* UM 1056 Guideline 1 c, Order No. 07-002.

expected future resources separately. This allows the Company to do a scenario based analysis that includes, but does not rely on, the likelihood of future resources being economically or otherwise viable.

The Company models its Oregon service territories (Medford/Roseburg, Klamath, La Grande) separately, which is a sound approach considering the diverse geographic spread and attendant supply and demand heterogeneities expected with such a spread.

As shown below (Staff's Figure 2) from the Company's IRP (copied below), first year peak demand is not met with existing resources in 2 of the 3 service territories in the high growth and low price cases. However, the Company notes that the likelihood of this scenario occurring is slim, per its models.

The Company then modeled its potential future supply resources to determine whether its current expected case is least-cost/least risk. As the Company states in its IRP, may of the potential resources are not yet commercially available or well tested (e.g., coalbed methane, LNG imports, natural gas hydrates). Based on this analysis, Staff is satisfied that the Company has done a robust least cost/least risk analysis as required by Commission guidelines with respect to its strategy at large. Nevertheless, Staff reiterates its concern regarding data sources, granularity, and assumptions as discussed in detail in its Supply Side and Demand Side comments (i.e., climate, population, weather, and growth).

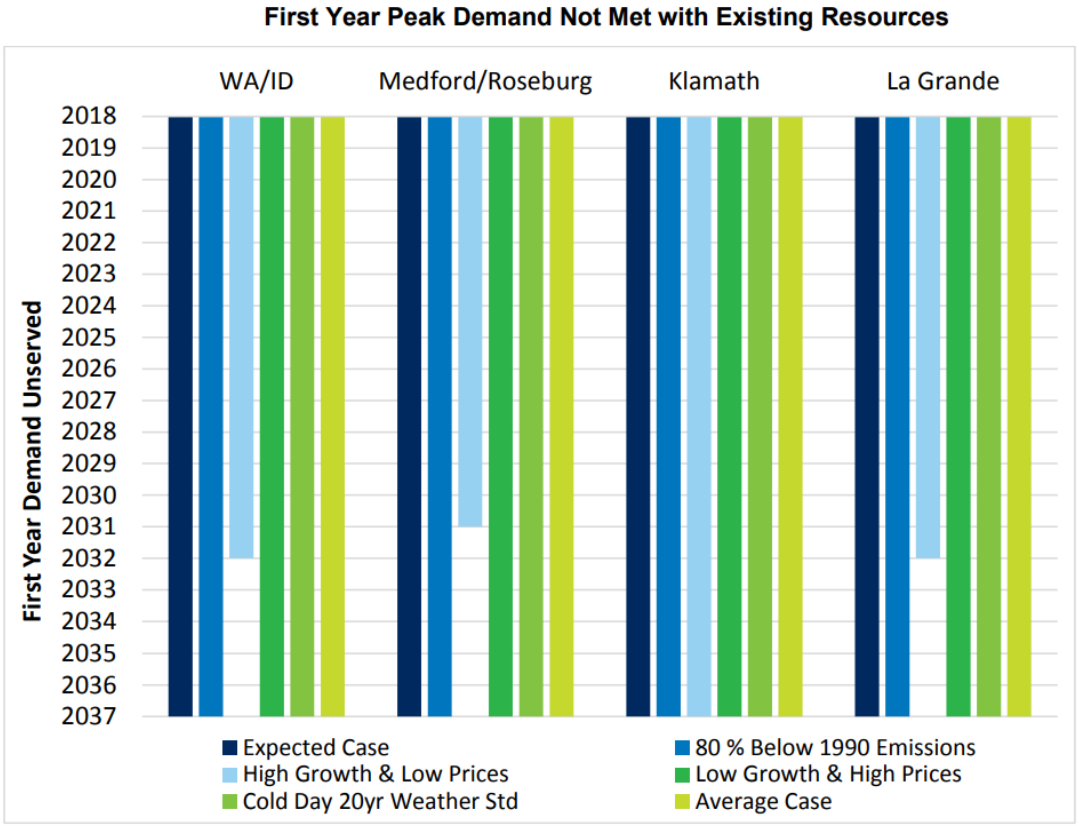

Figure 1 First year peak demand not met with existing resources. From IRP.

While Staff commends Avista's broader modeling strategy on the deterministic side, Staff does have some concerns regarding the stochastic analysis. At the outset, Staff notes that the Company's stochastic approach, which is based on a Monte Carlo analysis containing 200 draws, is in line with the practices historically used in IRP analysis by LNGs. Monte Carlo analysis, when performed with a small number of runs and without regard to variations in the input probability distributions and careful examination of the base case, is essentially a deterministic model, not a truly stochastic one (except in name).

Avista, like other natural gas distribution companies, has used 200 "draws" in its Monte Carlo models. For example, the Company used Monte Carlo analysis to model peak day occurrences based in part on a base case of historical weather data. While Monte Carlo analysis can be used as a statistical tool to assess the probability of certain outcome (in this example, peak days) 200 draws is a very small number of draws from which to predict probabilities. For Monte Carlo analysis to provide realistic predictions of probabilities, it is necessary to have a very large number of "draws" (thousands, if not millions), and also to carefully evaluate the base case data used to seed the Monte Carlo analysis (in this example, weather data), as well as the statistical distribution used to create the shape of the model output (e.g., a normal distribution versus a lognormal distribution).

Staff has initiated several IRs to the Company regarding the Monte Carlo analysis input variables and input distributions. Staff has also requested more information from the Company on the derivation of its base case data. It appears from the limited data Staff currently has available, that the Company used normal distributions for its weather assumptions. In a normal distribution, all occurrences are equally distributed around a mean. Staff questions whether this assumption (if correctly stated), is valid. Current scientific literature suggests that trends in extreme weather events related to climate change are changing the statistical distribution of weather patterns from the normal distribution (i.e., more extreme events, decreases in heating degree days, more powerful storms)[23] [24]. For this reason, Staff will need to independently evaluate the Company's inputs, but nevertheless recommends that the Company, in its next IRP, develop an alternative stochastic approach that does not rely on Monte Carlo simulations. This can be done via a Commission Workshop (with other utilities), and through informal collaboration with Staff.

To illustrate the difference that the number of Monte Carlo "draws" and the input distribution used can have on the predictions of a Monte Carlo model, Staff has independently written a simple Monte Carlo code, which shows:

1. How the statistical distribution of the input variables used in the simulation influence the model predictions;
2. How the number of "draws" influence the model predictions.

Staff's Figure 3 shows the results of four "dummy" Monte Carlo simulations. In case 1 (Figure 3A), Staff has performed a 200 draw Monte Carlo simulation to simulate a dependent or "predicted" variable, using a normally distributed independent, or "input" variable.

[23] Meehl et al, Trends in Extreme Weather and Climate Events: Issues Related to Modeling Extremes in Projections of Future Climate Change, Bulletin of the American Meteorological Society (2000).
[24] Mal et al, Introducing Linkages Between Climate Change, Extreme Events, and Disaster Risk Reduction, Climate Change, Extreme Events and Disaster Risk Reduction pp 1-14 (2017).

In case 2 (Figure 3B), Staff performed the same simulation, but instead of 200 draws, 100,000 draws were used.

In case 3 (Figure 3C), Staff applied a gamma transformation function separately to each variable to transform the marginal distributions Staff ran 200 draws.

In case 4 (Figure 3D), Staff repeated the transform procedure and ran 100,000 draws instead of 200.

In case 1 the normal case with 200 draws, the most common predicted value of the dependent variable falls between **-0.5 and 0**. When that number of normal case draws is extended to 100,000 in case 2, the most common predicted value is between **0.5 and 1**. This is a substantial difference in predictions. Even the sign of the predictions (i.e. positive versus negative) is changed when a larger number of simulations are used.

In case 3 (Figure 3C), where the transformation is applied and 200 draws are used, the most common predicted value is between **0.5 and 1**. In case 4 (Figure 3D), the most common predicted value is between **1.5 and 2.0**.

To recap, in Staff's "dummy" simulation, depending on the statistical distribution and number of "draws" the Monte Carlo simulator predicted values of anywhere between **-0.5 and +2.0**. Even more variability in results would be expected in the case of a real simulation using multiple independent variables. In the context of real world stochastic modeling for IRP purposes, Staff re-iterates that the Monte Carlo approach as currently used, is not a reliable way to meet Commission requirements for stochastic analysis as it is somewhere between deterministic and highly error prone, depending on the number of draws and assumptions underlying the model and its statistical distributions.

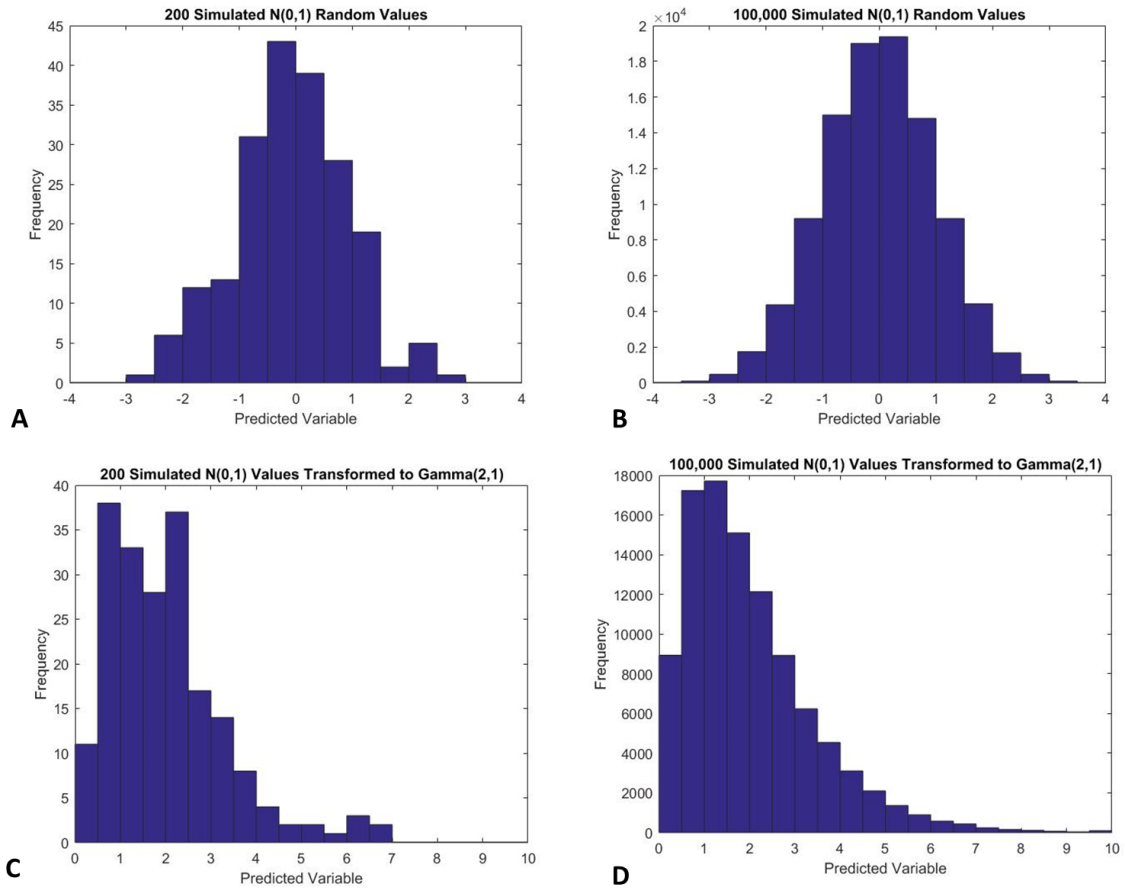

Figure 2 A) 200 Monte Carlo simulated random variables using a normal distribution B) 100,000 Monte Carlo simulated random variable using a normal distribution C) 200 Monte Carlo simulated random variables using a gamma distribution D) 100,000 simulated random variables using a gamma distribution. Simulations and modeling performed by OPUC Staff on dummy data for illustrative purposes.

Staff Recommendations Alternate Scenarios, Portfolios, and Stochastic Analysis

- Staff reiterates its recommendations made in the Demand Side and Supply Side sections with respect to data sources and modeling of weather, population, and related parameters;
- Staff recommends that in its next IRP, the Company develop an alternative stochastic approach to Monte Carlo analysis;
- Staff recommends a Commission Workshop be held after the 2018 IRP but before 2020, to collaboratively evaluate alternate stochastic modeling approaches; and
- Staff recommends that the Company carefully explain its assumptions and data sources in the body of its current IRP, and update the document accordingly.

Distribution Planning

Avista conducts two primary types of evaluations in its distribution system planning efforts including capacity requirements and integrity assessments. Capacity requirements include distribution system reinforcements and upgrades, as well as expansions to accommodate new demand, while integrity assessments include system maintenance evaluation. These planning

efforts provide a long-term planning and strategy outlook and integrate into the capital planning and budgeting process, which incorporates planning for other types of distribution capital expenditures and infrastructure upgrades. Tables 8.1 and 8.2 of the 2018 IRP summarize the cost of major distribution system enhancements addressing growth-related system constraints, system integrity issues, and the timing of expenditures.

Discussion
Avista describes its Distribution Planning Capital Projects criteria as follows:[25]

- Prioritized need for system reliability (necessary to maintain reliable service);
- Scale of project (large in magnitude and will require significant engineering and design support); and
- Budget approval (will require approval for capital funding).

The majority of Avista's capital projects are outside of its Oregon service territory. Avista provides information about a number of key, near-term projects including:

- The last phase of the Coeur d'Alene High Pressure Reinforcement project, referred to as the Post Falls Phase.
- The Cheney High Pressure Reinforcement project.
- The Schweitzer Mountain Road and Warden high pressure reinforcement projects (deferred but anticipated for the future).

These projects are not discussed in Staff's comments at length since they are not specific to Oregon. The 2018 IRP also contains a list of city gate stations identified as over utilized or under capacity, with associated plans to remediate the capacity concern by year. The only Oregon gate stations identified are Sutherlin, OR (Sutherland #2626), and Klamath Falls, anticipated following 2022. However, as the OPUC guidelines clearly call for the action plan to cover activities that will take place over the next two to four years, Avista must specify the cost of these two gate station projects and include it as a specific item in the 4-year Action Plan.

Other reinforcement projects and city gate upgrades listed in anticipation of future changes are preliminary estimates of timing and costs. The Company notes the scope and needs of each project evolve with new information and require ongoing reassessment, while actual solutions may differ due to differences in actual growth patterns and/or construction conditions that differ from the initial assessment. Staff agrees with the Company's understanding of the evolution of future projects and will address other near-term distribution planning need assessments as they are presented in the IRP process in the future.

Regarding its model, Synergi, Avista states that during the modeling process the Company assumes that regulator and compressor stations are always operational and at full capacity. The purpose of this is to make sure each regulator station is capable of handling 115-120 percent of peak cold-weather flows. Staff requests that in its reply comments, Avista provide information and analysis on whether this assumption matches the actual operations in prior years. Specifically, were all compressor and regulator stations always operational and at full capacity? What proportion of the time were compressors or regulators not operated at full capacity, or non-operational? Since compressor and regulator operation is a non-trivial monetary and energy cost, Staff is concerned that overestimating the actual operational usage of this infrastructure may lead to an overestimate of the actual distribution.

[25] *See* the 2018 Avista IRP, pg. 176.

Regarding high pressure distribution or city gate station capital work, Avista does not expect any supply side or distribution resource additions to be needed in the Oregon territory for the next four years, based on current projections. However, should conditions warrant that capital work is needed in order to deliver safe and reliable services to customers, the Company is not precluded from doing such work. Avista's 2018 IRP Action Plan contains New Activities for the 2020 IRP that lists examples of necessary capital investments including natural gas infrastructure investment not included as discrete projects in the IRP and other ongoing non-IRP investments common to all jurisdictions. Staff agrees that the company should complete necessary projects as they arise in order to maintain safe and reliable service to customers.

Staff notes that Avista has not specified the specific distribution system upgrades in its Action Plan. In addition to the above distribution planning capital projects, Avista's 2018 IRP Action Plan contains New Activities for the 2020 IRP with other items relating to distribution planning that include:

- Work with Staff to get clarification on types of natural gas distribution system analyses for possible inclusion in the 2020 IRP.
- Work with Staff to clarify types of distribution system costs for possible inclusion in our avoided cost calculation.

Staff appreciates Avista's efforts to refine their distribution planning methodology. However as discussed with the Company prior to its 2018 Oregon IRP filing, Staff expects Avista to extend its 2-year Action Plan to a 4-year Action Plan, as has been required by this Commission for other natural gas IRPs. To this end, projects expected to commence between 2020 and 2022 should also be reflected, modeled, and explicitly noted in Avista's revised IRP.

Staff Recommendations on Distribution Planning

- Staff recommends that the Company include its specific distribution plan upgrades in its Action Plan.
- The Company must model and explicitly state which distribution plan upgrades it anticipates between present and 2022 (i.e., Sutherlin and Klamath Falls), such that a 4-year rather than 2-year Action Plan horizon is reported.
- Staff requests that in its reply comments, Avista provide information and analysis on whether this assumption matches the actual operations in prior years. Specifically, were all compressor and regulator stations always operational and at full capacity? What proportion of the time were compressors or regulators not operated at full capacity, or non-operational?

Action Plan

The purpose of an action plan is to position Avista to provide the best cost/risk resource portfolio and to support and improve IRP planning. The Action Plan identifies needed supply and demand side resources and highlights key analytical needs in the near term.

The Action Plan also highlights essential ongoing planning initiatives and natural gas industry trends Avista will monitor as a part of its planning processes. As was stated earlier, Avista essentially filed a 2 year Action Plan with a single, Oregon-specific bullet covering a four year time span for potential investments. This is ultimately not in compliance with Commission guidelines. Avista must file a 4-year Action Plan for this IRP by extending its 2019-2020 Action

plan through 2022, which includes a pipeline of proposed projects in Oregon. This should be done before the March 2019 public meeting to acknowledge the IRP.

Avista also noted in its Action Plan new activities that the Company plans to undertake as part of its preparations for the 2020 IRP. Staff is supportive of these activities and list several of them below:

1. Avista's 2020 IRP will contain an individual measure level for dynamic DSM program structure in its analytics. In prior IRP's, it was a deterministic method based on based on Expected Case assumptions. In the 2020 IRP, each portfolio will have the ability to select conservation to meet unserved customer demand. Avista will explore methods to enable a dynamic analytical process for the evaluation of conservation potential within individual portfolios.

2. Work with Staff to get clarification on types of natural gas distribution system analyses for possible inclusion in the 2020 IRP.

3. Work with Staff to clarify types of distribution system costs for possible inclusion in our avoided cost calculation.

4. Revisit coldest on record planning standard and discuss with TAC for prudency.

5. Provide additional information on resource optimization benefits and analyze risk exposure.

6. DSM—Integration of Energy Trust and AEG/CPA data. Discuss the integration of Energy Trust and AEG/CPA data as well as past program(s) experience, knowledge of current and developing markets, and future codes and standards.

7. Carbon Costs – consult Washington State Commission's Acknowledgement Letter Attachment in its 2017 Electric IRP (Docket UE-161036), where emissions price modeling is discussed, including the cost of risk of future greenhouse gas regulation, in addition to known regulations.

8. Regarding high pressure distribution or city gate station capital work, Avista does not expect any supply side or distribution resource additions to be needed in our Oregon territory for the next four years, based on current projections. However, should conditions warrant that capital work is needed on a high pressure distribution line or city gate station in order to deliver safe and reliable services to our customers, the Company is not precluded from doing such work.

Staff Recommendations for the Action Plan

- Avista must file a 4-year Action Plan for this IRP by extending its 2019-2020 Action plan through 2022, which includes a pipeline of proposed projects in Oregon.

Summary of All Staff Recommendations

- Staff proposes that the Company include in reply comments a thorough explanation of why Avista generates its own near-term population forecast when a population forecast from IHS is available.
- Staff recommends that Avista explain the terms and lack of differencing in its customer forecast model.
- Staff recommends Avista consider using auto-ARIMA process for the selection of its ARIMA terms.
- Staff would like to encourage Avista to evaluate the known penetration rate of new homes with natural gas service in its Oregon territory in future IRPs, and requests that Avista consider including a variable in its customer forecast in future IRPs to reflect policies to promote conversion to natural gas.
- Staff requests an explanation of how the high and low customer/population growth scenarios were calculated as well as any data files used to create the high and low forecasts.
- Staff requests Avista explain why it has not adopted Staff's recommendation from the 2016 IRP and looked into using economic drivers in its industrial forecast.
- Staff requests the Company clarify what method was used to forecast population for Douglas, Klamath, and Union Counties in Oregon.
- Staff suggests reducing the timeframe of historical weather data for peak day planning. Instead of planning to meet the coldest day on record for each demand area simultaneously, Staff recommends utilizing a planning standard that results in meeting peak day load in 99 percent of the coldest weather events over the last forty years on a rolling basis. This is similar to the methodology being considered by Cascade for its 2020 IRP and those proposed by NW Natural and recommended by Staff in NW Natural's 2018 IRP.[26,27] This planning standard is less likely to over-estimate needed capacity but still allows the Company to plan to meet load on a reliable basis.
- Staff recommends that the Company work with Staff to develop a shared understanding of best practices and definitions for developing forward curves for IRPs.
- Staff suggests Avista consider adding wind chill data to the predictive model for peak day in order to address this concern for future IRPs.
- Staff requests Avista provide an explanation of why its price elasticity and non-conservation assumptions are different in the reference case than the rest of the IRP, and whether the same assumptions are also made in each of the 18 demand sensitivity cases.
- Provide Staff with an explanation of why Energy Trust and Avista believes only 8.5 million therms of energy efficiency savings by 2037 instead of the 17.2 million identified of cost-effective, achievable potential.
- Staff requests that Avista provide a reason for the substantial shift in estimated price elasticity between its 2016 and present IRP.

[26] Cascade. LC 69. Amended Four Year Action Plan. Filed June 20, 2018. Page 10-5.
[27] NW Natural. LC 71. Staff's Opening Comments. Filed October 15, 2018. Page 9.

- Staff requests that Avista develop a "business as usual" reference case to more accurately reflect real world scenarios, and bring it in line with other utilities.
- When Avista develops peak day factors for a future IRP, Staff requests that Avista provide work papers demonstrating how its peak day factors are calculated.
- Staff recommends that the Company provide a thorough explanation of the value of using of forward curves.
- Staff reiterates its recommendations made in the Demand Side and Supply Side sections with respect to data sources and modeling of weather, population, and related parameters.
- Staff recommends that in its next IRP, the Company develop an alternative stochastic approach to Monte Carlo analysis.
- Staff recommends a Commission Workshop be held after the 2018 IRP but before 2020, to collaboratively evaluate alternate stochastic modeling approaches.
- Staff recommends that the Company carefully explain its assumptions and data sources in the body of its current IRP, and update the document accordingly.
- Staff recommends that the Company include its specific distribution plan upgrades in its Action Plan.
- Staff recommends that the Company model and explicitly state which distribution plan upgrades it anticipates between present and 2022 (such as the two city gate projects noted above), such that a 4-year rather than 2-year Action Plan horizon is reported.
- Staff requests that in its reply comments, Avista provide information and analysis on whether this assumption matches the actual operations in prior years. Specifically, were all compressor and regulator stations always operational and at full capacity? What proportion of the time were compressors or regulators not operated at full capacity, or non-operational?
- Avista must file a 4-year Action Plan for this IRP by extending its 2019-2020 Action plan through 2022, which includes a pipeline of proposed projects in Oregon.

Conclusion

Overall, though Staff sees room for improvement in some particulars, Avista's 2018 IRP provides a well-balanced analysis, and an adequate assessment of least-cost-least-risk planning. Staff re-iterates the importance of extending this analysis to a 4-year Action Plan in its revised 2018 IRP filing; this Commission has required in other gas IRPs[28]. Staff is confident that Avista will be able to make the necessary updates to its Action Plan as part of their final 2018 IRP filing.

Although Staff has raised several concerns regarding the particulars of Avista's modeling, Staff would like to commend Avista on its overall approach with respect to the deterministic modeling of future scenarios. Staff notes that many of its concerns related to the Company's modeling (as specified in Staff's Comments) are not unique to Avista, but have also been reflected in Staff's comments in other recent LDC IRPs. To that end, while Staff has explicitly specified areas where it believes Avista's 2018 IRP would benefit from a more detailed analysis of its data for the current IRP, several areas for improvement would be better addressed in future IRPs.

[28] E.g., LC 69

This concludes Staff's comments.

Dated at Salem, Oregon, this 19st day of November, 2018.

Deborah Glosser
Senior Utility Analyst
Energy Resources and Planning Division