



Western
Area Power
Administration

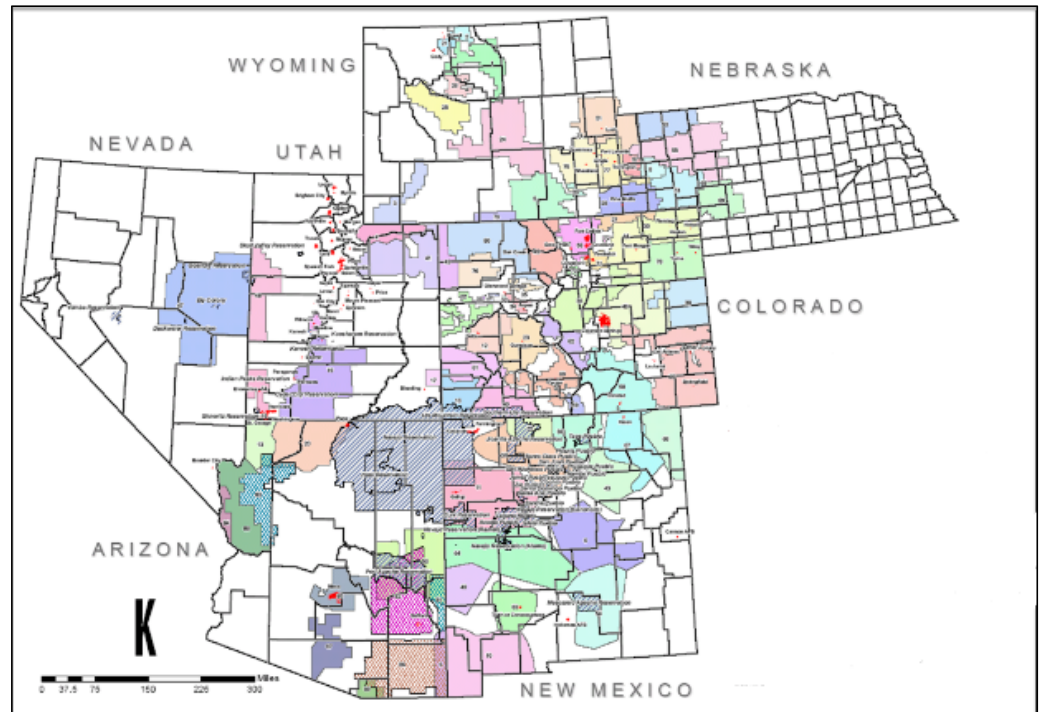
Status and Trends of Hydropower and Energy

January 25, 2017

Glen Canyon Dam Adaptive
Management Program
2017 Annual Reporting Meeting
Phoenix, AZ

Hydropower Generation at Glen Canyon

- Key unit of CRSP
- Maximum generating capacity
 - 8 units
 - 1,320 MW
- 5 billion KWh/year
- Service area
 - WY, UT, CO, NM, AZ, NV, NE
 - 135 long-term customers
 - 54 Native American Tribes (40% of total)
- Offsets 2.5 million tons of CO₂ emissions/year



see Lynn Jeka's AMWG presentation Aug 24-25, 1016

https://www.usbr.gov/uc/rm/amp/amwg/mtgs/16aug24/Attach_08.pdf



How has recent Experimentation (HFEs) at Glen Canyon Dam affected Power Production?

- Water bypasses the power plant
- Water is moved from other months within the water year to stay within annual release requirements
- Change in monthly water volume released through the powerplant
- Electrical reserves must be moved to other CRSP facilities

see Jerry Wilhite's presentation at the HFE workshop

http://gcdamp.com/images_gcdamp_com/f/f2/Wilhite_HFEworkshop_hydropower.pdf



Financial Impact of an HFE

Hydropower Cost =

Bypassed Water (\$)

+

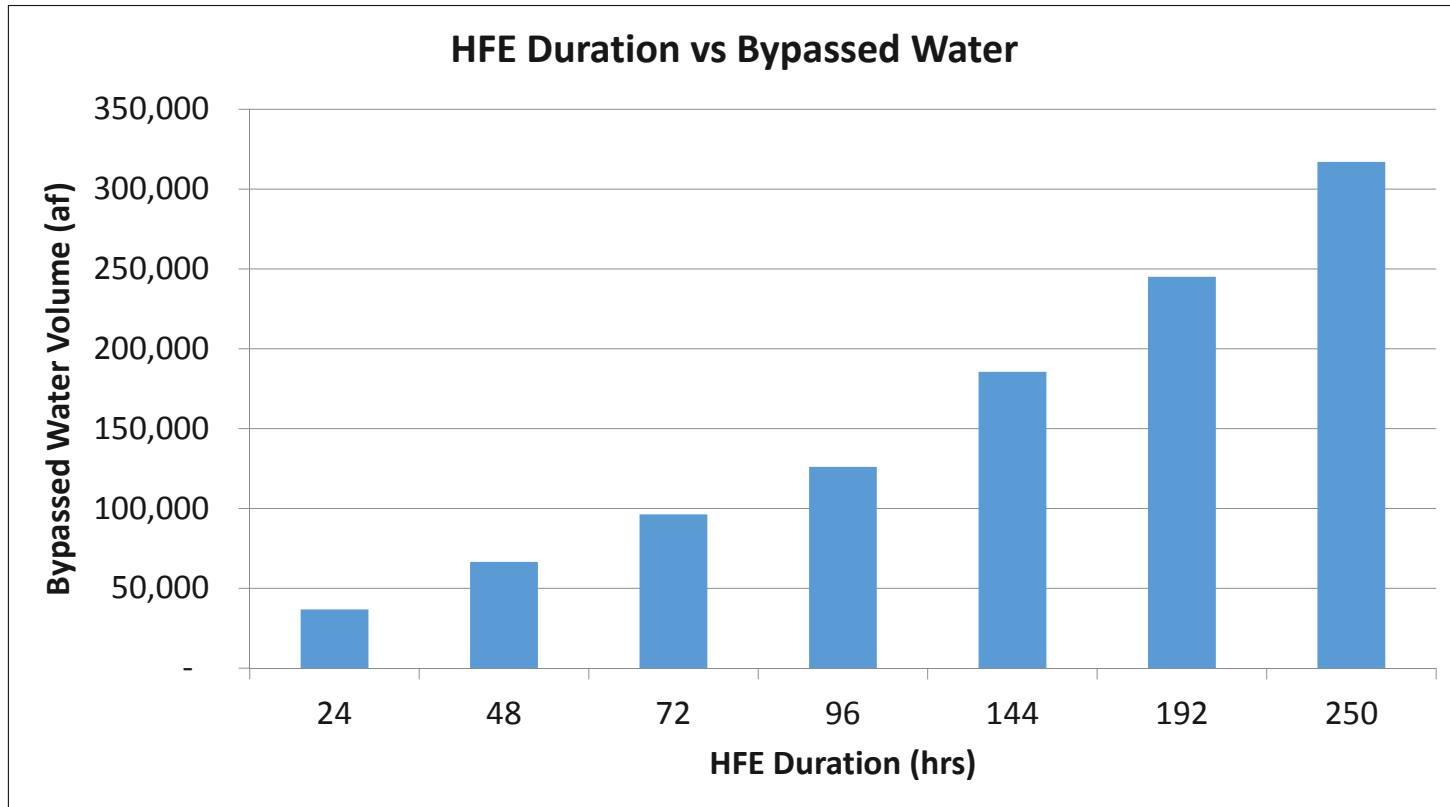
Water Moved from other
Months (\$)

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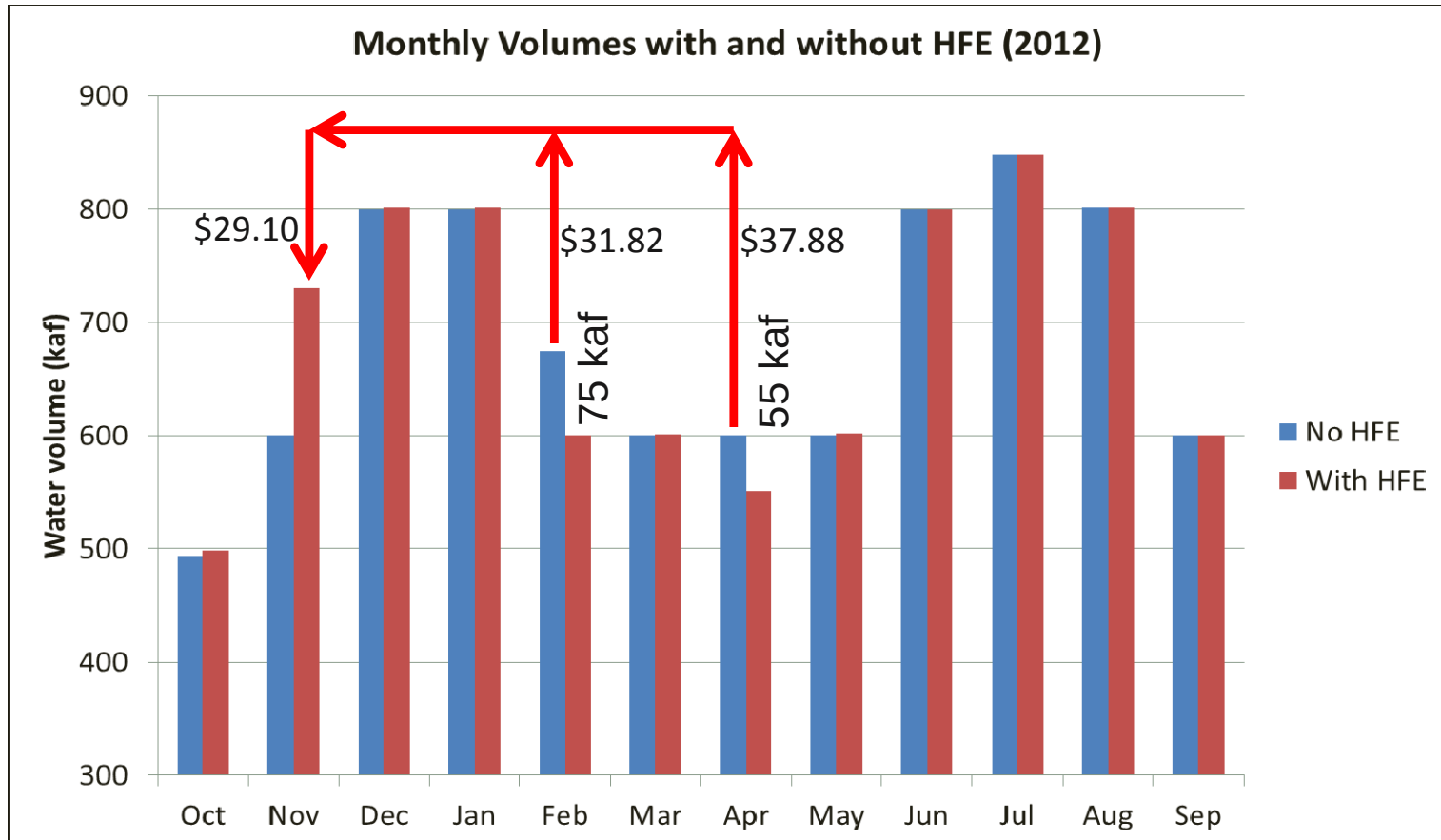
Additional Power Generation
during the HFE (\$)



Hydropower Cost = \$ (Bypass Water) + \$ (Water Moved from other Months) - \$ (Power Generation during the HFE)

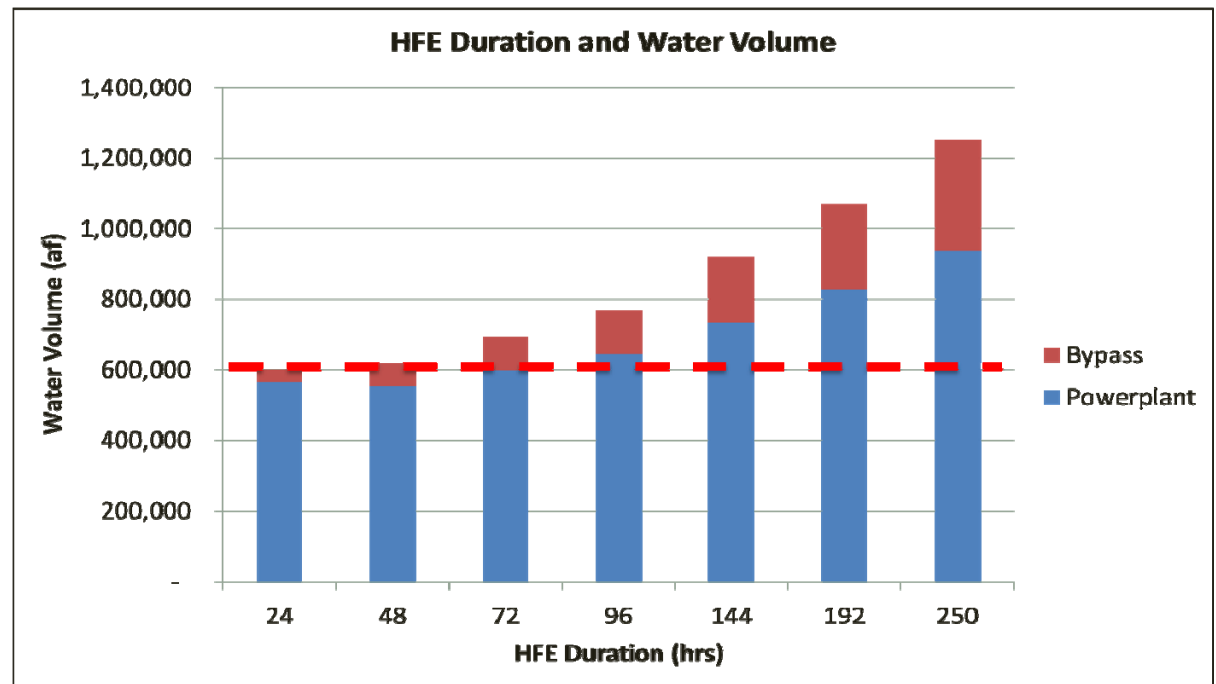


Hydropower Cost = \$ (Bypass Water) + \$ (Water Moved from other Months) - \$ (Power Generation during the HFE)



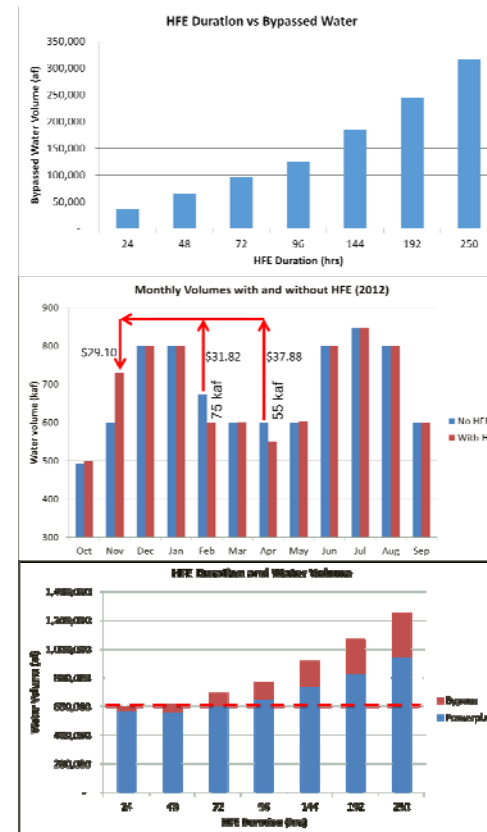
Hydropower Cost = \$ (Bypass Water) + \$ (Water Moved from other Months) - \$ (Power Generation during the HFE)

- Substantial effort is made to market the additional power produced during the HFE, but...
- We typically have to sell power generated in excess of our customers' needs for less than market value.



Economic Impacts of Recent HFEs

- Nov. 2016 HFE
 - Actual cost: TBD
 - Estimated cost: \$1.5 million
- Nov. 2014 HFE
 - Actual cost: \$2.1 million
 - Estimated cost: \$1.7 million
- Nov. 2013 HFE
 - Actual cost: \$2.6 million
 - Estimated cost: \$1.7 million



Hydropower Cost =

\$ (Bypass Water)

+

\$ (Water Moved from other Months)

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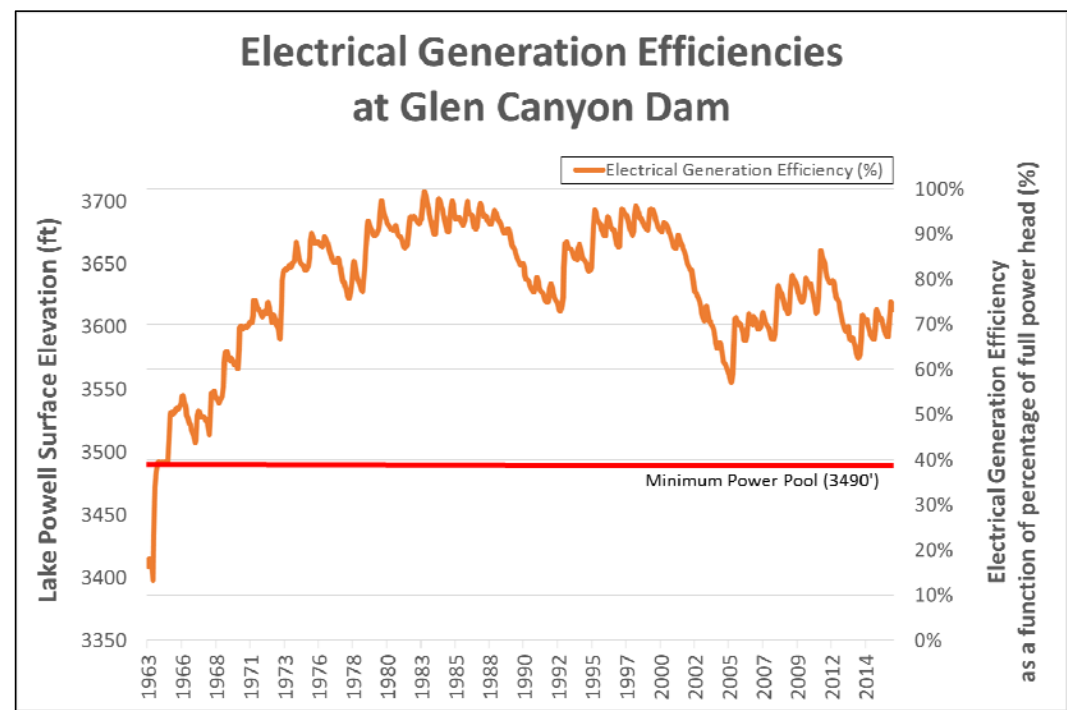
\$ (Power Generation during the HFE)



Effect on hydropower production from changes in Lake Powell elevations

Generating Efficiencies

- Lower head reduces generating efficiency
- December 2016
 - Lake Powell: 3600 ft
 - Releases: 11,000 – 19,000 cfs
 - Generation: 397 – 696 MW
- At full pool (3700 ft)
 - Generation: 516 – 905 MW
- Even though WY17 is a 9.0 MAF release, there is a 30% reduction in generating efficiency (acre feet into MWhs) with current reservoir elevations
- Increases firming costs



Hydropower Knowledge Assessment Update

Resource Characteristics and Measures

- Electric generation (energy)
 - MWh generated/year
 - Market Price/MWh generated/year
- Electric generation (capacity)
 - Marketable MW/peak power month (Jul/Aug)
 - Annual measure in capital investment in SLCA/IP market system (\$)
- Load following capability
 - Annual MW available above/below WAPA customer demand
- Emissions
 - Changes in emissions to compensate for energy losses resulting from changes in operations at Glen Canyon Dam (tons of CO₂, SO₂ and NO_x emissions/year)
- Net firming purchases
 - \$/year
- Hydro-mechanical equipment
 - \$/year (O/M and replacement)

The Team:

- WAPA: Craig Ellsworth, Shane Capron, Clayton Palmer, Dave Welker, Chrystal Dean
- Reclamation: Paul Davidson, Nick Williams
- GCMRC: Lucas Bair
- CREDA: Leslie James
- UAMPS: Cliff Barrett
- SRP: Jenika Raub
- NTUA: Arash Moelemi
- SEAHG chair: Ben Reeder
- CRC-Nevada: Peggy Roefer



Emergency Energy Support

Aliso Canyon Gas Storage Facility

- Depleted oil field used for underground storage of imported natural gas to fuel gas-fired power plants in southern California
- Storage well leak discovered October 2015
- Leak contained February 2016
- Remaining wells have to be tested or capped before refilling the facility
- The facility is still off-line
- Glen Canyon Dam was in line to be called up to provide emergency back up power for southern California during spring and summer 2016 but was never called on.

Provided an opportunity for WAPA and Reclamation to update emergency power operation protocols.



Questions

