2019 Integrated Resource Plan
September 13, 2018
IRP Advisory Council Meeting

• Agenda
  – IRP Kick-Off Remarks
  – 2017 IRP Review
  – IRP Overview and 2019 Process Road Map
  – Lunch
  – 2019 IRP Carbon Outlook
  – Natural Gas Price Forecast
  – Closing comments
Important Notice

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If you are uncertain whether information is either confidential or competitive, or whether any particular information has been publicly disclosed, please ask. Adhering to this practice helps protect both you and Idaho Power.
2017 IRP Review Outline

2017 IRP Key Outlooks
2017 IRP Key Plan Drivers
Portfolio Evaluation Matrix
Preferred Portfolio
IRP Post Filing Feedback
Review some of the items that feed into the 2019 IRP
2017 IRP Key Outlooks

Natural Gas Price Forecast
- EIA High Oil and Gas Production Forecast

Carbon Outlook
- 111(D) Mass based approach restricting self generation emissions

Existing Resources
- Hydro relicensing
- PURPA wind retirements
- Future of Coal
2017 IRP Key Outlooks

Regional Adequacy

• Mid Columbia market availability
• Mid-Point South market availability
2017 IRP Key Plan Drivers

Growth and

- .9% growth in average energy – Earliest deficit 2029
- 1.4% growth in peak-hour capacity – Earliest deficit July 2026

Coal

Retirements

- Boardman plant – 60 MW (Dec 2020)
- North Valmy plant – 260 MW (Dec 2019, Dec 2025)
- Jim Bridger units 1 and 2 – 385 MW (2021, 2022 or ???)

Resource Choices

- Boardman to Hemingway Transmission & SCR investments
- Least Cost Alternatives to B2H and SCRs
- System Flexibility Considerations
12 Portfolios Evaluated

Jim Bridger Unit 1 and Unit 2 SCR
- Install SCR 2021 and 2022
- Shutdown 12/2021 and 12/2022
- Shutdown 12/2024 and 12/2028 without SCR investment
- Shutdown 12/2028 and 12/2032 without SCR investment

Resource Focuses For each Jim Bridger SCR future
- Natural Gas (Combined Cycle with Reciprocating Engines)
- Solar and Natural Gas (Reciprocating Engines)
- Boardman to Hemingway and Natural Gas
## 2017 Preferred Portfolio

<table>
<thead>
<tr>
<th>Additions</th>
<th>Portfolio 7</th>
<th>Retirements</th>
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<tbody>
<tr>
<td>NV Import for Peak</td>
<td>2019</td>
<td>Valmy Unit 1 -125 MW</td>
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<tr>
<td></td>
<td>2020</td>
<td>Boardman -60 MW</td>
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<td>2021</td>
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<td>2023</td>
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<td></td>
<td>2024</td>
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<tr>
<td>NV Import for Peak</td>
<td>2025</td>
<td>Valmy Unit 2 -135 MW</td>
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<tr>
<td>B2H (500 MW/200 MW)</td>
<td>2026</td>
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<tr>
<td></td>
<td>2027</td>
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<td></td>
<td>2028</td>
<td>Jim Bridger Unit 2 -175 MW</td>
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<td>2029</td>
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<td>2030</td>
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<tr>
<td>Recip eng (36 MW)</td>
<td>2031</td>
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<tr>
<td>Recip eng (36 MW)</td>
<td>2032</td>
<td>Jim Bridger Unit 1 -175 MW</td>
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<tr>
<td>CCCT_1x1 (300 MW)</td>
<td>2033</td>
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<td>2034</td>
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<tr>
<td>Recip eng (54 MW)</td>
<td>2035</td>
<td></td>
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<tr>
<td>Recip eng (54 MW)</td>
<td>2036</td>
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<tr>
<td>+ 980 MW</td>
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+ 980 MW -670 MW of coal + NV import 260 MW = -410 MW
IRP Post Filing Feedback

- Portfolio Design using a Capacity Expansion Optimization Program
- Increase Portfolio Resource Diversity
- More Energy Efficiency Resource Options
- Include Carbon Adder in Portfolio Evaluation
- Continue Evaluation of B2H and Alternative Resources
- Natural Gas Price Forecast “Reasonableness”
- Evaluate Climate Change Impacts to IPC System
Items identified in the 2017 IRP and other inputs to the 2019 process

- 8760 Hour Evaluation of Incremental PV Resources ELCC
- Coal Unit Economic Analysis
- Updated Load Forecast
- DSM Potential Study
- T&D Deferral Value of DER (solar) Analysis
- 2018 Variable Energy Resources Integration Analysis
- Regional Resource Adequacy Review
IRP Overview and 2019 Process Road Map

Phil DeVol
IRP Advisory Council Meeting
September 13, 2018
Integrated Resource Plan

“The IRP describes the company’s projected need for additional electricity and the resources necessary to meet that need while balancing reliability, environmental responsibility, efficiency, and cost.”
Integrated Resource Plan

Fast Facts

- Submitted every two years
- 2019 IRP will be filed with Idaho and Oregon Commissions on June 28, 2019
- 2019 IRP is Idaho Power’s 14th resource plan
- 2019 IRP planning period 2019-2038
Integrated Resource Planning

Primary Goals

1. Identify sufficient resources to reliably serve the demand for energy and flexible capacity within the Idaho Power service area throughout the 20-year planning period.
2. Ensure the selected resource portfolio balances cost, risk, and environmental concerns.
3. Give equal and balanced treatment to supply-side, demand-side, and transmission resources.
4. Involve the public in the planning process in a meaningful way.
How is Reliability Assessed?

1. Energy
2. Peaking capacity
3. Flexible capacity
Energy (Annual)

1800 MW avg
15.8 million MWh
Energy (Monthly)

- **1,800 MW annual avg**
  - 15.8 million MWh
- **1,400 MW April avg**
  - 1.0 million MWh
- **2,550 MW July avg**
  - 1.9 million MWh
Hourly – Peaking Capacity

MW customer load

IDaho Power
Peaking Capacity
July 2017

MW customer load

Boise temp: 102 deg

Monthly average

Annual average
January 2017
Load, Wind, and Solar MW
July 2017
Load, Wind, and Solar MW
Flexible Capacity
Flexible Capacity
Add Wind to the Net Load
Reliability Today
Current Carbon Outlook

John Carstensen
9/13/2018 IRPAC
Current Carbon Outlook

- Proposed Affordable Clean Energy (ACE) Rule
- Other Carbon Futures
- Existing and Proposed State Programs
- Idaho Power Carbon Assumptions for 2019 IRP
Idaho Power’s Current Carbon Reduction

CO$_2$ ABSOLUTE EMISSIONS

2005 LEVEL

CO$_2$ REDUCTION

47%
Affordable Clean Energy (ACE) Rule

- On August 21, 2018, the U.S. EPA released the Affordable Clean Energy ("ACE") Rule:
  - Determine the Best System of Emission Reduction (BSER) for existing electric generating units based on heat rate improvement measures at an affected source (i.e., any fossil fuel-fired electric utility steam generating unit that is not an IGCC unit that was in operation or commenced construction as of the date of publication in the Federal Register)
    - BSER is limited to emission reduction measures that can be applied to or at an individual stationary source; measures must be based on a physical or operational change to a building, structure, facility or installation at that source rather than measures the source’s owner can implement at another location (Inside the Fence)
    - **Reduced utilization “is not a valid system of emission reduction for purposes of establishing a system of performance”**
      - EPA will revise New Source Review as it applies to power plants to accommodate heat rate improvement projects
  - Covers 600 coal-fueled electric generating units at 300 facilities, including Jim Bridger, Boardman, and North Valmy
Affordable Clean Energy (ACE) Rule (cont.)

- EPA determined that the most impactful heat rate improvement measures that should be included in BSER (Candidate Technologies) are:
  - Neural network/intelligent sootblowers
  - Boiler feed pumps
  - Air heater and duct leakage control
  - Variable frequency drives
  - Steam turbine blade path upgrades
  - Economizer redesign/replacement
  - Improved O&M practices

- Carbon capture, utilization and storage, fuel switching, and co-burning with natural gas not required.

- No ability to use renewables to comply.
ACE Estimated Timeline

- Proposed Rule Released: August 21, 2018
- Proposed Rule Published in Federal Register: August 31, 2018
- Rule Finalized: October 1, 2019
- Final Rule Published in Federal Register: December 1, 2019
- State Plans Submittal Deadline: December 1, 2022
- EPA Determination of Completeness: June 1, 2023
- EPA to Act on State Plan: June 1, 2024
- Units Required to Implement HRI*: June 1, 2026
- IPC Ends Participation North Valmy Unit 1: December 31, 2019
- Boardman Ceases Coal-Fired Operations: December 31, 2020
- IPC Ends Participation North Valmy Unit 2: December 31, 2025

* If more than 24 months are needed, a compliance schedule must be submitted.
Operational Implications of ACE on Idaho Power’s Resources in the 2019 IRP

- Boardman – No impact
  - Cease coal-fired operations by the end of 2020

- North Valmy – No expected impact
  - Idaho Power to end participation of unit 1 by end of 2019 and unit 2 by end of 2025

- Jim Bridger – No currently identified specific Heat Rate Improvement projects
  - Do not expect large capital investments
Possible National Carbon Futures

- U.N. Conference of the Parties (COP21) – Paris
  - U.S. Initial targets: 28% below 2005 levels by 2025
    • U.S. power sector has already met this goal

- Clean Power Plan - Cap on Emissions
  - Target of 32% below 2005 levels by 2032
    • U.S. power sector expected to meet this goal in 2018/2019

- Affordable Clean Energy Rule - Increased efficiency
  - EPA estimates that the ACE Rule could reduce 2030 CO2 emissions by up to 1.5% from projected levels without the CPP

- Third Party Perspectives - Federal Adder
  • Starting in 2028 at $2/MT and Increasing by $2/MT per year, $26/MT at 2040
State Programs

- **California Energy Commission**
  - Target 40% below 1990 levels by 2030
    - Low $16.81 in 2018 to $36.55 in 2030
    - Med $16.56 in 2018 to $70.99 in 2030
    - High $17.43 in 2018 to $107.87 in 2030

- **Oregon Proposed Cap and Invest Bill**
  - Preliminary target of 45% below 1990 levels by 2035

- **Washington Proposed Initiative 1631**
  - Target of 25% below 1990 levels by 2035
  - 2020: $15.00/MT of carbon content – escalate at $2/ton per year + inflation

- **Regional Greenhouse Gas Initiative (RGGI)**
  - 2018: $3 - $4/MT
Idaho Power’s Proposed Carbon Assumptions

• Adder on CO₂ emissions Per Metric Ton

• Planning Case
  – Federal Adder in 2028 at $2/MT and Increasing by $2/MT per year, $26/MT at 2040

• Low Case
  – No adder - $0
  – No federal or state regulations

• High Case
  – California IEPR 2017 Carbon Price Projections High Price starting in 2025
    • Start at $14.76/MT in 2025, escalating to $107.87/MT in 2037
Questions
Natural Gas Price

Eric Race
IRP Advisory Council Meeting
September 13, 2018
Natural Gas Price Forecasts $/MMBtu

- EIA-2018 REF
- EIA-2018 HOG
- EIA-2018 LOG
- 17 IRP (2016 EIA HOG)
- 2018 Market
- EIA-2016 REF

EIA 2018 LOG
EIA 2016 REF
EIA 2018 REF
EIA 2018 HOG

2018 Market

2019 2021 2023 2025 2027 2029 2031 2033 2035 2037
## Oil and Natural Gas Prices

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>As of 9/11/2018</th>
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<tbody>
<tr>
<td>5 Yr. Avg. WTI Crude Oil</td>
<td>$64.88</td>
<td>$48.52</td>
<td>$56.23</td>
<td>$54.56</td>
<td>$62.00</td>
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<tr>
<td>Forward Price US$/Bbl</td>
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<tr>
<td>5 Yr. Avg. Henry Hub Natural</td>
<td>$3.667</td>
<td>$2.879</td>
<td>$3.085</td>
<td>$2.839</td>
<td>$2.630</td>
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<tr>
<td>Gas Forward Price US$/MMBtu</td>
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As of 9/11/2018
### Natural Gas Supply and Demand

<table>
<thead>
<tr>
<th>Natural Gas Units in BCF/D</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
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<tbody>
<tr>
<td><strong>Dry U.S. Natural Gas Production</strong></td>
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<tr>
<td>Dry U.S. Natural Gas Production</td>
<td>74.15</td>
<td>72.86</td>
<td>73.54</td>
<td>80.95</td>
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<tr>
<td><strong>Total US Natural Gas Imports</strong></td>
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<tr>
<td>Total US Natural Gas Imports</td>
<td>7.45</td>
<td>8.21</td>
<td>8.33</td>
<td>7.97</td>
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<tr>
<td><strong>Total US Natural Gas Exports</strong></td>
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<tr>
<td>Total US Natural Gas Exports</td>
<td>-4.89</td>
<td>-6.38</td>
<td>-8.68</td>
<td>-9.94</td>
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<tr>
<td><strong>Net Total US Natural Gas Production</strong></td>
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<tr>
<td>Net Total US Natural Gas Production</td>
<td>75.53</td>
<td>75.78</td>
<td>74.13</td>
<td>79.94</td>
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<td><strong>Total US Natural Gas Demand</strong></td>
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<tr>
<td>Total US Natural Gas Demand</td>
<td>74.8</td>
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<td>79.86</td>
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