JD Pool Pumped Storage Project
FERC No. 13333

January 27, 2015
Project purpose & need – flexible capacity/energy

BPA Balancing Reserves Deployed

NW Wind Capacity (MW)
By Year and Cumulative

BPA Balancing Authority Total Near-Real-Time Wind Generation

3680 MW
Future Market and Regulatory Drivers

• Energy Imbalance Market

• Optimization of FCRPS/Columbia River Treaty (i.e. flood, power, irrigation, ecosystem function, etc.)

• EPA Section 111(d)

• Washington State 2015 Climate Legislation

• California 50% RPS
Regional Project Location and Study Area

- Near significant high-voltage transmission (i.e. 500kV, DC Intertie)
- Close to 1000’s of MWs of Gorge wind
- Brownfield re-development (i.e. former aluminum smelter)
- Technically attractive site (over 2000’ net head, < 5 for L:H ratio)
Preliminary Design Concept Project Features

- **Reservoirs** – formed with cut/fill embankment dams, fully lined with concrete
  - 2 × Upper Reservoirs (UR):
    - UR1: 5,000 AF active + dead volume (4,700 AF active)
    - UR2: 7,700 AF active + dead volume (7,100 AF active)
  - Lower Reservoirs (LR): 12,100 AF active + dead volume (11,800 AF active)
  - 2 × waterways/conveyances between URs and LR (each 21’ diameter, 9,500’ length)

- **“Pit-style” powerhouse** (PH) – 1,200 MW nameplate capacity (4 × 300-MW reversible pump/turbine motor/generator units)

- **Interconnection** – 3,000’ new 230-kV from PH to BPA’s existing Harvalum Substation within project area

- **Upgraded river intake** and 11,000’ water supply pipeline for initial fill and periodic make-up water

The Pre-Application Document (PAD) can be found at: [http://www.klickitatpud.com/yourPUD/projects/PumpedStorage.aspx](http://www.klickitatpud.com/yourPUD/projects/PumpedStorage.aspx)
• URs capable of storing ~17 GWh of energy

• Average annual generation could be as high as 4,200 GWh/year, based on operating at full capacity for 10 hours/day (includes O&M downtime)
2 × waterways/conveyances between URs and LR (each 21’ diameter, 9,500’ length)

150’ water level fluctuation
**Existing water right and intake (“closed-loop”)**

<table>
<thead>
<tr>
<th>KPUD Water Right</th>
<th>As Percent of Min River Flow</th>
<th>As Percent of Max River Flow</th>
<th>As Percent of Avg. River Flow</th>
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<tr>
<td>Max Instantaneous Flow (cfs)</td>
<td>34.63</td>
<td>0.05%</td>
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<td>Max Cumulative Annual Volume (AFY)</td>
<td>15,479</td>
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<tr>
<th></th>
<th>UR1</th>
<th>UR2</th>
<th>Lower Reservoir</th>
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<tr>
<td>Volume at Mean Sea Level</td>
<td>5,000 AF</td>
<td>7,700 AF</td>
<td>12,100 AF</td>
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<td>Surface Area at Mean Sea Level</td>
<td>46 acres</td>
<td>67 acres</td>
<td>100 acres</td>
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<td>Estimated Net Loss / Estimated Refill</td>
<td>161 AFY</td>
<td>235 AFY</td>
<td>350 AFY</td>
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<td>Initial Fill Volume, total project</td>
<td>13,000 AF</td>
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Time required for initial fill and make-up water:
- Initial fill: ~ 6 months
- Annual make-up: ~ 10 days (timing flexible)
Viable, constructable site with positive development characteristics

- Site has previously studied for energy projects

- **No desktop fatal flaws**, but significant geotechnical studies necessary

- **Water rights** secured by KPUD and for the specific purpose of pumped storage facility by Washington law

- **Site control** – land lease agreed upon by landowner and KPUD

- **Broad-based favorable support** from surrounding counties, stakeholders, etc. lending certainty that a license will be issued by FERC in a reasonable timeframe without controversy
## Preliminary Overall Project Schedule

### Project Development, Design and Construction

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<td>Preliminary Design (30%)</td>
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*Long lead-time project (i.e. 10+ years)*
1. Economic analysis and modelling for **sub-hourly energy grid services** and **environmental benefits** not traditionally valued both as generation and load

2. Market/regulatory framework to support a pumped storage project

3. Sponsor to **fund** a **capital intensive, long lead-time** project with certainty of cost-recovery, rate of return, return on investment, etc.

**Environmental**
- GHG
- Renewable Integration
- Ecosystem Function