March 3, 2022

EDAM working group #3 participants,

Below is a filled-out revised scope document for the proposed resource-specific approach for GHG accounting in the Extended Day-Ahead Market (EDAM) using the scope document that was posted on February 18. This document was completed by the CAISO policy team that initially raised the resource-specific approach in the working group.

The purpose of this document is to serve as a reference document for the evaluation of the resource-specific approach that we’ll conduct during the 3/3 working group meeting. I expect that it will also be a useful resource when preparing the working group deliverables. There are still a few items marked as TBD which we’ll discuss in the working group meeting as well. Also, you’ll see certain codes/IDs below (e.g. RA-2, UC-1). These are references to the homework assignment responses that are posted to the working group website [here](http://www.caiso.com/InitiativeDocuments/HomeworkResponses-ExtendedDay-AheadMarket-WorkingGroup3-GreenhouseGasAccounting-Costs-Feb17-2022.pdf).

Best,

Kevin Head

EDAM working group #3 facilitator

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| **Issue** | **Key Market Design Question** | **Homework assignment question ID** | **Detailed Market Design Question(s)** |
| **1) General Accounting** |
| **Area**Identify GHG Compliance Area(s) | Are entities aligned that state boundaries are the GHG compliance area?  | A | Decide: What should the GHG compliance area be? Geographic: GHG Regulation Area within a BAAInternational considerations: Allowed, as applicable Topics: * Boundaries (UA-1) and potential need for alignment of transmission boundary concepts developed in Transmission working group: N/A as GHG transfers are distinct from BAA transfers and transmission boundary issues.
* Implications for BAA spanning multiple states (RA-2, RA-3)
	+ The GHG Regulation Area is a defined group of nodes that can partially overlap with a BAA. The CAISO is proposing defining GHG Regulation Areas independently from BAAs. This will facilitate a BAA spanning multiple states and GHG Regulation Areas to accurately reflect bids/compliance obligations.
	+ *RA-2: BPA: How specifically does this work for multi-state BAAs, i.e. how will the WA load in BPA’s BAA be identified (nodes?) and how will the volume of resources deemed delivered to those loads be calculated? And how will BPA’s resources be modeled (under WA cap and trade, BPA’s system – and generating units – are all considered imports to the state. Answer: This will be done via a node group definition in the Master File. CAISO’s understanding from WA DOE is that imports must use the unspecified rate. The CAISO can provide WEIM Entities with their specific market data to assist them with reporting obligations under Washington’s Cap and Invest program. The CAISO may also be able to provide aggregate information to help Washington state and reporting entities ensure accurate accounting of power obtained from the WEIM.*
	+ *RA-3: How would CAISO determine GHG net exports for a single state in a multi-state BA for the purposes of limiting GHG attribution (in the resource-specific GHG attribution enhancement)? Answer: Creating the GHG Regulation Area allows CAISO to attribute GHG net exports for a single state in a multi-state BAA. The net import into a GHG Regulation Area (not necessarily, but probably a State) is determined as the net of scheduled demand minus scheduled supply in that area.*
* Impacts to WEIM
	+ Yes, it will modify the WEIM designation at the BAA level to a GHG Regulation Area. This is a necessary enhancement to the WEIM, as soon there will be multiple GHG Regulation Areas in the WEIM footprint.
* Rules that need to be established for renewable resource dispatch in/out of a GHG zone (UA-4)
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| **Availability**Eligibility to serve demand in the GHG compliance area | What rules for availability need to be developed for EDAM for GHG?  | B | Decide: What will availability to serve load in a GHG compliance area look like? * Availability to serve load in a GHG compliance area will be optional and based on hourly GHG bids submitted.

Topics: * Determining availability
* Supply resources election to make capacity available to support transfers to a GHG compliance area (RB-1, RB-2, UB-1)

*RB1: How will this allow a utility to direct where energy is accounted for? Answer: The load resources in CAISO’s market and EDAM have wide aggregations (i.e., the entire BAA for WEIM BAAs). This does not provide sufficient granularity for a supply to load matching system. To increase the granularity of load would impose severe performance issues to IFM, but more important, it will be detrimental to load settlement and CRRs because of the myriad of different load aggregation point LMPs. Furthermore, it will be very challenging, or impossible, to separate load customers at the same node, or LAP, and track load migration among the various LAPs.**RB2: How will this preserve the ability to sell non-emitting surplus into a GHG zone? Answer: Within EDAM, a resource would indicate a GHG compliance cost and quantity, and make its non-emitting surplus available for the GHG zone based on co-optimized results.*  |
| **Costs being optimized** | Which costs should be included in the market optimization? |  | Are we optimizing:* Carbon prices: The GHG cost of compliance is optimized based on bids submitted:
	+ Quantity: MW
	+ Price: $/MWh
	+ Frequency: Hourly basis
* RPS/CES: No

Types* Carbon pricing (including how to consider GHG costs reflected in natural gas prices):
	+ Carbon pricing: Internal to EDAM GHG costs would be reflected in energy bids, external to EDAM costs would be included through either an unspecified rate or if it is offering to the CA GHG Regulatory Area it would also have the option to use the ACS emissions rate, if approved by CARB.
	+ Carbon pricing and natural gas prices: Currently, CA gas pays a decreased cost to adjust for GHG compliance costs reflected in energy bids. More discussion will be needed to understand if WA will use the same methodology or not. This same issue will apply for EDAM/WEIM when new GHG Regulation Areas are established.
* Clean energy/renewable:
	+ Clean energy or renewable energy would also have a resource-specific emissions rate internal to EDAM if offering to a GHG Regulatory Area, but would need to use the unspecified rate or ACS if it is coming from outside the EDAM. Transactions covered: See section below on “Multiple GHG Zones”
* GHG zone:
	+ Generation w/in GHG zone
	+ Imports into GHG zone
* Non-GHG zone:
	+ Generation w/in non-GHG zone
	+ Exports into GHG zone
 |
| **Emissions attribution**  | How should GHG emission attribution be determined?  |  | Decide: How should emissions be attributed? * The CAISO is proposing to use a resource specific emissions rate for resources within EDAM
* Emissions rate
	+ EDAM BAA: Specified Resource (resource specific emissions rate)
	+ Non-EDAM BAA
		- Unspecified Resource (default emissions rate)
			* CARB: 0.428 mTCO2e/MWh
			* WA Department of Ecology: 0.437 mTCO2e/MWh
		- Asset Controlling Supplier (ACS) emissions rate: average emissions rate based on their areas, as approved by CARB
 |
| **Participation options** |  | A | Determining emissions attribution with different participation options (RA-4): * Imports at EDAM Boundaries: Subject to WG 2 discussions on external resource participation. After this is resolved in WG 2, this issue can come back to the GHG working group to discuss how this will impact GHG attribution.
* GHG pseudo-ties: Included in the GHG Regulation Area they are pseudo-tied to. This is because pseudo-tie resources are physically outside their BA but are contractually treated as internal generation for the purposes of the market optimization.
* Wheels though GHG compliance area: N/A as it is movement from a non-EDAM BAA to an import to a non-EDAM BAA. There is no GHG attribution in a GHG zone.
* Virtual bids: Excluded, as GHG attribution is limited to physical supply. Virtual supply does not have GHG attribution, even though their schedules outside of GHG regulation areas may contribute to net import transfers into GHG Regulation Areas.
* Energy storage: Included, if they submit a GHG bid for the discharge portion of their battery
* Jointly-owned units: Included, if within GHG Regulation Area. If the resource resides outside of all GHG Regulation Area(s), its JOU children, may bid GHG bids for attribution to specific GHG Regulation Areas.
* Self-scheduled resources (RA-1, UA-2, UA-3): Included, if they submit a GHG bid and energy bid.
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| **Multiple GHG Zones** | Can the model accommodate multiple GHG zones? If so, how? | C | * From a technical perspective, can the model accommodate multiple GHG zones? (RC-2)

From a technical perspective, multiple GHG zones can be accommodated. * If it can, how are the following impacted?
	+ Bidding between GHG zones (GHG zone A -> GHG zone B), linked versus unlinked
	+ Bidding from non-GHG zone to multiple GHG zones
	+ How market decides which GHG zone should be served

**Bidding structure without linkage**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Bid to GHG Zone 1 (CA) (Cost A) | Bid to GHG Zone 2 (WA) (Cost B)  | Non-GHG Zone  |
| Resource in GHG Zone 1 (CA)  | GHG cost embedded in energy bid  | \*Subject to further policy and implementation discussions  | N/A |
| Resource in GHG Zone 2(WA)  | \*Subject to further policy and implementation discussions  | GHG cost embedded in energy bid | N/A |
| Resource in Non- GHG Zone  | GHG bid adder (Cost B) | GHG bid adder (Cost B) | N/A  |

**Bidding structure with linkage**

|  |  |  |
| --- | --- | --- |
|  | Linked GHG Zone | Non-GHG Zone  |
| Resource in GHG Zone | GHG cost embedded in energy bid | N/A |
| Resource in Non- GHG Zone  | GHG bid adder | N/A  |

\*TBD. The CAISO recognizes that additional discussions with GHG Regulatory Agencies (WA DOE and CARB) will be necessary to finalize any policy and implementation details for how resoruces between GHG Regulation Areas will bid their resources. This will also be required as any new GHG Regulation Area is developed. * When there are multiple state GHG areas (e.g. WA and CA), how will the algorithm determine and prioritize which resources are deemed to which GHG area? (RC-1, UC-1)
	+ The determination and prioritization on which resources are deemed to which GHG area is a function of economic dispatch when the resources are co-optimized.

*RC-4: When will an emitting resource in a GHG zone ever get dispatched to another GHG zone when it appears “ripe” for double counting of emission offsets? In other words, how do ensure that the resources are not paying twice – once for CA and once for WA? Answer: Subject to further policy and implementation discussions.*  |
| **2) Approach-specific Issues** |
| **Baseline for evaluation of attribution (Resource-specific)** | What should the baseline for evaluating GHG attribution? | D | * Under the WEIM model today, GHG attribution quantity (MW) is limited by the upper economic limit minus the base schedule (note: not limited by WEIM incremental dispatch, but it is limited by the total dispatch). Because there will be no base schedule in EDAM, what will the UEL be compared to determine GHG attribution? (RD-1)
	+ The CAISO proposes to use the Resource Sufficiency Evaluation (RSE) solution at 10AM as a reference for limiting secondary dispatch, similarly to the base schedule in WEIM. The RSE optimization model is run prior to the IFM to assess if there is sufficient supply in an EDAM BAA to meet the respective demand forecast and uncertainty requirements. This model accounts of power balance requirements, imbalance reserve requirements, ancillary service requirements, unit commitment inter-temporal constraints, capacity constraints, ramp capability constraints, VER forecasts, and energy limitations for hydro and battery resources. The RSE solution identifies any upward and downward supply shortfall in meeting the RSE requirements; without any shortfall, the EDAM BAA passes the test. The RSE optimal schedule minimizes bid costs for meeting BAA requirements and as such it can be used as a counterfactual for resource-specific GHG attribution.
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| **Hurdle rate calculation (unspecified)** | How would the hurdle rate calculation work? | E | * Will the hurdle rate be an exogenous input into the market? What are the components of this calculation? (UE-9, UE-11, UE-12)
* Will the hurdle rate be dynamic or static? (UE-2, UE-8)
	+ If static, does this present gaming opportunities?
* Will the hurdle rate be responsive to the prevailing market rate of GHG allowances? (UE-2)
* Will the hurdle rate factor in the grid emissions intensity? If so, should it use an average emissions intensity or the marginal emissions intensity? How frequently would this be adjusted? Are out-of-zone clean resources that are "assigned to the zone" backed out of the unspecified rate (i.e. “the calculation of imports reflects that [the out-of-zone resources are] in the zone”)? (UE-6)
* Can EDAM SCs negotiate their own specified emissions rate? Would self-scheduled power qualify for a resource specific emission rate? (UE-1, UE-4)
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| **Alternate pathways to serve GHG zones (unspecified)** | What alternative pathways would exist for a resource in a non-GHG zone to serve a GHG zone? | F | * What are the criteria for resources outside the zone to be included inside the zone? (UF-1, UF-3)
* Can entities voluntarily opt-in? If so, how frequently can this election be made? (UF-2)
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| **3) Secondary Dispatch and Other Consequences** |
| **Leakage minimization** | What mechanisms exist to limit leakage and secondary dispatch? | G | * How would secondary dispatch occur in the model and how it is designed to limit it? (RG-1, RG-2, UG-1, UG-2)
	+ A market based on least cost dispatch will inherently send cleaner resources to a GHG zone because low emitting resources face either fewer or no costs to comply with GHG regulations. In some instances, higher-emitting resources will need “to backfill” this dispatch to serve load in a non-GHG zone.
	+ Every GHG proposal in EDAM will have to solve the issue of secondary dispatch. The CAISO does not have estimates of secondary dispatch in EDAM, but recognizes that the volume of MW will be higher than the imbalance in WEIM.
	+ Secondary dispatch in the CAISO’s proposal will be limited by:
		1. EDAM BAA net export transfer schedule (Note: this is also an enhancement that would apply to the WEIM)
		2. The difference between the Upper Economic Limit and the Reference Schedule (from the RSE optimal solution)
 |
| **Other consequences of approach** | Are there other unintended consequences of the model and how does the approach deal with these? | E, G | * Resource-specific approach
	+ Under the resource-specific approach, it is possible for resources to have been deemed to serve CA when it is impossible based on their transmission capabilities? If so, how does the approach deal with this?
	+ The GHG attribution is limited by the energy schedule, which in turn is limited by transmission congestion. For this reason, transmission constraints are not directly considered in calculating GHG attributions. However, the CAISO proposes to limit GHG attributions to resources in a BAA to the net export transfer schedule for that BAA.
* Unspecified approach:
	+ It is possible that non-emitting resources might need to clear the hurdle rate that is meant to reflect GHG costs? (UE-10)
	+ Would the proposal shift concerns about secondary dispatch from the day-ahead and real-time markets into the forwarding contracting horizon? (UG-2)
	+ In what specific way does this approach provide advantages to zero or low-emitting resources as compared to high-emitting resources outside GHG Regulation Areas? (UG-4)
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| **4) Reporting and Settlements** |
| **Reporting:** Market Results | What type of information and at what granularity will GHG information be reported to support state reporting requirements? | H | * What process can be developed to ensure that LSEs and other market participants subject to GHG/RPS/CES regulations will receive data necessary to satisfy compliance obligations? What entity is responsible for reporting imported energy into a GHG zone? (RH-2, UH-1, UH-2, UH-4, UH-6, UH-7)
	+ For GHG compliance, the CAISO proposes that EDAM will follow the approach of the WEIM and deeming energy delivered to a GHG Regulation Area for the purpose of complying with regulatory reporting programs. The CAISO can provide EDAM/WEIM Entities with their specific market data to assist them with reporting obligations under GHG reporting programs. The CAISO may also be able to provide aggregate information to help state and reporting entities ensure accurate accounting of power obtained from the final results from the WEIM.
	+ EDAM does not propose to have special functionality to provide information for the purposes of complying with RPS and CES regulations, but would like to better understand what requested information would be necessary to support that reporting and if that data are readily available and generated by the market.
	+ Any GHG attribution is reported by the Market Operator (MO) and the Scheduling Coordinator (SC).
* Should we consider policy that is in effect/will be in effect by Jan 2024 or try to accommodate hypothetical reporting systems?
	+ TBD.
* What data needs to be tracked for compliance and harmonization with clean energy policy purposes (including other instruments that attribute generation to load)?
	+ The CAISO would like to hear from stakeholders on what additional data needs to be tracked.
	+ For REC reporting, depending on the reporting requirements developed, the CAISO anticipates it could support sharing GHG resource specific information with WREGIS. The CAISO also supports the concept of WREGIS moving to all generation tracking system, subject to approval by states and programs.
* How would energy be identified/tracked or tagged under a specified approach? (RH-3)
	+ When the CAISO moves to utilizing a GHG Regulation Area instead of a BAA construct, the CAISO will use the GHG Regulation Area and GHG transfer for attribution. The GHG transfer is similar to the BAA transfer, but it applies to the GHG Regulation Area instead. There is no issue from a modeling or reporting perspective. E-tags will not be used to account for GHG attributions. Any GHG attribution is reported by the MO and the SC.
 |
| **Settlements**  | How are GHG costs settled?  | I | * What implications of GHG settlement must be incorporated into EDAM design?

GHG costs are settled based on the GHG Day Ahead GHG attribution settlement followed by an incremental GHG attribution settlement for any deviation in FMM and RTD. * Will entities bearing GHG compliance obligations be made whole for purchasing credits? If so, how? (RI-1)

Entities will be compensated for their GHG allocations. Generators outside of a GHG Regulation Area with a GHG bid will be compensated based on the marginal cost difference between serving load in a GHG Regulation Area and serving load outside of the GHG Regulation Area.* In the unspecified approach, how will the hurdle rate revenue be distributed to the suppliers? (UI-1, UI-3)
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| **5) Miscellaneous** |
| **Bidding of GHG costs** | How will GHG costs be reflected to EDAM within, between, and outside a GHG zone?  |  | Topics: * Should GHG costs be reflected in bids? If so, how? GHG costs are reflected passed on the price and quantity offered:
	+ Quantity: MW
	+ Price: $/MWh
	+ Frequency: Hourly basis
* How do cost reference level (DEBs and proxy costs) reflect GHG costs?
	+ Within GHG Regulation Area: Included based on prevailing GHG index price and the resource’s specific characteristics (GHG emissions rate, heat rate, etc.).
	+ External GHG Regulation Area: Cap based on GHG index price
* Do they differ between DAM and RTM?
	+ TBD. Will depend on EDAM design and proposed interactions between DA and RT.
* How would this differ between WA and CA in terms of indices used?
	+ Currently, only California index prices are [used in cost reference levels](https://bpmcm.caiso.com/BPM%20Document%20Library/Market%20Instruments/BPM_for_Market%20Instruments_V69_redline.pdf), taking the average values sourced from at least two providers (ICE and Argus). The CAISO proposes, that when applicable, the index prices used are updated to reflect other GHG Regulatory Area prices in cost reference levels.

And how are they used in market power mitigation? |
| **Effects of WEIM** | What GHG bid and settlement implications arise from DA vs. RT deviation?  | I, K | * Do we need to make updates to the RTM WEIM GHG model to align it with EDAM? (UK-1) If not, what are the implication of this decision? (UK-2)
	+ Yes. The CAISO anticipates that to maintain alignment with EDAM, the following two changes will be needed to the WEIM: 1.) Updating the area from the BAA to the “GHG Regulation Area” 2.) Limiting GHG attribution to the EDAM BAA net export transfer schedule.
	+ The RSE optimization model will now be the new counterfactual to calculate secondary dispatch. While not a change to the WEIM, it is important to note that CAISO is proposing that the EDAM schedule will automatically become the WEIM base schedule for an EDAM BAA.
* What allowable changes to either GHG quantity or bid price between DA and RT should be allowed?
	+ TBD. Will depend on EDAM design and proposed interactions between DA and RT.
* What are the associated settlement impacts to any variation allowed? (UI-2)
 |