Statement of Karl Gawell, Executive Director, Geothermal Energy Association

Before the

Senate Select Committee on California's Energy Independence

& Assembly Select Committee on Renewable Energy Economy in Rural California

April 3rd, 2014

Mr. Chairmen, Members of the Committees. The Committee has asked GEA to appear today to provide expert input on the subject of the status of geothermal power in California. GEA staff, Benjamin Matek and I, recently published the "Report on the State of Geothermal Energy in California," dated February 2014. Today, I will summarize its findings and address any other questions the Committees may have.

California is a global leader in geothermal power. If California was an independent nation it would rank second (behind the U.S.) with about 2,700 MW of installed nameplate capacity. These 2,700 MW generated 4.4% of total system power in California in 2012, but could have generated substantially more. Mistaken perceptions about the state of geothermal power in California have stymied growth so that only about half of California's identified geothermal resources remain undeveloped.

Table 1, which is appended to this statement, shows geothermal fields in California and their current level of production. This table is based upon GEA data and compared to heat-in-place estimated potentials from Jim Lovekin's 2004 report to the California Energy Commission. In total, roughly 50% of the identified, producing resource base at are not being utilized. Figure 1, also appended, shows these same results graphically for the larger fields.

However, this table only examines identified resources, which is comparable to a "reserve estimate" if we were to discuss oil and gas fields. The state's geothermal resources also include significant untapped reservoirs that are not yet identified. The US Geologic Survey conducted analyses of geothermal potential at the direction of the US Congress, and Figure 2 represents their estimate of the undiscovered, or hidden, geothermal resources in the state. As Figure 2 shows, there are substantial undiscovered geothermal resources, with the USGS's mean estimate over 11,000 MW. These estimates are additional to those shown in Figure 1. Table 2 expands on Figure 2 to provide the specific numbers with which the USGS 2008 analysis reports.

Basically, this data underscores the fact that California's unique geology has engendered some of the largest geothermal reservoirs of not only any U.S. state but the world. The Geysers in California is currently one of the largest operating geothermal fields internationally creating stable jobs that cannot be exported and tax revenue to California's governments. California already has the technical knowhow, experienced developers, and vast geothermal reserves positioned to rapidly expand this industry in a time where jobs and tax revenue are often short at hand. An average 50 MW geothermal power plant employs 700-850 workers during construction, which includes occupations from welders, drill hands, and construction workers

to geologist, hydrologist, engineers, and lawyers. In addition, this typical 50 MW plant will also employ 45 - 60 permanent positions for the duration of the 20+ year contract.

USGS estimates California may contain up to 5,400 MW of Identified Resource and an additional 11,000 MW of Undiscovered Resources. If all these resources were developed it would meet about a quarter of California's current power needs. For comparison, that is more energy reserves contained within the boundaries of California than current estimates predict for entire countries like Mexico or India.

As an aside, I wish to note that these resource estimates do NOT involve what has become known as Enhanced Geothermal Systems, or EGS. EGS is technology still under development that would expand the resource base much further, but EGS is not commercially available today. However, if research and demonstration efforts continue to advance successfully then the available geothermal resource estimates for the state could grow significantly from those we have presented

In brief, the GEA status report shows that:

- geothermal power generated 4.4% of total system power in California in 2012, but could have generated substantially more;
- geothermal power produces some of the lowest life-cycle emissions when compared to almost every other energy technology and even some renewables;
- depending on the resources characteristics and plant design geothermal power plants can be engineered to provide firm and/or flexible power;
- even with high upfront capital costs, geothermal power is a competitive renewable energy source;
- about half of California's identified geothermal resources are still untapped, and significant resources may remain undiscovered;
- geothermal power can be a key to achieving an expanded post 33% renewable power portfolio at the lowest total cost;
- distributed generation geothermal power and heating projects have potential in a number of areas, but are not eligible for the type of support provided other distributed generation projects ; and,
- challenges to growth of utility scale plants include weak demand, inadequate transmission, permitting delays, and a lack of coordinated policies.

In addition, the report highlighted that the leading opportunity in the near term for California is development of geothermal resources that are part of the Salton Sea Known Geothermal Resource Area. As Table 1 and Figure 1 show, there is at least 1,000 MW of undeveloped reserves in this field, and that is the only accessible onshore resource available today. There is

significant additional power potential now under water that is expected to become accessible as the sea area contracts. As the Committee knows, the Imperial Irrigation District has proposed a Salton Sea Restoration and Renewable Energy Initiative that would address both energy opportunities and environmental problems simultaneously as these events unfold.

Recently, the GEA Board of Directors approved a resolution supporting this initiative. In it, GEA has pledged to:

- support The Salton Sea Restoration and Renewable Energy Initiative, and to work collaboratively to achieve the goals of the Initiative; and,
- urge state and local officials to take the actions necessary to help IID achieve the goals of their Initiative; and,
- recommend that the Governor direct the California Public Utilities Commission to mandate expanding geothermal power in the state with the goal of having policies in place by the end of the year to support the expansion of 500 MW and ultimately achieve no less than 1,700 MW of new geothermal power production as envisioned by the Salton Sea Restoration and Renewable Energy Initiative.

Implementing the public policy and initiatives to build 500 MW of geothermal resources will only be the first step. As California seeks to expand geothermal power it will need to address three additional challenges including,

- inadequate transmission infrastructure or a disparity between available transmission service and the location of geothermal resources at the Salton Sea Field; and,
- permitting delays that hinder projects adding to an already lengthy development timeline and raising costs; and,
- A lack of coordination in decision making, for example, utility power solicitations that are not effectively coordinated with transmission planning efforts.

We believe the largely untapped geothermal resources will be crucial for meeting California's climate and greenhouse gas emissions reduction goals by producing electricity with one of the lowest costs to the environment of any energy technology. In addition, geothermal power plants can bring jobs and revenues to rural communities throughout the state where these resources are located. While an expansion of geothermal power is expected at the Salton Sea in the near term, several steps must be taken to support a statewide expansion.

In examining the current policy milieu in California for renewable power and geothermal in particular, we would like to offer the following observations:

- The policy of Least Cost-Best Fit (LCBF) is not being implemented adequately. As a result, the policy creates an un-level playing field that threatens grid stability and reliability.

LCBF does not account for integrated system costs and the positive ancillary benefits of different renewable technologies; it is hardly best fit if a price competitive technology which would lessen the need for flexibility procurement and storage is regularly overlooked. Geothermal base-load technology has significant positive attributes that are not

recognized in current IOU RFPs and, more importantly, geothermal power does not add to issues of concern such as grid stability, variability and ramping. In fact, geothermal base-load power will assist in furthering renewable penetration into the electricity supply and doing so without the need of natural gas shaping, firming and ramping.

The absence of RFOs (request for offer) awarded to geothermal plants paints a very vivid picture. According to CPUC's records of most recent renewable RFOs, including the 2012 RPS RFO and the RAM (renewable auction mechanism) 4, PG&E awarded 12 intermittent projects, SCE has awarded 11 intermittent, and SDG&E have awarded 6 intermittent projects (2 are bilateral negotiations), and all with no geothermal procured. The current methodology used to evaluate bids in the RPS solicitation represents a market failure. Geothermal power won zero contracts even though according to the U.S. Energy Information Agency (EIA) geothermal plants are estimated to have one of the lowest levelized costs when compared to other energy technologies when integrated costs are recognized.

- Procurement is not resulting in the best mix of resources, and instead favors a higher mix of variable energy resources due to improper valuation of power attributes and lack of defined integration costs.

Renewable integration is currently being tabled across all proceedings underway at the Commission, which is inhibiting resolution of this important issue. This effectively removes integration from the conversation and negates it from being meaningfully considered in any forum.

An integration cost adjustment needs to be established as soon as possible. This would open up the opportunity to introduce integration studies establishing an integration cost adder. Immediate action is needed to change the rules governing utility resource solicitations to allow all potential resources to bid on a level playing field. In addition, a cost mechanism should be adopted to identify all energy, capacity and ancillary service attributes desired for the resource portfolio to truly provide LCBF resources that maximize value to ratepayers.

Some recommendations to consider:

- Should the Renewable Auction Mechanism (RAM) be extended to include larger projects and an expanded area for qualifying projects?

- Would a geothermal carve-out could create market opportunity and open up the possibility for new development.

An expansion and increased cap of the RAM program could be a great platform for success in energy in California, particularly as it allows base-load to compete against base-load and intermittents against intermittents.

Geothermal bidders have been successful in the RAM, why? Because it's a competition not between technologies but between different intermittent and base-load resources. The RAM provides an opportunity to address issues in the market due to the failure to account for integration costs.

Under rulemaking docket 11-05-005, decision makers are currently reviewing the extension and modification of the RAM program. We strongly support continuation of the program with changes allowing larger projects and an expanded area for qualifying projects, currently now limited to CAISO's control area which eliminates several geothermal resource areas.

Another approach being proposed to address the current situation in California, where geothermal projects are losing momentum, is a geothermal specific requirement, perhaps not dissimilar to the approach being taken for storage.

Conclusion

We believe that recent studies, like the E3 study, commissioned by California's five largest utilities that investigates renewable penetration beyond 33%, demonstrates the value to California of promoting a mix of renewable power generation, including geothermal. One of the most important implications from the E3 study is that the value and importance of geothermal power as a flexible and baseload resource and that these attributes need to be reflected in today's policies and pricing. The E3 study shows, there are costs to using intermittent resources to meet baseload power demand that are not now being recognized, and conversely the values of using baseload geothermal power to replace retiring baseload facilities are not properly valued either.

Finally, let me be clear that GEA expects California to continue to expand its intermittent energy resources. However, geothermal power and other technologies that can support baseload power or provide flexible output are also necessary. We believe geothermal expansion will be a facilitator of achieving higher renewable penetration levels within the state, and help the state meet its Greenhouse Gas Emission reduction targets.

Thank you.

Table 1: California Geothermal Power Resource Estimates by Field[i]

Fields and their Installed Capacities				Lovekin et al. Estimates		
California Geothermal Fields	County	Nameplate Capacity in 2004	Nameplate Capacity as of Jan. 2014	Min. Certainty	Most Likely Field Generation Capacity	Mean
Salton Sea	Imperial	350	437	1350	1750	1880
Geysers	Lake-Sonoma	1000	1585	1200	1400	1400
Coso Field	Inyo	300	302	246	355	490
Telephone Flat (Medicine Lake)	Siskiyou	0	0	110	175	256
East Mesa	Imperial	73	115	119	148	167
Heber	Imperial	100	180	109	142	158
North Brawley	Imperial	0	50	88	135	144
East Brawley, CA	Imperial	0	0	85	129	138
Long Valley (Mammoth)	Mono	30.1	37	70	111	148
Niland	Imperial	0	0	59	76	92
South Brawley	Imperial	0	0	45	62	70
Randsburg	San Bernardino	0	0	32	48	82
Sulphur Bank	Lake	0	0	27	43	61
Lake City/Surprise Valley	Siskiyou	0	0	23	37	49
Fourmile Hill (Medicine Lake)	Siskiyou	0	0	25	36	70
Calistoga	Napa	0	0	17	25	35
Mount Signal	Imperial	0	0	12	19	29
Dunes	Imperial	0	0	7.4	11	18
Superstition Mountain	Imperial	0	0	6	10	15
Honey Lake	Lassen	6.4	3.8	5.7	8.3	13
Glamis	Imperial	0	0	4	6	11
Sespe Hot Springs	Ventura	0	0	4	5	8
TOTAL		1860	**2710**	3644	4732	**5334**

Figure 1: Large Geothermal Fields Potential Generation[ii]

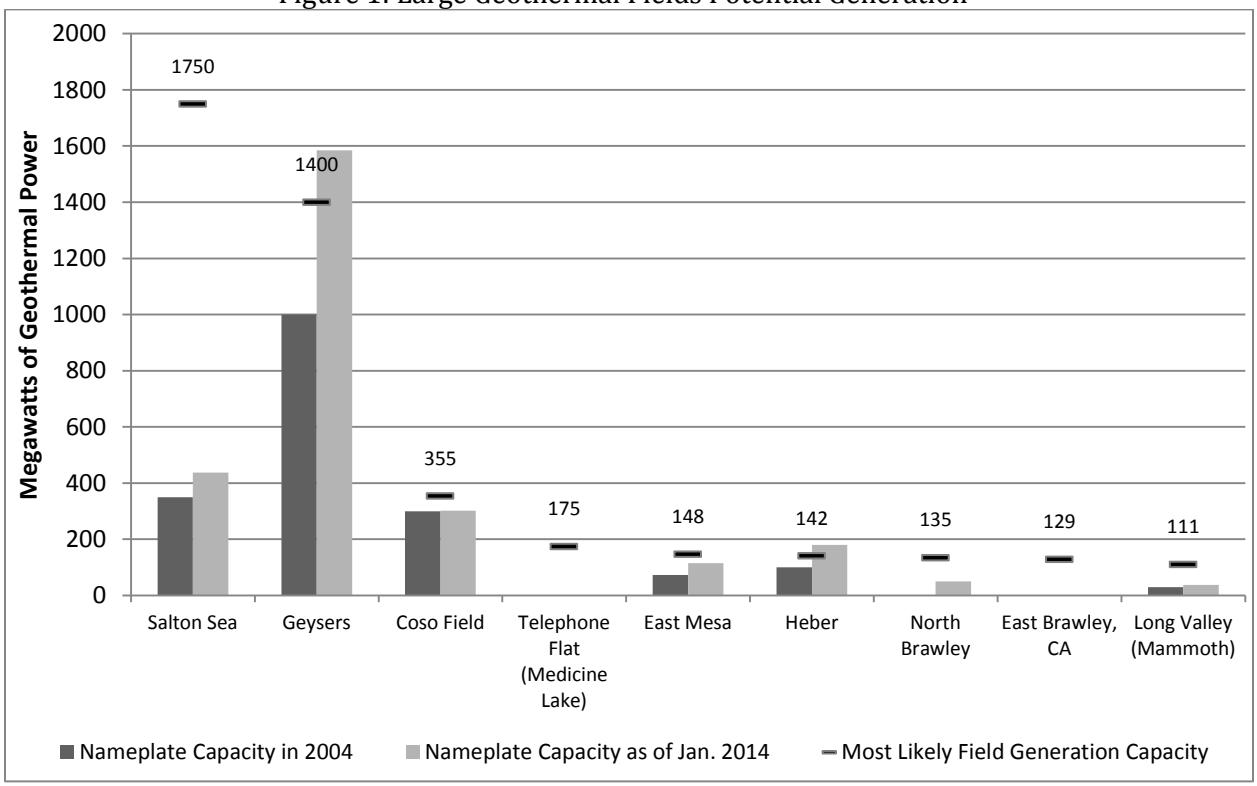

Figure 2: USGS California Geothermal Resource Estimates[iii]

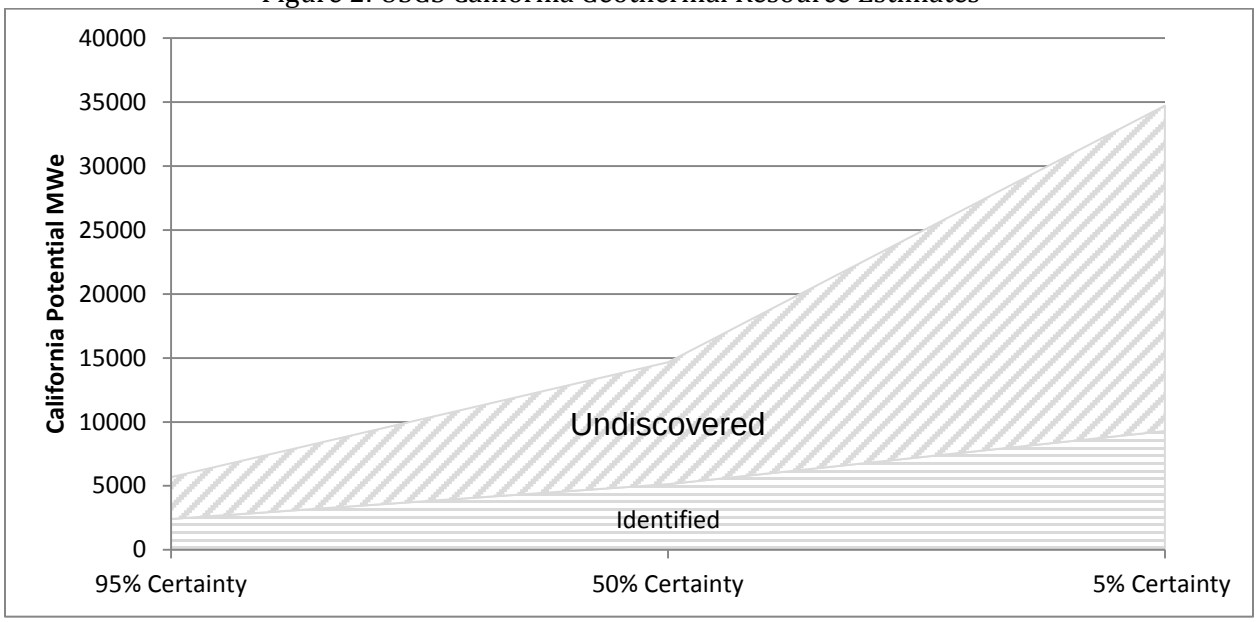

Table 2: Figure 2 Expanded

State MW_e of Resource		95% Certainty	50% Certainty	5% Certainty	Mean
California	Identified	2,422	5,140	9,282	5,404
	Undiscovered	3,256	9,532	25,439	11,340

[i] Lovekin, James W., Subir K. Sanyal, Christopher W. Klein. 2004. "New Geothermal Site Identification and Qualification." Richmond, California: California Energy Commission: Public Interest Energy Research Program. Accessed January, 16th, 2014. http://www.energy.ca.gov/reports/500-04-051.PDF

[ii] *Ibid.*

[iii] *Ibid.*