

Re: docket number 12-EPIC-01

February 11, 2014

Dear Mr Sethi,

Thank you for informing us of the February 7<sup>th</sup> workshop. I was able to call into the second panel discussion and found it to be quite interesting and informative.

I've attached a filled out questionnaire as well as a document with answers to some of the questions asked at the workshop.

I would welcome the opportunity to talk to you a bit more about StratoSolar and how we can help California meet its renewable energy production targets.

StratoSolar designs and develops photovoltaic systems on large buoyant platforms suspended at 65,000 feet using existing proven technology.

Because sunlight is available 100% of the time during daylight hours and there is no rain, hail, snow or moisture in the stratosphere, PV panels are 2 to 4 times as efficient there than on the ground.

Electricity produced on these platforms is transported via high-voltage cables/tethers and is cost competitive with coal without subsidies.

Please let me know if you would like to know more about our project.

Best regards,

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**EPIC TRIENNIAL INVESTMENT PLAN 2015-17**  
**Proposed Energy Research Initiative**  
**Questionnaire**  
**docket number 12-EPIC-01**

**Title of Proposed Initiative:**

StratoSolar –  
A technology demonstration and deployment of photovoltaic systems on large buoyant platforms producing electricity that is cost competitive with coal without subsidies.

**Investment Areas:**

- Technology Demonstration and Deployment

**Electricity System Value Chain**

- Generation

**Issues and Barriers:**

*Describe the issues and barriers that are impeding full market adoption of the proposed clean energy technology or strategy (such as cost, integration, or lack of information).*

StratoSolar needs technical and market validation in order to get market adoption. Because this is dependant on a successful technology demonstration, our main barrier to validation is receiving sufficient funding to build a working prototype.

**Initiative Description and Purpose:**

*How will this technology or strategy help address the issue/issues? Describe knowledge to be advanced to overcome critical barriers. Include the recommended funding level (minimum and maximum) for each project under this initiative.*

The minimum funding level for this project is \$2,000,000. The maximum funding level is \$15,000,000.

The minimum funding level would enable StratoSolar to build a working prototype that would be a technology demonstration of the entire systems and its component parts. This would effectively be a proof of concept that would validate the technical feasibility of the power system.

The maximum funding level would enable StratoSolar to build a prototype and then to also build a fully operational 5MWp pilot system. The pilot system would enable technology deployment and market validation.

**Stakeholders:**

*Identify the stakeholders who support the initiative.*

**Background and the State-of-the-Art:**

*What research development and demonstration has been done or is currently being done*

*to advance this technology or strategy (cite past research as applicable)?*

- Accurate Simulations of sunshine available at 20km from atmospheric models developed to model climate
- Simulations and lab measurements of PV silicon cell efficiency at -55C
- Simulations of worst case wind loads on tethers and platform
- Modelling of earth electricity and lightning

*Describe any public and/or private successes and failures the technology or strategy has*

*encountered in its path through the energy innovation pipeline: lab-scale testing, pilot-scale*

*testing, pre-commercial demonstration, commercial scale deployment, market research, workforce development.*

- Fabricating and testing lightweight PV panel designs for 20km altitude.
- Schematic design/assembly of the prototype instrumentation system.
- Testing gasbag materials and fabrication.
- Preliminary design of rigid structure.

*Identify other related programs and initiatives that deal with the proposed technology or*

*strategy, such as state and federal programs or funding initiatives (DOE, ARPA-E, etc.).*

There are none that we are aware of.

**Justification:**

*Describe how this technology or strategy will provide California IOU electric ratepayer benefits and provide any estimates of quantified annual savings/benefits in California, including:*

The main benefits to California electric ratepayers will be having a large portion of their electricity come from renewable sources (i.e. environmental benefits) and drastically reducing the cost of renewable energy (by 2/3rds vs. current alternatives).

StratoSolar reduces the cost of electricity from PV to below that from natural gas in several ways. 1) by reducing the cost of PV generation by a factor of three, 2) by

including built in energy storage which reduces the cost of backup for interruption by clouds etc., 3) by energy storage eliminating the need for a matching fossil fuel plant to cover nighttime electricity and 4) by providing electricity within a reasonable distance of urban areas, eliminating the need for transmission and a smart grid.

☒ *Name of sector and estimated size and energy use.*

Solar energy PV electricity generation and storage. Currently electricity generation capacity is about 100GW in California

☒ *Quantifiable performance improvements for the proposed technology/strategy.*

Photovoltaic panels on StratoSolar systems will be 2 to 4 times as efficient as those on the ground.

☒ *Maximum market potential, if successful.*

A majority of California electricity could be provided by StratoSolar, or similar, systems.

☒ *Number of direct jobs created in California.*

Up to 80,000 in ten years.

☒ *Why this research is appropriate for public funding.*

This research is worth funding because, if successfully deployed, it would help California successfully reach its 2020 renewable energy production goals.

### **Ratepayer Benefits:**

- Promote greater reliability relative to other clean energy production
- Potential energy and cost savings
- Societal benefits
- Environmental benefits – Aside from reducing CO2 emissions, StratoSolar systems use a lot less land, and disturb a lot less land, than current renewable energy solutions.
- GHG emissions mitigation/adaptation in the electricity sector at the lowest possible cost
- Economic development

*Describe specific benefits (qualitative and quantitative) of the proposed initiative*

- Generate electricity from a clean reusable source
- Cost competitive without subsidies.
- Geographically flexible
- Fast deployment (2 years)
- Modular design that can grow organically and scale rapidly to utility scale.

**Public Utilities Code Sections 740.1 and 8360:**

*Please describe how this technology or strategy addresses the principles articulated in California Public Utilities Code Sections 740.1 and 8360.*

Once deployed, the StratoSolar project has a high probability of providing economic and environmental benefits to ratepayers. Expenditures on this project are minimal compared to other sources of renewable energy. Even at the maximum funding level, a StratoSolar pilot system would cost 80-90% less than comparable wind or ground PV projects.

The StratoSolar project is unique and does not duplicate research currently, previously, or imminently undertaken by other corporations or research organizations.

The StratoSolar project supports environmental improvement and development of new renewable resources and processes.

A successful implementation of the StratoSolar project would help generate and integrate cost-effective renewable resources.

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**Electric Program Investment Charge Program Workshop  
February 7, 2014**

**Panel 2 Questions:**

*1. What key services, such as testing centers and independent validation, are needed to help clean energy entrepreneurs successfully commercialize good innovations?*

- Education about state government resources
- Government liaison to navigate regulatory environment

*At what technology development stage(s) are these key services needed?*

- The Technology demonstration and deployment stage. Specifically, resources and services to assist in proof of concept (e.g. prototypes post concept but pre-pilot)

*How should the Energy Commission prioritize the top few technological areas or companies that should receive services?*

Priority should be given to new innovative experimental projects with significant potential for fundamental positive change that can be demonstrated in the short term and that will get California closest to its long-term clean energy goals.

*2. What activities, tools, or information are needed by the financial community to help facilitate investments in early-stage clean energy companies?*

The financial community wants to see technology and market validation of clean energy concepts.

*What role can the Energy Commission play in facilitating this through the market facilitation program area of the EPIC program?*

The energy commission can help facilitate power purchase agreements for market validation and connect companies with funding sources for the funds necessary for technology validation.

*3. Is this a current funding gap not adequately covered by the private sector?*

There is a funding gap at the technology demonstration and deployment stage. Early pure research is funded by education institutions or can be self-funded by entrepreneurs. Venture Capitalists are looking to fund clean energy companies with products already in the market generating revenue or about to be introduced to the market. The difficult gap to cross do to lack of funding -- between research and having completed products in the market -- is the technology demonstration and deployment stage (prototypes and pilots).

*4. What funding levels would be needed to pilot these potential business models or strategies?*

The equivalent of early stage financing by venture capitalists (\$1m-\$15m) would be sufficient for funding prototypes and pilot systems in the technology demonstration and deployment stage and maximize the chance that innovative clean energy projects get to market.

*5. To what extent do existing clean energy business incubators, business plan competitions, and innovation clusters support companies in scaling up to commercial production?*

- Business plan competitions provide insufficient funding and exposure.
- Clean energy business incubators are good for helping formulate plans but not for helping scale to commercial production.
- Innovation clusters are good for supporting existing revenue generating companies that are already in commercial production.

*What critical need would be addressed if EPIC funds were available to help startup companies gain access to these services? How can the Energy Commission through EPIC address critical needs related to facilitating partnerships to bring innovative clean energy technologies to market?*

The federal government provides very large funding for deployment of alternative energy

through the tax system and loan guarantees, and some small direct funding for pure early stage research in universities and national labs.

Venture capital is supposed to bridge the gap between these two, but is failing miserably. Energy has never been a strength of the VC community. After 2008/2009, early stage financing of clean energy companies has evaporated. Venture capitalists are now only investing in later stage companies with products almost or already in the market.

The Energy Commission could help address the difficulty in bringing innovative clean energy solutions to the market by:

- facilitating relationships with utilities and helping companies obtain PPA's,
- helping deal with state and federal government regulatory agencies, and
- directly funding companies technology demonstration and deployment projects.