

WESTERN AREA POWER ADMINISTRATION

Glen Canyon Dam Hydropower Production and Value Status & Trends, 2018

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CRSP MC



Glen Canyon Powerplant

Capacity: 1,320 MW

Energy: 3,978 GWhs (10-year average annual)



GCD Hydropower Metrics

- ✓ Electric generation (energy value)
- ✓ Electric generation (capacity)
- ✓ Load following capability
- Emissions
- ✓ Net firming purchases
- ✓ Hydro-mechanical equipment

Source: GCD AMP Knowledge Assessment – Status and Trends: Hydropower and Energy

- ✓ Topics covered in this presentation

Status and Trends

Recent variables affecting hydropower metrics

- Recent increase in power efficiency (hydropower head)

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

This effects electrical generation, capacity & net firming purchases

- Implementation of LTEMP operating criteria
This effects capacity and load following capability

- Recent trend of declining electrical energy prices

This effects electrical energy value & net firming purchases

Recent Improvement in Power Efficiency



Recent Increase in Lake Powell Elevation

GLEN CANYON DAM

POOL
ELEVATION
(FEET)

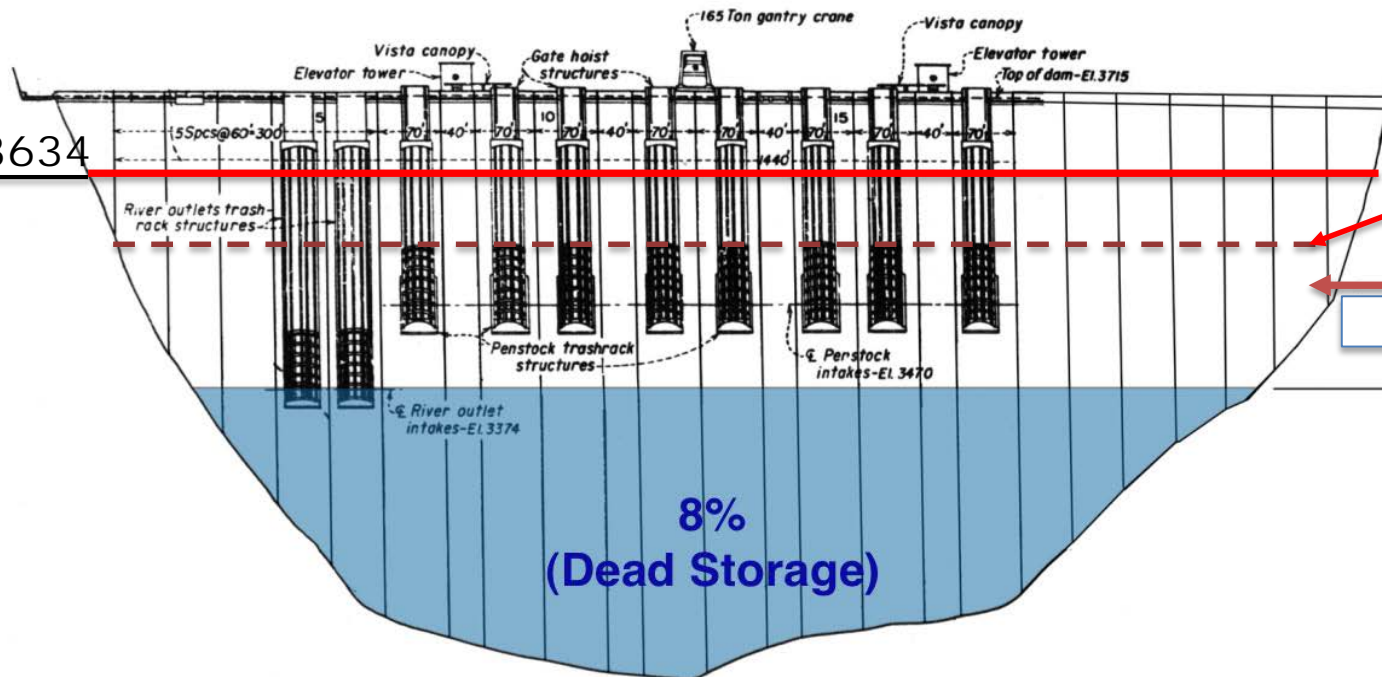
3700

3555 03/14

3490 Min Power

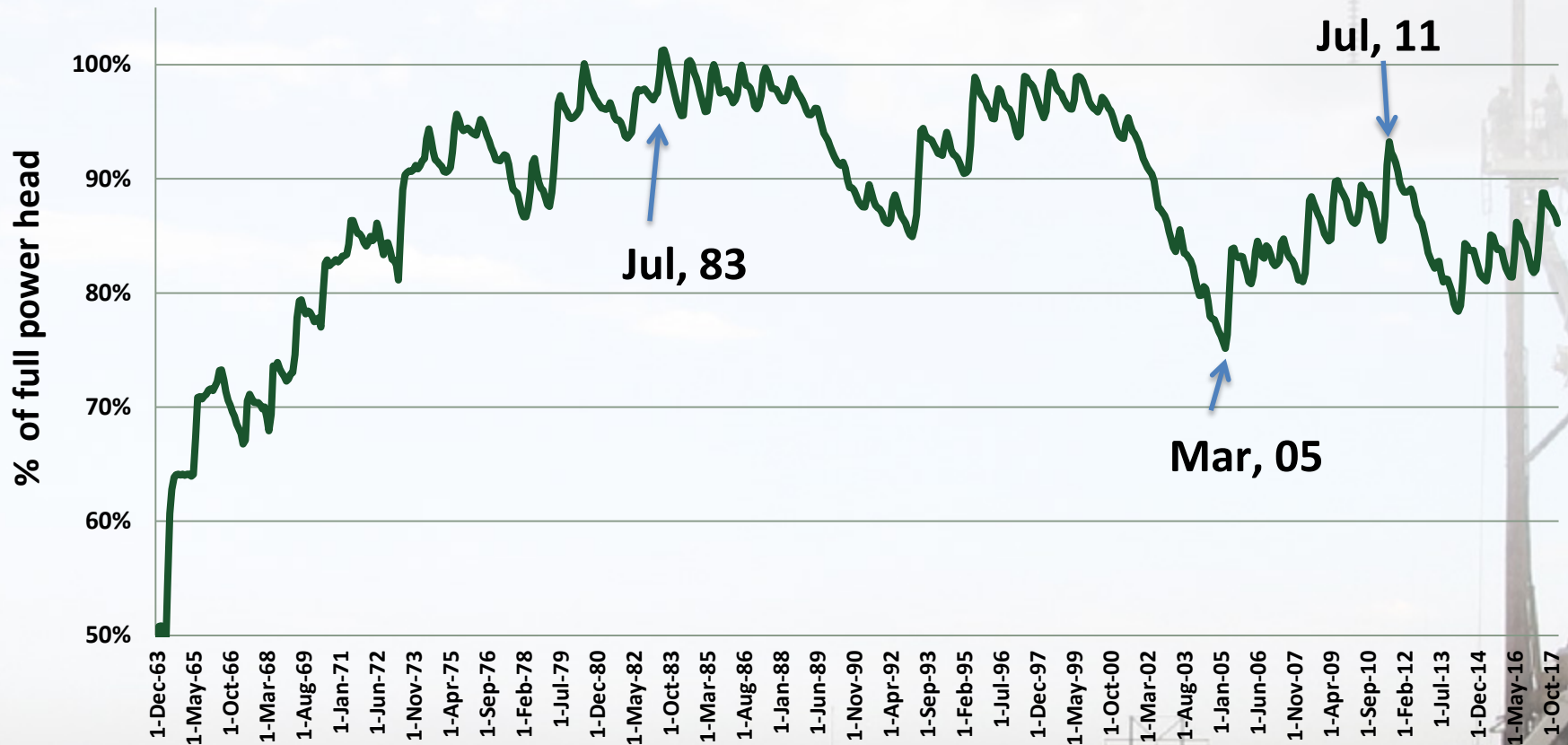
3374

EOY 17 3634



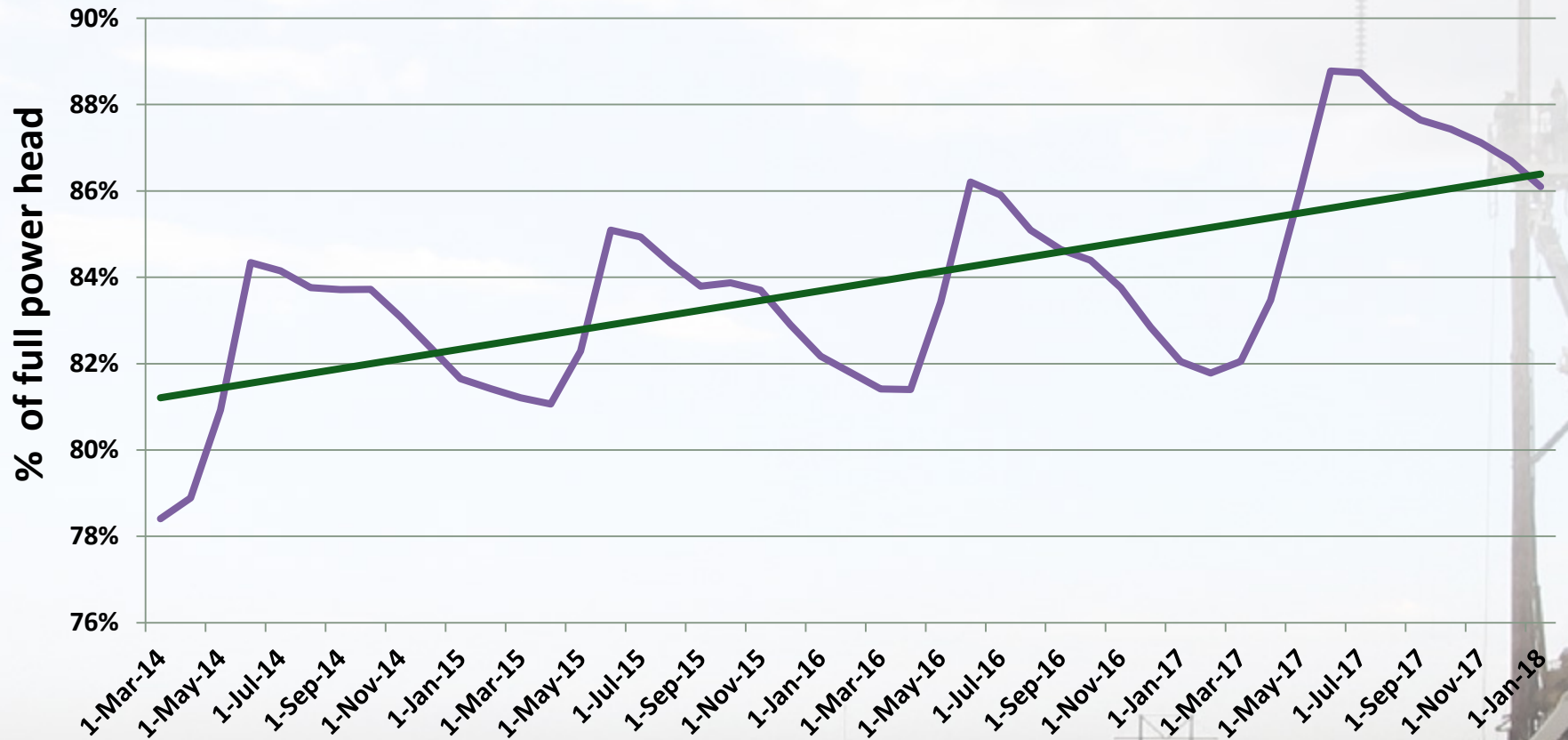
GCD Hydropower Head 1963 - 2018

Percentage of full power head



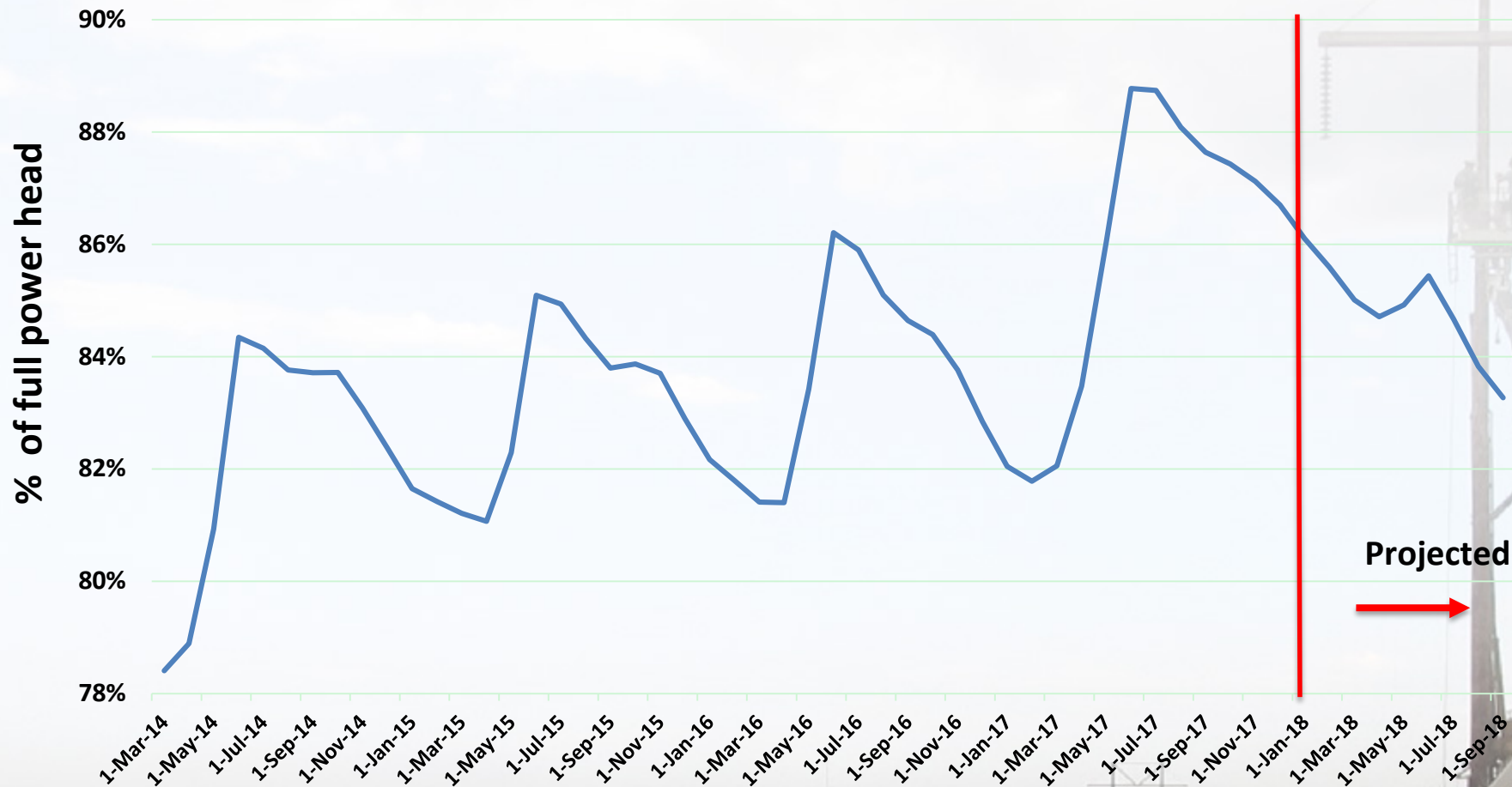
Improvement in Power Efficiency since 2014

Percentage of full power head



Recent improvements – and WY 18 Projections

Percent of full power head



Projected



The Effect of Power Efficiency on GCD Energy Production

Date	Lake Powell Elevation (ft)	Energy production in a 9.0 maf year (GWh)	Percentage of production vs full powerhead
July, 1983	3,707.40	4,617	101.25%
Mar., 2005	3,555.90	3,378	74.09%
Jan., 2014	3,578.69	3,575	78.39%
Jan., 2018	3,619.38	3,916	85.89%

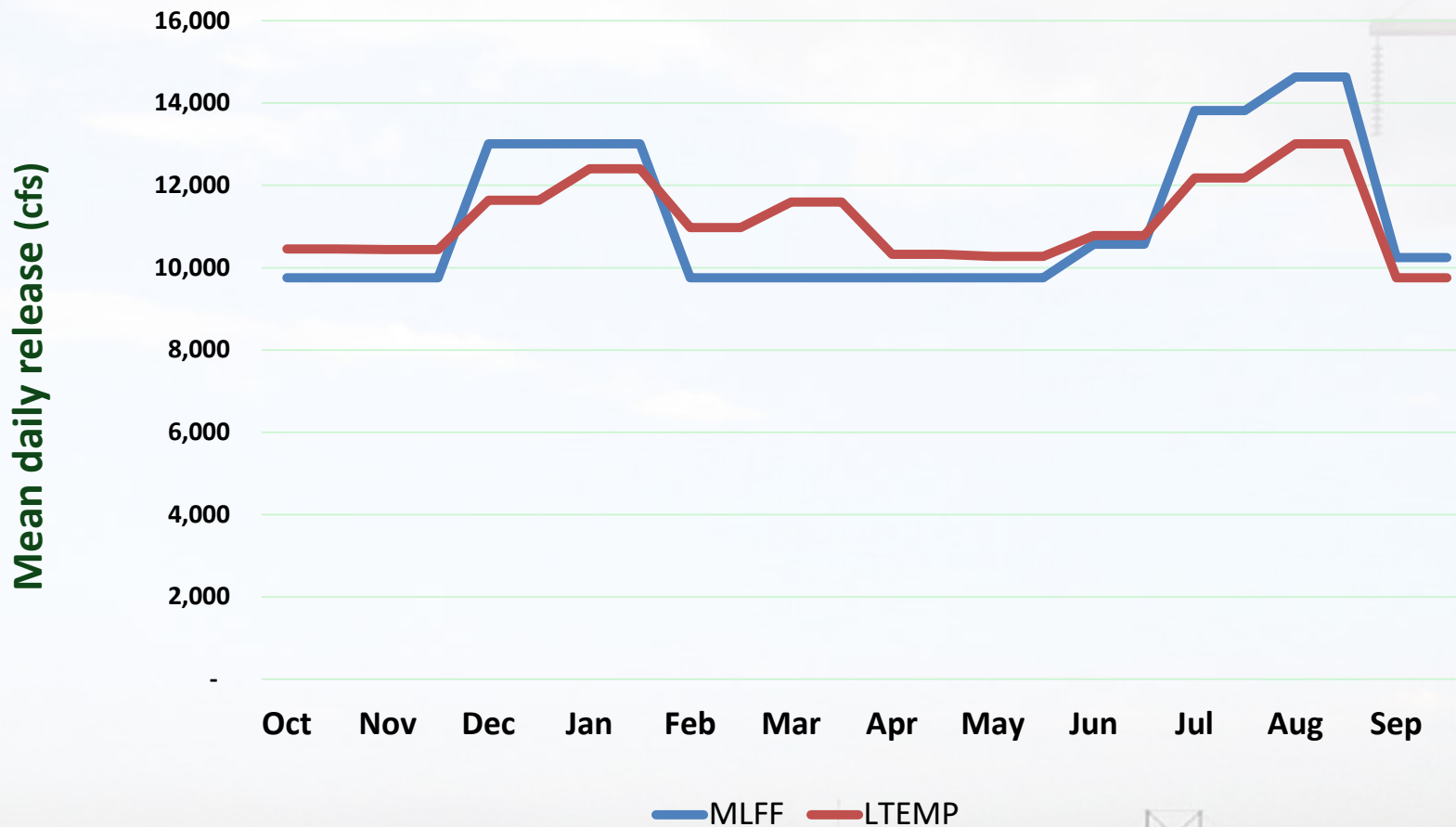
LTEMP ROD & Operating Criteria

Changes from MLFF

- *Maximum downramp*: increased from 1,500 cfs/hr – 2,500 cfs/hr
- *Distribution of monthly volume*: changed so it is based on SLCA/IP FES electrical demand
- *Maximum allowed daily change in release*: changed so that it is a strict proportional relation to monthly volume
- *GCD experiments*: there will be a greater variety & number of operational experiments

GCD Monthly Water Volume MLFF vs LTEMP

(8.23 maf year)



Maximum Daily Allowed Change in Release: LTEMP; a strict proportion of monthly volumes

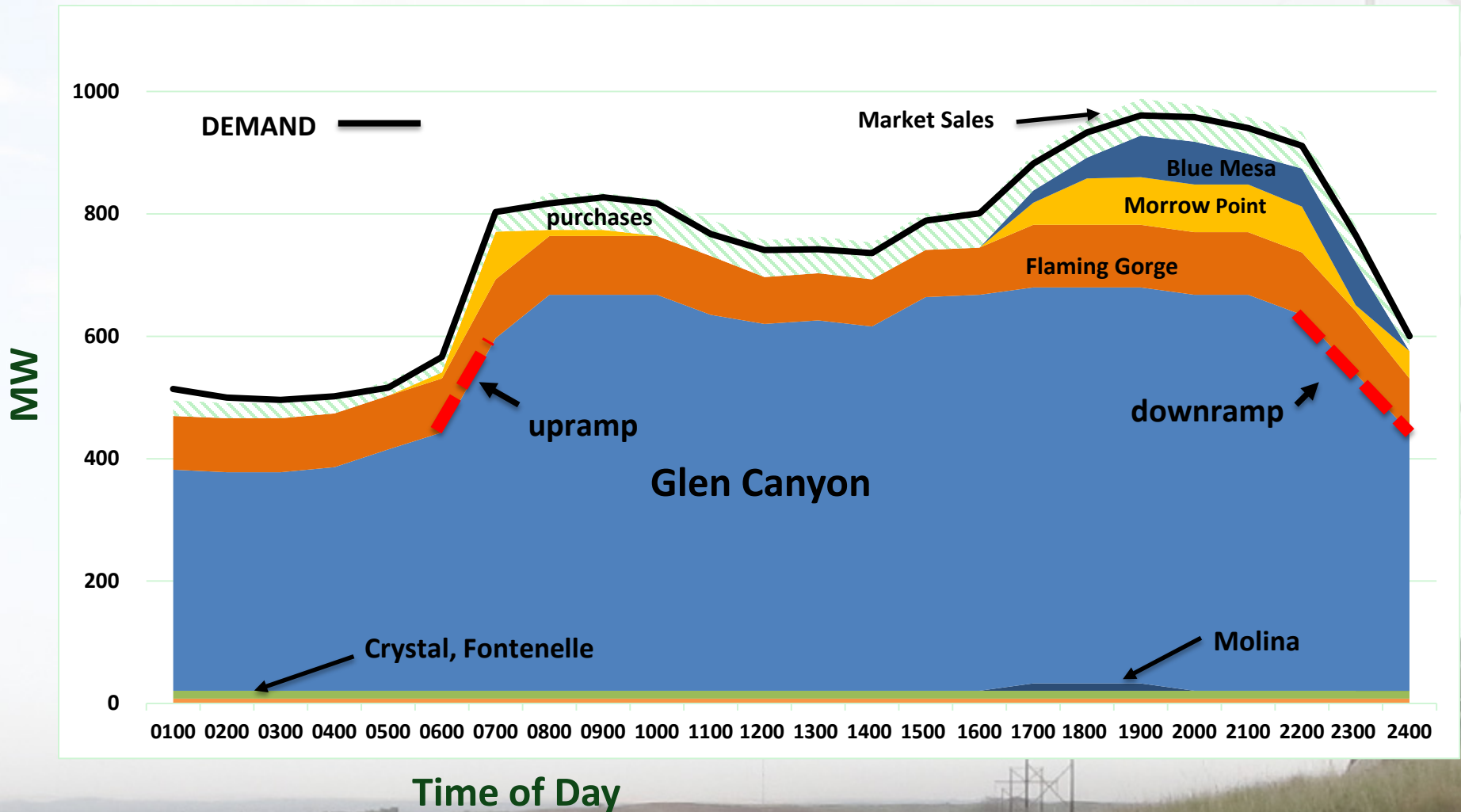
- MLFF had 3 thresholds based on monthly volume: 500 kaf, 600 kaf & 800 kaf
- LTEMP: maximum daily change is
 - 10 x monthly volume June – August [/ 1,000]
 - 9 x monthly volume Sept. – May [/ 1,000]
 - “Cap” is 8,000 cfs change / day

WY 2018, so far

MONTH	VOLUME (af)	ALLOWED DAILY CHANGE
October, 2017	640,000	5,760 cfs
November, 2017	630,000	5,670 cfs
December, 2017	740,000	6,660 cfs
January, 2018	860,000	7,740 cfs
February, 2018	730,000	6,570 cfs

CRSP Generation vs Demand

(data from Jan. 15 preschedule)





What have we learned about operating GCD under LTEMP so far?

1. Allowable daily change based on a proportion of monthly volume provides additional flexibility for setting monthly volumes and for meeting the daily change in energy demand
2. So far, in WY 18, two of the months had higher daily fluctuation allowance than MLFF. Four had a greater restriction
3. The 8 k “cap”, was a binding restriction in one month
4. Faster down ramps are often fully utilized. However, GCD downramps still do not match the reduction in electrical demand at the end of the day



The Effect of Electrical Prices on GCD Economics and Finances

- The economic and financial impact of GCD experiments is a function of the market prices of electrical power.
- Impacts are also a function of the difference between peak and off-peak prices. The less the difference, the less the impact of GCD experiments that constrain operations.
- Both prices and the peak/off price differential are variable.
- In recent years, electrical prices have trended lower and the peak/off peak price differential is smaller

Average Wholesale Electrical Prices 2014 – 2017

(ICE Mid C High)



Onpeak/offpeak price difference (since the California energy crisis)



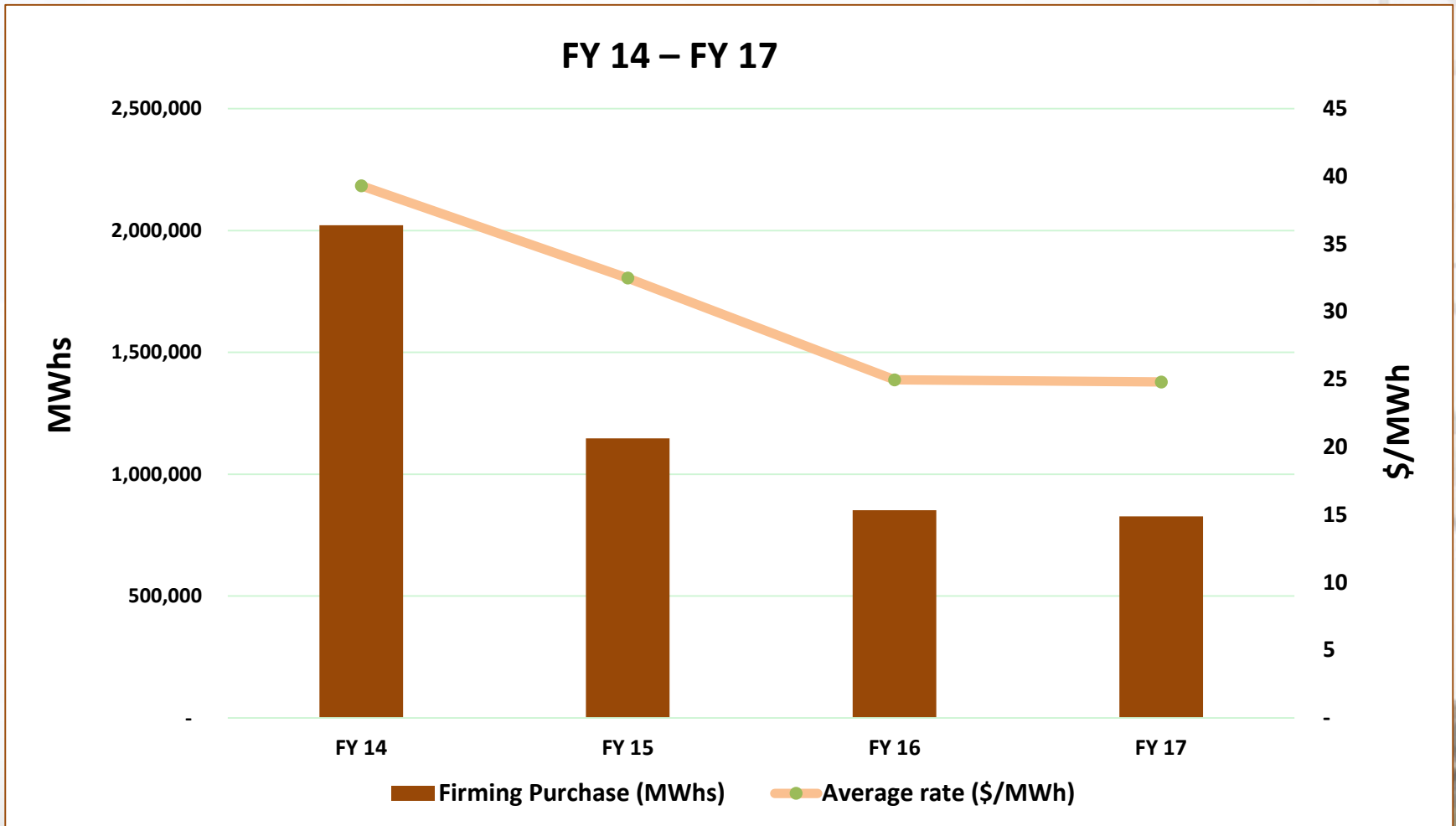
GCD Operational Experiments

Experimental Flow	Number	Date(s)	Estimated Cost
Aerial Photography Steady Flow	9	Once each year: 1997 - 2004	\$20,000
Low Summer Steady Flows (LSSF)	1	Summer, 2000	\$26,800,000
Habitat Maintenance Flow (HMF)	1	Nov., 1997	\$1,000,000
Beach Habitat Beach Flow (BHBF)	2	Spring, 1996, Fall, 2004	\$ -
High Flow Experiment (HFE)	5	Various	\$4.1 - \$2.1 million
Non-native Fish Suppression Flows (TSF)	3	Winter, 2003 - 2005	WY 05 \$2.32 million (benefit)
Steady Fall Flows	3	Fall 2009 - 2011	\$270 ,000

Net Firming Purchases

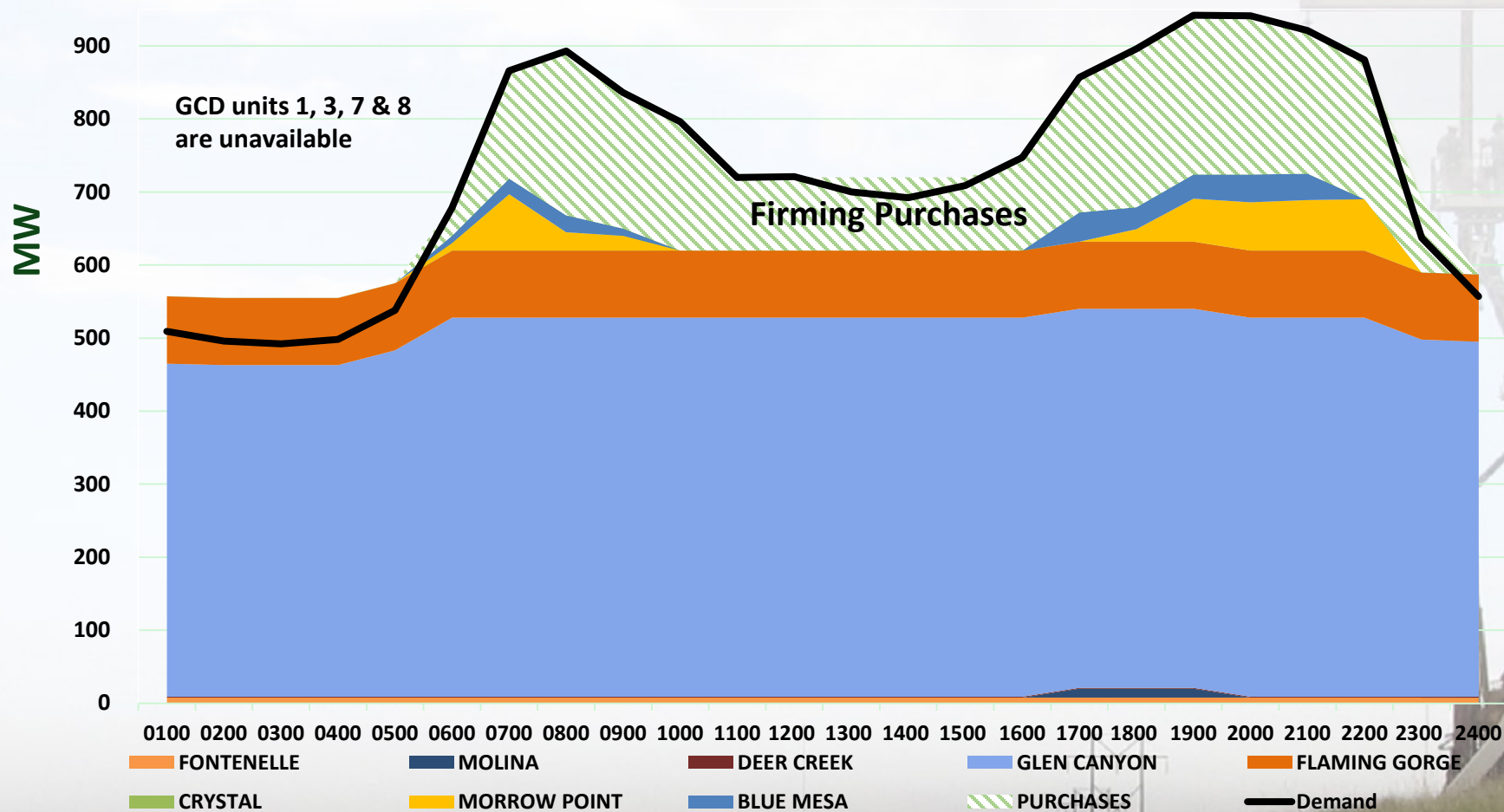
- WAPA incurs firming purchases because it has firm electrical delivery obligations, while hydrological conditions and GCD releases vary considerably
- Net firming purchases is a financial metric (rather than an economic metric)
- Firming purchase expenses are variable. They are a function of:
 - GCD releases, market rates, power head, other CRSP units
- Firming purchases expenses have been falling because of higher hydraulic head and lower purchase prices

WAPA Firming Purchase Expense & Average Purchases Price by Year



Effect of GCD Maintenance

February 8, 2018



Results & Conclusions

- Recent improvements in power efficiency have reduced the financial impact of GCD operational experiments and have reduced WAPA firming purchase expenses. WY 18 forecast may indicate a reversal of this trend
- Implementation of LTEMP operating criteria:
 - Has improved load-following capability by increasing GCD down-ramps. However, changes in electrical demand still exceed allowed ramp rates
 - Has allowed some additional flexibility in selecting monthly release volumes because strict daily fluctuation allowances are no longer tied to monthly volume brackets.
- Recent decline in electrical energy prices have aided in reduced WAPA firming purchase expenses and reduced the financial impact of GCD operational experiments

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Questions ?

