STATE OF CALIFORNIA

Energy Resources
Conservation and Development Commission

In the Matter of: Petition For Amendment for the **PALEN SOLAR ELECTRIC GENERATING SYSTEM**	**DOCKET NO. 09-AFC-07C** **DECLARATION OF CHARLES TURLINSKI**

I, Charles Turlinski, declare as follows:

1. I am presently employed by BrightSource Energy, Inc. as Director of Project Development.

2. A copy of my professional qualifications and experience was included with my Opening Testimony and is incorporated by reference in this Declaration.

3. I prepared the attached supplemental testimony relating to Overriding Considerations for the Petition for Amendment for the Palen Solar Electric Generating System (California Energy Commission Docket Number 09-AFC-07C).

4. It is my professional opinion that the attached prepared testimony is valid and accurate with respect to issues that it addresses.

5. I am personally familiar with the facts and conclusions related in the attached prepared testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct to the best of my knowledge and that this declaration was executed on Feb 10 2014.

Charles Turlinski

STATE OF CALIFORNIA

Energy Resources
Conservation and Development Commission

In the Matter of: Petition For Amendment for the **PALEN SOLAR ELECTRIC GENERATING SYSTEM**	**DOCKET NO. 09-AFC-07C** **DECLARATION OF MATTHEW STUCKY**

I, Matthew Stucky, declare as follows:

1. I am presently employed by Abengoa Solar LLC as Manager of Business Development.

2. A copy of my professional qualifications and experience was included with my Opening Testimony and is incorporated by reference in this Declaration.

3. I prepared the attached supplemental testimony relating to Overriding Considerations for the Petition for Amendment for the Palen Solar Electric Generating System (California Energy Commission Docket Number 09-AFC-07C).

4. It is my professional opinion that the attached prepared testimony is valid and accurate with respect to issues that it addresses.

5. I am personally familiar with the facts and conclusions related in the attached prepared testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct to the best of my knowledge and that this declaration was executed on 2/10 2014.

Matthew Stucky

Matthew Stucky

STATE OF CALIFORNIA

Energy Resources
Conservation and Development Commission

In the Matter of: Petition For Amendment for the **PALEN SOLAR ELECTRIC GENERATING SYSTEM**	**DOCKET NO. 09-AFC-07C** **DECLARATION OF BRUCE KELLY**

I, Bruce Kelly, declare as follows:

1. I am presently employed by Abengoa Solar LLC as a Senior Engineering Advisor.

2. A copy of my professional qualifications and experience was included with my Supplemental Testimony and is incorporated by reference in this Declaration.

3. I prepared the attached supplemental testimony relating to Overriding Considerations for the Petition for Amendment for the Palen Solar Electric Generating System (California Energy Commission Docket Number 09-AFC-07C).

4. It is my professional opinion that the attached prepared testimony is valid and accurate with respect to issues that it addresses.

5. I am personally familiar with the facts and conclusions related in the attached prepared testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct to the best of my knowledge and that this declaration was executed on February 7, 2014.

Bruce Kelly

Bruce Kelly

STATE OF CALIFORNIA

Energy Resources
Conservation and Development Commission

In the Matter of: Petition For Amendment for the **PALEN SOLAR ELECTRIC GENERATING SYSTEM**	**DOCKET NO. 09-AFC-07C** **DECLARATION OF DAVID SCHLOSBERG**

I, David Schlosberg, declare as follows:

1. I am presently employed by BrightSource Energy as Senior Manager of Regulatory and Market Affairs.

2. A copy of my professional qualifications and experience was included with my Supplemental Testimony and is incorporated by reference in this Declaration.

3. I prepared the attached supplemental testimony relating to Overriding Considerations for the Petition for Amendment for the Palen Solar Electric Generating System (California Energy Commission Docket Number 09-AFC-07C).

4. It is my professional opinion that the attached prepared testimony is valid and accurate with respect to issues that it addresses.

5. I am personally familiar with the facts and conclusions related in the attached prepared testimony and if called as a witness could testify competently thereto.

I declare under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct to the best of my knowledge and that this declaration was executed on February 10, 2014.

David Schlosberg

PALEN SOLAR ELECTRIC GENERATING SYSTEM
OVERRIDING CONSIDERATIONS
SUPPLEMENTAL TESTIMONY

I. <u>Names</u>:

Charles Turlinski
Matthew Stucky
Bruce Kelly
David Schlosberg

II. <u>Purpose</u>:

Our supplemental testimony addresses the subject of Overriding Considerations associated with the construction and operation of the Palen Solar Electric Generating System (PSEGS) (09-AFC-7C).

III. <u>Qualifications</u>:

<u>Charles Turlinski:</u> I am currently employed by BrightSource Energy Inc. and I am a developer of utility scale renewable energy projects with 10 years experience. I have managed the development and interconnection processes for wind and solar projects throughout the country, including the negotiation and execution of Large Generator Interconnection Agreements (LGIAs) for over 1000 megawatts of capacity in the CAISO. I have a MBA from the Massachusetts Institute of Technology (MIT). I reviewed the Presiding Member's Proposed Decision (PMPD).

<u>Matthew Stucky:</u> I am presently Manager of Business Development at Abengoa Solar LLC and have been for the past four (4) years. I have degrees in Civil Engineering and Environmental Studies and a graduate degree in Environmental Engineering. My experience includes managing permitting and compliance activities for the California Energy Commission-licensed Mojave Solar Project. I reviewed the PMPD.

<u>Bruce Kelly:</u> I am currently a Senior Engineering Advisor at Abengoa Solar LLC, holding the position since 2008. I have a Bachelor of Mechanical Engineering, and a Master of Mechanical Engineering, from UC Berkeley. My experience includes the design, startup, and operation support of the 10 MWe Solar Two central receiver project in Barstow, and engineering support of the thermal storage system at the 250 MWe Solana parabolic trough solar project near Phoenix.

<u>David Schlosberg:</u> I am currently employed by BrightSource Energy, Inc., and have been so for the past two and a half years. I am responsible for BrightSource's regulatory and governmental affairs in California and the U.S. Southwest. I serve as a board member to the Large-scale Solar Association and Concentrating Solar Power Alliance. I have an MBA from the University of California, Berkeley. I reviewed the PMPD.

Detailed descriptions of our qualifications are presented in the resumes which were included in Attachment A to our Opening Testimony package or are attached.

To the best of our knowledge all referenced documents and all of the facts contained in this testimony are true and correct. To the extent this testimony contains opinions, such opinions are our own. We make these statements and provide these opinions freely and under oath for the purpose of constituting sworn testimony in this proceeding.

IV. Opinion and Conclusions:

We have reviewed the PMPD and in accordance with the direction provided at the PMPD Conference Hearing on January 7, 2014, we hereby provide supplemental testimony describing the ability of the PSEGS to incorporate Thermal Energy Storage (TES) and operational flexibility in the future and to further elaborate on the benefits of the PSEGS that would support the Commission's making findings of override.

OVERRIDING CONSIDERATIONS

Future Thermal Energy Storage at PSEGS Site

At the evidentiary hearing on October 29, 2013 Commissioner Hochschild asked a series of questions regarding the technical and financial feasibility of incorporating TES at the PSEGS site. As stated at the evidentiary hearing, it is technically feasible to incorporate TES at the PSEGS site, although financial and policy barriers prevent the actual construction of TES equipment at this time. Section 1 below demonstrates that the current configuration of the PSEGS can accommodate the incorporation of TES at each power block once the barriers are removed. For the purpose of discussion herein, PSH is providing technical detail on a 2 hour TES system; however, different storage capacities could be considered, depending on future market conditions. Section 2 below describes the barriers to incorporating TES at this time, as well as opportunities for use of TES in the future.

1. Description of TES Upgrade at PSEGS

The preliminary design for the PSEGS could accommodate the addition of a future TES system at each power block without modifying the solar field. A preliminary layout showing how a future equipment upgrade in the power block area that could provide for a 2 hour TES system is being prepared and will be docketed under separate cover.

The energy storage upgrade would allow PSEGS to sustain output capacity through reduced solar conditions, curtail immediate electricity production in favor of delayed generation, and ensure maximum output capacity during hours of high demand. The TES system capacity would be equivalent to two hours of full Maximum Continuous Rating ("MCR") power production.

The TES system that would be most suitable for use with the PSEGS given current technology would use molten salt, a mixture of sodium and potassium nitrates, as the heat transfer and energy storage medium. The system would also include the following elements:

- Cold nitrate salt storage tank
- Hot nitrate salt storage tank
- Vertical salt pumps fixed above the roofs of the tanks
- Four (4) vertically oriented heat exchangers located between the hot and cold tanks

Charge Mode

The storage system would be charged during hours, or intervals, that the level of the thermal energy exceeds the levels necessary to result in the desired electricity production of the facility as determined by the plant operator, utility off-taker and/or independent system operator. The charge would utilize part of the live steam generated by the Solar Receiver Steam Generator ("SRSG"). This part of the live steam would be directed to the heat exchangers, transferring heat to the molten salt flowing in the opposite direction.

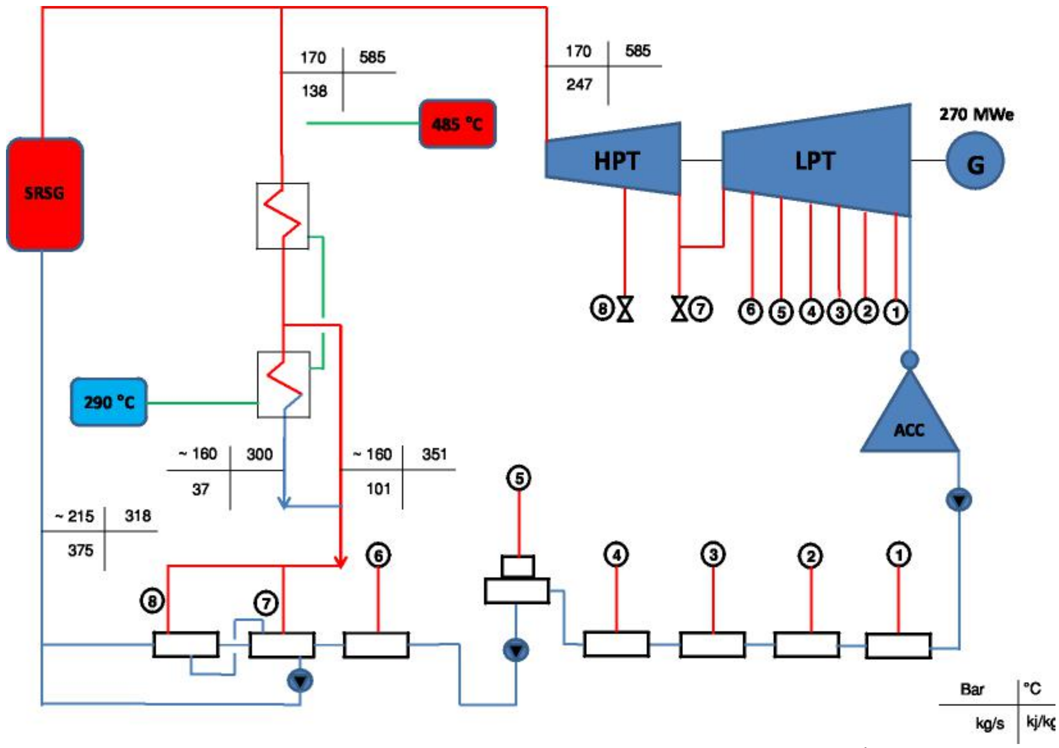

Figure 1: Cycle Configuration During TES Charging at 100%[1]

Discharge Mode

The TES system discharge could operate in two modes:

- TES Stand-alone
- TES Boost to SRSG Production

Discharging in TES Stand-alone mode

The TES could be discharged in TES Stand-alone mode when solar energy is not available. The TES could be discharged at capacities up to MCR, generating both intermediate pressure (IP) and high pressure (HP) superheated steam. The steam from the storage would be superheated by a gas fired Independent Superheater ("ISH") auxiliary boiler to increase the system's efficiency.

The discharge of TES in Stand-alone mode is shown in Figure 2 below.

[1] 270 MWe gross generator rating, exclusive of plant internal auxiliary loads

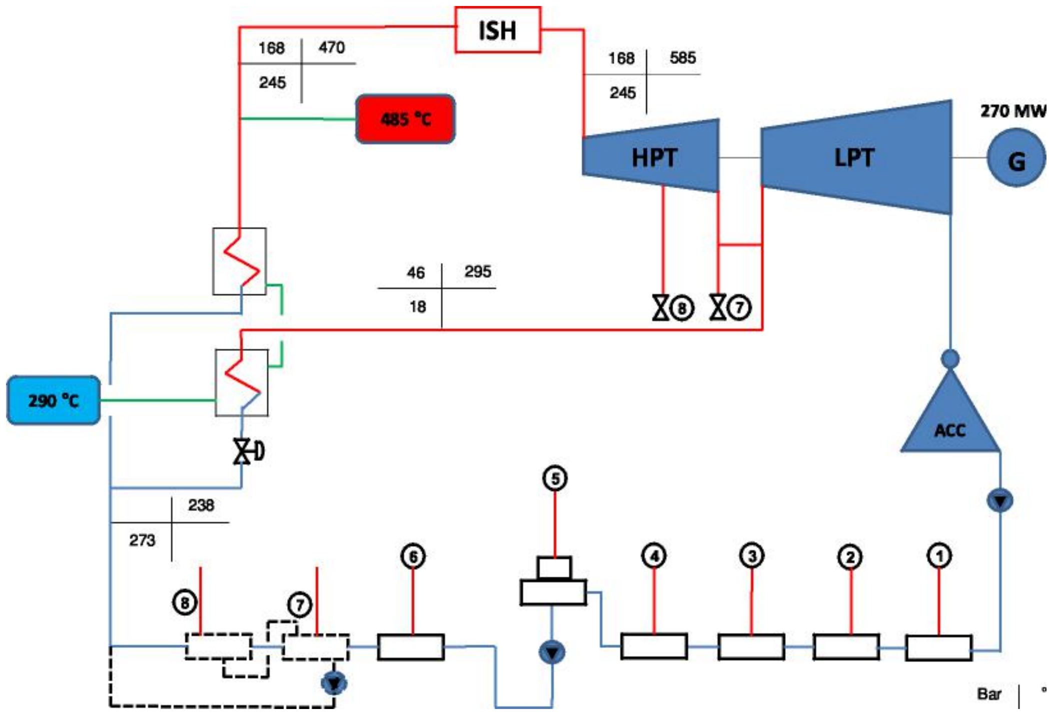

Figure 2: Cycle Configuration During TES Stand-alone Mode

TES Boost to SRSG Production

The TES could boost the SRSG operation during hours of lower solar insolation by means of parallel generation of steam. The steam generated by TES and the SRSG would then be mixed before entering the steam turbine.

Both the SRSG and the TES would be fed by the boiler feed pump ("BFP"). As the radiation decreases, the feedwater flow would be increasingly directed to the storage system at the expense of the SRSG. Meanwhile, the flow of salt through the TES heat exchanger would increase with the flow of the feedwater entering the heat exchanger. As the SRSG contributes less to the overall production, the resulting mixed flow would be reduced in temperature. Therefore, the steam would be superheated by the gas-fired ISH boiler in order to avoid conversion efficiency losses.

TES Tanks – Design Basis and Sizing

The Cold/Hot tanks would be designed under API 650 with the changes required to compensate for the high temperature. The tanks would have an insulated vertical cylindrical design with domed roofs. The required volume of each tank to sustain operation for 2 hours storage period would be approximately 2.5 million gallons per tank.

Table 1: Tank Dimensions

Parameter	Values	Units
Diameter	98 30	Ft M
Height at the perimeter (including insulation)	50 15.2	Ft M
Height at the center	63 19.3	Ft M
Total weight	16,000	ton/tank
Static load for design	24	ton/m2
Static load under annular ring	29	ton/m2

<u>TES Heat Exchangers – Design Basis and Sizing</u>

The thermal storage subsystem would use four (4) heat exchangers to transfer heat from receiver-generated steam to the molten salt, and to produce superheated steam while transferring heat from the hot salt to the feed water. The heat exchangers would be mounted on a rigid structural steel support.

Table 2: Heat Exchanger Block Dimensions

Parameter	Values	Units
Length	98 30	Ft M
Width	82 25	Ft M
Height (overall)	131 40	Ft M
Weight (including fluids and piping)	300	ton / unit

2. Barriers and Opportunities to Incorporating Storage Today

As described above, it is technically feasible to incorporate TES at the PSEGS project. The power blocks, as currently designed, could accommodate the incorporation of thermal storage. The solar fields – the heliostat arrays and solar receivers – already have the necessary solar collection infrastructure to accommodate TES in the future.

However, before TES could feasibly be incorporated into the PSEGS project, A) revisions to the Power Purchase Agreements (PPAs) would have to occur and be approved by regulators, and B) market and policy conditions would have to evolve.

A. Power Purchase Agreements

As discussed at the evidentiary hearing on October 29, 2013, PSEGS has two CPUC approved PPAs, one assigned to each unit. The PPAs specifically designate the technology to be utilized as the exclusive means of compliance with and execution of the terms of each PPA. The stated technology is the “LPT Power Tower” solar thermal technology, and the designation and description of the technology does not include thermal energy storage. Therefore, we believe there would need to be an amendment to the PPAs or new PPAs specifically incorporating storage, both of which would require agreement of commercial terms by both counterparties and California Public Utilities Commission (CPUC) approval. We believe approved PPAs that expressly cover TES would be required in order to support the financing of the TES upgrade equipment.

As described above, the PSEGS design can accommodate the installation of TES equipment in the future, if it eventually becomes feasible to do so.

As described in the Alternatives Supplemental Testimony, counterparty negotiation and CPUC approval of new or amended PPAs could not be accomplished in time to support the current PPA performance deadlines. While PSH has demonstrated that the TES upgrade equipment can technically be incorporated at the PSEGS site, such equipment would trigger the need for new air permits at the South Coast Air Quality Management District (SCQAMD) because it would include the addition of an auxiliary boiler and salt melting equipment. The addition of the TES upgrade equipment would also require another Petition to Amend the PSEGS and the ROW Grant from the Bureau of Land Management (BLM). Such amendments to the permits could not support PSH’s construction schedule at this time. Provided the other financial barriers were removed, however, PSH could seek such permits after PSEGS construction is complete. It is fundamental to the financing of the PSEGS that it demonstrate that it can be completed in time to qualify for the federal Investment Tax Credit in addition to its ability to become commercial as required by the current CPUC approved PPAs.

B. Market, Policy and Regulation Conditions

Future market, policy and regulatory conditions may evolve to increase the commercial value of CSP projects with thermal storage, including at a hypothetical PSEGS project with thermal storage. Some of these potential changes may include, but are not limited to:

i. GHG Goals by 2050 – In 2005, California's Gov. Schwarzenegger issued an Executive Order proposing that California reduce its greenhouse gas (GHG) emissions by 80% from 1990 levels by 2050. Future policies and legislation may be enacted to achieve these reductions, including those impacting the electricity generation sector, potentially resulting in greater demand for flexible, dispatchable and carbon-free generation resources.

ii. Shifting Peak Pricing – As an increasing share of electricity generated during daylight hours is provided by zero marginal cost, solar generators without storage, wholesale energy prices are likely to be depressed during these periods of the day. Before sunrise and after sundown, when customer loads are still significant, wholesale energy prices may be higher for generators which can deliver energy during those time periods.

iii. Resource Adequacy Evaluation Methodology – The assessment of Resource Adequacy (RA) value for wind and solar resources using an ELCC (effective load carrying capacity) methodology has been mandated by California Senate Bill 2 (1x). This requirement is in the process of being implemented by the CPUC. The impact of this methodology will likely be to attribute higher RA value to resources that deliver electricity more reliably, in more hours of the year.

iv. Flexible Resource Adequacy Capacity – The CPUC and CAISO are planning to introduce a Standard Flexible Capacity Product that load serving entities (LSEs) in the CAISO balancing area would be required to procure on an annual basis. This product would provide the CAISO with access to resources in order to ensure reliable grid operations under higher penetrations of renewable energy.

v. Integration Cost Adder – The CPUC may in the future require or allow investor-owned utilities to estimate the cost of grid integration services associated with an offer for renewable energy when evaluating the cost-effectiveness of the offer. Presently, the CPUC mandates that these costs be treated as zero in bid evaluations.

ADDITIONAL BENEFITS

Based on the statements in the PMPD and the discussion at the January 7, 2014 PMPD Conference Hearing, we provide the following supplemental testimony of the many benefits of the PSEGS.

1. Environmental Benefits of the PSEGS

The evidentiary record contains evidence of the many environmental benefits of the PSEGS. To assist the Committee in considering making overriding findings, we have compiled the following summary of these benefits. While we understand that the Committee should be weighing the benefits of the PSEGS while considering the potentially significant and unmitigatable impacts, we believe the Committee should also weigh the many environmental benefits and reduction in impacts that the PSEGS provides over the Approved Project as well.

- Air Quality – The PSEGS will provide clean renewable power with minimal burning of fossil fuel and will reduce grading from 4.5 million cubic yards for the Approved Project to 0.2 million yards, thereby significantly reducing associated fugitive dust and construction vehicle emissions.

- Climate Change – The PSEGS will produce clean renewable energy thereby reducing greenhouse gas emissions. The PSEGS is a very important part of an integrated Statewide approach to combat the effects of Climate Change. While the PSEGS would combust some natural gas and thus emit GHGs as part of its operations, it would produce far less GHG emissions (emitting approximately 132 lbs CO_2/MWh) than the coal- and natural gas-fired resources it would displace. As described in the Final Staff Assessment, Part C, Exhibit 2013, coal-fired generation requires the combustion of 9,000 – 10,000 Btu/MWh, resulting in more than 1,800 lbs CO_2/MWh. Natural gas-fired generation in California requires an average of 8,566 Btu/MWh, yielding approximately 1,000 lbs CO_2/MWh (CEC 2011b). Compared to a natural gas-fired plant generating a comparable amount of electricity, the PSEGS will result in a savings of 13.9 million metric tons of CO_2 equivalent over the life of the project.

- Worker Safety/Fire Protection, Hazardous Materials and Waste Management – The PSEGS eliminates the use of millions of gallons of flammable Therminol, thereby reducing the risk of fire across the large expanse of the solar fields, eliminating the need for treatment of soil contaminated with leaks of the Therminol.

- Biological Resources – The PSEGS eliminates onsite and offsite impacts to washes by eliminating grading and rerouting of washes within the vast majority of the site, while still mitigating as if all of the washes and associated habitat have been eliminated. The footprint of the entire facility has been reduced by 572 acres resulting in decreased impacts to desert tortoise habitat and other species. In addition, the PSEGS reduces the evaporation ponds from four, four-acres ponds to two, two acre ponds, thus reducing the surface area of a potential attractant for birds by 75 percent.

- Soil and Water Resources – The PSEGS has reduced water use from 300 acre feet per year (AFY) to 201 AFY and reduces water use during construction from 5,750 acre feet to 1,130 acre feet, resulting in a total of more than a 50 percent reduction in water use over the life of the project. In addition, the elimination of the large drainage channels eliminates the risk of failure and downstream impacts similar to those that occurred at the Genesis Solar Energy Project during construction.

- Cultural Resources and Paleontological Resources – The PSEGS reduces the total areal extent of grading and reduces the amount of soil disturbance by over 90 percent, thereby reducing the potential to disturb buried cultural and paleontological resources.

2. Solar Thermal Benefits of the PSEGS

The CSP technology to be used at PSEGS helps utilities and grid operators address integration challenges by delivering a more firm, reliable and controllable renewable power source compared to other variable generation resources. Because of the plant's synchronous steam turbine generator, the PSEGS provides important reliability benefits, such as reactive power support, dynamic voltage support, voltage control and some degree of inertia response. *(See technical explanation of these terms, below)*

The PSEGS technology compensates for solar resource variability through the ability to increase or decrease the number of mirrors focusing on the receiver. This capability adds stability to the generation profile by allowing facility operators to shape the profile as system needs change. The Project's operational attributes can also reduce the need for back-up fossil-fuel generation to meet grid reliability requirements. The systems also use a small amount of natural gas to achieve quicker morning startup and longer solar generation at the end of each day as well as to produce a less variable, more reliable power output compared to other solar technologies.

Grid Reliability Services

PSEGS will use synchronous generators that provide the same types of support for the reliable operation of the transmission system as do conventional synchronous generators. As a result, the PSEGS provides numerous important reliability services, such as reactive power and voltage support, primary and secondary frequency control and some degree of inertia response.

These attributes promote reliable operation of the transmission grid by controlling voltage and frequency within an acceptable band. The primary grid reliability benefits of the project are described in more detail below.

Reactive Power and Voltage Support

The power system requires reactive power from generators, synchronous condensers, capacitors or other voltage support devices to support power transfer and maintain operating voltage levels under both normal and emergency conditions. On the one hand, inadequate reactive power can result in power transfer reductions and voltage collapse and thus could lead to widespread blackouts. On the other hand, the over-supply of reactive power can increase voltage at points in the system to very high levels and create an unintentional electrical arc that can damage the grid and customer equipment and create unsafe operating conditions.

Power system voltages are affected by a variety of factors, including customer loads, the distance power is transmitted to the loads, and the amount of loading on the power lines. Because the power system conditions are variable and constantly changing, the amount of reactive power needed at various points in the transmission system to maintain adequate voltage is also variable and constantly changing. As such, the power system must include devices capable of constantly and automatically adjusting (injecting and withdrawing) the reactive power supply at specific points in the system. The PSEGS's synchronous generators are this type of device—they are capable of automatically adjusting the reactive power supply through the exciter/automatic voltage regulator control under normal (all facilities in-service) conditions and under contingency conditions.

During and after sudden changes in grid conditions (e.g., during a fault or following the outage of transmission facilities), fast and automatic injecting and withdrawing of reactive power is crucial to maintaining voltage stability and reliable system operations. In addition, if the system voltage begins to collapse, fast automatic increases in reactive power output are required to raise the voltage and prevent a collapse that could cause a blackout. The PSEGS's synchronous generators are capable of providing this grid reliability service and do so in a manner more effectively than other devices, such as Static VAR Compensators (SVC) or Static Synchronous Compensators (STATCOM). The reactive power provided by SVC and STATCOM decreases as the voltage drops, making them less effective as the voltage collapses, exactly when reactive power is needed. The Project's synchronous generators will help prevent excessive voltage drop by providing automatic and continuously the same amount of reactive power independent of system voltage levels; thus, better supporting the transmission system as voltage decreases and thus helping to prevent voltage collapse.

Frequency Control

To maintain system frequency in an acceptable band, the system needs to hold resources in reserve to provide frequency control. This is accomplished in two ways - primary frequency control and secondary frequency control. Primary frequency control is the ability to automatically and autonomously adjust output rapidly (within seconds) after the sudden outage of other generators. Secondary frequency control refers to the ability to respond within minutes to changes in system frequency through Automatic Generation Control (AGC) under normal operating conditions. Both primary and secondary frequency control are critical to maintaining overall grid stability and can be provided by synchronous generators. Moreover, since the output of PV is intermittent and PV does not intrinsically offer frequency control services, synchronous generators will serve to promote PV integration by providing the option of a clean source of frequency control needed to maintain grid reliability.

Inertia Response

Inertia on the grid is created by the energy stored in the rotating mass of conventional power plants. Inertia acts as a buffer that helps suppress frequency deviation due to various changes in the system. During and after the sudden loss of a transmission facility or a generator, inertia helps arrest the frequency decay (or overshoot) and allows time for generators in the system to stabilize the system. Since they provide rotating mass, inertia response is provided by the PSEGS's synchronous generators.

Solar Field Multiple and System Inertia

The PSEGS project, as well as other solar thermal projects, typically have collector field mirror areas which allow, during periods of high radiation and the hours near solar noon, more thermal energy collection than can be accommodated by the solar receiver and the steam turbine-generator, commonly referred to as the "solar field multiple". This combination allows the solar receiver and the steam turbine-generator to operate at maximum continuous duty during the mid-morning hours, the hours near noon, and the mid-afternoon hours. In effect, solar energy collection is reduced in the hours near noon to allow the steam turbine-generator to operate at maximum continuous duty during the shoulder periods of the day. The ability of the solar field to supply thermal power to the receiver in excess of the receiver rating also allows the steam turbine-generator to operate at high outputs during partially cloudy periods.

In addition, solar thermal tower technology, compared to non-thermal solar technologies, possesses an inherent system thermal inertia that results in less immediate and less volatile effects of reduced solar radiation on the electric output of the plant. At the beginning of such a weather event, a significant quantity of saturated water exists in the steam drum of the receiver. Further, the temperatures of the superheater section of the receiver, and the main steam descending piping to the steam turbine, are equal to the normal steam turbine inlet temperature. For the first few minutes of a cloud event, thermal energy can be withdrawn from the steam drum, the superheater section of the receiver, and the descending piping to maintain the output of the steam turbine at a level which is greater than the solar radiation would normally allow. Under certain conditions, the reduction in the electric output can also be minimized by taking advantage of the excess thermal energy capacity of the collector field, as noted above.

Controllability

Concentrating solar thermal tower technology has the particular ability to control the number of heliostats focusing on the receiver to account for variability of insolation in time of day and season, further stabilizing and shaping the project's generation profile to meet power system needs. PSEGS will be able to decrease or "turn down" excess mirrors when available solar energy is greater than can be absorbed by the receiver system and converted to electricity by the turbine. Similarly, toward the end of the day or during times of lesser insolation (e.g., winter), the PSEGS can increase the number of heliostats focused on the receiver to increase production and extend the generating day. These capabilities have the effect of reducing output variability.

Over the long term, one of the compelling attributes of solar thermal power tower technologies is its natural synergy with thermal energy storage, which will provide valuable, clean grid reliability services, such as load following and spinning reserves. As described above, the PSEGS design can accommodate the addition of a thermal energy storage system.

Increased Solar Energy and Reduced Variability from Natural Gas

The PSEGS project is located along an existing natural gas transmission line corridor and is equipped with auxiliary gas boilers. These boilers provide several benefits to the project, including increased renewable energy production and reduced variability of facility output. The auxiliary boilers are used to aid in system start-up, re-startup and shutdown. By pre-heating portions of the solar receiver, the time to reach initial synchronization and solar electricity generation is accelerated. At the end of each day, generation can also be extended after which a minimal amount of gas-fired steam is used to control safe system cool down. In addition, during periods of transient cloud cover, the boilers can reduce the frequency and magnitude of facility output fluctuations that would otherwise need to be balanced by offsite, conventional power sources. If in the future, additional, efficient uses of natural gas integrated with a primary renewable generating resource are supported by market participants, regulators and/or policymakers, the PSEGS project could seek to supplement its natural gas operations, subject to any required environmental or air quality approvals. Until such time, the auxiliary gas boilers at the PSEGS project will continue to benefit California's renewable energy goals by increasing the amount of renewable energy on the grid and mitigating imbalances on the system.

Transmission Reliability and Utilization Benefits
As discussed above, the PSEGS synchronous generators can increase the reliability of a system by providing voltage control and inertia response due to the transient and post-transient stability benefits of these generators. The practical effect is that the transfer capability, or maximum line loading, of a transmission corridor can be greater in scenarios where synchronous generators, such as the PSEGS, and asynchronous generators, such as wind or solar PV, are both interconnected, as compared to a corridor with only asynchronous generators.[2]

These important and differentiating benefits of the solar thermal technology, described above, are the very type of attributes which contribute to a future electricity system in California that the CEC has called for in its 2012 Integrated Energy Policy Report Update[3]:

- "Current processes for infrastructure planning and resource procurement should do a better job of maximizing portfolio value and diversifying risk. Examples of areas where renewable benefits can be further realized include [among other things]: … Developing a variety of technologies can create a more attribute-based, diversified portfolio to minimize risks and realize cobenefits."
- "Procurement decisions should consider an expanded suite of renewable energy benefits, including RPS-eligible facilities that can provide integration benefits… [and] reduced transmission and distribution costs. … The Energy Commission also encourages the publicly owned utilities to consider actions to develop a higher value portfolio as discussed below. … More broadly, to the extent ratepayer benefits can be identified, the valuation of individual RPS projects by the CPUC and publicly owned utilities should consider [among other things not repeated here]:
    - Integration benefits.

[2] These benefits of synchronous generation generally exist where the transfer capability is limited by transient or post-transient stability constraints, rather than by thermal overload constraints.

[3] Pgs 57,59 http://www.energy.ca.gov/2012publications/CEC-100-2012-001/CEC-100-2012-001-CMF.pdf

- o The capability of the project to provide other services needed for reliability.
- o Interconnection costs.
- o Technology diversity."

The solar thermal technology to be employed at the PSEGS project assists utilities and grid operators address integration challenges by delivering a firmer, more reliable, and more controllable renewable power source. The project promotes broader integration and higher penetration of renewable resources in California by means of its synchronous generator, providing significant benefits such as grid reliability services, including reactive power, voltage support, frequency control, inertia response, and controllability.

3. Transmission Planning and PSEGS

The PSEGS is an important component of the planned expansion of the transmission system in Southern California. The transmission planning process must predict and rely on the types, location and amounts of future generation projects. Transmission resource planning for renewable resources is critical to achieve the Statewide RPS and ultimate Climate Change goals.

In the 2014 Long Term Procurement Process (LTPP), the CPUC uses the "RPS Calculator" to project the renewable resource portfolios under various scenarios. These scenarios vary depending on levels of renewables (33% and 40%), different policy assumptions (Cost Constraints, Environmental Constraints, Commercial Interests) as well as levels of behind-the-meter resource growth (EE, DG and DR). The RPS Calculator indicates which major transmission projects will need to be constructed to support the various scenarios of renewable generation and the achievement of California policy goals – now and projected in the future. In 4 out of the 6 scenarios utilized in the LTPP[4], the West of Devers Upgrade Project[5] ("West of Devers") is triggered as a necessary upgrade to support the renewables build out and policy goals. However, all the transmission capacity needed by the other Transition Clusters projects have been largely satisfied by the Interim West of Devers Upgrades (completed in 2013)[6]. Although these upgrades were originally

[4] "Planning Assumptions and Scenarios for use in the CPUC 2014 Long-Term Procurement Plan Proceeding and CAISO 2014-15 Transmission Planning Process" [DRAFT] California Public Utilities Commission. December 24, 2013. Pg 26.

[5] "Riverside East – 1" is the West of Devers transmission project assigned to the LGIA's of Transition Cluster projects in Riverside County

[6] "Interim West of Devers Letter Agreement," Southern California Edison, January 13, 2012,

intended as temporary, it is possible that if PSEGS is not constructed, that a Certificate of Public Convenience and Necessity ("CPCN") application at the CPUC for West of Devers could be rejected. If PSEGS is not constructed, but West of Devers were to be approved by the CPUC, it is possible that FERC may not deem the full extent of the upgrades as "used and useful," thereby giving Southern California Edison ("SCE") potential pause in proceeding with West of Devers as planned.

Without the PSEGS project, uncertainty regarding the future of the West of Devers transmission project increases. This is concerning because several of the planning scenarios for California's grid and renewables targets are predicated on the existence of the West of Devers transmission project.

In addition, CAISO documents from the 2013/2014 Transmission Planning process indicate that West of Devers is in the Base Case of transmission upgrades and has been for several years (since the 2010/2011 cycle).[7] On page 8 of CAISO's Conceptual Statewide Plan Update, West of Devers is identified as associated with Transition Cluster in the East of Palm Springs Area.[8] The PSEGS is part of the Transition Cluster.

> The ISO demonstrated the need for the West of Devers and Coolwater-Lugo transmission projects in the 2010-2011 ISO Transmission Plan based on the base and sensitivity portfolios. The base and sensitivity renewable portfolios in subsequent ISO Transmission Plans have continued to support the need for these two projects. In addition, the ISO has counted on these projects as part of the transmission plan needed to achieve the 33% RPS by the year 2020.

While it cannot be said that the West of Devers transmission project is completely dependent upon the PSEGS, clearly generation at the PSEGS site has been relied upon for the transmission planning that has identified the West of Devers transmission project as necessary to reach California's RPS goals.

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http://www3.sce.com/sscc/law/dis/dbattach10.nsf/0/8D39DF415449C35388257984005B2F43/$FILE/120113+ER12-804+SCE+submits+NextEra+Desert+Center+Blythe.pdf.

[7] "2013-2014 Transmission Plan," [DRAFT] California Independent System Operator - Prepared by Infrastructure Development, February 3, 2014.

[8] "2012/2013 Conceptual Statewide Transmission Plan Update; 2013/2014 Transmission Planning Cycle," California Independent System Operator – Prepared by Market & Infrastructure Development, October 31, 2013.