

# Glen Canyon Hydropower Production and Value

Status and Trends, 2022

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Annual Reporting Meeting  
January 24-25, 2023



# Glen Canyon Electrical Production

Year	Release Volume (maf)	Electrical Production (GWhs)
2022	7.0	3,443
2021	8.23	4,258
1992-2022 Average	9.11	5,400

Power production in 2022 was 19% less than 2021 and 36% less than the 30-year average



# Changes in Hydropower Head Affects the Efficiency of Electrical Production

*Hydropower head = elevation of Lake Powell – elevation of GCD tailrace*

- Example:
- At full pool, it takes 1.9 acre feet to produce 1 MWh
- At elevation 3522.16 (Jan 23), it takes 2.75 Acre Feet to produce 1 MWh



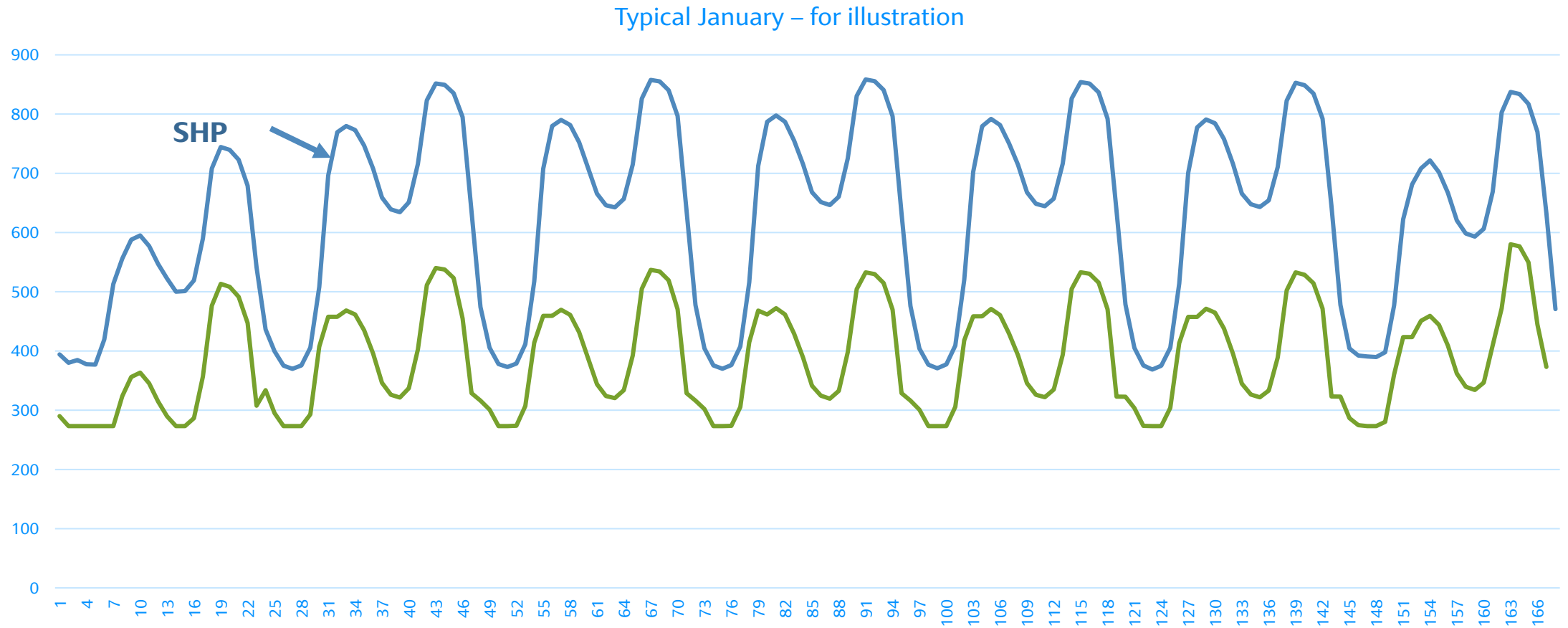
# WAPA-199: Description & Consequences

- WAPA-199 is a new SLCA/IP rate - implemented December 2021
- Customers are charged a SLCA/IP rate for the electric power that is actual generation. Firming energy purchases, beyond what is actually generated, are charged to customers at the end of the month
- Customers can avoid these charges by taking only their share of what is generated
- SLCA/IP customers must either generate more of their own power or buy more power on the market
- Customers are interested in more water release from the CRSP units in peak electrical months



# WAPA-199

## Comparison of SHP versus WAPA-199 Energy

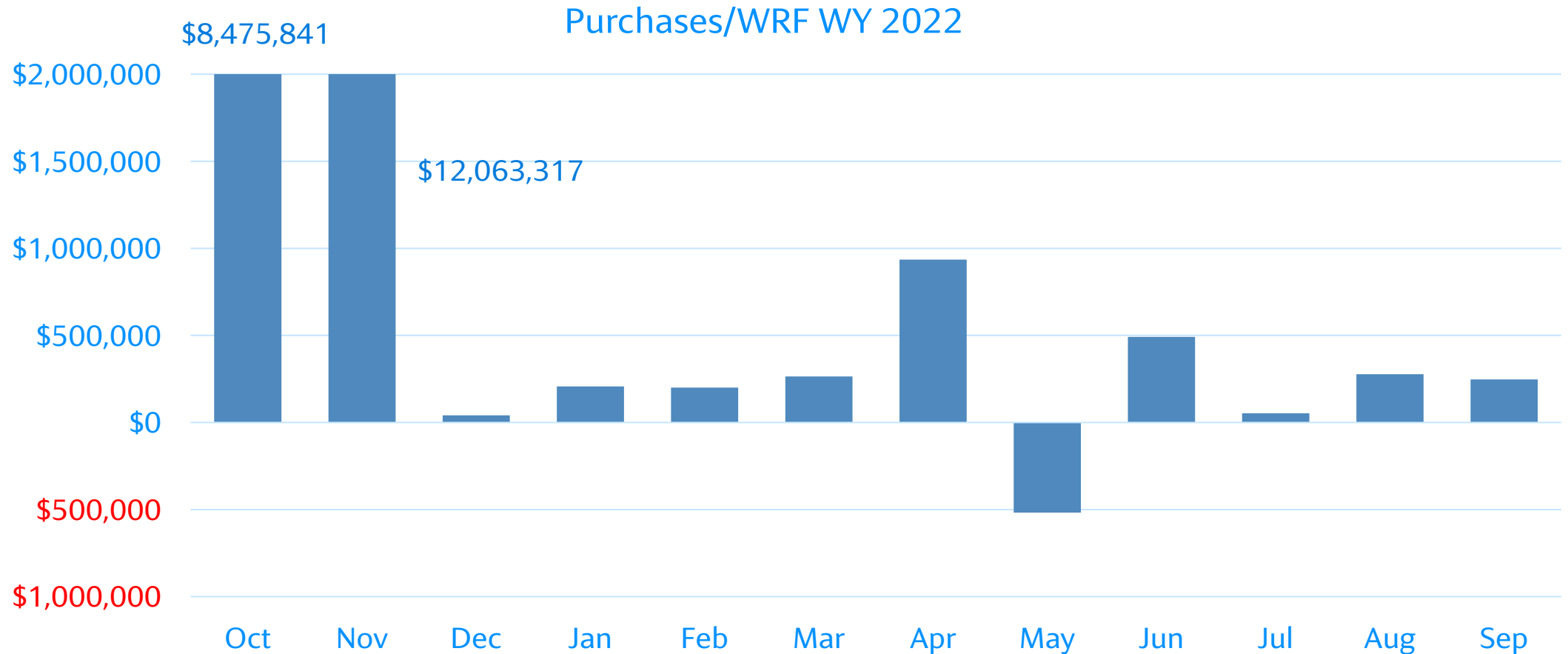




# Purchase Power



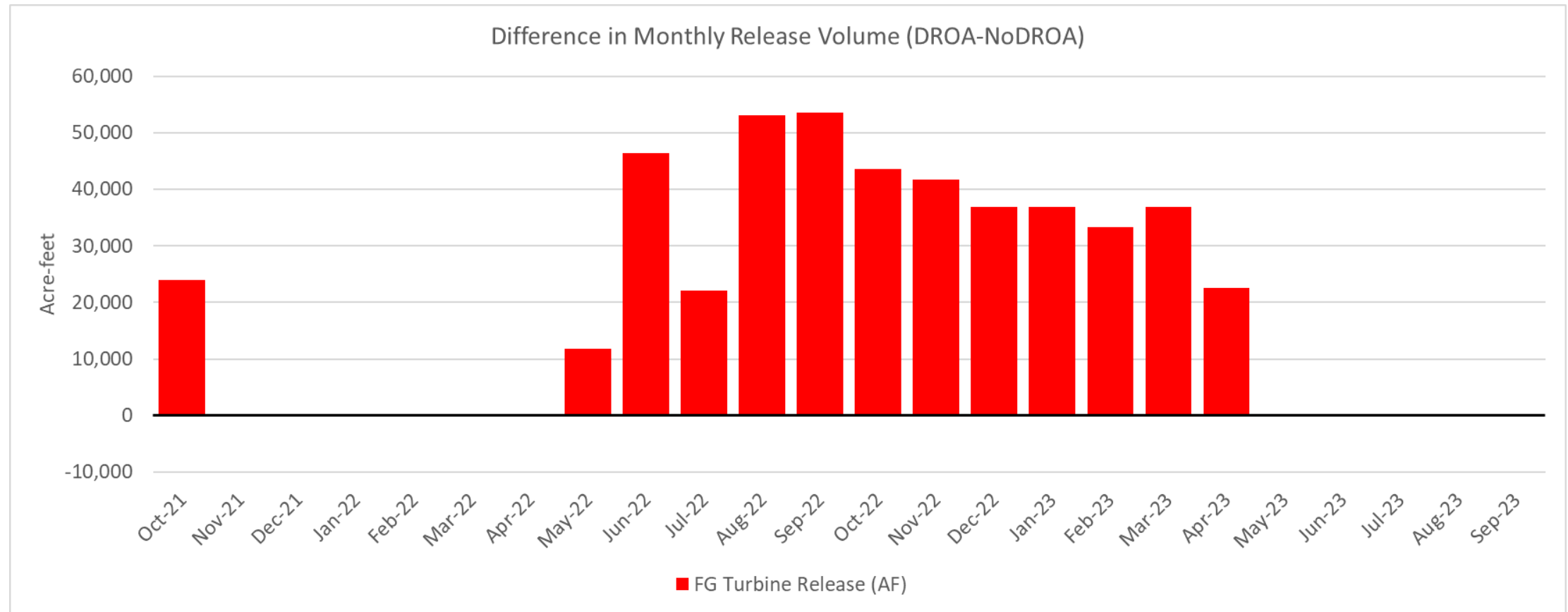
# Purchases/WRF WY 2022



**Net Annual Purchase Power**  
2022 = \$22.7 million

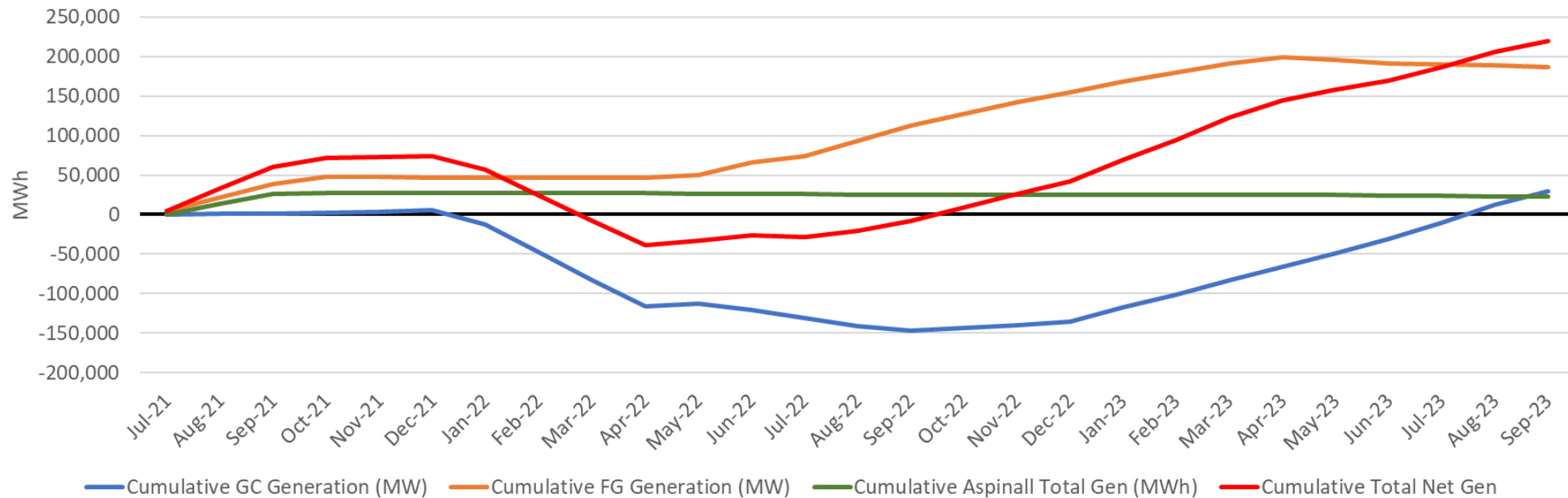
**Glen Canyon Release**  
2022 = 7.0 maf

# DROA: Higher Flaming Gorge Releases

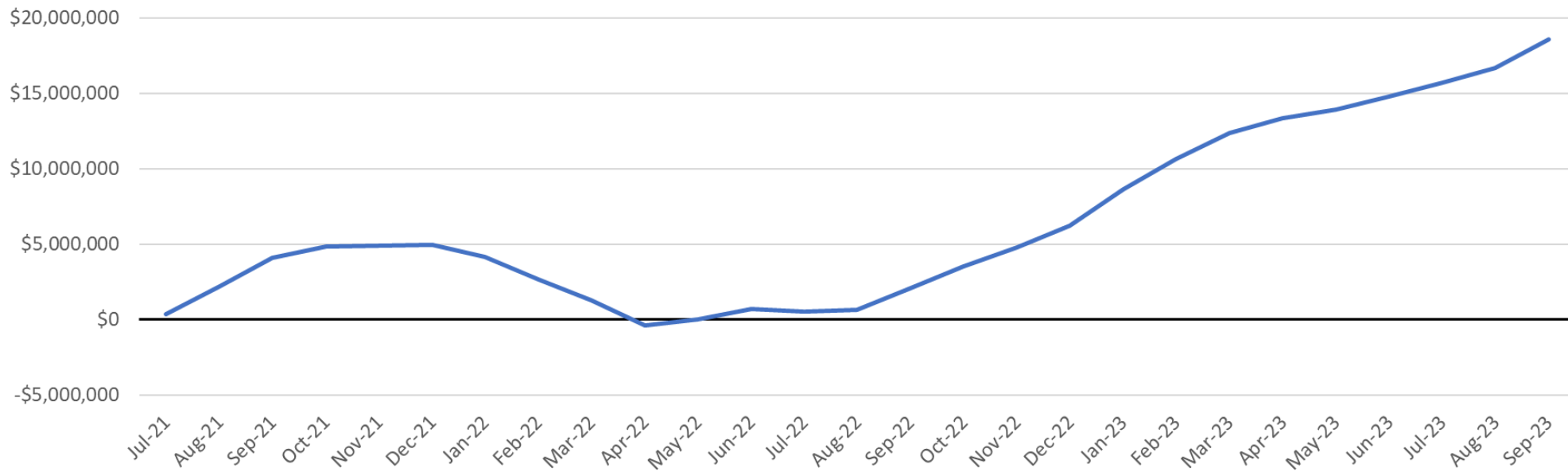




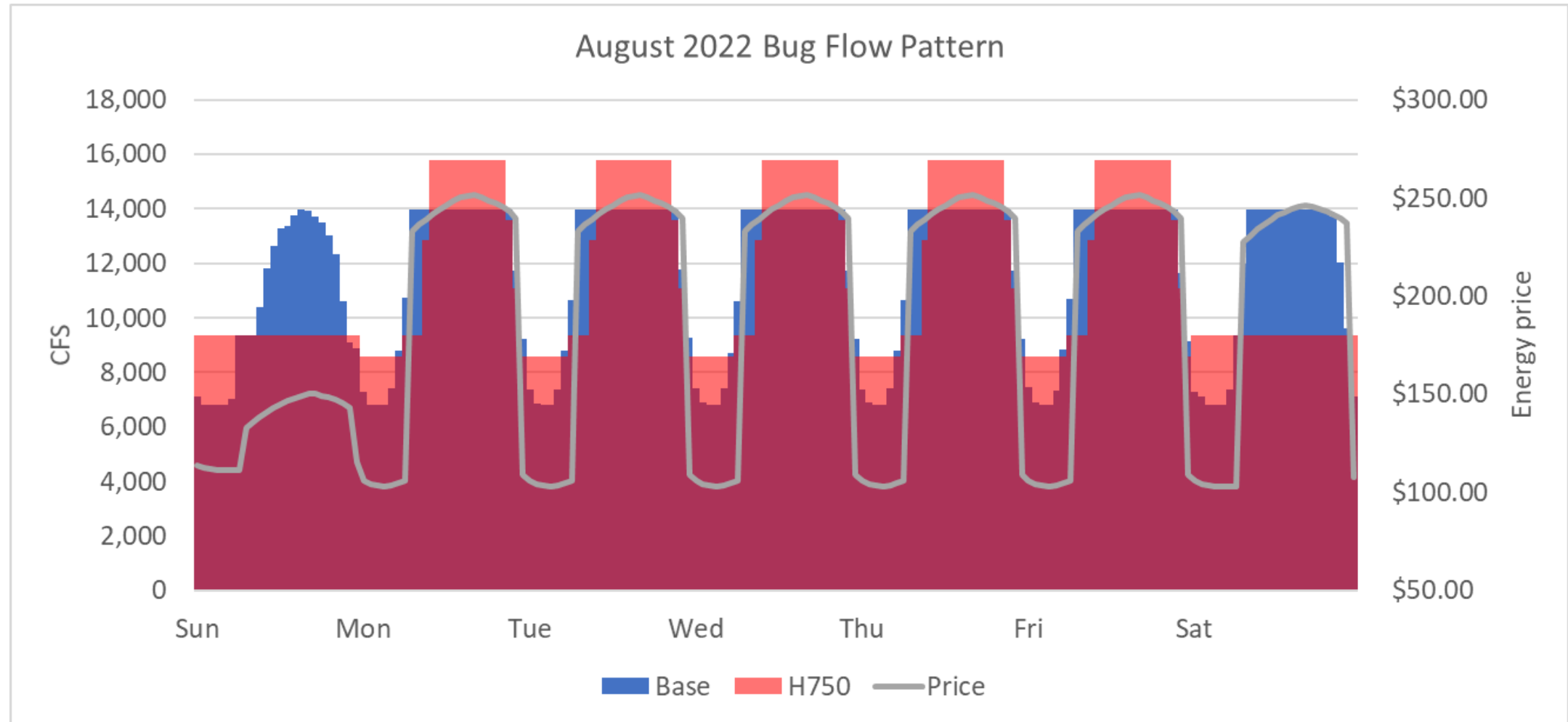
### Cummulative Difference (DROA - NoDROA) in Generation (MWh) at Individual Plants



### Cummulative Difference (DROA-NoDROA) Energy Value



# Macroinvertebrate Flows – Summer 2022



# Macroinvertebrate Flows Costs - Summer 2022

Month	Cost
May	\$238k
June	\$235k
July	\$468k
August	\$213k
Total	\$1.154M

## In comparison:

- 2018: \$165k
- 2019: \$330k
- 2020: \$940k
- 2022 a priori estimate: \$1.4m

## Why have Bug Flow expenses increased over these years?

- Summer wholesale market prices have risen

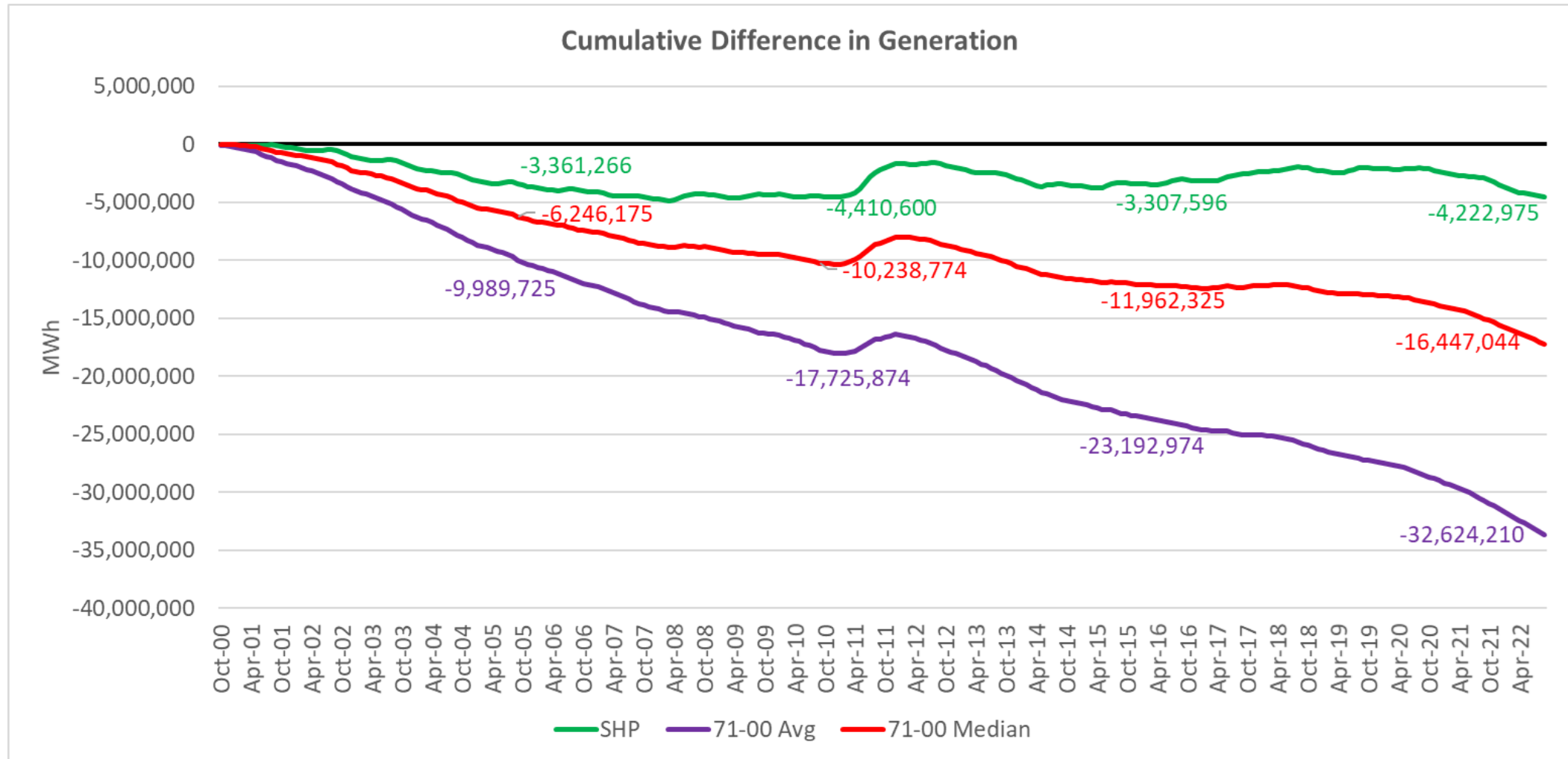


# CRSP Hydropower Drought Analysis

- From WY 2000 - 2022 the cumulative reduction in total generation compared to the pre-drought period is 32,624 GWh.
- \$1.5B in economic value
- GCD 19% capacity reduction
- The CRSP rate is almost 50% higher



# CRSP Hydropower Drought Analysis (continued)





# Smallmouth Bass Experiments

## Electrical Power Impacts

- The National Renewable Energy Laboratory, Argonne National Laboratory, and WAPA developed an analysis of the impacts of the proposed GCD SMB flow options on CRSP hydropower and the attached electrical systems
- NREL calibrated the PLEXOS energy system model for this analysis
- Argonne modeled the CRSP hydropower system using the GTMAX SL model
- The modeling was done under WAPA's sponsorship and guidance using Reclamation's descriptions of the flow options and WAPA's modeling of these options.



# Smallmouth Bass Experiments

## Electrical Power Impacts (continued)

### Assumptions for PLEXOS model runs:

- Geographic scope is the WECC system
- Time frame is June – October 2023
- Assumes “free exchange” of generating sources to meet WECC retail electrical demand
- Analysis does not include new construction or uprates
- PLEXOS model is constrained by transmission capacity
- Treats Glen Canyon hourly power generation as “must run”, i.e., SMB flow options are strictly adhered to
- For each PLEXOS model run, assumes just one flow option is implemented for the entire time frame



# Smallmouth Bass Experiments

## Electrical Power Impacts (continued)

### Assumptions for GTMAX SL model runs:

- For each GTMAX model run, only one flow option is implemented for the entire time frame
- Assumes that, during the experiment, WAPA purchases firming energy to make up the difference between GCD “normal” operations and the experiment.
- “Normal” operations is a “no experiment” condition: GCD operates according to the LTEMP operating criteria
- Market prices used to estimate firming expenses are forecasted by ARGUS (with hourly adjustments)



# Smallmouth Bass Experiments

## Electrical Power Impacts (continued)

Research Questions (analysis is in progress)

- Is replacement energy available?
- Since the CRSP transmission grid was built to distribute GCD power to federal points of delivery, if replacement energy is available, can it be transmitted from new generation sites to retail load?
- Will reductions in GCD power production decrease the reliability or stability of the electrical system?
- How will flow options impact exchange prices?
- How much will firming expenses be and how will these expenses impact the CRSP Basin Fund



# GTMAX model results – Reduction in GCD Power Production

 Penstock release
  Bypass release





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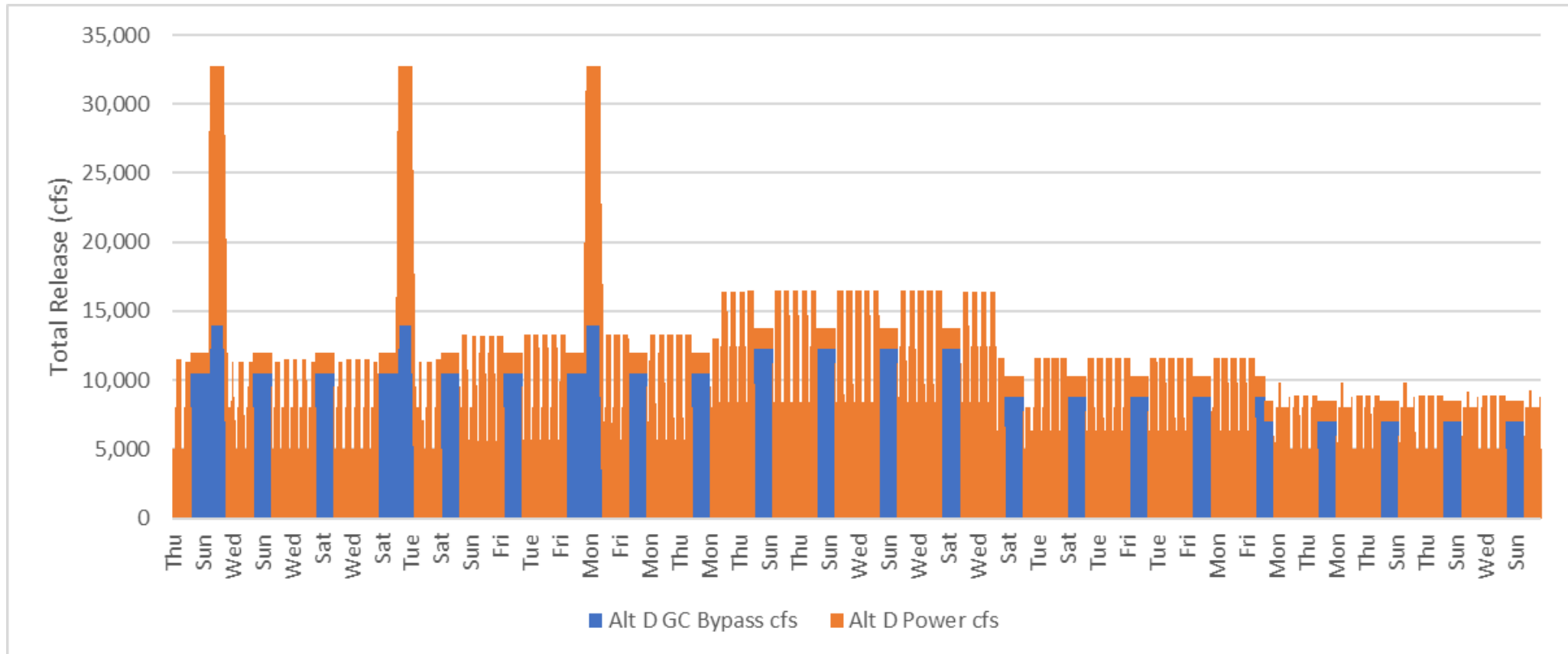


# Flow Option D

## GTMAX model results – Reduction in GCD Power Production

Lost Generation: 380.2 GWh

Penstock release Bypass release



# Questions?



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