

**2010 Electric Transmission &
Distribution Benchmarking
Results from the 2010 Study
May 2011 Completion**

2010 Electric T&D Community Members

•T&D Leaders

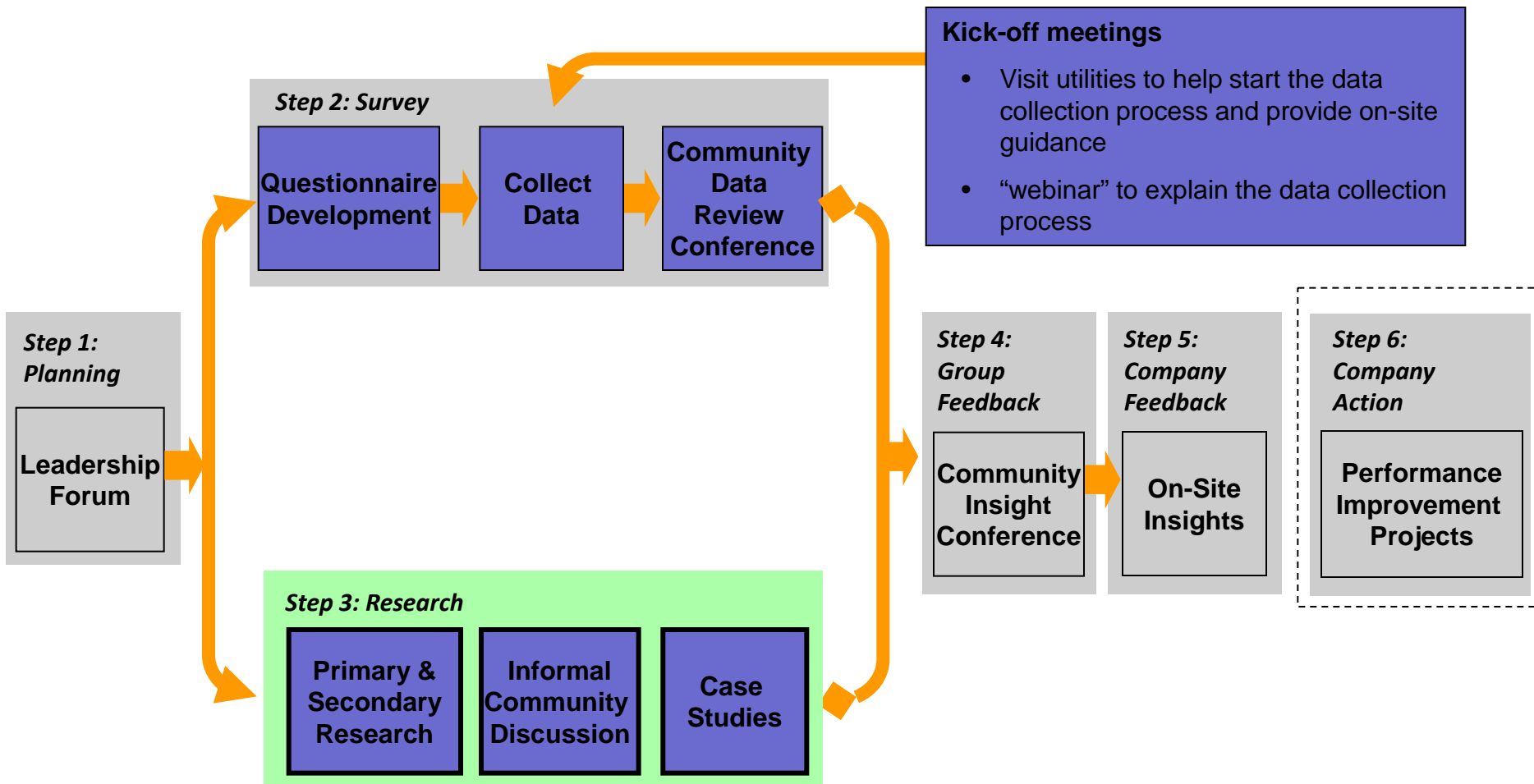
- Austin Energy
- BG&E
- BC Hydro
- Bonneville Power Administration
- CenterPoint Energy
- CPS Energy
- Entergy (multiple operating companies)
- E.ON U.S. (LG&E and Kentucky Utilities)
- Exelon (PECO & ComEd)
- Hydro One
- Hydro-Quebec
- National Grid (multiple operating companies)
- Oncor Electric Delivery
- Puget Sound Energy
- Westar

•T&D Members

- Arizona Public Service
- Kansas City Power & Light
- Northwestern Energy
- Omaha Public Power District
- PEPCO (3 operating companies)
- PSE&G
- Tennessee Valley Authority
- Tucson Electric Power
- PG&E (research topics only)
- We Energies (research topics only)

1QC Benchmarking Approach

- A two-track approach combines surveys and focused research on practices



Company Demographics

BPA is in a group of the “Big 5”* that has >1k circuit miles, >10M MWh Transmitted, and 500kV circuits . . .

Company #	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	38	39	40	41	42	43	45	46	47	103	105	
Distribution end-use customers	<500k	<500k	500k - 1M	500k - 1M	1M - 2M	>2M	>2M	1M - 2M	>2M	<500k	500k - 1M	500k - 1M	500k - 1M	500k - 1M	>2M	1M - 2M	<500k	<500k	1M - 2M	>2M	1M - 2M	1M - 2M	<500k	1M - 2M	<500k	1M - 2M	Trans	Trans	
MWh Sales	<10M	10M-20M	20M - 50M		20M - 50M	>50M	>50M	20M - 50M	>50M	<10M	10M-20M	20M - 50M		10M-20M	>50M	>50M	<10M	10M-20M	20M - 50M	>50M	20M - 50M	20M - 50M		20M - 50M	10M-20M	20M - 50M			
MWh Transmitted							>3M	>3M	>3M			<3M			>10M			<3M	>10M	>10M				<3M	<3M	>3M	>10M	>10M	
# of Substations	<500		500-1000		>1000		>1000	500-1000	500-1000	<500	<500	<500	500-1000		>1000	<500		<500	>1000	>1000	>1000	>1000	500-1000		500-1000	<500		<500	<500
Circuit Miles		>3000	<3000				>3000	<3000	>3000			<3000	>3000	>3000	>1000			<3000	>1000	>1000	<3000			<3000	<3000	>3000	>1000	>1000	
>400kV Panel															x				x							x	x	x	
Substation Age Panel			x				x								x		x		x	x	x			x	x		x	x	
Transmission System age			x				x							x			x		x	x					x		x	x	

*Notes: Big 5: BPA #105, Entergy, Hydro One, Oncor, TVA (Numbers #34, #39, #40, #103)
Substation and Transmission Age Panels are designed to compare companies with similar age patterns to BPA*

Note: The Company ID #'s are confidential, not to be shared outside of BPA.

Methodology

- **Benchmarking performance requires normalizing the results to make “apples-to-apples” comparisons. There are a multitude of potential normalizations.**
- **Our first step is to use simple linear regression to find those variables that have the highest correlation with costs. For transmission costs, we have found that “Total Assets” has the best correlation, with circuit miles and MWh transmitted as other relatively strong correlations with costs. It should be noted that the correlation, as defined by R^2 is not very strong compared to what we find with Distribution, which is very strongly correlated with customer count.**
- **We use multiple normalizing variables, but do not use multi-factor analysis. Instead we rely on providing enough data to triangulate the results. We also analyze the cost structure, so that we can compare the causes of spending by activity. In many ways, activity costs are more useful than aggregate measures.**

BPA Results Overview: Transmission Lines

•Financial

- **BPA's Transmission O&M spending is higher than average on all three normalizing variables, but demographics influence these costs (e.g. extensive 500kV system and large territory)**
 - **When costs are adjusted to add an allowance for 500kV, then O&M costs are less than average**
- **BPA has a high ratio of O&M to capital compared to other companies**
- **Major components of O&M costs for BPA are ROW and Transmission Ops Center**
 - **When these cost components are removed from all participants, BPA's relative position shifts from above the median to below the median**
- **For BPA, Transmission Substations receive the majority of FERC capital additions**
- **Transmission Line Capital additions rate per asset is low compared to the group and has been decreasing over the last few years**
- **BPA's Capital Spending rate (Activity-based) is considerably higher than its FERC capital additions, but this is mostly explained by changes in Construction Work In Progress***
- **Overall Capital spending (Activity-based) is lower than average, and replacement rate is low, but has been increasing steadily over the last 4 years.**

**BPA could not allocate CWIP between lines and subs, so answers are approximate*

Benchmarking Summary Results: BPA Substations

- Demographics

- **BPA has a higher percentage of stations delivering at <69kV than the majority of the comparison panel**
- **BPA transformers are generally older than average**

- Financial

- **For O&M spending, BPA is among the highest over the last several years, and trending up.**
- **As a percent of assets, BPA's capital additions (FERC) are below the average compared to the panel and trending up over the last several years**
- **Transmission Substation capital spending on an activity basis is higher than the group, even when spending on new substations is removed.**
 - **This is mostly explained by an increase in CWIP of \$140M***

**Although BPA cannot allocate between lines and subs, it is assumed that most of the CWIP is in subs (since subs represented the bulk of the spending).*

Transmission Line Cost Performance

BPA's Transmission O&M spending is higher than average, while spending for capital replacement is quite low.

	BPA	Q	Rank	Mean	Q1	Q2	Q3	# of Bars
O&M Cost								
Transmission Lines O&M Expense per Circuit Mile	\$5,677	3rd	13	\$5,893	\$3,972	\$4,541	\$5,677	17
Transmission Line O&M per MWh transmitted	\$0.54	3rd	8	\$0.49	\$0.28	\$0.50	\$0.59	13
Transmission Line O&M per Total Transmission Assets	3.42%	3rd	11	3.02%	2.29%	3.32%	3.51%	17
Investment Rate								
Transmission Line Capital Spending less New Lines per Asset [Activity Based]	2.16%	4th	11	4.67%	6.00%	4.37%	2.19%	14

NOTE: Q values show the cutoff point between quartiles

Note also that Q1=low cost for O&M, and Q1=high spending for capital investment rate

Transmission Line Cost – Panel Comparison Results

Adjusted for 500kV circuits, BPA is in the 3rd quartile compared to the Big 5. The comparison against the full panel is more favorable, with BPA in 2nd quartile.

	BPA	Q vs All	Rank vs All	Q vs Big 5	Rank vs Big 5*
O&M Cost (adjusted for 500kV)					
Transmission Lines O&M Expense per Circuit Mile	\$3,903	2 nd	8 of 17	3 rd	4 of 5
Transmission Line O&M per MWh transmitted	\$0.37	2 nd	5 of 13	3 rd	4 of 5
Transmission Line O&M per Total Transmission Assets	2.35%	2 nd	7 of 17	3 rd	4 of 5
Investment Rate (not adjusted for 500kV)					
Transmission Line Capital Spending less New Lines per Asset [Activity Based]	2.16%	4 th	11 of 14	3 rd	4 of 5

**Big 5 are: BPA, Entergy, Hydro One, Oncor, TVA.*

Age Panel includes KCPL, ComEd, Northwestern, HydroOne, Oncor, Tucson Electric, and TVA

Note: While the panel was selected to include companies with 500kV lines, the O&M costs have not been adjusted in this table for the relative weighting of 500kV lines.

Transmission Line Capital By Activity

The “replacement” rate can be estimated by successively subtracting activities, such as new business, capacity additions, mandatory relocations, and storm restoration. The calculation shows that BPA spends less than the average on “Replacement Capital” (BPA did not break out capacity additions. For 2009 there were no mandatory relocations and no capitalized storm restorations.)

	Mean	Q1	Q2	Q3	BPA
Total Activity (N=14)	4.7%	6.00%	4.37%	2.19	3.2%
Less New Business (N=14)	4.87%	6.0%	4.37%	2.19%	2.2%
Less Capacity Adds	3.43%	4.41%	2.85%	1.53%	2.2%
Less Mandatory Relocations	3.13%	4.41%	2.53%	1.16%	2.2%
Less Storm Restoration	3.02%	4.45%	2.9%	1.10%	2.2%

The “Capital Replacement Rate” is the bottom line in the table.



Note: Current plan is to revise the categories for 2011:

- New
- Expand
- Sustain

Substation Cost – Whole Panel

For BPA, substation spending is higher than average for the group, both in O&M and in Capital replacement.

		BPA	Q	Rank	Mean	Q1	Q2	Q3	# of Bars
O&M Cost									
	Substation O&M per Installed MVA								
	Transmission Substations O&M per MVA	\$899	3rd	9	\$623	\$235	\$422	\$946	12
	Substation O&M per Total Substation Assets								
	Transmission Substations per Asset	2.67%	4th	16	1.40%	0.54%	1.23%	1.93%	18
Investment Rate									
	Substation Capital Spending less New Subs per Asset [Activity Based]								
	Transmission Substations Replacement Rate	7.33%	1st	4	5.45%	7.26%	5.74%	3.21%	14

Note that O&M costs for Distribution substations (i.e. the smaller stations) are consistently higher than those for Transmission substations. The impact of including all the BPA stations in the Transmission analysis is that some that might be considered Distribution are compared against Transmission stations for others.

NOTE: Q values show the cutoff point between quartiles

Note also that Q1=low spending for O&M, and Q1=high spending for capital investment rate

Substation Cost – Comparison to Panels

BPA's relative position doesn't change significantly compared to the Big 5* or compared to the "Age panel".

		BPA	Q	Rank vs All	Rank vs >400kV	Rank vs Age
O&M Cost						
Substation O&M per Installed MVA						
	Transmission Substations O&M per MVA	\$899	3rd	9 of 12	3 of 4	4 of 5
Substation O&M per Total Substation Assets						
	Transmission Substations per Asset	2.67%	4th	16 of 18	5 of 5	8 of 8
Investment Rate						
Substation Capital Spending less New Subs per Asset [Activity Based]						
	Transmission Substations Replacement Rate	7.33%	1st	4 of 14	1 of 4	3 of 8

*Big 5 are: BPA, Entergy, Hydro One, Oncor, TVA

Age Panel includes KCPL, ComEd, Northwestern, HydroOne, Oncor, Tucson Electric, and TVA

NOTE: Q values show the cutoff point between quartiles

Note also that Q1=low cost for O&M, and Q1=high spending for capital investment rate

Transmission Substation Capital (Activity)

• **BPA’s Transmission Substation capital spending (activity based) is higher than the group . . . Note: BPA was not able to break out capacity additions. There was no capitalized storm restoration in 2009.**

The “replacement” rate can be estimated by sequentially removing new business, capacity additions, mandatory relocations, and storm response.

	Mean	Q1	Q2	Q3	BPA
Total (N=14)	5.45%	7.26%	5.74%	3.21%	8.09%
Serve New (N=13**)	6.45%	8.88%	6.08%	2.88%	7.3%
Capacity Adds	4.83%	5.78%	4.32%	2.65%	7.3%
Less Storm	4.67%	5.76%	4.26%	2.65%	7.3%

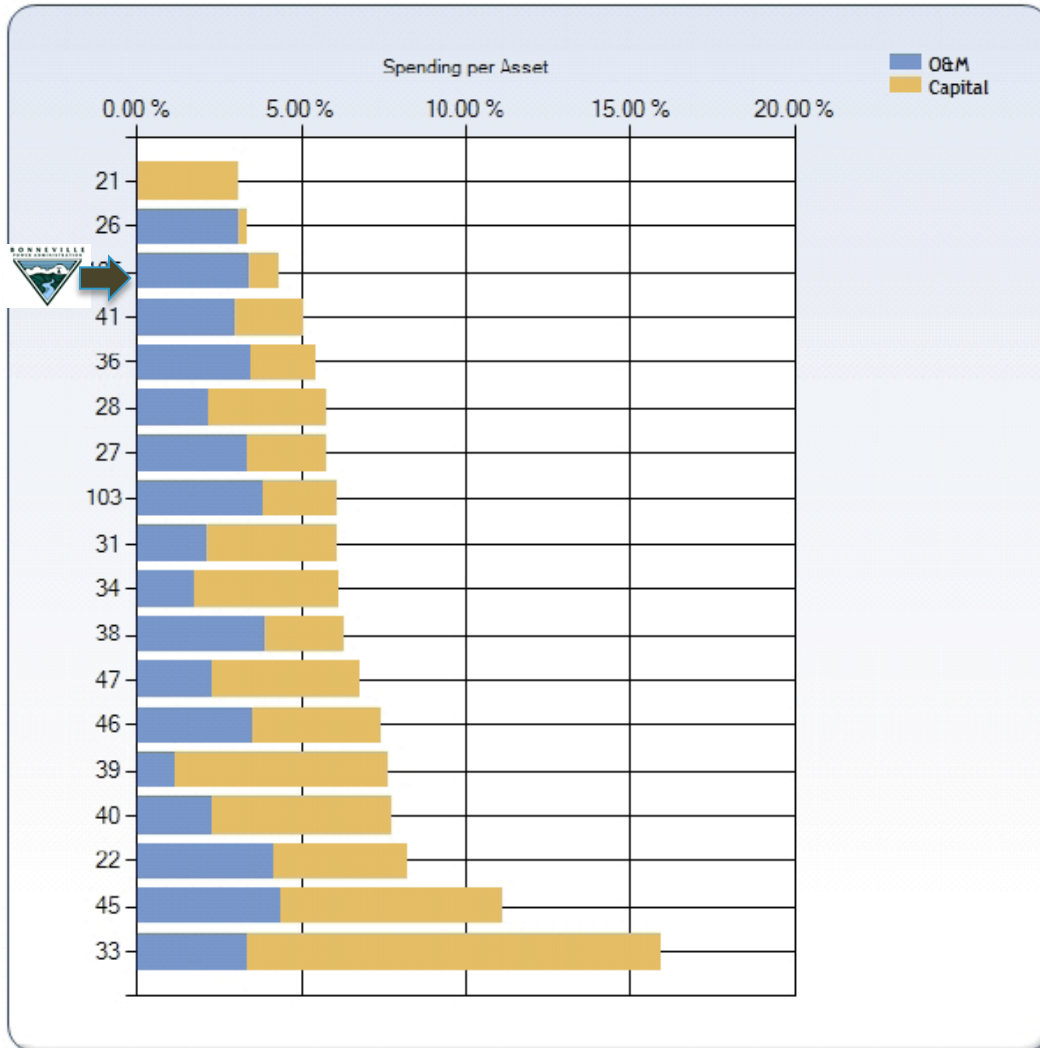
The “Capital Replacement Rate” is the bottom line in the table.



Question C105

**the sample size of companies who reported individual categories was smaller, leading to the anomalous increase in means when categories were excluded.

TOTAL Transmission Lines Capital + O&M (FERC)

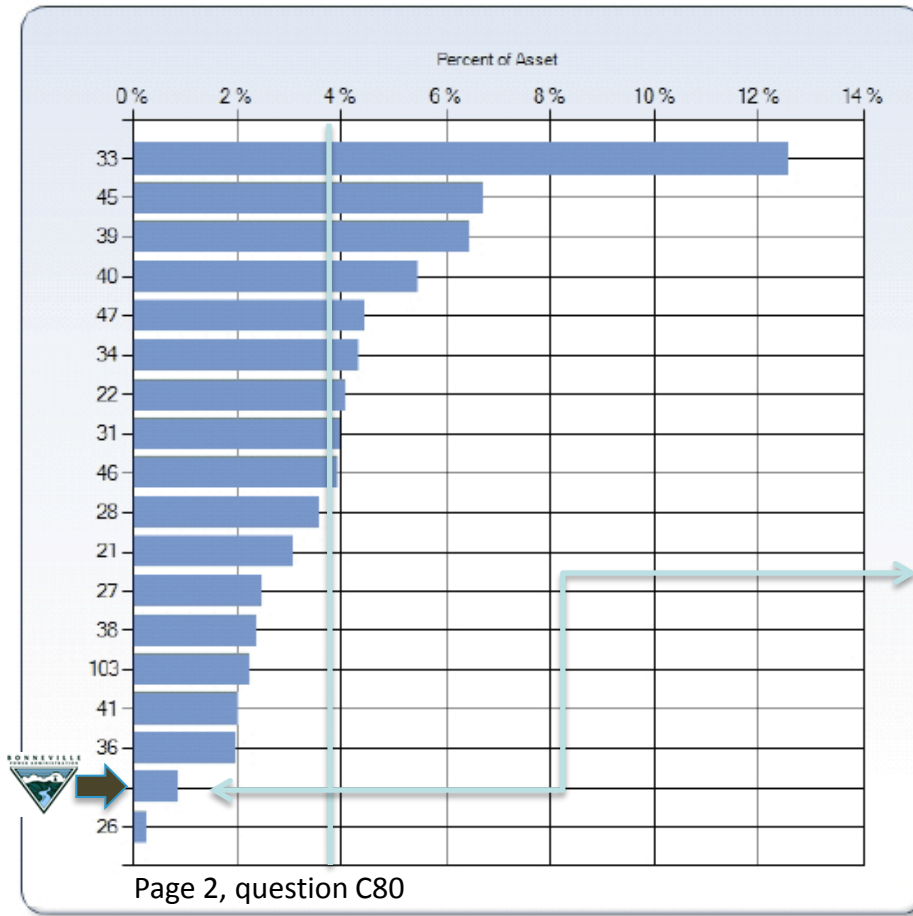


Capital is slightly more than O&M for most companies. However, for BPA, O&M makes up the majority of costs, and only one company has a higher ratio of O&M to capital.

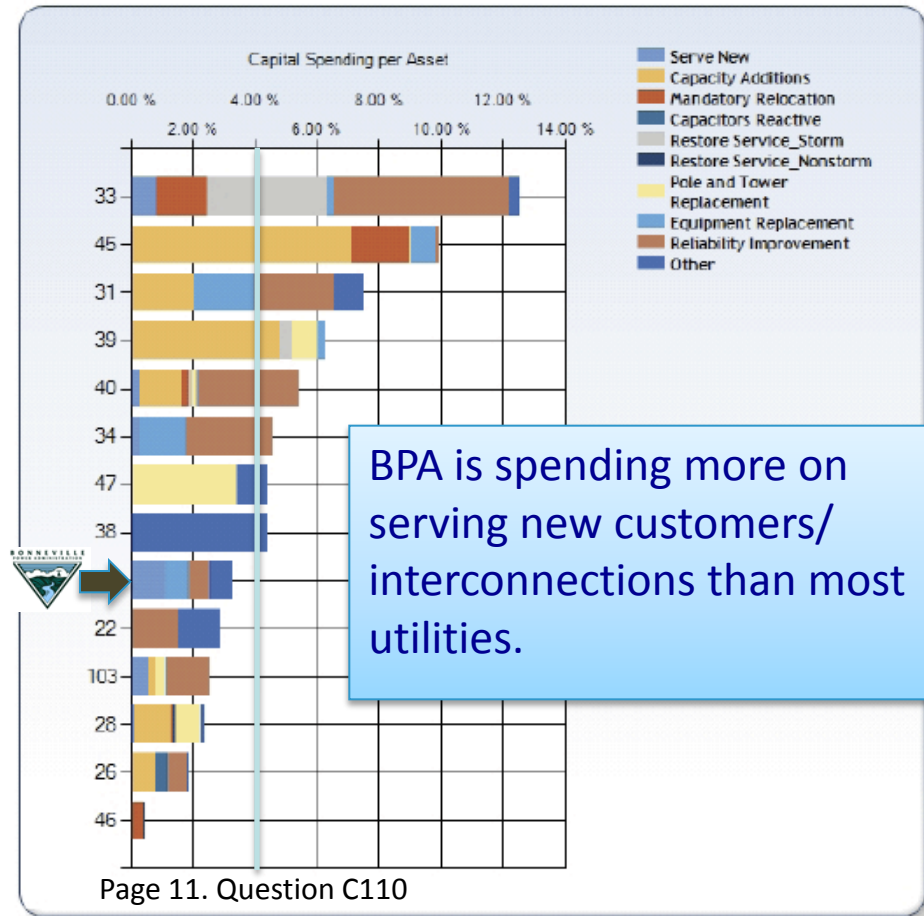
BPA's lower capital investment rate may place upward pressure on its O&M budget.

Capital: FERC vs. Activity

TRANSMISSION LINE CAPITAL SPENDING PER ASSET [FERC]



TRANSMISSION LINE CAPITAL SPENDING PER ASSET [ACTIVITY-BASED]



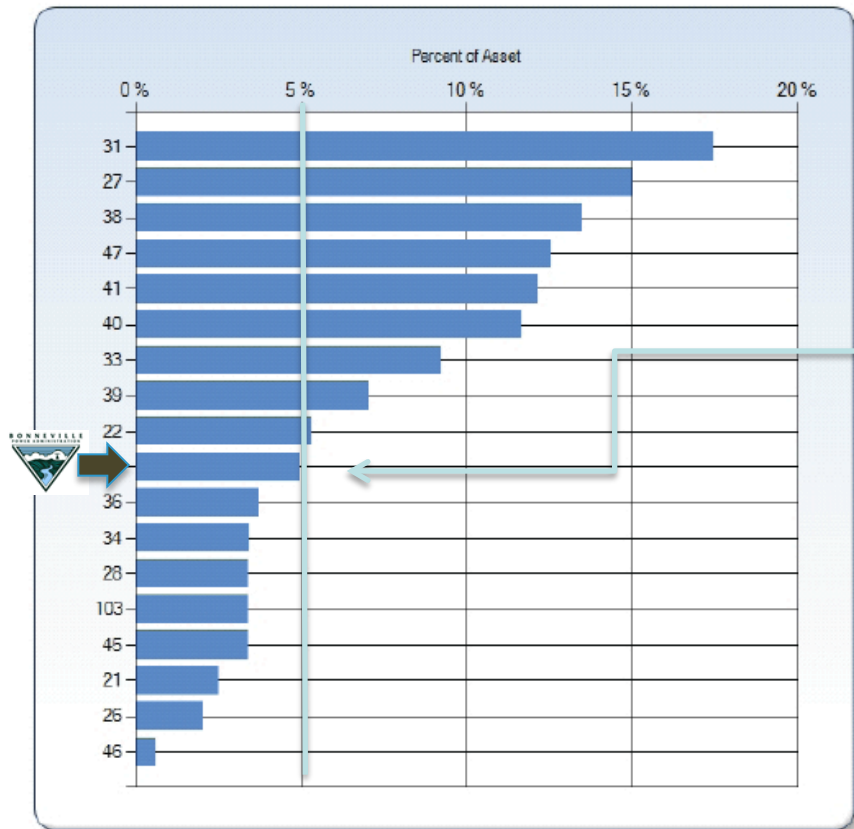
BPA is spending more on serving new customers/interconnections than most utilities.

Activity Costs for BPA are much higher than FERC additions; Changes in CWIP likely explain the differences, although BPA cannot allocate between Lines and Subs.

Capital: FERC (T-sub) Vs. Activity (T-sub)

The majority of companies provided activity data, but the activity cost was very different than FERC. CWIP may explain the differences.

Trans. Subs. Capital Spending per Asset (FERC)



Trans. Subs. Capital Spending per Asset (Activity-Based)

