Variable Operations & Maintenance Cost Review

Training Session

October 14, 2021

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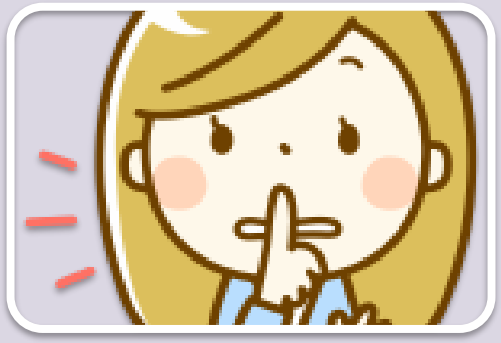
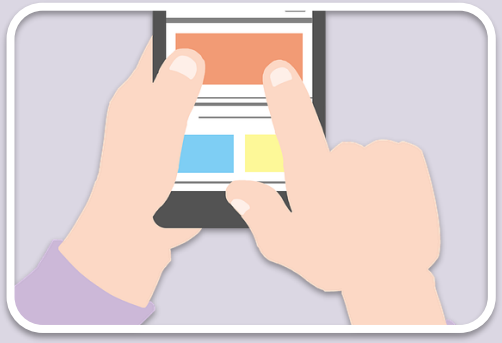
Customer Readiness

Updated 10/14/2021

Housekeeping



Keep yourself muted to minimize background noise



Unmute to ask verbal questions or write questions in the chat pod

Raise your hand using WebEx interactivity tools

Objectives: Variable O&M cost review

- Update the default O&M adder values
- Reflect variable O&M costs in start-up costs, minimum load costs, and/or default energy bids, thus replacing the current cost framework consisting of major maintenance adders and variable O&M adders
- Clarify the categorization principles for variable operations and variable maintenance costs

Agenda

This training will cover the following topics:

- High-level review of changes
- Application-specific details
- Changes to calculations

Acronyms

Abbreviation	Term
CCGT	Combined Cycle Gas Turbine
CIDI	Customer Inquiry and Dispute Information
CT	Combustion Turbine
DEB	Default Energy Bid
MMA	Major Maintenance Adder
MSG	Multi-stage Generator
O&M	Operations & Maintenance
RDT	Resource Data Template
RMR	Reliability Must Run
SC	Scheduling Coordinator
SIBR	Scheduling Infrastructure and Business Rules
VOM	Variable Operations and Maintenance
VOM Adder	Variable Operations and Maintenance Adder

VARIABLE O&M COST REVIEW

Implementation timeline

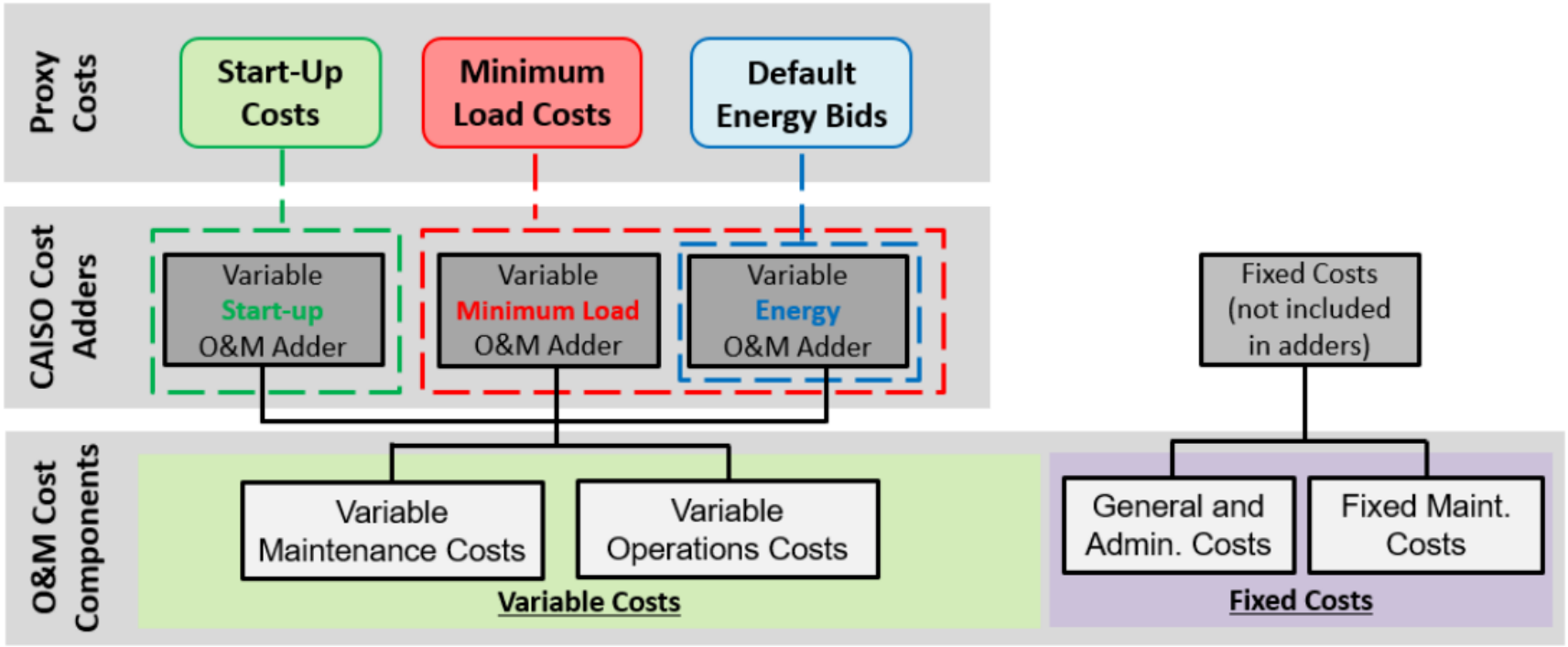
- Tariff amendment filed with FERC: 3/3/2021
- FERC approval obtained: 5/12/2021
- Market simulation: N/A
- Production implementation: 1/1/2022

BACKGROUND: HIGH-LEVEL REVIEW OF CHANGES

Background

- This project changes the structure of how O&M costs are accounted for in the ISO markets to ensure market participants' bids reflect these costs more accurately
- ISO has adopted a new framework for O&M cost recovery based on new O&M adders for start-up, minimum load, and energy costs
- These adders will replace the existing adders for major maintenance expenses and variable O&M costs
- Any existing negotiated variable O&M adder and major maintenance adders existing on 1/1/2022 will be "legacied" in under the new cost framework

O&M cost framework



Selecting default values vs. negotiated values

- **Default values**
  - Market participants can use the default VOM adders based on resource technology type if they do not want to pursue the negotiated option
  - The default option is sufficient for many market participants and requires no action – the ISO assigns the value based on the resource's Master File data

- **Negotiated values**
  - Or, the adders can be negotiated with the ISO
  - The negotiated option requires more effort from the market participant but can help them more accurately reflect O&M costs in their proxy costs

Cost categorization principles: Variable operations

- **Variable operations** costs are the costs of consumables and other costs that vary directly with electrical production of a resource (i.e., start-up/shut-down, run-hours, or electricity output)

- **Variable operations** costs exclude:
  - Maintenance costs
  - Auxiliary power costs
  - Greenhouse gas allowance prices
  - Fuel costs
  - Grid management charges
  - Opportunity costs and other excluded costs

Cost categorization principles: Variable maintenance

- **Variable maintenance** costs are the costs associated with the repair, overhaul, replacement, or inspection of a resource that meet the following conditions:
  - The costs must vary with the electrical production of the resource (i.e., start-up/shut-down, run-hours, or electricity output)
  - The costs should reflect future maintenance costs that are expected to be incurred within the service life of a major component of plant or equipment
  - The costs should be consistent with Good Utility Practice
  - The costs should not effect a substantial betterment of the resource
  - If the item is a replacement, it cannot be a replacement of an existing major component of plant or equipment

Written guidance

- The ISO has posted guidance on the release planning webpage in the form of an updated Attachment L of the BPM for Market Instruments that covers:
  - The updated cost framework, cost categorization principles, and new default values
  - The treatment of currently negotiated variable operations and maintenance adders and major maintenance adders under the updated cost framework

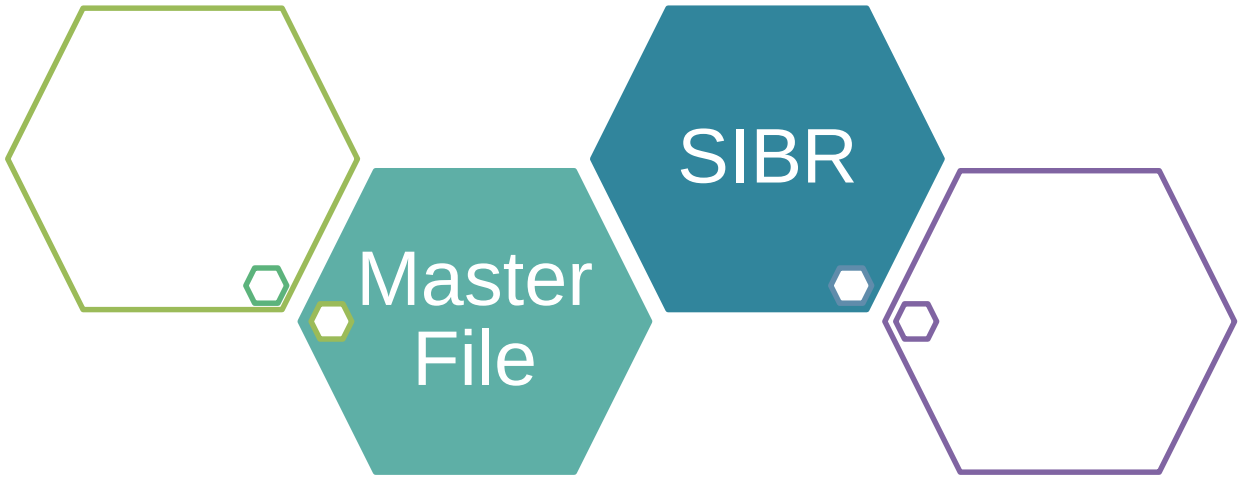
Submitting applications for negotiated variable O&M adders

- Submit applications via a CIDI ticket with Case Record Type “Negotiated Rate Application” and Application Type “MMA”
  - Scheduling coordinators should add the text “NEW O&M FRAMEWORK” in the CIDI ticket description and use the new template available
- Please review the detailed guidance in the updated Attachment L prior to submitting the CIDI ticket

Where to go for answers

- **General questions**: Any general questions regarding the variable O&M initiative should be submitted via a CIDI Inquiry ticket with a request that the ticket be routed to the Market Analysis team

Questions



Master File

SIBR

REVIEW APPLICATION-SPECIFIC DETAILS

Master File

Master File

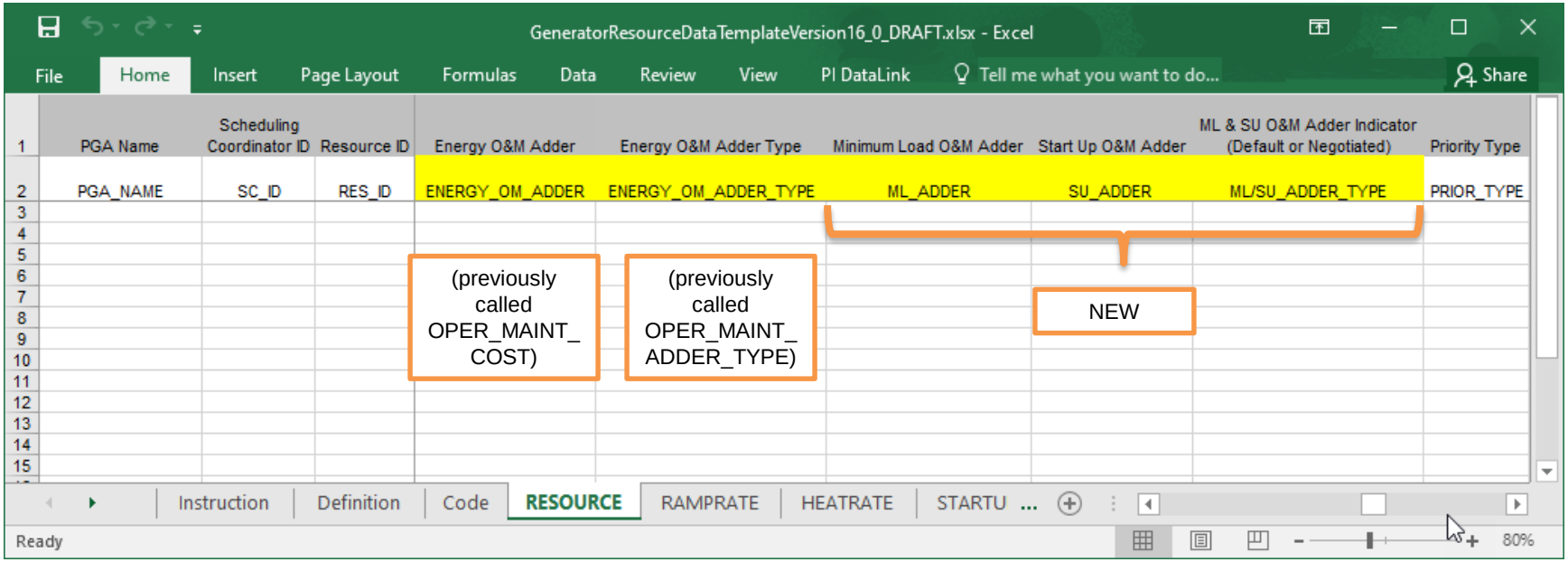
- Default variable energy, minimum load, and start-up O&M adders will be stored on a resource and MSG configuration-specific level
  - Variable Minimum Load O&M Adder
  - Variable Start-up O&M Adder
  - Variable Energy O&M Adder (existing on resource level, new on the configuration level)

- A new flag will be added at the resource level to identify whether the values are default or negotiated
  - ML & SU O&M Adder Indicator

- Note field name changes:
  - **Variable Energy O&M Adder** replaces the **Operating Maintenance Cost**
  - **Variable Energy O&M Adder Type** replaces the **Operating Maintenance Adder Type**

Master File: RDT – Resource tab

Master File



- **ML & SU O&M Adder Indicator**:
  - This flag identifies whether the variable minimum load and start-up operations and maintenance adder are the default value (D) or a negotiated (N) value

Resource tab: New field definitions

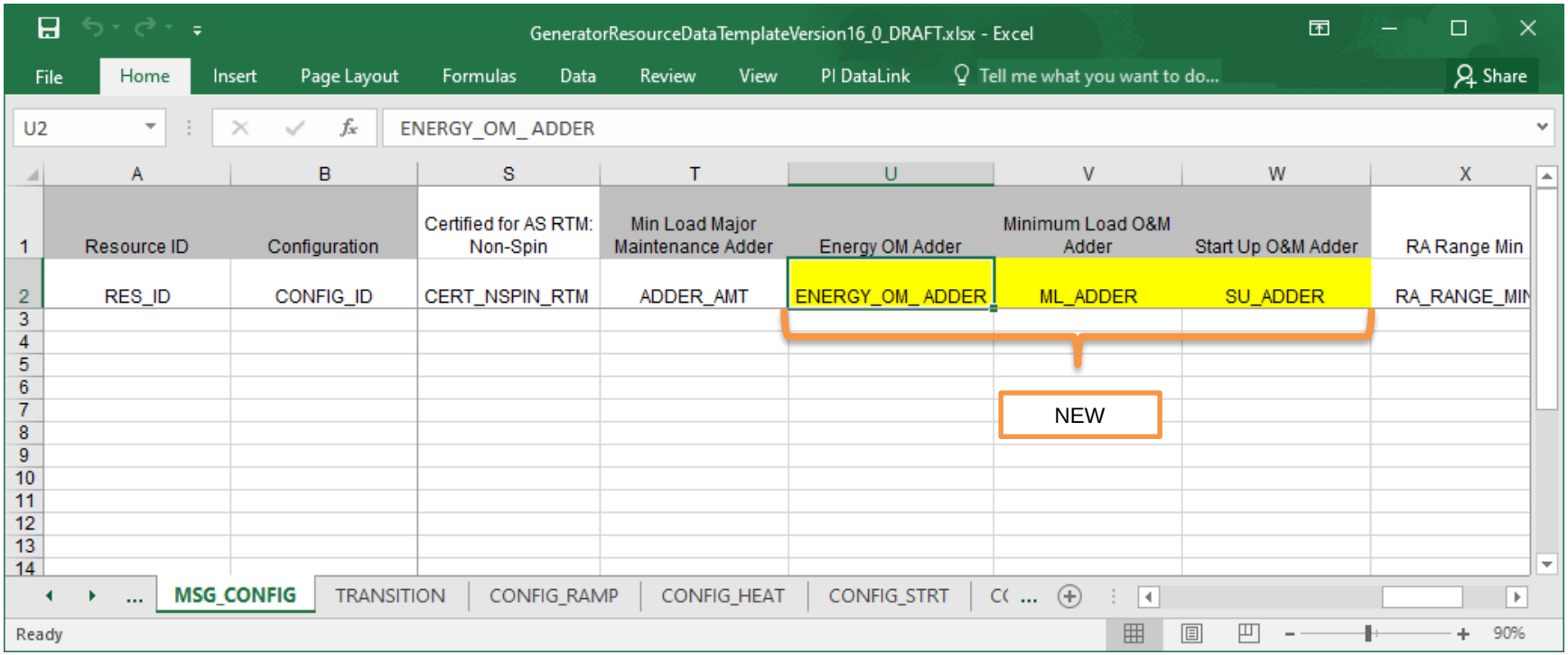
Master File

- **Minimum Load O&M Adder:** Variable minimum load O&M costs that are incurred in terms of hours of operation
  - For resources that have a negotiated variable minimum load O&M adder, that value will display in this field
  - Units of measurement differ based on whether the adder type is Negotiated (N) or Default (D)
    - If it is N, the units are $/run-hour
    - If it is D, the units are $/run-hour per MW of Pmax

- **Start-Up O&M Adder:** Variable start-up O&M costs that are incurred in terms of starts
  - For resources that have a negotiated variable start-up O&M adder, that value will display in this field
  - Units of measurement differ based on whether the adder type is Negotiated (N) or Default (D)
    - If it is N, the units are $/start
    - If it is D, the units are $/start per MW of Pmax

Master File: RDT – MSG configuration tab

Master File



- **Energy O&M Adder:**
  - Variable energy O&M costs that are incurred in terms of MWh
  - For resources that have a negotiated variable energy O&M adder, that value will display in this field

MSG configuration tab: New field definitions

Master File

- **Minimum Load O&M Adder:** Variable minimum load O&M costs that are incurred in terms of hours of operation
  - For resources that have a negotiated variable minimum load O&M adder, that value will display in this field
  - Units of measurement differ depending on whether the adder type is Negotiated (N) or Default (D)
    - If it is N, the units are $/run-hour
    - If it is D, the units are $/run-hour per MW of Pmax

- **Start-Up O&M Adder:** Variable start-up O&M costs that are incurred in terms of starts
  - For resources that have a negotiated variable start-up O&M adder, that value will display in this field
  - Units of measurement differ depending on whether the adder type is Negotiated (N) or Default (D)
    - If it is N, the units are $/start
    - If it is D, the units are $/start per MW of Pmax

New generator technology types

Master File

Technology Type	Gen Tech Type	Fuel Type	Comments
Coal	N/A	COAL	
Steam turbines	STUR	GAS	
CCGTs	CCYC	GAS	
CT (Frame CT)	FTUR	GAS	New
Aeroderivative CT	GTUR	GAS	Continue to use GTUR
RICE	RECP	GAS	
Nuclear	N/A	NUCL	
Biomass	N/A	BIOM	
Geothermal	N/A	GEOT	
Landfill	N/A	BGAS, WAST	
Hydro	<>PUMP	WATR	
Solar	N/A (PHOT, OTHR)	SOLR	Same as Photovoltaic
Wind	WIND	WIND	
Storage	N/A	LESR	Not impacted with the VOM effort. No default values.

Scheduling Infrastructure & Business Rules (SIBR)

SIBR

- SIBR rules will be updated to reflect the latest terminology
- Change major maintenance adder to new terms:
  - Variable start-up O&M adder
  - Variable minimum load O&M adder

SIBR

SIBR

- SIBR will use the resource/configuration specific O&M adder to calculate the proxy minimum load cost and proxy start-up cost (including reasonableness threshold values)

- if the resource has elected the default option SIBR will perform an automated calculation:
  - Min load O&M Adder = Default Min load O&M Adder * Resource's PMAX
  - Start-up O&M Adder = Default start up O&M Adder * Resource's PMAX

- Update the minimum load cost to include the min load and energy O&M adder
  - Based on Master File selection of default or negotiated

Questions

CHANGES TO CALCULATIONS

Default variable O&M adder values

Technology Type	Energy O&M Adder ($/MWh)	Minimum Load O&M Adder ($/run-hour/MW[1])	Start-up O&M Adder ($/start/MW)
Default values represents:	*Variable Operations Costs*	*Variable Maintenance Costs*	*Variable Maintenance Costs*
Coal	2.69	-	-
Steam Turbines	0.33	-	-
CCGTs	0.59	1.74	-
[Frame] CTs	0.97	-	52.13
Aeroderivative CTs	2.15	4.38	-
RICEs	1.10	-	-
Nuclear	1.08	-	-
Biomass Power Plant	1.65	-	-
Geothermal Power Plant	1.16	-	-
Land Fill Gas	1.21	-	-
Hydro	-	0.65	-
Solar	-	-	-
Wind	0.28	-	-
Storage/NGRs/PDRs/RDRRs	-	-	-

[1] The default Minimum Load and Start-up O&M Adders are expressed in $/run-hour/MW and $/start-up/MW units, respectively. To arrive at a resource-specific O&M Adder, the CAISO will multiply the proposed default value by the Pmax of the resource or configuration. This results in the resource-specific Minimum Load and Start-up O&M Adders being expressed in $/run-hour or $/start-up units, respectively.

Example of two new flags in use

Res ID	Default or Negotiated Min Load & Start Up O&M Adder	Min Load O&M Adder	Start-Up O&M Adder	Default or Negotiated Energy O&M Adder	Energy O&M Adder ($/MWh)
Res A	Default	0.00 ($/run-hour/MW)	52.89 ($/Starts/MW)	Default	0.97
Res B	Default	1.69 ($/run-hour/MW)	0.00 ($/Starts/MW)	Negotiated	0.69
Res C	Negotiated	123 ($/run-hour)	0.00 ($/Starts)	Default	0.33
Res D	Negotiated	107 ($/run-hour)	43.20 ($/Starts)	Negotiated	1.20
Res E – Config 1	Default	1.69 ($/run-hour/MW)	0.00 ($/Starts/MW)	Default	0.97
Res E – Config 2	Default	1.69 ($/run-hour/MW)	0.00 ($/Starts/MW)	Default	0.97
Res F – Config 1	Negotiated	123 ($/run-hour)	52.20 ($/Starts)	Negotiated	3.69
Res F – Config 2	Negotiated	246 ($/run-hour)	21.20 ($/Starts)	Negotiated	5.20

Updated formulas

The primary formulas being modified are as follows:

- Variable Cost option
  - DEB calculation
- Proxy Cost option
  - Minimum Load Bid Cap, Start-up Bid Cap
- Registered Cost option*
  - Maximum Registered Minimum Load Costs, Maximum Registered Start-up Costs

*Registered Cost changes are substantially the same as those for Proxy Cost

Variable Cost Default Energy Bid formula

Current DEB =

*1.10 * [(Incremental Heat Rate/1000 x Fuel Region Price)*

*+ **VOM adder** + GMC adder + (Incremental Heat Rate/1000 x Emission Rate x GHG Allowance Price)] + FMU adder (if eligible) + Variable Energy Opportunity Cost (if eligible)*

New Variable Cost DEB =

*1.10 * [(Incremental Heat Rate/1000 x Fuel Region Price)*

*+ **Energy O&M adder** + GMC adder + (Incremental Heat Rate/1000 x Emission Rate x GHG Allowance Price)] + FMU adder (if eligible) + Variable Energy Opportunity Cost (if eligible)*

Proxy Minimum Load Cost formula

Current MLC =

*1.25 * [(Minimum Load Heat Rate/1000 x Pmin x Fuel Region Price) + **(VOM adder x Pmin)** + (GMC adder x Pmin) + (Pmin x Minimum Load Heat Rate/1000 x Emission Rate x GHG Allowance Price) + **Major Maintenance Adder**] + Minimum Load Opportunity Cost (if eligible)*

New MLC =

*1.25 * [(Minimum Load Heat Rate/1000 x Pmin x Fuel Region Price) + **(Energy O&M adder x Pmin)** + (GMC adder x Pmin) + (Pmin x Minimum Load Heat Rate/1000 x Emission Rate x GHG Allowance Price) + **Minimum Load O&M Adder**] + Minimum Load Opportunity Cost (if eligible)*

Proxy Start-up Cost formula

Current SUC =

*1.25 *[(Start-Up Fuel x Fuel Region Price) + (Start-Up Energy x Electricity Price Index) + (Pmin x Start-Up Time Period x GMC adder / 2) + (Start-Up Fuel x GHG Emission Rate x GHG Allowance Price) + **Major Maintenance Adder**] + Startup Opportunity Cost (if eligible)*

New SUC =

*1.25 *[(Start-Up Fuel x Fuel Region Price) + (Start-Up Energy x Electricity Price Index) + (Pmin x Start-Up Time Period x GMC adder / 2) + (Start-Up Fuel x GHG Emission Rate x GHG Allowance Price) + **Startup O&M Adder**] + Startup Opportunity Cost (if eligible)*

Settlements: Configuration guide updates

- Updates will be made to the configuration guide for charge code 7020 - Daily RMR Capacity Payment
- Change in terminology for the maintenance costs that can be included in the calculation of RMR capacity payments

Final Questions

Thank you for your participation!

For more detailed information on anything presented, please visit our website at:

www.caiso.com

Or send an email to:
CustomerReadiness@caiso.com

REFERENCE MATERIAL

Reference material

- Application template for Variable O&M Adder:
  - https://www.caiso.com/Documents/Variable-Operations-and-Maintenance-Adder-Application-Template.xlsx
- Approved tariff amendment has been posted on the ISO's Regulatory webpage:
  - http://www.caiso.com/Documents/May12-2021-Order-VariableOperations-Maintenance-ER21-1266.pdf
- Attachment L – BPM for Market Instruments:
  - https://www.caiso.com/Documents/BPMforMarketInstruments-AttachmentL-DRAFT_V2.pdf
- Business Practice Manual changes will be submitted as Proposed Revision Requests in the BPM tool:
  - BPM Change Management
- Business Requirements Specification:
  - https://www.caiso.com/Documents/BusinessRequirementsSpecification-VariableOperationsandMaintenanceCostReview.pdf
- Variable O&M Initiative webpage:
  - https://stakeholdercenter.caiso.com/StakeholderInitiatives/Variable-operations-maintenance-cost-review