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<b>DOCKET</b>	
<b>09-IEP-1E</b>	
DATE	APR 22 2009
RECD.	APR 23 2009

## Transmittal

**To:** California Energy Commission  
 Docket Office, MS-4  
 Re: Docket No. #09-IEP-1E  
 1516 Ninth St.  
 Sacramento, CA 95814-5512

**Date:** April 22, 2009

**Project No.:** IEPR Staff Workshop

**Project:**

We have enclosed 1 copy of:

- B/W Prints       Reproducible       Letter  
 Specifications       Memorandum      X **Other** Workshop Comments

Description

I attended the CEC staff workshop on Present and Future Central Station Renewable Plant costs held in the CEC Hearing room on April 16, 2009. I had offered a few comments to the presenters during the workshop. The attached submittal formalizes my comments at the workshop.

Sent Via:

- Messenger       1st Class Mail       FedEx       Other CA/ON

Copy to:

Very truly yours,

  
 Shan Bhattacharya PE  
 Principal Consultant

## **Bhattacharya, Shankar (San Francisco,CA-US)**

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**From:** Bhattacharya, Shankar (San Francisco,CA-US)  
**Sent:** Wednesday, April 22, 2009 11:15 AM  
**To:** 'docket@energy.state.ca.us'  
**Cc:** 'jhingtge@energy.state.ca.us'; 'kevin.sullivan@kema.com'; 'ltenhope@energy.state.ca.us'  
**Subject:** Present and Future Central Station Renewable Plant Costs: Comments of Staff Workshop  
**Attachments:** CEC\_IEPR\_Comments.doc

CEC,  
My comments on the subject staff workshop is attached. I submit these comments in the spirit of continuous improvement. A paper copy is being sent to the Dockets office.  
Thank you for allowing me to participate.  
Regards,

Shan Bhattacharya PE  
Principal Consultant



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## **Renewable Energy Cost Generation study**

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### **Comments from:**

*Shan Bhattacharya PE, (sbhattacharya@trcsolutions.com)*

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### **Introduction:**

I attended the CEC staff workshop on Present and Future Central Station Renewable Plant costs held in the CEC Hearing room on April 16, 2009. The staff as well as CEC's consultant, KEMA should be commended for their work. In the spirit of continuous improvement, I had offered a few comments to the presenters during the workshop. The following sections formalize my comments at the workshop.

### **Preamble:**

To harness renewable energy, the **Californians will spend between \$10 and \$15 billion** over a period of next five to seven years. These investments will be directed towards Transmission, Wind and Solar development.

Wind and, to a lesser extent, solar has **dispatchability issue**. Availability of these renewable resources is not always coincidental with the demand. If this issue is not addressed soon, Californians will end up with

- a. Stranded MW (in wind and transmission investments)
- b. Highly inefficient simple cycle, low capacity factor gas turbines to bridge the dispatchability issue,
- c. Increased reliance on Natural Gas from Canada and other overseas countries (LNG), and
- d. Much higher cost of generation, which will ultimately affect the competitiveness of California's industries?

**The dispatchability issue has to be addressed holistically from all angles: from reducing and shifting the peak demand to selecting a cost effective generation portfolio that balances between Greenhouse Gas (GHG) Emission and optimal resource utilization.**

Over the last decade, the CEC's primary focus has been in the area of Energy Efficiency and Demand Side Management;

- Energy Efficiency keeps the overall load growth in check. We are very proud of CEC's achievement. Under the championship of Commissioner, Art Rosenfeld, the per capita electric consumption in California has been kept relatively flat for over two decades.
- DSM program for load shifting has had mixed results:

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- i. Voluntary curtailment (Good Job so far) in exchange for lower rates
- ii. Dynamic Pricing - Smart Meter and Price signal to change customer behavior has worked well in certain European countries. Jury is still out in my mind, if it will work in Calif. Unlike in Europe, the electric bill represents a small component of the disposable income of Californians. In the next few years, the California utilities will invest over \$3 billion in smart meters. If the dynamic pricing does not work, what is our back-up plan?
- iii. AC management- highly intrusive and has been successfully tried out in targeted area in the Southern California. Calif. utilities are directed by the CPUC to promote this scheme at the residential level.
- iv. Plug-in Hybrid (though it is not a DSM item, it improves utilization of electric infrastructures during non-peak hours and help reduce GHG in the transportation sector.

Energy Efficiency and the DSM programs will continue to keep the peak demand growth in check. However, with the overall growth of population and the shift of population growth from the coastal region to the temperate central valley, the peak demand will continue to grow between 1.5% and 2% per year.

2. **What more should we be doing to improve dispatchability of the renewable power mix?**
  - a. Upgrade existing Hydro facilities.
  - b. Explore utility level storage
    - i. Hydro Pump Storage: Must develop LEAPS project. Also, investigate if some of the existing hydro projects can be converted to provide pump storage capability and promote construction of more pump storage facilities.
    - ii. Compressed Air Energy Storage (CAES): There are several sites in Calif. where CAES plants can be built. Regulatory foresight and support is needed to promote development of these projects.
    - iii. Large scale batteries ( its size and cost limit application)
  - c. Explore opportunities for accelerated biomass development

### **Comments on Renewable Plant Costs**

**C-1** Dispatchability: Not all Mega Watts are created equal. Fair comparison of plant costs requires close examination of their dispatchability. For example, a natural gas driven power plant with 95% availability factor (also known as, Equivalent Operating Availability or EOA) has operational advantage over a wind generation facility with substantially lower EOA. With increase emphasis on wind generation, dispatchability and system integration will become a critical cost driver in future. As non-dispatchable renewable power encroach more into the currently used 15% resource margin, we are increasing the risk of potential summer brown-outs. CEC must address the cost impact of this issue sooner than later.

**C-2:** Upgrade Hydro Facilities: California Hydro systems are old and CPUC has not incentivized the utilities to upgrade the hydro facilities. As a result, most of the plants operate at sub-optimal

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level. In the opinion of this author, 10% capacity upgrade is achievable at low cost. This implies that the investor owned utilities can provide additional capacity of 400MW to 500MW from their existing units and the public agencies can extract another 500MW to 1,000MW.

**C-3:** There are several existing hydro sites in California that are ripe for conversion into pumped storage facilities. These conversions will go a long way in resolving the dispatchability issues associated with wind and solar generation. CEC in partnership with CPUC should take the lead in promoting this development. Cost of these facilities should be incorporated, among others, to address the integration cost of non-dispatchable wind and solar plants.

**C-4:** CEC should explore other types of Energy storage in California such as Compressed Air Storage (CAS). There are at least three or four possible sites in the Sacramento and San Joaquin Valley where underground compressed air storage is feasible. In the 1970s and 1980s, EPRI had performed studies that confirmed the feasibility of CAS in central California. However, cost did not justify their development at that time. Although not a CAS facility, PG&E's Mac Donald island gas storage facilities confirms the feasibility of CAS facilities in the central and north valley. In the next IEPR, CEC should open a debate on developing CAS facilities in California and the associated cost and benefit.

**C-5:** Geothermal Energy: Geothermal energy is a key component of the renewable resources. The production cost computation should include the waste disposal cost. The Geyser power plant cost data should provide guidance on these costs

**C-6:** Overall system cost of future generation: The previous IEPRs dealt with cost of various sources of power. However, these costs were developed in isolation. The cost of integration was recognized, but not addressed in quantitative terms. The 2007 IEPR provided a comprehensive but qualitative discussion on what the state will have to do to meet its RPS and GHG emission standards/goals. But it also failed to provide any indication on the impact of these public policies on the cost of power and on the overall California economy.

I recommend that the 2009 IEPR should shed light on the composite cost of generation as the RPS and the GHG standards/goals are being implemented over time. The development of these costs is very complex and could be politically explosive. However, side-stepping this critical topic at this juncture will make the report inadequate. My recommendation is that CEC should offer a range of system wide weighted average cost of generation as the state implements the RPS standards (say, 20%, 25% and 33% penetration of the renewables). These costs can be compared with the cost of generation from a combined cycle plant to establish, what I would call, the renewable premium.

Developing these costs is very complex. One of the simpler ways of performing this task is through scenario planning and macroeconomic generation modeling that will address, among others, the following;

- Impact of various portfolio mix of renewable generation
- Impact of major transmission infrastructure cost, and
- Cost of dispatchability (storage, peaking units etc.)