Development Opportunities and Challenges at the Salton Sea

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EnergySource Introduction

EnergySource specializes in the development, construction, and operation of geothermal power facilities on the Salton Sea.

- Developed, own and operate the 49.9 MW John L. Featherstone Plant at Hudson Ranch. Commissioned in 2012; the first new geothermal plant in America’s largest field in 22 years.

- EnergySource team is comprised of industry veterans from Unocal and Magma Energy – firms that developed all the greenfield projects on the Salton Sea resource.

- Ownership complemented by Mercury (f/k/a Mighty River Power), a New Zealand utility and geothermal heavyweight (450MW), and Chevron (tax owner).

- First major renewable project to be financed after the 2008 financial crisis shows a resilient and resourceful development team.
Industry Wide Development Challenges

Geothermal power combines universal project development risk with downhole exploration risk, unique in the power industry.

- Exploratory drilling and flow testing – timing and cost.
  - Availability and sustainability of the resource.
  - Impacts facility design; with flash plants designs are not standardized owing to modifications needed to match resource conditions.
- Water availability in low and high deserts: water cooled vs. air cooled designs.
- Transmission and interconnection process: timing aspects are hard to manage.
- Asymmetric tax policy (federal ITC and CA property tax).
- Competition for PPAs in shifting supply mix; differences in risk allocation:
  - Natural gas – low CapEx, but fuel price risk borne by ratepayers.
  - Solar / Wind – low CapEx, but variable risk/cost borne by system.
  - Geothermal – reliable, but resource risk capitalized in the project.
Geothermal – Improvements/Portfolio Benefits

Renewable power has experienced tremendous change in market pricing owing to the precipitous drop in solar PV.

- Economies of scale (i.e. not 49.9MW) delivers more competitive pricing.
  - Unit costs go down for both construction and operation.
  - Limited PPA off-takers for 1,000 GWhs or more.
  - Challenge to utilize tax equity benefits ($300M+).
- Mineral recovery should lower geothermal power pricing but power operations must be built first on the strength of a long term PPA.
  - Mineral recovery project is financed differently owing to a cyclical commodities business and short term contracts.
- A holistic system approach like the California 2030 LCGS provides empirical data and quantifies system costs not just individual project cost.
  - Diverse RPS reduces emissions, curtailments, and overall system cost.
EnergySource’s Operational Experience

The geothermal resource at the Salton Sea is robust and reliable, but these benefits come with some real challenges.

- Value engineering exercises are essential when considering high capacity factor operation, economic life, and capital costs.
  - Materials of construction: high nickel alloys / titanium vs. carbon steel.
  - Equipment redundancy due to extreme service conditions.
- O&M cost at the Salton Sea are not comparable to other geothermal resources like the Geysers, Coso, or binary units.
EnergySource’s Development Experience

In 2010, we drilled two of the largest geothermal wells in the world; a half mile away and 2 years later, we didn’t; in 2016 we are developing an integrated power and minerals approach.

- At the John L. Featherstone plant, well 13-2 is over 40 MWs (over 500°F and 500 psig) but it is over 30% total dissolved solids.
- In 2012, time constraints in our second PPA necessitated drilling on the eastern edge of the resource for our second project - well outputs that would be good in nearly every other geothermal field in the world are economically challenged with $20M well drilling and casing completions.
- We have subsequently added another 2,500 acres of on-shore resource that is preferentially positioned (State of California and additional private lands).
- Long-lived assets versus ever shortening IOU PPA term lengths.
- Risks identified by buyers – Salton Sea mitigation, deliverability.
R&D Topics for Consideration

Interest in Salton Sea geothermal is high, unless you are a vendor. Its harsh service application, limited market size, and limited transferability doesn’t merit vendor experimentation.

- Cheaper and more robust materials of construction: casing, valve assemblies, pump internals, etc.
- Technology transfer across industries: expand the knowledge sharing across complementary and unconnected industrial efforts (e.g. drilling technology, water chemistry, scale inhibitors).
- Next generation mineral recovery (low concentration / high value).
R&D Topics for Consideration

When to support is as important as what to support.

The “valley of death” is caused by costs increasing faster than risks decrease

INDICATIVE

Probability successful business not established

Level of risk

Chance of success per unit investment

Required investment

Source: Carbon Trust analysis; Mahler Ventures Ltd
Thank You

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