



Stakeholder Comments Template

Variable Operations and Maintenance Cost Review Working Group – Gas Resources

This template has been created for submission of stakeholder comments on the VOM Cost Review working group for gas resources that was held on July 15, 2019. The workshop, stakeholder meeting presentations, and other information related to this initiative may be found on the initiative webpage at:

<http://www.caiso.com/informed/Pages/StakeholderProcesses/VariableOperations-MaintenanceCostReview.aspx>.

Upon completion of this template, please submit it to initiativecomments@caiso.com. Submissions are requested by close of business on **July 26, 2019**.

Note: Upon submission, please indicate if you would like your comments to be confidential.

Submitted by	Organization	Date Submitted
Ryan Millard (ryan.millard@pqn.com) and Susan Hill (susan.hill@pqn.com)	Portland General Electric Company	7/26/2019

Please provide your organization's comments on the following topics and questions.

- 1. Appendix A to this template contains a list of maintenance activities for gas-resources. What maintenance activities are missing from this list that should be included for consideration?**

As noted in PGE's comments under Appendix A, several of the activities identified seem duplicative and/or ambiguous. Moreover, categorizing maintenance activities for gas resources assumes that asset management strategies are uniform across all utilities. If CAISO seeks input on each of these maintenance activities, however, PGE proposes that CAISO develop a list of major equipment components and then group all of the associated components that will require maintenance (**see PGE proposal beginning on page 7**). This will better aid commenters in their review.

- 2. Appendix A also allocates the maintenance activities to three cost components (Major Maintenance [green], Other Maintenance – Variable [yellow], Other Maintenance – Fixed [red]). Please review and note whether you disagree with our proposed allocation and why.**

In general, maintenance activity costs are most easily classified as costs related to “wear-and-tear” from dispatch (i.e., repair money only spent if the unit is started up and/or operated) and “other” costs that ensure stand-by dispatchability (i.e., money spent regardless of whether it operates 0 days or 1 month, 3 months or 12 months). PGE maintains that the first classification would be considered “variable” and the second would be considered “fixed.” It should be noted, however, that there will always be specific exceptions or hybrids to these classifications. PGE could classify some of the items listed as “variable” and “fixed” because it depends on the type of unit and the accounting of the operating profile of the asset in question, the age of the asset, the asset management strategy, and whether there is a service agreement in place with a maintenance provider.

As an example, an expansion joint in an air duct may need to be replaced every three years (regardless of operating profile) due to the composition of its material. If the expansion joint is made of an elastomer material it could suffer a degradation with exposure to UV light. A mechanical expansion joint, on the other hand, may last for the effective life of the unit if it never runs because its exposure to heat cycles will be the primary catalyst for wear-and-tear of the equipment. As such, the elastomer expansion joint repairs may actually be classified as “fixed” (replacement/repair independent of operating profile) whereas the metal expansion joint would be “variable” (repair /replacement driven by exposure to operating temperatures). This is just one instance where maintenance classification by equipment may prove counterproductive to this effort.

- 3. Please provide any comments or updates you may have to the definitions of Major Maintenance Costs, Variable Operations Costs, and General and Administrative Costs, if any, listed in the July 2, 2019 report found on the stakeholder initiative website.**

PGE agrees with the Variable Operations Cost and General and Administrative Cost definitions presented in this process. However, PGE is concerned with CAISO’s attempt to divide “Major Maintenance” and “Other Maintenance” costs based on how large the scale of the costs are and the frequency of spending. Separating “Major Maintenance” and “Other Maintenance” is difficult to defend because the frequency with which a generator owner performs repairs related to wear-and-tear is highly dependent. Factors influencing frequency include the asset age, the operating profile, equipment type, risk tolerance for reliability, and vendor agreements (if applicable). Additionally,

as operating profiles on fossil units have changed with the increase of renewable penetration, many generator asset management strategies have also altered. This has made it more difficult to base classifications simply on the historical frequency of the maintenance activity.

Given that most wear-and-tear is related to two failure mechanisms – creep or fatigue – it is easier to **first** classify all variable maintenance work as maintenance that is required due to exposure to either type of these two mechanisms. Once the variable work has been identified and a dollar cost has been assigned to that work, the generator owner has several options for determining the allocation of the wear-and-tear obligation on the unit. For creep related damage, this is typically incurred by an operating hour basis. For fatigue related damage, this is typically incurred by on/off cycling. Unlike consumables and chemicals (which correlate closely with fuel firing, and, therefore, MWH production) maintenance activities are seldom related to load set points. However, PGE maintains that there may be exceptions.

In the past, when operating profiles were reliably static (i.e., a unit was clearly a “base load” unit, an “intermediate unit,” and a “peaking unit”), the total maintenance costs could be reliably predicted by utilizing a \$/MWH profile because the historic trend of both cost and MWH did not alter with time. With the change in operating profiles for fossil units on the grid and a drive in the industry to optimize maintenance costs to a more predictive and condition-based forecast, creep and fatigue mechanisms are being identified. Maintenance repairs are being linked to either work required per operating hour or per start up, depending on the dominant failure mechanism. This has resulted in a notable shift in marginal cost representation for maintenance to a more accurate wear-and-tear obligation of \$/hour and \$/start. This is especially true for combustion turbine technologies and is reinforced by the increased prevalence of long-term service agreements in the industry that are billed by production hours or starts (not MWH).

In noting these changes, PGE encourages the CAISO to limit the examination of the maintenance component of the VOM in scope for gas turbine technologies. For most modern combustion turbine asset management maintenance strategies, the majority of the repair cost obligation is being incurred not by MWH, but by run hours or starts.

Additionally, PGE is concerned by how these costs have been separated. The governance of the representation of the variable wear-and-tear costs are different depending on the mechanism CAISO has offered to a market participant. The VOM component can be effectively “marked up” as part of the energy bid to well over \$1000/MWH, but the Major Maintenance Adder component is capped at 125% of

actual. This inconsistency persists even when market mitigation is engaged; the VOM is subject to a 110% cap, while the MMA is capped at 125%.

Given the fact that the guidelines CAISO has proposed to differentiate “Other Maintenance Costs” and “Major Maintenance Costs” are entirely dependent on a survey of generator owners who may be using very different asset management strategies (or accounting processes) and that the represented costs are not being equitably treated in mitigation or bidding caps, PGE strongly encourages the CAISO to align the governance and economic treatment of the maintenance components across all of the representations of energy costs in the market.

- 4. Please provide any comments or updates to the categories/sub-categories of generation technologies for VOM adders. Should the “Combined Cycle and Steam” or “Combustion Turbine & Reciprocating Engine” categories currently found in the CAISO BPM for Market Instruments be further disaggregated into sub-categories (e.g. CC H Frame, CC F Frame, E Class CT, H Class CT)?**

PGE has reciprocating combustion engines that were not presented in the technology specific examples. Additionally, PGE agrees with other commenters that further disaggregation may cause confusion as certain resources may not fit into any of the more granular categories, or may have special considerations driving costs (e.g., the same class of resources may have different costs depending on where on the CAISO system they are located). PGE recommends simplifying to the highest standard within reason. CAISO has a negotiated DEB option for those market participants seeking more specificity in their cost representation. Additionally, the market design encourages bidding at or near cost which should incentivize participants to utilize the most correct VOM possible, including utilizing a smaller number than provided in the tariff.

- 5. Please offer your feedback on structure of this stakeholder initiative and working groups.**

PGE appreciates the opportunity to provide comments on the ISO’s efforts to review the VOM cost adders and recognizes the challenges associated with identifying those maintenance activities that are directly linked to variable costs.

Additional comments:

Appendix A:

Cost Component Allocation		
Major Maintenance	Other Maintenance - Variable	Other Maintenance - Fixed

Maintenance Activity	Please note if you disagree and why
Inspections, Repairs and Overhauls, and Replacements:	
1) Air Heater/Pre-Heater	More detail needed – is this gas turbine Inlet bleed heat?
2) Alignment Checks	N/A – this will be part of other maintenance activities
3) Battery System	
4) Bearings	More detail needed – are these “Turbine/Generator” Bearings?
5) Boilers, Burners, and Related Items	Too broad and potential duplicative (covered below?). Not clear what “related items” are referring to?
6) Borescopes	Too broad – is this limited to turbines? If so, would be variable.
7) Casings, Shells, and Frames/Diffusers	
8) Combustion Turbine Generator Evaporative Cooling System Media	Should remove “Generator” from description – this should apply to all “inlet cooling.”
9) Combustion Turbines and Related Items	Not clear what “related items” is referring to?
10) Compressor, Generator, and/or Turbine Rotors	Too broad – all but the “Generator” are part of the Combustion Turbine.
11) Condensers and Evaporators	More detail needed - is this the steam turbine “condenser”?
12) Communication Systems	More detail needed – comm system should be N/A?
13) Compressor Blades	More detail needed – is this part of the Combustion Turbine?
14) Compressor Wash System	
15) Condensate Systems	
16) Clutches and Gears	More detail needed – N/A for most Gas Turbines
17) Cooling Tower Equipment	
18) Demineralization Systems	
19) Device Calibrations	
20) Distributed Control Systems	More detail needed – unclear how this differs from #63? Maintenance associated with this system would be variable (consistent with #63).
21) Duct Burner and Liners	More detail needed – unclear why this would fall under Major Maintenance vs. Variable.
22) Emissions Control Equipment Repairs	

23) Emissions Monitoring Tests	
24) Filters	
25) Fuel Metering Equipment	
26) Fuel Treatment System	
27) Generator Field Rewinds	
28) Heat Transfers	
29) High Energy Piping	Piping – redundant classifications
30) Hot Gas Paths	Ambiguous
31) Hot Sections	Ambiguous – needs to be defined?
32) Hotwell and Related Items	
33) Instrument and Service Air and Water Supply Systems	
34) Main Steam Piping	
35) Nozzle Block	
36) Oil Changes	What kind of oil? Turbine? Other?
37) Oxygen Boiler	More detail needed. Unclear what this is referring to?
38) Plant Electrical Systems	
39) Pumps & Motors	
40) Radial and Axial Clearance Checks	More detail needed. Do these relate to turbines?
41) Seals	
42) Steam Drum and Related Items	More detail needed. Not clear what “related items” are referring to?
43) Tubes and Piping	
44) Transformer	
45) Turbine Blades and Diaphragms	
46) Turbine Lube Oil Sampling	Move to testing section.
47) Turning and Ratchet Gear Maintenance	
48) Valves	
49) Vibration Analysis Monitoring	Move to testing section.
50) Water Circuits	More detail needed. Is this “Circulating Water”?
51) Waterbox	
**Add: Cooling Tower Cleaning	
**Add: Condenser Cleaning	

Cleaning	
52) Boiler Cleaning	
53) Chemical Cleaning	
54) Heat Transfer Cleaning	

56) Hydro-Blast Cleaning	
57) Relay Cleaning	More detail needed. Have not done “Relay Cleaning” but have done Circuit Breaker testing and cleaning.

Testing	
58) Hydrogen Embrittlement Testing	N/A
59) Non-Destructive Testing	More detail needed. Likely variable in most cases.
60) Performance Testing (Oxygen Boiler Tests, On-Line Testing, Pre-Air Heater Test)	More detail needed. Likely N/A for a gas fired plant.
61) Relay & Interlock Testing	
<i>Add: Breaker Testing (Variable)</i>	

Other	
62) Balance-of-Plant	More detail needed. Ambiguous.
63) Distributed Control System Upkeep	See note under #20

Materials	
64) Instruments	N/A
65) Safety Equipment	N/A
66) Shop Supplies	N/A
67) Tools	N/A

***PGE proposes the following change to Appendix A:**

Combustion Turbine

- Hot Gas Path Section (nozzles, buckets, shrouds, seals, etc.)
- Compressor Section (inlet guide vanes, blades, etc.)
- Turbine Rotor
- Casing, Shells, Frame/Diffusers & Expansion Joints
- Inlet Air Heating/Cooling/Filtration
- Fuel Gas Control Components/System
- Fuel Gas Conditioning to include Heating & Filtering
- Fuel Burning Components (nozzles, liners transition pieces, crossfire tubes, ignitors, flames scanners, cooling air components, etc.)
- Control System
- Generator to include Hydrogen Cooling System
- Starting System
- Excitation System
- Battery System
- Compressor Wash System

- Turning Gear
- Bearings
- Lube Oil System

Steam Turbine

- Turbine Nozzles & Buckets
- Rotor
- Generator
- Condenser (Circulating Water and Condensate Side)
- Lube Oil System
- Steam Control & Non-Return Valves
- Control System
- Turning Gear
- Bearings
- Electro-Hydraulic Control (EHC)

Heat Recovery Steam Generator (HRSG)/Boiler

- Heat Transfer Sections
- Steam Drums
- Steam Piping
- Drains & Vents
- Casing & Chimney
- Control and Relief Valves
- Chemistry Treatment/Control Systems
- Duct Burning System
- Cleaning (Interior & Exterior)
- Expansion Joints

Balance of Plant Systems

- Distributive Control
- Feed Water
- Condensate
- Circulating Water to include Cooling Towers
- Demineralized Water
- Exhaust Gas Conditioning (Selective Catalytic Converter & Associated Ammonia Injection)
- Emissions Monitoring Equipment
- Electrical Systems to include Generator Breakers and Transformers
- Water & Steam Sampling System
- Instrument and Service Air
- Uninterruptable Power Supply

Testing

- Continuous Emissions Monitoring RATA
- Rotating Equipment Vibration Monitoring
- Lube Oil Sampling

Electrical Breakers
Protective Relays & Interlocks
Instrument/Device Calibrations
Relief Valve