BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Oversee the Resource Adequacy Program, Consider Program Refinements, and Establish Annual Local Procurement Obligations.	Rulemaking 11-10-023 (Filed October 20, 2011)

SIERRA CLUB AND VOTE SOLAR INTITIATVE COMMENTS ON THE RESOURCE ADEQUACY AND FLEXIBLE CAPACITY PROCUREMENT JOINT PARTIES' PROPOSAL

Kelly M. Foley
The Vote Solar Initiative
2089 Tracy Court
Folsom, CA 95630
Telephone: (916) 367-2017
E-mail: kelly@votesolar.org

Attorney for Vote Solar Initiative

Matthew Vespa
Staff Attorney
Sierra Club
85 Second St., 2nd Floor
San Francisco, CA 94105
Telephone: (415) 977-5753
E-mail: matt.vespa@sierraclub.org

Attorney for Sierra Club

Dated: December 26, 2012

TABLE OF CONTENTS

TABLE OF AUTHORITIES

CASES

STATUTES

SIERRA CLUB AND VOTE SOLAR INTITIATVE COMMENTS ON THE RESOURCE ADEQUACY AND FLEXIBLE CAPACITY PROCUREMENT JOINT PARTIES' PROPOSAL

Pursuant to the Phase 2 Scoping Memo and Ruling of Assigned Commissioner and Administrative Law Judge filed December 6, 2012, the Sierra Club and Vote Solar Initiative (Vote Solar) submit the following comments on the October 29, 2012 Resource Adequacy and Flexible Capacity Procurement Joint Parties' Proposal ("Joint Proposal") prepared by the California Independent System Operator (CAISO), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE) (collectively, the "Joint Parties").

I. INTRODUCTION

The Joint Proposal seeks to impose an "interim" flexible capacity procurement obligation on all LSEs beginning in 2014. The Joint Proposal is intended to address perceived urgency in ensuring the availability of flexible resources to address a projected steep late afternoon ramp rate caused by the higher penetration of solar and wind resources. The Joint Proposal would limit participation to fossil-fuel resources, defines the flexible capacity product in a manner that would likely exclude low-carbon solutions, is silent with regard to potential added cost, and provides little, if any, technical support to justify the near-term need for flexible capacity procurement. The Sierra Club and Vote Solar urge the Commission to reject the Joint Proposal.

As a threshold matter, flexible capacity procurement is not needed in the near-term. The Joint Proposal's assertion that flexible capacity will be required by 2015 is based on unsupported factual assertions, unjustified timing assumptions, and flawed technical analyses. For example, the CAISO analysis uses an erroneous 2020 solar resource output curve to depict future ramping need and overly conservative assumptions about the ramp rates of existing gas-fired generation resources in California. To the limited extent the need for system flexibility will increase by 2020, this need can be met with existing resources that are already providing these services as part of their existing obligation to serve. In short, the Joint Proposal is a solution to a manufactured crisis.

Second, the Joint Proposal is inconsistent with Commission policies and Resource Adequacy (RA) requirements including required cost, economic, and environmental considerations. "Interim" or not, the exclusive ability of fossil fuel resources to qualify for the proposed flexible capacity procurement is contrary to the loading order and will create reliance

and expectation for added payments to fossil fuel generators that function to crowd out innovative low-carbon solutions to renewable integration. In addition, although minimization of costs associated with RA is required under the Public Utilities Code, the Joint Proposal's failure to address cost makes it impossible to meaningfully evaluate the Proposal and potential alternatives.

By proposing to provide additional financial payments to further incentivize development and retention of fossil fuel generators, the Joint Proposal has significant greenhouse gas and air quality implications. The Commission must analyze these potential impacts under the California Environmental Quality Act (CEQA). CEQA review is not only required, but will provide the Commission and the public with a much needed opportunity to understand the environmental consequences of changes to the existing capacity program and ensure that any changes to RA are consistent with California's near and long-term greenhouse gas reduction objectives.

The Sierra Club and Vote Solar recognize that significantly increased penetration of wind and solar resources may ultimately necessitate a shift in the existing Resource Adequacy program to valuing flexible capacity over firm capacity. However, rather than rush to put in place an unneeded and costly compensation scheme that bolsters fossil fuels, the Commission should thoughtfully consider modification to Resource Adequacy through an open and transparent process that accounts for cost, accurately estimates need, ensures preferred resources and storage can effectively participate, and assesses and adopts feasible design changes to mitigate any potential environmental impacts.

II. INTERIM FLEXIBLE CAPACITY PROCUREMENT IS UNNECESSARY

The Joint Proposal's underlying premise that there is an immediate need to ensure procurement of flexible capacity does not withstand scrutiny. The Joint Parties significantly overstate the need for additional ramping capability through 2020. Moreover, existing generation can provide more than enough ramping capacity to meet even the most inflated projections of need for 2020. The significant excess ramping capacity already in the system highlights the lack of immediate need for additional RA payments to flexible resources. Indeed, the Joint Parties have made no compelling showing that existing or new generators should be paid a supplemental fee for a service they were designed to provide (load following) and have

always been expected to provide.[1]

A. Critical Grid Reliability Risks in 2020 Will Not Be Substantially Different in 2020 than in 2012

The CAISO peak load has decreased nearly 4,700 MW from the all-time 2006 peak of 50,085 MW to 45,429 MW in 2011.[2] The peak load in 2012 was 46,654 MW,[3] about 3,500 MW below the 2006 peak. The 2012 planning reserve margin for the CAISO system is approximately 33 percent, about double the planning reserve margin requirement of 15 to 17 percent.[4] The CAISO control area has ample reserve generation to meet foreseeable peak demand, whether or not San Onofre Nuclear Generating Station is available.[5]

CAISO indicates it anticipates a need for a system-wide ramp rate of as much as 7,700 MW/hr in 2020 (130 MW/min). This is only incrementally higher than the current maximum ramp rate of approximately 6,000 MW/hr experienced in the CAISO control area.[6,7]

B. The CAISO 2020 Load Curve Is Based on an Erroneous Solar Profile

The Joint Parties' exclusive justification for flexible procurement is the 2020 late afternoon ramp rate projected by CAISO caused principally by a rapid decline in solar resource output. The steep ramp rate presumed by CAISO is not supported by the solar profile relied on by CAISO.

CAISO has identified its July 2011 testimony before the CPUC as the basis for the graphical CAISO solar profile that is driving the need for fast response peaking resources.[8] The

---

[1] Technical analysis of the Joint Parties' Proposal was conducted for the Sierra Club and Vote Solar by Bill Powers, P.E, Powers Engineering.

[2] CAISO, *2012 Summer Loads and Resources Assessment*, March 15, 2012, p. 7. "The ISO summer peak dropped each year from 50,085 MW in 2006, which was high because of extreme weather conditions, to 45,809 MW in 2009 as demand moderated during the recession and rose to 47,127 MW in 2010 and fell to 45,429 MW in 2011."

[3] CAISO OASIS "System Demand" database, August 13, 2012, HE 17.

[4] Ibid, p. 2. "Under the normal peak demand scenario, the planning reserve margin is expected to be 32.7% for the ISO system as a whole."

[5] Subtracting 2,000 MW for the SONGS outage, and adding 452 MW for the restart of Huntington Beach Units 3 and 4, results in an adjusted CAISO system planning reserve margin of 27 percent.

[6] CAISO PowerPoint presentation to Sierra Club, August 21, 2012, p. 8. Peak ramp rate on typical high demand day in 2020 occurs between 17:00 and 19:00. Load at 17:33 is 22,500 MW. Load at 18:51 is 32,500 MW. Hourly ramp rate = 60 min/hr × [(32,500 MW – 22,500 MW)/(18:51 – 17:33)] = 60 min/hr × (10,000 MW/78 min) = 7,692 MW/hr.

[7] Comment of CAISO CEO Steve Berberich during meeting with Sierra Club representatives, August 21, 2012. Maximum current ramp rate in CAISO control area is approximately 6,000 MW/hr.

[8] CAISO, *Track I Direct Testimony of Mark Rothleder on Behalf of the California Independent System Operator Corporation*, CPUC R.10-05-006 - Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans, July 1, 2011, Exhibit 2.

testimony addresses five CPUC 33% RPS scenarios. All five scenarios include some level of fixed and tracking solar resources, as well as 1,749 MW of fixed CSI rooftop PV. A summary of the solar resources included in the CPUC "basecase" and "environmental" 33% RPS scenarios is provided below in Table 1.

Table 1. Solar resources included in "basecase" and "environmental" CPUC 33% RPS scenarios

Category	Basecase (MW)		Environmental (MW)	
	Tracking	Fixed	Tracking	Fixed
Solar thermal	3,939	0	~1,500	0
Large PV	1,560	2,464	~1,600	~1,100
Small PV	0	1,045	0	~9,000
Distributed PV	0	1,749	0	1,749
Totals:	5,499	5,258	~3,100	~11,850

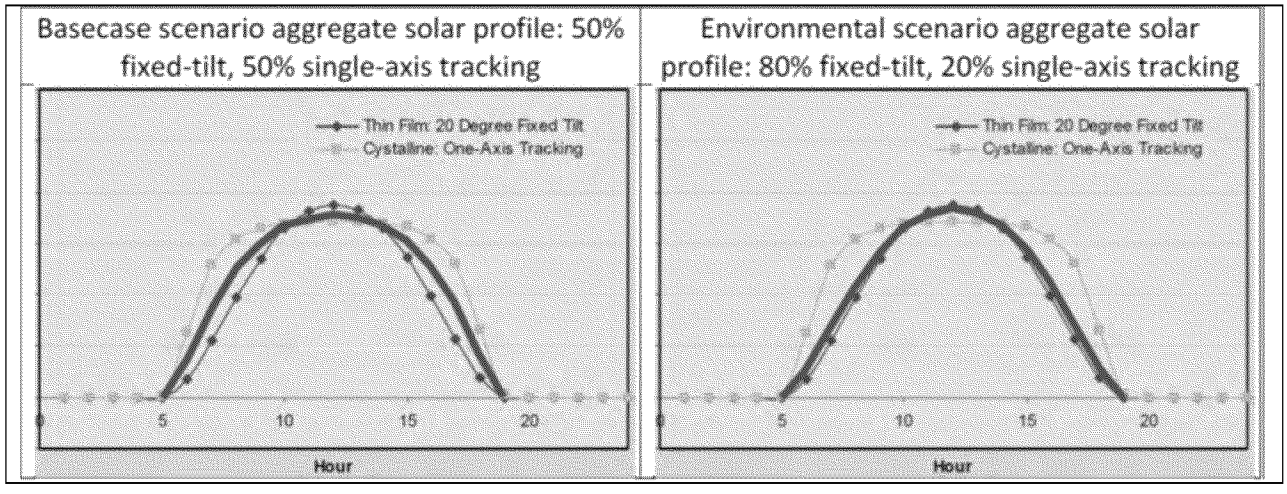
In the "basecase" scenario, the scenario CAISO utilized to develop its graphical solar profile, approximately 50 percent of the solar resources are fixed-tilt (5,258 MW) and 50 percent are tracking (5,499 MW). The aggregate solar profile for this solar resource mix would be half-way between a gradual fixed-tilt profile and a steep single-axis tracking profile. In the CPUC "environmental" scenario, 80 percent of the solar resources are fixed-tilt and the aggregate solar profile will be very similar to a fixed-tilt profile. The aggregate solar profile of these two scenarios is shown in Figure 1.

However, the graphical profile of the CPUC 50/50 fixed-tracking solar basecase profile being used by CAISO to assert a 13,000 MW ramp rate over two hours in 2020, shown in Figure 2 (yellow line), matches a single-axis tracking profile. This results in a significant overstatement of flexibility need through 2020. To provide a more accurate estimate, CAISO must present a graphical solar profile that is consistent with the assumed 50/50 solar resource mix. The solar profile being used by CAISO is not consistent with a 50/50 solar resource mix.[9]

/////

[9] CAISO should also be critically assessing a range of RPS scenarios (including the CPUC "environmental" scenario) and their implications for fast response resources, and weighing-in on which scenario(s) results in the minimum amount of fast response resource requirements, and not assuming the basecase CPUC 2020 RPS scenario is the only scenario.

Figure 1. Aggregate solar profiles of "basecase" and "environmental" 33% RPS scenarios



The decline rate of solar output in the afternoon, assuming the basecase 2020 solar resource profile of 10,757 MW assumed by CAISO and presented in Figure 1, is shown quantitatively in Table 2. The highest 1-hour solar output decline rate of 3,200 MW per hour occurs from 6 pm to 7pm.

Table 2. Estimated Basecase 2020 Solar Profile Afternoon Output Decline

Hour	1 pm	2 pm	3 pm	4 pm	5 pm	6 pm	7 pm
Solar output, MW	10,750	10,500	9,700	8,300	5,700	3,200	0

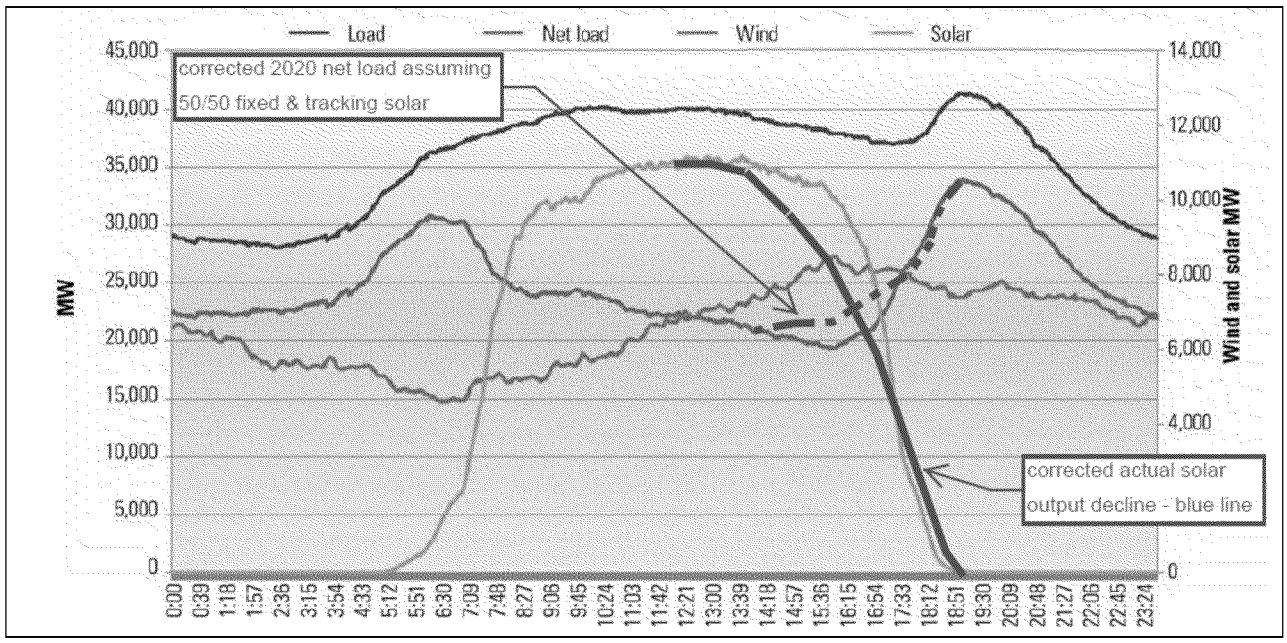
Utilizing an accurate 2020 solar resource output decline rate results in a substantially less rapid ramp rate-of-change in 2020 than has been represented by CAISO. Figure 2 is the CAISO graphic showing the solar and wind resource assumptions that drive the projected afternoon net load ramp rate. The ramp rate is almost entirely driven by the assumed solar output decline rate, and secondarily by the projected early evening load increase shown as a hump between 6 pm and 9 pm in the total load curve (top blue line). Powers Engineering has overlaid an accurate solar resource decline curve (blue) on the CAISO assumed solar output curve. The result is a more gradual afternoon ramp rate (dashed red line), especially in the 5 pm to 6 pm period.

The peak hour-to-hour CAISO system ramp rates projected in 2020, using the accurate 2020 solar resource profile, are provided in Table 3.

Table 3. Hourly 2020 Ramp Rates When Accurate 2020 Solar Profile Is Used

Hour	4 – 5 pm	5 – 6 pm	6 – 7 pm	7 – 8 pm
Ramp rate, MW/hr	+3,000	+3,000	+7,000	-2,000

Figure 2. Revised CAISO Afternoon Ramp Rate Assuming Accurate Solar Profile



CAISO already experiences ramp rates as high as 6,000 MW/hr.[10] Steep ramp rates are a characteristic of the CAISO control area and these ramp rates are being effectively met with existing resources.

C. CAISO Assumptions about Ramp Rates of Existing Resources Are Overly Conservative

CAISO ramp rate assumptions for existing California generation are overly conservative. Table 4 summarizes CAISO assumptions regarding the ramp rates of existing resources.[11] CAISO shows a typical ramp rate for combined cycle units of 5 to 10 MW per minute

[10] Sierra Club California, *Stakeholder Comment – CAISO Flexible Capacity Procurement Revised Draft Final Proposal August 17, 2012*, August 28, 2012. p. 3, *available at* http://www.caiso.com/Documents/SierraClubCA-Comments-FlexibleCapacityProcurementRevisedDraftFinalProposal.pdf.

[11] CAISO, *Integration of Renewable Resources – Operational Requirements and Generation Fleet Capability at 20% RPS*, Table 2-9, p. 39.

(MW/min). Yet the published ramp rate for combined cycle units is 7 percent per minute.[12,13] There is 16,200 MW of combined cycle capacity in California.[14] The typical minimum load on a combined cycle plant is approximately 40 percent.[15]

Table 4. CAISO Assumptions on Ramp Rates of Existing Generation

Generation Type		Ramp Rate (MW/min) by Category						
		RR < 0.5	0.5 ≤ RR < 1	1 ≤ RR < 5	5 ≤ RR < 10	10 ≤ RR < 20	20 ≤ RR	Total MW
Non-OTC Units	Combined Cycle			4,885	4,630	3,617		13,132
	Dynamic Schedule				552	1,746	2,379	4,676
	Gas Turbine	32	68	1,040	4,635	1,601	553	7,929
	Hydro	99	157	427	1,135	1,927	3,671	7,416
	Other	5	4	14	1,633		4	1,660
	Pump/Storage				440		1,792	2,232
	Recovery	61	17	115	13			206
	Steam	357	355	1,328	747	59		2,847
	Not specified	5	6	42	1,568	20	525	2,165
Non-OTC Unit Total		559	607	7,851	15,353	8,970	8,924	42,263
OTC units	Combined Cycle			600				600
	Gas Turbine			15				15
	Steam		354	8,542	5,650	1,516	1,510	17,573
OTC Unit total		0	354	9,158	5,650	1,516	1,510	18,188
All Units Total		559	961	17,008	21,003	10,486	10,434	60,451

Forty percent of 16,200 MW is 6,480 MW. California has nearly 10,000 MW, from 6,480 MW to 16,200 MW, of usable combined cycle capacity that can ramp collectively at 700 MW/min. There are also combined cycle units in Nevada, Arizona, and Baja California, such as SDG&E's 500 MW El Dorado plant in Boulder City, NV and Sempra's 600 MW plant in Mexicali, Baja California (under CAISO dispatch control), that are available to contribute additional ramping capacity. 10,000 MW of combined cycle capacity ramping up at 7 percent per minute means the entire 10,000 MW can be added to meet demand in the CAISO control area in less than 15 minutes. This exceeds the 7,700 MW/hr ramp rate projected by CAISO in 2020.

[12] Southern California Public Power Authority, *Request for Proposals for Software Products and Services for the Magnolia Power Project*, July 17, 2012, pdf p. 41. "Design ramp rate over the Normal Range is approximately 18 MW per minute." Unfired capacity of Magnolia is 254 MW per Magnolia CEC Staff Assessment, January 2002, p. 3.9-5. With duct firing and steam augmentation maximum plant output is 328 MW. Ramp rate of 18 MW/min over 254 MW of unfired capacity equals a ramp rate of 18 MW/min ÷ 254 MW = 7%/min.

[13] Northwest Power Planning Council, *New Resource Characterization for the Fifth Power Plan - Natural Gas Combined-Cycle Gas Turbine Power Plants*, August 8, 2002, p. 5. "New & clean: 540 MW (baseload), 610 MW (peak), Minimum load: 40%, Ramp rate: 7%/min." See: http://www.westgov.org/wieb/electric/Transmission%20Protocol/SSG-WI/pnw_5pp_02.pdf.

[14] CEC, *Thermal Efficiency of Gas-Fired Generation in California – Staff Paper*, August 2011, Table 2, p. 3.

[15] See footnotes 16 and 17.

As of August 2011, California had added 4,331 MW of new combustion turbines since 2000.[16] Most of these new turbines are either 50 MW LM6000s, 50 MW FT-8s, or 100 MW LMS100s. The predominant model is the LM6000. All of these units can go from cold start to full power in 10 minutes. The LM6000 can go from cold to full power in 5 minutes by maintaining package purge requirements and keeping the lube oil warm.[17] The LM6000 can ramp at 30 MW/min under normal conditions.[18] The FT-8 can ramp at a rate of at least 15 MW/min.[19] The LMS100 can ramp at 50 MW/min.[20] Much of the 3,000 MW of pre-2000 combustion turbine and internal combustion engine capacity, such as smaller Frame 5 combustion turbines, can also go from cold to full capacity in approximately 10 minutes.[21] The Frame 5 can move through its entire range in one minute.[22]

CAISO identifies 7,416 MW of hydro resources and 2,232 MW of pumped hydro resources. CAISO claims that these hydro resources have an average ramp rate of approximately 20 MW/min. PG&E states that Helms can go from a dead stop to 1,212 MW in eight minutes.[23]

---

[16] CEC, *Thermal Efficiency of Gas-Fired Generation in California – Staff Paper*, August 2011, Table 2, p. 3.

[17] E. Wacek – GE, *Aeroderivative Technology: A more efficient use of gas turbine technology*, presented at World Energy Congress, January 15, 2010, p. 7 (draft). "Also to support quick and frequent starts/stops, the LM6000 standard 10 minutes start time can be improved to just 5 minutes. The 10-min start is outlined in Figure 3, and shows the sequence that includes purge time, warm-up time, and finally gas turbine ramp time. By properly maintaining the package purge requirements, and by keeping the lube oil 'warm', approximately 2 minutes can be removed from the 10-min start sequence. Then the gas turbine acceleration rate to full load can be increased from 12 MW/min to 50 MW/min, reducing the time from sync idle to full load from 4 minutes down to approximately 1 minute. This reduced start time greatly enhances the LM6000's ability to get online quickly to support a reduction in load from the wind farm due to sudden changes in wind conditions."

[18] GE Energy, VOC Emissions from LM6000 for Mariposa Energy, LLC, May 26, 2010, p. 2. "These unique features of Aeroderivative gas turbines result in a superior simple-cycle efficiency (40-44%) with unmatched operational flexibility (10min start, 30 MW/min ramp rate)." See: http://www.baaqmd.gov/~/media/Files/Engineering/Public%20Notices/2010/20737/Application%20Correspondence%20and%20Supporting%20Documents/043-email%205-26-2010%20CH2M%20to%20Patil%20Attached%20Doc_26.ashx?la=en.

[19] W. Rhoads – Northwest Energy, *Mill Creek Generating Station - A Model For Future Regulation Needs*, Presented at PowerGen 2010, December 15, 2010, p. 16. "Once in operation, a single (FT-8) unit can ramp up or down at a rate of at least 15 MW per minute."

[20] CEC, *Final Staff Assessment - CPV Sentinel Energy Project*, October 2008, p. 5.3-6. "When running at half load (50 MW), the machine can reach full load of nearly 100 MW in less than a minute. In addition, the LMS100 can go from a cold start to full load in ten minutes."

[21] E-mail from S. deMille, senior technician, Kaui Electric, to B. Powers, Powers Engineering, regarding cold to full load for two Kaui Electric Frame 5 turbines, July 30, 2012. "A normal cold start or any start will ramp GT-1 on line in about 14 minutes and GT-2 in about 11 minutes. Initiating a" Fast Start" will probably cut that time in half."

[22] E-mail from S. deMille, senior technician, Kaui Electric, to B. Powers, Powers Engineering, regarding cold to full load for two Kaui Electric Frame 5 turbines, August 27, 2012. "We can bring the units on line to sync our units in, and load them as quickly as we wish. We have seen them absorb full load within a minute."

[23] M. Yeung – PG&E, *Helms Pumped Storage Plant*, Northwest Wind Integration Forum Workshop, October 17, 2008, p.4.

This is a ramp rate of approximately 150 MW/min.[24] Extrapolating from the ramp rate data presented by PG&E for Helms, assuming other pumped hydro units in California are smaller than Helms, the total pumped hydro resource of 2,232 MW could go from dead stop to rated capacity in under 10 minutes.

It is reasonable to assume that the 80 MW/min ramp rate per unit at Helms is representative of hydroelectric units generally.[25] Even if only one-half to two-thirds of the hydro resource potential was available for fast ramping, this is still 3,708 to 4,944 MW of fast ramp hydro resources.

Using the hydro ramp rate assumption reported by PG&E, the combined fast ramp pumped hydro and conventional hydro resource is in the range of 5,000 to 7,000 MW,[26] with a collective ramp rate of at least 500 to 700 MW/min.[27]

The collective ramp rate of California's existing fleet of combined cycle plants, 2000 and later combustion turbines, and hydro units is at least 1,600 MW/min assuming all combustion turbines are ramping from a cold start.[28] The total ramping capacity of the existing combined cycle plants, combustion turbines built in 2000 or later, and hydro units, achievable in less than one hour, is approximately 20,000 MW. This ramping capacity does not include approximately 3,000 MW of older pre-2000 peaking units and over 16,000 MW of OTC steam boiler units. There is no 2020 ramping scenario that would come close to requiring the ramping rate speed in MW/min or ramping capacity in MW that is achievable with existing generation resources. Moreover, the significant excess of ramping capacity already in the system further illustrates the lack of need for additional resource adequacy payments to flexible resources.

/////

/////

---

[24] Ibid, p. 4. PG&E identifies the ramp rate for the three-unit Helms Pumped Storage Plant as 80 MW/min per unit. PG&E does not explain the discrepancy between an 80 MW/min ramp rate for each of the three hydroturbine units at Helms, a total of 240 MW/min, and the combined ramp rate of 150 MW/min.

[25] Power Engineering, *Hydroelectricity: The Versatile Renewable*, June 1, 2009, p. 4. "Hydro also provides high-quality ancillary grid support. For example, Grand Coulee Dam on the Columbia River in Washington State can go from low load to full load (about 800 MW) in matter of seconds."

[26] It is assumed that 100 percent of pumped hydro capacity is available for ramping, and one-third to one-half of hydro capacity is available for ramping.

[27] It is conservatively assumed that any hydro resource can go from full stop to full load in ten minutes or less.

[28] Combined cycle, 700 MW/min; 2000 and later combustion turbines (cold start to full load in 10 minutes); 400 MW/min; hydro units, 500 to 700 MW/min.

The new flexible resources sought by CAISO have a substantial cost to ratepayers. 4,600 MW of rapid response peaking capacity would have a capital cost of more than $5 billion.[29,30] The CEC projects the levelized cost-of-energy for new merchant combustion turbines at 5 percent capacity factor at $0.84/kWh.[31] All this cost would be borne by ratepayers. In contrast, no costs would be borne by ratepayers for behind-the-meter DG solar or combined heat and power installations that are higher in the state's preferred resource loading order than peaking gas-fired generation.

D. CAISO Presumption of Across-the-Board OTC Thermal Unit Retirements in 2017 is Unsupported

Owners of the coastal OTC thermal units indicate that cooling towers could be added to these units for $125/kW or less, about one-tenth the cost of new combustion turbine or combined cycle capacity,[32] to allow indefinite operation of these units as low-cost peaking generation with heat rates comparable to those of new combustion turbines.[33] The CAISO presumption of a wholesale retirement of OTC thermal units by 2017 is unsupported. CAISO is now seeking authority to keep the OTC boiler plants online even after their OTC compliance dates if CAISO deems these units necessary for grid reliability.[34]

E. Large Amounts of New Flexible Generation Continue to Come Online in the CAISO Control Area

Large amounts of new flexible generation continue to come on-line in the CAISO control area. For example, over 2,000 MW of gas-fired generation is scheduled to come online in PG&E

---

[29] CAISO, *2013 Flexible Capacity Procurement Requirement - Supplemental Information to Proposal*, March 2, 2012, p. 3. "ISO projects this capacity gap to grow to 4,600 megawatts by 2020. The ISO's analyses identifying this capacity gap take into account new capacity additions, most of which will be variable energy resources. The 4,600 megawatt deficiency by 2020 also assumes that the 535 megawatt Sutter Energy Center, which is currently at risk of retirement, is part of the supply fleet."

[30] CEC, *Comparative Costs of California Central Station Electricity Generation – Final Staff Report*, January 2010, Table 2, p. 9. Capital cost of 49.9 MW combustion turbine = $1,292/kW in 2009 dollars. 4,000 MW x $1,292/kW x 1,000 kW/MW = $5.168 billion. The CEC report also indicates a substantial increase in capital of combustion units over time.

[31] Ibid, Table 4, p. 18 (assumes combustion turbine capacity factor of 5 percent).

[32] Ibid, Eric Pendergraft – AES, p. 108. ". . . rough ballpark for wet cooling at our sites it's approximately $125 or $115 a kilowatt. So for our 4,000 megawatts you're looking at, you know, 500 million dollars, half a billion dollars to retrofit with wet cooling."

[33] CEC, *Thermal Efficiency of Gas-Fired Generation in California – Staff Paper*, August 2011, Table 2, p. 3. Heat rate aging OTC boiler plant = 11,269 Btu/kWh. Heat rate combustion turbine online in 2000 or later = 11,202 Btu/kWh.

[34] SNL Financial, *CAISO to ask FERC for "backstop" procurement authority for flexible generation*, August 21, 2012.

territory in the next few years (600 MW RCEC, 760 MW Marsh Landing, 624 MW Oakley, 200 MW Mariposa). Approximately 2,000 MW of new gas-fired generation is under construction in SCE territory (800 MW Sentinel, 570 MW El Segundo, 500 MW Walnut Creek). All of this SCE territory generation is expected to be online by August 1, 2013 to address 2013 peak demand. It is not clear whether the Joint Parties or CAISO is accounting for this large influx in flexible generation in asserting the need for even more flexible generation by 2020. The significant amount of additional generation coming on-line also suggests that additional resource adequacy payments for flexibility are unnecessary to prompt new investment in gas-fired generation.

F. Generators Should Not Receive Additional Payments for Capabilities They Are Already Expected to Provide

As set forth above, there is no physical shortage of sufficient flexible resources. Two hours of ramping in the 5 to 7 pm window (see Figure 2) over 90 spring days would be 180 hours of ramping per year. 180 hours per year of ramping duty in the springtime (approximately 2 percent of total hours in a year), when daytime loads are much lower than during the summer peak demand period, can readily be met by existing and under- construction combined cycle and simple cycle units in the CAISO control area.

Historically, this ramping power would have been provided without further discussion as a part of the IOU's obligation to serve. Ramping at the rate necessary to meet the 2020 afternoon load shown in Figure 2 presents no technical or resource challenges for the existing fleet of gas turbine resources in the CAISO control area. Combined cycle units will be online in the daytime and can ramp just as fast as state-of-the-art peaking units when online. 1970s-vintage Frame 5 turbines can go from a cold start to full power in 10 minutes, just as the state-of-the-art units can.

The Joint Proposal's effort to pay generators for "flexibility" is akin to paying a taxi driver a premium for using fourth gear while driving on the freeway to the airport. Use of fourth gear is simply a part of the range of service provided by the taxi driver to assure prompt arrival to the destination. Under the proposed pricing regime however, the customer would be charged a separate premium to use the full capabilities of the taxi. Nothing has changed operationally.

G. Ramping Needs Will Be Predictable, and Resources to Meet the Forecast Can Be Scheduled in Day-Ahead and Hour-Ahead Markets

CAISO does not currently monitor or control DG solar output,[35] despite DG solar being the predominant solar resource in the state in 2012. In contrast, SCE included the ability to both monitor and control solar inverter output from its DG solar urban warehouse rooftop project totaling 250 to 500 MW.[36] 100 kW or larger DG solar projects in Germany are required to incorporate smart inverters that permit remote monitoring and control by the grid operator.[37] Requiring this same inverter functionality for solar resources in California would provide CAISO with the ability to control transients at the source and lessen/eliminate the need for CAISO to dispatch order the emergency dispatch of flexible units to meet unanticipated ramping loads.

State-of-the-art solar and wind forecasting can eliminate the need to add additional rapid response flexible resources. Germany has focused its efforts on improved wind and solar forecasting, not the construction of a new generation of rapid response gas turbines.[38] The accuracy of renewable energy resource forecasts in Germany, Spain, and California are compared in Table 4.[39]

/////

/////

/////

---

[35] KEMA, *European Renewable Distributed Generation Infrastructure Study – Lessons Learned from Electricity Markets in Germany and Spain*, prepared for CEC, December 27, 2011, p. 114. *See* http://www.energy.ca.gov/2011publications/CEC-400-2011-011/CEC-400-2011-011.pdf. "Unlike Germany, the California ISO has no visibility of the energy production of DG resources connected to the distribution system and cannot send dispatch commands to these DG resources. This is especially true for DG resources that are connected behind the meter at a customer site and the DG output is netted with the customer load. By virtue of its balancing area authority status, the California ISO must be prepared to cover the total load at the customer site in the event that the DG unit shuts down, but the amount of load being offset by DG output is typically unknown to the California ISO."

[36] SCE Application A.08-03-015 (to CPUC), *Solar Photovoltaic (PV) Program Testimony*, March 27, 2008, p. 27. "The inverter can be configured with custom software to be remotely controlled. This would allow SCE to change the system output based on circuit loads or weather conditions."

[37] KEMA, *European Experience Integrating Large Amounts of DG Renewables – CEC IEPR Committee Workshop*, May 9, 2011, p. 19. See: http://www.energy.ca.gov/2011_energypolicy/documents/2011-05-09_workshop/presentations/04_KEMA_Morning_5-9-11.pdf.

[38] KEMA, *European Experience Integrating Large Amounts of DG Renewables – CEC IEPR Committee Workshop*, May 9, 2011, p. 21. "Originally, a significant increase in reserve requirement as a result of growing wind power was expected in the future. However, latest studies have concluded that improved wind forecasts will not require any additional reserves until 2020."

[39] Id. at 22.

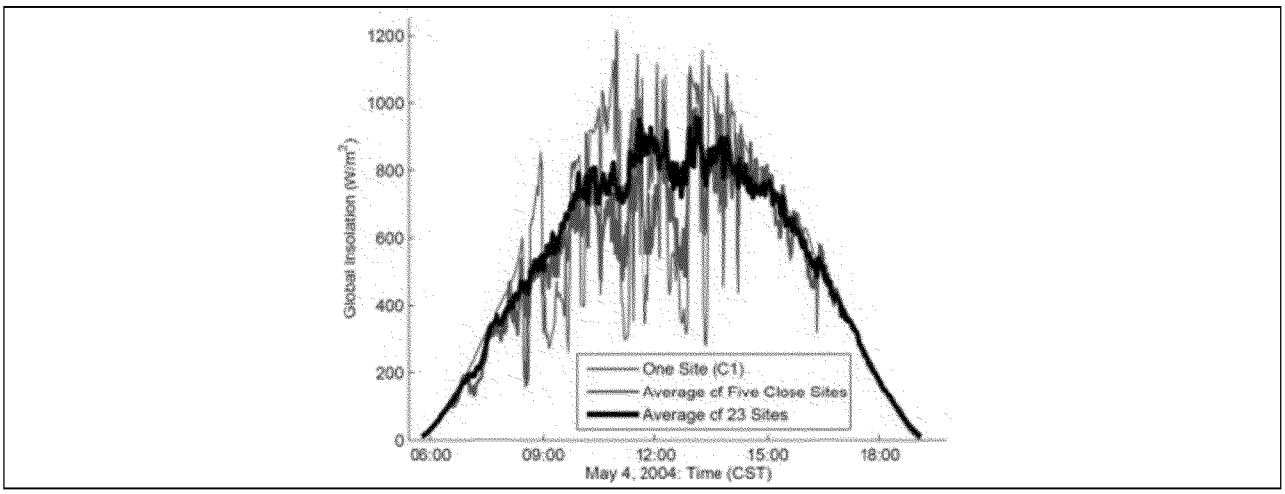
Table 4. Renewable energy forecast accuracy in Germany, Spain, and California

RMSE Renewables Forecast Error	Germany, Spain[2]	California[1]
Day-Ahead	< 5%	< 15%
1 Hour-Ahead	1.5%	<10%

CAISO identifies a large degree of "variability and uncertainty" in solar resources on a minute-to-minute basis on partly cloudy days, implying that large amount of rapid response gas-fired generation will be necessary to "fill the gaps."[40] This is also an erroneous assumption on the level of the CAISO control area. There are tens of thousands of distributed solar installations spread over thousands of square miles in California in 2012 that collectively produce a bell curve output on partly cloudy days.[41] See Figure 4.

Dozens of utility-scale RPS solar installations spread over thousands of square miles in the Colorado Desert, Mojave Desert, and Central Valley will also produce a collective bell curve output on partly cloudy days. The output of a single solar installation on a partly cloudy day, whether distributed solar or utility-scale solar, is not representative of the collective solar output in the CAISO control area now or in 2020.

Figure 4. Output Variability of Multiple Dispersed Solar Facilities



[40] CAISO PowerPoint presentation to Sierra Club, August 21, 2012, p. 8.
[41] Lawrence Berkeley National Laboratory, *Implications of Wide-Area Geographic Diversity for Short-Term Variability of Solar Power*, September 2010, p. 25. See: http://eetd.lbl.gov/ea/emp/reports/lbnl-3884e.pdf.

H. 2020 Ramp Rates Can Be Met with Current Requirement that 50 Percent of Reserves Must Be Spinning Reserves

The percentage of spinning reserves maintained in 2012 is adequate as well for 2020, given the maximum projected 2020 ramp rate will not be substantially different than the maximum ramp rate in 2012.

III. THE JOINT PROPOSAL IS CONTRARY TO COMMISSION POLICIES AND RESOURCE ADEQUACY REQUIREMENTS

A. The Joint Proposal Ignores Added Cost to the RA Program

The Joint Proposal's lack of any economic and cost information is a serious informational omission that both precludes an informed evaluation of the proposal and is contrary to RA requirements. Public Utilities Code section 380(b) requires that the Commission, "in establishing resource adequacy requirements," achieve all of several objectives, including:

> (1) Facilitate development of new generating capacity and retention of existing generating capacity ***that is economic and needed***.
>
> (3) ***Minimize*** enforcement requirements and ***costs***.[42]

Despite these clear requirements, the Joint Parties fail to provide any information on or discussion of the potential economics and costs associated with implementing their vision for a flexible capacity procurement obligation. As a result, neither the Commission nor stakeholders have any idea of whether the Joint Proposal will result in a flexible capacity product that is economic or cost-effective for LSEs, in particular, non-IOU LSEs, to implement. Prior to the adoption of any changes to the RA program, the Commission must thoroughly explore cost implications and ensure costs are minimized to the extent feasible.

For example, during the CAISO's December 17, 2012 web meeting, a non-IOU LSE representative stated that the Joint Proposal may be difficult and expensive for non-IOU LSE's to implement, especially since the Joint Proposal mandates that only flexible capacity products that can provide three hour ramping can qualify. The representative stated it may be more economic and less costly for non-IOU LSE's to procure three one-hour ramping products as opposed to a single three hour ramp product. Another benefit of allowing LSEs to procure ramping products of less than three hours duration would be to significantly increase the number and variety of generation resources that could provide flexible capacity, thereby increasing options and

[42] Emphasis added.

competition and reducing prices. Limiting flexible capacity procurement products to only those capable of providing three hour ramping will, for all practical purposes, require LSEs to purchase fossil-fired generation products, resulting in decreased competition, increased prices and GHG emissions and freezing out more preferred resources for years to come.

In addition to considering the economic value of procurement of a shorter duration ramping product, any legitimate proposal to alter the RA program should evaluate the feasibility of cost neutrality. For example, as system needs shift toward the need for flexible over firm capacity, it may be that resources that offer flexibility are valued more and those that offer only firm capacity are valued less. As firm, non-flexible, capacity will increasingly become unneeded and potentially problematic as higher levels of solar and wind generation come on-line, the Commission should consider devaluation of firm capacity as part of any changes to the RA program.

B. The Joint Proposal Would Result in a Locked-In, Long-Term Preference for Fossil-Fired Generation at the Expense of Preferred Resources, More Cost-Effective Solutions, and Technological Innovation

The Joint Parties disingenuously assert that the Joint Proposal is only an "interim" requirement until a final, long-term flexible capacity solution can be vetted and adopted by the Commission. Yet, as the CAISO acknowledged during its Dec. 17, 2012 web meeting, the key elements of its "interim" proposal, in particular, the three hour ramping requirement, are intended to be "durable" and continue as the basis for the final solution. In other words, if the Commission adopts the interim Joint Proposal, the Commission will have both predetermined the framework for the final solution and virtually mandated the long-term use of fossil-fueled generation for that purpose. Although the CAISO asserts that the Joint Proposal is "technologically agnostic,"[43] the practical result of the Joint Proposal's three hour ramping requirement is to eliminate all but fossil-fueled generation from qualifying to supply the specified flexible capacity procurement obligation. Since it must be presumed that fossil-fueled generators will require long-term contracts to supply the three hour ramping flexible capacity product, the result of adopting the interim Joint Proposal will be to lock-in the use of fossil-fired generation for the long-term. This will preclude the use of preferred resources and storage to address the perceived problem at the expense of ratepayers and California's environmental and

[43] Joint Proposal, p.12 and Dec.17, 2012 CAISO web meeting.

clean energy policies. In effect, the Joint Proposal is like an employer that wants a specific person to be hired, regardless of requirements for open and fair hiring requirements, and so tailors the job requirements in such a way that only that specific person can qualify.

In addition, adoption of the Joint Proposal would have a chilling effect on the development and implementation of technological improvements that may be available by the end of the decade, when some kind of flexible capacity procurement obligation may be beneficial. For example, new, more sophisticated inverters are being installed for PV systems that can provide frequency response, reactive power and other services; improved PV panel efficiencies and a change from fixed to tracking will increase capacity and availability; and adding storage to all types of renewable energy will increase flexibility and dispatchability and reduce variability. The Commission should be moving forward to encourage these and other low- and no-carbon means of providing system capacity and reliability, which will help California to reach its policy goals for improved efficiency, lower costs and reduce emissions and environmental impacts. Adoption of the Joint Proposal would be a giant step backward in realizing these beneficial outcomes.

C. The Joint Proposal Violates Loading Order Requirements

Fundamental to the Commission's RA review process is compliance with loading order requirements and the need to meet greenhouse gas emission reduction goals. By mandating the use of fossil-fired generation to satisfy its proposed flexible capacity procurement obligations, the Joint Proposal improperly circumvents the Commission's authority and mandate to consider whether more preferred resources in the loading order would better satisfy the proposed RA obligations.

In particular, the Joint Proposal fails to consider whether demand response might provide some or all of the necessary flexibility to deal with the asserted over generation and ramping problems supposedly demonstrated in Figure 1 of the Joint Proposal. The Joint Proposal's exclusion of demand response is contrary to the CAISO's own recognition of the critical role of demand response in renewable integration. In the prior RA proceeding, R.09-10-032, during a Jan. 18, 2011 workshop on demand response and RA issues, the CAISO presented the following slide:

The Commission does not have the freedom to ignore loading order requirements or the benefits of demand response in its determinations about RA capacity requirements. The Commission must consider whether other, more preferable resources can satisfy a flexible capacity procurement obligation and ensure that such resources are not preempted by the Joint Parties' Proposal.

D. "Simplicity" Cannot Trump Commission Resource Adequacy Goals and Requirements

As the Joint Parties note, their Joint Proposal is a "simplified" solution, with the implication that the Joint Proposal can, therefore, be implemented quickly and easily.[44] However, as discussed in these comments, this "simplified" solution cannot be properly vetted in the time frame requested by the Joint Parties and, if adopted, will impose excessive and unnecessary costs on LSEs and lock-in in for years to come fossil-fired generation as the only permitted source for their proposed flexible capacity procurement requirements. Especially in

[44] Joint Proposal, p.25

light of the actual lack of near-term need, simplicity and speed do not justify Commission adoption of the Joint Proposal.

IV. ADOPTION OF THE JOINT PROPOSAL WILL HAVE REASONABLY FORESEEABLE INDIRECT EFFECTS ON THE ENVIRONMENT THAT MUST BE ANALYZED UNDER CEQA

The Joint Parties' proposed flexible capacity procurement obligation has significant implications for both the achievement of California's near and long-term greenhouse gas reduction objectives and emissions of other air pollutants. The proposal would provide additional financial payments of undisclosed magnitude to fossil fuel generators in exchange for a commitment from these generators to standby to provide 3-hour ramping capability. Zero and low-emission resources, such as energy storage and demand response, are excluded or disfavored under the proposal. Even among fossil fuel resources, the proposal is indifferent to their respective environmental attributes and fails to incentivize procurement from cleaner and more efficient facilities. By providing additional economic incentives exclusively to fossil fuel generators, new fossil fuel facilities will likely be constructed, fossil fuel power sources that may otherwise have retired absent these payments will likely stay operational, generators that may have turned off will likely stay idled. Indeed, this is the Proposal's very purpose.

The California Environmental Quality Act (CEQA) requires the Commission to analyze and disclose the environmental implications of increased payment to fossil fuel generators for the provision of flexible capacity. CEQA is intended to "[e]nsure that the long-term protection of the environment … shall be the guiding criterion in public decisions" by compelling "government at all levels to make decisions with environmental consequences in mind."[45] The foremost principle under CEQA is that the Legislature intended the act "to be interpreted in such manner as to afford the fullest possible protection to the environment within the reasonable scope of the statutory language."[46] With limited exceptions, CEQA requires state and local agencies to prepare and certify "an environmental impact report on any project which they propose to carry out or approve that may have a significant effect on the environment."[47]

/////

[45] Pub. Res. Code § 21001(b); *Bozung v. LAFCO* (1975) 13 Cal.3d 263, 283.
[46] *Laurel Heights Improvement Ass'n v. Regents of Univ. of Cal.* (1988) 47 Cal.3d 376, 390 (citation omitted).
[47] Pub. Res. Code § 21100(a).

The addition of flexible capacity procurement to the Resource Adequacy program is a "project" under CEQA triggering environmental review. CEQA defines "project" as an "activity which may cause either a direct physical change in the environment of a reasonably foreseeable indirect physical change to the environment."[48] Agency approval of financial payments to incentivize actions with environmental effects is considered a "project." For example, in *California Unions for Reliable Energy v. Mojave Desert Air Quality Management District*, the court determined that a proposed agency rule providing payments for road paving projects to offset increases in airborne dust and other airborne pollution triggered CEQA because the additional road paving that would result from the increased financial incentives under the rule would have adverse environmental impacts.[49] Similarly, by proposing a compensation regime that provides additional economic incentives for fossil fuel generation, the Joint Parties' Flexible Capacity Procurement would result in adverse environmental impacts from increased emissions of carbon and other air pollutants. CEQA requires the Commission analyze the extent to which the added financial payments to fossil fuel resources would undermine California's ability to achieve its near and long-term carbon goals of reducing greenhouse gas pollution to 1990 levels by 2020 and 80% below 1990 levels by 2050.[50]

Not only is CEQA review required, but it will provide the Commission and the public with a much needed opportunity to understand and mitigate the environmental consequences of changes to the existing capacity program. As noted by the Regulatory Assistance Project in a study on capacity markets, "[a] market price for capacity or energy that favors the construction and operation of high carbon-emitting resources over clean resources will lead to increases – rather than reductions – in the cumulative level of emissions in the power sector."[51] While a cap-and-trade program can internalize some of these costs, additional payment to fossil fuel plants through the proposed Flexible Capacity Procurement would dilute the modest price signal sent by a price on carbon emissions. Indeed, with global carbon pollution continuing to increase along a trajectory that will result in increasingly severe climate-related impacts, the importance

[48] Pub. Res. Code § 21075; Ca. Code Regs., tit. 14 [hereinafter "Guidelines"] § 15378.
[49] *California Unions for Reliable Energy v. Mojave Desert Air Quality Management District* (2009) 178 Cal.App.4th 1225.
[50] See *Cleveland National Forest Foundation et al v. San Diego Ass'n of Governments*, Case No. 2011-00101593 (San Diego Sup. Ct., Dec. 3, 2012) (regional transportation plan violated CEQA by failing to address project's lack of consistency with California's 2050 greenhouse gas emission reduction targets)."
[51] See, e.g., Regulatory Assistance Project, The Role of Forward Capacity Markets in Increasing Demand-Side and Other Low-Carbon Resources (May 2010) at 20, available at http://raponline.org/document/download/id/91.

of ensuring that California's capacity program does not operate at cross purposes with the State's decarbonization objectives cannot be overstated.[52]

Relevant questions to ask in evaluating the environmental effects of changes to the Resource Adequacy program include:

- Whether the changes encourage new investments in high-emitting resources (including repowering) at the expense of low-carbon alternatives?
- Whether the changes encourage continued (or increased) operation of existing, high emitting power plants?
- Whether the changes result in build-out of capacity and cumulative emissions that conflict with needed levels of de-carbonization – or make attainment of these levels more costly?[53]

Potential mitigation of environmental effects could include:

- Factoring in carbon intensity of resources providing flexibility such that high polluting resources are paid less than zero/low carbon resources for provision of the same service. This could be designed in a cost neutral manner.
- Provide a mechanism for demand response and energy storage to qualify as flexible capacity resources prior to program initiation
- Minimize need for flexible capacity through an energy imbalance market

/////

/////

/////

[52] See, e.g., United Nations Environmental Programme (UNEP), The Emissions Gap Report 2012 (Nov. 2012) at 1, available at http://www.unep.org/pdf/2012gapreport.pdf (finding that "[c]urrent global emissions are already considerably higher than the emissions level consistent with the 2°C target"). The 2°C target was originally adopted by the European Union as the threshold level for "dangerous" climate change in 1996. However, much smaller increases in global mean temperature than previously thought are now believed to result in substantial environmental and socio-economic consequences. See, e.g., Joel B. Smith et al., Assessing Dangerous Climate Change Though an Update of the Intergovernmental Panel on Climate Change (IPCC) "Reasons for Concern," PNAS EARLY EDITION (2008) at 1, available at http://www.pnas.org/content/106/11/4133.full.pdf+html?sid=484b9fdf-3109-42f2-81fc-a20271a6bae4.

[53] These questions are derived from Regulatory Assistance Project, The Role of Forward Capacity Markets in Increasing Demand-Side and Other Low-Carbon Resources (May 2010). While that paper focuses on forward capacity markets, the market signals resulting from added payment for flexible capacity raise similar concerns.

V. THE COMMISSION SHOULD BEGIN AN OPEN AND TRANSPARENT STAKEHOLDER PROCESS TO CONSIDER CHANGES TO THE RESOURCE ADEQUACY PROGRAM

The Joint Proposal is the result of an exclusive three month collaboration of the CAISO and the three major IOUs (although PG&E ultimately declined to sign on to the Joint Proposal).[54] Given its many shortcomings, the Commission should reject the Joint Proposal and order the CAISO and IOUs to begin an open and transparent stakeholder process at the Commission to determine the need for, timing of, and acceptable design for any future flexible capacity procurement obligation.

VI. CONCLUSION

The Sierra Club and Vote Solar appreciate the opportunity to comment on the Joint Proposal and look forward to working with the Commission in ensuring any changes to the RA program are made in an environmentally sustainable and cost-effective manner.

Dated: December 26, 2012

Respectfully submitted,

/s/ Kelly Foley

Kelly M. Foley
The Vote Solar Initiative
2089 Tracy Court
Folsom, CA 95630
Telephone: (916) 367-2017
E-mail: kelly@votesolar.org

Attorney for Vote Solar Initiative

/s/ Matthew Vespa

Matthew Vespa
Staff Attorney
Sierra Club
85 Second St., 2nd Floor
San Francisco, CA 94105
Telephone: (415) 977-5753
E-mail: matt.vespa@sierraclub.org

Attorney for Sierra Club

[54] Id.