



Glen Canyon Hydropower Production & Value: Status & Trends, 2020 S. Clayton Palmer



January 20-21, 2021

Annual Reporting Meeting

ry 20-21, 2021

GCD Experiments

Bug Flows Experiment: May – August, 2020

2019 Bug Flow Experiment Revisited

- July, 2019 is characterized by changes each week in volume and weekday pattern
- This illustrates that Bug Flows are a "weekend" experiment. The weeks days during the Bug Flows are driven by electrical needs.







2020 Bug Flow Experiment



 Estimated cost of \$407,000 (estimate)







Glen Canyon Electrical Production

WY 2020 Electrical Production Glen Canyon Dam & Total CRSP TOTAL GCD = 3,823,966 MWhs

WY 2020 Electrical Production GCD & CRSP TOTAL GCD = 3,647 GWhs





How Does WY 2020 GCD Electrical Production Compare With 2019?

GCD Electrical Production: 2020 vs 2019				
2019	3,823,966	MWhs		
2020	3,647,451	MWhs		
Difference (2020 - 2019)	(176,515)	MWhs		
Percentage Difference	-4.62%			





Changes in Hydropower Head Affect the Efficiency of Electrical Production

hydropower head = elevation of Lake Powell – elevation of GCD tailrace

Lake Powell elevation 2019 vs 2020







Lake Powell Elevation: 2014-2020



Wholesale Electrical Energy: Price Trends

- Wholesale electrical prices have been falling in recent years
- The most valuable times of electrical generation is changing





Wholesale electrical prices had been falling. Recent prices are up.

- Decrease in market-wide average wholesale prices since 2008 is largely due to changing natural gas prices*
- 2020 has seen increasing wholesale electrical prices in the West. Is this a new trend or just a blip?

* Impact of Wind, Solar, and Other Factors on Wholesale Power Prices, Nov., 2019, Lawrence Berkeley National Laboratory



The most valuable times of day for electrical generation are changing

 Significant additions to wind and solar generation are having a more consequential impact on temporal and geographic pricing patterns *

> * Impact of Wind, Solar, and Other Factors on Wholesale Power Prices, Nov., 2007, Lawrence Berkeley National Laboratory



Impact of "Duck Curve" on Electrical Market Prices



How does this relate to the Hydropower Metrics?

- Lower wholesale electrical prices will lower the financial impact of GCD experiments (e.g. HFEs)
- The development of the "duck curve" is changing when electrical energy production is most valuable
 - Capacity the ability to produce when demand is higher has become more valuable
 - Load-following: specifically following changes in "net demand" is becoming more valuable
 - Electrical energy production is more valuable in the pre-dawn hours and in the twilight hours
- This means that experiments that reduce the ability of the GCD to load follow will have a higher financial and economic impact



Purchased Power







FY 2020 Purchases to Meet FES Contractual Obligations

	MWh	Cost	Price/MWh
October	51,708	\$1,360,209	\$26.31
November	67,852	\$2,224,233	\$32.78
December	30,168	\$860,693	\$28.53
January	57,004	\$1,423,960	\$24.98
February	61,493	\$1,319,640	\$21.46
March	53,802	\$1,136,932	\$21.13
April	12,290	\$243,873	\$19.84
May	2,843	\$48,237	\$16.97
June	6,497	\$131,891	\$20.30
July	23,520	\$931,073	\$39.59
August	-12,345	-\$739 <i>,</i> 466	\$59.90
September	54,857	\$2,054,943	\$37.46



Hydrology and Purchase Power

- 8.23 MAF releases from Glen Canyon in 2020
- 8.23 MAF releases from Glen Canyon in 2021
- 8.23/7.48 MAF releases from Glen Canyon in 2022



MWHs of Energy - Short in Most Months



CRSP Resource Scheduling: A primer

To Begin – SHP Demand

 CRSP Firm Electric Service load input into the Energy ¹⁰⁰ Management and Marketing Office Customer Portal ⁸⁰



CRSP Demand

Western Area Power Administration

Base Loaded Resources



Glen Canyon Dam



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Western Area Power Administration

Flaming Gorge Dam



Aspinall Units



Putting it all Together

CRSP Generation vs Demand Term Purchases 01/22/2020 Block purchases on/off 1000 peak 2-3 months in advance 900 **Purchase SHP** Demand Hedged to anticipate 800 changes in hydrology **Blue Mesa** and energy prices **Morrow Point** 700 **Flaming Gorge** Day Ahead purchases 600 Using current BOR and energy pricing, 500 purchase to cover SHP schedules not covered **Glen Canyon** 400 by CRSP resources 300 **Real Time purchases** 200 If any changes to AHP Crystal, Deer Creek and due to curtailments of **Fontenelle** Molina 100 Note: Base loaded units raise the graph by 24 MW 0

0100 0200 0300 0400 0500 0600 0700 0800 0900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400

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Power Administration

Similar Process and Results July 2020



Questions?

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