



# FCRPS Program Strategy

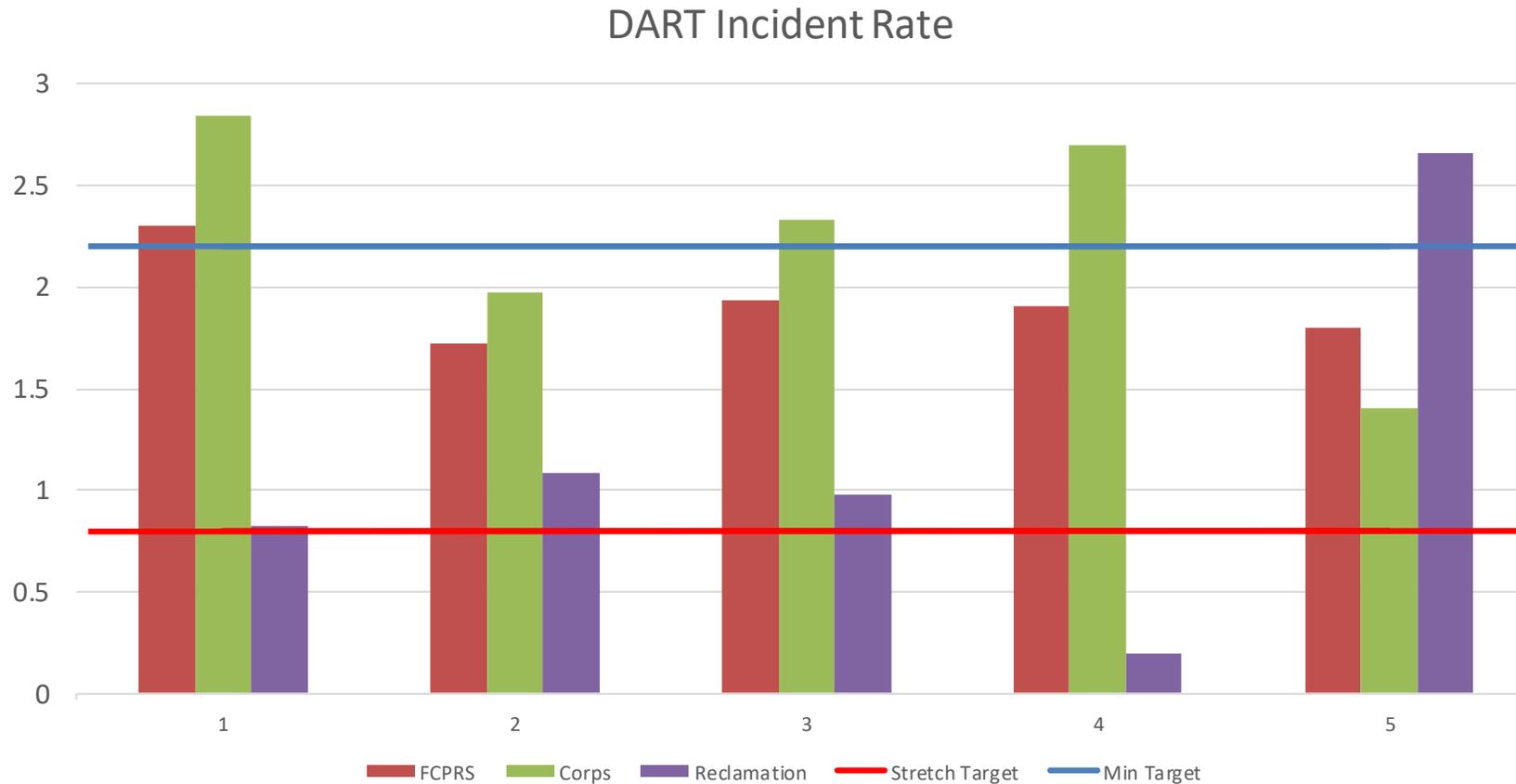
# Federal Columbia River Power System

## 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

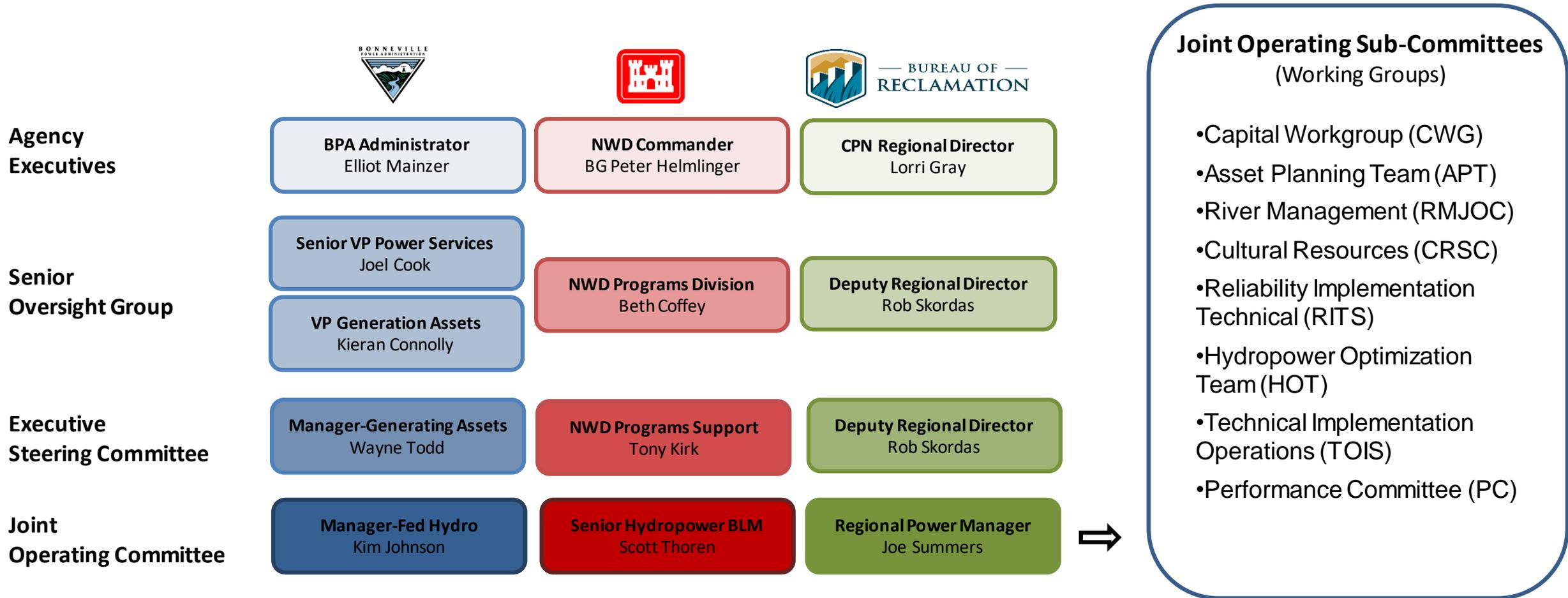
- Safety First - protect our people and equipment
- Asset Management principles that improve efficiency, affordability and reliability
  - Process improvements for program execution
- Cost effective operation and maintenance
  - Balance cost, performance, and risk
- Risk informed investment decisions
  - “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



# 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 agencies will strive to sustain the efficiency, affordability and reliability of the System's long-term value through business processes that reflect industry best-practices in asset management. These processes include all aspects of planning, resourcing, and approving work, while informing strategies for operations, maintenance, and reinvestments 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 comprised of billions of dollars in assets and provides great economic and social benefits for the Pacific Northwest and beyond.

### Mission

The FCRPS exists to deliver benefits to 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. This will enable us to provide those products and services with the highest regard to safety, environment, reliability, reputation, and cost.

### Asset Management Values

#### Customers

- Embrace the FCRPS' role as a service provider to a broad range of customers and stakeholders. Cultivate a culture of commitment 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 while being good stewards of the public's assets.

#### People

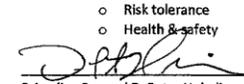
- Value safety above all else – every process and action first identifies risks and preventative measures to protect our greatest asset, our employees.
- Ensure that roles and responsibilities of our organizations are clear, meaningful, valuable and rewarding.
- Enable staff to exercise leadership and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

#### Process/Information

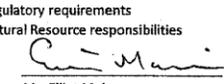
- Balance cost, performance, and risk through a consistent and credible decision-making process. Key stakeholders understand and have confidence in its integrity.
- Manage and utilize information and knowledge to enable informed decisions and effective work execution.
- Leverage innovative solutions 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:
  - o Generation & Capacity
  - o Cost
  - o Risk tolerance
  - o Health & safety
  - o Environmental responsibilities
  - o Legislative risks/requirements
  - o Regulatory requirements
  - o Cultural Resource responsibilities

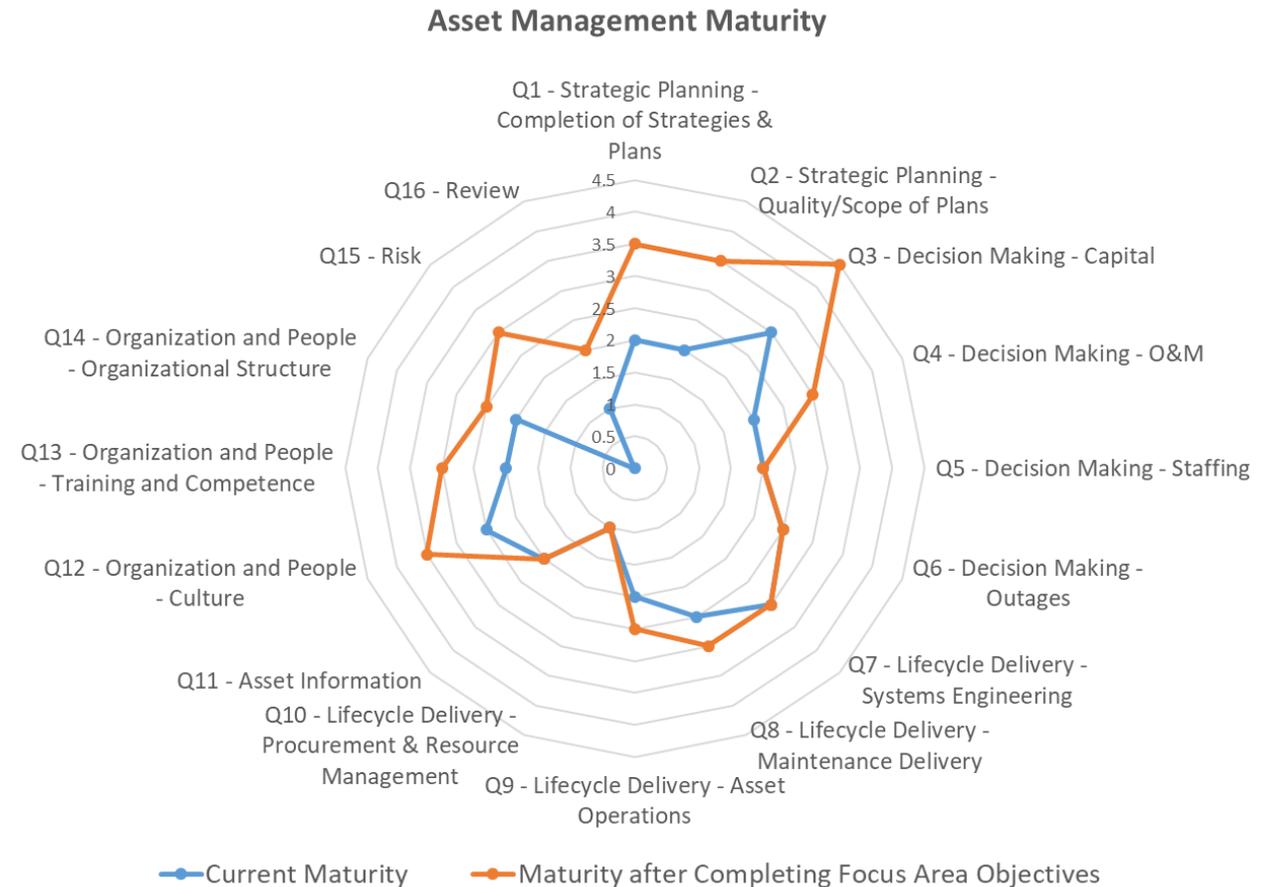
  
Brigadier General D. Peter Helmlinger  
Commander, Northwestern Division  
U.S. Army Corps of Engineers

  
Ms. Lorri Gray  
Regional Director, Pacific Northwest Region  
U.S. Bureau of Reclamation

  
Mr. Elliot Mainzer  
Administrator  
Bonneville Power Administration

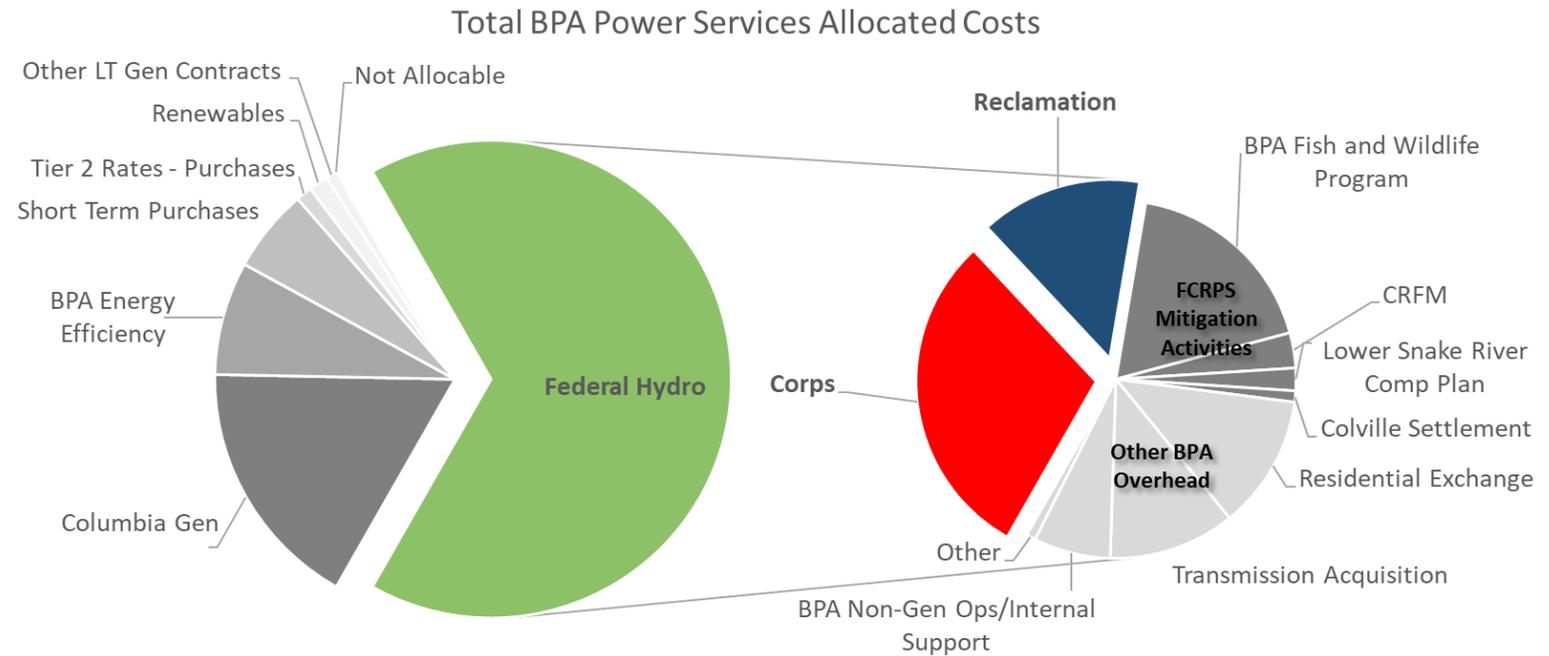
# Asset Management

- 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

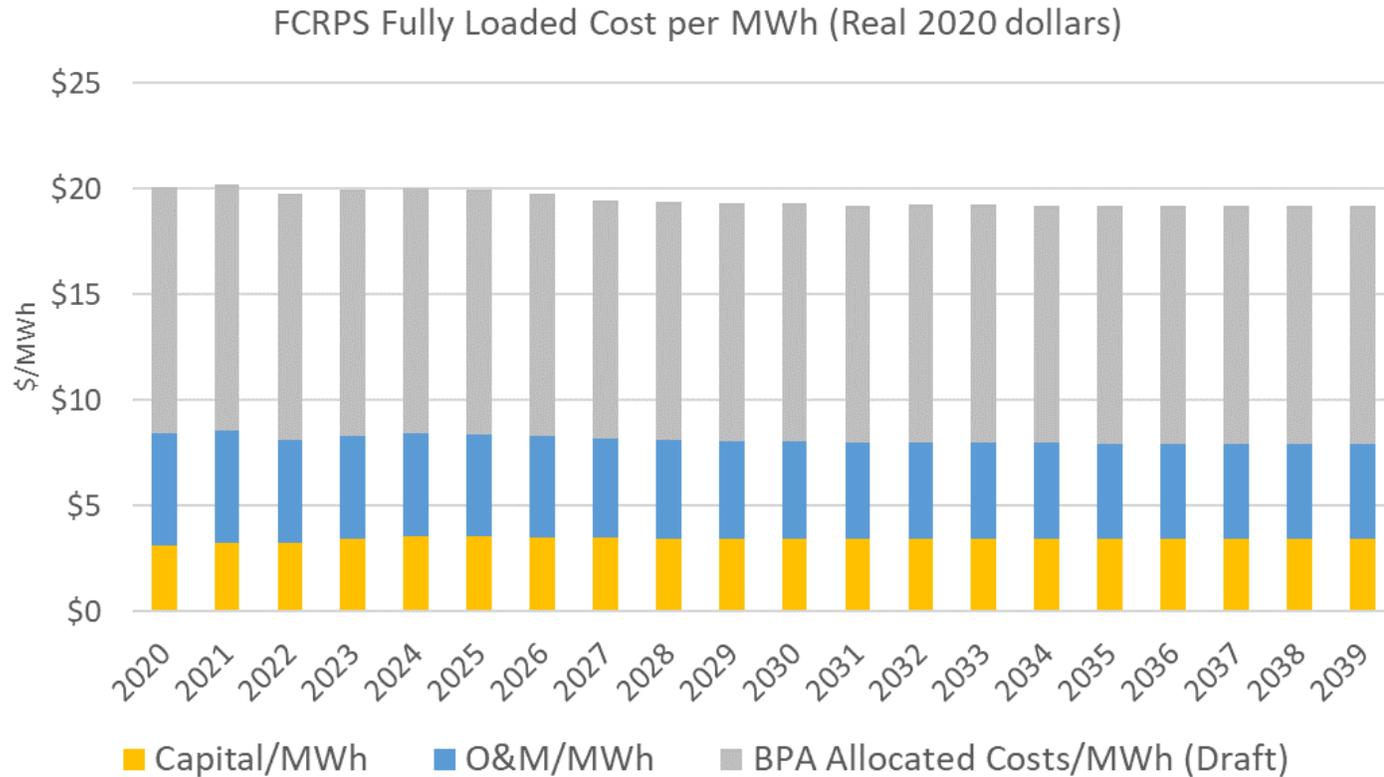
# Cost Effectiveness

Cost of Generation - 5 year Average, 2014-2018  
Operations, Maintenance, Administration and Investment (Capital & Non-Routine Expense)



- 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.

# Cost Effectiveness



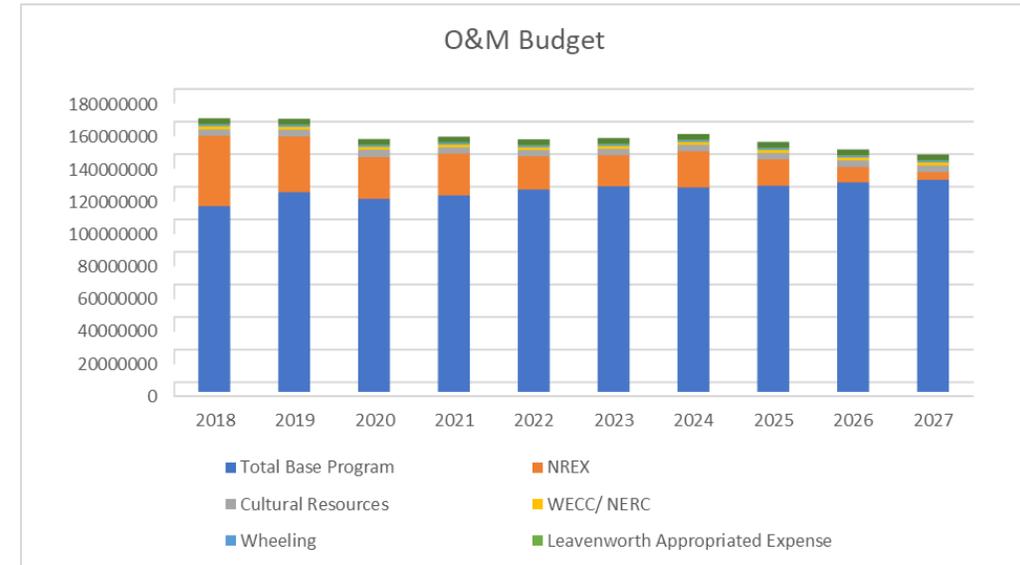
- Fully Loaded Cost represent all Power Services costs attributable to the FCRPS (including Fish and Wildlife).
- Long-term capital and expense programs are expected to be flat in real 2020 dollars.
- Increases in capital are offset by mitigated lost generation risk.
- Expense program is assumed to increase with inflation after the 2022-2023 rate period.

# Reclamation - O&M Budget

- Detailed O&M Budget and Proposed Spending Levels

FY	Total Base Program	NREX	Cultural Resources	WECC/NERC	Wheeling	Leavenworth Appropriated Expense	Total Budget
2018	\$114,070	\$43,152	\$3,966	\$1,921	\$1,000	\$500	\$164,609
2019	\$122,626	\$34,273	\$4,084	\$1,790	\$1,000	\$500	\$164,273
2020	\$118,535	\$25,677	\$4,507	\$1,680	\$1,000	\$500	\$151,899
2021	\$120,629	\$25,735	\$3,763	\$1,706	\$1,000	\$500	\$153,333
2022	\$124,269	\$20,364	\$3,820	\$1,732	\$1,000	\$500	\$151,684
2023	\$126,271	\$19,056	\$3,878	\$1,758	\$1,000	\$500	\$152,463
2024	\$125,528	\$22,194	\$3,936	\$1,784	\$1,000	\$500	\$154,941
2025	\$126,546	\$16,215	\$3,995	\$1,811	\$1,000	\$500	\$150,067
2026	\$128,617	\$9,459	\$4,055	\$1,838	\$1,000	\$500	\$145,469
2027	\$130,225	\$4,687	\$4,116	\$1,866	\$1,000	\$500	\$142,394

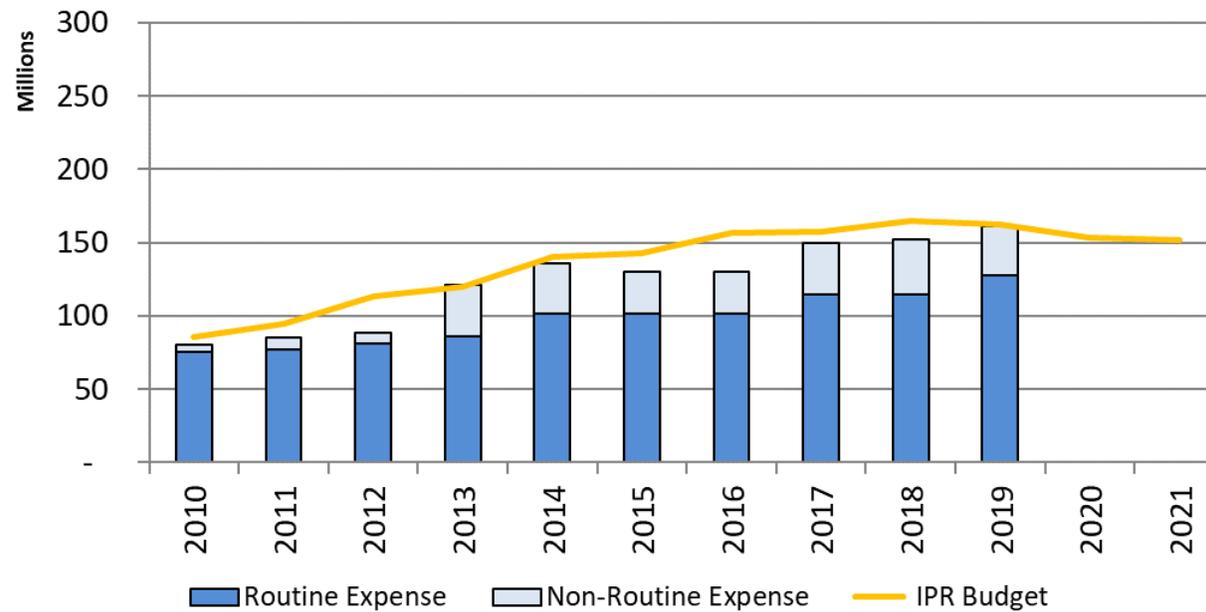
Notes: 1) Grand Coulee G19-21 scope of work not fully identified and costs are not included in NREX  
 2) FY19 IPR budget approved at \$162,623K. Total budget shown is the approved power budget required for actual expenditures.



# Reclamation - O&M Budget

- O&M Expenditures

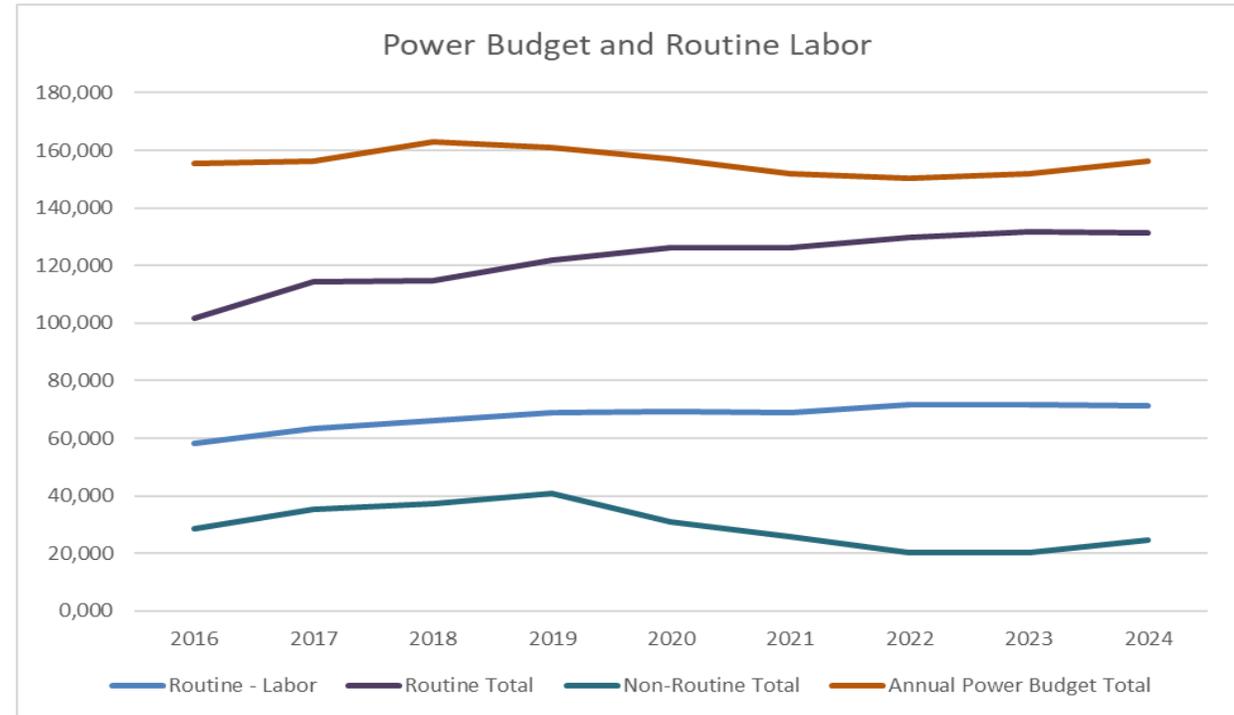
**Expense Program Expenditures  
2010-2019**



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Routine Expense	75,039,000	77,269,000	81,105,000	85,992,000	101,801,000	101,582,000	101,617,057	114,481,199	114,817,000	121,971,000
Non-Routine Expense	5,550,000	7,580,000	7,203,000	35,137,000	33,676,000	28,709,000	28,590,955	35,176,577	37,288,000	40,780,000
IPR Budget	85,368,000	94,610,000	113,672,000	119,891,000	140,601,000	143,033,000	156,818,000	157,621,000	164,609,000	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)

FY	Average Craft Wage Increase at Grand Coulee	Average Craft Wage Increase in Snake River Area Office	GS Wage Increase
2015	3.54%	3%	1%
2016	1.95%	2.65%	1.17%
2017	1.30%	2.38%	1.63%
2018	4.62%	2.88%	1.67%
2019	3.95%	3%	1.66%
2020	3.47%	3% - 3.50%	2.85%
2021 (est)	3% - 3.50%	3% - 3.50%	1% - 3%
2022 (est)	3% - 3.50%	3% - 3.50%	1% - 3%
2023 (est)	3% - 3.50%	3% - 3.50%	1% - 3%

# 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 – Delivering Value

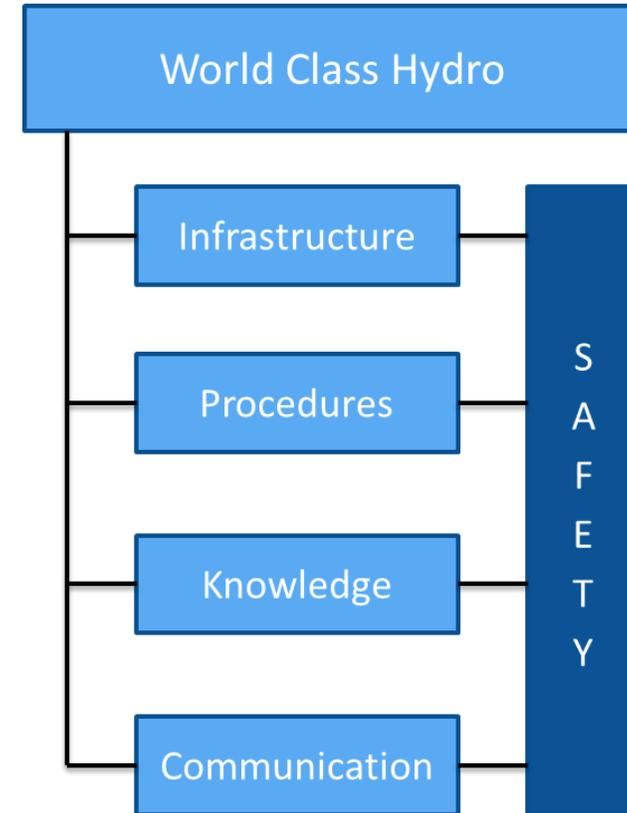
- Reclamation Efficiency/Availability Improvements
  - Grand Coulee Left and Right Powerhouse Crew Realignment
    - Major Maintenance Crew
      - 6-year cycle
      - 4-month outage vs. 7 month (15% overall availability improvement)
    - Running Crew
      - PMs, TRs, Recommendations
    - Support 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



# Reclamation – Delivering Value

- 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

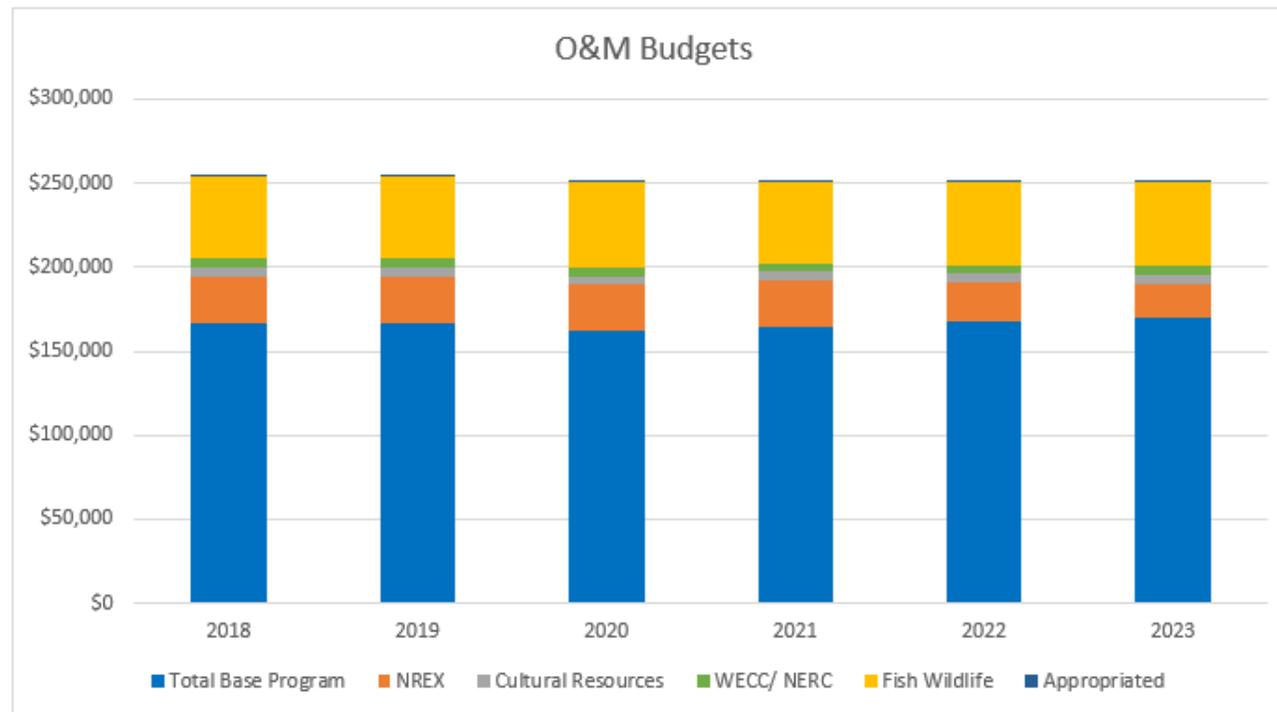


Inman U9 Distributor

# Corps O&M Budget

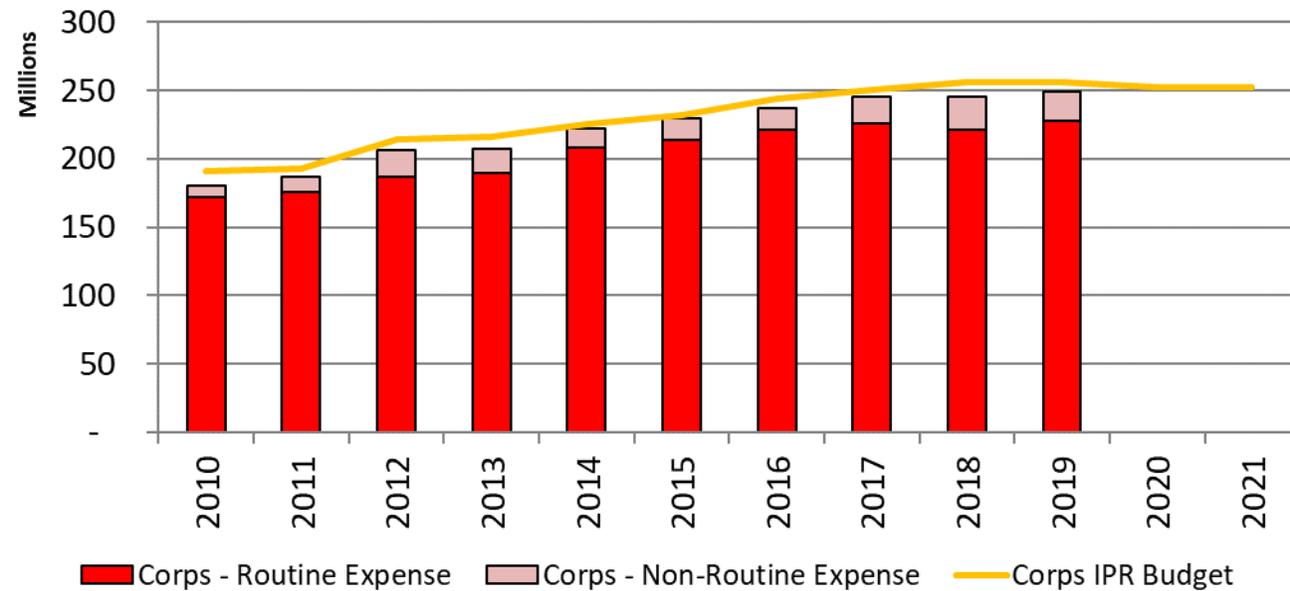
- Corps Detailed Budget and Proposed Spending Levels

FY	Total Base Program	NREX	Cultural Resources	WECC/NERC	Fish Wildlife	Appropriated	Total Budget
2018	\$166,614	\$28,100	\$5,366	\$4,997	\$48,894	\$500	\$256,057
2019	\$166,160	\$28,100	\$5,113	\$5,498	\$49,100	\$500	\$256,057
2020	\$161,688	\$28,100	\$4,996	\$5,273	\$50,459	\$500	\$252,557
2021	\$164,013	\$28,100	\$5,072	\$4,851	\$48,480	\$500	\$252,557
2022	\$167,235	\$24,000	\$5,072	\$4,928	\$49,250	\$500	\$252,557
2023	\$170,246	\$20,000	\$5,200	\$5,003	\$50,004	\$500	\$252,557



# Corps O&M Budget

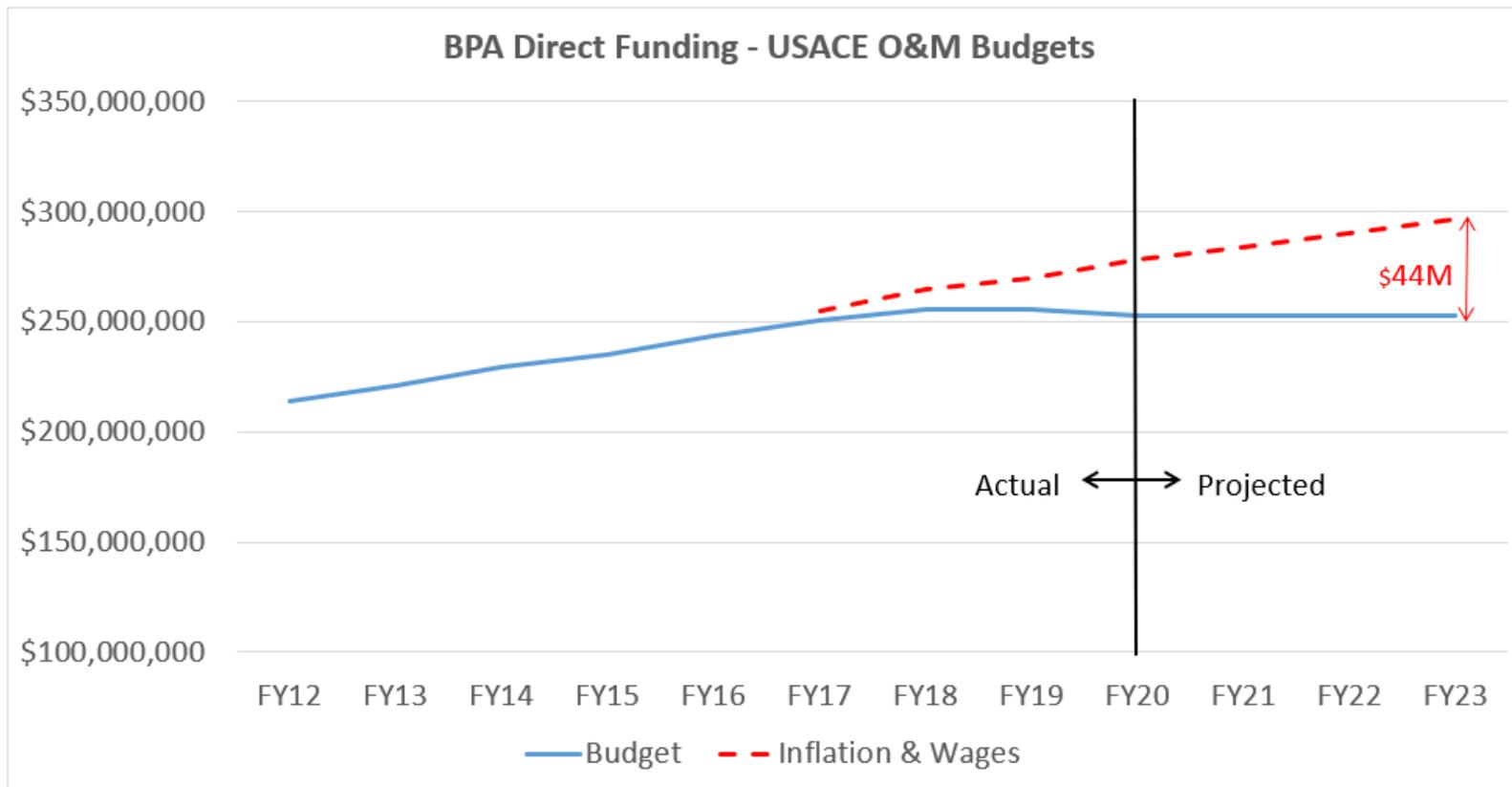
**Expense Program Historical Actuals by Expense Category  
Corps 2010-2019**



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Corps - Routine Expense	171,822,755	176,027,257	186,393,747	189,680,233	208,271,687	214,235,000	220,986,635	225,956,798	221,471,906	227,957,000
Corps - Non-Routine Expense	8,478,000	10,909,000	20,173,000	17,471,000	13,463,000	15,823,000	16,521,000	19,072,000	24,116,000	20,763,000
Corps IPR Budget	190,560,000	192,433,000	214,000,000	215,700,000	225,687,000	231,878,000	243,885,000	250,981,000	256,057,000	256,057,000

# Corps Cost Drivers

- Flat Budget Projections:
  - Inflation and wage increases create \$44 million deficit in 2023
  - Taken proportionally, ~200 FTE and \$10 million non-labor



# 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

# Corps Reliability and Availability

- 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

# Corps – Delivering Value – Revenue Enhancement

## O&M Optimization

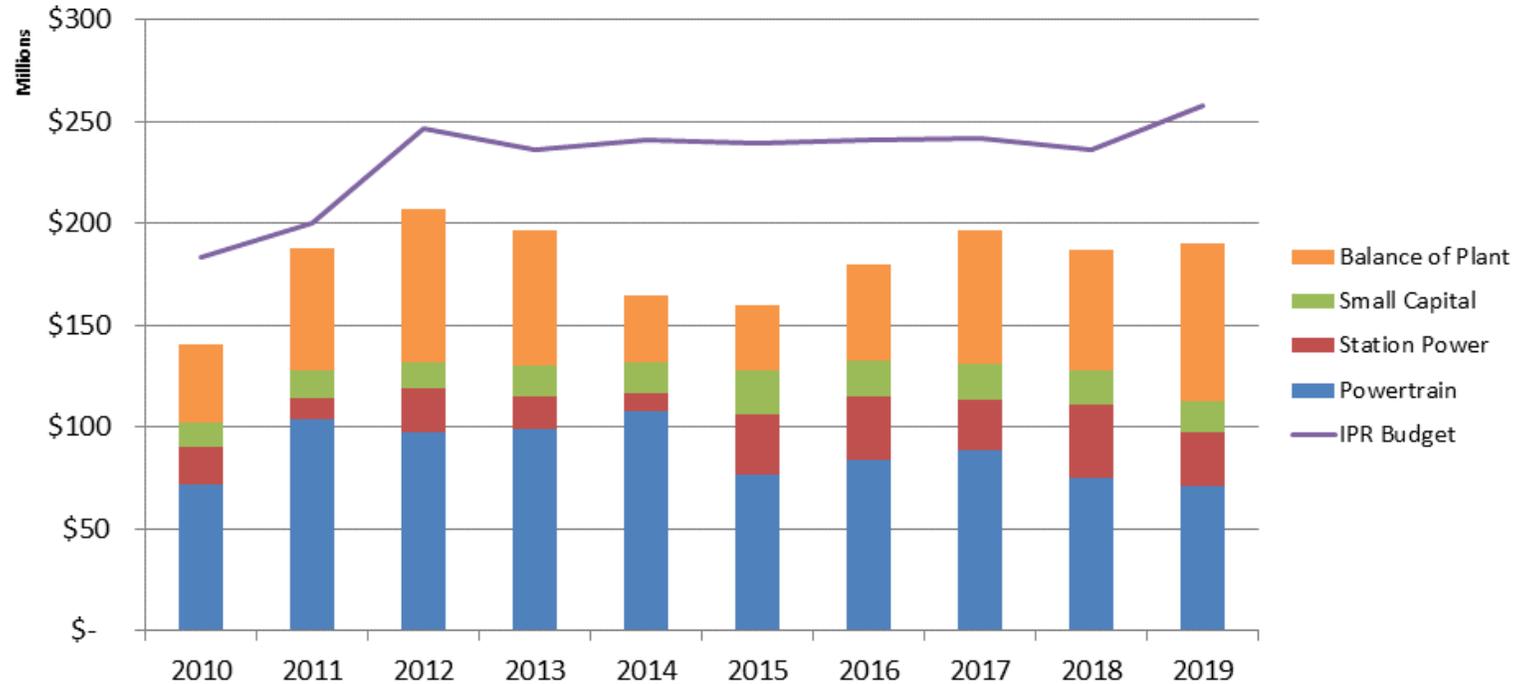
- Demand Analysis
  - Types of Value
  - Services Provided
  - Operating Conditions
  - Level of Service
- Next Steps
  - Plant-Specific Operating Principals
  - Define Required Levels of Service
  - Outage Schedule Refinement
  - Integrate O&M Value into Capital Program

# Capital Decision Making



# Historical Program Execution

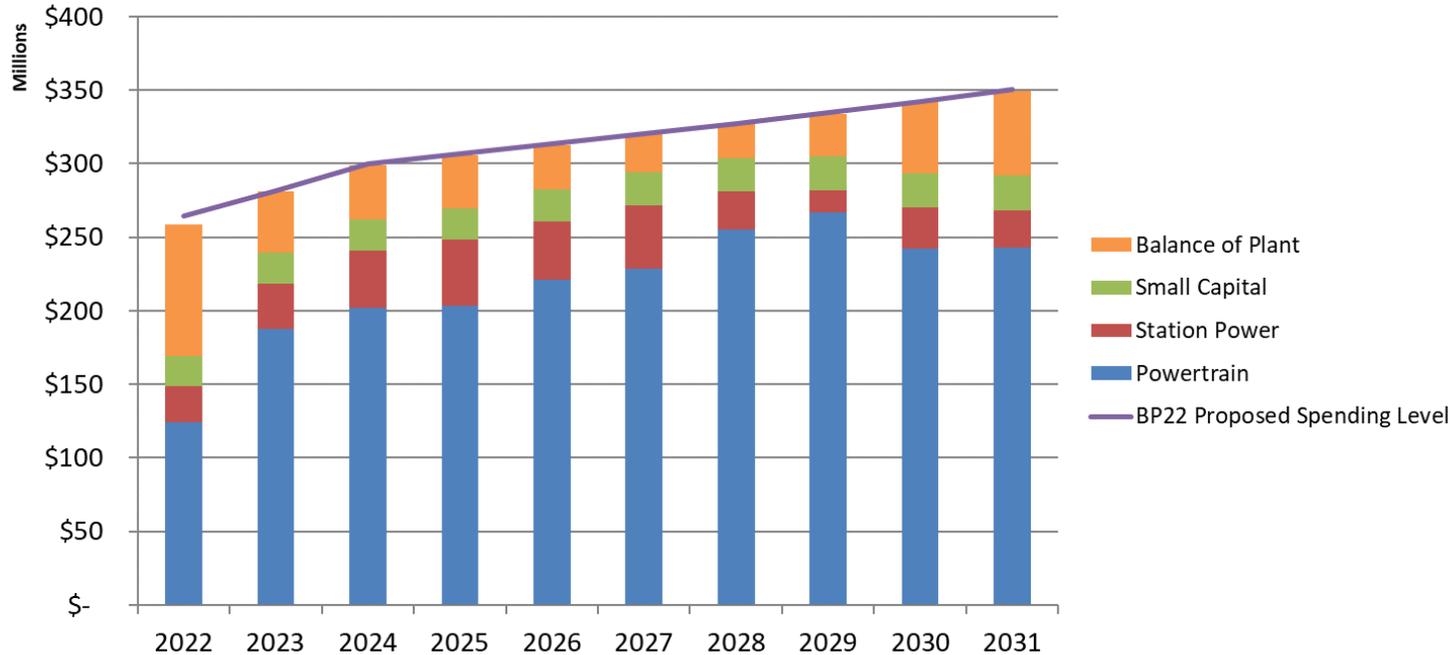
Capital Program Historical Actuals by Equipment Category  
2010-2019



- Underexecution
  - Complexity of large powertrain projects
  - Forecast Accuracy
- Process Improvements
  - Asset Planning Team (2016)
  - System Asset Plan (2017 1<sup>st</sup> edition)
  - Project lifecycle framework (2019)

# Recommended Strategy

**10-Year Capital Program Forecast by Equipment Category  
2022-2031**

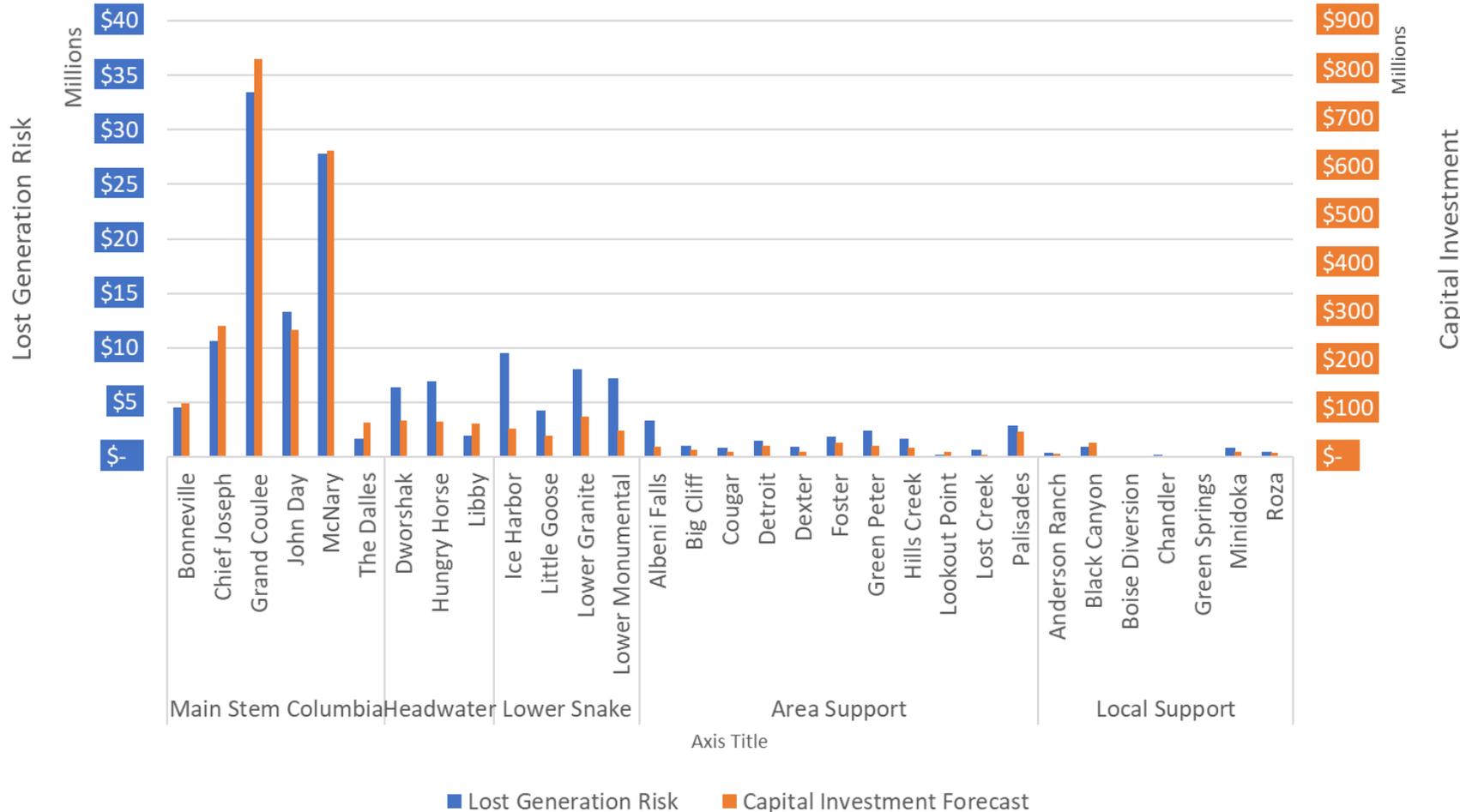


- Ramp up to \$300 million by 2024, then increase with inflation
- Increase investment in powertrain components

Capital Sustain	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Corps of Engineers	216,296	229,286	256,656	269,006	269,926	273,102	234,960	196,496	231,379	240,702
Bureau of Reclamation	47,824	51,974	43,344	37,844	43,721	47,364	92,578	138,379	111,056	109,590
<b>Total Capital Sustain</b>	<b>264,120</b>	<b>281,260</b>	<b>300,000</b>	<b>306,850</b>	<b>313,647</b>	<b>320,466</b>	<b>327,538</b>	<b>334,875</b>	<b>342,435</b>	<b>350,292</b>

# Plant Detail

Current Lost Generation Risk vs Capital Investment Forecast (2022-2031)



- 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



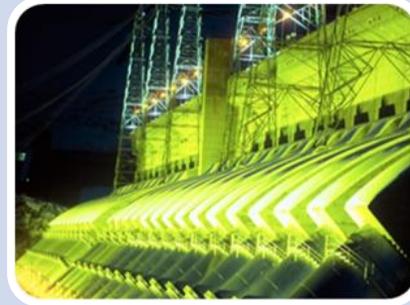
## Grand Coulee

- 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

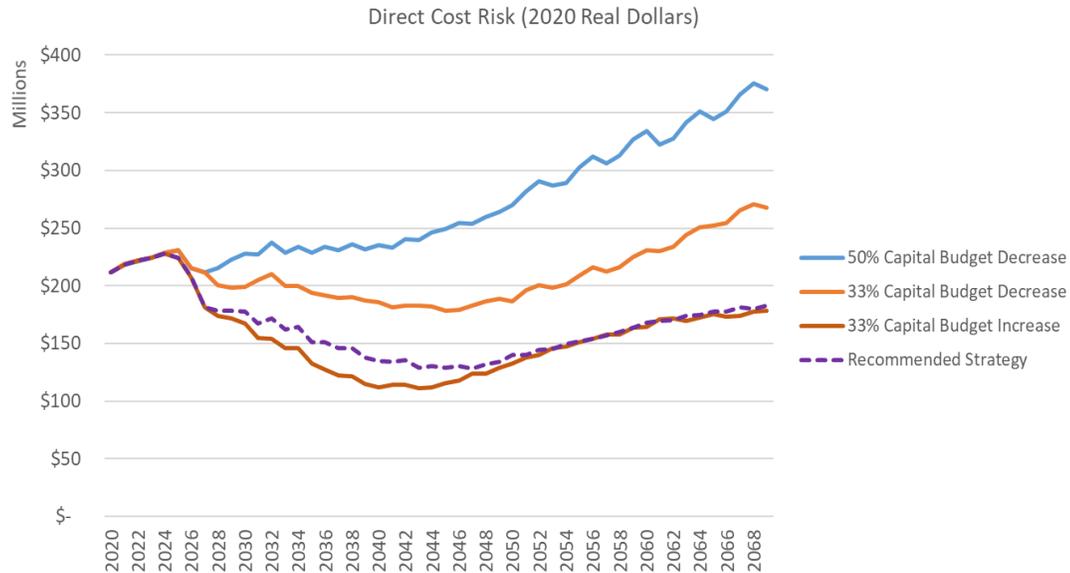
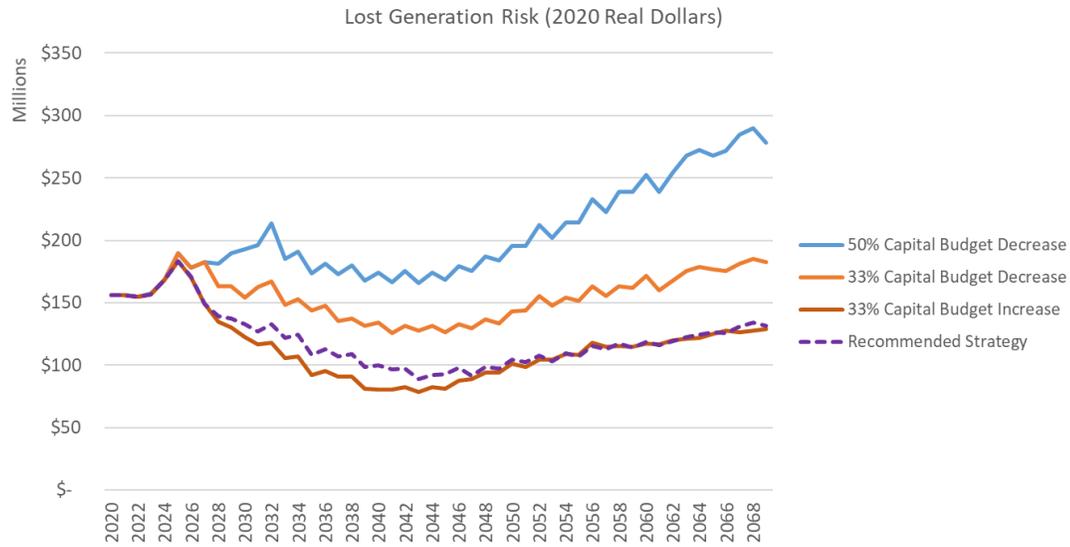
- Generator Rewinds (2022 – 2032)
- Currently in preliminary design and scoping



## John Day

- Turbine Replacement and Generator Rewinds (2032 – 2043)
- Currently in preliminary design and scoping

# Long-Term Benefits of the Strategy



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

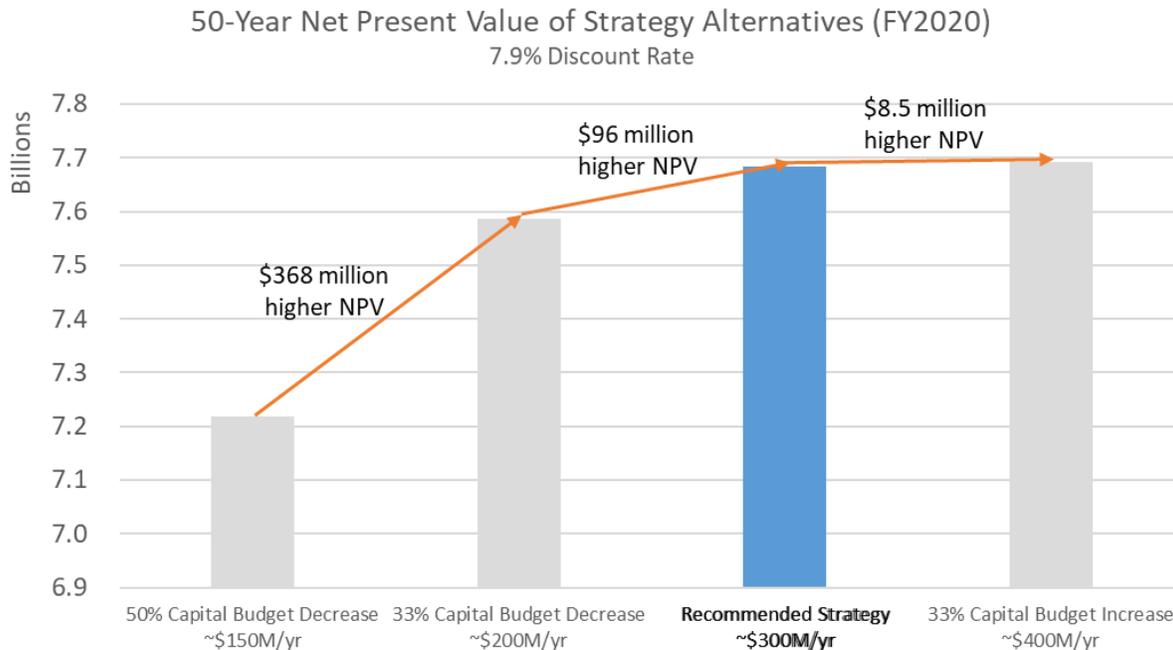
- 96 aMW to date
- 20 aMW expected from ongoing projects
- Minimal incremental cost (secondary benefit of end-of-life replacement)
- Renewable Energy Credits are passed directly to customers

Completed Turbine Projects	# of Units	Effic. Gain	aMW avg water	MWh avg water	Upgrades Completed
Bonneville 1-10	10	4.2%	11.8	103,825	2010
Grand Coulee 1-18	18	4.2%	33.9	297,115	2011
Cougar	2	4.8%	0.8	7,153	2005
Chief Joseph 5,9,11-14	6	6.2%	16.5	144,865	2013
Chief Joseph 6-8,10	4	6.2%	11.0	96,576	2015
Lookout Point	3	6.1%	2.4	20,961	2014
Hills Creek	2	5.0%	1.0	8,328	2016
Chief Joseph 1-4,15,16	6	4.4%	11.7	102,807	2018
Palisades	4	7.4%	6.8	59,679	2017
<b>Total Completed</b>	<b>55</b>		<b>96.0</b>	<b>841,308</b>	

Ongoing Turbine Projects	# of Units	Effic. Gain	aMW avg water	MWh avg water	Upgrades Completed
Ice Harbor 1-3	3	3.5%	4.73	41,462	2019-21
McNary Units	14	2.5%	15.6	136,311	2030+
<b>Total Ongoing</b>	<b>17</b>		<b>20.3</b>	<b>177,774</b>	

<b>Total Completed and Ongoing Projects</b>	<b>72</b>		<b>116</b>	<b>1,019,082</b>	
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# Net Present Value of Investment



\*Net Present Values greater than 0 mean annual benefits are higher than costs, on average

## 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

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

- 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.

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.

A photograph of a forest path with sunlight rays filtering through the trees. The path is dirt and covered with fallen leaves, leading into a dense forest of tall, thin trees. Sunlight rays are visible, creating a hazy, golden atmosphere. The ground is covered with green ferns and other forest floor vegetation.

# Questions?

# FINANCIAL DISCLOSURE

This information was publicly available on June 12, 2020, and contains information not sourced directly from BPA financial statements.