EAGLE MOUNTAIN Hydro-Electric Pumped Storage Project

Eagle Crest Energy Company
Making Renewable Energy Dependable

Northwest Wind Integration Forum
Portland, Oregon
October 17, 2008

By
Gil Tam
Electric Power Group
Eagle Crest Energy Company

• Privately held company
• Capital provided by:
  – Individual investors
  – East Coast Energy Fund that manages over $7 billion in assets
• Executive advisory group includes major leaders in the energy field
• ECE is in discussions with some of the world’s largest hydro plant equipment suppliers, such as Alstom, Voith-Siemens, Toshiba, etc.
Location and Site Conditions

- Eagle Mountain Project located 65 miles east of Palm Springs near Desert Center
- Project sited at open-pit, abandoned iron ore mines
- Initial water fill and replenishment from non potable ground water sources
- Underground powerhouse 50’ wide x 150’ high x 500’ long
- 6,200’ long access tunnel to powerhouse
- Interconnection to the proposed Colorado River (Midpoint) 500 kV Substation via two new 46-mile transmission lines or to a new closer collector substation under consideration by SCE
- Initial project capacity of 1,300 MW with a potential expansion to over 4,000 MW total
Location Of Eagle Mountain Site
Eagle Mountain’s Proposed Transmission Route

[Map of Eagle Mountain Pumped Storage Project at Eagle Mountain, CA]
Eagle Mountain Schematic

• 1,400 ft head

• As it is a closed loop, (meaning the reuse of same working fluid), in a remote desert site with no aquatic resource issues. There are no expected plant operation restrictions, such as fish endangerment, water release requirements, recreation use or low flow restrictions from drought.
Current Status/Schedule

- January 2008 FERC Filings
  - A PAD (Pre-Application Document)
  - Notice of Intent to File License Application
  - Request for Traditional Licensing Process (TLP)
- March 4, 2008 – FERC approves TLP request
- May 2008 – Valid Interconnection Request in CAISO queue
- June 2008 – Draft License Application to FERC
- June 29, 2008 – FERC Notice Period Ended with No Intervention
- November 2008 – Final License Application to FERC
- FERC license approval expected in 12-18 months
- Estimated Commercial Operation date in 2015 / 2016
Key Operating Data

• Initial Rated Capacity 1,300 MW
• Number of Units 4 @ 325 MW
  – Variable speed pumps
  – Designed for quick switch between generation mode and pump back mode
• Tunnel/Shaft Diameter 35 ft.
• Upper Reservoir Capacity 20,000 ac-ft
• Lower Reservoir Capacity 21,900 ac-ft
• Annual evaporation and seepage is estimated at 2,400 ac-ft
• Head 1,400 feet
• On-Peak Weekday Generation 9 hours
• Off-Peak Daily (7 days/week) Pumping 8 hours
• Cycle Efficiency 80%
Eagle Mountain Project Benefits

- Compared to most pumped storage projects, the presence of the existing pits/reservoirs will significantly reduce total costs, to (less than $1,000/kW)
- Uses lower cost, off-peak power to store energy for generation during higher cost on-peak hours
- Available on-peak and for emergency response
- Dispatchable -- provides ramping, frequency regulation, minimum load management and operating flexibility
- Pumped storage can convert intermittent renewable resources, such as wind, into firm dispatchable resources.
- Environmental enhancement - No emissions, no interference with aquatic resources (such as fish kills), no endangered species.
Eagle Mountain Operating Attributes

- Black-start capability
- Rapid ramping
- Voltage and reactive support to the EOR transmission system while operating in the generation mode
- Quick start capability
- Regulation and load following capability
- Complements intermittent renewable resources
- Mitigates minimum load conditions
Tehachapi Wind Generation in April – 2005

Could you predict the energy production for this wind park either day-ahead or 5 hours in advance?

Each Day is a different color.

Day 29
Day 9
Day 5
Day 26
Average
California Energy Commission (CEC) and CAISO Renewable Integration Studies

- CEC Study - July 2007 (GE was primary researcher):
  - California can successfully integrate renewable resources at the mandated 20% level, but will require:
    - Investment in transmission, generation and operations infrastructure to support renewable additions
    - Appropriate changes in operations, policy and market structure
    - Cooperation among all market participants
    - Pursuing generation resources with greater operating flexibility (minimum turndown, quick start, pumped storage)
    - Capability to meet multi-hour load following requirements, example - 3 hour morning load pick-up of 12,000 MW
California Energy Commission (CEC) and CAISO Renewable Integration Studies (cont.)

• CAISO’s Transmission and Operating Issues Study – November 2007:
  – Some of the key recommendations related to future resource requirements to better facilitate renewable integration:
    • Encourage the development of new energy storage technology to facilitate the storage of off-peak wind energy for delivery on-peak periods.
    • Include changes in resource adequacy standard to require more generation with faster and more durable ramping capabilities to meet future ramp requirements.
    • Include changes in resource adequacy standard to require additional quick start units that will be required to accommodate hour-ahead forecast errors and inter-hour wind variations.
Issues and Challenges

• Monetizing operating attributes of Hydro Pumped Storage Projects (HPSP)

• Providing contract certainty – consensus on need for HPSP for renewable resource integration and real time operations management but revenue and contract methods uncertain
  – Utilities vs. CAISO
  – Market based or contract based?
  – Bidding against a peaking resource is undervaluing the HPSP because it provides A/S that a peaking unit can not provide

• Mandating power storage projects to enable intermittent renewable resource integration and provide grid reliability support

• Regulatory and revenue certainty (contracts or tariffs) to promote energy storage project development
Conclusions

• There is a need for substantial policy consensus on energy storage for integration of intermittent renewable resources

• Technical studies by CAISO, GE and others all point to need for energy storage resources for managing real time operations and reliability

• Energy storage provides the needed operating attributes – load following, regulation, quick start, etc.

• Policy options to consider:
  – Storage portfolio standard of 5%
  – 4 hour resource adequacy capacity procured via long term contracts and long term energy contracts
  – On-call peak energy supply contracts at pre-established price benchmarks (eg,14,000 heat rate times gas index for the day; 400 hours at CAISO ceiling price)
  – Intermittent generation energy firming contracts
Contact Info

Art Lowe
Eagle Crest Energy
(760) 779-0040
ALowe@EagleCrestEnergy.com

Gil Tam
Electric Power Group
(626) 685-2015
Tam@ElectricPowerGroup.com