

EDAM GHG Accounting and Costs: Additional Resource- Specific Option

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About Gridwell Consulting

- Women-owned economics and energy consulting firm – www.gridwell.com
 - Educate, model, advise, and advocate
 - Experts in energy and ancillary service markets, resource adequacy, interconnection, and storage optimization and modeling for RFOs, due diligence, and bid strategy
- Kallie Wells, co-founder and Senior Partner
 - Designed CAISO's Opportunity Cost methodology for use-limited resources
 - Has developed GridSolver, a resource valuation and dispatch optimization model to assess storage and storage + renewable resources in CAISO market
 - Represent WPTF at the CAISO, full client list on website



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.



Outline

- Topic 1: Recap of GHG EDAM Efforts
- Topic 2: Additional Resource Specific Approach
- Topic 3: Case Studies
- Topic 4: Key Take Aways and Next Steps



Topic 1

OVERVIEW OF CURRENT EDAM GHG

GHG Working Group Challenge

- EDAM GHG Working Group has recognized from the beginning that there are two competing objectives in this effort
 1. Centralized optimal dispatch that results in least cost solution to serve load
 2. Accurate accounting of emissions to serve load in GHG regulated areas
- “There is no perfect solution”
 - This group is tasked with the challenge of having to weigh pros and cons of all the options on the table
 - Working group should evaluate the trade offs between all viable options

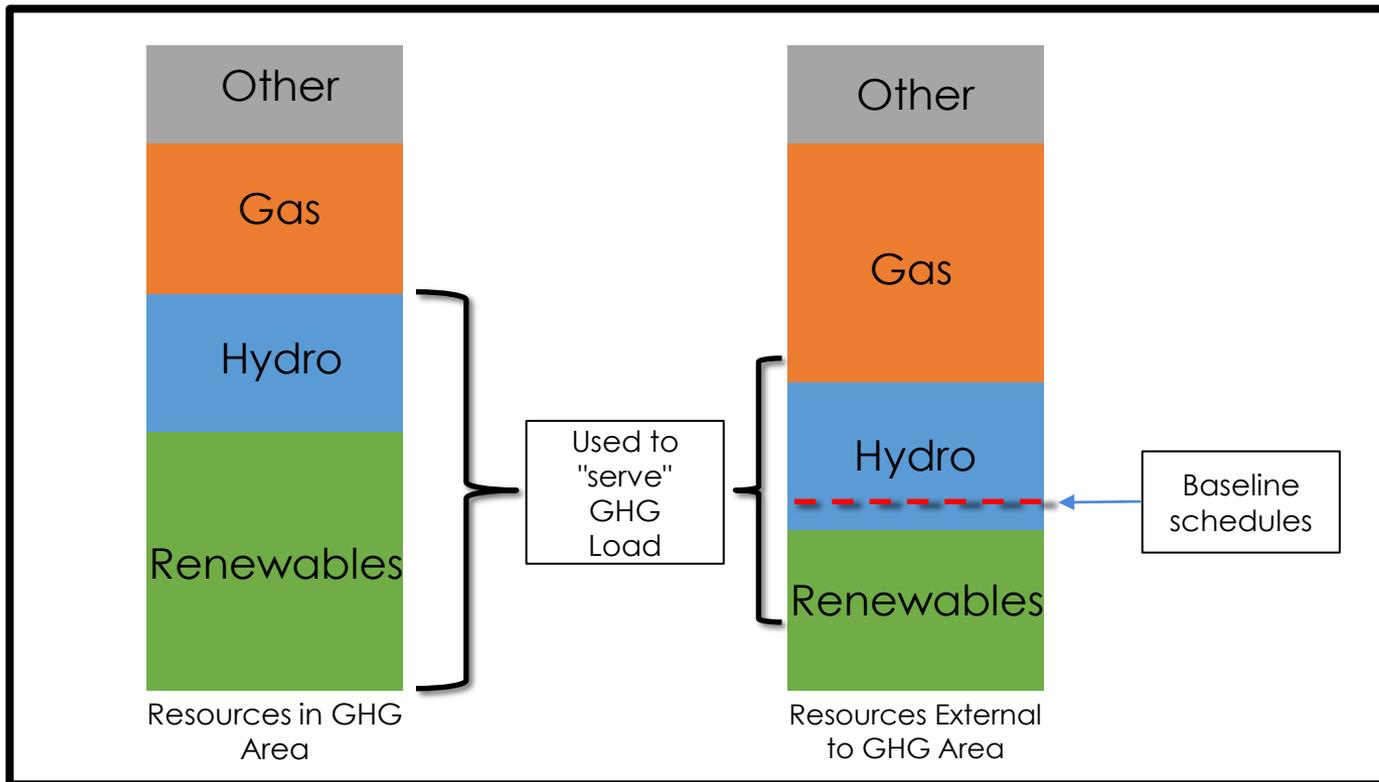


EDAM Working Group Options

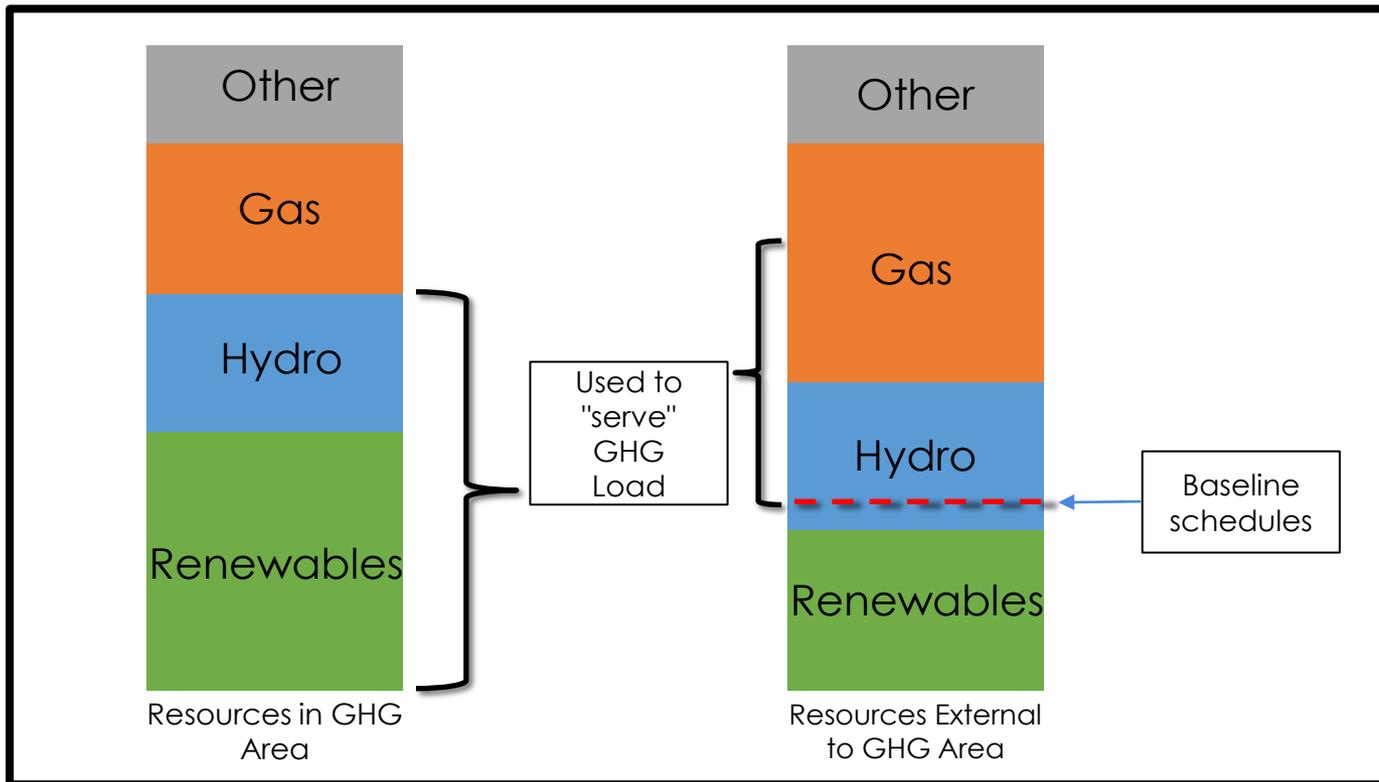
- Approaches have been discussed thus far
 - Zonal approach
 - Resource Specific V2.0 approach (RS V2.0)
- 3rd option – Resource Specific V2.5
 - RS V2.5 limits deeming to incremental dispatch above a counterfactual baseline schedule
 - Addresses key concern that RS V2.0 deems resources even if not incrementally dispatched above baseline
 - Like all approaches, there are pros and cons
- WPTF asks that all three options be evaluated and tested prior to CAISO finalizing the direction in the straw proposal



Resource Specific V2.0 “deeming”



Resource Specific V2.5 “deeming”



Decision making

- WPTF offers Resource Specific V2.5 as an additional approach for consideration and will walk through details in this deck
- Option warrants additional discussion and testing
 - Preliminary testing by Gridwell has shown it to address primary concerns raised
 - The additional constraint added may impact pricing
- WPTF does not have a preferred approach because without testing within the CAISO market simulation it is impossible to know the pros and cons of the different approaches in advance



Topic 2

RESOURCE SPECIFIC APPROACH VERSION
2.5

Overview of Resource Specific V2.5

- This option is the Resource Specific Approach V2.0 with two key differences
 - Include internal transmission in baseline schedule
 - Limit deeming to incremental dispatch above baseline schedule
- Resources are identified as either being within a GHG area or outside a GHG area
- Resources submit hourly GHG bids (MW, \$/MWh) if willing to be deemed delivered
- Deemed MWs limited by incremental dispatch above baseline schedule and GHG bid MW
- Requires two runs - Baseline and IFM Optimization



Baseline Schedule Run

- Baseline schedule run is an optimization run done prior to IFM to determine the baseline schedule of each resource without EDAM transfers
 - Reflects the optimal use of each resource as if dispatched to serve its own local load in non-GHG area
- Baseline schedule should closely mimic IFM optimization without EDAM transfers
 - Could use proposed RSE Optimization with energy bids *and* internal transmission constraints
- Baseline schedules become an input into IFM optimization

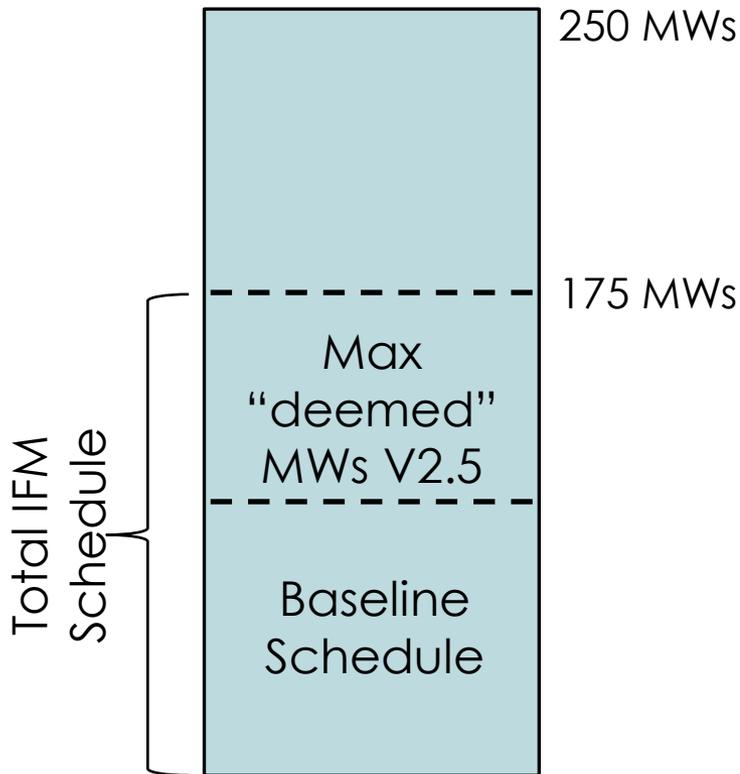


Deeming MWs in IFM Optimization

- Add a constraint in the IFM that limits “deemed” MWs to incremental dispatch above baseline schedule
 - Dispatch – Deemed MWs – Baseline MWs ≥ 0
- IFM will then dynamically determine the MWs from resources in a non-GHG area that were dispatched up to serve load in GHG area
- Deemed MWs is limited by the minimum of:
 - Dispatch minus baseline schedule
 - Bid GHG MWs
- Resources deemed delivered will receive GHG marginal price for each MW deemed



Resource Specific Deeming Example



	V2.5	V2.0
Pmax	250 MWs	250 MWs
Dispatch	175 MWs	175 MWs
Baseline Sch.	100 MWs	100 MWs
GHG Bid MW	200 MWs	200 MWs
Max "Deemed" MWs	75 MWs	150 MWs

Key Features:

- Does not always start with the "cleanest" resource first
- Limits deeming to incremental dispatch above baseline
- Able to make trade-offs between internal and external emitting resources on an equal playing field



Other Features

- Expandable to multiple GHG areas that are not linked
- All resources would bid GHG cost separate from energy bids
- Resources that are contracted to serve load in a GHG region can be modeled as if in the GHG region
- Could consider including a constraint or participation rule that better aligns deeming with ability to be delivered



Topic 3

CASE STUDIES

Summary of Case Studies

- Developed an optimization model with two zones
 - A GHG and non-GHG zone with different load levels
 - Each zone has a combination of emitting and non-emitting resources
 - Each resource has different energy and carbon cost bids
- Case 1: “Deemed” MWs with Price Separation
- Case 2: No “Deemed” MWs without Price Separation
- Case 3: No “Deemed” MWs with Price Separation
- Case 4: Edge case to highlight non-convexity concern

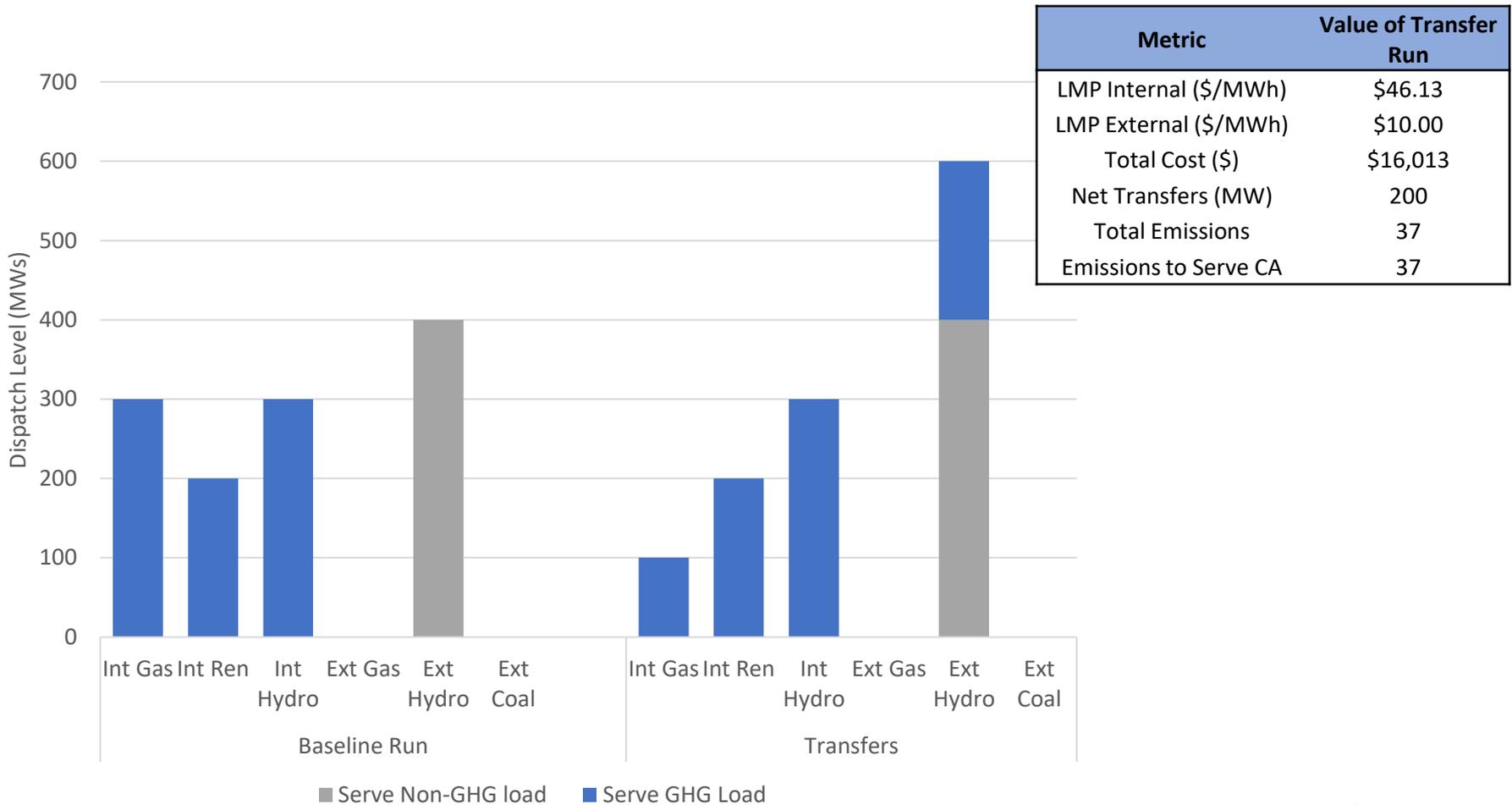


Case Study 1-3 Assumptions

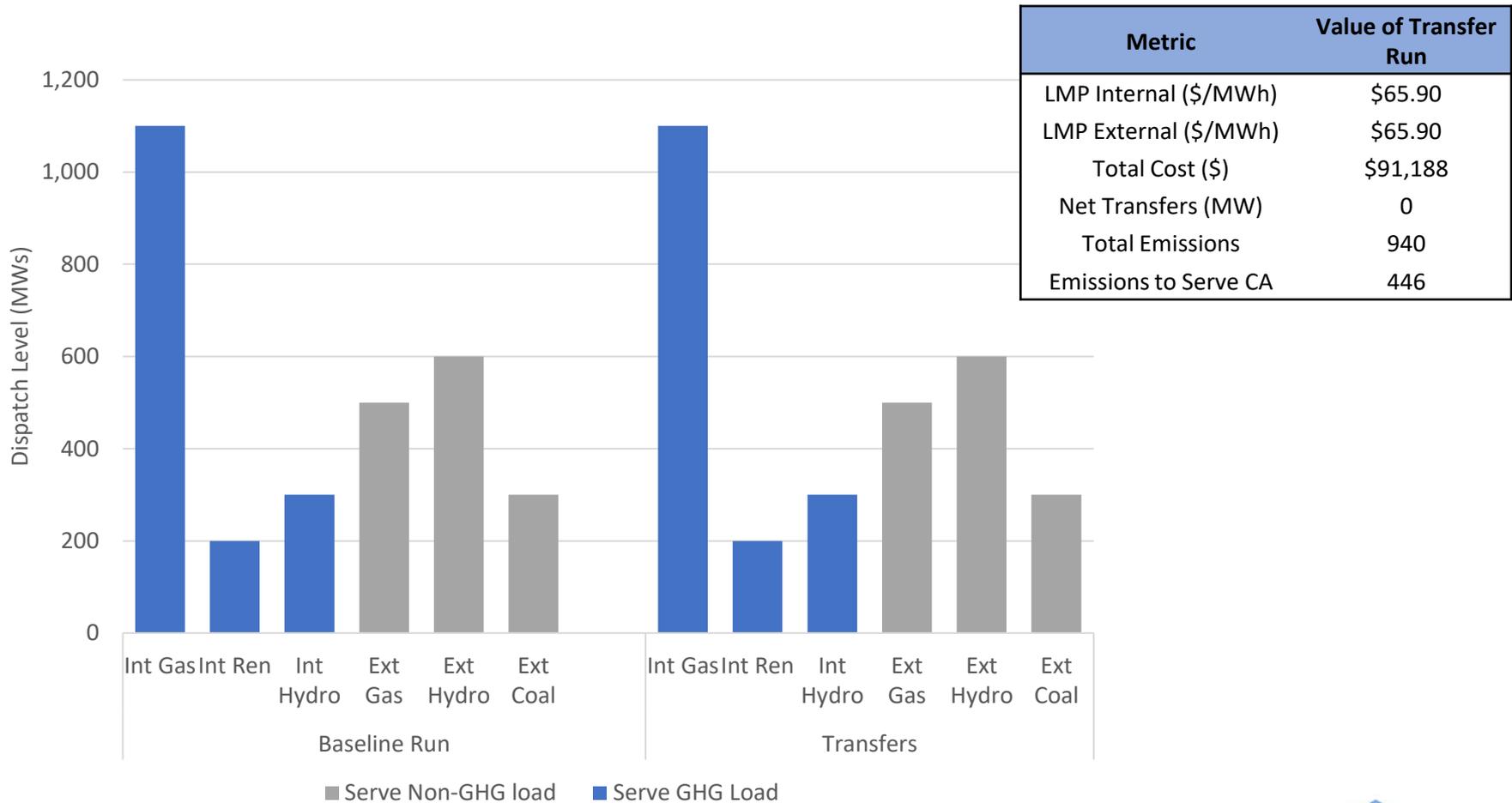
GHG Area	Resource	Type	Max Output	GHG Bid MW	Energy Bid	Carbon Bid	All-in Bid
GHG (Int)	G1	Gas	300	N/A	\$35.00	\$11.13	\$46.13
	G2	Gas	300		\$35.50	\$11.29	\$46.79
	G3	Gas	300		\$36.50	\$11.61	\$48.11
	G4	Gas	400		\$50.00	\$15.90	\$65.90
	H1	Hydro	300		\$18.00	\$0.00	\$18.00
	RE1	Renewable	200		\$0.00	\$0.00	\$0.00
Non-GHG (Ext)	G5	Gas	300	300	\$36.00	\$11.45	\$47.45
	G6	Gas	200	200	\$37.50	\$11.93	\$49.43
	H2	Hydro	600	600	\$10.00	\$0.00	\$10.00
	C2	Coal	300	300	\$20.00	\$30.00	\$50.00



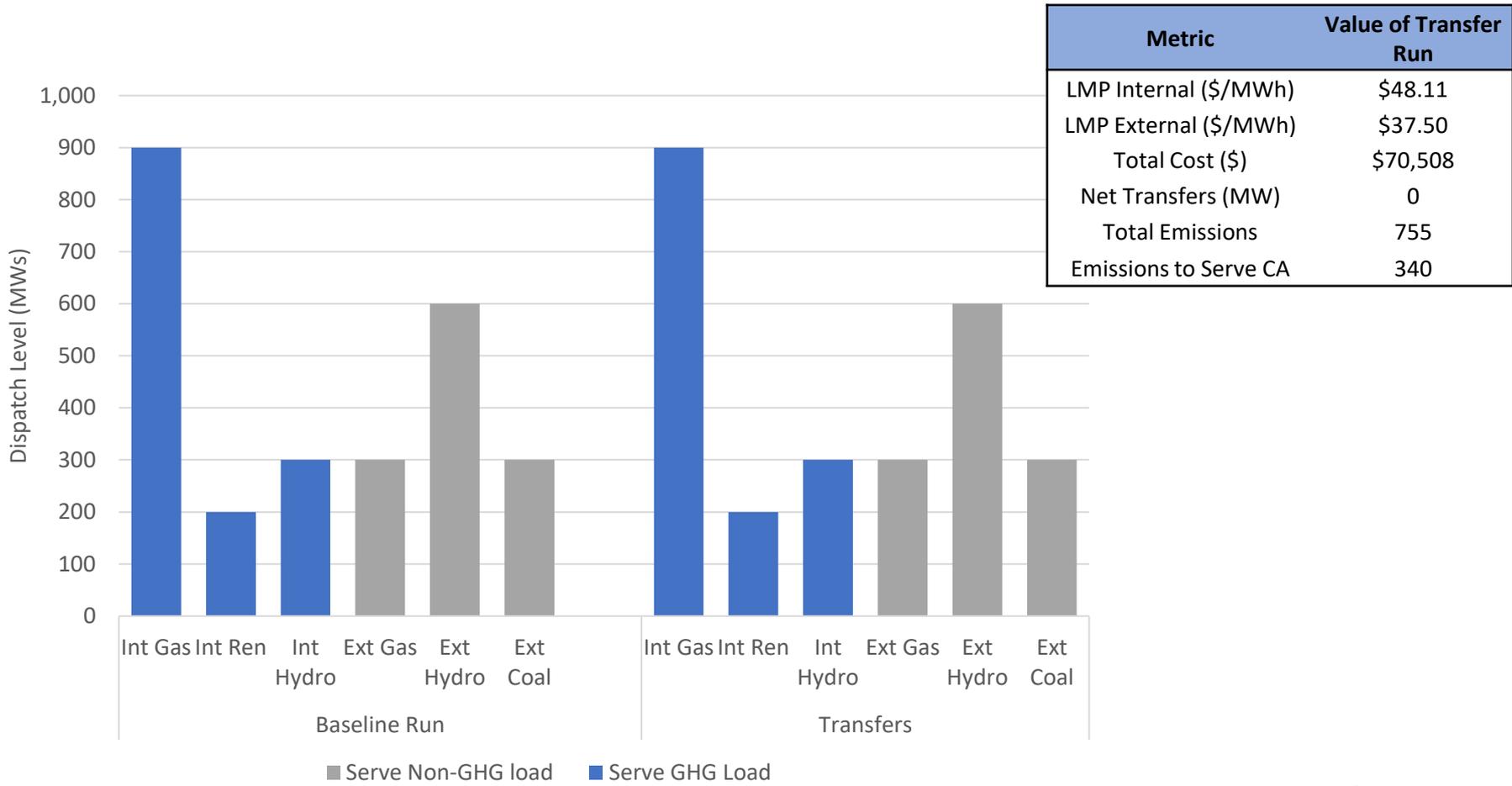
Case Study 1: Deemed MWs with Price Separation



Case Study 2: No Deemed MWs without Price Separation



Case Study 3: No Deemed MWs with Price Separation



Metric	Value of Transfer Run
LMP Internal (\$/MWh)	\$48.11
LMP External (\$/MWh)	\$37.50
Total Cost (\$)	\$70,508
Net Transfers (MW)	0
Total Emissions	755
Emissions to Serve CA	340

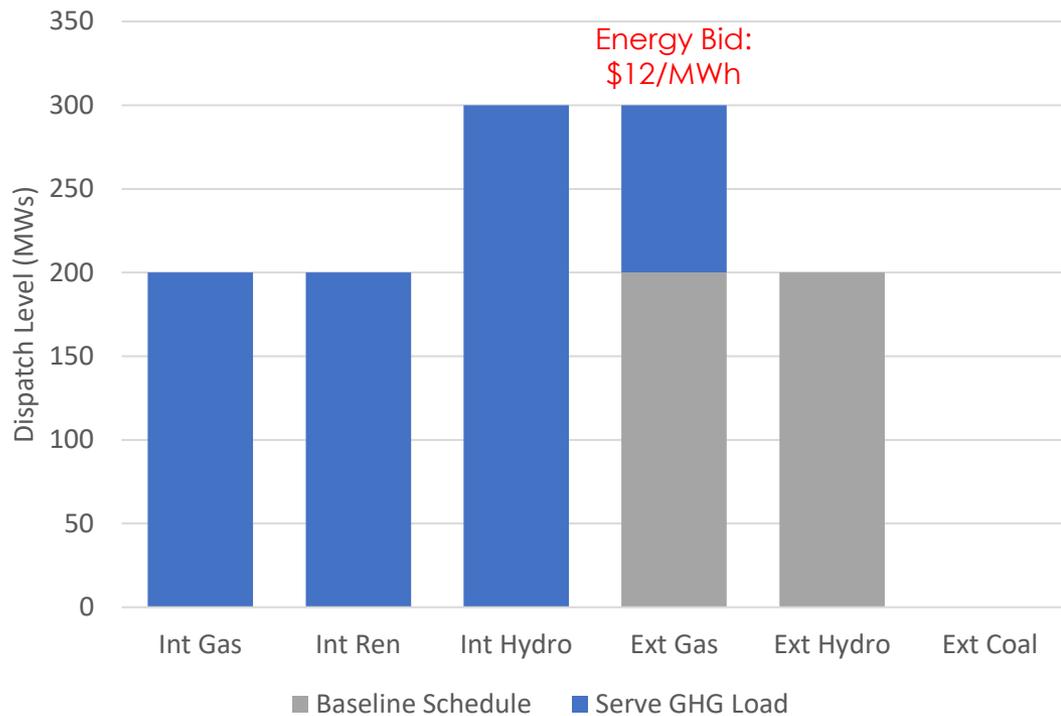


Non-Convexity Case with RS V2.5

- Limiting the “deemed” MWs to incremental dispatch above the baseline schedule introduces non-convexity cases
 - This is not a new issue and likely an edge case in EDAM
- Can impact price formation
 - Probability of the edge case occurring should be considered
- Following case study shows how the energy price can be lower than the energy bid of a dispatched resource
 - Uses different cost and resource assumptions than prior case studies



Case Study 4: Non-Convexity Case



Metric	Value of Transfer Run
LMP Internal (\$/MWh)	\$46.13
LMP External (\$/MWh)	\$10.00
Total Cost (\$)	\$21,371
Net Transfers (MW)	100
Total Emissions	189
Emissions to Serve CA	112

- Cheaper to dispatch external gas up to be deemed delivered
- Total revenues received (energy plus GHG revenues) always cover costs
- Probability of edge case reduced the closer baseline run is to IFM
- Similar pricing outcomes occur today given the other constraints in the market

Note: In this case, the baseline schedule was forced to be a suboptimal schedule



Topic 4

OBSERVATIONS AND NEXT STEPS

Key Takeaways and Next Steps

- Limiting deeming to incremental dispatch above baseline schedule is feasible to enforce in market
 - RS V2.5 is worth at least consideration by stakeholders
- Addresses price formation and secondary dispatch/leakage concerns with current EIM approach
- Compatible with additional constraints as proposed in RS V2.0 if found preferable by stakeholders
- Critical to test each option on the table to make educated trade off decisions
 - Want to assess probability of edge cases occurring



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