



Applying EIM Greenhouse Gas Regulation Model to EDAM

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Overview

- Description of EIM GHG Regulation model
- Relevant California GHG Regulations
- Limitations
- Potential enhancements
- Application to EDAM
- Specific elements related to EDAM

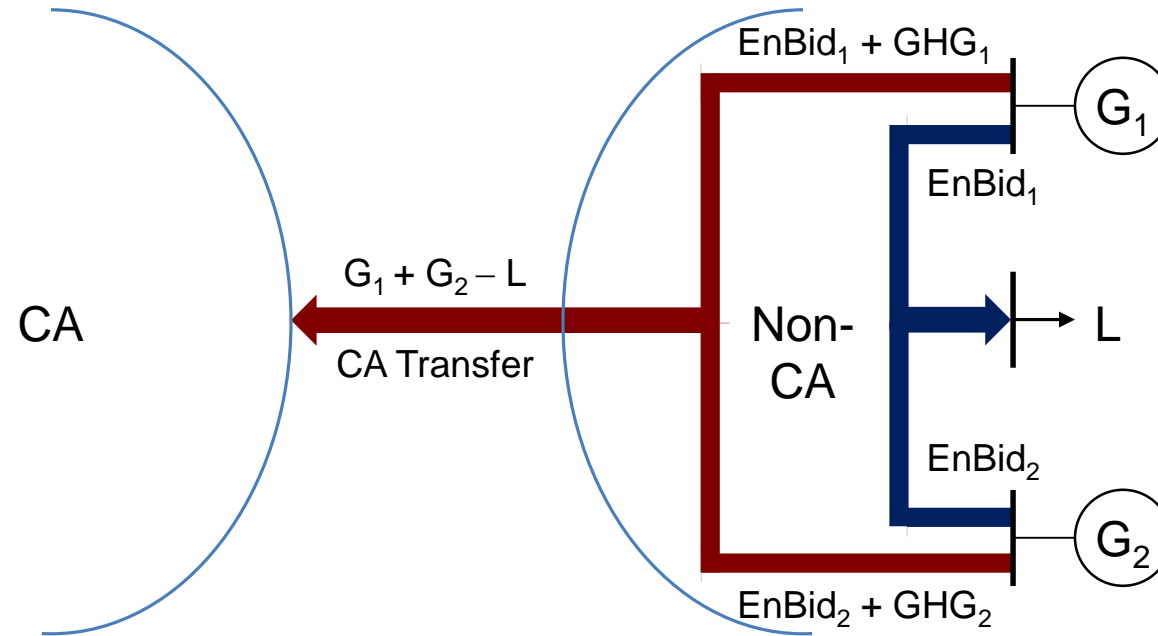
California Greenhouse Gas Regulation

- California Air Resources Board (CARB) implements several regulations for GHG emissions
 - ◆ Cap-and-Trade Regulation
 - Declining cap on statewide GHG emissions
 - ◆ Mandatory Reporting Regulation
 - Annual reporting and verification of GHG emissions

CARB's GHG Regulation needed to be addressed in EIM design

- Before EIM, generating resources in CISO BAA and import resources on CISO interties included GHG compliance costs in their energy bids
 - ◆ Still applicable in EIM, but must conform to the GHG Regulation Area (CA state boundary)
 - Current implementation aligns the CA GHG Regulation Area to the BAAs in CA (CISO, BANC, LDWP, and TID), which is not entirely accurate
- Imbalance energy from EIM resources outside CA
 - ◆ If it serves load outside CA, it is not subject to GHG regulation
 - ◆ If it is imported into CA, it is subject to GHG regulation

GHG Regulation model in EIM



Market optimization model changes for GHG Regulation in EIM

- Allow a GHG bid from EIM Participating Resources outside CA
- Introduce a new decision variable for each EIM Participating Resource outside CA: GHG attribution
- Add the GHG bid cost of the GHG attribution to the objective function
- Cap the GHG attribution by the dispatch and the difference between the Upper Economic Limit and the Base Schedule
- Fully allocate the CA import transfer to the GHG attributions of EIM Participating Resources outside CA

GHG Regulation Settlement in EIM

- Marginal GHG compliance cost is the shadow price of the CA import transfer allocation constraint
 - ◆ Zero if the net CA transfer is an export
- It becomes the 4th LMP component for locations outside CA
- GHG compliance revenue from net imbalance energy settlement due to the GHG price difference across the CA boundary
 - ◆ Paid to EIM Participating Resources outside CA for their GHG attribution
- Market Operator is revenue neutral

Secondary dispatch

- Primary dispatch is the counterfactual solution to EIM where BAA resources are dispatched to serve load only in their BAA
 - ◆ Base schedules are assumed to be the primal dispatch
- Secondary dispatch (emissions leakage), is the portion of EIM dispatch that backfills GHG attributions that are imported into CA
- The emission intensity of secondary dispatch may be higher than the emission intensity of GHG attributions
- EIM GHG Regulation model may not account for the full atmospheric effect of secondary dispatch

Limiting and accounting for the atmospheric effects of secondary dispatch

- If all EIM dispatch is above base schedule, there is no secondary dispatch from the market perspective
- However, economic displacement may result in EIM dispatch below base schedule resulting in some secondary dispatch
- Capping the GHG attribution to the energy bid volume above Base Schedule reduces secondary dispatch
- CARB captures the atmospheric effect of EIM secondary dispatch:
 - ◆ $\text{EIM outstanding emission} = \text{CA EIM imports} \times \text{unspecified emission factor} - \sum(\text{EIM GHG attribution} \times \text{respective resource-specific emission factor})$
 - ◆ Assigned to UDCs pro-rata on retail load by reducing their freely allocated allowances

GHG Regulation model enhancements

- Current model aligns GHG Regulation Area with BAA boundaries
 - ◆ Issue: some resources belong to CISO or LDWP, but are located outside CA and should not be subject by default to GHG Regulation
 - ◆ Solution: separate the definition of GHG Regulation Area from BAAs; use GHG transfers into the GHG Regulation Area instead of BAA transfers
- Current model supports a single GHG Regulation Area
 - ◆ Issue: not scalable for GHG Regulation development in the West
 - ◆ Solution: expand the model for multiple non-overlapping GHG Regulation Areas, GHG bids, GHG attributions, and marginal GHG prices

EDAM changes for applying the EIM GHG Regulation model

- Virtual supply schedules outside GHG Regulation Areas may contribute to net import transfers into GHG Regulation Areas, but they do not have GHG attributions
 - ◆ Solution: use physical GHG transfers where only GHG attributions contribute
- Settlement: day-ahead GHG attribution settlement followed by real-time GHG attribution deviation settlement
- GHG compliance: only real-time GHG attributions are reported

EDAM counterfactual to limit secondary dispatch

- There is no Base Schedule in EDAM
 - ◆ Solution: use the RUC D+1 solution without RCU/RCD transfers from the previous day
 - Caveats: 2-day-ahead forecast; non-financially binding bids

