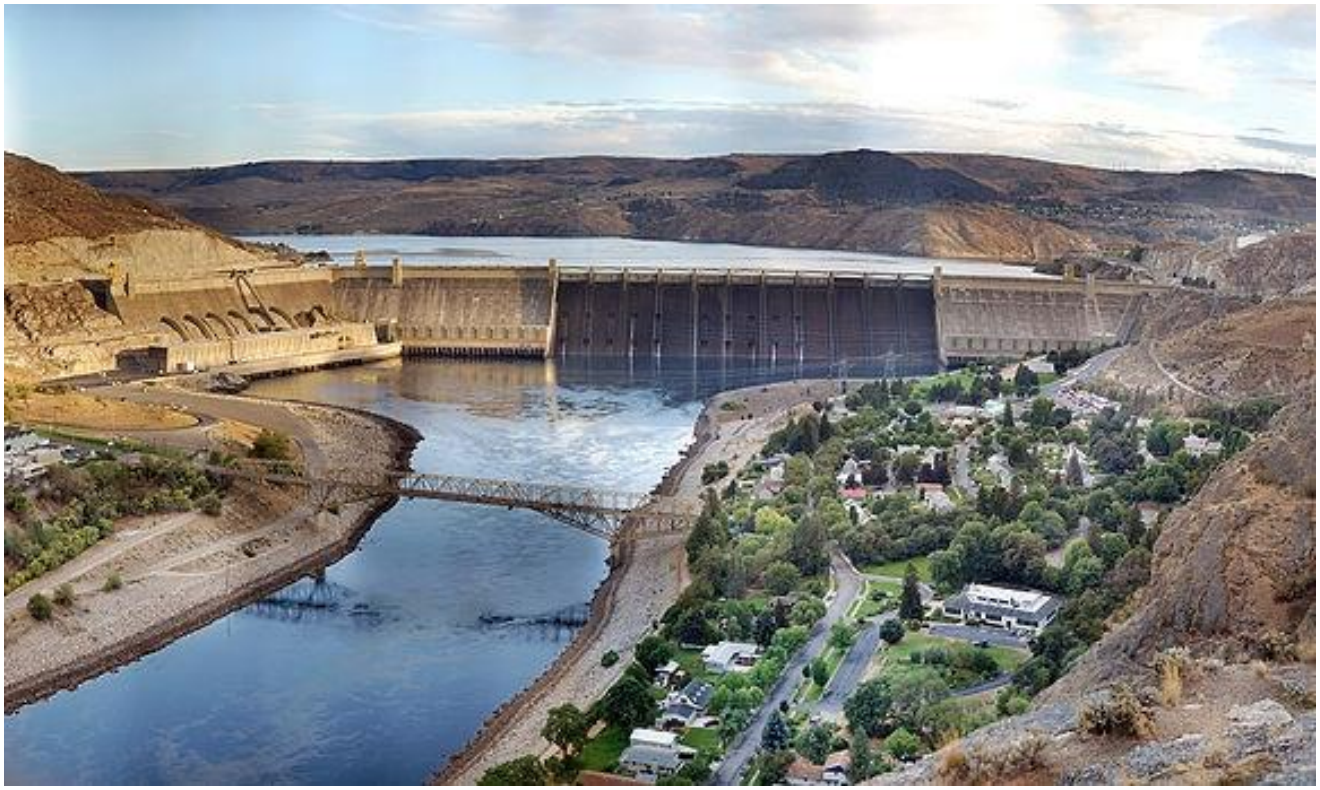
Federal Hydro

CIR Workshop
March 11, 2014



Federal Hydro Asset Strategy

System Overview

The Federal Columbia River Power System (FCRPS) includes 31 hydroelectric plants – 21 operated by the U.S. Army Corps of Engineers (Corps) and 10 by the U.S. Bureau of Reclamation (Reclamation). With an installed capacity of 22,060 megawatts, the FCRPS is the largest hydropower system in the United States and second largest in North America. In an average water year, it produces 76 million megawatt-hours of electricity, displacing fossil-fired generation emitting in excess of 40 million tons of carbon dioxide.

The FCRPS is a multi-purpose system producing products and services for power, flood damage reduction, navigation, irrigation, municipal and industrial water supply, and fish and wildlife. Power generation value is estimated at $4.4 billion annually with an additional avoided carbon dioxide emission value of $1.4 billion per year.

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Criticality of Plants

The plants are grouped within strategic classes and according to their criticality, based largely on the quantity of energy produced, particularly during peak periods, and by the relative cost of unavailability, i.e., the financial consequence of the loss of generation at the margin. Five plants – **Grand Coulee, McNary, Chief Joseph, John Day and Dworshak** – are considered particularly critical to the power system based on the significant financial impact of generating unit outages at these facilities. The program outlined in this strategy targets a significant portion of investments at these five plants to improve condition and reliability.

FCRPS Hydro Plant Classification

Relative Cost of Unavailability (RCU)	Local Support	Area Support	Headwater/ Lower Snake	Main Stem Columbia
Severe >$40m/yr				CHJ GCL MCN
Extreme $10 - $40m/yr			DWR	JDA
Major <$10m/yr	AND, BCD BDD, MIN, ROZ, CDR, GSP	BCL, DEX, LOS, DET, GPR, LOP, HCR, CGR, FOS, ALF, PAL	LIB, HGH, IHR, LGS, LWG, LMN	BON TDA

Federal Hydro Asset Strategy

Objective and Scope

The objective of the hydro strategy is to invest in equipment refurbishments and replacements to manage risk within funding constraints established by Bonneville's Access to Capital Strategy.

The scope of the hydro strategy covers two major program areas:

- The **Capital Program** is comprised primarily of large, discrete investment needs for equipment replacement or refurbishment, largely driven by condition and risk.
- The **O&M Program** reflects core funding for maintenance, operations, and minor equipment replacements, and is largely driven by the staffing needs of each facility.

The Capital Program funding proposals presented within this strategy focus on the 10-year period, FY2014 – FY2023, with an additional 10-year horizon to outline a 20-year view of risk forecasts resulting from alternative investment levels. Investments target electrical and mechanical systems, less on civil features for dam safety, which are typically funded through appropriations, a share of which is reimbursed by Bonneville.

Reinvestment costs for civil features have been relatively low for the history of the FCRPS. Civil features are long-lived and refurbishment and replacement needs are typically negligible for the first 50 years of plant life. However, at some point significant reinvestment in civil features is needed to assure public safety and extend asset life.

Federal Hydro Asset Strategy

Exclusions

The following issues are considered exclusions in the development of this asset strategy:

- For the focus period of this strategy, we have identified a limited amount of civil features, primarily gates, in the analysis of risk and investment needs. The exclusion of costs for other **dam safety civil features** likely underestimates the total funding need forecast. As the hydro system continues to age, anticipating funding needs for all civil features will require more explicit attention in future strategies.
- The use of an **Enterprise Asset Management (EAM)** system is a key element in providing data for evaluating historical and future maintenance activities. The Corps and Reclamation both have implemented EAM solutions for tracking of work orders and management of their preventive maintenance programs. However, the use of these systems is still evolving, particularly for the Corps which has recently completed a major upgrade of its system and processes. As a result, gaps remain in the FCRPS' ability to perform detailed analysis of the O&M Program.
- The plan does not yet consider **program management and implementation issues** such as succession planning, skill gaps, automation, or mechanisms for planning and executing major projects.
- The plan does not include a risk assessment of **changes in fuel supply** based on factors such as changes in weather patterns or fish operations. Additional capital projects could be mandated to address fisheries concerns, and any change in fuel supply could affect the economic value of generating assets and, therefore, the selection of projects.

Federal Hydro Asset Strategy

Strategic Challenges

Aging Infrastructure: The hydro system infrastructure is aging, with an average age of over 50 years. The oldest plant in the system is Minidoka, with an in-service date of 1911. Bonneville Dam is the oldest Main Stem Columbia plant, with an in-service date of 1938. While many more years of valuable production can be expected from the hydro system, it faces significant challenges associated with maintenance and replacements demands to preserve this value.

Aging Workforce: The power industry as a whole is now in a retirement bubble that poses significant risk to maintaining the workforce needed to operate and maintain facilities effectively. A large percentage of personnel working on-site at FCRPS hydro plants are eligible for retirement within five years. The workforce of accountants, engineers and project managers who support the hydropower facilities are also nearing or at retirement age.

Funding Constraints: Bonneville limits capital funding to the hydropower program as part of its Access to Capital Strategy for debt management. The resulting hydro capital program declines by 10 percent in real dollars over the next ten years. The analyses included in this hydro strategy suggest that higher levels of capital funding are needed to improve equipment condition and manage performance risk effectively.

Federal Hydro Asset Strategy

Cost Benchmarks

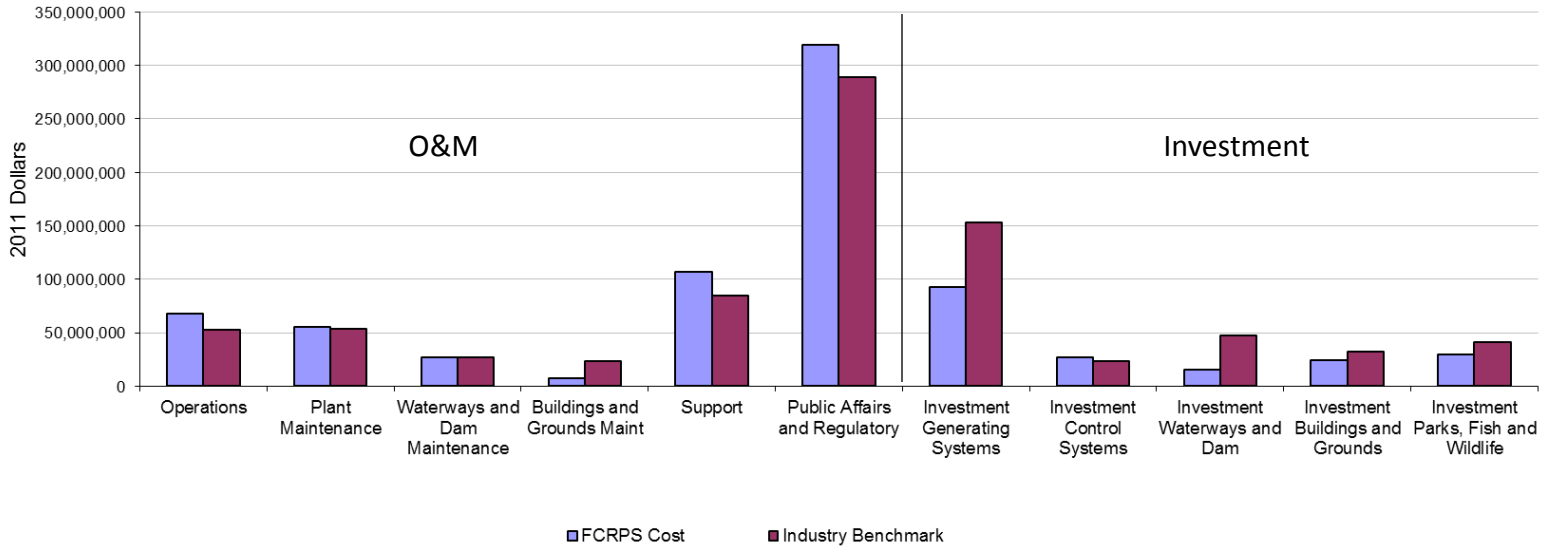
Most O&M Program function costs are above the benchmark median.

- Over half of O&M costs are in Public Affairs and Regulatory, most of which is BPA's fish program
- FCRPS total O&M Program cost of $583 million is 110 percent of the industry median

With the exception of Control Systems, all Investment function costs are below the median.

- The investment function looks at the average annual cost over a five year window
- Nearly half of FCRPS Investment costs are in Generating Systems
- FCRPS total Investment averaging $189 million per year is 64 percent of the industry median

FCRPS Costs and Industry Benchmark Medians by Function



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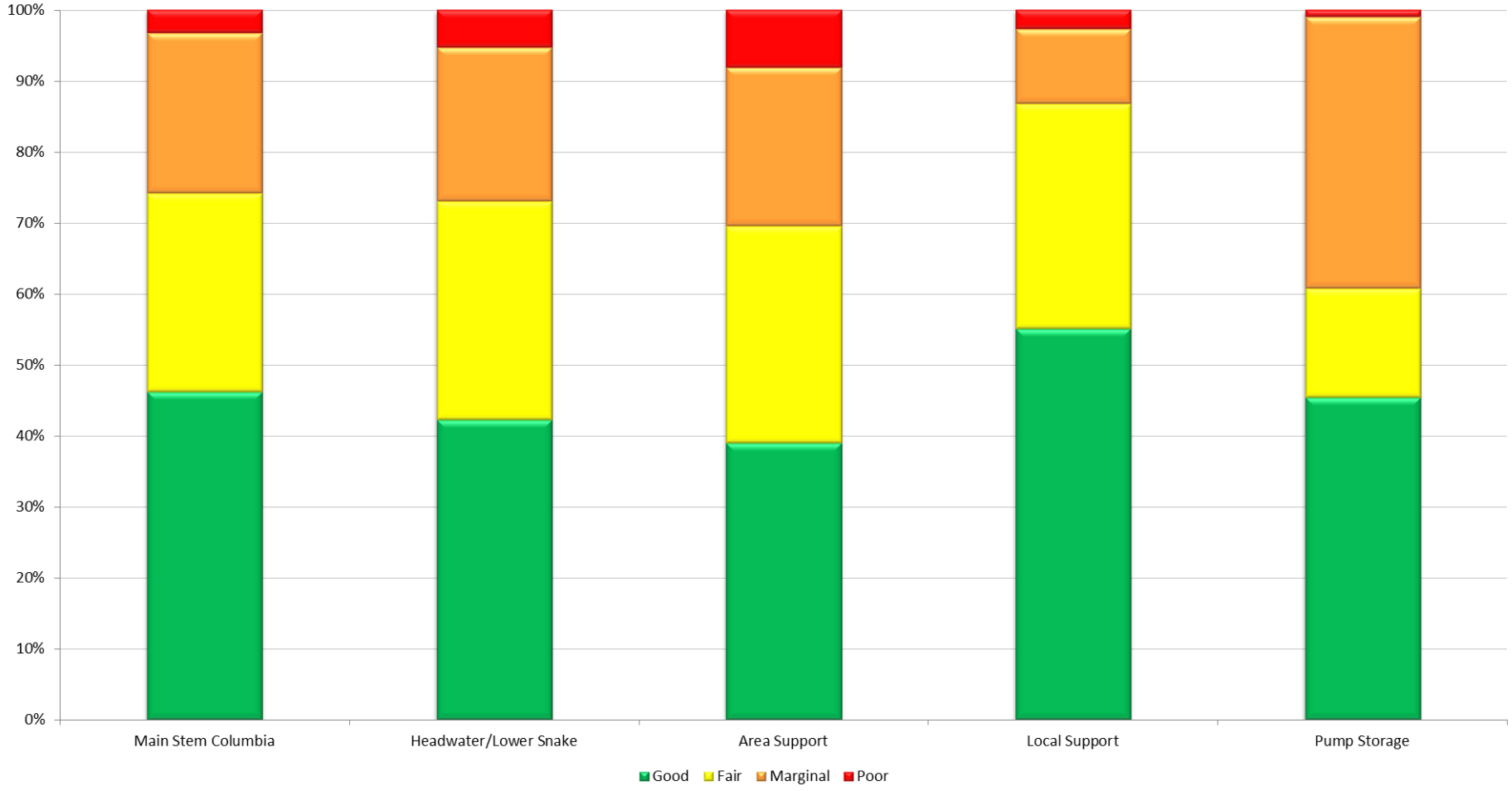
Equipment Condition



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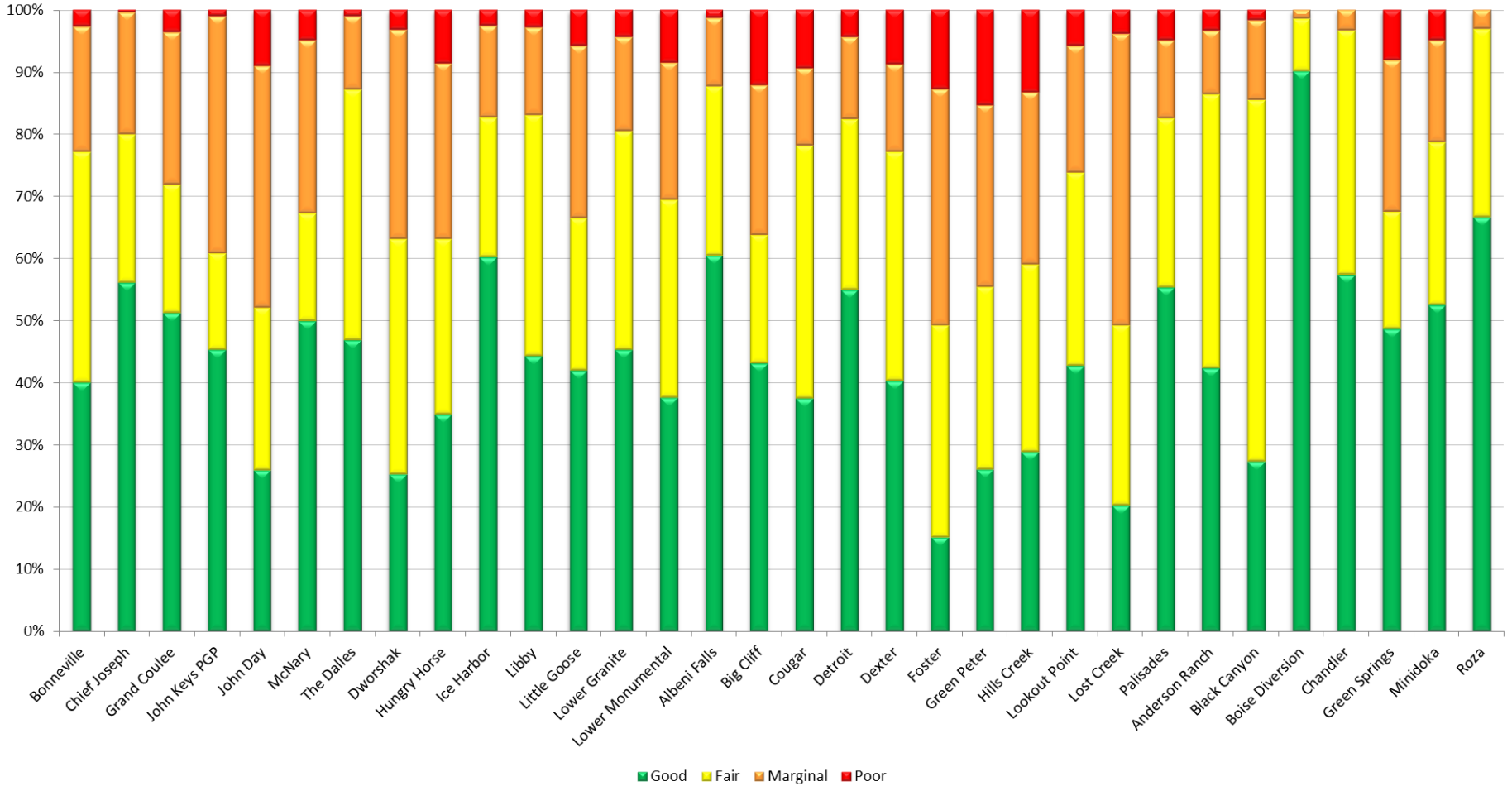
Equipment Condition



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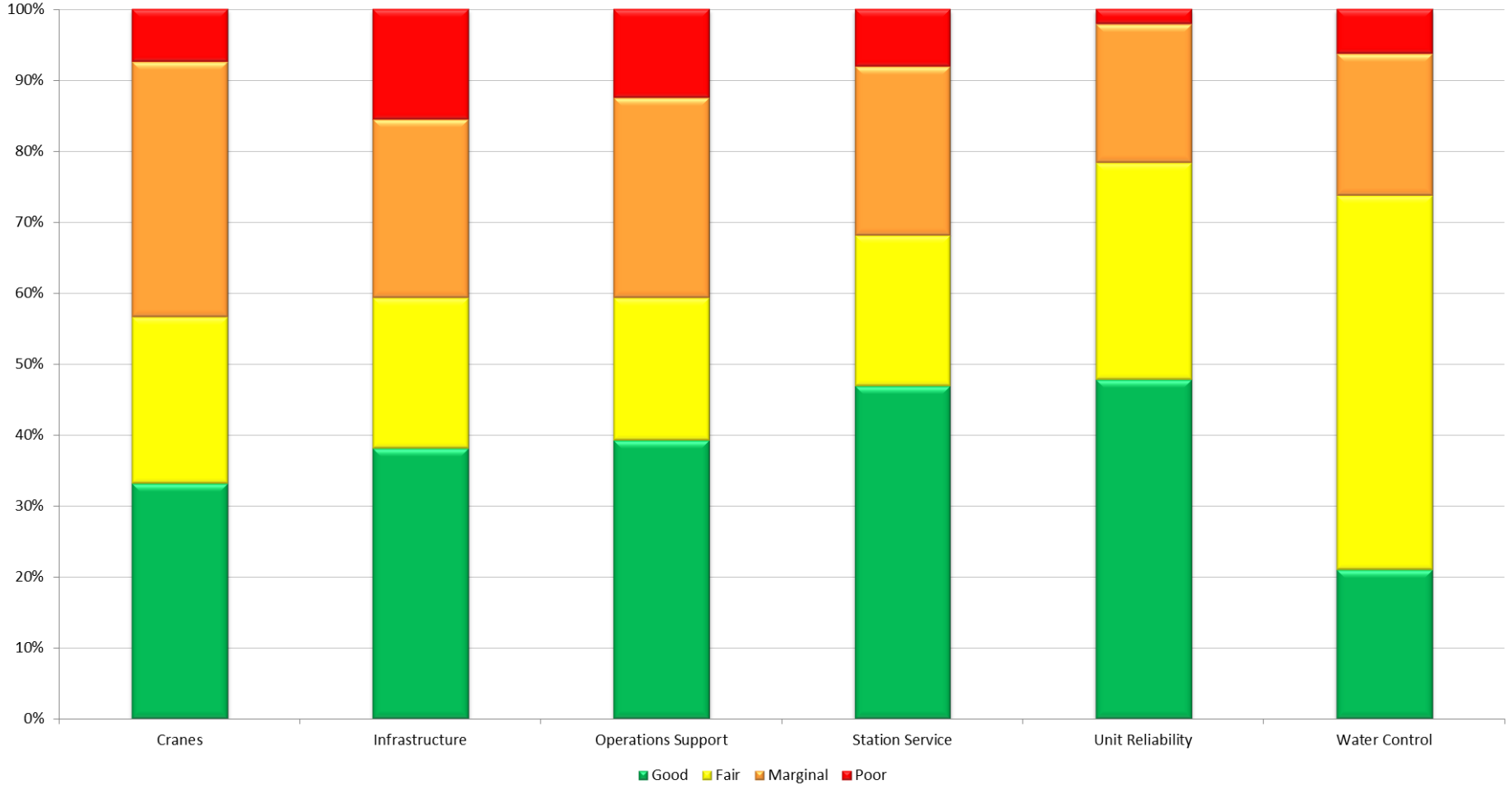
Equipment Condition



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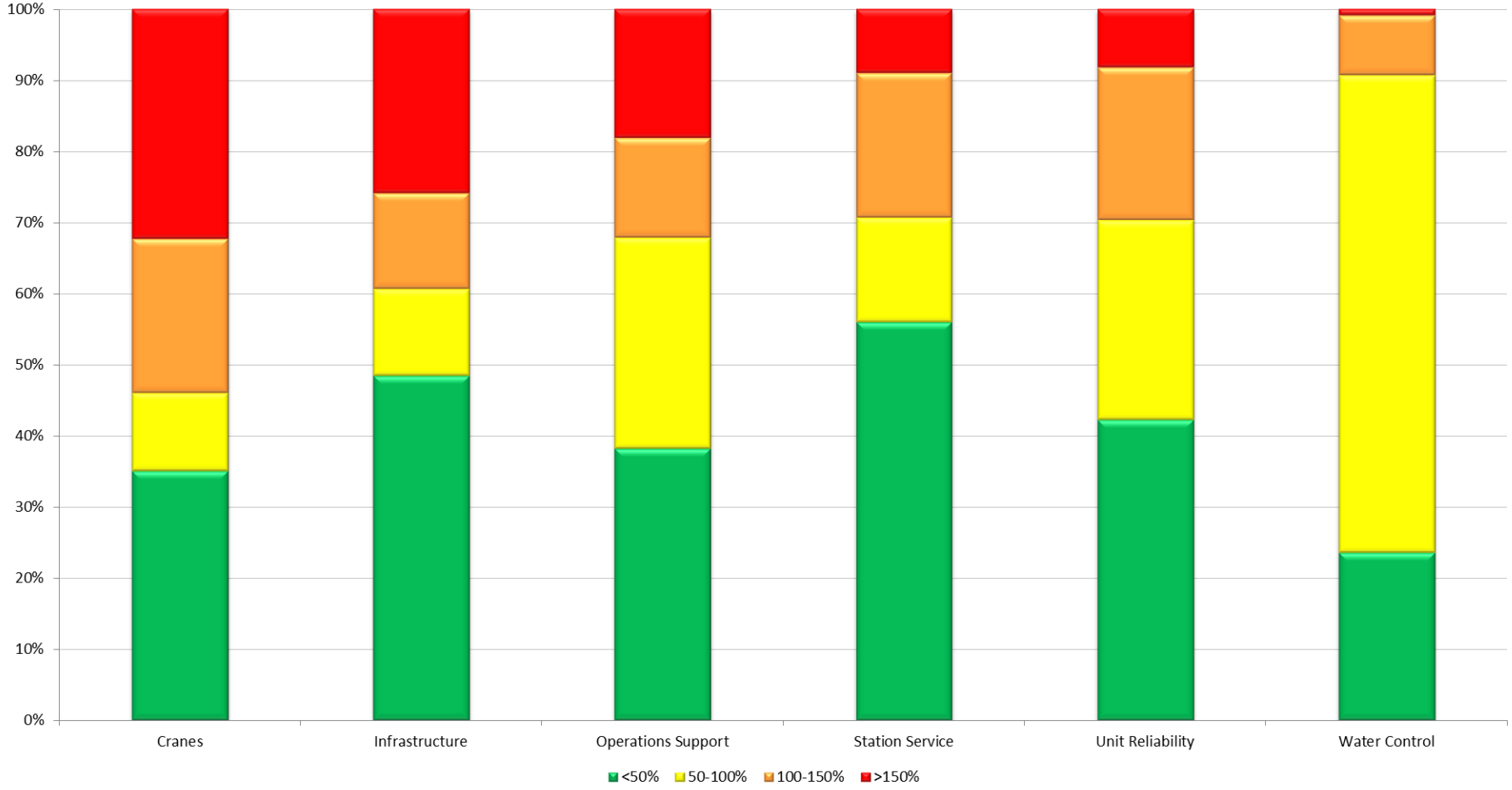
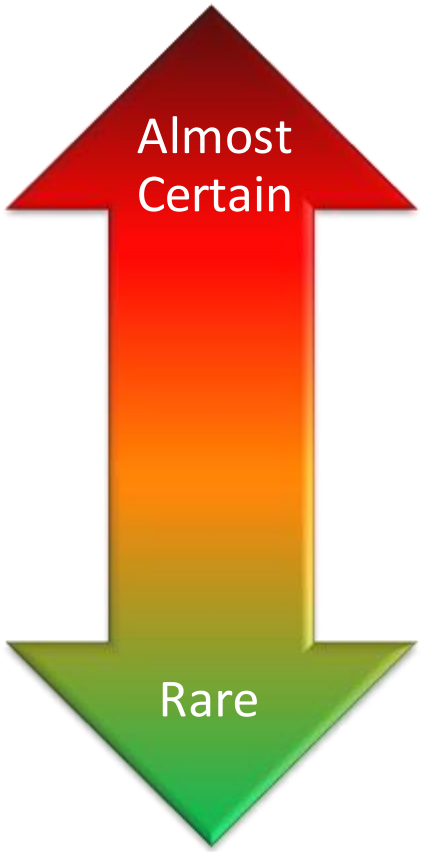
Equipment Age



Federal Hydro Asset Strategy

Risk: Condition vs. Likelihood of Failure

Likelihood	Condition Index	Description
	0 to 0.9	Poor
	1 to 1.9	
	2 to 2.9	
	3 to 3.9	Marginal
	4 to 4.9	
	5 to 5.9	
	6 to 6.9	Fair
	7 to 7.9	
	8 to 8.9	Good
	9 to 10	

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Risk

HydroAMP is a common element used to identify equipment risk. The FCRPS hydro program correlates equipment condition with the likelihood of equipment failing to perform as expected. Using hydroAMP as a risk map input provides a quantitative view of risks by mapping the likelihood of failure for specific equipment components against the consequence of that failure causing a loss of generation availability. Without intervention, condition declines over time and equipment tends to move up on the risk map. The number preceding each equipment type listed on the map corresponds to the number of equipment items in that category. Similar maps are generated for safety and environmental risk.

Risk Map Based on Current Condition and Financial Consequence of Failure

Likelihood	Insignificant < $ 10K	Minor $ 10K to $ 100K	Moderate $ 100K to $ 1 M	Major $ 1 M to $ 10 M	Extreme > $ 10 M
High	3 Operations Support 1 Station Service	2 Cranes 25 Operations Support 13 Station Service 2 Unit Reliability 3 Water Control	17 Infrastructure 21 Operations Support 10 Station Service 16 Unit Reliability 4 Water Control	3 Infrastructure 1 Operations Support 15 Station Service 7 Unit Reliability 1 Water Control	1 Operations Support
Medium	13 Operations Support 7 Station Service	14 Operations Support 10 Station Service 35 Unit Reliability 1 Water Control	8 Cranes 10 Infrastructure 30 Operations Support 23 Station Service 25 Unit Reliability 14 Water Control	7 Cranes 7 Operations Support 51 Station Service 134 Unit Reliability 10 Water Control	1 Cranes 2 Station Service 16 Unit Reliability 2 Water Control
Low	1 Infrastructure 19 Operations Support	1 Cranes 6 Infrastructure 20 Operations Support 6 Station Service 21 Unit Reliability 3 Water Control	42 Cranes 15 Infrastructure 31 Operations Support 24 Station Service 82 Unit Reliability 16 Water Control	26 Cranes 2 Infrastructure 4 Operations Support 47 Station Service 305 Unit Reliability 4 Water Control	4 Cranes 85 Unit Reliability 1 Water Control
Very Low	3 Operations Support	4 Infrastructure 4 Station Service 4 Water Control	5 Cranes 8 Infrastructure 3 Station Service 44 Unit Reliability 35 Water Control	14 Cranes 1 Infrastructure 4 Station Service 166 Unit Reliability 3 Water Control	4 Station Service 45 Unit Reliability
None	5 Infrastructure 97 Operations Support 6 Station Service	1 Cranes 16 Infrastructure 62 Operations Support 115 Station Service 351 Unit Reliability 11 Water Control	50 Cranes 62 Infrastructure 52 Operations Support 124 Station Service 781 Unit Reliability 89 Water Control	56 Cranes 5 Infrastructure 4 Operations Support 162 Station Service 1329 Unit Reliability 20 Water Control	1 Operations Support 14 Station Service 310 Unit Reliability 3 Water Control

Consequence

Condition: 0 (top) to 10 (bottom)

Risk Level	Low	Medium	High

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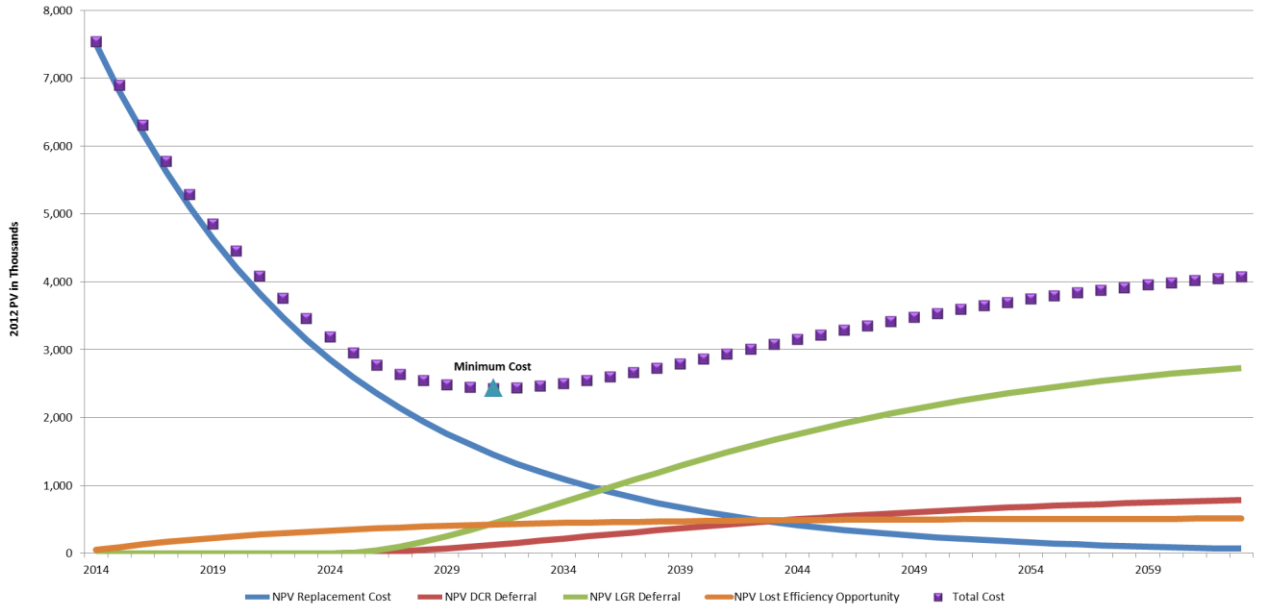
Timing of Investments

Investments to maintain reliability are less about "if" than "when" to make equipment repairs or replacements. The strategy uses a risk-based approach to forecast the optimum time for making these investments. To determine the optimum timing for replacement, each equipment component is evaluated in yearly time steps over 50 years. In each year, the present value of accumulated financial risk cost is added to the present value cost of replacing the equipment in that year. The sum of these present value costs is the Total Cost related to a decision to delay equipment replacement until that year. The optimum time to plan on equipment replacement is at the low point (cost minimum) of the Total Cost curve, i.e., the point at which financial risk costs begin growing faster than the benefit of deferring the investment.



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Modeling Assumptions

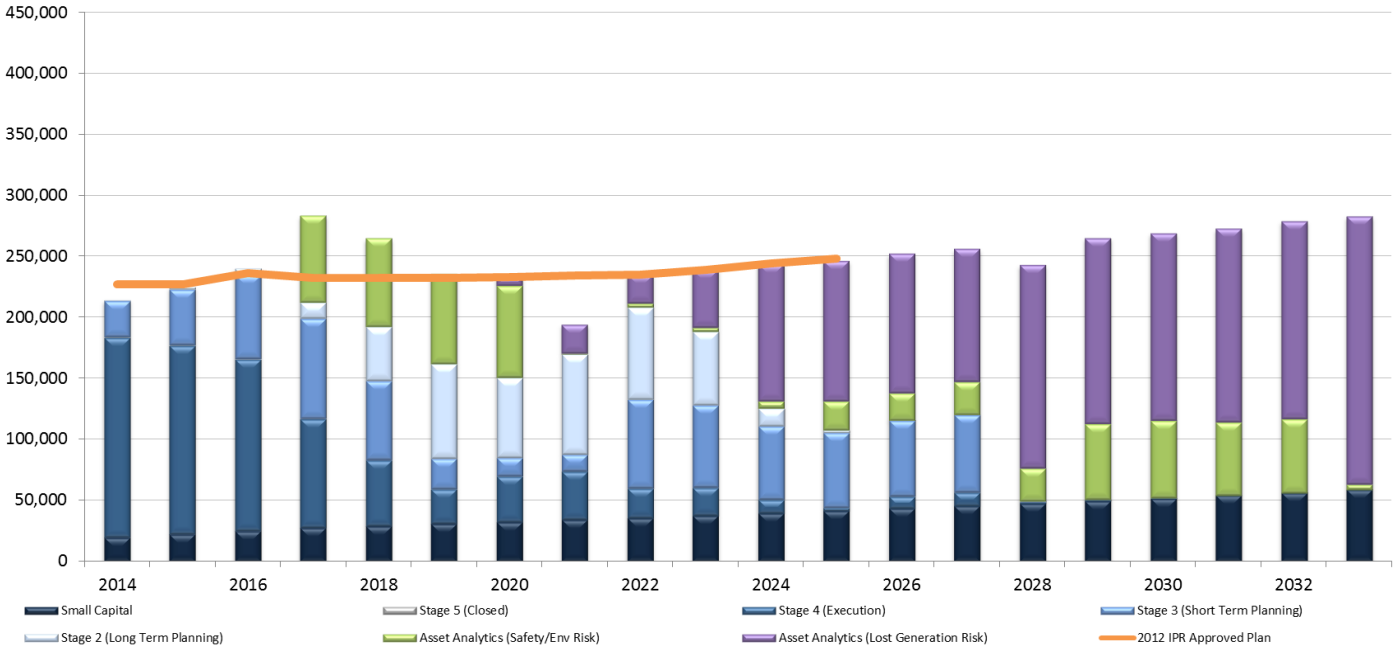
Assumption	Value	Source	Comment
Discount rate	12.0 percent	BPA Finance	10 percent real
Inflation rate	1.7 percent	BPA Finance	Average annual rate, 20-yr forecast
Forward energy price curve	20-yr, by month, HLH, LLH, flat	BPA Power Services Resource Program	Includes spot prices and a component for long-term firm capacity consistent with rate case demand rate.
Equipment cost	Varies by equipment type	FCRPS hydro program	Based on industry cost data
Real cost escalation	0 percent	BPA Finance	Global Insight
Failure curves	Varies by equipment type	BPA Federal Hydro	Based on industry data for certain equipment
Outage duration for LGR	Varies by equipment type	FCRPS hydro program	Based on industry experience
Environment and safety	Risk	BPA Federal Hydro	Treats all high risk items as “must do”
Value of avoided CO2	$35/ton	BPA Corporate Strategy	Based on Presidential Directive
Alternative resource for hydro lost generation	Natural gas-fired Combined-Cycle Combustion Turbine	BPA Agency Asset Management	0.48 tons of CO2 per MWh of generation

Federal Hydro Asset Strategy

2012 IPR Approved Plan Funding Level

Modeling funding constraints in this strategy has little effect on the 2014 – 2017 program. Nearly all available funding is committed during this period, so there is limited ability to turn these projects off without significant negative financial consequences. Funding constraints affect the number of projects that can be undertaken 5 to 20 years into the future to mitigate forecasted growth in risk.

The graph below shows results when constrained to the 2012 IPR Approved Plan budget level (2012 Access to Capital level). Funding constraints beyond 2025 escalate the 2012 IPR Approved Plan at 1.7% per year.



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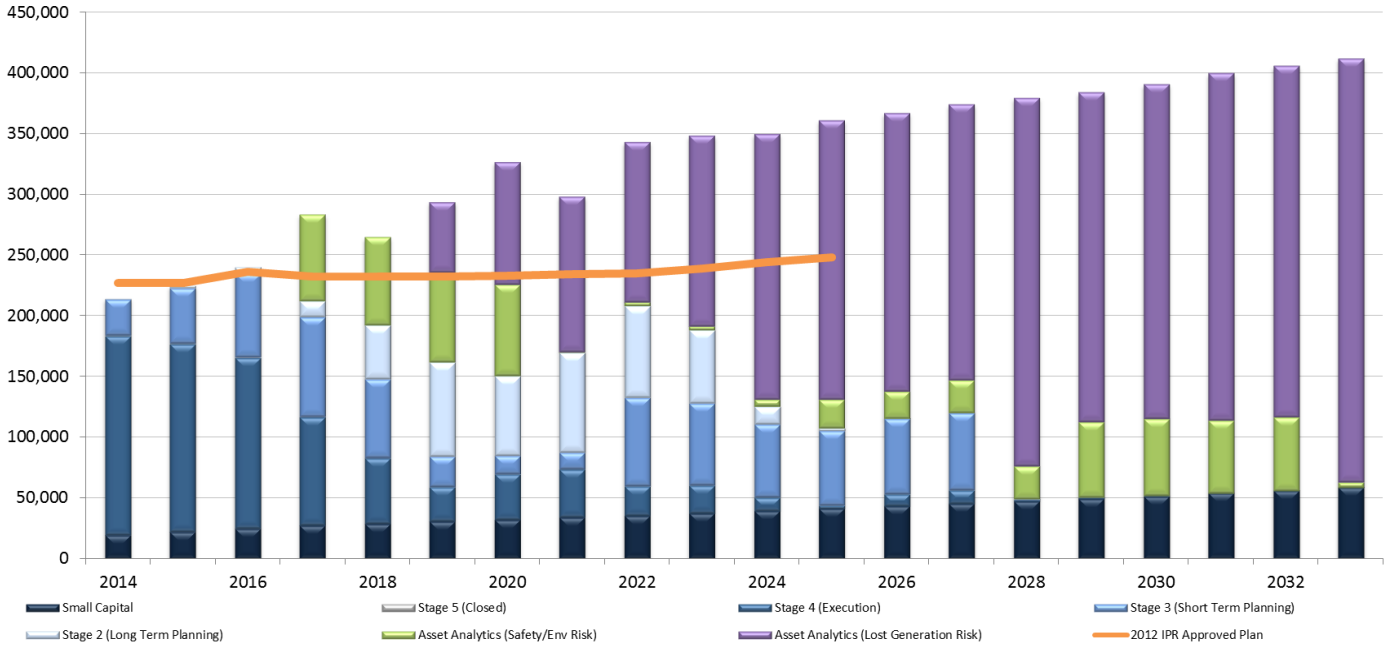
Other Funding Levels

Funding constraints require that some investments are delayed beyond their cost minimum, resulting in higher risk and Total Cost for the system. For the strategy, we looked at the impact of various higher available funding levels and their associated reduction in risk. Several sensitivities were run with 2012 IPR Approved Plan funding constraints through 2017, which then increased $25 million per year until a threshold funding level was reached, after which the constraint was held constant in real dollars for the remainder of the 50-year study period. A funding stream for a $300 million constraint threshold is shown below.



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Lost Generation Risk Forecast for Different Funding Levels

The capital program is fully committed through 2017. New investments started after then do not affect condition and risk for several years until work is completed. Therefore, all funding scenarios result in a similar risk profile thru 2021, after which higher funding levels reduce risk more quickly. At the current program level established by the Access to Capital Strategy, risk increases thru 2022 and returns to current levels by 2027 and beyond. Fairly dramatic risk reduction is seen in higher funding scenarios, with a $300 million per year program reducing risk to about half of the current level by 2023 and by 75 percent in 2031.

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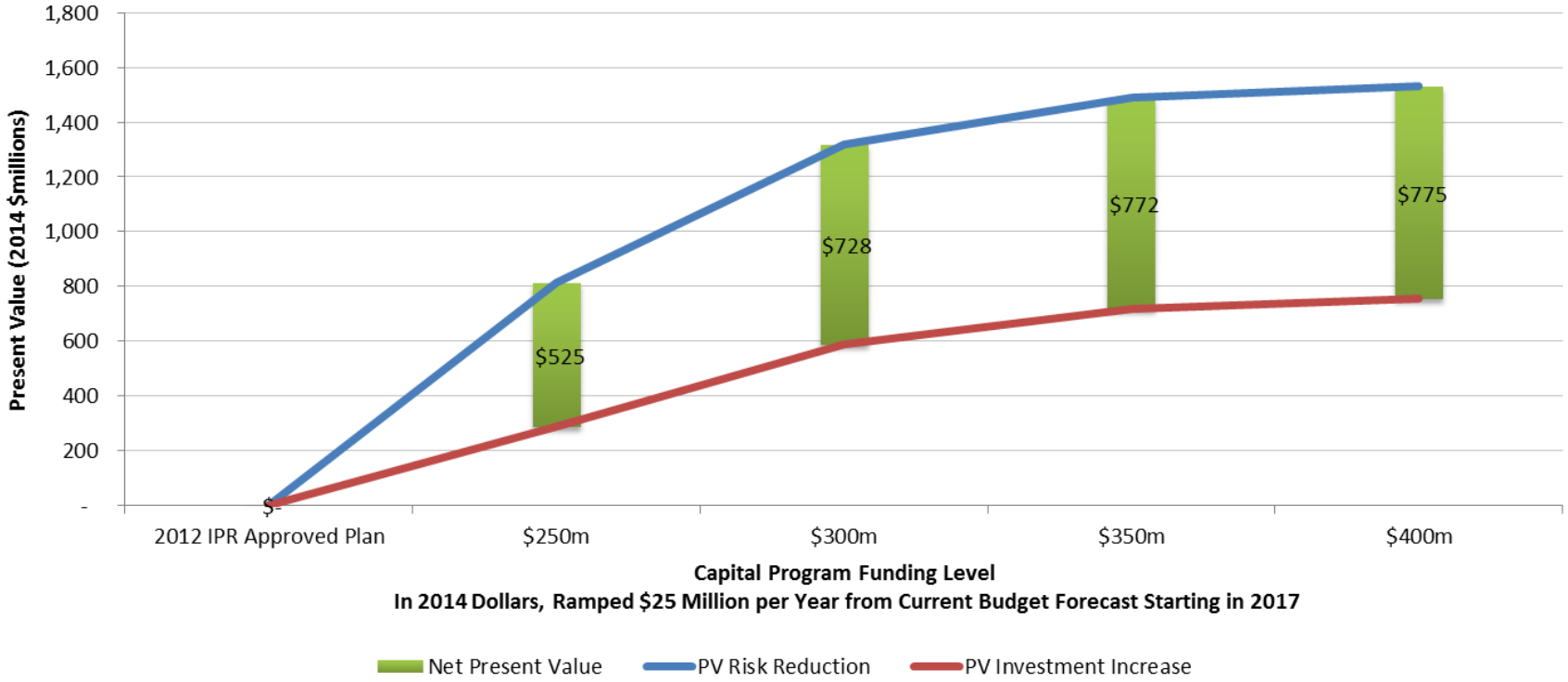
Net Present Value of Investment Levels (12% Discount Rate)

The net present value (NPV) of higher funding levels increases fairly dramatically up to $300 million per year (2014 dollars), after which it increases more slowly. For a $300 million program level, the present value of costs increases by $600 million, but the present value of risk increases by more than $1.3 billion, resulting in a NPV of $728 million relative to the current 2012 IPR Approved Plan (2012 Access to Capital Strategy). A $300 million per year program level is also near the investment benchmark median for a comparable system, shown previously on the Cost Benchmarks slide.



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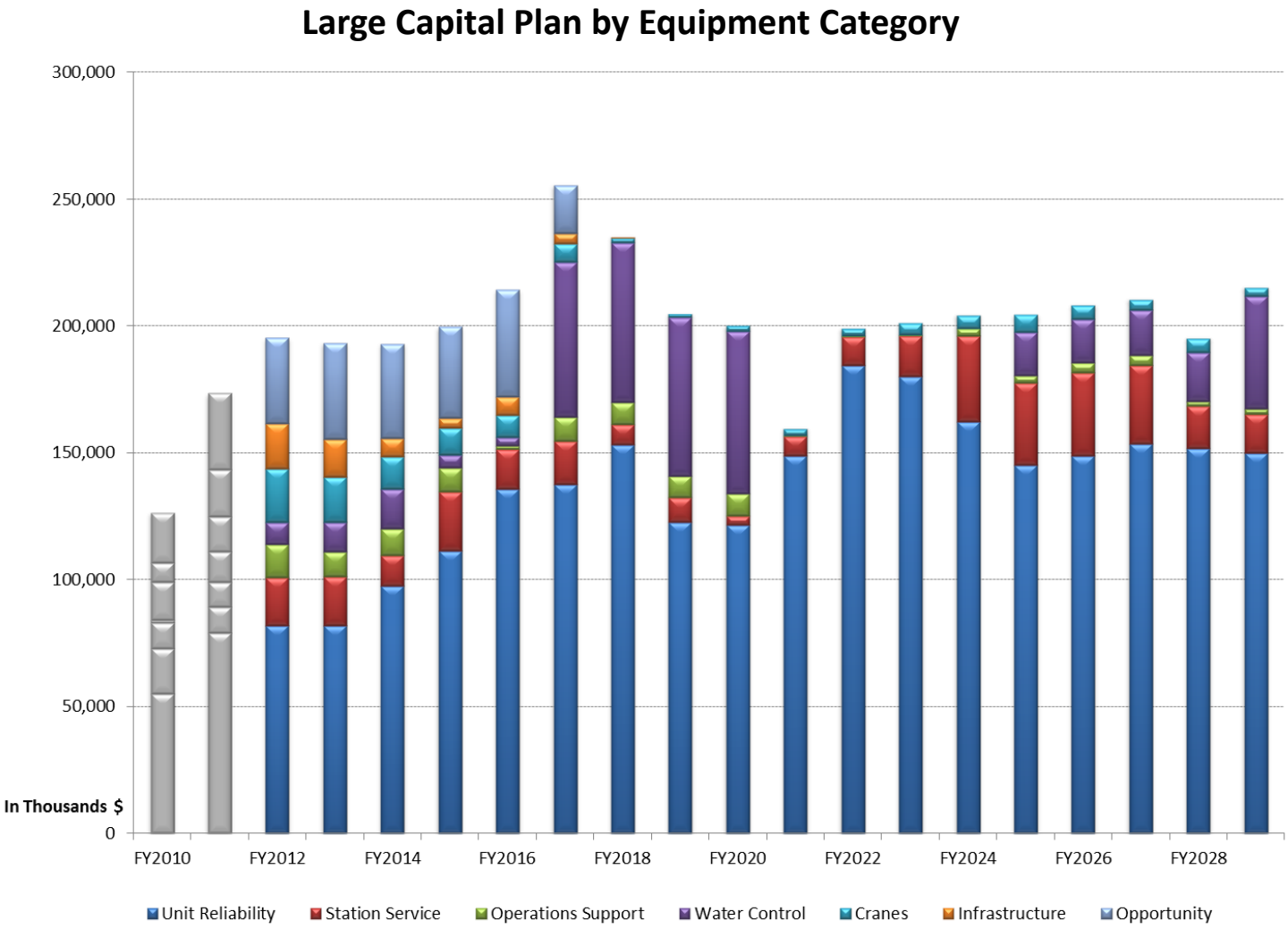
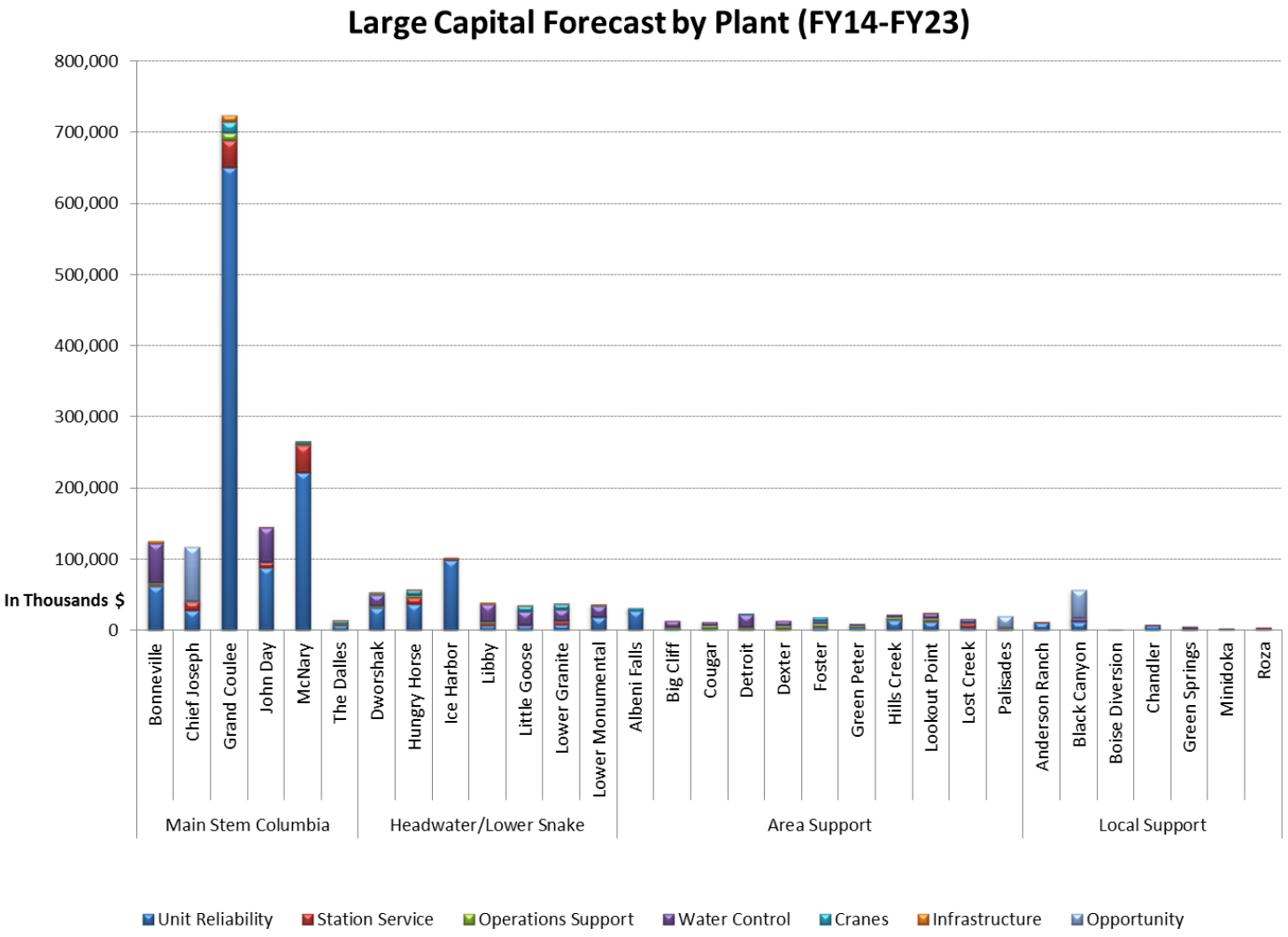
2012 IPR Approved Plan Funding Level



Federal Hydro Asset Strategy

2012 IPR Approved Plan Funding Level



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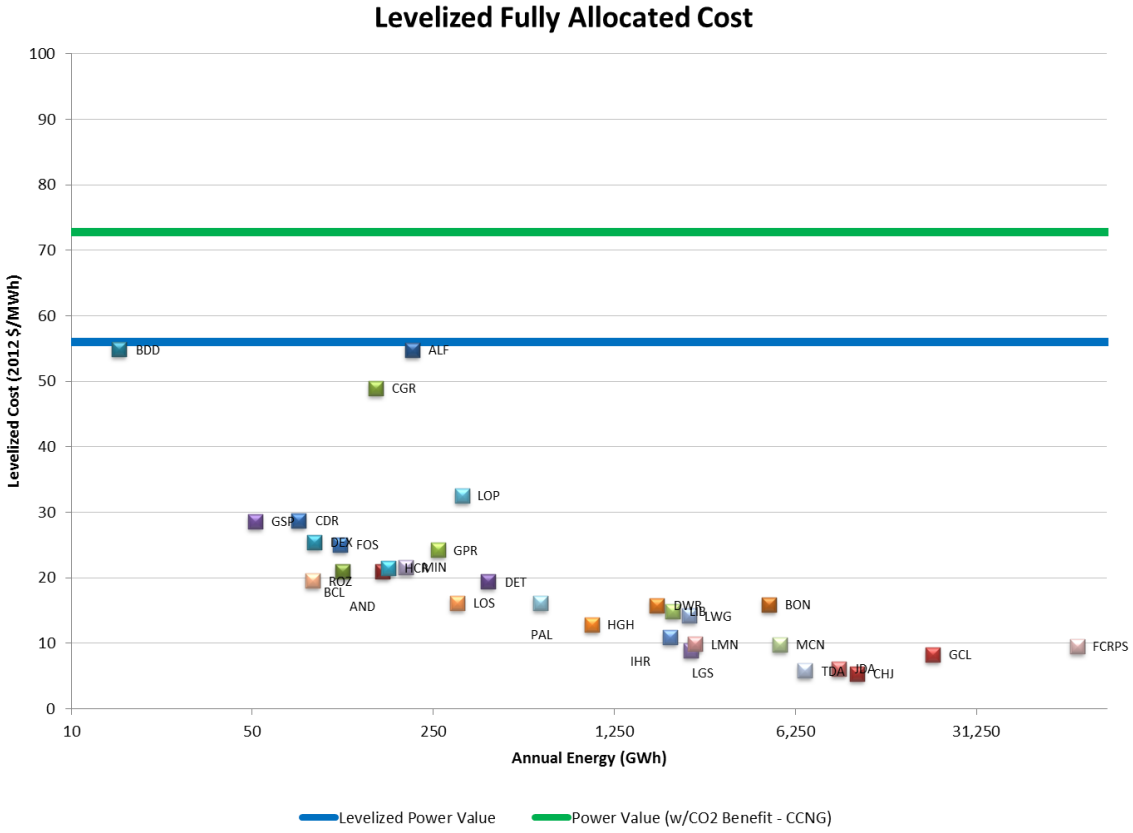
Fully Allocated Cost Forecast

The levelized fully allocated cost (outstanding debt plus a 20-year forecast for capital and expense) of the hydro system under the 2012 IPR Approved Plan funding level is about $9.50/MWh in 2012 dollars, or 17% of the value of power generated by the system, excluding avoided CO2 benefits.

Costs for each plant are below the value of power generated by the facility.



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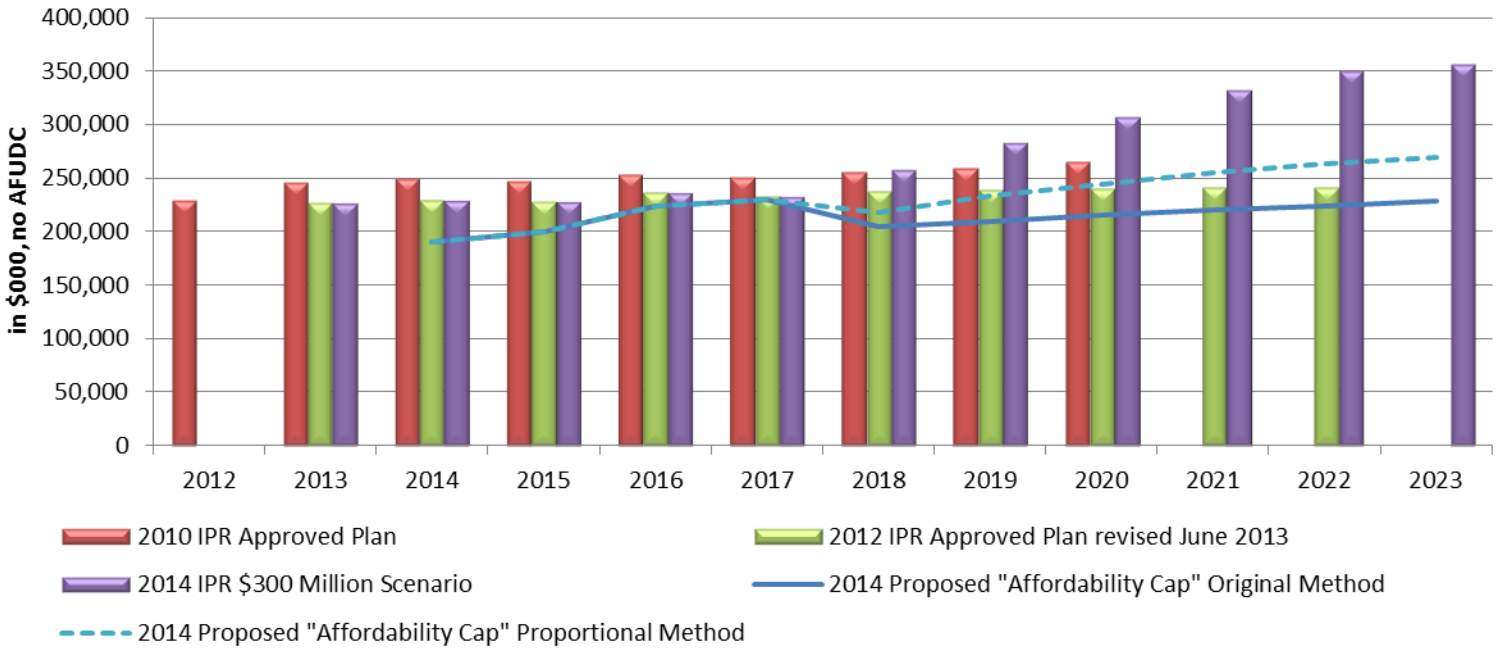
Capital Summary

The 2012 IPR Approved Plan resulted in an 8 percent reduction in the capital budget from the approved plan in the 2010 IPR. The 2014 proposed "Affordability Cap" to create funding for Bonneville's expansion program could reduce available funding for hydro reliability investments by an additional 6 to 10 percent thru 2020.

Capital funding in the $300 Million Scenario included in this strategy for the 2014 IPR is $26 million less than the 2010 IPR Approved Plan for the period 2013 – 2020.



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Impacts of Affordability Cap

Between 2018-2023, the Affordability Cap could reduce the amount of Hydro capital investment by up to $213 million from the 2012 IPR Approved Plan. Requests for core sustain funding above this amount will have to go through the prioritization process and compete with other investments for funding.

- Less critical plants will absorb reductions in investment levels to the extent possible but in order to comply with a lower budget level, large projects at critical plants will also need to be delayed.
- Prioritized investment, pertaining largely to generator and station service projects at Main Stem Plants, will be deferred outside the 10-year planning window.
- Substantial Power Train investment across the Main Stem will also be deferred.
- Many Stage 2 projects – primarily other electrical reliability investments, including the Grand Coulee switchyards and station service – will be pushed outside of the 10-year investment window.
- Roughly $20 million in Keys reliability investments is included in the Strategy. This represents a small portion of BPA's costs for base reliability investments at the plant. Additional investment will displace more Stage 2 projects from the 10-year investment window.
- The uprate of Grand Coulee Units 19-21 is not included in the asset strategy or the current Fed Hydro budget. This will need to proceed through the Agency Prioritization process.

Federal Hydro Asset Strategy

Summary

The plan in this strategy is defined by BPA's Access to Capital Strategy.

- The 2012 IPR Approved Plan capital program level of about $235 million per year increases current risk levels by 50 percent through 2022, after which risk returns to current levels by 2027 and beyond. This plan represents a sub-optimal level of future investment for adequate business continuity and cost effective reliability.
- A $235 million program level has a lower net present value than higher capital reinvestment scenarios. The need to manage near term capital borrowing limits may result in higher long term system cost by increasing the risk of unit outages and replacement power costs.
- A $235 million program level is about 75 percent of what is suggested by strategy planning analyses and cost benchmarking studies.
- The plan does not include costs for modernization of John W. Keys Pump Generating Plant or other uncommitted economic opportunity investments (e.g., additional units at Dworshak, Libby, or John Day).
- A program consistent with 2012 IPR Approved Plan levels through 2017, but which then ramps to $300 million per year (2014 dollars) by 2022, is projected to reduce risk by 50 percent in 2023 and 75 percent by 2031 with a net present value of $728 million relative to the 2012 IPR Approved Plan.

- Under this plan, the 20-year levelized fully allocated cost of the hydro system is forecasted to be $9.50 per MWh (2012 dollars).

- The Capital Workgroup defines and implements a capital program consistent with this strategy.

Federal Hydro Asset Strategy

Implementing the Strategy

The Capital Workgroup is the primary mechanism for implementing the Asset Strategy.

- The capital program is managed by a 3-Agency Capital Workgroup.
- The CWG meets six times per year to review and approve new investments.
- Capital program managers also meet six times per year to:
  - review investments identified in the asset strategy and, from that, develop a high level plan for out years; and,
  - to do real-time management of active subagreement contracts in order to prioritize and schedule projects within the program budget.

The CWG uses staging to order projects within the program based on each project's level of maturity.

- Stage 1: Equipment identified in the asset strategy not yet aggregated into projects. Stage 1 items are not considered "ripe', that is, the need is not yet certain and near, rather it is based on a forecast of future condition and risk.
- Stage 2: Equipment identified in the asset strategy aggregated into first order projects. Schedules are high level and fluid. These projects are not yet ripe.
- Stage 3: Mature projects that are not yet in flight, but are next in line. These projects are considered "ripe"; the need to undertake the project is certain and the timing is near.
- Stage 4: Mature projects that are in flight (committed). Projects are ranked to support real-time management.

Federal Hydro Asset Strategy

Capital Program Implementation Criteria

Planning Criteria	Stage	Implementation Criteria					
Approved projects in flight	4	Under contract (non-deferrable)	Priority, Critical, Essential (life safety, environmental or regulatory compliance, etc) (non-deferrable)	Phase 2 approved, contract advertized but not awarded (non-deferrable)	Phase 2 approved, contract not advertized (deferrable)	Phase 1 underway (exploratory studies to refine project Phase 2 scope, cost and schedule) (deferrable)	Phase 1 approved but not yet underway (exploratory studies to refine project Phase 2 scope, cost and schedule) (deferrable)
Mature projects not yet approved	3	Refined cost and schedule estimates awaiting funding approval. Consistent with asset strategy	Developing refined cost and schedule estimates				
Equipment identified in the asset strategy aggregated into first order projects	2	Cost and schedule estimates are high level and fluid					
Equipment identified in the asset strategy not covered in other stages	1						

Federal Hydro Asset Strategy

Capital Program Projects: by Plant, Stage and Start Year

Albeni Falls	ALB Reroof Powerhouse	Stage 4 (Execution)	2001
Albeni Falls	ALB Governor (SYS Governor Repl.)	Stage 4 (Execution)	2002
Albeni Falls	ALB GDACS and Spillway	Stage 4 (Execution)	2004
Albeni Falls	ALB Protective Relay Replacement (Phase 1&2)	Stage 4 (Execution)	2006
Albeni Falls	ALB Unit 1 Bulkhead Gate Replacement	Stage 4 (Execution)	2006
Albeni Falls	ALB High Lift Pumps	Stage 4 (Execution)	2007
Albeni Falls	ALB Auxiliary Boards	Stage 4 (Execution)	2008
Albeni Falls	ALB Spillway Crane Modernization (Ph. 1 & Ph. 2)	Stage 4 (Execution)	2009
Albeni Falls	ALB Intake Crane Modernization (Ph. 1 & Ph. 2)	Stage 4 (Execution)	2009
Albeni Falls	ALB DC System Boards & Breakers (Ph. 1 & Ph. 2)	Stage 4 (Execution)	2009
Albeni Falls	ALB Spillway Gate Modifications (Ph. 1&2)	Stage 4 (Execution)	2012
Albeni Falls	ALB Powerhouse Life Safety Alarm System	Stage 4 (Execution)	2013
Albeni Falls	ALB Generator Windings	Stage 2 (Long Term Planning)	2020
Anderson Ranch	AND Station Service Upgrade	Stage 4 (Execution)	2014
Anderson Ranch	AND Turbine Replacement G1 & G2	Stage 3 (Short Term Planning)	2015
Big Cliff	BCL Spillway Bulkhead Gates (Joint)	Stage 4 (Execution)	2009
Big Cliff	BCL Spillway Tainter Gate Rehabilitation	Stage 4 (Execution)	2011
Big Cliff	BCL Digital Governor	Stage 4 (Execution)	2012
Big Cliff	WVY and LOS GDACS_BCL (Phase 1)	Stage 4 (Execution)	2014
Big Cliff	BCL Control Data Link (Phase 1)	Stage 3 (Short Term Planning)	2017
Black Canyon	BCD Units 1 & 2 Upgrades (Phase 1)	Stage 4 (Execution)	2011
Black Canyon	BCD Install Trash Rake System	Stage 4 (Execution)	2011
Black Canyon	BCD Third Unit Installation (Ph. 2)	Stage 4 (Execution)	2015
Black Canyon	BCD Units 1 & 2 Upgrades (Ph 2)	Stage 3 (Short Term Planning)	2014
Black Canyon	BCD Trash Racks & Rake System Replacement	Stage 3 (Short Term Planning)	2016
Black Canyon	BCD Governor Replacement G1 & G2	Stage 2 (Long Term Planning)	2021
Bonneville	BON 1 & 2 Headgates	Stage 4 (Execution)	2000
Bonneville	BON 1 Rehabilitation	Stage 4 (Execution)	2004
Bonneville	BON 2 Exciter Installation	Stage 4 (Execution)	2005
Bonneville	BON Control Room Fire Protection Upgrades	Stage 4 (Execution)	2006
Bonneville	BON 2 Gantry Crane 7 Rehab.	Stage 4 (Execution)	2006
Bonneville	BON 2 Station Service Repl.	Stage 4 (Execution)	2007
Bonneville	BON 1 Tailrace Deck & Crane	Stage 4 (Execution)	2007
Bonneville	BON 1 Elevators 1 & 2 Replacement	Stage 4 (Execution)	2009
Bonneville	BON 1 Main Unit Breaker & Station Service Reconfiguratio	Stage 4 (Execution)	2010
Bonneville	BON 2 Digital Governors (Ph. 1 and 2)	Stage 4 (Execution)	2011
Bonneville	BON 2 Generator Protective Relay Replacement	Stage 4 (Execution)	2011
Bonneville	BON 1 & 2 Vibration and Air Gap Monitoring	Stage 4 (Execution)	2012
Bonneville	BON 1 & 2 Governor Oil Filtration System	Stage 4 (Execution)	2012
Bonneville	BON 2 Transformer Improvements (Ph. 1)	Stage 4 (Execution)	2012
Bonneville	BON GSU Instrument Transformers (Phase 1)	Stage 4 (Execution)	2013
Bonneville	BON Unit 11 Generator Repair	Stage 4 (Execution)	2013
Bonneville	BON 1 Auto Synchronization Upgrade	Stage 3 (Short Term Planning)	2014
Bonneville	BON 1 Main Unit Breaker Replacement & Station Service R	Stage 3 (Short Term Planning)	2015
Bonneville	BON GSU Instrument Transformers (Phase 2)	Stage 3 (Short Term Planning)	2015
Chandler	CDR Exciter Repl.	Stage 4 (Execution)	2007
Chandler	CDR KY1A Transformer & Breaker Repl	Stage 4 (Execution)	2009
Chandler	CDR Rewind Units 1 & 2	Stage 3 (Short Term Planning)	2014
Chief Joseph	CHJ Powerhouse Cranes (Bridge & End Trucks)	Stage 4 (Execution)	1999
Chief Joseph	CHJ SS Transformer	Stage 4 (Execution)	2000
Chief Joseph	CHJ SS Governor	Stage 4 (Execution)	2000
Chief Joseph	CHJ SS Breaker Repl. (SYS SS Brk.)	Stage 4 (Execution)	2000
Chief Joseph	CHJ MUB (SYS)	Stage 4 (Execution)	2000
Chief Joseph	CHJ CO2 System Repl.	Stage 4 (Execution)	2001
Chief Joseph	CHJ Sup. Cont. Consoles Replacement	Stage 4 (Execution)	2005
Chief Joseph	CHJ Emergency Notification	Stage 4 (Execution)	2006
Chief Joseph	CHJ Units 17-27 Exciter Repl.	Stage 4 (Execution)	2007
Chief Joseph	CHJ Protective Relay Replacement	Stage 4 (Execution)	2007
Chief Joseph	CHJ Governor (SYS Governor Repl.)	Stage 4 (Execution)	2007
Chief Joseph	CHJ Automatic Synchronizer Replacement	Stage 4 (Execution)	2008
Chief Joseph	CHJ DC and Preferred AC Upgrade	Stage 4 (Execution)	2009
Chief Joseph	CHJ Generator Cooling System Upgrades	Stage 4 (Execution)	2009
Chief Joseph	CHJ Generator Brake System Repl	Stage 4 (Execution)	2009
Chief Joseph	CHJ Power House HVAC Upgrade	Stage 4 (Execution)	2015
Chief Joseph	CHJ Fire Detection and Protection - Facility Plant	Stage 2 (Long Term Planning)	2015
Chief Joseph	CHJ SQ 4&5, SU 17-27 Replacement (units 17-27 480V)	Stage 2 (Long Term Planning)	2017
Chief Joseph	CHJ T01 Transformer Replacement	Stage 2 (Long Term Planning)	2018
Cougar	COU Exiter Replacement	Stage 4 (Execution)	2000
Cougar	COU Powerhouse Upgrade	Stage 4 (Execution)	2001
Cougar	COU Generator Fire Protection & HVAC	Stage 4 (Execution)	2005
Cougar	COU/HCR (COU Only) Powerhouse and Transformer Oil W	Stage 4 (Execution)	2009
Cougar	COU Protective Relays Replacement	Stage 4 (Execution)	2009
Cougar	CGR Digital Governors	Stage 4 (Execution)	2012
Cougar	WVY and LOS GDACS_CGR (Phase 1)	Stage 4 (Execution)	2014
Detroit	DET Repl. Windings (includes BCL) & Oil Repl.	Stage 4 (Execution)	2001
Detroit	DET Remote Control (includes BCL)	Stage 4 (Execution)	2002
Detroit	DET Crane Refurbishment (includes BCL)	Stage 4 (Execution)	2003
Detroit	DET Spare Transformer	Stage 4 (Execution)	2004
Detroit	DET/BCL Generator Fire Protection & HVAC	Stage 4 (Execution)	2005
Detroit	DET Electric Reliability Upgrades	Stage 4 (Execution)	2006
Detroit	DET Emergency Engine Gen. (includes BCL)	Stage 4 (Execution)	2007
Detroit	DET/BCL Fire Protection & HVAC	Stage 4 (Execution)	2009
Detroit	DET Powerhouse and Transformer Oil Water Separator (PH	Stage 4 (Execution)	2012
Detroit	DET Digital Governor	Stage 4 (Execution)	2012
Detroit	WVY and LOS GDACS_DET (Phase 1)	Stage 4 (Execution)	2014
Dexter	DEX Spillway Bulkhead Gates (Joint)	Stage 4 (Execution)	2009
Dexter	DEX Spillway Tainter Gate Repair	Stage 4 (Execution)	2011
Dexter	DEX Powerhouse and Transformer Oil Water Separator (PH	Stage 4 (Execution)	2012
Dexter	DEX Digital Governors	Stage 4 (Execution)	2012
Dexter	DEX Electrical Reliability Upgrades (Phase 1)	Stage 4 (Execution)	2013
Dexter	WVY and LOS GDACS_DEX (Phase 1)	Stage 4 (Execution)	2014
Dworshak	DWK Emergency Notification (Pagers)	Stage 4 (Execution)	2006
Dworshak	DWK PH Bridge Cranes	Stage 4 (Execution)	2008
Dworshak	DWK Elevators	Stage 4 (Execution)	2008
Dworshak	DWR U3 Standby Generator Guide Bearing and Oil Cooler A	Stage 4 (Execution)	2011
Dworshak	DWR DNFH Boiler Control Replacement (Phase 1 & 2)	Stage 4 (Execution)	2011
Dworshak	DWR Powerhouse HVAC Upgrade (Phase 1 and 2A)	Stage 4 (Execution)	2012
Dworshak	DWR Unit 3 Rehabilitation	Stage 4 (Execution)	2013

Federal Hydro Asset Strategy

Capital Program Projects: by Plant, Stage and Start Year

Dworshak	DWR Powerhouse HVAC Upgrade (Phase 2)	Stage 3 (Short Term Planning)	2014
Dworshak	DWR Upgrade Telephone Switch and System	Stage 3 (Short Term Planning)	2014
Dworshak	DWR Upgrade Telephone Switch and System (Ph 2B)	Stage 3 (Short Term Planning)	2015
Dworshak	DWR Spillway Gates Fit For Svc Recommendations	Stage 2 (Long Term Planning)	2015
Dworshak	DWR Exciter Replacement (Phase 1)	Stage 2 (Long Term Planning)	2016
Dworshak	DWR Tailrace Crane Rehab	Stage 2 (Long Term Planning)	2016
Dworshak	DWR Exciter Replacement (Phase 2)	Stage 2 (Long Term Planning)	2017
Dworshak	DWR Transformer Separation (Main and SS)	Stage 2 (Long Term Planning)	2017
Dworshak	DWR Unit 3 Spare Winding	Stage 2 (Long Term Planning)	2018
Foster	FOS Repl. (SYS Exciter)	Stage 4 (Execution)	2000
Foster	FOS Stop Log Fabrication	Stage 4 (Execution)	2009
Foster	FOS Digital Governors	Stage 4 (Execution)	2011
Foster	FOS Powerhouse and Transformer Oil Water Separator (PH	Stage 4 (Execution)	2012
Foster	FOS Main Unit Breakers Replacement - Ph 1	Stage 4 (Execution)	2013
Foster	FOS Bridge Crane Rehabilitation (Phase 1)	Stage 4 (Execution)	2013
Foster	WVY and LOS GDACS_FOS (Phase 1)	Stage 4 (Execution)	2014
Foster	FOS Main Unit Breaker Replacement	Stage 3 (Short Term Planning)	2013
Foster	FOS Bridge Crane Rehabilitation (Phase 2)	Stage 3 (Short Term Planning)	2015
Grand Coulee	GCL CO2 Replacement	Stage 4 (Execution)	1999
Grand Coulee	GCL 22-24 Spare TX & 19-21 Replacement Bank	Stage 4 (Execution)	1999
Grand Coulee	GCL 21 Powerhouse Transformer	Stage 4 (Execution)	1999
Grand Coulee	GCL G1-18 Stator, Winding, Core & Spare	Stage 4 (Execution)	2002
Grand Coulee	GCL SCADA Replacement	Stage 4 (Execution)	2004
Grand Coulee	GCL 11.95 KV Switchgear	Stage 4 (Execution)	2004
Grand Coulee	GCL G1-18 Air Housing Coolers	Stage 4 (Execution)	2006
Grand Coulee	GCL 500 kV Switchyard Relay Replacement	Stage 4 (Execution)	2006
Grand Coulee	GCL TPP Roof Rehabilitation	Stage 4 (Execution)	2006
Grand Coulee	GCL Left/Right Roof Replacement	Stage 4 (Execution)	2007
Grand Coulee	GCL K10 Transf. Bank Repl.	Stage 4 (Execution)	2007
Grand Coulee	GCL G19-24 Exciter Replacement	Stage 4 (Execution)	2007
Grand Coulee	GCL G19-20 236 MVA Transf. Repl. (6 tanks)	Stage 4 (Execution)	2007
Grand Coulee	GCL XRS Switchgear Replacement	Stage 4 (Execution)	2007
Grand Coulee	GCL G1-9 Unit Transformer Replacement	Stage 4 (Execution)	2008
Grand Coulee	GCL G19-24 Governor Replacement	Stage 4 (Execution)	2008
Grand Coulee	GCL Fixed Wheel Gate Chamber Modification	Stage 4 (Execution)	2009
Grand Coulee	GCL Elevator Rehabilitation	Stage 4 (Execution)	2009
Grand Coulee	GCL TPP Crane Rehabilitation	Stage 4 (Execution)	2009
Grand Coulee	GCL TPP High Voltage Cable Repl.	Stage 4 (Execution)	2009
Grand Coulee	GCL Material Storage Building	Stage 4 (Execution)	2009
Grand Coulee	GCL G19-20 Unit Uprate (winding)	Stage 4 (Execution)	2010
Grand Coulee	GCL Laser Light Show Replacement (Ph 1 & 2)	Stage 4 (Execution)	2011
Grand Coulee	GCL G22-G24 Wear Ring Replacement	Stage 4 (Execution)	2011
Grand Coulee	GCL Powerplant Battery Replacement	Stage 4 (Execution)	2013
Grand Coulee	GCL Warehouse 3 Replacement	Stage 4 (Execution)	2013
Grand Coulee	GCL G11-G18 Transformer Replacement	Stage 4 (Execution)	2013
Grand Coulee	GCL 500 kV Tie to 230 kV Switchyard	Stage 4 (Execution)	2013
Grand Coulee	GCL Station Service Compressed Air System Upgrades	Stage 4 (Execution)	2013
Grand Coulee	GCL G1-G18 Static Exciter Replacement	Stage 4 (Execution)	2014
Grand Coulee	GCL G1-G18 Governor Replacement	Stage 4 (Execution)	2014
Grand Coulee	GCL TPP K21A-K24A Transformer Replacement	Stage 3 (Short Term Planning)	2014
Grand Coulee	GCL RPH Substation Replacement	Stage 3 (Short Term Planning)	2014
Grand Coulee	TPP Station Service Transformers to Auxiliaries	Stage 3 (Short Term Planning)	2014
Grand Coulee	GCL G1-G18 Isophase Bus	Stage 3 (Short Term Planning)	2014
Grand Coulee	GCL Powerplant Battery Replacement (Phase 2)	Stage 3 (Short Term Planning)	2015
Grand Coulee	GCL - Switchyard DC Battery Upgrades	Stage 3 (Short Term Planning)	2015
Grand Coulee	GCL RPH Substation ZLRS/UARS Replacement	Stage 3 (Short Term Planning)	2015
Grand Coulee	GCL RPH Motor Control Boards (ZRS, MRS, MARS) Replacen	Stage 3 (Short Term Planning)	2015
Grand Coulee	GCL G1-G18 Governor Replacement (Phase II)	Stage 3 (Short Term Planning)	2016
Grand Coulee	GCL TPP K21A-K24A Transformer Replacement (Phase II)	Stage 3 (Short Term Planning)	2016
Grand Coulee	GCL G1-G18 Static Exciter Replacement (Phase II)	Stage 3 (Short Term Planning)	2016
Grand Coulee	GCL 11.95 kV Switchgear Replacement (Local Service)	Stage 3 (Short Term Planning)	2017
Grand Coulee	GCL TPP KX26a Transformer Bank (3@400MVA)	Stage 2 (Long Term Planning)	2013
Grand Coulee	GCL - TPP Turbine Overhauls (AA adjustment)	Stage 2 (Long Term Planning)	2015
Grand Coulee	GCL Industrial Area Crane Controls	Stage 2 (Long Term Planning)	2016
Grand Coulee	GCL G19-21 Winding Replacements	Stage 2 (Long Term Planning)	2016
Grand Coulee	GCL TPP 125 VDC Battery Distribution Boards (BS3B/BS3E) I	Stage 2 (Long Term Planning)	2016
Grand Coulee	GCL Dam Station Service Switchgear and Cable Replaceme	Stage 2 (Long Term Planning)	2017
Grand Coulee	GCL - Replace SS Transformers KALS and KBLS	Stage 2 (Long Term Planning)	2017
Grand Coulee	GCL 230 kV Switchyard Breaker Replacement	Stage 2 (Long Term Planning)	2017
Grand Coulee	GCL Replace TPP SS Xformer D19A, 21A, 23A, DS3A, US3A	Stage 2 (Long Term Planning)	2018
Grand Coulee	GCL New Firehouse	Stage 2 (Long Term Planning)	2018
Grand Coulee	GCL RPH/LPH 48 VDC Battery Chargers (BRA/BRB) Replacer	Stage 2 (Long Term Planning)	2018
Grand Coulee	GCL - LPH/RPH Crane Control Upgrades	Stage 2 (Long Term Planning)	2018
Grand Coulee	GCL - Powerhouse Switchgear Upgrades	Stage 2 (Long Term Planning)	2018
Grand Coulee	GCL - TPP Governor Pump Motor Control Assembly (M19A-	Stage 2 (Long Term Planning)	2018
Grand Coulee	GCL Replace SS Substation DWA 230 Swyd	Stage 2 (Long Term Planning)	2018
Grand Coulee	GCL Replace SS Substation DNA 115 Swyd	Stage 2 (Long Term Planning)	2019
Grand Coulee	GCL New G1-18 Transformer Disconnects (High Side)	Stage 2 (Long Term Planning)	2019
Grand Coulee	GCL Additional Station Service Feed to RPP/PGP	Stage 2 (Long Term Planning)	2020
Grand Coulee	GCL 500 kV Unit Breakers (D Breaker)	Stage 2 (Long Term Planning)	2020
Green Peter	GPR Repl. (SYS Exciter)	Stage 4 (Execution)	2000
Green Peter	GPR/FOS Generator Fire Protection & HVAC	Stage 4 (Execution)	2005
Green Peter	GPR/FOS Protective Relays Replacement	Stage 4 (Execution)	2009
Green Peter	GPR Digital Governors	Stage 4 (Execution)	2011
Green Peter	GPR Spillway Gate Rehabilitation - 1 gate	Stage 4 (Execution)	2012
Green Peter	GPR Powerhouse and Transformer Oil Water Separator (PH	Stage 4 (Execution)	2012
Green Peter	WVY and LOS GDACS_GPR (Phase 1)	Stage 4 (Execution)	2013
Green Peter	GPR Main Unit Breakers and Electrical Reliability Upgrades	Stage 4 (Execution)	2013
Green Springs	GSP Transformer Repl.	Stage 4 (Execution)	2003
Green Springs	GSP Excitation System Replacement	Stage 4 (Execution)	2012
Hills Creek	HCR Repl. (SYS Exciter)	Stage 4 (Execution)	2000
Hills Creek	HCR Generator Fire Protection & HVAC	Stage 4 (Execution)	2005
Hills Creek	HCR Turbine Runner and Generator Rewind	Stage 4 (Execution)	2006
Hills Creek	HCR Bridge Crane Rehab.	Stage 4 (Execution)	2008
Hills Creek	HCR Protective Relays Replacement	Stage 4 (Execution)	2009
Hills Creek	COU/HCR (HCR Only) Powerhouse and Transformer Oil Wa	Stage 4 (Execution)	2010
Hills Creek	HCR Digital Governor	Stage 4 (Execution)	2011
Hills Creek	WVY and LOS GDACS_HCR (Phase 1)	Stage 4 (Execution)	2014

Federal Hydro Asset Strategy

Capital Program Projects: by Plant, Stage and Start Year

Hungry Horse	HGH CO2 Replacement	Stage 4 (Execution)	1999
Hungry Horse	HGH Fiber	Stage 4 (Execution)	2000
Hungry Horse	HGH SCADA Replacement	Stage 4 (Execution)	2004
Hungry Horse	HGH Roof Replacement	Stage 4 (Execution)	2010
Hungry Horse	HGH Main Transformer Fire Protection System Replaceme	Stage 4 (Execution)	2011
Hungry Horse	HGH SS and MCC Upgrades	Stage 4 (Execution)	2011
Hungry Horse	HGH Static Exciters	Stage 4 (Execution)	2013
Hungry Horse	HGH Powerplant Crane Controls	Stage 4 (Execution)	2013
Hungry Horse	HGH G1-G4 Governor Replacement	Stage 4 (Execution)	2013
Hungry Horse	HGH G1-G4 Governor Replacement (Phase II)	Stage 3 (Short Term Planning)	2015
Hungry Horse	HGH Powerplant Crane Controls (Phase II)	Stage 3 (Short Term Planning)	2015
Hungry Horse	HGH Turbine/Stator/Winding Study and Upgrade	Stage 2 (Long Term Planning)	2017
Ice Harbor	IHR Turbine Runner Design & Repl. Units 1,2,3	Stage 4 (Execution)	2001
Ice Harbor	IHR Emergency Notification (Pagers)	Stage 4 (Execution)	2006
Ice Harbor	IHR Tailrace Crane Rehab	Stage 4 (Execution)	2008
Ice Harbor	IHR T6 Transformer Replacement	Stage 4 (Execution)	2009
Ice Harbor	IHR Potable Water System Repl.	Stage 4 (Execution)	2009
Ice Harbor	IHR Project Storage Building	Stage 4 (Execution)	2010
Ice Harbor	IHR DC System Upgrade (Ph. 1 & 2)	Stage 4 (Execution)	2011
Ice Harbor	IHR Low Voltage Switchgear Upgrades - SQ Boards (Ph. 1 &	Stage 4 (Execution)	2011
Ice Harbor	IHR T1,T2,T3 Cooler Leak Repair (Phases 1 & 2)	Stage 4 (Execution)	2012
Ice Harbor	IHR Main Units 1-6 Digital Governor (Phase 1 & 2)	Stage 4 (Execution)	2012
Ice Harbor	IHR Drainage & De-Watering Pump Upgrade (Phase 1 and F	Stage 4 (Execution)	2012
Ice Harbor	IHR Draft Tube & Scroll Case Access Tugger (Phase 1)	Stage 4 (Execution)	2013
Ice Harbor	IHR XW-5 Breaker Repair (Phase 1 & 2)	Stage 4 (Execution)	2013
Ice Harbor	IHR Draft Tube & Scroll Case Access Tugger (Phase 2)	Stage 3 (Short Term Planning)	2013
Ice Harbor	IHR Upgrade Telephone Switch and System	Stage 3 (Short Term Planning)	2014
Ice Harbor	IHR MU Cooling Water Strainers Replacement	Stage 3 (Short Term Planning)	2014
John Day	JDA Exciter Repl. (SYS Exciter)	Stage 4 (Execution)	2000
John Day	JDA Control Room Fire Protection Upgrades	Stage 4 (Execution)	2006
John Day	JDA Bridge Crane Rehab	Stage 4 (Execution)	2006
John Day	JDA Protective Relays Replacement	Stage 4 (Execution)	2009
John Day	JDA Elevator Rehabilitation (Ph 1 & 2)	Stage 4 (Execution)	2010
John Day	JDA Fish Hydro Pump Rehabilitation	Stage 4 (Execution)	2011
John Day	JDA Powerhouse Unit 11 Repair	Stage 4 (Execution)	2011
John Day	JDA Digital Governors	Stage 4 (Execution)	2011
John Day	JDA DC System Upgrades (Ph 1)	Stage 4 (Execution)	2012
John Day	JDA Draft Tube Bulkheads and Intake Gates(Ph. 1)	Stage 4 (Execution)	2013
John Day	JDA BLH Turbine Hub Upgrades and Fixed Blade Conversio	Stage 4 (Execution)	2013
John Day	JDA BLH Hub Upgrade Kits	Stage 4 (Execution)	2013
John Day	JDA Oil Replacement	Stage 4 (Execution)	2013
John Day	JDA SS Transformer Replacements (Phase 1)	Stage 4 (Execution)	2013
John Day	JDA BLH Turbine Hub Upgrades and Fixed Blade Conversio	Stage 4 (Execution)	2014
John Day	JDA Powerhouse Unit 5 Blocking and Ph 1 Repair	Stage 3 (Short Term Planning)	2013
John Day	JDA DC System Upgrades (Ph 2)	Stage 3 (Short Term Planning)	2014
John Day	JDA Draft Tube Bulkheads and Intake Gates (Ph. 2)	Stage 3 (Short Term Planning)	2014
John Keys PGP	GCL PG Transformer Repl. & Circuit Addition	Stage 4 (Execution)	2000
John Keys PGP	GCL PG Plant Modernization and Upgrades	Stage 4 (Execution)	2010
John Keys PGP	GCL KP10B Transformer Replacement (Phase 1)	Stage 4 (Execution)	2012
John Keys PGP	GCL P5 and P6 Impellers, Stators and Core Rewinds Ph1	Stage 4 (Execution)	2012
John Keys PGP	GCL P5 and P6 Impellers, Stators and Core Rewinds Ph 2	Stage 3 (Short Term Planning)	2013
John Keys PGP	GCL KP10B Transformer Replacement (Phase 2)	Stage 3 (Short Term Planning)	2013
Libby	LIB System Reliability	Stage 4 (Execution)	1997
Libby	LIB Powerhouse Cranes	Stage 4 (Execution)	1999
Libby	LIB Transformer Refurbishment (SYS)	Stage 4 (Execution)	2001
Libby	LIB MUB (SYS Main Unit Breakers)	Stage 4 (Execution)	2003
Libby	LIB Spare Transformer	Stage 4 (Execution)	2004
Libby	LIB GDACS and Spillway	Stage 4 (Execution)	2004
Libby	LIB Exciter Replacement	Stage 4 (Execution)	2004
Libby	NWS Remoting (LIB)	Stage 4 (Execution)	2005
Libby	LIB Governor (SYS Governor Repl.)	Stage 4 (Execution)	2007
Libby	LIB HVAC Controls and Rehab.	Stage 4 (Execution)	2008
Libby	LIB Selective Withdrawal Crane (Ph 1&2)	Stage 4 (Execution)	2009
Libby	LIB Powerhouse Elevators Rehab. (Ph 1&2)	Stage 4 (Execution)	2009
Libby	LIB Monolith 28 Elevator Rehab. (Ph 1&2)	Stage 4 (Execution)	2009
Libby	LIB Powerhouse Electrical Distribution Equipment Replace	Stage 4 (Execution)	2013
Libby	LIB Dam Electrical Distribution Equipment	Stage 4 (Execution)	2013
Libby	LIB System Control Console - Plant (SCC)	Stage 3 (Short Term Planning)	2014
Libby	LIB Water Mist - Oil Room	Stage 3 (Short Term Planning)	2014
Libby	LIB Powerhouse DC Emergency Lighting System	Stage 3 (Short Term Planning)	2014
Libby	LIB Powerhouse Roof Replacement	Stage 3 (Short Term Planning)	2014
Libby	LIB Vibration Monitoring System	Stage 2 (Long Term Planning)	2015
Libby	LIB DC Boards & Bkrs Sys 1 & 2	Stage 2 (Long Term Planning)	2015
Libby	LIB Additional Station Service TAP	Stage 2 (Long Term Planning)	2018
Little Goose	LGS Emergency Notification (Pagers)	Stage 4 (Execution)	2006
Little Goose	LGS Diesel Generator	Stage 4 (Execution)	2007
Little Goose	LGS 1-6 Exciter Replacement	Stage 4 (Execution)	2009
Little Goose	LGS Powerhouse HVAC Control Upgrade	Stage 4 (Execution)	2009
Little Goose	LGS Wastewater Treatment Plant (Ph. 1)	Stage 4 (Execution)	2010
Little Goose	LGS Intake Crane Replacement (Ph1 & Ph 2)	Stage 4 (Execution)	2011
Little Goose	LGS Standby Thrust Bearing Shoes, Thurst Runner & Oil As	Stage 4 (Execution)	2011
Little Goose	LGS Powerhouse Bridge Crane Rehab (Phase 1 and 2)	Stage 4 (Execution)	2011
Little Goose	LGS Digital Govenors Upgrade (Phases 1 & 2)	Stage 4 (Execution)	2013
Little Goose	LGS Upgrade Telephone Switch and System	Stage 3 (Short Term Planning)	2014
Little Goose	LGS Iso Phase Bus & Housing Mod (Phase 1)	Stage 3 (Short Term Planning)	2014
Little Goose	LGS Upgrade Telephone Switch and System (Ph 2B)	Stage 3 (Short Term Planning)	2015
Little Goose	LGS DC System Upgrade (Phase 1)	Stage 2 (Long Term Planning)	2015
Little Goose	LGS Tailrace Gantry Crane Replacement	Stage 2 (Long Term Planning)	2015
Lookout Point	LOP Generator Fire Protection & HVAC	Stage 4 (Execution)	2005
Lookout Point	LOP Cranes (was WVL assessment)	Stage 4 (Execution)	2005
Lookout Point	LOP Turbine Runner Replacement (Ph. 1&2)	Stage 4 (Execution)	2005
Lookout Point	LOP Penstock Roller Gates	Stage 4 (Execution)	2008
Lookout Point	LOP/DEX Protective Relays Replacement	Stage 4 (Execution)	2009
Lookout Point	LOP Emergency Engine Generator (Phase 1& 2)	Stage 4 (Execution)	2011
Lookout Point	LOP Powerhouse and Transformer Oil Water Separator (Ph	Stage 4 (Execution)	2012
Lookout Point	LOP Digital Governors	Stage 4 (Execution)	2013
Lookout Point	LOP Spillway Gate Rehabilitation -- 2 gates plus	Stage 4 (Execution)	2013
Lookout Point	WVY and LOS GDACS_LOP (Phase 1)	Stage 4 (Execution)	2014

Federal Hydro Asset Strategy

Capital Program Projects: by Plant, Stage and Start Year

Lookout Point	LOP Spillway Gate Rehabilitatioin -- 2 plus gates - Ph2	Stage 3 (Short Term Planning)	2014
Lost Creek	LOS Fire Protection (Ph. 1)	Stage 4 (Execution)	2009
Lost Creek	LOS Digital Governors	Stage 4 (Execution)	2011
Lost Creek	LOS Butterfly Valves Replacement (Ph 1)	Stage 4 (Execution)	2013
Lost Creek	LOS Wicket Gate Seals Redesign/Upgrade Ph 1	Stage 4 (Execution)	2013
Lost Creek	WVY and LOS GDACS_LOS (Phase 1)	Stage 4 (Execution)	2014
Lost Creek	LOS Wicket Gate Seals Redsign/Upgrade - Ph 2	Stage 3 (Short Term Planning)	2014
Lost Creek	LOS Butterfly Vales Replacement - Ph 2	Stage 3 (Short Term Planning)	2014
Lower Granite	LGR Replacement Windings 1-3 (SYS Gen)	Stage 4 (Execution)	2001
Lower Granite	LGR -- SNK Spare Winding for units 4-6 (SYS Gen)	Stage 4 (Execution)	2002
Lower Granite	LGR Rotor Pole Refurbishment (SYS Gen)	Stage 4 (Execution)	2004
Lower Granite	LGR Governor (SYS Governor Repl.)	Stage 4 (Execution)	2004
Lower Granite	LGR Emergency Notification (Pagers)	Stage 4 (Execution)	2006
Lower Granite	LGR Intake Crane Replacement	Stage 4 (Execution)	2006
Lower Granite	LWG Diesel Generator	Stage 4 (Execution)	2007
Lower Granite	LGR Elevator Rehab.-CNO&NNO	Stage 4 (Execution)	2009
Lower Granite	LWG 4-6 Exciter Replacement	Stage 4 (Execution)	2009
Lower Granite	LGR SQ2 Replacement	Stage 4 (Execution)	2009
Lower Granite	LGR Spillway Emerg. Diesel Gen. Transfer Switch	Stage 4 (Execution)	2010
Lower Granite	LWG 8th FL. Office Expansion (Phase 1)	Stage 4 (Execution)	2011
Lower Granite	LWG Sewage Treatment Plant Upgrade (Phase 1)	Stage 4 (Execution)	2011
Lower Granite	LWG Powerhouse Bridge Crane Rehab (Phase 1 and 2)	Stage 4 (Execution)	2011
Lower Granite	LWG Powerhouse HVAC Upgrade (Phase 1)	Stage 4 (Execution)	2012
Lower Granite	LWG Powerhouse Roof Repair (Phase 1 & 2)	Stage 4 (Execution)	2013
Lower Granite	LWG Digital Governor Upgrade (Phases 1 & 2)	Stage 4 (Execution)	2013
Lower Granite	LWG Upgrade Telephone Switch and System (Ph 2B)	Stage 3 (Short Term Planning)	2014
Lower Granite	LWG Upgrade Telephone Switch and System	Stage 3 (Short Term Planning)	2014
Lower Granite	LWG ZJ6 Breakers	Stage 2 (Long Term Planning)	2017
Lower Granite	LWG Wicket Gate Gatelocks U4-U6	Stage 2 (Long Term Planning)	2021
Lower Monumenta	LMN Exciters 1-3	Stage 4 (Execution)	2002
Lower Monumenta	LMN Intake Crane Rehab.	Stage 4 (Execution)	2005
Lower Monumenta	LMN Emergency Notification (Pagers)	Stage 4 (Execution)	2006
Lower Monumenta	LMN Diesel Generator	Stage 4 (Execution)	2007
Lower Monumenta	LMN Bridge Crane	Stage 4 (Execution)	2008
Lower Monumenta	LMN U1 Refurb, U1 and U2 Cavitation Work (Ph. 1)	Stage 4 (Execution)	2009
Lower Monumenta	LMN SQ2 Replacement	Stage 4 (Execution)	2009
Lower Monumenta	LMN 4-6 Exciter Replacement	Stage 4 (Execution)	2009
Lower Monumenta	LMN U1 Refurb, U1 and U2 Cavitation Work (Ph. 2)	Stage 4 (Execution)	2013
Lower Monumenta	LMN Bridge Crane Drive Upgrades	Stage 4 (Execution)	2013
Lower Monumenta	LMN Digital Governor Upgrade (Phases 1 & 2)	Stage 4 (Execution)	2013
Lower Monumenta	LMN Upgrade Telephone Switch and System	Stage 3 (Short Term Planning)	2014
Lower Monumenta	LMN Upgrade Telephone Switch and System (Ph 2B)	Stage 3 (Short Term Planning)	2015
McNary	MCN Turbine Runner Replacement	Stage 4 (Execution)	2002
McNary	MCN Turbine Runner Accessories	Stage 4 (Execution)	2002
McNary	MCN Reliability Improvement (except turbine)	Stage 4 (Execution)	2002
McNary	MCN Governor (SYS Governor Repl.)	Stage 4 (Execution)	2002
McNary	MCN Roof Replacement	Stage 4 (Execution)	2006
McNary	MCN Fire Protection	Stage 4 (Execution)	2006
McNary	MCN Generator Rewinds	Stage 4 (Execution)	2008
McNary	MCN Transformer Purchase	Stage 4 (Execution)	2008
McNary	MCN T1, T2, T4 & T5 Transformer Install	Stage 4 (Execution)	2008
McNary	MCN Protective Relays (Ph. 1 & 2)	Stage 4 (Execution)	2009
McNary	MCN 4160-480V Station Service Replacement	Stage 4 (Execution)	2010
McNary	MCN Turbine Design and Replacement (Phase 1)	Stage 4 (Execution)	2011
McNary	MCN Potable Water System Upgrade (Ph. 1)	Stage 4 (Execution)	2011
McNary	MCN WAFL Entrance Logs (Phase 1)	Stage 4 (Execution)	2011
McNary	MCN Fishway Exit Crane 9 and 10 Replacement (Ph. 1 & 2)	Stage 4 (Execution)	2011
McNary	MCN PH Heat Pump & Control Replacement (Ph. 1 and 2)	Stage 4 (Execution)	2011
McNary	MCN Levee Drainage Pump Station Upgrades (Ph. 1)	Stage 4 (Execution)	2011
McNary	MCN Bridge Crane Fall Protection System	Stage 4 (Execution)	2012
McNary	MCN Digital Governors U1-14 (Phase 1 & 2)	Stage 4 (Execution)	2013
McNary	MCN 4160-480V Station Service Repl (Ph. 2B)	Stage 4 (Execution)	2014
McNary	MCN WAFL Entrance Logs Phase 2	Stage 3 (Short Term Planning)	2014
McNary	MCN Fourth Spare Tailrace Bulkheads	Stage 3 (Short Term Planning)	2014
McNary	MCN Project Storage Building	Stage 3 (Short Term Planning)	2014
McNary	MCN Upgrade Telephone Switch and System	Stage 3 (Short Term Planning)	2014
McNary	MCN Exciters Upgrade (Phase 1)	Stage 3 (Short Term Planning)	2014
McNary	MCN Upgrade Telephone Switch and System (Ph 2B)	Stage 3 (Short Term Planning)	2015
McNary	MCN Turbine Design and Replacement (Phase 2)	Stage 3 (Short Term Planning)	2016
McNary	MCN Iso-Phase Bus Upgrade (Phase 1)	Stage 2 (Long Term Planning)	2019
Minidoka	MIN/PAL Modifications	Stage 4 (Execution)	2000
Minidoka	MIN Microwave System Backbone East Side	Stage 4 (Execution)	2014
Palisades	PAL Powerplant Fire Detection and Alarm System	Stage 4 (Execution)	2012
Palisades	PAL Microwave System Backbone East Side	Stage 4 (Execution)	2014
Roza	ROZ Exciter Repl.	Stage 4 (Execution)	2007
Roza	ROZ Switch Rehab and Breaker Upgrade	Stage 4 (Execution)	2014
The Dalles	TDA Governor (SYS Governor Repl.)	Stage 4 (Execution)	2001
The Dalles	TDA Oil/Water Separator (SYS)	Stage 4 (Execution)	2003
The Dalles	TDA Synchr. Cond. Upgrade (funded by TBL)	Stage 4 (Execution)	2004
The Dalles	TDA Station Service Improvement	Stage 4 (Execution)	2004
The Dalles	TDA Spare 230 KV Transformer Repl.	Stage 4 (Execution)	2005
The Dalles	TDA Control Room Fire Detection Upgrades	Stage 4 (Execution)	2005
The Dalles	TDA Spillway Repair	Stage 4 (Execution)	2006
The Dalles	TDA Heat Pump #3 & Coil Replacement	Stage 4 (Execution)	2006
The Dalles	TDA Powerhouse Roof Replacement	Stage 4 (Execution)	2010
The Dalles	TDA Elevator Rehabilitation (Ph 1 & 2)	Stage 4 (Execution)	2010
The Dalles	TDA DC System Upgrades	Stage 4 (Execution)	2011
The Dalles	TDA SCC Control Replacement (Ph. 1)	Stage 4 (Execution)	2012
The Dalles	TDA Tailrace Gantry Crane (Ph 1)	Stage 4 (Execution)	2012
The Dalles	TDA Preferred AC System Upgrades	Stage 4 (Execution)	2013
The Dalles	TDA Transformer Replacement T1,3,5,6,7,8 (Phase 1)	Stage 4 (Execution)	2013
The Dalles	TDA Turbine Model ERDC	Stage 3 (Short Term Planning)	2013
The Dalles	TDA Tailrace Gantry Crane (Ph 2)	Stage 3 (Short Term Planning)	2014
The Dalles	TDA SCC Control Replacement (Ph. 2)	Stage 3 (Short Term Planning)	2014

Federal Hydro Asset Strategy

Questions

- ***More detailed information about…how capital spending within the [Affordability] Cap is expected to increase power and transmission rates.***

BPA is required to recover its costs via rates. All spending, capital or otherwise, will have an impact on those rates. In the short term, individual investments in the hydro system will result in upward pressure on rates. But over the long term, those capital projects should result in lower rates than would have been realized absent the investment in the system. This is because the projects approved for capital investment involve cost-minimizing preventive care as opposed to more expensive reactive repairs and maintenance. The investments we make minimize the total life cycle cost of the FCRPS and therefore keep rates lower than they otherwise would be. The goal of minimizing total life cycle costs is the cornerstone of the Hydro Asset Strategy.

- ***Please discuss how BPA considers the market value of power,…***

The market value of power used in the Fed Hydro Asset Strategy considers both a spot price forecast at Mid-C and a firm capacity component that is consistent with the demand charge used in the rate case. (See Slide 15)

- ***Specific details about the projects BPA and other agencies (primarily but not limited to, the U.S. Army Corps of Engineers and Bureau of Reclamation) would cut or defer in order to reach the Cap, as well as the operational, regulatory and reliability consequences of cutting or deferring specific projects to reach the Affordability Cap goal.***

Regulatory, Safety and Environmental driven investments are the first priority when funding capital investments in the FCRPS. Any remaining budget is prioritized using the cost minimization algorithm. Financially-driven investments will be selected to minimize risk and will typically be higher value projects. When the Fed Hydro budget is reduced, the Regulatory, Safety and Environmental investments are still made and the investments that get deferred are likely to be those chosen for financial reasons. This means that the investments that contribute to lower long-term rates (everything with a positive NPV should contribute to lower rates) are pushed beyond their cost minima, thus increasing the total lifetime cost of the system and putting upward pressure on rates over the long run.

Federal Hydro Asset Strategy

Questions

- ***More details about the Asset Strategy for Federal Hydro, including the validity of assumptions used to estimate lost generation replacement costs, and how the Asset Strategy will be modified to be consistent with the Affordability Cap.***

The assumptions used in the Asset Strategy are listed on slide 15. The modeling used in the strategy can be altered to suit any budget level. The process of determining the optimal budget level, however, will continue to remove financial constraints and determine the budget necessary to replace all equipment at exactly its cost minima. This results in some unrealistic program levels in the near term but generally serves to highlight the chronic underinvestment over the life-thus-far of our Hydro Assets. This "bow wave" of investment of need is then smoothed into a more realistic and achievable program level, which is subsequently recommended by Fed Hydro for funding.

- ***Please re-estimate the ratio using only the market value of energy as the basis for the benefit of power projects and specify the basis for the estimate.***
- ***At a prior briefing regarding BPA's hydro spending plans, it was noted that BPA was assuming a 72 mill power price (including a carbon credit), and was also assuming a 12% discount rate. We would be interested in seeing how the optimal level of hydro investment would change given a lower assumed power market price and a lower discount rate--say, a 40 mill power market price (which would include a carbon credit), and an 8% discount rate. How sensitive are the calculations of optimal hydro investment to changes in assumed power price and discount rate?***

We did not consider lower power price values in our analyses. The results of the modeling are most sensitive to discount rates and inflation, followed by energy value and Co2 value. We will provide alternative scenario analysis results prior to completion of the customer comment period.

Federal Hydro Asset Strategy

Questions

- ***Please provide a list and the spending for all projects excluded form the prioritization process.***

Slides 27-30 list all projects currently in any stage of development or execution. The spending for these cannot be shared, as that would compromise the government bidding process. And while these projects are largely considered "sustain" investments and thereby excluded from the "expansion" Agency Prioritization process, rest assured that they are prioritized within the Fed Hydro program using the aforementioned life-cycle-cost-minimization algorithm.

- ***On page 11 of the CIR kickoff discussion document, there is a graph showing a quantification of risks to the hydro system (measured in dollars), based on varying levels of investment in the hydro system. Can you differentiate between risks to the hydro system due to serious equipment failures (say, losing a critical crane at a dam), and less serious failures that simply reduce potential electrical output at a dam?***

The graph you are referring to (on slide 18 of this presentation) only considers the risk of lost generation due to unexpected equipment failure. Direct Cost Risk (DCR) is calculated separately from Lost Generation Risk (LGR) and represents collateral damage due to a forced outage and scheduling inefficiencies associated with replacement, among other things. DCR is quantified for each piece of equipment on the system, along with LGR, Equipment Replacement Cost and Lost Efficiency Opportunity. The sum of all of those costs yields a Total Cost curve, the minimum point on which coincides with the optimal timing for equipment replacement (see slide 14).

Financial Disclosure

This information has been made publicly available by BPA March 7, 2014 and contains information not reported in agency financial statements.