DEMAND FORECAST METHODOLOGY COMPARISON

The following is a brief overview of the methods utilized by Cascade Natural Gas, Avista Utilities, Northwest Natural, and Puget Sound Energy to develop their demand forecasts. A summary of the step-by-step approach strives to provide a general insight into the similarities and differences in the analysis performed by each company.

Cascade Natural Gas:
Cascade has developed a 20-year forecast of customers, therm sales, and peak requirements which are utilized in annual budgeting as well as their long-term planning process.

Customer counts are built from the district level up and take into account both demographic trends and economic conditions. The usage forecast utilizes median household income, weather, and natural gas prices to determine therms per customer. The Company then completes a review of low and high growth scenarios which examine load growth under poor and higher than expected improvements in economic conditions by altering forecasts completed by Woods & Poole to examine the strongest and weakest performing decades over thirty years.

Additionally, a peak day forecast is implemented in conjunction with the base load forecast, which attempts to ensure demand is met on the coldest days of the year. A 60-year weather history is obtained and peak day is based on the coldest day in the past 30 years (61 HDD on 12/21/1990). Therm usage is adjusted upward based on coldest day in *recent* history (56 HDD on 1/05/2004) to 61 HDD to show what usage would have been at 61 HDD. Therm usage is then applied to each district at the forecasted therm usage annual growth rate.

Finally, the various scenarios that are developed are used as inputs in SENDOUT optimization models to assist in the determination of supply and DSM resources.

Avista Utilities:
Within their IRP process, Avista Utilities utilizes both an annual and a peak day demand forecast. The former is used for preparing revenue budgets, developing natural gas procurement plans, and preparing PGA filings while the Peak Day forecast is used primarily for resource planning.

The Company starts by creating their forecasts for customer count and use per customer. The goal is to "develop base and weather sensitive demand coefficients that can be combined and applied to HDD weather parameters to reflect average use per customer."

Demand coefficients are determined by gathering three years of daily historical gas flow data for all city gates and segregating by service territory, temperature zone, and month. Weather normalized July and August data is used to calculate base demand coefficients which are allocated by customer class. Weather sensitive demand coefficients remove the base demand and then use linear regression to assess the relationship of usage to HDD, also allocated by customer class. Additionally, a set of "super-eak" demand coefficients are developed to reflect the flattening of the demand curve at extremely cold temperatures.

A backcast approach is used to verify the reliability of the forecast by applying coefficients to actual customer count and weather data then comparing the results to actual demand.

After developing their expected base case and identifying pertinent demand drivers, Avista then runs the following, less likely, demand scenarios:

1. High Growth/Low Price: customer growth 50% higher than base case with low natural gas prices
2. Low Growth/High Price: customer growth 50% lower than base case with high natural gas prices
3. Green Future: increased costs factored into gas prices due to higher CO_2 costs and drilling restrictions

4. Alternate Weather Standard: change in weather planning standard to coldest day in 20 years for each service territory (as opposed to coldest day on record)
5. Supply Constraints: economic growth 50% lower than base case

Avista has identified economic and pricing conditions to be the primary indicators of potential demand and have considered a range of consumption outcomes focusing on core natural gas.

Northwest Natural:
As described in their IRP, Northwest Natural's demand forecasting "kicks off with the projection of customer growth by region and category. Next, recent usage data is collected and analyzed for customer base use and heat use behavior in response to historic weather and gas rates. The data is then used to fit the coefficients for a statistical load model for each category and region. A natural gas price forecast and forward weather pattern is used in combination with the load model and customer forecast to project demand over the 20-year planning horizon. This constitutes the base case demand forecast, which the Company believes is the most likely outcome for natural gas demand during a year with a severe winter. However, other customer growth, natural gas price futures, and usage behavior could occur, so NW Natural also develops other, less likely demand scenarios for planning purposes. Finally, load forecast accuracy is checked against recent, actual customer usage under a variety of conditions."

The aforementioned base case and less likely demand scenarios reflect the following conditions developed around customer growth:

1. Low Growth Case: due to "economic malaise"
2. High Growth Case: sharper than expected economic rebound
3. Low Growth II: significantly low customer growth attributed to "electric utility breakthrough" (inexpensive and clean electric power decreasing use of natural gas)

Finally, the accuracy of the forecast is tested using a "backcast" methodology which uses the load forecast model factors to predict historic use and then compares those results against actual historic use.

Puget Sound Energy:
Puget Sound Energy approaches their forecast by developing "ranges of forecasts, estimates and assumptions" for demand, gas prices, and CO_2 costs, which are considered to be the Company's key areas driving demand. These forecasts are then combined to create several scenarios beyond their base case, further observed under various sensitivity tests to identify the effect a single variable has on their model.

The base case is modified in order to examine the following six additional scenarios reflecting integrated assumptions that could occur together:

1. Low Growth: caused by weak long-term economic growth
2. High Growth: robust long-term economic growth
3. Very Low Gas Prices: models impact of very weak long-term gas prices
4. Very High Gas Prices: models impact of extremely high gas prices
5. Base + CO_2: moderate CO_2 costs
6. Green World: high CO_2 costs

The 20- year demand forecast modeled by PSE is intended to be an estimate of energy sales, customer counts, and peak demand. The outcomes of which are broken down by region and customer class, then used in long-term resource and delivery system planning.

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Key Comparisons across Utilities:

	Cascade	**Avista**	**NW Natural**	**PSE**
Breakdown by Location	15 Districts	Eight Demand Areas	Eight Regions	*Not Specified*
Breakdown by Customer Class	Residential Core Commercial Core Industrial	Residential Core Commercial Core Industrial	• Residential Existing Single Fam Constr. Multi-Fam Constr. • Commercial Existing Construction Conversions • Industrial Firm Sales	• Firm Residential Commercial Industrial Comm. Lg Volume Indust. Lg Volume • Interruptible Commercial Industrial • Transportation Commercial Firm Comm. Interrupt. Industrial Firm Indust. Interrupt.
Projection	20-Year Forecast	20-Year Forecast	20-Year Forecast	20-Year Forecast
Development of Price Forecast	Internally developed based on external and proprietary info	Internally developed based on external and proprietary info	Internally developed based on external and proprietary info	Wood Mackenzie
Peak Day Determination	61 HDD, based on coldest day in past 30 years	Adjust average weather to reflect 5 day cold weather event for each service territory	45 HDD, based on John Little and Jeffrey Rosenbloom's paper "Bend-Over"	52 HDD based on the costs and benefits of meeting a higher or lower design day temperature

Conclusions:

Each utility has developed its own strategy when it comes to forecasting demand. The goals are the same across companies, with variations in not just method, but in what factors are considered to be primary components driving demand. Specifically, the economic indicators vary across each Company, though differences in the location of service territories may warrant the consideration of different sub-sets of data for different geographical regions.

In general, the primary similarities between demand forecasts amongst the four observed utilities are as follows:

- Each Utility uses a combination of economic inputs to forecast their customer base
- Weather and natural gas prices are used as primary inputs for forecasting therms
- Economic data forecasts are typically sourced through Woods & Poole (Avista uses Global Insight, Inc.)
- Weather data is typically sourced through NOAA
- Price forecasts are sourced from outside consultants such as Wood Mackenzie, taking into consideration public forecasts such as those from the Northwest Power and Conservation Council and the Energy Information Administration.
- All utilities use peak day and variations of high/low growth scenarios to project load growth
- Each Company projects their forecast out 20 years
- All utilities ultimately implement their demand forecasts into a long-term planning model using the SENDOUT software

Significant differences in model development are also observed across these utility companies:

- Economic indicators used to develop customer counts are inconsistent
- Therm usage inputs are inconsistent, though weather and natural gas prices are recognized as primary drivers of consumption
- There is inconsistency when it comes to the breakdown of data into location and customer class
- There is no standard for determining peak day
- Scenarios range from simply a high/low view of growth to assessing impact of additional outside forces

Finally, the charts below detail the data compiled (and sources thereof) for the determination of customer count and customer usage, which are the primary steps within each of the four Company's demand forecasts.

Customer Count:

Utility Company	Data	Source
Cascade Natural Gas	Employment Number of Households Mortgage Rate Prime Rate	Woods & Poole Woods & Poole FHLMC Federal Reserve
Avista Utilities	Population Growth Employment Number of Households Personal Income	Global Insight, Inc. Global Insight, Inc. Global Insight, Inc. Global Insight, Inc.
Northwest Natural	• Residential: Regional Growth Trends Housing Starts Population • Commercial: New Construction Conversion Activity *"Similar factors as res, but com. Viewpoint"* • Industrial *Not specified*	*NW Natural notes that they "rely on internal business intelligence along with information from outside sources such as the Oregon Office of Economic Analysis (OEA) and the Northwest Power and Conservation Council"*
Puget Sound Energy	Household Size Population Employment levels/growth Building Permits	*It is noted that data for national and regional economic indicators are provided by Moody's Analytics*

Customer Usage:

Utility Company	Data	Source
Cascade Natural Gas	Median Household Income Weather (HDD) Natural Gas Prices	Woods & Poole NOAA Wood Mackenzie
Avista Utilities	Weather (HDD) Natural Gas Prices	NOAA Wood Mackenzie
Northwest Natural	Weather (HDD) Natural Gas Prices	NOAA NW Natural
Puget Sound Energy	Weather (HDD) Natural Gas Prices Income Household Size Employment	*Not Specified* Wood Mackenzie *It is noted that data for national and regional economic indicators are provided by Moody's Analytics*