Federal Columbia River Power System

Presenters:
• Bonneville Power Administration
  – Kim Johnson, Fed Hydro Manager
  – Gordon Ashby, Resource Economic Planner

• Bureau of Reclamation – Columbia-Pacific Northwest Region
  – Joe Summers, Regional Power Manager
  – Jake Nink, Deputy Power Manager

• U.S. Army Corps of Engineers – Northwestern Division
  – Scott Thoren, Senior Power Business Line Manager
  – Roger James, Large Capital Program Manager
Safety

- **Days Away, Restricted, or Transferred**
  - Min target and Stretch target are established by the Performance Subcommittee
Fed Hydro Commitment

• Safety First - protect our people and equipment

• Asset Management principles that improve efficiency, affordability and reliability
  – Process improvements for program execution

• Cost effective operation and maintenance
  – Balance cost, performance, and risk

• Risk informed investment decisions
  – “Right project at the right time at the right cost”

• Deliver value to customers and stakeholders
Direct Funding History

• 1992 National Energy Policy Act
  – Section 2406: Direct Funding Legislation
    • Capital investments, operations and maintenance
    • Power specific and joint costs

• Memoranda of Agreement between Agencies
  – Bureau of Reclamation
    • 1993: Capital
    • 1996: O&M
  – U.S. Army Corps of Engineers
    • 1994: Capital
    • 1997: O&M
FCRPS Organization

Joint Operating Sub-Committees
(Working Groups)

- Capital Workgroup (CWG)
- Asset Planning Team (APT)
- River Management (RMJOC)
- Cultural Resources (CRSC)
- Reliability Implementation Technical (RITS)
- Hydropower Optimization Team (HOT)
- Technical Implementation Operations (TOIS)
- Performance Committee (PC)
Asset Management

- FCRPS AM Commitment
  - **Vision**
    - Efficiency, affordability and reliability of the system's long-term value.
  - **Mission**
    - Deliver benefits to power, irrigation, navigation, and other customers and key stakeholders.
    - Proactively implement asset management practices to enable us to provide products with the highest regard to safety, environment, reliability, reputation, and cost effectiveness.
  - **Asset Management Values**
    - Customers: Transparency
    - People: Safety, Invest
    - Process/Information: Informed decisions
    - Plant: Optimize value

**FCRPS Asset Management Commitment**

**Vision**
The FCRPS mission is to assure the efficiency, effectiveness and reliability of the system's long-term value through business practices that reflect industry best practices in asset management. These processes include all aspects of planning, implementing and enforcing the policies and procedures for operations, maintenance, and improvements of FCRPS assets.

**Background**
The U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, and Bonneville Power Administration act together through a strong three-agency alliance as responsible stewards of the Federal Columbia River Power System (FCRPS). The FCRPS is compact of billions of dollars in assets and provides great economic and social benefits for the Pacific Northwest and beyond.

**Mission**
The FCRPS mission is to assure the efficiencies of power, irrigation, navigation, and other customers and key stakeholders. We owe it to those customers and stakeholders to proactively implement and utilize industry leading asset management practices.

**Asset Management Values**
- **Customers**
  - Emphasize the FCRPS role as a service provider to a broad range of customers and stakeholders.
  - Cultivate a culture of accountability as federal partners to deliver demonstrated value to those customers.
  - Establish ourselves as competent and transparent providers of the services expected by our customers and stakeholders.

- **People**
  - Value safety above all else — every process and action first identifies risks and preventative measures to protect our greatest asset, our employees.
  - Ensure that the role and responsibilities of our organization are clear, meaningful, valuable and rewarding.
  - Enable staff to exercise leadership and appropriate levels of decision-making.
  - Invest in employee training and development to effectively accomplish their function.

- **Process/Information**
  - Balance cost, performance, and risk through a consistent and credible decision making process.
  - Manage and utilize information and knowledge to enable informed decisions and effective information execution.
  - Leverage innovative solutions and industry best practices to continuously improve achievement of FCRPS objectives.

- **Plant**
  - Operate, maintain, and invest in our facilities to optimize their value to customers and stakeholders over the long-term that is consistent with the financial health and stability of the FCRPS.
  - Identify the business value of each facility, asset, and component and align performance expectations with that value, including all areas listed below:
    - Generation & Capacity
    - Cost
    - Risk Management
    - Health & Safety
    - Environmental responsibilities
    - Legislative requirements
    - Regulatory requirements
    - Cultural and natural responsibilities

SIGNED:
- General D. Peter Cafmeyer
  - Commander, Northwestern Division
  - U.S. Army Corps of Engineers
- Reginald London
  - National Director, Pacific Northwest Region
  - U.S. Bureau of Reclamation
- Mr. Elliot Muleezer
  - Administrator
  - Bonneville Power Administration
Asset Management

- **Maturity Assessment**
  - Adapted from Institute of Asset Management

- **Focus Areas**
  - Culture and Communication
    - Develop and update strategic objectives
    - Evaluate governing process
    - Leadership communication
  - Quality and scope of strategies and plans
    - Value assessments
    - Define risk tolerances
    - Plant specific asset plans
Cost Effectiveness

- Federal Hydro System related costs represent about 2/3 of Power Services total costs.
- Corps and Reclamation costs (operations, maintenance and capital-related costs) represent 44% of the fully-loaded Federal Hydro System costs.

- Power Services costs
- Fully-loaded Federal Hydro System costs.

*3-year average 2017-2019*
Cost Effectiveness

- Cost of Generation represents the capital and expense costs associated with producing power at the facilities.

- Corps and Reclamation are first quartile performers among 14 North American utilities.

- BPA costs (asset management, generation planning, etc.) are allocated to Corps and Reclamation facilities and included in benchmark costs.
• Fully Loaded Cost represent all Power Services costs attributable to the FCRPS (including Fish and Wildlife).

• Long-term capital and expense programs are expected to be flat in real 2020 dollars.

• Increases in capital are offset by mitigated lost generation risk.

• Expense program is assumed to increase with inflation after the 2022-2023 rate period.
Reclamation - O&M Budget

- Detailed O&M Budget and Proposed Spending Levels

<table>
<thead>
<tr>
<th>FY</th>
<th>Total Base Program</th>
<th>NREX</th>
<th>Cultural Resources</th>
<th>WECC/NERC</th>
<th>Wheeling</th>
<th>Leavenworth Appropriated Expense</th>
<th>Total Budget</th>
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<tr>
<td>2018</td>
<td>$114,070</td>
<td>$43,152</td>
<td>$3,966</td>
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<td>$20,364</td>
<td>$3,820</td>
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<td>$1,866</td>
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<td>$500</td>
<td>$142,394</td>
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</table>

Notes:
1) Grand Coulee G19-21 scope of work not fully identified and costs are not included in NREX
2) FY19 IPR budget approved at $162,623K. Total budget shown is the approved power budget required for actual expenditures.
Reclamation - O&M Budget

- O&M Expenditures

### Expense Program Expenditures 2010-2019

**Routine Expense**
- 2010: $75,039,000
- 2011: $77,269,000
- 2012: $81,105,000
- 2013: $85,992,000
- 2014: $101,801,000
- 2015: $101,582,000
- 2016: $101,617,057
- 2017: $114,481,199
- 2018: $114,817,000
- 2019: $121,971,000

**Non-Routine Expense**
- 2010: $5,550,000
- 2011: $7,580,000
- 2012: $7,203,000
- 2013: $35,137,000
- 2014: $33,676,000
- 2015: $28,709,000
- 2016: $28,590,955
- 2017: $35,176,577
- 2018: $37,288,000
- 2019: $40,780,000

**IPR Budget**
- 2010: $85,368,000
- 2011: $94,610,000
- 2012: $113,672,000
- 2013: $119,891,000
- 2014: $140,601,000
- 2015: $143,033,000
- 2016: $156,818,000
- 2017: $157,621,000
- 2018: $164,609,000
- 2019: $162,623,000
Reclamation - O&M Budget

- FY16 - 24 O&M Cost Analysis
  - Annual Power Budget: $785K increase
  - Routine Expenses: 29.3% Increase
  - Routine Labor: 22.3% Increase
    - 60% Routine Budget
      - 62% Craft
      - 38% GS
  - Non Routine: 13.5% Reduction

Notes: FY16 – 19 Actuals
       FY20 – 24 Estimated
       Does not include Grand Coulee G19 - 21
Reclamation - Cost Drivers

- **Routine O&M Labor FY 16 – FY 19**
  - Labor cost increase 18.7% ($10.8M)
    - Significant wage increases in NW utilities pay pool
    - Overtime decreased = 9.5% ($5.5M)

- **Routine O&M Labor FY 20 and FY 21**
  - Estimated labor increase requirement 8.4% ($5.7M)
  - Available labor increase 2.2% ($1.5M)

- **Routine O&M Labor FY 22 and FY 23:**
  - Estimated labor increase 6.7% ($4.6M)

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<table>
<thead>
<tr>
<th>FY</th>
<th>Average Craft Wage Increase at Grand Coulee</th>
<th>Average Craft Wage Increase in Snake River Area Office</th>
<th>GS Wage Increase</th>
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<tbody>
<tr>
<td>2015</td>
<td>3.54%</td>
<td>3%</td>
<td>1%</td>
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<tr>
<td>2016</td>
<td>1.95%</td>
<td>2.65%</td>
<td>1.17%</td>
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<tr>
<td>2017</td>
<td>1.30%</td>
<td>2.38%</td>
<td>1.63%</td>
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<tr>
<td>2018</td>
<td>4.62%</td>
<td>2.88%</td>
<td>1.67%</td>
</tr>
<tr>
<td>2019</td>
<td>3.95%</td>
<td>3%</td>
<td>1.66%</td>
</tr>
<tr>
<td>2020</td>
<td>3.47%</td>
<td>3% - 3.50%</td>
<td>2.85%</td>
</tr>
<tr>
<td>2021 (est)</td>
<td>3% - 3.50%</td>
<td>3% - 3.50%</td>
<td>1% - 3%</td>
</tr>
<tr>
<td>2022 (est)</td>
<td>3% - 3.50%</td>
<td>3% - 3.50%</td>
<td>1% - 3%</td>
</tr>
<tr>
<td>2023 (est)</td>
<td>3% - 3.50%</td>
<td>3% - 3.50%</td>
<td>1% - 3%</td>
</tr>
</tbody>
</table>
Reclamation – Funding Constraints

• FY 20/21 Backlog carry over to FY 22/23
  – Grand Coulee power circuit breaker reconditioning
  – Grand Coulee World Class Hydro
  – Black Canyon thrust bearing cooling coils and cooling water piping
  – Black Canyon/Boise Diversion vibration monitoring controls

• FY 22/23 Deferred activities due to lack of funding
  – Grand Coulee machine conditioning and system monitoring

• FY 22/23 Program Risks
  – CRSO EIS implementation, NPDES Permits, 401 Certification, TMDL
Reclamation - Reliability and Availability

• Weighted Forced Outage
  – FY 02 – FY 19 Average: 3.21%
  – FY 02 High: 8.38%
  – FY 05 Low: 0.44%
  – FY 19: 1.24%

• FY 20 Weighted Forced Outage
  – Forced Outage Rate = 9.15%
  – Grand Coulee Affected Units
    • G21 (transformer)
    • G23 and G24 (warranty rotor poles)
  – Non routine funding not available to respond after hours/weekends
    • Upon request G20 returned to service early from maintenance
    • Upon request G21 transformer change out

Grand Coulee Third Power Plant Overhaul
• Reclamation Efficiency/Availability Improvements
  – Grand Coulee Left and Right Powerhouse Crew Realignment
    • Major Maintenance Crew
      – 6-year cycle
      – 4-month outage vs. 7 month (15% overall availability improvement)
    • Running Crew
      – PMs, TRs, Recommendations
    • Support Crew
      – Equipment modifications, forced outages
    • Crew composition defined by need not by craft
  – Grand Coulee Unit Optimization
    • Dispatch units at or near most efficient point
    • Algorithm: Reclamation’s HydrOS
    • 1.3% Estimated Efficiency Improvements

FY 18 Grand Coulee Right Power House (nine units online)
Reclamation – Delivering Value

- Reclamation World Class Hydro
  - Grand Coulee World Class Hydro
    - Infrastructure (FY 20 – FY 23)
      - Warehouse modernization
      - Fleet management strategy
    - Procedures
      - Maintenance policies and procedures
      - Action plans to address inadequate procedures
      - Computerized maintenance management system best practices
    - Knowledge
      - Maintenance videos

- Procedures
- Knowledge
- Communication
• O&M Optimization: Demand Analysis
  – Ongoing study to define value (power and non-power) of facilities
  – Assesses benefits and risks
  – Assists development of plant level specific asset plans
    • Optimize investment and operational/maintenance plans
  – Assists prioritization of operations and maintenance activities

• Remoting
  – Snake River Area Office (Southern Idaho Control Center)
    • Black Canyon, Boise Diversion, Anderson Ranch, Minidoka, Palisades
  – Hungry Horse (Grand Coulee Control Center)

• Multi-Craft
  – Columbia Cascades and Snake River facilities
Corps O&M Budget

- Corps Detailed Budget and Proposed Spending Levels

<table>
<thead>
<tr>
<th>FY</th>
<th>Total Base Program</th>
<th>NREX</th>
<th>Cultural Resources</th>
<th>WECC/NERC</th>
<th>Fish Wildlife</th>
<th>Appropriated</th>
<th>Total Budget</th>
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</thead>
<tbody>
<tr>
<td>2018</td>
<td>$166,614</td>
<td>$28,100</td>
<td>$5,366</td>
<td>$4,997</td>
<td>$48,894</td>
<td>$500</td>
<td>$256,057</td>
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<td>$28,100</td>
<td>$5,113</td>
<td>$5,498</td>
<td>$49,100</td>
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<td>$4,996</td>
<td>$5,273</td>
<td>$50,459</td>
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<td>$48,480</td>
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<td>$24,000</td>
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<td>$5,200</td>
<td>$5,003</td>
<td>$50,004</td>
<td>$500</td>
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</tr>
</tbody>
</table>

**O&M Budgets**

- Total Base Program
- NREX
- Cultural Resources
- WECC/NERC
- Fish Wildlife
- Appropriated
### Corps O&M Budget

#### Expense Program Historical Actuals by Expense Category

**Corps 2010-2019**

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Corps - Routine Expense</td>
<td>171,822,755</td>
<td>176,027,257</td>
<td>186,393,747</td>
<td>189,680,233</td>
<td>208,271,687</td>
<td>214,235,000</td>
<td>220,986,635</td>
<td>225,956,798</td>
<td>221,471,906</td>
<td>227,957,000</td>
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<tr>
<td>Corps - Non-Routine Expense</td>
<td>8,478,000</td>
<td>10,909,000</td>
<td>20,173,000</td>
<td>17,471,000</td>
<td>13,463,000</td>
<td>15,823,000</td>
<td>16,521,000</td>
<td>19,072,000</td>
<td>24,116,000</td>
<td>20,763,000</td>
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<td>Corps IPR Budget</td>
<td>190,560,000</td>
<td>192,433,000</td>
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<td>215,700,000</td>
<td>225,687,000</td>
<td>231,878,000</td>
<td>243,885,000</td>
<td>250,981,000</td>
<td>256,057,000</td>
<td>256,057,000</td>
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</tbody>
</table>
• Flat Budget Projections:
  – Inflation and wage increases create $44 million deficit in 2023
  – Taken proportionally, ~200 FTE and $10 million non-labor

![Graph showing BPA Direct Funding - USACE O&M Budgets from FY12 to FY23, with a blue line for budget and a red line for inflation & wages. The graph highlights a $44M deficit projected in FY23.](image-url)
Corps Cost Drivers

- 68% of O&M cost is labor; since FY 16:
  - United Power Trades Organization (UPTO) salary increases – 16.5%
  - GS salary increases – 9.2%
  - Non-labor increases – 8.1%

- Cost impacts in FY 23 due to flat budgets:
  - UPTO salary increases – $17 million (~$2.5 million/yr)
  - GS salary increases – $16.5 million (~$2 million/yr)
    - Engineering Special Salary Rate - $3.5 million
  - Non-labor increases – $10.6 million (~$1.5 million/yr)

- Reduction in “buying power” for FY 22 & FY 23:
  - $38 million and $44 million due to labor and non-labor
Corps – Affordability Actions

• Corps of Engineers Actions
  – O&M labor headcount statistics FY 17-FY 20
    • NWP reduced 29 FTE
    • NWS reduced 3 FTE (since FY 18)
    • NWW reduced 24 FTE
  – Cumulative O&M overtime reductions during FY 18 & FY 19
    • NWP reduced 8,200 hr (4.7 FTE)
    • NWS reduced 10,100 hr (5.8 FTE)
    • NWW reduced 16,500 hr (9.4 FTE)
Corps – Funding Constraints

• Non-Routine Expense Projects – FY 21/22 NREX New Starts
  – Little Goose DSAC Spillway 1 Failed Waterstop
  – Lower Granite Transformer Leak Repairs
  – Lower Granite Thrust Bearings
  – Ice Harbor Spillway Pressurized Leaks
  – Libby Spillway Repairs

• FY 23/24 NREX New Starts
  – Chief Joseph Cavitation Repair U17-27
  – Chief Joseph, The Dalles and Dworshak SF6 Breaker Overhauls
  – John Day Draft Tube Bulkheads and Intake Gate Repairs
  – Dworshak Turbine Efficiency Testing
  – Little Goose Training Wall and Stilling Basin Repair

• Program Risk
  – CRSO EIS implementation, NPDES Permits, 401 Certifications, TMDL
• Weighted Forced Outage
  – FY 02 – FY 19 Average: 4.3%
  – FY 17 High: 7.2%
  – FY 06 Low: 2.8%
  – FY 17-19 Average: 6.7%

• FY 17-19 Forced Outage Drivers
  – Turbine Oil Accountability
  – Bearings
  – Transformers
  – Stator Windings
  – Have had extensions due to funding availability @ year end
Corps – Delivering Value – Cost Reduction

• Remote Control of Hydropower
  – Operations Centric Team Established
  – Three Courses of Action
    • Status Quo
    • Regional control (Nodes)
    • Centralized Controls – Portland/Vancouver
  – Albeni Falls Study

• Multi-crafting & Labor Discussions

• Acquisition
  – Training Workshops
  – Regional COAs to Improve Communication, Knowledge, Consistency
  – Acquisition Board to Streamline Strategies and Delivery Processes
O&M Optimization

• Demand Analysis
  – Types of Value
  – Services Provided
  – Operating Conditions
  – Level of Service

• Next Steps
  – Plant-Specific Operating Principals
  – Define Required Levels of Service
  – Outage Schedule Refinement
  – Integrate O&M Value into Capital Program
Capital Decision Making

FCRPS Capital Planning

- Strategic Asset Management Plan
- Investment Identification and Development
- Investment Portfolio Optimization
- System Asset Plan
Historical Program Execution

- Underexecution
  - Complexity of large powertrain projects
  - Forecast Accuracy

- Process Improvements
  - Asset Planning Team (2016)
  - System Asset Plan (2017 1st edition)
  - Project lifecycle framework (2019)
Recommended Strategy

- Ramp up to $300 million by 2024, then increase with inflation
- Increase investment in powertrain components
• Majority of capital investment is targeted at Main Stem Columbia.

• Investments are closely tied to lost generation risk mitigation.

Lost Generation Risk is the expected value of lost revenue from replacement power purchases or lost sales due to equipment failure. It is the product of equipment probability of failure times outage consequences at average water conditions. Current Lost Generation Risk by plant is a sum of the lost generation risk for each piece of equipment based on current equipment condition.
Major Capital Projects

Grand Coulee
- G19-21 Modernization (2024-2031)
- Grand Coulee Arc Flash Mitigation (2023-2045)
- G1-18 Electrical Modernization (2030-2038)

McNary
- Exciter and Governor Upgrades (2020 to 2022)
- Turbine Replacement (2023 – 2030)

Chief Joseph
- Generator Rewinds (2022 – 2032)
- Currently in preliminary design and scoping

John Day
- Turbine Replacement and Generator Rewinds (2032 – 2043)
- Currently in preliminary design and scoping
The recommended strategy:

- Reduces lost generation and direct cost risks by 33% in 20 years.
- Reduces the number of assets posing high safety and environmental risks by 44% in 20 years.
- Increases unit efficiency and capacity through turbine replacements and unit uprates.
- Assesses the optimal number of units to replace/rehabilitate.
Efficiency Improvements

- 96 aMW to date
- 20 aMW expected from ongoing projects
- Minimal incremental cost (secondary benefit of end-of-life replacement)
- Renewable Energy Credits are passed directly to customers

### Completed Turbine Projects

<table>
<thead>
<tr>
<th># of Units</th>
<th>Effic. Gain</th>
<th>aMW avg water</th>
<th>MWh avg water</th>
<th>Upgrades Completed</th>
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<tr>
<td>Bonneville 1-10</td>
<td>10</td>
<td>4.2%</td>
<td>11.8</td>
<td>2010</td>
</tr>
<tr>
<td>Grand Coulee 1-18</td>
<td>18</td>
<td>4.2%</td>
<td>33.9</td>
<td>2011</td>
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<tr>
<td>Cougar</td>
<td>2</td>
<td>4.8%</td>
<td>0.8</td>
<td>2005</td>
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<tr>
<td>Chief Joseph 5,9,11-14</td>
<td>6</td>
<td>6.2%</td>
<td>16.5</td>
<td>2013</td>
</tr>
<tr>
<td>Chief Joseph 6-8,10</td>
<td>4</td>
<td>6.2%</td>
<td>11.0</td>
<td>2015</td>
</tr>
<tr>
<td>Lookout Point</td>
<td>3</td>
<td>6.1%</td>
<td>2.4</td>
<td>2014</td>
</tr>
<tr>
<td>Hills Creek</td>
<td>2</td>
<td>5.0%</td>
<td>1.0</td>
<td>2016</td>
</tr>
<tr>
<td>Chief Joseph 1-4,15,16</td>
<td>6</td>
<td>4.4%</td>
<td>11.7</td>
<td>2018</td>
</tr>
<tr>
<td>Palisades</td>
<td>4</td>
<td>7.4%</td>
<td>6.8</td>
<td>2017</td>
</tr>
<tr>
<td><strong>Total Completed</strong></td>
<td><strong>55</strong></td>
<td><strong>96.0</strong></td>
<td><strong>841,308</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Ongoing Turbine Projects

<table>
<thead>
<tr>
<th># of Units</th>
<th>Effic. Gain</th>
<th>aMW avg water</th>
<th>MWh avg water</th>
<th>Upgrades Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ice Harbor 1-3</td>
<td>3</td>
<td>3.5%</td>
<td>4.73</td>
<td>2019-21</td>
</tr>
<tr>
<td>McNary Units</td>
<td>14</td>
<td>2.5%</td>
<td>15.6</td>
<td>2030+</td>
</tr>
<tr>
<td><strong>Total Ongoing</strong></td>
<td><strong>17</strong></td>
<td><strong>20.3</strong></td>
<td><strong>177,774</strong></td>
<td></td>
</tr>
</tbody>
</table>

| **Total Completed and Ongoing Projects** | **72** | **116** | **1,019,082** | |
The recommended strategy:

- Delivers almost $7.7 billion in Net Present Value at 7.9% discount rate.
- Has a $96 million greater Net Present Value than a $200 million per year investment level.
## FCRPS Long-Term Program Summary

<table>
<thead>
<tr>
<th>Strategic Class^1/</th>
<th>% of FCRPS Average Annual Generation</th>
<th>% of 50-Year Capital Forecast</th>
<th>% of 50-Year Expense Forecast</th>
<th>50-Year Cost of Generation ($/MWh)^2/</th>
<th>50-Year Fully Loaded Cost ($/MWh)^3/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Stem Columbia</td>
<td>77%</td>
<td>61%</td>
<td>64%</td>
<td>$7.54</td>
<td>$19.04</td>
</tr>
<tr>
<td>Lower Snake</td>
<td>12%</td>
<td>15%</td>
<td>14%</td>
<td>$12.13</td>
<td>$29.80</td>
</tr>
<tr>
<td>Headwater</td>
<td>6%</td>
<td>8%</td>
<td>8%</td>
<td>$11.76</td>
<td>$23.56</td>
</tr>
<tr>
<td>Area Support</td>
<td>4%</td>
<td>11%</td>
<td>10%</td>
<td>$30.07</td>
<td>$45.52</td>
</tr>
<tr>
<td>Local Support</td>
<td>1%</td>
<td>5%</td>
<td>4%</td>
<td>$42.48</td>
<td>$56.06</td>
</tr>
<tr>
<td>FCRPS</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>$9.56</td>
<td>$22.00</td>
</tr>
</tbody>
</table>

- Capital and Expense programs are heavily driven by generation importance but support multiple missions for the three agencies.

- The long-term programs developed for this IPR result in a 50-year Cost of Generation under $10/MWh and a fully loaded cost of $22/MWh.

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1/ Headwater and Lower Snakes have been broken out into two distinct Strategic Classes for BP-22.

2/ Cost of Generation represents the forecasted levelized capital and expense costs associated with producing power at the facilities for the next 50 years.

3/ Fully Loaded Cost includes the Cost of Generation plus allocations for all remaining Power Services costs attributable to the FCRPS including Fish and Wildlife. The majority of these costs are system-wide costs that would still be incurred and reapportioned across other Strategic Classes if generation ceased at a certain project or projects.
Questions?
This information was publicly available on June 12, 2020, and contains information not sourced directly from BPA financial statements.