Torresol Energy
reinventing solar power

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Chairman Bob Weisenmiller
Commissioner Karen Douglas
Commissioner Carla Peterman
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October 3, 2011

Re: California Energy Commission Docket No. 11-IEP-1N: Comments on CEC Staff Report "Renewable Power in California: Status and Issues"

Chairman Weisenmiller, Commissioner Douglas, and Commissioner Peterman:

Thank you for the opportunity to provide comments on the Energy Commission Staff's report entitled "Renewable Power in California: Status and Issues". We appreciate the extensive work that went into the report and the staff's efforts to fully characterize the current state of renewable development and the issues associated with achieving the legislative and executive goals to further our reliance on renewables to reduce greenhouse gas emissions, improve energy security, and stimulate the economy. We also recognize the significant challenge facing Commissioner Peterman in crafting a plan to accomplish these goals.

Overall Comments

After reviewing the report, we suggest there are two areas that warrant further discussion. The first involves the California Public Utility Commission's (CPUC) procurement process. While the report goes into depth on the renewable goals and current generation status, discusses infrastructure and planning, touches on permitting, and includes an extensive presentation on research; it has only a minimal mention of the procurement process and the critical role it has played and will play in the future. Procurement is one of the funnels all renewable projects must pass through and is key in defining what criteria the utilities will use in their evaluation and selection of future projects. This was emphasized at the Committee's September 14, 2011 workshop during discussions over how the competing concepts of "least cost" and "best fit" are viewed by the different stakeholders. Torresol Energy firmly believes that dispatchability, storage, and similar values need to be reflected in the CPUC's procurement process and the utilities' project selection process. The "best fit" criteria should also be made transparent to all the competitors.

The procurement process is also important because it establishes the timeline for implementing many of the policies proposed at the Energy Commission and elsewhere. The length of time between when a procurement proceeding is initiated and final project contracted are approved can take four or more years. This long lead-time can result in a significant delay between adoption of a new energy policy and the development of projects with utility contracts. For example, the CEC Staff's report emphasizes the important role energy storage will play in the reliability of the electricity system and its ability to integrate increasing amounts of renewables. Without the appropriate signals in the CPUC's 2010

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procurement process, however, serious efforts to develop renewable projects with integrated storage capability could be delayed by years.

The relationship between energy and transmission system planning, procurement, interconnection, and permitting should also be explored in the report so the subsequent action plan can determine if improvements are needed to better integrate and accelerate the overall process to more rapidly deploy renewable projects with the most desired attributes.

The second area that warrants further discussion is the use of molten salt as a commercial, utility scale energy storage medium. Torresol Energy and its parent SENER Engineering have been pioneers in the development of molten salt both as a heat transfer fluid in solar trough and tower technologies and for use as energy storage. The result has been the development and operation of fully dispatchable solar power plants. Potentially because this development has taken place in Europe, it is largely ignored throughout the Staff's report. In our specific comments below, we provide information that can be used to present a more accurate and complete discussion of this technology.

Detailed Comments

Page 118 – The report does not discuss the ramp rates for molten salt storage combined with solar thermal trough or tower technologies. Ramp rates for Torresol Energy's facilities are two to three minutes. We are willing to provide the CEC staff with information on other attributes of our solar power plants using integrated molten salt storage technology.

Page 118 – The report discusses the installed forms of energy storage but leaves out molten salt in combination with solar trough or tower. To date Torresol Energy/SENER has four solar trough/molten salt power plants with a total of 200 MW of generating capacity in operation; 50 MW of this total has been in operation since 2008. Torresol Energy also has one solar tower/molten salt power plant with 20 MW of generating capacity in operation. It should be noted that the total amount of generating capacity in operation of solar molten salt power plants is 470 MW in Spain to date with another 150 MW coming online in the next few months.

Page 119 – For a full comparison, molten salt should be added to Table 16 as a bulk energy storage technology. Based on Torresol Energy's experience, the values in each of the columns should be as follows:

	Molten Salt with SENERTrough	**Molten Salt with SENERTower**
Maturity	Commercial	Commercial
Energy (MWh)	1,000 to 6,000	6,000
Power (MW	50 to 300	20 to 200
Duration (hrs)	3 to 8	3 to 18
% Efficiency	95	99
Total Cost ($/kW)	Varies with amount of storage	Varies with the amount of storage
Cost of storage ($/kWh)	60 to 100	40 to 60

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Page 126 – The last sentence of the first full paragraph on this page points out one of the key barriers associated with the deployment of storage – being compensated for storing energy. The current procurement rules do not value energy storage as an integral component of a renewable project and hence make it less competitive than projects without storage.

Page 224 – Molten salt thermal storage should be included in the list of well-established technologies.

Page 229 – The one paragraph description of thermal storage does not present a full and accurate description of the molten salt storage technology, its current applications, and ancillary services benefits.

The application of molten salt as a heat transfer fluid and storage medium in conjunction with solar power was developed in parallel in the United States and Europe. The first application in California was at the 10 megawatt Solar Two facility located in Daggett, California in 1995. SENER has used molten salt storage directly and indirectly in solar trough facilities in Spain since 2008.

The Gemasolar Thermosolar Plant is the first fully dispatchable solar power plant operating in the world. Developed by Torresol Energy, this 20 MW power plant began operating in April 2011 and uses molten salt both as the heat transfer fluid and storage medium. Through the use of an integrated solar collection and thermal storage technology, Gemasolar has been able to generate continuous power for 24 hours a day. Its molten salt storage tanks allow it to generate electricity for up to 15 hours without sunlight. It is expected to produce 110 GWh of electricity a year.

When developed using dry cooling, both of these renewable technologies have minimal water requirements. In addition the solar tower technology can be built with minimal on-site grading and vegetation removal. An integrated solar trough and thermal storage power plant requires 5 to 8 acres of land per megawatt and an integrated solar tower and thermal storage plant requires 7 to 10 acres per megawatt.

Both technologies have been demonstrated to provide a full range of ancillary services including ability to:

- Provide flexible and controllable ancillary services at the transmission level
- Neutralize the impact of intermittent and volatile renewable generators
- Provide voltage support that will reduce flicker and meet voltage standards
- Automatically inject energy to provide frequency response
- Provide grid stability by supplying immediate energy to stop grid oscillations and improve grid damping
- Provide inertia

Contrary to the statement on page 229, thermal energy storage using molten salt is capable of delivering ancillary services comparable to other storage technologies. When integrated with

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a solar collection system such as Gemasolar, they are able to provide these ancillary services without producing greenhouse gas emissions.

Both integrated generation and storage technologies can also be used in combined heat and power applications. Since molten salt is both the heat transfer fluid and thermal storage medium, it can be used to generate electricity through a steam turbine or process steam to an industrial application.

Page 232 – The report briefly identifies further research needed in conjunction with thermal storage. The first item listed was additional research on financial models and tariffs. As a couple of the speakers noted at the CPUC's Thought Leader's forum held on September 20, 2011 to discuss energy storage, California should stop studying storage and begin applying it. They recommended, for example, establishing pilot tariffs such as were used to implement California's demand response.

Thank you again for your efforts to characterize the status and issues associated with renewable development and particularly for identifying the critical role energy storage can play in our energy system.

Sincerely,

Felicia L. Bellows
Senior Vice President of Development
Torresol Energy