GHG Price Formation Discussion

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Gridwell
CONSULTING

About Gridwell Consulting

- Analysis and advocacy consulting firm located in Sacramento, California
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- Educate, model, advise, and advocate

- Legislative support and advocacy

- California regulatory agency support and advocacy

- Seminars on CAISO market, resource adequacy, interconnection, and hydrogen development

- Interconnection evaluation and contract negotiation services

About WPTF

- The Western Power Trading Forum (WPTF) is a broad-based industry organization of companies that do business and advocate for competitive market rules throughout the Western Interconnection.

Disclaimer

- California ISO (CAISO) and the California Public Utility Commission (CPUC) are constantly updating their rules, processes, and market optimization

- This presentation contains information on the current CAISO and CPUC market rules, as of April 2024

Outline

- Role of GHG Price Formation

- Examples of Pricing Outcomes

- Policy Questions and Next Steps

Topic 1

ROLE OF GHG PRICE FORMATION

Importance of Price Signals

- Price printed by the market for all products are providing a signal to participating entities

    - Value of various products relative to others
    - Need for additional capabilities, products, capacity, etc

- Direct and non-direct participating entities use price signals to make business decisions and long-term investments

    - Optimal investments reduce overall costs and minimize dead weight loss in the long run

- It's not just about the overall LMP, the individual components provide an additional layer of transparency and information

Use Cases for GHG and SMEC Components

- Want the market to optimally displace emitting resources with non-emitting when most valued

  - GHG marginal cost provides insight into when emitting resources in non-GHG regulated areas are driving the GHG shadow price

- GHG component of the LMP used to evaluate contracting opportunities

  - Used to evaluate ability to cover compliance obligations or provide additional revenue stream for lower/non-emitting resources
  - Feedback loop to cap-and-trade program and auction participation

- SMEC is used in commercial viability evaluations

  - There is an interaction between GHG and SMEC
  - Used to evaluate against future expectations

Marginal GHG Cost

- What it represents today: *"the change in the total cost paid by load if the WEIM transfer into California were to change by 1 MWh"* – CAISO

- What it does NOT represent
  - *"Not a reflection of the GHG cost associated with the "marginal" resource for energy (i.e. the resource that sets the SMEC)"* – CAISO
  - Not a reflection of the GHG cost of the highest emitting resource dispatched to serve load in GHG area

- Policy decisions shape what the marginal GHG cost represents
  - How resources bid, constraint used to reflect GHG cost, etc

Purpose of Today's Discussion

- Here to initiate discussion around GHG price formation by talking through various pricing outcomes under different scenarios

- WPTF does not have a formalized opinion on the "right" price formation at this moment

- Main policy question: What should the marginal GHG component represent?

- Goal of Discussion: Coalesce around what the ideal price formation would represent (may take a few engagements)
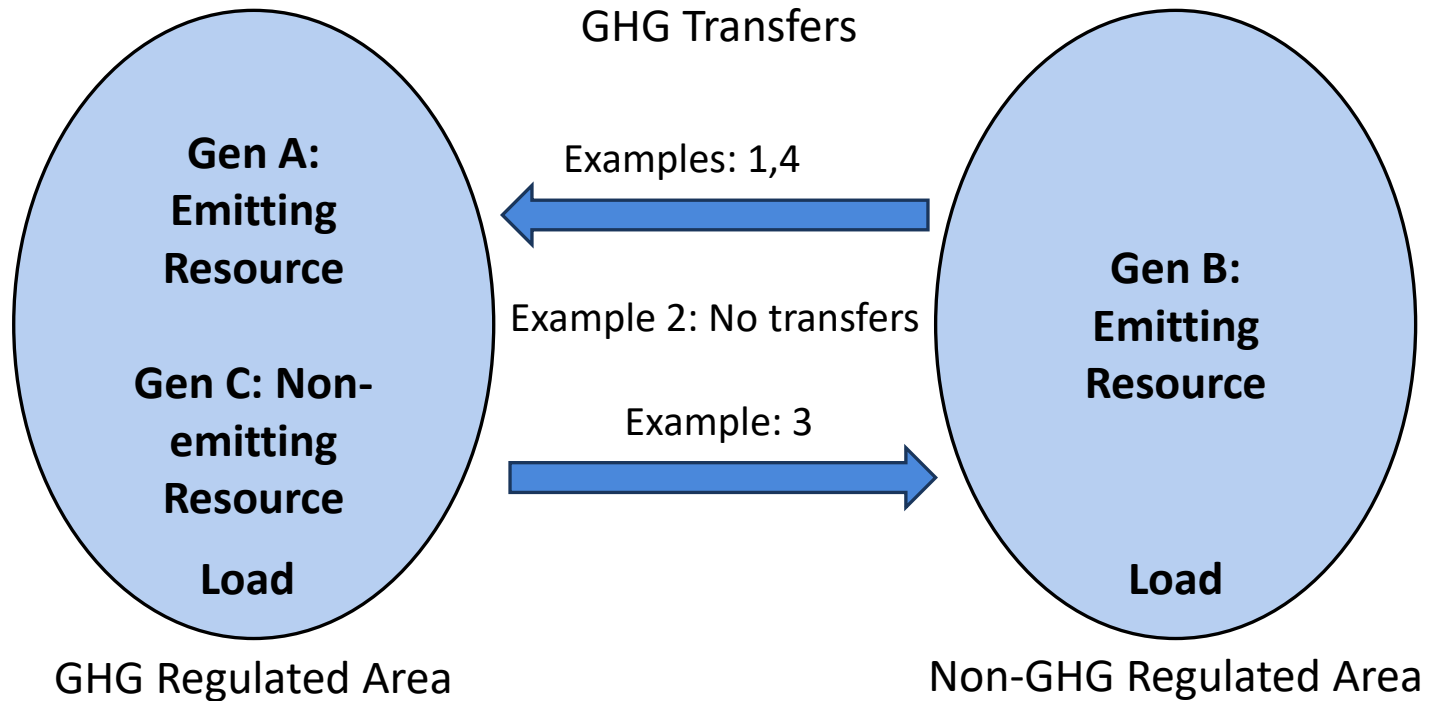
Topic 3

GHG PRICE FORMATION EXAMPLES

GHG Price Formation "Today" vs "Tomorrow"

- "Today", the GHG component is subtracted out of LMP for resources external to GHG area

- "Tomorrow" under EDAM, the GHG component will be added in for resources internal to a GHG area

	WEIM "Today"		EDAM/WEIM "Tomorrow"	
	GHG Area	Non-GHG Area	GHG Area	Non-GHG Area
LMP	$100	$75	$100	$75
SMEC	$100	$100	$75	$75
GHG	$0	-$25	$25	$0
Load Pays	$100	$75	$100	$75
Gen Paid	$100	$100(deemed) $75 (not deemed)	$100	$100(deemed) $75 (not deemed)

Example Set Up

GHG Transfers

Gen A: Emitting Resource

Gen C: Non-emitting Resource

Load

GHG Regulated Area

Examples: 1,4

Example 2: No transfers
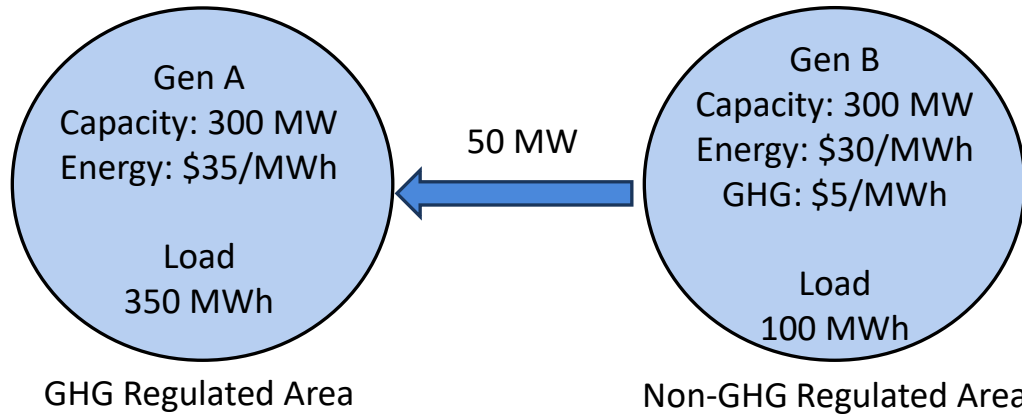
Example: 3

Gen B: Emitting Resource

Load

Non-GHG Regulated Area

- All examples, unless otherwise noted, assume pricing under EDAM design
- Assumes no binding transfer constraints, congestion, or losses
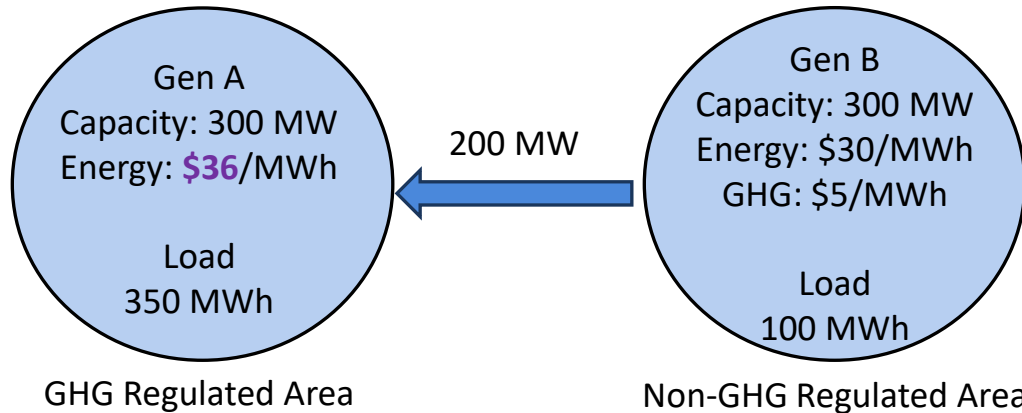- Utilized CAISO's GHG Pricing Model

Example 1A: Transfers into GHG Area

Gen A
Capacity: 300 MW
Energy: $35/MWh

Load
350 MWh

GHG Regulated Area

50 MW

Gen B
Capacity: 300 MW
Energy: $30/MWh
GHG: $5/MWh

Load
100 MWh

Non-GHG Regulated Area

Proper price formation

	GHG Area	**Non-GHG Area**
Dispatch	300 MW	150 MW
LMP	$35/MWh	$30/MWh
SMEC	$30/MWh	$30/MWh
GHG	$5/MWh	$0/MWh
Load Pays	$35/MWh	$30/MWh
Gen Paid	$35/MWh	$30/MWh; $35/MWh (deemed)

Example 1B: Transfers into GHG Area

Gen A
Capacity: 300 MW
Energy: **$36**/MWh

Load
350 MWh

GHG Regulated Area

200 MW

Gen B
Capacity: 300 MW
Energy: $30/MWh
GHG: $5/MWh
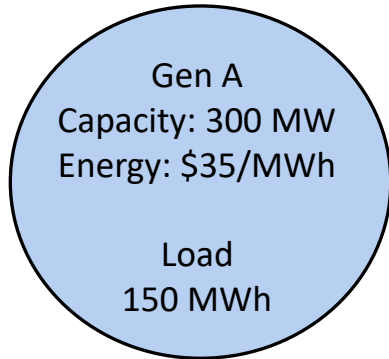
Load
100 MWh

Non-GHG Regulated Area

- LMP in GHG area is proper signal
- Does the price formation (including all components) in non-GHG area make sense?
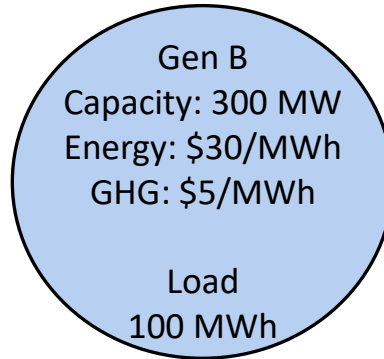- Does it make sense to have a GHG component of $5/MWh not knowing the actual GHG cost of Gen A?

	GHG Area	**Non-GHG Area**
Dispatch	150 MW	300 MW
LMP	$36/MWh	$31/MWh
SMEC	$31/MWh	$31/MWh
GHG	$5/MWh	$0/MWh
Load Pays	$36/MWh	$31/MWh
Gen Paid	$36/MWh	$31/MWh; $36/MWh (deemed)

Example 2: No Transfers into GHG Area

Gen A
Capacity: 300 MW
Energy: $35/MWh

Load
150 MWh

GHG Regulated Area

Gen B
Capacity: 300 MW
Energy: $30/MWh
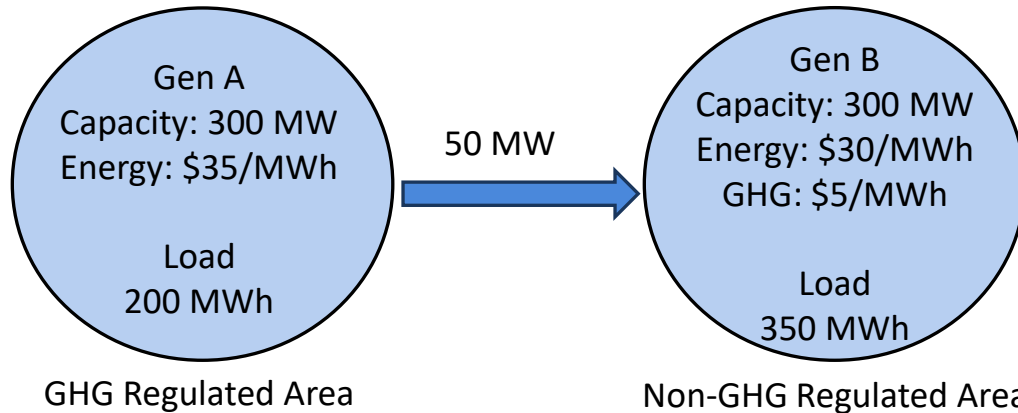GHG: $5/MWh

Load
100 MWh

Non-GHG Regulated Area

- Overall LMPs appear to have proper price signal

- Price formation in non-GHG area is appropriate

- Does it make sense to have $5/MWh GHG cost in GHG area if the actual GHG cost of Gen A is something else?

	GHG Area	Non-GHG Area
Dispatch	150 MW	100MW
LMP	$35/MWh	$30/MWh
SMEC	$30/MWh	$30/MWh
GHG	$5/MWh	$0/MWh
Load Pays	$35/MWh	$30/MWh
Gen Paid	$35/MWh	$30/MWh; $35/MWh (deemed)

Example 3: Transfers into non-GHG Area

Gen A
Capacity: 300 MW
Energy: $35/MWh

Load
200 MWh

GHG Regulated Area

50 MW →

Gen B
Capacity: 300 MW
Energy: $30/MWh
GHG: $5/MWh

Load
350 MWh

Non-GHG Regulated Area

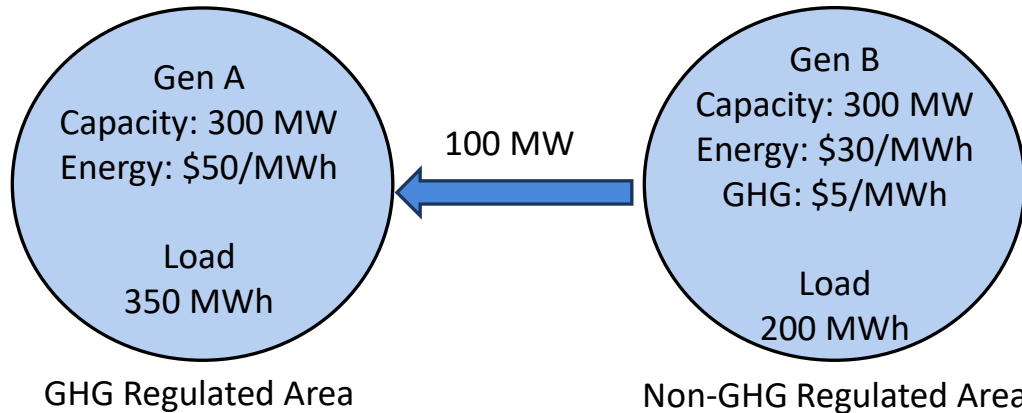|	GHG Area	Non-GHG Area
Dispatch	250 MW	300 MW
LMP	$35/MWh	$35/MWh
SMEC	$35/MWh	$35/MWh
GHG	$0/MWh	$0/MWh
Load Pays	$35/MWh	$35/MWh
Gen Paid	$35/MWh	$35/MWh

- Overall LMPs appear to have proper price signal
- Price formation in non-GHG area is appropriate but no transparency of GHG cost from Gen A
- Does it make sense to have $0/MWh GHG cost in GHG area knowing Gen A is an emitting resource and has a non-zero GHG cost?

Example 4A: Non-emitting in GHG Area on Margin

Gen A
Capacity: 300 MW
Energy: $50/MWh

Load
350 MWh

GHG Regulated Area

100 MW

Gen B
Capacity: 300 MW
Energy: $30/MWh
GHG: $5/MWh

Load
200 MWh

Non-GHG Regulated Area

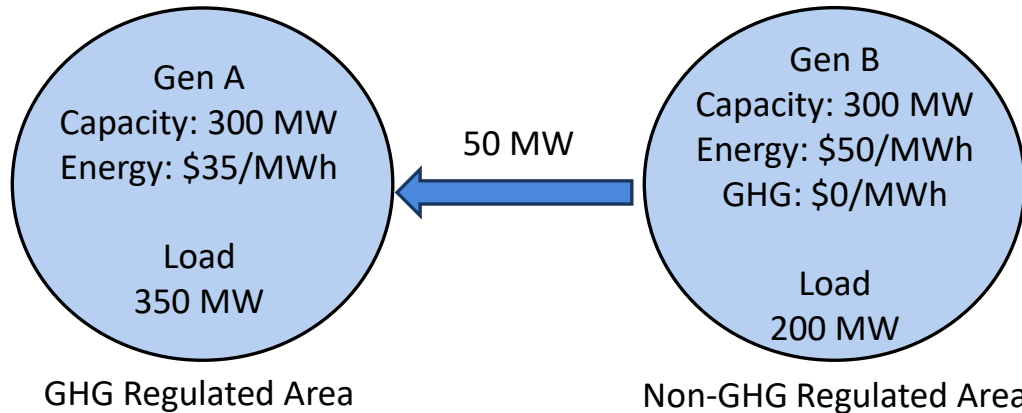|	GHG Area	Non-GHG Area
Dispatch	250 MW	300 MW
LMP	$50/MWh	$45/MWh
SMEC	$45/MWh	$45/MWh
GHG	$5/MWh	$0/MWh
Load Pays	$50/MWh	$45/MWh
Gen Paid	$50/MWh	$45/MWh;$50/MWh (deemed)

- Overall LMP in GHG area is appropriate
- $45/MWh SMEC based on difference of marginal energy bid and GHG bid of resource in non-GHG area
- Does the price formation in non-GHG area make sense?
- Does it make sense to reduce the SMEC for GHG cost when marginal unit is non-emitting?

Example 4B: Non-emitting in Non-GHG Area on Margin

Gen A
Capacity: 300 MW
Energy: $35/MWh

Load
350 MW

GHG Regulated Area

50 MW ←

Gen B
Capacity: 300 MW
Energy: $50/MWh
GHG: $0/MWh

Load
200 MW

Non-GHG Regulated Area

	GHG Area	Non-GHG Area
Dispatch	300 MW	250 MW
LMP	$50/MWh	$50/MWh
SMEC	$50/MWh	$50/MWh
GHG	$0/MWh	$0/MWh
Load Pays	$50/MWh	$50/MWh
Gen Paid	$50/MWh	$50/MWh

- Overall LMPs and SMECs are appropriate

- Does it make sense for the GHG component to be $0/MWh knowing that an emitting resource is used to serve load in GHG area?

- Is there a valuable loss in transparency?

Observations

- GHG signal occurs only when:
  - There are transfers into GHG area, or
  - There are no transfers between areas
- GHG signal is not generated when transfers from GHG area to non-GHG area even when emitting resources are generating and/or on margin
- GHG signal seems to always equal the GHG cost of the resource in the non-GHG area even when a resource in the GHG area was on the margin and potentially has a different GHG cost
- The SMEC seems to always be based on the marginal unit's energy cost minus the GHG cost of the resource in the non-GHG area
  - Recall resources in the GHG area embed GHG cost in energy offers

Topic 4

POLICY QUESTIONS AND NEXT STEPS

Outstanding Policy Questions

- What should the GHG cost component represent?

  - Always be based on marginal GHG cost of transfers?
  - What is the appropriate signal if a non-emitting resource is on the margin and does the answer differ if its internal or external to GHG area?
  - Should the GHG cost component impact the SMEC?
  - Should there ever be a GHG price if GHG area is not net importing?

- What benefit would be gained if all resources bid energy and GHG costs separately?

  - More accurate and transparent GHG and SMEC price signals?
  - Help facilitate bidding and price formation under linked programs?

WPTF Ask of CAISO

- Update model to reflect EDAM design

- Enhance modeling capabilities and test various scenarios

  - Separate out energy and GHG bids for all resources

  - Create an option to price GHG based on a shadow price to serve load in GHG area, not just transfers into area

  - Create an option to price GHG based on the marginal energy resource's GHG cost

  - Expand scenarios to include multiple resources

- Hold a stakeholder meeting to discuss results and initiate policy questions posed

Thank you! Questions?

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