



Stakeholder Comments Template

Variable Operations and Maintenance Cost Review

This template has been created for submission of stakeholder comments on the Variable Operations and Maintenance Cost Review straw proposal. The proposal, stakeholder meeting presentation, and other information related to this initiative may be found on the initiative webpage at: <http://www.caiso.com/StakeholderProcesses/Variable-operations-maintenance-cost-review>.

Upon completion of this template, please submit it to initiativecomments@caiso.com. Submissions are requested by close of business on **January 21, 2020**.

Submitted by	Organization	Date Submitted
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Please provide your organization's comments on the following issues and questions.

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.

- The current working definition for [Variable Operating Cost \(VO\)](#) is improved from that discussed previously. We ask CAISO to consider several additions to the definition:
 - The cost of supplemental staff to operate and/or monitor plant operations outside of normal working hours. This recommended addition would apply to plants with very low capacity factors that may have a small baseline staff when in standby conditions, and require additional people to properly support operations.
 - The definition of consumables might be expanded (here or elsewhere) to specifically include raw water, boiler chemicals, cooling tower chemicals, ammonia, etc. The additional specificity is intended to drive consistency among market participants.
 - Costs related to generation plant pre-start, start-up, shutdown activities, and return to pre-start stand-by conditions should also be considered in

this category alongside steady-state operations costs. Such activities are routine in plant operations and are not specifically identified in the definition. Again, the additional specificity is intended to drive consistency among market participants.

- Certain plant types have a \$0 adder in CAISO's proposal, while specifically including production-based fees to landowners. It is recommended that other production-based fees (e.g., to FERC or to other stakeholder groups) also be considered. If such costs exist for the owner/operator, an option for inclusion in VO should be specified.
- The current working definition for Variable Maintenance Cost (VM) is improved from that discussed previously. Combining major and minor maintenance costs into one definition is an important and beneficial simplification. We ask CAISO to consider several revisions to the definition:
 - The current definition includes costs related to "...repair, overhaul, replacement, or inspection..." CAISO might consider removing inspection costs from this definition insofar as inspection is more commonly associated with fixed costs and is not by itself a VM activity.
 - In the examples given for variable maintenance costs, "...preventative¹, predictive, or routine maintenance ..." is not included. CAISO might consider differentiating predictive monitoring from predictive maintenance in its variable maintenance definition. Predictive monitoring, like inspection, is more commonly associated with fixed costs and is not by itself a VM activity. Maintenance work identified through predictive monitoring indicates equipment deterioration due to use, and restoration of equipment performance would be a legitimate VM activity.

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.*"

- The concept being discussed here is one of Substantial Betterment, and that term is familiar to generation plant operators under FERC accounting rules. This term is used in federal rulemaking and policy guidance as noted below:
 - 18 CFR § 367.59: Substantial Betterment (the primary aim of which is to make the property affected more useful, more efficient, of greater durability, or of greater capacity)...
 - BPA Policy 212-1: Substantial Betterment substantially increases the capacity, operating efficiency, general utility, or which extends the service life...

¹ The correct term here is Preventive.

- It is recommended that CAISO consider clarifying its exclusion condition to the definition of variable maintenance by incorporating language similar to federal guidance. Performing equipment maintenance activities intended to restore operation, efficiency, capacity, durability, utility, and service life of generation equipment would not be considered a Betterment if any associated lifecycle or performance improvement were incidental to the activity. As such, these maintenance activities would be the result of accumulated operating hours or starts and would be included in the definition of variable maintenance. Maintenance activities intended to improve operation, efficiency, capacity, durability, utility, and service life of generation equipment would be considered a Betterment and not included in the definition of variable maintenance.
 - Example (1), consider a generation plant control system that is inoperable due to a bad component or module. Replacement of the bad component or module will restore plant performance to original specifications and technology and would be considered a maintenance activity. No intended improvement to operations, efficiency, capacity, etc. is associated with the maintenance, although there may arguably be an incidental improvement to plant service life.
 - Example (2), consider the same inoperable generation plant control system, however, now the bad component or module is no longer repairable or available due to obsolescence. In this example, the control system is replaced and modernized using up-to-date systems and technology, resulting in improved operation, efficiency, capacity, service life, etc. This work would be considered a Betterment and its cost would not be included in VM.
- As long as the plant owner/operator is compliant with federal rulemaking and policy guidance on Betterments, it is recommended that CAISO adopt the same standard for purposes of its definition of variable maintenance.

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)

- We are generally supportive of CAISO's definitions for O&M cost components with the caveats noted above.
- In addition, the definition for fixed maintenance includes a reference to "predictive" maintenance. As noted previously, it is recommended that CAISO differentiate between predictive monitoring and predictive maintenance. Predictive monitoring can be considered a fixed cost insofar as the activity is condition assessment independent of operating hours or starts. However, maintenance activities resulting from equipment deterioration identified by predictive monitoring would be considered variable maintenance. This maintenance is associated with starts and/or runtime and is intended to restore operational performance.

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.

- Please note that the right column heading for the December-2018 estimates references "VOM" in its title, while CAISO is now proposing to disaggregate maintenance from this parameter. The column may be retitled "VO."
- While it is difficult to weigh in on the default numbers in the CAISO proposal without doing additional plant-specific analysis, some of the non-zero default VO adders might be reconsidered given the revised definition of variable operations:
 - Hydroelectric and pumped storage facilities are assumed to have a \$0 VO in the proposal. In the revised definition of VO, production-based fees to landowners are included. While these fees are common to wind power, there may be circumstances where they also apply to hydro and pumped storage, as well as other production-based fees to FERC or to other stakeholder groups. If such costs exist for the owner/operator, an option for inclusion in the default VO adder should be specified.
 - The above bullet applies similarly for wind and solar facilities.

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.

- The additional technology groups are beneficial to the estimation and accuracy of the default VO adders. CAISO making its reference calculations and the underlying data available to market participants would be useful to subsequent analyses and appreciated.
- Please make clear that aeroderivative combustion turbines are included in the advanced CT group. While the narrative proposal does include this information, the companion slide deck does not.

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)

- We are generally supportive of CAISO's definitions for variable operations costs with the caveats noted above.

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.

- While it is difficult to weigh in on the calculation procedure in the CAISO proposal without doing additional plant-specific analysis, the procedure itself seems simple, but adds complexity to each plant owner/operator. It is difficult to see in advance if the representative unit is in fact representative of actual operations and maintenance, or just a modeling exercise based on manufacturer specifications and idealized operating assumptions. We must reserve judgement here until more information is available, and plant-specific analysis takes place.
- CAISO making its reference calculations and the underlying data available to market participants would be useful to subsequent analyses and appreciated.

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.

- For purposes of discussion and advancing this process, below are some example definitions for variable operations and maintenance which may be useful to revising the CAISO proposal definitions.
- Variable costs are those expenditures that fluctuate with plant starts or production. Some variable costs increase at a constant rate relative to plant output, such as consumables, raw water supplies, or fees tied to plant electrical production. Some variable operations costs may not respond in a linear manner with plant production, such as contract fees and incentive payments, even though they change based on energy production.

Costs definitions suggested for VO and VM:

- Variable Operations Cost
 - Variable operations costs include costs incurred to operate production facilities (outside of normal stand-by conditions) when a plant is being prepared to start, starting up, increasing or decreasing output, in steady state operation, shutting down, or being secured after shutdown until normal stand-by conditions are achieved. Variable operations costs do not include the costs of any maintenance activities, nor the cost of non-supplemental straight-time labor.
 - Specific items included as variable operations costs are:
 - Raw water consumption;

- Boiler chemicals;
 - Emission control system chemicals (e.g., ammonia);
 - Cooling tower chemicals;
 - Variable lease fees;
 - Variable license fees (if any);
 - Variable O&M supplier contract fees;
 - Purchased station service power in excess of offline consumption (for certain stations only, where station power is purchased from a third-party rather than self-generated by the plant); and
 - Labor for simple-cycle CT operations, if outside of normal work hours.
- Variable Maintenance Cost
 - Variable maintenance costs are incurred only as the result of plant starts or production. As the volume of production increases, equipment wear and tear also increases, as will the cost of restorative or corrective maintenance. Conversely, when there are less starts or production, variable maintenance costs will consequently decrease. Examples of variable maintenance costs are corrective maintenance, certain overtime labor costs related to maintenance, and the cost of parts or materials used in corrective maintenance.
 - Costs incurred on production facilities for restoration of plant performance or function, including maintenance, repair, or replacements due to degradation resulting from incremental use are included in Variable Maintenance.
 - Specific items included as variable maintenance costs include:
 - Labor (OT related to corrective maintenance only)
 - Predictive maintenance activities resulting from predictive monitoring, inspections, or testing
 - Corrective maintenance
 - Variable O&M service contract fees
 - Predictive Maintenance, PdM
 - Predictive maintenance is work that is performed based on equipment condition inspection results or predictive/condition monitoring findings to reduce the likelihood of functional failure. Predictive maintenance is performed when functional deterioration is identified in order to maintain performance and/or function.
 - Predictive maintenance is generally planned in advance so that necessary resources are available, equipment outages are forecast and approved, and replacement equipment (if needed) has been acquired or

scheduled. Insofar as predictive maintenance is performed to correct known functional deterioration, it is considered a subset of variable maintenance. The routine predictive monitoring that gives rise to predictive maintenance costs is not included in variable maintenance.

- Corrective Maintenance, CM
 - Corrective maintenance is work that is performed to restore performance or function after a failure has occurred. Corrective maintenance is performed after the equipment has ceased performing and functioning properly, and may result in an unexpected outage. Corrective maintenance may be planned in advance, but is frequently initiated after functional failure has already occurred.
 - It is assumed that no corrective maintenance would be required if the plant had not been operational causing deterioration. Consequently, Corrective Maintenance is considered a variable maintenance.
 - Costs that vary with production:
 - Labor (OT related to corrective maintenance events)
 - May include Predictive maintenance
 - O&M service or supply contract fees that vary with production

Cost Categories NOT Included in VO or VM:

- Fixed O&M Cost
 - Specific items included as fixed costs are:
 - Fixed operations and maintenance costs are those expenses that remain unchanged regardless of starts or production. Whether a facility is producing electricity or not, certain preventive maintenance, contract, utility, and programmatic costs will continue to accrue independently of output. Examples of fixed costs are rent, employee straight-time salaries, insurance, office supplies, etc. Although, fixed costs can change over a period of time, the change will not be related to starts or production.
 - The cost of routine equipment inspections, monitoring, and planned maintenance activities area fixed cost insofar as such expenditures are part of good management practice to maintain operational availability of the equipment.
 - Labor (all ST and any OT related to normal shifts and activities)
 - Equipment inspections
 - Time-based (preventive) maintenance
 - Predictive monitoring, testing, or inspections
 - Safety programs

- Regulatory fees
- Personnel training
- Recurring O&M service or supply contract fees
- Recurring equipment rents
- Purchased station service power if the plant can self-supply in operation
- Consumables not associated with variable operations or maintenance (e.g., hydrogen, CEMS gases, rags, small fasteners, incidental oil and grease, cleaners, etc.)
- Inspections and/or other preventive maintenance activities
- Minimum lease fees
- Minimum license fees
- Administrative supplies and expenses (e.g., paper, pens, pencils, printer supplies, forms, clips, tape, phones, furniture, etc.)
- Operations and maintenance costs for non-production facilities (e.g., buildings, habitat, grounds, landscaping, fences and gates, security, public facilities telecommunications, fisheries, etc.)
- Costs related to the transmission system use, operations, maintenance, or ancillary services
- Administrative & general expenses
- Preventive Maintenance, PM
 - Preventive maintenance is work that is regularly performed based on pre-determined time intervals to reduce the likelihood of functional failure (monthly, quarterly, annually, etc.) Preventive maintenance is performed while the equipment is still performing and functioning properly to sustain performance and prevent unexpected failure. Preventive Maintenance is not included in VO or VM.
 - Preventive maintenance is planned in advance so that any necessary resources are available, equipment outages are forecast and approved, and replacement equipment (if needed) has been acquired or scheduled.
- Major Maintenance
 - Major Maintenance for the gas-fired turbine plants includes the maintenance activity related to heavy maintenance or overhauls to gas turbines and steam turbines and their associated generators for purposes of performance restoration. The activity will follow a starts or service hours schedule set by the turbine or generator manufacturer, and may include testing as part of this activity.
- Capital Replacement and Betterments

- Expenditures for the purchase, construction, and replacement of full Units of Property², or the Substantial Betterment of full Units of Property. Such expenditures shall be treated separately from variable operations and maintenance expense for accounting purposes, and are not included in VO or VM for any production facilities.
- Fuel Cost
 - Fuel costs include the total cost of fuel delivered to the production facilities as purchased from an offsite fuel supplier. While fuel costs are certainly variable with starts or production, they are captured and accounted separately from VO and VM costs for dispatch purposes. As a result, fuel costs are not included in variable operations or maintenance.

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)

- While it is difficult to weigh in on the procedure in the CAISO proposal without doing additional plant-specific analysis, the procedure itself seems simple, but adds complexity to each plant owner/operator. It is difficult to know in advance if the representative unit is in fact representative of actual operations and maintenance, or just a modeling exercise based on manufacturer specifications and idealized operating assumptions. We must reserve judgement here until more information is available, and plant-specific analysis takes place.
- Given the wide diversity in the size, operational restrictions, FERC license requirements, and project configuration, hydro may not be able to universally fit into a 50/50 split of the maintenance adder into Starts and Run Hours. Small hydro, run of river plants, and flood control projects will be challenging to fit the 50/50 model due to the difficulty of accurately forecasting future operation. Without additional analysis, we are not in a position to recommend an alternate split.
- The calculation of a unit-specific maintenance adder will take considerably more analysis to become comfortable with the implications of using a representative unit as the base case, then calculating a unit-specific number via simple ratio of P_{max} . There are many variations in unit manufacturer, age, parts availability and cost, operating characteristics, known maintenance issues, and plant mission or use case, that making the selection of representative unit and calculation of this adder is quite complex in reality.
- The 60% scalar may seem a simple solution to a curve fit, but this too adds to the complexity. In fact using the scalar as intended would result in a default maintenance adder that is below the CAISO unit data trend line until about 325

² Units of Property ("UOP"), also known as Retirement Units in FERC, are "those items of plant which, when retired, with or without replacement, are accounted for by crediting the book cost to the appropriate plant account in which included."

MW. Owner/operators can always go through negotiation, but why start there? Would CAISO consider a range of acceptable values to allow flexibility in application for the issues noted above? There might well be fewer negotiations, and the owner/operator would shoulder the risk of choosing properly given their specific circumstances.

- PSE supports CAISO's proposed calculation methodology with caveats. PSE agrees the variable maintenance is better reflected as a combination of \$/hour and \$/start values (rather than a split between VOM and MMA specific to starts or run hours), but questions the designated split for hydro resources and the appropriateness of the 60% scalar. PSE proposes that CAISO remain flexible regarding the start and run hour maintenance adder split for hydro resources. PSE also requests that CAISO reevaluate the appropriateness of the 60% scalar as the scalar appears to poorly reflect maintenance costs for units with less than 325 MW capacity.

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.

- PSE agrees that this proposal may increase the need for resource owners and the CAISO to negotiate default VO and maintenance adders. As such, PSE is supportive of changes to the CAISO tariff modifying the negotiation response time from 15 calendar days to 15 business days.
- PSE also supports the implementation schedule suggested by the CAISO. As PSE previously mentioned in Section 3 of our comments, the change in approach to calculating maintenance adders adds complexity for each generation facility and will thus require PSE and other resource owners to calculate VO and maintenance adders differently than in the past. PSE believes that providing resources owners with a one year timeline after implementation to change negotiated DEBs is both necessary and adequate.

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)

- PSE supports with caveats the direction and implementation timeline in the proposal.

Additional comments

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

