



California ISO

Variable Operations and Maintenance Cost Review

Working Group 5 – Other Resources

Nuclear, Coal, Geothermal, Landfill Gas, Biomass, and any others

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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

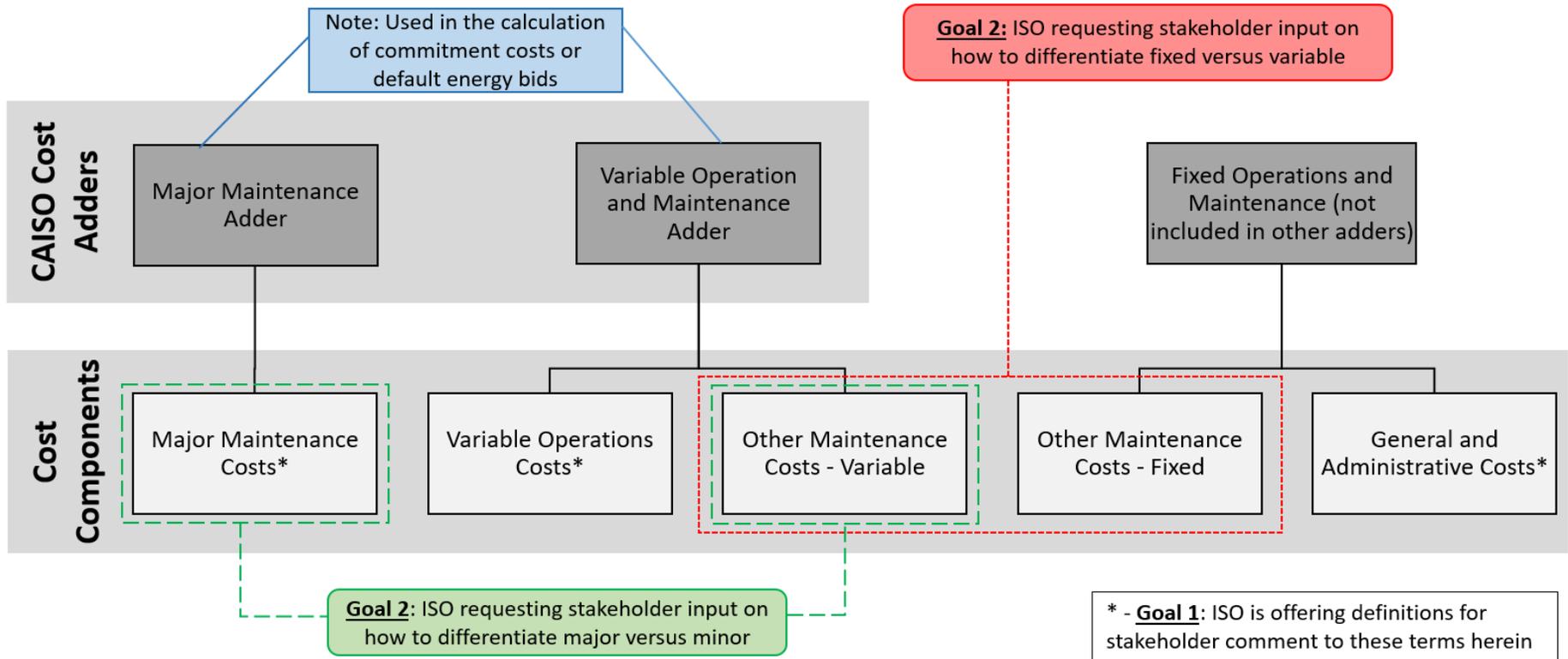
Background

- 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:
 - Raw water, particularly water used in the steam cycle
 - Waste and wastewater disposal expenses (incl. H₂S treatment)
 - Lubricants, fluids, and hydraulic oils consumed in production
 - Chemicals used in plant emissions control processes such as ammonia, SCR catalyst and CO oxidation catalyst

Major Maintenance Costs

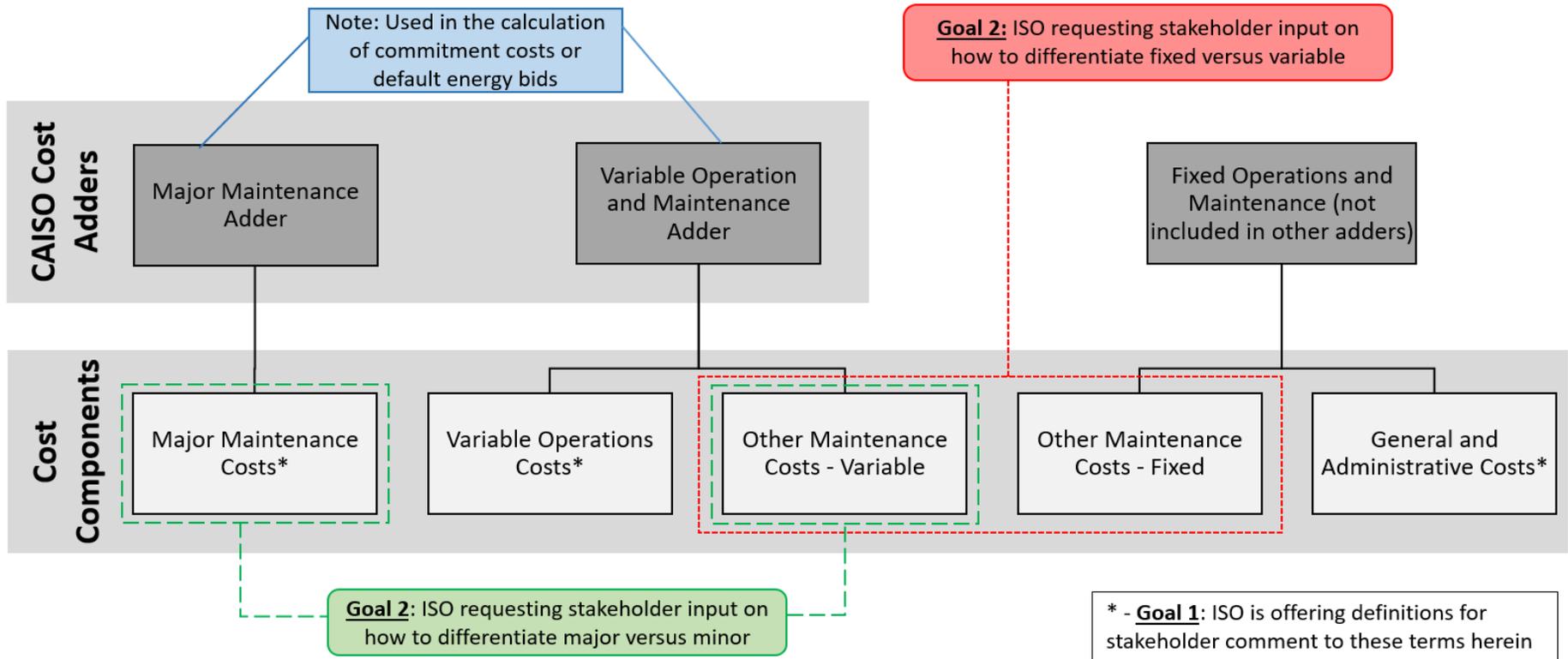
- Costs associated with *extensive maintenance of a generating unit* that cannot be done as part of routine maintenance. Major maintenance costs must be *associated with electrical production* of the generating unit such that the costs can be *related to run-hour production or the startup* of the generating 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		Proposed in December 2018 Report	
Generation Technology	Adder Value (\$/MWh)	Generation Technology	Adder Value (\$/MWh)
Nuclear	\$1.00	Nuclear Plant Size 1100 MWs	\$1.87
		Advanced Nuclear Plant	\$1.96
Coal	\$2.00	Coal Plant - Pulverized Coal – Subcritical	\$2.69
		Coal Plant - Pulverized Coal – Supercritical	\$2.64
		Coal Plant - Ultra-Super-Critical Coal Plant	\$2.60
		Coal Plant - Super-Critical with 90% Carbon Capture and Sequestration (CCS)	\$5.21
		Integrated Coal Gasification Combined-Cycle (IGCC)	\$1.57
Geothermal	\$3.00	Geothermal Power Plant	\$1.16
Landfill Gas	\$4.00	Land Fill Gas	\$1.21
Biomass	\$5.00	Biomass Power Plant	\$1.65

Maintenance Costs - Discussion

General and/or Landfill Gas Fired-Related Items	
Inspections, Repairs and Overhauls, and Replacements:	
1) Air Heater/Pre-Heater	27) Generator Field Rewinds
2) Alignment Checks	28) Heat Transfers
3) Battery System	29) High Energy Piping
4) Bearings	30) Hot Gas Paths
5) Boilers, Burners, and Related Items	31) Hot Sections
6) Borescopes	32) Hotwell and Related Items
7) Casings, Shells, and Frames/Diffusers	33) Instrument and Service Air and Water Supply Systems
8) Combustion Turbine Generator Evaporative Cooling System Media	34) Main Steam Piping
9) Combustion Turbines and Related Items	35) Nozzle Block
10) Compressor, Generator, and/or Turbine Rotors	36) Oil Changes
11) Condensers and Evaporators	37) Oxygen Boiler
12) Communication Systems	38) Plant Electrical Systems
13) Compressor Blades	39) Pumps & Motors
14) Compressor Wash System	40) Radial and Axial Clearance Checks
15) Condensate Systems	41) Seals
16) Clutches and Gears	42) Steam Drum and Related Items
17) Cooling Tower Equipment	43) Tubes and Piping
18) Demineralization Systems	44) Transformer
19) Device Calibrations	45) Turbine Blades and Diaphragms
20) Distributed Control Systems	46) Turbine Lube Oil Sampling
21) Duct Burner and Liners	47) Turning and Ratchet Gear Maintenance
22) Emissions Control Equipment Repairs	48) Valves
23) Emissions Monitoring Tests	49) Vibration Analysis Monitoring
24) Filters	50) Water Circuits
25) Fuel Metering Equipment	51) Waterbox
26) Fuel Treatment System	

Coal-Specific Items	
Inspections, Repairs and Overhauls, and Replacements:	
52) Ash Handling Equipment	60) Coal Freeze
53) Ash Hopper	61) Coal-Handling and Distribution Equipment
54) Boiler Condition Assessment	62) Deaerator
55) Coal Bunker	63) Evaporator Tubing
56) Coal Burner	64) Fire Extinguishing Equipment
57) Coal Crusher	65) Precipitator/Bag House
58) Coal Drying	66) Stack, Fans, and Draft
59) Coal Feeder Pulverizing Equipment	67) Superheater/ Reheater/ Economizer Tubing and Headers



Maintenance Costs – Example Proposal

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Major Maintenance	Other Maintenance - Variable	Other Maintenance - Fixed
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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 8/6

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