Columbia River System Operations EIS

PPC March Member Forum March 4, 2020

CRSO EIS

US Army Corps of Engineers® Northwestern Division

U.S. Department of the Interior Bureau of Reclamation

Bonneville Power Administration

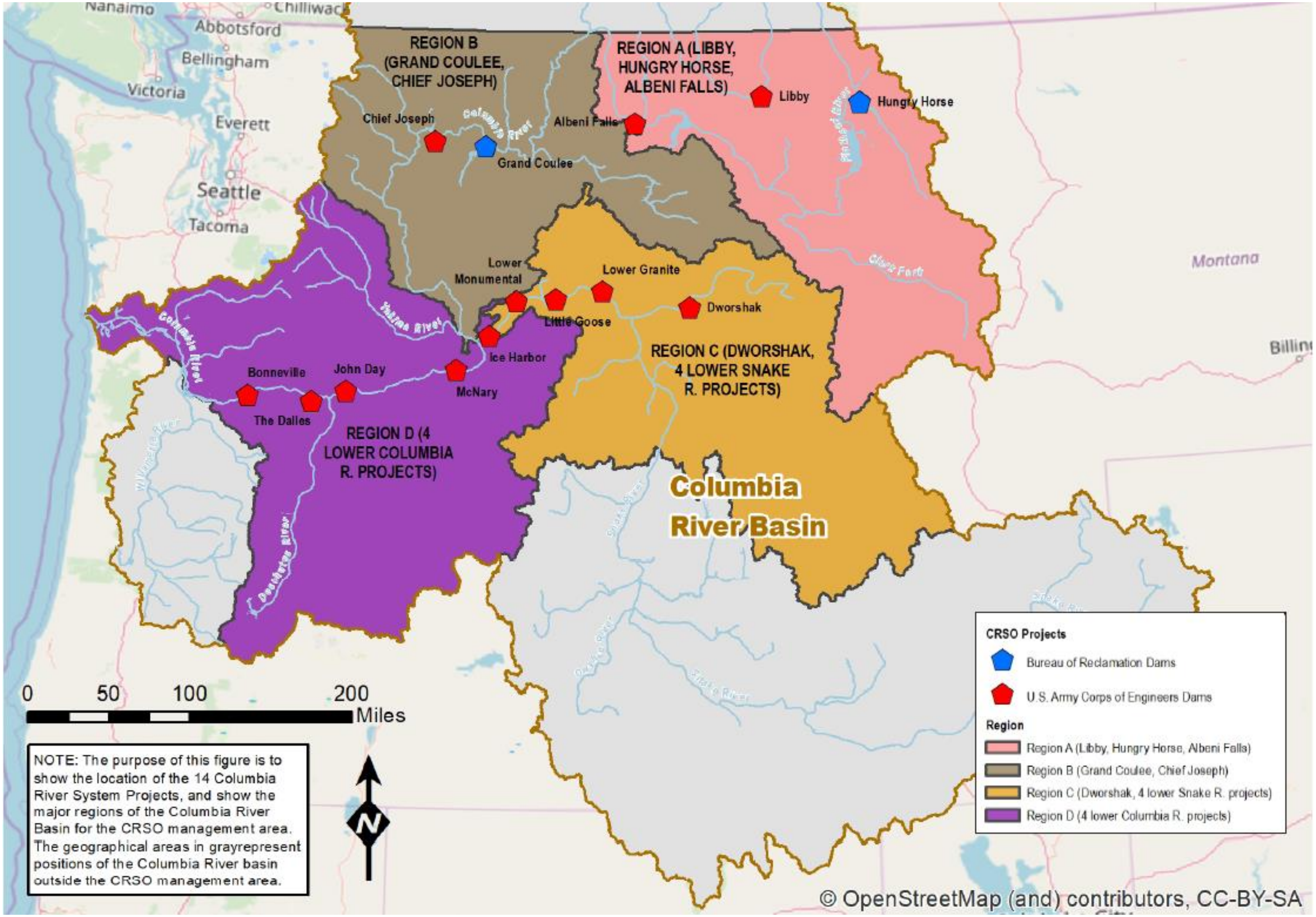
30+ entities

Tribes, Federal agencies, and state and local governments

6 alternatives

An approach to river management that balances multiple objectives & perspectives

14 CRS Multiple Purpose Dams (projects)

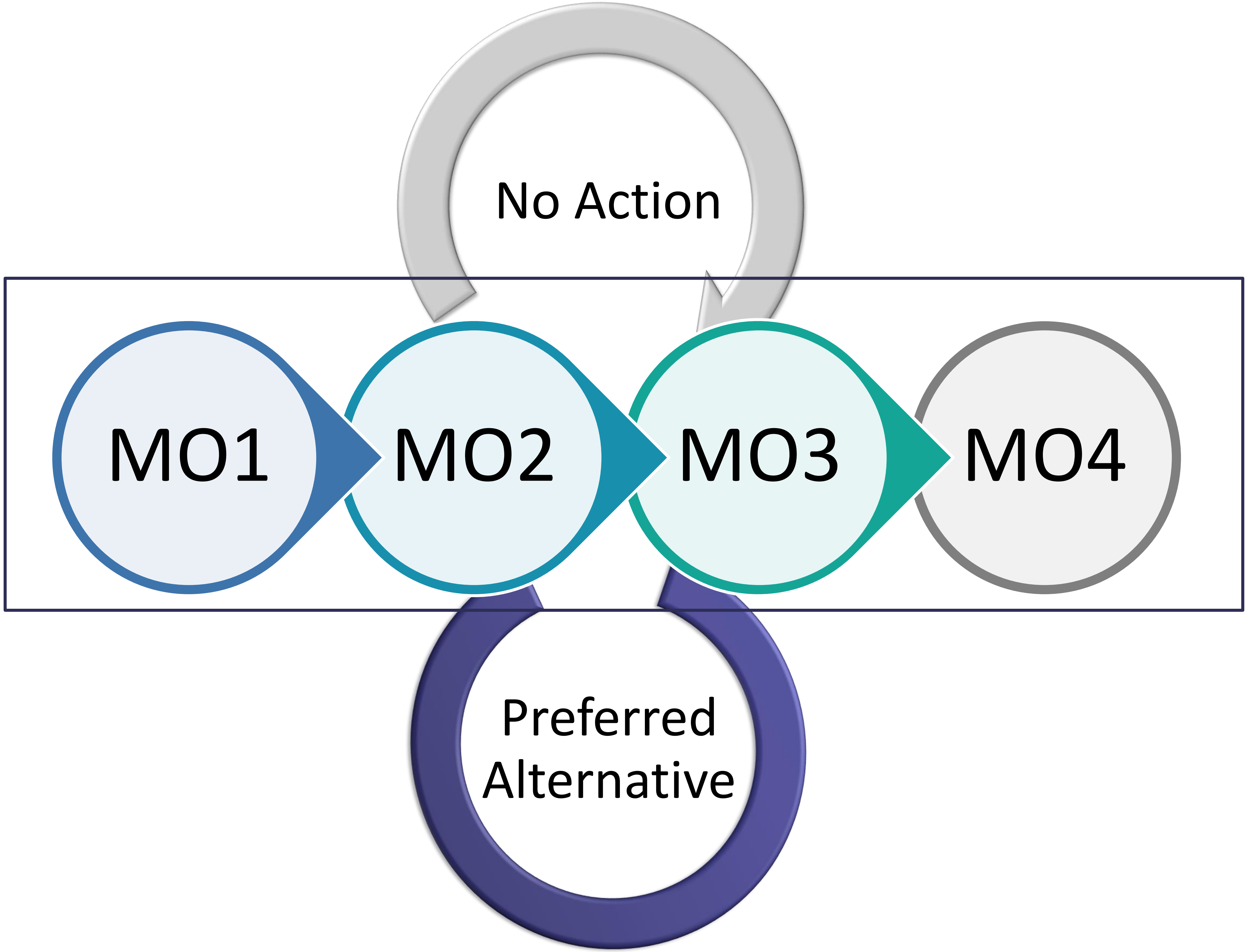


CRS Operations Objectives

COLUMBIA RIVER SYSTEM OPERATIONS OBJECTIVES

- Improve ESA-listed anadromous salmonid juvenile fish rearing, passage, and survival within the CRS through actions including but not limited to project configuration, flow management, spill operations, and water quality management. (**Improve Juvenile Salmon**)
- Improve ESA-listed anadromous salmonid adult fish migration within the CRS through actions including but not limited to project configuration, flow management, spill operations, and water quality management. (**Improve Adult Salmon**)
- Improve ESA-listed resident fish survival and spawning success at CRS projects through actions including but not limited to project configuration, flow management, improving connectivity, project operations, and water quality management. (**Improve Resident Fish**)
- Provide an adequate, efficient, economical, and reliable power supply that supports the integrated FCRPS. (**Provide a Reliable and Economic Power Supply**)
- Minimize greenhouse gas (GHG) emissions from power production in the Pacific Northwest by generating carbon-free power through a combination of hydropower and integration of other renewable energy sources. (**Minimize GHG Emissions**)
- Maximize operating flexibility by implementing updated, adaptable water management strategies to be responsive to changing conditions, including hydrology, climate, and the environment. (**Maximize Adaptable Water Management**)
- Meet existing contractual water supply obligations and provide for authorized additional regional water supply. (**Provide Water Supply**)
- Improve conditions for lamprey within the CRS through actions potentially including but not limited to project configurations, flow management, spill operations, and water quality management. (**Improve Lamprey**)

Range of Alternatives



Preferred Alternative Structural Measures

1) Upgrade Spillway Weirs to Adjustable Weirs when they are due for replacement
2) Modify Lower Granite Trap
3) Modify Bonneville Ladder Serpentine Weir
4) Lamprey Passage Structures
5) Turbine Strainer Lamprey Exclusion
6) Bypass Screen Modifications for Lamprey
7) Lamprey Passage Ladder Modifications
8) Improved Fish Passage Turbines at John Day
9) No annual installation of fish screens at non-collector projects

Preferred Alternative Operational Measures (1 of 2)

1) Flex Spill to 125% in spring, per the Flex Spill Agreement
2) Summer, reduce spill mid-August to surface spill, per the Flex Spill Agreement
3) Early transport for fish
4) Larger MOP and MIP range (matches 2019 and 2020 operations), end MOP/MIP when summer spill is reduced or ends; John Day larger winter operating range; John Day April/May higher range to disrupt avian predator nesting
5) Allow contingency reserves to be carried within juvenile fish passage spill
6) Modified draft and refill at Libby (FRM measure)
7) Update system FRM calculations at Grand Coulee
8) Decrease Grand Coulee draft rate used in planning drawdown (0.8 ft/day)
9) Operational constraint for ongoing Grand Coulee maintenance

Preferred Alternative Operational Measures (2 of 2)

10) Lake Roosevelt additional water supply (45 kaf/yr)

11) Implement Sliding Scale summer draft at Libby and Hungry Horse

12) Cease installation of fish screens at non-collector projects—Ice Harbor, McNary, and John Day

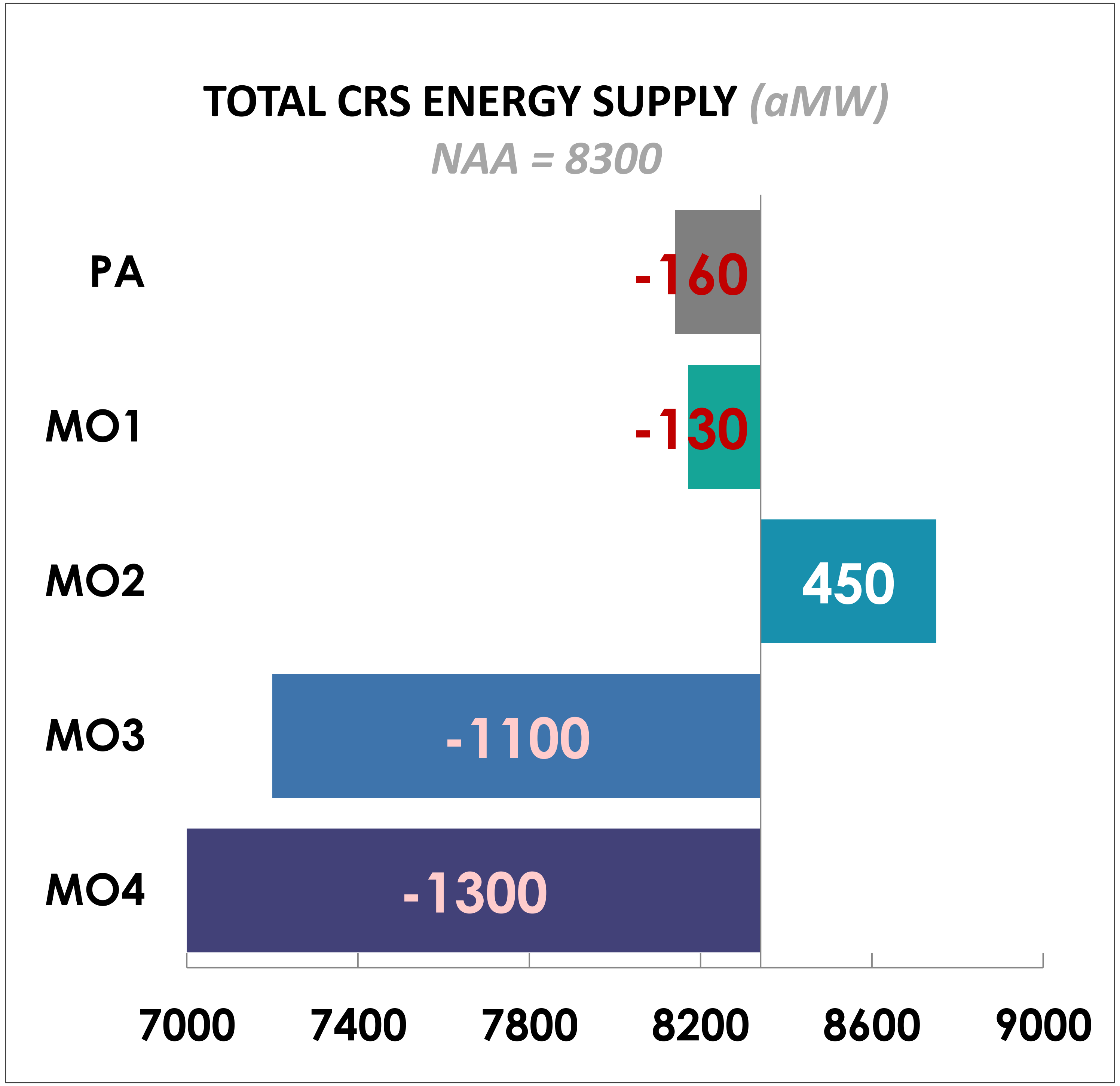
13) Dworshak uses FCRC or VDL logic to draft slightly deeper for drawdown

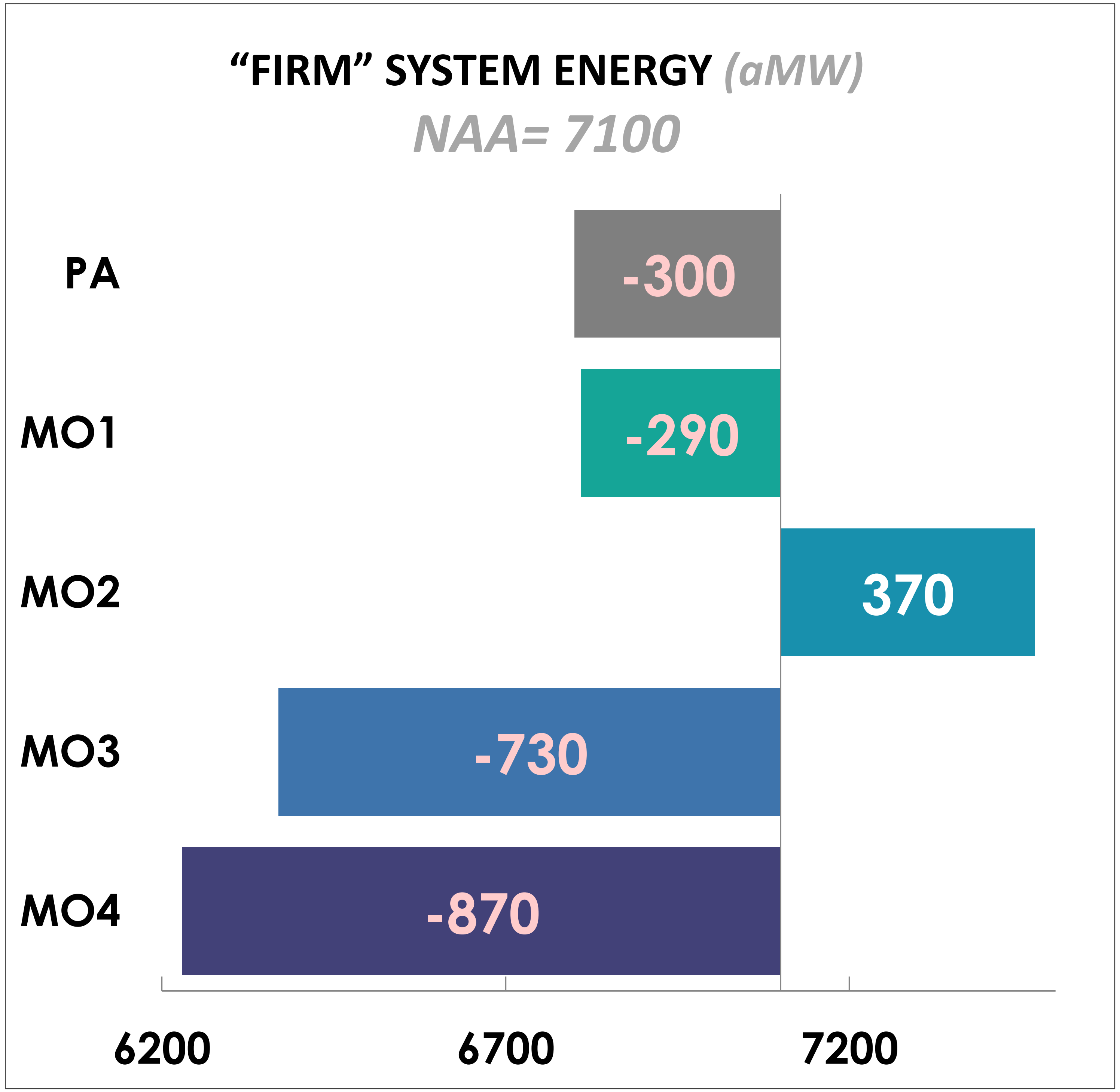
14) Grand Coulee refills to 1283 by end of October (instead of end of September)

15) Zero Generation operations at night Oct 15-Feb 28, daytime mid-Dec to Feb 28

16) Operate turbines (LCOL and LSN) within and above 1% efficiency during fish passage season

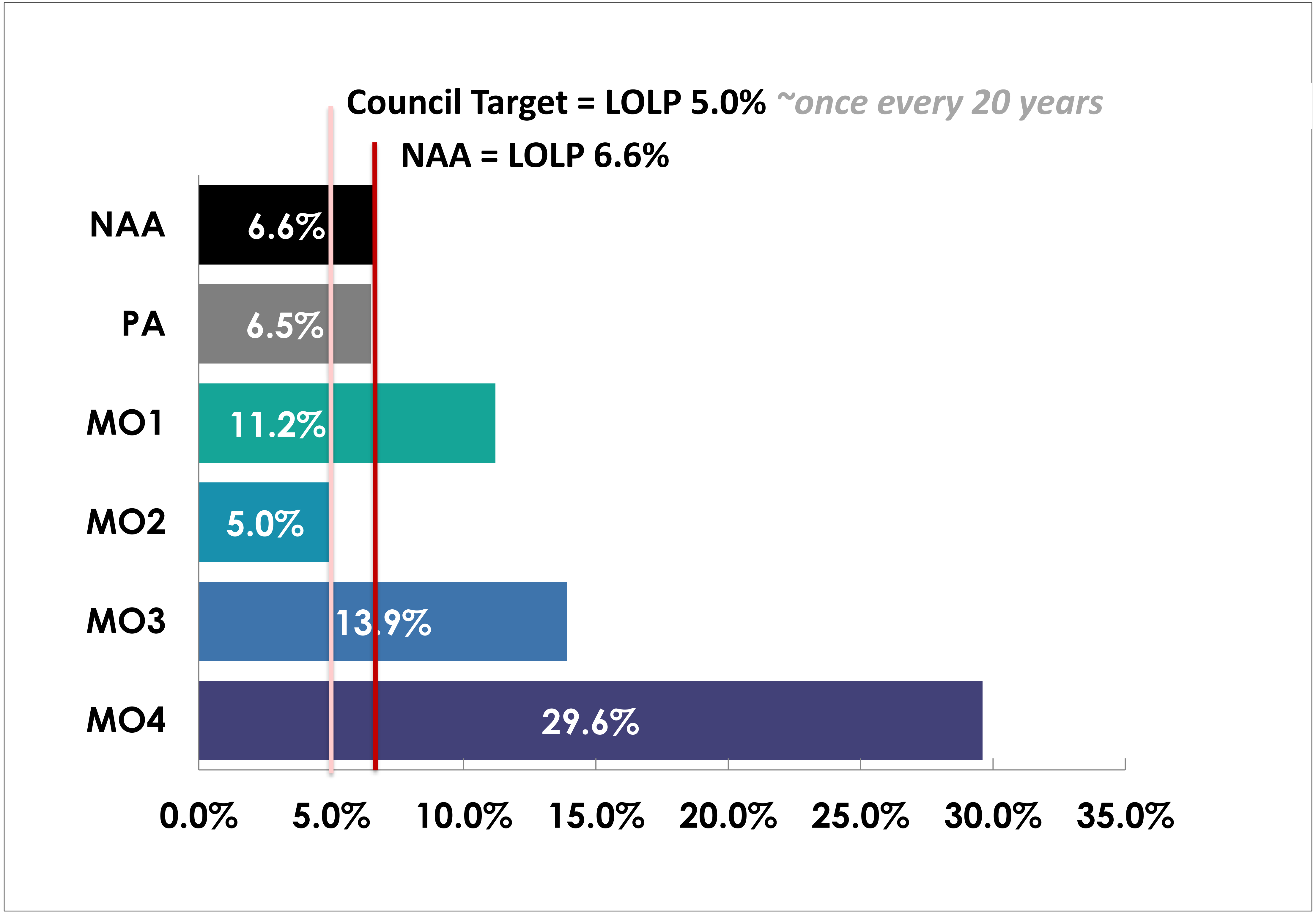
Generation Impacts



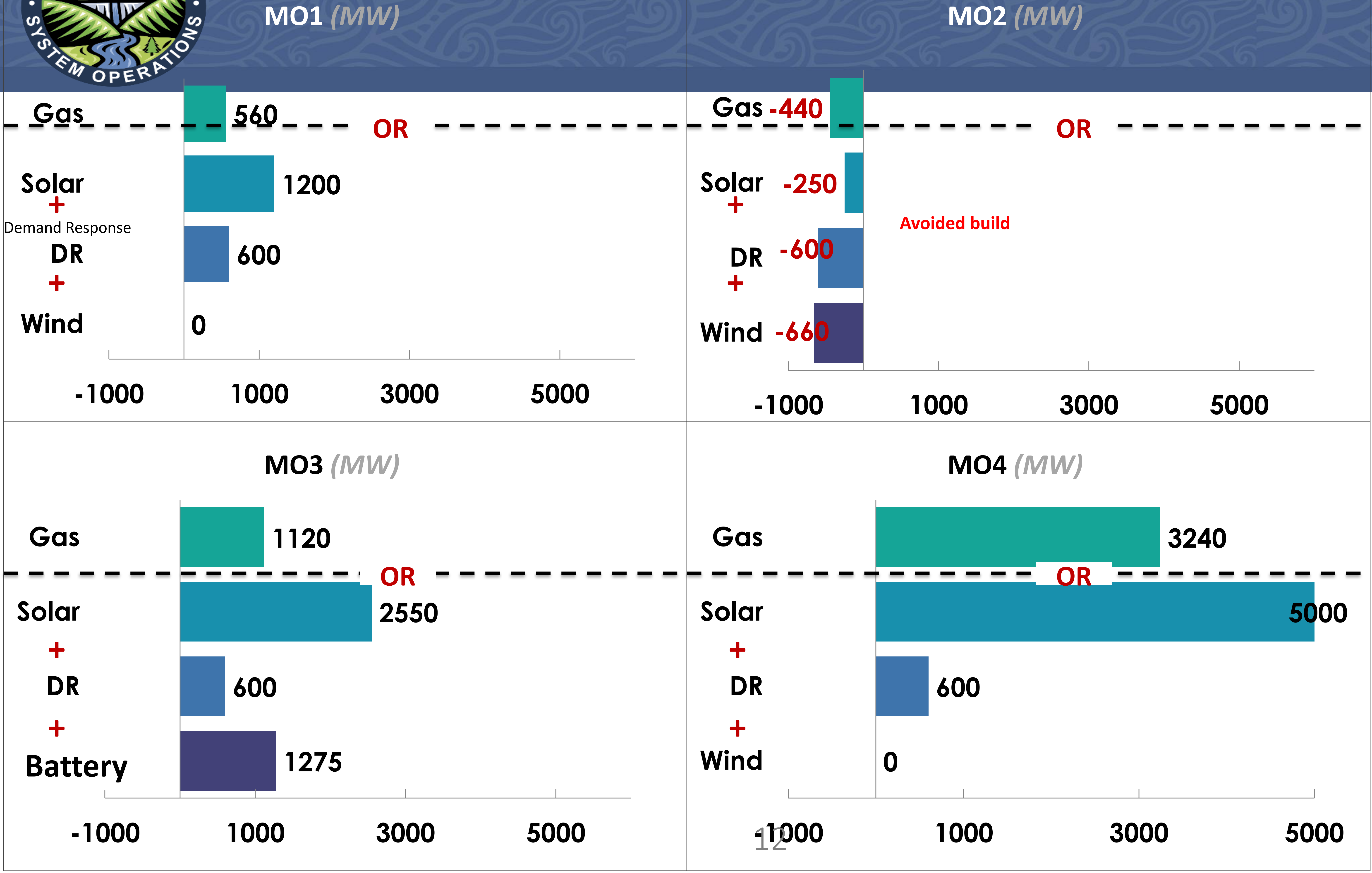


Power Reliability

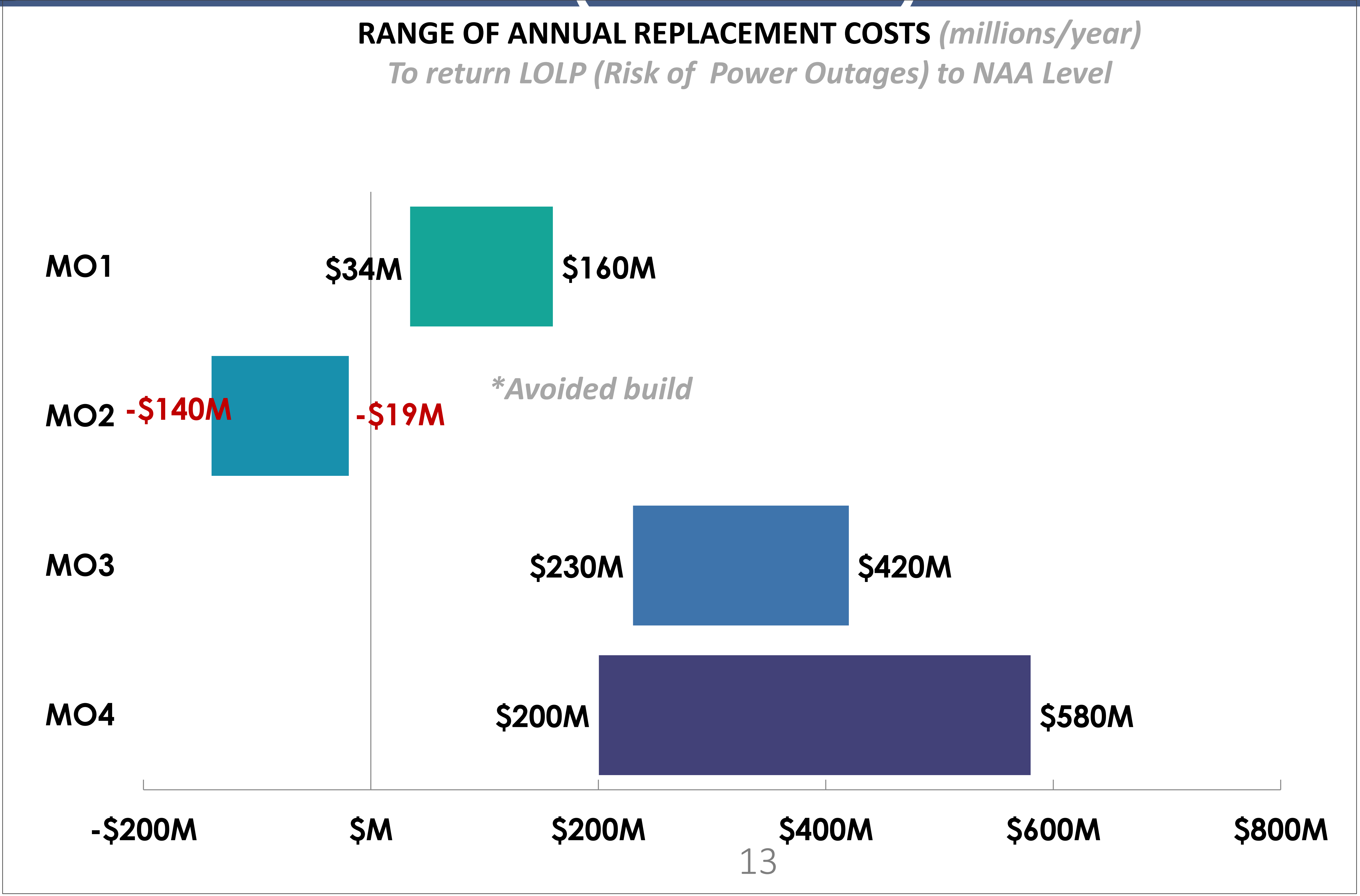
Loss of Load Probability (LOLP) = Risk of Power Outages



Replacement Resources



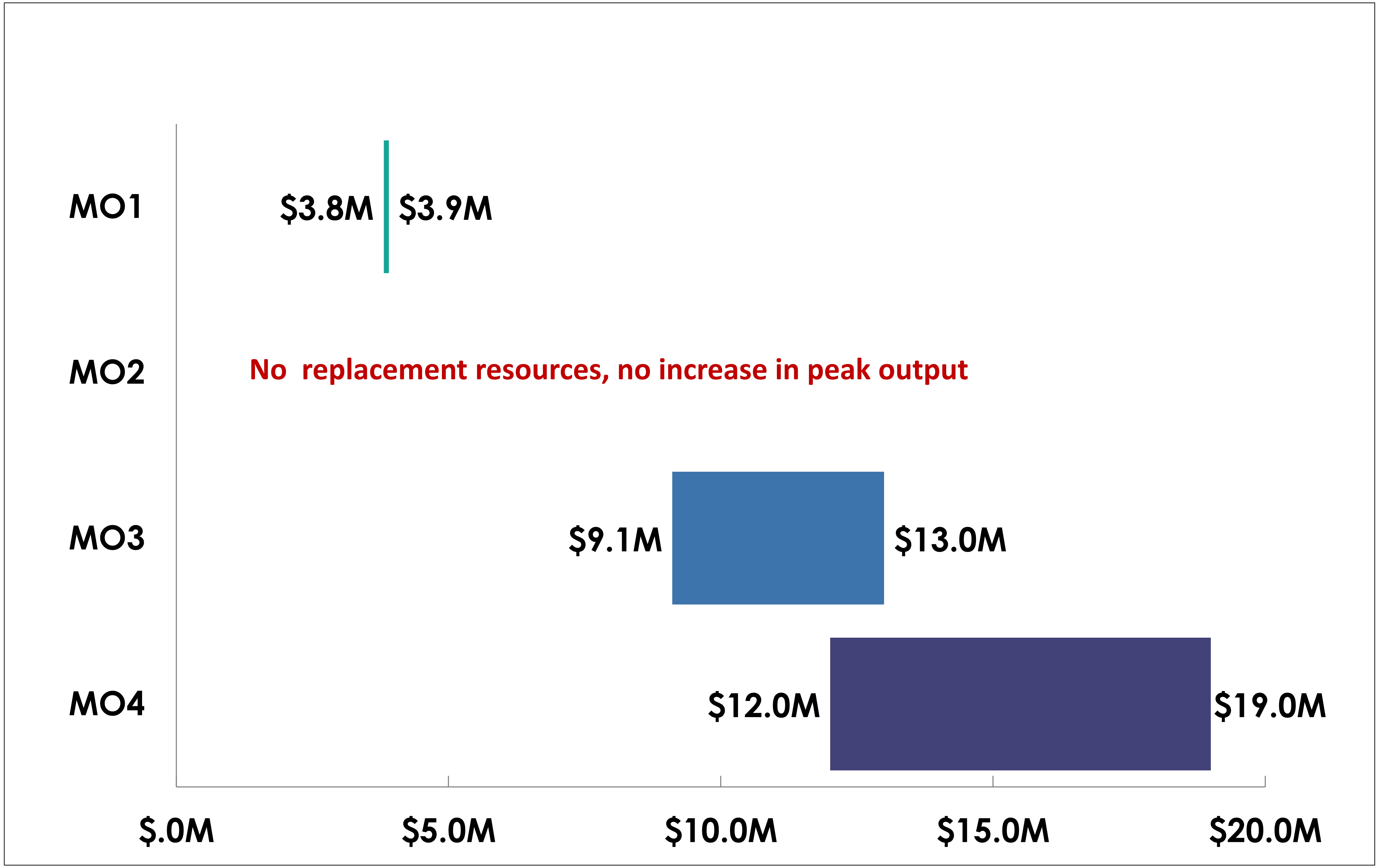
Power Reliability Impact Costs (Base Case)



BPA Transmission Reliability Impact Costs

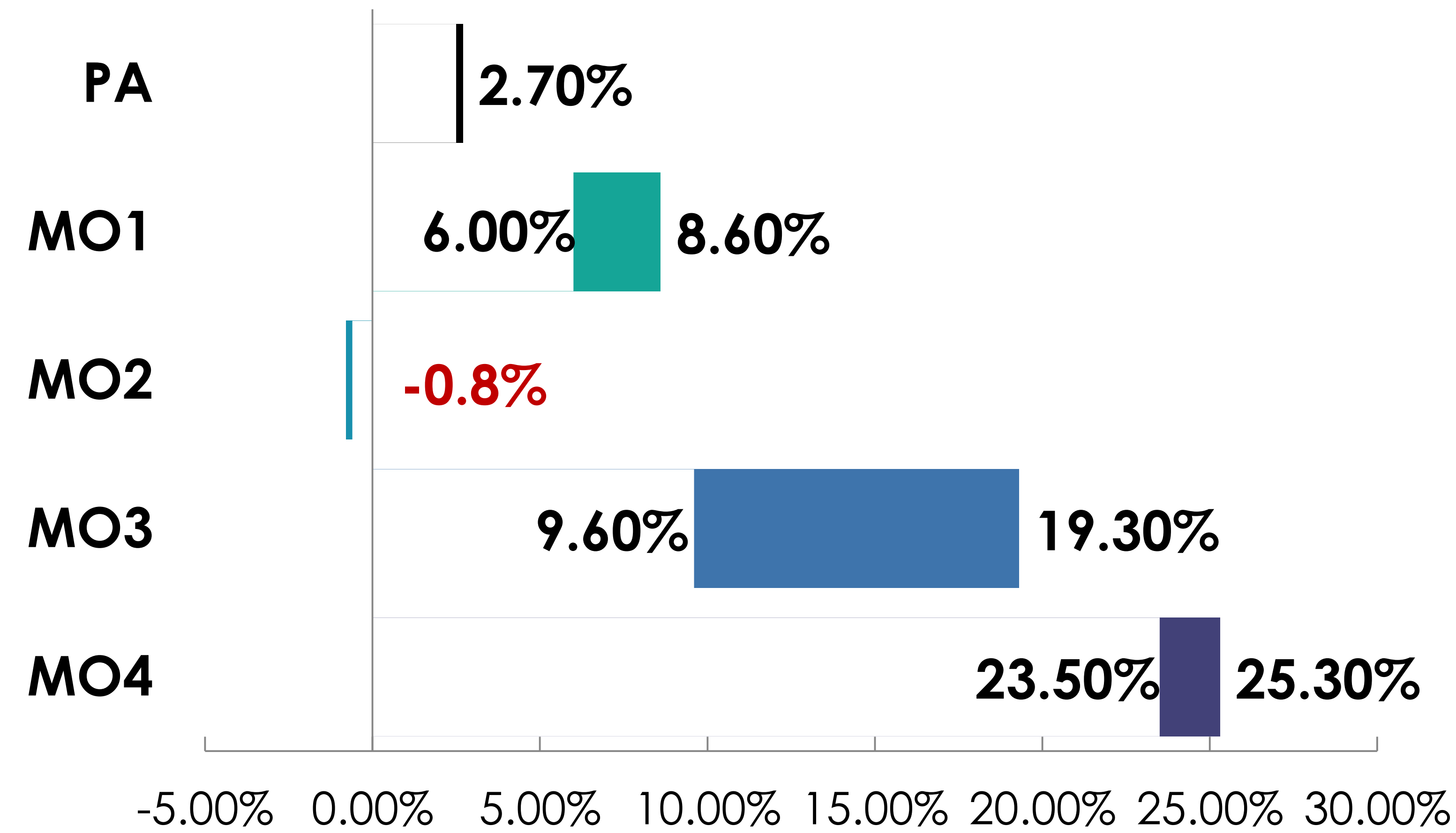
Transmission Infrastructure to return to LOLP (Risk of Blackout) at NAA Level

($millions/per year)

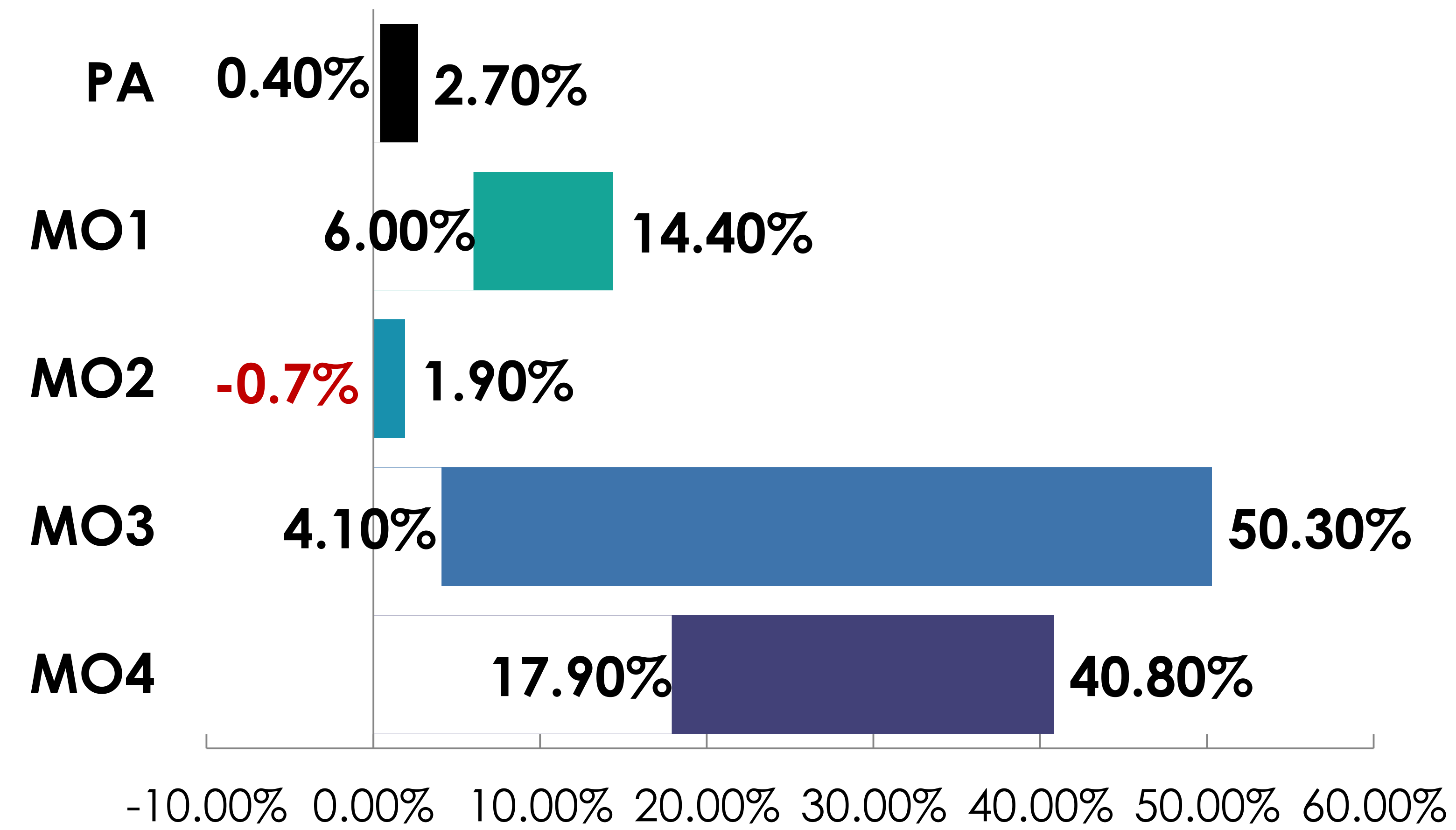


Bonneville Wholesale Power Rate Pressure

Average BPA Wholesale Power Rate Pressure
(Base Analysis, Gas or Zero-Carbon)



Potential Range of BPA Wholesale Power Rate
(including rate sensitivities)

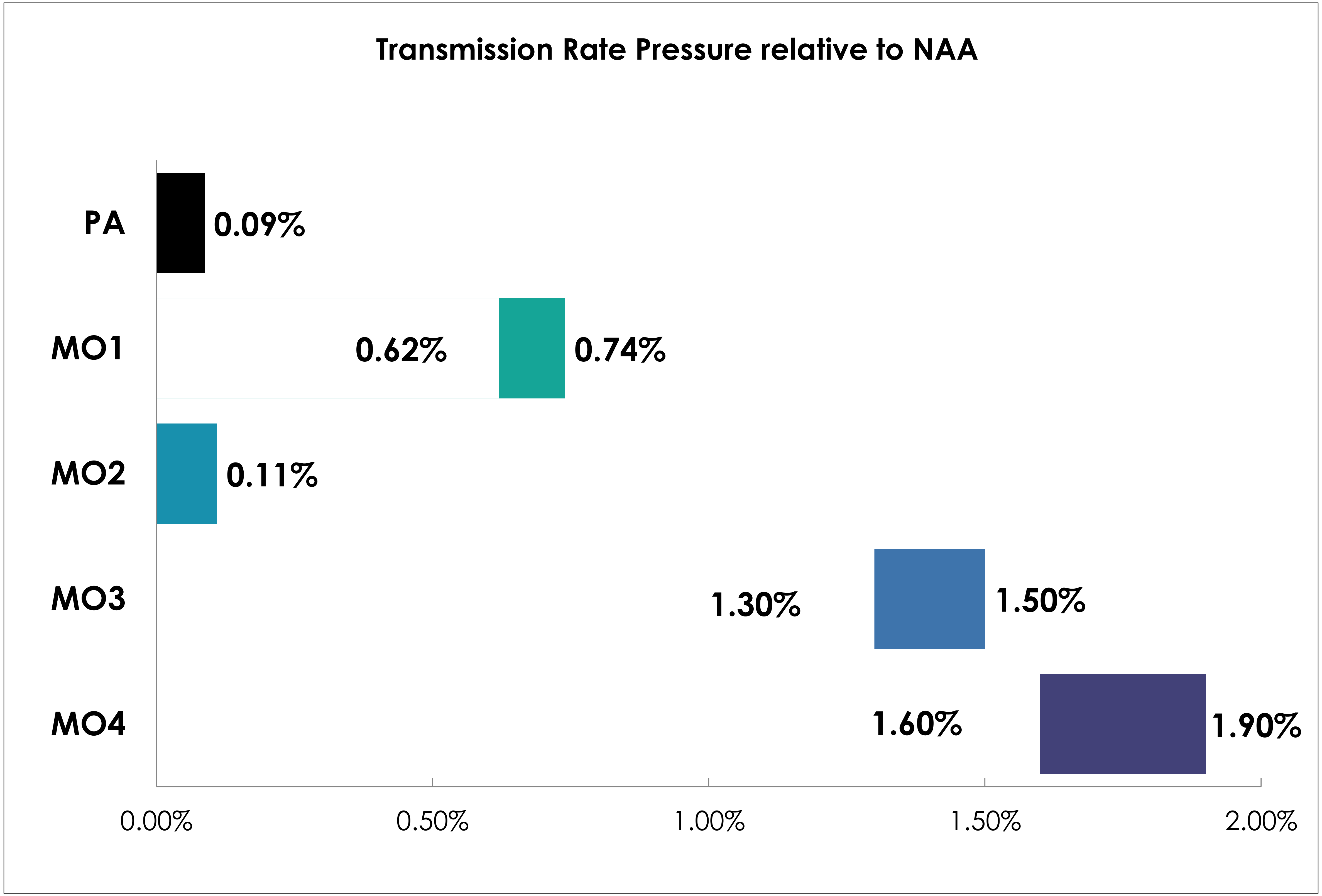


Potential BPA Wholesale Power Rate $/MWh – BASE CASE	
PA	$34.56
MO1	$36.64 - $37.53
MO2	$34.28
MO3	$37.88 - $41.23
MO4	$42.70 - $43.32

Potential Range of BPA Wholesale Power Rate - Rate Sensitivities

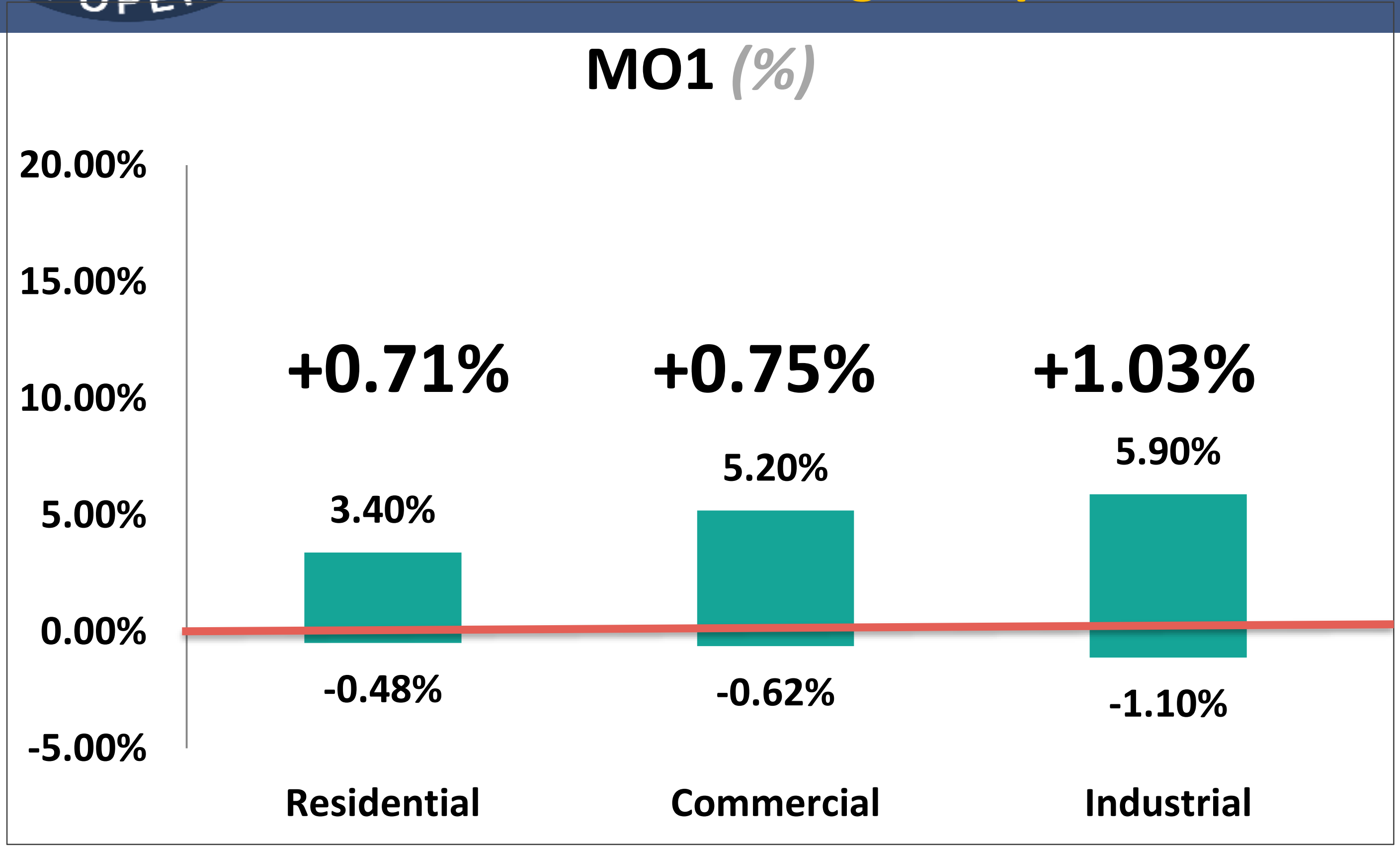
	Least Cost	Zero-Carbon
PA	0.4% to 2.7%	
MO1	6.0% to 6.4%	9.5% to 14.4%
MO2	-0.7% to 1.9%	
MO3	4.1% to 10.7%	13.7% to 50.3%
MO4	17.9% to 25.7%	25.3% to 40.8%

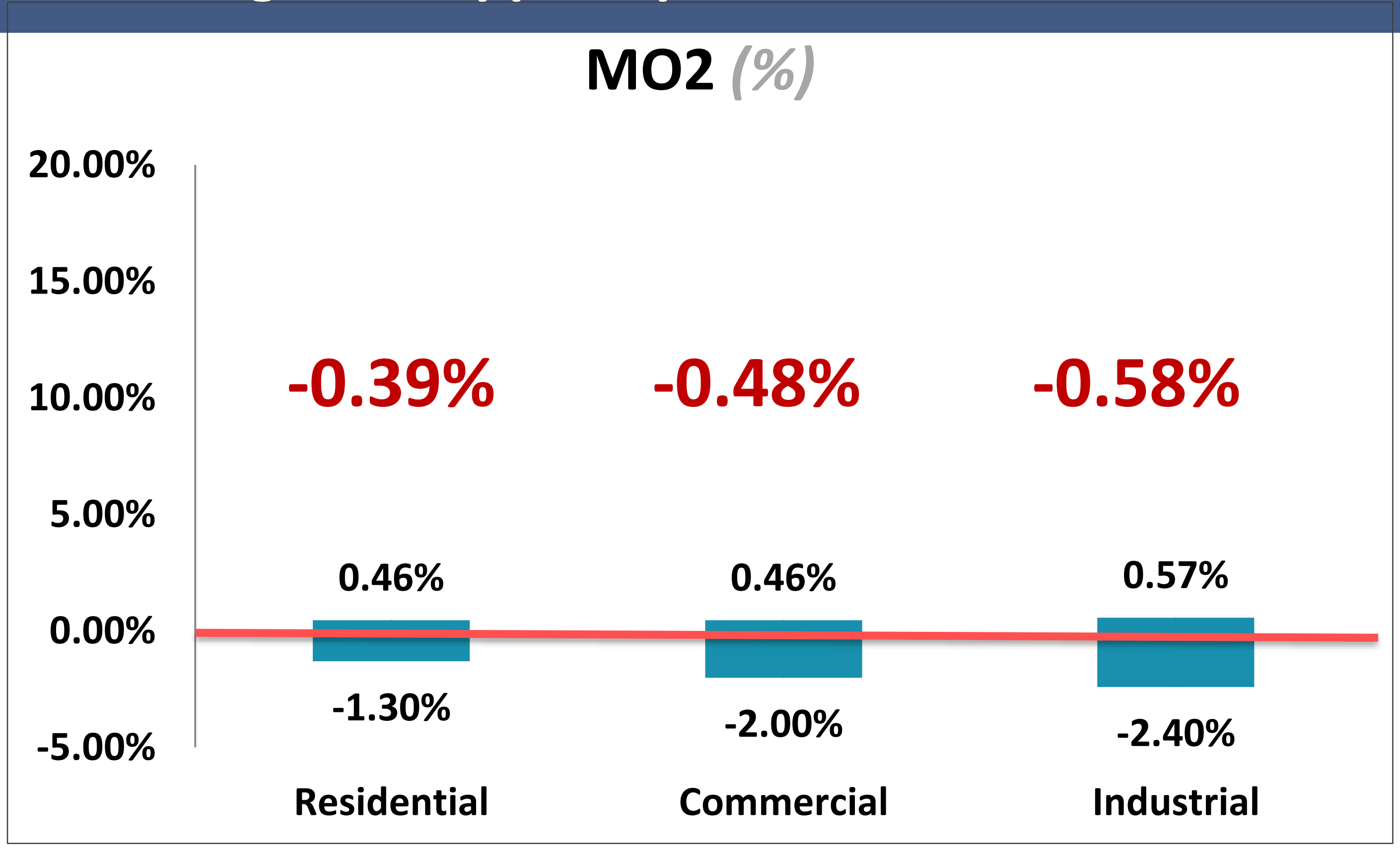
Annualized Transmission Rate Pressure

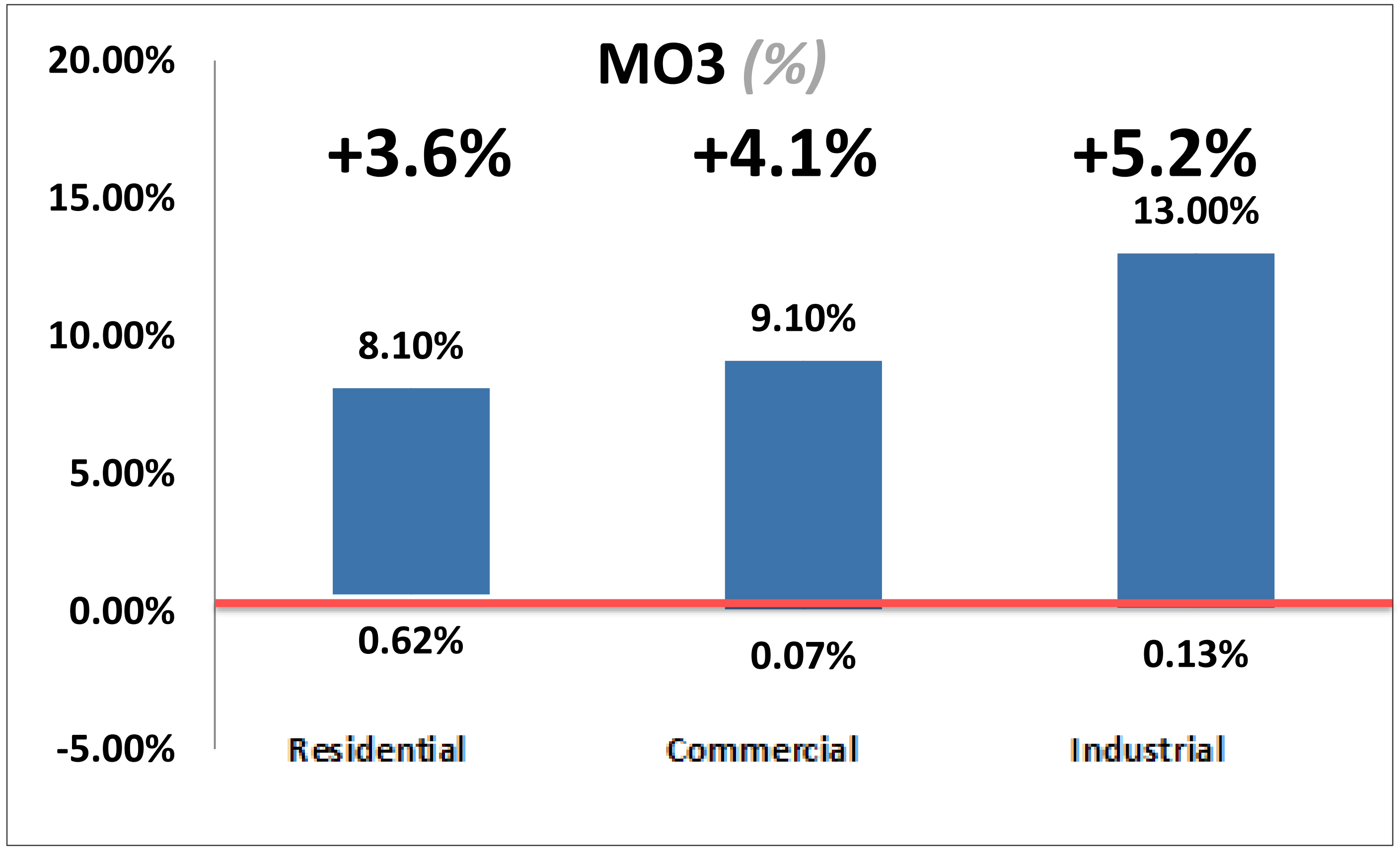


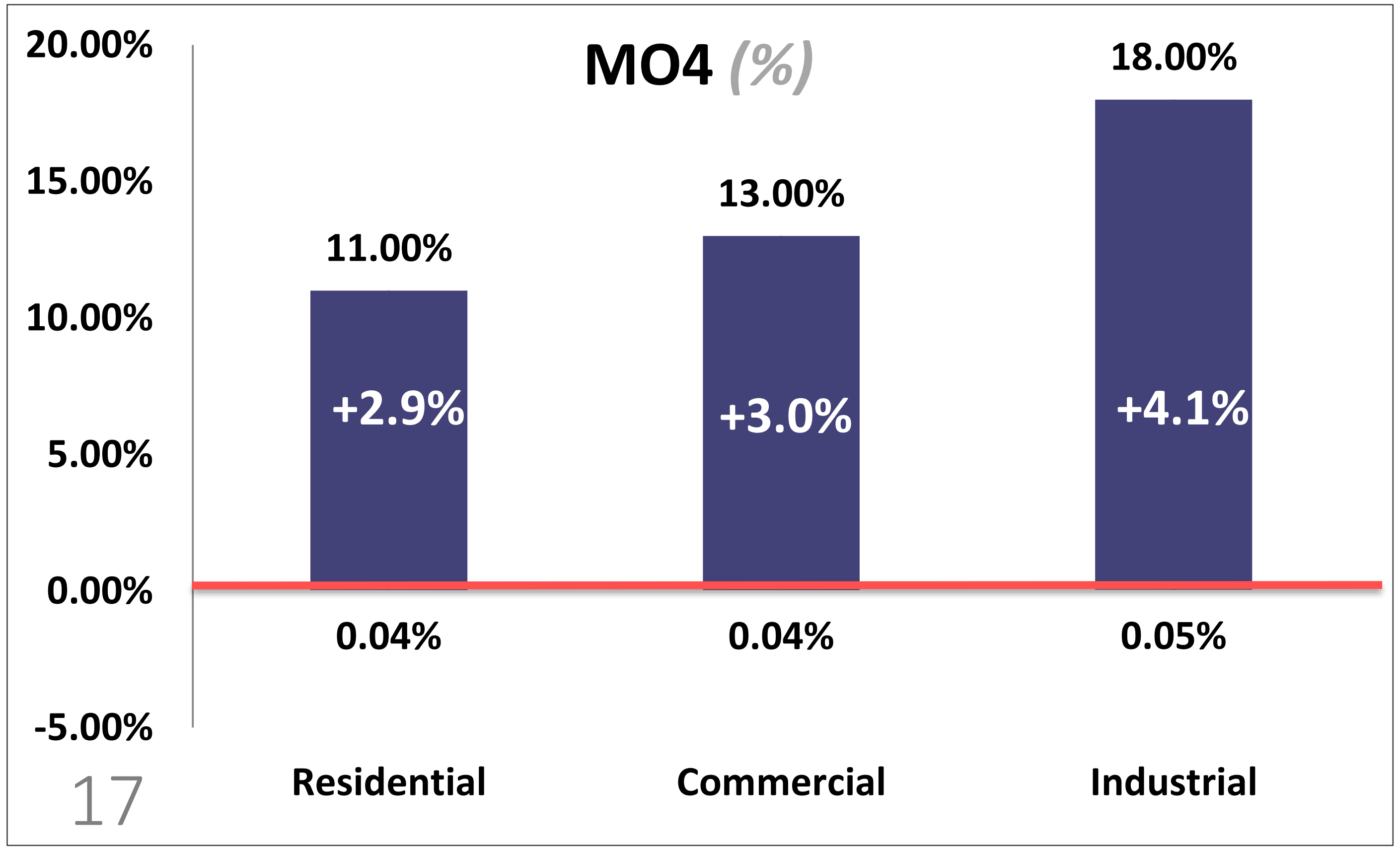
Retail Rate Effects: Weighted Average & Range

Change relative to NAA (MO1-MO4) for whole region, with larger impact to customers receiving BPA-supplied power



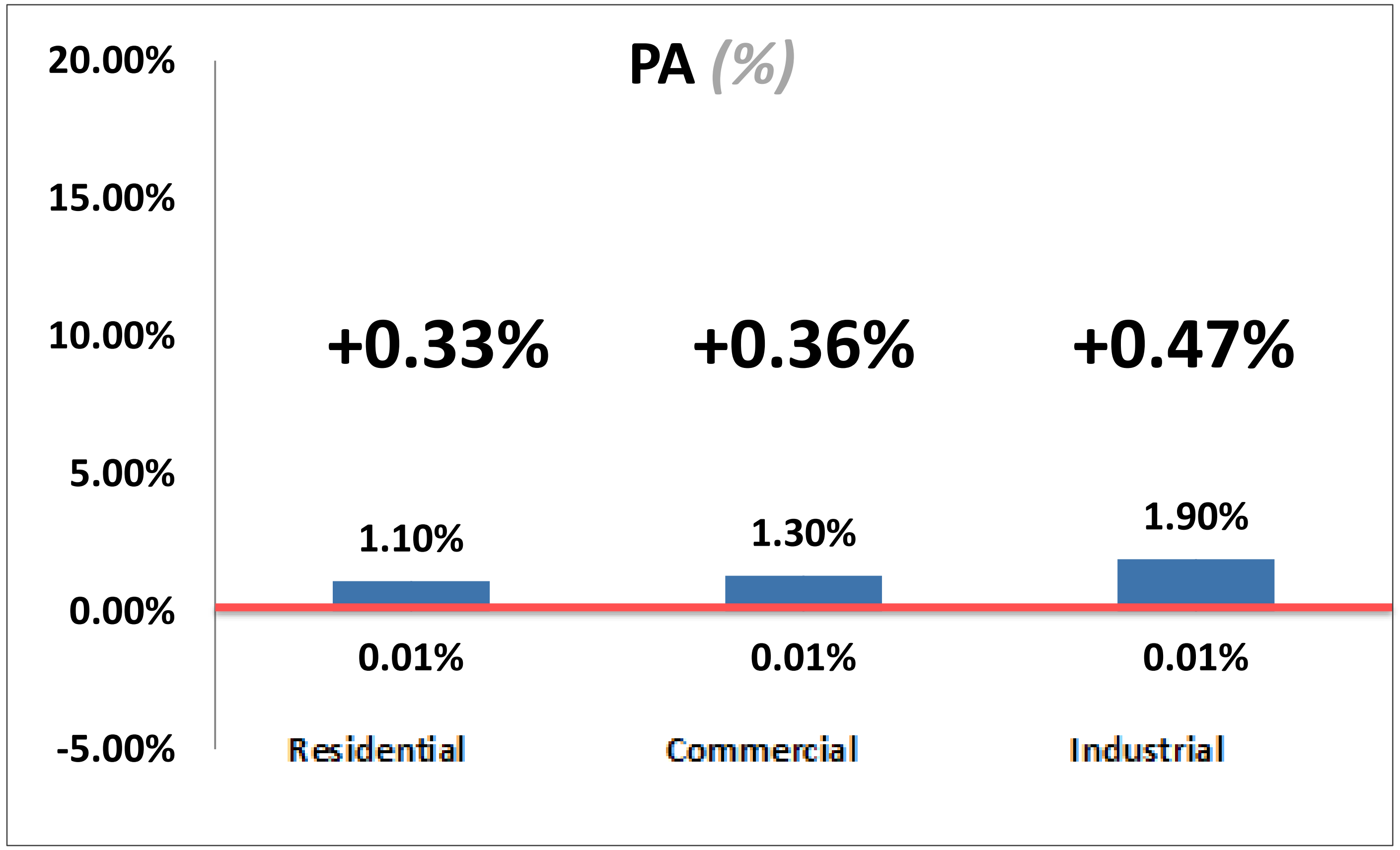




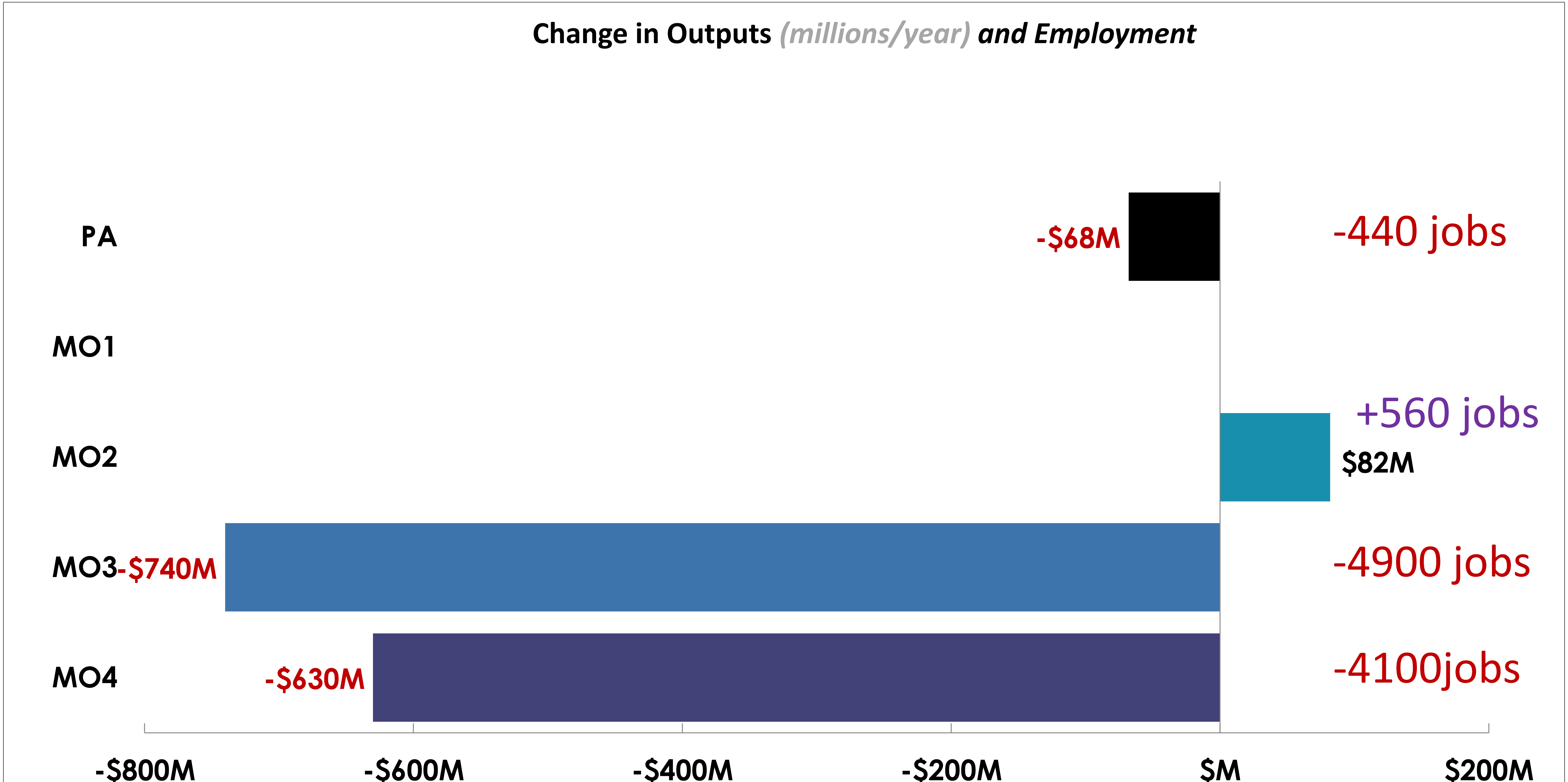


Retail Rate Effects: Weighted Average & Range

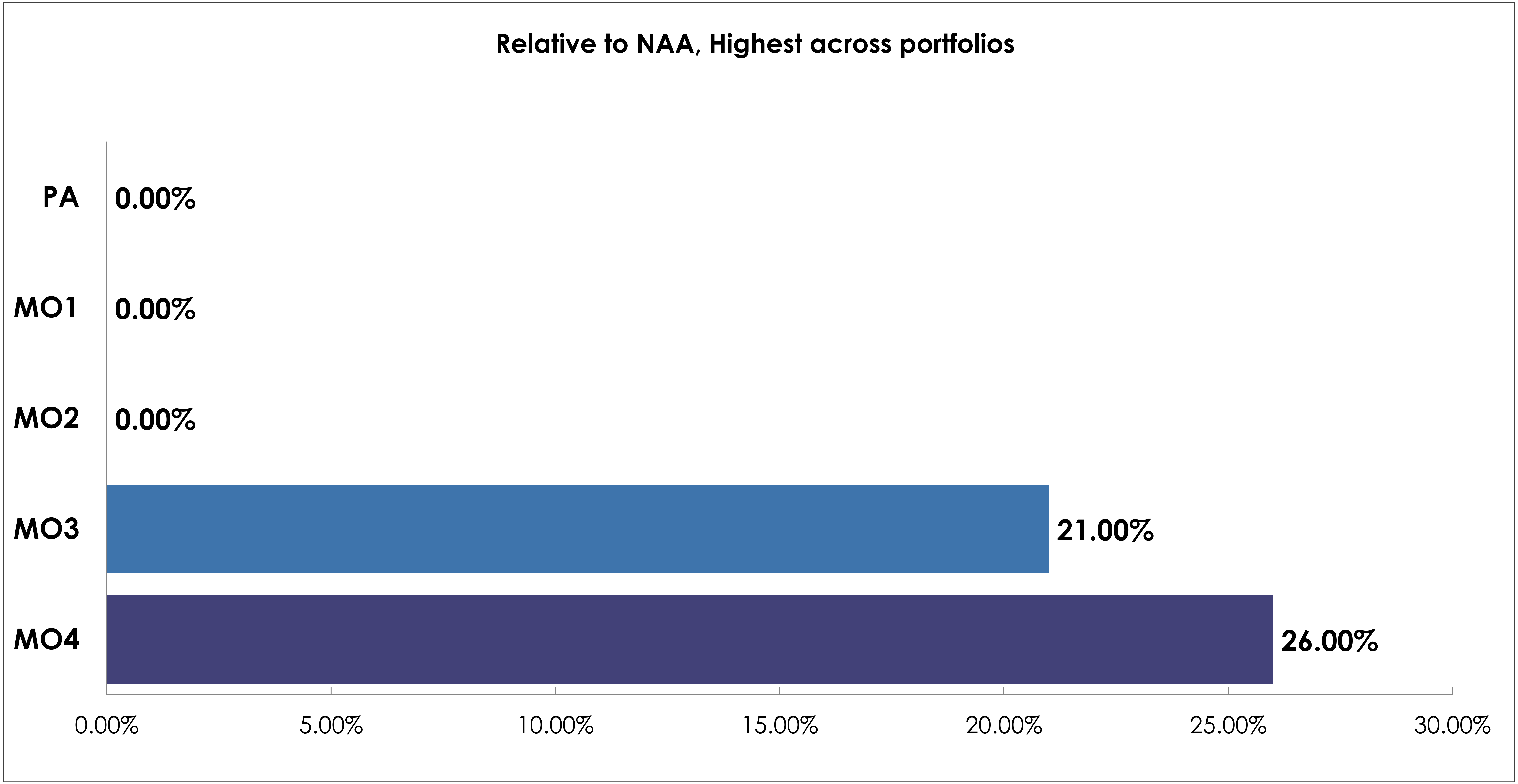
Change relative to NAA (PA) for whole region,
with larger impact to customers receiving BPA-supplied power



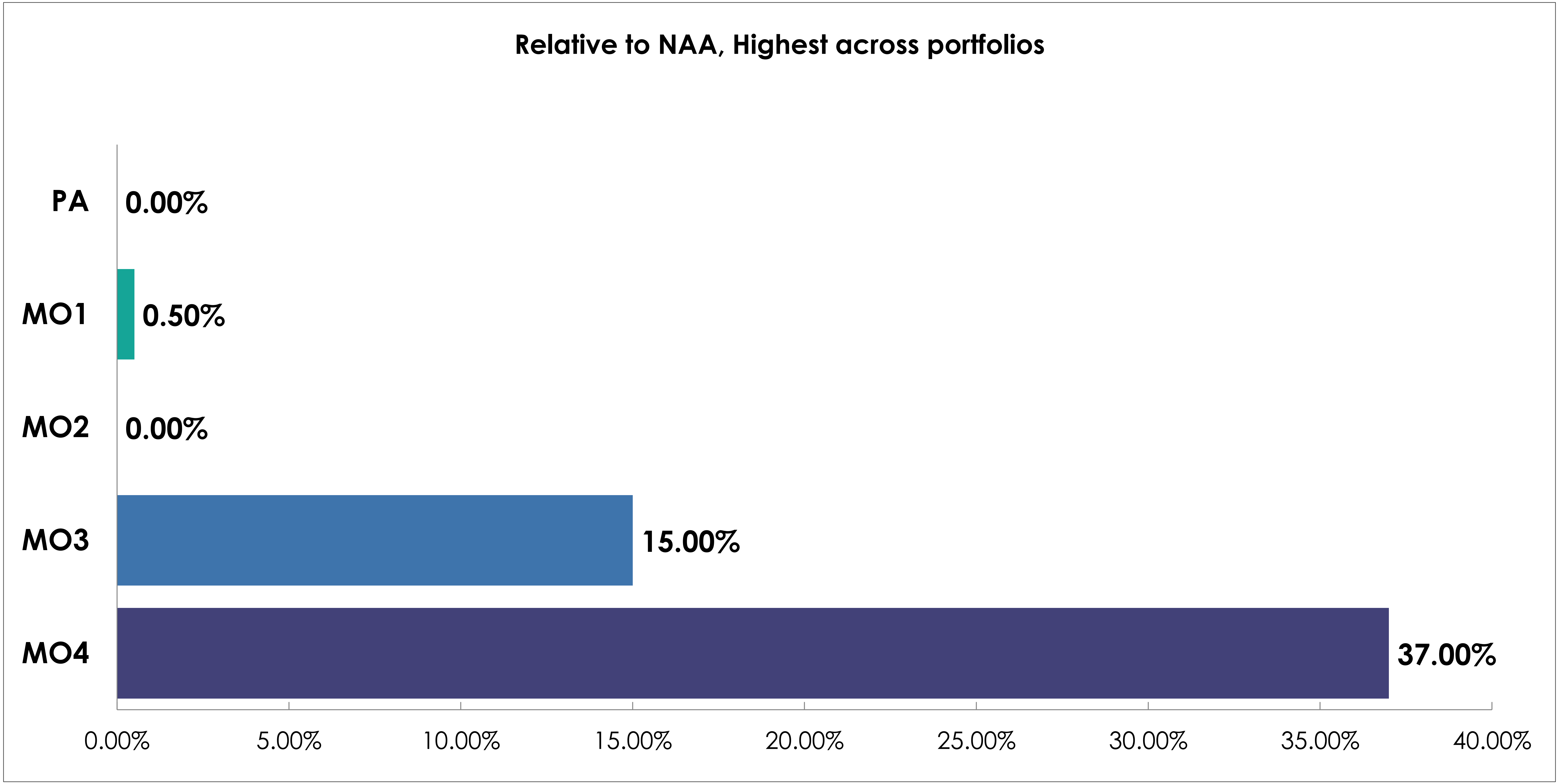
Regional Economic Productivity Effects



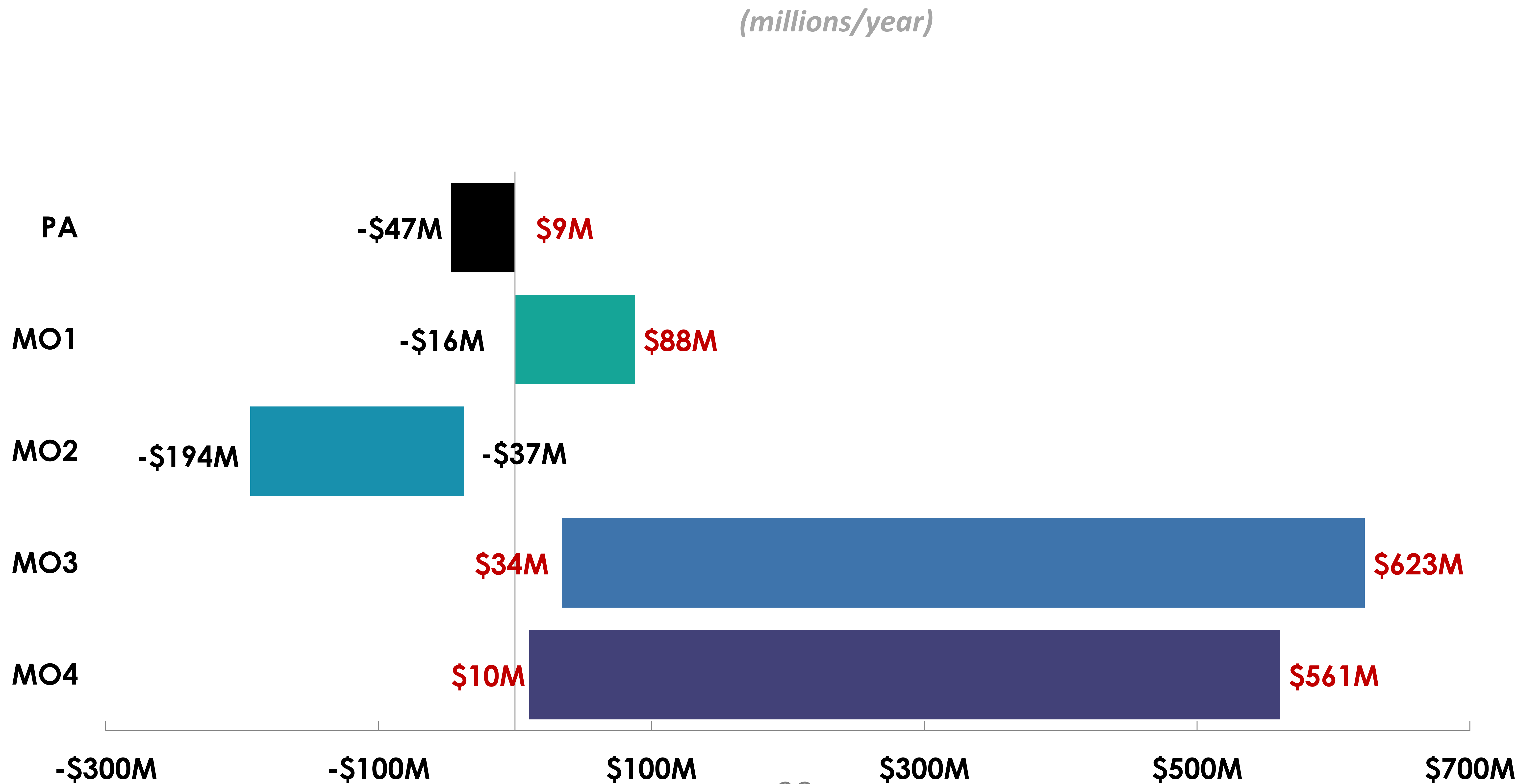
Share of Households Experiencing >5% increase in rates



Share of Businesses Experiencing >5% increase in rates



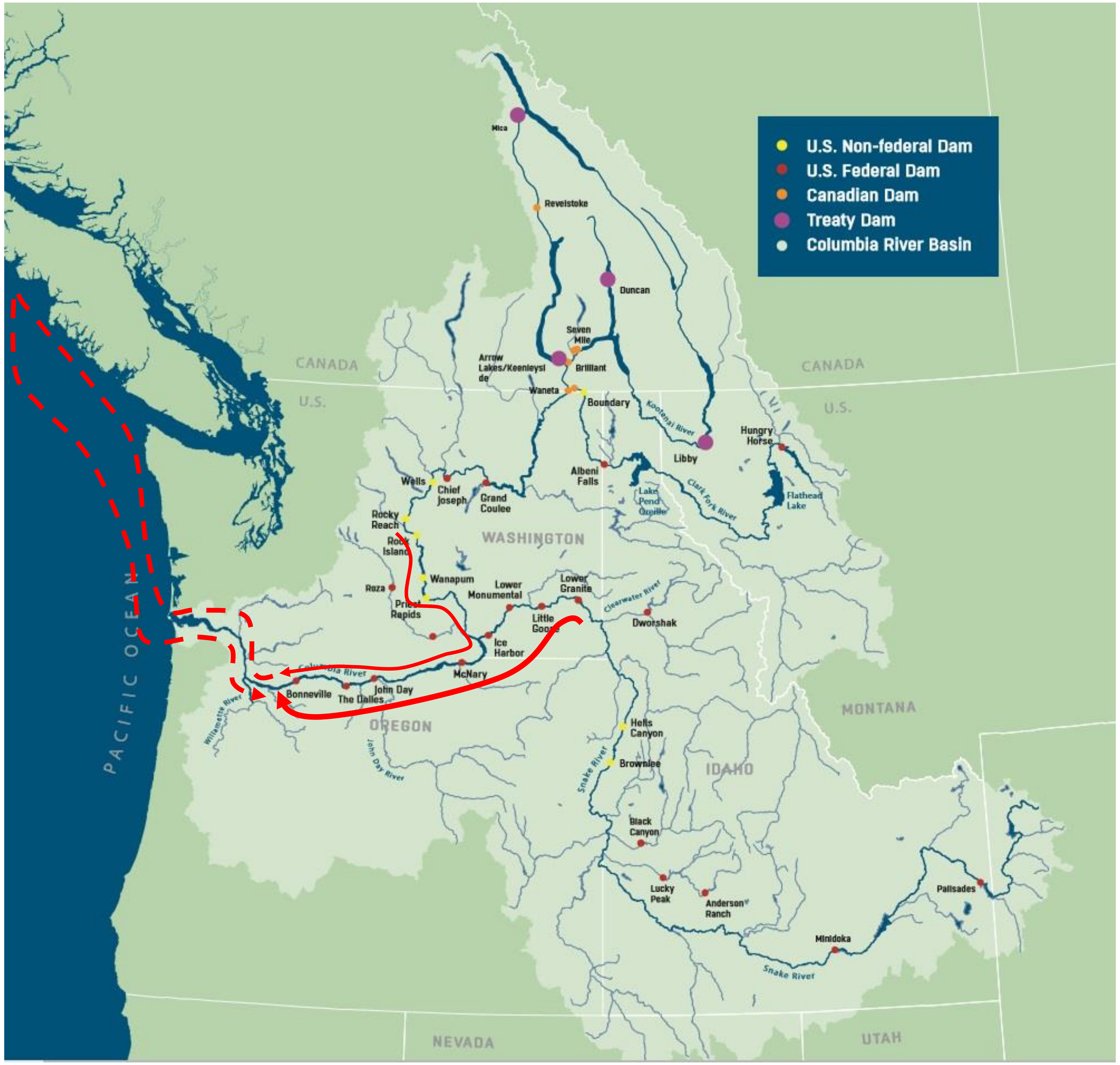
Regional Cost of Carbon Compliance



CRSO Analysis of Fish Impacts – Methods and Models Used for Analysis

Species/ESU/DPS	Analysis Methods
Upper Columbia River Spring-Run Chinook Salmon	**COMPASS, NWFSC Life Cycle Model (Wenatchee Population),** TDG Tool, CEM, Qualitative
Upper Columbia River Steelhead	**COMPASS**, TDG Tool, CEM, Qualitative
Upper Columbia River Coho Salmon	UC Spring Chinook surrogate, CEM, Qualitative
Columbia River Sockeye Salmon	UC Spring Chinook surrogate, CEM, Qualitative
Upper Columbia Summer/Fall Chinook Salmon	CEM, Qualitative
Middle Columbia Spring-Run Chinook salmon	UC Spring Chinook surrogate, CEM, Qualitative
Middle Columbia Steelhead	UC Spring Chinook surrogate, CEM, Qualitative
Snake River Spring/Summer Chinook Salmon	**COMPASS, CSS cohort model, NWFSC Life Cycle Model (Upper Salmon, South Fork Salmon, and Middle Fork Salmon MPGs), CSS Life Cycle Model (Grande Ronde/Imnaha MPG)** TDG Tool, CEM, Qualitative
Snake River Steelhead	**COMPASS, CSS cohort model, CSS Life Cycle Model (Grand Ronde/Imnaha MPG),** TDG Tool, CEM, Qualitative
Snake River Coho Salmon	Snake River Spring Chinook Salmon Surrogate, CEM, Qualitative
Snake River Sockeye Salmon	Snake River Spring Chinook Surrogate, CEM, Qualitative
Snake River Fall Chinook Salmon	CEM, Qualitative
Lower Columbia Spring Chinook Salmon	Snake River Spring/Summer-Run Chinook Salmon Surrogate, CEM, Qualitative
Lower Columbia Steelhead	Snake River Steelhead Surrogate, CEM, Qualitative
Lower Columbia River Coho Salmon	Snake River Spring Run Chinook Salmon Surrogate, CEM, Qualitative
Chum Salmon	Snake River Spring Run Chinook Salmon Surrogate, CEM, Qualitative
Pacific Eulachon	CEM, Qualitative
Green Sturgeon	CEM, Qualitative
Pacific Lamprey	CEM, Qualitative
American Shad	Qualitative

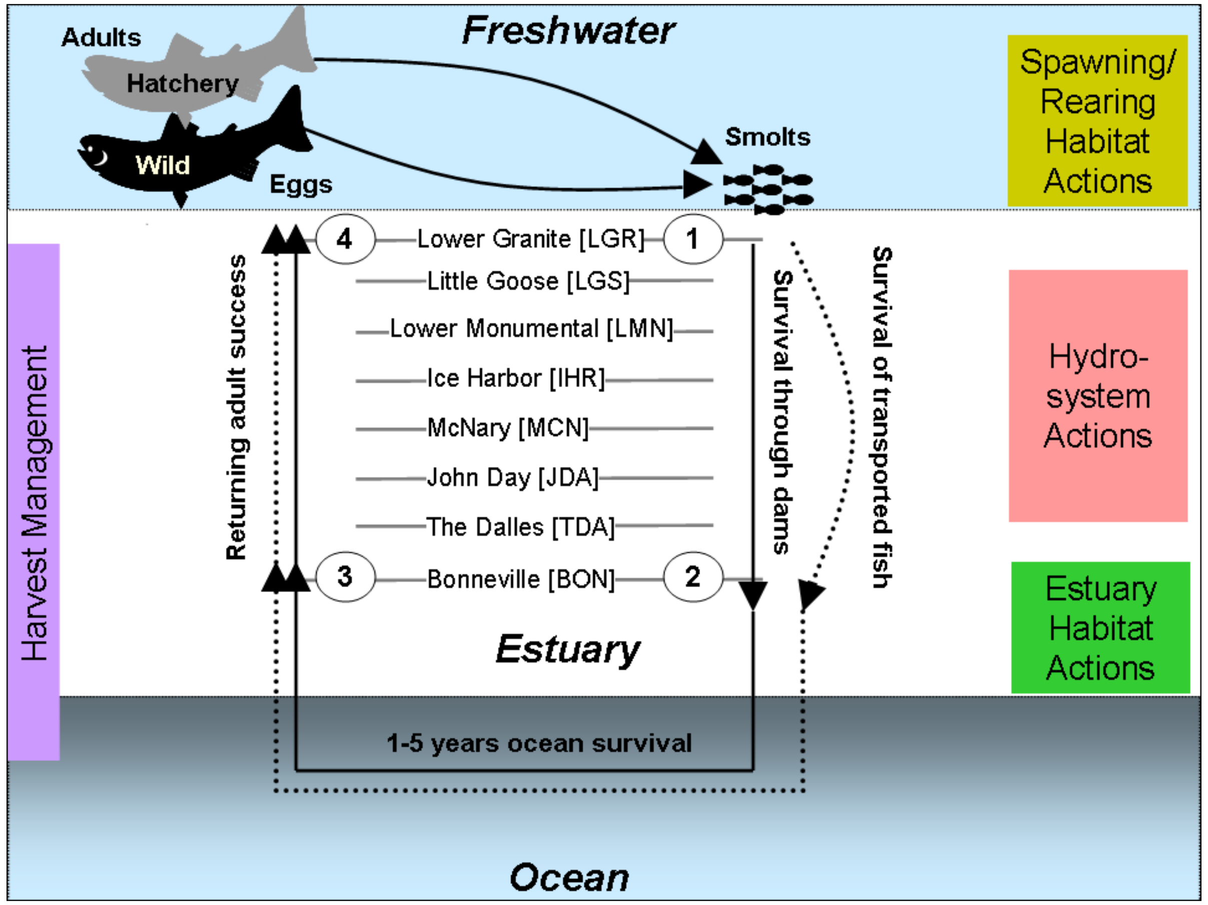
Columbia River System – Areas of quantitative model coverage



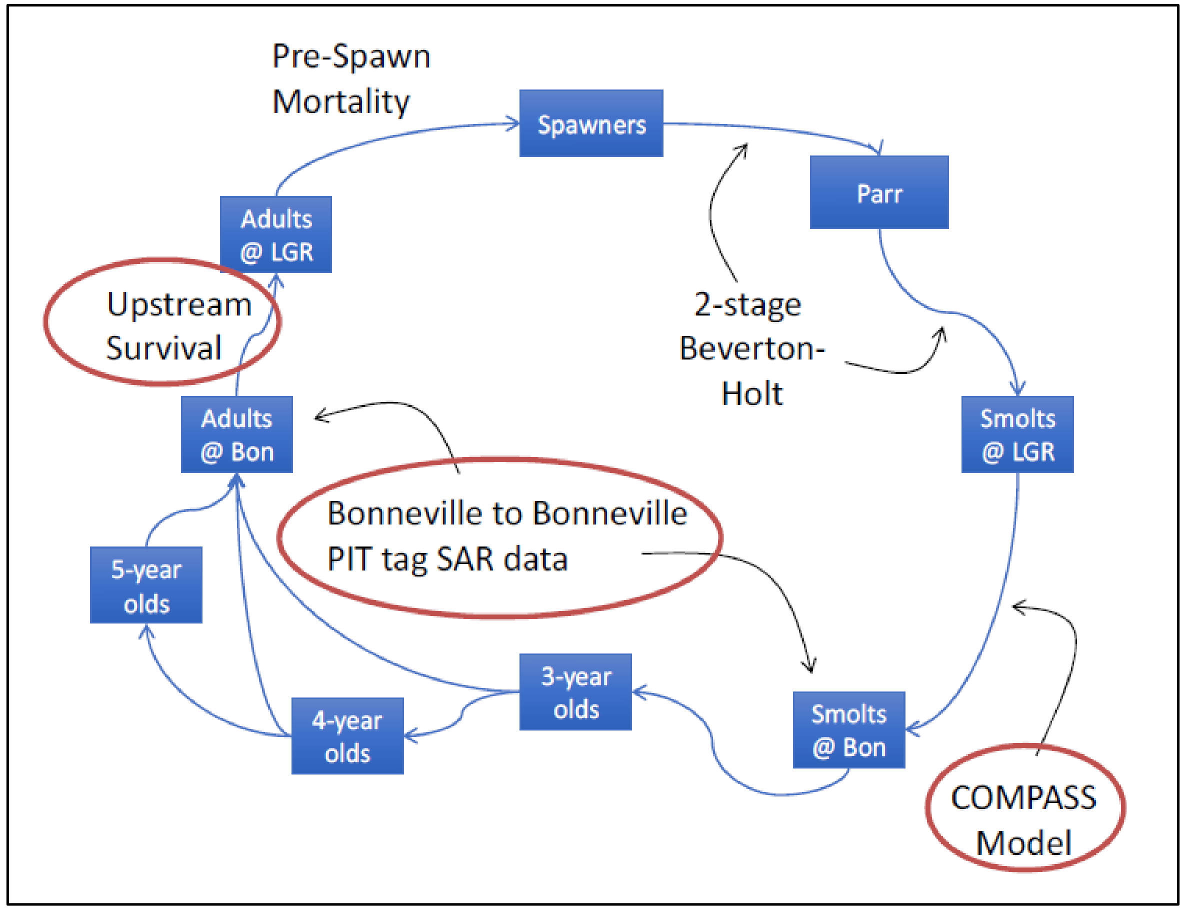
CSS and NOAA use various combinations of hatchery and natural origin fish

Both models use fish tagged specifically for study purpose as well as other studies

Life Cycle Model Analysis



Comparative Survival Study



NMFS - Life Cycle Model

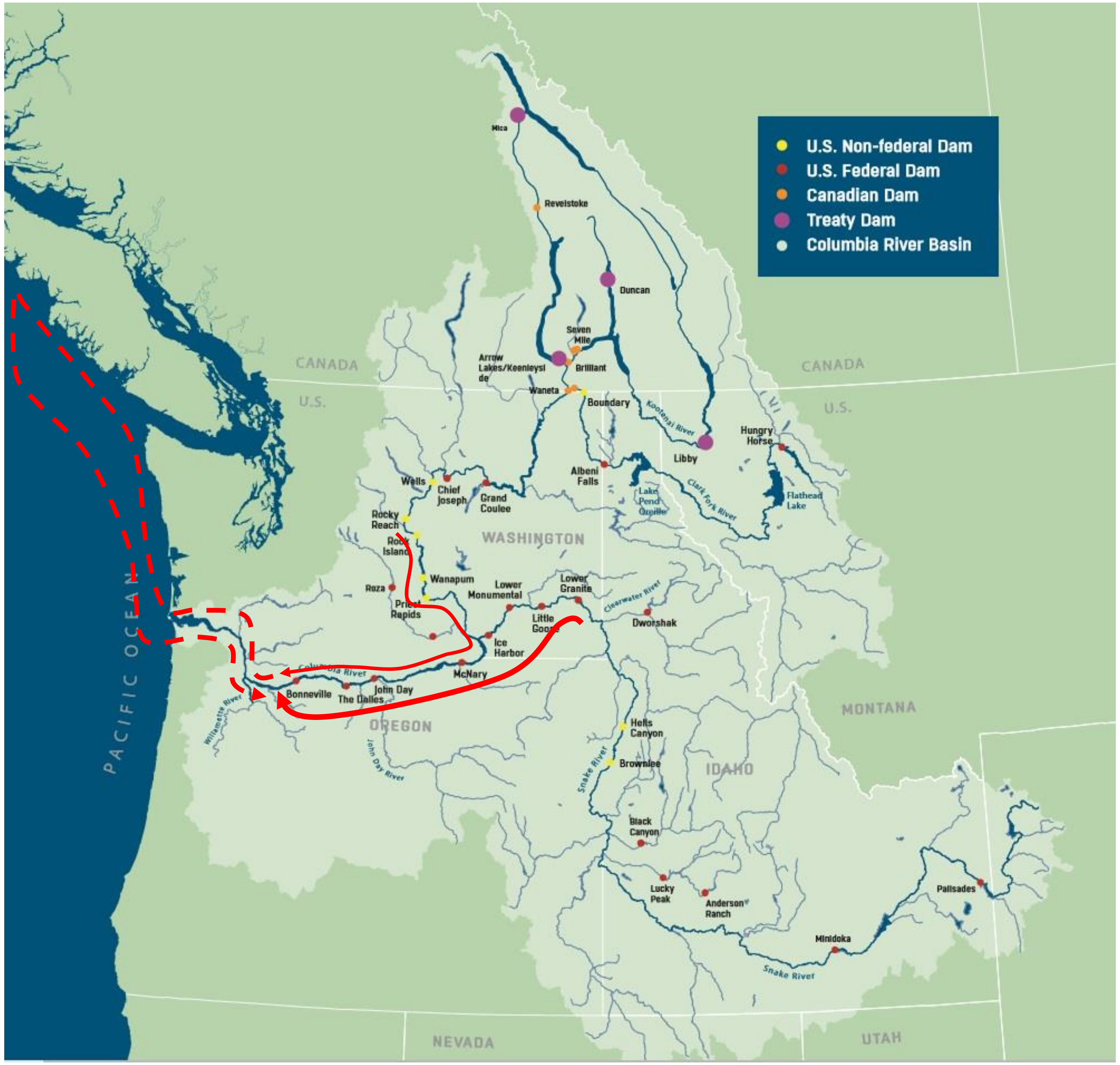
Primary Metrics Used in CRSO Analysis

- In-River Survival
- Powerhouse Encounter Rates
- Travel Time (fish and water)
- Transportation Rates
- Smolt to Adult Return Rates

Latent Mortality

- Delayed or “latent” mortality is mortality attributed to the CRS, but not experienced by juvenile salmon and steelhead until after they pass through the freshwater CRS.
- The CSS model attributes the reductions in returning adult salmon and steelhead to decreased ocean survival (delayed mortality) directly associated with passage past the dams (PITPH), but the CSS models also consider numerous other factors including:
    - Ocean conditions
    - Day of Year
    - Water Travel Time
    - Water Temperature
- NMFS’s LCM attributes the primary influence to adult returns to the arrival time of juveniles entering the ocean (e.g., fish that enter the ocean later in their migration run-timing tend to have lower survival), and deteriorating ocean conditions (decadal scale cycles in ocean productivity and warming water in the Northeast Pacific).

Columbia River System – Areas of quantitative model coverage



UCR Spring Chinook Salmon

Anadromous Fish

Absolute & Relative to NAA Values

	NAA	MO1	MO2	MO3	MO4
In-river Survival	LCM 69.5%	70.0% 0%	68.2% -2%	70.1% +1%	71.0% +2%
PITPH	LCM 3.29	3.08 -6%	3.66 +11%	2.89 -12%	2.53 -23%
SARS	LCM 0.94%	0.95% +1%	0.93% -1%	0.95% +1%	0.96% +2%

UCR Spring Chinook Salmon

Anadromous Fish

Absolute & Relative to NAA Values

	NAA	PA	MO1	MO2	MO3	MO4
In-river Survival	LCM 69.5%	70.4% +1%	70.0% -0%	68.2% -2%	70.1% +1%	71.0% +2%
PITPH	LCM 3.29	2.96 -8%	3.08 -6%	3.66 +11%	2.89 -12%	2.53 -23%
SARS	LCM 0.94%	0.97% +3%	0.95% +1%	0.93% -1%	0.95% +1%	0.96% +2%

UCR Steelhead

Anadromous Fish

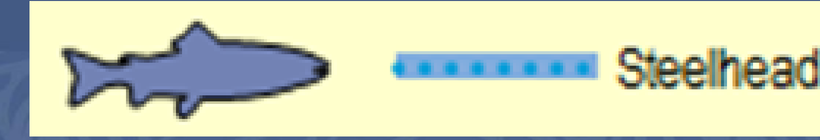
Steelhead

Absolute & Relative to NAA Values

	NAA	MO1	MO2	MO3	MO4
In-river Survival	LCM 65.8%	65.6% -0%	63.4% -3.5%	65.6% -0%	66.1% +0.4%
PITPH	LCM 2.72	2.59 -5%	2.89 +6%	2.52 -7%	2.31 -15%
SARS	LCM 2.26	N/A	N/A	N/A	N/A

UCR Steelhead

Anadromous Fish



Absolute & Relative to NAA Values

	NAA	PA	MO1	MO2	MO3	MO4
In-River Survival	65.8%	65.7% -0.2%	65.6% -0%	63.4% -3.5%	65.6% -0%	66.1% +0.4%
PITPH	2.72	2.58 -5%	2.59 -5%	2.89 +6%	2.52 -7%	2.31 -15%
SARS	2.26	N/A	N/A	N/A	N/A	N/A

Chinook Salmon

Snake River Spring Chinook Salmon

Anadromous Fish

Absolute & Relative to NAA Values

	NAA	MO1	MO2	MO3	MO4
In-river Survival	CSS 57.6% LCM 50.4%	58.3%/+0.7% 51.0%/-0.6%	53.7%/-6.7% 50.1%/-0.6%	68.2%/+18.4% 60%/+19.0%	63.5%/+10.2% 50.7%/+0.7%
PITPH	CSS 2.15 LCM 2.25	1.74/-19.0% 1.88/-16.0%	3.48/+62.0% 3.02/+34.0%	0.56/-74.0% 0.66/-71.0%	0.34/-84.0% 0.49/-78.0%
SARS	CSS 2.0% LCM 0.88%	2.2%/+10.0% 0.88%/0.0%	1.4%/-30.0% 0.9%/+2.3%	4.3%/+115.0% 1.0%/+13.6%	3.5%/+75.0% 0.8%/-12.5%

Chinook Salmon

Snake River Spring Chinook Salmon

Anadromous Fish

Absolute & Relative to NAA Values

	NAA	PA	MO1	MO2	MO3	MO4
In-river Survival	CSS 57.6% LCM 50.4%	60.5%/+5% 51%/+1%	58.3%/+0.7% 51.0%/-0.6%	53.7%/-6.7% 50.1%/-0.6%	68.2%/+18.4% 60%/+19.0%	63.5%/+10.2% 50.7%/+0.7%
PITPH	CSS 2.15 LCM 2.25	.98/-54% 1.2/-48%	1.74/-19.0% 1.88/-16.0%	3.48/+62.0% 3.02/+34.0%	0.56/-74.0% 0.66/-71.0%	0.34/-84.0% 0.49/-78.0%
SARS	CSS 2.0% LCM 0.88%	2.7%/+35% 0.81%/-7.5%	2.2%/+10.0% 0.88%/0.0%	1.4%/-30.0% 0.9%/+2.3%	4.3%/+115.0% 1.0%/+13.6%	3.5%/+75.0% 0.8%/-12.5%

Snake River Steelhead

Anadromous Fish

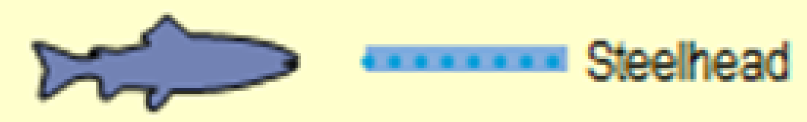
Steelhead

Absolute & Relative to NAA Values

	NAA	MO1	MO2	MO3	MO4
In-river Survival	CSS 57.1% LCM 42.7%	58.8%/+2.9% 42.2%/-1.1%	44.4%/-22.2% 40.2%/-6.0%	83.1%/+45.5% 52.7%/+23.3%	73.7%/+29.1% 43.1%/-1.0%
PITPH	CSS 1.96 LCM 1.73	1.64/-16.3% 1.47/-14.7%	3.26/+66.3% 2.26/+30.8%	0.46/-76.5% 0.42/-75.6%	0.28/-85.7% 0.35/-79.9%
SARS	CSS 1.8% LCM N/A	1.9%/+5.6% N/A	1.3%/-27.8% N/A	5.0%/+177.8% N/A	3.1%/+72.2% N/A

Snake River Steelhead

Anadromous Fish

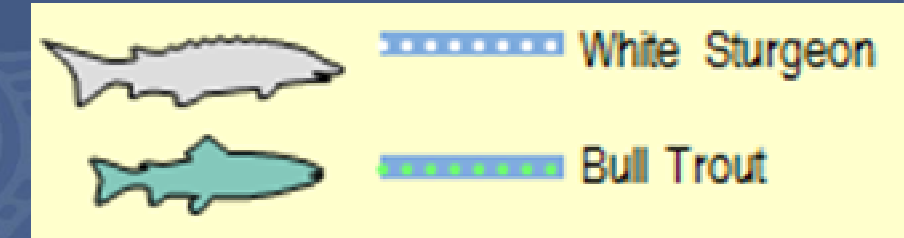


Absolute & Relative to NAA Values

	NAA	PA	MO1	MO2	MO3	MO4
In-river Survival	CSS 57.1% LCM 42.7%	64.5% 42.8%	58.8%/+2.9% 42.2%/-1.1%	44.4%/-22.2% 40.2%/-6.0%	83.1%/+45.5% 52.7%/+23.3%	73.7%/+29.1% 43.1%/-1.0%
PITPH	CSS 1.96 LCM 1.73	0.88 0.93	1.64/-16.3% 1.47/-14.7%	3.26/+66.3% 2.26/+30.8%	0.46/-76.5% 0.42/-75.6%	0.28/-85.7% 0.35/-79.9%
SARS	CSS 1.8% LCM N/A	2.3% +28% LCM N/A	1.9%/+5.6% N/A	1.3%/-27.8% N/A	5.0%/+177.8% N/A	3.1%/+72.2% N/A

Resident Fish

Effects for multi-species for regions A-D



Qualitative Results	PA	MO1	MO2	MO3	MO4
Region A Upper Basin	Mixed Results Minor +/-	Mixed Results Minor +/-	Moderate -	Mixed Results Minor +/-	Major -
Region B Grand Coulee & Mid-C	**Minor -**	Minor -	Minor -	Mixed Results Minor or moderate +/-	Moderate -
Region C Lower Snake & Salmon	Mixed Results Minor +/-	Minor -	Minor -	Major - then Major +	Minor / Moderate -
Region D Lower Columbia	Mixed Results Minor +/-	Minor -	Moderate -	Minor -	Minor / Moderate -