UTILITY ASSISTANCE PROGRAMS - UPDATE

January 8, 2020
Francine Artis
2019 ASSISTANCE ACTIVITIES AT A GLANCE

1,861 /86%  
New Households Enrolled in Programs

38/90%  
Community Events & Presentations

4,602/-6%  
Pledges from Outside Agencies Processed

62  
Households Completed Financial Education
UTILITY ASSISTANCE PROVIDED

2018 vs 2019

Internal Assistance Funds
(Discount Rates/BCAP/Emergency Assistance)

<table>
<thead>
<tr>
<th>Year</th>
<th>Assistance</th>
<th># of Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>$3,191,415</td>
<td>6,879</td>
</tr>
<tr>
<td>2019</td>
<td>$3,665,047</td>
<td>7,666</td>
</tr>
</tbody>
</table>
COMMUNITY OUTREACH

2019 Activities & Events

- Tacoma Urban League
- Tacoma Community College
- Farmers Market
- Safeway Stores
- Council Member Beale Community Forum
- Hilltop Street Fair
- McKinley Street Fair
- Ethnic Fest
- Fife Harvest Festival
- Tacoma Community House
COMMUNITY OUTREACH

Eastside Community Resource Fair

Giaudrone Middle School Fair

Boze Elementary Fair
QUESTIONS?
Our Energy Future Series

Session 6: Pump Storage Hydro

Michael Hill
Tacoma Public Utilities
Sr. Power Analyst
253-779-7796
1. What is Pump Storage Hydro?

2. How does it work?

3. Existing & proposed projects

4. Benefits and challenges

5. Summary

6. IRP update
What is pump storage hydro?
**Section 1: What is Pump Storage Hydro?**

Pump Storage Hydro (PSH) is a type of hydroelectric energy storage used by electric power systems for load balancing. The method stores energy in the form of gravitational potential energy of water, pumped from a lower elevation reservoir to a higher elevation.

**P/G efficiency:**

\[
\frac{\text{Generation energy (downhill)}}{\text{Pumping energy (uphill)}} = \approx 80\%
\]

**Requirements:**

- Topology – elevation between upper & lower basins
- Power lines – Access to transmission grid
- Water Supply
Section 1: What is Pump Storage Hydro?

Types of PSH

Closed – Loop
- Disconnected from any existing waterway
- Fewer environmental impacts
- Makeup water constraints

Open – Loop
- Connected to existing waterway
- Ready water supply
- Additional environmental impacts
How does it work?
Section 2: How does it work?

Traditional purpose

- Existing PSH fleet constructed mid- to late-1970s
- Load Shaping and Peak Shaving
- Energy Arbitrage, Peak/Off-Peak
Section 2: How does it work?

New PSH interests

- Increase penetration of variable renewable energy resources
- Electricity Market Designs: Energy, Capacity and Ancillary Services
- New Technology – Variable Speed Pumps/Generators
Existing and future projects
Section 3: Existing PSH projects

Where in the US?

Licensed Pumped Storage Projects

<table>
<thead>
<tr>
<th>State</th>
<th>Capacity (MW)</th>
<th>State</th>
<th>Capacity (MW)</th>
</tr>
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<tbody>
<tr>
<td>CA</td>
<td>4,243</td>
<td>NJ</td>
<td>365</td>
</tr>
<tr>
<td>CO</td>
<td>336</td>
<td>NY</td>
<td>1,900</td>
</tr>
<tr>
<td>CT</td>
<td>31</td>
<td>OK</td>
<td>260</td>
</tr>
<tr>
<td>GA</td>
<td>1,120</td>
<td>OR</td>
<td>393</td>
</tr>
<tr>
<td>MA</td>
<td>1,833</td>
<td>PA</td>
<td>1,280</td>
</tr>
<tr>
<td>MI</td>
<td>1,785</td>
<td>SC</td>
<td>1,221</td>
</tr>
<tr>
<td>MO</td>
<td>443</td>
<td>SC/NC</td>
<td>1,065</td>
</tr>
<tr>
<td>MT</td>
<td>400</td>
<td>VA</td>
<td>2,722</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TOTAL CAPACITY 18,897 MW</td>
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</table>

Source: FERC Staff, September 1, 2019
Section 3: Proposed PSH Projects

Where in the US?

Issued Preliminary Permits for Pumped Storage Projects

<table>
<thead>
<tr>
<th>State</th>
<th>Proposed Capacity (MW)</th>
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<tbody>
<tr>
<td>AR</td>
<td>600</td>
</tr>
<tr>
<td>AZ</td>
<td>2,150</td>
</tr>
<tr>
<td>CA</td>
<td>1,544</td>
</tr>
<tr>
<td>ID</td>
<td>720</td>
</tr>
<tr>
<td>KY</td>
<td>500</td>
</tr>
<tr>
<td>MN</td>
<td>1,998</td>
</tr>
<tr>
<td>MT</td>
<td>280</td>
</tr>
<tr>
<td>NV</td>
<td>950</td>
</tr>
<tr>
<td>NY</td>
<td>289</td>
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<table>
<thead>
<tr>
<th>State</th>
<th>Proposed Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OH</td>
<td>1,500</td>
</tr>
<tr>
<td>PA</td>
<td>1,621</td>
</tr>
<tr>
<td>SD</td>
<td>1,200</td>
</tr>
<tr>
<td>UT</td>
<td>300</td>
</tr>
<tr>
<td>VA</td>
<td>890</td>
</tr>
<tr>
<td>WA</td>
<td>305</td>
</tr>
<tr>
<td>WV</td>
<td>1,000</td>
</tr>
<tr>
<td>WY</td>
<td>1,100</td>
</tr>
</tbody>
</table>

TOTAL CAPACITY = 19,347 MW

Capacity (MW):
- 0 - 100
- 101 - 300
- 301 - 500
- 501 - 800
- 801 - 1100
- 1101 - 1400
- > 1400

Source: FERC Staff, September 1, 2019
Section 3: Possible PSH Projects

Pump Storage Hydro at Cowlitz?
Section 3: Possible PSH Projects

Pump Storage at Cowlitz

Opportunities

✓ Existing project/reservoirs
✓ Open 3rd pump/generator bay at Mossyrock
✓ Promising economics

Challenges

✓ Environmental impacts
✓ Additional upper reservoir
✓ Re-opens FERC licensing process
✓ Transmission: located near critical flowgate
✓ Scale (250 – 300 MW)
✓ Co-operations
Benefits and challenges
Advantages of Pump Storage Hydro:

Flexible and reliable

- Reacts to network fluctuations
- Contingency outages
- Load following
- Absorbs excess generation
- Reserve output at low wind or lack of sunshine

Concepts

- Hybrid -- Combining pumped storage with wind and/or solar generation
- Symbiotic – Renewable Resource used to integrate Renewable Energy with clean hydropower
- "Green" battery -- Currently the most viable utility-scale energy storage technology

Reservoir management and flood control

Exceptional lifetime of more than 80 years
Section 4: Benefits & Challenges

Challenges of Pump Storage Hydro

Projects are Capital Intensive

✓ Development ($millions)
✓ Construction ($billions)

Regulatory

✓ FERC Licensing and permitting

Scale

✓ Capitalization – Equity vs. PPA, Governance vs. Operations, etc.
✓ Joint operations – Shared costs/benefits, project optimization

Market Limitations

✓ Missing revenue streams – deriving value from Energy & Ancillary Services (AS).
✓ Market Design – lack of market structure for monetizing value clean dispatchable generation resources.
**Section 4: Benefits & Challenges**

**Missing Money**

Market prices do not fully reflect the value of investment necessary to meet load

- Insufficient Resource Adequacy standards undervalue existing clean dispatchable generation such as hydro
- Inadequate incentives to invest in new forms of dispatchable generation like Pump Storage Hydro

* Environment costs, taxes, etc.
Summary
Section 5: Summary

Future State: Pump Storage Hydro part of a well-integrated grid

Benefits
- Complements Renewable Energy Resources
- Very Flexible Resource
- Improves Reliability
- Longevity

Challenges
- Long-term Economics
- Development costs
- Construction time
- Scale
- Market Design
IRP Update

Section 6
Section 6: IRP Update

Stakeholder Input Process

**Working Group Workshops**
- Smaller group selected by utility with goals of ensuring **committed participation** and **balance of perspectives**
- Responsibility for reviewing materials and providing feedback on assumptions, analysis, etc.

**Input Opportunities for Other Community Members**
- Observe & comment during open comment time
- Written comment on workshop materials
- Online contact form for general comments

**General Information Sharing**
- Email distribution list to interested parties
- All materials to be posted on website
## Section 6: IRP Update

### Working Group Membership

Selected with goals of ensuring **committed participation** and **balance of perspectives**

### Customer Classes
- Residential (1 to 2 representatives)
- Small business (1 to 2 representatives)
- Large commercial (1 to 2 representatives)
- Industrial (1 to 2 representatives)
- JBLM (1 representative)
- Puyallup Tribe of Indians (1 representative)

### Environment & Sustainability
- Regional organizations (1 to 2 representatives)
- Local organizations (1 to 2 representatives)

### Other Expertise
- NW Power & Conservation Council (1 representative)
- Academic (1 representative)
## Section 6: IRP Update

### Anticipated 2020 Study Session Schedule

<table>
<thead>
<tr>
<th>Topic</th>
<th>Date</th>
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<tbody>
<tr>
<td>1 Resource planning 101</td>
<td>August 28 (complete)</td>
</tr>
<tr>
<td>2 Resource adequacy</td>
<td>October 9 (complete)</td>
</tr>
<tr>
<td>3 Our current portfolio &amp; resource options</td>
<td>October 23 (complete)</td>
</tr>
<tr>
<td>4 Small nuclear reactors</td>
<td>November 13 (complete)</td>
</tr>
<tr>
<td>5 Energy storage</td>
<td>December 4 (complete)</td>
</tr>
<tr>
<td>6 Pump storage hydro</td>
<td>January 7 (today)</td>
</tr>
<tr>
<td>7 Key inputs: Load &amp; price forecasts, Preliminary metrics,</td>
<td>March 25</td>
</tr>
<tr>
<td>resource options &amp; scenarios</td>
<td></td>
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<tr>
<td>8 Final metrics, analysis of uncertainty, current resource</td>
<td>May 13</td>
</tr>
<tr>
<td>need and final resource options &amp; scenarios to model</td>
<td></td>
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<tr>
<td>9 Analysis results &amp; recommendations</td>
<td>July 8</td>
</tr>
<tr>
<td>10 (If needed) Revised Results &amp; Recommendations</td>
<td>July 22</td>
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<tr>
<td>11 Approve IRP (BOARD MEETING)</td>
<td>August 12</td>
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## Section 6: IRP Update

### IRP Schedule

<table>
<thead>
<tr>
<th>Activities</th>
<th>Anticipated Completion</th>
<th>2020</th>
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<tbody>
<tr>
<td><strong>MODEL &amp; ANALYSIS</strong></td>
<td></td>
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<tr>
<td>Draft base case system model results (current portfolio)</td>
<td>20-Mar-20</td>
<td></td>
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<tr>
<td>Final portfolio performance metrics selected</td>
<td>15-May-20</td>
<td></td>
</tr>
<tr>
<td>Final resources &amp; scenarios selected for evaluation</td>
<td>15-May-20</td>
<td></td>
</tr>
<tr>
<td>Full draft analysis results</td>
<td>1-Jun-20</td>
<td></td>
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<tr>
<td>Final draft IRP document complete</td>
<td>31-Jul-20</td>
<td></td>
</tr>
<tr>
<td>Submit IRP</td>
<td>14-Aug-20</td>
<td></td>
</tr>
<tr>
<td>Publish IRP &amp; communicate findings externally</td>
<td>31-Dec-20</td>
<td></td>
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<tr>
<td><strong>INPUT</strong></td>
<td></td>
<td></td>
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<tr>
<td>Stakeholder Workshops</td>
<td>11-Jun-20</td>
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<tr>
<td>PUB Study Sessions</td>
<td>22-Jul-20</td>
<td></td>
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<tr>
<td>PUB Approval of IRP</td>
<td>12-Aug-20</td>
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