



Washington WEIM Greenhouse Gas Enhancements Training

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August 28, 2023

Revised: 08/29/23

- Slide 7 (updated Market Sim link)
- Side 13 – language change to “Tab”
- ADDED slide 37&38 (Q&A)

Updated: 08/29/23

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

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Agenda

This training will cover the following topics:



Review of WA WEIM GHG history and current timeline



Walkthrough application-specific details



Understand Readiness Activities





Washington WEIM GHG Enhancements

BACKGROUND: HIGH-LEVEL REVIEW OF CHANGES

Background on the WA GHG Project

2013

California's thermal generating resources became subject to a greenhouse gas (GHG) allowance cap-and-trade system run under the authority of the California Air Resources Board (CARB).

2023

Washington state's Department of Ecology implemented a similar program.

May 2023

The ISO implemented an alternative interim solution for these changes in May 2023.

Fall 2023

The ISO is implementing the full WA GHG project.

Interim Alternative Approach Effective May 1, 2023

- The interim alternative solution adds the GHG costs into the fuel cost component of default energy bids (DEBs) and commitment costs instead of having an explicit GHG component

Full functionality solution

$$\text{Fuel Costs}_0 + \text{VOM} + \text{GMC} + \text{GHG}$$

Alternative solution

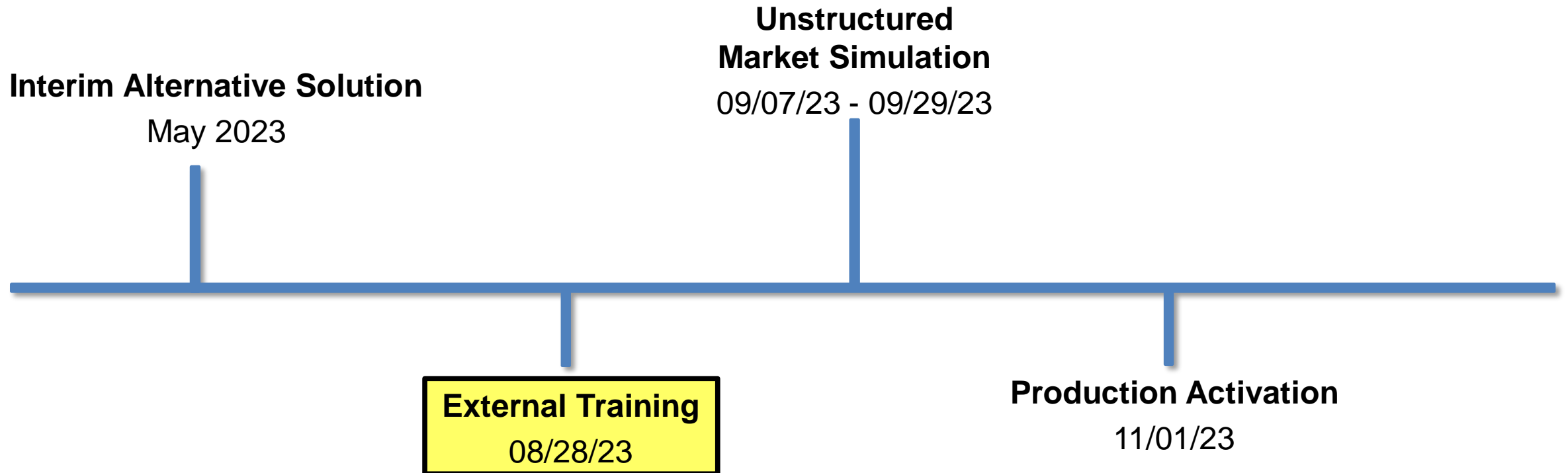
$$\text{Fuel Costs}_1 + \text{VOM} + \text{GMC} + \text{GHG}$$

$$\text{Where: Fuel Costs}_1 = \text{Fuel Costs}_0 + \text{GHG}$$

VOM = Variable Operations and Maintenance Costs ; **GMC** = Grid Management Charge ; **GHG** = Greenhouse Gas Costs

[Notice link](#)
[PRR 1507](#)
[PRR 1506](#)

Implementation timeline



[Policy Initiative Page: Washington WEIM greenhouse gas enhancements link](#)

What Questions Do You Have?



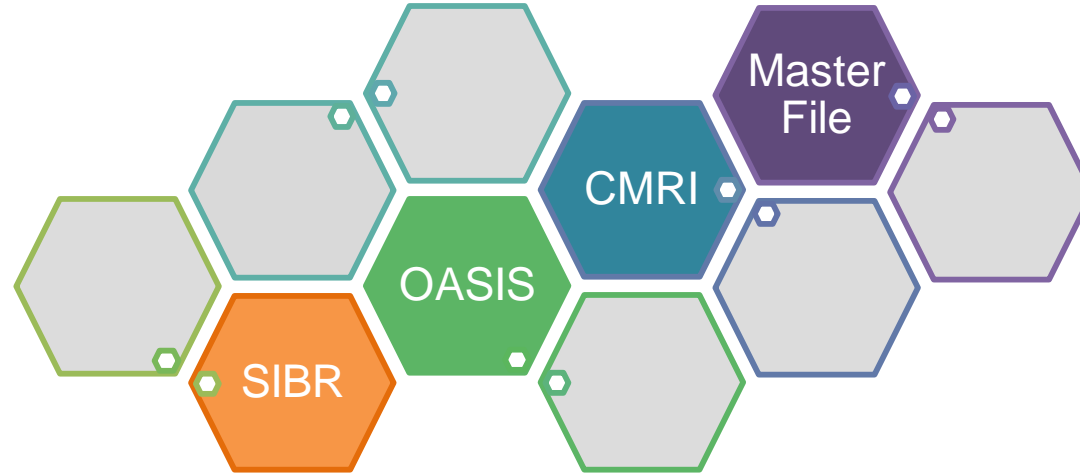
Keep yourself muted to minimize background noise until you are ready to speak



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REVIEW APPLICATION - SPECIFIC DETAILS FOR WA WEIM GHG

Fall 2023 Release Overview – System Interface Changes

System	Project	UI	API	Data	Technical Specifications
RIMS	ESET2	Existing: Existing > App & Study > Equipment Configuration tab > Generation as Modeled and Implemented grid	NA	> Pull storage resource MWh from MF > Add new field for calculated MWh > Add new field for storage resource duration in hours	NA
ITS	RSEE2T2	Existing	NA	Exports e-Tagging Submission Requirement > SCs shall be required to e-tag the following as "Firm Provisional Energy (G-FP)", via utilizing Misc. field: <ul style="list-style-type: none"> o RT economic (RTECON) exports that clear HASP o DA economic (DAECON) exports that clear both RUC and HASP o RTLPT exports that clear HASP o DALPT exports that clear both RUC and HASP > SCs shall be required to e-tag the following as "Firm Energy (G-F)": <ul style="list-style-type: none"> o RTPT exports that clear HASP o DAPT exports that clear both RUC and HASP 	NA
CMRI	WA WEIM GHGE	NA	NA	New Attributes/Records to indicate state/include GHG index price for each state	NA
OASIS*	WA WEIM GHGE	Existing: Prices > Index Prices > Greenhouse Gas Allowance Index Prices	Existing – Prices > Index Prices > Greenhouse Gas Allowance Index Prices	Add WA GHG index prices, display average of daily WA GHG price indices	7/17/23
MF RDT*	WA WEIM GHGE	Add a new BAA level attribute to identify BAAs associated with Washington State	SubmitGeneratorRDT_MFRDv5 SubmitGeneratorRDT_MFRDv5_DocAttach RetrieveGeneratorRDT_MFRDv5 RetrieveGeneratorRDT_MFRDv5_DocAttach Minor Version 20231001 Added GHG section in the Elements Table - GHGComplianceObligFlag - GHGEmissionFactor - State	1. Convert the GHG details in 0..N nested element to record GHG details for each State applicable to the Generator. 2. Add an additional element "State" to indicate CA, WA etc.	8/10/23
SIBR	WA WEIM GHGE	Existing	Existing	Consume WA GHG adders	NA
SIBR*	ESE2	New Hourly feature on Hourly tab to elect Y/N for Off Grid Charge.	New optional element in xsd for 'offGridCharge' used by designated resource to manage Sub/Stand Alone ACC. RawBidSet, BidResults, CleanBidSet v5 xsd. Version 20231101.	New HourlyParameter for offGridCharge this is a Yes/No type that is optional.	8/10/23

Market Simulation Plan – Fall 2023 Release



Washington WEIM GHG Enhancements

MASTER FILE (MF)

Master File for WA GHG (prior to change)



- Previously, GHG Regulation Areas would see the “Resource” tab with two columns for:
 - Green House Gas Emission Rate
 - Green House Gas Compliance Obligation



A	B	C	CP	CQ	CR	CS	CT	CU
PGA Name	Scheduling Coordinator ID	Resource ID	RMT Max On Peak	RMT On Peak Expiration Date	RMT Max Off Peak	RMT Off Peak Expiration Date	Green House Gas Emission Rate	Green House Gas Compliance Obligation
PGA_NAME	SC_ID	RES_ID	RMT_MAX_ON_PEAK	RMT_MAX_ON_PEAK_EXP	RMT_MAX_OFF_PEAK	RMT_MAX_OFF_PEAK_EXP_DT	GHG_EMISSION_RATE	GHG_COMPLIANCE_OBLIG

RESOURCE

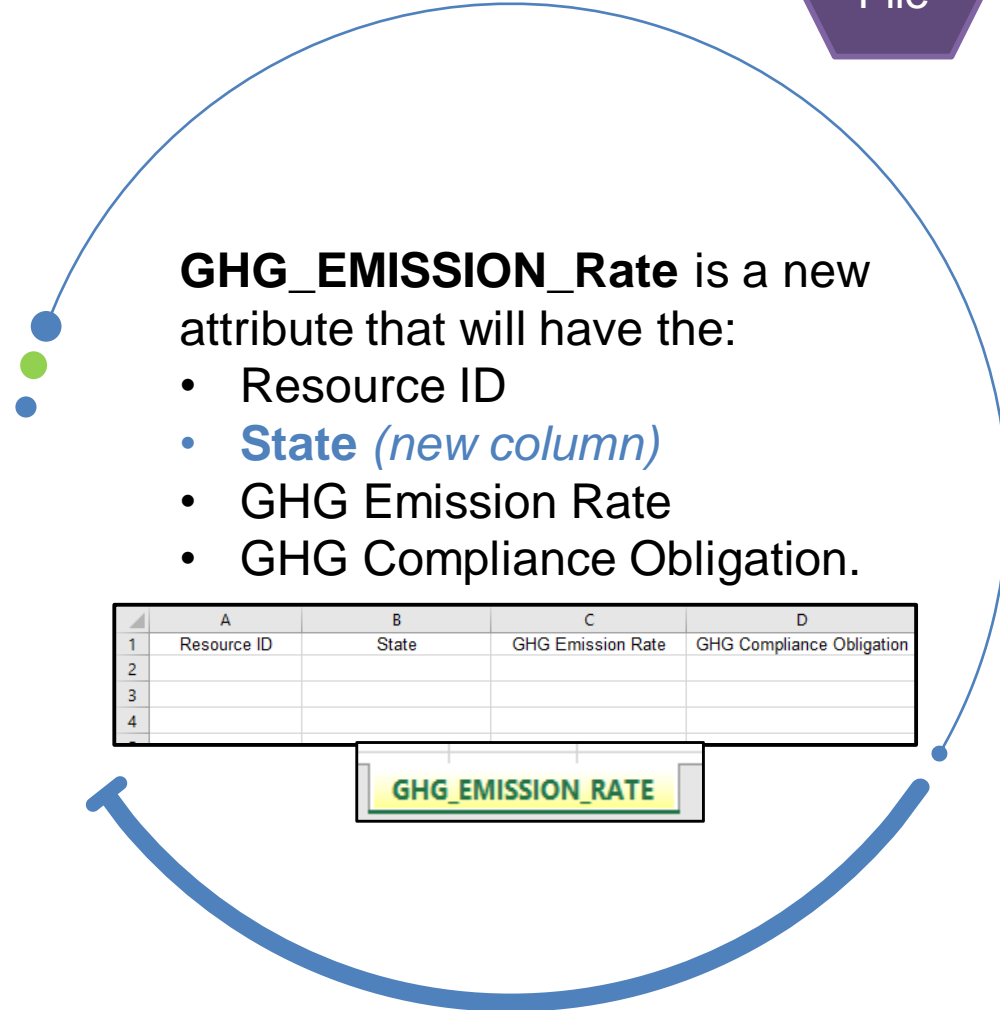
➤ These two columns will be removed from Resources and added to the new attribute: **GHG_Emissions_Rate**.
➤ By default these rates would refer only to California.

Masterfile: New Tab (GHG_EMISSION_RATE) and Column Added (State)



Resource ID	Identifier of the resource.
State	Options are California (CA) and Washington (WA). The emission state may differ from the resource's physical location.
GHG Emission Rate	The GHG emission rate applicable to this compliance obligation
GHG Compliance Obligation	Y = resource has a GHG compliance obligation N = resource does not have a current GHG compliance obligation

Resources will have to register their unit to be included in GHG cost. Resources could have a rate for California and for Washington.



What Questions Do You Have?



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Washington WEIM GHG Enhancements

CUSTOMER MARKET RESULTS INTERFACE (CMRI)

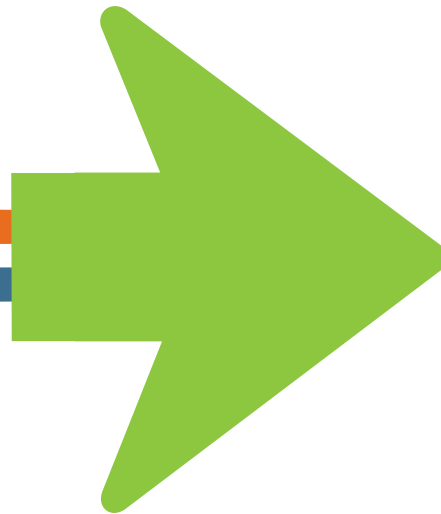
Calculation Changes to the Default Energy Bid Curves Report & Default Commitment Cost Report

Current Calculations

Operations
Maintenance
Fuel Cost

When Fall Initiative Goes Live Calculations

Washington
State GHG
Compliance



Calculation impacts only:

- WEIM entities **AND**
- That have resources in Washington **AND**
- Those resources need to have a compliance obligation for GHG

Examples: GHG Regulation Areas Impacted by New Calculation



Located inside Washington

This resource has a compliance obligation for greenhouse gas



Located inside Washington

This resource DOES NOT have a compliance obligation for greenhouse gas



Located outside Washington → Nevada

This resource is NOT located inside of Washington

Default Energy Bid Curves



California ISO Customer Market Results Interface

Day-Ahead Real-Time Post-Market **Default Bids** Incentive Bidding Forecast Reference LSE Energy Imbalance Market Phase Shifter Gas Burn Reliability Coordination

Start Date: 08/21/2023 End Date: 08/21/2023

Day-Ahead Ancillary Services

Trade Date SC ID Resource

No Data found

- Default Energy Bid Curves
- Default RMR Minimum Load and Startup Cost Bid Curves
- Greenhouse Gas Bid Cap
- Default Commitment Costs
- Daily Electricity Price Index (EPI)
- Actual Limitation Values
- Resource Opportunity Costs

Schedule Type: [ALL]

Schedule Type	HE01 [MW]	HE02 [MW]	HE03 [MW]	HE04 [MW]	HE05 [MW]	HE06 [MW]	HE07 [MW]
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Report Generated: 08/21/2023 07:10:24

[Customer Market Results Interface \(CMRI\) link](#)

Default Energy Bid Curves Report – No User Interface (UI) Changes



CMRI > Default Bids > Default Energy Bid Curves

Day-Ahead Real-Time Post-Market **Default Bids** Convergence Bidding Forecast Reference LSE Energy Imbalance Market Phase Shifter Gas Burn Reliability Coordination

Start Date:
Entity:
Resource:
Default Bid Type:

End Date:
Market:
Peak:

Default Energy Bid Curves

- 20 of 94

Interval Start Time	Interval End Time	SC ID	Resource	Configuration	Market	Peak	Adder	Default Bid Type	Bid Segment 1 Type	Bid Segment 1 [MW]	Bid Segment 1 [\$]
07/28/2023 00:00:00	07/29/2023 00:00:00				Real-Time	Off	No	Cost		3.50	80.91
07/28/2023 00:00:00	07/29/2023 00:00:00				Real-Time	On	No	Cost		3.50	80.91
07/28/2023 00:00:00	07/29/2023 00:00:00				Real-Time	Off	No	Cost		0.00	0.21
07/28/2023 00:00:00	07/29/2023 00:00:00				Real-Time	On	No	Cost		0.00	0.21
07/28/2023 00:00:00	07/29/2023 00:00:00				Real-Time	Off	No	Hydro		23.00	278.60
07/28/2023 00:00:00	07/29/2023 00:00:00				Real-Time	On	No	Hydro		23.00	278.60
07/28/2023 00:00:00	07/29/2023 00:00:00				Real-Time	Off	No	Hydro		55.00	278.60
07/28/2023 00:00:00	07/29/2023 00:00:00				Real-Time	On	No	Hydro		55.00	278.60
07/28/2023 00:00:00	07/29/2023 00:00:00				Real-Time	Off	No	Hydro		55.00	278.60
07/28/2023 00:00:00	07/29/2023 00:00:00				Real-Time	On	No	Hydro		55.00	278.60

While there is no UI changes, the calculation for the CAISO default energy bid for WA WEIM GHG entities will change and is reflected in the Market Instruments BPM.

Calculation: Variable Default Energy Bid for Gas-Fired Resource with a GHG Component

- The following equation shows how the Cost-Based DEB is calculated for an individual segment of a gas-fired unit's heat rate curve for resource with a greenhouse gas compliance obligation

- $\{([Unit\ Conversion\ Factor * IHR * GPI] + O\&M + GMC + [Unit\ Conversion\ Factor * IHR * Emission\ Rate * \text{GHG Cost}]) * 1.1\} + FMU\ adder\ (if\ eligible) + Variable\ Energy\ Opportunity\ Cost\ (if\ eligible)$

A detailed walkthrough is located in the References section

Default Commitment Costs



California ISO Customer Market Results Interface

Day-Ahead Real-Time Post-Market **Default Bids** Urgence Bidding Forecast Reference LSE Energy Imbalance Market Phase Shifter Gas Burn Reliability Coordination

Start Date: 07/28/2023 End Date: 07/28/2023

Day-Ahead Ancillary S

- Default Energy Bid Curves
- Default RMR Minimum Load and Startup Cost Bid Curves
- Greenhouse Gas Bid Cap
- Default Commitment Costs**
- Daily Electricity Price Index (EPI)
- Actual Limitation Values
- Resource Opportunity Costs

Schedule Type: [ALL]

Schedule Type	HE01 [MW]	HE02 [MW]	HE03 [MW]	HE04 [MW]	HE05 [MW]	HE06 [MW]	HE07 [MW]
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No Data found

Report Generated: 08/21/2023 07:37:31



Default Commitment Costs – Minimum Load Costs, Start-Up Costs, & Transition Costs

CMRI > Default Bids > Default Commitment Costs

Default Commitment Costs

Minimum Load Costs

1 - 20 of 86

Interval Start Time	Interval End Time	Market Type	Commitment Cost Type	SC ID	Resource	Configuration	Minimum Load Cost [\$/Hour]	Publication TimeStamp
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				377.49	07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				73.13	07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				9,323.34	07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				22,219.86	07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				22,219.86	07/27/2023 21:15

Start-Up Costs

1 - 20 of 86

Interval Start Time	Interval End Time	Market Type	Commitment Cost Type	SC ID	Resource	Configuration	Bid Segment 1 [min]	Bid Segment 1 [\$]	Bid Segment 2 [min]	Bid Segment 2 [\$]	Bid Segment 3 [min]	Bid Segment 3 [\$]	Publication TimeStamp
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				0.00	230.23					07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				0.00	0.00					07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				0.00	503.58					07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				0.00	1,489.10					07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				0.00	1,489.10					07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxv				0.00	504.06					07/27/2023 21:15

Transition Costs

Interval Start Time	Interval End Time	Market Type	Commitment Cost Type	SC ID	Resource	Transition Cost [\$]	From Configuration	To Configuration	Publication TimeStamp
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy			0.00			07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy			77.84			07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy			0.00			07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy			67.80			07/27/2023 21:15

Proxy Start-Up Cost including a GHG Compliance Obligation

CMRI > Default Bids > Default Commitment Costs

Start-Up Costs

Interval Start Time	Interval End Time	Market Type	Commitment Cost Type	SC ID	Resource	Configuration	Bid Segment 1 [min]	Bid Segment 1 [\$]	Bid Segment 2 [min]	Bid Segment 2 [\$]	Bid Segment 3 [min]	Bid Segment 3 [\$]	Publication TimeStamp
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				0.00	230.23					07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				0.00	0.00					07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				0.00	503.58					07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				0.00	1,489.10					07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				0.00	1,489.10					07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxv				0.00	504.06					07/27/2023 21:15

$$\text{Proxy Start-Up Cost} = (\text{Start-Up Fuel} \times \text{Fuel Region Price}) + (\text{Start-Up Energy} \times \text{Electricity Price Index}) + (\text{PMin} \times \text{Start-Up Time Period in min} / 60 \text{ min/hour} \times \text{GMC adder} / 2) + (\text{Start-Up Fuel} \times \text{GHG Emission Rate} \times \text{GHG Allowance Price})$$

An example of this equation is in the References section

Proxy Minimum Load Costs including a GHG Compliance Obligation

CMRI

CMRI > Default Bids > Default Commitment Costs
Default Commitment Costs

Minimum Load Costs

Interval Start Time	Interval End Time	Market Type	Commitment Cost Type	SC ID	Resource	Configuration	Minimum Load Cost [\$/Hour]	Publication TimeStamp
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				377.49	07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				73.13	07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				9,323.34	07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				22,219.86	07/27/2023 21:15
07/28/2023 00:00:00	07/29/2023 00:00:00	DAM	Proxy				22,219.86	07/27/2023 21:15

Proxy Minimum Load Cost with a GHG component = (Unit Conversion Factor x Minimum Load Heat Rate x Minimum Operating Level x Fuel Region Price) + (VOM-EN x Minimum Operating Level) + (GMC adder x Minimum Operating Level) + (Minimum Operating Level x Unit Conversion Factor x Minimum Load Heat Rate x **GHG Emission Rate** x **GHG Allowance Price**)

An example of this equation is in the References section

What Questions Do You Have?



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Washington WEIM GHG Enhancements

SCHEDULING INFRASTRUCTURE & BUSINESS RULES (SIBR)

SIBR functionality is remaining the same



Scheduling Coordinators



There will be slightly higher bid caps for WA GHG compliance

There is no UI or API changes in SIBR → the data is consuming WA GHG adders



Washington WEIM GHG Enhancements

**OPEN ACCESS SAME-TIME
INFORMATION SYSTEM (OASIS)**



PRICES

- Energy Prices ▶
- Shadow Prices ▶
- Ancillary Services Prices ▶
- Index Prices ▶
- Market Power Mitigation ▶



- Fuel Prices
- Greenhouse Gas Allowance Index Prices

New Column Added to Report & Calculation Change



Welcome to the California ISO OASIS site. On OASIS you will find real-time information about the ISO transmission system and its Market, such as system status, market prices and market

Standards Information

- [North American Energy Standards Board \(NAESB\)](#)
- [ISO Business Practice Manuals](#)
- [Available Transfer Capability Information](#)

Transmission Information

- [Base Case Data](#)
- [Interconnection Study Statistics](#)

System Help

- All technical specifications and artifacts for OASIS are available on the [ISO Developer site](#). Self-registration is required to access the site.
- To download data without using the OASIS interface, see [How to use report URLs to download OASIS data](#) on the ISO Developer site.
- Access non-technical OASIS reference documents on www.caiso.com

[Open Access Same-Time System \(OASIS\) link](#)

Current View: Greenhouse Gas Allowance Index Price Report



OASIS > Prices > Index Prices > Greenhouse Gas Allowance Index Prices



ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND

Date From: 08/01/2023 To: 08/23/2023 Apply Reset

Download XML Download CSV

Trade Date	GHG Index Price
08/01/2023	37.51
08/02/2023	36.89
08/03/2023	36.04
08/04/2023	35.96
08/05/2023	36.34
08/06/2023	36.34
08/07/2023	36.34
08/08/2023	36.85

Before this project went into effect, the only GHG allowance price that was used was the California price but, after the project implementation, the Washington price is included for Washington resources.

New Column – State: Greenhouse Gas Allowance Index Price Report



OASIS > Prices > Index Prices > Greenhouse Gas Allowance Index Prices

ATLAS REFERENCE REPORT DEFINITION **PRICES** TRANSMISSION SYSTEM DEMAND

Date From: 08/12/2023 To: 08/30/2023

Greenhouse Gas Allowance Index Prices

Trade Date	State	GHG Index Price
08/12/2023	CA	36.31
08/12/2023	WA	67.08
08/13/2023	CA	36.31
08/13/2023	WA	67.08
08/14/2023	CA	36.31
08/14/2023	WA	67.08
08/15/2023	CA	36.06
08/15/2023	WA	68.03
08/16/2023	CA	35.91

There is a new column called "State," that separates California and Washington GHG Index Prices.

This report is updated at 21:00-22:00 PST for the next day.

Greenhouse Gas Allowance Index Price Calculation

- The industry sources for greenhouse gas allowance trade prices:
 - Intercontinental Exchange (ICE) End of Day Report
 - ARGUS Air Daily
- The ISO will calculate a Greenhouse Gas Allowance Price for each GHG regulation area by averaging the data from **ICE** and **ARGUS**.
 - California Price
 - Washington Price

[Tech Specs Posted – OASIS Interface Specification v7.4.0](#)

Example: Greenhouse Gas Allowance Index Pricing



Entity	GHG Allowance Index Price California	GHG Allowance Index Price Washington
ARGUS	\$32	\$56
ICE	\$33	\$58



<u>California GHG Allowance Index Price</u>	\$32.50 $(\$32 + \$33) \div 2$
<u>Washington GHG Allowance Index Price</u>	\$57 $(\$58 + \$56) \div 2$

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Market Simulation

READINESS ACTIVITIES

Market Simulation

WA WEIM GHG Unstructured Market Sim starts on **September 7, 2023**

- View the [CAISO public calendar](#) for full schedule

Submit questions and/or concerns through the CIDI application or email MarketSim@caiso.com.

Functional Environment, select: **Market Simulation Fall 2023**

CONTACT CUSTOMER SUPPORT
TELL US HOW WE CAN HELP

* SCID

i Review for Price Correction

i Manual Reference Level Change Request

* Subject

* Functional Environment

--None--

- None--
- Production
- Market Simulation
- Parallel Operations
- RC Integration
- RC Shadow Operations
- Market Simulation Spring 2023
- Market Simulation Summer 2023
- Market Simulation Fall 2023**
- Market Simulation Independent 20
- Market Simulation Summer 2024
- Market Simulation Fall 2024
- Market Simulation Independent 20

Q1: Does this mean there will be no Settlements statements issued if there are no Structured Market Sim Scenario?

Answer: We will have Settlement Statements in the Market Simulation environment publishing for the month of September 2023. There is a [Settlements calendar](#) that is published but there are no direct settlement impacts for the WA GHG initiative.

Q2: For the Market Sim, if we choose a specific trade date (even if it's unstructured) are you going to run the market at least simulate on of these changes so that we can go in and review in on the report?

Answer: Once the functionality is activated in the MAP Stage environment, the updated formulas for the calculation of the Default Energy Bids and Default Commitment costs will be included. In theory, every day of the Market Simulation, you will be able to check the results. It is only impacting the resources that are located in Washington or subject to Washington Cap-& Invest program. For PG&E, this formula is not impacting your resources as your resources are located in California.

Q3: When we look at the report, how do we differentiate if this component is part of the calculation? We want to understand how the WA GHG allowance is going to impact us.

Answer: you could use this formula to re-create the minimum load cost. Again, this really should not impact any resources located in California because this is only impacting specific resources that have Compliance Obligation under Washington's program.

Post Training Q&A (Continued)

New Slide

Q4: Are you going to transfer the GHG information that's currently on the resource tab over to the new field or do we have to physically do something?

Answer: Existing data for GHG for California will be transferred over to the new tab under state CA by the ISO. No action is required for you.

Q5: Is there a calculation of an emission rate that is applied to imports to California and perhaps then to Washington as well. Does this initiative impact that calculation in any way?

Answer: There is no impact on the new process.

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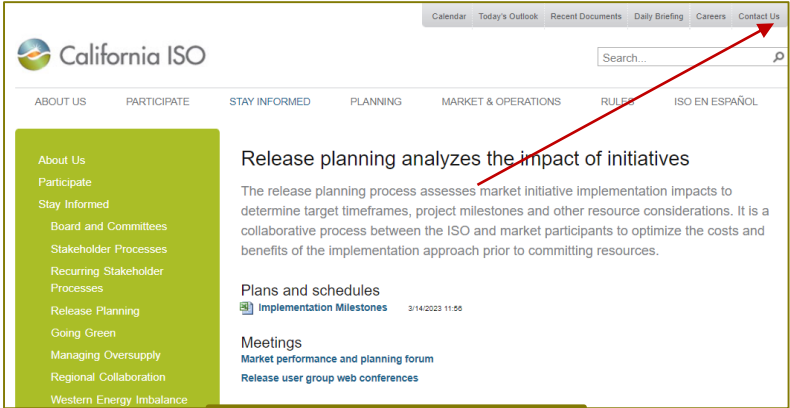
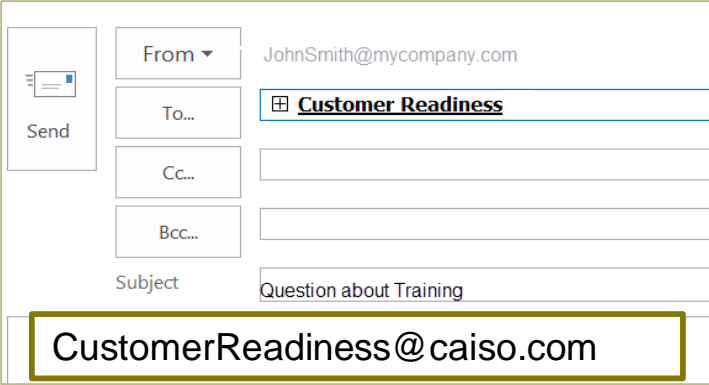


Raise your hand using WebEx interactivity tools to be put in verbal queue

Thank you for your participation!

For clarification on anything presented in this training, send an email to: CustomerReadiness@caiso.com

For any other questions or stakeholder specific questions or concerns, please [submit a ticket](#).



REFERENCE MATERIALS

DETAILED EXAMPLES

Example Calculation: Variable Default Energy Bid for Gas-Fired Resource with a GHG Component

- For a gas-fired Combined Cycle Gas Turbine (CCGT) with a segment with an 8,000 BTU/Kwh Incremental Heat Rate, the default energy bid (DEB) for that segment would be calculated as follows:
- $\{([Unit\ Conversion\ Factor * IHR * GPI] + O\&M + GMC + [Unit\ Conversion\ Factor * IHR * Emission\ Rate * GHG\ Cost]) * 1.1\} + FMU\ adder\ (if\ eligible) + Variable\ Energy\ Opportunity\ Cost\ (if\ eligible)$

Example: Variable Default Energy Bid for Gas-Fired Resource with a GHG Component cont.

CMRI

{{[Unit Conversion Factor*IHR * GPI] +

{{[8 * \$5] +

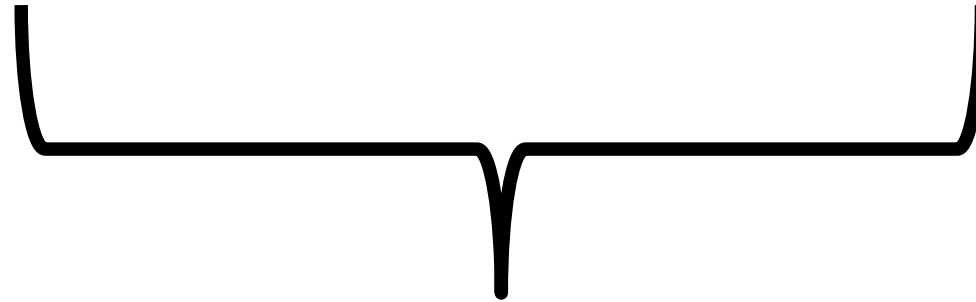
The 8,000 Btu/KWh heat rate is converted into MMBtu/MWh by multiplying 0.001 to the incremental heat rate (IHR).

Given a gas price of \$4.50/MMBtu and the proxy gas transport cost were \$0.50, making a GPI of \$5/MBTU

Example: Variable Default Energy Bid for Gas-Fired Resource with a GHG Component cont.

{([Unit Conversion Factor*IHR * GPI] + **O&M** +

{([8 * \$5] + \$2.80 +



The variable energy O&M adder is \$2.80/MWh

Example: Variable Default Energy Bid for Gas-Fired Resource with a GHG Component cont.

CMRI

$$\{([\text{Unit Conversion Factor} * \text{IHR} * \text{GPI}] + \text{O\&M} + \text{GMC})\}$$

$$\{([8 * \$5] + \$2.80 + \underline{\$0.50})\}$$

The grid management charge (GMC) adder is \$0.50

Example: Variable Default Energy Bid for Gas-Fired Resource with a GHG Component cont.

CMRI

$\{([Unit\ Conversion\ Factor * IHR * GPI] + O\&M + GMC + [Unit\ Conversion\ Factor * IHR * Emission\ Rate * GHG\ Cost]) * 1.1\} +$

$\{([8 * \$5] + \{([8 * \$5] + \$2.80 + \$0.50 + [8 * 0.053165 * 15.34]) * 1.1\} +$

If the resource is subject to a greenhouse gas compliance obligation, CAISO will include the greenhouse gas allowance cost in the fuel cost estimate. The cost will be calculated using the e Greenhouse Gas Allowance Price assume for this scenario the GHG allowance price is \$15.34/mtCO₂e.

Example: Variable Default Energy Bid for Gas-Fired Resource with a GHG Component cont.

CMRI

$\{([Unit\ Conversion\ Factor * IHR * GPI] + O\&M + GMC + [Unit\ Conversion\ Factor * IHR * Emission\ Rate * GHG\ Cost]) * 1.1\} + \text{FMU adder (if eligible)} + \text{Variable Energy Opportunity Cost (if eligible)}$

$$\begin{aligned} & \{([8 * \$5] + \$2.80 + \$0.50 + \\ & [8 * 0.053165 * 15.34]) * 1.1\} + \underline{\$0} + \underline{\$0} \\ & = \$54.81/MWh \end{aligned}$$

Presume that this unit is not eligible for the FMU adder or a Variable Energy Opportunity Cost on top of the fuel cost estimate.

Example: Proxy Start-Up Cost including a GHG Compliance Obligation

What We Know:

- **GHG Allowance Price** = \$15.34/mtCO₂e
- **GHG Emission Rate** = 0.053165 mtCO₂e /MMBtu

$$\begin{aligned}\text{Proxy Start-Up Cost} &= (1,083 \text{ MMBtu} \times \$8.50/\text{MMBtu}) + (20\text{MWh} \times \$80/\text{MWh}) + \\ &+ (20 \text{ MW} \times (600 \text{ minutes} / (60\text{minutes}/\text{hour})) \times \$0.50/\text{MWh} / 2) + (1083 \text{ MMBtu} \times \\ &0.053165 \text{ mtCO}_2\text{e} / \text{MMBtu} \times \$15.34) \\ &= (9,205.5) + (1,600) + (50) + (883.24) \\ &= 11,738.74 \\ &= \underline{11,739 \text{ (rounded)}}\end{aligned}$$

Example: Proxy Minimum Load Cost with a GHG component

What We Know:

- GHG Allowance Price = \$15.34/mtCO₂e
- GHG Emission Rate = 0.053165 mtCO₂e /MMBtu

$$\begin{aligned} \text{Proxy Minimum Load Cost with a GHG component} &= (\text{Unit Conversion Factor} \times \text{Minimum Load Heat Rate} \times \text{Minimum Operating Level} \times \text{Fuel Region Price}) + (\text{VOM-EN} \times \text{Minimum Operating Level}) + (\text{GMC adder} \times \text{Minimum Operating Level}) + (\text{Minimum Operating Level} \times \text{Unit Conversion Factor} \times \text{Minimum Load Heat Rate} \times \text{Emission Rate} \times \text{GHG Allowance Price}) \\ &= (0.001 \times 14,000\text{Btu/kWh} \times 20\text{MW} \times \$8.50/\text{MMBtu}) + (\$4/\text{MWh} * 20\text{MW}) + (\$0.50/\text{MWh} \times 20\text{MW}) + (20\text{MW} \times 0.001 \times 14,000\text{Btu/kWh} \times 0.053165 \text{ mtCO}_2/\text{MMBtu} \times 15.34) \\ &= (\$2,380) + (\$80) + (\$10) + (\$228) \\ &= \underline{\underline{\$2,698}} \end{aligned}$$