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)

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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
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**

\[
\text{Fuel Costs}_1 + \text{VOM} + \text{GMC} + \text{GHG}
\]

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

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

Interim Alternative Solution
May 2023

External Training
08/28/23

Unstructured Market Simulation
09/07/23 - 09/29/23

Production Activation
11/01/23

Policy Initiative Page: Washington WEIM greenhouse gas enhancements link
What Questions Do You Have?

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REVIEW APPLICATION - SPECIFIC DETAILS FOR WA WEIM GHG
# Fall 2023 Release Overview – System Interface Changes

<table>
<thead>
<tr>
<th>System</th>
<th>Project</th>
<th>UI</th>
<th>API</th>
<th>Data</th>
<th>Technical Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIMS</td>
<td>ESET2</td>
<td>Existing &gt; App &amp; Study &gt; Equipment Configuration tab &gt; Generation as Modeled and Implimented grid</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>ITS</td>
<td>RSEE272</td>
<td>Existing</td>
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<td>NA</td>
<td>NA</td>
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<tr>
<td>CMU</td>
<td>WA WEIM GHGE</td>
<td>Existing &gt; Prices &gt; Index Prices &gt; Greenhouse Gas Allowance Index Prices</td>
<td>NA</td>
<td>NA</td>
<td>New Attributes/Records to indicate state/indicate GHG index price for each state</td>
</tr>
<tr>
<td>OASIS*</td>
<td>WA WEIM GHGE</td>
<td>Existing &gt; Prices &gt; Index Prices &gt; Greenhouse Gas Allowance Index Prices</td>
<td>NA</td>
<td>NA</td>
<td>New Attributes/Records to indicate state/indicate GHG index price for each state</td>
</tr>
<tr>
<td>MF RDT*</td>
<td>WA WEIM GHGE</td>
<td>Add a new BAA level attribute to identify BAA's associated with Washington State</td>
<td>SubmitGeneratorRDT_MFRsharedV5 SubmitGeneratorRDT_MFRsharedV5_DocAttach RetrieveGeneratorRDT_MFRsharedV5 RetrieveGeneratorRDT_MFRsharedV5_DocAttach</td>
<td>Add WA GHG index prices, display average of daily WAGHG price indices</td>
<td>Minor Version 20231001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>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 &quot;State&quot; to indicate GA, WA etc.</td>
</tr>
<tr>
<td>SIBR</td>
<td>WA WEIM GHGE</td>
<td>Existing</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>SIBR*</td>
<td>ESE2</td>
<td>New Hourly feature on Hourly tab to select Y/N for Off-Grid Charge</td>
<td>New optional element in xsd for OffGridCharge used by designated resource to manage Sub/Stand Alone ACC. RawBidSet, BidResults, CleanBidSet vs xsd Version 20231101.</td>
<td>New HourlyParameter for OffGridCharge this is a Yes/No type that is optional.</td>
<td>8/10/23</td>
</tr>
</tbody>
</table>

---

**Market Simulation Plan – Fall 2023 Release**
Washington WEIM GHG Enhancements

MASTER FILE (MF)
• Previously, GHG Regulation Areas would see the “Resource” tab with two columns for:
  ➢ Green House Gas Emission Rate
  ➢ Green House Gas Compliance Obligation

  ➢ 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)

<table>
<thead>
<tr>
<th>Resource ID</th>
<th>Identifier of the resource.</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>Options are California (CA) and Washington (WA). The emission state may differ from the resource’s physical location.</td>
</tr>
<tr>
<td>GHG Emission Rate</td>
<td>The GHG emission rate applicable to this compliance obligation</td>
</tr>
<tr>
<td>GHG Compliance Obligation</td>
<td>Y = resource has a GHG compliance obligation \nN = resource does not have a current GHG compliance obligation</td>
</tr>
</tbody>
</table>

GHG_EMISSION_Rate is a new attribute that will have the:
- Resource ID
- State (new column)
- GHG Emission Rate
- 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.

Changes in Market Instruments Attachment K & Energy Imbalance Market BPM PRRs 1534 and 1535
Tech Specs posted
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
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:

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

A detailed walkthrough is located in the References section.
Default Commitment Costs
# Default Commitment Costs – Minimum Load Costs, Start-Up Costs, & Transition Costs

## CMRI > Default Bids > Default Commitment Costs

### Minimum Load Costs

<table>
<thead>
<tr>
<th>Interval Start Time</th>
<th>Interval End Time</th>
<th>Market Type</th>
<th>Commitment Cost Type</th>
<th>SC ID</th>
<th>Resource</th>
<th>Configuration</th>
<th>Minimum Load Cost [$/Hour]</th>
<th>Publication TimeStamp</th>
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</thead>
<tbody>
<tr>
<td>07/28/2023 00:00:00</td>
<td>07/29/2023 00:00:00</td>
<td>DAM</td>
<td>Proxy</td>
<td>proxy</td>
<td>[Data Table]</td>
<td>377.49</td>
<td>07/27/2023 21:15</td>
<td></td>
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<tr>
<td>07/28/2023 00:00:00</td>
<td>07/29/2023 00:00:00</td>
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<td>proxy</td>
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<td>07/29/2023 00:00:00</td>
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<td>proxy</td>
<td>[Data Table]</td>
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<td>07/27/2023 21:15</td>
<td></td>
</tr>
</tbody>
</table>

### 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 | proxy | [Data Table] | 0.00 | 230.23 | 07/27/2023 21:15 |
| 07/28/2023 00:00:00 | 07/29/2023 00:00:00 | DAM | Proxy | proxy | [Data Table] | 0.00 | 0.00 | 07/27/2023 21:15 |
| 07/28/2023 00:00:00 | 07/29/2023 00:00:00 | DAM | Proxy | proxy | [Data Table] | 0.00 | 503.55 | 07/27/2023 21:15 |
| 07/28/2023 00:00:00 | 07/29/2023 00:00:00 | DAM | Proxy | proxy | [Data Table] | 0.00 | 1,489.10 | 07/27/2023 21:15 |
| 07/28/2023 00:00:00 | 07/29/2023 00:00:00 | DAM | Proxy | proxy | [Data Table] | 0.00 | 1,489.10 | 07/27/2023 21:15 |
| 07/28/2023 00:00:00 | 07/29/2023 00:00:00 | DAM | Proxy | proxy | [Data Table] | 0.00 | 564.96 | 07/27/2023 21:15 |

### Transition Costs

<table>
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<th>Commitment Cost Type</th>
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<th>Resource</th>
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<th>To Configuration</th>
<th>Publication TimeStamp</th>
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<td>07/29/2023 00:00:00</td>
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<td>proxy</td>
<td>[Data Table]</td>
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<td>0.00</td>
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<tr>
<td>07/28/2023 00:00:00</td>
<td>07/29/2023 00:00:00</td>
<td>DAM</td>
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<td>proxy</td>
<td>[Data Table]</td>
<td>0.00</td>
<td>87.80</td>
<td>07/27/2023 21:15</td>
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</tbody>
</table>
Proxy Start-Up Cost including a GHG Compliance Obligation

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

An example of this equation is in the References section.
### Proxy Minimum Load Costs including a GHG Compliance Obligation

**CMRI > Default Bids > Default Commitment Costs**

#### Default Commitment Costs

<table>
<thead>
<tr>
<th>Interval Start Time</th>
<th>Interval End Time</th>
<th>Market Type</th>
<th>Commitment Cost Type</th>
<th>SC ID</th>
<th>Resource</th>
<th>Configuration</th>
<th>Minimum Load Cost ($/Hour)</th>
<th>Publication Time/Stamp</th>
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<tr>
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<td>07/29/2023 00:00:00</td>
<td>DAM</td>
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<td>07/27/2023 21:15</td>
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<td>07/28/2023 00:00:00</td>
<td>07/29/2023 00:00:00</td>
<td>DAM</td>
<td>Proxy</td>
<td></td>
<td></td>
<td></td>
<td>73.13</td>
<td>07/27/2023 21:15</td>
</tr>
<tr>
<td>07/28/2023 00:00:00</td>
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<td>DAM</td>
<td>Proxy</td>
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<td>07/28/2023 00:00:00</td>
<td>07/29/2023 00:00:00</td>
<td>DAM</td>
<td>Proxy</td>
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<td></td>
<td>22,219.86</td>
<td>07/27/2023 21:15</td>
</tr>
<tr>
<td>07/28/2023 00:00:00</td>
<td>07/29/2023 00:00:00</td>
<td>DAM</td>
<td>Proxy</td>
<td></td>
<td></td>
<td></td>
<td>22,219.86</td>
<td>07/27/2023 21:15</td>
</tr>
</tbody>
</table>

**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)
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

SIBR functionality is remaining the same
Washington WEIM GHG Enhancements

OPEN ACCESS SAME-TIME INFORMATION SYSTEM (OASIS)
New Column Added to Report & Calculation Change
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.
There is a new column called “State,” that separates California and Washington GHG Index Prices.

<table>
<thead>
<tr>
<th>Trade Date</th>
<th>State</th>
<th>GHG Index Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/12/2023</td>
<td>CA</td>
<td>36.31</td>
</tr>
<tr>
<td>08/12/2023</td>
<td>WA</td>
<td>67.08</td>
</tr>
<tr>
<td>08/13/2023</td>
<td>CA</td>
<td>36.31</td>
</tr>
<tr>
<td>08/13/2023</td>
<td>WA</td>
<td>67.08</td>
</tr>
<tr>
<td>08/14/2023</td>
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<td>36.31</td>
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<td>08/14/2023</td>
<td>WA</td>
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<tr>
<td>08/16/2023</td>
<td>CA</td>
<td>35.91</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Entity</th>
<th>GHG Allowance Index Price California</th>
<th>GHG Allowance Index Price Washington</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARGUS</td>
<td>$32</td>
<td>$56</td>
</tr>
<tr>
<td>ICE</td>
<td>$33</td>
<td>$58</td>
</tr>
</tbody>
</table>

California GHG Allowance Index Price: $32.50 \( ($32 + $33) \div 2 \)

Washington GHG Allowance Index Price: $57 \( ($58 + $56) \div 2 \)
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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](mailto:MarketSim@caiso.com).

Functional Environment, select: ‘**Market Simulation Fall 2023**’
Post Training Q&As

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 wants 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.
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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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.

www.caiso.com
DETAILED EXAMPLES
Example Calculation: Variable Default Energy Bid for Gas-Fired Resource with a GHG Component

• For a gas-fired Combined Cycle Gas Turbine (CCBT) with a segment with an 8,000 BTU/Kwh Incremental Heat Rate, the default energy big (DEB) for that segment would be calculated as follows:

• \{([\text{Unit Conversion Factor} \times IHR \times \text{GPI}] + \text{O&M} + \text{GMC} + [\text{Unit Conversion Factor} \times IHR \times \text{Emission Rate} \times \text{GHG Cost}]) \times 1.1\} + \text{FMU adder (if eligible)} + \text{Variable Energy Opportunity Cost (if eligible)}
Example: Variable Default Energy Bid for Gas-Fired Resource with a GHG Component cont.

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

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.

\[
\{([\text{Unit Conversion Factor} \times \text{IHR} \times \text{GPI}] + \text{O&M} + \\
\{([8 \times 5] + $2.80) + \\
\]

The variable energy O&M adder is $2.80/MWh
Example: Variable Default Energy Bid for Gas-Fired Resource with a GHG Component cont.

\[\text{[Unit Conversion Factor} \times \text{IHR} \times \text{GPI}] + \text{O&M} + \text{GMC}\]

\[\text{[8} \times \$5] + \$2.80 + \$0.50\]

The grid management charge (GMC) adder is $0.50
Example: Variable Default Energy Bid for Gas-Fired Resource with a GHG Component cont.

\[
\{([\text{Unit Conversion Factor}\times\text{IHR} \times \text{GPI}] + \text{O&M} + \text{GMC} + [\text{Unit Conversion Factor}\times\text{IHR}\times\text{Emission Rate}\times\text{GHG Cost}]) \times 1.1 \} + \\
\{([8 \times $5] + ([8 \times $5] + $2.80 + $0.50 + [8\times0.053165\times15.34])\times1.1\} +
\]

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 Greenhouse Gas Allowance Price assumed 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.

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

\[
\{([8 \times $5] + $2.80 + $0.50 + [8 \times 0.053165 \times 15.34]\) \times 1.1\} + $0 + $0
\]

\[= $54.81/\text{MWh}\]

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** = $15.34/mtCO$_2$e
- **GHG Emission Rate** = 0.053165 mtCO$_2$e /MMBtu

Proxy Start-Up Cost = (1,083 MMBtu x $8.50/MMBtu) + (20 MWh x $80/MWh) + (20 MW x (600 minutes / (60 minutes/hour)) x $0.50/MWh / 2) + (1083 MMBtu x 0.053165 mtCO$_2$e /MMBtu x $15.34)

= (9,205.5) + (1,600) + (50) + (883.24)

= 11,738.74

= 11,739 (rounded)
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

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 Emission Rate x GHG Allowance Price)

= (0.001 x 14,000Btu/kWh x 20MW x $8.50/MMBtu) + ($4/MWh * 20MW) + ($0.50/MWh x 20MW) + (20MW x 0.001 x 14,000Btu/kWh x 0.053165 mtCO2/MMBtu x 15.34)

= ($2,380) + ($80) + ($10) + ($228)

= $2,698