Hydropower 101

Steve Johnson
Senior Vice President and Colorado River Storage Project Manager
What is WAPA?

- A DOE power marketing administration
- Created in 1977 to separate the generation and transmission functions
- WAPA assumed Reclamation’s function of marketing and delivering power generated at Federal hydroelectric powerplants in the west and mid-western U.S.
Colorado River Storage Project

- 12 power plants
- 27 generating units
- 1,827 MW total installed capacity (73% from Glen Canyon)
- 4,225 GWh Net Generation (74% from Glen Canyon)
- 2,325 circuit miles (Arizona, Colorado, New Mexico, Utah, Wyoming)
CRSP Management Center

• Committed to protecting the delicate balance of the Colorado River and its tributaries. Agencies that manage this river's resources must weigh multiuse needs: irrigation, recreation, hydropower, flood control, cultural resources, and native and non-native species, and endangered species protection.

• Balancing these resources with the needs of water and electrical energy is a chief concern.
Responsibilities

WAPA

• Owns and operates the transmission system infrastructure

• Markets, schedules and delivers energy to long term firm electric service customers

• Dispatches generation from the powerplants at the dams for electrical regulation and emergencies

• Rate setting and repayment of project debt to U.S. Treasury from revenue

Reclamation

• Owns, operates, and maintains dams and power plants

• Water management (reservoir management, irrigation, flood control, and water compact deliveries)

• Generates power which is delivered to WAPA at the plant transformers
Electrical System
Regulation and Emergencies

• NERC and WECC requirement of electrical utility
  • Contingency Reserves
  • Regulating Reserves
  • Black start/safe shutdown power

• Regulation signal
  • Comes from WAPA dispatch office to Glen Canyon Dam, every few seconds.
  • Purpose is to maintain system frequency while managing transmission line loading and providing voltage support
  • Changes caused by changes in demand or intermittent resource output
Lake Powell Elevation Affects Power Efficiency:
The efficiency in turning Acre Feet into Megawatt hours
Important Lake Powell Elevations

GLEN CANYON DAM

EOY 19 3584

8% (Dead Storage)

3490 Min Power

3470

3374

Upper Colorado River Commission | 8
Glen Canyon Dam Hydropower Head
From the beginning of current drought  1999 - 2019

% of full power head

Jul, 18
Mar, 14
The Effect of Power Efficiency on Glen Canyon Dam Energy Production

<table>
<thead>
<tr>
<th>Date</th>
<th>Lake Powell Elevation (ft)</th>
<th>Energy production in a 9.0 maf year (GWh)</th>
<th>Percentage of production vs full powerhead</th>
</tr>
</thead>
<tbody>
<tr>
<td>July, 1983</td>
<td>3,707.40</td>
<td>4,617</td>
<td>101.25%</td>
</tr>
<tr>
<td>Mar., 2005</td>
<td>3,555.90</td>
<td>3,378</td>
<td>74.09%</td>
</tr>
<tr>
<td>Jan., 2014</td>
<td>3,578.69</td>
<td>3,575</td>
<td>78.39%</td>
</tr>
<tr>
<td>Jan., 2018</td>
<td>3,619.38</td>
<td>3,916</td>
<td>85.89%</td>
</tr>
<tr>
<td>Jul., 2019</td>
<td>3,583.66</td>
<td>3,620</td>
<td>79.98%</td>
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</tbody>
</table>
Purchase Power

- Glen Canyon Releases
- Releases at other CRSP facilities
- Hydrology
- Pool Elevation/Efficiency
- Market Prices
CRSP Generation vs Demand
(data from Jan. 15 preschedule)
CRSP Customers

- 135 long-term customers
  - 54 Native American tribes
  - 64 Municipalities, cooperatives, irrigation districts
- 17 Other
Setting CRSP Power Rates

Cost-based rates

- Operations & maintenance
- Required principal & interest payments
- Amortized capital replacements (WAPA & BOR)
- Purchase power to “firm” contractual commitments
- Repayment of CRSP and participating irrigation projects
- Salinity Control Program – reduce salt in Colorado River water
- Repayment of Loan to fund Capitalized UCRIP expenses

Revenue requirement

- Rate = revenue requirement/projected energy sales
- Simplified Example:
  - $200 required revenue to cover costs
  - Contracts = 200 KWh of energy delivery
  - Rate = $1.00/KWh
- Rate change is done only if projected revenue is insufficient to meet future projected expenses

Basin Fund cash balance is not a component of the rate
What’s in the SLCA/IP Rate

<table>
<thead>
<tr>
<th>Category</th>
<th>FY2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Revenue</td>
<td>$225</td>
</tr>
<tr>
<td>Operations &amp; Maintenance</td>
<td>$96.8</td>
</tr>
<tr>
<td>Purchase Power &amp; Wheeling</td>
<td>$43.4</td>
</tr>
<tr>
<td>States’ MOA Funds</td>
<td>$11.5</td>
</tr>
<tr>
<td>Repayment of Investment</td>
<td>$61.3</td>
</tr>
<tr>
<td>Interest on Investment</td>
<td>$12.7</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$225</td>
</tr>
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</table>
Basin Fund Obligations

• Manage the financial requirements of the CRSP Act
  • Glen Canyon, Aspinall, Flaming Gorge
  • Several additional units that include dams, reservoirs, powerplants, transmission facilities and other related works

• Reclamation operations are funded by periodic transfers from the CRSP Basin Fund to a Reclamation subaccount
  • Allows Reclamation to maintain programmatic oversight of their facilities
  • Funds are transferred approximately on a monthly basis and only the amount they need to operate for the fiscal year
### Basin Fund Balance
### FY 2008 - 2018

**EOY BALANCE**

<table>
<thead>
<tr>
<th>FY</th>
<th>EOY Balance</th>
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<tbody>
<tr>
<td>2008</td>
<td>$75,364,005</td>
</tr>
<tr>
<td>2009</td>
<td>$83,334,271</td>
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<tr>
<td>2010</td>
<td>$85,738,364</td>
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<tr>
<td>2011</td>
<td>$121,255,274</td>
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<tr>
<td>2012</td>
<td>$137,456,809</td>
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<tr>
<td>2013</td>
<td>$112,172,609</td>
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<tr>
<td>2014</td>
<td>$114,399,747</td>
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<tr>
<td>2015</td>
<td>$114,261,801</td>
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<tr>
<td>2016</td>
<td>$101,627,138</td>
</tr>
<tr>
<td>2017</td>
<td>$100,349,158</td>
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<tr>
<td>2018</td>
<td>$126,900,381</td>
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</table>

- 8.23 maf release
- 7.48 maf release
- 9 maf release each year (2015-2019)
CRSP Basin Fund Status

• Current FY 2019 Balance...$128M
  • As of 6/24/2019

• Projected FYE 2019 Balance.....$117M or $146M*
  * Projection based on actual revenue and expense data through June 24th. Difference is due to potential M&I monies being placed in the Basin fund by Reclamation.

• Direction to return cash?
  • Last cash return was $25M to the General Fund of the U.S. Treasury in 2012
  • No cash return was made in 2013-2018.
  • Annual Constructive Returns (non-cash) around $18-23M per year (2013-2018)
  • FY19 will be significantly lower due to OMB direction to not transfer funds to Reclamation
Basin Fund Balance

Reserve Strategy
- WAPA-wide strategy for maintaining fund balances
- CRSP target is ~$180M
- Projected end of fiscal year balance is $112M

Risk Factors
- Replacements (Reclamation & WAPA)
- Environmental Programs
- Bypass (including Spring Flows out of Flaming Gorge and Aspinall)
- Market Price for Purchase Power
- Hydrology/Releases/Pool Elevation
Environment and Cultural Resources

• Environmental programs (historically) funded by CRSP electric power revenues
  • Upper Colorado Recovery Program – endangered fish species program - $6 million, annually
  • San Juan Recovery Program – endangered fish species program - $2 million, annually
  • Glen Canyon Dam Adaptive Management Program – environmental program in the Grand Canyon - $10 million, annually
  • Salinity Control Program – reduce salt in Colorado River water - $2 million

• Note: In 2019, CRSP power revenues are not funding the RIPs and the GCDAMP
CRSP Challenges and Opportunities

• Drought

• State Apportionment/MOA

• Basin Fund and Returns to Treasury

• Operations within a changing energy mix
Questions

Steve Johnson
Senior VP & CRSP Manager
johnsons@wapa.gov
970.252.3000
www.wapa.gov