



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 revised straw proposal. The proposal, stakeholder call 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 **May 26, 2020**.*

Submitted by	Organization	Date Submitted
<i>The Department of Market Monitoring</i>	<i>Department of Market Monitoring, California ISO</i>	<i>May 28, 2020</i>

Please provide your organization's overall position on the Variable Operations and Maintenance Cost Review revised straw proposal:

- Support
- Support w/ caveats**
- Oppose
- Oppose w/ caveats
- No position

The Department of Market Monitoring (DMM) continues to support the ISO's effort to clarify definitions of variable operations and maintenance costs, to update the current default variable operations adder, and to establish a default maintenance adder. The following comments are provided based on DMM's experience reviewing major maintenance adder (MMA) applications and addressing issues that arise during the MMA review process.

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 (page 7). Please explain your rationale and include examples if applicable.

DMM supports the ISO's effort to clarify the definitions of operations and maintenance for Tariff and BPM language. DMM agrees that this level of detail is useful at this period in the stakeholder process.

DMM suggests the following refinements, each discussed in further detail below:

1. Refine the definition of betterment in both the Tariff and BPM;
2. Define equipment types which should be considered "retirement units";
3. Define operations and maintenance costs to be those costs within "good utility practice";
4. Exclude maintenance costs beyond the service life for that major component of equipment;
5. Remove the exclusion of all predictive, preventative, and corrective maintenance from operations and maintenance costs; and
6. Recognize that some maintenance that may appear to be calendar based is instead variable, due to relatively fixed operating profiles.

DMM supports the recognition, included in this draft of the proposal, allowing some labor costs to be considered major maintenance.

1) Betterment: add detail to the Tariff criteria and BPM guidance

DMM supports including a criteria for *betterment* in the Tariff definition of Variable Maintenance Costs. In addition, we suggest that more detail may strengthen the criteria and help participants understand the term and its application better.

DMM suggests either explicitly defining betterment or including the specific clarifying language from FERC (FERC Uniform System of Accounts (USoA), Electric Plant Instruction 10, paragraph B (3)) so that the tariff definition reads:

"If the item is a replacement of existing plant or equipment, such costs should not effect a substantial betterment to the Generating Facility (the primary aim of which is to make the property affected more useful, more efficient, of greater durability, or of greater capacity)"

In addition, it should be clear that many maintenance activities can both improve and extend the life of a unit and be included in variable maintenance cost components. The

important distinction is whether the unit is being maintained for reliable operation, as opposed to improving the unit beyond its original life or operating characteristics (including, but not limited to improving efficiency or environmental performance).

Similarly, DMM supports the ISO's exclusion of upgrades due to design flaws from variable maintenance cost components. DMM believes these costs should be considered fixed based on the principle of betterment as well. The cost of fixing a design flaw is incurred because of the flaw, and should be considered a fixed, capital expense to upgrade the unit from its original characteristics. It is not a cost being incurred due to market operation of the resource.

2) Replacements – Capital fixed or variable cost? DMM suggests that the ISO use the conceptual framework from FERC, but define a short list of items that would be considered capital, fixed cost if replaced.

Defining the terms “retirement units” and “minor items” is useful for distinguishing maintenance costs from capital replacement costs. However, DMM recommends refining the proposed treatment, as did other stakeholders.

As other stakeholders mentioned, the definition of a retirement unit is subjective to each entity and their accounting practices. The concept is useful, but the ISO needs to define which types of equipment should be defined as “retirement units”, potentially defining a separate term to recognize that this will not be exactly equivalent to the FERC definition, although similar in spirit.

For example, it may be useful to label “major components” and “minor items”. In previous comments, stakeholders provided insight into which types of equipment should be considered. Given this information, the ISO could develop a short list of “major components”, for which any replacement of the entire component would be considered a fixed capital cost. These examples of major components from DMM and stakeholder comments:

Combustion turbines:

- Gas turbine
- Generator

Combined cycle units

- Gas turbine
- Generator
- Steam turbine
- Boiler

Thermal boilers (coal and steam)

- Boiler
- Turbine
- Condenser
- Coal Mills

- Forced draft and induced draft fans
- Feed water heaters
- Boiler feed pumps
- Scrubbers, precipitators, or other pollution control systems

Hydroelectric

- Turbine and water wheels
- Generator

Under this framework, whenever one of these entire items of equipment is replaced (e.g. an entire GE LM6000 or Siemens SGT6-5000F turbine), this would be considered a capital replacement and not maintenance. Conversely, if a minor item of equipment that is part of the turbine is replaced (e.g. a turbine blade), this would be considered maintenance – in accordance with the FERC definition.

3) Good utility practice: DMM supports the idea of including terminology related to ‘good utility practice’, and suggests adding a definition and further clarity either in the Tariff definition or BPM guidance.

A summary of the FERC definition of Good Utility Practice¹ is:

- Any practices, methods, or acts engaged in or approved by a significant portion of the electric utility industry, or
- Any practices, methods, or acts which, in the exercise of reasonable judgement, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practice, reliability, safety, and expedition.

DMM suggest clarifying the anticipated use and interpretation of this criteria in the BPM. For example:

Examples that would fall outside of Good Utility Practice for inclusion in variable maintenance costs include maintaining an old unit beyond the cost of repowering, or performing maintenance that disregards OEM recommendations in such a manner that it would impact the reliability, safety, or environmental protection of operating the unit.

4) Lifespan and depreciation schedule of plant: DMM suggests using FERC concepts of service life and depreciation to help clarify this definition.

DMM suggests changing the word “lifespan” to “service life” in the criteria definition for Variable Maintenance Cost to align with FERC and other industry practices of service life and financial depreciation (not tax depreciation). DMM also suggests changing the criteria

¹ Order No. 888, section 1.15 of the pro forma Open Access Transmission Tariff (OATT)

definition for the tariff to align with major components of equipment individually, rather than defining one service life for the entire generating unit.

Because all utilities must define the service life and depreciable schedule for their assets, there should not be maintenance scheduled beyond the equipment's planned depreciation date. Future maintenance should be included only if such depreciation schedules are updated.

FERC USoA Operating Instruction 22 says the following regarding each entities' responsibility to determine a service life and method of depreciation accounting:

- A. Method. Utilities must use a method of depreciation that allocates in a systematic and rational manner the service value of depreciable property over the service life of the property.
- B. Service lives. Estimated useful service lives of depreciable property must be supported by engineering, economic, or other depreciation studies.
- C. Rate. Utilities must use percentage rates of depreciation that are based on a method of depreciation that allocates in a systematic and rational manner the service value of depreciable property to the service life of the property. Where composite depreciation rates are used, they should be based on the weighted average estimated useful service lives of the depreciable property comprising the composite group.

Additionally, FERC states that a service life may be defined in terms of production rather than time. In this scenario, the rule still applies; maintenance costs should not be included beyond the service life according to production. For example, if a plant intends to depreciate its gas turbine after 100,000 service hours, costs should not be included for maintenance predicted at 150,000 hours.

FERC USoA definition 36. If depreciation is accounted for on a production basis rather than on a time basis, then service life should be measured in terms of the appropriate unit of production.

One nuance to consider when defining service life is that there may be differing service lives for each major component of equipment (or 'retirement unit'). For example, a gas turbine may be defined with a different depreciation schedule than the gas generator. DMM suggests considering maintenance schedules for each major component of equipment separately.

Hypothetically, say the turbine has a service life of 30 years and the generator has a service life of 60 years. If the resource has been in operation for 25 years, and there are 5 years remaining in the turbine life, any *turbine* maintenance that would occur at 45 years should not be considered a valid maintenance cost. If the owner decides to repower and extend the life of the generating unit, the owner could update their maintenance schedule after repowering to establish a new maintenance cycle. Importantly, the cost of the turbine replacement (repower) is not a variable maintenance cost.

For the generator that has been in operation for 25 years and which has 35 years left of service, maintenance at year 45 would be allowed. The reason is that it is feasible for the resource owner to replace the turbine and continue running. The generating asset at year 25 is far from being fully depreciated and still holds value.

This example highlights the principle DMM suggests adhering to when considering maintenance costs and service lives: *maintenance should not be included for any major component of equipment (retirement unit) after the service life for that major component of equipment.*

Suggested language for the Tariff definition criteria is:

Such costs should reflect going forward costs that are expected to be incurred within the service life of the [‘retirement unit’ or ‘major components of equipment’].

5) Predictive, Preventative, and Corrective cost.

DMM disagrees with the proposal’s characterization of preventative and predictive maintenance as, routine in nature and thus, generally, excluded from variable maintenance costs. These activities may in fact be driven by market operation. For example, borescope and combustion inspections appear to fall into the category of predictive maintenance, but are often performed on hour or start intervals defined by the OEM, just as a hot section overhaul would be. These activities are variable under the Tariff definition, but the BPM guidance seems to indicate that they should be excluded.

In addition, DMM recognizes that other stakeholders have suggested these distinctions in order to help categorize costs. However, our experience is that it can be challenging to uniformly categorize across every entity. And therefore trying to define variable versus fixed maintenance by an entire category may cause confusion.

Because of these and other exceptions, DMM suggests removing the categorization of maintenance as preventative and predictive maintenance for potential exclusion from variable maintenance costs, and instead relying on the core components that define variable maintenance: varying with respect to hours, starts, or MWh, and not routine or explicitly calendar-based.

6) Calendar time or routine maintenance activities

In principle, calendar-based maintenance is not variable. However, there are sometimes situations where the maintenance initially *appears* to be calendar based, but is actually production based.

Maintenance actions may be incurred (or budgeted) after an approximate number of years *because the operating profile of the unit is relatively fixed.* In reality, the

maintenance may be carried out as a result of wear-and-tear accumulated through starting or running the unit.

For example, if a unit performs maintenance on a 12 year cycle because the plant typically operates a fixed number of hours per year, it's possible this maintenance may in fact be variable. If for example, a unit changes from running 8,000 hours per year to 3,000 hours per year, and the maintenance cycle is no longer performed on a 12 year cycle, then this maintenance is likely incurred due to hours and possible to be included in a maintenance adder. In this case, there is an assumption that maintenance is done at a certain number of years assuming certain operations, but if that operating profile were to change, the frequency with which maintenance is performed would also change.

Conversely, if the unit changed from running 8,000 hours per year to 3,000 hours per year, and the exact same maintenance was done every 12 years, then the conclusion is likely that the 12 year maintenance cycle would occur irrespective of plant operation. This would be a fixed cost.

7) Labor costs

DMM supports the updated language regarding labor costs. This treatment aligns with the FERC USoA regarding pay and expense of employees, which states that employee time may be split to various accounts, such as maintenance. FERC's accounting rules do not explicitly imply a relationship to variable maintenance costs, but they do recognize labor (even if it is an annual, salaried employee) as relevant to maintenance expenses rather than purely to operating expenses.

From the General Instructions Section, Instruction 9. Distribution of Pay and Expenses of Employees.²

The charges to electric plant, operating expense and other accounts for services and expenses of employees engaged in activities chargeable to various accounts, such as construction, maintenance, and operations, **shall be based upon the actual time engaged in the respective classes of work**, or in case that method is impracticable, **upon the basis of a study of the time actually engaged during a representative period.**

Please provide your organization's position on establishing definitions for the O&M cost components as described in section 4 (page 7). (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

Support with caveats

² From FERC Uniform System of Accounts

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 (page 12). Please explain your rationale and include examples if applicable.

Please provide your organization's position on the ISO's proposal to refine variable operations adders as described in section 4 (page 12). (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

3. Proposal Component C: Calculate Default Maintenance Adders

Please provide your organization's feedback on calculating default maintenance adders as described in section 4 (page 15) as well as in the supporting calculations posted as a separate file. Please explain your rationale and include examples if applicable.

Option 1 calculation

DMM is generally supportive of Option 1 for developing default major maintenance adders because it uses sources that require minimal conversions and assumptions. DMM recommends that the ISO consider using additional sources that meet this criteria including maintenance costs directly in the format of cost-per-cycle, cost-per-hour, or cost-per-start. One example is PJM's Cost of New Entry study. Please see DMM's comments on additional sources for maintenance cost data under the third question of section 3. . In principle, DMM would prefer using more than one source.

Further, DMM recommends that the ISO review the appropriateness of the conversion of costs expressed in the NYISO reports as \$/MWh in the calculation of the defaults.

The 2016 NYISO report expresses maintenance costs for a combined cycle at \$22.1 million per major cycle (combustion turbine only), or roughly \$27.3 million per cycle after accounting for labor costs, inflation, and geographic scaling. The report also expresses combined cycle maintenance costs in the format of \$/MWh, which includes costs for unscheduled maintenance. The ISO converts this to a cost per cycle by multiplying the \$/MWh amount by the capacity of the unit and then by 48,000 hours. This assumes the unit is running at full capacity for the entire 48,000-hour maintenance cycle — adding \$13.0 million to the cost per cycle.

In the supporting spreadsheet, the ISO cites that this conversion utilizes the methodology discussed in the 2010 NYISO report, "for hours-based maintenance, the average major maintenance cost in \$/MWh is equal to the total cost of parts and labor

over a complete major maintenance interval divided by the factored operating hours between overhauls, divided by the unit capacity in megawatts.”

However, there is not enough information in the 2016 NYISO report to determine how the \$/MWh costs were calculated, and what is included in these costs. Instead, accounting for this piece as instead variable maintenance in the format of \$/MWh may be a more direct way to account for this piece. DMM recommends that the ISO consider reaching out to the authors of the NYISO reports (Analysis Group, Inc., NERA) to avoid assumptions that may introduce error in the calculation.

Further, a complete maintenance cycle for a combined cycle per the OEM recommendation is from the earlier of a threshold of operating hours or starts. The CAISO’s conversion of the \$/MWh piece assumes that hours will be the binding factor by multiplying \$/MWh costs over a 48,000 hour maintenance cycle, which is not necessarily the case.

Similarly, DMM recommends that the ISO also review the appropriateness of the conversion of unscheduled maintenance in the calculation of the aeroderivative default MMA.

Option 2 calculation

Although DMM supports relying on multiple sources in theory, DMM is not supportive of Option 2 for developing major maintenance adders because of the sources selected. Option 2 relies on external sources that are in the format of \$/MWh. DMM believes that the assumptions necessary to convert these costs to a usable amount as \$/start or \$/hour introduces more error than the benefit gained from having additional sources.

This includes the following assumptions:

- (1) Using CAISO/EIM operating data to convert costs-per-year to costs-per-hour/start. The results from the external estimates are very sensitive to the operation data the ISO uses to estimate annual hour or annual starts. To the extent that the average operation from the set of CAISO/EIM resources differs from the operation of the resource in the external source, this can introduce significant error in the calculation. Further, the set of CAISO/EIM observations includes a large spread of model types, sizes, and exceptional circumstances that may not be representative of the resource in the external source.
- (2) Assuming Variable Operations (VO) costs for some external sources. The ISO subtracts out their estimate of VO costs for the external sources that did not explicitly breakout these costs from the total of \$/MWh. This can have a significant impact on the final calculation.
- (3) Assuming the capacity factor. For the external sources that did not explicitly indicate a capacity factor, the ISO estimated the capacity factor using CAISO/EIM observations. This can introduce significant error into the calculation to the extent that the estimates by the ISO differ from the underlying capacity factor used in the external sources.

Please indicate your organization's preference for Option 1 versus Option 2. The ISO particularly wants to understand stakeholders' preferences regarding the balance between making assumptions about unit conversions versus the number of technology groups covered by default maintenance adders. If a different option is preferable, please indicate in detail your organization's preferred option.

The report characterizes option 1 as covering fewer resources and fewer technology types. From a coverage perspective, the only difference between option 1 and option 2, is that the ISO is proposing a default MMA for hydro resources under option 2. However, DMM does not find either the external estimate or the interpolated-MMA-based value for hydro resources to be robust enough to support a default major maintenance adder. DMM is supportive of the development of a default major maintenance adder for hydro resources, but recommends that the ISO consider additional sources, that would require fewer assumptions to derive defaults.

There are only two sources used for the calculation of the hydro external estimate, EIA and EPA. In both cases, the calculation is very dependent on an ISO estimation of capacity factor, derived from CAISO/EIM operating data. This introduces a significant amount of uncertainty in the conversion.

The proposed default for hydro resources is based on the ISO's interpolation of hydro MMAs. However, DMM does not believe that there is a sufficient number of negotiated and approved MMAs to carry out this calculation.

If your organization has additional sources of maintenance cost data that it would like the ISO to consider, please provide these sources.

In the short-term, the ISO should review and consider additional sources for maintenance costs that are directly in the format of per cycle, per hour, or per start. One such source is the PJM Cost of New Entry study prepared by the Brattle Group: <https://www.pjm.com/~media/committees-groups/committees/mic/20180425-special/20180425-pjm-2018-cost-of-new-entry-study.ashx>. This source provides data in both dollar per start and dollar per run hour formats. The methodology and definitions are similar to the NYISO reports.

In the future, as long as the ISO is allowing the use of proprietary data, the ISO could improve the quality of default adders by utilizing other industry experts (as other ISOs have done). Both the PJM and NYISO values are developed using consultants who rely on Sargent and Lundy's proprietary database of operating cost data (see quotes from studies below). In addition, the California Energy Commission develops a Cost of New Entry Study, which relies on proprietary data from a survey conducted of plants in California. DMM anticipates that these sources would allow the ISO to potentially develop more robust estimates than introducing conversions, relying on an uncertain interpretation of publicly reported numbers, and a small sample size of confidential MMA data for some groups.

From PJM's Cost of New Entry study:

PJM Interconnection, L.L.C (PJM) retained The Brattle Group (Brattle) and Sargent & Lundy (S&L) to review key elements of the Reliability Pricing Model (RPM), as required periodically under PJM's tariff.

Sargent & Lundy (S&L) estimated plant proper capital costs—equipment, materials, labor, and the engineering, procurement, and construction (EPC) contracting costs—based on a complete plant design and S&L's proprietary database on actual projects.

From NYISO's Cost of New Entry study:

S&L was primarily responsible for developing construction cost estimates, operating cost data and plant operating characteristics.

All equipment and material costs are based on S&L in-house data, vendor catalogs, or publications.

Please provide your organization's position on calculating default maintenance adders as described in section 4 (page 15) as well as in the supporting calculations posted as a separate file. (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

Support with caveats

4. Implementation of Proposal

Please provide your organization's feedback on the suggested implementation details described in section 4 (page 24). Please explain your rationale and include examples if applicable.

Please provide your organization's position on the suggested implementation details described in section 4 (page 24). (Please indicate Support, Support with caveats, Oppose, or Oppose with caveats)

Support.

Additional comments

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

DMM is not supportive of the use of interpolated MMA values in default calculations. Our analysis of confidential MMA data shows that results presented in this proposal are not representative. Estimated linear values are dependent on choices made in sample selection and functional form. In some case the ISO may be using a small sample that is not representative of industry costs. The results presented here are not used for negotiation of major maintenance adders at the ISO.