Agenda

- Introductions & Logistics
- Safety Moment
- Purpose of IRP and Avista’s IRP Process
- System Wide Peak Day
- Avista’s Demand Overview and 2016 IRP Revisited
- Economic Outlook and Customer Count Forecast
- Demand Forecast Methodology
- Dynamic Demand Forecasting
- Demand Side Management
- Questions/Wrap Up
Safety Moment

Make it Safe, Make it Personal, Make it Home
2018 IRP Timeline

- **August 31, 2017** – Work Plan filed with WUTC
- **January through May 2018** – Technical Advisory Committee meetings. Meeting topics will include:
  - **TAC 1: Thursday, January 25, 2018**: TAC meeting expectations, review of 2016 IRP acknowledgement letters, customer forecast, and demand-side management (DSM) update.
  - **TAC 2: Thursday, February 22, 2018**: Weather analysis, environmental policies, market dynamics, price forecasts, cost of carbon.
  - **TAC 3: Thursday, March 29, 2018**: Distribution, supply-side resources overview, overview of the major interstate pipelines, RNG overview and future potential resources.
  - **TAC 4: Thursday, May 10, 2018**: DSM results, stochastic modeling and supply-side options, final portfolio results, and 2020 Action Items.
- **June 1, 2018** – Draft of IRP document to TAC
- **June 29, 2018** – Comments on draft due back to Avista
- **July 2018** – TAC final review meeting (if necessary)
- **August 31, 2018** – File finalized IRP document
## IRP Calendar

### 2018

#### JANUARY

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#### Key Dates

- **ETO & AEG DSM Analysis**
- **2018 Avista Scenario Analysis**
- **TAC Meetings**
- **Draft Sent out/due for TAC Members**
- **Draft IRP sections due to Tom by COB**
- **IRP Filing Date in ID, OR, WA**

**TAC 1, TAC 2, TAC 3, TAC 4, TAC 5** - if necessary
Purpose of Integrated Resource Planning

- Comprehensive long-range resource planning tool
- Fully integrates forecasted demand requirements with potential demand side and supply side resources
- Process determines the least cost, risk adjusted means for meeting demand requirements for our firm residential, commercial and industrial customers
- Responsive to Idaho, Oregon and Washington rules and/or orders
Avista’s IRP Process

• Comprehensive analysis bringing demand forecasting and existing and potential supply-side and demand-side resources together into a 20-year, risk adjusted least-cost plan

• Considers:
  – Customer growth and usage
  – Weather planning standard
  – Demand-side management opportunities
  – Existing and potential supply-side resource options
  – Risk
  – Public participation through Technical Advisory Committee meetings (TAC)
  – Distribution upgrades

• 2016 IRP filed in all three jurisdictions on August 31, 2016 and acknowledged
The Natural Gas System

1. Producer Supply
2. Gathering System
3. Pipeline
4. Delivery Point/Gate Station
5. Receipt Point
6. Storage
7. Local Distribution System
8. My House
Avista’s Demand Overview and 2016 IRP Re-Visited

Tom Pardee
Manager of Natural Gas Planning
Avista’s Demand Overview
Service Territory and Customer Overview

- Serves electric and natural gas customers in eastern Washington and northern Idaho, and natural gas customers in southern and eastern Oregon
  - Population of service area 1.5 million
    - 371,000 electric customers
    - 348,000 natural gas customers

- Has one of the smallest carbon footprints among America’s 100 largest investor-owned utilities

- Committed to environmental stewardship and efficient use of resources

<table>
<thead>
<tr>
<th>State</th>
<th>Total Customers</th>
<th>% of Total</th>
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<tbody>
<tr>
<td>Washington</td>
<td>163,000</td>
<td>47%</td>
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<tr>
<td>Oregon</td>
<td>102,000</td>
<td>29%</td>
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<td>Idaho</td>
<td>83,000</td>
<td>24%</td>
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<tr>
<td>Total</td>
<td>348,000</td>
<td>100%</td>
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2017 Customer Make Up and Demand Mix

WA/ID Customer Make up
- Res: 90.23%
- Com: 9.68%
- Ind: 0.09%

Oregon Customer Make up
- Res: 88.30%
- Com: 11.67%
- Ind: 0.03%

WA/ID Customer Demand
- Res: 61.51%
- Com: 36.47%
- Ind: 2.02%

Oregon Customer Demand
- Res: 54.40%
- Com: 42.97%
- Ind: 2.63%
Seasonal Demand Profiles

Washington/Idaho

Medford/Roseburg

Klamath Falls

LaGrande

[Graphs showing demand profiles for different locations and sectors, categorized by residential, commercial, and industrial demand over the months of the year.]
OR Daily Demand Profiles

*Data is from 2006-2017
WA-ID Daily Demand Profiles
System Wide Peak Day
### AREA_CODE

<table>
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<th>Min</th>
<th>Max</th>
<th>Average</th>
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<td>6</td>
<td>59</td>
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<td>La Grande</td>
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<td>65</td>
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<td>Klamath Falls</td>
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### Area

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<td>76</td>
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<td>La Grande</td>
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<td>Roseburg</td>
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System Wide Peak Day – 1/5/2017

313,000 Dth
System Wide Peak Day – 1/5/2017 by class
Avista’s 2016 Natural Gas IRP Re-Visited
Washington/Idaho IRP Forecast vs. Actual
(Commercial Use per Customer and Customer Count)
First Year Peak Demand Not Met with Existing Resources
Scenario Comparisons

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<th>Medford/Roseburg</th>
<th>Klamath</th>
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Legend:
- Expected Case - Low Prices
- Expected Case
- High Growth & Low Prices
- Low Growth & High Prices
- Cold Day 20yr Weather Std
- Average Case
Existing Resources vs. Peak Day Demand
Existing Resources vs. Peak Day Demand

Expected Case – Medford/Roseburg

[Graph showing expected case with Medford/Roseburg existing resources vs. peak day demand from 2015 to 2034. The graph includes different resources such as Existing GTN, Existing NWP, JP TF-2, Peak Day Demand, and Prior IRP Peak Day Demand.]
Existing Resources vs. Peak Day Demand
Expected Case – Klamath Falls
Existing Resources vs. Peak Day Demand

Expected Case – La Grande

Graph showing the comparison between expected resources and peak day demand from 2016 to 2035. The graph includes data for Existing NWP, JP TF-2, Peak Day Demand, and Prior IRP Peak Day Demand.
Our Biggest Risk Last IRP
“Flat Demand” Risk

Figure 1.9 Flat Demand Risk Example

- **Demand**
  - Y-axis: 0 to 8
- **Years**
  - X-axis: 0 to 10
- **Resources**
- **Initial Demand**
- **Revised Demand**
2016 IRP Final
Action Items
Staff believes public participation could be further enhanced through “bill stuffers, public flyers, local media, individual invitations, and other methods.”

Result: Avista utilized its Regional Business Managers in addition to digital communications and newsletters in all states in order to try and gain more public participation. Previous IRP’s relied on website data and word of mouth.

- eCommunity newsletter was sent out on January 15, 2018
OPUC

• Staff Recommendation No. 1
  – Staff recommends in Avista's 2018 IRP that Avista pursue an updated methodology, wherein the low/high gas price curves continue to be based on low (high) historic prices in a Monte Carlo setting, but are inflated to match the growth rate (yr/yr) of the expected price curve. The resulting curves would be based on historic prices and also produce symmetric risk profiles throughout the time horizon.

• Staff Recommendation No. 2
  – Staff recommends that Avista forecast its number of customers using at least two different methods and to compare the accuracy of the different methods using actual data as a future task in its next IRP.
  – Result: Avista analyzed the data, but there was nothing material discovered the come up with a meaningful forecast alternative.

• Staff Recommendation No. 3
  – Avista's 2018 IRP will contain a dynamic DSM program structure in its analytics.
    • In, prior IRPs, it was a deterministic method based on Expected Case assumptions, in the 2018 IRP, each portion 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 and will work with Energy Trust of Oregon in the development of this process and in producing any final results for its 2018 IRP for Oregon customers.
OPUC cont.

- **Staff Recommendation No. 4**
  - Staff recommends that Avista provide Staff and stakeholders with updates regarding its discussions and analysis regarding possible regional pipeline projects that may move forward.

- **Staff Recommendation No. 5**
  - Staff recommends that in its 2018 IRP process Avista work with Staff and stakeholders to establish and complete stochastic analysis that considers a range of alternative portfolios for comparison and consideration of both cost and risk.

- **Staff Recommendation No. 6**
  - Environmental Considerations
    - 1. Carbon Policy including federal and state regulations, specifically those surrounding the Washington Clean Air Rule and federal Clean Power Plan;
    - 2. Weather analysis specific to Avista's service territories;
    - 3. Stochastic Modeling and supply resources; and
    - 4. Updated DSM methodology including the integration of ETO
WUTC

• Include a section that discusses impacts of the Clean Air Rule (CAR).
  – In its 2018 IRP expected case, Avista should model specific CAR impacts as well as consider the costs and risk of additional environmental regulations, including a possible carbon tax.

• Provide more detail on the company’s natural gas hedging strategy, including information on upper and lower pricing points, transactions with counterparties, and how diversification of the portfolio is achieved.

• Ensure that the entity performing the CPA evaluates and includes the following information:
  – All conservation measures excluded from the CPA, including those excluded prior to technical potential determination
  – The rationale for excluding any measure
  – A description of Unit Energy Savings (UES) for each measure included in the CPA, specifying how it was derived and the source of the data
  – The rationale for any difference in economic and achievable potential savings, including how the Company is working towards an achievable target of 85 percent of economic potential savings.
  – A description of all efforts to create a fully-balanced cost effectiveness metric within the planning horizon based on the TRC.
WUTC cont.

- Discuss with the TAC:
  - The results of Northwest Energy Efficiency Alliance (NEEA) coordination, including non-energy benefits to include in the CPA.
  - The appropriateness of listing and mapping all prospective distribution system enhancement projects planned on the 20 year horizon, and comparing actual projects completed to prospective projects listed in previous IRP’s.
- Provide a rationale for any difference in economic and achievable potential savings
2017 – 2018 Avista’s Action Plan

- The price of natural gas has dropped significantly since the 2014 IRP. This is primarily due to the amount of economically extractable natural gas in shale formations, more efficient drilling techniques, and warmer than normal weather. Wells have been drilled, but left uncompleted due to the poor market economics. This is depressing natural gas prices and forcing many oil and natural gas companies into bankruptcy. Due to historically low prices Avista will research market opportunities including procuring a derivative based contract, 10-year forward strip, and natural gas reserves.

- Result: After exploring the opportunity of some type of reserves ownership, it was determined the price as compared to risk of ownership was inappropriate to go forward with at this time. As an ongoing aspect of managing the business, Avista will continue to look for opportunities to help stabilize rates and/or reduce risk to our customers.

- Monitor actual demand for accelerated growth to address resource deficiencies arising from exposure to “flat demand” risk. This will include providing Commission Staff with IRP demand forecast-to-actual variance analysis on customer growth and use-per-customer at least bi-annually.

- Result: actual demand was closely tracked and shared with Commissions in semi-annual or quarterly meetings.
Ongoing Activities

• Continue to monitor supply resource trends including the availability and price of natural gas to the region, LNG exports, methanol plants, supply and market dynamics and pipeline and storage infrastructure availability.

• Monitor availability of resource options and assess new resource lead-time requirements relative to resource need to preserve flexibility.

• Meet regularly with Commission Staff to provide information on market activities and significant changes in assumptions and/or status of Avista activities related to the IRP or natural gas procurement practices.

• Appropriate management of existing resources including optimizing underutilized resources to help reduce costs to customers.
Avista Natural Gas Forecasting

Grant D. Forsyth, Ph.D.
Chief Economist
Grant.Forsyth@avistacorp.com
Load Forecasts-Two Step Process

- First, forecast customers (C) by month by schedule (s) by residential (r), commercial (c), industrial (i)—for example, $C_{t,y,s,r}$

- Forecast use per customer (U) by month by schedule by class—for example, $U_{t,y,s,r}$

- Load forecast (L) is the product of the two:

$$L_{t,y,s,r} = C_{t,y,s,r} \times U_{t,y,s,r}$$

For weather sensitive schedules a 20-yr MA defines normal weather.
The Basic Forecast Approach

- Firm Residential and Commercial
  - Population Growth Forecast
  - Residential Customer Forecast ARIMA Model
  - Commercial Customer ARIMA Forecast Model
  - Vary Population Growth Assumptions

- Firm Industrial
  - No Drivers
  - Forecast of no Significant Growth
  - Vary “No Growth” Assumption

*Note:* The diagram shows the flow of the forecast approach with arrows indicating the process from population growth forecasts to residential and commercial customer forecasts, culminating in industrial forecasts with variations in growth assumptions.
No real change since January 2007
Getting to Population as a Driver, 2018-2023 & 2024-2037

2018-2023 For Spokane, WA; Kootenai, ID, and Jackson, OR counties

Average GDP Growth Forecasts:
• IMF, FOMC, Bloomberg, etc.
• Average forecasts out 6-yrs.

Non-farm Employment Growth Model:
• Model links year y, y-1, and y-2 GDP growth to year y regional employment growth.
• Forecast out 6-yrs.
• Averaged with GI forecasts.

Regional Population Growth Models:
• Model links regional, U.S., and CA year y-1 employment growth to year y county population growth.
• Forecast out 6-yrs for Spokane, WA; Kootenai, ID; and Jackson, OR.
• Averaged with IHS forecasts.
• Growth rates used to generate population forecasts for customer forecasts for residential schedules 101 and 410.

Kootenai and Jackson: IHS population growth forecasts for 2024-2037

Spokane: OFM population growth forecasts for 2024-2037

OR Union, Klamath, and Douglas counties: IHS population growth forecasts for 2018-2037

Interpolation assumes: \( P_N = P_0 e^{rN} \)
The Relationship Between Classes

Residential customer growth is approximately equal to population growth in the long-run.

Commercial customer growth is highly correlated with residential growth in the long-run.

Industrial’s correlation to residential is lower and negative. Customer numbers stable or slightly declining.

### Year-over-year Growth, Gas Correlations by Class, Jan. 2005-Jan 2016

<table>
<thead>
<tr>
<th>Customers</th>
<th>Residential</th>
<th>Commercial</th>
<th>Industrial</th>
<th>Load</th>
<th>Residential</th>
<th>Commercial</th>
<th>Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>1.00</td>
<td></td>
<td></td>
<td>Residential</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>0.80</td>
<td>1.00</td>
<td></td>
<td>Commercial</td>
<td>0.94</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>-0.38</td>
<td>-0.23</td>
<td>1.00</td>
<td>Industrial</td>
<td>0.21</td>
<td>0.24</td>
<td>1.00</td>
</tr>
</tbody>
</table>
WA-ID Region Firm Customers: 2018 IRP and 2016 IRP

<table>
<thead>
<tr>
<th>IRP</th>
<th>Avg. Annual Growth 2018-2037</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>1.1%</td>
</tr>
<tr>
<td>2018</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

≈ +16,500

WA-ID Base 2016

WA-ID Base 2018
Medford, OR Region Firm Customers: 2018 IRP and 2016 IRP

<table>
<thead>
<tr>
<th>IRP</th>
<th>Avg. Annual Growth 2018-2037</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>1.2%</td>
</tr>
<tr>
<td>2018</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

≈ -3,800
Roseburg, OR Region Firm Customers: 2018 IRP and 2016 IRP

<table>
<thead>
<tr>
<th>IRP</th>
<th>Avg. Annual Growth 2018-2037</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>0.9%</td>
</tr>
<tr>
<td>2018</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

Approximate growth rate: ≈ -60
Klamath, OR Region Firm Customers: 2018 IRP and 2016 IRP

<table>
<thead>
<tr>
<th>IRP</th>
<th>Avg. Annual Growth 2018-2037</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>1.2%</td>
</tr>
<tr>
<td>2018</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

≈ -790
La Grande, OR Region Firm Customers: 2018 IRP and 2016 IRP

<table>
<thead>
<tr>
<th>IRP</th>
<th>Avg. Annual Growth 2018-2037</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>0.5%</td>
</tr>
<tr>
<td>2018</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

≈ -50
System Firm Customers: 2018 IRP and 2016 IRP

<table>
<thead>
<tr>
<th>IRP</th>
<th>Avg. Annual Growth 2018-2037</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>1.1%</td>
</tr>
<tr>
<td>2018</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

≈ +11,900
### WA-ID Region Firm Customer Range, 2018-2037

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low Growth</th>
<th>Base Growth</th>
<th>High Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA-ID Customers</td>
<td>0.9%</td>
<td>1.3%</td>
<td>1.6%</td>
</tr>
<tr>
<td>WA Population</td>
<td>0.5%</td>
<td>0.8%</td>
<td>1.1%</td>
</tr>
<tr>
<td>ID Population</td>
<td>1.1%</td>
<td>1.6%</td>
<td>2.1%</td>
</tr>
<tr>
<td>WA-ID Population</td>
<td>0.6%</td>
<td>0.9%</td>
<td>1.3%</td>
</tr>
</tbody>
</table>
System Firm Customer Range, 2018-2037

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low Growth</th>
<th>Base Growth</th>
<th>High Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
<td>0.8%</td>
<td>1.2%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Population</td>
<td>0.5%</td>
<td>0.9%</td>
<td>1.2%</td>
</tr>
</tbody>
</table>
# Summary of Growth Rates

<table>
<thead>
<tr>
<th>System</th>
<th>Base-Case</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>1.2%</td>
<td>1.6%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Commercial</td>
<td>0.7%</td>
<td>1.0%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Industrial</td>
<td>-0.3%</td>
<td>2.2%</td>
<td>-3.3%</td>
</tr>
<tr>
<td>Total</td>
<td>1.2%</td>
<td>1.5%</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WA</th>
<th>Base-Case</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>1.2%</td>
<td>1.5%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Commercial</td>
<td>0.7%</td>
<td>1.0%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Industrial</td>
<td>-0.8%</td>
<td>1.9%</td>
<td>-3.1%</td>
</tr>
<tr>
<td>Total</td>
<td>1.2%</td>
<td>1.5%</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID</th>
<th>Base-Case</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>1.5%</td>
<td>2.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Commercial</td>
<td>0.6%</td>
<td>1.1%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.1%</td>
<td>1.7%</td>
<td>-2.7%</td>
</tr>
<tr>
<td>Total</td>
<td>1.4%</td>
<td>1.9%</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OR</th>
<th>Base-Case</th>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>1.0%</td>
<td>1.3%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Commercial</td>
<td>0.7%</td>
<td>1.1%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.1%</td>
<td>4.7%</td>
<td>-7.8%</td>
</tr>
<tr>
<td>Total</td>
<td>0.9%</td>
<td>1.3%</td>
<td>0.6%</td>
</tr>
</tbody>
</table>
Forecasting with Permits or Housing Starts

- Potential data sources have poor coverage in our service territory or series are not long enough. This is especially a problem for non-MSA areas like Roseburg, Klamath, and La Grande.
- IHS has annual and quarterly housing start data only for MSAs. IHS’s MSA housing starts are estimates:

  “We then use the permits-to-starts ratio for the national and regional level from the Census that is released every year to derive the starts. Unfortunately, until recently, the census only has these ratios at the national and regional level. As a consequence, we use this ratio for any county, metro and state within the region to derive our starts from.”

- Prior use of IHS housing start forecasts resulted in significant over forecasting of customers.
- NAHB also produces a housing start series, but their data only covers fairly large MSAs.
Estimating the IMPACT of LEAP in WA: Residential Customers

<table>
<thead>
<tr>
<th>Year</th>
<th>WA IRP</th>
<th>Residential Change by 2037</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>130,000</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>135,000</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>140,000</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>145,000</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>150,000</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>155,000</td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td>160,000</td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>165,000</td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td>170,000</td>
<td></td>
</tr>
<tr>
<td>2027</td>
<td>175,000</td>
<td></td>
</tr>
<tr>
<td>2028</td>
<td>180,000</td>
<td></td>
</tr>
<tr>
<td>2029</td>
<td>185,000</td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>190,000</td>
<td></td>
</tr>
<tr>
<td>2031</td>
<td>195,000</td>
<td></td>
</tr>
<tr>
<td>2032</td>
<td>200,000</td>
<td></td>
</tr>
<tr>
<td>2033</td>
<td>205,000</td>
<td></td>
</tr>
<tr>
<td>2034</td>
<td>210,000</td>
<td></td>
</tr>
<tr>
<td>2035</td>
<td>215,000</td>
<td></td>
</tr>
<tr>
<td>2036</td>
<td>220,000</td>
<td></td>
</tr>
<tr>
<td>2037</td>
<td>225,000</td>
<td></td>
</tr>
</tbody>
</table>

- **2018 IRP with LEAP Less 2016 IRP**: +11,300
- **2018 IRP w/o LEAP Less 2016 IRP**: +2,200
- **LEAP Contribution**: +9,100
Estimating the IMPACT of LEAP in WA: Residential Growth Rates
Demand Forecast Methodology

Tom Pardee
Manager of Natural Gas Planning
Temperature & Degree Days

Cooling Degree Days (CDD)

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Degree Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>35</td>
</tr>
<tr>
<td>90</td>
<td>25</td>
</tr>
<tr>
<td>80</td>
<td>15</td>
</tr>
<tr>
<td>70</td>
<td>5</td>
</tr>
<tr>
<td>65</td>
<td>0</td>
</tr>
</tbody>
</table>

Heating Degree Days (HDD)

<table>
<thead>
<tr>
<th>Temp</th>
<th>Degree Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>5</td>
</tr>
<tr>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>10</td>
<td>55</td>
</tr>
<tr>
<td>0</td>
<td>65</td>
</tr>
<tr>
<td>-10</td>
<td>75</td>
</tr>
<tr>
<td>-20</td>
<td>85</td>
</tr>
</tbody>
</table>
Natural Gas Demand Forecasting

- Procurement Planning
- Corporate Budget
- Average Demand
- IRP
- IRP Peak Day Planning
- Scenario Analysis
- PGA
- Financial Planning and Analysis
- Resource Accounting
- Gas Supply
- Rates
- Regulatory Staff
- Industry Stakeholders

Other
Weather

- NOAA 20 year actual average daily HDD’s (1998-2017)
- Peak weather includes two winter storms (5 day duration), one in December and one in February
- Planning Standard – coldest day on record
- Sensitivity around planning standard including
  - Normal/Average
  - Coldest in 20 years
  - Monte Carlo simulation
The Use per Customer Forecast cont.

- Historical data is used to determine initial base and heat coefficients.
- Adjustments are made to incorporate DSM and price elastic responses.
Residential – UPC and Weather

<table>
<thead>
<tr>
<th>Location</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA/ID Res</td>
<td>97%</td>
</tr>
<tr>
<td>Roseburg Res</td>
<td>65%</td>
</tr>
<tr>
<td>Medford Res</td>
<td>71%</td>
</tr>
</tbody>
</table>
Residential – UPC and Weather

Klamath Falls Res  71% Correlated

La Grande Res  83% Correlated
Base Coefficients

July and August Average
Demand Modeling Equation – a closer look

SENDOUT® requires inputs expressed in the below format to compute daily demand in dekatherms. The base and weather sensitive usage (degree-day usage) factors are developed outside the model and capture a variety of demand usage assumptions.

Table 3.2 Basic Demand Formula

<table>
<thead>
<tr>
<th># of customers ( \times ) Daily base usage / customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plus</td>
</tr>
<tr>
<td># of customers ( \times ) Daily weather sensitive usage / customer</td>
</tr>
</tbody>
</table>
1. Expected customer count forecast by each of the 5 areas

2. Use per customer coefficients – Flat all classes, 5 year, 3 year or last year average use per HDD per customer

3. Weather planning standard – coldest day on record
   - WA/ID 82; Medford 61; Roseburg 55; Klamath 72; La Grande 74
Dynamic Demand Methodology

Tom Pardee
Manager of Natural Gas Planning
Dynamic Demand Methodology

Demand Influencing
- Conditions that **DIRECTLY** affect core customer volume consumed

Price Influencing
- **PRICE SENSITIVE** conditions that, through price elasticity, **INDIRECTLY** affect core customer volume consumed
Demand Drivers

Demand Influencing
- Weather
  - Normal
  - Planning Standard
  - Other
- Customer Mix Shifts
  - Res/Com/Ind
  - Core vs. Transport
  - Interruptible
- Customer Growth
  - New Construction
  - Conversion/Direct Use
  - Economy

Technology
- Increased efficiency/DSM
- New Uses
- Demand Response

3rd Party Demand Trends
- Thermal Generation
- Non-Core Customer
- LNG Exports

Supply Trends
- Conventional vs. Unconventional
- Canadian Imports
- LNG

Pipeline Trends
- Regional Pipeline Projects
- National Pipeline Projects
- International Pipeline Projects

Other
- Storage
- Climate Change Legislation
- Energy Correlations (i.e. oil and gas)

Price Influencing

Demand
Customer Growth and Mix – Demand Influencing

- Key driver in demand growth
- Can change the timing and/or location of resource needs
- Currently we model expected, high, and low growth scenarios
- New construction vs. conversions
- Residential/Commercial/Industrial vs. Transportation
- New uses – CNG/NGV
Weather Standard – Demand Influencing

- Has the potential to significantly change timing of resource needs
- Significant qualitative considerations
  - No infrastructure response time if standard exceeded
  - Significant safety and property damage risks
- Current Peak HDD Planning Standards
  - WA/ID 82
  - Medford 61
  - Roseburg 55
  - Klamath 72
  - La Grande 74
Technology – Demand Influencing

- Demand side management initiatives will reduce demand **H O W E V E R**, it is dependent upon customers’ willingness/ability to participate.
- Development of new uses for natural gas
  - CNG
  - NGV
  - LNG
  - ???NG
- Demand response (Smart Grid)
- New technologies in Demand Side Management
Price Elasticity Factors Defined

• Price elasticity is usually expressed as a numerical factor that defines the relationship of a consumer’s consumption change in response to price change.

• Typically, the factor is a negative number as consumers normally reduce their consumption in response to higher prices or will increase their consumption in response to lower prices.

• For example, a price elasticity factor of -0.13 means:
  – A 10% price increase will prompt a 1.3% consumption decrease
  – A 10% price decrease will prompt a 1.3% consumption increase
Price Elasticity

• Establishes factors for use in other price influencing scenarios

• Very complex relationship – we use historical data however……
  • Historical data has DSM, rate changes (PGA, general rate, etc.), economic conditions, technological changes, etc.
  
• History is not necessarily the best predictor of future behavior
Price Elasticity Assumptions From 2018 IRP

<table>
<thead>
<tr>
<th>Elasticity Assumption</th>
<th>Real Price annual increase within 30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Negative .20</td>
</tr>
<tr>
<td>Expected</td>
<td>Negative .10</td>
</tr>
<tr>
<td>Low</td>
<td>No response</td>
</tr>
</tbody>
</table>

Expected Elasticity is derived from Medford and Roseburg and applied to all areas.
3\textsuperscript{rd} Party Demand Trends – Price Influencing

- Gas fired generation
- Coal plant retirements driving gas for power
- CNG/NGV Transportation Fleets
- Export LNG
- Non-firm customer trends
- Mexico Exports
Supply Trends – Price Influencing

- Shale is Everywhere
- LNG Export

- Associated gas from Oil – 25% of overall US production
Pipeline Trends – Price Influencing

- Regional Pipeline Proposals
  - Sumas Express
  - Pacific Connector – from Jordan Cove LNG
  - Trail West/N-Max (GTN to NWP – Molalla area)

- National Pipeline Proposals
  - International Pipeline Proposals
  - T-South Looping
  - NGTL Westpath Expansion
  - Southern Crossing Expansion
Other Supply Issues – Price Influencing

- Storage
- Climate Change and Carbon Legislation
- Energy Correlations
- Extraction cost
Sensitivities, Scenarios, Portfolios

Core Cases

Price Forecast

Demand and Supply Side Sensitivities

Optimize Resource Portfolio

Stochastic Cost/Risk Analysis

Prices and Weather

Preferred Portfolio selection

Highest Performing Portfolios selection
## Sensitivities for 2018 IRP

<table>
<thead>
<tr>
<th>INPUT ASSUMPTIONS</th>
<th>Reference Case</th>
<th>Reference Plus Peak Case</th>
<th>Reference Plus LEAP Case</th>
<th>Low Cust Growth</th>
<th>High Cust Growth</th>
<th>No Conversion to natural gas Growth</th>
<th>Alternate Weather Std</th>
<th>DSM Case</th>
<th>Peak Plus DSM Case</th>
<th>Demand Destruction Reference Case</th>
<th>Demand Destruction Reference Plus Peak Case</th>
<th>Alternate Historical UPC Case</th>
<th>Expected Elasticity</th>
<th>Low Prices</th>
<th>High Prices</th>
<th>Carbon Legislation</th>
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<tbody>
<tr>
<td>Customer Growth Rate</td>
<td>Reference</td>
<td>Reference Plus</td>
<td>Reference minus LEAP Case</td>
<td>Low Growth</td>
<td>High Growth</td>
<td>3 Year Historical</td>
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</table>
2018 Natural Gas IRP
DSM - Energy Efficiency

Amber Gifford & Ryan Finesilver
First Technical Advisory Committee Meeting
January 25, 2018
Demand Side Management (DSM)

The process of helping customers use energy more efficiently.

The term DSM is used interchangeably with Energy Efficiency and Conservation.

DSM Programs benefit the IRP by contributing to the deferral of plant assets.
Team Roles

DSM Planning & Analytics Team

Applied Energy Group (AEG)

Gas Supply

ACP CPA IRP

Oregon DSM Programs
Who DSM Serves

Three Jurisdictions
- Washington
- Idaho
- Oregon (ETO except for Low-Income)

Multiple Customer Segments
- Residential
- Industrial/Commercial
- Low-Income Residential

The Company’s Infrastructure
- Aids in reducing overall capacity
- Defers capital investments
DSM Funding – Natural Gas

Tariff percentage of customer bill by state:

- Washington: 3.7%
- Idaho: 2.1%
- Oregon: 3%

$8.5 Million Annual Funding (2017)
Figures exclude the negative impact to therm savings due to fuel conversions. 2014 & 2015 target variance due to commodity price decrease. Cost-effectiveness shift to UCT. 2015 large increase in actuals is due to multiple large non-res projects coming to completion. 2017 Actuals are Unverified.
ID Gas Targets to Actual Savings

- **Business Plan Target**
- **IRP Target**
- **Actual**

<table>
<thead>
<tr>
<th>Year</th>
<th>Business Plan Target</th>
<th>IRP Target</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>0</td>
<td>456,000</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>0</td>
<td>228,000</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>232,737</td>
<td>114,000</td>
<td>189,295</td>
</tr>
<tr>
<td>2017</td>
<td>219,272</td>
<td>197,640</td>
<td>245,747</td>
</tr>
<tr>
<td>2018</td>
<td>252,712</td>
<td>246,440</td>
<td></td>
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</tbody>
</table>

*Figures exclude the negative impact to therm savings due to fuel conversions.*

No Gas Programs in 2014 or 2015
2017 Actuals are Unverified
2018 Business Plan - DRAFT

![Image of bar chart with data points and annotations](image-url)
DSM Business Planning
Conservation Potential Assessment (CPA)

• Primary Objectives
  – Meet legislative and regulatory requirements
  – Support integrated resource planning
  – Identify opportunities for savings; key measures in target segments

• Key Deliverables
  – 20-year conservation potential
  – Individual measures
  – IRP target
Conservation Potential Assessment

<table>
<thead>
<tr>
<th>Technical Potential</th>
<th>Achievable Technical Potential</th>
<th>Achievable Potential</th>
</tr>
</thead>
</table>
| • Theoretical upper limit of conservation  
  • All efficiency measures are phased in regardless of cost | • Realistically achievable, accounting for adoption rates and how quickly programs can be implemented  
  • Does not consider cost-effectiveness of measures | • Includes economic screening of measures (cost effectiveness)  
  • Informs our IRP Target |
Business Planning Process

Conservation Potential Assessment → Business Planning

Business Planning → Annual Conservation Report

Annual Conservation Report → Adaptive Management

Adaptive Management → EM&V

EM&V → Annual Conservation Plan

Annual Conservation Plan → Conservation Potential Assessment
Business Planning Process

1. **CPA**
   - Sets overall Savings Goal
   - Identifies Measures

2. **Avista Programs**
   - Consult with our existing programs
   - Add new measures to existing programs

3. **Update and Evaluate**
   - Update existing savings values
   - Test for Cost-Effectiveness (UCT)

4. **Feedback and Modify**
   - DSM Program Managers
   - Engineers
   - Industry Trends
   - Other Parties

Energy Efficiency Advisory Group
Incentive Setting

Cost-Effective Test

Utility Cost Test (UCT) | Must have a UCT of 1.0 or Higher

Decide Incentive Level

$3 per Therm | 70% of CIC | UCT Impact | Portfolio Alignment
Significant Costs and Benefits

COSTS

• Administration
  (e.g., program design, development, operations, maintenance, overhead, customer service, marketing & outreach, sales, IT infrastructure, customer education, program evaluation, measurement & verification)

• Measure (Capital) Costs
  (equipment costs incurred by the utility and participants)

• Incentives

• Revenue Loss
  (bill reductions)

• Participant Costs
  (Other than capital costs – value of service lost & transaction costs)

BENEFITS

• Avoided Costs
  (complex)

• Tax Credits
  (currently available for DG only)

• Market/Reliability Benefits

• Non-energy benefits

• Incentives

• Bill reductions

From Cost-effectiveness training (3/6/15) Powerpoint
http://www.cpuc.ca.gov/General.aspx?id=5267
Questions?
2018 IRP Timeline

• **August 31, 2017** – Work Plan filed with WUTC

• **January through May 2018** – Technical Advisory Committee meetings. Meeting topics will include:
  – **TAC 1:** Thursday, January 25, 2018: TAC meeting expectations, review of 2016 IRP acknowledgement letters, customer forecast, and demand-side management (DSM) update.
  – **TAC 2:** Thursday, February 22, 2018: Weather analysis, environmental policies, market dynamics, price forecasts, cost of carbon.
  – **TAC 3:** Thursday, March 29, 2018: Distribution, supply-side resources overview, overview of the major interstate pipelines, RNG overview and future potential resources.
  – **TAC 4:** Thursday, May 10, 2018: DSM results, stochastic modeling and supply-side options, final portfolio results, and 2020 Action Items.

• **June 1, 2018** – Draft of IRP document to TAC

• **June 29, 2018** – Comments on draft due back to Avista

• **July 2018** – TAC final review meeting (if necessary)

• **August 31, 2018** – File finalized IRP document