Comments of the Geothermal Energy Association
Submitted to the California Energy Commission
Workshop on Renewable Energy Costs, Docket Number 12-IEP-1D
June 5, 2012

GEA appreciates the work of the California Energy Commission conducting this integrated energy planning and policy process. GEA believes that this effort is particularly important as California seeks to meet its clean energy goals under AB 32, the California Renewable Portfolio Standard, and other related electric power supply and environmental initiatives.

The workshop seeks input on "renewable costs, how those costs are incorporated into procurement decisions and electricity rates, and policy solutions for minimizing cost." The notice indicates, "The Lead Commissioner will consider input from this workshop together with other information from the 2012 IEPR Update proceeding to develop specific strategies and action items to minimize costs associated with renewable development in California."

Geothermal Generation

Attached is a copy of the letter which GEA submitted to the California ISO in April which "presents a fair and accurate view of the relative state of development of geothermal power projects and their total power potential."

As that letter states: "Nevada, California and Oregon all had substantial geothermal power resources reported under development. Nevada, California and Oregon were the top three states out of the 15 reporting projects under development. As noted in the table below, Nevada had 59 projects under development with over 2,000MW of power potential. California was the second highest with 31 projects also roughly 2,000MW of power potential, and Oregon was third with 16 projects and over 300MW of power potential."

This, however, is different from a total resource estimate of geothermal potential in California and nearby states. The above estimates of resources under development do not include undiscovered hydrothermal resources, small power generation and heat recovery potential, oil field co-production, and production using enhanced geothermal systems technology. According to Google Inc.'s philanthropic arm, known as Google.org, the potential amount of power that could be produced using advanced EGS technology could dwarf the total power production today from all power sources. At a 2% recovery rate of the accessible heat, EGS potential in California is over 140,000 MW. (*See:* http://Google.org/egs/)

The Full Value of Geothermal Power

Geothermal power costs need to be viewed within the context of the full value of geothermal power production in the state, which the Energy Commission should lead its sister California energy agencies to recognize is a firm and flexible generation source that meets or exceeds the values of any other clean power technology. Geothermal power provides reliable power that

adds to grid integrity, and can provide power at long-term, stable prices. Geothermal has one of the smallest footprints of any energy technology, has minimal environmental impacts and avoids significant greenhouse gas emissions. Geothermal power plants have demonstrated they can provide power for decades -- The Geysers just passed its fiftieth anniversary, and expect to continue producing power for many years to come. Geothermal power also creates a wide range of jobs, many of which are in-state and permanent. Geothermal power provides the state, federal and local governments with bonus bid revenues, royalty revenues, and tax revenues. Geothermal power development stimulates economic growth and supports an active export business by California businesses. (These benefits are further enumerated at http://www.geo-energy.org/pdf/FINALforWEB_WhySupportGeothermal.pdf.)

Job Creation

Table 1 provides the Renewable Energy Policy Project's estimates of job creation from renewable energy development based on existing and planned projects in California and the market outlook of project developers and equipment manufacturers. Natural gas is included in the table because the bulk of new nonrenewable generation is expected to rely upon natural gas. The table indicates that according to REPP geothermal and landfill methane energy generation yields significantly more jobs per MW of installed capacity than do natural gas plants. Without endorsing the specifics of their analysis, we do believe that the comparative job creation value of geothermal is significant and believe that future planning should examine this question on a comparative basis.

Table 1. Employment Rates by Energy Technology

Power Source	Construction Employment (jobs/MW)	O&M Employment (jobs/MW)	Total Indirect Employment for 500 MW Capacity	Factor Increase over Natural Gas
Wind	2.6	0.3	5,635	2.3
Geothermal	4.0	1.7	27,050	11.0
Solar PV	7.1	0.1	5,370	2.2
Solar thermal	5.7	0.2	6,155	2.5
Landfill methane/digester gas	3.7	2.3	36,055	14.7
Natural gas	1.0	0.1	2,460	1.0

http://www.repp.org/geothermal/geothermal_brief_economics.html

Pricing Impacts and Policy

The Energy Commission has already conducted a number of publicly reviewed analyses examining the comparative cost of power of technologies. But, it is important to note that the cost of geothermal power will vary considerably depending on government policies related to transmission (in-state and interstate), exploration and resource risk, permitting time and complexity, and health of the industry. Both the length of time it takes to develop a project (from exploration to power production) and the uncertainties companies face with changing market and policy signals, only increase the cost of power production.

To begin with, we believe that "sustained growth" should be the objective for all renewable technologies expected to contribute to the state's climate and RPS goals, and that achieving policies which support sustained growth in that manner will lead to the least-cost, best-fit renewable power solution.

We believe that developing in-state and nearby geothermal power will be the most cost-effective and system supportive way to displace retiring base load generation resources such as imported coal fired generation utilized by California and retiring Once Through Cooling generation facilities. Geothermal power can displace base load resources with high reliability, and without the need for significant and costly firming capacity. In addition, geothermal has demonstrated its reliability, low land use footprint, and long facility life.

When considering costs as part of the IEPR process, we would encourage the Energy Commission to look at the total cost involved in sustaining power production for 50 years or more. Sometimes a shorter lifetime is used to reflect financial considerations, but in terms of power supply the state should be looking for project lifetimes that are significantly longer. The Energy Commission should also support those findings with historical examination of the useful lifetime of operating systems.

Further, given the economic situation in the state and country, the Energy Commission should consider the full economic value to the state which includes the value of technological leadership and exports of goods and services to the dynamic world geothermal power market.

Also, the cost of all renewable power will vary with the level and effectiveness of federal and state subsidies, which are currently under scrutiny and reconsideration in light of budget deficits. While the discourse around subsidies is known for highly charged rhetoric, looking through the fog of obfuscation it would appear that there is no “level playing field” either between renewable technologies or between conventional technologies and renewable energy. The CEC should examine the relative subsidy levels federal and state policies provide for different technologies as part of its planning efforts. In addition to examining utility scale power, where distributed generation receives special consideration small geothermal power systems and geothermal heat pumps should be considered for equal treatment.

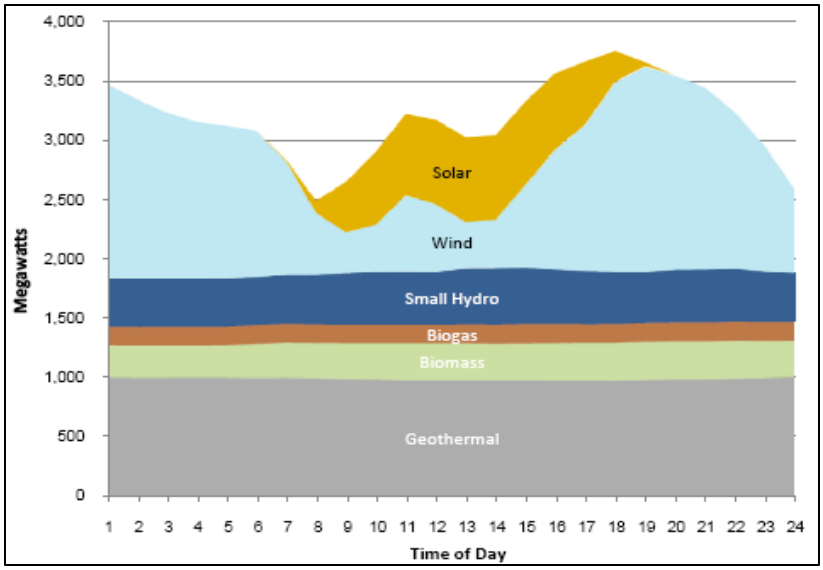
In addition, the CEC should look at how geothermal energy provides a foundation for other critical energy infrastructure and products, including supplying geothermal brines to support the emerging and established markets for lithium, manganese, and zinc. California can develop its critical resources in a fundamentally different way from traditional, invasive methods of materials extraction. By supporting geothermal development in Imperial Valley, California would be strategically well positioned to competitively, sustainably, and reliably meet the world's needs for high performance battery materials for years to come.

System Integration

The Workshop notice specifically raises the question of "Integration and Transmission." The notice states, "there are further issues with integrating large amounts of intermittent renewable electricity, such as solar and wind, into the state's electric grid." Renewable integration costs have not generally been considered in utility/CPUC bid evaluations. This is due, in part, to the uncertainty about the exact cost of a single project. Still, since integration costs can be a significant cost component of adding renewable resources, we suggest that integration costs be included in cost considerations, and propose the Energy Commission look at comparative values instead of seeking to identify absolute integration values. Furthermore, integration costs vary with the type, location and the penetration levels of the selected resources which warrants development of a best practices approach to integrating renewable energy resources.

Further, the current procurement process appears to provide incentive multipliers on a time-of-day basis which benefits some solar projects. Recent research by the Lawrence Berkeley National Lab (Mills and Wiser, 2012) indicates that the capacity value of solar generation without storage declines as penetration increases and thus these incentive multiplier values should be re-examined for some types of solar resources in light of this fact. We suggest that incentives should consider other factors including: multipliers for location (does it serve a local region with low capacity?), transmission access (is it along an existing line, a planned line, or a new line?), and whether or not a technology is base load or intermittent (assuming displacing base load coal power is an important objective of state policy.).

We hope that the Energy Commission will recognize that there is significant need to provide base load renewable power to meet the states long term policy goals. Below is a chart from the California ISO for renewable power generation on May 7, 2012 which illustrates the importance of base load generation technologies to the states renewable energy mix:



This translates into the following capacity and power production levels on the same date:

Renewable Resources	Peak Production (MW)	Daily Production (MWh)
Solar	704	6,037
Wind	1796	25,022
Small Hydro	480	10,464
Biogas	167	3,839
Biomass	327	7,276
Geothermal	1015	22,595
Other Renewables *	74	1,689
Total Renewables		**76,922**
Total 24-Hour System Demand (MWh):		*644,145*

These charts only show renewable production. On a typical day the Cal ISO system faces an hourly power demand ranging from roughly 20,000 MW to 30,000MW (based on Cal ISO System Status Reports). This would imply that biogass, biomass, small hydro and geothermal could be preferred sources for as much as 20,000 MW of the base power demand. It would also appear that neither solar nor wind can displace a substantial portion of the power demand without additional supporting/firming capacity and its associated cost since, based on the Cal ISO data, neither appears to match demand with precision. The issue before the Energy Commission and other California agencies should be how to best implement procurement, integration, transmission planning and construction, and other policies to achieve the long-run, least-cost, highly reliable power system needed for the state's future. We believe given the large

amount of base load power used in the state, particularly retiring Once Through Cooling gas generation and imported coal generation, it should be one of the Commission's objectives to develop a plan to substitute base load renewable generation for that power.

However, the focus appears, instead, to be in other areas. Instead of meeting demand by building from the bottom up, it appears the effort focuses on how to work from the top down, or how to make a growing amount of intermittent power work effectively for a reliable system. Again, the notice for the workshop states, "Because generation from these resources may vary over time in periods as short as seconds, it can cause difficulties for grid operators who must maintain a constant balance between generation supply and real-time customer demand while also meeting established standards for controlling fluctuations in frequency and voltage."

Many in the geothermal industry feel that the true value of their power is being undervalued despite the significant role geothermal should play in the over-all power mix. Today, it appears that base load renewable power is disadvantaged when a utility has contracts to take intermittent resources at a time of day when demand is low and when it has other pre-existing, non-renewable power supplies that must be taken or paid for if not used. This creates difficulties for both the power system and power generators, and almost certainly raises the overall cost of achieving the state's renewable goals and raises reliability questions for the power system as well. This simply makes no sense given the large amount of base load power the state still uses, and how much of it is produced by out-of-state, coal-fired power plants. According to CEC data, in 2010 almost 8% of California's total system power (22,424 GWh) was generated by coal, over 80% of which was imported from out-of-state.
(http://energyalmanac.ca.gov/electricity/total_system_power.html)

Transmission

As noted earlier, the workshop notice also identifies transmission as an issue to address. We recommend the Energy Commission examine and encourage others to examine transmission and procurement together. The current practice of looking at them separately discriminates against achieving a full portfolio of renewable technologies, including geothermal.

An example of this arose in discussion GEA recently had with a major California utility regarding the potential for geothermal power from Nevada. That utility expressed the opinion that "there was no geothermal power" available in Nevada. Apparently, this entity came to this conclusion because it had not received any bids for geothermal power to be delivered to California in response to a recent procurement. However, the real reasons for this became clear during the discussions: 1) the procurement required power production within two years, 2) plans for a transmission line from Nevada to Northern California were uncertain, and if initiated would take roughly six years to complete. Procurement and transmission planning were out of synch.

Despite the fact that utilities in California agreed they would have significant need for base load renewable power like geothermal in six years, and the fact that in six years substantial new

geothermal capacity could be put on line in Northern Nevada to fully subscribe a new transmission line, there was little to no coordination (and little incentive) between transmission planning and procurement to make demand and supply match-up. The Energy Commission can help fix this problem.

Conclusion

As you develop a Renewables Strategic Plan in this 2012 IEPR process, you have an opportunity to address these and related issues, and put California on the path to a sustainable energy future. We hope the Energy Commission will address these and other planning and policy gaps in the current process to achieve "sustained growth" in all eligible renewable power technologies -- solar, wind, geothermal, biomass, small hydro. This would be in our view the best path to provide the least cost, most reliable clean power system for the residents and businesses of the State of California.

Thank you for considering our views.

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Attachment: Text of April 13, 2012 GEA Letter to California ISO

[Original on Letterhead]

April 13, 2012

Dear California ISO,

The Geothermal Energy Association has recently completed its annual review of geothermal power projects across the United States in its *April 2012 Annual US Geothermal Power Production and Development Report* (available at: http://geo-energy.org/reports.aspx). We believe that the results of this annual report present a fair and accurate view of the relative state of development of geothermal power projects and their total power potential. We hope it provides California ISO with fundamental information needed for the transmission planning needed to facilitate projects wishing to sell to the California market.

Nevada, California and Oregon all had substantial geothermal power resources reported under development. Nevada, California and Oregon were the top three states out of the 15 reporting projects under development. As noted in the table below, Nevada had 59 projects under development with over 2,000MW of power potential. California was the second highest with 31 projects also roughly 2000MW of power potential, and Oregon was third with 16 projects and over 300MW of power potential.

State	Total Projects	Overall Total (MW)
California	31	1860-2009
Nevada	59	2030-2250
Oregon	16	320-365

As this year's report shows, geothermal power under development could continue to provide a substantial portion of California's renewable power needs. While the report does not present a market forecast, we are aware from discussions with the many project developers that whether and when these projects, and others yet to be developed, will be brought on-line will depends significantly on government policies, and in many cases transmission capacity.

As the California ISO considers future transmission needs, we hope it will refer to the GEA document as a primary source of information regarding future geothermal power generation.

On background, the GEA report is based upon a published set of criteria which were developed through months of consultation and review. In May 2010, GEA formed and began consulting with a committee of industry experts, as well as its own Scientific and Technical Advisory Committee, and began the process of drafting and adopting a set of *New Geothermal Terms and Definitions*. The final document was published in November of 2010 and is the basis for our annual industry reporting since that date (also available at: http://geo-energy.org/reports.aspx).

The geothermal power industry in California and the West is robust, and the resources identified by specific companies as now under development are not the limit of geothermal energy's contribution. However, we are aware from discussions with geothermal developers that utility information requests and regulatory processes do not always reflect their needs and the full potential of the resources.

GEA wishes to express its willingness to work with the California ISO to help support the information needs of the agency about geothermal energy. Please let us know how we should follow up to make sure the information needed is included in your planning process. Also, feel free to contact us for additional information about the 2012 Update or other matters that might be appropriate.

Sincerely,

Karl Gawell, Executive Director

Dan Jennejohn, Industry Analyst