Transmission

Transmission

System Overview

BPA provides transmission service to a population of more than 12 million through a network of transmission facilities spanning four states and approximately 300,000 square miles.

About three-fourths of the Northwest region's high-voltage transmission assets are owned and managed by BPA.

The BPA transmission network includes over $4.3 billion in assets:

- Approximately 15,000 circuit miles of transmission lines
- 298 alternating current substations
- One direct current substation

Greater than 50% of the facilities were constructed prior to 1962.

Transmission Asset Strategy

Challenges

In recent years the utility industry has experienced a great deal of change, as a result, demands on BPA's transmission system are increasing.

BPA is faced with numerous challenges in the coming age.

- Delayed investment in replacements gave BPA flexibility in the past to address expansion needs, rate pressure and unplanned contingencies; however, BPA is now faced with a substantial backlog, higher O&M and a heightened risk of equipment failure/obsolescence.
- Rapidly evolving technology and underinvestment has left BPA lagging behind the industry. Costs are increasing to operate vintage systems and system flexibility is limited.
- A balance is needed between customer demand for system availability and the outages necessary to execute maintenance and replacement projects.
- Regulatory and compliance requirements continue to increase and evolve.
- Reliance on critical real-time data is increasing due to the demands of evolving markets.
- Currently, several transmission paths are at or near their capacity limits, which can force changes to the optimal dispatch of generating resources and lead to higher regional costs for delivered power.
- Greater system visibility, more accurate models, and enhanced automated controls are required to maintain reliability.
- Much of BPA's system is located within the Cascadia Subduction Zone, causing a well known seismic hazard.
- BPA continues to face physical and cyber hazards that put the transmission system at risk.
- Pressure remains to minimize the cost.

Transmission Asset Strategy

Objectives

Vision for Managing Transmission Assets

We will manage our assets to achieve high reliability, availability and adequacy standards and maximize economic value for the region. We will use efficient and transparent practices that are effective in managing risks and delivering assets.

- The asset management strategy has two main objectives:
  - *Sustain* existing infrastructure to meet reliability and availability requirements; and
  - *Expand* the system to provide needed transmission capacity and flexibility into the future.

These objectives must be accomplished while optimizing the lifecycle of transmission assets and reducing total economic costs.

Transmission Asset Strategy

Program Composition

BPA's transmission asset management ***sustain*** program is divided into equipment groups each with long- term asset specific strategies and plans:

- Substations
- Control Centers
- Power System Control / System Telecommunications
- System Protection and Control
- Rights of Way
- Wood Pole Lines
- Steel Lines

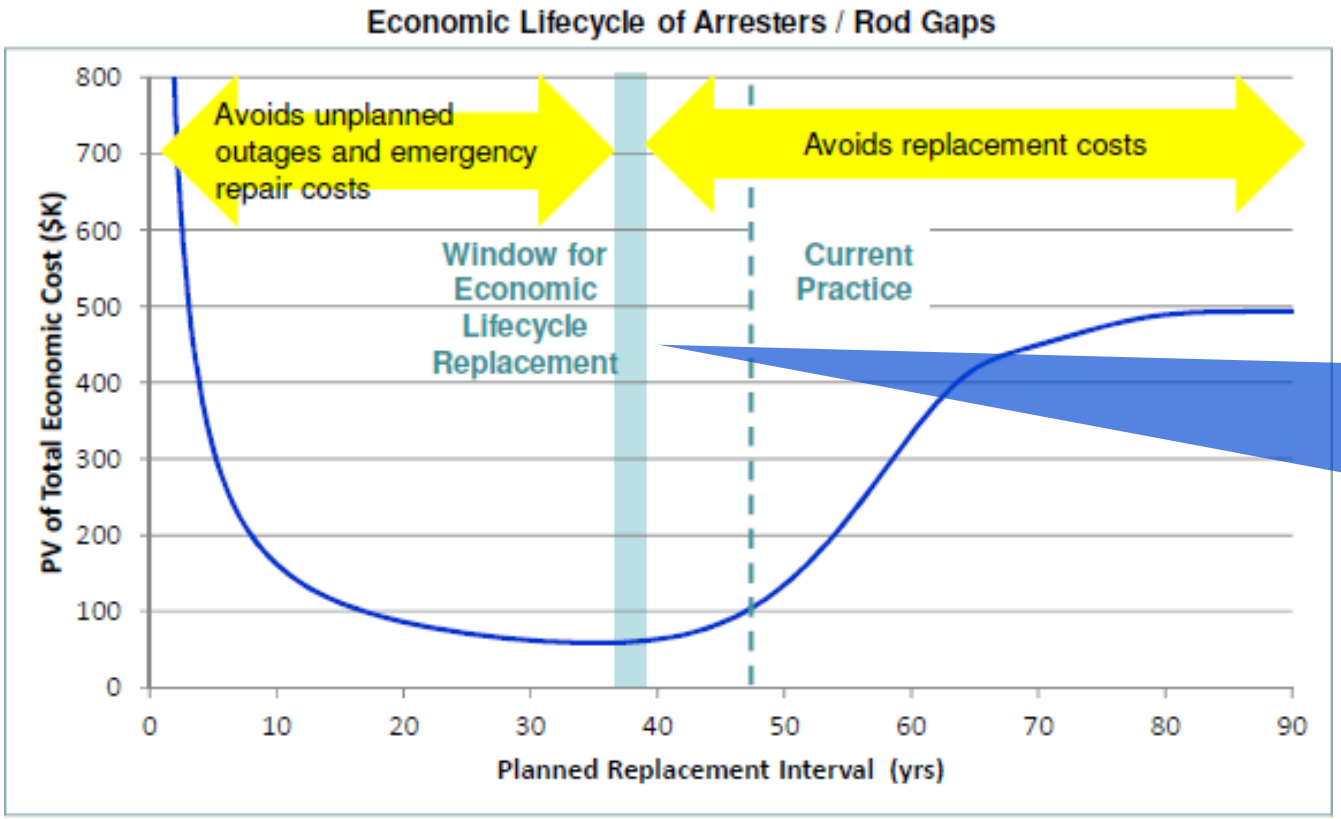
Transmission's ***expansion*** program is driven by:

- System reliability
- Regulatory and compliance requirements
- Generation interconnection
- Customer service requests
- Transmission congestion relief

Transmission Asset Strategy

Sustain program methodology – total economic cost evaluation

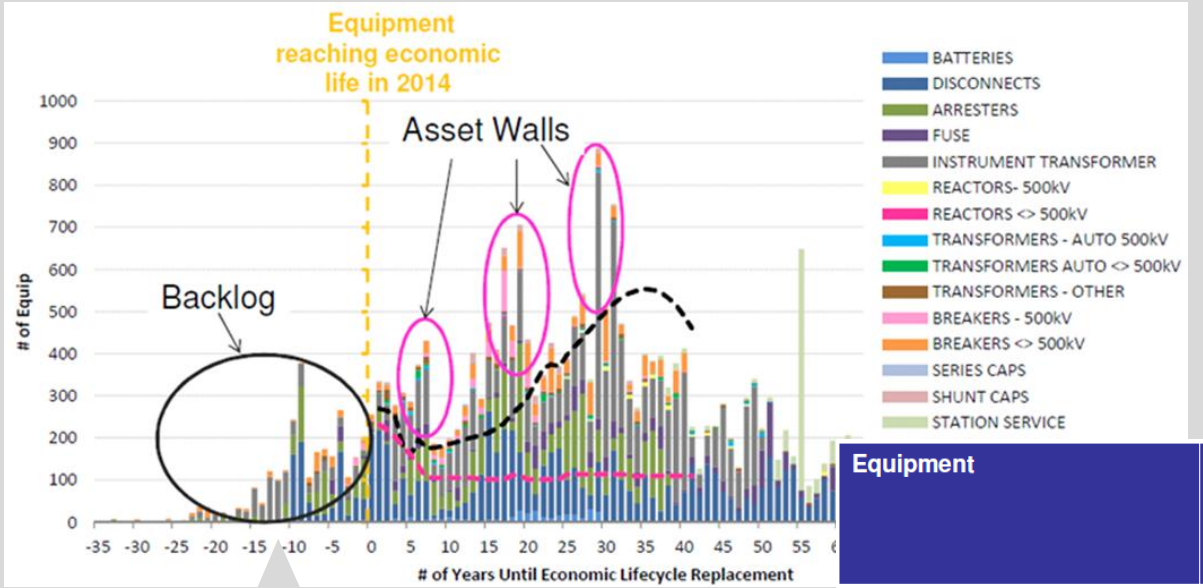
Transmission's sustain program strategies are being developed on the risk-informed basis of evaluating *total economic cost* using assessments of the health condition of equipment, the likelihood of equipment failure and the potential for line derates and outages should equipment failure occur.



Economic lifecycle balances the equipment replacement frequency against repair cost and the unplanned outage cost of a failure.

Transmission Asset Strategy

Sustain Program - Economic Lifecycle Asset Plan Example



The capital replacement plan for AC Subs aims to reduce total costs based on replacing equipment per its economic lifecycle

Equipment	Current Practice (years equip stays on system)	Economic Lifecycle & Equip Replacement Per Year	
		years	replacement/yr
Arresters / Rod Gaps	47	38-39	97
Power Transformer - Other	80	67-75	4.9
Disconnect Switches	57	64-67	102
Power Circuit Breaker - 500kV	35	41-46	8.4
Power Circuit Breaker - Other	55	41-46	35
Power Transformer - Other Auto	70	72-80	2.4
Series Capacitor	35	21-23	1
Shunt Capacitor	35	34-35	6
Batteries / Chargers	23	29-30	9.4
Instrument Transformers	47	52-54	134
Power Transformer - 500 Auto	70	54-64	2.1
Power Reactor - 500kV	Run until major problem	72-79	1.3
Power Reactor - Other		67-69	0.3
Fuse Links		72-73	23
Station Service		100	18
Substation Bus		78-79	10.1

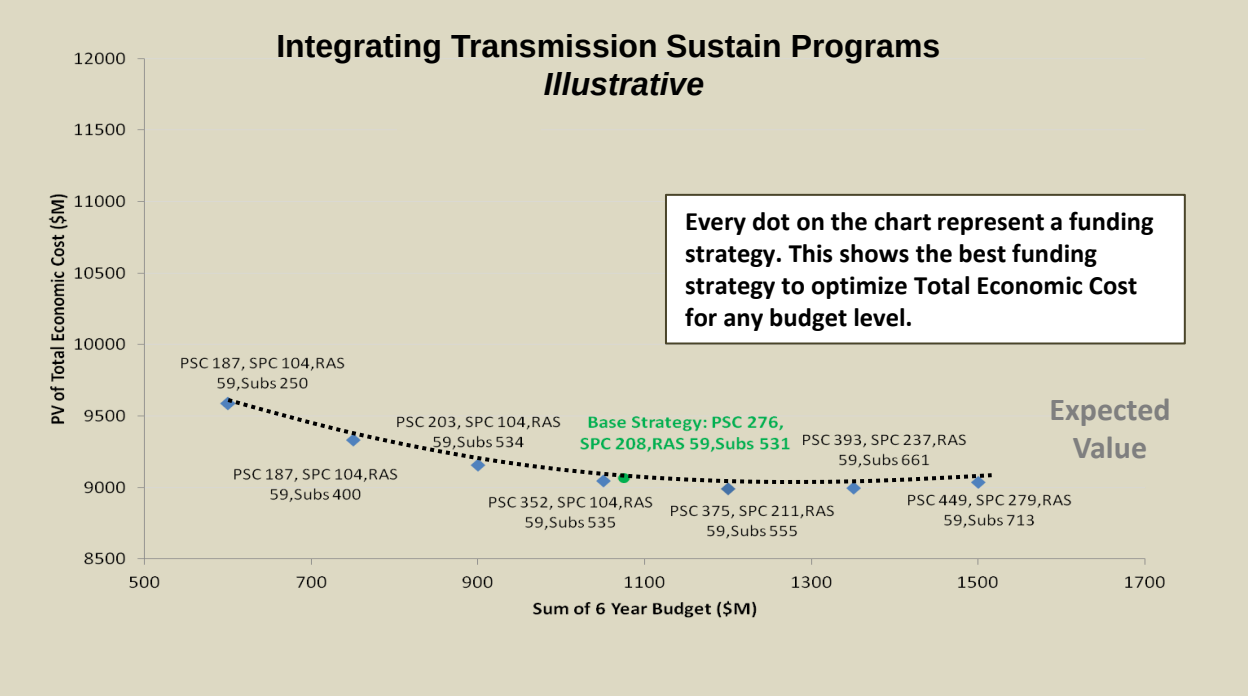
Evaluations indicate:

- Over 2400 pieces of Substation equipment are past their economic lifecycle
- The presence of “asset walls” when a significant portion of the equipment population is expected to reach its end of life

Transmission Asset Strategy

Sustain Program - Prioritizing Investments

By the end of 2015, all sustain programs will have asset strategies developed using the Total Economic Cost methodology.



This integrated, standardized approach facilitates cross-program trade-offs that ensure the most critical replacements with the highest level of risk from an economic perspective are prioritized first.

Transmission Asset Strategy

Sustain Program - Initially Submitted Investment Levels

To implement the prioritized sustain asset strategies for over $4.3 billion of transmission assets, an average of $200 million direct capital per year is needed. For most programs, these funding levels reflect the results of minimizing impact on total economic costs while taking into account funding, resource, and execution constraints.

Capital FY2012-13 Actuals and FY2014-23 Ten Year Forecast (Nominal Dollars in '000, Direct Capital Only, No Indirects)
Transmission Services – Sustain Programs

	Actuals												*Excludes FY12-13
	FY12	**FY13**	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**	**FY23**	**Total**
AC Substations	15,007	30,219	28,367	31,508	32,870	34,331	34,703	37,157	40,728	40,861	44,012	42,082	**366,619**
DC Substations	11,813	11,826	1,907	8,500	8,300	400							**19,107**
Control Center	3,228	4,701	5,811	5,827	6,104	6,206	6,437	6,516	6,597	6,677	6,760	6,837	**63,773**
PSC	7,793	9,795	13,500	15,500	17,500	19,500	21,500	22,850	23,798	25,975	26,204	26,437	**212,764**
System Telecom	10,986	22,152	24,845	29,559	28,000	10,750	8,750	8,899	9,050	9,204	9,360	9,519	**147,937**
SPC	7,280	12,877	20,350	23,898	27,284	27,420	27,814	28,252	28,897	31,036	31,946	32,310	**279,208**
Access Roads	13,422	12,491	15,000	16,000	18,000	20,000	22,500	23,500	25,000	25,425	25,857	27,297	**218,579**
Land Rights	3,134	7,551	6,042	9,790	7,778	7,910	8,045	8,181	8,321	8,462	8,043	8,180	**80,751**
Wood Pole Lines	44,516	33,282	33,020	46,520	57,270	52,850	55,900	51,000	52,000	54,100	54,100	56,000	**512,760**
Steel Lines	28,407	21,881	19,603	12,625	14,865	15,276	17,449	18,623	19,741	20,024	21,200	22,074	**181,479**
TEAP Tools	2,410	1,369	1,176	1,200	1,224	1,248	1,273	1,299	1,325	1,351	1,378	1,406	**12,880**
Misc.Replacmnts		9,349											
Sustain Total	$147,995	$177,493	$169,622	$200,927	$219,195	$195,892	$204,371	$206,277	$215,455	$223,115	$228,862	$232,143	**$2,095,858**

Transmission Asset Strategy

Expand Program – In flight investments for FY2014-2017

Expand investments currently underway are broken down into three categories:

- Compliance driven projects - 16% of forecasted costs.

  Examples:

  - Lower Valley
  - Shunt capacitors to provide voltage support during peak flow hours and outage conditions, to ensure that BPA meets NERC/WECC reliability standards
  - Line upgrades to mitigate overloads that could lead to uncontrolled loss of load

- Policy investments (NOS) - 72% of the forecasted costs include:
  - I-5 (Reliability project that meets NOS requirements)
  - Big Eddy-Knight
  - Central Ferry – Lower Monumental

- Discretionary – 11%
  - Projects that address operations/maintenance concerns (O&M Flex program)
  - Control house expansions or replacements to address structural or space concerns
  - Engine generator upgrades to replace existing units that are generally well past end of life

Transmission Asset Strategy

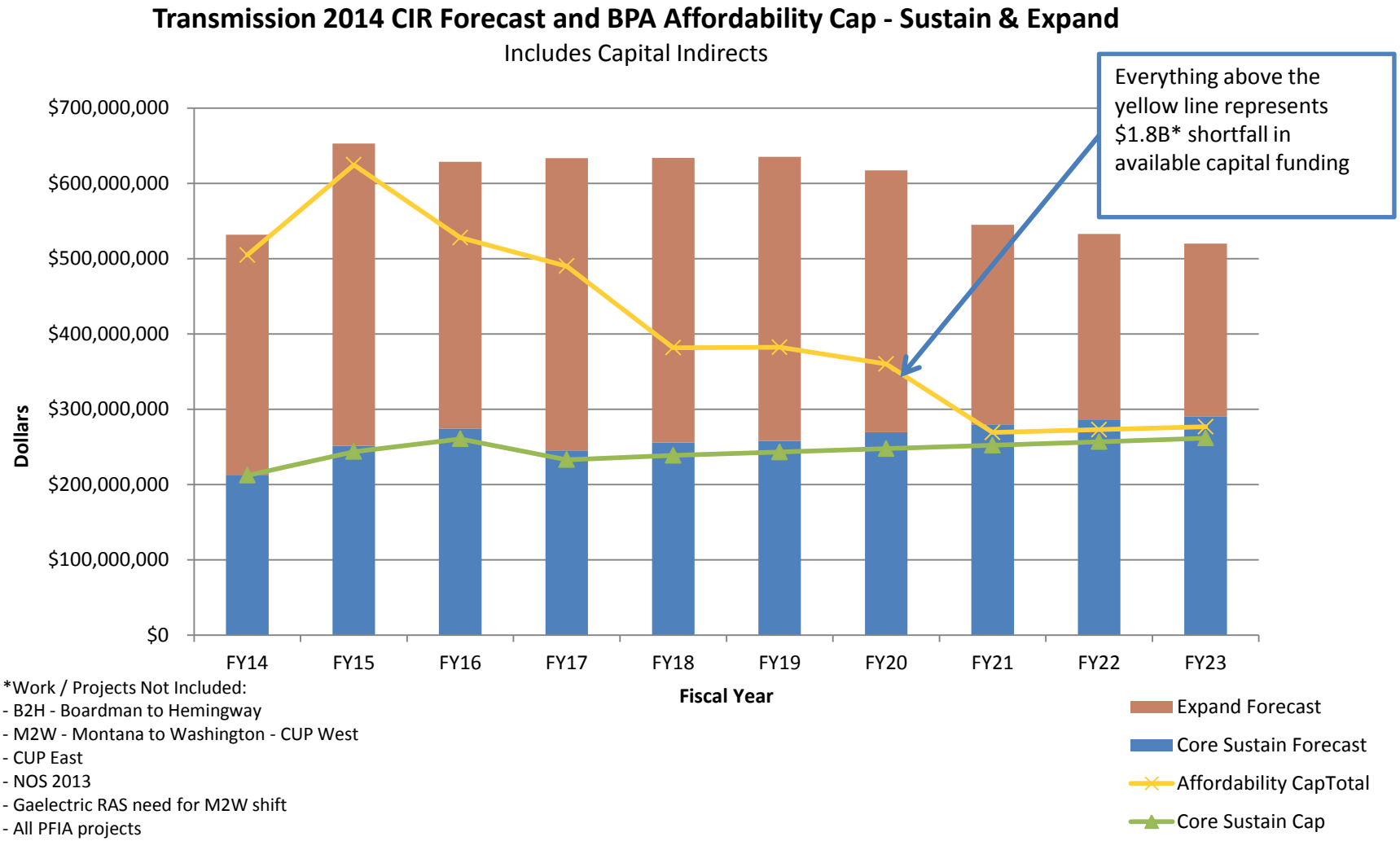
Expand Program – In flight investments for FY2014-2017

Expand investments receiving the green light from the BPA Capital Project Prioritization process to move forward:

- Compliance driven projects - 23% of forecasted costs
  - Control Center compliance required projects
  - DeMoss-Fossil Shunt Reactive Project
  - Phasor Measurement Units for FY2015-2017
- Policy investments (NOS) – 16% of the forecasted costs include
  - Aggregated Area & Customer Service small capital projects
  - Aggregated PFIA small capital projects
- Discretionary – 59%
  - Carlton Substation Reliability Improvement Project, Phase 1 (O&M Flex)
  - Monroe 500kV Line Retermination
  - Walla Walla Reinforcement (Tucannon River-Hatwai 115kV)
  - Spare Transformers (Central Ferry, John Day, Rock Creek, Slatt Substations)

Transmission Asset Strategy

Application of Affordability Cap (Illustrative)



*Work / Projects Not Included:
- B2H - Boardman to Hemingway
- M2W - Montana to Washington - CUP West
- CUP East
- NOS 2013
- Gaelectric RAS need for M2W shift
- All PFIA projects

This chart shows the potential impact of the affordability cap on Transmission's sustain and expand programs. The cap lines are drawn based on the lower end of the cap and represent a speculative, but reasonable determination of the allocation of capital to transmission investments.

Transmission Asset Strategy

Total Proposed Funding Levels for FY2015-2017 CIR

Transmission Services

Revised 10 Year Capital Forecast Based on Prioritization (Nominal Dollars in '000)

	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Sustain	$169,623	$194,835	$208,436	$186,299						
Expand - Projects in flight & Projects <$3M *(Not subject to prioritization)*	$162,472	$115,808	$105,206	$69,945						
Expand - Prioritized Projects	$1,844	$9,400	$10,600	$13,200	*$8,400*	*$2,714*	*$2,036*	*$679*		
PDCI (Celilo) Upgrades Project	$81,000	$149,600	$48,000	$3,000	*$4,100*	*$1,400*				
I-5 Corridor Project	$10,000	$30,000	$50,000	$100,000	*$100,000*	*$100,000*	*$80,000*			
DIRECT CAPITAL GRAND TOTAL	$424,939	$499,643	$422,242	$372,444						
PFIA (includes prioritized LGIA)	$12,200	$15,000	$15,000	$15,000						
Total with Transmission Indirects (Cap)	$546,423	$643,303	$546,552	$484,305						

(No AFUDC)

Notes regarding revised sustain funding levels:

- FY2015-2017 reflect a 5% reduction from originally submitted forecasts in the asset strategies
- The allocation of a 5% reduction to the specific sustain programs will be performed in the near future based on an evaluation on priority replacements
- FY2018-2023 funding levels have not been allocated to specific asset categories at this time. The sustain funding is aggregated for all asset categories as previously shown in the overview section of this presentation. Allocation will occur at a future date.

Notes regarding revised expand funding levels:

- FY2015-2017 forecasts contain funding for projects green lit during prioritization process and all projects not subject to the prioritization process such as projects in flight and those less than $3 million
- Funding levels shown beyond FY2018 reflect the funding required to complete approved or prioritized projects
- Funding requirements for projects beginning in FY2018 will be taken through the prioritization process within the next year

Appendix

Transmission Asset Strategy

Impacts of Affordability Cap - Sustain

- The BPA proposed prioritized portfolio specifies a 5% reduction in core sustain for FY2015-2017. Preliminary evaluation indicates that while it poses some delay in the implementation of the sustain program strategies, it is believed the impact can be managed through careful re-prioritization of projects.
- It should be noted that the proposed FY2015-2017 program levels were already reduced based on the availability of adequate labor resources to fully execute the asset plans.
- A modest ramp up based on the expected resolution of the labor shortfall had been planned. This reduction and future reductions further prolong the time it will take to reach the steady state of replacements identified in the strategies.
- Protracted deferral of replacing aged and poor condition equipment will increase reliability risks to the system. For FY2018-2023, a specific allocation for sustain investments has not been provided, yet it is expected that sustain investments will still not be funded to the levels identified in the strategies to reach the steady state of replacements needed to optimize asset lifecycle. The reduced funding level will exacerbate the growing backlog of deferred replacements impact on system reliability thereby increasing risks and total economic costs.
- For the long term, every dollar not spent on the sustain programs, increased risks create the potential for failures that may cost BPA customers twice the amount.
- Transmission will evaluate reliability risks using the total economic models and funding needed above the funding allocation to address unacceptable risks will be requested through the prioritization process.

Transmission Asset Strategy

Impacts of Affordability Cap - Expand

- A comprehensive rate based affordability case has not been completed for Transmission. Completion of this will provide better understanding of the gap between needed expand investments and capital availability.
- While funding levels provided for Transmission expand investments for FY2018-2023 are not known, the "headroom" will clearly be inadequate to meet projected expansion needs for the 10-year period
- Transmission Services, at this point projects a capital shortfall of over $1.5 billion for system capacity, customer requests, and congestion relief
- To compound the issue, the transmission capital funding forecasts, do not include estimates for several large proposed projects
  - Boardman to Hemingway
  - Montana to Washington (M2W) – Colstrip Upgrade Project (CUP) West
  - CUP East
  - Network Open Season 2013
  - Remedial Action Scheme (RAS) requirement due to the M2W shift
- Large transmission expansion projects can sometimes take years to plan. Unknown future funding availability will affect Transmission Services' ability to adequately plan and resource the projects in the timeframes required for the investment.

Financial Disclosure

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