# 2020 Electric Integrated Resource Plan
## Technical Advisory Committee Meeting No. 4 Agenda
### Tuesday, August 6, 2019
#### Conference Room 130

<table>
<thead>
<tr>
<th>Topic</th>
<th>Time</th>
<th>Staff</th>
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</thead>
<tbody>
<tr>
<td>Introductions and TAC 3 Recap</td>
<td>9:00</td>
<td>Lyons</td>
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<tr>
<td>Washington SB 5116 and IRP Updates</td>
<td>9:10</td>
<td>Lyons</td>
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<tr>
<td>Energy and Peak Load Forecast Update</td>
<td>9:30</td>
<td>Forsyth</td>
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<td>Natural Gas Price Forecast</td>
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<td>Pardee</td>
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<td>Lunch</td>
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<tr>
<td>Electric Price Forecast</td>
<td>1:00</td>
<td>Gall</td>
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<tr>
<td>Existing Resource Overview</td>
<td>2:00</td>
<td>Lyons</td>
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<tr>
<td>Final Resource Needs Assessment</td>
<td>3:00</td>
<td>Lyons</td>
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<td>Adjourn</td>
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2020 Electric IRP
TAC Meeting Introductions and Recap

John Lyons, Ph.D.
Fourth Technical Advisory Committee Meeting
August 6, 2019
Integrated Resource Planning

The Integrated Resource Plan (IRP):

• Required by Idaho and Washington every other year
• Guides resource strategy over the next twenty years
• Current and projected load & resource position
• Resource strategies under different future policies
  – Generation resource choices
  – Conservation / demand response
  – Transmission and distribution integration
  – Avoided costs
• Market and portfolio scenarios for uncertain future events and issues
Technical Advisory Committee

• The public process piece of the IRP – input on what to study, how to study, and review of assumptions and results

• Wide range of participants in all or some of the process

• Open forum while balancing need to get through all of the topics

• Welcome requests for studies or different assumptions.
  – Time or resources may limit the studies we can do
  – The earlier study requests are made, the more accommodating we can be
  – June 15, 2019 at the latest to be able to complete studies in time for publication

• Planning team is available by email or phone for questions or comments between the TAC meetings
TAC #3 Recap – April 16, 2019

- Introductions and TAC 2 Recap, Lyons
- Regional Legislative Update, Lyons
- IRP Transmission Planning Studies, Rolstad
- Distribution Planning Within the IRP, Fisher
- Conservation Potential Assessment, AEG
- Demand Response Potential Assessment, AEG
- Pullman Smart Grid Demonstration Project, Doege
- E3 Study – Resource Adequacy in the Pacific Northwest, Gall

Meeting minutes available on IRP web site at: https://www.myavista.com/about-us/our-company/integrated-resource-planning
Today’s Agenda

9:00 – Introductions and TAC 3 Recap, Lyons
9:10 – Washington SB 5116 and IRP Updates, Lyons
9:30 – Energy and Peak Load Forecast Update, Forsyth
11:00 – Natural Gas Price Forecast, Pardee
Noon – Lunch
1:00 – Electric Price Forecast, Gall
2:00 – Existing Resource Overview, Lyons
3:00 – Final Resource Needs Assessment, Lyons
4:00 – Adjourn
Future TAC Topics

• TAC 5: Tuesday, October 15, 2019
  – Ancillary services and intermittent generation analysis
  – Energy Imbalance Market analysis
  – Review Preliminary PRS
  – Market scenario results
  – Preliminary Portfolio scenario results

• TAC 6: Tuesday, November 19, 2019
  – Review of final PRS
  – Market scenario results (continued)
  – Final Portfolio scenario results
  – Carbon cost abatement supply curves
  – 2020 IRP Action Items
Washington SB 5116 and IRP Updates

John Lyons, Ph.D.
Fourth Technical Advisory Committee Meeting
August 6, 2019
Clean Energy Transformation Act (CETA)

- E2SSB 5116 Clean Energy Transformation Act (CETA)
- No coal serving Washington customers after 2025 or earlier
- Carbon neutrality beginning in 2030
  - 80% or greater clean energy requirement
  - Alternate compliance options for up to 20%
  - Penalties for non-compliance unless out of utility’s control or for reliability
  - Four-year compliance periods beginning with 2030-33
- 100% clean energy 2045
- 2% incremental cost cap
- Many areas of additional rule making are required and discussed later
Other CETA Provisions

- A utility extending service to new customers through condemnation must comply with the clean energy standard and Energy Independence Act (EIA)
- Utilities must assess and plan for obtaining enough funds to meet 60% of low-income energy assistance need by 2030 and 90% by 2050
- By January 1, 2022, the company must begin filing four-year clean energy implementation plans with the UTC
- Affirms the UTC authority to use alternative ratemaking mechanisms
- Clarifies the identification of used and useful property during a rate period for up to four years
- Allows deferred accounting for up to three years for major projects in a utilities clean energy action plan as part of its IRP
- Allows an imputed return on power purchase agreements of no less than the cost of debt and no more than the authorized rate of return
- Includes federal incremental hydroelectricity in the definition of an eligible renewable resource under the EIA
- Extends sales and use tax breaks for renewable resource until 2030 provided specific labor standards are met
CETA Rule Making

- WUTC opened Docket U-190485 for implementation of legislation passed in the 2019 legislative session
- Phase 0: July 1, 2019 to August 30, 2019
  - Initiate rulemaking processes
  - Docket U-190531: Inquiry into Valuation of Public Service Company Property Used and Useful after Rate Effective Date
  - Timeline finalized after public comment
  - Close IRP Rulemaking Docket No. U-161024, incorporate IRP procedural rules, RFP rules and Distributions System Planning in this docket
- Phase 1: August 2019 to January 1, 2021
  - Results due by January 1, 2021
- Phase 2: Beginning January 1, 2021
  - Results due on or before June 30, 2022
Phase 1

- Publication of social cost of carbon with inflation rate
- Issue policy statement for Valuation of Public Service Company Property Used and Useful after Rate Effective Date (U-190531)
- Start four rulemakings and one policy statement
- IRP Updates
  - IRP inputs, structure, public involvement process, outputs of Clean Energy Action Plans, social cost of carbon, equitable distribution of benefits, and assessment informed by cumulative impact analysis
- Used and useful standard policy statement
- EIA rulemaking
  - Equitable distribution, definitions of low-income and energy assistance need, low-income efficiency target, and updated hydro eligibility and tracking
- Clean Energy Implementation Plan (CEIP) rulemaking
  - Guidelines, equitable distribution of benefits, and incremental cost methodology
- Acquisition rulemaking
  - Existing RFP work, ensure new standard met for construction and acquisition of property and the provision of electric service, and resource adequacy
Phase 2 and Additional Projects

Start four rulemakings
1. Cumulative impact analysis
2. Carbon and electricity markets
3. Natural gas conservation
4. Natural gas IRP

Additional projects without statutory deadlines
• Interconnection standard
• Capital budgeting
• Distribution system planning
• Reliability and resiliency
• Demand response policy statement
• Pricing signals policy statement
• Pilot projects policy statement
• Rate making adequacy inquiry
Load and Economic Forecasts: Redux

Grant D. Forsyth, Ph.D.
Chief Economist
Fourth Technical Advisory Committee Meeting
August 6, 2019
Main Topic Areas

- Service Area Economy
- Peak Load Forecast
- Long-run Forecast

Painting: Jan Steen, 1640, Netherlands. As the Old Sing, Pipe the Young.
Service Area Economy

Grant D. Forsyth, Ph.D.
Chief Economist
Grant.Forsyth@avistacorp.com
Distribution of Employment: Services and Government are Dominant

WA-ID MSA Employment, 2018

- Private Services: 66%
- Private Goods: 14%
- Other: 18%
- Farm: 2%
- Local: 11% (61%)
- State: 4% (21%)
- Federal: 2% (9%)
- Military: 1% (8%)

Source: BLS, BEA and author’s calculations.
Non-Farm Employment Growth, 2009-2019

Source: BLS and author's calculations.
Non-Farm Employment: Finally Catching Up

Source: BLS and author's calculations.
Population Growth: Recovering with Employment Growth

Population Growth in Avista WA-ID MSAs

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Spokane+Kootenai+Nez Perce-Asotin, WA-ID MSA Pop. Growth</th>
<th>U.S. Pop. Growth</th>
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<td>1.9%</td>
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<tr>
<td>2018</td>
<td>1.8%</td>
<td>0.6%</td>
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Source: BEA, U.S. Census, and author's calculations.
Peak Load Forecast

Grant D. Forsyth, Ph.D.
Chief Economist
Grant.Forsyth@avistacorp.com
The Basic Model

- Monthly time-series regression model that initially excludes certain industrial loads.

- Based on monthly peak MW loads since 2004. The peak is pulled from hourly load data for each day for each month.

- Explanatory variables include HDD-CDD and monthly and day-of-week dummy variables. The level of real U.S. GDP is the primary economic driver in the model—the higher GDP, the higher peak loads. **Model was recently recalibrated to allow GDP impact to differ between winter and summer.** The historical impacts of DSM programs are “trended” into the forecast.

- The coefficients of the model are used to generate a distribution of peak loads by month based on historical max/min temperatures, holding GDP constant. An expected peak load can then be calculated for the current year (e.g., 2019). Model confirms Avista is a winter peaking utility for the forecast period; however, the summer peak is growing at a faster than the winter peak.

- The model is also used to calculate the long-run growth rate of peak loads for summer and winter using a forecast of GDP growth under the **“ceteris paribus”** assumption for weather and other factors.
GDP Growth Assumptions: 2019 IRP vs. 2017 IRP

Source: Various and author’s calculations.
Current Peak Load Forecasts for Winter and Summer, 2019-2045

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<tr>
<td>2045</td>
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Avg. Growth 2019-2045
- Winter: 0.34%
- Summer: 0.44%
Current and Past Peak Load Forecasts for Winter Peak, 2011-2043

Winter Peak Forecast: Current and Past

2009 IRP
2011 IRP
2013 IRP
2015 IRP
2017 IRP
2019 IRP
Current and Past Peak Load Forecasts for Summer Peak, 2011-2045
Long-Term Load Forecast

Grant D. Forsyth, Ph.D.
Chief Economist
Grant.Forsyth@avistacorp.com
Basic Forecast Approach

1. Monthly econometric model by schedule for each class.
2. Customer and UPC forecasts.
3. 20-year moving average for “normal weather.”
4. Economic drivers: GDP, industrial production, employment growth, population, price, natural gas penetration, and ARIMA error correction.
5. Native load (energy) forecast derived from retail load forecast.

1. Bootstrap off medium term forecast.
2. Apply long-run load growth relationships to develop simulation model for high/low scenarios.
3. Include different scenarios for renewable penetration with controls for price elasticity, EV/PHEVs, and natural gas penetration.
The Long-Term Residential Relationship, 2020-2040

Load = Customers X Use Per Customer (UPC)

Load Growth ≈ Customer Growth + UPC Growth

Assumed to be same as population growth, commercial growth will follow residential, and slow decline in industrial.

Assumed to be a function of multiple factors including renewable penetration, gas penetration, and EVs/PHEVs.
Residential Customer Growth, 2020-2045

Annual Residential Customer Growth Rates

Average annual growth rate from 2020-2045 = 0.78%. Shape of time-path mimics a combination of IHS (ID) and OFM (WA) population forecasts.
Residential Solar Penetration, 2008-2018

Customer Penetration vs. Customers Since 2008

Share of Residential Solar Customers to Total Residential Customers

Customers

Residents
Current penetration is 0.25% and typical size is 7,800 watts. By 2045, penetration will be near 2.2% of residential customers and average size of installed systems will be 10,000+ watts.

Penetration was near 0.5% of residential customers and average size of installed systems was 6,000 watts.
## Residential EVs/PHEVs, 2020-2045

### Projected Residential EVs/PHEVs

<table>
<thead>
<tr>
<th>Forecast</th>
<th>By 2045</th>
<th>Prob.</th>
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<tr>
<td>Low</td>
<td>45,000</td>
<td>50%</td>
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<td>Middle</td>
<td>100,000</td>
<td>30%</td>
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<tr>
<td>High</td>
<td>250,000</td>
<td>20%</td>
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**Weighted Average 103,000**

- **Current ≈ 800**

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**2017 IRP Projected EV/PHEV**

**2019 IRP Projected EV/PHEV**
Residential EVs/PHEVs by Household Income

Source: EIA, Today in Energy, May 2018. Regional data from U.S. Census
Estimated EV/PHEV Gasoline CO2 Reduction in Metric Tons

Estimated with DOE data. Assumes 5.18 metric tons of CO2 per gasoline vehicle.

Savings = Number of EV/PHEV x 5.18
Native Load Forecast, 2020-2045

Native Load Forecast (no CWTR), Average Megawatts

2019 IRP Native Load Base-Line, No CWTR
2017 IRP Base-Line Native Load, No CWTR
2015 IRP Base-Line Native Load, No CWTR
Net Solar and EV/PHEV Impact, 2020-2045

aMW Impact of Solar and EV/PHEV

Medium Term

Long Term

2019 IRP Solar aMW (Load Reduction)
2019 IRP EV/PHEV aMW (Load Addition)
2019 Net IRP Solar and EV/PHEV Impacts aMW
Native Load Growth Forecast, 2020-2045

Native Load Growth

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<th>Year</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
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<tr>
<td>Avg. Annual Growth</td>
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2019 IRP Base-Line Native Load Growth

2017 IRP Base-Line Native Load Growth

EV/PHEV “Bend”
Long-Term Load Forecast: Conservation Adjustment

Grant D. Forsyth, Ph.D.
Chief Economist
Grant.Forsyth@avistacorp.com
Monthly Conservation as a Share of Total Actual Retail Load: Navigant Estimates

\[
\text{Ratio of Conservation to KWH Load} = \frac{\text{Estimated Conservation Month } t, \text{Year } y}{\text{Actual KWH Load Month } t, \text{Year } Y}
\]
Median Monthly Conservation as a Share of Total Actual Retail Load: Navigant Estimates

**Median Ratio Month** \( t = \text{Median} \left( \frac{\text{Estimated Conservation Month} \ t}{\text{Actual KWH Load Month} \ t} \right) \), excluding 2001
Comparison of Native Load Forecasts, 2020-2045

aMW Load Comparison with Conservation

- **Base-Line Native Load**
- **Base-Line Native Load with Conservation Added Back**

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<tr>
<th>Year</th>
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<th>Base-Line Native Load with Conservation Added Back</th>
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Agenda

• Market Dynamics
• Pipeline Transportation
• Renewable Natural Gas (RNG)
Avista Natural Gas Service Areas, Gas Fields, Trading Hubs and Major Pipelines

KEY
- Avista Service Territory
- Williams Northwest Pipeline
- Spectra Energy
- TransCanada — GTN
- TransCanada — BC (Foothills)
- TransCanada — Alberta
- Jackson Prairie Storage Project
- Trading Hubs

as of 3/31/2015
Canada
Canada Natural Gas Production

British Columbia 0.5 Bcf per day
Alberta 15 Bcf per day
300 Years of resources at current levels
AECO cash vs. forwards
Canadian Natural Gas Storage

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<td>674</td>
<td>733</td>
<td>798</td>
<td>826</td>
<td>792</td>
<td>695</td>
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<tr>
<td>2016</td>
<td>635</td>
<td>583</td>
<td>589</td>
<td>601</td>
<td>664</td>
<td>712</td>
<td>740</td>
<td>776</td>
<td>818</td>
<td>815</td>
<td>807</td>
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<td>2015</td>
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<td>664</td>
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<td>768</td>
<td>765</td>
<td>732</td>
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<tr>
<td>2014</td>
<td>425</td>
<td>286</td>
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<td>253</td>
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<td>401</td>
<td>495</td>
<td>586</td>
<td>662</td>
<td>717</td>
<td>668</td>
<td>610</td>
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<tr>
<td>2013</td>
<td>615</td>
<td>519</td>
<td>453</td>
<td>448</td>
<td>521</td>
<td>585</td>
<td>659</td>
<td>732</td>
<td>791</td>
<td>830</td>
<td>766</td>
<td>599</td>
</tr>
<tr>
<td>2012</td>
<td>658</td>
<td>596</td>
<td>594</td>
<td>607</td>
<td>668</td>
<td>708</td>
<td>729</td>
<td>769</td>
<td>812</td>
<td>819</td>
<td>793</td>
<td>725</td>
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<tr>
<td>5-yr/ans max.</td>
<td>635</td>
<td>583</td>
<td>589</td>
<td>601</td>
<td>664</td>
<td>712</td>
<td>740</td>
<td>776</td>
<td>818</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-yr/ans min.</td>
<td>425</td>
<td>286</td>
<td>218</td>
<td>253</td>
<td>322</td>
<td>401</td>
<td>495</td>
<td>586</td>
<td>662</td>
<td>717</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: CGA
LNG Canada

Daily liquefaction:
3.5 Bcf Or
1,025,749 MWh

LNG used to displace coal in China would reduce CO₂ emissions by 60 to 90 million tonnes/year. This is equivalent to...

- Removing up to 80% of all the cars on the road in Canada
- 100% of the CO₂ produced by BC every year, which is 10% of the CO₂ produced by Canada every year
- Shutting down 20 to 40 coal-fired power plants

Source: https://www.lngcanada.ca/about-lng-canada/
US
US Natural Gas Production

Map of U.S. interstate and intrastate natural gas pipelines

Source: EIA
80 Years of resources at current levels
Henry Hub cash vs. forwards
# US Natural Gas Storage

## Stocks

<table>
<thead>
<tr>
<th>Region</th>
<th>07/26/19</th>
<th>07/19/19</th>
<th>net change</th>
<th>implied flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>East</td>
<td>597</td>
<td>575</td>
<td>22</td>
<td>22</td>
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<tr>
<td>Midwest</td>
<td>677</td>
<td>650</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Mountain</td>
<td>156</td>
<td>151</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Pacific</td>
<td>270</td>
<td>271</td>
<td>-1</td>
<td>-1</td>
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<tr>
<td>South Central</td>
<td>934</td>
<td>921</td>
<td>13</td>
<td>13</td>
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<tr>
<td>Salt</td>
<td>226</td>
<td>229</td>
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<tr>
<td>Nonsalt</td>
<td>708</td>
<td>692</td>
<td>16</td>
<td>16</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>2,634</strong></td>
<td><strong>2,569</strong></td>
<td><strong>65</strong></td>
<td><strong>65</strong></td>
</tr>
</tbody>
</table>

## Historical Comparisons

<table>
<thead>
<tr>
<th></th>
<th>Year ago (07/26/18)</th>
<th>5-year average (2014-18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bcf</td>
<td>% change</td>
</tr>
<tr>
<td>East</td>
<td>548</td>
<td>8.9</td>
</tr>
<tr>
<td>Midwest</td>
<td>548</td>
<td>23.5</td>
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<tr>
<td>Mountain</td>
<td>146</td>
<td>6.8</td>
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<tr>
<td>Pacific</td>
<td>250</td>
<td>8.0</td>
</tr>
<tr>
<td>South Central</td>
<td>809</td>
<td>15.5</td>
</tr>
<tr>
<td>Salt</td>
<td>207</td>
<td>9.2</td>
</tr>
<tr>
<td>Nonsalt</td>
<td>602</td>
<td>17.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,300</strong></td>
<td><strong>14.5</strong></td>
</tr>
</tbody>
</table>
U.S. net exports of natural gas continue to grow in the Reference case—

Natural gas trade (Reference case)
trillion cubic feet

Source: EIA AEO 2019
2020 IRP Henry Hub Natural Gas Price Forecast: 2021-2040: $3.99 per Dth
Pipeline Transportation
Fugitive Emissions

• Unintended emissions from facilities or activities (e.g., construction) that "could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening."

Fugitive emissions estimated at 0.783%

*This figure includes all emissions from production, transport & lost and unaccounted for gas

Source – NEB for Canadian infrastructure and EIA for US infrastructure
GTN & NWP Fully Subscribed

• Contractually both pipelines are now fully subscribed.
• Canadian producers signed up for new contracts in order to get natural gas out of Canada and into more lucrative markets.
Avista Transport for Electric Generation
Current Transport & Gas Generation

- **Lancaster**: 49,000 DTh/Day
- **Rathdrum**: 43,600 DTh/Day
- **Boulder**: 5,400 DTh/Day

- **Total**: 151,550 DTh/Day

- **Firm Rights**: 60,592 DTh/Day
- **Shortfall**: 90,958 DTh/Day

* Based on the non-coincidental winter peak-day

**Pipeline Capacity**
- **26,388 DTh/Day**
- **Malin**

**Coyote Springs**
- **53,550 DTh/Day**
- **Stanfield**

**AECO**

**21**
Renewable Natural Gas (RNG)
RNG Process Overview

Source: Promoting RNG in WA State

*Released December 1, 2018
## Renewable Natural Gas Comparison to Non-Renewable Natural Gas Reserves

<table>
<thead>
<tr>
<th>WA RNG Potential</th>
<th>Bcf</th>
<th>dth</th>
<th>dth/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>3.9</td>
<td>4,002,400</td>
<td>10,965</td>
</tr>
<tr>
<td>Near-Term</td>
<td>5.2</td>
<td>5,395,010</td>
<td>14,781</td>
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<tr>
<td>Mid-Term</td>
<td>5.6</td>
<td>5,729,010</td>
<td>15,696</td>
</tr>
<tr>
<td>Total</td>
<td>14.7</td>
<td>15,126,420</td>
<td>41,442</td>
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</tbody>
</table>

### Avista Natural Gas Consumption

<table>
<thead>
<tr>
<th>Description</th>
<th>Bcf</th>
<th>dth</th>
<th>dth/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avista Power Load 2018</td>
<td>23.4</td>
<td>24,114,712</td>
<td>66,068</td>
</tr>
<tr>
<td>Avista LDC Load 2018</td>
<td>33.4</td>
<td>34,456,500</td>
<td>94,401</td>
</tr>
<tr>
<td>Total Avista Consumption</td>
<td></td>
<td>58,571,212</td>
<td>160,469</td>
</tr>
</tbody>
</table>

### Gas Consumption of CS2

- **Gas Consumption of CS2**: 50,000

### North American Gas Reserves

<table>
<thead>
<tr>
<th>Description</th>
<th>Bcf</th>
<th>dth</th>
<th>dth/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Gas Reserves (300 years)</td>
<td>1,828,891</td>
<td>1,885,586,517,900</td>
<td></td>
</tr>
<tr>
<td>U.S. Gas Reserves (80 years)</td>
<td>2,459,000</td>
<td>2,535,229,000,000</td>
<td></td>
</tr>
<tr>
<td>Total NA Gas Reserves</td>
<td>4,287,891</td>
<td>4,420,815,517,900</td>
<td></td>
</tr>
</tbody>
</table>

### WA RNG Potential Share of NA Gas Reserves

- **WA RNG Potential Share of NA Gas Reserves**: 0.0003%
## NREL Estimates – Idaho RNG

Total Potential Annual Production = 32 Bcf

<table>
<thead>
<tr>
<th>Source – Anaerobic</th>
<th>MMBtu per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfills</td>
<td>3,712,221</td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>6,196,531</td>
</tr>
<tr>
<td>Agriculture Manure</td>
<td>20,220,571</td>
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<tr>
<td>Source-Separated Organics (Solid Waste)</td>
<td>2,311,354</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32,440,676</strong></td>
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</table>

*National Renewable Energy Laboratory, NREL Biofuels Atlas*
## RNG $ per Dth/MMBtu

<table>
<thead>
<tr>
<th>Avista Owned and Operated</th>
<th>ID - WA 2035 Premium Estimate ($ / Dth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RNG - Landfills</td>
<td>$7 - $10</td>
</tr>
<tr>
<td>RNG - Waste Water Treatment Plants (WWTP)</td>
<td>$12 - $22</td>
</tr>
<tr>
<td>RNG - Agriculture Manure</td>
<td>$28 - $53</td>
</tr>
<tr>
<td>RNG - Food Waste</td>
<td>$29 - $53</td>
</tr>
</tbody>
</table>

Source: Promoting RNG in WA State
2020 IRP Electric Market Price Forecast

James Gall, IRP Manager
Fourth Technical Advisory Committee Meeting
August 6, 2019
Our Region

Source: NERC
### US Western Interconnect Generation

<table>
<thead>
<tr>
<th>Year</th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Nuclear</th>
<th>Other Gases</th>
<th>Geothermal</th>
<th>Hydro</th>
<th>Wind</th>
<th>Solar</th>
<th>Other</th>
<th>Petroleum</th>
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<td>2016</td>
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</tr>
</tbody>
</table>

Source: EIA Data
Mid-Columbia Flat Firm Price Index History

$ per MWh


$0 $20 $40 $60 $80 $100 $120 $140

Energy Crisis

Energy Crisis

Natural Gas Market Tightens

Cheap Natural Gas, good hydro

Shale Development

Forwards as of July 29, 2019
2018 Fuel Mix Comparison (NW vs West)

US Western Interconnect
- Hydro: 24%
- Natural Gas: 30%
- Coal: 21%
- Nuclear: 8%
- Wind: 7%
- Solar: 6%
- Other: 4%
- Petroleum: 0%

Northwest Four States
- Hydro: 62%
- Petroleum: 0%
- Wind: 8%
- Solar: 1%
- Coal: 9%
- Other: 2%
- Nuclear: 4%
- Natural Gas: 14%

Source: EIA Data
Natural Gas vs. On-Peak Electric Prices (2003-19)

\[ y = 6.8131x + 9.9432 \]
\[ R^2 = 0.8886 \]
Market Indicators

Spark Spread

Implied Market Heat Rate

Daily Price Standard Deviation
Western Greenhouse Gas Emissions Power Industry

Source: EPA
Adjusted for plants in the Western Interconnect system

1980: 185 MMT
1990: 227 MMT
2008: 307 MMT
2017: 228 MMT
Northwest Greenhouse Gas Emissions

Million Metric Tons

- 1980
- 1982
- 1984
- 1986
- 1988
- 1990
- 1992
- 1994
- 1996
- 1998
- 2000
- 2002
- 2004
- 2006
- 2008
- 2010
- 2012
- 2014
- 2016

MT  WA  OR  ID

- 0
- 5
- 10
- 15
- 20
- 25
- 30
- 35
- 40
- 45
Electric Market Modeling

- 3rd party software- Aurora by Energy Exemplar
- Electric market fundamentals- production cost model
- Simulates generation dispatch to meet load
- Outputs:
  - Market prices (electric & emission)
  - Regional energy mix
  - Transmission usage
  - Greenhouse gas emissions
  - Power plant margins, generation levels, fuel costs
  - Avista’s variable power supply costs
Stochastic Approach

- Simulate Western Electric market hourly for next 25 years (2021-45)
  - That is 175,248 hours for each study
- Model 500 potential outcomes
  - Variables include fuel prices, loads, wind, hydro, outages, and inflation
  - Simulating 87.6 million hours
- Run time is about 14+ days on 20 processors
- Why do we do this?
  - Allows for complete financial evaluation of resource alternatives
  - Without stochastic prices we cannot account for tail risk
Modeled Western Interconnect Topology
How Aurora derives hourly prices

Note: minimum price is negative $25/ MWh (2018$)
Approach to New Resource Selection

- **Baseline**
  - 3rd party consultant new resource outlook
  - known retirements

- **Policy Constraints**
  - California, BC, and Alberta include CO$_2$ price adder
  - OR: Emissions Cap (3.6 million tons)
  - WA: CETA: resources & social cost of carbon
  - ID: Clean Power Plan Emission’s Intensity (delayed)
  - No new coal-fired generation
  - Uses existing state Renewable Portfolio Standards

- **Resource Adequacy**
  - Achieve close to 1-in-20 loss of load probability (LOLP/LOLE)
New Resources Forecast - US West

Natural Gas: 49 GW
Wind: 50 GW
Solar: 110 GW
Storage: 24 GW
Customer: 15 GW
Other: 4 GW

Note 1: 2019-2021 additions are spread evenly between the 3 years, these are all added in 2021 for modeling purposes

Note 2: Storage is assumed to be a blend of technologies, average of 3 hours duration in 2021, ramping to 6 hours average duration by 2045
New Resources Forecast - Northwest States

- Natural Gas: 5 GW
- Wind: 13 GW
- Solar: 27 GW
- Storage: 3 GW
- Customer: 0.5 GW
- Other: 2 GW

Note 1: 2019-2021 additions are spread evenly between the 3 years, these are all added in 2021 for modeling purposes

Note 2: Storage is assumed to be a blend of technologies, average of 3 hours duration in 2021, ramping to 6 hours average duration by 2045
Resource Type Mix Forecast
(US Western Interconnect)

Average Megawatts

- Other
- Hydro
- Nuclear
- Coal
- Wind
- Solar
- Natural Gas

Fuel Type | 2045 minus 2018 aGW |
--- | --- |
Natural Gas | -14.7 |
Hydro | +1.4 |
Solar | +28.7 |
Wind | +14.9 |
Other | +0.9 |
Coal | -13.2 |
Nuclear | -4.1 |
Resource Type Mix Forecast (NW States)

Note: Hydro change is due to actual hydro vs. average hydro
Stanfield Natural Gas Price Forecast

20-year levelized price: $3.98/Dth
25-year levelized price: $4.66/Dth

Note: Coefficient of variation (stdev/mean) in 2021 is 13%, in 2040, the volatility increases to 32%
Mid-Columbia Electric Price Forecast (Deterministic)

Levelized Prices

<table>
<thead>
<tr>
<th></th>
<th>20 year</th>
<th>25 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat</td>
<td>$25.03/MWh</td>
<td>$26.06/MWh</td>
</tr>
<tr>
<td>On Peak</td>
<td>$25.07/MWh</td>
<td>$25.92/MWh</td>
</tr>
<tr>
<td>Off Peak</td>
<td>$24.99/MWh</td>
<td>$26.25/MWh</td>
</tr>
</tbody>
</table>
Mid-Columbia Electric Price Forecast
(Stochastic Flat Price Statistics)

20yr Levelized: $26.39 per MWh, 25 yr Levelized: $27.79 per MWh

Note: Coefficient of variation (stdev/mean) in 2021 is 28%, in 2040, the volatility increases to 42%
Historical IRP Price Forecasts (Annual Flat Prices)

Note: * Represents IRP forecast expected cases without carbon “taxes” in plant dispatch
Hourly Price Shape

2025 Mid Columbia Average Prices - Avg: $22.83

$ per MWh

Hour
Hourly Price Shape

2030 Mid Columbia Average Prices- Avg: $25.17

$ per MWh

Hour

2030 Mid Columbia Average Prices- Avg: $25.17

$ per MWh

Hour
Hourly Price Shape

2035 Mid Columbia Average Prices- Avg: $31.44

$ per MWh

Hour
Hourly Price Shape

2040 Mid Columbia Average Prices- Avg: $33.70

$ per MWh

1 2 3 4 5 6 7 8 9 10 11 12 Hour

Jan — Feb — Mar
Apr — May — Jun
Jul — Aug — Sep
Oct — Nov — Dec

Hourly Price Shape
Hourly Price Shape

2045 Mid Columbia Average Prices- Avg: $40.00

$ per MWh

Hour

$0 $50 $100 $150 $200 $250 $300 $350

1 2 3 4 5 6 7 8 9 10 11 12

Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec

DRAFT
Renewable Curtailments

2030: 0% to 5% curtailment
2045: 14% to 17% curtailment
2030: 4% to 9% curtailment
2045: 10% to 32% curtailment

Note: Both wind and solar use a -$8.00/MWh + inflation variable charge + PTC if available
Greenhouse Gas Emissions Forecast
(US Western Interconnect Total)
Greenhouse Gas Emissions Forecast
(Northwest- WA, OR, ID, MT)
Regional Resource Adequacy

Resource adequacy results are not detailed enough to judge regional resource adequacy and are used for price forecasting only.
Electric Price Forecast Scenarios

• Social Cost of Carbon in Dispatch
• No CETA resource build
• Low Natural Gas Prices
• High Natural Gas Prices
Social Cost of Carbon Price Forecast

Note: Inflation from 2007 uses CPI between 2007 and 2018, then 2% per year
Scenario Price Forecast Results

- Expected Case - Deterministic
- Scenario: No CETA
- Scenario: SCC
- Scenario: Low NG Prices
- Scenario: High NG Prices

$ per MWh

Years: 2021 to 2045
Scenario Levelized Prices

$ per MWh

<table>
<thead>
<tr>
<th>Scenario</th>
<th>20 yr</th>
<th>25 yr</th>
</tr>
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<tbody>
<tr>
<td>Expected Case-Deterministic</td>
<td>$26.06</td>
<td>$28.74</td>
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<tr>
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<td>$27.32</td>
<td>$30.12</td>
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<tr>
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<td>$45.71</td>
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<tr>
<td>Scenario: Low NG Prices</td>
<td>$18.27</td>
<td>$20.15</td>
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<td>Scenario: High NG Prices</td>
<td>$36.10</td>
<td>$39.81</td>
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</table>
US Western Interconnect
Generation Mix Forecast by Scenario (2040)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Natural Gas</th>
<th>Solar</th>
<th>Wind</th>
<th>Nuclear</th>
<th>Coal</th>
<th>Hydro</th>
<th>Other</th>
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</thead>
<tbody>
<tr>
<td>Deterministic</td>
<td>13.0</td>
<td>28.9</td>
<td>16.7</td>
<td>4.2</td>
<td>5.9</td>
<td>21.7</td>
<td>4.4</td>
</tr>
<tr>
<td>No CETA</td>
<td>13.5</td>
<td>28.1</td>
<td>16.7</td>
<td>4.2</td>
<td>6.0</td>
<td>21.7</td>
<td>4.4</td>
</tr>
<tr>
<td>SCC</td>
<td>7.7</td>
<td>27.9</td>
<td>28.3</td>
<td>4.0</td>
<td>1.6</td>
<td>21.7</td>
<td>3.4</td>
</tr>
<tr>
<td>Low NG Prices</td>
<td>13.9</td>
<td>28.8</td>
<td>16.6</td>
<td>4.2</td>
<td>5.2</td>
<td>21.7</td>
<td>4.4</td>
</tr>
<tr>
<td>High NG Prices</td>
<td>12.9</td>
<td>28.9</td>
<td>16.7</td>
<td>4.2</td>
<td>6.1</td>
<td>21.7</td>
<td>4.3</td>
</tr>
</tbody>
</table>
GHG Emission Forecast

US Western Interconnect

Northwest

- Expected Case - Deterministic
- Scenario: No CETA
- Scenario: SCC
- Scenario: Low NG Prices
- Scenario: High NG Prices
Colstrip Dispatch

- Expected Case
- Scenario: SCC
- Scenario: No CETA
- Scenario: Low NG Prices
- Scenario: High NG Prices

Capacity Factor

- 2021
- 2022
- 2023
- 2024
- 2025
Existing Thermal Resource Overview

Darrell Soyars, Manager of Corporate Environmental Compliance
John Lyons, Ph.D.
Fourth Technical Advisory Committee Meeting
August 6, 2019
Purpose

• Review major environmental regulatory programs that may impact current and future operations
• This is not intended to be a discussion or debate about past practices or current approach to achieve compliance with these programs
• Questions are welcome within the scope of this presentation
Colstrip Environmental Considerations
## Colstrip Ownership Information

### Colstrip Basic Data

<table>
<thead>
<tr>
<th>Colstrip Unit #</th>
<th>Size (MW)</th>
<th>Year Online</th>
<th>Avista</th>
<th>NorthWestern Energy, LLC</th>
<th>PacifiCorp</th>
<th>Portland General Electric</th>
<th>Talen Energy, LLC</th>
<th>Puget Sound Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit #1</td>
<td>333</td>
<td>1975</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Unit #2</td>
<td>333</td>
<td>1976</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Unit #3</td>
<td>805</td>
<td>1984</td>
<td>15%</td>
<td>0%</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
<td>25%</td>
</tr>
<tr>
<td>Unit #4</td>
<td>805</td>
<td>1986</td>
<td>15%</td>
<td>30%</td>
<td>10%</td>
<td>20%</td>
<td>0%</td>
<td>25%</td>
</tr>
<tr>
<td>Total</td>
<td>2,094</td>
<td></td>
<td>11%</td>
<td>11%</td>
<td>7%</td>
<td>14%</td>
<td>25%</td>
<td>32%</td>
</tr>
</tbody>
</table>

### Colstrip Ownership Percentages

- Generating Units 1 and 2: 333 MW each scheduled to shut down end of 2019, required to shut down by July 2022
- Generating Units 3 and 4: 805 MW each
  - Assumed to operate until 2040, depreciation varies by owner
  - Will not be serving Washington loads after 2025
Air Quality – Montana Mercury Rule

- Program established 2010, mercury site-wide annual average below 0.9 lb/Tbtu
- Colstrip installed mercury oxidizer/sorbent injection system in 2010
- MDEQ recently concurred with our pollution equipment technology review
- Units 3 & 4 operate in the 0.8 lb/Tbtu range
- No major changes expected
Mercury Air Toxics (MATS) Rule:
- Program established 2016
- Particulate Matter (PM) used as a surrogate for air toxics
- PM site-wide 30-day rolling average below 0.030 lb/MMBtu
- PM and mercury are controlled by existing wet scrubbing equipment with injection
- Units 3 & 4 typically operate in the 0.024 lb/MMBtu range
- Both units exceeded permit limitations during second quarter testing in June 2018
- Root cause analysis led to corrective actions; re-achieved compliance in September 2018
- Expect MDEQ penalty for emissions exceedances
- No major changes expected
Air Quality – Regional Haze Rule

- Program established 1999, Improve visibility in Class 1 areas
- Federal plan for Montana was vacated by courts in 2015
- NOx is controlled by LoNOx burners, Overfire air and Smartburn
- MDEQ issued progress plan in 2017, now ready to take leadership of program
- Request for Colstrip analysis due in late 2019 for next planning period
- Regional unit shutdowns would indicate that emissions are below glide path
- No changes or additional pollution controls expected
Air Quality

• Affordable Clean Energy (ACE) Rule
  – Program established 9/16/19, replacement for Clean Power Plan (CPP)
    • Reduce CO₂ emissions by Heat Rate Improvements (HRI)
    • MDEQ will determine future limitations based on evaluation of HRI technologies
    • Cost and remaining useful life consideration
    • MDEQ must submit plan by July 2022, unit compliance by 2024
    • Impacts are unknown at this time
Water Use

• Raw water is withdrawn from the Yellowstone River to Castle Rock Lake (a.k.a., the Surge Pond) via a 29-mile long pipeline.
• From the Surge Pond, water is piped to holding tanks at the Plant Site for use in boilers, cooling towers and scrubber systems.
• Fly ash from the scrubber system is transported to paste plants which remove excess water and deposit paste in disposal cells.
• Bottom ash is transported to holding ponds, dewatered, and then transported to disposal cells for evaporation.
• Clearwater from paste plants and dewatering is recirculated for reuse.
• All water is reused or lost through evaporation - Zero discharge facility.
Three Storage Areas

- The **Plant Site** contains Generating Units 1 through 4 and several associated ponds (Avista share)

- The **Units 3 & 4 EHP** contains several ponds for the disposal of fly ash scrubber slurry/paste from Generating Units 3 and 4, and bottom ash from Generating Units 1 through 4, and is located approximately 2.5 miles southeast of the Plant Site. (Avista share)

- The **Units 1 & 2 SOEP/STEP** contains several ponds for the disposal of fly ash scrubber slurry/paste from Generating Units 1 and 2, and is located approximately 2 miles northwest of the Plant Site. (No Avista share)
Management Drivers

• Regulatory programs
  – The Site Certificate originally issued including the amended 12(d) stipulation under the Major Facility Siting Act in Montana, Nov. 1975.
  – Administrative Order on Consent (AOC) Regarding Impacts Related to Wastewater Facilities, MDEQ (July 2012), Settlement agreement entered (2016).

• Operational facility
  – Units 1 and 2 announced early shutdown at the end of 2019.
  – Units 3 and 4 must maintain on-going operations
  – Convert to dry ash storage by the end of 2022.
Strategic Water Planning

• Master Plan originally developed in November 2015, Executive Summary (Sept. 2016) is available on MDEQ-AOC website:
  • http://deq.mt.gov/DEQAdmin/mfs/ColstripSteamElectricStation
• AOC public process will select actions to be performed and requires Financial Assurance (FA) of approved plan amounts.
• AOC Process>Site Characterization>Cleanup Criteria and Risk Assessment>Remedy Evaluation>Implement the selected remediation
• CCR Requirements tracking:
  • https://www.talenenergy.com/generation/fossil-fuels/ccr-colstrip
Plant Site Ponds
Colstrip Units 3 & 4 Evaporative Ponds
Major Water Activities

• Must remove Boron, Chloride and Sulfate in groundwater
• Achieve source control
  – Close existing ash storage ponds
  – Build water treatment system
  – Dry ash storage
• Install and operate groundwater treatment system
• Achieve clean-up criteria
• Must take place regardless of plant operation
Avista’s Financial Assurance Share

• Plant Site area
  – Remedy Plan – $5,841,000 posted 12/21/18
  – Closure Plan – $383,713 posted 2/1/19

• Units 3 & 4
  – Remedy Plan – currently under review, expected late 2019
  – Closure Plan – $6,793,050 posted 2/1/19

• Annual bond reconciliation required
Colstrip Fuel Contract

• Coal supplier has emerged from bankruptcy and agreed to honor the current contract, which ends 12/31/19
• New contract is being negotiated and results will be used to model Colstrip in this IRP
Modeled Colstrip Costs

<table>
<thead>
<tr>
<th></th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>2029</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed O&amp;M</td>
<td>10.3</td>
<td>9.4</td>
<td>9.7</td>
<td>10.1</td>
<td>11.2</td>
<td></td>
<td></td>
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<tr>
<td>Coal Combustion Residuals O&amp;M</td>
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<td>0.6</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
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<td>0.9</td>
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<tr>
<td>Existing Capital Revenue Requirement – WA</td>
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<td>11.3</td>
<td>10.5</td>
<td>9.8</td>
<td>9.1</td>
<td>0.4</td>
<td></td>
<td></td>
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<td>Existing Capital Revenue Requirement – ID</td>
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<td>5.1</td>
<td>4.8</td>
<td>4.5</td>
<td>4.2</td>
<td>3.9</td>
<td>0.2</td>
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<tr>
<td>Traditional Capital Spending (Expensed)</td>
<td>9.4</td>
<td>3.2</td>
<td>4.2</td>
<td>9.5</td>
<td>6.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Asset Retirement Obligation Capital Revenue Requirement</td>
<td>1.7</td>
<td>1.7</td>
<td>1.6</td>
<td>1.6</td>
<td>1.5</td>
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<td>1.4</td>
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<td>1.3</td>
<td>1.3</td>
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<td>Coal Combustion Residuals Master Plan Capital Revenue Requirement</td>
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<td>0.9</td>
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<tr>
<td>Total</td>
<td>40.3</td>
<td>32.3</td>
<td>32.9</td>
<td>37.8</td>
<td>34.7</td>
<td>8.0</td>
<td>7.2</td>
<td>3.5</td>
<td>3.1</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Table does not include fuel and variable O&M costs

Coal Combustion Residuals O&M and Master Plan Capital Revenue Requirement, and Asset Retirement Obligation Capital Revenue Requirement continue through 2045
Lancaster Power Purchase Agreement

- Current PPA ends in October 2026
- Directly connect to either AVA or BPA transmission system
- Avista controls firm GTN transportation rights
- This IRP will evaluate an extension of this contract
Thermal Plant Book Value and Remaining Depreciation

<table>
<thead>
<tr>
<th>Thermal Plant</th>
<th>Book Value (millions)</th>
<th>Remaining Life (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boulder Park</td>
<td>$ 17.4</td>
<td>20</td>
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<tr>
<td>Colstrip Units 3 and 4</td>
<td>$ 121.4</td>
<td>See Note</td>
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<tr>
<td>Coyote Springs 2</td>
<td>$ 124.8</td>
<td>21</td>
</tr>
<tr>
<td>Kettle Falls CT</td>
<td>$ 3.7</td>
<td>24</td>
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<tr>
<td>Northeast</td>
<td>$ 0.6</td>
<td>&lt;2</td>
</tr>
<tr>
<td>Rathdrum</td>
<td>$ 36.5</td>
<td>14</td>
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</table>

- This table includes land, total generation and transmission/interconnection.
- Remaining life is for the generation, transmission may differ.
- Numbers are from the end of 2018 and may change as pieces depreciate or new capital is added.
- Colstrip modeling will use a 2025 for Washington and 2027 for Idaho.
2020 Electric IRP
Final Resource Need Assessment

John Lyons, Ph.D.
Fourth Technical Advisory Committee Meeting
August 6, 2019
Agenda

• 2020 IRP Load & Resource Balance
• Avista’s Clean Energy Goals
• Energy Independence Act Renewable Requirement Forecast
• Clean Energy Transformation Act Forecast
Load & Resource Methodology Review

- Sum resource capabilities against loads
- Resource plans are subject to 5% LOLP analysis – determines planning margins
- Capacity
  - Planning Margin (14% Winter, 7% Summer)
  - Operating Reserves and Regulation (~8%)
  - Reduced by planned outages for maintenance
  - Plant to largest deficit months between 1- and 18-hour analyses
- Energy
  - Reduced by planned and forced outages
  - Maximum potential thermal generation over the year
  - 80-year hydro average, adjusted down to 10th percentile
One Hour Peak Load & Resource Position

[Bar chart showing the peak load and resource position for January and August from 2020 to 2045, with megawatts on the y-axis and years on the x-axis.]
18-Hour Sustained Peak L&R

Megawatts

January
August
Load Variability (Temperature Variation)

<table>
<thead>
<tr>
<th></th>
<th>Winter</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>90th Percentile</td>
<td>1,881</td>
<td>1,710</td>
</tr>
<tr>
<td>Mean</td>
<td>1,718</td>
<td>1,627</td>
</tr>
<tr>
<td>10th Percentile</td>
<td>1,565</td>
<td>1,542</td>
</tr>
<tr>
<td>90th - Mean</td>
<td>163</td>
<td>83</td>
</tr>
</tbody>
</table>

Winter Plan: 10 Degrees

Summer Plan: 80 Degrees

241 MW Planning Margin @ 14%

114 MW Planning Margin @ 7%
Energy Load & Resource Position

Megawatts

- January
- August
- Annual

2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045

(500) (400) (300) (200) (100) 0 100 200 300 400

January
August
Annual
Avista’s Clean Energy Goal

**Goals**
- 2027 – 100% carbon-neutral
- 2045 – 100% clean electricity

**How we will get there**
- It’s not just about generation – various solutions are necessary
- Maintain focus on reliability and affordability
- Natural gas plays an important part of a clean energy future
- Cost effective technologies need to emerge and mature
Avista Corporate Clean Energy Goals

![Bar chart showing dispatched average megawatts from 2021 to 2045. The chart includes categories for Hydro, Wind, PURPA, Solar, and Wood. The system retail sales (aMW) are also shown as a line graph.](image-url)
Washington State Clean Energy Goals

• Energy Independence Act or Initiative 937
  – 15% of Washington retail load after 2020
  – Qualifying resources less any forward sales obligations
  – Banking provisions mitigate year-to-year variation
  – Addition of qualifying BPA and Wanapum, which are not included in the chart. Will update when amounts are known.

• Clean Energy Transformation Act
Avista’s Washington CETA Goals