Lake Elsinore Advanced Pump Storage (LEAPS)
and
Talega-Escondido / Valley-Serrano (TE/VS) Transmission Line

FERC PN-11858-002 and ER06-278-005  CPUC Docket 07-10-005

Northwest Power and Conservation Council
Pumped Hydro Storage Workshop
October 17, 2008
Issues to Discuss

• Description of LEAPS
• LEAPS connection to grid via TE/VS Interconnect
• Benefits vs. Revenue
• Questions
Lake Elsinore Advanced Pump Storage (LEAPS)
LEAPS + TE/VS Interconnection

- 500 kV transmission line linking SDG&E into main California Grid + 500 MW advanced pumped storage
- Innovative, private sector solution with 500 MW of renewable storage.
- Only 500 kV link between San Diego and the robust SCE 500 kV system to the north.
- Final EIS issued January 2007.
- Construction start scheduled for 2009.
- Critical asset to help State manage renewables.
- Rate base ok’ed for TE/VS by FERC April 2008
Talega-Escondido/Valley-Serrano 500-kV Interconnect Project
Lake Elsinore Agricultural Pumped Storage Project
Talega-Escondido Tower Upgrade Facilities Plan Vicinity Map

Project Location

THE NEVADA HYDRO COMPANY, INC.
LEAPS + TE/VS

Lake Elsinore Advanced Pump Storage Project Conceptual Single Line Diagram

Day 11 July 08

To SCE Serrano Sub 32 miles
2.5 miles
To SCE Valley Sub 15 miles
2.5 miles

Lake Switchyard

Earth Dam
Decker Canyon

Upper reservoir

5.5 miles
~ 2.5 miles
~ 2.5 miles

500/230/13.8 kV Auto Xformer, 3
500 MVA 3 Phase Banks

Case Springs Substation

230/230 kV Phase-Shifter, 3
500 MVA Banks, each
15 Ohms & +/- 33 degrees

500/230/13.8 kV Line

SCE 115 kV
600/1150 kV Auto. Xformer, 2, 670 MVA 3 Phase Banks

Notes:
1. 1/0 copper kV Line conductors double bundled (two per phase) spaced 12" apart.
2. Talega – Case Springs 230 kV, single conductor, Falcon 1033 ACSR, double circuit.
3. Case Springs – Escondido 230 kV, double bundled Falcon 1033 ACSR, double circuit.
4. OL insulator at 4000 meters continuous load.
Pump Storage Project Description

• 500 MW pumped storage.
• Upper reservoir in Decker Canyon of the Cleveland National Forest.
• Lake Elsinore to be the lower reservoir with penstock tunnels for inlet/outfall.
• Power plant ~ 240 ft below the surface of Lake Elsinore.
• Advanced pump storage plant:
  – Pump lower reservoir water to upper reservoir during off peak energy periods,
  – Return water through the turbines and generate power during peak energy periods.
• Will be one of the most efficient pump storage plants in the world.
Easy LEAPS Performance Facts

• 82%+ wire–to–wire efficiency for electricity storage.
• Pump for 1 hour (@ 600 MW) allows generation for 1 hour (@ 500 MW).
• Daily maximums:
  – Generation: 12 hours at 500 MW
  – Storage: 12 hours at 600 MW
  – Nominal Storage: 6,000 MW Hours
• Fully dispatchable in 15 seconds.
• Can operate for up to 18 continuous hours in emergency.
• Lake will fluctuate ± 6 inches to a maximum 18 inches.
Comparison to Other Generation Types

- High Capital Expense (compared to thermal generation).
- Low O&M cost (compared to thermal generation).
- Extended Asset Longevity - (compared to thermal).
- Significantly lower GHG emissions (wind is expected to be a significant component in the pumping energy source portfolio).
- Potential for remote operation.
- Very reliable (high equivalent availability - 93+%).
- Predictable and short start time, avoids uneconomic startup time typical of cycling intermediate resources (CC).
- No minimum run time.
## Turbine – Leaps Comparison

<table>
<thead>
<tr>
<th></th>
<th>Peaker</th>
<th>Combined Cycle</th>
<th>LEAPS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Quality Issues</strong></td>
<td>NOx, CO, VOC, PM10 Offsets</td>
<td>NOx, CO, VOC, PM10 Offsets</td>
<td>None required</td>
</tr>
<tr>
<td><strong>Dispatchability</strong></td>
<td>10 – 60 minutes</td>
<td>1 – 4 hours</td>
<td>15 Seconds</td>
</tr>
<tr>
<td><strong>Black Start</strong></td>
<td>10 – 30 minutes</td>
<td>No</td>
<td>15 Seconds</td>
</tr>
<tr>
<td><strong>Dispatchable Capacity</strong></td>
<td>Can produce either energy or capacity</td>
<td>Dispatchable capacity limited between 70-100% full load</td>
<td>Dispatchable capacity from 1-100% of full load</td>
</tr>
<tr>
<td><strong>Regulation</strong></td>
<td>No</td>
<td>Yes; limited to 5 MW/min.</td>
<td>Yes; up to 500 MW/min.</td>
</tr>
<tr>
<td><strong>Spinning Reserve</strong></td>
<td>No</td>
<td>Yes; limited to 5 MW/min.</td>
<td>Yes; up to 500 MW/min.</td>
</tr>
<tr>
<td><strong>Voltage Support</strong></td>
<td>Yes; but typically not used for voltage support</td>
<td>Yes</td>
<td>Yes. When pumping and generating</td>
</tr>
<tr>
<td><strong>Comparable Heat Rate</strong></td>
<td>Appx. 10,000 – 12,000</td>
<td>7,000</td>
<td>Appx. 18% more efficient than lowest off-peak rate</td>
</tr>
<tr>
<td><strong>Alternative Fuels or Renewables</strong></td>
<td>No</td>
<td>No</td>
<td>Yes; can source pumping energy from renewables</td>
</tr>
<tr>
<td><strong>Mitigation of Overgeneration Conditions</strong></td>
<td>No</td>
<td>No</td>
<td>Yes; up to 600 MW of pumping load during off peak periods</td>
</tr>
</tbody>
</table>
Talega-Escondido / Valley-Serrano (TE/VS) Transmission Line
Talega-Escondido / Valley-Serrano Transmission Line Project Description

- 28.5 mile 500 kV transmission line, with a portion underground.
- Up to 1,600 MW throughput capacity.
- Most of the line runs through National Forest land.
- Only 500 kV link from San Diego into main California Grid.
- Allows for 1,100 MW import to San Diego in contingency conditions.
- Can link real renewable resources (like Tehachapi wind resources) for use in San Diego.
- Required to connect LEAPS to grid but may be built as stand-alone project or may be started before LEAPS.
Permitting History  
(For both Projects)

- 9/15/00 – Submitted preliminary application to FERC
- 2/21/01 – FERC issued preliminary permit #11858-000
- 9/09/03 – Draft FERC application distributed to 140 agencies and interested parties
- 2/2004 – Final Application filed with FERC
- 5/2004 – USFS agrees to cooperate with FERC for NEPA
- 2/25/05 – FERC accepts License Application for Filing
- 2/28/05 – FERC issues REA
- 3/28/05 – Interconnection Application filed with CAISO
- 2/17/06 – Draft Environmental Impact Statement issued by FERC
- 10/2/06 – Final Route Map issued by FERC and USFS
- 1/30/07 – Final EIS issued By FERC
- 9/2009 – California PUC accepts CEQA lead
Project Status

Permitting:
• Route in National Forest approved by USFS August 2006.
• Final USFS Sec. 4(e) conditions published March 2007.
• CEQA in process with PUC as lead agency.

Connection to grid:
• System Impact Studies and Interconnection Studies with SDG&E/SCE/CAISO completed.
• Interconnection agreements with SDG&E/CAISO approved by FERC on May 8, 2008 (Docket ER08-654)
• Interconnection agreements with SCE/CAISO now under negotiation.
• Approval to connect to CAISO grid granted by CAISO March 2007.

FERC granted rate base treatment for TE/VS, April 2008
Engineering for TE/VS now underway.
500/230 kV transformers on order
Project Estimated Cost

- LEAPS Total Cost: ± $750 Million
- TE/VS Total Cost: ± $350 Million
- System upgrades: ± $100 Million
Project Benefits
Grid Benefits

- Store off peak to sell on peak (renewables & overgeneration management).
- Dispatchable in 15 seconds (with units spinning).
- Black start in 10 minutes.
- Full range of ancillary services.
- Provides regulation, load following and voltage support.
- Increased system reliability.
- Management and conservation of renewable resources.
- FERC has identified LEAPS as “advanced transmission technology” under Energy Policy Act of 2005.
Pumped Storage Benefits

• Fast Start
• Fast ramp rate
• Superior Spinning Reserve
• Reliable Capacity Resource (Hydro)
• Intermediate Resource with peaking Capabilities – Cycle Time / Starting Cost
• Voltage Support - multi mode
• Black Start

• Significant Regulation Capability
• Thermal Generation Optimization
• Very reliable / timely starting
• Efficiency 82+%
• Fuel diversity/hedging
• Storage Volume / Weekly / Daily Cycles
• Flexibility !!
Benefits of TE/VS

- Construction should commence in 2009.
- Brings 1,100 MW of reliability to San Diego starting in 2010.
- Links to real renewable resources like Tehachapi and Imperial Valley.
- In addition, TE/VS connects San Diego to main, robust California grid.
LEAPS Benefits ($)

- CAISO found $100 - $150 million in annual benefits.
- We see at least $200 - $250 million in annual benefits.
- Benefits include production cost savings, ancillary services, wind integration, overgeneration & capacity.
- Excludes energy, RPS, greenhouse gas, black start, and other benefits.
Paying for Pumped Storage: Converting Benefits to Revenue
Paying for Pumped Storage: Converting Benefits to Revenue

- Rate base???
  - Utility owned vs. non-utility owned
- Long-Term Contracts (PPA)
- Link to Renewables?
  - Firming intermittent resources
  - Rapid response
  - Load following
  - Market development?
    - Timing for new products?
Converting Benefits to Revenue (cont’d)

• Markets?
  – Energy Markets: Off/on peak spread
  – Ancillary services
    • Regulation up/down
    • Spinning reserve
    • Voltage support
    • Black start
  – Other?
Key Team Members

- Nevada Hydro Company
- Morgan Stanley
- Voith Siemens Hydro
- Siemens Power Transmission & Distribution
- Elsinore Valley Municipal Water District