

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA



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Order Instituting Rulemaking to Oversee the
Resource Adequacy Program, Consider
Program Refinements, and Establish Annual
Local and Flexible Procurement Obligations
for the 2019 and 2020 Compliance Years.

Rulemaking 17-09-020
(Filed September 28, 2017)

**COMMENTS OF THE CENTER FOR ENERGY EFFICIENCY AND
RENEWABLE TECHNOLOGIES ON
ADMINISTRATIVE LAW JUDGE'S RULING OF AUGUST 1, 2018**

August 8, 2018

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**COMMENTS OF THE CENTER FOR ENERGY EFFICIENCY AND
RENEWABLE TECHNOLOGIES ON
ADMINISTRATIVE LAW JUDGE’S RULING OF AUGUST 1, 2018**

The Center for Energy Efficiency and Renewable Technologies (CEERT) respectfully submits these Opening Comments pursuant to the Administrative Law Judge’s (ALJ’s) Ruling issued in R.17-09-020 (Resource Adequacy (RA)) on August 1, 2018 (August 1 ALJ’s Ruling). These Comments are timely filed and served pursuant to the Commission’s Rules of Practice and Procedure and the August 1 ALJ’s Ruling, including an Appendix with the Track 2 Opening Prepared Testimony of the Center for Energy Efficiency and Renewable Technologies served in this proceeding on July 10, 2018.

**I.
INTRODUCTION**

During the Prehearing Conference (PHC) held in this proceeding on August 1, 2018, consideration was given as to whether evidentiary hearings should be held in Track 2 at this time and what best next steps should be taken in Track 2. As a result of that PHC, the August 1 ALJ’s Ruling was issued that made the following directions: (1) instead of serving Responsive Testimony on August 8, parties were directed to file Comments on that same date “to include recommendations for process, scope and scheduling for Track 2,” (2) parties could also include substantive responses to the opening testimony and proposals served on July 10, 2018, (3) parties were directed to “clearly delineate the procedural and substantive sections” of their comments,

and (4) parties were directed to attach their July 10, 2018 testimony as an appendix to the comments.¹

CEERT offers these Comments in response to this Ruling that (1) address procedural recommendations, (2) offer substantive comment on the failure of many of the proposals to address the biggest long-term LCR issues, and (3) append CEERT’s Track 2 Opening Prepared Testimony served in R.17-09-020 (RA) on July 10, 2018, as Appendix A.

II.
CEERT’S RECOMMENDATIONS ON
TRACK 2 PROCESS, SCOPE, AND SCHEDULING

A. The Highest Priority Issue in Track 2 is for the Commission to Develop RA Counting Rules for Preferred Resources and Hybrid Resources.

The issue that CEERT believes should be given highest priority in Track 2 of this proceeding pertains to RA counting rules. The RA counting rules for Local Capacity Requirement (LCR) resources are still not designed to deal with preferred resources and hybrid resources. The Commission made an important step in Decision (D.) 18-06-030 by ordering that “[c]ombined storage and demand response projects are eligible to participate in the Resource Adequacy program.”² However, it gave no guidance as to how these resources should be counted.

On July 31, 2018, Southern California Edison (SCE) submitted its Revised Moorpark Sub-Area Local Capacity Requirements Procurement Plan of SCE Submitted to Energy Division Pursuant to D.13-02-015 (“Revised Moorpark Sub-Area Procurement Plan”). The Revised Moorpark Sub-Area Procurement Plan provides proposed RA counting for hybrid resources, including pairing a battery with a dispatchable generating resource, pairing a battery with a non-

¹ August 1 ALJ’s Ruling, at p. 1.

² D.18-06-030, Ordering Paragraph 14, at p. 54.

dispatchable renewable resource and pairing a battery with demand response (DR).³ It is essential that the Commission take a similar approach to the Revised Moorpark Sub-Area Procurement Plan and work with stakeholders to establish guidance on how these resources should be counted immediately.

B. CEERT’s Recommended Process for the Remainder of Track 2.

CEERT recommends the following process for the remainder of Track 2:

- *Ruling seeking comments on RA Counting Rules for Preferred Resources and Hybrid Resources.*
- *Workshop on RA Counting Rules for Preferred Resources and Hybrid Resources.*
- *Legal Briefs on identified or unresolved legal issues regarding proposals.*
- *CPUC Decision Adopting RA Counting Rules for Preferred Resources and Hybrid Resources.*

III.

CEERT IS CONCERNED THAT MOST OF THE PROPOSALS SUBMITTED THROUGH TESTIMONY DO NOT ADDRESS THE BIGGEST LONG-TERM LCR ISSUES

The only proposal submitted through testimony served on July 10, 2018 that addresses the biggest long-term LCR issues is that of California Community Choice Association (“CalCCA”).⁴ CalCCA proposes a process and general goals in Track 2 of this proceeding to initiate longer-term strategies.⁵ Specifically, CalCCA recommends the following: removing existing distributed energy resource (DER) barriers, implementing DER solutions to transmission constraints, long-term strategy benefits and long-term strategy implementation.⁶ Furthermore, CalCCA’s is the only proposal that directly addresses the market power that pivotal

³ Revised Moorpark Sub-Area Procurement Plan, at pp. 41-44.

⁴ Prepared Direct Testimony of Witnesses Lorenzo Kristov, Richard McCann and Shehzad Wadalawala on behalf of the CalCCA – Track II Issues (“CalCCA Testimony”), at pp. 32-42.

⁵ CalCCA Testimony, at p. 32.

⁶ *Id.*, at pp. 32-42.

resources have in local areas (resources that, if they retire, would create an LCR deficiency) and also the only proposal that encourages preferred resource solutions to LCR needs.⁷ The other proposals do not provide a clear strategy for how to transition to lower cost, lower carbon, non-fossil fuel resources.

This concern of how to address long-term LCR issues has been demonstrated in other areas at the Commission. For example, Pacific Gas & Electric (“PG&E”) in its Reply to Protests of Advice Letter 5322-E for Energy Storage Contracts Resulting from PG&E’s Local Sub-Area Request for Offers Per Resolution E-4909 (PG&E’s AL 5322-E Reply) addressed this issue.

PG&E stated that in that case

The specific issue in the three local sub-areas identified by the Commission is that no local capacity margin exists, meaning that when the California Independent System Operator (CAISO) identifies capacity and voltage deficiencies, the circumstances lead almost inexorably to an [Reliability Must Run (“RMR”)] designation instead of meaningful competition or considerations of alternatives, to the detriment of PG&E’s customers.⁸

This demonstrates the importance of having a clear strategy to address any LCR deficiencies and taking advantage of alternatives to non-fossil fuel resources to address these needs.

Lastly, as to the issue of the Central Buyer, CEERT recommends a movement away from a strictly Central Buyer requirement. For example, the Oakland Clean Energy Initiative (“OCEI”) Request for Offer was recently issued jointly on behalf of PG&E and East Bay Community Energy.⁹ This template offers an alternative to the 100% Central Buyer exclusivity wherein more than one entity can receive RA credit for LCR procurement.

⁷ *Id.*, at pp. 32 and 41-43.

⁸ PG&E’s AL 5322-E Reply, at p. 2.

⁹ https://www.pge.com/en_US/for-our-business-partners/energy-supply/electric-rfo/wholesale-electric-power-procurement/2018-oakland-clean-energy-initiative-rfo.page?WT.mc_id=Vanity_rfo-ocei&ctx=business

IV. CONCLUSION

As discussed above, CEERT believes that the most important issue to be considered in Track 2 is how to perform RA counting for preferred resources and hybrid resources. Furthermore, CEERT supports the CalCCA's proposal to develop a more concrete, long-term strategy to address LCR need and how to transition to lower cost, lower carbon, non-fossil fuel resources. CEERT further recommends that the Commission consider a movement away from a strict Central Buyer requirement. Finally, CEERT Appends herein as Appendix A CEERT's Track 2 Opening Prepared Testimony served on July 10, 2018.

Respectfully submitted,

August 8, 2018

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APPENDIX A

**TRACK 2 OPENING PREPARED TESTIMONY OF
THE CENTER FOR ENERGY EFFICIENCY AND RENEWABLE TECHNOLOGIES
(Exhibit CEERT-1) July 10, 2018**

Rulemaking No.: 17-09-020 (RA)

Exhibit No.: CEERT-1

Witness James H. Caldwell, Jr.

Commissioner Liane M. Randolph

ALJs Peter V. Allen
Debbie Chiv

**TRACK 2 OPENING PREPARED TESTIMONY OF THE
CENTER FOR ENERGY EFFICIENCY AND
RENEWABLE TECHNOLOGIES**

Rulemaking 17-09-020 (Resource Adequacy)

July 10, 2018

R.17-09-020 (RA)
TRACK 2 OPENING PREPARED TESTIMONY OF
CENTER FOR ENERGY EFFICIENCY AND RENEWABLE TECHNOLOGIES

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1 R.17-09-020 (RA)
2 TRACK 2 OPENING PREPARED TESTIMONY OF
3 CENTER FOR ENERGY EFFICIENCY AND RENEWABLE TECHNOLOGIES
4

5 I.
6 INTRODUCTION
7

8 The Center for Energy Efficiency and Renewable Technologies (CEERT) is a
9 nonprofit public-benefit organization founded in 1990 and based in Sacramento.
10 CEERT is a California partnership of major environmental groups and private-sector
11 clean energy companies. CEERT develops, advances, supports, and advocates for
12 policies and decisions that promote global warming solutions and increased reliance on
13 clean, renewable energy sources for California and the West. CEERT has been a long-
14 time, active party in multiple proceedings before the Commission to advance those
15 interests since its founding in 1990, including active participation to date in the
16 Commission’s Rulemaking (R.) 17-09-020 (Resource Adequacy (RA)).

17 By this testimony, Exhibit (Ex.) CEERT-1, CEERT provides its proposals on the
18 Track 2 issues identified for party testimony by Decision (D.) 18-06-030, Ordering
19 Paragraphs 10 (multi-year forward local RA requirement with a three-to-five-year
20 duration) and 11 (central buyer structures for multi-year local RA procurement).¹ By
21 D.18-06-030 issued in R.17-09-020 (RA) on June 21, 2018, the Commission sets a new
22 course for the RA program. By recognizing the long-stated argument of gas fleet
23 operators that capacity prices must rise to compensate for the fall in energy prices
24 caused by the expansion of near zero marginal cost renewables in order to keep the
25 fleet financially viable, the Commission is beginning to deal with the consequences of
26 success of the State’s Renewables Portfolio Standard (RPS) Program.

27 The Commission’s RA program currently costs ratepayers roughly \$1 billion per
28 year, and, unless action is taken to reduce the overall demand for Local Capacity
29 Requirements (LCRs) and develop cost-effective preferred resource alternatives, is on a
30 course to roughly double that figure. As the Commission begins implementing a multi-
31 year forward procurement obligation for LCR, it must make reducing LCR demand and

¹ D.18-06-030, at p. 54.
R.17-09-020 (RA)
CEERT Track 2 Opening Prepared Testimony

1 increasing alternative preferred resource supply a priority to allow for a rational
2 shrinking of the gas fleet as renewable resource penetration roughly doubles over the
3 next ten years. That process starts with Track 2 implementation of this multi-year
4 forward LCR obligation.

5 The out-year (years 2 to 5 in a multi-year obligation) LCR obligations must be
6 adjusted for investments in transmission upgrades to reduce LCR demand and RA
7 counting rules. Furthermore, dispatch practices must be modified to allow cost-effective
8 preferred resource alternatives to flourish. This is the path to cost containment while
9 maintaining reliability standards.

10 **II.**
11 **MULTIPLE YEAR FORWARD PROCUREMENT OBLIGATIONS**
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13 For the first time in years, the Commission has made a significant change in the
14 RA program in its annual RA decision. Decision 18-06-030 dated June 21, 2018, (D.18-
15 06-030) for the first time establishes a multi-year obligation for local RA at a minimum
16 for three years forward and sets the year 2 obligation at 95% of the 2019 obligation. It
17 then invites parties to propose detailed implementation proposals in Track 2.² In setting
18 the year 2 requirement at 95%, the Commission notes that the current level of LCR
19 procurement in year 2 (2020 program year) is 81%, yet significant backstop
20 procurement has taken place.³ However, the Commission also “note(s) that the
21 [California Independent System Operator] CAISO, through its existing Transmission
22 Planning Process [(TPP)], is currently considering transmission alternatives to reduce
23 LCR. Any identified alternatives through the TPP should be coordinated with future
24 procurement of local RA.”⁴

² D.18-06-030, at pp. 28 and 30.

³ In 2018, Metcalf, Yuba City and Feather River received RMR contracts and Moss Landing and Encina received CPM designations. (See D.18-06-030, at p. 25). In addition, the CAISO, in response to announced retirements of Ormond Beach and Ellwood is processing RMR/CPM applications for a portion of those units. (See D.18-06-030, at p. 35; see also CAISO 2019 Local Capacity Technical Analysis Final Report and Study Results). Finally, 3 Oakland jet fuel fired peaking plants have the only pre-existing RMR contract. (See CAISO 2017-2018 TPP).

⁴ D,18-06-030, at p. 34.

1 Every existing approved and pending Reliability Must-Run Resource (RMR)
2 contract and Capacity Procurement Mechanism (CPM) designation already has a
3 specific plan for alternative resolution that eliminates the need for continuing RMR/CPM
4 LCR procurement past 2019. However, none of these alternatives appear in the 2019
5 Local Capacity Requirements Tables in D.18-06-030.⁵ Thus, procurement of existing
6 fossil resources at 95% of 2019 requirements for 2020 will inevitably result in significant
7 over procurement for the 2020 RA program year. In fact, the CAISO 2017-2018 TPP
8 approved transmission projects that, in total, reduce 2019 LCR requirements by 1150
9 MW.⁶

10 Utility Applications pending Commission approval⁷ promise procurement of
11 another 660 MW of new preferred resource LCR supply that are not existing resources
12 in the CAISO 2019 Local Capacity Technical Analysis. Commission approved preferred
13 resource procurements that are in progress with bid due dates this very month that are
14 slated to be on line prior to 12/2020⁸ add approximately another 200 MW of LCR
15 supply. All of this will occur before any of the ongoing CAISO LCR reduction studies
16 noted by the Commission for “coordination” in the 2018 2019 TPP (draft results due Nov
17 2018) become available. These already approved plans will result in elimination of all
18 LCR requirements in the Moorpark, Santa Clara, and Oakland sub-areas and reduce
19 the South Bay/Moss Landing area need by over 50%. In addition, these plans will
20 eliminate all existing and pending RMR contracts and CPM designations.

21 At a minimum, this total of over 2000 MW of LCR reduction/new preferred
22 resource supply must be deducted from the 2019 LCR requirements before the 95%
23 2020 procurement obligation is established. Further, November draft results of studies
24 in the 2018-2019 TPP must be made part of the Track 2 record when setting the

⁵ *Id.*, at pp. 9, 10.

⁶ Various minor upgrades in the South Bay/Moss Landing area producing 568 MW of LCR benefits, the Moorpark/Pardee #4 230 kv line producing 318 MW of LCR benefits, the S Line reconductoring producing 213 MW of LCR benefits, and the transmission and storage pieces of the Oakland Clean Energy Project producing approximately 50 MW of LCR benefits. (See CAISO 2017-2018 TPP).

⁷ Pacific Gas & Electric (PG&E) Advice Letter (AL) 5322-E and Southern California Edison (SCE) Application (A.)16-11-002 (SCE Preferred Resources Pilot (PRP)-2).

⁸ PG&E Oakland Clean Energy Project and SCE Moorpark/Goleta Request for Offers (RFO). R.17-09-020 (RA)

1 baseline 2020 LCR demand that is then multiplied by 0.95 to establish the proposed
2 2020 LCR RA procurement requirements.

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**III.
CENTRAL BUYER OF A MULTIPLE YEAR FORWARD
LOCAL RA PROCUREMENT OBLIGATION**

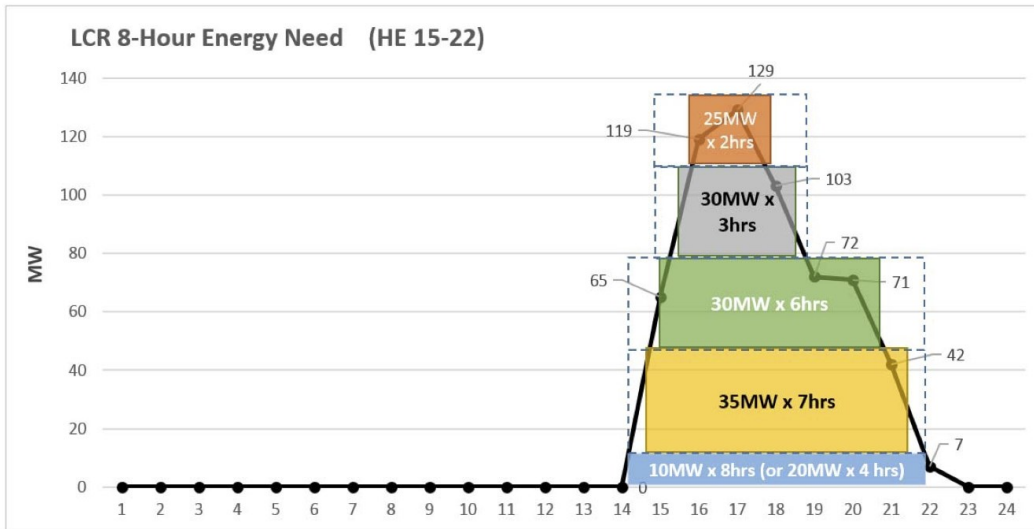
8 The only viable central buyer of Local Capacity is the Distribution System
9 Operator (DSO) of the load pocket that defines the local area. As the system transitions
10 from virtually exclusive reliance on conventional gas-fired resources to a grid that
11 depends on its dominant resource (renewables) for capacity and other essential
12 reliability services, the DSO is the only entity capable of procurement, dispatch and
13 settlement of these use-limited, distributed, hybridized resources to meet LCRs. The
14 CAISO and its optimization engine lose the ability to simultaneously optimize both the
15 system and the load pocket as the system partially islands following the transmission
16 contingency that creates the load pocket. Its optimization engine cannot “partially”
17 dispatch individual components of the mitigation package. Saving the rest of the energy
18 in each “battery” for later or using every opportunity to recharge those batteries since
19 the short run variable cost of the resource that the software optimizes is essentially
20 irrelevant under these circumstances. The engine can only deal with a single resource
21 ID for all of the hybrid parts and cannot manage the state of charge of the batteries
22 used to provide the LCR capacity over a multi-day event.


23 Thus, any action by the CAISO to procure, dispatch or financially settle these
24 clearly cost-effective and reliable preferred resources must pass through the DSO and
25 back to the CAISO, risking exceptional dispatch, slowing response time, limiting
26 flexibility and creating ambiguity. The CAISO can notify the DSO whenever load is
27 projected to be high enough that, if the contingency occurs, a load pocket will be
28 created. The CAISO can also notify the DSO that such an event has occurred, but it is
29 then virtually powerless to “optimize” the response with distributed, use limited

1 resources. The following graph from the SCE Moorpark/Goleta Request for Proposal
2 (RFP)⁹ illustrates the point:

3
4

SCE Santa Clara Sub-area Need



5  Depiction of meeting LCR energy need in 4-hour blocks

6

7 The Slide illustrates the Santa Clara LCR need as calculated by the CAISO and
8 as SCE intends to meet the need with 100% RA eligible resources. Assuming that the
9 entire need is met with 4-hour batteries, the LCR need in SCE's scenario is 645 MWH
10 and requires over 800 MWH of energy to recharge the batteries. The CAISO's dispatch
11 software is incapable of dispatching the batteries in this manner and only "sees" a 129
12 MW deficiency spread over 8 hours. Its optimization engine would require 816 MWH of
13 batteries and require over 1 GWH of energy to recharge them for the next day. The
14 situation only gets worse from there as the DSO "learns" how to use Energy Efficiency
15 (EE), Demand Response (DR) and local solar photovoltaic (PV) to meet the LCR need.
16 Imagine the "hill" that is depicted above with its top lopped off by EE, with a large "bite"
17 taken out of its afternoon flank by local PV and another large bite taken out of its late
18 afternoon/early evening flank by "slow response" DR. The CAISO optimization engine is
19 now truly at a loss. Only the DSO can dispatch these resources effectively. A balanced

⁹ SCE 2018 Local Capacity Requirements Request for Proposals (LCR RFP), Demand Response and RA Capacity Webinar, June 21, 2018 Slide 5

1 portfolio of these resources effectively substitutes low cost DR and EE and on-peaking
2 energy supplying solar PV for long duration energy storage. A roughly equal portion of
3 each of these resources reduces batter requirements to roughly 200 MWH and reduces
4 the portfolio cost by roughly 50% or more.

5 Note that none of these very effective measures “counts” for LCR under current
6 rules. The EE does not have enough duration, the DR takes too long to be called, and
7 the Effective Load Carrying Capability (ELCC)¹⁰, and therefore the Net Qualifying
8 Capacity (NQC), of the solar is very low. All of these issues will have to be dealt with in
9 future RA proceedings, but they are obviously cost-effective and RA counting rules will
10 surely evolve to recognize the obvious.

11 Track 2 needs to start this process now by designating the DSO as the “central
12 buyer” and delegating the task of dispatch of these resources and settling financially
13 with its customers to the DSO – regardless of who is the LSE in the load pocket.

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¹⁰ Note that if the ELCC were to be calculated for LCR only, and not for system RA, the NQC of a solar storage hybrid would be very high since the solar reduces the need to discharge the batteries and provides charging energy during peak load hours.

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IV. CONCLUSION

It is CEERT's position that the Commission has the wrong priorities in choosing to increase RA costs through multi-year procurement obligations as a way of "bribing" existing generators to stick around a little while longer. Instead, the priorities should be to reduce LCR demand and increase the supply of zero carbon LCR preferred resources as a means of mitigating the market power of existing resources under current rules. However, the Commission can take modest, common sense steps in Track 2 along this path and factor in these steps in setting forward procurement obligations. This is a lower cost, higher reliability win-win in both the short term and the long view.

R.17-09-020 (RA)
TRACK 2 OPENING PREPARED TESTIMONY OF
CENTER FOR ENERGY EFFICIENCY AND RENEWABLE TECHNOLOGIES

APPENDIX A

STATEMENT OF QUALIFICATIONS

CENTER FOR ENERGY EFFICIENCY AND RENEWABLE TECHNOLOGIES

STATEMENT OF QUALIFICATIONS OF JAMES H. CALDWELL, JR.

Q1 *Please state your name and business address.*

A1 My name is James H. Caldwell, Jr., and my business address is 1650 E Napa Street, Sonoma CA 95476. The offices of the Center for Energy Efficiency and Renewable Technologies (CEERT) are located at 1100 11th Street, Suite 311, Sacramento, CA 95814.

Q2 *Briefly describe your present employment.*

A2 I am an independent consultant who specializes in renewable resources and transmission policy. My current clients include CEERT and several renewable developers interested in the California market. My detailed resume is attached.

Q3 *Please summarize your professional background.*

A3 My academic and professional background includes over fifty years of experience in the energy industry. For the past thirty years, I have specialized in renewable technology and project development including photovoltaic solar, concentrating solar thermal power, wind, biomass, and geothermal. I have been employed in technical and executive positions in the oil industry (Atlantic Richfield), the California utility industry (Los Angeles Department of Water and Power), the US Department of Energy, renewable trade associations, and several large and small renewable resource developers. I have a BS degree in Chemical Engineering from Stanford University and an MBA from California State University at Long Beach. My detailed resume is attached.

Q4 *Have you previously testified on behalf of CEERT before the California Public Utilities Commission?*

A4 Yes. I have testified multiple times before the Commission over the last 25 years on topics ranging from energy resource planning and policy to procurement. Most recently, I testified on behalf of CEERT in A.16-08-006 (Pacific Gas and

Electric Company (PG&E) Diablo Canyon) and Tracks 1 (Local Reliability) and 4 (San Onofre Nuclear Generating Station (SONGS) of the Commission's Long-Term Procurement Plan (LTPP) Rulemaking (R.12-03-014).

Q5 *What is the purpose of your testimony?*

A5 The purpose of my testimony is to sponsor Exhibit CEERT-1, the Track 2 Opening Prepared Testimony of the Center for Energy Efficiency and Renewable Technologies (CEERT) in R.17-09-020 (RA).

Q6 *Are the statements made in your testimony true and correct to the best of your knowledge and belief?*

A6 Yes.

Q7 *Do you adopt Exhibit CEERT-1 as your sworn testimony in R.17-09-020?*

A7 Yes.

Q8 *Does this conclude your statement of qualifications?*

A8 Yes, it does.

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James Caldwell is a renowned energy professional with fifty years of experience in virtually all phases of energy production and public policy. He has Chemical Engineering and MBA degrees with an extensive plant operations and construction management background, as well as hands on corporate planning and finance experience. He has managed large organizations, been an officer of a Fortune 100 company, and started his own business. Relevant experience is as follows:

PRIVATE CONSULTING (October 2010 to Present)

For the past six years, Mr. Caldwell has used his expertise to leverage the achievement of California's goal for producing a large majority of its electricity from renewable resources with an interim goal of 33% of electric demand by 2020 while maximizing development of in-state renewable resources, managing customer bills through cost control of renewable development and grid integration, improving energy efficiency, and actively involving consumers through what is known as Demand Response. He serves as Senior Advisor for the Center for Energy Efficiency and Renewable Technologies (CEERT) in advocating this long term policy and near-term actions to achieve defined milestones before the California Public Utilities Commission, the California Energy Commission, the California Independent System Operator, the Legislature, Governor's Office, and other state and local government agencies. He also advises a number of renewable development companies on specific project matters typically involving grid interconnection, transmission and wholesale market issues.

SOLAR MILLENNIUM, LLC (February 2010 to October 2010)

Mr. Caldwell was an executive consultant to Solar Trust of America, a German owned manufacturer/developer of solar thermal technology, assisting them in permitting and interconnecting 2250 MW of solar projects in California and Nevada. He devised a transmission strategy to interconnect 1500 MW of these projects to the CAISO grid with over 90% of the required transmission upgrades funded by the interconnecting utility rather than the project developer. This strategy required two policy changes by the CAISO and favorable FERC and CPUC rulings.

He also functioned as President of Solar Millennium, LLC (the development arm of Solar Trust of America) in charge of permitting before the California Energy Commission and the Bureau of Land Management. This strategy resulted in receiving both State and Federal authorization to commence construction on 1500 MW of new solar thermal facilities covering more than 11,000 acres in the Eastern Mojave Desert. Formal agreements to support the projects were reached not only with State and Federal regulatory agencies, but also with Riverside County, Native American Tribes, labor unions, and five national and regional environmental groups.

LOS ANGELES DEPARTMENT OF WATER AND POWER (December 2006 to October 2009)

Mr. Caldwell joined the Los Angeles Department of Water and Power as a full time executive consultant reporting to the General Manager and the Board of Water and Power Commissioners. In March 2008, he was appointed Assistant General Manager of LADWP for Environmental Affairs. He resigned from that position in October 2009. He managed corporate environmental affairs and advised the Department on its Power Integrated Resource Plan to dramatically increase the use of renewable energy, eliminate reliance on coal, engage the customer base in energy efficiency and clean distributed generation, and improve the efficiency and flexibility of the Department's natural gas generation. He also advised the Department on

its Water Integrated Resource Plan to generate all new water resources for the City of Los Angeles from recycling and storm water capture while significantly reducing per capita water consumption. In addition to the Corporate Planning role for both the Water and the Power System Integrated Resource Plans, Mr. Caldwell had line responsibility for siting, permitting and obtaining California Environmental Quality Act approvals for the projects that made up the Department's Integrated Resource Plans. He also designed and implemented new City Planning ordinances for water conservation, customer based renewable energy development (called a "Feed In Tariff"), and low impact development.

PPM ENERGY (June 2004 to December 2006)

Mr. Caldwell joined PPM Energy (now Iberdrola Renewable Energy) as Director of Renewable Policy. At PPM, he was responsible for regulatory affairs, transmission policy, and wholesale market structure issues nationwide, and legislative affairs in California. PPM Energy has a wind project development pipeline of over 10,000 MW spread throughout the country. Mr. Caldwell was responsible for ensuring that state legislation, transmission tariffs, market rules, and transmission expansion projects are in place to facilitate the build-out of that pipeline. Much of this effort focused on implementation of ambitious Renewable Portfolio Standard programs in California, Colorado, Minnesota, New York, Iowa, and Texas.

AMERICAN WIND ENERGY ASSOCIATION (May 2001 to May 2004)

As Policy Director, Mr. Caldwell was responsible for AWEA's Transmission Initiative to integrate wind into the nation's wholesale electricity market structure and create regional grids capable of moving significant amounts of wind energy from resource rich areas to load centers. He led the wind industry effort at the Federal Energy Regulatory Commission to adopt balanced national market rules to facilitate entry of this unique technology into wholesale electricity markets while ensuring grid reliability and avoiding subsidies to wind and/or cost shifting onto other technologies and market participants. This effort led to a series of FERC Orders and adoption of innovative market rules at, for example, the Bonneville Power Administration, the California Independent System Operator, the Midwest Independent System Operator, the PJM Independent System Operator, ERCOT (Texas), the New York Independent System Operator, and the Western Area Power Administration. He advised AWEA's Legislative and Communications staff on all technical matters and served as liaison to regionally based environmental/energy company organizations (including CEERT in California) pursuing renewable energy development.

RENEWABLE RESOURCES (October 1980 to April 2001)

Mr. Caldwell is the former President of ARCO Solar Inc., the photovoltaic subsidiary of Atlantic Richfield Company. In that position, he was also a Vice President of Atlantic Richfield Company. As President of ARCO Solar, Mr. Caldwell took that company from a research organization with less than \$3 million in revenue to an integrated worldwide manufacturing and marketing operation with over \$30 million in sales. He created joint ventures in Japan and Germany, and partnered with ninety-six exclusive distributors selling ARCO Solar products in 126 countries. Prior to becoming President, Mr. Caldwell was the Senior Vice President for Manufacturing, Research, and Engineering where he constructed what, at the time, was the world's largest photovoltaic central station power plant, the 6.5 MW Carisso Plains project in Central California, as well as every large grid connected photovoltaic project constructed anywhere in the world prior to 1990. When Atlantic Richfield decided to sell ARCO Solar, Mr. Caldwell left ARCO and attempted to purchase the company. He raised over \$50 million in equity to purchase and fund the company's business plan, but was outbid by Siemens AG in July of 1989.

After leaving ARCO, Mr. Caldwell started his own consulting/project development business. He developed numerous power plant projects around the globe in partnership with Bechtel Enterprises and several European organizations. Projects included a 300 MW combined cycle gas fired power plant in Thailand, a 30MW gas turbine/water desalination cogeneration facility in an oil refinery on the island of

Cyprus, a 10 MW waste wood fired power plant in northern California, and a 5 MW diesel generator/water desalination cogeneration facility in the Cape Verde Islands.

Mr. Caldwell's consulting clients included most of the national environmental organizations with a direct interest in energy policy including the National Resources Defense Council, the Sierra Club, Union of Concerned Scientists, and Environmental Defense. He also consulted for several independent power producers including Enron and PG&E's National Energy Group, and regional transmission organizations such as the California Independent System Operator.

ATLANTIC RICHFIELD COMPANY (August 1965 to September 1980)

Prior to his assignment with ARCO Solar, Mr. Caldwell held a variety of positions over a twenty-four year career with Atlantic Richfield. After graduating from college, he began employment with ARCO's predecessor, Richfield Oil Corporation, as a Refinery Process Engineer. A fourteen-year stint in refinery operations culminated in the position of Refinery Operations Manager at ARCO's Los Angeles refinery.

Mr. Caldwell was then assigned as Manager of Downstream Planning in ARCO's Corporate Planning Department. He oversaw ARCO's capital budget and worldwide strategic business plan for refining and marketing; petrochemicals; transportation including oil and gas pipelines and marine shipping; and ARCO's non-energy related diversification program. He led a corporate team that developed company investment and research policy for all synthetic fuels including coal gasification, coal liquefaction, biomass to energy, and concentrating solar power.

After leaving Corporate Planning and before assignment to ARCO Solar, he was the Project Manager and Owner's Representative for the Colony Oil Shale Development Company in Denver CO -- ARCO's primary venture into synthetic fuels. In addition, he managed ARCO's non-energy diversification effort into agricultural genetic engineering and vegetable seed production.

AFFILIATIONS

Mr. Caldwell is a former member of the Clean Air Act Advisory Committee for the Environmental Protection Agency, the Energy Modeling Committee of the Energy Engineering Board of the National Academy of Sciences, the Advisory Committee on Energy Policy for the Office of Technology Assessment, and the Advisory Board for the USAID Energy Training Program. He is a life member of the IEEE and the AIChE. Along with his wife, Jan McFarland and V. John White, in 1990 he helped found the Center for Energy Efficiency and Renewable Technologies in Sacramento, CA, and currently serves as Senior Advisor and At Large Member of the Board of Directors.

EDUCATION

Mr. Caldwell received a B.S. Degree in Chemical Engineering from Stanford University (1965) and an MBA from California State University at Long Beach (1978). He is married with three children and three grandchildren.

References on request.