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May 7, 2024

MEMORANDUM

TO: Council Members

FROM: Dor Hirsh Bar Gai

SUBJECT: Comparison of System Changes under New Federal Commitments

BACKGROUND:

Presenter: Dor Hirsh Bar Gai, John Ollis

Summary: For power planning and resource adequacy assessments, the Council aims to model the existing system to the best of its capabilities. An important piece of this is to model the hydro operations consistent with any requirements for river operations. To that end, staff recently made updates to the Council's GENESYS model to reflect changes to hydro operations resulting from the US Government commitments issued in December 2023 to increase spill for improved juvenile fish survival in the Lower Snake and Lower Columbia. Staff will present the results of implementing those changes, focusing on the impacts on hydro generation.

The impact of increased spill is reduced spring and early summer hydro generation. There is minor hydro generation reduction in the fall and winter, varying by project. However, an increase in hydro generation is expected in August. In addition to monthly changes in average hydro generation, minor changes in daily hydro generation flexibility are also expected.

While hydropower is slightly reduced, based on the limited subset of studies used for this analysis, the commitments do not lead to a

significantly different regional adequacy result. Offsetting the reduced hydropower is a small increase in regional thermal generation and net imports throughout most of the year, especially at night. These system implications seem to result in a small regional cost savings. However, further analysis would be needed to better understand full system impact.

Relevance: A change in hydro operations can have reverberating impacts throughout the region's power system. Continuously reviewing and modeling new assumptions and requirements in the hydro system is key for Council analysis. These new commitments will serve as the new assumed hydro spill operations in GENESYS, the Council's adequacy and detailed hydro operations production cost model.

Workplan: B.1.3 Continued Enhancement of GENESYS operations to support periodic studies and next power plan.

Background: The new US Government commitments aim to improve juvenile fish survival through the Lower Snake and Lower Columbia rivers. The commitments focus on modifying spill operations, with the biggest changes during April-August featuring higher levels of maintained spill.

The main spill change driving the commitments is a shift away from the 125% flex spill operation during the spring and summer. Previously, what staff analysis calls "existing system", spill included two types of operations depending on the plant during each day: constant spill and percent of flow. From the start of the spill season (April 3rd for Lower Snake and April 10th for Lower Columbia) until June 15th (Lower Columbia) or June 20th (Lower Snake) the operations could include a combination of constant and percent spill, fluctuating for periods of 16 and 8 hours per day. June 16 to August 14 had a different spill regime (again, either constant or percent), as well as August 15-31.

Instead of 125% flex spill, the new commitments require for most projects in the Lower Snake and Columbia a consistent spill regime at higher levels of maintained spill without changing during the day - no more fluctuating between 16- and 8-hour changes from start of April spill until June 15th or the 20th. The summer operations have modified the date for the reduction of summer spill to July 31 instead of August 15, resulting in a reduced spill regime for all of August 1-31.

Comparison of System Changes under New Federal Commitments

May 14, 2024 Council Meeting

Dor Hirsh Bar Gai
John Ollis



Northwest **Power** and
Conservation Council

Agenda

- Background
- The study
- High level insights
 - Spill impacts on hydro operations
 - Generation
- Additional system perspectives
 - Thermal generation
 - Market dynamics
- System costs

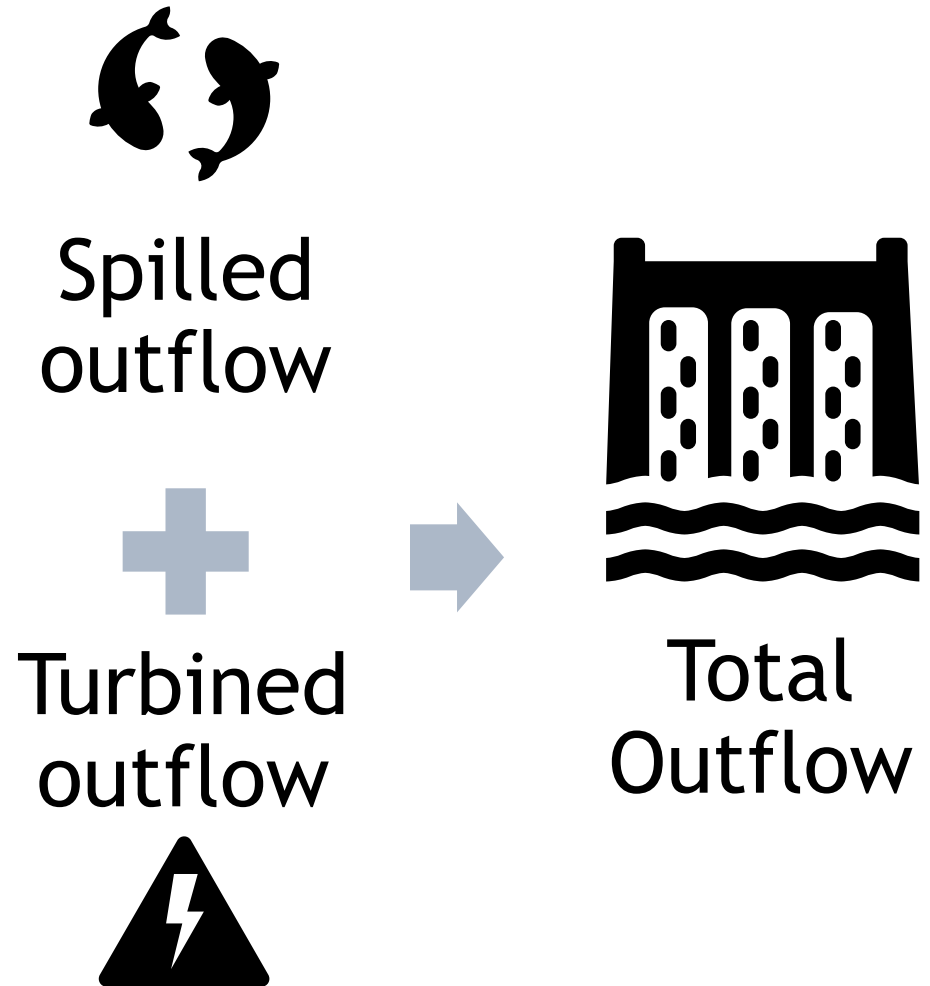


Background Information and Study Setup

Overview of Commitments from a Modeling Perspective

Background

- The US Government commitments aim to improve juvenile fish survival through the Lower Snake and Lower Columbia rivers by increasing spill operations
 - Mainly shifting away from April-August 125% Flex Spill regime to feature higher levels of maintained spill
- The PNW hydro system is highly constrained, where changes to operations could have multiple impacts



In a system with heavily regulated outflows, an increase in spill can result in a reduction of turbined outflow and less generation, as well as changes to reservoir storage use

The New Commitments

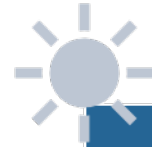
Model cannot dynamically adjust generation and flow by fish quantity metrics



Spring

- **Lower Snake**
 - 4/3 to 6/20
 - Modification: spill to 125% TDG for full 24 hours/day
 - Previously: combination of spill requirements across 16- and 8-hour periods per day
- **Lower Columbia**
 - 4/10 to 6/15
 - Modification:
 - McNary & Bonneville: flex spill to 125% TDG for full 24 hours/day
 - John Day: changes to day- and nighttime- spill
 - The Dalles: no change

Updated spill values



Summer

- **Lower Snake**
 - 6/21 to 7/31 (previous ended on 8/14)
 - 8/1 to 8/31 (previously 8/15-8/31)
 - No change to spill percent or volume, just dates when applied
- **Lower Columbia**
 - 6/16 to 7/31 (previous ended on Aug 14)
 - 8/1 to 8/31 (previously 8/15-8/31)
 - No change to spill percent or volume, just dates when applied

Updated spill dates



Fall & Winter

- **Lower Snake**
 - 9/1 to 11/15, 3/1 to 3/20 → surface weir (SW) 4-hour (5-9am) spill, 7 days per week,
 - 3/21 to 4/2 SW spill 24 hours
- **Lower Columbia**
 - McNary & John Day:
 - 9/1 to 11/15, 3/1 to 3/20 → surface weir (SW) 4-hour (5-9am) spill, 7 days per week,
 - 3/21 to 4/9 SW sill 24 hours
 - No change for the Dalles & Bonneville

Updated spill values

The Comparison Study

30 climate change water years spanning three climate scenarios (10 each)

- CanESM2 (A)
- CCSM4 (C)
- CNRM (G)

Shared assumptions (identical setup)

- Loads
- Resources
- Market fundamentals
- Hydro operations (excluding spill)
- “Everything else”

Different assumptions - the change to test influence on system

- Existing spill regime (used in the 2021 Power Plan, 2027 adequacy assessment) - the “Existing” Study
- New Commitment spill regime - the “New Federal” Study



Spill Impacts on Hydro Operations

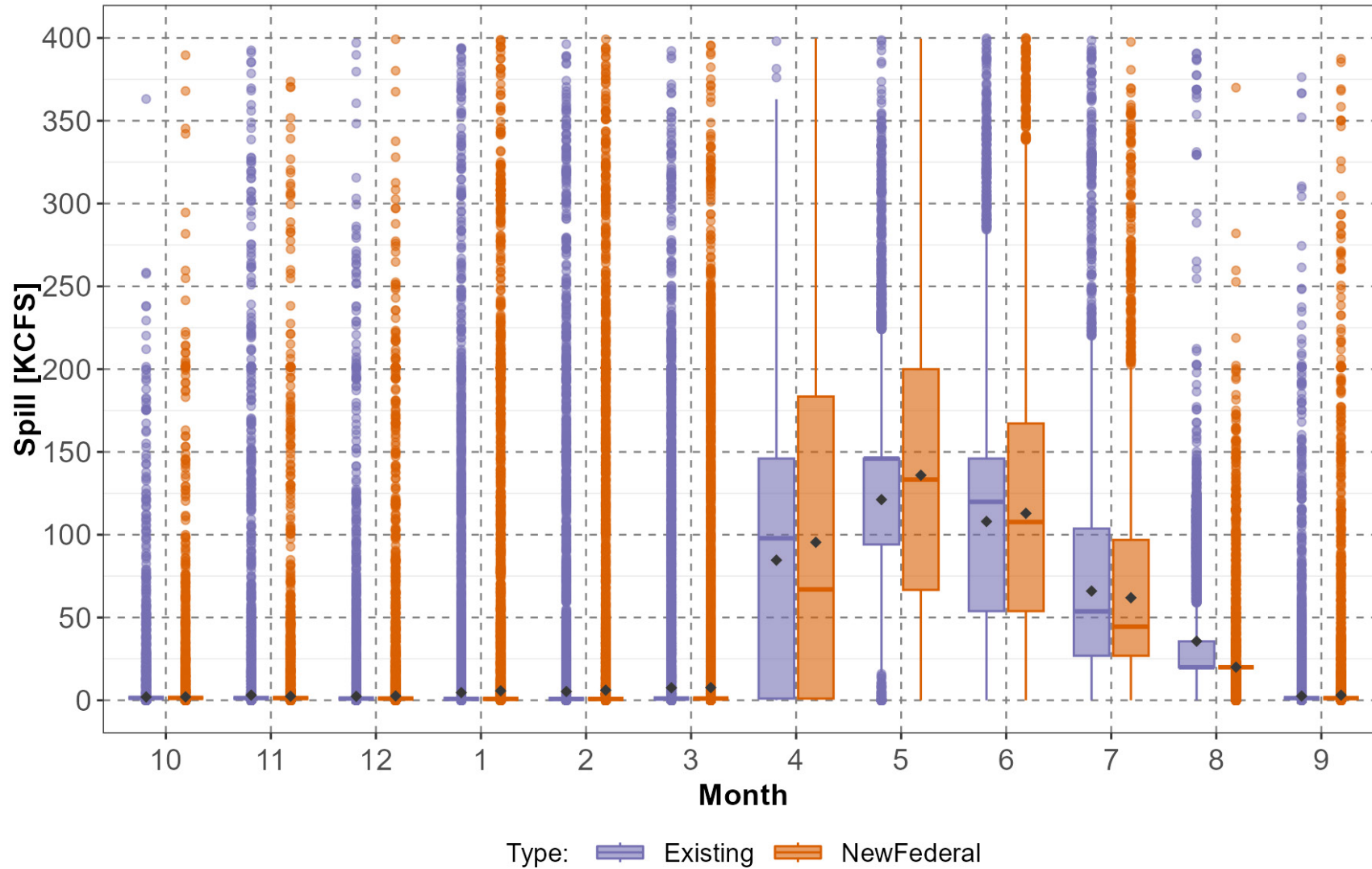
High level summary and examples of operations changes in GENESYS

High level impact of New Spill on Hydro Operations

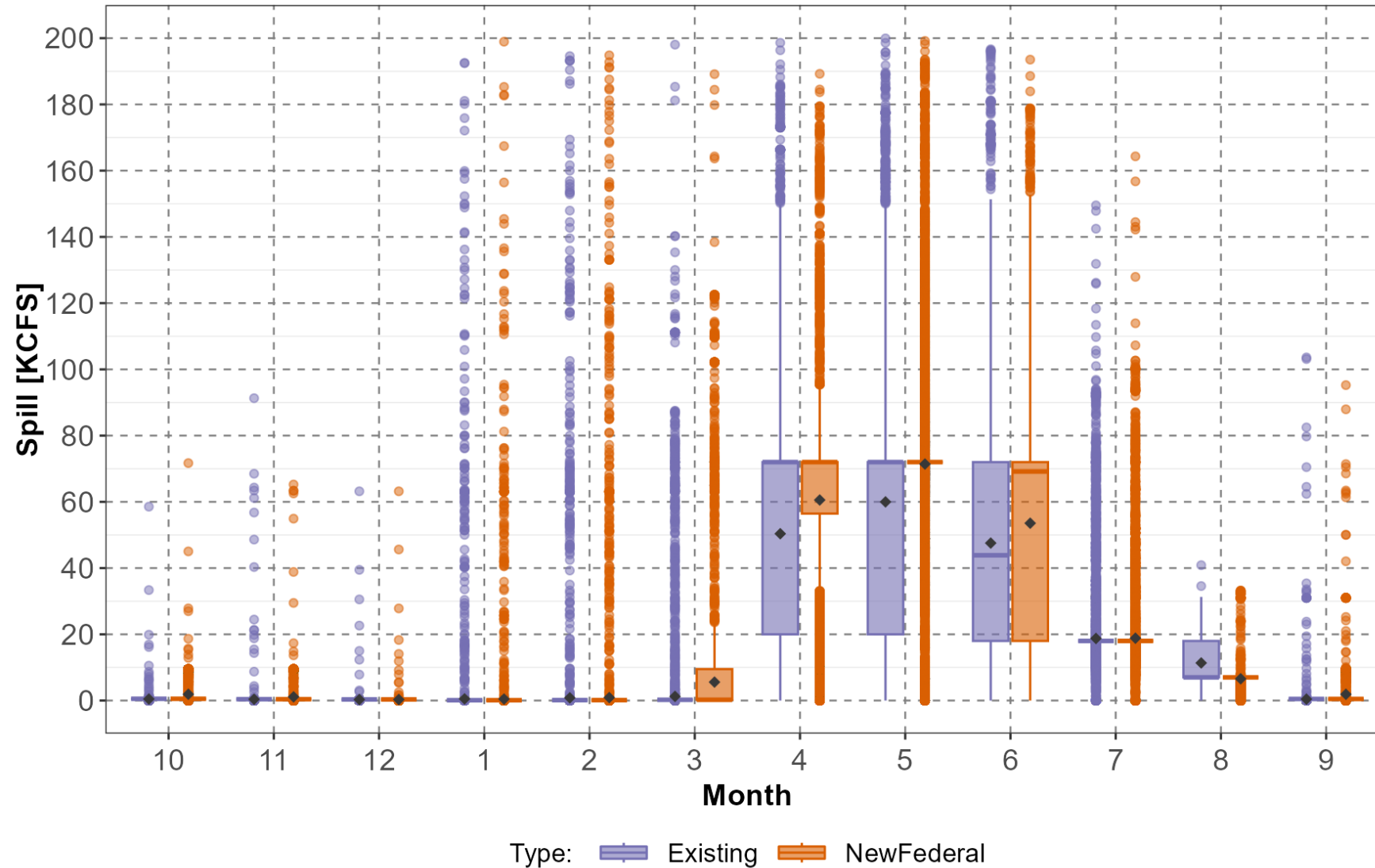
- Increased spill at plants as can be expected, either as:
 - Increased average spill
 - Higher floor / maintained high ceiling
- Various and typically minor changes to total outflow and storage
 - Plant specific
 - Slightly greater use of storage in winter (lower hourly storage levels)
 - Mix of similar, greater, or lower use of storage in spring and summer by plant

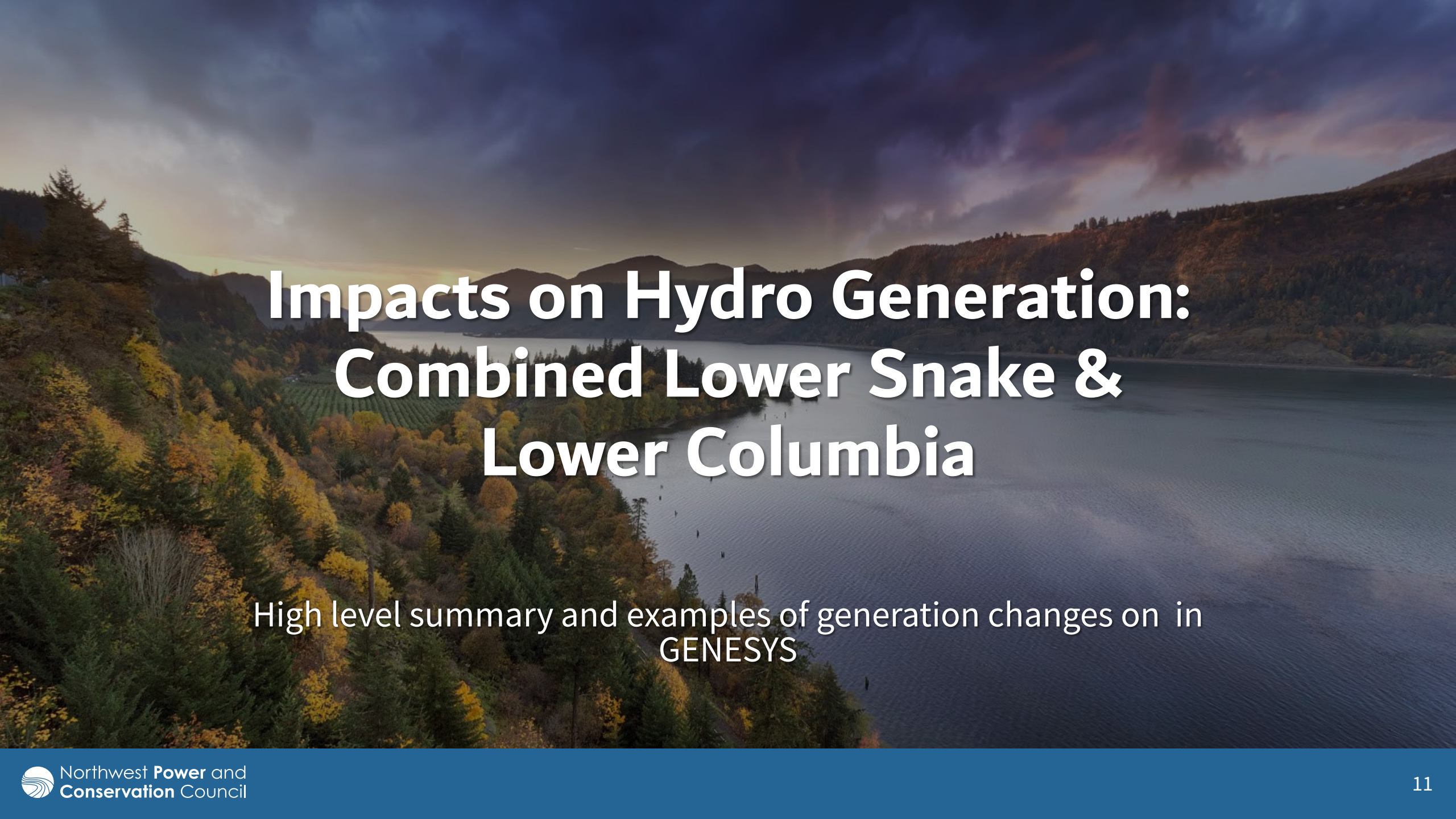
Staff is happy to hold follow up discussions on individual plants

John Day Hourly Spill



Lower Granite Hourly Spill





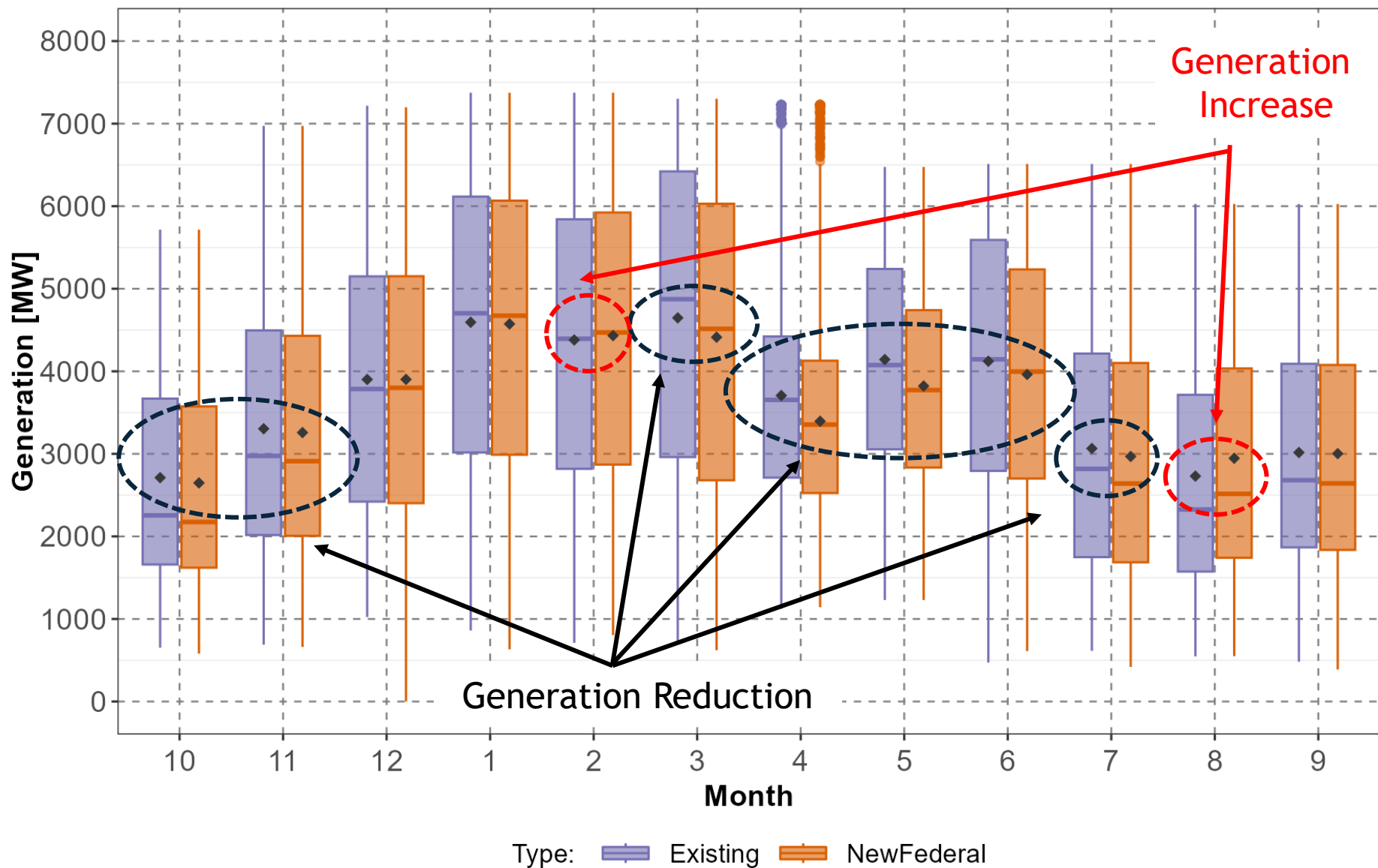
Impacts on Hydro Generation: Combined Lower Snake & Lower Columbia

High level summary and examples of generation changes on in
GENESYS

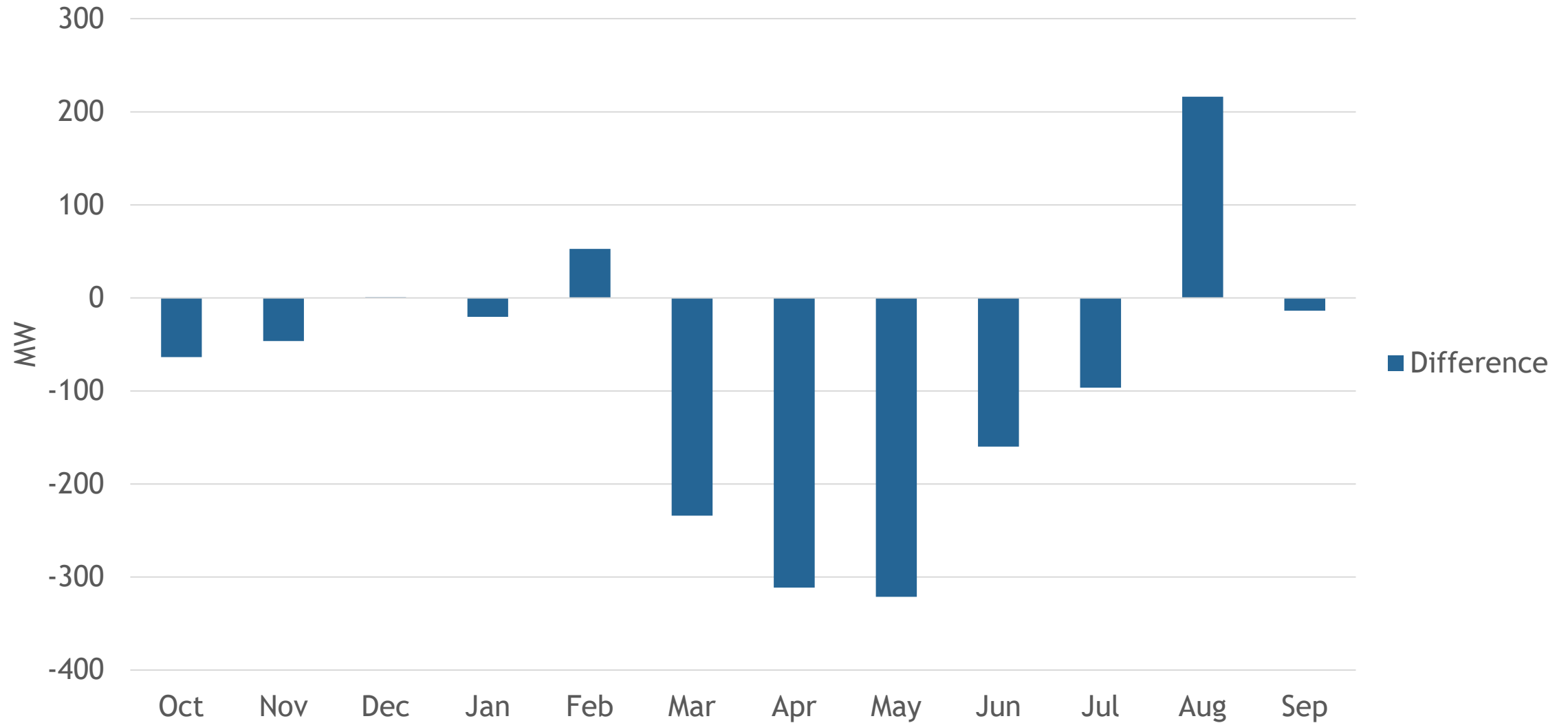
Overall Generation

- Reduced spring and early summer generation
 - Greater generation changes in Lower Snake
- Minor generation reduction in the fall and winter
 - Variation between Lower Snake and Lower Columbia
- Increased August generation
 - Also minor generation increase for Lower Snake in July
- Minor changes to generation flexibility
 - Tend to reduce flexibility in fall, increase in spring, and varies by river in summer and winter

Comparison of Total Hourly Generation by Month



Combined Lower Snake & Lower Columbia Average Generation Difference

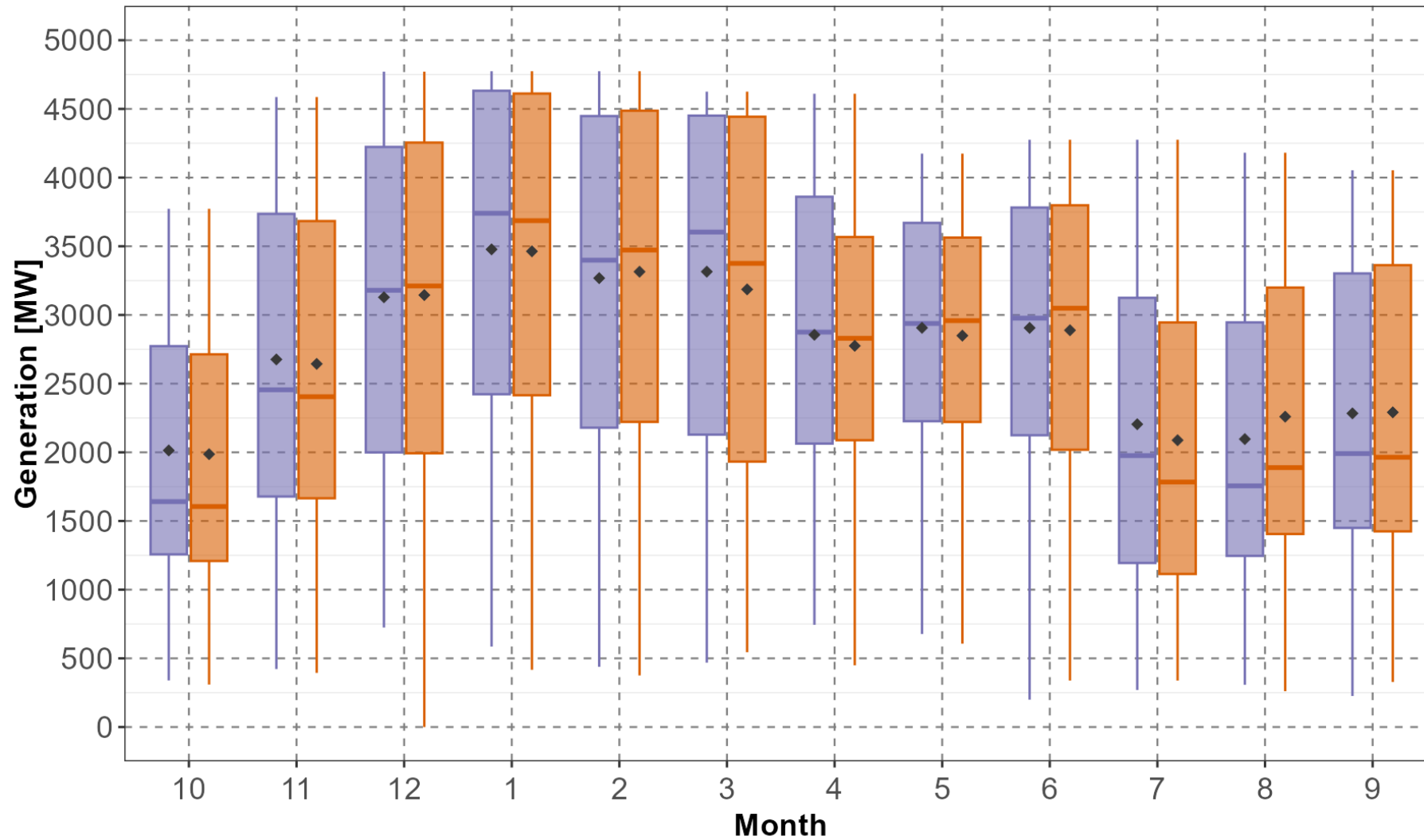




Impacts on Hydro Generation: Lower Columbia

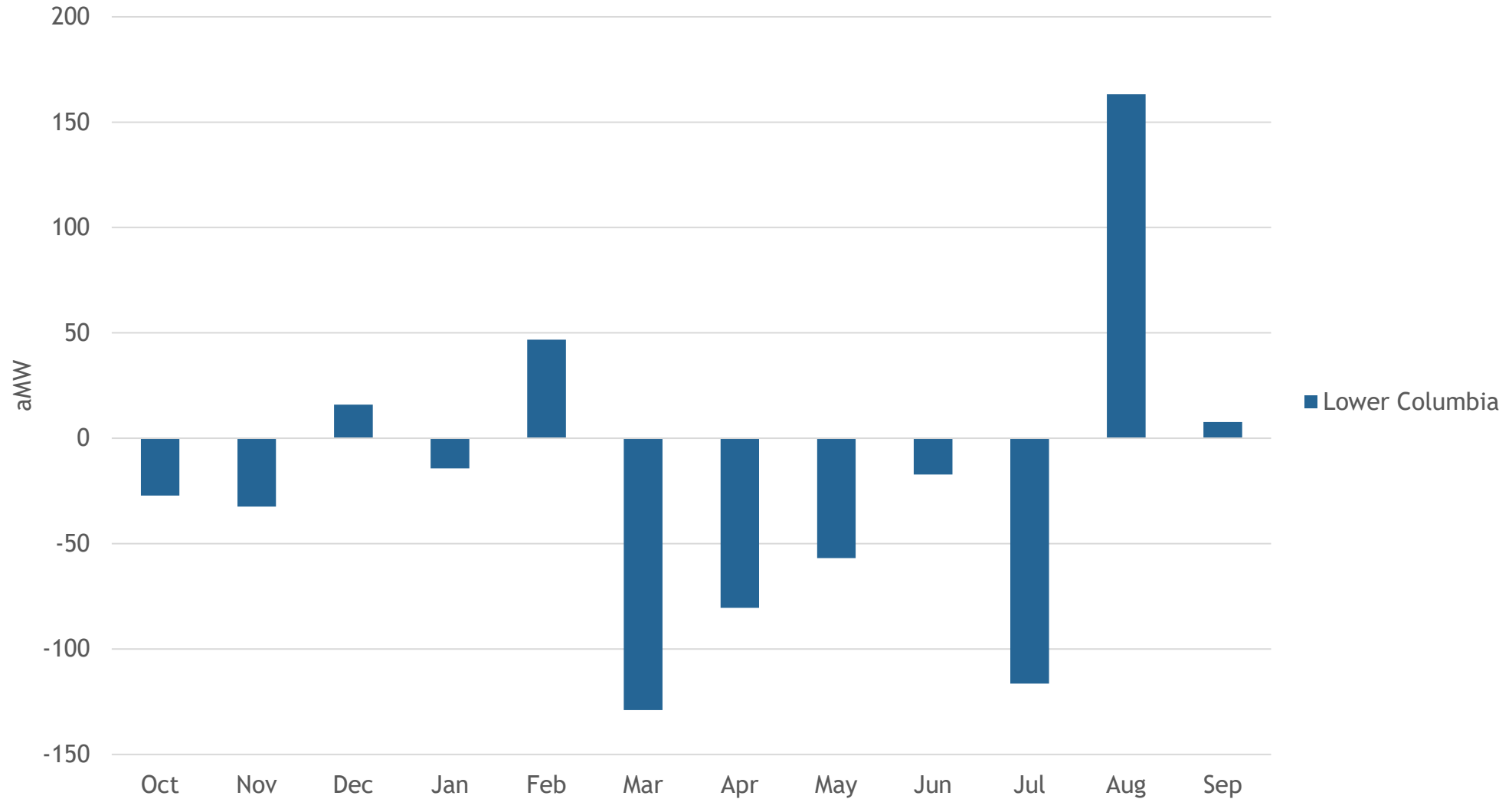
High level summary and examples of generation changes on in
GENESYS

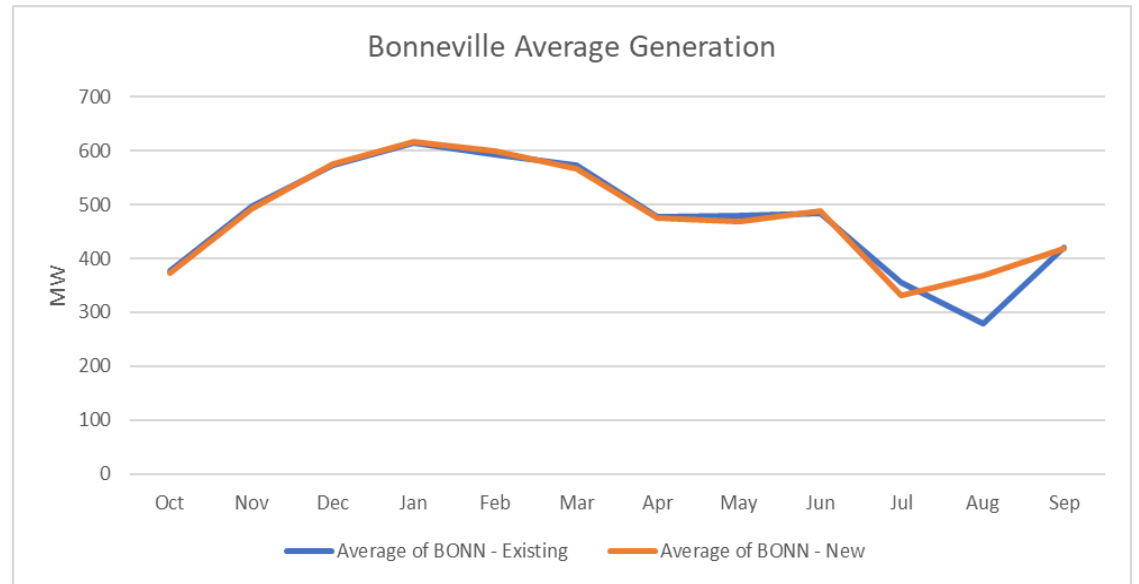
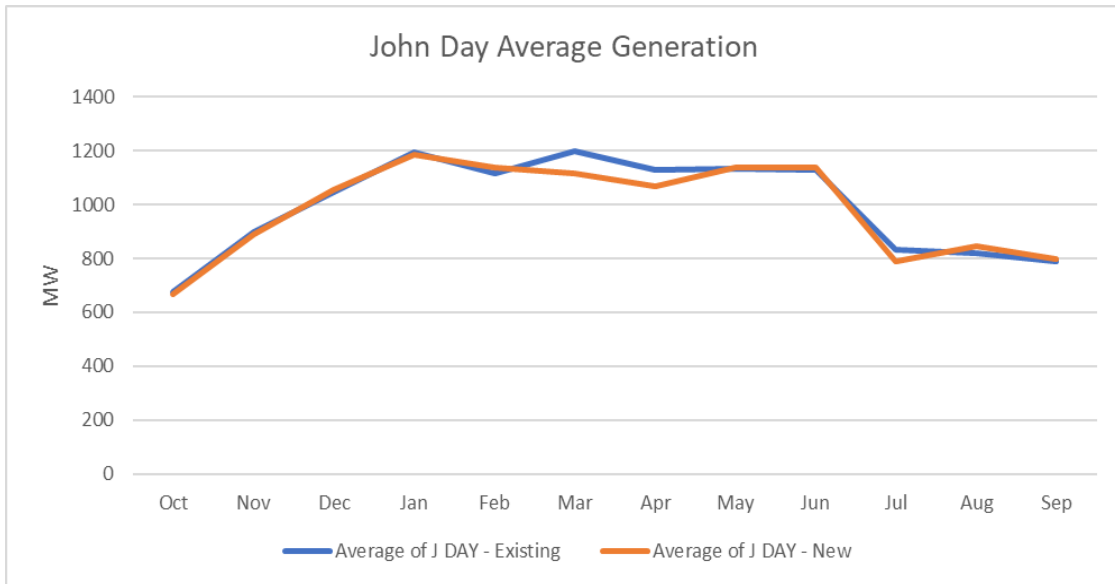
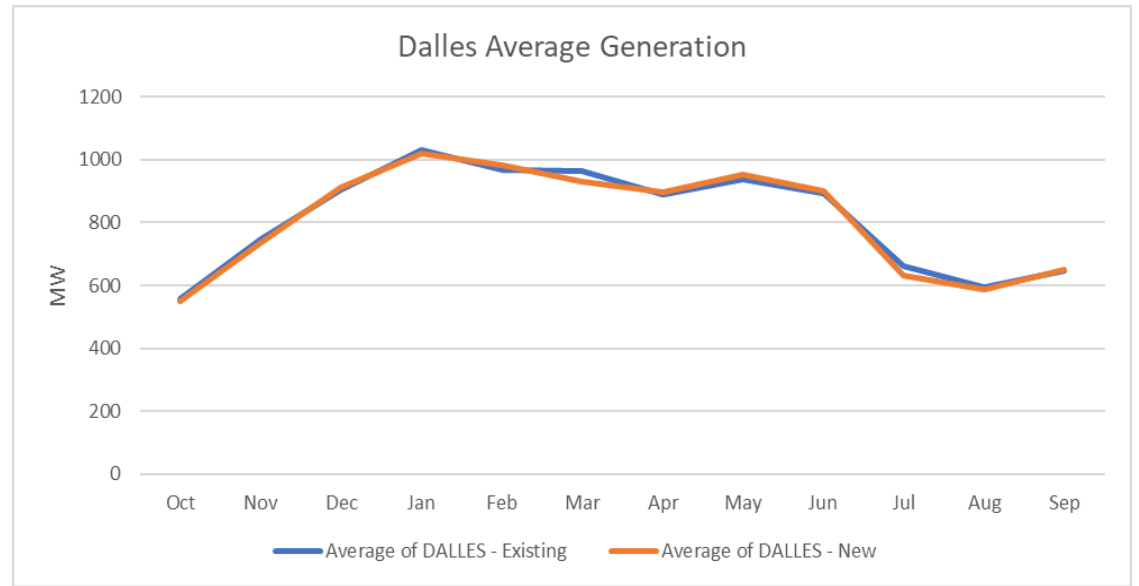
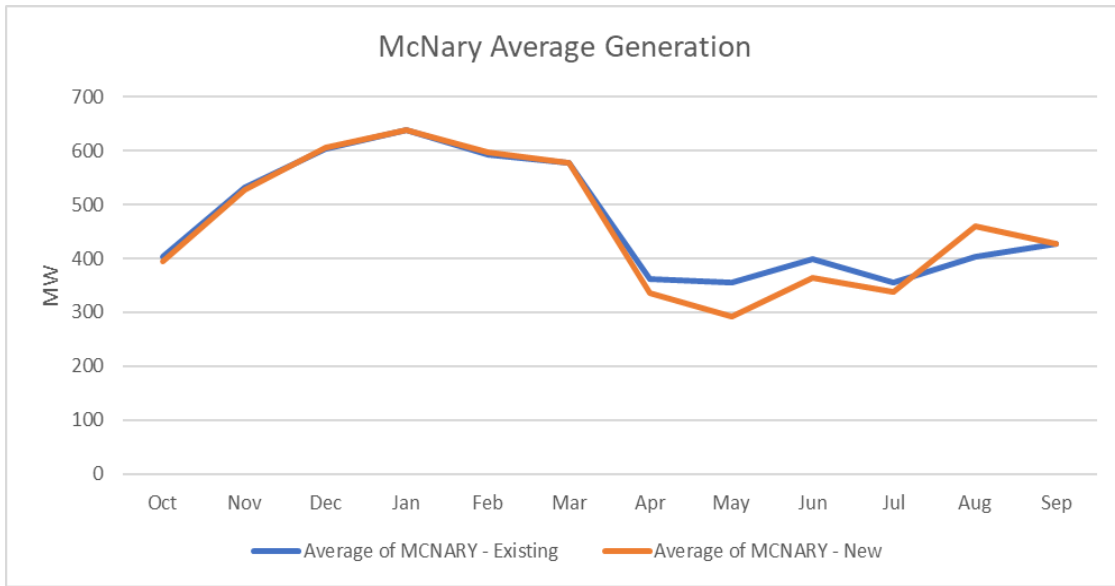
Comparison of Lower_Columbia Hourly Generation by Month



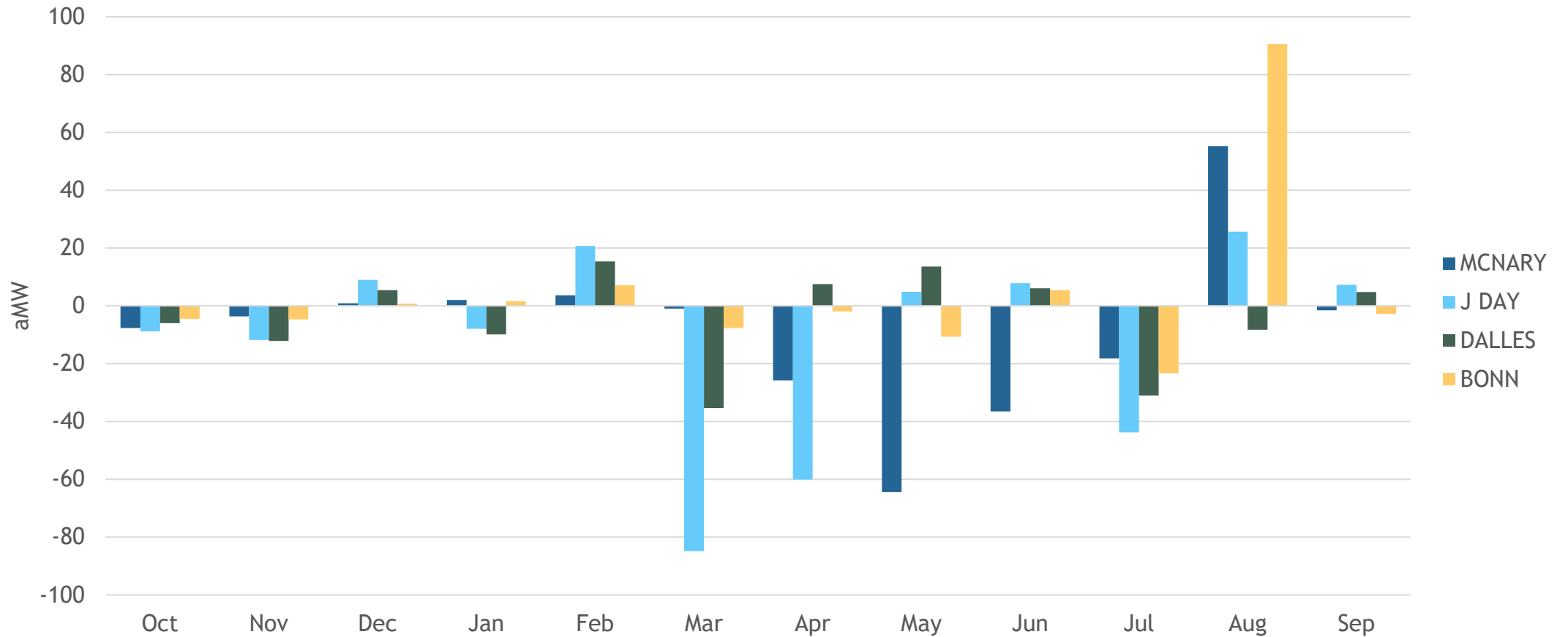
Type: Existing NewFederal

Lower Columbia Average Generation Difference



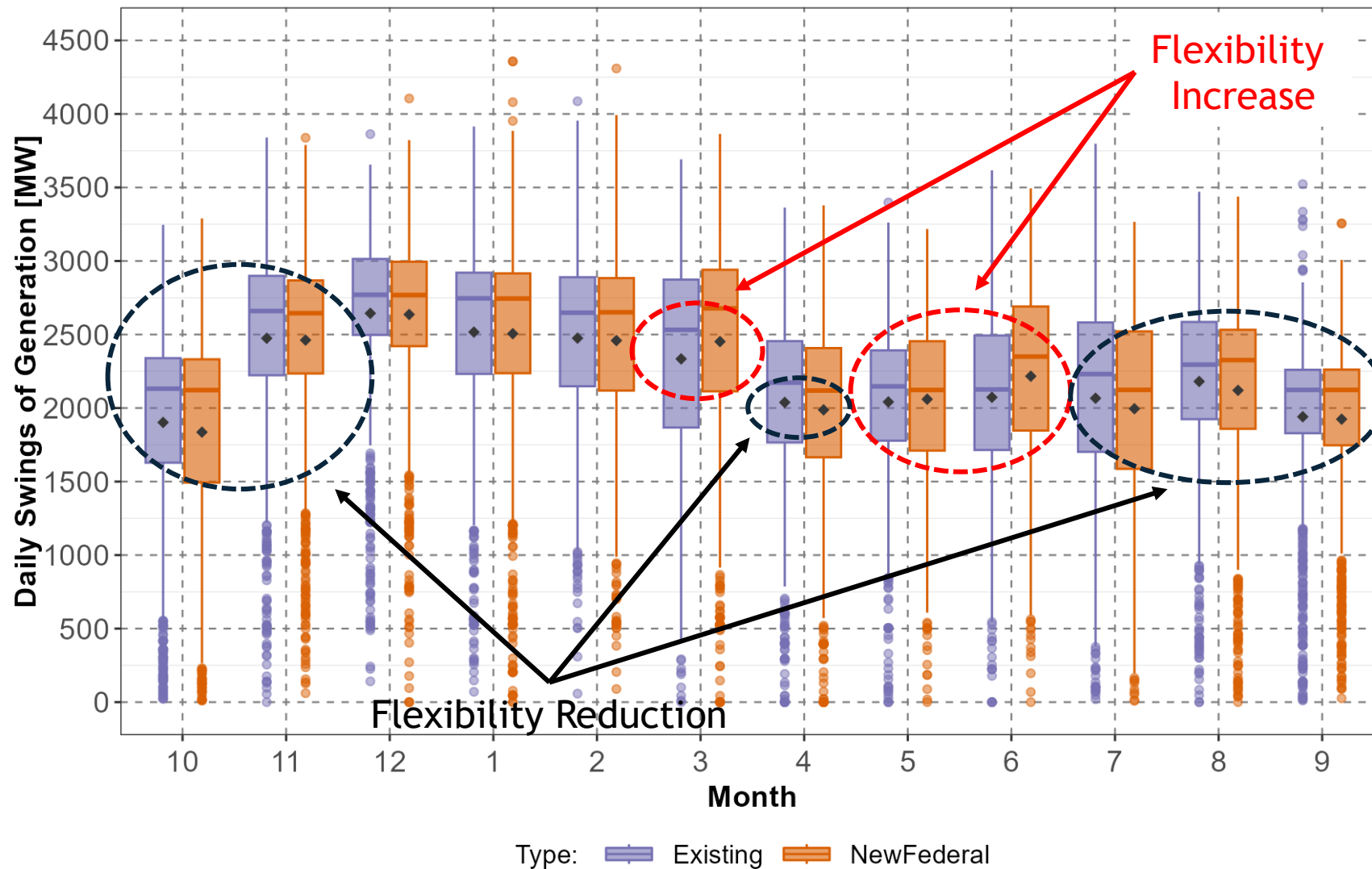


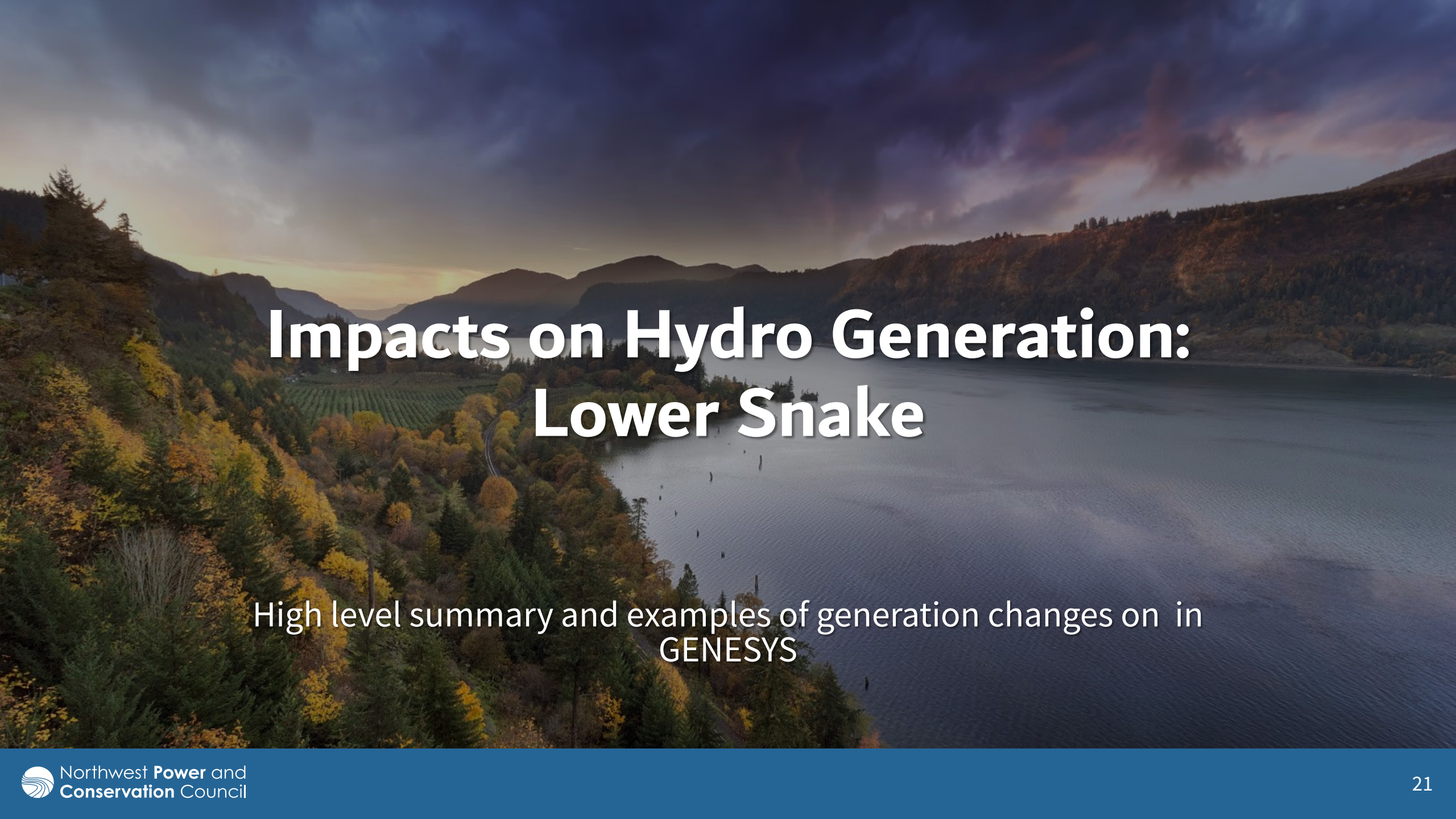
Lower Columbia Average Generation Difference



Daily Flexibility

Comparison of Lower_Columbia Daily Swing of Generation by Month

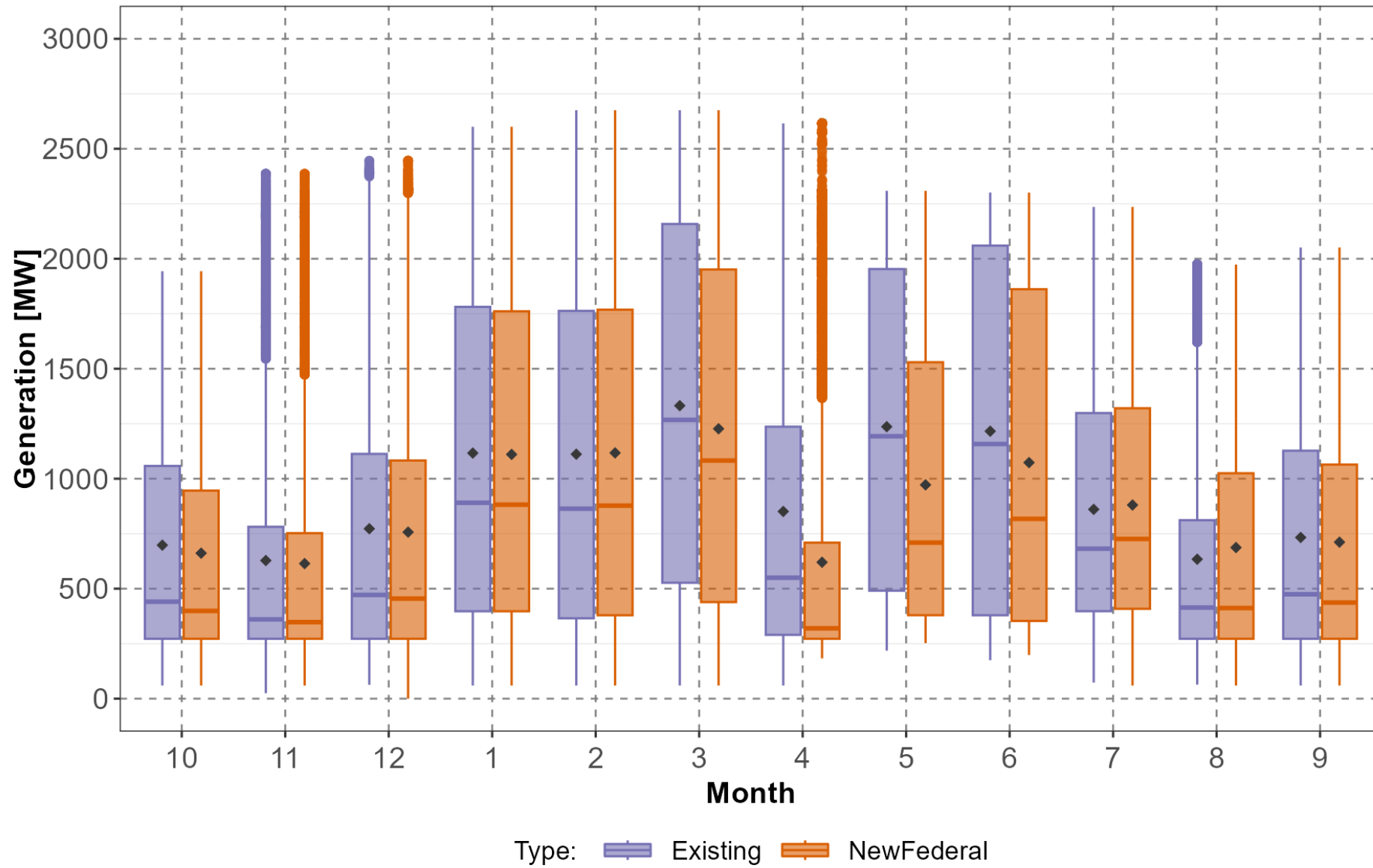




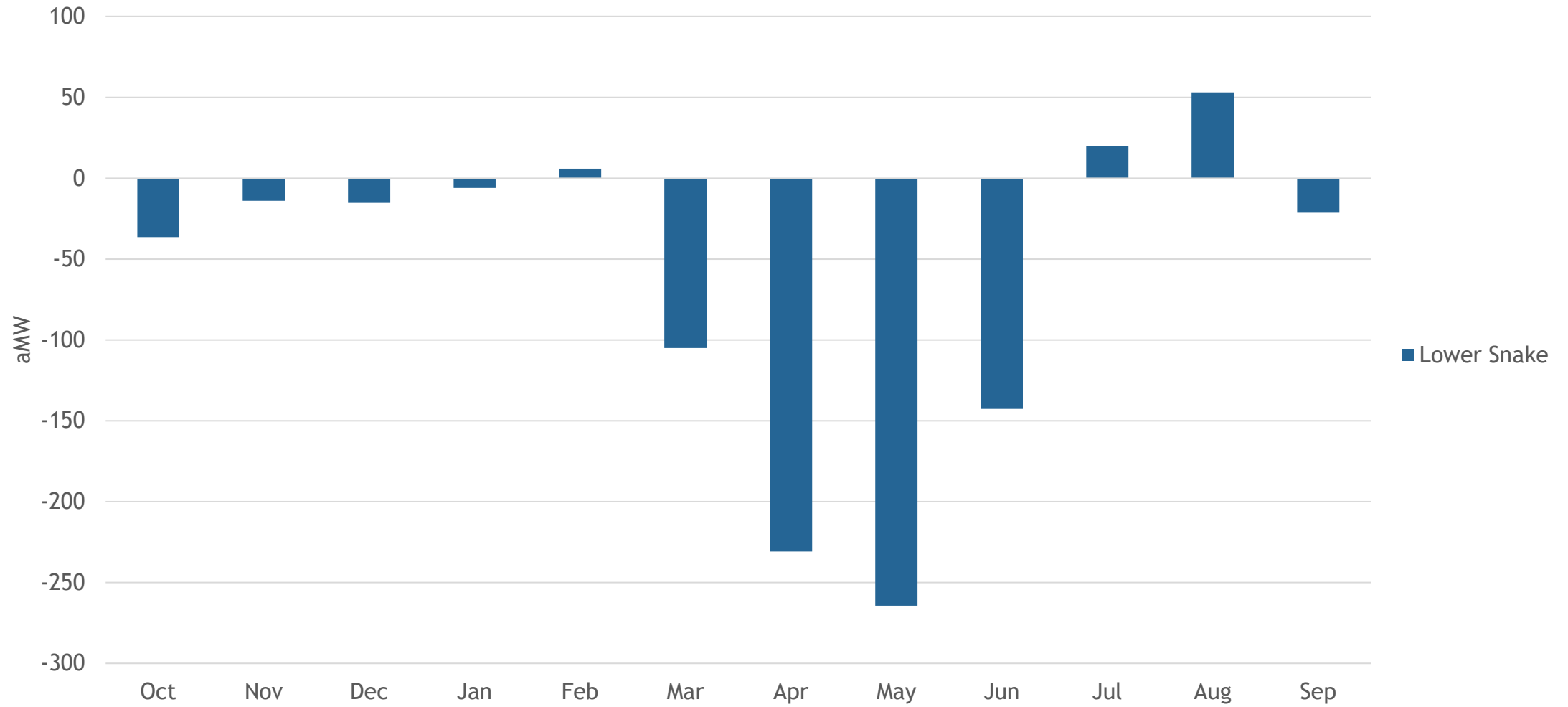
Impacts on Hydro Generation: Lower Snake

High level summary and examples of generation changes on in
GENESYS

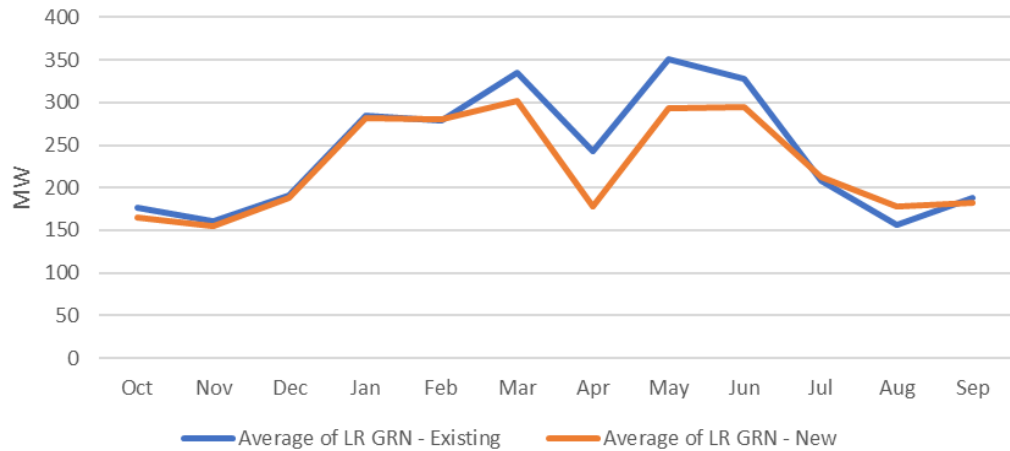
Comparison of Lower_Snake Hourly Generation by Month



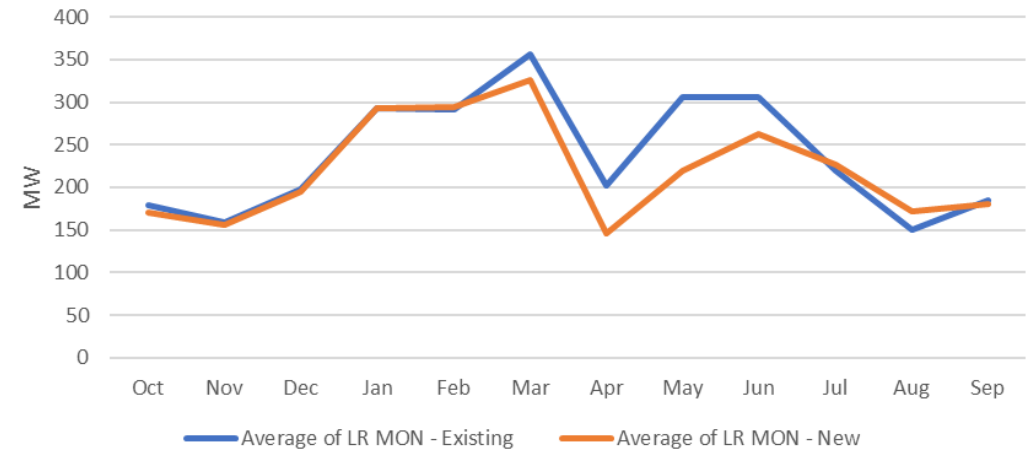
Lower Snake Average Generation Difference



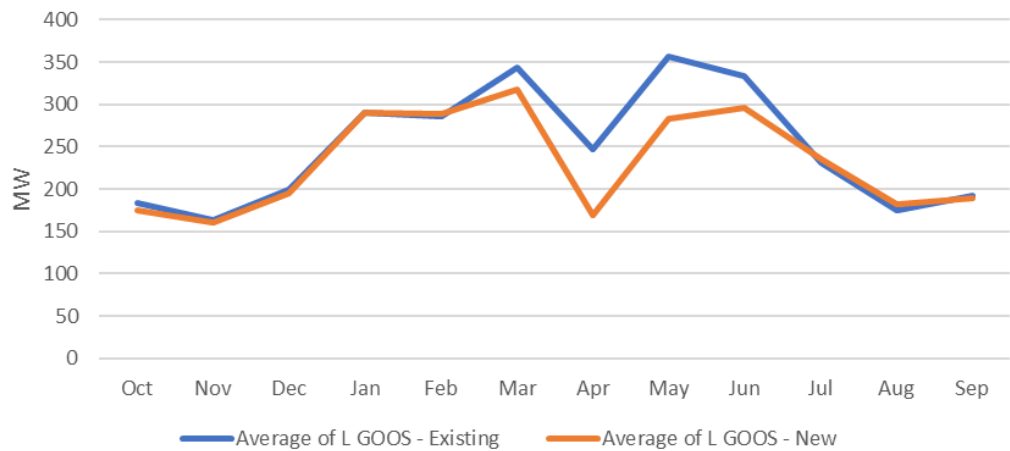
Lower Granite Average Generation



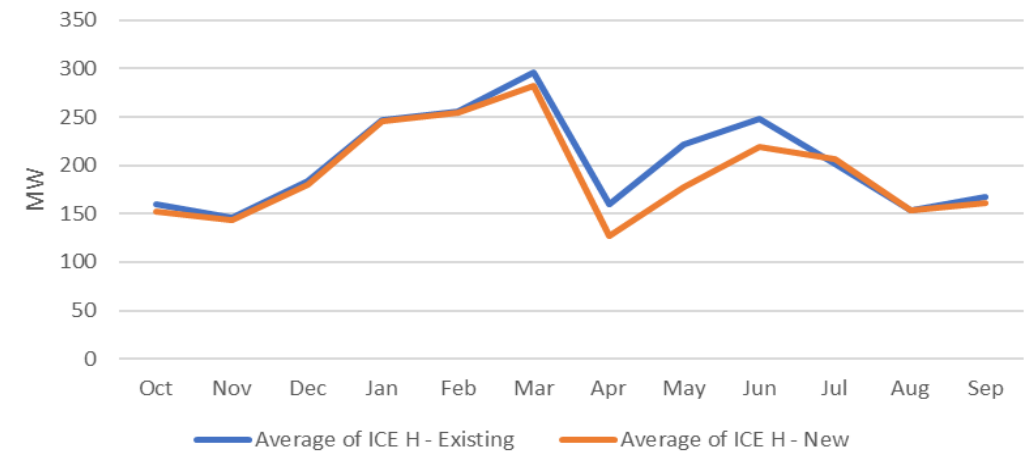
Lower Monumental Average Generation



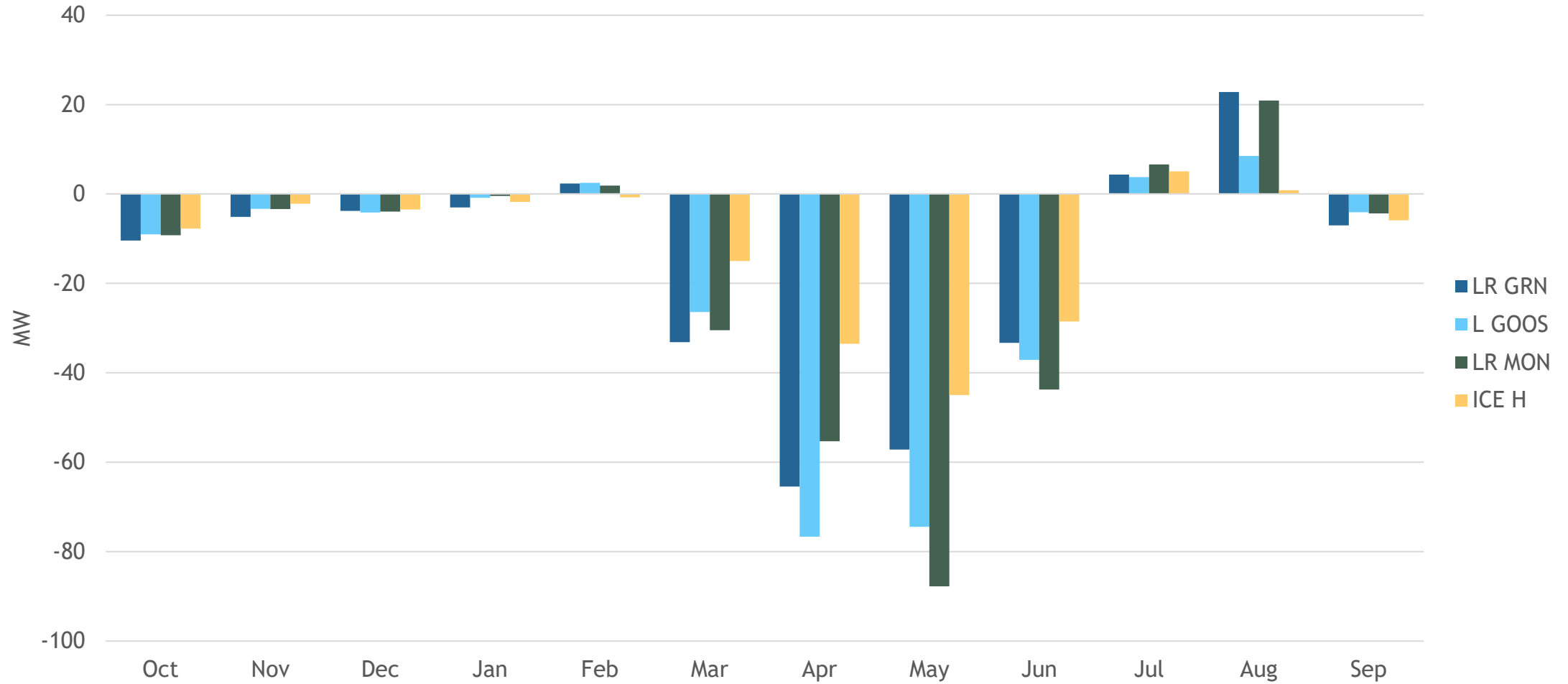
Little Goose Average Generation



Ice Harbor Average Generation

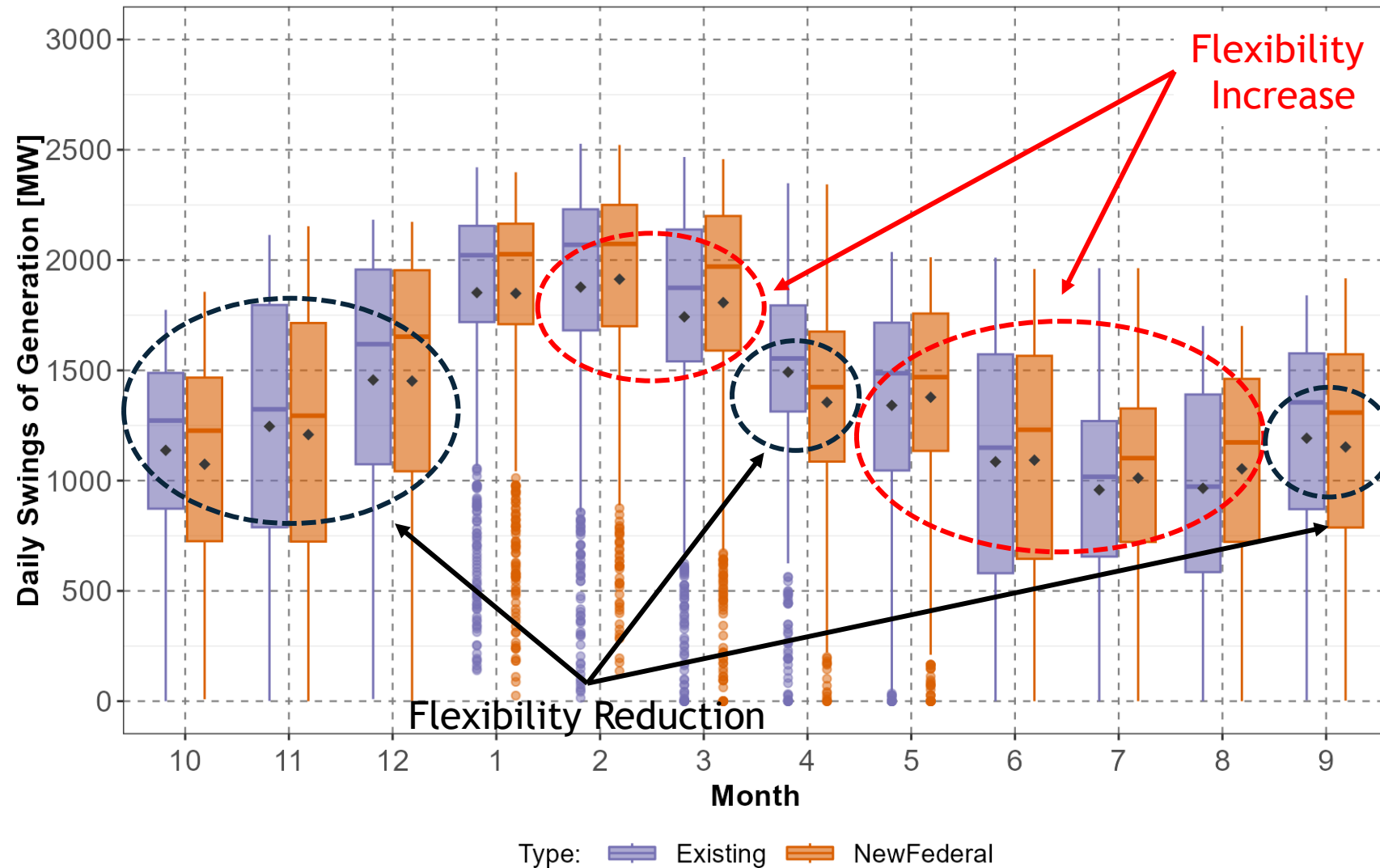


Lower Snake Average Generation Difference



Daily Flexibility

Comparison of Lower_Snake Daily Swing of Generation by Month





Regionwide System Impacts

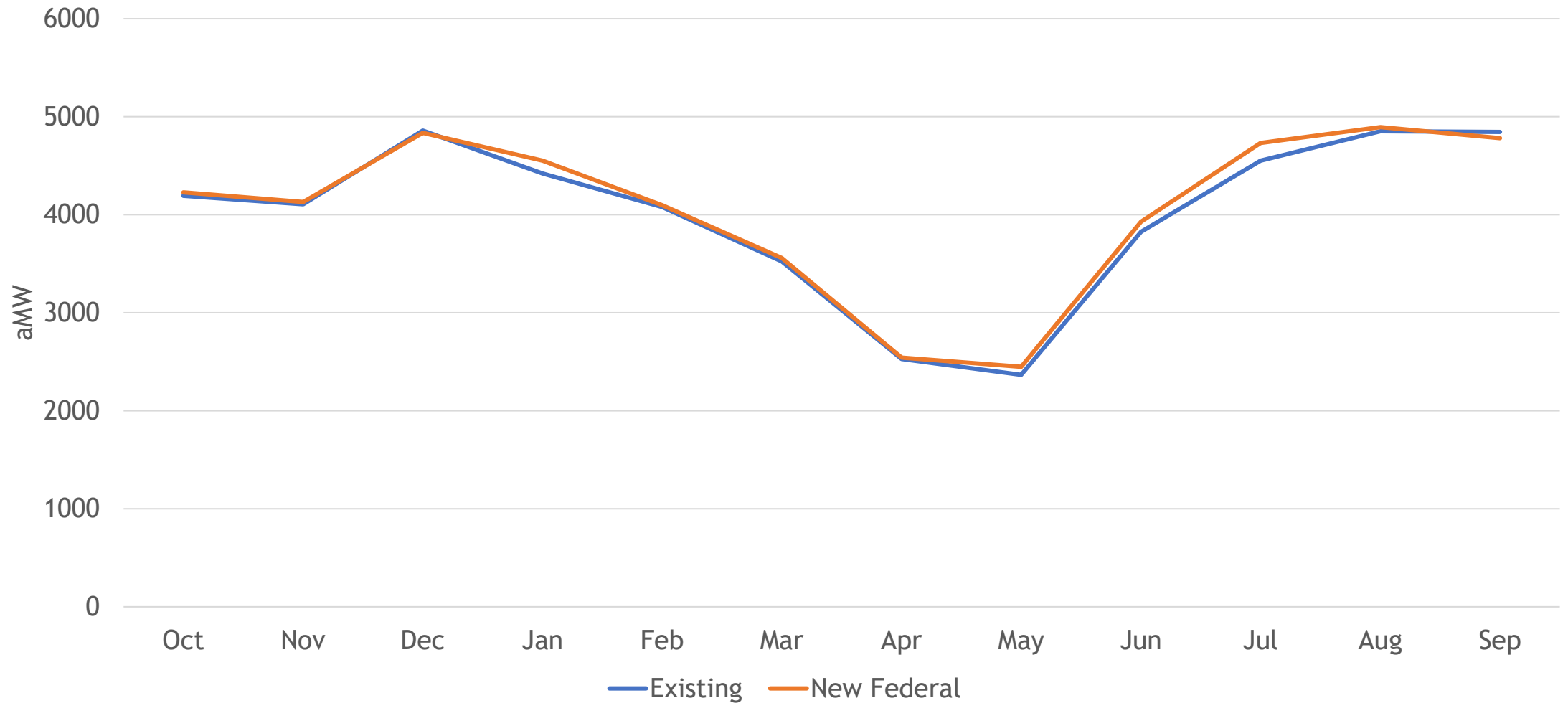
High level summary and examples of generation and market transaction changes on in GENESYS

Additional System Perspectives

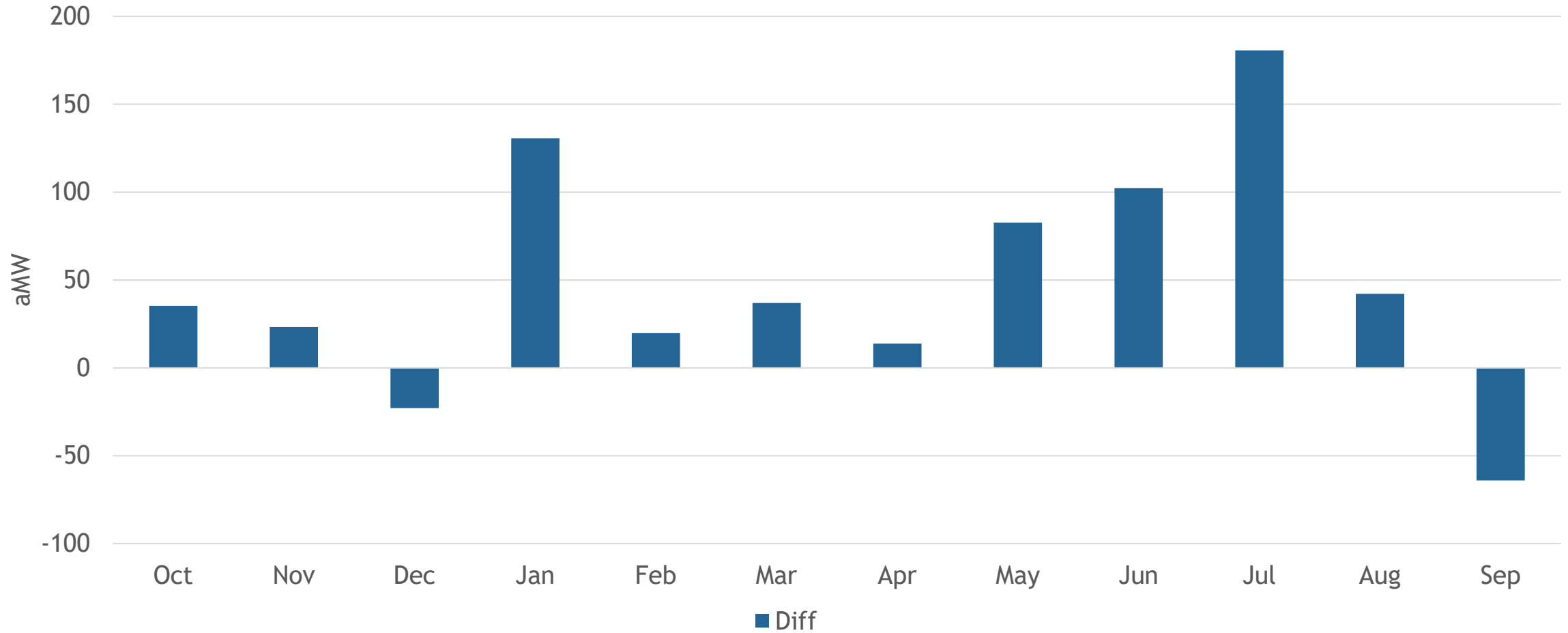
- Adequacy does not appear to be negatively impacted
- How is the region responding to the reduced generation?
 - Changes to regional thermal generation
 - Increased thermal generation
 - Often at night, sometime across the day
 - Changes to regional import and export dynamics
 - Greater market reliance (still within limits)



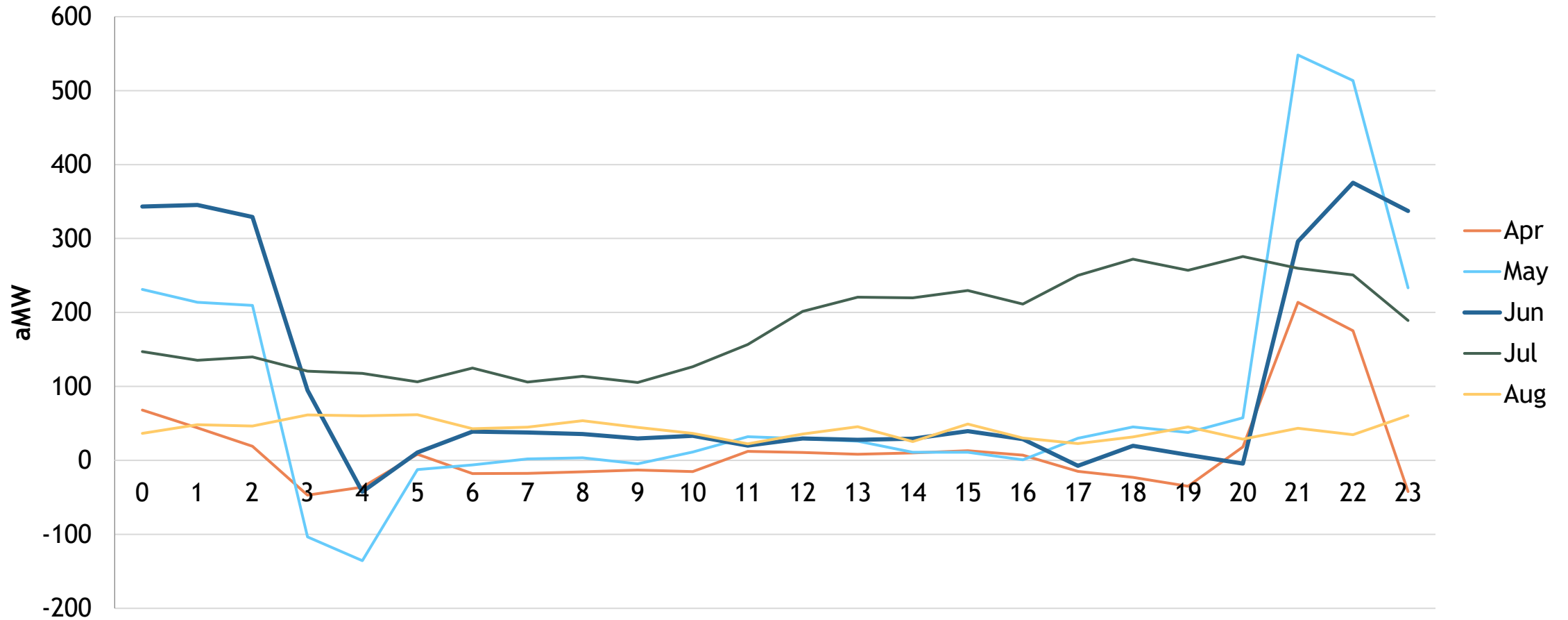
Regional Thermal Generation



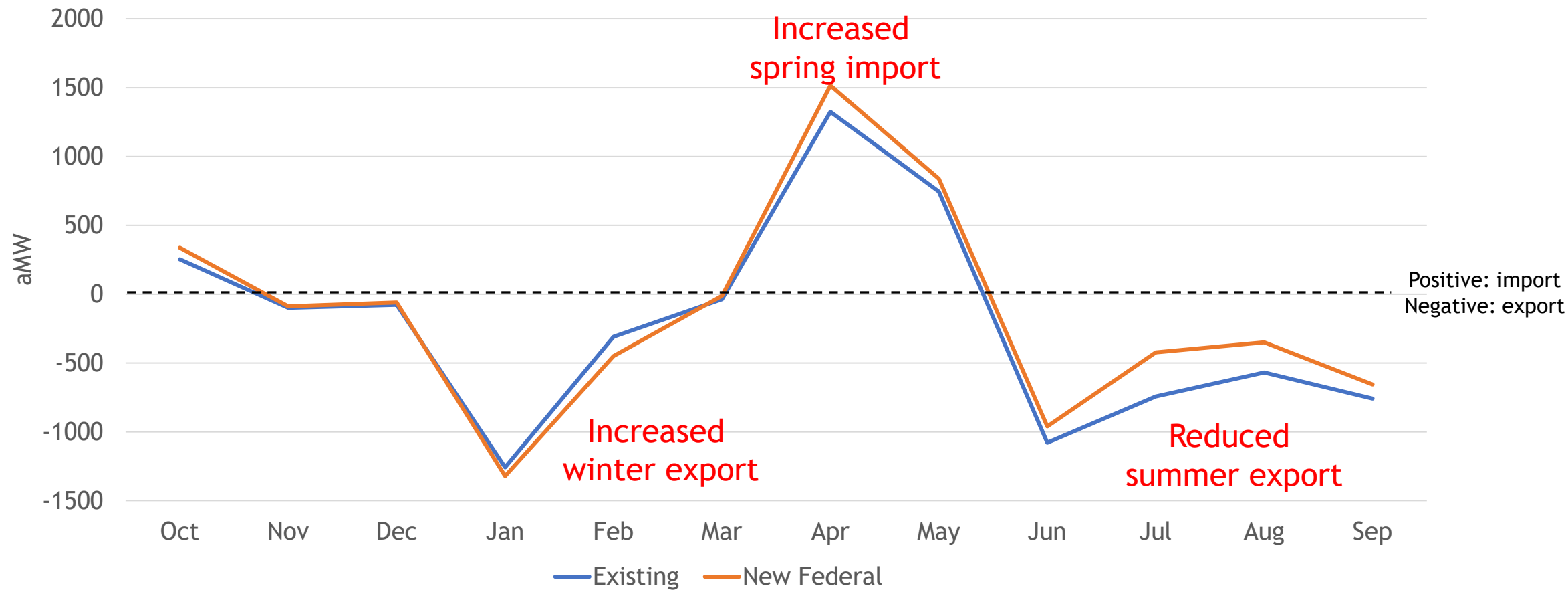
Regional Thermal Generation Difference



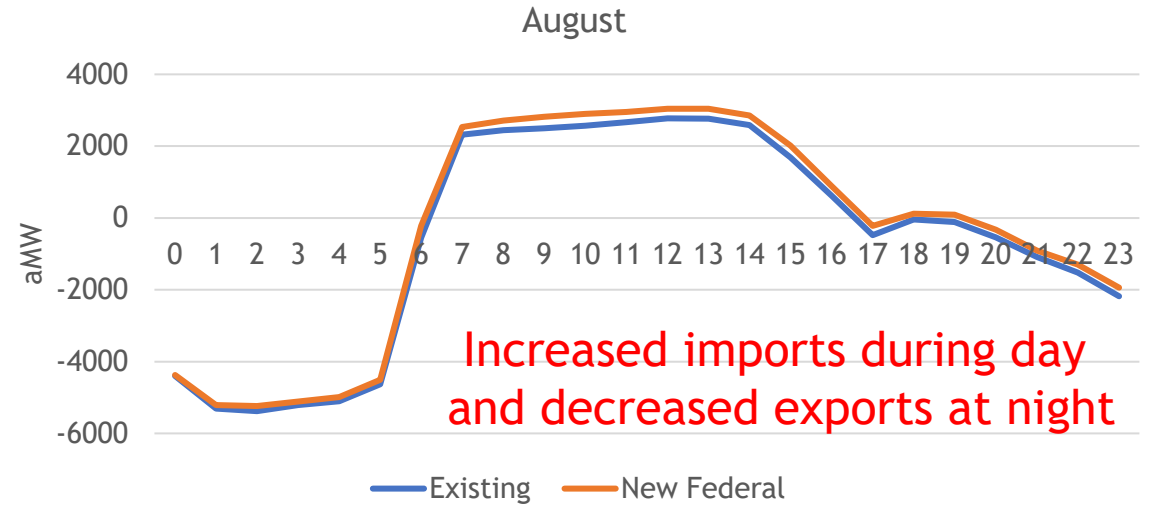
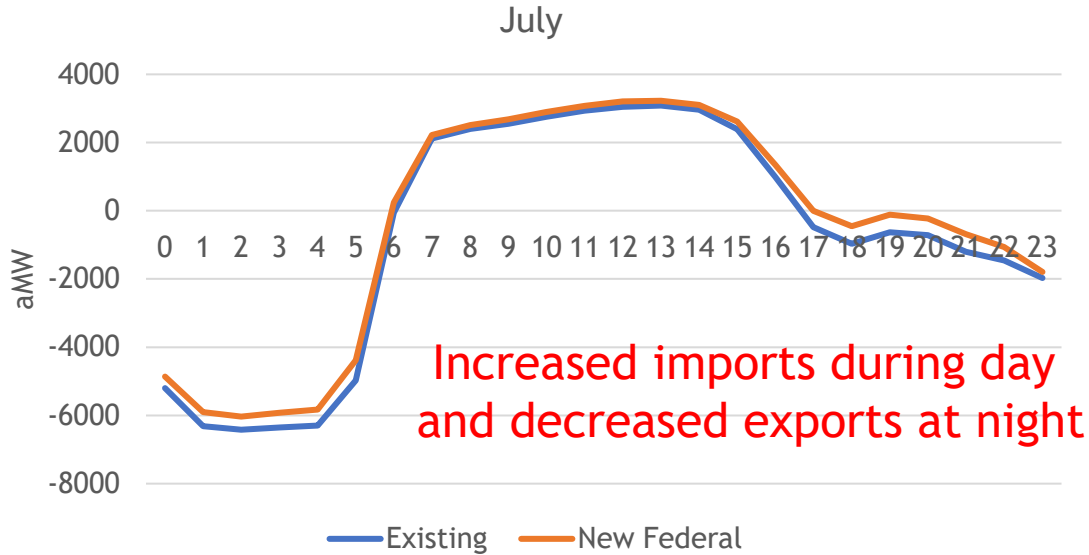
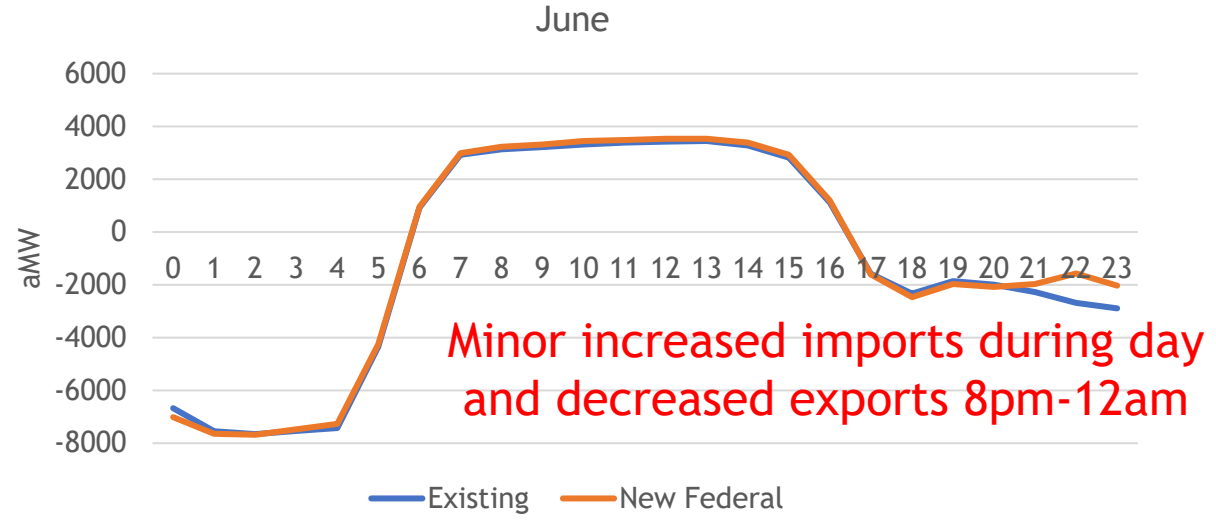
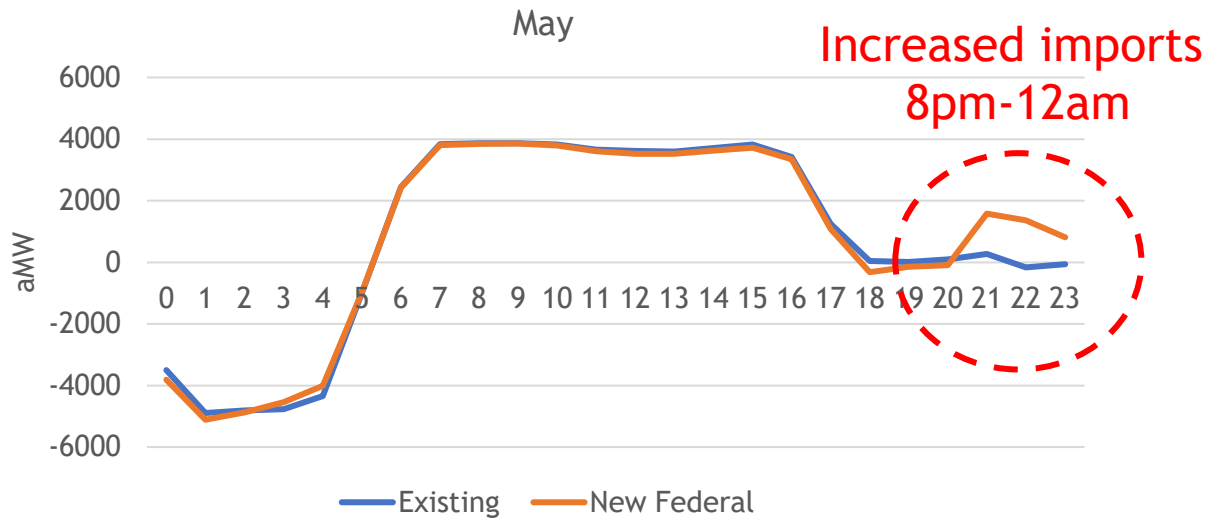
Hourly Changes in Average Thermal Generation

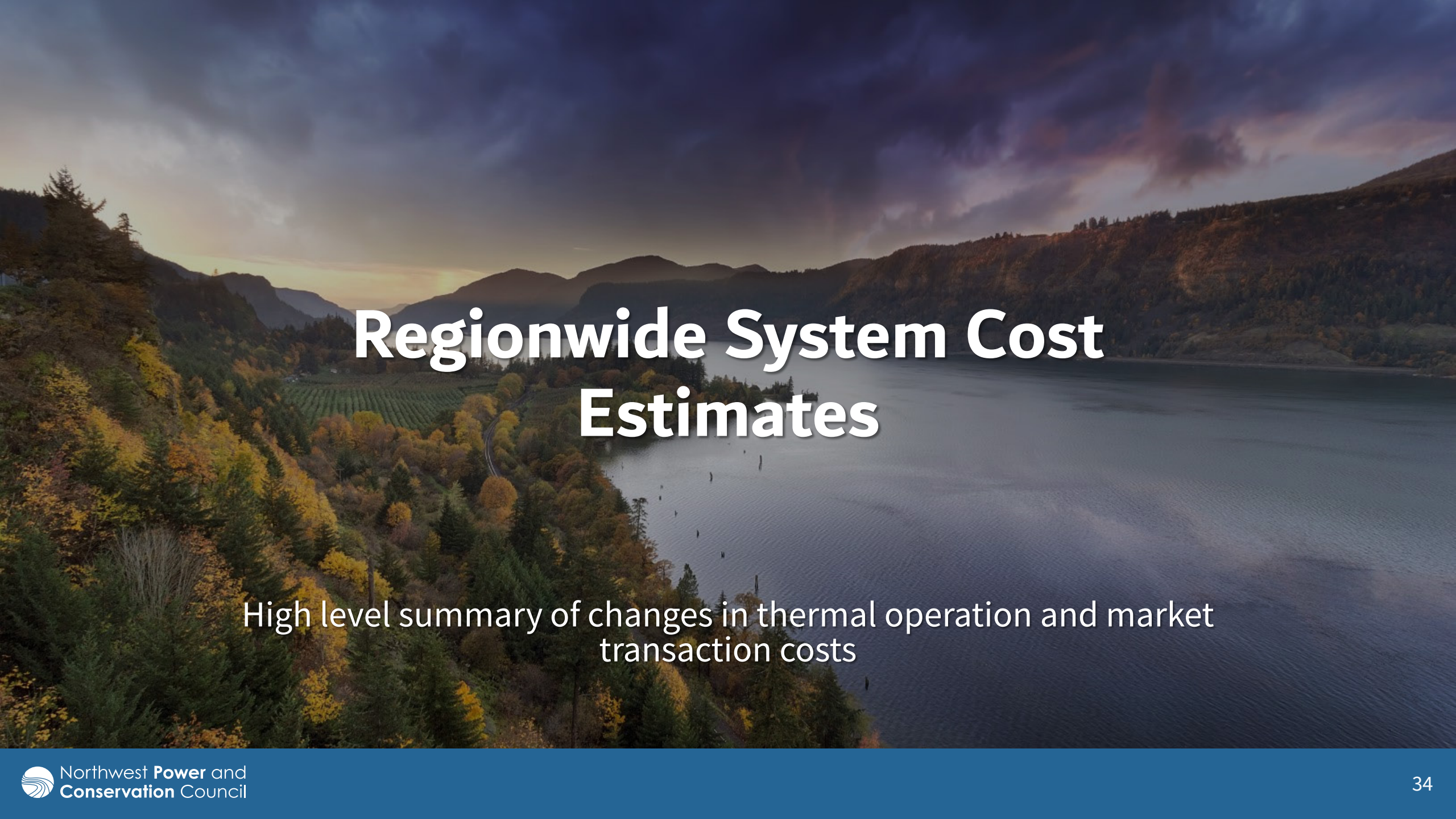


Market Dynamics - Average Net Imports



Average Import/Export Changes





Regionwide System Cost Estimates

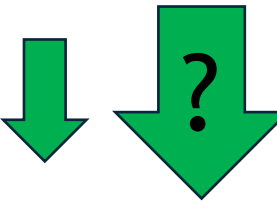
High level summary of changes in thermal operation and market transaction costs

Costs Associated with Federal Commitments Versus Previously Existing Operations

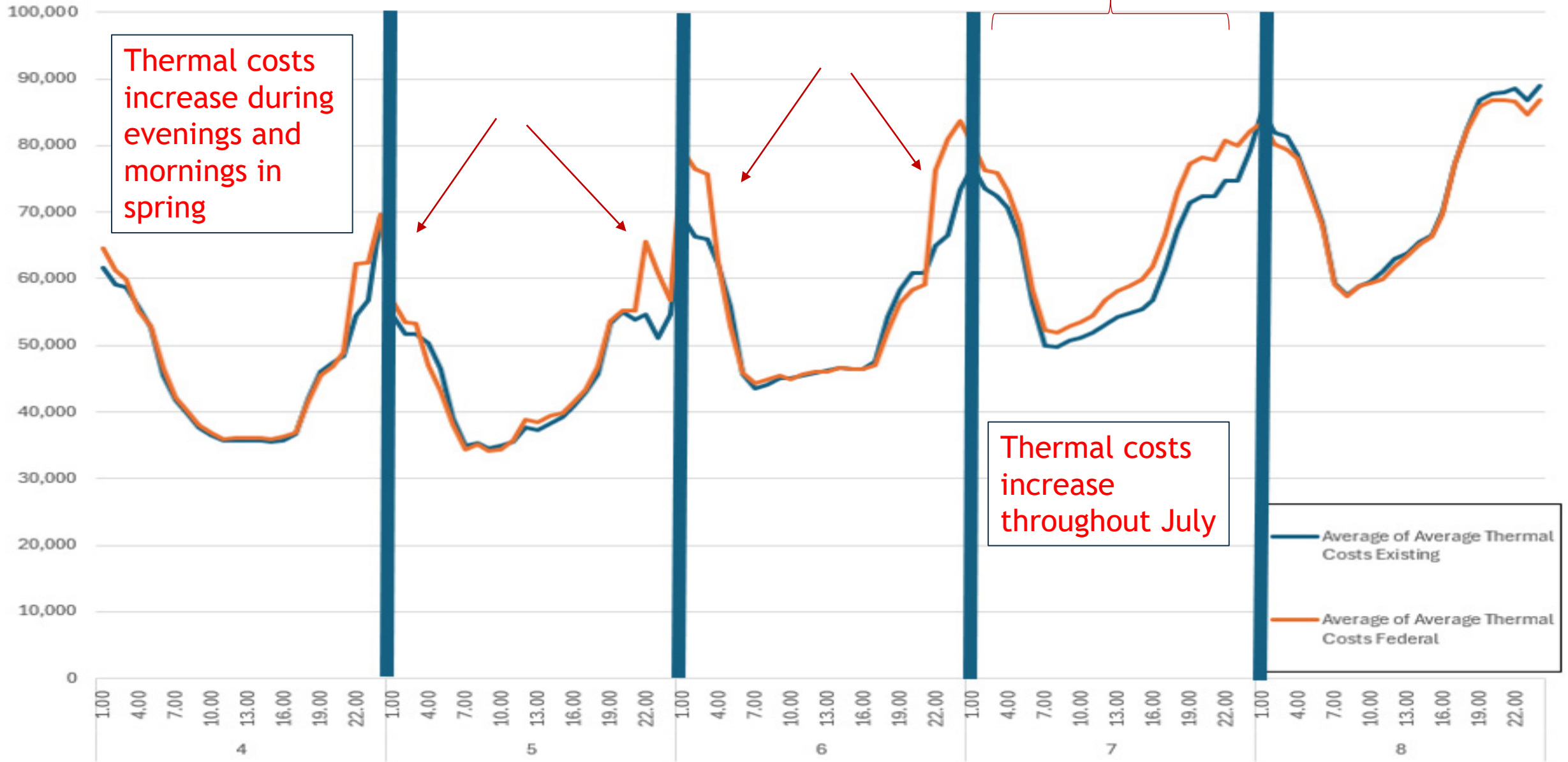


Key Takeaways

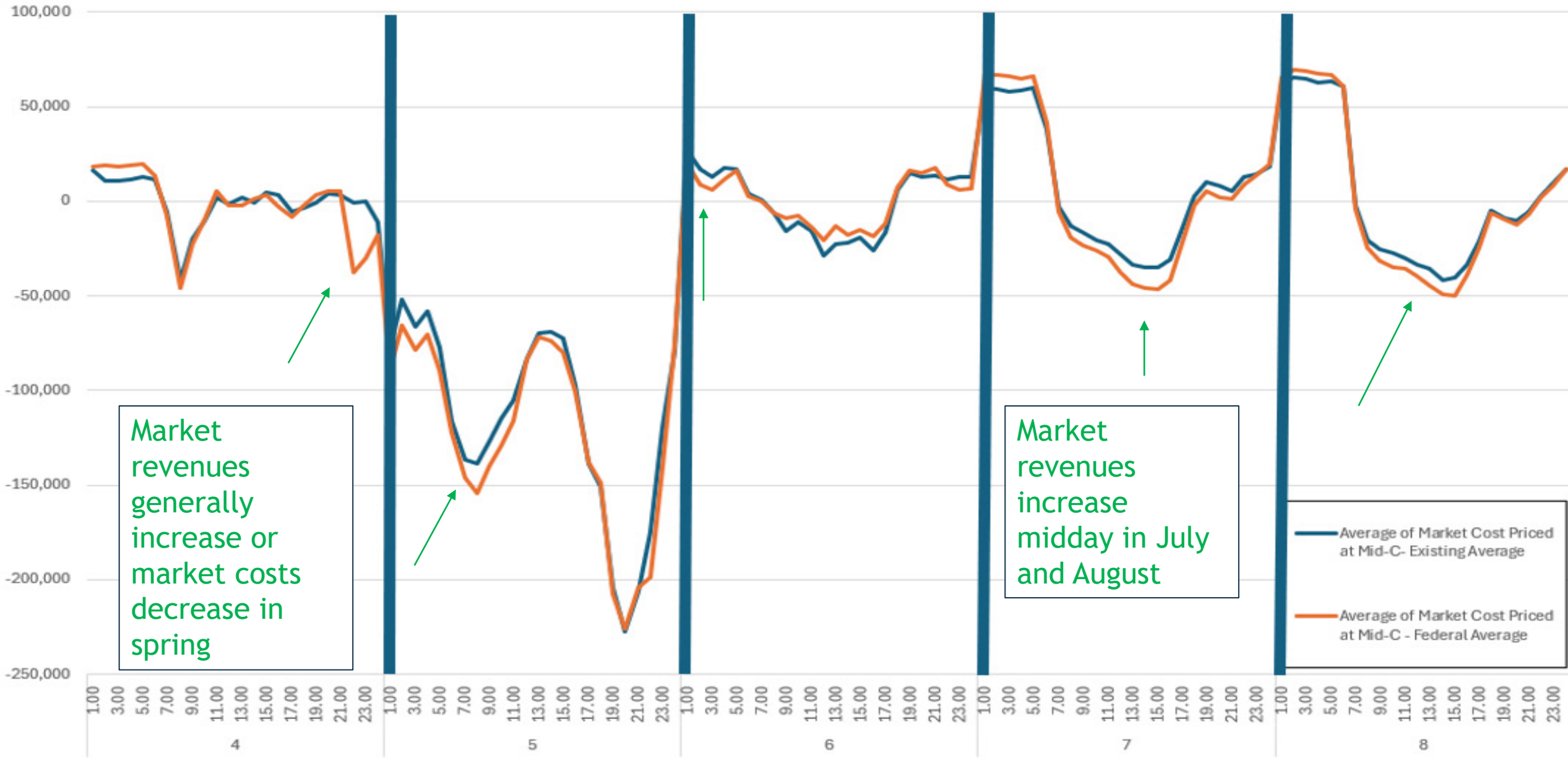
- Expected **regional thermal generation operation costs increase**
 - Tracks increase in regional thermal generation
- Expected **costs associated with out-of region net market imports decrease**
 - Increased low or negatively priced net market imports backfill some of decreased hydro generation in spring and summer.
 - Increased lower priced net market imports midday in July and August
- **Sum of expected costs** associated with regional thermal generation and out of region market transactions **decreases**



Average Thermal Operation Costs in \$



Average Market Transaction Costs in \$



Market revenues generally increase or market costs decrease in spring

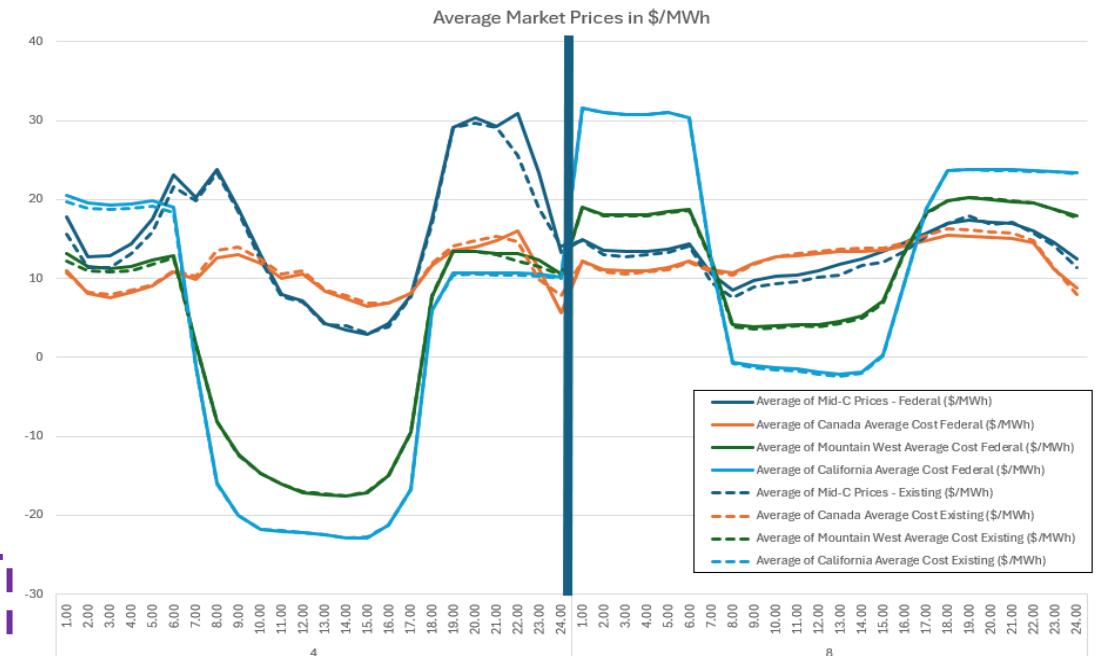
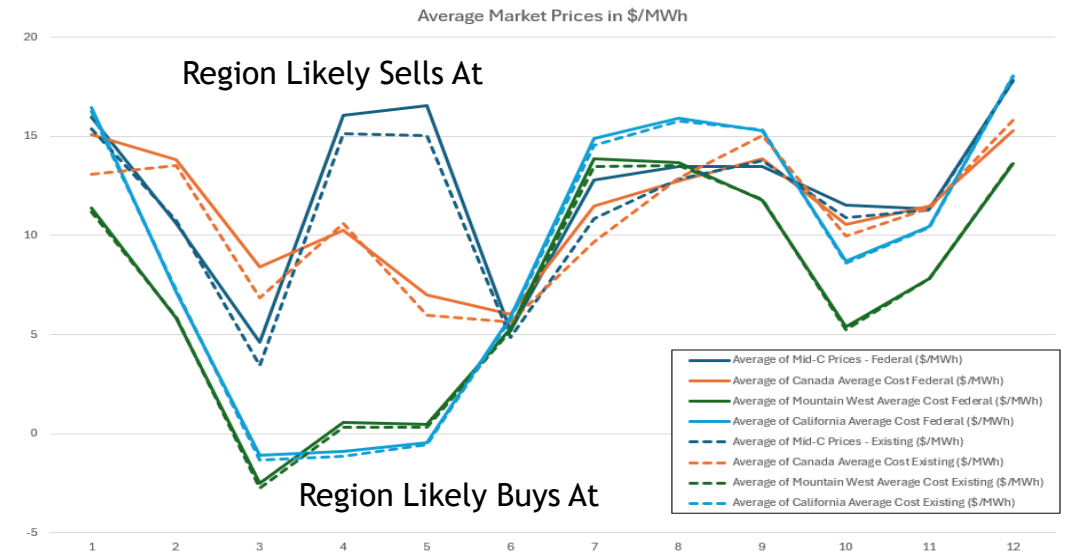
Market revenues increase midday in July and August

Market revenue increase not associated with thermal cost increase in August

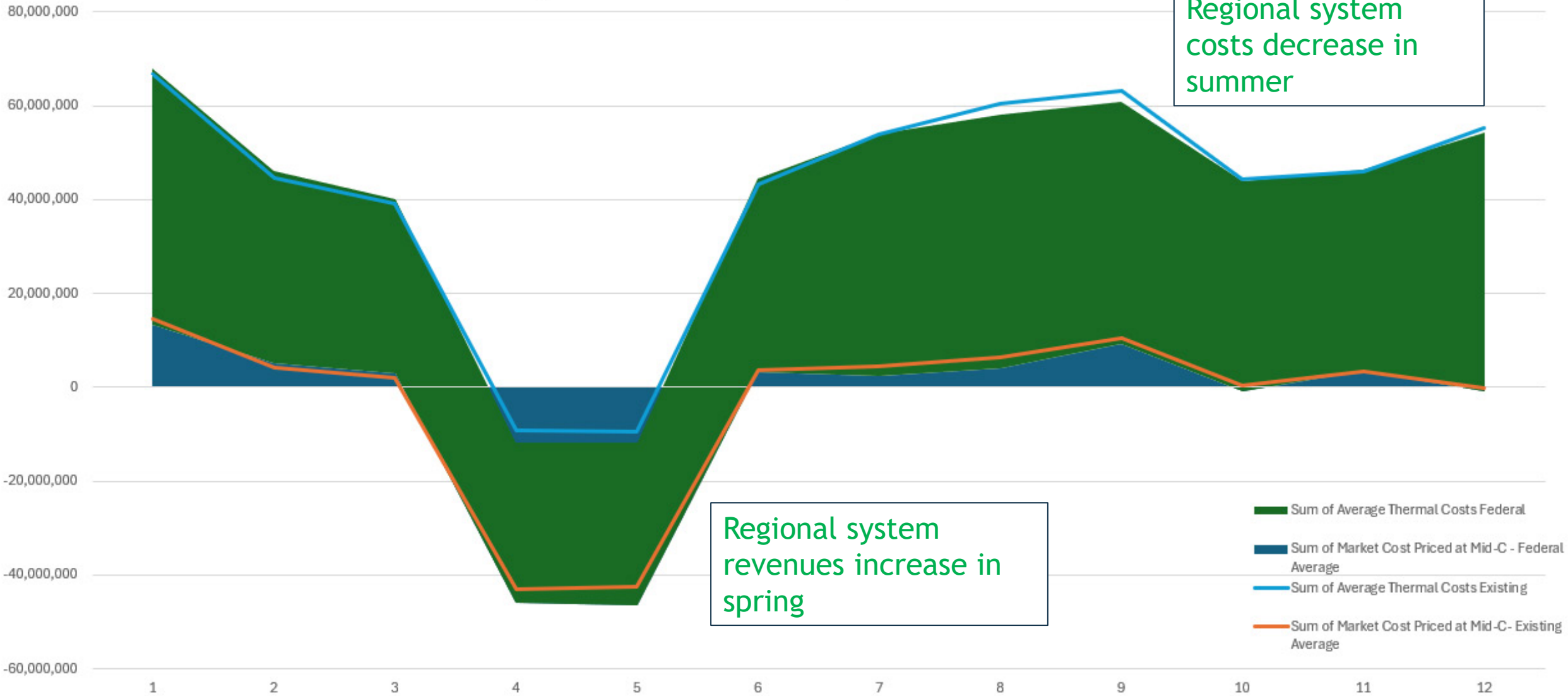
Why Uncertainty About Market Cost/Revenue?

- Estimated market revenues/costs are made by pricing at the Mid-C
- Major import partner hubs in the Mountain West, California and Canada have price differentials with regional pricing (Mid-C) that likely would decrease market costs and increase revenues.
- Note the seasonal differentials in spring and summer
- Note the hourly differentials midday and overnight

Staff is happy to follow up on details of cost uncertainty



Average Thermal and Market Costs in \$



Regional system costs decrease in summer

Regional system revenues increase in spring

- Sum of Average Thermal Costs Federal
- Sum of Market Cost Priced at Mid-C - Federal Average
- Sum of Average Thermal Costs Existing
- Sum of Market Cost Priced at Mid-C - Existing Average

System Costs Summary

- Overall, increased spill and decreased hydropower generation in spring and early summer increases regional thermal operating costs, but that increased cost is mitigated by increased market revenues and decreased market costs by timely increases in net imports and decreases in net exports.
- Decreased spill and increased hydropower generation in August decreases regional system costs
- Total magnitude of estimated benefit of the decreased regional cost to changed operations is likely conservative due to significant market price differentials especially due to net imports/exports position on a daily and seasonal basis.

Questions?

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