

# Transmission Services

June 23, 2016

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# Transmission Services

Transmission Services organizations are responsible for planning, designing, marketing, operating and maintaining approximately three-fourths of the Pacific Northwest's high-voltage transmission assets across multiple states.

In this IPR/CIR, Transmission Services approached spending levels by prioritizing and making trade-offs in order to propose a portfolio of work that supports safety, compliance, reliability and market transformation activities.

Transmission Services principles include:

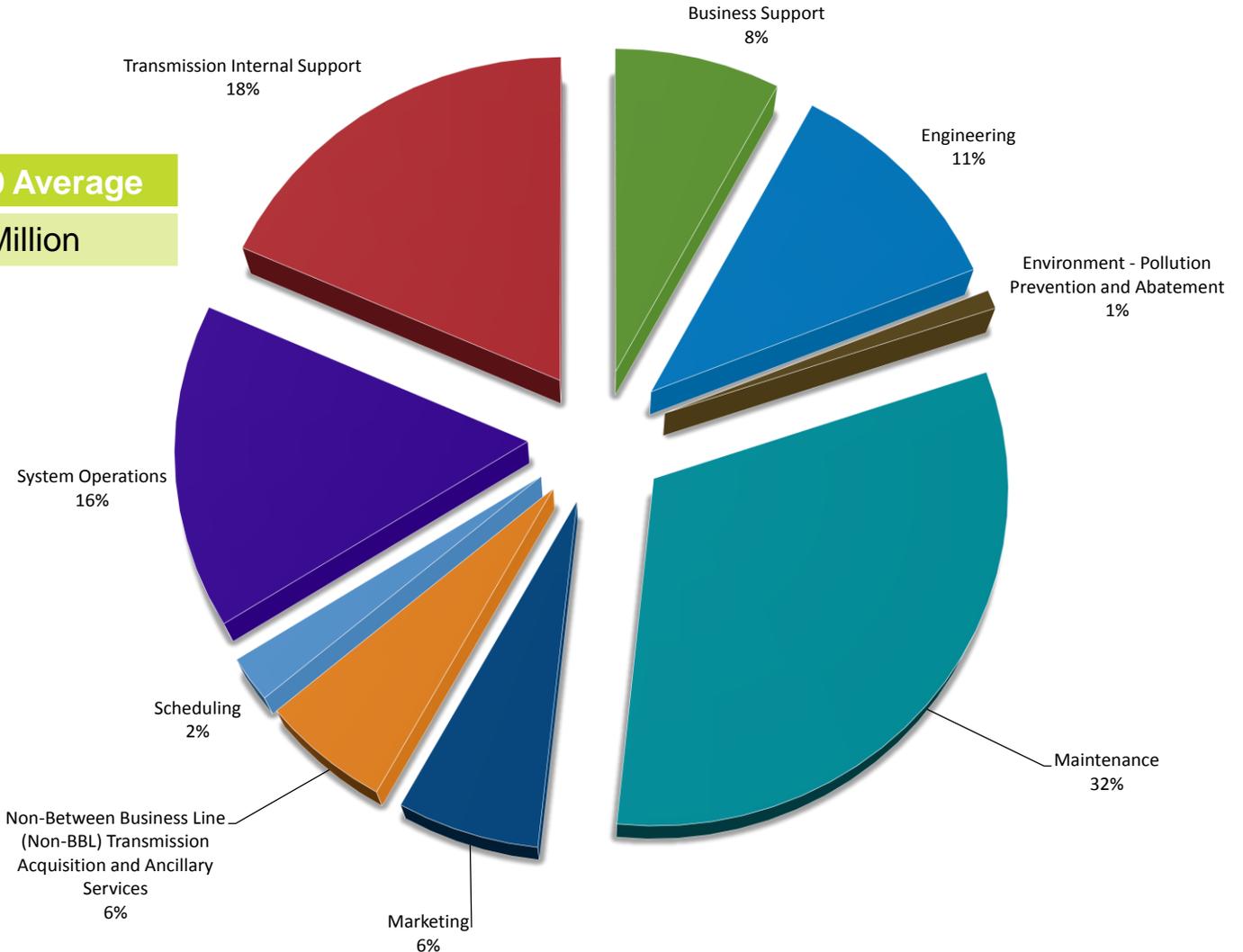
- Hold the line on spending to limit rate increases.
- Focus on maintaining mission critical work.
- Make investments that will provide greater savings to ratepayers if done today.

# Transmission expense

- For the FY 2018-19 rate case period, the proposed overall Transmission rate increase is 3 to 5 percent.
- Transmission Services held budgets to BP-16 levels plus personnel cost increases (special salary & hourly) and KSI costs.
- Approximately \$90 million in expense projects has been deferred.

# IPR FY 2018-19 average

	<b>FY2018-19 Average</b>
<b>Total</b>	<b>\$531 Million</b>



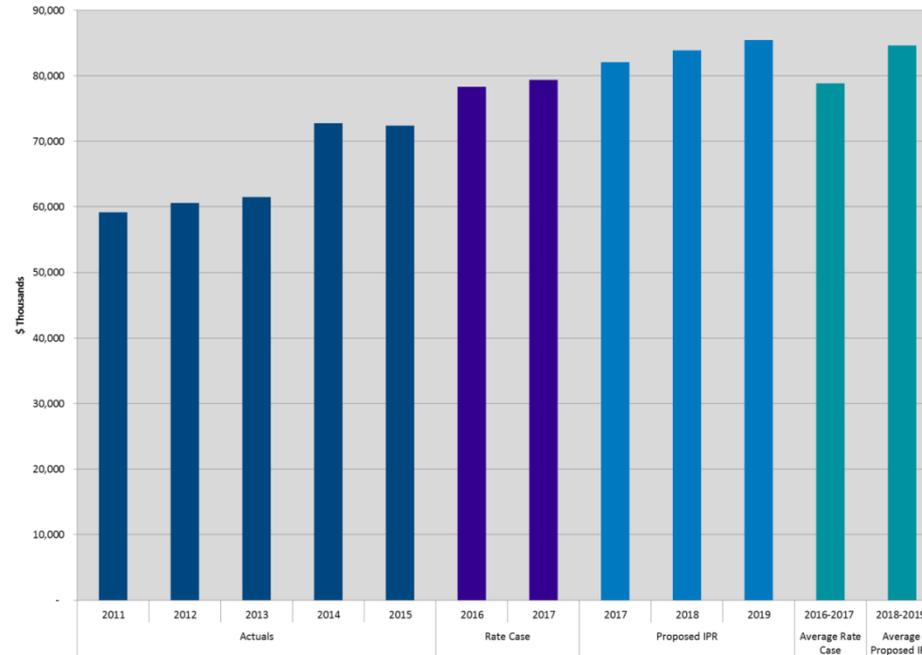
# Preliminary Transmission rate effect for FY 2018-19

<b>Expenses</b>	<b>A</b>	<b>B</b>
	<b>Change from BP-16 to FY 18/19</b>	
	\$ (Million)	% Change in Rates
1. Operations	15	1.9%
2. Maintenance	14	1.8%
3. Engineering	6	0.7%
4. Internal Support & Undistributed Reduction	7	0.8%
<b>5. IPR Sub-Total</b>	<b>42</b>	<b>5.3%</b>
6. Ancillary Services	4	0.6%
<b>7. Non-IPR Sub-Total</b>	<b>4</b>	<b>0.6%</b>
<b>8. Capital Related Costs <sup>1/</sup></b>	<b>(24)</b>	<b>-3.0%</b>
<b>9. Total Revenue Requirement (Lines 5+7+8) <sup>2/</sup></b>	<b>22</b>	<b>2.8%</b>
<b>10. Revenues</b>	<b>-</b>	
<b>11. Uncertainty</b>	<b>18</b>	<b>2.0%</b>
<b>12. Total Change</b>	<b>22 to 40</b>	<b>2.8% to 4.8%</b>

1/ Includes Net Interest Expense, Depreciation/Amortization and Minimum Required Net Revenues.

2/ Change in rates reflects average across all segments.

# System operations



(\$Thousands)	Actuals	Rate Case		Proposed IPR		
	2015	2016	2017	2017	2018	2019
Information Technology	8,103	10,377	10,558	5,768	6,004	6,095
Power System Dispatching	13,209	13,536	13,671	15,791	16,082	16,376
Control Center Support	20,849	18,572	18,757	26,808	27,187	27,524
Technical Operations	6,288	6,913	6,983	7,543	7,727	7,932
Strategic Integration	585	7,522	7,555	1,358	1,404	1,447
Substation Operations	23,347	21,399	21,817	24,786	25,452	26,091
<b>Grand Total</b>	<b>72,381</b>	<b>78,319</b>	<b>79,341</b>	<b>82,055</b>	<b>83,855</b>	<b>85,466</b>

# System operations

**FY18/19 average proposed levels: \$84.7 million**

**Increase from BP-16 rate case: \$5.8 million**

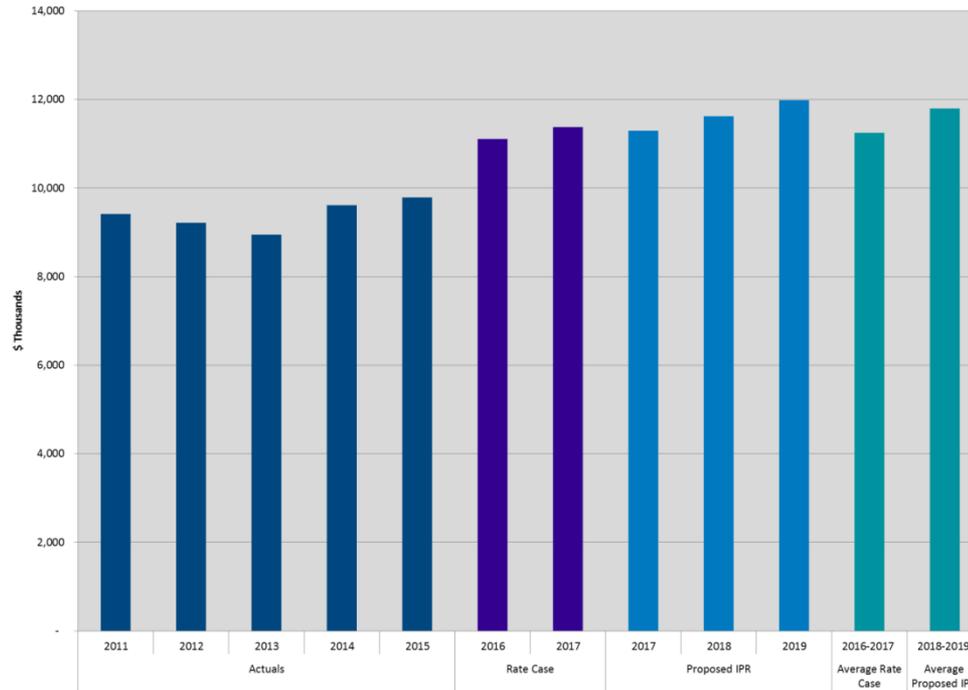
## ***Changes from BP-16***

- Improvements in reliability and compliance posture.
- Increased workload due to NERC and WECC standard improvements.
- System operations reorganization and new Transmission technology organization.

## ***Risks of operating below the proposed level***

- System reliability and compliance risks.
- Not fully realizing strategic improvements.
- Loss of flexibility to adapt to emerging initiatives.

# Scheduling



(\$Thousands)	Actuals	Rate Case		Proposed IPR		
	2015	2016	2017	2017	2018	2019
Reservations	1,156	1,362	1,383	1,564	1,598	1,638
Pre-Scheduling	344	268	276	416	426	442
Real-Time Scheduling	4,323	5,038	5,169	4,736	4,888	5,052
Technical Support	3,732	4,161	4,259	4,056	4,168	4,291
After-the-Fact Scheduling	237	281	289	525	542	558
<b>Grand Total</b>	<b>9,792</b>	<b>11,110</b>	<b>11,376</b>	<b>11,296</b>	<b>11,621</b>	<b>11,981</b>

# Scheduling

**FY18/19 average proposed levels: \$11.8 million**

**Increase from BP-16 rate case: \$0.6 million**

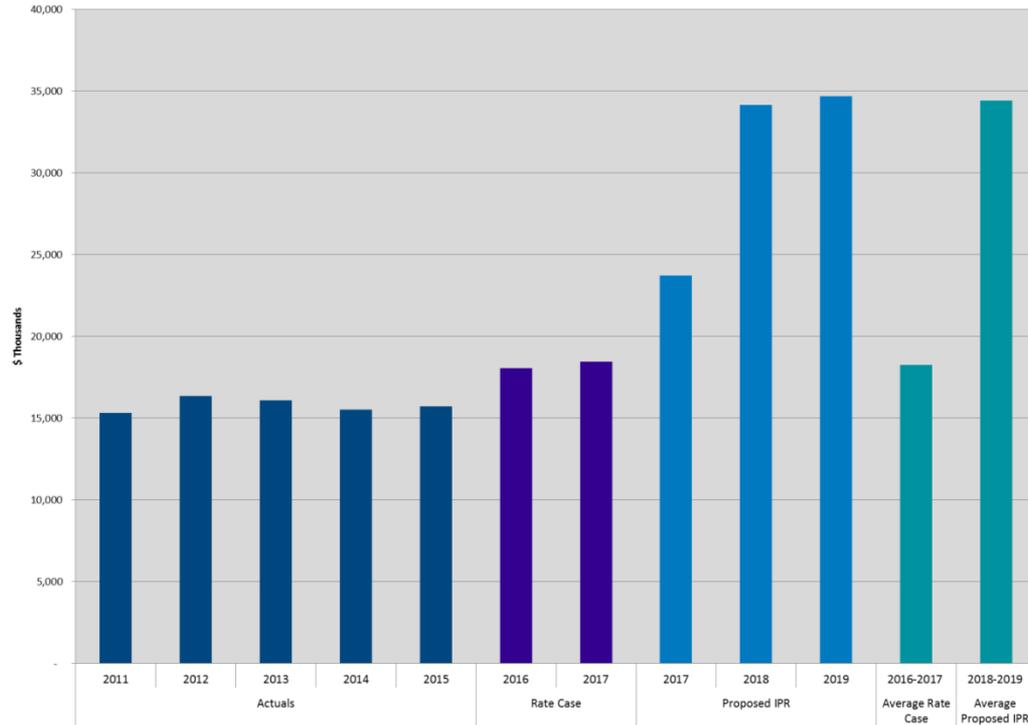
## *Changes from BP-16*

- Implementation of NITS-NAESB that meets the tariff and network customer needs, 15-minute scheduling and short-term firm network product.

## *Risks of operating below the proposed level*

- Inability to absorb the costs of implementing the commercial non-wire solution creates challenges.
- Inability to invest in systems and reporting tools to monitor BPA's compliance status.

# Marketing



(\$Thousands)	Actuals	Rate Case		Proposed IPR		
	2015	2016	2017	2017	2018	2019
Transmission Sales	2,354	2,700	2,775	3,430	3,526	3,627
Contract Management	4,244	4,862	4,984	4,728	4,897	5,066
Transmission Billing	2,414	3,301	3,377	2,433	2,518	2,611
Business Strategy and Assessment	6,687	7,171	7,291	13,099	23,195	23,364
<b>Grand Total</b>	<b>15,698</b>	<b>18,033</b>	<b>18,426</b>	<b>23,689</b>	<b>34,136</b>	<b>34,668</b>

# Marketing

**FY18/19 average proposed levels: \$34.4 million**  
**Increase from BP-16 rate case: \$16.2 million**

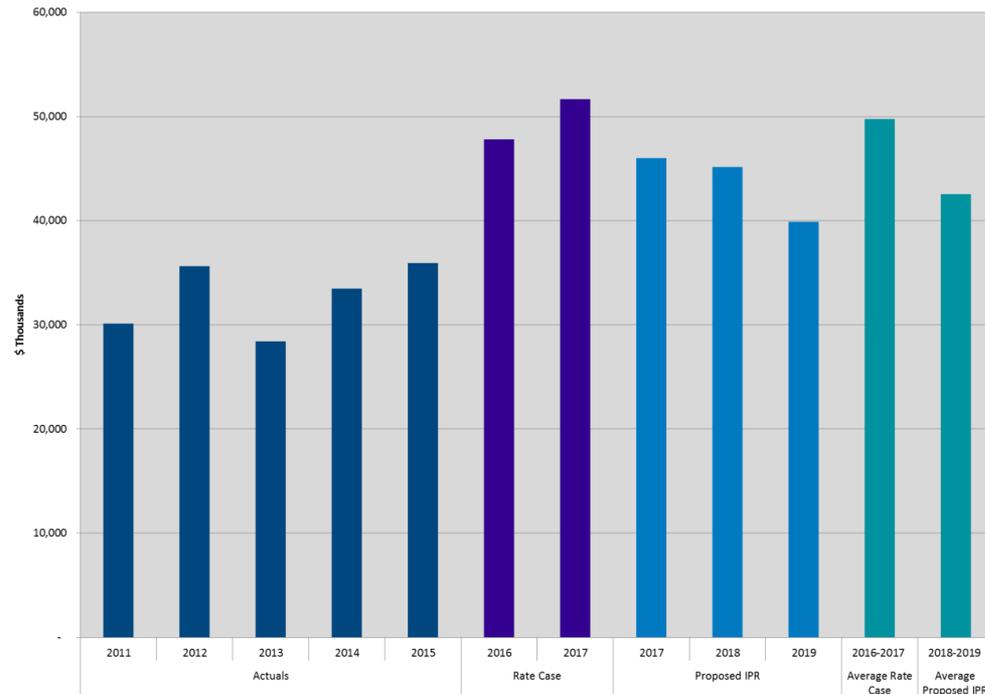
## ***Changes from BP-16***

- BPA's marketing program budget now includes funding for the Commercial Operations and Asset Management KSI.

## ***Risks of operating below the proposed level***

- Inability to participate in drafting committees and respond to new FERC initiatives in a timely manner.
- Inability to respond to customer needs in a timely manner.

# Business support



(\$Thousands)	Actuals	Rate Case		Proposed IPR		
	2015	2016	2017	2017	2018	2019
Executive and Administrative Services	12,727	24,235	27,540	23,035	22,679	17,009
Legal Support	2,250	3,331	3,548	1,641	1,716	1,792
General Administrative	12,913	12,961	13,135	13,716	12,824	12,934
Aircraft Services	1,234	2,205	2,230	3,003	3,032	3,060
Logistics Services	5,598	4,325	4,488	3,968	4,266	4,415
Security Enhancements	1,201	754	716	630	644	658
<b>Grand Total</b>	<b>35,922</b>	<b>47,811</b>	<b>51,657</b>	<b>45,993</b>	<b>45,160</b>	<b>39,868</b>

# Business support

**FY18/19 average proposed levels: \$42.5 million**

**Decrease from BP-16 rate case: -\$7.2 million**

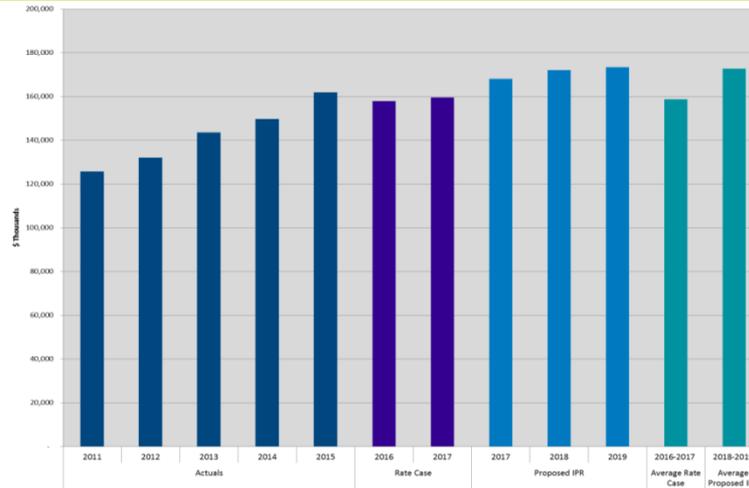
## ***Changes from BP-16***

- Identification of key outcomes for four Transmission strategies with a desired end-state of 2018.
- New aircraft services scheduling program with a goal to provide aerial support to meet emergency call-outs with a high effectiveness rate.

## ***Risks of operating below the proposed level***

- Reprioritized functions to reprogram funding to higher priority work within Transmission Services.
- The fleet of aircraft will be grounded if not upgraded or replaced by 2020 due to FAA-mandated avionics and navigation systems requirements.

# Maintenance



(\$Thousands)	Actuals	Rate Case		Proposed IPR		
	2015	2016	2017	2017	2018	2019
Non-Electric Maintenance	32,203	30,750	31,424	30,356	32,058	31,180
Substation Maintenance	36,926	28,566	29,043	35,353	36,000	36,658
Transmission Line Maintenance	27,733	27,054	27,482	29,319	29,817	30,228
System Protection Controls	12,718	13,541	13,741	15,283	15,640	15,999
Power System Maintenance	18,939	18,239	18,507	20,020	20,437	20,859
Joint Cost Maintenance	175	111	113	148	148	149
System Maintenance Management	6,041	9,954	9,556	8,000	8,138	8,285
Row Maintenance	6,502	10,098	10,162	9,901	9,944	9,986
Heavy Mobile Equipment Maintenance	116	0	0	18	18	18
Technical Training	2,317	2,368	2,418	2,423	2,471	2,526
Vegetation Management	18,223	17,181	17,039	17,282	17,354	17,441
<b>Grand Total</b>	<b>161,894</b>	<b>157,861</b>	<b>159,485</b>	<b>168,103</b>	<b>172,025</b>	<b>173,329</b>

\* The Maintenance program excludes Environment – Pollution, Prevention, and Abatement costs.

# Maintenance

**FY18/19 average proposed levels: \$172.7 million**  
**Increase from BP-16 rate case: \$14 million**

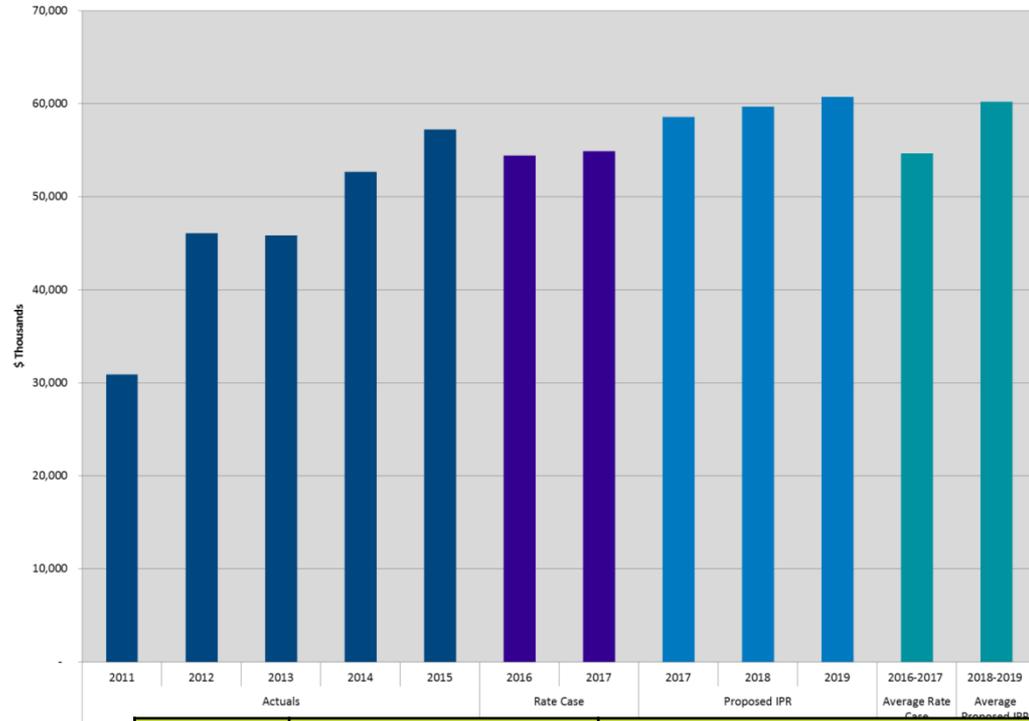
## *Changes from BP-16*

- Personnel cost increases and a growing maintenance backlog have driven cost increases.
- Increased funding to accelerate the existing high voltage bushing upgrade and replacement program.

## *Risks of operating below the proposed level*

- Safety and compliance risk if BPA does not implement new OSHA requirements for arc flash protection and mandatory personal protective equipment for over 1,000 employees.
- Increased maintenance backlog may lead to equipment failure, system reliability issues, and unplanned outages.

# System engineering



(\$Thousands)	Actuals	Rate Case		Proposed IPR		
	2015	2016	2017	2017	2018	2019
Research and Development	7,359	9,522	9,555	7,762	8,170	8,585
Transmission System Development Planning and Analysis	22,796	16,486	16,738	21,690	21,983	22,282
Capital to Expense Transfers	6,836	4,307	4,351	4,285	4,285	4,285
NERC/WECC Compliance	17,168	20,311	20,422	21,024	21,355	21,667
Environmental Planning and Analysis	1,225	1,599	1,642	1,641	1,695	1,747
Engineering Line Rating	1,867	2,195	2,207	2,200	2,200	2,200
<b>Grand Total</b>	<b>57,251</b>	<b>54,421</b>	<b>54,915</b>	<b>58,602</b>	<b>59,688</b>	<b>60,765</b>

# System engineering

**FY18/19 average proposed levels: \$60.2 million**

**Increase from BP-16 rate case: \$5.6 million**

## ***Changes from BP-16***

- Aligned with the Asset Management KSI and focused on achieving key business outcomes by the end of 2018.
- New special salary rate for engineers.

## ***Challenges:***

- Prioritizing between both sustain and expand capital projects.
- Continued compliance with WECC, NERC and FERC issues.
- Impacted ability to complete LiDAR survey work.

## Internal support & undistributed reduction

### Internal support:

**FY18/19 average proposed levels: \$99.7 million**

**Increase from BP-16 rate case: \$16 million**

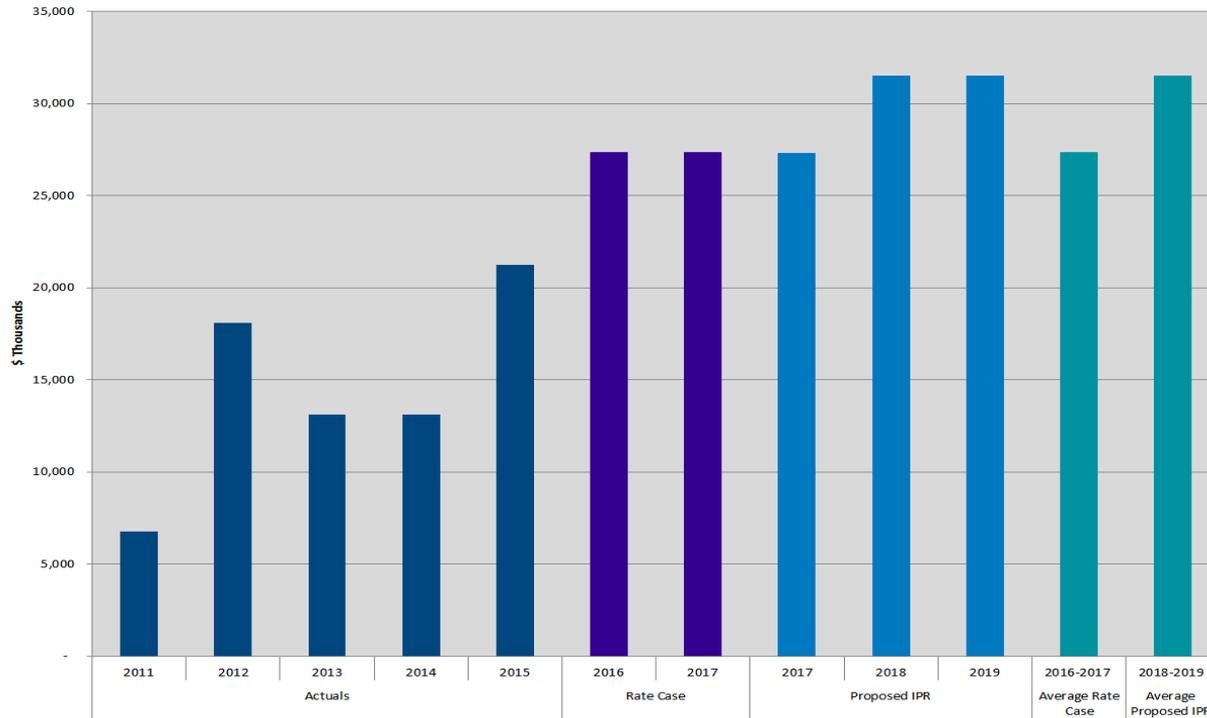
### Undistributed reduction:

**FY18/19 average proposed levels: -\$11.8 million**

**Increase from BP-16 rate case: -\$9.7 million**

(\$Thousands)	Actuals	Rate Case		Proposed IPR		
	2015	2016	2017	2017	2018	2019
Additional Post-Retirement Benefits	18,819	19,143	19,748	17,023	17,591	18,209
Transmission Internal Support	64,371	62,895	64,775	75,031	81,011	82,576
<b>Grand Total</b>	<b>83,190</b>	<b>82,038</b>	<b>84,523</b>	<b>92,053</b>	<b>98,602</b>	<b>100,786</b>
Undistributed Reduction/Other Income (Loss)	-161	-2,100	-2,100	-7,668	-11,831	-11,825
<b>Grand Total</b>	<b>-161</b>	<b>-2,100</b>	<b>-2,100</b>	<b>-7,668</b>	<b>-11,831</b>	<b>-11,825</b>

# Transmission ancillary services



(\$Thousands)	Actuals	Rate Case		Proposed IPR		
	2015	2016	2017	2017	2018	2019
Leased Facilities	5,478	7,447	7,447	7,447	7,447	7,447
Settlement Agreements	9,716	18	18	0	0	0
Non-Between Business Line Ancillary Services	2,323	18,560	18,560	18,865	18,865	18,865
Oversupply Displacement Costs	2,702	0	0	0	0	0
Reliability Demand Response/Redispatch	1,033	1,313	1,328	1,019	5,188	5,188
<b>Grand Total</b>	<b>21,253</b>	<b>27,338</b>	<b>27,353</b>	<b>27,331</b>	<b>31,500</b>	<b>31,500</b>

## Transmission ancillary services

**FY18/19 average proposed levels: \$31.5 million**

**Increase from BP-16 rate case: \$4.2 million**

### ***Changes from BP-16***

- The increase is due to budget needed to pay for the dispatch program that is in lieu of the South of Allston build solution.

### ***Risks of operating below the proposed level***

- Not having the funding to invest in non-wires solutions leads to having to cut other programs to fund it.

# Transmission capital

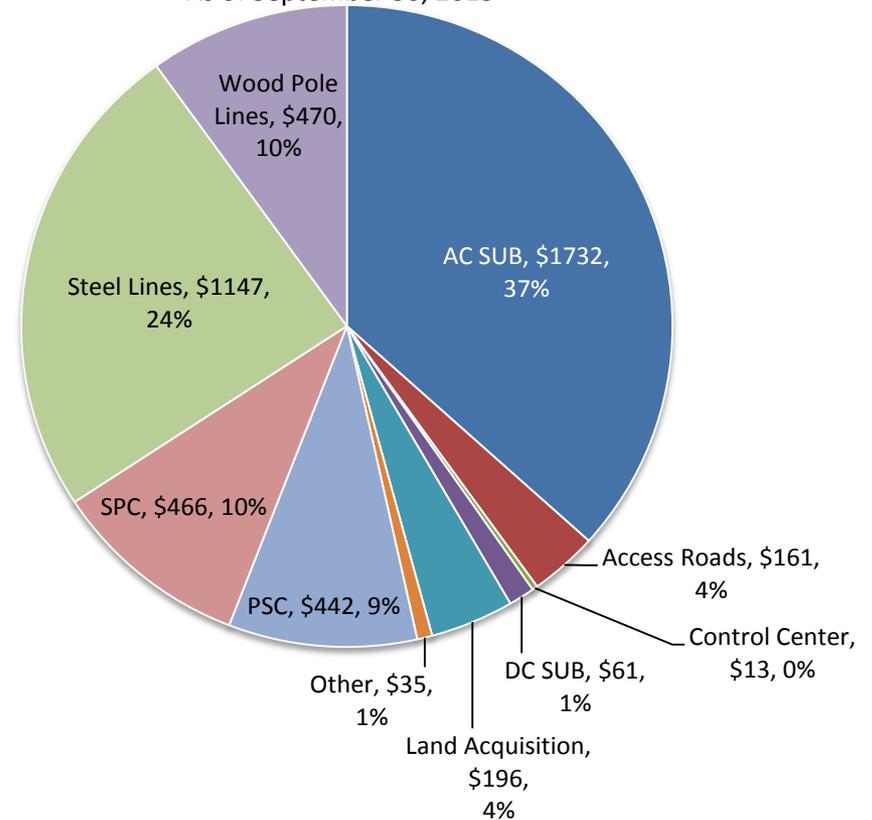
The BPA transmission network includes over \$4.72 billion in assets:

- Approximately 15,100 circuit miles of transmission lines.
- 261 alternating current substations.
- One direct current substation.
- Approximately 3,200 miles of fiber optics.
- 200+ radio paths.
- Two regional control centers.

## Transmission Net Book Value

**Total: \$4.72B**

As of September 30, 2015



A robust asset management strategy and plan for capital deployment is essential.

# Transmission capital program FY16-30

- Objectives of the Transmission Asset Management Strategy
- Recent accomplishments
- Strategic challenges
- Benefits realized
- FY16-30 levels

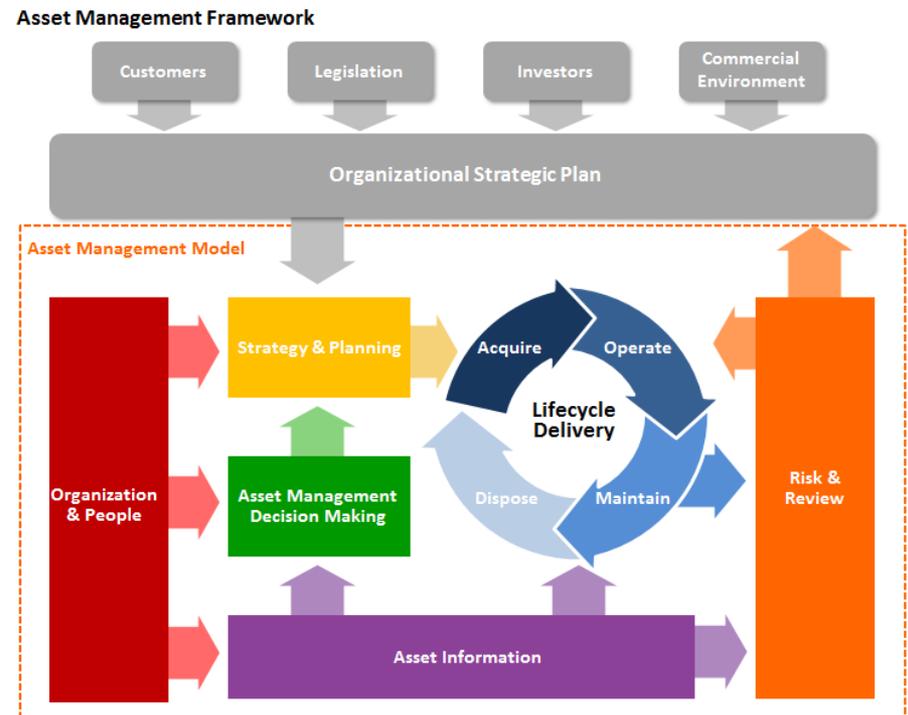
# Objectives of the Transmission Asset Management Strategy

*Long-term goals for improving asset management practices*

Replacements and maintenance are integrated, prioritized in terms of asset criticality and risk, and directed at meeting reliability and other standards at lowest total economic cost.

To **sustain** the existing infrastructure:

- reliability risks and total economic costs are reduced.
- technological obsolescence is addressed.
- safety and regulatory compliance are assured.
- technology is introduced that provides greater system visibility.



*The Institute of Asset Management (IAM)*

# Recent accomplishments

## Expansion program accomplishments

- Energized several major projects
  - Big Eddy-Knight No 1: 28 miles of new 500-kilovolt Line
  - Central Ferry-Lower Monumental No 1: 38 miles of new 500-kV Line
  - PDCI Upgrade: Upgraded the Pacific DC Intertie from 3,100 to 3,220 MW

## Sustain program accomplishments

- FY 2014 program highlights
  - Rebuilt 66.5 miles of wood pole lines and 418 priority poles.
  - Replaced 140 miles of steel line hardware.
  - Re-built 47 miles of access roads.
  - Replaced 120 relays and 37 meters.
  - Replaced 33 field internet networks and 33 transfer trips.
  - Replaced 66 circuit breakers and switchgear.
  - Replaced 14 transformers and reactors.
- **FY 2015 Sustain Project Highlights**
  - Olympia-Grand Coulee insulator replacements
  - McNary substation replace indoor analog meters with digital
  - Maple Valley substation replace transfer trip
  - Lower Monumental substation breakers and structure replacements

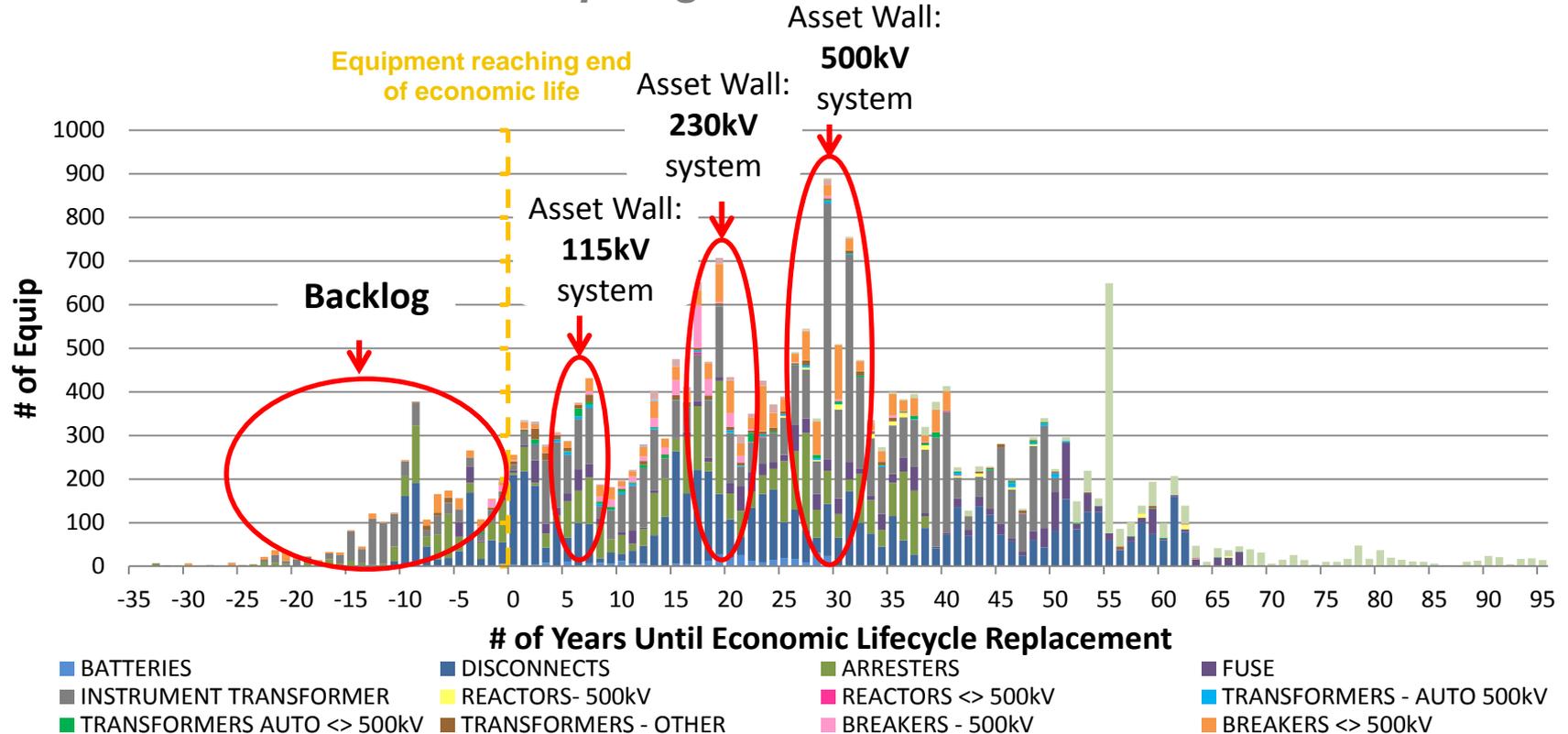
# Strategic challenges

## Asset plans aim to:

- **Gain valuable efficiencies** through new technology and market dynamics.
- Ensure reliability and interoperability of equipment, and **avoid obsolescence**.
- Make **health condition data accurate, available and useful** to prioritize critical work.
- **Address backlogs** in sustain investments and maintenance.
- Balance **demand for system availability** with the **necessary outages** to execute maintenance and replacement projects.
- Respond to **evolving and increasing regulatory and compliance requirements**.
- Address **increasing physical and cyber hazards** that put the transmission system at risk.
- Ensure transmission operators have **greater system visibility, more accurate models, and enhanced automated controls** to maintain reliability and safety.

# Strategic challenges

## Risk spotlight: AC substations

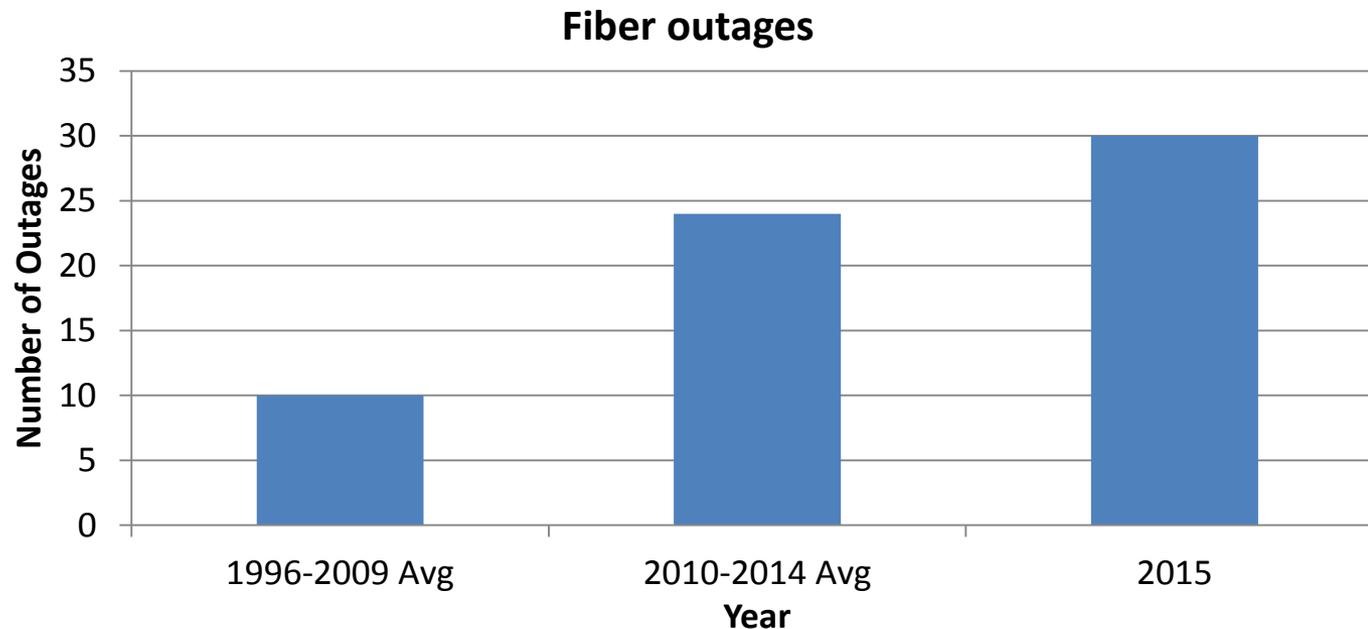


The AC substation strategy has revealed about a \$770 million backlog and “asset walls” in the future.

# Strategic challenges

## *Risk spotlight: System telecommunications*

By 2025, approximately 3,100 miles of fiber will be over 20 years old. Beyond 25 years, the likelihood of double outages on the same ring is statistically high.

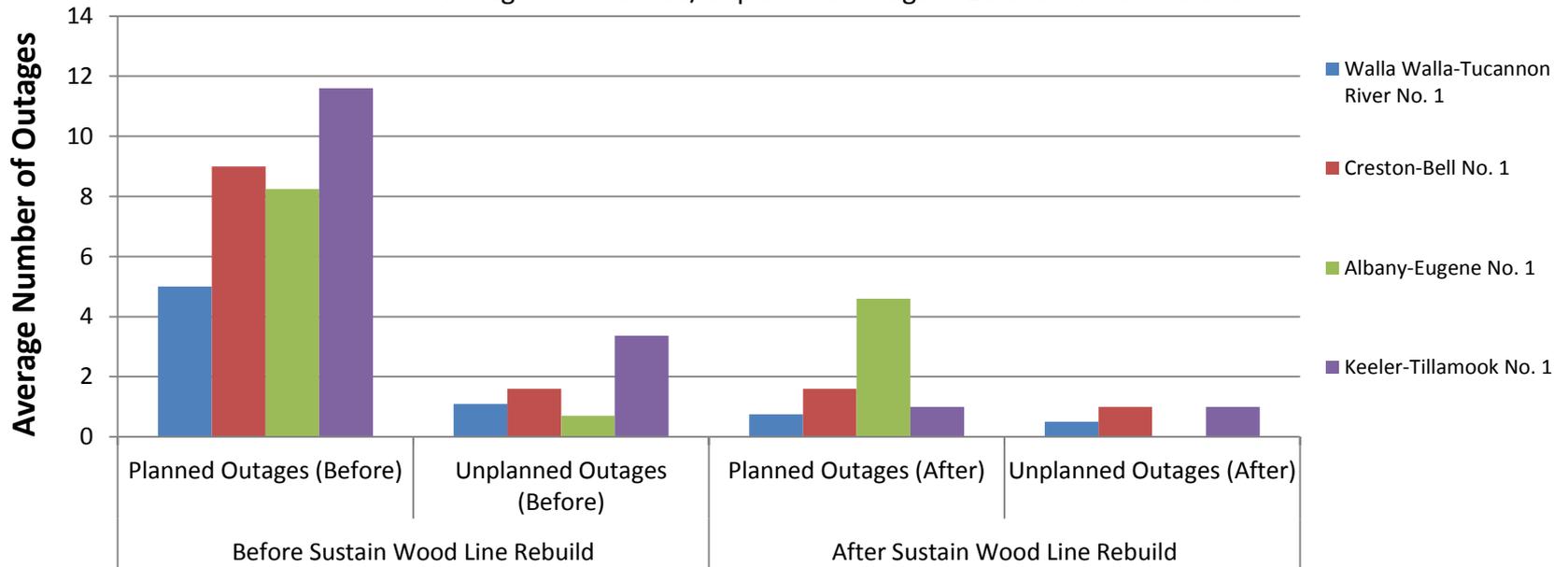


# Benefits realized

## *Sustain program spotlight: Wood pole lines*

### Sustain Wood Pole Line Rebuild Examples

Average # of Planned/Unplanned Outages - Before & After Rebuild



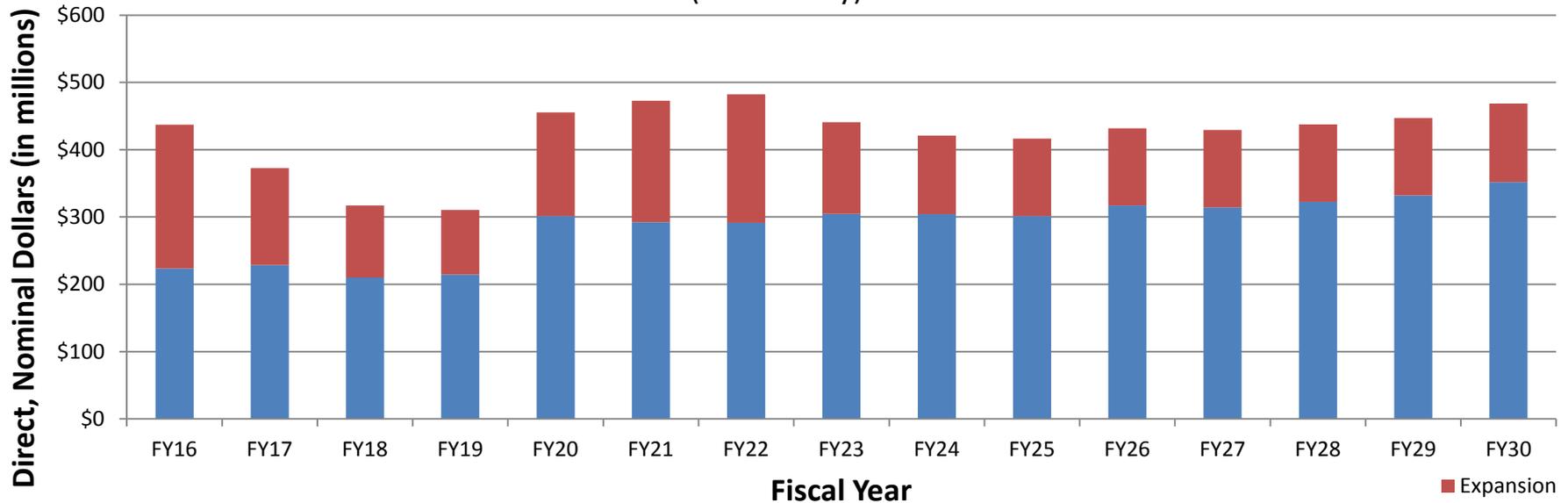
### Type of Outage, Before and After Wood Line Rebuild

(Forced and lightning- caused outages not included)

# FY16-30 capital program base levels

*Submitted CIR numbers*

**Capital Program FY16-30 Base Levels**  
(Preliminary)



Program (\$M)	EOY	Forecast														FY17-30 Total
	Forecast FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	
Sustain	223	229	210	214	302	292	291	305	304	302	317	314	322	332	352	4,086
Expansion	214	144	107	96	154	181	191	136	117	115	115	115	115	115	117	1,818
<b>Capital Program Total</b>	<b>437</b>	<b>372</b>	<b>317</b>	<b>311</b>	<b>456</b>	<b>473</b>	<b>482</b>	<b>441</b>	<b>421</b>	<b>417</b>	<b>432</b>	<b>429</b>	<b>437</b>	<b>447</b>	<b>469</b>	<b>5,904</b>

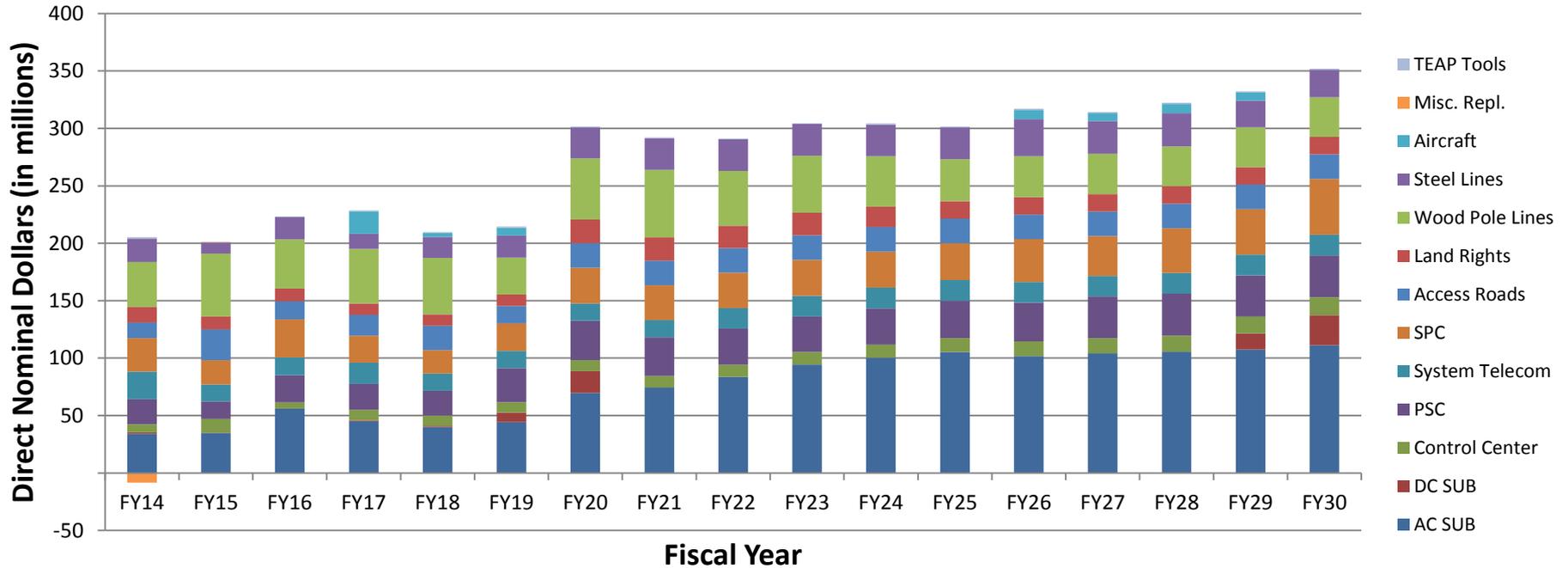
# Appendix

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# FY2016-2030 sustain capital base levels

## Sustain Capital - Base

Capital FY2014-2015 Actuals and FY2016-2030 Base Levels (Preliminary)



Program (\$M)	Actuals		EOY Forecast	Forecast														Total FY17-30
	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	
Sustain Capital Base Total	197	201	223	229	210	214	302	292	291	305	304	302	317	314	322	332	352	4,086

# Profile of the assets

Asset Classification	Number of Assets	Equipment Covered
AC Substations	261 Substations with ~32,000 major equipment categories	Power Transformers and Reactors, Power Circuit Breakers, Circuit Switchers, DC Control Batteries and Chargers. Shunt Capacitors, Current Limiting Reactors, Instrument Transformers, Engine Generators, Surge Arrestors, Fuses, Disconnect Switches, Rigid Riser Replacement, Substation Grounding, Substation; Bus and Structures, Low Voltage Station Auxiliary, Control Houses
DC Substation	Celilo converter station	HVDC Converter Station, Static Var Compensators, Fixed Series Capacitor Banks, Thyristor Controlled, Series Capacitor Bank
Control Center	2 Control Centers with 85 plus automation systems	Real-time Grid control and management systems; Grid and data center monitoring, protection, and alarm systems; CC critical power infrastructure; Non-real-time operations analysis and support systems; Commercial Business Systems/facilities integration and support
Power System Control / Telecom	732 sites and ~ 11,000 pieces of equipment, 3,100 miles of fiber optic cable	RAS, Transfer Trip, SCADA remote terminal units, Fiber cable, Comm batteries/chargers, SONET/MW Radios, VHF/mobile/portable radios, UHF, DATS, Multiplex, Power Line Carrier, Telemetry, Operational Networks and their management, Engine Generators, Supervisory Control Systems, UPS, Telephone systems, Telephone protection, Field Information Network, Misc support systems
System Protection and Control	956 locations, ~28,000 pieces of equipment, 33 equipment types	Transformer relays, Bus relays, Line relays, Breaker relays, RAS, Reactive relays, Revenue metering and Control, SER, DFR, Control equip, Load shedding relay, Indicating Meter Transducers, Relay Communications
Rights of Way	195,600 acres of BPA maintained ROW corridors, approx. 11,860 miles of access roads, approx. 80,000 tracts of easement	Access roads, Roads, Bridges, Culverts, Trails and gates, Tracts of easement
Wood Lines	Approx. 4,800 miles, 336 separate transmission lines with 73,500 wood poles	Poles, Conductors, Insulator assemblies, Guy assemblies, Fiber optic cable, Line disconnect switches, Ground wire, Counterpoise
Steel Lines	10,300 circuit miles with 43,500 lattice steel and engineered steel pole transmission lines	Towers, Connectors, Conductors, Insulator assemblies, Footings, Dampers, Counterpoise

# Financial Disclosure

This information has been made publicly available by BPA on June 22, 2016, and contains information not sourced directly from BPA financial statements.