Update on Project N Activities Including a Discussion of Hydropower Improvement Flows

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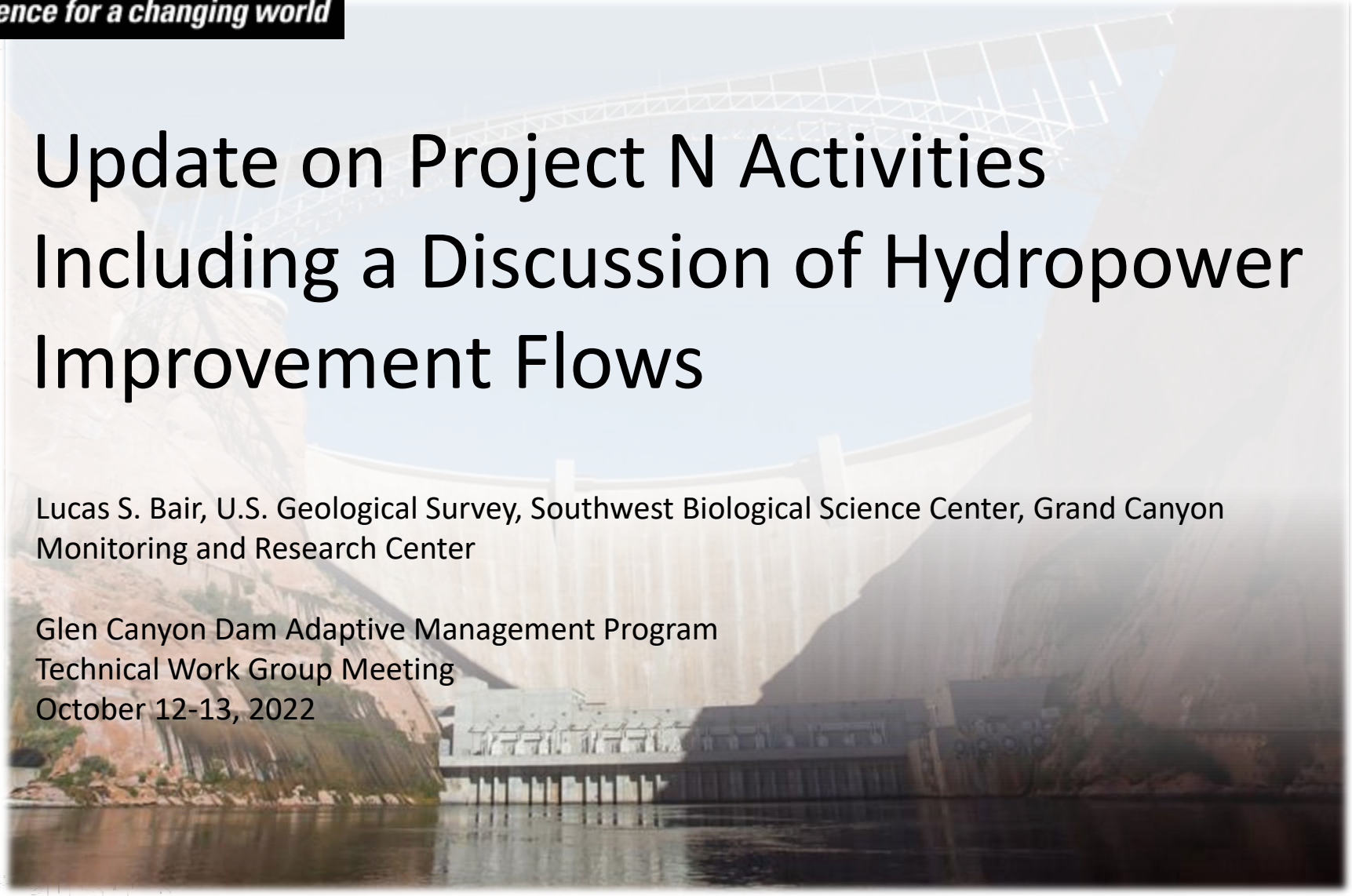
Glen Canyon Dam Adaptive Management Program
Technical Work Group Meeting
October 12-13, 2022



Hydropower and Energy Goal

- Maintain or increase Glen Canyon Dam (GCD) electric energy generation, load following capability, and ramp rate capability, and minimize emissions and costs to the greatest extent practicable, consistent with improvement and long-term sustainability of downstream resources.

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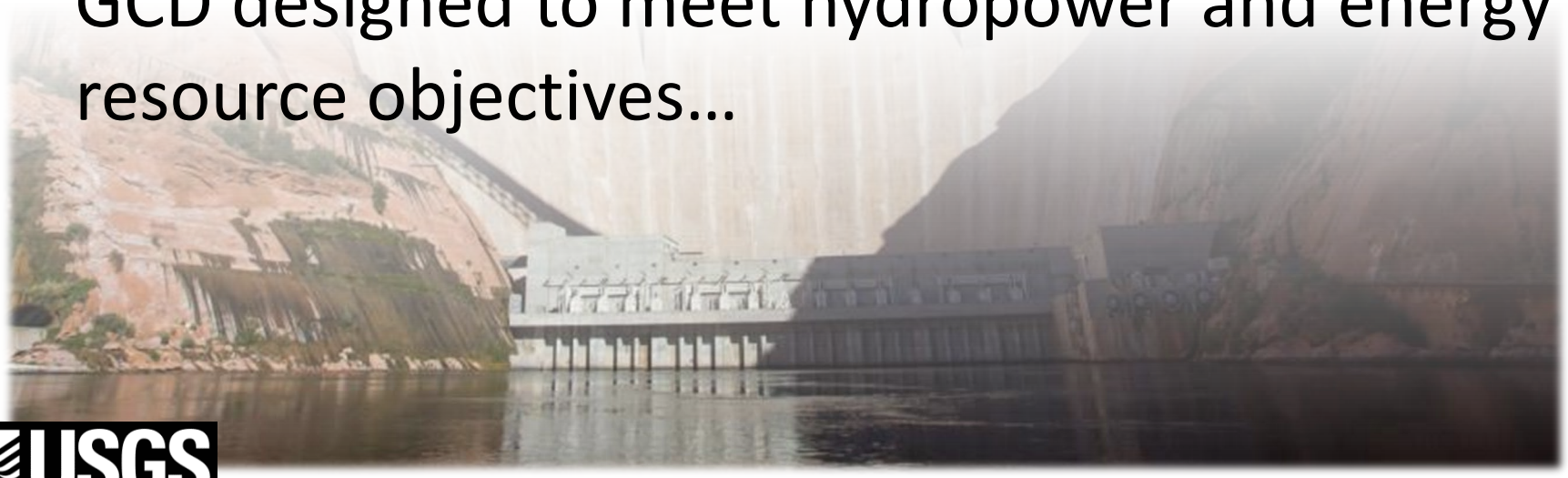
Project N: Hydropower Monitoring and Research

- Project N will identify, coordinate, and collaborate with external partners on monitoring and research opportunities associated with operational experiments at GCD designed to meet hydropower and energy resource objectives…



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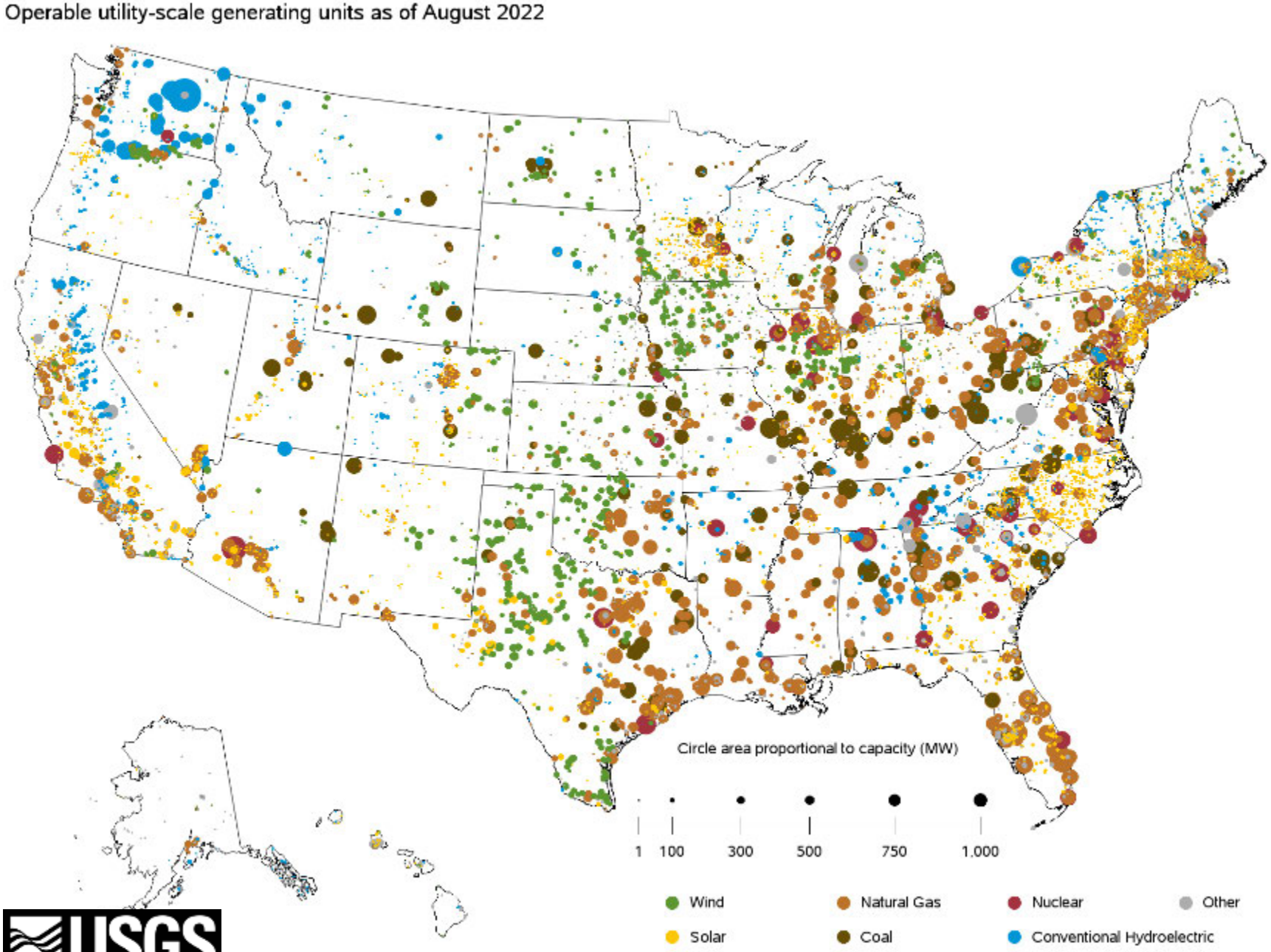

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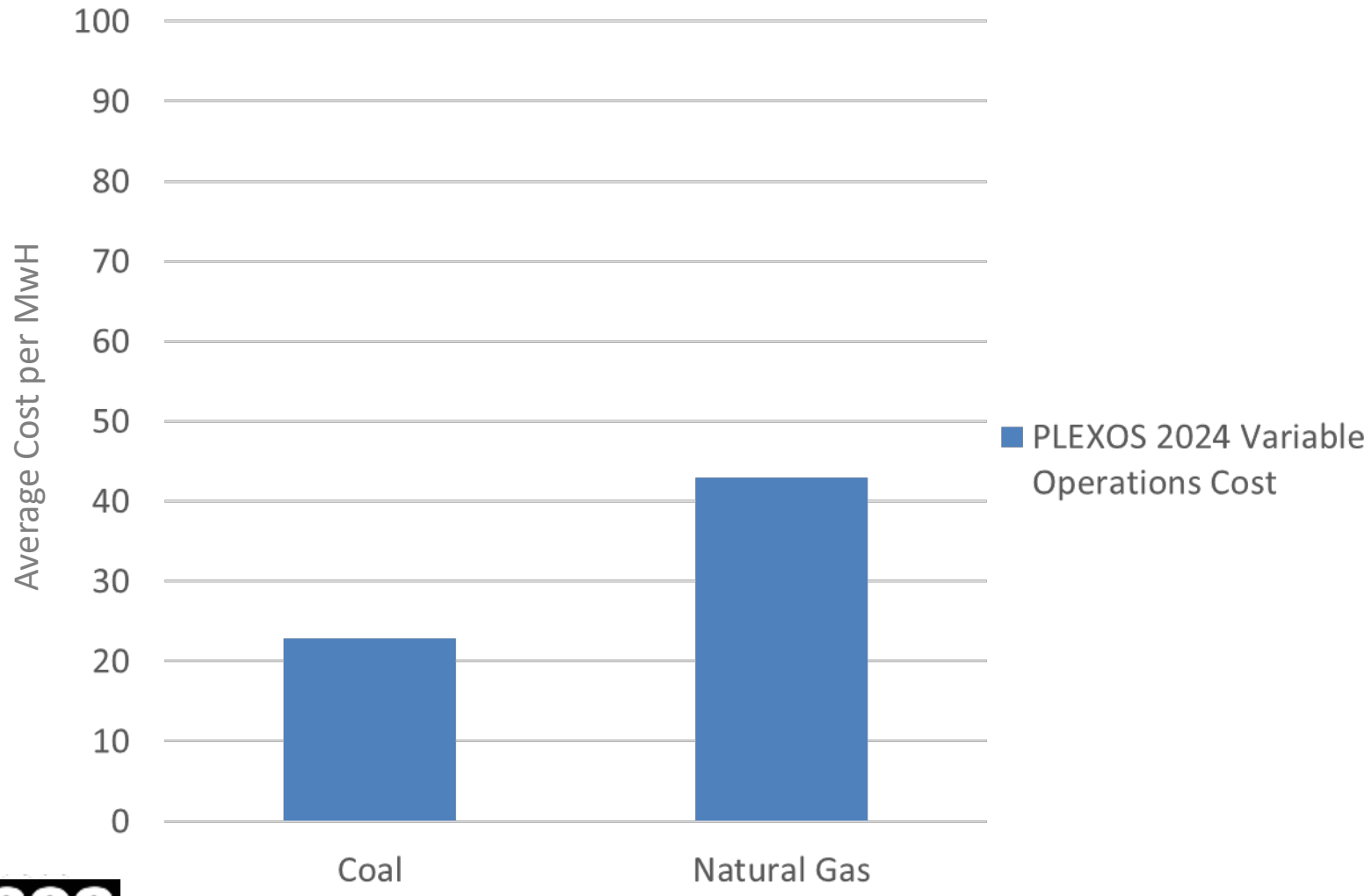
Sources: U.S. Energy Information Administration, Form EIA-860, 'Annual Electric Generator Report' and Form EIA-860M, 'Monthly Update to the Annual Electric Generator Report.'

Total 2024 WECC variable operations cost by generation type when natural gas is $4/mbtu



Preliminary data, do not cite

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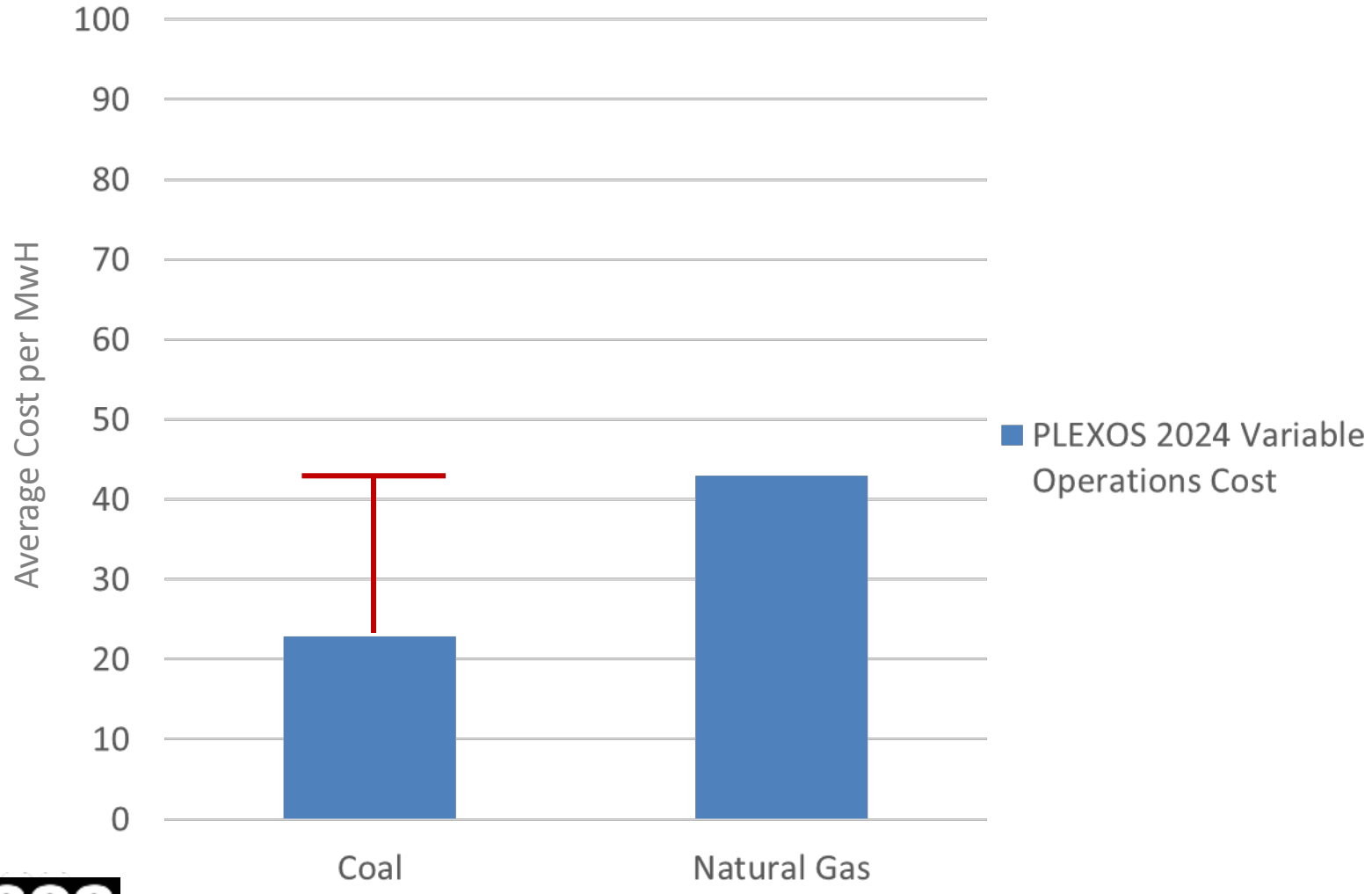
Total 2024 WECC variable operations cost by generation type when natural gas is $4/mbtu



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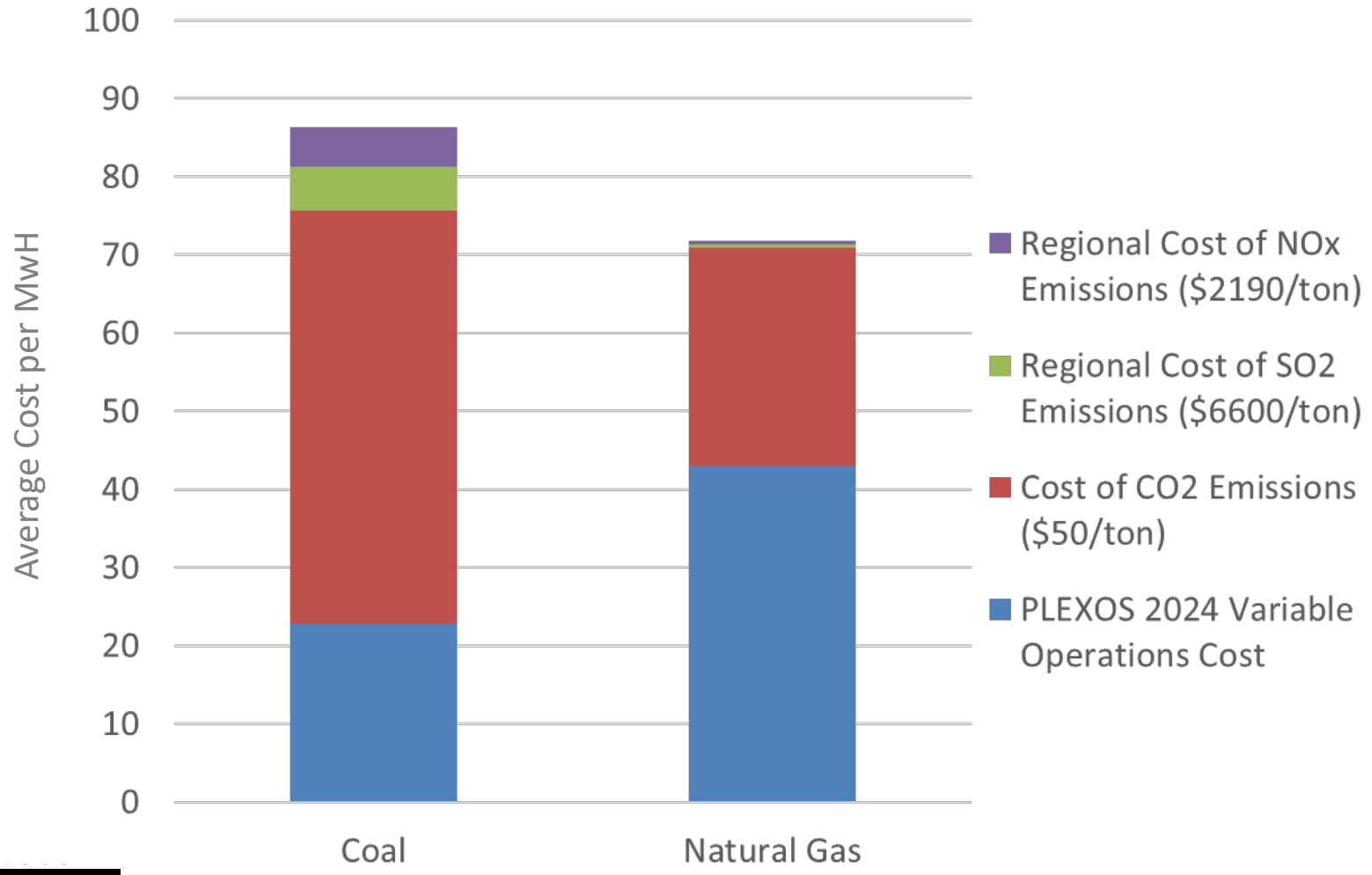
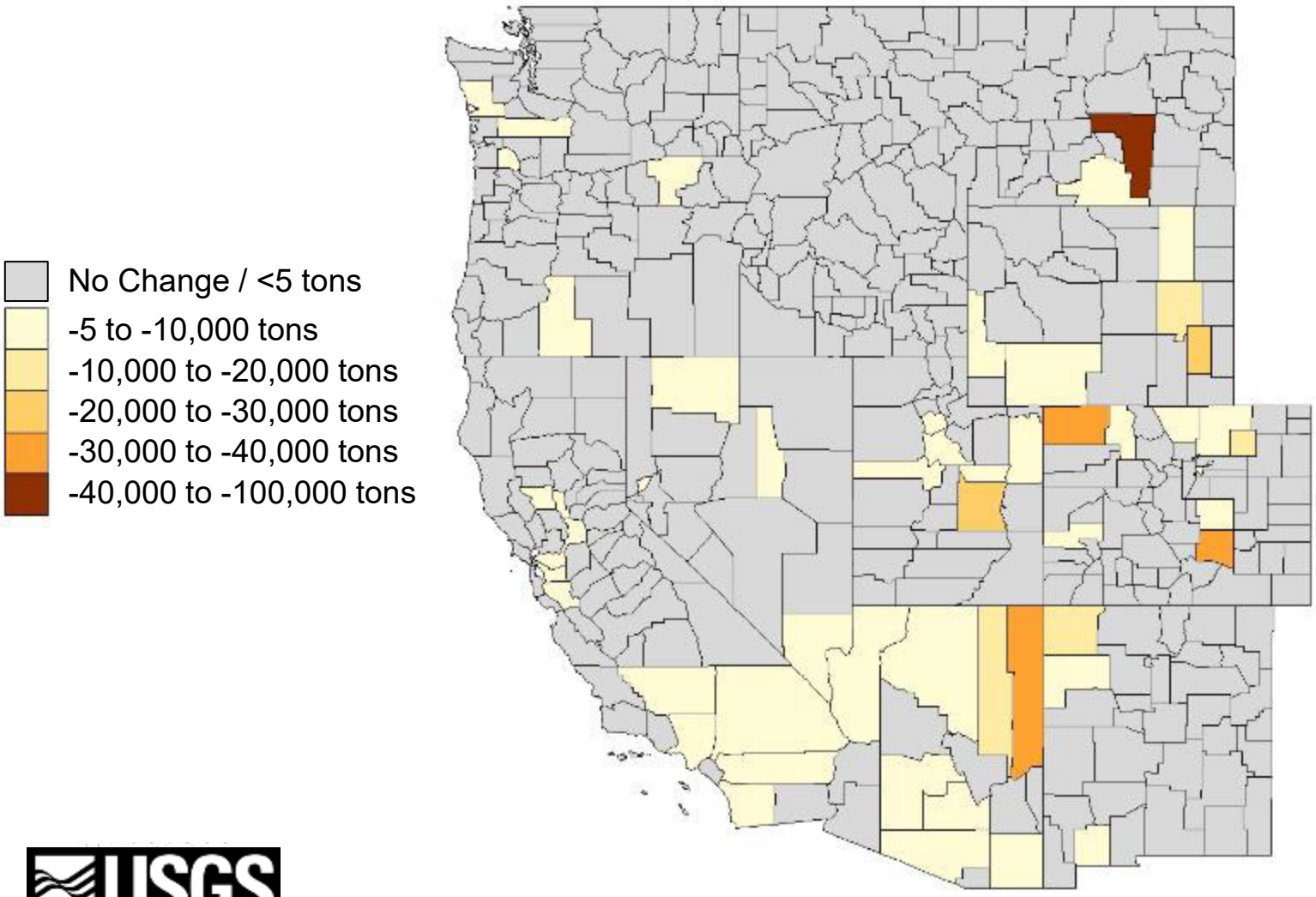
Total 2024 WECC variable operations and emissions cost by generation type when natural gas is $4/mbtu



Preliminary data, do not cite

Change in annual 2024 SO_2 emissions with 'flat flows' at GCD and natural gas at $4/mbtu



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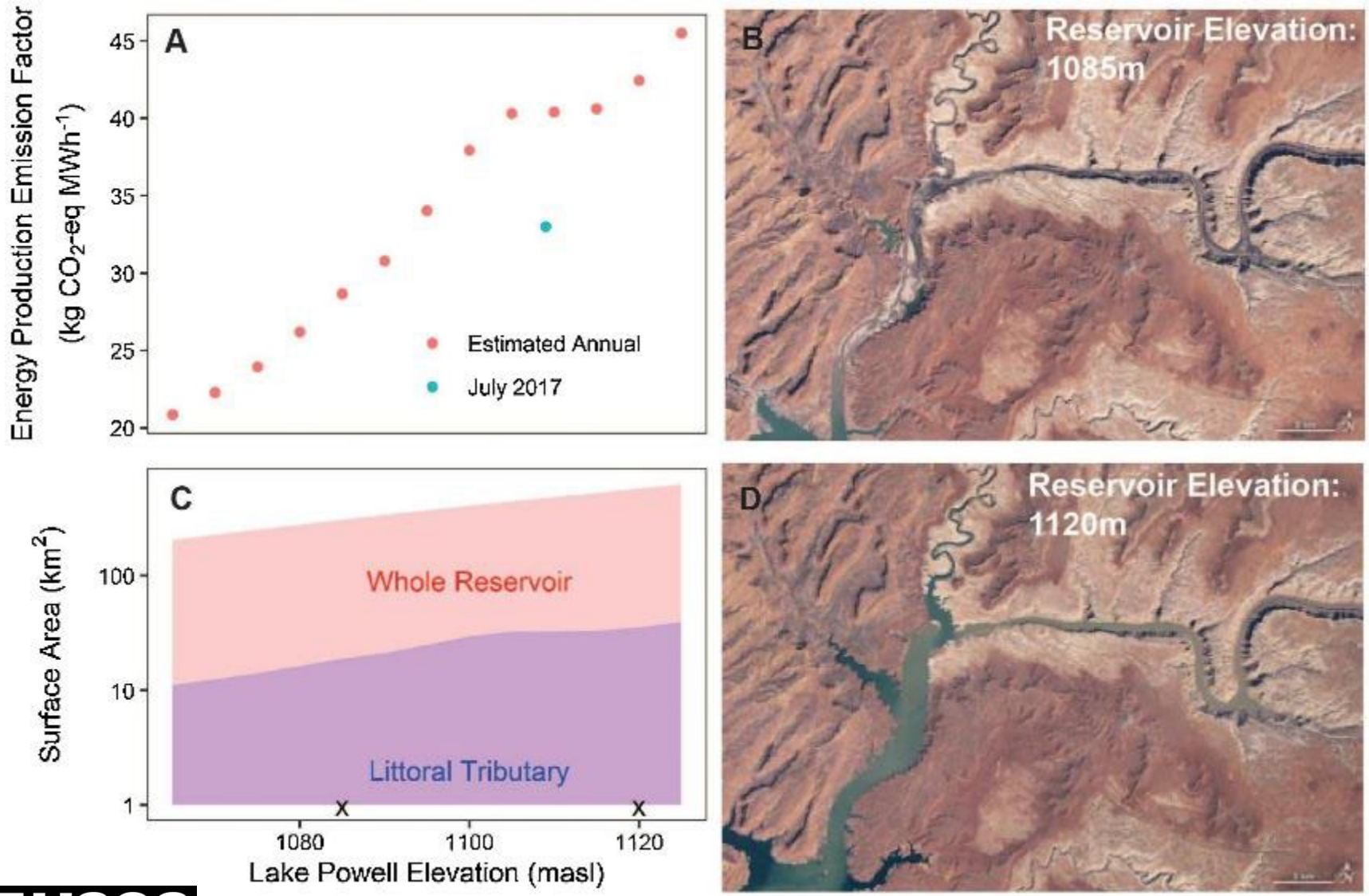

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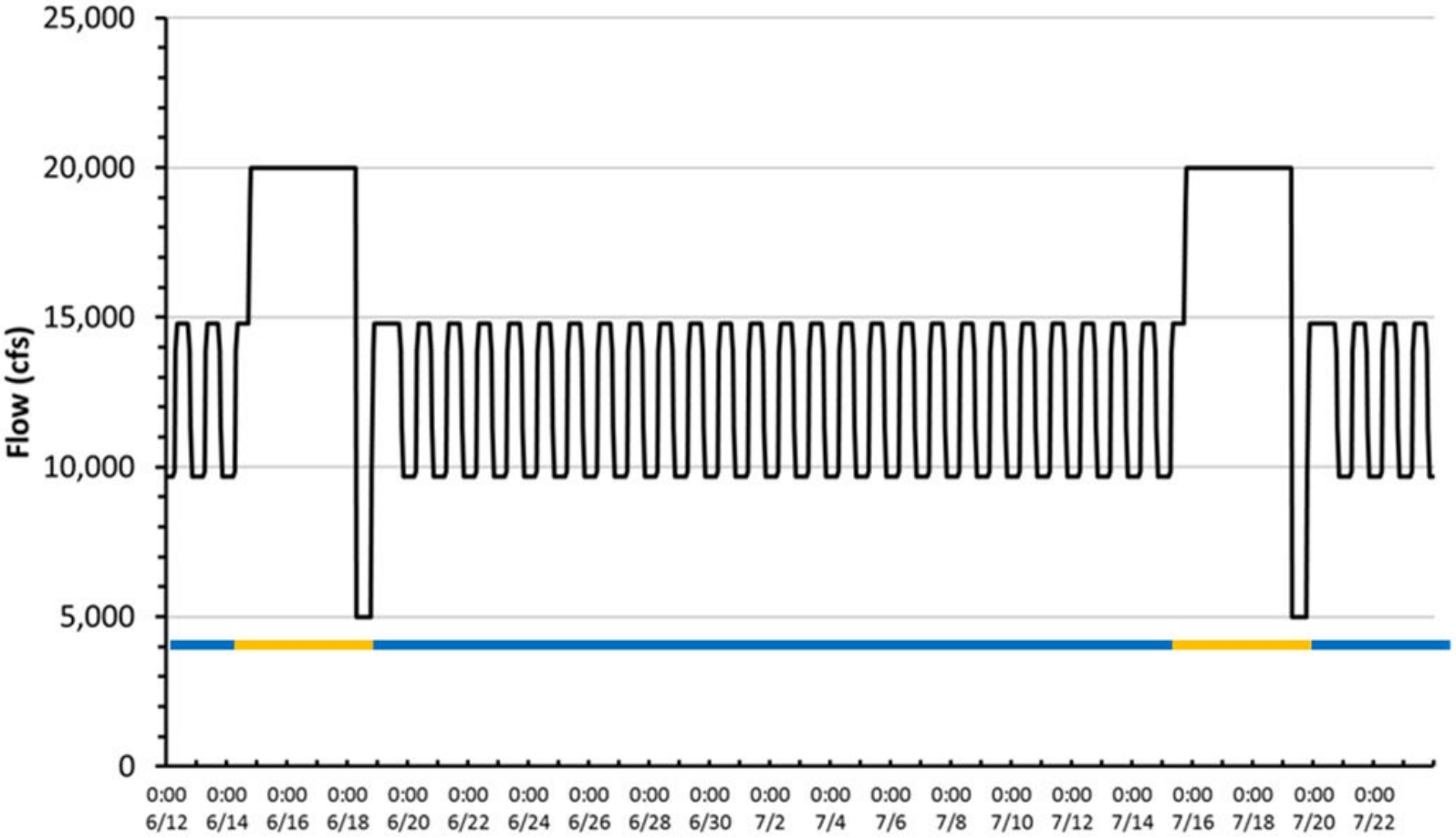
Waldo, S., Deemer, B.R., Bair, L.S. and Beaulieu, J.J., 2021. Greenhouse gas emissions from an arid-zone reservoir and their environmental policy significance: Results from existing global models and an exploratory dataset. Environmental Science & Policy, 120, pp.53-62.

Trout Management Flows



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U.S. Department of Interior, 2016, Glen Canyon Dam Long-term Experimental and Management Plan final Environmental Impact Statement (LTEMP FEIS): U.S. Department of the Interior, Bureau of Reclamation, Upper Colorado Region, National Park Service, Intermountain Region, online, http://ltempeis.anl.gov/documents/final-eis/.

Hydropower Modeling

- We developed a constrained optimization problem to assess the short run economic costs of environmental constraints on hydropower operation.

- The objective of the hydropower model is to maximize the economic value of hydropower over the planning horizon subject to monthly volumes, reservoir levels, and operational constraints.

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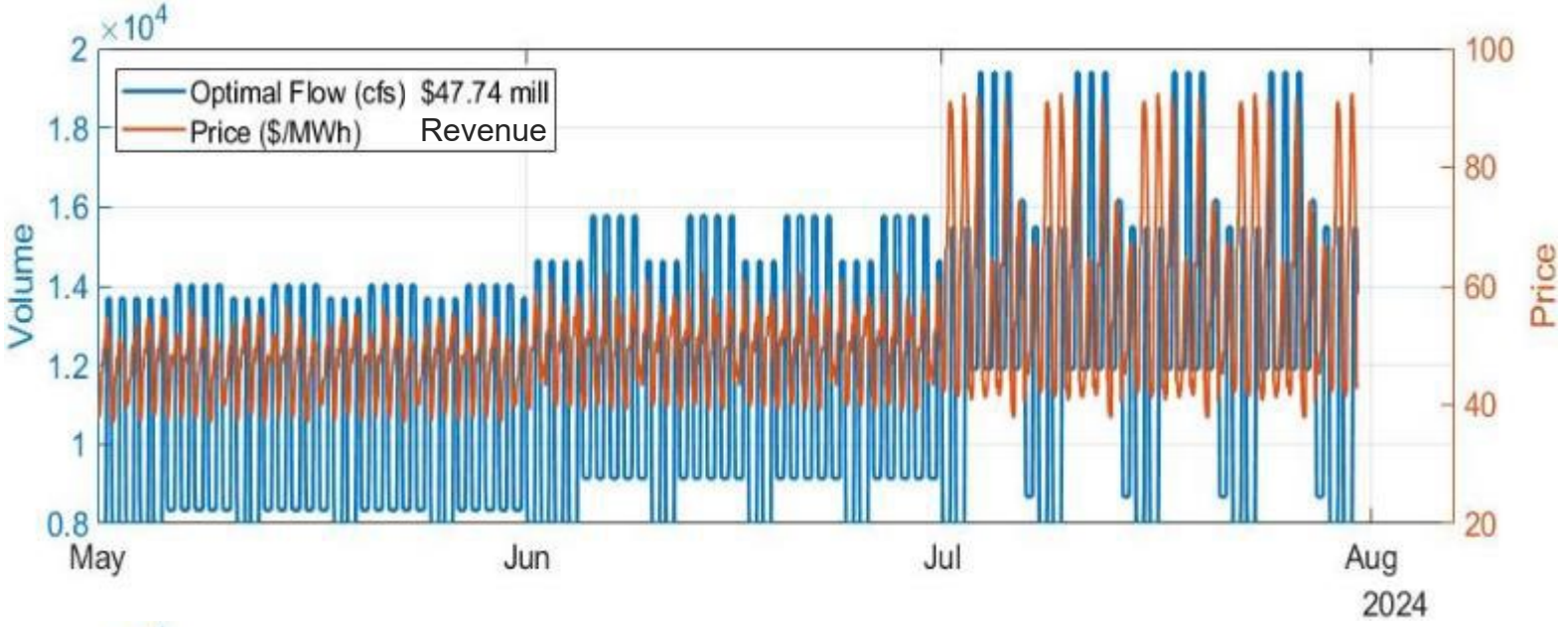
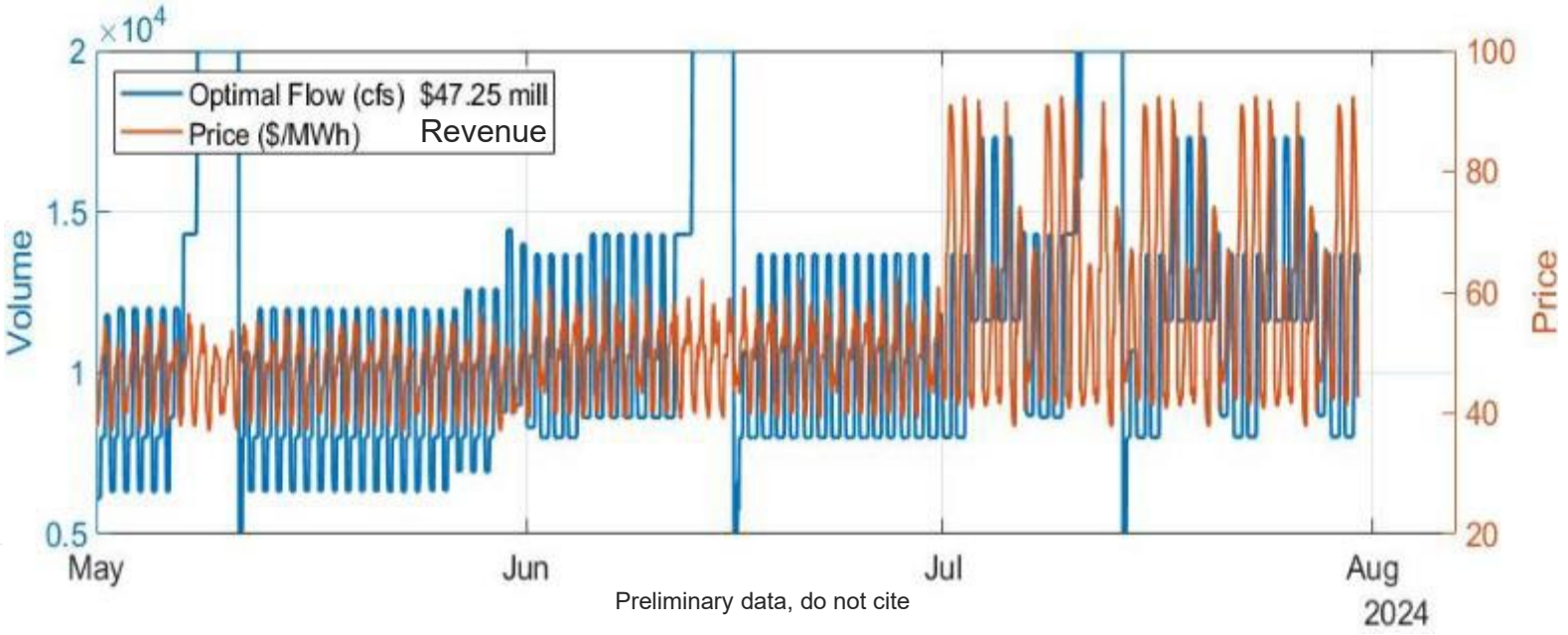
Hydropower Optimization Results

Without TMFs

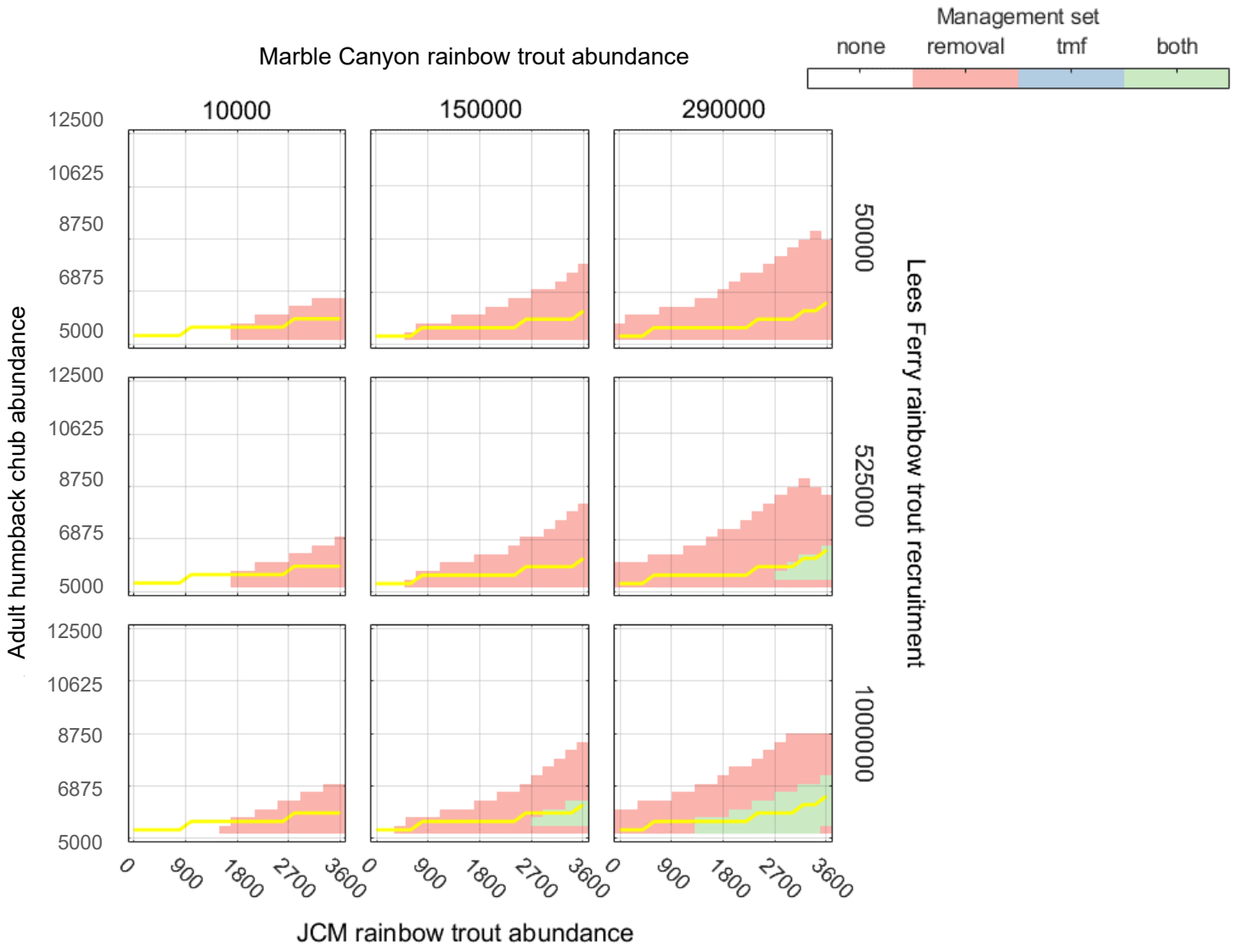


With TMFs



Preliminary data, do not cite

Optimal Trout Management Flow Policy



Secretary's Designee's Requests

- The Secretary's Designee's August 2022 Requests – How to Optimize High-Flow Experiments in the Current Environment
- Project Element J.1. Predictive Models for Adaptive Management
- Project N: Hydropower Monitoring and Research

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Project J.1: Predictive Models for Adaptive Management

- Sub-element: sandbars
  - The primary objective of this sub-element is to use the physically based sandbar model of individual bar response, using flow, stage, sediment concentration, and sediment grain size, to predict changes in sandbar size, while considering the economic costs to hydropower, over various future flow and sediment scenarios.

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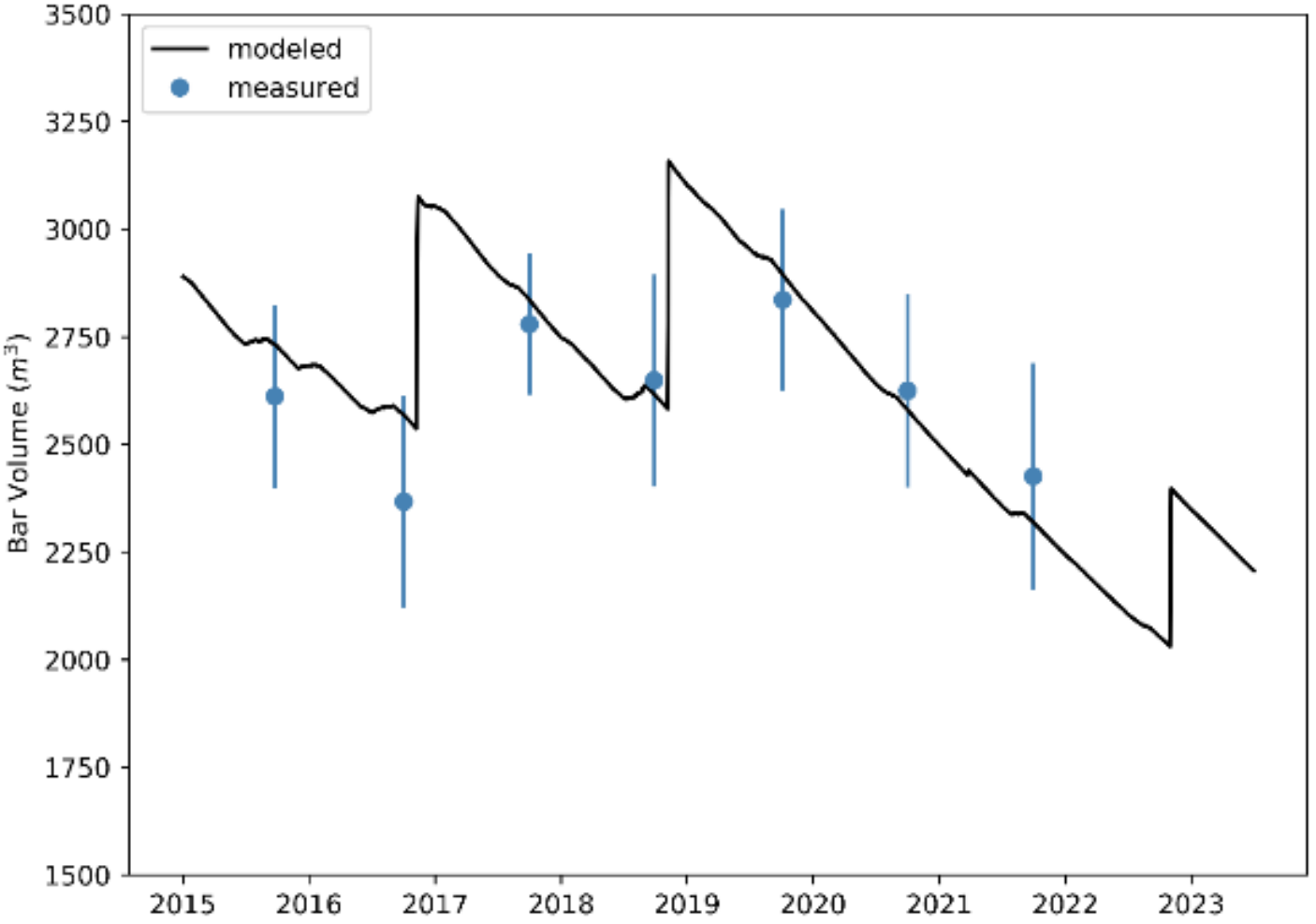
Morphodynamic Model

November 2022 33,100 cfs 48-hr High Flow Experiment (HFE)



Mueller, E. R., & Grams, P. E. (2021). A morphodynamic model to evaluate long-term sandbar rebuilding using controlled floods in the Grand Canyon. Geophysical Research Letters, 48, e2021GL093007. https://doi.org/10.1029/2021GL093007

Photo Credit: Amy S. Martin

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