California ISO

GHG Coordination Working Group

November 12, 2024

Housekeeping reminders

- This call is being recorded for informational and convenience purposes only. Any related transcriptions should not be reprinted without ISO's permission.
- These collaborative working groups are intended to stimulate open dialogue and engage different perspectives.
- Please keep comments professional and respectful.

Instructions for raising your hand to ask a question

- If you are connected to audio through your computer, open the participant and chat panels on the bottom right. 
- If you dialed in to the meeting, press *3 to raise your hand.
- Please remember to state your name and affiliation before making your comment.
- You may also send your question via chat to all panelists.

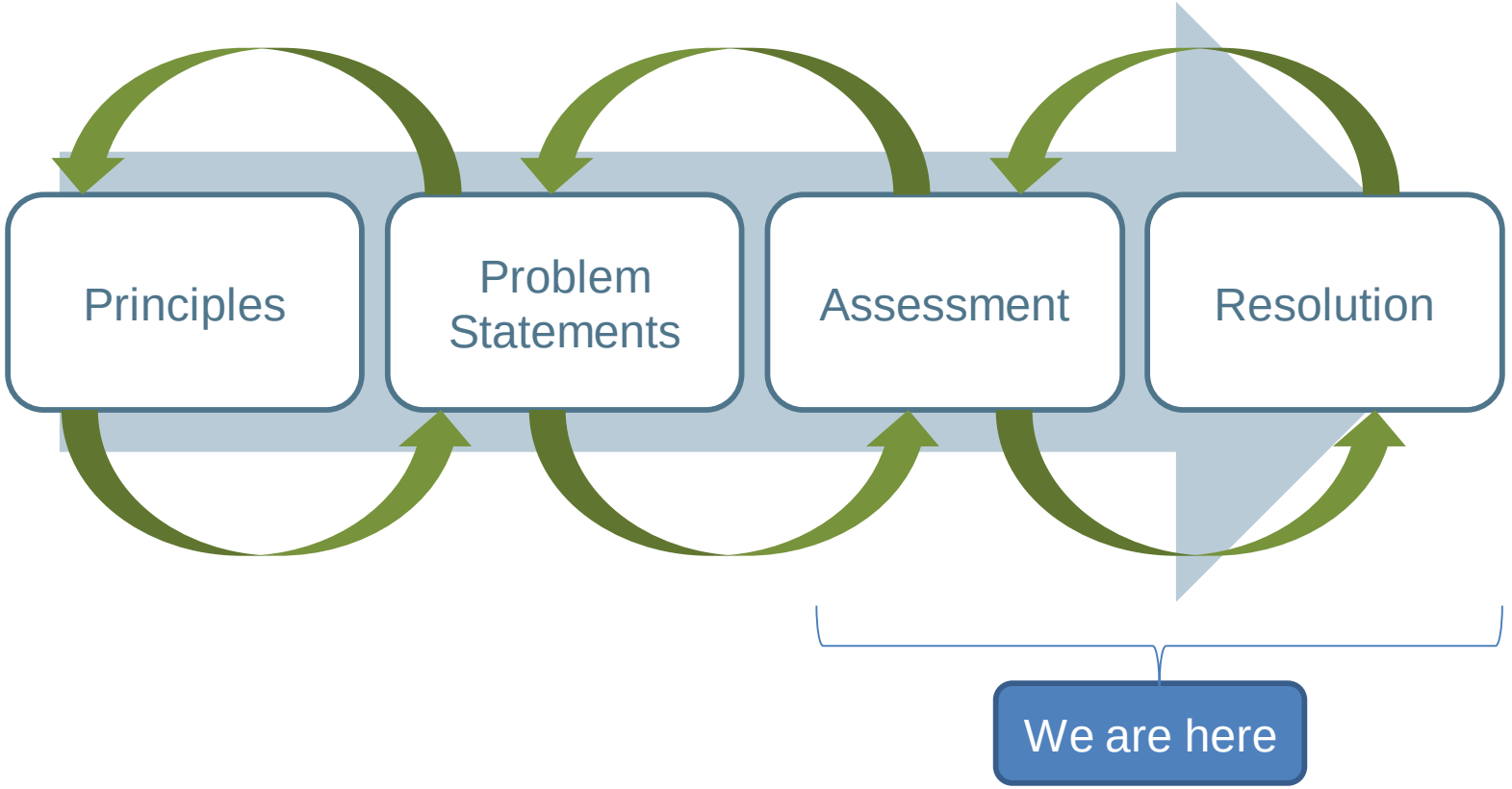
Notice to Participants

***Please be reminded**, Commissioners and advisors from state public utility commissions may be in attendance.*

Agenda

Time	Topic	Speaker
1:00 – 1:05	Welcome & Introductions	Isabella Nicosia
1:05 – 2:30	Accounting and Reporting Approach: *Attribute Scorecards and Residual Rate Options*	Anja Gilbert & Sylvie Spewak
2:30 – 2:45	Break	
2:45 – 3:45	Counterfactual Options	George Angelidis
3:45 – 4:00	Next steps	Isabella Nicosia

Working group progress to date

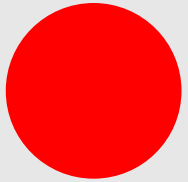


Accounting and Reporting Approach: Context for today's discussion

- The LSE-level Accounting and Reporting approach was supported by a majority of stakeholders in comments.

- Today's meeting focuses on both refining the LSE-level Accounting and Reporting approach as well as an interim no-cost approaches to support greater accuracy of a "residual" emissions rate.

Solution Scorecard Key

Solution characterization	Stakeholder Feedback	CAISO	Market Participant	Working Group Coordination
 • **Trade-offs between feasibility and outcome intended by policy** • **Long development time, high cost project**	• No direct support expressed • Would impose un-due costs	• Requires tariff changes, new systems, modifications to core systems • Conflicts with existing processes with regulators	• Requires new business practices • Imposes a financial cost	• Policy requires stakeholder consensus • Decisions may conflict with principles or existing policy goals
• **Requires incremental changes** • **Feasible in the medium-term**	• Stakeholders expressed interest, request further discussion	• Data privacy, confidentiality will require workarounds • Requires new calculations, additional data validation processes	• Requires incremental engagement, administrative cost	• Requires alignment, additional discussion • ISO needs more information
 • **Low-hanging fruit** • **Feasible in the near term**	• Stakeholders broadly support • Demonstrated regulatory requirement exists	• Existing business practice • No liability concerns	• No change to today's participation model	• Does not require coordination, new policy

Scorecard Considerations: Geographic Area

Option	Stakeholder Feedback	CAISO	Market Participant	Working Group Coordination
BAA level	• Some stakeholders support BAA-level reporting as an overview of market GHG impacts in addition to more granular reporting	• Public, raw data may require aggregation to maintain data privacy • BAA-level residual would require new validation, calculation	• ISO-BAA coordination exists today	• How do MJEs want to be modeled?
LSE level	Most stakeholders support LSE level reporting: • more precise tracking • reduce double counting • better aligned with state LSE-specific targets • monitoring and analysis	• New systems: data collection, mapping, and publication process • New means of facilitating data to non-SCs/BAs authority to access ISO systems? • Potential conflict with existing process with state regulators	• Financial cost: LSEs would pay for service • Administrative cost: LSEs may need to manage data inputs and outputs	• What are stakeholder suggestions for how LSEs could receive data? • How do we model non-participating LSEs' owned/contracted resources? Resource characteristics?
Climate Region	• Concerns with cost shifts/ leaning/ sharing attribution • Support from PGE	• Requires new rules to establish the "climate region"		• Who gets to be in a climate region? Does this need to be decided if the ISO produces raw data? • Does a BAA level approach alleviate attribution concerns?

Scorecard Considerations: Load Modeling

Option	Stakeholder Feedback	CAISO	Market Participant	Working Group Coordination
BAA level		• Existing process for measuring/settling BAA-level load		
LSE level	• LSE can provide load data directly to the ISO	• New systems and business processes to allow the ISO to receive load data	• New business process for LSEs (coordination with the ISO to provide data)	• Alignment on load data: forecast vs actual (metered)

Scorecard Considerations: Contract Granularity

Option	Stakeholder Feedback	CAISO	Market Participant	Working Group Coordination
Accept Contracts > 10 days out	• No stakeholder opposed this option, but requested further discussion • Long-run policies may not require LSEs show compliance in short run intervals	• Expectation that information provided to the ISO is accurate, subject to audit • Requires new IT systems • Rules stakeholders develop could result in IT systems approving/rejecting information	• Existing business practice: Scheduling Coordinators manage contract ownership today	• Is the role of validation necessary?
Include Contracts < 10 days out	• Most stakeholders requested further discussion • Supports use of short term, low-carbon specified contracts	• Requires new systems to dynamically update information • Requires new, more detailed, IT systems • Rules stakeholders develop could result in IT systems approving/rejecting information	• Cost if systems are needed to reflect contracts < 10 days out • Manage conflicts, confirm ownership of shared capacity • New business practice to update contracts in ISO systems	• What types of contracts fall within the 10 day window?

Scorecard Considerations: Report Medium and Format

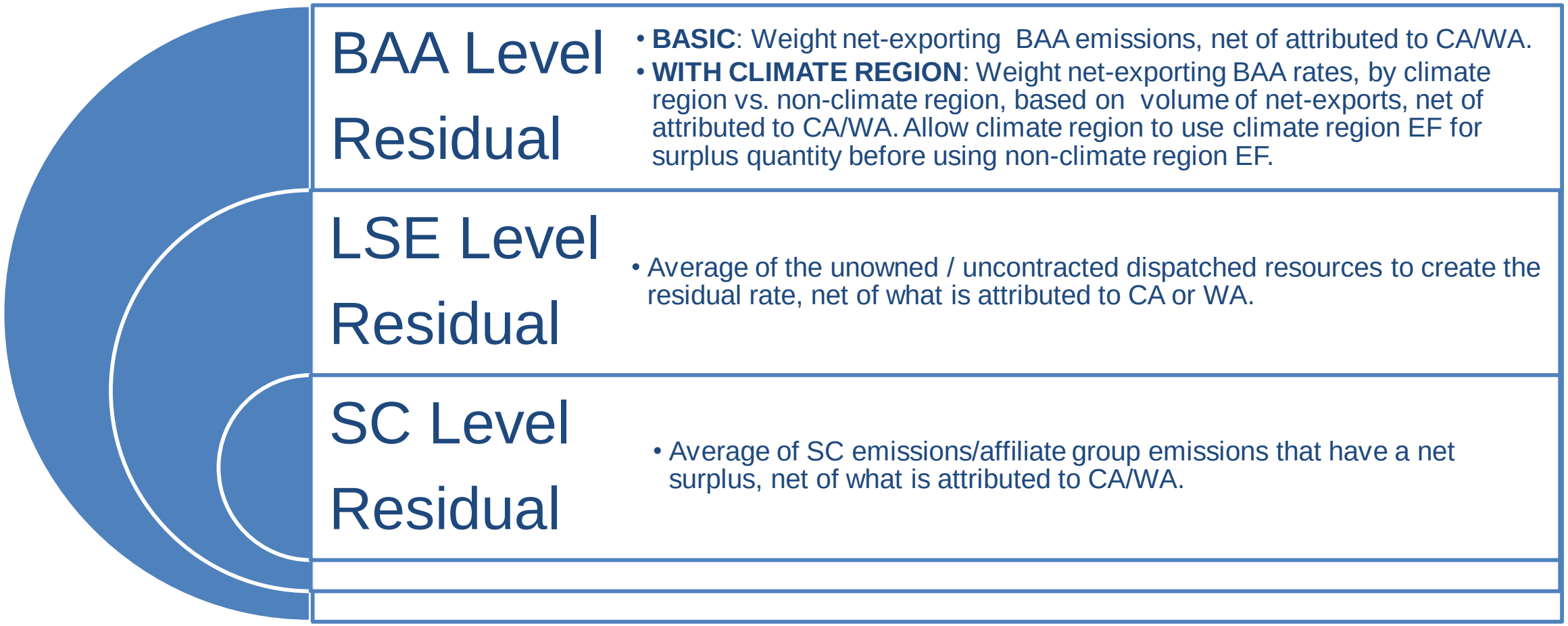
Option	Stakeholder Feedback	CAISO	Market Participant	Working Group Coordination
Raw Data	• Most stakeholders support raw data, which would support different methodologies and requirements	• Requires validation and aggregation to ensure data privacy	• Increased data management for stakeholders and regulators	• Modeling assumptions for imports/exports outside the market footprint, storage, DR? • Public vs. private?
Single, Defined Metric	• One stakeholder notes this would be helpful for harmonization, analysis • Offers an alternative where the ISO cannot provide sufficiently granular raw data due to privacy concerns	• Legal caveat: metrics would be for informational purposes only.	• Need to understand the metric, sufficient transparency and understanding of how it's calculated	• Public vs. private?
Granularity	• Stakeholders recommend 5 minute granularity			
Frequency	• Three utilities suggested quarterly, annual	• Continue CIDI ticket practice for fixing participant identified errors.	• How would a resolution period, post-publication revisions impact business practices?	• Should there be any changes to the CAISO's current CIDI ticket process for fixing errors?

Summary of the Proposed Accounting and Reporting Approach

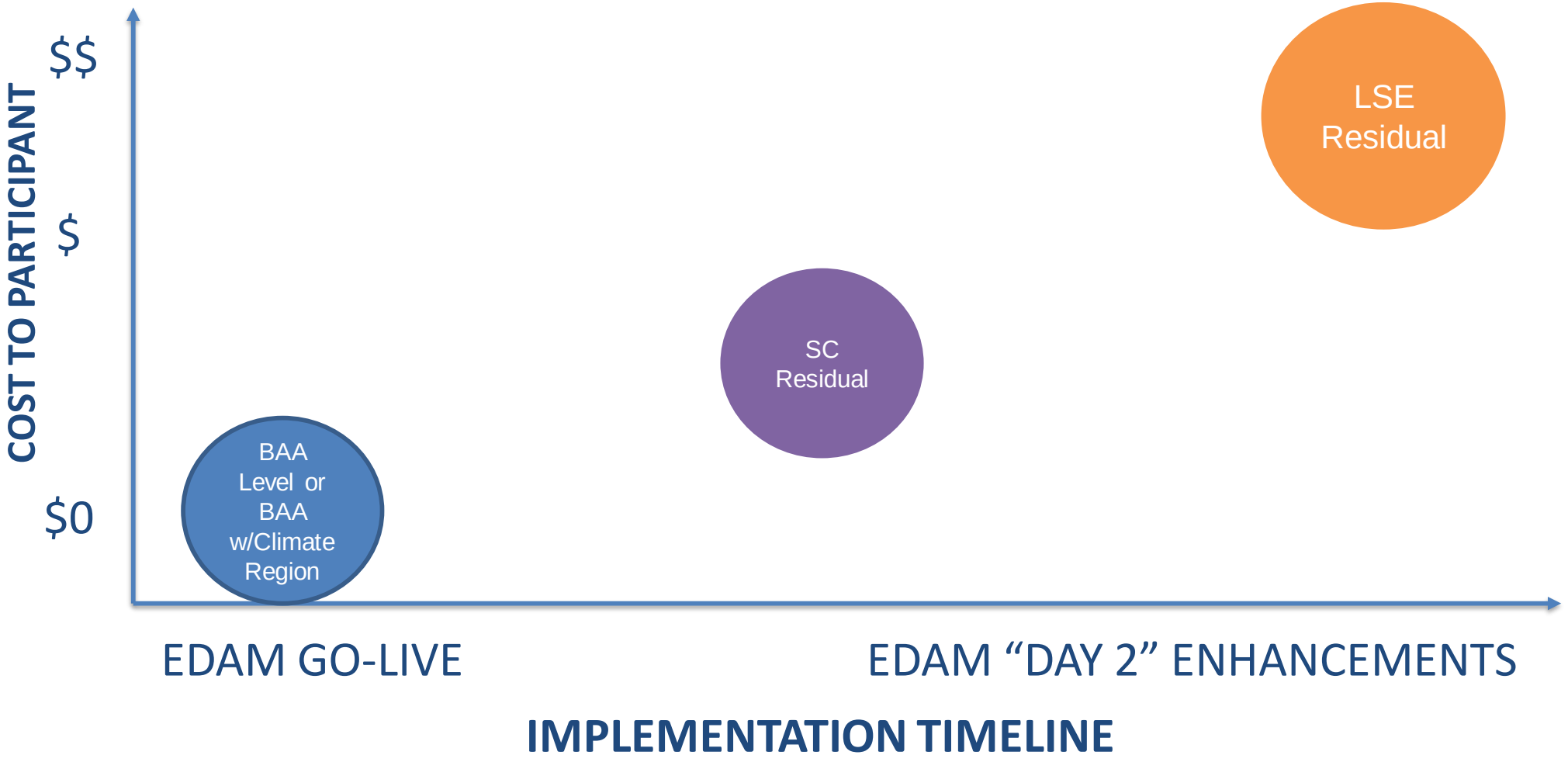
On a 5 minute basis for a state, LSE or energy user, calculate:

	Dispatched Owned Resources
+	Dispatched Contracts for Purchase
	Total for owned/contracted
-	Attributed owned/contracted
	Total for owned/contracted - attributed
If Total > load	
-	*Energy @ LSE emissions rate*
If Total < load	
	Energy @ residual emissions rate
+	*(considerations for null power)*
	FINAL TOTAL

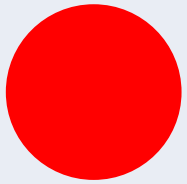
Example Approaches to a “Residual Rate”



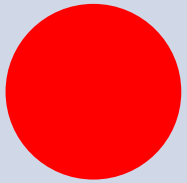
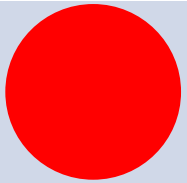
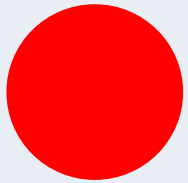
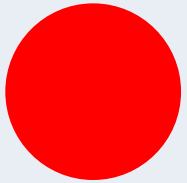
Illustrative Cost vs. Implementation of Approaches



Initial Scorecard for BAA-level residual emissions rate

	Stakeholder Priority	Legal and Technology	Market Participant Impact	Working Group Coordination
Geographic Area–BAA level				
Contract validation – static				
Report Format–public metric				

Initial Scorecard for LSE level residual emissions rate

	Stakeholder Priority	Legal and Technology	Market Participant Impact	Working Group Coordination
Geographic Area–LSE level				
Contract validation – dynamic				
Report Format–Raw data				

BAA Level Residual: Residual set by net exporting BAAs

Exporting BAAs

BAA 1	MWh	Emission Rate (MT/MWh)	Emissions Accounting (MT)
Solar	100	0	0
Wind	100	0	0
Hydro	200	0	0
Gas	200	0.5	100
Assigned Energy	600	N/A	
Contribution to Residual Market Supply	100	0.167	-16.7
Load	500	0.167	83.33

BAA 2	MWh	Emission Rate (MT/MWh)	Emissions Accounting (MT)
Solar	100	0	0
Wind	100	0	0
Hydro	200	0	0
Gas	200	0.4	80
Assigned Energy	600	N/A	
Contribution to Residual Market Supply	100	0.133	-13.3
Load	500	0.133	66.7

Importing BAAs

BAA 3	MWh	Emission Rate (MT/MWh)	Emissions Accounting (MT)
Solar	100	0	0
Wind	100	0	0
Hydro	100	0	0
Gas	100	0.5	50
Assigned Energy	400		
Purchase of Residual Market Supply	100	0.15	15
Load	500	0.13	65

BAA Level Residual Rate

(MT Exporting BAA 1 + MT Exporting BAA 2)
/MWh Contribution to Residual Supply =
(16.7+13.3)]/200 =
0.15

Methodology Assumptions:

- Calculations are performed at the BAA level
- Surplus is above dispatch relative to load, net attribution
- Shortfall is below dispatch relative to load, net attribution
- The average emissions of the resources in a BAA with a supply surplus sets the residual rate
- Would also include imports, exports, WEIM/EDAM transfers
- There is one BAA level residual rate per 5 min interval

BAA Level Residual: Residual set by net exporting BAAs

Non-Climate Region

Climate Region

Net Exporting BAAs

BAA 1	MWh	Emission Rate (MT/MWh)	Emissions Accounting (MT)
Solar	100	0	0
Wind	100	0	0
Hydro	200	0	0
Gas	200	0.5	100
Assigned Energy	600	N/A	
Contribution to Resid. Mkt Sply	100	0.167	-16.7
Load	500	0.167	83.33

BAA 2	MWh	Emission Rate (MT/MWh)	Emissions Accounting (MT)
Solar	100	0	0
Wind	100	0	0
Hydro	200	0	0
Gas	200	0.4	80
Assigned Energy	600	N/A	
Contribution to Resid. Mkt Sply	100	0.133	-13.3
Load	500	0.133	66.7

BAA 3	MWh	Emission Rate (MT/MWh)	Emissions Accounting (MT)
Solar	100	0	0
Wind	100	0	0
Hydro	400	0	0
Gas	0	0.4	0
Assigned Energy	600	N/A	
Contribution to Resid. Mkt Sply	100	0	0
Load	500	0	0

Net Importing Climate Region BAA

BAA 4	MWh	Emission Rate (MT/MWh)	Emissions Accounting (MT)
Solar	100	0	0
Wind	100	0	0
Hydro	100	0	0
Gas	100	0.5	50
Assigned Energy	400		
Purchase of Residual Market Supply Calc	600	0.133333333	= [(200*0.066)+ (400*0.167)] = 80
Load	1000	0.13	130

Climate Region Residual Rate

(MT BAA 2 + MT BAA 3)/MWh Contribution to Residual Supply from Climate Region) = 13.3 + 0 /200 = 0.066

Non- Climate Region Residual Rate

(MT BAA 1)/MWh Contribution to Residual Supply from Non-Climate Region = 16.7/100 = 0.167

Summary:
Allows climate regions to allocate their first shortfall MW from the residual emissions rate from neighboring climate regions prior to allocating the next shortfall MW from the non-climate region residual rate

Methodology Assumptions:

- Calculations are performed at the BAA Level
- Surplus is above dispatch relative to load, net attribution
- Shortfall is below dispatch relative to load, net attribution
- Would also include imports, exports, WEIM/EDAM transfers
- For net exporting BAAs in a climate region: Take excess energy and associated emissions and first allocate it to the BAAs in a the "residual climate region" prior to allocating it to the broader region
- If there is insufficient excess energy to cover climate region, use non-climate region residual rate
- Non-climate region residual rate is the average of the resources in a BAA with a supply surplus
- There is one BAA level residual rate per 5 min interval

SC-Level Residual

BAA 1: GHG Non-Priced Area A

		MW	Emission Rate (MT/MWh)	Emissions Accounting (MT)	Contracts	Accounting
SC 1	Gen 1	240	0.1	20	40 MW contract to L2	
	Load 1	100				*100 MW supplly surplus
TOTAL (SC1)				20		
SC 2	Gen 2	100	0.2	20		
	Load 2	300	(100 * 0.1 + 100 * 0.4)/(100 + 100) = 0.25	75	40 MW contract from G1 60 MW contract from G3	*100 MW demand shortfall
TOTAL (SC2)				95		

BAA 2: GHG Non-Priced Area B

		MW	Emission Rate (MT/MWh)	Emissions Accounting (MT)	Contracts	Accounting
SC 3	Gen 3	160	0.3	30	60 MW contract to L2	
	Load 3	200	(100 * 0.1 + 100 * 0.4)/(100 + 100) = 0.25	50		*100 MW demand shortfall
TOTAL (SC3)				80		
SC 4	Gen 4	300	0.4	80	100 MW attributed to L5	
	Load 4	100				*100 MW supply surplus
TOTAL (SC4)				80		

BAA 3: GHG Non-Priced Area C

		MW	Emission Rate (MT/MWh)	Emissions Accounting (MT)	Contracts
SC 5	Gen 5	900	0		
	Attributed EF	100	0.4	40	100 MW attributed from G4
	Load 5	10000			
TOTAL (SC 5)				40	

Methodology Assumptions:

- Calculations are performed at the SC (or affiliate group) level
- Aggregate supply/demand for GHG Pricing Areas (no SC granularity)
- Supply surplus is supply above owned and contracted/attributed load
- Demand shortfall is load above owned and contracted/attributed supply
- GHG attributions and contractual obligations are accounted for the supply/load they are contracted or attributed to
- Average emission rate for demand shortfall in GHG Non-Priced Areas is the weighted average of emission rates of supply surplus in the market footprint

LSE Level Residual Rate: LSEs with excess supply set the residual rate

LSE as Net Purchaser

	MWh	Emission Rate (MT/MWh)	Emissions Accounting (MT)
Solar	100	0	0
Wind	100	0	0
Hydro	100	0	0
Gas	100	0.5	50
Assigned Energy	400		
Purchase of Residual Market Supply	100	0.4	40
Load	500	0.09	90

LSE as Net Buyer

	MWh	Emission Rate (MT/MWh)	Emissions Accounting (MT)
Solar	100	0	0
Wind	100	0	0
Hydro	200	0	0
Gas	200	0.5	100
Assigned Energy	600	N/A	
Contribution to Residual Market Supply	100	0.167	-16.7
Load	500	0.167	83.33

Methodology Assumptions:

- Calculations are performed at the LSE level
- Supply surplus is supply above owned and contracted/attributed load
- Demand shortfall is load above owned and contracted/attributed supply
- Average emission rate for LSE when the LSE is long, is credited back based on an average of emissions in their footprint
- Purchase of Residual for LSE is based on an average of emissions in the market footprint based on what is not owned and not contracted

Alternative approach: Locational Emissions

- Prior stakeholder feedback suggests some form of a locational emissions rate would be valuable:
  - Stakeholder problem statements for GHG metrics have included contracting, development and citing decisions, 24/7 matching, load shifting
  - Stakeholders want more visibility into emissions associated with LMPs
  - Some stakeholders have expressed interest in understanding what a marginal emissions rate is and potential use-cases; requested nodal data

- There is no single, standard methodology for calculating locational emissions

Example Approaches for Locational Emissions

Marginal Emissions Rate, gen-node	• Produce a marginal emission rate at each gen-node in RTD, or an average of the marginal resources emissions rates
Average Emissions Rate, gen-node	• Produce an average emissions rate at each gen-node in RTD
Average Emissions Rate, System	• Average all resources dispatched in RTD • *Produced today by the ISO*

BREAK

California ISO

Greenhouse Gas Counterfactual

George Angelidis, Ph.D.
Executive Principal
Power Systems and Market Technology

Greenhouse gas counterfactual purpose

- Reduce secondary dispatch due to GHG attributions in the IFM by limiting them to resource capacity not scheduled in the GHG counter-factual pass
  - GHG attributions optimally attribute resource schedules to net import into GHG regulation areas
  - Secondary dispatch is the phenomenon where higher emitting resources outside GHG regulation areas backfill for GHG attributions of lower emitting resources to serve non-GHG regulation area demand, thereby increasing the atmospheric cost of emissions that is not captured in the market solution

Greenhouse gas counterfactual alternative methods

- No GHG Cost
  - Like IFM, but without GHG bids and GHG cost in energy bids
  - Optimal net import into GHG regulation areas
  - Optimal BAA transfers

- CAISO method (filed with and approved by FERC)
  - Like IFM, but without GHG bids
  - No net import into GHG regulation areas
  - Optimal BAA transfers

- Vistra et. al
  - Like IFM, but without GHG bids
  - No net import into GHG regulation areas
  - No BAA transfers

Greenhouse gas counterfactual: CAISO method

- Answers the question: what would have been the optimal solution if GHG regulation areas were not in the market footprint?
  - No GHG bids, thus no GHG attributions and no net import into GHG regulation areas
  - Optimal BAA transfers like in the IFM

Greenhouse gas counterfactual: Vistra method

- Answers the question: what would have been the optimal solution if GHG regulation areas were not in the market footprint and there were no transfers between BAAs?
  - No GHG bids, thus no GHG attributions and no net import into GHG regulation areas
  - No BAA transfers; BAA supply meets BAA demand

Greenhouse gas counterfactual: No GHG Cost method

- Answers the question: what would have been the optimal solution if there were not any GHG cost in the market footprint?
  - No GHG cost in energy bids, no GHG bids, no GHG attributions
  - Optimal net import into GHG regulation areas
    - Used as reference for GHG attributions in IFM
  - Optimal BAA transfers like in IFM

Greenhouse gas market model and settlement

- GHG counter-factual schedules are used as reference for GHG attributions in IFM
  - GHG attributions have specific GHG bids
  - GHG attribution is limited to (UEL – GHG Reference)
- Net import into a GHG regulation area is allocated to GHG attributions to that area
  - The shadow price of the allocation constraint is the marginal GHG cost for the respective GHG regulation area
  - GHG attributions are paid the respective marginal GHG cost

Additional details for the No GHG Cost counterfactual method

- Net import into a GHG regulation area above the counterfactual reference is allocated to GHG attributions to that area
- The counterfactual import reference has no resource-specific GHG attributions
  - *It is priced at the average emission cost of resource schedules without GHG attributions and charged to the GHG regulation area load*
  - *The difference between the GHG revenue for the import reference at the marginal GHG cost and the average emission cost is uplifted to the GHG regulation area load*

Greenhouse gas counter-factual comparison

Effect	CAISO Method	Vistra Method	No GHG Cost Method
Overall IFM cost (objective function)	Baseline for comparison	Lower because it allows higher GHG attribution volume	Lowest because the import reference is priced ex post at the average emission cost
Secondary dispatch	Baseline for comparison	Higher because it allows higher GHG attribution volume	Lower because it results in lower GHG attribution volume
Settlement for GHG cost	GHG attribution payment at the marginal GHG cost	GHG attribution payment at the marginal GHG cost	GHG attribution payment at the marginal GHG cost and import reference charge to GHG load
Settlement impact to GHG load	Baseline for comparison	Lower because it reserves more capacity for GHG attributions	Lowest because import reference is not priced on the margin
Settlement impact to no GHG load	Baseline for comparison	Higher because it reserves more capacity for GHG attributions	Lowest because the reference ignores all GHG cost

Next Steps

- Please submit written comments on the working group meeting by end of day November 26, 2024, through the ISO's commenting tool using the link on the initiative webpage.
- Next working group meetings:
  - Friday, December 20, 2024
  - Week of February 10th, 2025

Additional information

- Submit requests to present to ISOStakeholderAffairs@caiso.com
- Relevant information: https://stakeholdercenter.caiso.com/StakeholderInitiatives/Greenhouse-gas-coordination-working-group

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