Docket No.: R.10-05-006

Exhibit No.: ____________________

Date: August 4, 2011

TRACK 1 DIRECT TESTIMONY
OF CALPINE CORPORATION

Q. Please state your name and title.

A. My name is Matthew Barmack. I am Director, Market and Regulatory Analysis for Calpine Corporation ("Calpine"). In this role, I work on market and regulatory issues before the California Public Utilities Commission ("Commission") and the California Independent System Operator Corporation ("CAISO") related to long-term procurement, resource adequacy ("RA") requirements, and renewable resources.

Q. Briefly summarize your educational background and professional experience.

A. I have been at Calpine for approximately two years. Prior to joining Calpine, I worked at Pacific Gas and Electric Company ("PG&E") for approximately two years. During my time at PG&E, I focused on resource adequacy policy, the valuation of offers in competitive solicitations, and analytic issues associated with valuing the capacity attributes of generation, demand response, and other resources. Before joining PG&E, I worked in economic consulting for nine years, first at the Brattle Group and subsequently at Analysis Group. Most of my consulting work involved the economic analysis of wholesale power markets, including the estimation of integration costs for renewable resources, the analysis of bidding behavior in bid-based wholesale markets, and the application of the competitive screens that the Federal Energy Regulatory Commission uses in analyzing mergers and granting market-based rate authority. I have an AB degree in economics from Harvard College and a Ph.D. in economics from the Massachusetts Institute of Technology.

Q. What is the purpose of your testimony?

A. My testimony addresses the need for existing resources to satisfy flexibility and other capacity-related reliability requirements during the 2011-2020 planning horizon - specifically, existing resources that do not have contracts that ensure their continued availability. My testimony does not address the need for new resources at this time.

The renewable integration modeling preformed by the CAISO[1] and jointly by PG&E, Southern California Edison ("SCE") and San Diego Gas & Electric Company ("SDG&E") (jointly, the "IOUs")[2] assumes that most existing generation will remain available to help meet local and/or system needs, including renewable integration needs, through 2020. In particular, all of the scenarios modeled by the CAISO and IOUs assume the continued availability of existing resources that are not under contracts to, or owned by, load serving entities ("LSEs"). Current and expected wholesale market conditions, however, do not provide reasonable opportunities for such existing resources to secure sufficient revenue streams to recover going forward costs, including maintenance necessary to ensure availability in the future. Accordingly, the assumption that existing resources without contracts will remain available throughout the 2011-2020 planning horizon may not be valid.

As I discuss in detail below, two sensitivity analyses performed by Calpine demonstrate that, if existing resources assumed to be available in the CAISO and IOU models shut

[1] *See* Track 1 Direct Testimony of Mark Rothleder on Behalf of the California Independent System Operator Corporation ("CAISO Track 1 Testimony").

[2] *See* Southern California Edison Company, Pacific Gas and Electric Company, and San Diego Gas & Electric Company System Resource Plan ("Joint IOU Supporting Testimony").

down during the planning period, substantial amounts of new replacement resources may be necessary to satisfy reliability and renewable integration needs. Such replacement resources are undesirable from both social and ratepayer perspectives, because retaining existing flexible capacity is generally lower cost than developing equally flexible new resources.

In addition, the potential exists to increase the operating flexibility of existing generation resources through modest additional investment. Such upgrades could improve flexibility by, for example, shortening start times and improving ramp rates. If future modeling identifies a need for additional flexible resources during the planning horizon, upgrades to existing resources could be a cost-effective option for meeting future integration and reliability needs. However, if existing resources shut down, the opportunity to upgrade these units will be lost.

To better ensure that existing resources assumed to be available in the CAISO and IOU modeling are actually available, procurement mechanisms to secure the availability of existing resources are necessary. Such mechanisms must provide a sufficiently stable revenue stream to recover going forward costs and support maintenance necessary to ensure availability in the future. Calpine recommends that the IOUs be directed to hold intermediate term (3-5 years) resource solicitations for flexible capacity from existing resources. Terms of 3-5 years will secure the availability of existing resources while remaining uncertainty about the need for renewable integration resources and new compensation opportunities, such as those associated with the CAISO's development of new products for renewable integration, is resolved. To the extent the Commission determines that the costs of additional procurement of existing resources should be allocated to other LSEs, mechanisms such as the Cost Allocation Mechanism ("CAM") already exist that can serve as a template for such cost allocation.[3]

Q. What is the purpose of the sensitivity analyses performed by Calpine?

A. The purpose of the sensitivity analyses is to identify the contribution of existing resources to satisfying the flexibility and other capacity requirements that have been the focus of the renewable integration modeling in this proceeding, including the impact on the need to procure additional resources should certain existing resources assumed to be available in the CAISO and IOU modeling shut down.

Q. Explain how the sensitivities were performed.

A. The contribution of existing resources to flexibility requirements was identified by making certain changes to the "Step 2" modeling done by the CAISO and IOUs. Specifically, approximately 3,200 MW of uncontracted Calpine combined cycle gas turbine ("CCGT") capacity was removed from the Step 2 modeling to represent an "economic retirement" scenario in which existing resources shut down because revenues are insufficient to recover going forward costs or do not support investment in maintenance necessary to ensure availability in the future.

[3] Alternatively, procurement requirements could be placed on all LSEs, including non-IOUs.

The CAISO's Trajectory High Load case was used as the baseline case for one of the sensitivities because it reflects a reasonable middle ground in the 0 – 8,200 MW range of "need" identified in the various modeling scenarios performed by the CAISO and IOUs.[4] In addition, focusing on a case in which new resources are needed (and hence all existing resources are needed as well) avoids complexities associated with the unquantified surplus flexibility that may be latent in existing resources.

I performed a separate sensitivity using the Commission prescribed Trajectory case. The Trajectory case does not show a need for new resources to satisfy reliability and renewable integration needs.

Q. Why were 3,200 MW of Calpine CCGTs used in the sensitivity analysis?

A. The specific Calpine CCGTs were used because some of the units do not currently have contracts and none of the units have contracts that extend beyond 2013 (*i.e.*, they will be exposed to short-term markets in the near future). In addition, the units are generally similar to other units (both Calpine and non-Calpine) that were built in the past 10 years and are not under long-term contracts. Thus, the Calpine CCGTs represent a broader set of existing resources at risk of economic retirement.

[4] *See* Joint IOU Supporting Testimony at 3-3 (Table 3-1); CAISO Track 1 Testimony at 43.

Q. Why are existing units without multi-year contracts at risk for economic retirement?

A. Because existing resources traditionally have been precluded from participating in the IOUs' long-term resource solicitations, market opportunities for resources without contracts are limited to the short-term bilateral market for RA capacity; energy and Ancillary Services ("AS") markets operated by the CAISO; and medium-term (2-5 year) bilateral contracting opportunities associated primarily with the IOUs' intermediate-term solicitations for energy, RA, and bundled products. While some combination of these mechanisms may provide adequate compensation to some resources, there is no certainty that a specific resource can obtain adequate compensation through these mechanisms. For example, as discussed below, the supply of RA at both the system level and in many local areas is greater than the required procurement. Similarly, intermediate term resource solicitations are competitive and many offers into these solicitations are rejected. Calpine recommends additional procurement that parallels the structure of these existing mechanisms in order to ensure that more resources are secured.

For example, the short-term bilateral market for RA capacity generally yields low compensation and is likely to yield even lower compensation as the RA market becomes oversupplied. The RA program imposes obligations on LSEs to procure RA capacity at the "system" level as well as in specific load pockets.[5] Because there is no demand elasticity for RA capacity and because, at least in the short-run, the supply of RA

[5] RA requirements are fixed. At the system level, LSEs are required to procure sufficient capacity to meet a 15-17% planning reserve margin. In local areas, LSEs are required to procure specific amounts of capacity set by the CAISO's Local Capacity Technical studies.

capacity is fixed and inelastic, when supply exceeds demand, as is projected to be the case at both the system level as well as in many local areas, many resources will be unable to obtain RA contracts and, for those that do, fundamentals will drive prices low.

At the system level, the load and resource ("L&R") balance that the IOUs and the CAISO were required by the CPUC to use in their renewable integration modeling is summarized on slide 40 of the CAISO's July 1, 2011 presentation of their renewable integration modeling results.[6] After correcting for double- or over-counting of certain resources, the L&R balance shows excess supply of 14,144 MW above the planning reserve margin in 2020 and even higher amounts in the intervening years.

The L&R balances in some local areas show excess supply as well. For example, I developed estimates of the over-supply of RA capacity in the Bay Area local area using the Load and Resource Scenario Study Tool developed by the CAISO (with input from the Commission). The Load and Resource Scenario Study Tool is based on many of the same assumptions as the tool used in the CAISO and IOU renewable integration modeling in this proceeding.[7]

---

[6] *See* CAISO Track 1 Testimony, Exhibit 1 at Slide 40.

[7] Attachment 1 to the December 3, 2010 Assigned Commissioner and Administrative Law Judge's Joint Scoping Memo and Ruling articulates the standardized planning assumptions to be used in developing system plans, including the renewable integration modeling performed by the CAISO and the IOUs in this proceeding. The notes to the L&R tables in section VI of Attachment 1 indicate that the generation addition and retirement assumptions come directly from the CAISO's Load and Resource Scenario Study Tool. In addition, Attachment 1 requires the use of the most recent IEPR load forecast in the development of system plans, which also is the load forecast used in the Load and Resource Scenario Study Tool.

Based on the following input assumptions:[8]

Key Input Toggles	Please Select Valid Scenario
New Gen construction	Contracted Generation
New TX construction	None
Load Modifier Scenarios	Mid Net Load
Renewable Construction Scenarios	Trajectory Case
Retirement Scenarios	OTC/Retiring Generation
RPS compliance Year	2020

I estimate the following L&R balance in the Bay Area local area:[9]

	Study Result	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Bay Area	1 in 10 Peak Load (latest IEPR, split to Area)	9,131	9,247	9,360	9,435	9,511	9,590	9,679	9,760	9,839	9,932
	Transmission improvements that affect LCR	0	0	0	0	0	0	0	0	0	0
	LCR	4804	4921	5033	5108	5184	5263	5352	5433	5512	5605
	Total Net Qualifying Capacity in area as of 2010 plus new additions from scenarios (including supply side CHP additions)	6649	7444	8282	8293	8304	8314	8325	8336	8346	8357
	Renewable Construction Scenarios including Potential New Renewable Resource Additions related to Conceptual RPS Transmission	0	0	0	0	0	0	10	10	10	10
	Incremental Preferred Demand Side Management	12	20	66	108	154	210	270	334	395	456
	Demand Response Resources	359	431	443	455	469	482	495	507	519	531
	Retirements	206	206	880	880	880	880	2191	2191	2191	2191
	Surplus or deficiency	2010	2769	2878	2867	2862	2863	1558	1563	1568	1558

The above table shows that the Bay Area will have a surplus of more than 1,500 MW of capacity in 2020 and higher amounts in many of the intervening years.[10]

[8] The source document for this table can be found at: http://www.caiso.com/Documents/Once-through%20cooling%20generation%20-%20implementation/UpdatedOnceThroughCoolingLoad_ResourceAnalysisScreeningTool_Dec21_2010.zip.

[9] The source document for this table can be found at: http://www.caiso.com/Documents/Once-through%20cooling%20generation%20-%20implementation/UpdatedOnceThroughCoolingLoad_ResourceAnalysisScreeningTool_Dec21_2010.zip.

[10] The table does not account for the recently approved Contra Cost Generating Station in Oakley, California.

The compensation available in the energy and AS markets operated by the CAISO is also low and trending down. Each year, the CAISO's Department of Market Monitoring ("DMM") compares the levelized cost of generic CCGT resources to the net revenues that such resources could earn in CAISO markets. The results of the DMM's most recent analysis show that estimates of net revenues for CCGT units generally have been declining in recent years and are now far below the levelized costs of new units, which the CAISO assumes to be $191/kW-year:[11]

Results of DMM Analysis[12]

Table 2.8 Financial Analysis of new combined cycle unit (2006–2010)

Components	2006		2007		2008		2009		2010	
	NP15	SP15	NP15	SP15	NP15	SP15	NP15	SP15	NP15	SP15
Capacity Factor	63%	75%	69%	76%	74%	81%	57%	57%	67%	74%
DA Energy Revenue ($/kW - yr)	$319.65	$355.32	$369.59	$389.41	$489.17	$505.42	$172.67	$169.61	$137.95	$142.65
RT Energy Revenue ($/kW - yr)	$34.37	$50.02	$36.20	$41.98	$47.41	$51.98	$21.27	$15.50	$34.89	$37.31
A/S Revenue ($/kW – yr)	$1.01	$1.06	$0.37	$0.42	$0.41	$0.42	$0.76	$0.85	$1.01	$1.25
Operating Cost ($/kW - yr)	$279.50	$321.59	$321.86	$337.82	$425.16	$428.39	$154.57	$147.48	$143.25	$145.69
Net Revenue ($/kW – yr)	$75.53	$84.82	$84.30	$95.23	$111.82	$128.25	$40.14	$38.48	$30.60	$35.52
5-yr Average ($/kW – yr)	*$68.48*	*$76.46*								

In addition, the CAISO projects that net revenues for conventional generation resources could decline further as additional renewable resources come on-line:

> The combination of increased production of wind and solar energy will lead to displacement of energy from thermal (gas-fired) generation in both the daily offpeak and on-peak hours. Due to this displacement and to simultaneous reduction in market clearing prices, there may be significant reductions in energy market revenues to thermal generation across the operating day in all seasons.[13]

---

[11] *See* CAISO *Market Issues and Performance Annual Report 2010* at 53. The Market Issues and Performance Annual Report 2010 can be found at: http://www.caiso.com/Documents/2010AnnualReportonMarketIssuesandPerformance.pdf.

[12] *See CAISO Market Issues and Performance Annual Report 2010* at 53.

[13] CAISO *Integration of Renewable Resources; Operational Requirements and Generation Fleet Capability at 20% RPS* (August 31, 2010) ("*CAISO 20% RPS Integration Study*") at v. The *CAISO 20%*

For example, in the *CAISO 20% RPS Integration Study*, the CAISO found that revenues for a generic CCGT would decline by 16% under a 20% RPS relative to a baseline in which current levels of renewable generation are maintained but not expanded.[14] The CAISO also found that generic CCGTs would start 35% more frequently under a 20% RPS scenario compared to the baseline.[15] Starting more frequently generally entails additional maintenance costs for conventional generation. Thus, the CAISO found that revenues for CCGTs will be declining as cycling and associated costs increase.

Rather than selling directly into short-term markets for RA, energy and AS, some opportunities exist for existing generation resources to enter multi-year bilateral contracts for various combinations of these products. However, because LSEs generally undertake multi-year contracting for energy and AS to hedge their exposure to the respective short-term markets for these products, the compensation associated with multi-year contracting tends to be closely related to the compensation in the short-term markets (*i.e.*, if the alternative to a multi-year contract is buying from short-term markets, the prices associated with multi-year contracts will not rise significantly above the prices in short-term markets). As a result, multi-year contracts for RA, energy and AS are generally on terms similar to those available from short-term markets.

RPS Integration Study can be found at: http://www.caiso.com/Documents/Integration-RenewableResources-OperationalRequirementsandGenerationFleetCapabilityAt20PercRPS.pdf.

[14] *See* CAISO 20% RPS Integration Study at 87 (Table 5.4).

[15] *See* CAISO 20% RPS Integration Study at 87 (Table 5.4).

Q. Are other compensation mechanisms for existing generation under development?

A. Yes, however, it is uncertain if any of these mechanisms will actually be implemented and, if so, when.

The CAISO is considering additional products targeted at renewable integration in its Renewables Integration Market and Product Review Phase 2 stakeholder process.[16] In addition, the CAISO proposed modifications to the Commission's RA program to ensure that the resources that are procured by LSEs to satisfy Commission-mandated RA requirements actually provide the CAISO with resources that possess the operating characteristics that it requires.[17] The CAISO's attempts to develop new products for renewable integration, however, are still in their infancy and consideration of its NGCP proposal was deferred by the Commission to a future phase of the current RA proceeding, which has yet to occur.

Q. Are economic retirements a possibility facing California generators?

A. Yes. Existing generation resources will retire if the compensation from the markets available to them is not sufficient and stable enough to recover going forward costs.

---

[16] Information regarding the CAISO Renewables Integration Market and Product Review Phase 2 stakeholder process can be found at: http://www.caiso.com/informed/Pages/StakeholderProcesses/RenewablesIntegrationMarketProductReviewPhase2.aspx.

[17] The CAISO's proposed modifications to the Commission's RA program were embodied in the CAISO's Non-Generic Capacity Procurement proposal ("NGCP") submitted in R.09-10-032. A description of the NGCP can be found at http://docs.cpuc.ca.gov/efile/MOTION/127310.pdf.

Q. What is the impact of economic retirements on the need for flexible capacity?

A. If existing resources assumed to be available in the CAISO and IOU models shut down, substantial amounts of new replacement resources may be necessary to satisfy reliability and renewable integration needs during the planning period. The sensitivities I performed show that removing 3,200 MW of Calpine CCGT capacity from the High Load Trajectory case results in the need for approximately 2,600 MW of new replacement capacity.[18]

Removing 3,200 MW of Calpine CCGT capacity from the CPUC-prescribed Trajectory case results in the need for approximately 1,400 MW of new replacement capacity. Thus, even in a case in which there is no estimated need for new resources, removing existing generation creates the need for replacement capacity.

Q. Do the results of your sensitivity analysis identify a specific quantity of existing resources or specific resources that should be procured?

A. The sensitivity analyses demonstrate the potential consequences arising from the economic retirement of uncontracted existing generation that is necessary to meet reliability requirements under both the Trajectory and High Load Trajectory cases. While the sensitivity analysis does not identify a specific quantity of uncontracted existing resources that should be procured, it demonstrates that, even in cases that show no need for new resources, existing resources cannot be lost

---

[18] The replacement is less than 1-for-1 because on the day of the simulation in which the greatest amounts of new generic resources are needed to serve load and satisfy flexibility requirements, 600 MW of the resources that were modeled as retired in the sensitivity analysis are forced out. Because the 600 MW are forced out, removing them from the simulation does not increase need.

without substantial replacement. Consequently, my analysis supports the need for additional procurement to ensure that uncontracted existing generation remains viable until the uncertainty about renewable integration needs is resolved and/or additional compensation mechanisms for existing generation are established.

Q. What would be the estimated cost to replace the 3,200 MW of CCGT capacity in the Calpine sensitivities?

A. The model adds generic combustion turbines ("CTs") to satisfy flexibility and other reliability requirements. Based on publicly available estimates from the California Energy Commission ("CEC"), the cost of new CT capacity is approximately $1,200/kW.[19] Other public sources suggest that the cost of an LMS 100, the specific type of CT that is used to satisfy requirements for generic replacement capacity in the CAISO and IOU renewable integration modeling could be as high as $2,123/kW.[20] Given this range of cost estimates, the High Load Trajectory sensitivity shows that the retirement of 3,200 MW of CCGT capacity would require replacement with 2,600 MW of CT capacity at a cost of $3.12 billion to $5.52 billion. The Trajectory sensitivity shows that the retirement of 3,200 MW of CCGT capacity would require replacement with 1,400 MW of CT capacity at a cost of approximately $1.68 billion to $2.97 billion.

[19] *See* CEC *Comparative Costs of California Central Station Electricity Generation, Final Staff Report* (January 2010) at C-30 (Table C-25). The CEC *Comparative Costs of California Central Station Electricity Generation, Final Staff Report* can be found at: http://www.energy.ca.gov/2009publications/CEC-200-2009-017/CEC-200-2009-017-SF.PDF.

[20] *See Independent Study to Establish Parameters of the ICAP Demand Curve for the New York Independent System Operator* (November 15, 2020) at 27 (Table II-3). The *Independent Study to Establish Parameters of the ICAP Demand Curve for the New York Independent System Operator* can be found at: http://www.nyiso.com/public/webdocs/committees/bic_icapwg/meeting_materials/2010-12-01/Demand_Curve_Study_Report_11-15-10_Revised.pdf.

Furthermore, recent experience in California suggests that it is very difficult to permit and build new power plants. Thus, notwithstanding the costs, it is unclear whether it would be feasible to replace large amounts of existing conventional capacity if many large units are retired.

Q. Are there additional consequences associated with the economic retirement of existing resources?

A. Yes. The potential to add increased operational flexibility to existing resources through modest additional investment would be lost if existing resources retired. Constraints on the flexibility of existing CCGTs are generally associated with the steam cycle (constraints on heat-recovery steam generators and steam turbine generators). The CTs that are utilized in CCGTs are similar to the CTs that are used in some peaking plants and would be equally flexible on a standalone basis. CTs associated with CCGTs, however, cannot be operated as flexibly as on a standalone basis without imposing significant thermal stresses on heat recovery steam generators and steam turbine generators. Flexibility upgrades involve modifications that facilitate the management of these thermal stresses. These flexibility upgrades generally involve changes in hardware and/or operational practices that lower start times, increase ramp rates, and lower minimum operating levels.

Q. Please describe some of the specific ways in which the flexibility of CCGTs can be increased.

A. Examples of potential flexibility upgrades include:

- Installing auxiliary boilers and/or insulation to maintain the temperature of heat recovery steam generators and steam turbine generators while they are not operating so that they are exposed to smaller thermal gradients when they commence operation.

- Utilizing purge credit hardware and operational practices. One of the initial stages of starting a CCGT involves clearing gas from the heat recovery steam generator (or generators) to prevent explosions. Filling a heat recovery steam generator with nitrogen at shut down can obviate the need to purge it immediately before any associated CTs are started, shortening start times.

- Installing valves and attemperators to manage the temperature gradients to which elements of the steam cycle are exposed.

- Modifying air permits to allow multiple CTs associated with a single CCGT to be started simultaneously or in closer sequence than currently allowed.

All of the above actions can increase the operational flexibility of existing resources.

Q. How can the economic retirement of existing resources assumed to be available in the CAISO and IOUs models be avoided?

A. Economic retirements can be avoided by adopting procurement mechanisms that will provide sufficient revenues to recover going forward costs and support investment in maintenance necessary to ensure availability in the future. Calpine recommends that in the near term the Commission direct the IOUs to procure additional capacity through intermediate term (3-5 years) solicitations. The IOUs already conduct such solicitations on behalf of bundled customers and it would be relatively easy to incorporate additional procurement into such solicitations. To the extent that such procurement is viewed as satisfying system rather than bundled needs, cost allocation mechanisms to ensure that all load serving entities share in the cost of additional procurement already exist. Such resource solicitations represent a “least regrets” approach that will help to ensure that existing resources assumed to be available in the CAISO and IOU renewable integration modeling are actually available.

Q. How should solicitations for additional capacity be structured?

A. First, the Commission should establish the volume of additional procurement. Because the procurement is intended as a bridge mechanism to ensure that resources remain available until uncertainty about future need and market rules are resolved, the volume of procurement should not be tied to any specific estimate of near-term need. Instead, it should be based on a reasonable risk assessment of the costs and benefits of retaining existing units.

Based on the foregoing, Calpine believes that the volume of procurement should be sufficient to assure the continued availability of resources with the flexibility in aggregate that is presumed available from the existing fleet in the CAISO and IOU renewable integration modeling. Thus, taking account of resources that the IOUs already own or have under contract through the end of the period for which resources will be secured, the IOUs would be required to procure additional capacity so that, in aggregate, the portfolios that they secure through contracts, in combination with the resources that they already own or have under contract, would yield the same estimates of need for *new* capacity as currently represented in the CAISO and IOU renewable integration modeling.

The IOUs could satisfy such requirements by securing all of the resources that are assumed to continue to operate in the CAISO and IOU renewable integration modeling.

Alternatively, IOUs could obtain contractual commitments from a subset of uncontracted existing resources to provide flexibility and/or capacity above what was assumed in the modeling. It would be relatively easy to address such commitments in tolling agreements. In the case of capacity-only contracts, presumably suppliers would commit to offer into CAISO markets in a manner that reflects the flexibility that the IOUs secure through contract.

Second, the solicitations should consider the extent to which specific resources contribute to satisfying future flexibility requirements. One possible approach to quantifying the flexibility of different resources is to use a tool similar to the CAISO's renewable integration model. For example, starting from a specific modeling scenario, a base case would be simulated that reflects only the resources that LSEs have under contract or own. The base case would yield an estimate of need for generic flexible resources similar to the needs reported in the CAISO and IOU opening testimony. The contribution of a resource towards satisfying future flexibility requirement would be estimated by the extent to which adding it to the base case renewable integration model simulation reduces the estimated need.

Third, the IOUs could procure different bundles of products. For example, at one end of the spectrum, the IOUs could secure additional RA-only resources. These resources would contribute towards the IOUs' requirement to secure flexible resources for the future. In return, the supplier would submit to RA obligations, including the must-offer, over the term covered by any contract resulting from Calpine's proposed solicitations.

Moreover, as discussed above, suppliers would commit to submit offers into CAISO markets in a manner that reflects the flexibility that the IOUs secure through contract. To the extent that new RA requirements related to operating characteristics and/or renewable integration are introduced, the IOUs potentially could use the resources that it has secured to satisfy these new requirements.

At the other end of the spectrum, the IOUs could sign tolling agreements and obtain both RA and dispatch rights over the term of the tolls. To the extent that the CAISO introduces new reserves or other products related to renewable integration, the IOU could use the resources that they have procured to hedge against the costs of these new products. Thus, in addition to securing additional resources to satisfy future reliability requirements, the procured resources would provide the IOUs with a hedge against additional procurement costs as new markets and procurement requirements are developed.

As in current solicitations, the IOU would choose the mix of resources with the highest net market values in terms of established value streams such as energy, RA, and AS over the contract term. Analogously to long-term resource solicitations, in which IOUs select the highest net market value portfolio of resources that satisfy a need for new capacity, the IOUs would select the highest net market value portfolio of resources that secure sufficient resources to meet the IOU's allocated share of projected future flexibility requirements.

Q. Why is the use of a renewable integration model or a similar tool necessary to determine least cost portfolios of flexible resources?

A. Flexibility is a complex function of many different resource attributes including minimum loads, ramp rates, and start times. It is difficult to assess the contribution of the specific bundle of these attributes associated with a particular resource to satisfying flexibility requirements without using simulation tools such as the CAISO's renewable integration model. In fact, for related reasons, the CAISO proposed a similar approach in the recently concluded RA proceeding. In R.09-10-032, the CAISO attempted to address concerns that LSE procurement of RA was failing to provide the CAISO with resources with the specific operating characteristics that the CAISO requires to operate its system reliably, resulting in excess backstop procurement. In the year-ahead RA procurement time frame, the CAISO proposed to assess whether the portfolio of procured RA resources satisfied its flexibility requirements in aggregate utilizing a tool similar to the CAISO renewable integration model that has been used in this proceeding.