



Variable Operations and Maintenance Cost Review

Straw Proposal

Kevin Head
Market Analysis & Forecasting

Stakeholder Web Conference
January 6, 2020

CAISO Policy Initiative Stakeholder Process



Note that this is now a *new* Stakeholder Process in addition to the existing *recurring* Stakeholder Process

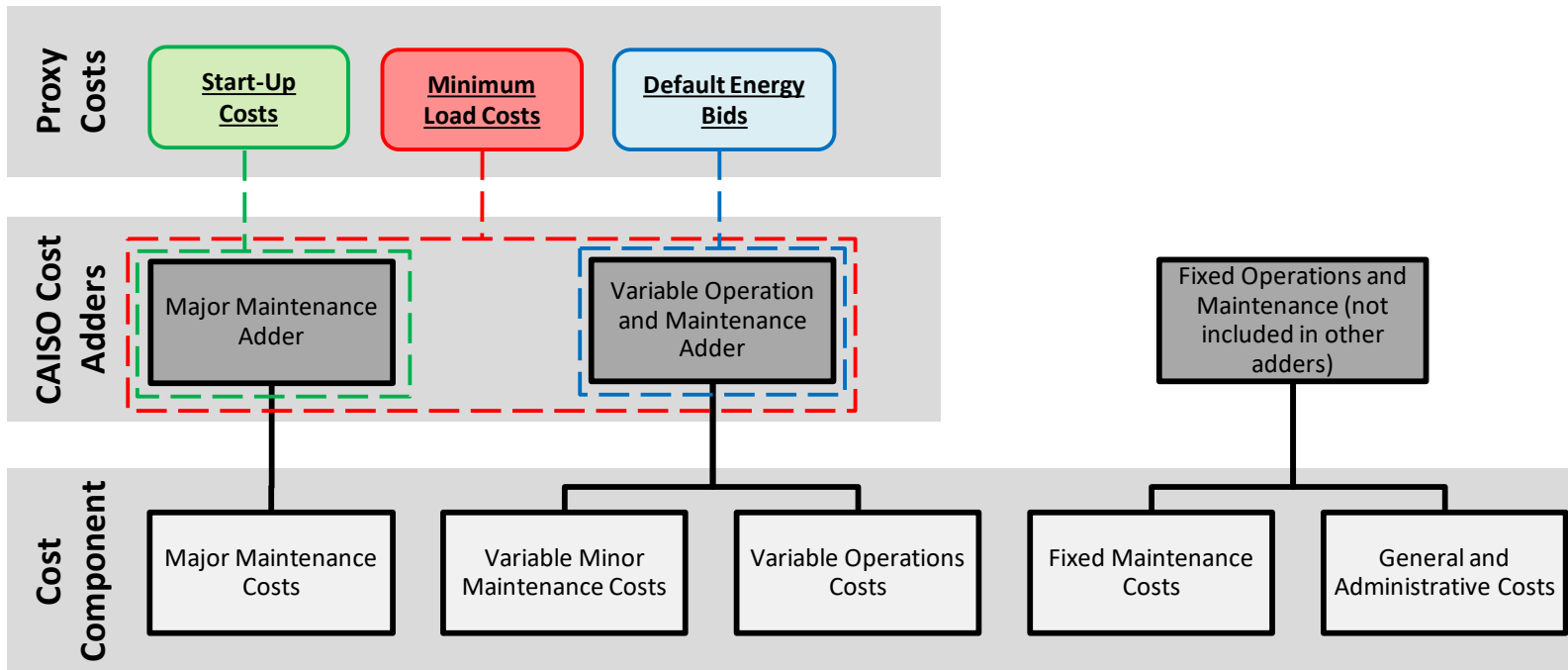
Agenda

Topic	
Welcome and stakeholder process	Isabella Nicosia
Introduction/Background	Kevin Head
Issues	Kevin Head
Proposal A. Establish definitions for the O&M cost components B. Refine Variable Operations Adders C. Calculate Default Maintenance Adders	Kevin Head
Next Steps	Isabella Nicosia

Introduction/Background

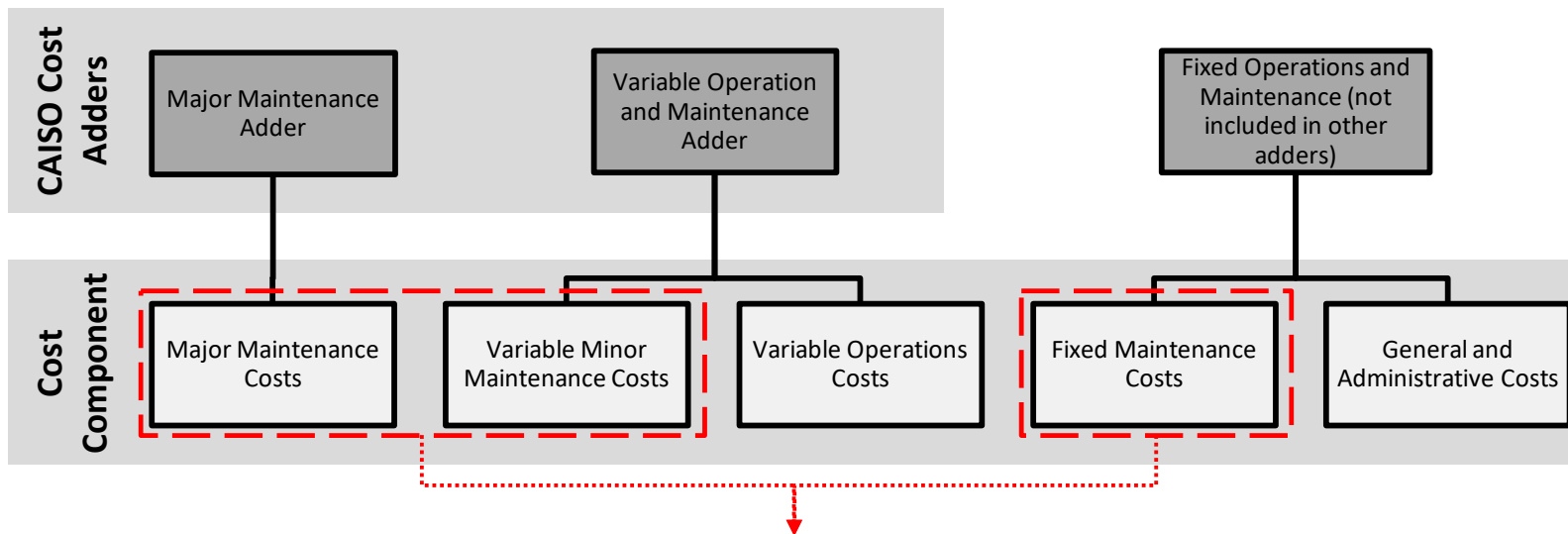
- CAISO has committed to revisit Variable O&M (VOM) adder values once every three years
- December 2018: CAISO published a report developed by Nexant proposing updates to VOM adder values that had been in place since 2012
 - Stakeholders noted a lack of definitions for major maintenance and variable operations and maintenance in the CAISO Tariff and other concerns with the proposed values (e.g. values weren't geographically-scaled)
- July 2019: Proposed updated definitions and held 5 tech specific stakeholder workshops to discuss definitions
- December 2019: Issued issue paper and straw proposal

Current Practice



Issue 1 – Need for better definitions

- Leads to:
 - Difficulty in quantifying these when updating default VOM values
 - Challenges in negotiating MMA and VOM values

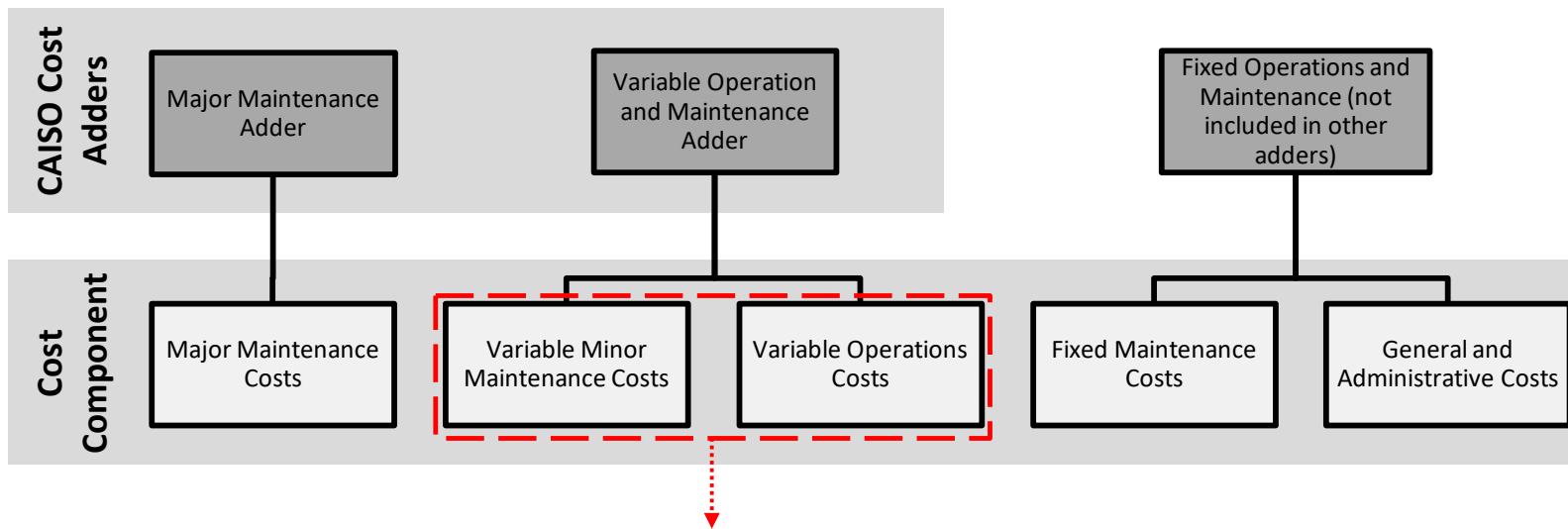


How to differentiate?

- Fixed versus variable
- Minor versus major

Issue 2 – Combining dissimilar cost components

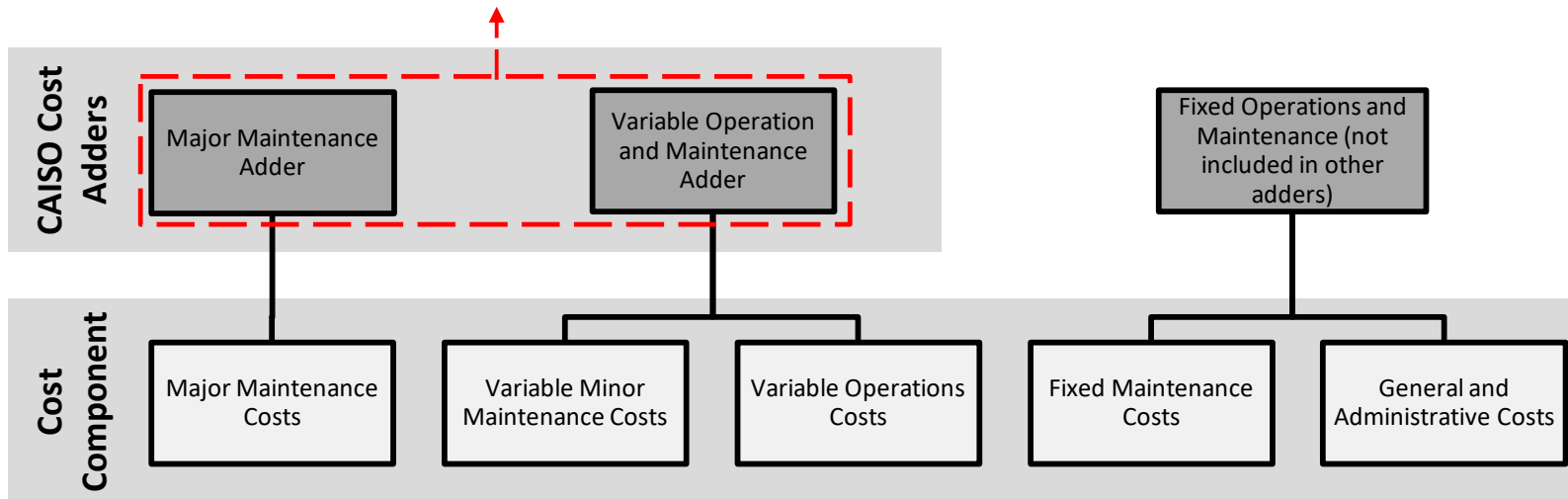
- Leads to:
 - Costs which are incurred differently (e.g. mostly due to MWh production vs. run-hours/starts) are include the same adder



Variable Operations and Variable Minor Maintenance costs are different in nature

Issue 3 – Undue burden from previously-proposed VOM adders

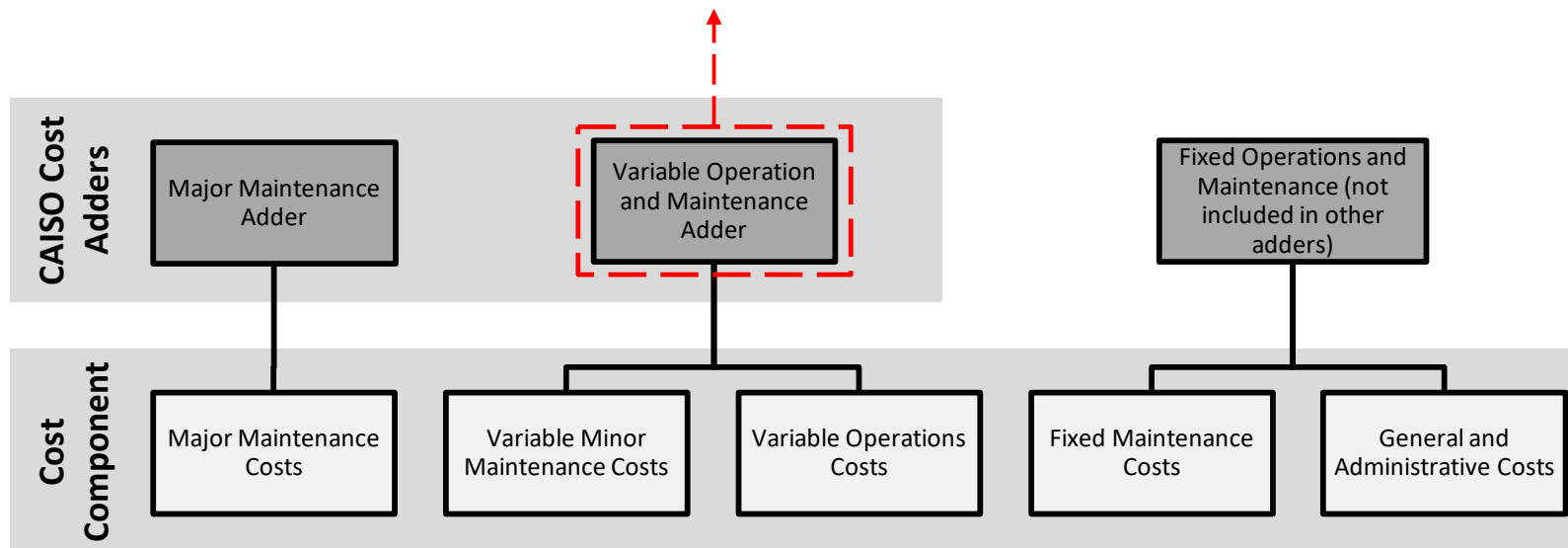
December 2018 proposed values may increase the quantity and frequency of negotiation of MMA and VOM values if default values are too low



Issue 4 – Risk of VOM adders becoming stale over time

Default values may become stale due to changes over time

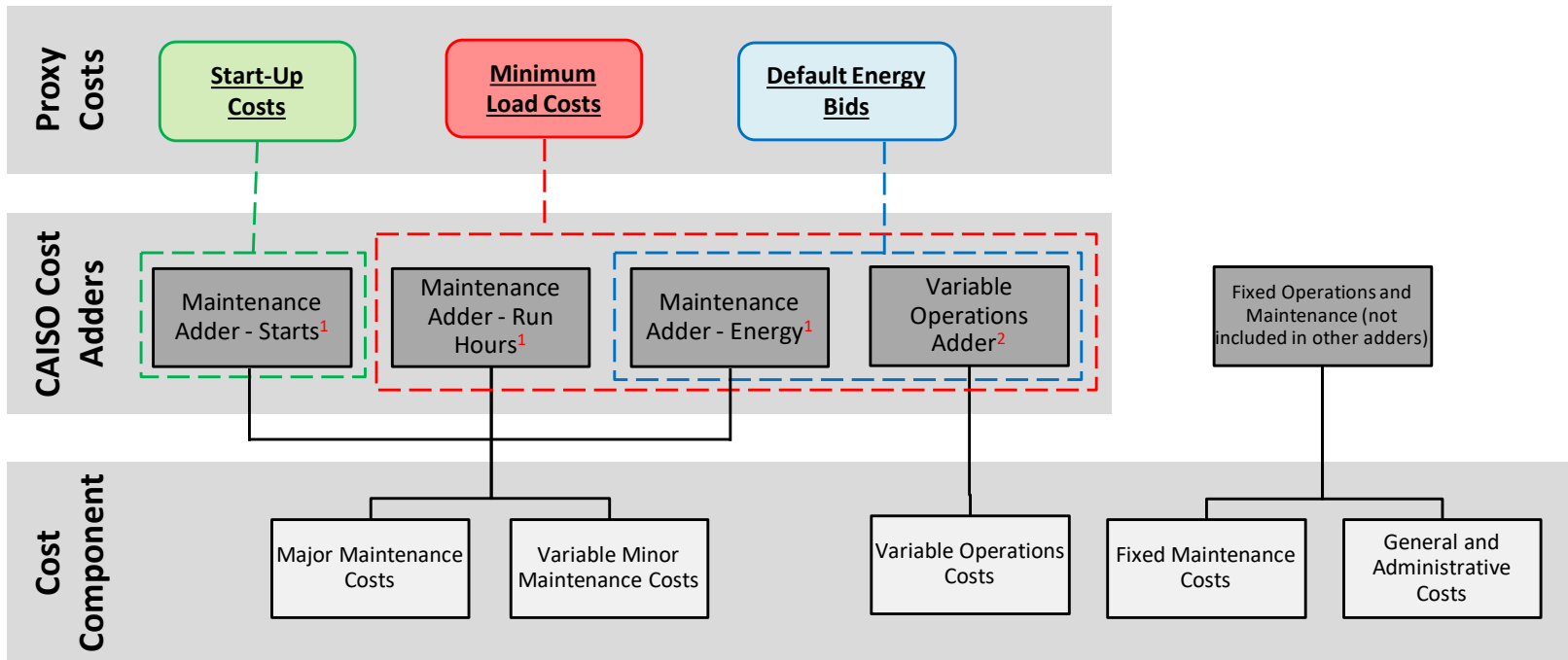
↳ With no definitions, CAISO will face the same difficulties when updating in the future



Straw Proposal

- To address these issues, the ISO proposes a more comprehensive approach that involves:
 - Defining the O&M cost components
 - Updating the VOM adder to a VO adder
 - Changing the MMA to be simply a maintenance adder

Proposed Cost Recovery Framework in ISO Markets

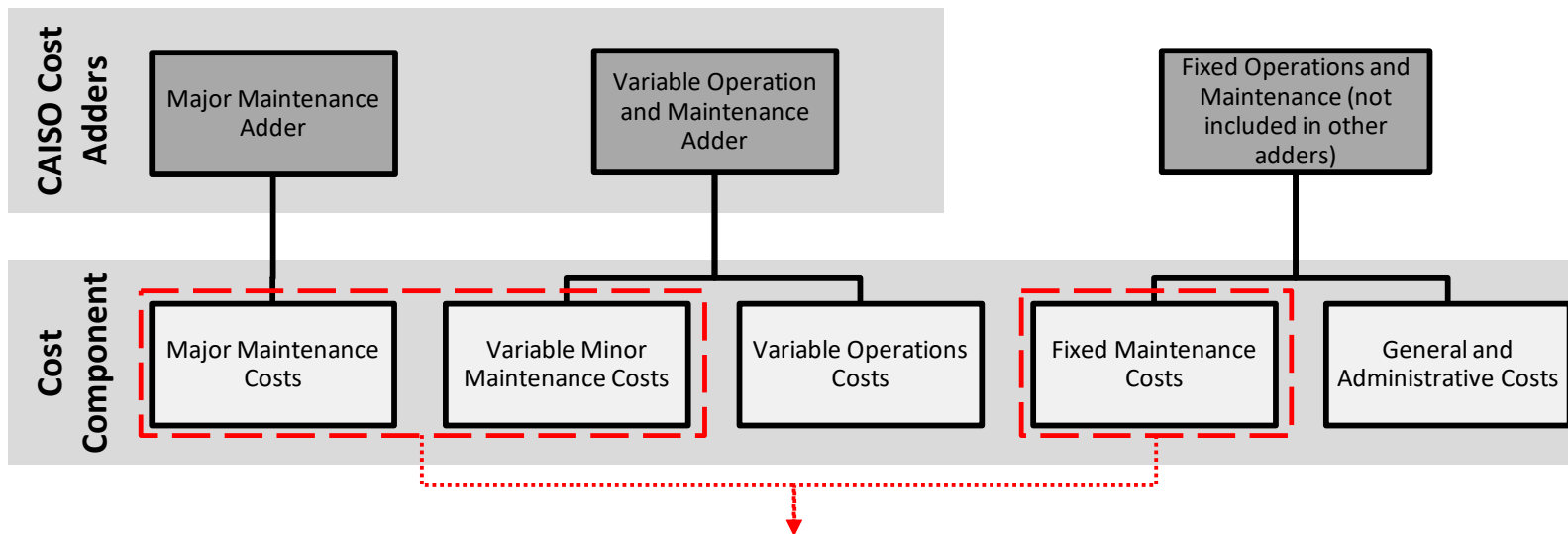


1 – Develop *low-threshold* default maintenance adders. If market participants would like to negotiate values different than the default, normal negotiations take place.

2 – Default values to be developed based on Nexant reports. VO cost value can continue to be negotiated with the ISO if default values are insufficient.

Issue 1 – Need for better definitions

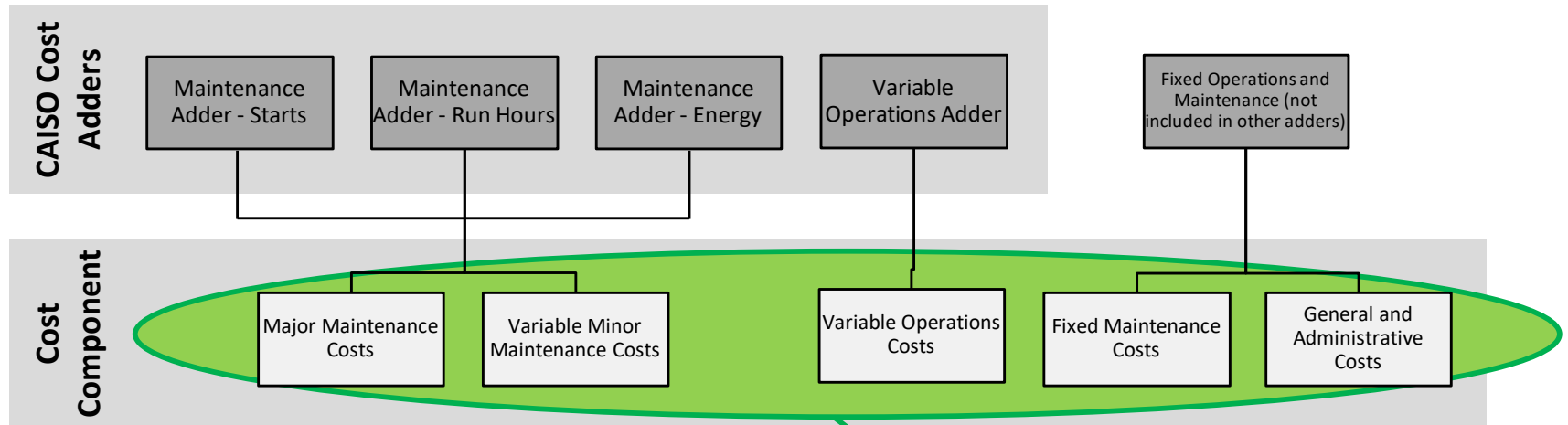
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 - Challenges in negotiating MMA and VOM values



How to differentiate?

- Fixed versus variable
- Minor versus major

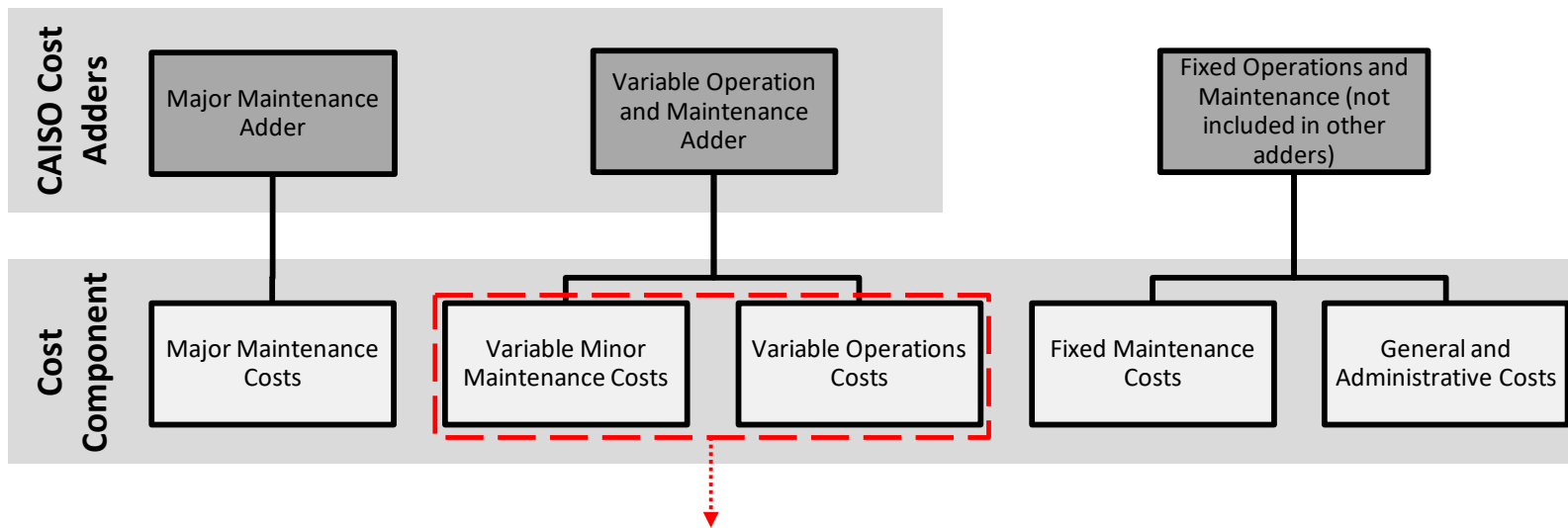
Solution 1 – Need for better definitions



New proposed definitions assist in estimating default values and make negotiating adder values easier

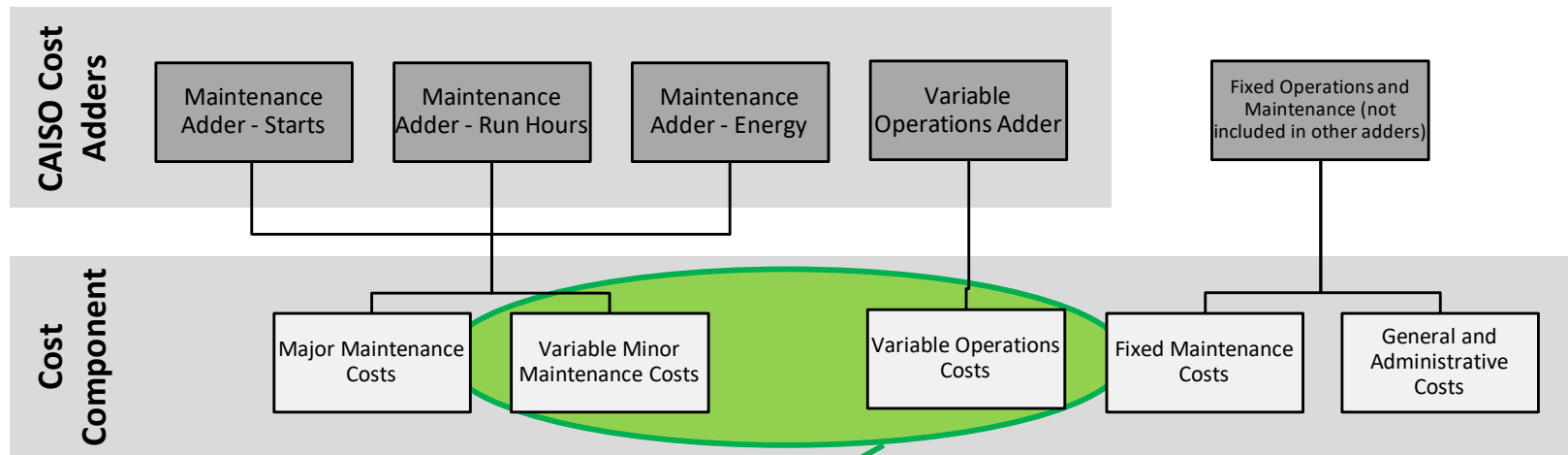
Issue 2 – Combining dissimilar cost components

- Leads to:
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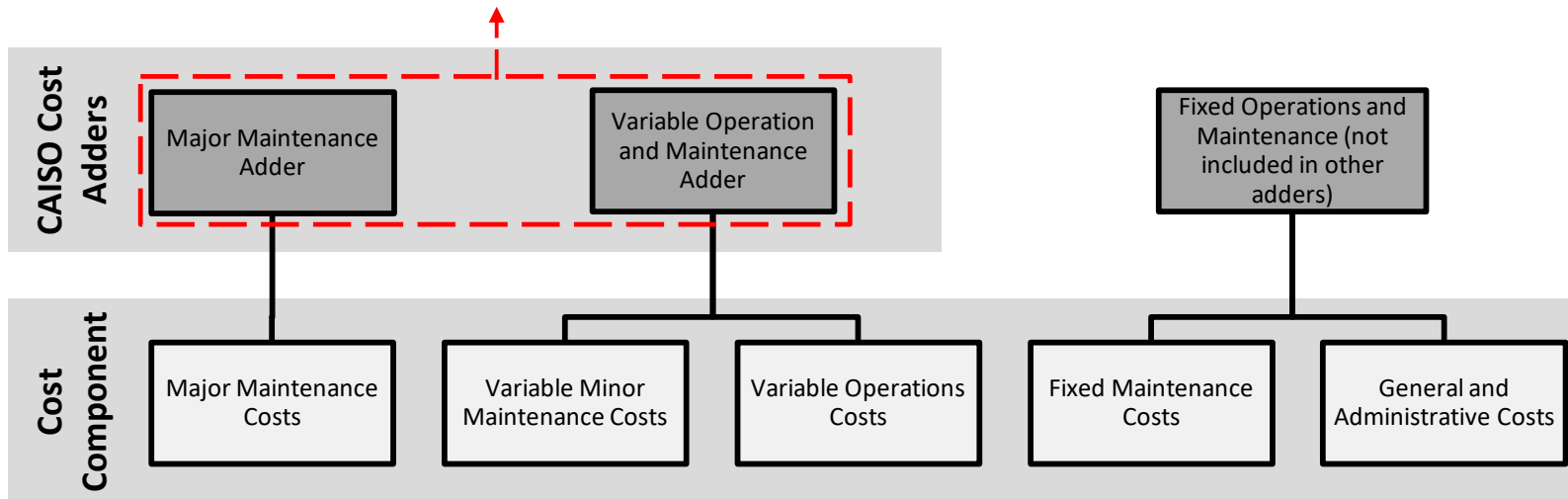
Solution 2 – Combining dissimilar cost components



Dissimilar cost components are now split between different adders

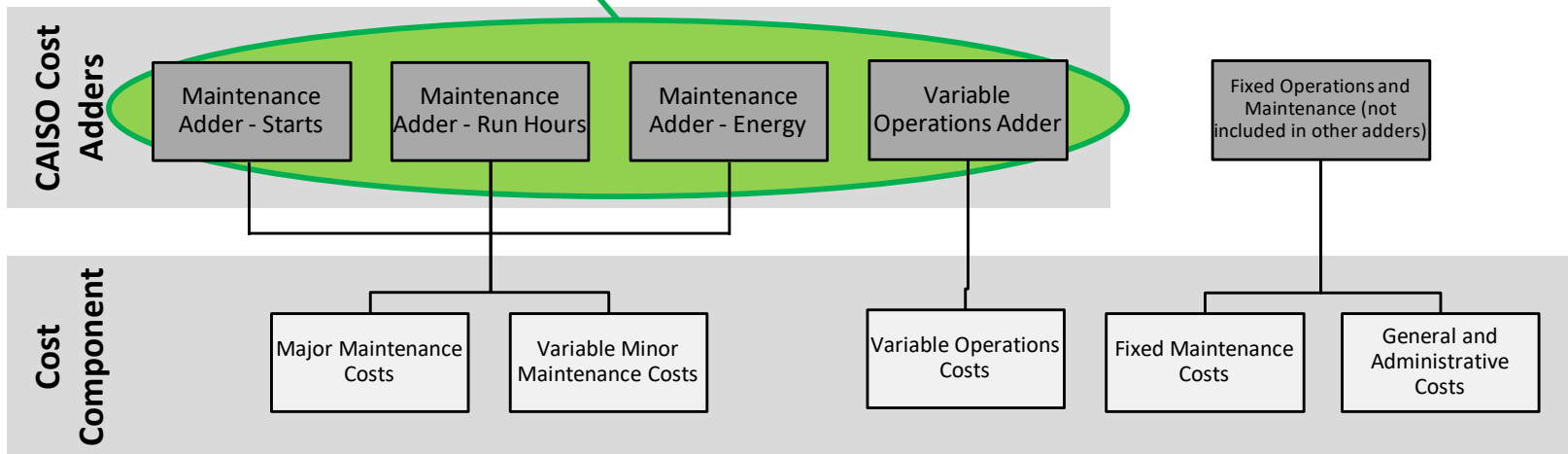
Issue 3 – Undue burden from previously-proposed VOM adders

December 2018 proposed values may increase the volume and frequency of negotiating MMA and VOM values if default values are too low



Solution 3 – Undue burden from previously-proposed VOM adders

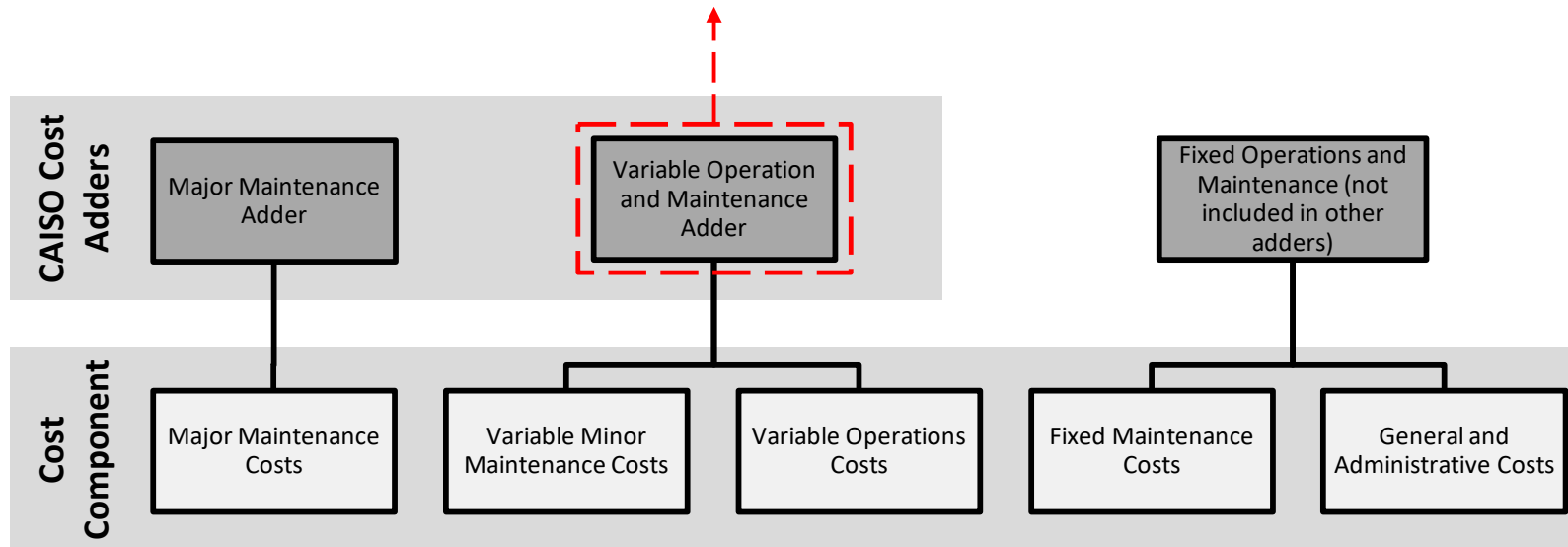
Default values for all adders diminish the need for negotiations



Issue 4 – Risk of VOM adders becoming stale over time

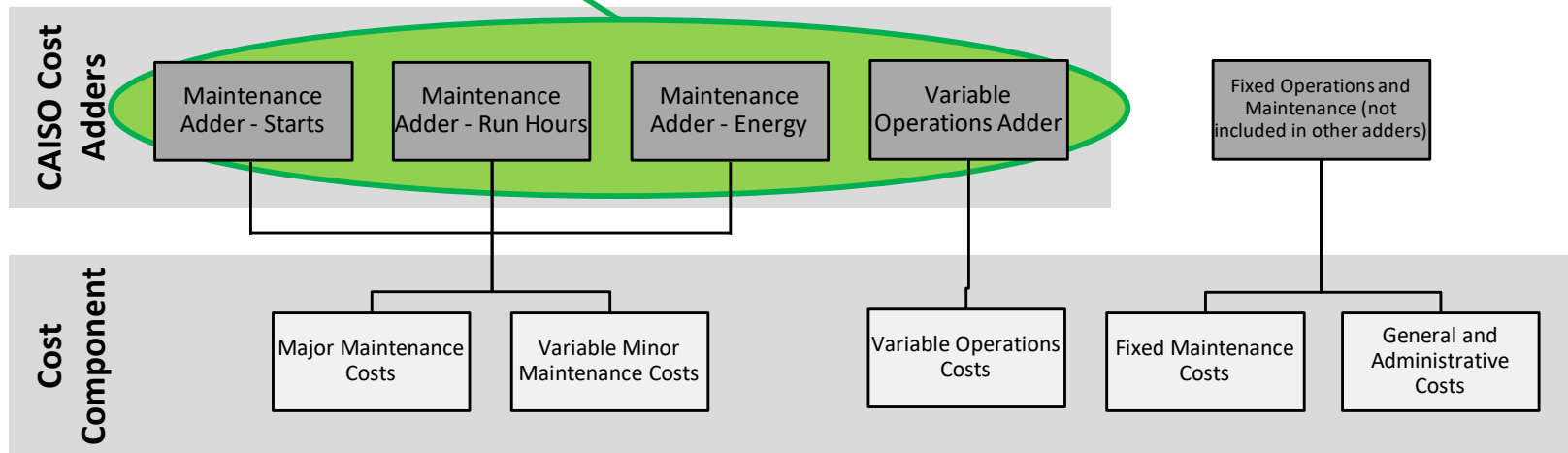
Default values may become stale due to changes over time

With no definitions, CAISO cannot update when needed in the future



Solution 4 – Risk of VOM adders becoming stale over time

Clarified definitions allow for updates to default values over time



Questions??

???

Component A: Define O&M cost components

Variable Operations Costs

“Costs of consumables and other costs that vary directly with the electrical production of a Generating Facility¹, specifically excluding both maintenance and fuel costs. Examples include consumable materials, production-based fees such as royalties paid to landowners, and costs associated with the energy needed to cool critical components.”

¹ In this context, a Generating Facility is defined as consistent with the ISO Tariff Appendix A: “[a]n Interconnection Customer’s Generating Unit(s) used for the production and/or storage for later injection of electricity identified in the Interconnection Request, but shall not include the Interconnection Customer’s Interconnection Facilities.”

Component A: Define O&M cost components

Variable Maintenance Costs

“Costs associated with the repair, overhaul, replacement, or inspection of a Generating Facility that adhere to the following conditions:

- 1. Such costs must be associated with the electrical production of the Generating Facility such that the costs vary with respect to run-hours, electricity output, and/or the startup of the generating unit.*
- 2. Such costs should reflect going-forward costs that are expected to be incurred within the Lifespan of the unit.*

Examples include hot gas path and combustion system inspections and major overhauls. Labor costs associated with maintenance staff that are supplementary to baseline staff (e.g. contractors or reassigned crews) are included in this category. These costs do not include preventative, predictive, or routine maintenance that is not incurred as a result of starting or running the resource.”

Component A: Define O&M cost components

Variable Maintenance Costs:

- CAISO would like to solicit stakeholder feedback on adding in an additional condition to the definition:
 - *“Such costs should not represent significant upgrades to the unit or significantly extend the life of the unit.”*
- Important considerations related to this:
 - Major overhauls and capital replacements are typically high dollar-value items and thus have a large impact on the adder value
 - Definition needs to tie in with existing CAISO definitions (e.g. Material Modifications¹)
 - If not recoverable here, where can these costs be recovered?

¹ See Section 5 of ISO Tariff Appendix EE: <http://www.caiso.com/Documents/AppendixEE-LargeGeneratorInterconnectionAgreementForGIDAP-asof-Apr30-2019.pdf>

Component A: Define O&M cost components

Fixed Maintenance Costs

“Maintenance costs that do not vary with the run-hours, electricity output, or the starting of the Generating Facility. Fixed Maintenance costs are typically routine, predictive, or preventative in nature. Examples include labor costs associated with tools, baseline staff, and shop supplies.”

General & Administrative Costs

“Costs are non-maintenance costs incurred at a Generating Facility that do not vary with or relate to production of the unit. Examples include, but are not limited to, leasing or rental costs, property taxes, insurance, and fixed industry-related fees.”

Component B: Refine Variable Operations Adders

- Below are CAISO's December 2018 estimates
 - CAISO is expecting to update these in the next round of this initiative*

<u>CAISO Technology Groupings</u>	<u>VOM Adder (Currently Used)</u>	<u>VOM Adder (Proposed Dec 2018)</u>
	<i>\$/MWh</i>	<i>\$/MWh</i>
Coal	2.00	2.69
Integrated Coal Gasification Combined-Cycle (IGCC)	2.00	1.57
Steam Turbines	2.80	0.32
Combined Cycle Gas Turbines (CCGTs)	2.80	0.26
Advanced CCGTs	2.80	0.38
Combustion Turbines (CTs)	4.80	0.82
Advanced CTs	4.80	0.82
Reciprocating Internal Combustion Engines (RICEs)	4.80	1.10
Hydro	2.50	0.00
Pumped Storage	2.50	0.00
Biomass Power Plant	5.00	1.65
Geothermal Power Plant	3.00	1.16
Land Fill Gas	4.00	1.21
Nuclear	1.00	1.87
Wind Turbines	2.00	0.00
Solar Thermal Power Plant	0.00	0.24
Solar Photovoltaic	0.00	0.00

Component B: Refine Variable Operations Adders

- CAISO also proposes to expand the technology groupings currently in place to allow for greater accuracy of default value estimates

CAISO Current (Tariff) Groupings	CAISO Proposed Groupings
Coal	Coal
	Integrated Coal Gasification Combined-Cycle
Combined Cycle and Steam	Steam Turbines
	Combined Cycle Gas Turbines
	Advanced Combined Cycle Gas Turbines
Combustion Turbine & Reciprocating Engine	Combustion Turbines
	Advanced Combustion Turbines
	Reciprocating Internal Combustion Engines
Nuclear	Nuclear
Hydro	Hydro
	Pumped Storage
Biomass	Biomass Power Plant
Geothermal	Geothermal Power Plant
Wind	Wind Turbines
Solar	Solar Thermal Power Plant
	Solar Photovoltaic
Landfill Gas	Land Fill Gas

Component C: Calculate Default Maintenance Adders

- CAISO also proposes to calculate default maintenance adders using a standard methodology across technology types in five steps:
 - 1) Estimate annual variable maintenance costs for a representative unit
 - 2) Estimate run-hours, start-ups, and MWh per year
 - 3) Determine whether the technology-type's maintenance costs is represented with a \$/run-hour, \$/start, or \$/MWh adder (or a blend of these)
 - 4) Calculate a default Maintenance Adder (MA) on a \$/run-hour, \$/start, or \$/MWh adder basis
 - 5) Calculate a unit-specific adder

Component C: Calculate Default Maintenance Adders

Step 1 - Estimate annual variable maintenance costs for a representative unit

- Uses data from same sources as Nexant report¹
- Utilizes a “representative unit” which is meant to be an average unit to serve as a baseline²

Step 2 - Estimate run-hours, start-ups, MWh per year

- Based on data from CAISO/EIM actual operations

¹ See Appendix A for CAISO’s initial comparison of estimates annual variable maintenance costs compared to other external sources

² See Straw Proposal paper for each representative unit’s Pmax

Component C: Calculate Default Maintenance Adders

Step 3 - Determine whether the technology type's maintenance costs is represented with a \$/run-hour, \$/start, or \$/MWh adder (or a blend of these)

Technology Type	Start-up Allocation	Run-Hour Allocation	Output Allocation	Justification (see references below)
	%	%	%	
Coal	0	100	0	1
IGCC	0	100	0	1
Steam Turbines	0	100	0	1
CCGTs	50	50	0	2
Advanced CCGTs	50	50	0	2
CTs	50	50	0	2
Advanced CTs	50	50	0	2
RICEs	0	100	0	1
Hydro	50	50	0	2
Pumped Storage	50	50	0	2
Biomass Power Plant	0	100	0	1
Geothermal Power Plant	0	100	0	1
Land Fill Gas	0	100	0	1

1 –The ISO proposes to assign these units only to run-hours based on their typical operating profile as baseload-type units

2 – The ISO proposes to have these units to incur costs evenly between start-ups and run-hours as they typically operate as peakers. Such units suffer from fatigue as well as creep and thus should recover costs through a \$/start and \$/run-hour adder.

Component C: Calculate Default Maintenance Adders

Step 4 - Calculate a default MA on a \$/run-hour, \$/start, or \$/MWh adder basis

- =Default MA [\$/run-hour] = Annual variable maintenance costs/(run-hours per year)
- Default MA [\$/start] = Annual variable maintenance costs/(start-ups per year)
- Default MA [\$/MWh] = Annual variable maintenance costs/(MWh per year)

This calculation varies slightly with resources which will receive a blend of \$/start and \$/run-hour adders

Component C: Calculate Default Maintenance Adders

Step 4 - Calculate a default MA on a \$/run-hour, \$/start, or \$/MWh adder basis

Parameter	Value
Technology Type	Steam Turbine
Estimated annual variable maintenance cost (\$/year)	\$1,800,000
Run-hours (hours/year)	2,052
Representative Unit Pmax (MW)	300

- Default Maintenance Adder (\$/run-hour) = Annual variable maintenance costs/run-hours per year
= \$1,800,000/2,052
= \$877 per run-hour

Component C: Calculate Default Maintenance Adders

Step 4 - Calculate a default MA on a \$/run-hour, \$/start, or \$/MWh adder basis

Technology Type	Default MA Start Adder	Default MA Run-Hour Adder	Default MA MWh Adder
	<i>\$/start</i>	<i>\$/run-hour</i>	<i>\$/MWh</i>
Coal		1,174	
Integrated Coal Gasification Combined-Cycle		2,642	
Steam Turbines		877	
Combined Cycle Gas Turbines	3,405	319	
Advanced Combined Cycle Gas Turbines	5,068	474	
Combustion Turbines	442	59	
Advanced Combustion Turbines	497	67	
Reciprocating Internal Combustion Engines		70	
Hydro	3,261	69	
Pumped Storage	9,511	480	
Biomass Power Plant		368	
Geothermal Power Plant		815	
Land Fill Gas		44	

Component C: Calculate Default Maintenance Adders

Step 5 - Calculate a unit-specific adder

Resource-specific MA = Default MA * (Resource's actual Pmax / representative unit's Pmax) * 60%¹

= Resource-specific MA

= value to be included in default commitment cost bids and/or default energy bids

¹ A scalar of 60% is included to lower the resource-specific maintenance adder to become a low-hurdle for resources which don't want to go through the negotiation process (see slide 35)

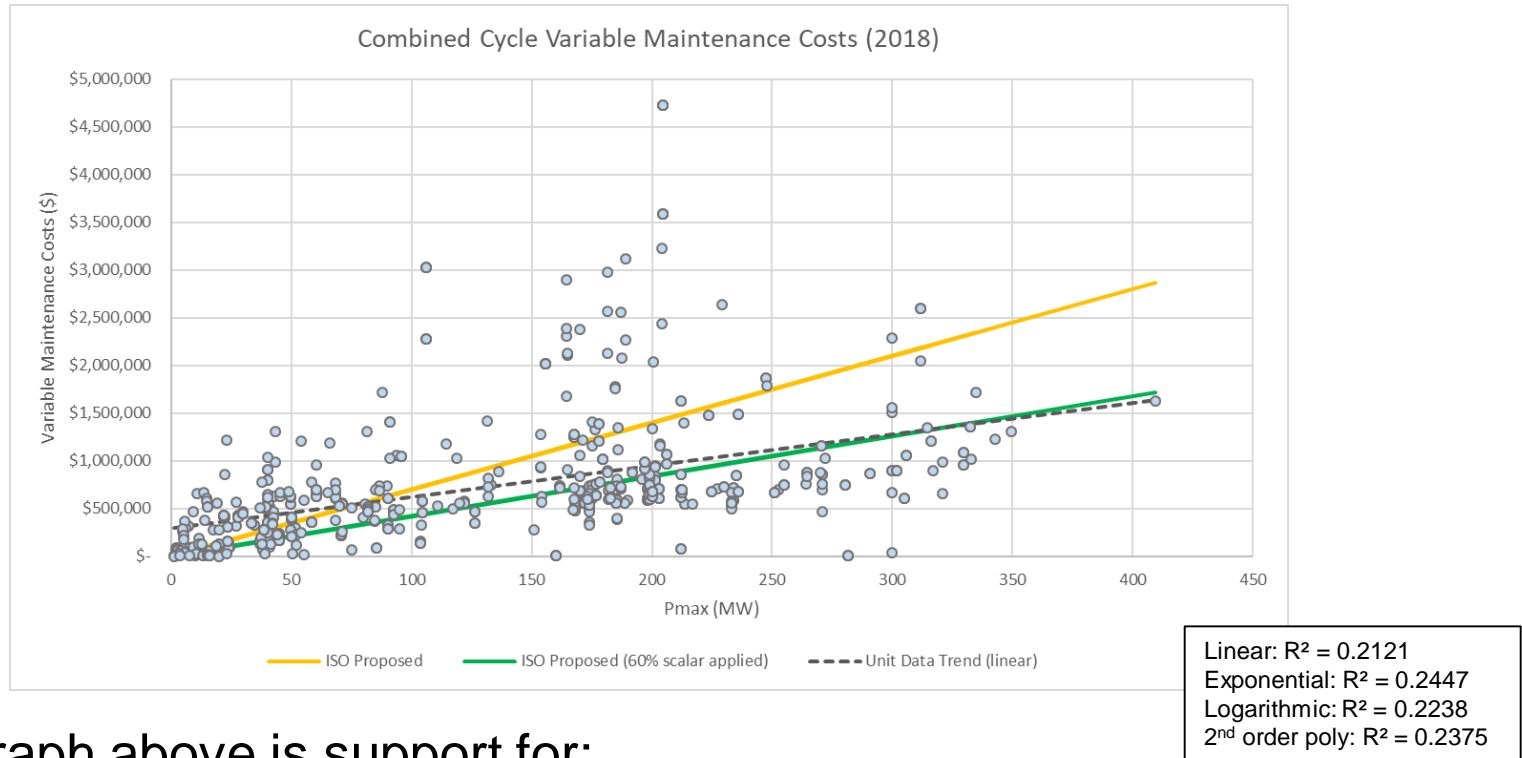
Component C: Calculate Default Maintenance Adders

Step 5 - Calculate a unit-specific adder

Parameter	Value
Technology Type	Steam Turbine
Representative Unit Pmax (MW)	300
Default Maintenance Adder (\$/run-hour)	\$877
Resource's actual Pmax (MW)	200

- Resource specific Maintenance Adder (\$/run-hour) = Default MA * (resource's actual Pmax / representative unit's Pmax) * 60%
= \$877 * (200/300) * 60%
= \$351 per run-hour

Component C: Calculate Default Maintenance Adders



- The graph above is support for:
 - Linear relationship between Pmax of unit and resource specific MA
 - 60% scalar applied to default maintenance adder

Source: S&P Market Intelligence data

Additional Items in the Scope of this Proposal

- CAISO also proposes to:
 - implement each component simultaneously because they are interdependent
 - outreach to stakeholders before implementation to assign resources to technology groupings
 - modify the Tariff section that subjects the ISO to a 15-day calendar day period in which the ISO must review and respond to MA applications and questions
 - provide a one-year transition period

Please read through this section of the straw proposal and comments

Stakeholder Engagement and Implementation Timeline

Date	Milestones
December 19, 2019	Post Straw Proposal
January 6, 2019	Hold stakeholder call on Straw Proposal
January 21, 2019 ¹	Stakeholder written comments due on Straw Proposal
February 7, 2020	Post Revised Straw Proposal
February 14, 2020	Hold stakeholder call on Revised Straw Proposal
February 28, 2020	Stakeholder written comments due on Revised Straw Proposal
March 13, 2020	Post Draft Final Proposal
March 20, 2020	Hold stakeholder call on Draft Final Proposal
April 3, 2020	Stakeholder comments due on Draft Final Proposal
April 15, 2020	Post Draft Tariff Language
April 15, 2020	Post BRS
April 30, 2020	Stakeholder written comments due on Draft Tariff Language
May 6, 2020	Hold stakeholder meeting on Draft Tariff Language
May 27, 2020	Post Final Tariff Language
June 2020	EIM Governing Body
July 2020	Board of Governors
Fall 2020	Go-Live

¹ Please note the updated date from the published straw proposal paper (date changed due to MLK Jr. holiday)

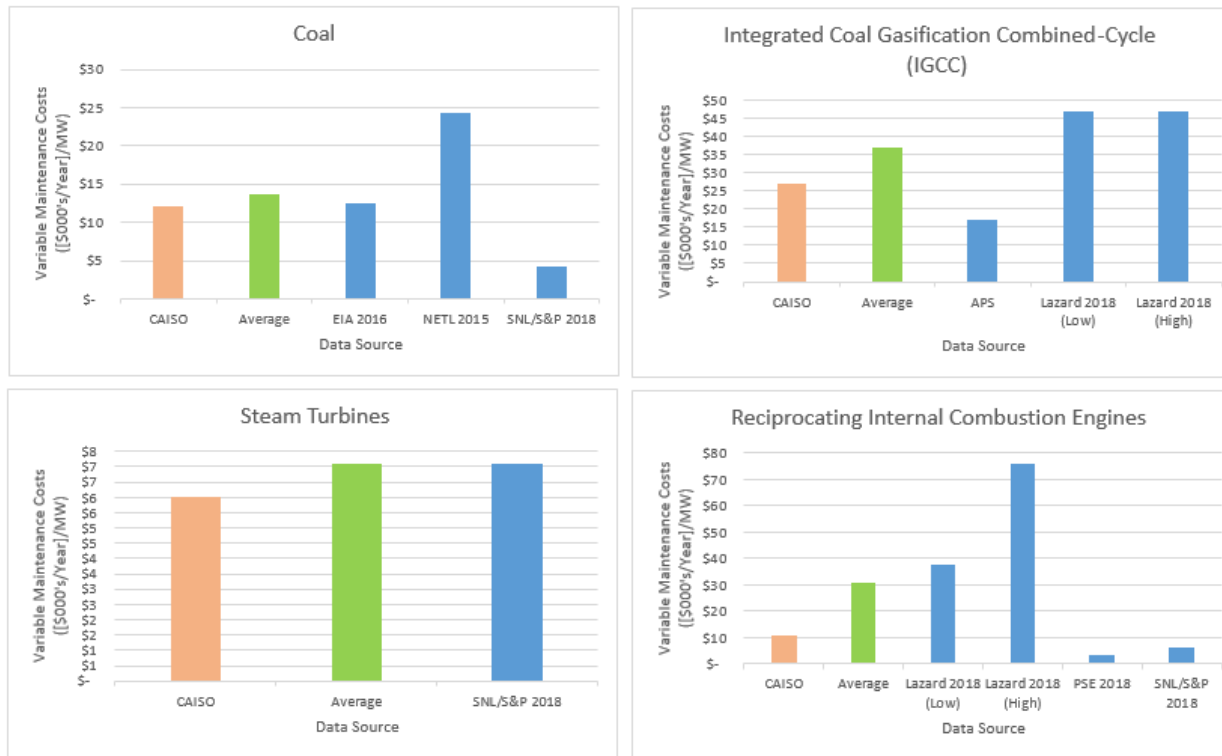
Next Steps

Please submit written comments by
January 21, 2020 to

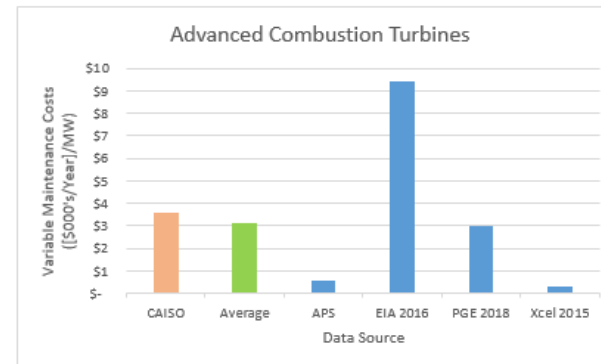
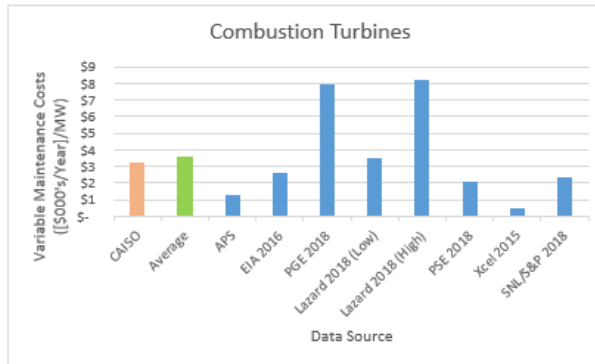
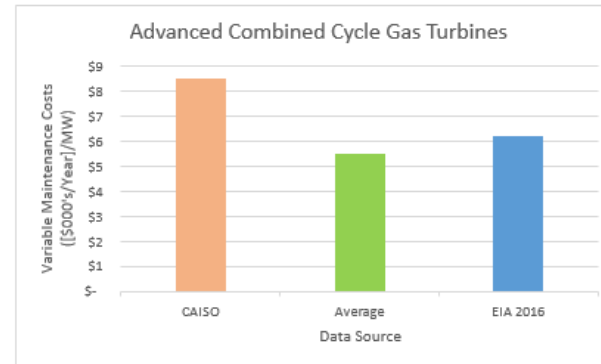
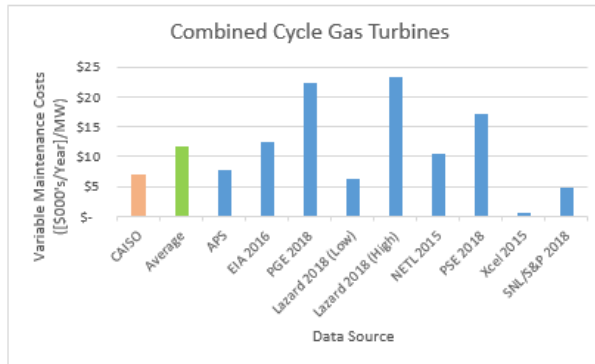
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Appendix:

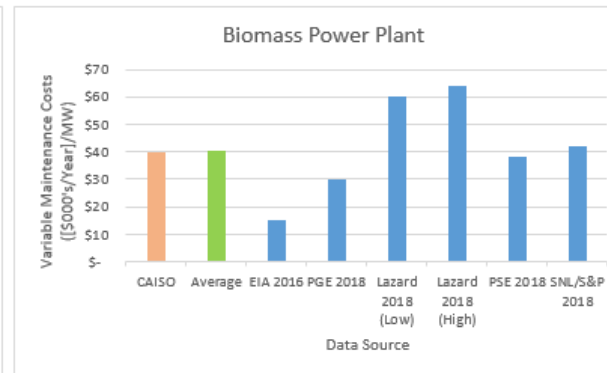
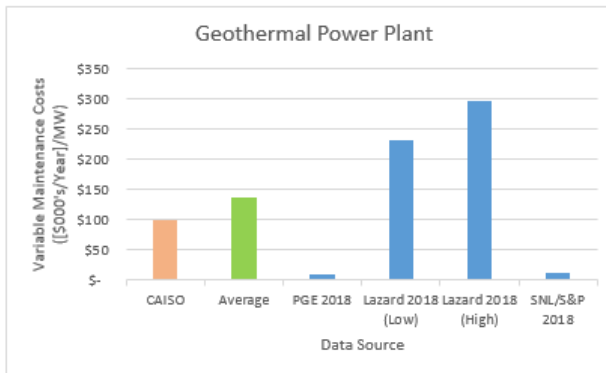
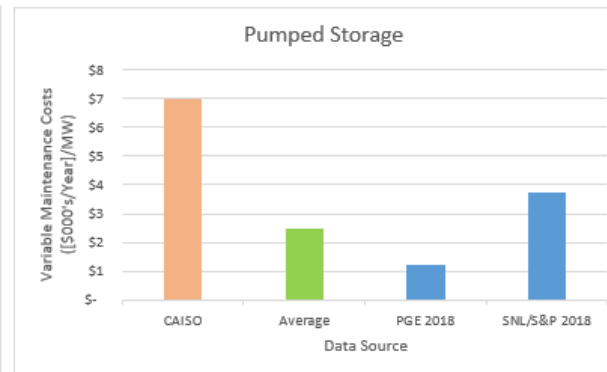
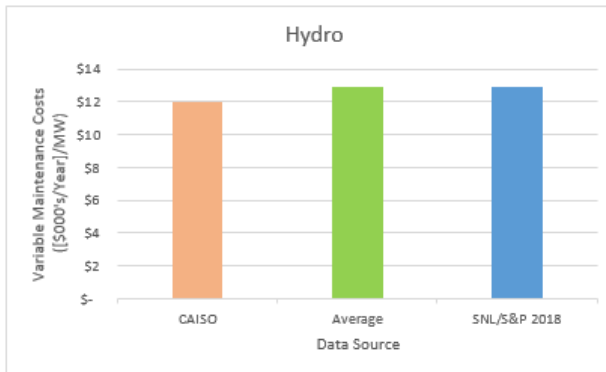
Appendix A: Comparison of Variable Maintenance Cost Inputs to External Sources



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