

2013 Science to Policy Summit: The Columbia River Treaty

Report on the
Bonneville Power Administration Analysis of
Impacts to Hydroelectric Operations and
Power Related Issues

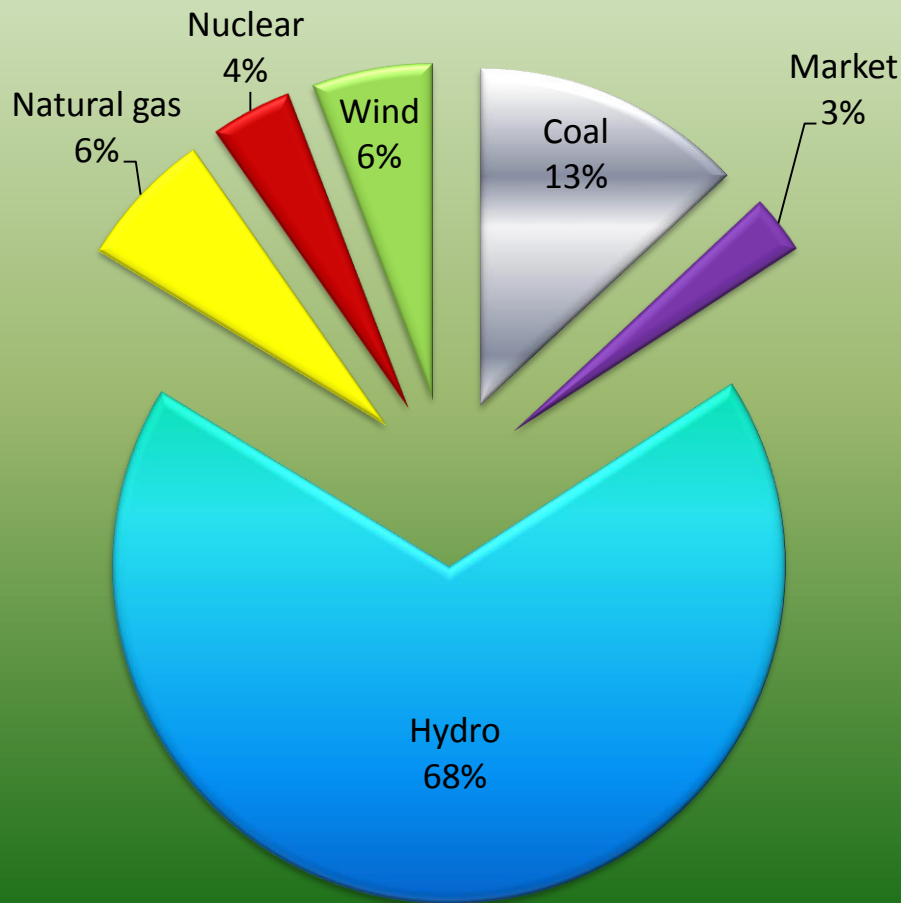
John Fazio
NW Power and Conservation Council
Friday May 10th 2013
Vancouver Hilton

Outline

- PNW Power Supply
- Scenarios/Flows
- Hydro Generation & Revenue
- Resource Adequacy
- Wind Integration Reserves
- Carbon Emissions
- Summary

Pacific NW Power Supply

2017 Average Resource Dispatch for **NW** Load



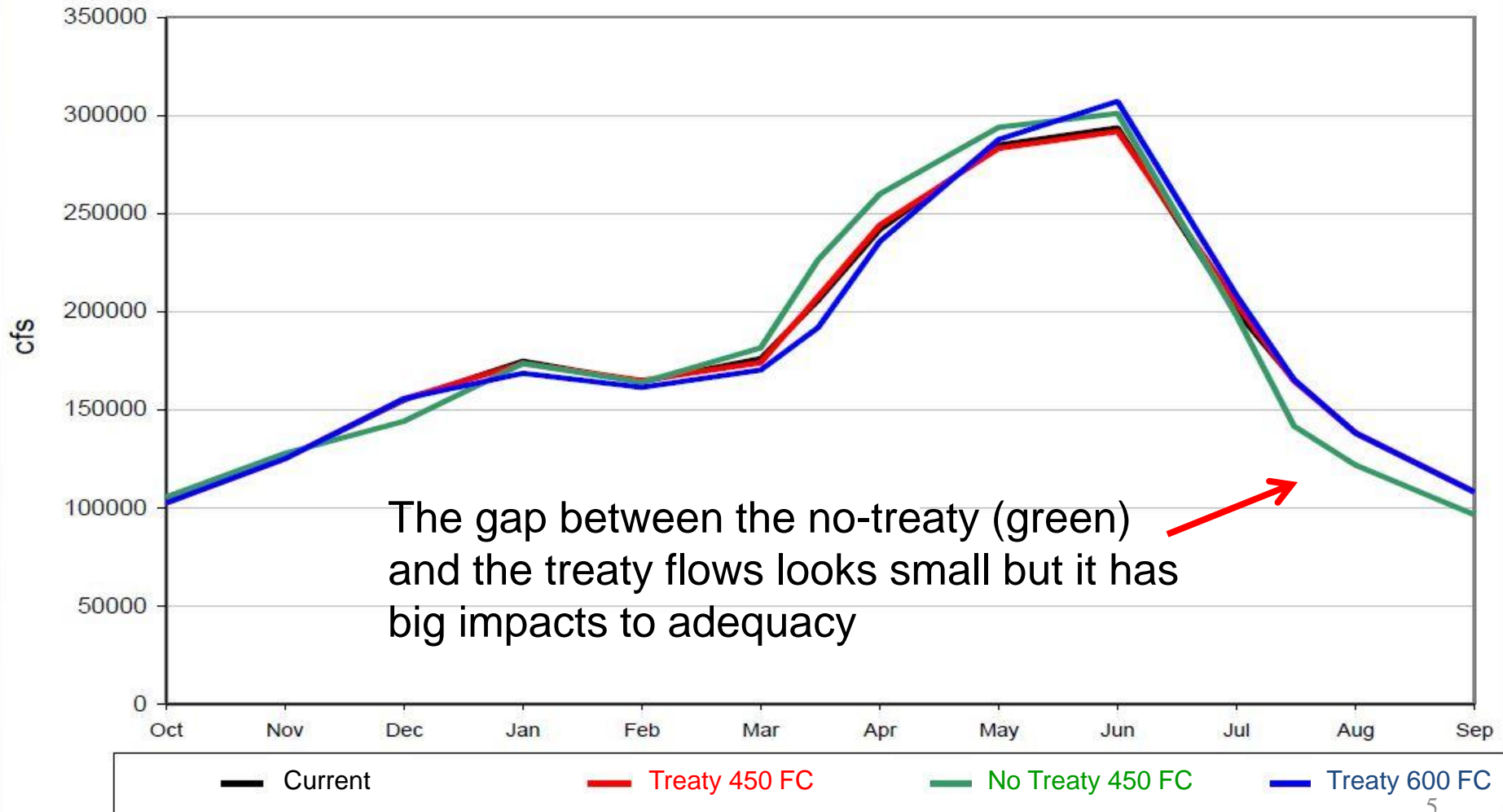
This chart illustrates the average resource dispatch for 2017 to meet PNW load, which is about **21,750 MWa** net of energy efficiency savings. On average, hydro meets about two-thirds of the region's total electricity needs. Market supplies are combined in-region and out-of-region generation.

Source: NW Power and Conservation Council's 2017 Adequacy Assessment

Scenarios Examined

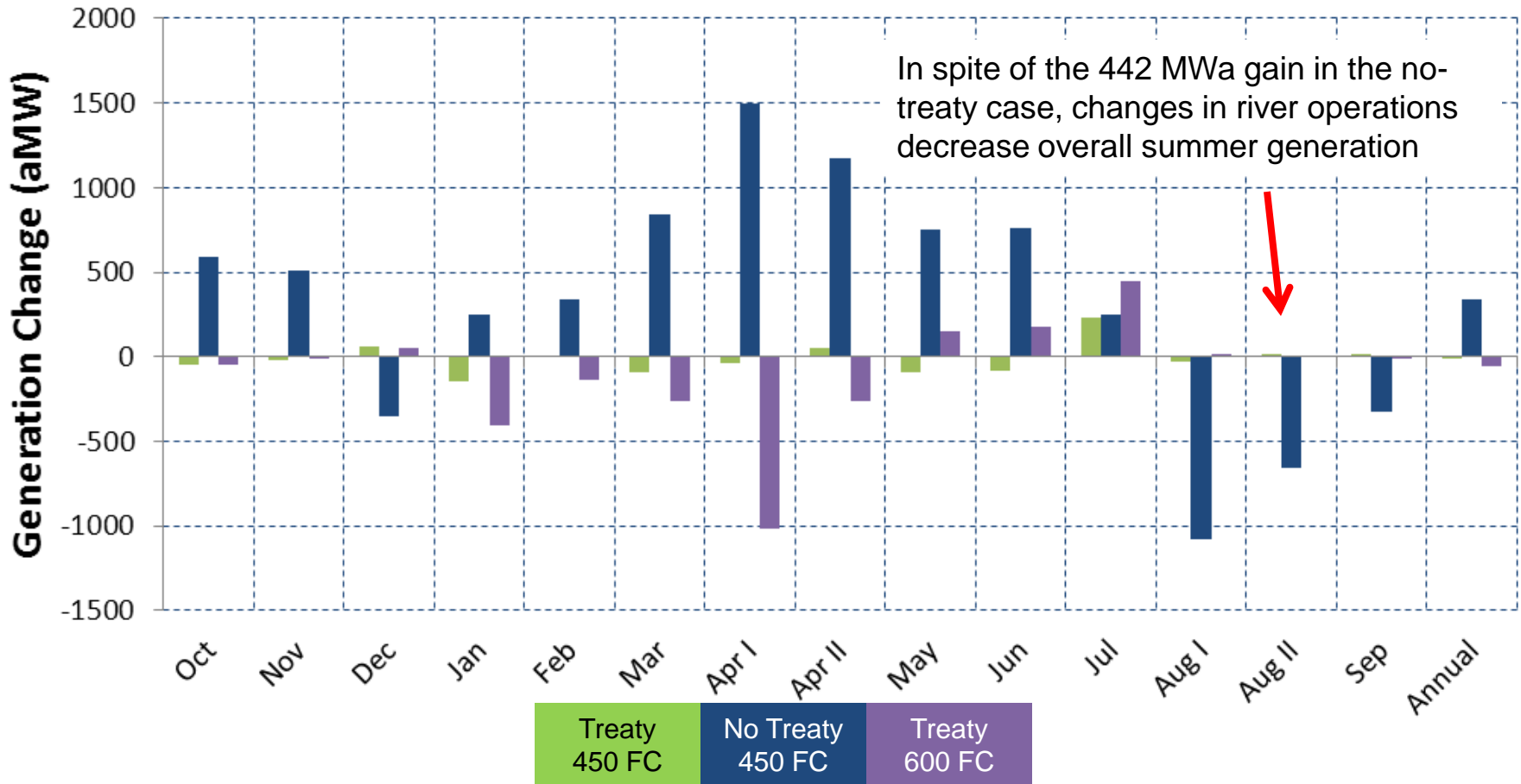
- RC-CC – Current conditions
- 2A-TC – Treaty, 450 kcfs Flood Control
- 2A-TT – No treaty, 450 kcfs FC
- 2B-TC – Treaty, 600 kcfs FC
- E1 – Normative flows
- E2b – Normative flows + elevation
- E3 – Improve summer flow
- E5 – Dry year strategy

Average Regulated Outflows at The Dalles Dam

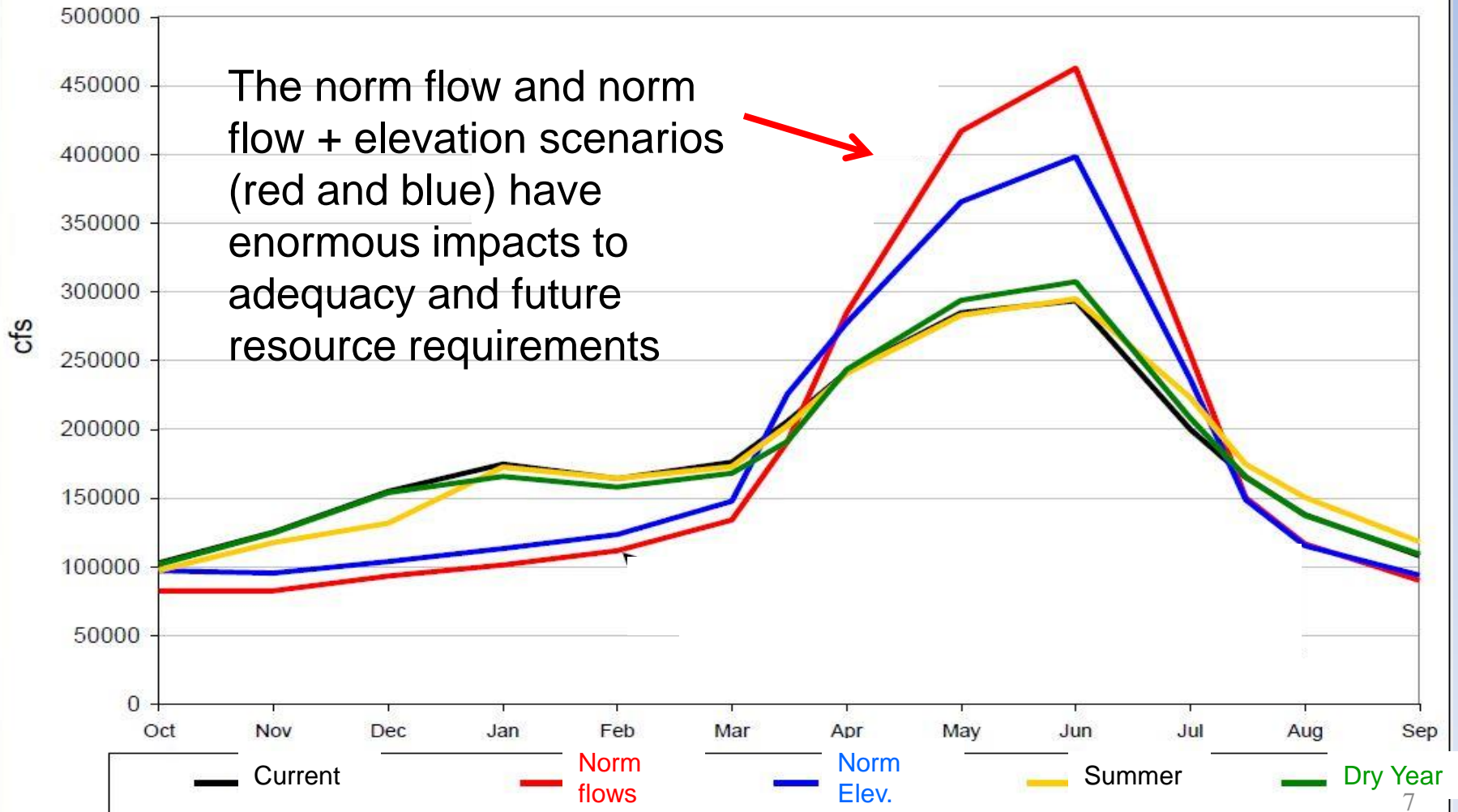


Average Hydro System Generation Difference

US System Generation: Change in Generation from Current Conditions (Less 442 aMW Under Treaty Continues Alternatives)

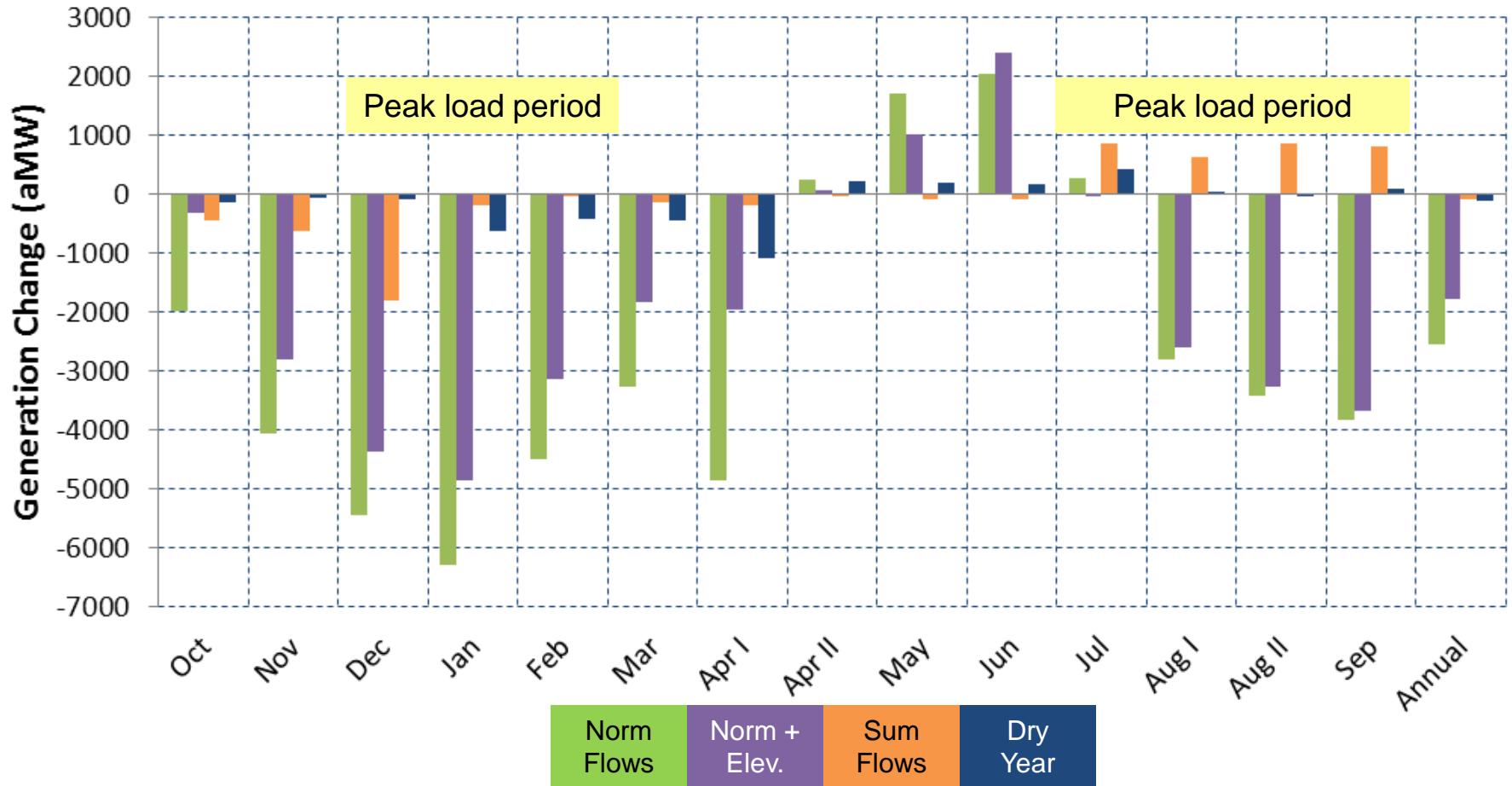


Average Regulated Outflows at The Dalles Dam

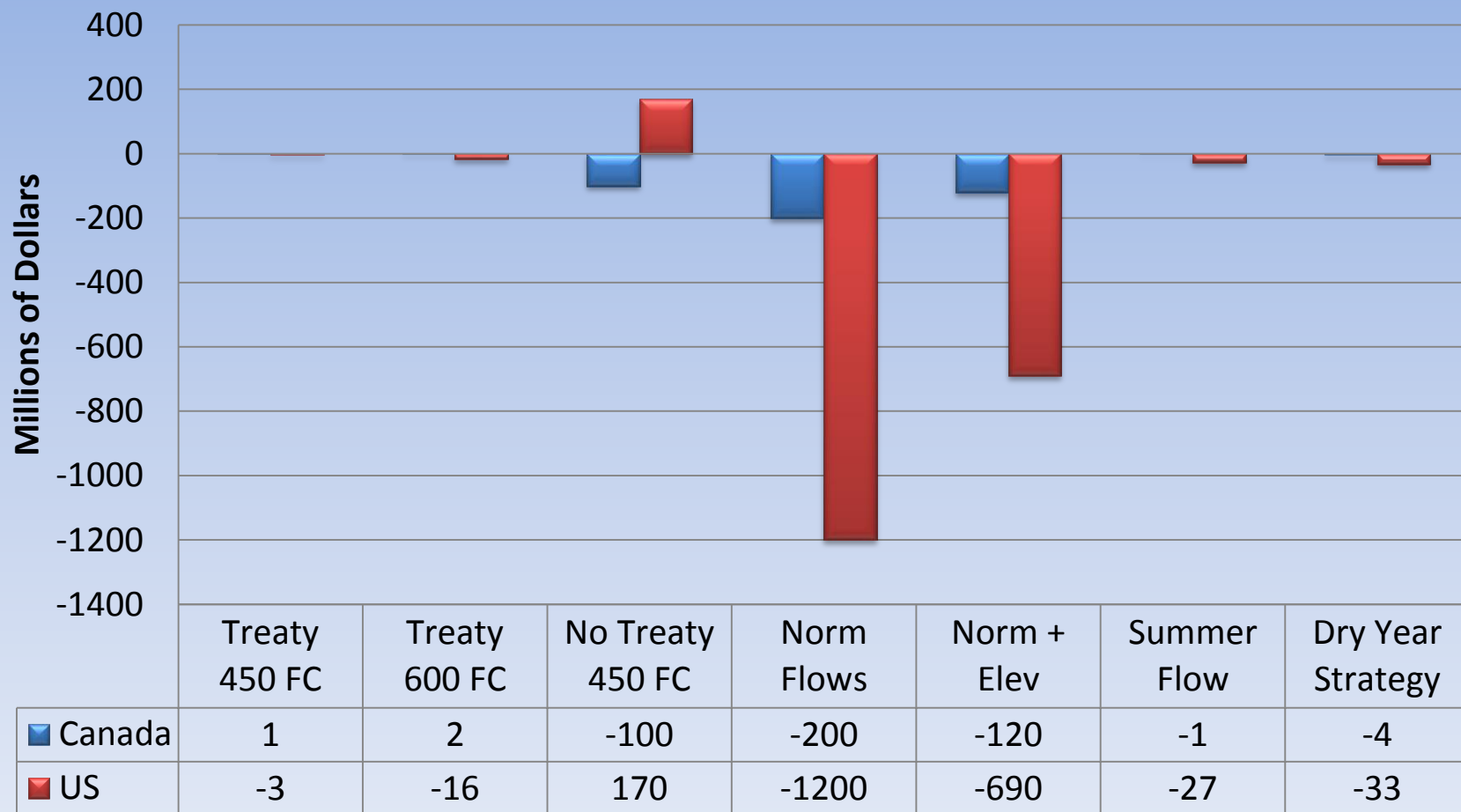


Average Hydro System Generation Difference

US System Generation: Change in Generation from Current Conditions (Less 442 aMW Under Treaty Continues Components)

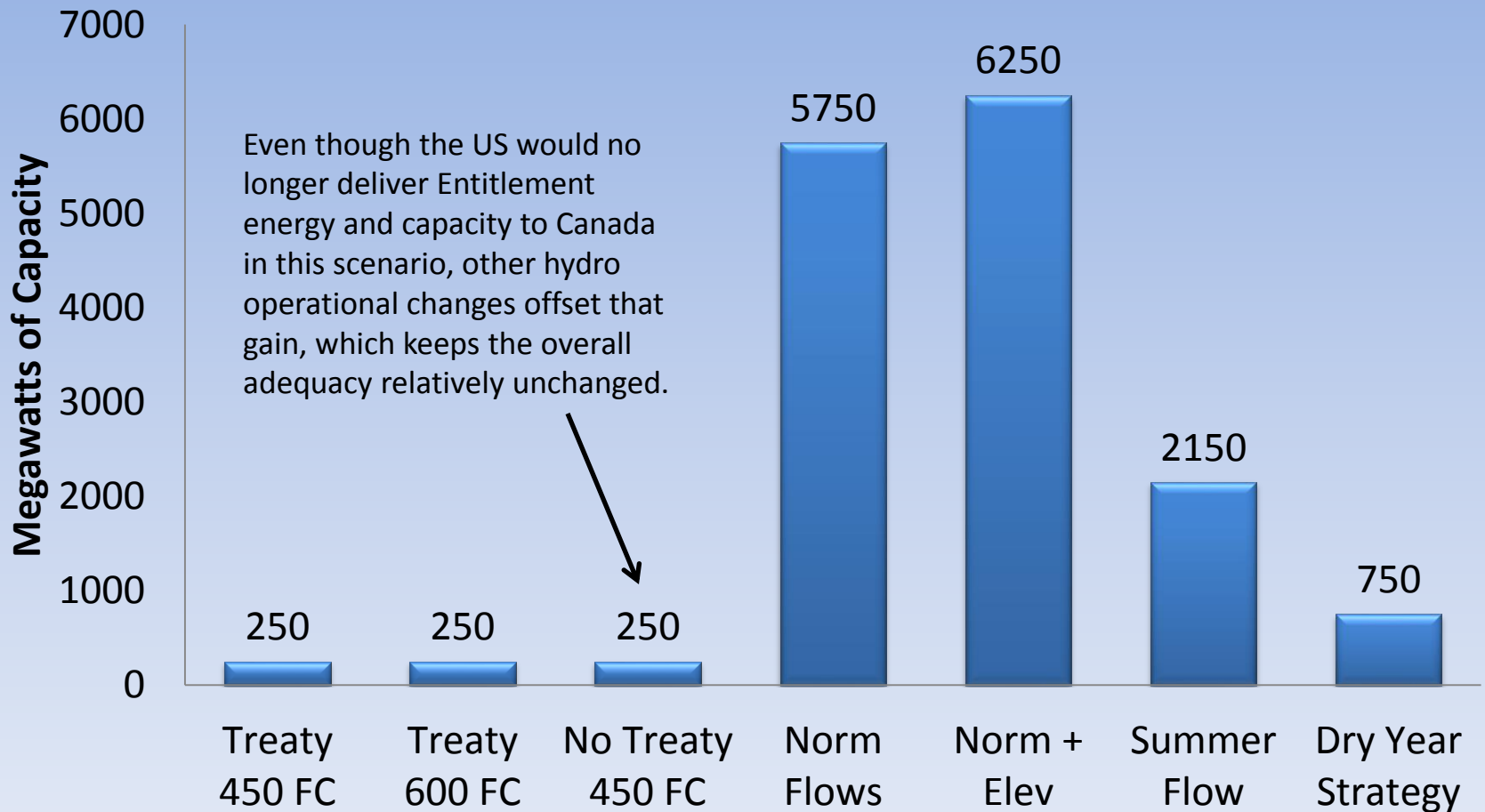


Annual Hydro-only Revenue Impacts relative to Current Conditions*



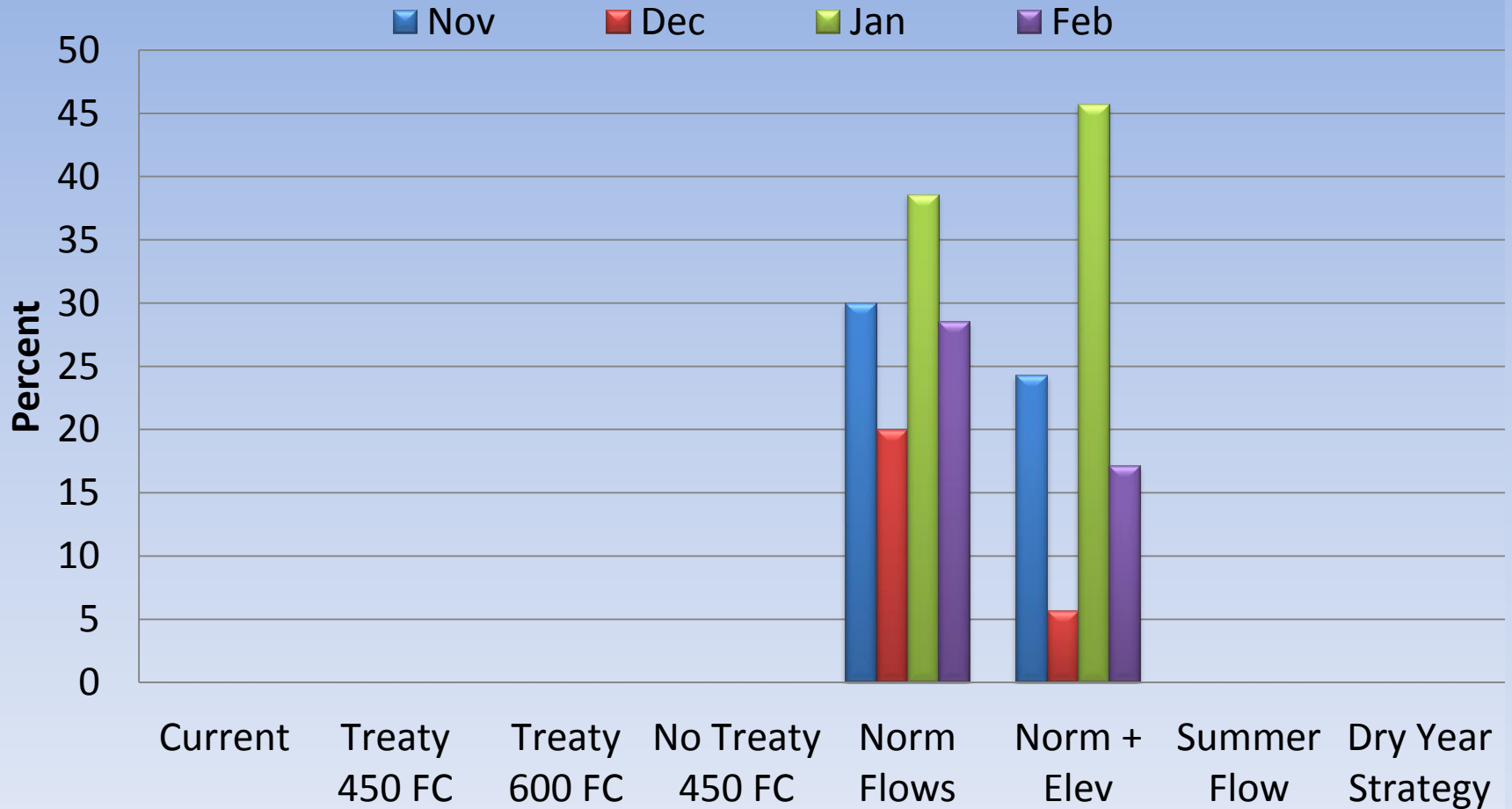
*Based on changes to hydroelectric operations only. Does not include cost of additional resources to meet load growth. BPA's current annual revenue requirement is on the order of \$2.6 billion.

Add'l Resources needed by 2024 to Maintain Adequacy*



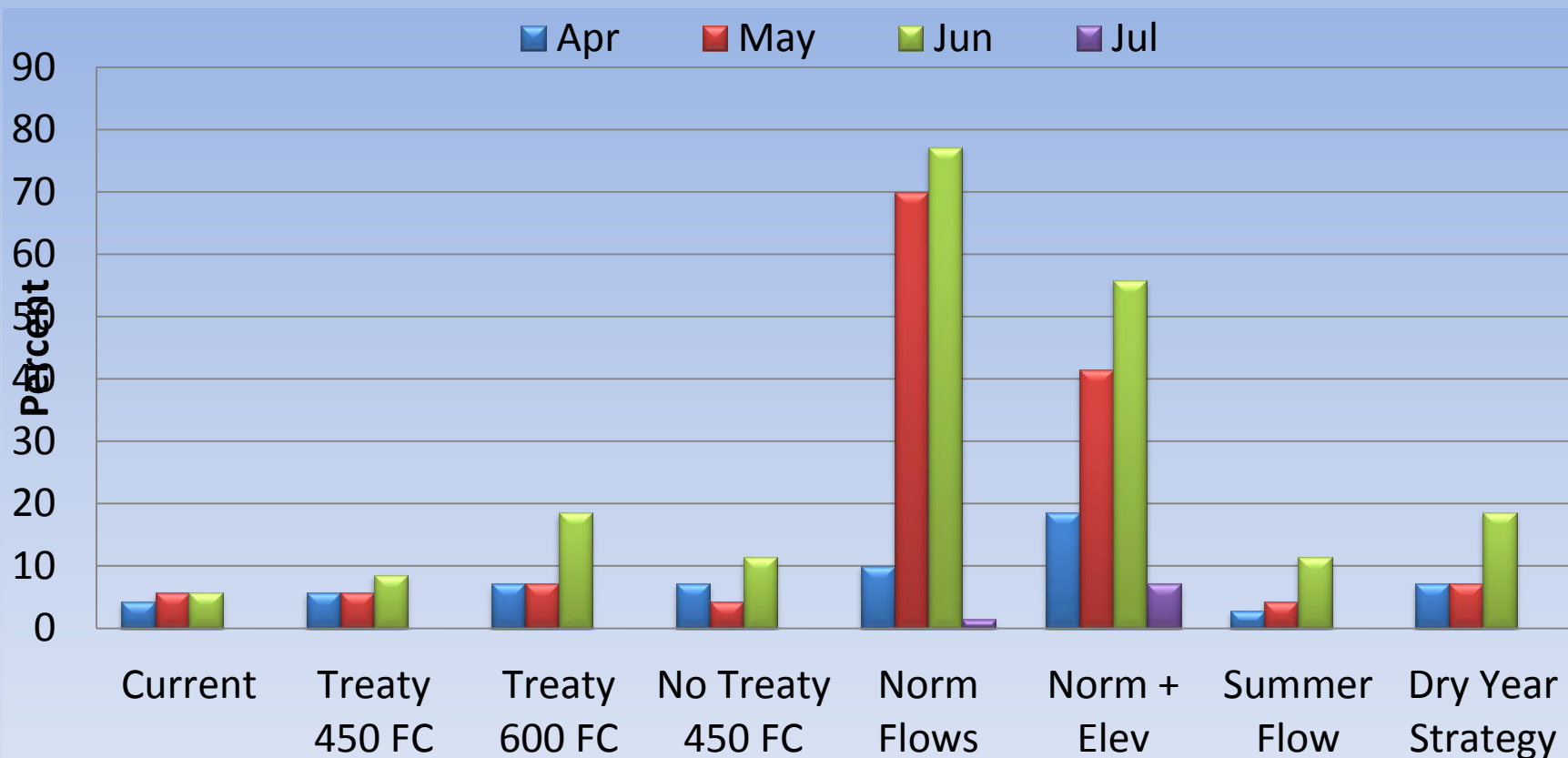
*Relative to the current condition scenario. Assumes 0.6% annual load growth after Council-targeted conservation savings and assumes RPS requirements will be met with wind. Assumes thermal resources are used to meet load growth. New capability needed under the current condition scenario is 3,450 MW and assumes the retirement of Boardman and Centralia coal plants.

Percent of Time Hydro Fails to Provide Incremental Reserves*



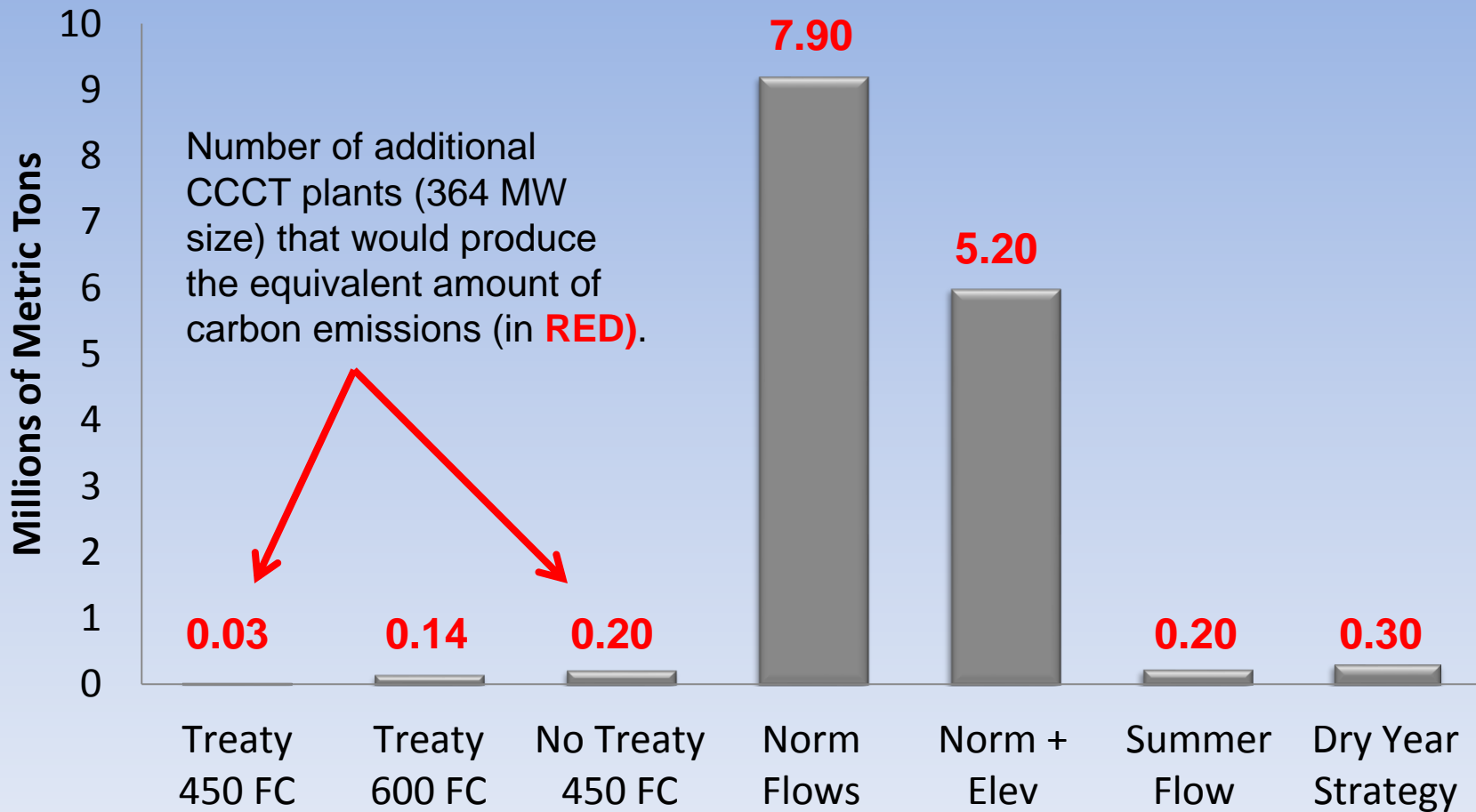
*Incremental reserves represent generation that can be produced quickly within the hour should wind generation drop unexpectedly.

Percent of Time Hydro Fails to Provide Decremental Reserves*



*Decremental reserves represent generation that can be turned off quickly within the hour should wind generation increase unexpectedly.

Add'l Annual Carbon Emissions by 2024 in the US and BC (millions of metric tons)*



*Relative to current conditions. Based only on replacing lost hydro generation.

Power System Impact Summary

Scenario	Change in US Hydro Revenue (millions)	Adequacy Resources Needed (MW)	Misses INC Reserves (Avg)	Misses DEC Reserves (Avg)	US + BC Add'l Carbon (M tons)
Treaty 450	(\$3)	250	0 %	1 %	0.04
Treaty 600	(\$16)	250	0 %	4 %	0.16
No Treaty 450	\$170	250	0 %	2 %	0.23
Norm Flows	(\$1200)	5750	29 %	36 %	9.2
Norm + Elev.	(\$690)	6250	23 %	27 %	6.0
Summer Flow	(\$27)	2150	0 %	1 %	0.24
Dry Year	(\$33)	750	0 %	4 %	0.32