BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

In the Matter of the Application of San Diego Gas & Electric Company (U 902-E) for a Certificate of Public Convenience and Necessity for the Sunrise Powerlink Transmission Project	Application 06-08-010 (Filed August 4, 2006)

PHASE II REPLY BRIEF OF POWERS ENGINEERING ON BEHALF OF BILL POWERS, P.E.

Bill Powers, P.E.
Powers Engineering
4452 Park Blvd., Suite 209
San Diego, California 92116
Telephone: 619-295-2072
Facsimile: 619-295-2073
E-Mail: bpowers@powersengineering.com

Dated: June 13, 2008

SUMMARY

SDG&E's Phase II opening brief is a methodical exercise in mischaracterizing the record to support its pre-determined position that non-wire options are not an alternative to the Sunrise Powerlink. The figurative elephant in the room is the March 27, 2008 SCE commercial PV application and testimony.[1] SDG&E does not mention the SCE commercial PV program once in its opening brief. There is a good reason for this. The technical viability and cost-effectiveness of the proposed SCE PV program contradict virtually every point made by SDG&E in its opening brief in opposition to the large-scale use of PV in San Diego County as a major element of the two non-wire alternatives to the Sunrise Powerlink identified in the DEIR.

A second elephant in the room is the high cost and pre-commercial status of dish Stirling technology, and the imminent failure of SDG&E's dish Stirling contract. Without the dish Stirling project, there is no renewable energy justification for the Sunrise Powerlink.

This reply brief is organized in "statement and response" format. A specific statement from the SDG&E Phase II opening brief is provided followed by the Powers Engineering response. Powers Engineering provides responses to thirty-four statements in this reply brief.

[1] Ex. SD-115, Ex. SD-116.

1. Mr. Powers wrote his Smart Energy Report on behalf of the "No Sunrise Team," not as an impartial analysis of how best to meet San Diego's energy needs. Moreover, Mr. Powers has never designed or constructed a PV system other than the 2 kW system on his home, he is not an electrical engineer. (p. 238)

The DEIR prepared by the Commission lists two non-wire alternatives as superior to the Sunrise Powerlink. Using SDG&E's logic, the Commission is also a member of the "No Sunrise Team." Mr. Powers clarified the significance of this term at TR at 3918 ln 8-16:

> "THE WITNESS: So the No Sunrise Team are people who are working against Sunrise? The point I want to make there is that the San Diego Smart Energy Report is based on the California Energy Action Plan and the loading order. The fact that the Energy Action Plan and the loading order are -- are consistent with a No Transmission Alternative in San Diego should in no way take away from the validity of that approach."

SDG&E mischaracterizes Mr. Powers experience with power systems by focusing exclusively on PV systems. Mr. Powers has extensive experience in power system design, as described at TR at 3914 ln 4-11:

> "My statement is that I have experience designing a large number of power systems. I was on the design team for three 50 megawatt peaking turbines in San Diego, the 3.5 megawatt CHP Project at Children's Hospital in San Diego, and am the coauthor of two Electric Power Research Institute documents on emission-control systems and cooling systems for gas-turbine power plants."

2. "Because Mr. Powers is proposing 920 MW of PV, *id.* at 7, the "renewable energy park" proposal apparently envisions up to 92 "parks" (if each "park" was 10 MW) to 920 "parks" (if each "park" was 1 MW)." (p. 240)

SDG&E misunderstands the renewable energy park alternative. Mr. Powers does not suggest transmitting 920 MW generated in renewable energy parks on the rural 69 kV grid. The proposal is to substitute the 290 MW solar trough plant in Borrego Springs described in the DEIR with 290 MW of renewable energy parks at or near rural SDG&E substations.[2] SDG&E acknowledges that the existing rural 69 kV can move up to 324 MW without upgrades.[3] Therefore the existing rural 69 kV grid has the capability move 290 MW of power from renewable energy parks without upgrades.

[2] Ex Powers-1, p. 6.
[3] SDG&E Phase II rebuttal testimony, p. 5-21.

3. Mr. Powers, however, admitted that he could not identify any "renewable energy parks" under development in San Diego County. (p. 241)

SDG&E mischaracterizes Mr. Powers' position. Mr. Powers stated that SDG&E was almost certainly receiving bids to install a large amount of renewable energy park capacity (TR at 3916 ln 9-28):

> "Next question: So when you said in your testimony that renewable-energy parks were a concept, you meant just exactly that, that they are a hypothetical concept but they are not currently under development?
>
> Powers: The point I would like to make there is that SDG&E currently has a renewables solicitation open. They are to receive renewable proposals I think on April 28th of this year. I am -- it is highly likely that they will receive numerous proposals for the energy park-type system, a number of megawatts at substations, and that they will also receive proposals to put in a tremendous amount of PV into San Diego.
>
> The -- PG&E already has done two – contracted for two solar renewable parks at two substations. So my point here is that the fact that I do not have an explicit list does not mean that within a couple of weeks SDG&E may have a whole suite of specific proposals for exactly that."

4. Third, Mr. Powers fails to show that such PV systems are cost-effective. (p. 241)

Commercial PV is more cost-effective than dish Stirling, SDG&E's renewable energy justification for the Sunrise Powerlink. The CEC identifies an installed capital cost of approximately $6,000/kW for dish Stirling.[4] The gross installed cost of 900 MW of dish Stirling would be $5.4 billion.[5] In contrast, the gross installed cost of flat-plate PV stated in the SCE PV application to the Commission is less than $4,000/kW.[6] The gross cost of 900 MW of PV using the SCE cost would be less than $3.6 billion.

The economics overwhelmingly favor developing the estimated 4,600 MW of commercial building and commercial parking area PV potential in San Diego County before paying for a 500 kV transmission line to access higher cost dish Stirling solar power in Imperial County.[7]

[4] RT at 3921 ln 3
[5] RT at 3921 ln 4
[6] Ex. SD-115. Average installed cost of PV is $3.5/watt DC (p. 13). DC to AC conversion factor is 0.9 (p. 1). Estimated AC output is $3.5/watt ÷ 0.9 = $3.85/watt ($3,850/kW).
[7] Ex. Powers-1, Attachment B, p. 48.

5. Whether 920 MW with a 100% capacity factor or 1840 MW with the 50% capacity factor recognized in the DEIR, the PV installations envisioned by Mr. Powers dwarf the amount of PV generation that the DEIR, the CEC, the CPUC and SDG&E believe is feasible." Bialek, Ex. SD-38 at 5.8. (p. 242)

SDG&E should have asked its neighboring utility, SCE, what it believes is feasible. SCE is proposing up to 500 MW of commercial PV in its current application before the Commission.[8] SCE also indicates in its testimony to the Commission that it has identified numerous potential leasing partners whose portfolios contain several times the amount of roof space needed for even the 500 MW program.[9]

6. Therefore, the CEC forecast also does not support Mr. Power's suggestion that there will be a surge of PV that displaces SDG&E's need for additional peak capacity. (p. 243)

SDG&E misrepresents the CEC forecast. The CEC forecast states, *"The energy and peak demand forecasts now include a projection of the impacts from penetration of rooftop solar photovoltaic (PV) systems as advanced through the California Solar Initiative (CSI)."*[10] The forecast is based solely on expected PV additions from the CSI program in SDG&E service territory. Any PV added outside the CSI program is not even considered in the CEC forecast. For that reason, the forecast does not consider or anticipate the potential addition of: a) the 920 MW of PV described in Powers Engineering Phase II direct testimony, or b) a commercial PV program in SDG&E service territory comparable in size and scope to the SCE commercial PV program described in Ex. SD-115 and Ex. SD-116.

The appropriate yardstick for how much PV should be developed in SDG&E service territory in the 2008-2016 period is not the CSI program. It is the 900 MW of solar power that SDG&E claims it will add in the 2008-2016 period. The CSI program includes a statewide incentive budget that is appropriately apportioned to each IOU based on the number of customers in each IOU service territory. SDG&E's renewable energy justification for the Sunrise Powerlink is 900 MW of dish Stirling solar power. This SDG&E commitment to add 900 MW of solar

[8] Ex. SD-115.
[9] Ex. SD-116, p. 44.
[10] CEC, *California Energy Demand 2008-2018 Staff Revised Forecast*, CEC-200-2007-015-SF2, November 2007, p. 10.

power is unrelated to any type of incentive program cost apportionment between PG&E, SCE, and SDG&E.

The dish Stirling contract will fail.[11] The dish Stirling contract failure will leave a 900 MW solar energy shortfall in SDG&E service territory in the 2008-2016 period. This shortfall should be met with 900 MW of lower cost, fully commercial PV in San Diego County.

7. SDG&E believes that the amount of PV systems that would need to be installed to reach both its 2010 and 2016 reliability capacity needs of 103 and 417 MW firm capacity, respectively, cannot be met by PV system installations based on SDG&E's experience with the rate at which such systems are currently being installed. (p. 243)

SDG&E's relative lack of experience with PV is not a legitimate excuse for failure to consider a PV solution for additional capacity needs. A SDG&E commercial PV program on the scale of the SCE PV program would be nearly sufficient by itself to meet the firm capacity requirement identified by SDG&E of 103 MW by 2010 and 417 MW by 2016.[12] SCE will install 105 MW DC by 2010, equivalent to approximately 95 MW AC.[13] Assuming SCE installs the entire 500 MW of PV described in its application, it will install 400 MW DC by 2016, equivalent to 360 MW AC.[14] The installation of 95 MW AC of PV would meet over 90 percent of SDG&E's identified firm capacity requirement of 103 MW for 2010. Installing 360 MW of PV by 2016 would meet approximately 86 percent of the firm capacity requirement of 417 MW identified by SDG&E for 2016. If this PV is equipped with storage, as contemplated by SCE in its application, this PV capacity would represent firm capacity.

8. Under cross-examination, Mr. Powers testified that his only "market analysis to determine whether a $700 million incentive program would trigger at least $6 billion in expenditures on PV systems" was to rely on Mr. Shah, the PV salesman at Sun Edison. (p. 243)

SDG&E misrepresents the record. A $700 million incentive program would trigger a net capital expenditure of $2.5 billion on PV systems using the PV pricing provided in the San Diego Solar Initiative. See response to No. 22. However, the San Diego Solar Initiative assumes

[11] Powers Phase II opening brief, p. 6.
[12] Ex. Powers-1, Attachment B, p. E3.
[12] SDG&E Phase II rebuttal testimony, Chapter 5, p. 5.9.
[13] Ex.SD-115, p. 13. SCE assumes a DC to AC conversion factor of 0.90.
[14] Id. at p. 13. Assumes 50 MW per year PV installation rate in 2014, 2015, and 2016.

a third party commercial power purchase agreement (PPA) structure. Using this structure, the customer agrees to pay a fixed retail sales price to the PV provider. A $700 million incentive budget would allow the third-party PV provider to offer the PV at a retail price of $0.12/kWh, well below the $0.17/kWh on-peak retail rate charged by SDG&E to commercial customers.[15] Neither SDG&E nor SDG&E's customers would be responsible for the gross or net capital cost of the PV system. SDG&E understands this (TR at 3441 ln 22-28, 3442 at ln 1-5):

A. And three, the PPA format doesn't function on the gross capital costs of the PV system.
Q. Okay.
A. That is, it's just a model that doesn't utilize that information as a core element. It's the developer, a third party is putting together a proposal where with the tax credits, with the accelerated depreciation, with the incentive, you can offer power at a certain rate to the consumer.
Q. Okay. So I understand that you have a PPA model in mind. So we'll step back from that for a minute and we'll get back to that at some point.

However, SDG&E chooses to ignore its understanding of the PPA model in an attempt to paint the gross capital cost of PV described in the San Diego Solar Initiative as prohibitively high. The problem for SDG&E in attempting to paint commercial PV as prohibitively expensive is that the cost of dish Stirling, combined with the cost of the transmission line to get dish Stirling power to San Diego, is even more expensive, as described in the response to No. 4 above.

SDG&E misrepresents Mr. Shah's position. Mr. Shah is the founder and chief strategy officer of SunEdison. SunEdison pioneered the use of PPAs for commercial PV systems and is the most successful developer of commercial PV systems in the country. That is the reason Mr. Powers requested Mr. Shah's assistance in developing a PV incentive budget for the proposed San Diego Solar Initiative. SDG&E is aware of Mr. Shah's position, as shown at TR at 3430 ln 1-6 and TR at 3850 ln 3-9, and simply chooses to mischaracterize it:

Q. Okay. And Mr. Shah is the chief strategy officer for SunEdison, correct?
A. That is correct.
Q. And SunEdison is a solar energy services provider, correct?
A. They are.

A. The extent of the market analysis was to confirm that the individual who put together that sheet, Mr. Shah, could deliver that scope of program with that incentive budget.

[15] Ex. Powers-1, Attachment B, p. 2.

That was the extent of the market budget. They are the most successful developer of commercial PV systems in the country.

9. Moreover, under current law, the federal tax credit for PV systems expires at the end of 2008. (p. 244)

SDG&E can own and operate the PV system as SCE is proposing for its commercial PV project. IOUs are not currently eligible for the federal tax credit.[16] Ownership by IOUs of PV systems will be unaffected if the federal tax credit is not renewed by the end of 2008.

10. Mr. Powers erroneously utilizes a DC to AC conversion factor of 0.77, *id.* (Smart Energy Report, App. K at 1), while the CEC recommends 0.67. Mr. Powers' error results in an overestimation of PV capacity by 13 percent. (p. 244)

Dr. Bialek relies on an obsolete 2001 residential PV study that uses very conservative assumptions to estimate a DC to AC conversion factor of 0.67 for polycrystalline silicon PV. SDG&E inadvertently established with its own exhibit that the DC to AC conversion factor for thin-film PV is in fact 0.88.[17] That one erroneous assumption by SDG&E reduces the grid power output of PV by more than 30 percent.[18] SCE implies in testimony that accompanies its commercial PV application to the Commission that much of the PV to be installed will be thin-film PV, stating:[19] "*All module technologies "derate" in hot weather, meaning as they get hotter, they become less and less efficient. Thin film modules derate less than crystalline modules. Therefore, thin film technology might be the preferred technology in certain southern California locations.*"

11. Regardless, the amount of PV available even if Mr. Powers' hypothetical installations occurred would not meet SDG&E's projected need for 103 MW of on-peak capacity in 2010." (p. 244)

SDG&E is mistaken. See response to No. 7.

[16] Ex. SD-116, p. 56, footnote 40.
[17] RT at 3871 ln 8-24
[18] 0.88 ÷ 0.67 = 1.31 (31 percent difference)
[19] Ex. SD-116, p. 27.

12. The most critical "assumption" in Mr. Powers' "comparison" is that there will be no growth in energy demand between 2003 and 2020, but rather a 20% reduction. A key part of this assumption is that there will be "no net additional burden from residential and commercial growth, new building growth." As an initial matter, it is now 2008 and Mr. Powers did not know the energy demand growth between 2003 and 2008. (p. 245)

Mr. Powers is fully aware of population growth over the 2003 to 2007 time period, as explained at Ex. Powers-1, Attachment B, p. 25 and p. D2, and TR at 3874 ln 11-20:

> Q. Okay. Do you know how much that new growth has added, in fact, to the demand in San Diego for electricity?
>
> A. Well, I know that between 2004 and 2007 or 2008 our net growth in San Diego has been almost zero. It's been -- we've been growing at .1, .2 percent per year. So we may in fact be missing somewhere between .5 percent and 1 percent of any potential growth in that time period between 2003 and 2008."

SDG&E has consciously withheld year-to-year information on energy demand growth. Mr. Powers summarizes his attempt to get annual energy demand growth data from SDG&E at TR at 3924 ln 28, and TR at 3925 ln 1-18, stating:

> "The inability to get year-to-year data on load growth: I am a member of the San Diego Association of Governments Energy Working Group. I sit on the Resource Committee and SDG&E sits on that Resource Committee. I explicitly asked a Transmission Manager at SDG&E, Mr. Anderson, to provide the Resource Committee with the peak load and annual energy load growth in San Diego from 2001 to 2005, or two thousand- -- I think that request was made in 2006.
>
> That became a point of embarrassment in the Resource Committee, and I pointed that out to Mr. Anderson, that we cannot function as a Resource Committee within the SANDAG Energy Working Group if we cannot get basic information from SDG&E on our annual energy growth rate and our peak load growth rate. And it became to the point where we had nothing to say. He -- he obviously was told that he could not provide that information to the Resources Committee."

13. In evaluating Mr. Powers' "comparison," what is notable is that none of that $700 million in incentives is available for any of the PV that Mr. Powers assumes will be placed on all new buildings to bring such buildings' energy demand to "net zero." Mr. Powers has not estimated the amount of PV that would be necessary for such new buildings. (p. 246)

Net zero in residential and commercial new construction is already Commission policy, as acknowledged by SDG&E.[20] As noted by SDG&E in its opening brief, the CEC has a PV program for new homes (p. 243): *"In addition, the New Solar Homes Partnership (administered*

[20] TR at 3877 ln 1-26

by the CEC) seeks to achieve 400 MW of solar electric capacity statewide. In the DEIR, Aspen estimates that the CEC will allocate 15% of the funding and goal to SDG&E's service territory, and thus, if achieved, would add 60 MW to SDG&E's target." Population growth in SDG&E service territory averaged 0.2 percent in the 2004-2006 timeframe.[21] Extrapolating from the 2004-2006 population growth trend, and assuming load growth is proportional to population growth, load could be expected to grow by 2 to 3 percent by 2020. Even if none of this load growth is equipped with PV, it will have little overall impact on Mr. Powers comparison due to the small amount of load growth.

14. Mr. Powers testified: "Non-renewable distributed generation (DG) should substitute for the 620 MW combined-cycle plant in the In-Area All-Source alternative, as explained in detail in [the Smart Energy Report]." Mr. Powers, however, admitted that: "I cannot identify any specific CHP plants," and he is not aware of any CHP plants under development. (p. 246)

SDG&E mischaracterizes Mr. Powers' position. Mr. Powers states (TR at 3917 at ln 19-26):

> "My response to that is that the combined-heat-and-power projects are being proposed on a continuous basis in the San Diego area. The -- I want to clarify that the fact that I did not put together a specific list of 80 or 100 CHP projects for -- as a substitute for a combined-cycle project somehow implies that there isn't a continuous stream of such proposals."

SDG&E cites in its Phase II rebuttal testimony (p. 5-38) an EPRI marketing study of additional CHP potential in SDG&E service territory of nearly 400 MW. EPRI found that "*A little over half would reject a project with a payback of 2 years.*" Two years is a very aggressive payback period. The CEC metric for cost-effective is a simple payback in ten years. A ten-year payback would greatly expand the cost-effective CHP potential in SDG&E service territory relative to the nearly 400 MW of additional CHP potential already identified in the EPRI CHP marketing study.[22]

[21] Ex. Powers-1, Attachment B, p. D2.
[22] Powers Phase II opening brief, p. 24.

15. Mr. Powers ignores the potential impact on the electrical grid of adding "renewable energy parks," commercial scale PV, or CHP plants, claiming: "The existing 69 kV system should be able of handling hundreds of MW of power generation from individual 1 to 10 MW solar installations in rural areas of the county." Mr. Powers is mistaken. (p. 247)

SDG&E is mistaken. SDG&E acknowledges in its Phase II rebuttal testimony that the existing rural 69 kV transmission grid can move up to 324 MW without upgrades. See response to No. 2.

16. Even if you assume that the 69 kV system could accommodate a couple of the energy 'parks' contemplated by Mr. Powers, it is a far stretch to then assume that the 69 kV system could accommodate between 92 and 920 such energy 'parks'." The same holds true for addition of CHP plants. (p. 248)

As noted in the response to No. 2, SDG&E misunderstands the renewable energy park concept presented by Mr. Powers. Renewable energy parks are presented as a potential substitute for the 290 MW solar trough plant in Borrego Springs described in the DEIR.

17. Mr. Powers admitted that he did not conduct any power flow analyses before making his statement about the 69 kV system being able to handle his proposed generation units. (p. 248)

SDG&E concedes in its opening brief that the rural 69 kV transmission system has 324 MW of capacity. This is more than sufficient for 290 MW of renewable energy parks proposed in Powers Engineering Phase II direct testimony as a substitute for the 290 MW Borrego Springs solar trough plant included in the All Renewable In-Region Alternative in the DEIR. Logically the renewable energy parks would be located optimally, in cooperation with SDG&E, to minimize or eliminate the need for any transmission or distribution system upgrades.

These renewable energy parks would be sited using the same commonsense approach to power flow management that SCE proposes to utilize in order to add 250 MW to 500 MW of commercial rooftop PV without distribution system upgrades.[23] SCE states, "*SCE will develop methods to determine the optimal location for the PV installations. SCE will consider: (1) quality of the local solar resource (estimate of expected PV generation based on factors such as*

[23] Powers Phase II opening brief, p. 8.

expected cloud/fog cover, haze and smog, ambient temperature, and geographic latitude) and other meteorological data, (2) roof capacity and other building attributes, and (3) local circuit concerns."[24]

18. Taken as independent solutions, Mr. Powers' ideas were explicitly screened out of full analysis in the DEIR as infeasible. (p. 249)

Mr. Powers does not propose any independent solutions in isolation. As Mr. Powers states at TR at 3880 ln 16-28 and TR at 3881 ln 1-11:

> Q. Let's turn to SDG&E's forecast, 4,679-gigawatt hour increase. Under your analysis how much PV would have to be installed to meet that additional demand?
> A. Now, the question is if we isolate a quantity of 4,700 gigawatt hours per year, how much PV would need to be installed to meet 100 percent, that value, even though this is a plan that has five different elements in it of which PV is only a component of those? You are asking me to take a plan that has PV maximum being 25 percent of total and apply 100 percent PV to this 4,700 megawatts (sic)? That is not my plan.
> Q. Okay. You indicated that all new residential and commercial growth should incorporate sufficient PV to meet projected annual energy demand, correct?
> A. Yes. However, the plan does not presume that building construction standards remain the same as they are today and that we use the same air conditioners we use today, the same everything as we use today, and we simply add power generation capability, which would be the most expensive way to do it, and that it would all be PV. That is absolutely not my plan. What my plan is we would knock down large part of that with energy efficiency, just like the California loading order or Energy Action Plan loading order.

The plan prepared by Mr. Powers uses a balanced mix of resources to achieve a 50 percent reduction in greenhouse gases by 2020 relative to SDG&E's current long-term procurement plan, while maintaining the retail cost of electricity at or below SDG&E rates.[25] Aggressive and cost-effective energy efficiency measures are used to reduce current annual energy demand by 20 percent and current peak demand by 25 percent. Generation will be supplied by: a) remote non-PV renewable energy to meet the AB 107 "20 percent by 2010" mandate, b) utility-scale natural gas-fired sources, c) local CHP, and 4) local PV.

The plan would add nearly 2,000 MW of new local generation resources to meet peak demand, in the form of CHP and local PV, in addition to approximately 1,600 MW to 1,800 MW of existing utility-scale natural gas-fired combined-cycle and simple cycle resources. This would

[24] Ex. SD-116, pp. 33-34.
[25] Ex.Powers-1, Attachment B, p. 6, Table 1-2: Limited San Diego Smart Energy 2020.

be more than sufficient local generation to meet the region's electric power needs, assuming the peak demand reduction target of 25 percent described in the plan is also achieved, even when wildfires force a simultaneous shutdown of SDG&E transmission import corridors and electrically isolate the San Diego area at a time of peak electrical demand.[26]

19. As SDG&E's Dr. Bialek testified: "Mr. Powers does not address the actual cost of his proposal for installation of 920 MW of PV in San Diego County; instead, he addresses only the amount of the incentive program he claims will lead to installation of such PV systems. That is not the true cost." Bialek, Ex. SD-38 at 5.13. "A simple total cost calculation for 920 MW of firm capacity neglecting any CAISO imposed requirements and costs of fossil fueled generation to charge the batteries; $12.9 billion." (p. 250)

The high and obsolete cost figures that SDG&E uses for PV completely misrepresent the current cost competitiveness of PV. Including energy management/battery storage adds about 10 percent to the cost of the PV system.[27] Assuming the SCE PV cost of approximately $4,000/kW, and adding 10 percent to account for energy management/battery storage, the cost of 920 MW of PV would be $4.0 billion.[28] This is less than one-third the SDG&E cost estimate.[29]

20. Dr. Bialek's calculation relied on the known current cost of PV panels, without making result-oriented assumptions about dropping prices. "The 2007 Itron Self Generation Incentive Program, SGIP, Sixth Year Impact Evaluation Final Report provides a weighted average PV system cost of $8,500/kW for active systems over 30 kW in size (commercial)." In fact, PV prices have not been dropping in recent years. (p. 250)

Dr. Bialek is mistaken. SCE indicates a 2007 commercial PV cost of $6,560/kW in its service territory. SCE cites a cost for 2007 commercial PV projects in SDG&E service territory of $6,470/kW.[30] The projected cost of a large PV system under construction in Germany is approximately $5,000/kW ($5/watt).[31] SCE has filed an application to ratebase commercial PV at less than $4,000/kW.[32] SDG&E's commercial PV cost estimates are clearly obsolete in light of the SCE PV costs. The PV industry is projecting a 40 percent decline in the cost of PV systems

[26] Id. at p. 6.
[27] Powers Phase II opening brief, p. 9.
[28] $4,000/kW x 1,000 kW/MW x 920 MW x 1.1 = $4.048 billion.
[29] Powers Phase II opening brief, p. 11.
[30] Ex. SD-116, p. 9, Table II-2. Commercial PV projects in SDG&E service territory in the CSI program are administered by the California Center for Sustainable Energy (CCSE).
[31] Powers Engineering Phase II opening brief.
[32] Ex. SD-115, p. 1 and p. 13.

by 2010 due to greatly expanded worldwide production capability.[33] The PV industry cost decline projection appears accurate and even conservative in light of the PV cost decline documented by SCE.

SCE states in testimony that accompanies its commercial PV application to the Commission that (Ex. SD-116, p. 26): "*Currently, thin film modules are less expensive than crystalline modules.*" SDG&E makes no effort to distinguish between polycrystalline silicon PV and thin-film PV, or to acknowledge that the widespread availability of thin-film PV is driving down PV costs.

21. His (Bialek's PV) estimate also recognized the need to replace inverters and batteries. *Id.* at 5.13-5.14. Thus, the estimated cost is: "920 MW*($8,500/kW (PV)+2*$900/kW (2 sets inverters) +3*$1,250/kW (3 sets batteries))=$12.9 billion." (p. 251)

Dr. Bialek's battery cost estimate, at 3*$1,250/kW = $3,750/kW, is approximately 100 percent of SCE's installed PV system cost of $3,850/kW AC for its commercial rooftop program. This is another example of a cost estimate so out-of-range with reality that any statement by Dr. Bialek on PV system cost is suspect.

Neither the summary of qualifications provided by SDG&E for Dr. Bialek or his Phase II rebuttal testimony indicate or suggest that Dr. Bialek has any direct experience with energy storage systems. The cost of lead-acid batteries is 2 to 3 percent of the initial installed PV system cost based on Mr. Powers direct experience with purchasing and operating a PV system equipped with battery storage (TR at 3851 ln 21-28, TR at 3852 ln 1-2). Two additional battery replacements over the system lifetime, a total of three sets of batteries, would result in a total battery expenditure of less than 10 percent of the initial installed PV system cost.

The first cost of the energy storage hardware in the Gaia Power Tower, which includes the energy storage-related electronics as well as the lead-acid batteries, is approximately 6 percent of total PV system cost.[34] As a result, a replacement set of lead-acid batteries for the Gaia Power Tower would be considerably less than 6 percent of total system cost, as the energy storage electronics that form part of the first cost would not be replaced along with the batteries.

[33] Ex. Powers-1, Attachment B, p. 47.
[34] Ex. SD-83.

The battery cost provided by Dr. Bialek, $1,250/kW, is given with no supporting information or context. Energy storage costs, including but not limited to the battery component of the energy storage system, were as low as $300/kW in 2005.[35] No weight should be accorded the SDG&E battery cost estimate as SDG&E has provided no context to support that its cost estimate is even relevant to the discussion.

22. Under cross-examination, however, Mr. Powers admitted that the estimated costs are extremely high and that Dr. Bialek's inclusion of replacement inverters and batteries is correct. (p. 251)

SDG&E is mistaken. Mr. Powers stated that Dr. Bialek's inclusion of replacement inverters is incorrect. See the response to No. 26 below.

23. Even if such price drops occur, which is inconsistent with current data and speculative into the future, Mr. Powers' estimated capital cost is well in excess of $6 billion. Mr. Powers did not include the total cost of either his limited or full San Diego Solar Initiative in his testimony or even in his Smart Energy Report. (p. 251)

Mr. Powers does address the capital cost of PV in the limited and full San Diego Solar Initiative (TR at 3920 ln 13-24 and 3921 ln 1-8):

> "And I want to clarify that the -- a developer of a project of this type -- and we have talked about this extensively -- under a -- a commercial power-purchase agreement is paying the net capital – will finance the net capital after the tax credits and accelerated depreciation are applied.
>
> That reduces the gross capital costs by 58 percent without even discussing CSI-type incentives, in that that developer, again without the CSI incentives, is looking at, for 920 megawatts of PV, a -- if it's all commercial, for simplicity, approximately $2.5 billion; if it's 2040 megawatts, approximately $5.5 billion in -- in financing.
>
> And the -- this cost is a cost that is significant. Also in a relative sense is the point of the Sunrise Powerlink is ostensibly to access 900 megawatts of dish solar, solar power in the desert.
>
> The CEC estimates the cost of that system as $6,000 a kW. 900 megawatts of dish solar is $5.4 billion plus the costs of the Sunrise Powerlink at $1.3 billion. If we prorate that up or extrapolate to 2,040 megawatts, you are looking at $12.2 billion for the dishes plus the cost of transmission."

[35] Ex. Powers-1, Attachment B, p. L2.

24. The $5.964 billion estimated cost of Mr. Powers' limited San Diego Solar Initiative is based on very optimistic assumptions about the future costs of PV panels and batteries, and does not include the cost of replacement batteries and inverters. Thus, it understates the true cost. (p. 252)

SDG&E is mistaken. First, Mr. Powers proposes that the PV would be installed under a third party PPA model. As described in the previous response, the third party PPA provider would be responsible for financing $2.5 billion, not the $5.964 billion stated by SDG&E. Second, the PV cost projection used in the San Diego Solar Initiative is quite conservation relative to the PV cost stated by SCE in its commercial PV program application ($3,850/kW AC). Third, the gross installed cost for 920 MW of PV with storage using SCE PV pricing would be approximately $4 billion. Fourth, if this PV was installed under a third party PPA as envisioned in the San Diego Solar Initiative, the PV developer could utilize the commercial PV federal tax credit and accelerated depreciation. As a result, the net capital cost for the 920 MW of PV would be reduced 58 percent to approximately $1.7 billion. $1.7 billion is approximately the current estimated capital cost of the Sunrise Powerlink. The Sunrise Powerlink includes 0 MW of generation, renewable or conventional.

25. By contrast to Mr. Powers adjusting the price to match his desired result, and as Dr. Bialek testified, "actual data demonstrates that PV system component costs have actually been increasing due to shortage in raw materials and an increase in demand. System costs have not changed significantly over the last six years." Ex. SD-38 at 5.16 (emphasis added). Dr. Bialek did not provide simply his opinion, but cited studies establishing the point. Mr. Powers provides no evidence that prices will drop as he predicts. (p. 253)

SDG&E is mistaken. Commercial PV costs are dropping rapidly. See response to No. 20.

26. Navigant Consulting, however, conducted surveys of inverter manufacturers, who indicated a range of inverter life from 5 to 10 years. Dr. Bialek also testified that inverters have a 10 year life. There is no factual basis to assume that inverters would not need to be replaced. (p. 255)

SDG&E misrepresents the survey conducted by Navigant Consulting. The survey also indicated that inverters can last up to 20 years. SCE assumes that inverters will last 20 years in

its commercial PV application to the Commission.[36] Mr. Powers clarified this point during the hearing (TR at 3923 ln 1-14):

> "The next comment is that SDG&E brought up the issue of Navigant's -- they provided a single page -- it's one of the exhibits -- they provided page 20 of a report that was done by Navigant, and I'd like to return to that exhibit and just point out that the – the exhibit cites numerous manufacturers indicating they do not expect that inverters could go beyond 20 years' lifetime without some additional support. And the program that is proposed here is a 20-year program. That comment supports the idea that for the assumption that these batt- -- these inverters are capable of lasting 20 years; and that is the assumption that SCE is using in their proposal to the PUC."

27. Mr. Powers does not estimate the additional costs of making all future construction "net zero" (by efficient building design or PV), or the costs of CHP plants.(p. 256)

There would be no additional costs to SDG&E ratepayers. SDG&E itself describes how to cost-effectively make existing construction near "net zero" based on its own retrofit experience, much less simply incorporating these steps in the design phase of new construction to cost-effectively ensure it is net zero.[37]

The costs of CHP plants are borne by the facility developing the CHP project, not SDG&E ratepayers. SDG&E cites an EPRI study that estimates nearly 400 MW of additional CHP potential in SDG&E service territory.[38] EPRI states in the study that more than half the potential customers would reject a CHP project with a payback of two years. This is a two-year payback relative to what the CHP operator would otherwise be paying SDG&E for the same electricity and natural gas. The reason a customer would go forward with a CHP project is because there would be less costs, not additional costs.

28. Dr. Bialek provides estimated costs for two scenarios requiring upgrades to the grid, and those estimated costs were $405 million and $345 million. (p. 256)

SDG&E's claim that it would need to invest $345 million to $405 million to upgrade the rural 69 kV grid is based solely on SDG&E's misunderstanding of the renewable energy park proposal described in Powers Phase II opening testimony. The proposal is to substitute the 290 MW solar trough plant in Borrego Springs described in the DEIR with 290 MW of

[36] Ex. SD-116, p. 17.
[37] Powers Phase II opening brief, pp. 17-18.
[38] Id. at p. 24.

renewable energy parks at or near rural SDG&E substations. SDG&E acknowledges that the existing rural 69 kV can move up to 324 MW without upgrades.[39] SDG&E confirms with this answer that the existing rural 69 kV grid can move 290 MW of power from renewable energy parks without upgrades.

29. Mr. Powers simply assumes that his "920 MW of PV" can be made fully available on peak by adding a Gaia Power Tower to the PV systems. He is mistaken. (p. 256)

SDG&E mischaracterizes Mr. Powers' position. The Gaia Power Tower is one example of off-the-shelf energy management/battery systems designed to work with PV systems, not the only option. The addition of limited storage to each PV system ensures that the PV nameplate capacity is firm on-peak capacity. The CEC is funding a demonstration in SCE service territory of sophisticated energy management/battery systems integrated with residential PV to serve as peaking units to meet the late afternoon summertime peak. Commercial-scale demonstration projects on 100 kW and 300 kW PV systems are also underway. The energy management/battery systems are fully controllable by the utility as peaking units. The addition of energy management and battery storage allows the PV system to supply the utility grid with its peak output through the late afternoon summertime demand peak. SCE states in its 250 MW PV application that it "*can coordinate generation or storage technologies at the substation level to moderate the inherent weather-caused variability in solar PV production before such intermittency cascades into the higher voltage CAISO-controlled transmission system. Such coordination will reduce system costs.***"** Clearly SCE envisions large-scale storage as a fully viable and complementary element to its proposed PV program. As noted, the energy management/battery system adds approximately 10 percent to the cost of the PV system.[40]

SDG&E's assertion that batteries are only capable of serving as back-up and can not send power back to the grid is ill-informed. SCE addresses the potential large-scale use of storage with its proposed commercial PV program. A large, 3.5 MW-hr stand-alone lead-acid battery system already operates as a peaking unit in the Los Angeles area. Lead-acid batteries are not the only current off-the-shelf storage option. For example, there is always the option to pay more initially for a lead-antimony thick plate battery guaranteed for 15 years that can last 20 years to avoid putting in batteries every seven years. The battery goes in with the initial system and lasts

[39] SDG&E Phase II rebuttal testimony, p. 5.21.
[40] Powers Phase II opening brief, pp. 8-9.

20 years. Both of these battery options are commercially available now. They are being used in PV systems now.[41]

30. Moreover, even if it is hypothetically possible to install 920 MW of PV systems with battery backup as proposed by Mr. Powers, it is important to determine the impact of this resource on SDG&E's system load profile. Because Mr. Powers' proposal to make PV "firm" using battery storage has not been shown to work and would not address SDG&E's peak demand needs even if assumed to work, it does not meet SDG&E's need to maintain system reliability. (p. 257)

SDG&E has a stated objective of filling the Sunrise Powerlink with 900 MW of pre-commercial dish Stirling solar power with no storage. SDG&E correctly observes that solar power will not be available at night to meet the 8 pm secondary peak (p. 250). Yet then SDG&E contradicts itself by claiming that the Sunrise Powerlink will be able to move 1,000 MW of energy 100 percent of the time.[42] Fully commercial PV solar power with storage is inherently more reliable than pre-commercial dish Stirling solar power with no storage. If reliability is in fact SDG&E's objective, it will prioritize the deployment of PV with storage over dish Stirling.

31. Further, Mr. Powers' proposal would do nothing to facilitate renewable energy development in Imperial Valley. (p. 258)

The renewable resources available in Imperial County are solar and geothermal.[43] The entirety of SDG&E's claim that the purpose of the Sunrise Powerlink is the importation of renewable energy is based on the SDG&E contract for up to 900 MW of dish Stirling solar power in Imperial County.[44] Dr. Bialek was a co-author of the August 2005 *Potential for Renewable Energy in the San Diego Region*, the document cited in SDG&E's opening Phase II brief that identifies dish Stirling as pre-commercial technology (p. 257). That same report identifies PV as fully commercial technology.

---

[41] Id. at p. 9.
[42] SDG&E Phase II rebuttal testimony, Chapter 5, p. 5.12. "*Sunrise Powerlink will also be available all year allowing access to 8,760 GWh of energy once constructed . .*" There are 8,760 hours in a year. 8,760 GWh equals 1,000 MW of energy output for all 8,760 hours in a year.
[43] Application A.06-08-010, Appendix I-1, p. 4. *"The proposed Sun Path Project is expected to increase California's ability to import additional energy including energy from renewable resources from the Salton Sea (geothermal generation) and southern Imperial County (solar thermal generation) area by at least 1000 MW without curbing economy power imports into California."*
[44] Application A.06-08-010, p. III-11.

SDG&E will contract for only 25 MW of new geothermal power in the 2007-2016 timeframe.[45]

The CEC identifies an installed capital cost of approximately $6,000/kW for dish Stirling.[46] The installed cost of 900 MW of dish Stirling would be $5.4 billion.[47] In contrast, the gross installed cost of flat-plate PV stated in the March 27, 2008 SCE application is less than $4,000/kW.[48] The gross cost of 900 MW of PV using the SCE cost would be less than $3.6 billion.

There is no economic driver to build the Sunrise Powerlink to access dish Stirling in Imperial County given the lower-cost PV alternative. There is clearly no technological driver for accessing dish Stirling in Imperial County, given SDG&E has identified dish Stirling as pre-commercial. The SDG&E dish Stirling contract will fail. In addition, SDG&E has shown no interest in facilitating Imperial County geothermal energy development on a significant scale.

SDG&E has presented no compelling evidence that the Sunrise Powerlink will facilitate any renewable energy development in Imperial County. In fact, the record contains compelling evidence that the construction of the Sunrise Powerlink will not facilitate any renewable energy development in Imperial County.

32. Mr. Powers states that "non-renewable DG, also known as 'combined heat and power' (CHP), is higher in the loading order than combined cycle generation is that it has the lowest CO_2 emissions of any fossil fuel power generation at 639 lb CO_2 per MWh" compared to "819 CO_2 per MWh for combined cycle plants." Mr. Powers is mistaken. (p. 258)

The SDG&E comment on CHP efficiency follows the same "the past is the future" logic used by SDG&E to address PV price trends. The past does not inevitably represent the future. Improperly sized small CHP plants have been built. State regulators, the CHP industry, and CHP customers are aware of this issue. It is reasonable to expect, given the sizing issue is now well known, that small CHP systems will be subject to considerably more scrutiny to assure proper

[45] Id. at p. III-12.
[46] RT at 3921 ln 3
[47] RT at 3921 ln 4
[48] Ex. SD-115. Average installed cost of PV is $3.5/watt DC (p. 13). DC to AC conversion factor is 0.9 (p. 1). Estimated AC output is $3.5/watt ÷ 0.9 = $3.85/watt ($3,850/kW).

sizing of future installations. CHP is rank-ordered above combined-cycle in the loading order under the presumption that CHP will be properly sized.

33. Although Mr. Powers claims that "600+ MW of firm on-peak capacity" is available "in the form of energy efficiency," Powers at 10, Mr. Powers does not explain what energy efficiency measures he is proposing that are not already being pursued and not already included within both the CEC's and SDG&E's forecasts of future energy needs. Nor does Mr. Powers discuss the cost-effectiveness of whatever measures he has in mind. (p. 238)

The energy efficiency measures would be the same as those SDG&E has already employed to cost-effectively retrofit buildings.[49] These measures include: 1) adding insulation to the interior of existing walls, 2) adding a film to the existing single glazed windows, 3) use of a variety of high efficiency lighting strategies, 4) occupancy sensors, 5) and use of a high efficiency air conditioning system.

CPUC decision D.07-10-032 on October 18, 2007 post-dates the energy efficiency commitments used by SDG&E to forecast energy usage and peak demand growth in the Sunrise Powerlink application and SDG&E's December 2006 Long Term Procurement Plan.[50] Decision D.07-10-032 requires the California electric utilities to achieve unprecedented levels of energy efficiency. The target of the plan is to incorporate 100 percent of cost-effective energy efficiency measures by 2020.[51] Cost-effectiveness is defined by the CEC as a simple payback within ten years.[52]

It is disingenuous for SDG&E to imply it is currently pursuing 100 percent of cost-effective energy efficiency measures. SDG&E is projecting that both per capita energy consumption and per capita peak electricity demand will increase in SDG&E service territory between 2007 and 2016. This forecast increase runs counter to California's 30-year history of "no change" in per capita energy consumption. It is the reliance on forecast paper reductions instead of absolute reductions relative to a fixed baseline year that allows SDG&E to state in the 2007-2016 Long-Term Procurement Plan that "*SDG&E does not believe that significantly more energy efficiency savings could be realistically achieved from a technical standpoint.*"

[49] Powers Phase II opening brief, pp. 17-18.
[50] Ex. Powers-1, Attachment B, p. 25.
[51] Powers Phase II opening brief, p. 17.
[52] Id. at p. 17.

34. Mr. Powers claims that 249 MW in demand reduction can be achieved by "[f]ocusing SDG&E efficiency rebate dollars" on air conditioning units with SEER 21 ratings. Powers at 12. Replacing existing units that are still operable is not cost-effective—Mr. Powers looks only at the incremental cost difference between a SEER 13 unit and a SEER 21 unit, and not the cost of replacement. Moreover, this program is optional and SDG&E cannot make it mandatory as Mr. Powers suggests. (p. 238)

SDG&E misunderstands the proposal. Air conditioning units wear out. Mr. Powers identifies a typical lifetime for a central air conditioning unit of 10 to 11 years.[53] SDG&E identifies a useful life of 18 years for central air conditioning units.[54] In either case the majority of central air conditioning units will wear out and require replacement over a 10-year period. At the time the replacement occurs, the new unit can be the federal minimum SEER 13, or it can be the highest SEER rating that is commercially available - SEER 21. It is the difference in the incremental cost of a new SEER 13 unit and a new SEER 21 unit, which is approximately $2,000 on a base cost of $9,000 (for a 3-ton SEER 13 central heat and air conditioning unit), that would be rebated by SDG&E to the customer.[55] The program would not need to be mandatory to be highly effective. It is improbable that a significant number of customers would reject a free upgrade to a high efficiency central heat and air unit when they replace a worn-out unit.

[53] Ex. Powers-1, Attachment B, p. 37.
[54] SDG&E Phase II rebuttal testimony, p. 5.33.
[55] Id. at p. 38.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of the foregoing Phase II reply brief on all parties identified in A.06-08-010 on the attached service list by electronic mail. Dated at San Diego, California, this 13th day of June, 2008.

Respectfully submitted,

_____/S/_____

Bill Powers, P.E.
Powers Engineering
4452 Park Blvd., Suite 209
San Diego, California 92116
Telephone: 619-295-2072
Facsimile: 619-295-2073
E-mail: bpowers@powersengineering.com

SERVICE LIST FOR A. 06-08-010

<sara@calparks.org>,
<thomas.burhenn@sce.com>,
<dwood8@cox.net>,
<dlindsay@sunbeltpub.com>,
<mwells@parks.ca.gov>,
<scotmartin478@msn.com>,
<david.lloyd@nrgenergy.com>,
<conniebull@cox.net>,
<dj0conklin@earthlink.net>,
<edwrdsgrfx@aol.com>,
<pwhalen2@cox.net>,
<oakhollowranch@wildblue.net>,
<jhfark@pacbell.net>,
<denis@vitalityweb.com>,
<hikermomma1@yahoo.com>,
"Barnes, E. Gregory" <GBarnes@sempra.com>,
<fortlieb@sandiego.gov>,
<hpayne@sdgllp.com>,
<mcalabrese@sandiego.gov>,
<liddell@energyattorney.com>,
<mshames@ucan.org>,
<sdenergy@sierraclubsandiego.org>,
<gorhamedward@cox.net>,
"O'Beirne, Kevin" <KO'Beirne@semprautilities.com>,
<kritchey@san.rr.com>,
<jleslie@luce.com>,
<dhogan@biologicaldiversity.org>,
<inbox858-cvcc@yahoo.com>,
<cadowney@san.rr.com>,
<barbschnier@yahoo.com>,
"Blattner, William" <WBlattner@semprautilities.com>,
<mflorio@turn.org>,
<wolff@smwlaw.com>,
<joc@cpuc.ca.gov>,
<nms@cpuc.ca.gov>,
<jaugustine@biologicaldiversity.org>,
<rcox@pacificenvironment.org>,
<norman.furuta@navy.mil>,
<bcragg@gmssr.com>,
<dkates@sonic.net>,
<jsanders@caiso.com>,
<btorgan@parks.ca.gov>,
<jjg@eslawfirm.com>,

<kmills@cfbf.com>,
<juile.greenisen@lw.com>,
<michael.gergen@lw.com>,
"Faber, Clay" <CFaber@semprautilities.com>,
<case.admin@sce.com>,
<darell.holmes@sce.com>,
<k.d.fuller@sbcglobal.net>,
<donnatisdale@hughes.net>,
<mjumper@sdihf.org>,
<rebeccap@environmentalhealth.org>,
<tgorton@cableusa.com>,
<ecp@ixpres.com>,
<ddowney@nctimes.com>,
<patricia_fallon@sbcglobal.net>,
<dandbcarey@julianweb.com>,
<gregschuett@mac.com>,
<celloinpines@sbcglobal.net>,
<vmp@sbcglobal.net>,
<skyword@sbcglobal.net>,
<colobiker@gmail.com>,
<nparinello@gmail.com>,
<cpuc@92036.com>,
<dwvoss@cox.net>,
<WSK@astro.caltech.edu>,
<carolyn.dorroh@cubic.com>,
<polo-player@cox.net>,
<soliviasmom@cox.net>,
<mkferwalt@yahoo.com>,
<oldjulianco@integrity.com>,
<wolfmates@cox.net>,
<Csmmarket@aol.com>,
<joe@ranchitarealty.com>,
<cesposit@sdcoe.k12.ca.us>,
<bgendron@nethere.com>,
<kimmerlys@yahoo.com>,
<gedrown@mindspring.com>,
<gecko_greens@juno.com>,
<webron7@yahoo.com>,
<perkydanp@yahoo.com>,
<karlhiggins@adelphia.net>,
<williegaters@earthlink.net>,
<aabed@navigantconsulting.com>,
<sfr@sandag.org>,
<jimbellelsi@cox.net>,
<srogers647@aol.com>,
<usdepic@gmail.com>,

<scottanders@sandiego.edu>,
<craig.rose@uniontrib.com>,
"Central Files" <CentralFiles@semprautilities.com>,
<Irene.stillings@sdenergy.org>,
<jennifer.porter@sdenergy.org>,
<sephra.Ninow@sdenergy.org>,
<TBlair@sandiego.gov>,
<Dahvia.Locke@sdcounty.ca.gov>,
<jfirooz@iesnet.com>,
<sanrocky@aol.com>,
<Thomas_Zale@blm.gov>,
<swilson@pcta.org>,
<Inastro@parks.ca.gov>,
<diane_fellman@fpl.com>,
<wolff@smwlaw.com>,
<rcox@pacificenvironment.org>,
<bbirdsall@aspeneg.com>,
<jay2@pge.com>,
<mspe@pge.com>,
<cem@newsdata.com>,
<jfieber@flk.com>,
<richard.raushenbush@lw.com>,
<dtk5@pge.com>,
<hzaininger@aol.com>,
<phiha@astound.net>,
<dietrichlaw2@earthlink.net>,
<editorial@californiaenergycircuit.net>,
<mrw@mrwassoc.com>,
<dmarcus2@sbcglobal.net>,
<kbagley@rwbeck.com>,
<kent@wkpalmerton.com>,
<e-recipient@caiso.com>,
<david@branchcomb.com>,
<PGS@IEEE.org>,
<lonwhouse@waterandenergyconsulting.com>,
<ddfreeman@yahoo.com>,
<abb@eslawfirm.com>,
<ahartmann@lspower.com>,
<kdw@woodruff-expert-services.com>,
<lawrence.lingbloom@sen.ca.gov>,
<rlauckhart@globalenergy.com>,
<alan.comnes@nrgenergy.com>,
<daniel@wildroseenergy.com>,
<mrx@cpuc.ca.gov>,
<jack.burke@sdenergy.org>,
<bcb@cpuc.ca.gov>,

<dhn@cpuc.ca.gov>,
<dsh@cpuc.ca.gov>,
<kwh@cpuc.ca.gov>,
<rae@cpuc.ca.gov>,
<wsc@cpuc.ca.gov>,
<sjl@cpuc.ca.gov>,
<saw@cpuc.ca.gov>,
<tdp@cpuc.ca.gov>,
<tbo@cpuc.ca.gov>,
<slee@aspeneg.com>,
<Claufenb@energy.state.ca.us>,
<mpryor@energy.state.ca.us>,
<trf@cpuc.ca.gov>,
<jgrau@energy.state.ca.us>,
<tmurphy@aspeneg.com>