Stakeholder Comments Template

Variable Operations and Maintenance Cost Review

Submitted by	Organization	Date Submitted
Mark Smith *Chris Karbuch*	*Calpine*	*1/21/20*

Summary:

In general, Calpine supports the cost categorizations of the straw proposal. Further definitions of cost categorization will aid in establishing reasonable default values. Below, we offer specific reactions, but given the detailed nature of these matters, suggest that the ISO convene a technical group to refine the approach, cost categorization and methods.

We do have significant concerns with several aspects of the proposal that are included below, but summarized as:

- We do not understand the nature of the data represented on the reference-unit scatter plots and are concerned that they do not meaningfully represent the cost of Calpine units that range from 500 to 900 MW in combined-cycle configuration. In addition we question the reference unit aggregations in some cases.

- The regression results of the scatter plot do not support the use of a linear model (R^2 of 0.22). Our own experience with multiple CCGT configurations (4x1, 3x1, 3x2, 2x1 and 1x1) confirms that cost data is not linearly scalable in the simple format suggested.

- We do not support the 60 percent scaling factor. Accepting, for the moment, that the reference unit data represents average values (simplifying to say 50 percent above and below), by scaling averages down (50 percent * 60 percent) the proposal seems to be setting default values at 30 percent of the sample. This would result in a very large number of individual negotiations. In fact, our rough calculations suggest that virtually all of our units would require negotiated rates.

- Finally, the rather dramatic operational changes driven by new supply fundamentals make the use of historic and class-average capacity factors obsolete. Understanding that a forward projection adds complexity, the CAISO must contemplate shorter runs and more starts going forward.

1. Proposal Component A: Establish definitions for the O&M cost components

Please provide your organization's feedback on establishing definitions for the O&M cost components as described in section 4.1. Please explain your rationale and include examples if applicable.

Fixed	*Variable Costs*	Reactions
Maintenance, consumables, or costs associated with the following equipment: safety equipment, shop supplies/parts, tools, buildings, structures, HVAC systems, distributed systems including control, electrical, or communications systems, unless such costs can be clearly tied to electrical production	*Consumables required for incremental production of electricity (e.g. raw water, lubricants, chemicals, cooling fluids)*	We appreciate the detailed representations. Consideration should also be given to the costs associated with duct firing and power augmentation (steam injection).
Preventative or predictive maintenance activities	*Corrective maintenance activities*	Disallowing preventative maintenance seems to punish a prudent operator. That is, if cost recovery is only assured to correct things that break, it seems to suggest running to failure is prudent.
Costs of labor and expenses incurred for general plant supervision and administration. This includes annual salaries, benefits, etc.	*Labor costs that are supplemental to regular full time staff and that are associated with variable maintenance activities (e.g. contract work).*	No comment at this point
Maintenance inspections that are scheduled and performed strictly on a calendar basis (e.g. annually, seasonally, monthly) and whose schedules would not change if the production or operating profile of the unit changed	*Maintenance inspections that are performed based on maintenance schedules that are defined in terms of hours, starts, and/or MWh production*	This should be clarified to include maintenance inspections described in OEM literature.
Leasing or rental costs for any component, facility, or land	*Production-based fees related to the operation & maintenance of the unit*	No comment at this point

Testing costs (e.g. emissions testing, vibration testing, hydrogen embrittlement testing, non-destructive testing, performance testing, relay & interlock testing)	*Waste and wastewater disposal expenses, if the waste is a byproduct of electrical generation*	No comment at this point
Balance-of-Plant, i.e. all supporting and auxiliary components and systems needed to keep a plant running, excluding the actual Generating Unit, unless these costs can be clearly tied to electrical production	*Auxiliary electricity costs (e.g. energy needed to cool critical components, energy needed to operate auxiliary equipment directly related to MWh production)*	No comment at this point

Please provide your specific feedback on adding the following condition to the definition of Variable Maintenance Costs (as per page 10 of the straw proposal): "*Such costs should not represent significant upgrades to the unit or significantly extend the life of the unit.*"

Calpine supports an exclusion of costs related to upgrades that would "increase the studied and approved interconnection capacity". Those incremental modifications should be submitted and studied according to the tariff.

However, as components age, their output may diminish. A fresh, maybe newer combustion turbine rotor, hot gas path inspection and remediation, steam turbine rotor replacements or other capital-intensive plant maintenance may restore lost capability or increase flexibility. These activities are properly categorized as maintenance so long as they do not increase the maximum delivery to the grid.

In the end, all maintenance activities are performed to extend the life of the unit. Without maintenance, systems and components would fail. As such we do not understand the suggestion that maintenance should not "extend the life of a unit." Even units that have exceed their "assumed life" can and should be maintained (and reasonable cost recovered) to allow continued operation if the units are otherwise economic.

Please provide your organization's position on establishing definitions for the O&M cost components as described in section 4.1. (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

Category	*Support/Oppose*	Reactions
Variable Operations (VO) Costs	*Support*	
Variable Maintenance Costs	*Oppose with caveats*	Consideration should also be given to including and clarifying the costs for balance of plant maintenance (steam piping, heat recovery, electrical) for the various technology groups[1].
Fixed Maintenance Costs	*Support*	
General & Administrative Costs	*Support*	

2. Proposal Component B: Refine Variable Operations Adders

Please provide your organization's feedback on the ISO's proposal to refine variable operations adders as described in section 4.2. Please explain your rationale and include examples if applicable.

Calpine is supportive of the effort to clearly define the Variable Operations Adders inclusive of the various categories as described in the proposal with the following caveat.

Mechanism/Template for Negotiated Option

Calpine can provide historic cost information for various cost categories aligning with our general ledger accounts. In order to facilitate inevitable negotiations, the ISO should prepare a prescribed data set and specify the desired timeframe and escalation mechanisms, such as described in Section 2.3.1 Escalating Costs to 2019 Target Year as described in the Variable Operations and Maintenance Cost Report Dec 21, 2019.

[1] Calpine suggests starting with the balance of cost described as "Other Maintenance" in the Variable Maintenance Cost Dec 26, 2018 report.

Please provide your specific feedback on the updated technology groups proposed in section 4.1. Specifically, please provide your feedback on the relative merits of greater accuracy in the estimation of default VO adders versus the complexity and burden of assigning resources to the more-detailed technology groups.

Straw Proposal will require Resource-by-Resource calculations

The aggregation of dissimilar configurations or technologies will likely drive to more negotiations rather than the use of default values. Even within a similar technology, the costs of a 4X1 CCGT can be material different than that of a 1X1. Disaggregation is better if the goal is to minimize one-off negotiated values.

Aero-derivative Gas Turbine technology group

The expansion of the technology groups does breakout various types of gas turbine in simple cycle and combined cycle applications. As owner of older as well as newer gas turbines including both frame and aero-derivative gas turbines, Calpine would make the following recommendation regarding combustion turbines:

- The advancement of the gas turbine technology is not as big a driver as the difference between a frame gas turbines (models E, F, G, and H) and an aero-derivative gas turbine (LM). As a result, Calpine recommends the aero-derivative family be removed from both the Advanced CCGTs + CTs and the categories switch to the following split – Frame CTs (E, F, G, H,), Aero CTs (LMs), Frame CCGT (E, F, and G, H) and Aero CCGTs.

Need for Energy Storage Default Values

Calpine is actively developing grid-scale storage projects. We encourage the CAISO to begin to develop (understanding that historic data is limited) default maintenance adders – or negotiation parameters -- for storage devices such as lithium ion and flow batteries.

Please provide your organization's position on the ISO's proposal to refine variable operations adders as described in section 4.2. (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

No comments at this point.

3. Proposal Component C: Calculate Default Maintenance Adders

Please provide your organization's feedback on calculating default maintenance adders as described in section 4.3. Please explain your rationale and include examples if applicable.

Step 1: Estimate annual variable maintenance costs for a representative unit

Representative Unit Pmax

The representative Unit Pmax seems rather arbitrary and Calpine would appreciate further support and explanation of these values in the next straw proposal.

Capacity Factor.

Calpine is an operator of many combined cycle plants nationwide, the majority of which were built in the last two decades. As the CAISO is well-aware, our resources are being dispatched in ways never envisioned by the designers. They are required to cycle (start and stop) more frequently and operate far fewer hours than designed.

This need for alternative operations is causing accelerated degradation and accelerated maintenance in not only the prime movers but also more maintenance in the balance of plant facilities including waste heat recovery, steam piping, and water systems.

Using an average capacity factor that is based on historic operations will ignore this apparent and continuing change in the expected operations of the facilities. In turn, this would lead to an understatement of future maintenance. While none of us can precisely estimate future reductions in capacity factor, or how an individual plant might be affected by the undeniable trends, we should not turn a blind eye to the trends.

Step 2: Estimate run-hours, starts and MWh per year

Run-hours per year and starts per year: Estimated on a technology-specific level using two years of actual ISO and EIM meter data.

No further comments

Step 3 - Determine whether the technology-type's maintenance costs is represented with a $/run-hour, $/start, or $/MWh adder (or a blend of these)

Calpine is supportive of the optionality to use a $/run-hour, $/start, or $/MWh. The straw proposal includes an important assumption about whether maintenance costs by technology are incurred in relation to run-hours, start-ups, or production, or a blend.

Overall the options will allow the market participants to select an accurate way to reflect various maintenance charges.

Recommending Blending Option Flexibility

As the market transforms, more maintenance is being driven by starts. However, units in different locations often have different run profiles and those run profiles will change over time. Calpine proposes that both peakers and combined cycle units should have the option to use the options shown below.

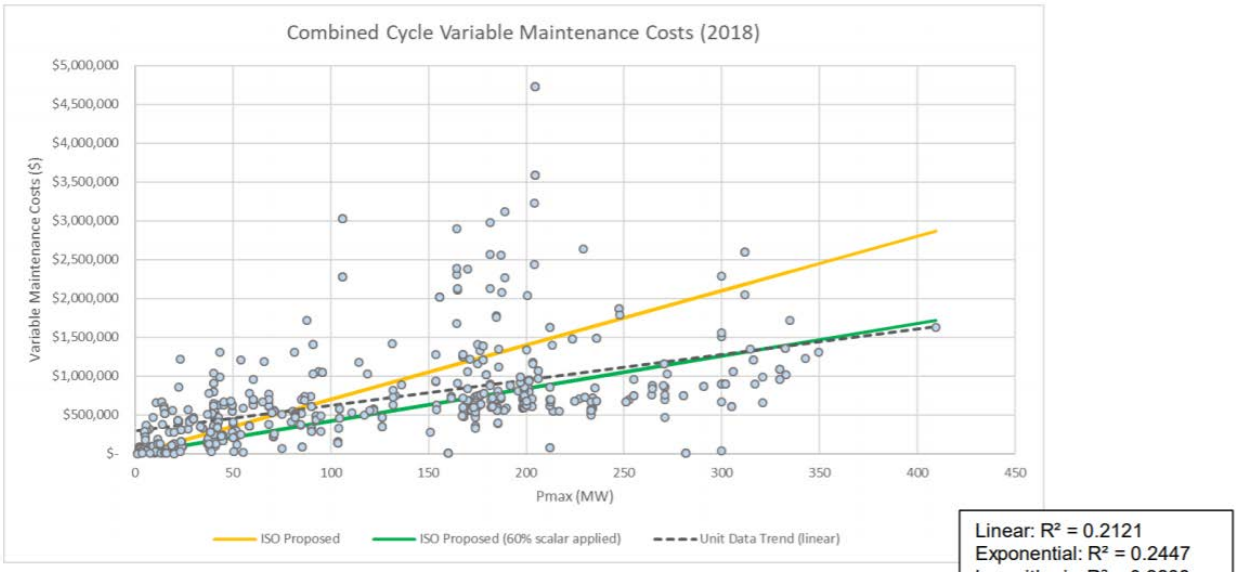
Technology Type	Start-up Allocation	Run-Hour Allocation	Output Allocation
Steam Turbine, CCGTs, and CTs	0	100%	
	25%	75%	
	50%	50%	
	75%	25%	
	100%	0	

Step 4 - Calculate a default MA on a $/run-hour, $/start, or $/MWh adder basis

Calpine does not understand the sources for the CAISO's total maintenance costs – as "based on external sources." These are critical pieces of data that are required to be fully vetted.

Step 5 – Calculate a unit-specific adder

The following chart appears to be a representative basis of the CAISO's proposal to establish reference and scaled default costs.



Representative data, does not appear to be representative

The data included in this table does not seem to represent the scale and scope of Calpine's operating assets. In particular, our CCGTs generally range from 120 MW all the way up to 900 MW. The configurations also vary, with some units in which one combustion turbine is connected to a single steam turbine – or as many as four combustion turbines are mated to a single steam turbine. The scale of the representative units does not encompass most of our machines and the configuration-basis of the units represented are not known. Certainly these data need further explanation.

Calpine opposes linear scaling

The regression results of the scatter plot strongly suggests that a linear model does not explain the data (R^2 of .21). Our own experience with multiple CCGT configurations (4x1, 3x1, 3x2, 2x1 and 1x1) confirms that cost data is not linearly scalable in the simple format suggested. As such, we are very concerned that the linear scaling will not represent the costs of the various configurations in the family of CCGTs.

Calpine opposes the 60% scaling factor

The choice of a 60 percent scaling factor seems arbitrary. Accepting, for the moment, that the reference unit data represents average values (simplifying to say 50 percent above and below), by scaling averages down (50 percent * 60 percent) the proposal seems to be setting default values at 30 percent of the sample. This would result in a very large number of individual negotiations. In fact, our rough calculations suggest that virtually all of our units would require negotiated rates.

Please provide any additional sources of O&M cost information (cost estimates, OEM recommendations, etc.) which you think would be appropriate for the ISO to review during this stakeholder process. If you would like to provide resource-specific data, the ISO can receive this information confidentiality.

No comment at this time.

Please provide your organization's position on calculating default maintenance adders as described in section 4.3. (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

As identified above, Calpine has serious concerns with the methodology identified in Section 4.3.

4. Implementation of Proposal

Please provide your organization's feedback on the suggested implementation details described in section 5. Please explain your rationale and include examples if applicable.

No comment at this time.

Please provide your organization's position on the suggested implementation details described in section 5. (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

No comments at this time.

Additional comments

Please offer any other feedback your organization would like to provide on the Variable Operations and Maintenance Cost Review straw proposal.

No Comments at this time.