# 2021 Electric Integrated Resource Plan
## Technical Advisory Committee Meeting No. 2 Agenda
### Thursday, August 6, 2020
#### Virtual Meeting- 9:00 AM PST

<table>
<thead>
<tr>
<th>Topic</th>
<th>Time</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductions &amp; IRP Process Updates</td>
<td>9:00</td>
<td>Lyons</td>
</tr>
<tr>
<td>Natural Gas &amp; RNG Market Overview</td>
<td>9:30</td>
<td>Pardee</td>
</tr>
<tr>
<td><strong>Break</strong></td>
<td>10:45</td>
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<tr>
<td>Natural Gas Price Forecast</td>
<td>11:00</td>
<td>Brutocao</td>
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<tr>
<td><strong>Lunch</strong></td>
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<td>Upstream Natural Gas Emissions</td>
<td>12:30</td>
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</tr>
<tr>
<td><strong>Break</strong></td>
<td>1:30</td>
<td></td>
</tr>
<tr>
<td>Regional Energy Policy Update</td>
<td>1:45</td>
<td>Lyons</td>
</tr>
<tr>
<td>Natural Gas and Electric Coordinated Study</td>
<td>2:15</td>
<td>Gall/Pardee</td>
</tr>
<tr>
<td>Highly Impacted &amp; Vulnerable Populations</td>
<td>3:00</td>
<td>Gall</td>
</tr>
<tr>
<td>Baseline Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjourn</td>
<td>3:45</td>
<td></td>
</tr>
</tbody>
</table>
2021 Electric and Natural Gas IRPs
TAC Introductions and IRP Process Updates
John Lyons, Ph.D.
Second Technical Advisory Committee Meeting
August 6, 2020
Updated Meeting Guidelines

- Gas and electric IRP teams working remotely, but still available by email and phone for questions and comments
- Some processes are taking longer remotely
- Virtual IRP meetings until back in the office and able to hold large group meetings
- TAC presentations, notes, work plans and past IRPs are posted on joint IRP page for gas and electric: [https://www.myavista.com/about-us/integrated-resource-planning](https://www.myavista.com/about-us/integrated-resource-planning)
Virtual TAC Meeting Reminders

• Please mute mics unless speaking or asking a question
• Use the Skype chat box to write questions or comments or let us know you would like to say something
• Respect the pause
• Please try not to speak over the presenter or a speaker who is voicing a question or thought
• Remember to state your name before speaking for the note taker
• This is a public advisory meeting – presentations and comments will be recorded and documented
Integrated Resource Planning

• Required by Idaho, Oregon 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
  – Resource choices
  – Conservation measures and programs
  – Transmission and distribution integration for electric
  – Gas distribution planning
  – Gas and electric market price forecasts
• Scenarios for uncertain future events and issues
• Key dates for modeling and IRP development are available in the Work Plans
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 involved in all or parts of the process
  - Ask questions
  - Help with soliciting new members

- 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 number or type of studies
  - Earlier study requests allow us to be more accommodating
  - August 1, 2020 was the electric study request deadline

- Planning teams are available by email or phone for questions or comments between the TAC meetings
2020 Electric IRP Meetings – IPUC

- Telephonic public hearing on August 5, 2020
- August 19, 2020 comment deadline, September 2, 2020 response
- Overview of topics discussed at July 9, 2020 virtual public workshop:
  - Moving away from coal
  - Cost impacts for Idaho customers from Washington laws
  - IRP procedural questions about acknowledgment of the IRP
  - Climate change questions and timing of actions
  - Colstrip: decommissioning, other owners, cost sharing with Washington
  - Consideration of social costs/externalities and public health
  - Support for clean energy and Commission authority to require it
  - Resource timing
  - Risks considered in the IRP: economic, qualitative and climate
  - Idaho versus Montana wind locations
  - Maintaining Idaho RECs
  - Climate change law applicability and lawsuits
2021 Natural Gas IRP TAC Schedule

- **TAC 1**: Wednesday, June 17, 2020
- **TAC 2**: Thursday, August 6, 2020 (Joint with Electric TAC)
- **TAC 3**: Wednesday, September 30, 2020
- **TAC 4**: Wednesday, November 18, 2020
- **TAC 5**: February 2021 – TAC final review meeting if necessary

Natural Gas TAC agendas, presentations and meeting minutes available at: [https://myavista.com/about-us/integrated-resource-planning](https://myavista.com/about-us/integrated-resource-planning)
2021 Electric IRP TAC Schedule

- TAC 1: Thursday, June 18, 2020
- **TAC 2: Thursday, August 6, 2020 (Joint with Natural Gas TAC)**
  - Economic and Load Forecast, August 2020
- TAC 3: Tuesday, September 29, 2020
- TAC 4: Tuesday, November 17, 2020
- TAC 5: Thursday, January 21, 2021
- Public Outreach Meeting: February 2021
- TAC agendas, presentations and meeting minutes available at: [https://myavista.com/about-us/integrated-resource-planning](https://myavista.com/about-us/integrated-resource-planning)
Process Updates

Economic and load forecast delay
- Special meeting 1:00 – 3:30 pm PST on Tuesday, August 18 or Wednesday, August 19, 2020 to cover the forecasts

AEG Conservation Potential Assessment and Demand Response Studies – delayed from TAC 2
- AEG has developed baseline assumptions, market profiles and energy/gas use per customer
- Market data has been collected and compiled
- Measure Assumption development is complete
- Compiled 2021 Power Plan Assumptions
- Measure List is in-process and is expected to be available mid-September
- CPA discussion with TAC – September TAC meeting.
Today’s TAC Agenda

9:00 – Introductions & IRP Process Updates, Lyons
9:30 – Natural Gas & RNG Market Overview, Pardee
10:45 – Break
11:00 – Natural Gas Price Forecast, Brutocao
11:30 – Lunch
12:30 – Upstream Natural Gas Emissions, Pardee
1:30 – Break
1:45 – Regional Energy Policy Update, Lyons
2:15 – Natural Gas and Electric Coordinated Study, Gall/Pardee
3:00 – Highly Impacted & Vulnerable Populations Baseline Analysis, Gall
3:45 – Adjourn
Natural Gas Market Overview

Tom Pardee, Natural Gas Planning Manager
Second Technical Advisory Committee Meeting
August 6, 2020
# Units

<table>
<thead>
<tr>
<th>Common Gas Units</th>
<th>1 Bcf</th>
<th>1 Dth</th>
<th>1 Therm</th>
</tr>
</thead>
<tbody>
<tr>
<td>kWh</td>
<td>302,062,888</td>
<td>293.001</td>
<td>29.300</td>
</tr>
<tr>
<td>MWh</td>
<td>302,063</td>
<td>0.293</td>
<td>0.029</td>
</tr>
</tbody>
</table>
Avista’s Supply

• Natural Gas LDC Side
  – 10% contracted from US supply basins
  – 90% contracted from Canadian supply basins

• Electric Side
  – 100% contracted from Canadian supply basins
US Demand

Source: Wood Mackenzie
US Supply

Source: Wood Mackenzie
Canadian Supply and Demand

**Canadian Gas Demand**

- Residential
- Commercial
- Industrial
- Power
- LNG Exports
- Piped exports
- Transport
- Other

**Canadian Supply**

- WCSB
- Eastern Canada

Source: Wood Mackenzie
North American LNG Export Terminals

Approved, Not Yet Built

Export Terminals

UNITED STATES

APPROVED - UNDER CONSTRUCTION - FERC
1. Hackberry, LA: 0.73 Bcf (Shippers-Balboa LNG Train 3) (CP13-25)
2. Corpus Christi, TX: 0.72 Bcf (Chesapeake-Balboa LNG Train 2) (CP12-50)
3. Sabine Pass, LA: 0.7 Bcf (Chesapeake Balboa LNG Train 3) (CP13-550)
4. Elba Island, GA: 0.41 MMBtu (Southern LNG Company Unit 7-10) (CP14-103)
5. Cameron Parish, LA: 1.41 Bcf (Venture Global Calcasieu Pass) (CP15-550)
7. Calcasieu Parish, LA: 4.0 Bcf (Shinnecock LNG) (CP17-11)

APPROVED - NOT UNDER CONSTRUCTION - FERC
A. Lake Charles, LA: 2.2 Bcf (Lake Charles LNG) (CP14-120)
B. Lake Charles, LA: 1.08 Bcf (Magnolia LNG) (CP14-347)
C. Hackberry, LA: 1.41 Bcf (Shippers-Balboa LNG Train 4 & 5) (CP15-560)
D. Port Arthur, TX: 1.86 Bcf (Port Arthur LNG Train 1 & 2) (CP17-20)
E. Freeport, TX: 0.72 Bcf (Freeport LNG Dev Train 4) (CP17-470)
F. Pascagoula, MS: 1.5 Bcf (Gulf LNG Liquefaction) (CP15-521)
G. Jacksonville, FL: 0.13 Bcf (Eagle LNG Partners) (CP17-41)
H. Plaquemines Parish, LA: 3.40 Bcf (Venture Global LNG) (CP17-66)
I. Brownsville, TX: 0.55 Bcf (Texas LNG Brownsville) (CP16-116)
J. Brownsville, TX: 3.8 Bcf (Rio Grande LNG - Mexico) (CP16-454)
K. Brownsville, TX: 0.9 Bcf (Aquia LNG Brownsville) (CP16-480)
L. Corpus Christi, TX: 1.86 Bcf (Chesapeake-Balboa LNG Train 3) (CP18-512)
M. Sabine Pass, LA: NA Bcf (Sabine Pass Liquefaction) (CP13-11)
N. Coos Bay, OR: 1.06 Bcf (Jordan Cove) (CP17-486)
O. Nikiski, AK: 0.63 Bcf (Alaska Gasline) (CP17-18)

APPROVED - NOT UNDER CONSTRUCTION - MARAD/Coast Guard
MC. Gulf of Mexico: 1.8 Bcf (Celtic LNG)

CANADA
For Canadian LNG Import and Proposed Export Facilities:
https://www.nrcan.gc.ca/energy/natural-gas/5683

As of May 29, 2020
North American LNG Exports

*WM does not assume Jordan Cove will enter service within forecasted period

Source: Wood Mackenzie
West

Total Demand by Census Region

Source: Wood Mackenzie
Power Generation and Transport demand

Source: Wood Mackenzie
West demand of Res-Com-Ind

Port of Kalama – NW Innovation Works

Source: Wood Mackenzie
Wood Mackenzie Disclaimer

• The foregoing [chart/graph/table/information] was obtained from the [North America Gas Service]™, a product of Wood Mackenzie.”
• Any information disclosed pursuant to this agreement shall further include the following disclaimer: "The data and information provided by Wood Mackenzie should not be interpreted as advice and
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• Wood Mackenzie accepts no responsibility for your use of this data and information except as specified in a written agreement you have entered into with Wood Mackenzie for the provision of such of such data and information
Us Natural Gas Storage

<table>
<thead>
<tr>
<th>Region</th>
<th>07/24/20</th>
<th>07/17/20</th>
<th>net change</th>
<th>implied flow</th>
<th>Year ago (07/24/19)</th>
<th>5-year average (2015-19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>East</td>
<td>705</td>
<td>693</td>
<td>13</td>
<td>13</td>
<td>591</td>
<td>625</td>
</tr>
<tr>
<td>Midwest</td>
<td>815</td>
<td>799</td>
<td>16</td>
<td>16</td>
<td>009</td>
<td>087</td>
</tr>
<tr>
<td>Mountain</td>
<td>190</td>
<td>190</td>
<td>0</td>
<td>0</td>
<td>155</td>
<td>170</td>
</tr>
<tr>
<td>Pacific</td>
<td>313</td>
<td>311</td>
<td>2</td>
<td>2</td>
<td>270</td>
<td>265</td>
</tr>
<tr>
<td>South Central</td>
<td>1,211</td>
<td>1,221</td>
<td>-10</td>
<td>-10</td>
<td>030</td>
<td>1,028</td>
</tr>
<tr>
<td>Salt</td>
<td>339</td>
<td>349</td>
<td>-10</td>
<td>-10</td>
<td>227</td>
<td>274</td>
</tr>
<tr>
<td>Nonsalt</td>
<td>872</td>
<td>872</td>
<td>0</td>
<td>0</td>
<td>703</td>
<td>754</td>
</tr>
<tr>
<td>Total</td>
<td>3,241</td>
<td>3,215</td>
<td>26</td>
<td>26</td>
<td>2,615</td>
<td>2,812</td>
</tr>
</tbody>
</table>

Historical Comparisons

Totals may not equal sum of components because of independent rounding.

*Source: U.S. Energy Information Administration*
# Rig Counts

<table>
<thead>
<tr>
<th>Area</th>
<th>Last Count</th>
<th>Count</th>
<th>Change from Prior Count</th>
<th>Date of Prior Count</th>
<th>Change from Last Year</th>
<th>Date of Last Year’s Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>24 July 2020</td>
<td>251</td>
<td>-2</td>
<td>17 July 2020</td>
<td>-665</td>
<td>26 July 2019</td>
</tr>
<tr>
<td>Canada</td>
<td>24 July 2020</td>
<td>42</td>
<td>+10</td>
<td>17 July 2020</td>
<td>-86</td>
<td>26 July 2019</td>
</tr>
<tr>
<td>International</td>
<td>June 2020</td>
<td>781</td>
<td>-24</td>
<td>May 2020</td>
<td>-357</td>
<td>June 2019</td>
</tr>
</tbody>
</table>

## US Rig Count History

![US Rig Count History](image-url)

## Canadian Rig Count History

![Canadian Rig Count History](image-url)
Production and Drilling efficiency

**Oil production**
- Thousand barrels/day
  - August-2019
  - August-2020

**Natural gas production**
- Million cubic feet/day
  - August-2019
  - August-2020

**New-well oil production per rig**
- Barrels/day
  - August-2019
  - August-2020

**New-well gas production per rig**
- Thousand cubic feet/day
  - August-2019
  - August-2020
Historic Cash prices
(Jan. 1997 – July 2020)
Upstream Emissions

Tom Pardee
Upstream Emissions

• Use based greenhouse gas emissions at the point of combustion and include upstream methane emissions

• Link for Natural Gas Advisory Committee information on upstream methane: https://www.nwcouncil.org/energy/energy-advisory-committees/natural-gas-advisory-committee
Global Warming Potential

<table>
<thead>
<tr>
<th>Greenhouse Gas</th>
<th>GWP – 100 Year</th>
<th>GWP – 20 Year</th>
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</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CH₄</td>
<td>34</td>
<td>86</td>
</tr>
<tr>
<td>N₂O</td>
<td>298</td>
<td>268</td>
</tr>
</tbody>
</table>

Global warming potential (GWP) factors for conversion to CO₂ equivalents (CO₂e)

https://www.c2es.org/content/ipcc-fifth-assessment-report/
Upstream Emissions Sources and Estimates

- Rockies emissions – The EPA estimates all leakage through a bottoms up analysis. It will estimate leaks based on equipment operated as designed and combines these values to determine an overall rate of 1%. The emissions and sinks study is published yearly and will capture emissions as they change.

- Canadian emissions (British Columbia and Alberta) – A value of 0.77% was developed from data pertaining to the recent environmental impact studies for the PSE Tacoma LNG plant, Kalama Manufacturing and Export Facility and the 2019 Puget Sound Energy IRP.
WSU Natural Gas Methane Study

• Sponsored by EDF and utilities to estimate the leakage of distribution systems
• National project and estimated a loss of 0.1 – 0.2 percent of the methane delivered nationwide
• Western region contributes much less as compared to the East
• “Out of 230 measurements, three large leaks accounted for 50% of the total measured emissions from pipeline leaks. In these types of emission studies, a few leaks accounting for a large fraction of total emissions are not unusual.”
## LDC Upstream Emissions

<table>
<thead>
<tr>
<th></th>
<th>Avista Specific Natural Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lbs. GHG/MMBtu</td>
</tr>
<tr>
<td><strong>Combustion</strong></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>116.88</td>
</tr>
<tr>
<td>CH4</td>
<td>0.0022</td>
</tr>
<tr>
<td>N2O</td>
<td>0.0022</td>
</tr>
<tr>
<td><strong>Total Combustion</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Upstream</strong></td>
<td></td>
</tr>
<tr>
<td>CH4</td>
<td>0.313406851</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
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<table>
<thead>
<tr>
<th>Upstream Emissions</th>
<th>Avista's Purchases</th>
<th>Emissions Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.77</td>
<td>89.72%</td>
<td>Canada</td>
</tr>
<tr>
<td>1.00</td>
<td>10.28%</td>
<td>Rockies</td>
</tr>
<tr>
<td>0.79</td>
<td></td>
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</tbody>
</table>

*Avista gas purchases
An average of the total volume purchased over the past 5 years by emissions location
## Electric Upstream Emissions

### Electric Upstream Emissions

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</tr>
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<td></td>
</tr>
<tr>
<td><strong>Upstream</strong></td>
<td></td>
</tr>
<tr>
<td>CH4</td>
<td>0.304065693</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
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</table>

### Upstream Emissions

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</tr>
<tr>
<td>0.77</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Avista Purchases
All firm transportation to supply gas is located in Canada.
Renewable Natural Gas (RNG)
What is Renewable Natural Gas (RNG)?
Why does RNG matter?

Climate Change Solution

• Natural gas plays critical role for meeting aggressive green house gas (GHG) reductions goals, RNG even more so!

• Utilizes existing infrastructure

• Advantages of RNG
  – “De-carbonizes” gas stream
  – Gives customers another renewable choice
## Carbon Intensity

<table>
<thead>
<tr>
<th>Fuel Pathway</th>
<th>Carbon Intensity</th>
<th>( \text{g CO}_2\text{e} / \text{MJ} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel*</td>
<td>102.01</td>
<td></td>
</tr>
<tr>
<td>Gasoline*</td>
<td>99.78</td>
<td></td>
</tr>
<tr>
<td>Fossil CNG†</td>
<td>78.37</td>
<td></td>
</tr>
<tr>
<td>Landfill CNG†</td>
<td>46.42</td>
<td></td>
</tr>
<tr>
<td>WWTP CNG*</td>
<td>19.34</td>
<td></td>
</tr>
<tr>
<td>MSW CNG*</td>
<td>-22.93</td>
<td></td>
</tr>
<tr>
<td>Dairy CNG†</td>
<td>-276.24</td>
<td></td>
</tr>
</tbody>
</table>

*California Code of Regulation Title 17, §95488, Table 6. Carbon intensity for WWTP is the average of two WWTP pathways.

†California Code of Regulation Title 17, §95488, Table 7.

†Method 2B Application CalBio LLC, Dallas Texas, Dairy Digester Biogas to CNG.
RFS and LCFS Effect on RNG Value

RIN = renewable identification number

Source: CARB

Source: EPA
What are the challenges & barriers?

• California RNG market ($30+/Dth v. $2/Dth)
  – Vehicle emission incentives shut-out other potential end users
  – Producers see the pot of gold in California

• Financing for producers
  – RIN market is volatile
  – No forward pricing for RNG RINs in carbon market
  – Vehicle market may be approaching saturation in CA
  – Producer/LDC partnerships may make sense
ID RNG NREL Estimates

Total Potential Annual Production = 32 Bcf

<table>
<thead>
<tr>
<th>Source - Anaerobic</th>
<th>MMBtu per Year</th>
</tr>
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<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>
</tr>
<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>
</tr>
</tbody>
</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>
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</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
Natural Gas IRP

A detailed level of RNG understanding and evaluation process will be included in the Natural Gas IRP TAC #3 meeting on September 30, 2020
Natural Gas Price Forecast

Michael Brutocao, Natural Gas Analyst
Second Technical Advisory Committee Meeting
August 6, 2020
Henry Hub Expected Price Methodology

- Expected Henry Hub prices derived from a blend of forward market prices on the NYMEX (as of 6/30/2020) and forecasted prices from the 2020 Annual Energy Outlook (EIA) and two consultants

<table>
<thead>
<tr>
<th></th>
<th>2020 – 2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026 – 2045</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYMEX</td>
<td>100%</td>
<td>75%</td>
<td>50%</td>
<td>25%</td>
<td>-</td>
</tr>
<tr>
<td>EIA/AEO</td>
<td>-</td>
<td>8.33%</td>
<td>16.66%</td>
<td>25%</td>
<td>33.33%</td>
</tr>
<tr>
<td>Consultant 1</td>
<td>-</td>
<td>8.33%</td>
<td>16.66%</td>
<td>25%</td>
<td>33.33%</td>
</tr>
<tr>
<td>Consultant 2</td>
<td>-</td>
<td>8.33%</td>
<td>16.66%</td>
<td>25%</td>
<td>33.33%</td>
</tr>
</tbody>
</table>
Henry Hub Expected Price and Average Annual Forecasts

Levelized Price
2022-2045: $4.11

Levelized Price
2022-2041: $3.90
Stochastic Price Forecasting Methodology

• Evaluate a set of potential future outcomes based on the probability of occurrence
  – Expected Price used as the input
  – At each period, random price adjustments follow a lognormal distribution based on the Expected Price
    • It is common practice to use lognormal distributions in forecasting prices as they have no upward bound and should not fall below zero

• A single “draw” contains a set of unique price movements
• 500 (electric) and 1000 (gas) draws were evaluated
Sample Stochastic Price Draws

$ per Dekatherm

| Year | 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 | 2046 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Price | $1.00 | $2.00 | $3.00 | $4.00 | $5.00 | $6.00 | $7.00 | $8.00 | $9.00 | $10.00 | $11.00 | $12.00 | $13.00 | $14.00 | $15.00 | $16.00 | $17.00 | $18.00 | $19.00 | $20.00 | $21.00 | $22.00 | $23.00 | $24.00 | $25.00 | $26.00 |

- **Input**
- **1**
- **100**
- **200**
- **300**
- **400**
- **500**
Stochastic Prices (Results from 500 Draws)

Levelized Price - 95th: $7.82

Levelized Price - 25th: $2.62
Levelized Stochastic Prices (Results from 500 Draws)
Stochastic Prices (Results from 1000 Draws)

Levelized Price - 95th: $7.90

Levelized Price - 25th: $1.83
Levelized Stochastic Prices (Results from 1000 Draws)
Prices by Gas Hub (Henry Hub Expected Price + Basis)
Levelized Prices 2022-2041

<table>
<thead>
<tr>
<th>Location</th>
<th>Price per Dekatherm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Henry Hub</td>
<td>$3.90</td>
</tr>
<tr>
<td>Rockies</td>
<td>$3.42</td>
</tr>
<tr>
<td>Malin</td>
<td>$3.38</td>
</tr>
<tr>
<td>Stanfield</td>
<td>$3.22</td>
</tr>
<tr>
<td>Sumas</td>
<td>$3.22</td>
</tr>
<tr>
<td>AECO</td>
<td>$2.62</td>
</tr>
</tbody>
</table>
Levelized Prices 2022-2045

- Herny Hub (Expected Price): $4.11
- Rockies: $3.64
- Malin: $3.59
- Stanfield: $3.44
- Sumas: $3.42
- AECO: $2.80
Production and Investment Tax Credits

- Production tax credit $15/MWh adjusted for inflation ($25/MWh for 2019) for 10 years for wind construction started by 12/31/20
- Investment tax credit for new solar construction drops from 30% in 2019
  - 26% in 2020
  - 22% in 2021
  - 10% from 2022 onward
- Will be watching for any possible extensions with all of the COVID-19 proposals
## State and Provincial Policies

<table>
<thead>
<tr>
<th>State/Province</th>
<th>No Coal</th>
<th>RPS</th>
<th>Clean Energy/Carbon Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Arizona</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>British Columbia</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>California</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Colorado</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Idaho</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Montana</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Nevada</td>
<td>No</td>
<td>Yes</td>
<td>Goal</td>
</tr>
<tr>
<td>New Mexico</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Oregon</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Utah</td>
<td>No</td>
<td>Goal</td>
<td>No</td>
</tr>
<tr>
<td>Washington</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Wyoming</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Washington

- Clean Energy Transformation Act (CETA) SB 5116:
  - No coal serving Washington customers by end of 2025
  - Greenhouse gas neutral by 2030, up to 20% alternative compliance
  - 2% cost cap over four-year compliance period
  - 100% non-emitting by January 1, 2045
  - Social cost of carbon for new resources
  - Additional reporting and planning requirements
  - Highly impacted and vulnerable community identification and resource planning implications
  - Ongoing rulemaking in various stages for planning and reporting
Washington

- HB 1257: Clean Buildings for Washington Act
  - Develop energy performance standards for commercial buildings over 50,000 square feet (2020 – 2028) “… to maximize reductions of greenhouse gas emissions from the building sector”
  - By 2022, natural gas utilities must identify and acquire all available cost-effective conservation including a social cost of carbon at the 2.5% discount rate. (Section 11 and 15)
  - Natural gas utilities may propose renewable natural gas (RNG) programs for their customers and offer a voluntary RNG tariff
  - Building code updates to improve efficiency and develop electric vehicle charging infrastructure
Oregon

Executive Order 20-04

• New GHG reduction goal
  – 45% below 1990 levels by 2035
  – 80% below 1990 levels by 2050

• Directs 16 Oregon agencies to “exercise any and all authority and discretion” to reach GHG reduction goals and “prioritize and expedite” action on GHG reductions “to the full extent allowed by law.”

• Agencies are working on rulemaking and implementation

SB 98

• Development of utility renewable natural gas programs
2021 Electric and Natural Gas IRPs
Natural Gas & Electric Coordinated Scenario

James Gall/Tom Pardee
Second Technical Advisory Committee Meeting
August 6, 2020
Scenario Goal

• Understand impact to electric resource planning if customers switch from natural gas to electric service

• Scenario Proposal:
  – By 2030: 50% of Washington Residential & Commercial customers
  – By 2045: 80% of Washington Residential & Commercial customers

• Potential Scenarios:
  – Hybrid natural gas/electric heat pumps
  – Highly efficient technology allows for cold temperature space heating
Converting Natural Gas Load to Electric Load

- Natural Gas (therms)
- End Use
- Efficiency
- Temperature
- Electric Service Provider
- Electric (kWh)
WA Res/Com Natural Gas Load Forecast
Customer Penetration Forecast

% Natural Gas Customer Reduction (WA Only)
End Use Efficiency

Note: All efficiency conversion use a 10% efficiency benefit to electric
Energy Conversion Factor

\[ y = -3 \times 10^{-6}x^4 + 0.0007x^3 - 0.0438x^2 - 0.7097x + 259.49 \]

\[ R^2 = 0.9775 \]

Use temperature point estimates for conversion efficiency

Curve fit to smooth out steps

Dth (Degree F)

kWh per Dth
Electric Peak Estimation Methodology

- Natural gas is typically daily nominations, while electric is instantaneous.
  - Hourly flow metering is available for some areas
- Sampled large gate-station hourly instantaneous natural gas flow data
- Use sample data to estimate hourly natural gas load from 2015-2019
- Estimate Peak-to-Energy load factor for each historical month
- Use average monthly load factor for the peak adjustment
Estimated Load Factors (2015-19)

[Bar chart showing estimated load factors for each month from January to December, with peak load factors indicated by triangles in orange and average and low factors indicated by diamonds in blue and yellow]
Hourly Electric Load History

2015-2019 Control Area Load + WA LDC as Electric
Eastern Washington Electric Service Providers

EIA reported retail sales for 2018
Scenario assumes Avista will receive 75 percent of electric conversions
2020 IRP Forecast for 2030 absent fuel conversion:
Peak: 1,762 MW
Energy: 1,209 aMW
2030 Monthly Load Forecast

![Monthly Load Forecast Chart]

- **Energy**
- **Peak**

The chart shows the forecasted energy usage and peak loads for each month from January to December. The energy usage is represented by blue bars, while the peak loads are marked with orange triangles. The values range from approximately 50 to 450 MW.
Scenario Analysis- Conversion Rates

![Graph showing kWh per Dth vs. Degree F for Current Technology, Hybrid Future, and High Efficiency Future.]

- Current Technology
- Hybrid Future
- High Efficiency Future

15
Scenario Analysis - Electric Energy

- Current Technology
- Hybrid Future
- High Efficiency Future

Average Megawatts
Scenario Analysis: Electric December Peak Load

Megawatts

- Current Technology
- Hybrid Future
- High Efficiency Future

Years:
- 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
Scenario Analysis: Natural Gas Demand

- Base LDC WA Forecast
- Hybrid Future
- Current Technology/High Efficiency Future
Next Steps

• Input into PRiSM model to determine resource selection and cost
  – Estimate cost meeting CETA requirements
  – Estimate cost using least cost methodology
  – Estimate emissions savings
  – Estimate $/tonne

• Conduct electric resource adequacy study if time permits
2021 Electric IRP
Washington Vulnerable Populations & Highly Impacted Communities
James Gall, IRP Manager
Second Technical Advisory Committee Meeting
August 6, 2020
Identifying Communities or “Customers”

Highly Impacted Communities
- Cumulative Impact Analysis
- Tribal lands
  - Spokane
  - Colville
- Locations should be available by end of 2020
  - State held workshops in August & September 2019

Vulnerable Populations
- Use Washington State Health Disparities map
  - What is disproportionate on a scale of 1 to 10?
  - Avista proposes areas with a score 8 or higher in either Socioeconomic factors or Sensitive population metrics
- Should we include other metrics to identify these communities?
Environmental Health Disparities Map

https://fortress.wa.gov/doh/wtw/wnbl/

Department of Health data is divided up by Federal Information Processing Standards (FIPS) Code
Environmental Health Scoring  
From WA Department of Health

<table>
<thead>
<tr>
<th>Final composite score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final composite score = Pollution Burden score × Population Characteristics score</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pollution burden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution burden score = ((\text{Average percentile of Environmental Exposures Indicators} × \text{VSI}) ÷ \text{Average percentile of Environmental Effects Indicators}))</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Population characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population characteristics score = ((\text{Average percentile of Sensitive Population Indicators} × \text{Severity of Socioeconomic Factors Indicators}))</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental exposures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel emissions</td>
</tr>
<tr>
<td>Ozone</td>
</tr>
<tr>
<td>Particulate Matter 2.5 (PM2.5)</td>
</tr>
<tr>
<td>Toxic releases from facilities</td>
</tr>
<tr>
<td>Traffic density</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead risk and exposure</td>
</tr>
<tr>
<td>Proximity to hazardous waste generators and facilities</td>
</tr>
<tr>
<td>Proximity to Superfund sites</td>
</tr>
<tr>
<td>Proximity to facilities with highly toxic substances</td>
</tr>
<tr>
<td>Wastewater discharge</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensitive populations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular disease</td>
</tr>
<tr>
<td>Low birth weight infants</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Socioeconomic factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor educational attainment</td>
</tr>
<tr>
<td>Housing burden</td>
</tr>
<tr>
<td>Linguistic isolation</td>
</tr>
<tr>
<td>Poverty</td>
</tr>
<tr>
<td>Race (People of color)</td>
</tr>
<tr>
<td>Transportation expense</td>
</tr>
<tr>
<td>Unemployment</td>
</tr>
</tbody>
</table>

Circle areas match definition of vulnerable population, although access to food & health care, higher rates of hospitalization are not expressively included but are an indication of poverty.
Selected Vulnerable Populations

Data is shown by combined score
Spokane Area “Avista” Vulnerable Populations

Data is shown by combined score

Resource Legend
- Natural Gas
- Biomass/Other
- Hydro
- Wind
- Solar
IRP Metrics *(From Last TAC Meeting)*

<table>
<thead>
<tr>
<th>Metric</th>
<th>IRP Relationship</th>
</tr>
</thead>
</table>
| Energy Usage per Customer     | • Expected change taking into account selected energy efficiency then compare to remaining population.  
                                 | • EE includes low income programs and TRC based analysis which includes non-economic benefits. |
| Cost per Customer             | • Estimate cost per customer then compare to remaining population.               
                                 | • How do IRP results compare to above 6% of income?                               |
| Preference                    | • Should the IRP have a monetary preference?                                    
                                 |   • For example- should all customers pay more to locate assets (or programs) in areas with vulnerable populations or highly impacted communities? 
                                 |   • If so, how much more?                                                       |
# IRP Metrics *(From Last TAC Meeting)*

<table>
<thead>
<tr>
<th>Metric</th>
<th>IRP Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reliability</strong></td>
<td>• Calculate baseline for each distribution feeder and match with communities</td>
</tr>
<tr>
<td>• SAIFI: System Average Interruption Frequency Index</td>
<td>• Estimate benefits for area with potential IRP distribution projects</td>
</tr>
<tr>
<td>• MAIFI: Momentary Average Interruption Frequency Index</td>
<td>• Compare to other communities as baseline</td>
</tr>
<tr>
<td><strong>Resiliency:</strong></td>
<td>• May be more appropriate in Distribution plan rather than IRP</td>
</tr>
<tr>
<td>• SAIDI: System Average Interruption Duration Index</td>
<td></td>
</tr>
<tr>
<td>• CAIDI: Customer Average Interruption Duration Index</td>
<td></td>
</tr>
<tr>
<td>• CELID: Customer’s Experiencing Long Duration Outages</td>
<td></td>
</tr>
<tr>
<td><strong>Resource Analysis</strong></td>
<td>• Estimate emissions (NO$_x$, SO$_2$, PM2.5, Hg) from power projects located in/near identified communities</td>
</tr>
<tr>
<td></td>
<td>• Identify new resource or infrastructure project candidates with benefit to communities; i.e. economic benefit, reliability benefit</td>
</tr>
<tr>
<td></td>
<td>• Identify how resource can benefit energy security</td>
</tr>
</tbody>
</table>
Energy Use Analysis Results

- Uses five years of customer billing data
- Median income over the same period is used to estimate affordability
- Separated electric only vs electric/gas customers
  - Future enhancement include single/multi family homes, and manufactured homes
Energy/Cost Analysis

Electric Only Customers

<table>
<thead>
<tr>
<th>Area</th>
<th>Fuel Type</th>
<th>Energy Use</th>
<th>Avg Bill</th>
<th>Income</th>
<th>% Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vulnerable Population Areas</td>
<td>Electric</td>
<td>998 KWh</td>
<td>$98</td>
<td>$42,730</td>
<td>2.8%</td>
</tr>
<tr>
<td>Other Areas</td>
<td>Electric</td>
<td>1,010 KWh</td>
<td>$100</td>
<td>$58,834</td>
<td>2.0%</td>
</tr>
</tbody>
</table>

Note: Mean energy use is statistically significantly different when removing energy use data below 100 kWh per month (1,049 kWh vs 1,082 kWh).

Natural Gas/Electric Customers

<table>
<thead>
<tr>
<th>Area</th>
<th>Fuel Type</th>
<th>Energy Use</th>
<th>Avg Bill</th>
<th>Income</th>
<th>% Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vulnerable Population Areas</td>
<td>Electric</td>
<td>820 KWh</td>
<td>$80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Areas</td>
<td>Electric</td>
<td>875 KWh</td>
<td>$84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vulnerable Population Areas</td>
<td>Gas</td>
<td>52 Therms</td>
<td>$47</td>
<td>$44,889</td>
<td>3.4%</td>
</tr>
<tr>
<td>Other Areas</td>
<td>Gas</td>
<td>62 Therms</td>
<td>$56</td>
<td>$68,250</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

Note: Combined natural gas/electric homes have higher energy burden due to fewer multifamily homes included in the population or all electric home including homes with alternative heat such as wood, propane, oil, pellets. Future analysis needed to validate this hypothesis.
Vulnerable Populations

Electric Only Customers - Energy % of Income

Spokane Area

Energy Cost as % of Income - Electric Only

<table>
<thead>
<tr>
<th>5 Year Avg for Electric Only Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2.08 %</td>
</tr>
<tr>
<td>≤ 2.24 %</td>
</tr>
<tr>
<td>≤ 2.41 %</td>
</tr>
<tr>
<td>≤ 2.56 %</td>
</tr>
<tr>
<td>≤ 2.69 %</td>
</tr>
<tr>
<td>≤ 2.95 %</td>
</tr>
<tr>
<td>≤ 3.12 %</td>
</tr>
<tr>
<td>≤ 3.34 %</td>
</tr>
<tr>
<td>≤ 3.84 %</td>
</tr>
<tr>
<td>≤ 4.27 %</td>
</tr>
</tbody>
</table>
Vulnerable Populations
Gas/Electric Only Customers - Energy % of Income

Spokane Area
Reliability Data - CAIDI

Measure of resilience - minutes of outages per event
Excludes Major Event Days (MED)
Reliability Data- CEMI

Measure of reliability- Events per Customer
Vulnerable Area vs Non Vulnerable Areas

Note: 5 yr Average differences are statistically significantly different
CAIDI- By Feeder Type

Mixed Feeders

- Vulnerable Areas
- Non-Vulnerable Areas

Rural Feeders

- Vulnerable Areas
- Non-Vulnerable Areas

Suburban Feeders

- Vulnerable Areas
- Non-Vulnerable Areas

Note: Avista has no vulnerable areas with urban feeders
CEMI - By Feeder Type

Mixed Feeders

- Vulnerable Areas
- Non-Vulnerable Areas

Rural Feeders

- Vulnerable Areas
- Non-Vulnerable Areas

Suburban Feeders

- Vulnerable Areas
- Non-Vulnerable Areas

Note: Avista has no vulnerable areas with urban feeders
Avista’s Washington Power Plant Air Emissions

Washington SO2 Emissions

Washington NOx Emissions

Washington Hg Emissions

Washington VOC Emissions
TAC Input

• What other metrics can we provide in an IRP to show vulnerable populations and highly impacted communities are not harmed by the transition to clean energy