



Variable Operations and Maintenance Cost Review

Working Group 3 – Solar and Wind Resources

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Purpose of Working Groups

- Goal 1: Offer definitions for comment for:
 - Major Maintenance Costs
 - Variable Operations Costs
 - General and Administrative Costs
- Goal 2: Seek stakeholder feedback on how to differentiate cost components from one another on a technology-specific level

Both goals will aid in the CAISO's updates to Variable Operations and Maintenance cost adder values and may result in addition of new definitions in the CAISO Tariff or BPM

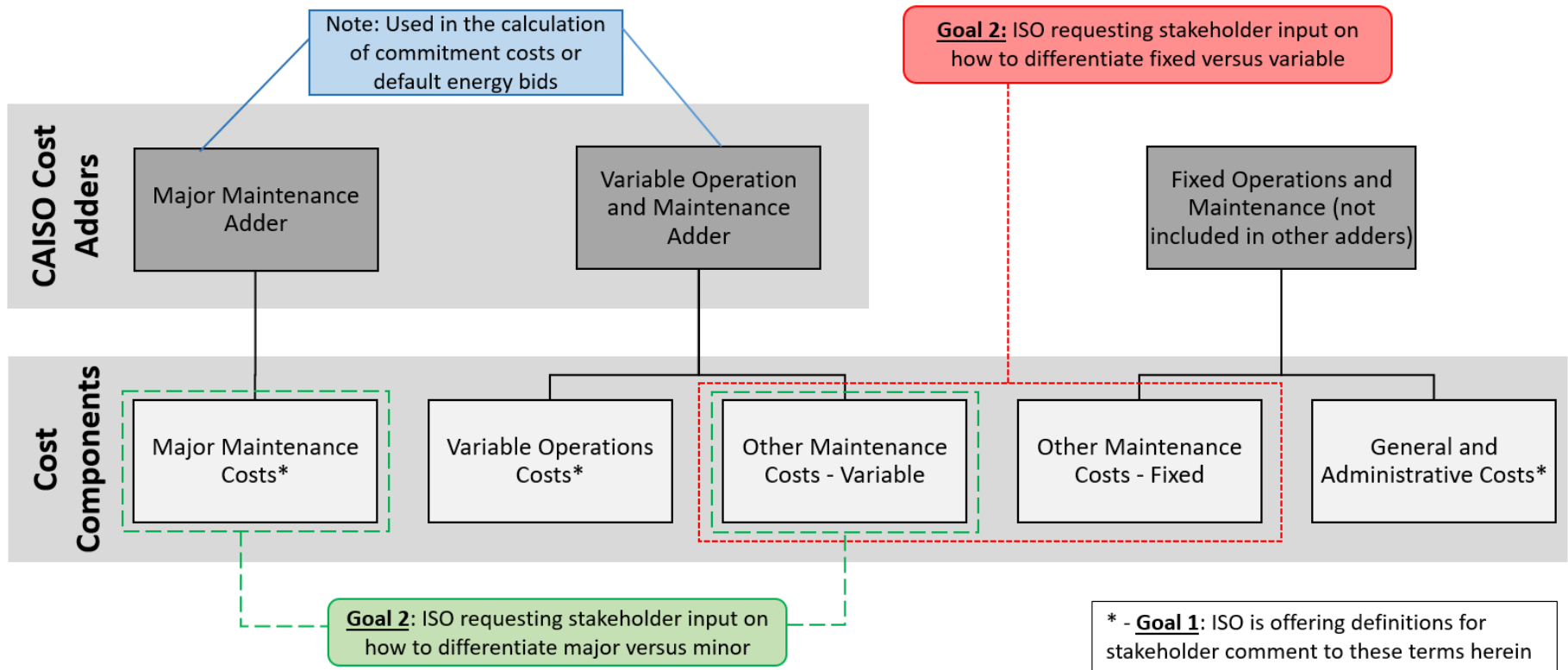
Background

- The CAISO has committed to revisit Variable O&M (VOM) adder values once every three years
- In December 2018, the CAISO and Nexant published a report proposing updates to VOM adder values that had been in place since 2012
- Stakeholders noted a lack of definitions for major maintenance and variable operations and maintenance in the CAISO Tariff and other issues with the values

Cost Components

- To aid in the discussion of the gray areas in the process of differentiating costs, CAISO is introducing some new cost component terms:
 - General and Administrative (G&A)
 - Variable Operations (VO)
 - Major Maintenance (MM)
 - Other Maintenance (OM)
 - Other Maintenance - Variable
 - Other Maintenance - Fixed

Cost Components and Cost Adders



The Low-Hanging Fruit

General & Administrative Costs

- General and Administrative costs are those costs incurred at a power plant that *do not vary with and/or relate to production.*
- These costs include:
 - Leasing or rental costs
 - Property taxes
 - Insurance
 - Industry-related fees and costs

The Low-Hanging Fruit

Variable Operations Costs

- Costs of consumables *associated directly with the electrical production* of a generating unit and *specifically exclude both maintenance and fuel costs.*
- These costs include:
 - Consumable materials and supplies
 - Lubricants, fluids, and hydraulic oils consumed in production, if any

Major Maintenance Costs

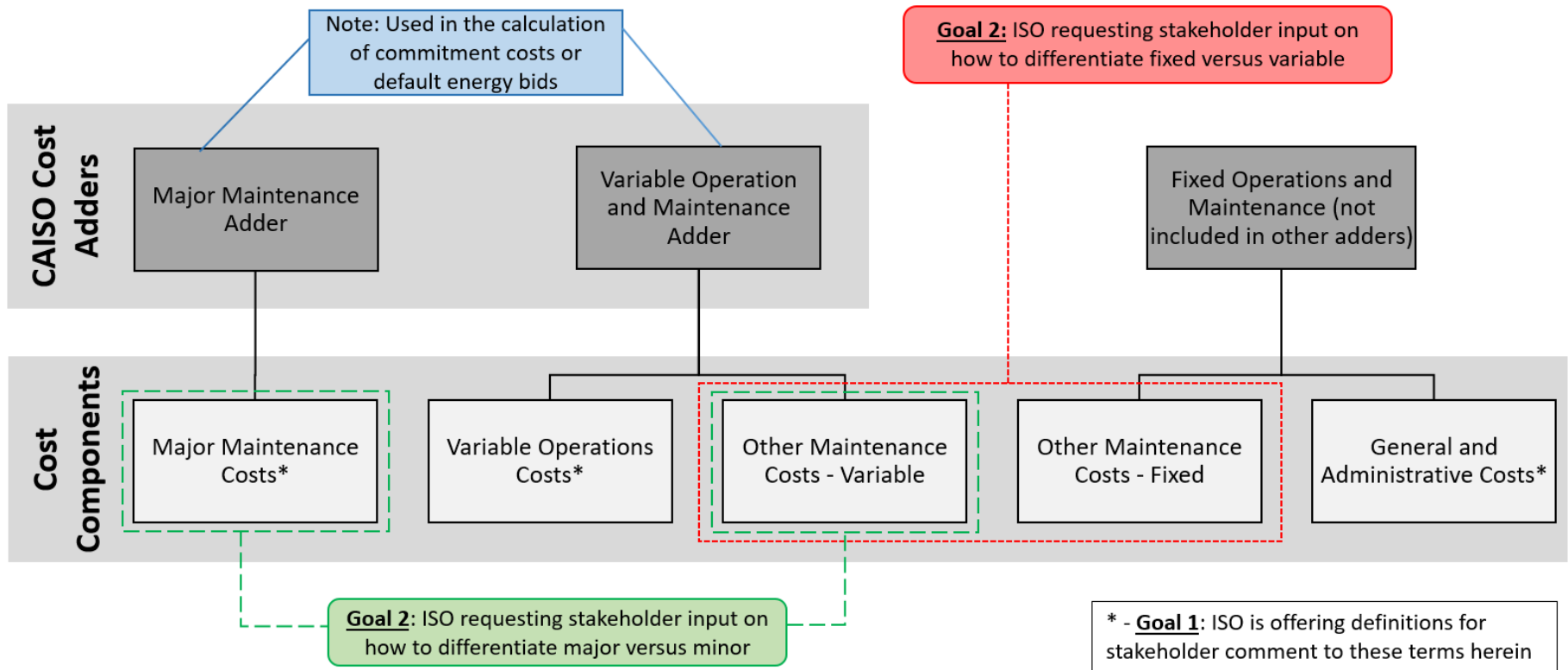
- Costs associated with *extensive maintenance of a generating unit* that cannot be done as part of routine maintenance. Major maintenance costs must be *associated with electrical production* of the generating unit such that the costs can be *related to run-hour production or the startup* of the generating unit.
- Major maintenance is an existing concept in the CAISO Tariff and an adder already exists for these costs

The Tricky Part

Other Maintenance Costs

- Other Maintenance costs are maintenance costs which *do not require the generator to undergo an extensive outage* and may be characterized as *fixed or variable*.
- Challenges:
 - Long-term Service and Power Purchase Agreements
 - Fixed \$ values covers all maintenance – variable and fixed
 - Predictive vs Corrective vs Preventative

Cost Components and Cost Adders



Previous VOM Adder Values

Currently used in CAISO markets

Generation Technology	Recommended VOM Cost Adder (\$/MWh)
Solar	\$0.00
Wind	\$2.00

Proposed in December 2018

Table 3-4: Variable Operations and Maintenance Costs – Renewable Generators with VOM (2019\$)

Plant Type	Variable O&M Cost
Solar Thermal Power Plant w/o storage	\$0.24 MWh
Solar Thermal Power Plant with storage	\$0.26 MWh

- Solar Thermal Power Plant w/o storage – Cost of water and water chemicals for the steam cycle and cooling tower and other miscellaneous consumables costs.
- Solar Thermal Power Plant with storage – Same as w/o storage plus cost of Nitrogen (or inert gas) blanketing of the molten salt storage tank

Table 3-5: Generating Plants without Variable Operations and Maintenance Costs

Plant Type
Solar PV of all sizes
Wind Generators

Maintenance Costs - Discussion

Inspections, Repairs and Overhauls, and Replacements:	
1) Alignment Checks	8) Generator Field Rewinds
2) Battery System	9) Panels, Inverters, and Trackers
3) Bearings	10) Plant Electrical Systems
4) Clutches and Gears	11) Transformer
5) Communication Systems	12) Turbine Blades
6) Device Calibrations	13) Vibration Analysis Monitoring
7) Distributed Control Systems	

Other	
14) Balance-of-Plant	15) Spare Parts

Materials	
16) Instruments	18) Shop Supplies
17) Safety Equipment	19) Tools

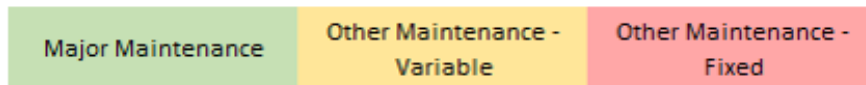


Maintenance Costs – Example Proposal

Inspections, Repairs and Overhauls, and Replacements:	
1) Alignment Checks	8) Generator Field Rewinds
2) Battery System	9) Panels, Inverters, and Trackers
3) Bearings	10) Plant Electrical Systems
4) Clutches and Gears	11) Transformer
5) Communication Systems	12) Wind Turbine Blades
6) Device Calibrations	13) Vibration Analysis Monitoring
7) Distributed Control Systems	

Other	
14) Balance-of-Plant	15) Spare Parts

Materials	
16) Instruments	18) Shop Supplies
17) Safety Equipment	19) Tools



Proposed Next Steps

After today's discussion, we'd like stakeholders to reflect on what was discussed and submit in writing:

- Maintenance activities missing that should be included in the future
- Which cost component the maintenance activities discussed should belong in
- Proposals for updates to definitions
- Feedback on structure of this stakeholder initiative and working groups

Send emails to initiativecomments@caiso.com by 8/2

Please note if you'd like your comments to be confidential