GreenFire Energy Inc. Comments on the January 28, 2016

California Energy Commission Geothermal Workshop

Purpose of the Workshop

We applaud the Commission for holding this workshop to:

- understand the barriers and limitations that face energy developers in California,
- surface ideas for useful research, and
- learn about new technologies that might help the State of California achieve its power and environmental objectives.

Background

GreenFire Energy is developing a new renewable geothermal power technology ("ECO2G") that overcomes the constraints of risk, permeability, and water availability that have limited geothermal development to a small percentage of its world-wide energy potential. ECO2G power is not only renewable, but also has no carbon emissions and no process water consumption, and, in principle, this baseload resource can also provide "flexibility." However, development and commercialization is made more difficult in today's competitive environment, where the other two renewable, non-carbon emitting resources, solar and wind power, do not directly bear the grid integration and backup costs imposed by their intermittency. In contrast, to wind and solar availabilities on the order of about 30%, conventional and advanced geothermal technologies are highly reliable, baseload power resources with 95% availability. In order to achieve California's mandated Renewable Power Standards of 33% of retail sales by 2020 and 50% by 2030, maintain grid reliability, and create renewable diversity, additional geothermal power resources will be needed.[1]

While California is seeking "flexible" resources it is clear that increasing the amount of intermittent renewables beyond 40% will decrease the reliability of the grid and change the nature of grid operations more rapidly than at any previous time. Moreover, grid-scale battery storage is not currently cost-competitive and introduces a host of additional issues to consider. Hence, additional geothermal power plants, some with flexibility, will not only help California to meet its carbon emission reduction goals, but also its renewable diversity goals, while improving overall grid reliability,

[1] Unfortunately, it appears that that the term "renewable" has become almost synonymous with "intermittent" to the extent that geothermal is excluded from the conversation. For example, the fact sheet describing EPA's Clean Energy Incentives Program to reduce carbon emissions by rewarding early investments in renewable energy generation does not even mention geothermal power, only solar and wind. Fortunately, California and the west have abundant geothermal resources that can be developed at competitive costs.

Workshop Comments by Geothermal Operators

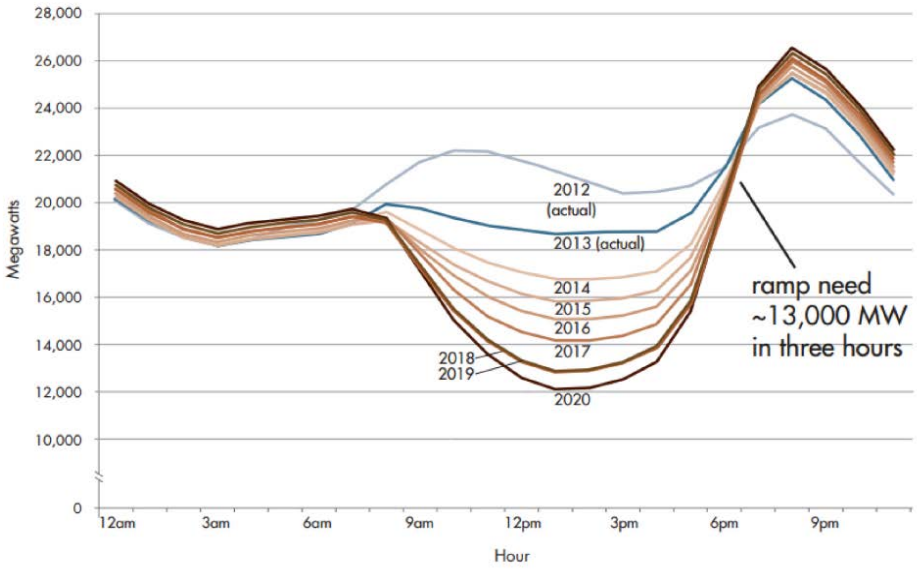
During the Geothermal Workshop, numerous questions were raised and observations made by industry participants. We endorse the following perspectives.

- *Why should geothermal power plants be required to curtail their baseload generation by wind and solar generators? If necessary, why not curtail them?*

  Geothermal electricity is a clean and renewable form of energy with lower overall environmental impacts and smaller life-cycle footprints than solar or wind power. Geothermal power is available about 95% of the time. In contrast, renewable solar and wind generators not only have greater overall environmental impacts, but are available only about 30% of the time and must be supported by substantial ancillary services.

  In order to capture the renewable benefits of solar and wind power plants, planning for CAISO grid operations after 2020 will require thousands of MW of fast, flexible ramping capacity. Yet, key storage technologies are only now being developed. In general, geothermal power provides better renewable benefits, but does not and will not impose huge changes on the grid with accompanying, unpriced costs and operating uncertainties.

Figure 1. CAISO "Duck Curve" Showing Projected Ramping Needs – March 31 Net Loads (2012-2020)[2]



[2] "During weekend spring conditions, the CAISO has observed that a combination of abundant solar, wind, and hydro production during the middle of the day, combined with only moderate demand, can encroach upon the minimum generation threshold…" CAISO, CAISO Time-of-use Periods Analysis. Report filed with the California Public Utilities Commission in OIR.15-12-012, "Order Instituting Rulemaking to Assess Peak Electricity Usage Patterns and to Consider Appropriate Time Periods for Future Time-of-Use Rates and Energy Resource Contract Payments." January 22, 2016, p.8.

- California does not properly value geothermal resources – price and value are two different things.
- If California wants stable clean power, it should encourage geothermal to the fullest extent, while adding solar and wind.
- Load following for conventional geothermal power plants can be difficult and potentially risky for dry stream projects and is impossible for geothermal projects that require moving water with a high concentration of minerals.
- Fortunately, due to its modular architecture, GreenFire's ECO2G is the most likely geothermal technology to be able to ramp power output up and down, but ancillary pricing needs to be appropriate to compensate for not being able to run at optimum efficiency 24/7.
- Asking geothermal to bear the cost of flexibility needs created by the solar and wind industries is fundamentally unfair to both ratepayers and the geothermal industry. Wind and solar (not geothermal) should be required to internalize the costs of battery storage required by the intermittency of wind and solar.
- Rapidly changing contractual provisions for special wholesale tariffs and rates, load following, curtailment etc., are making it difficult for some existing geothermal operators.
- It would be more cost-effective and efficient to design, demonstrate and operate new geothermal plants that can provide flexibility, than it is to try to adapt existing facilities that already operate reliably and cost-effectively in a baseload mode.
- Several existing geothermal plants do provide flexible operations with 24/7 reliability and better ramping parameters than natural gas steam plants.
- The CPUC philosophy of "least-cost, best-fit" (LCBF) ranking and selection of bids for power sales to the Investor-Owned-Utilities (IOUs) has in reality played out as "least-cost, least-cost," and has not included all relevant costs and benefits.
- Diversity of resources is, at present, an unpriced attribute that geothermal power brings to the table of renewable resources. Diverse, balanced generation portfolios that contain from 30 to 50 percent renewables will need significant geothermal additions, in order to create a true LCBF portfolio.

Current policies have unfairly rewarded new wind and solar power projects relative to geothermal power, because of the lack of curtailment provisions in these contracts and the failure to apply the costs of integration and backup power in making LCBF selections to meet RPS mandates. Under regulatory cost-causation principles, the costs of developing and demonstrating beneficial storage technologies made necessary by solar and wind, should properly be borne by solar and wind projects.

We urge the CPUC, CEC and CAISO to reform and revise LCBF criteria, as well as pay-for-performance tariffs and contract provisions, in order to better reflect both the <u>benefits and the burdens</u> imposed by wind, solar and geothermal power plants.

Unanswered Questions

The presentations and workshop discussions were a good first step toward recognizing the benefits of renewable geothermal power resources and identifying important problems and issues. The CEC has recognized that there are, in fact, three major renewable power sources in California: solar, wind and geothermal.

There are many important questions that remain unanswered. These include:

- *Why should a 24/7, reliable geothermal resource with no carbon emissions be curtailed and penalized economically, in order to operate a wind or solar plant, also with no carbon emissions but with intermittent availability that requires significant amounts of fast response ramping resources to be added, operated and adequately compensated?*
- *How should baseload geothermal resources be compensated for lost generation revenues (MWh), when curtailment occurs?*
- *Who is representing the interests of the geothermal industry in the critical regulatory proceedings that will determine the future viability of the industry?* Clearly, wind and solar get the lion's share of attention and appear regularly before state commissions, government agencies and the Federal Energy Regulatory Commission.
- *What R&D should be funded to level the playing field for geothermal technologies and to encourage the demonstration of advanced technologies?*

GreenFire Energy looks forward to further opportunities to identify and demonstrate the ways in which its innovative ECO2G technology can provide clean, renewable power, while helping meet our energy and environmental goals.

Respectfully submitted,

John R. Muir
Senior Vice President – Business Development

Andrew J. Van Horn, Ph.D.
Member GreenFire Energy Inc. Advisory Board

GreenFire Energy Inc.
4300 Horton St., Unit 15
Emeryville, CA 94608
Office (888) 320-2721
www.greenfireenergy.com