Water Energy Nexus

Tribal Renewable Energy Workshop
9/8/2016
Climate Change Challenges:

- Drought and other Extreme Weather Events
- Changes in seasonal precipitation patterns
- Increase in air temperatures and energy demand
- These changes will exacerbate existing pressures on water and power resources that are inexorably linked
Water Energy Nexus
Climate Change and Hydropower

- Hydropower can be part of the Climate Change solution
  - Low GHG Emitting Resource
  - Can be used to help integrate other renewables into the grid
  - Flexible and on demand resource

- But there are challenges from changes to hydrology
  - Loss of total generation
  - Loss of regulation capacity
  - Increased rough zones
  - Increased maintenance
What is Reclamation Doing?

• Capital and Operational Improvements
  – Gaining Efficiencies
• Policy Development and Research
  – Identifying new opportunities

Desired outcome: more flexible, resilient, and effective water resource projects
Reclamation Wide Turbine Replacements and Rewinds

• Generator Uprates/Rewinds
  – 3 rewinds completed in 2013
  – 2 rewinds completed in 2015
  – 3 rewinds ongoing
  – Many more in the out years

• Turbine Replacements
  – 31 turbine replacements since 2009
  – 3 - 7% efficiency gain
  – Wider head range
  – 319,122 MWh/year
  – 4 ongoing replacement projects
  – 5 scheduled replacement projects
Hoover Wide Head Turbines

- Increase available operation ranges (flexibility)
- Minimize rough zones
- Increase unit efficiency and capacity
- Increase power output at lower lake elevations
- Less water – More Power

- Five wide head turbines installed by FY17
- ~3% efficiency gains
What is Optimization?
- Continuous computer modeling to determine the best way to operate a hydroelectric powerplant to achieve desired power production using the least amount of water.

Increases Efficiency
- Uses Less Water at Same Power Output Level
- Or Increase Generation Levels – Use Same Amount of Water

When All Reclamation Plants are Optimized
- 1% - 3% Efficiency Gains
- 410,000 MWh – 1,230,000 MWh
- $10.3M - $30.8M Annually (at $25 per MWh)
• New Opportunities: Resource Assessments and other Research
# USBR Conventional Hydropower Potential – Resource Assessments

<table>
<thead>
<tr>
<th></th>
<th>Reclamation Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
</tr>
<tr>
<td>2011 Assessment</td>
<td>191</td>
</tr>
<tr>
<td>2012 Assessment</td>
<td>373</td>
</tr>
<tr>
<td>Total</td>
<td>564</td>
</tr>
</tbody>
</table>

Reclamation-Wide Pumped Storage Screening Study (2014)

- Screening-level analysis evaluated adding PS facilities to Reclamation’s 348 existing reservoirs

- 15 sites located at 7 reservoirs showed a preliminary cost estimate of less than $1.5 million per MW Installed
Demand Management Opportunities

- Reclamation is currently conducting a study in the Central Arizona Project to understand what opportunities may exist to:
  - Reduce pumping load or increase flexibility through equipment upgrades; and
  - Shift pumping loads or employ demand response to support renewable energy integration and/or grid stability
- Target Completion 01-2017
Lease of Power Privilege
Lease of Power Privilege (LOPP)

All other Reclamation facilities – i.e. dams not authorized for federal power development – would proceed through FERC.
Reclamation and Non-Federal Hydropower Development

All non-federal development must be consistent with Reclamation project purposes.

Power Delivery

Water Delivery
Reclamation Small Conduit Hydropower Act
PL 113-24

• Enacted August 9, 2013
• Amends the Reclamation Project Act of 1939 to:

1. Authorize LOPP at all Reclamation conduits
2. Reaffirms that LOPP projects cannot negatively impact the Reclamation Project
3. Requires that LOPP be offered *first* to an irrigation district or water users association operating or receiving water from the applicable transferred or reserved conduit.
4. Requires Reclamation to apply its categorical exclusion (CE) process to conduit development
# Conventional Non-Federal Snapshot

## Lease of Power Privilege

<table>
<thead>
<tr>
<th>Status</th>
<th>Sites</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating:</td>
<td>12 sites</td>
<td>43 MW</td>
</tr>
<tr>
<td>In Development (C):</td>
<td>17 sites</td>
<td>51 MW</td>
</tr>
</tbody>
</table>

## Federal Energy Regulatory Commission

<table>
<thead>
<tr>
<th>Status</th>
<th>Sites</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating:</td>
<td>52 sites</td>
<td>465 MW</td>
</tr>
<tr>
<td>In Development (C):</td>
<td>21 sites</td>
<td>59 MW</td>
</tr>
</tbody>
</table>

64 non-federal facilities, comprising approximately 508 MW currently operating on Reclamation infrastructure
Thank You!

Michael Pulskamp
Renewable Energy Program Manager
Bureau of Reclamation
mpulskamp@usbr.gov
(303)445-2931

Helpful Links:
http://www.usbr.gov/power
http://www.usbr.gov/power/LOPP/
http://www.usbr.gov/power/data/data.html