INNOVATIVE CLEAN ELECTRICITY IMPACT STRATEGIES

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Friday, Sep 5 11:00 AM–12:00 PM

Renewable Energy Markets™ 2025

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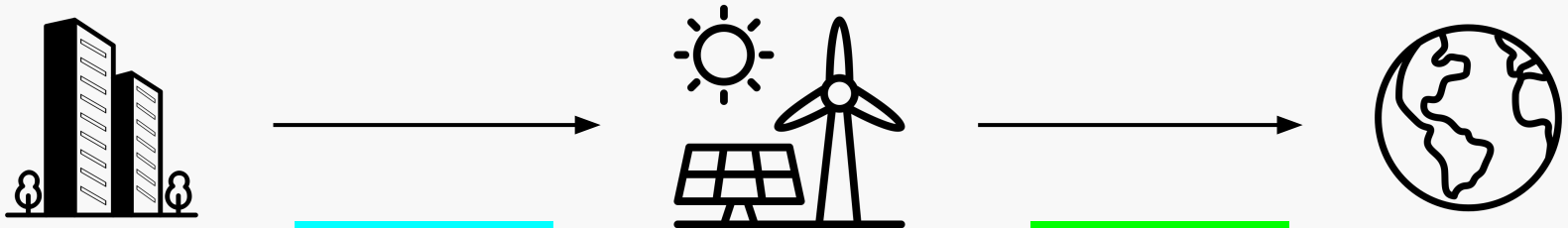
GREENHOUSE GAS PROTOCOL

Impact is one of three criteria being used to guide updating GHG Protocol guidelines.

Source: ghgprotocol.org

Two components of indirect impact

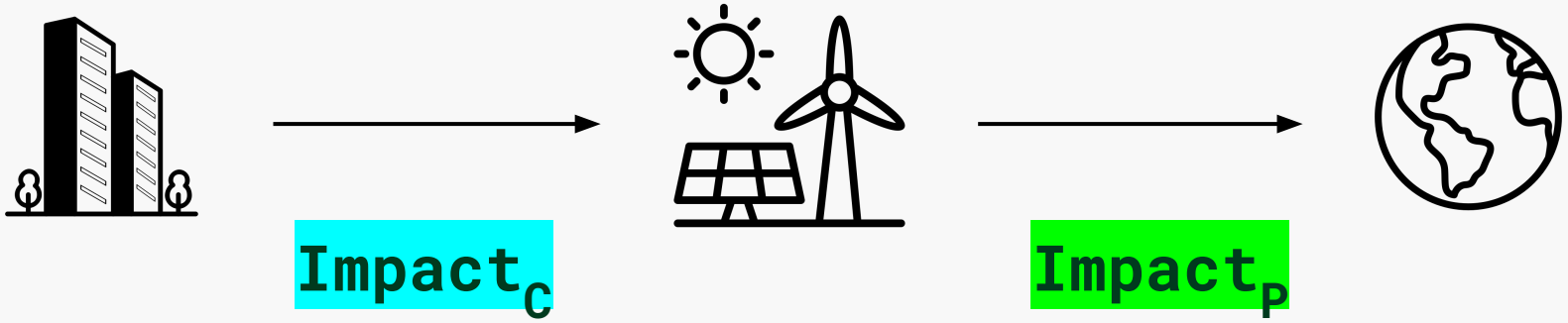


$Impact_C$

$Impact_P$

Company's impact on enabling a Project

Project's impact on the emissions

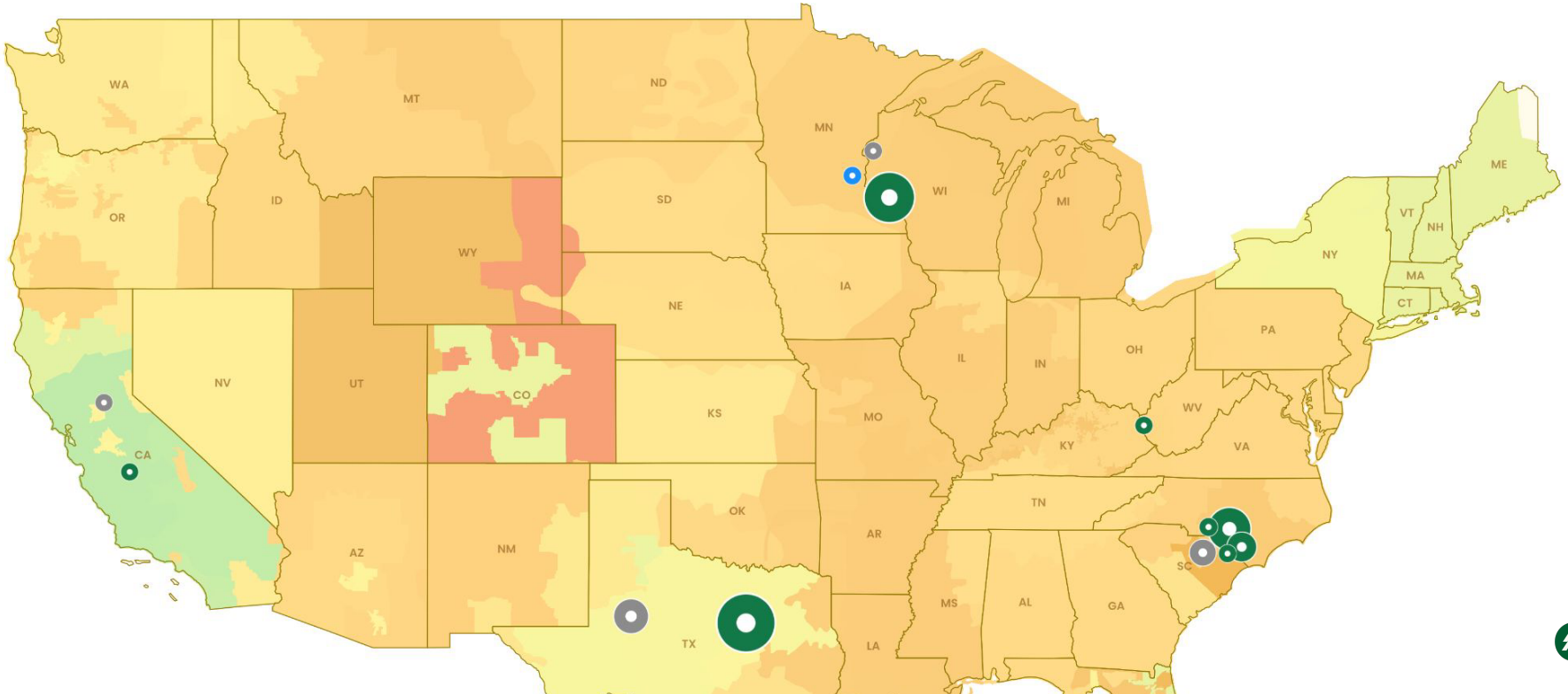


ever.green/additionality

ever.green/impact


Impact = Impact Company X Impact Project

Projects that make dirty grids cleaner



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Enhancing GHG Accounting and Dispatch Support in CAISO and SPP Markets+

PRESENTED BY

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PREPARED FOR

2025 Renewable Energy Markets

SEPTEMBER 5, 2025

Brattle

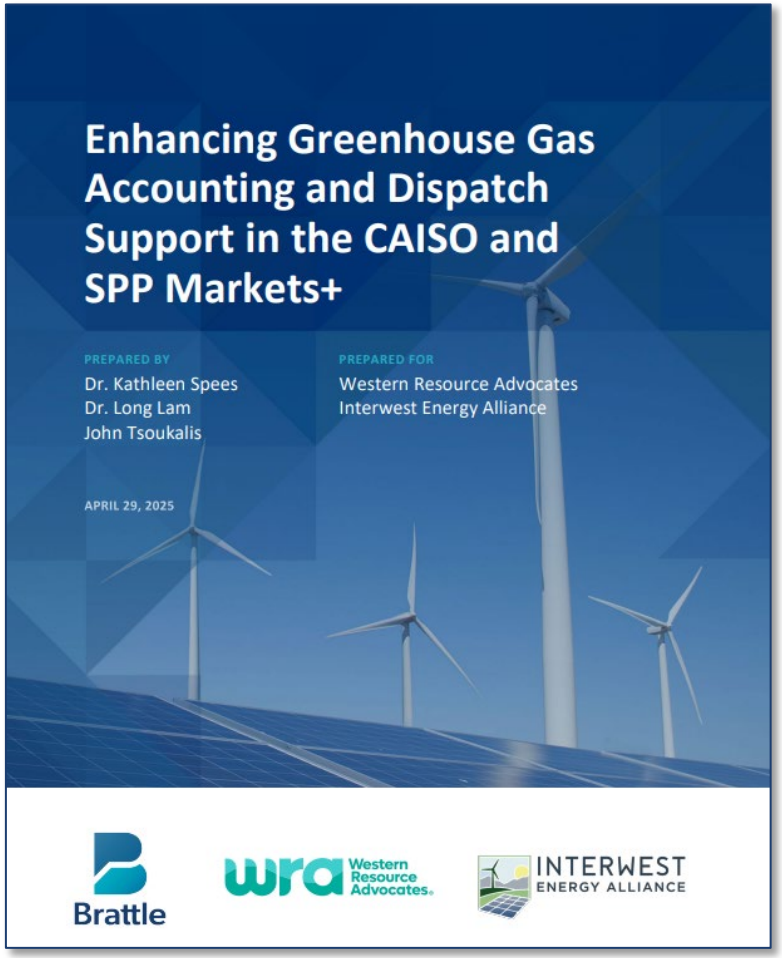
Motivation

Customers pursuing corporate sustainability commitments, including greenhouse gas (GHG) reduction targets, require accurate, high-resolution accounting data and dispatch support—ideally aligned with the latest GHG accounting standards and guidance

Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs) are uniquely qualified to provide this type of support. They can build on provide additional data and dispatch support via three tracks:

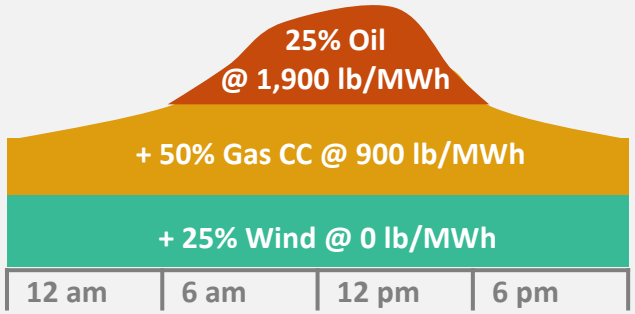
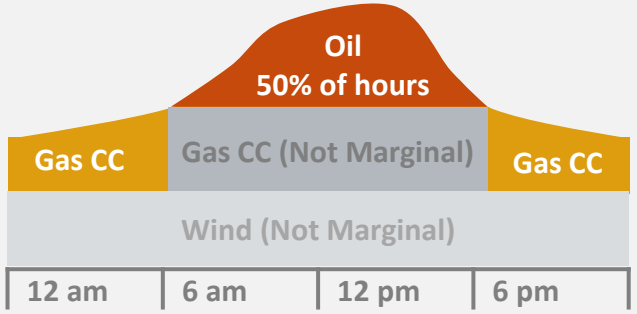
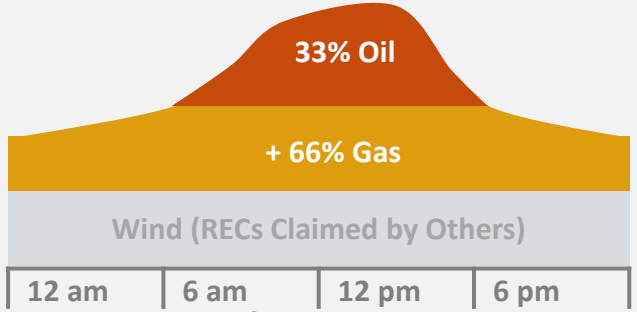
1. Physical System GHG Data
2. Allocational GHG & Residual Mix Reporting
3. In-Market Dispatch Support

Report evaluates how CAISO, SPP, and stakeholders have advanced their market designs and developed innovative solutions for supporting state policy needs

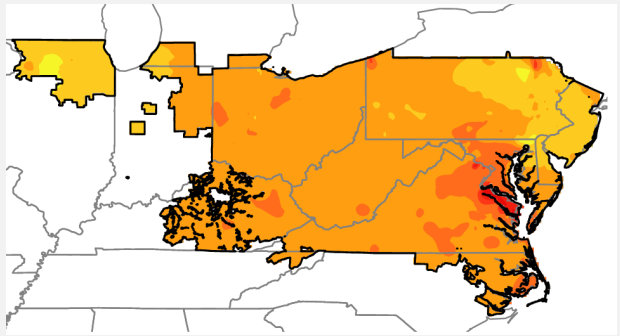
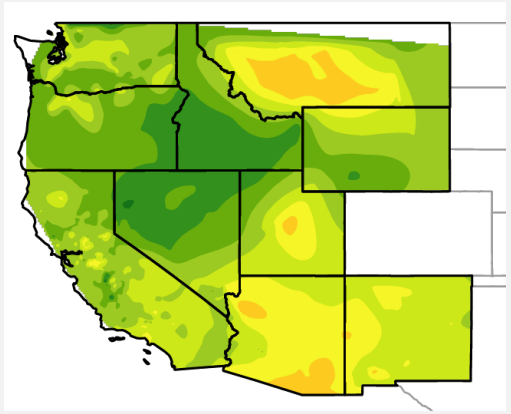
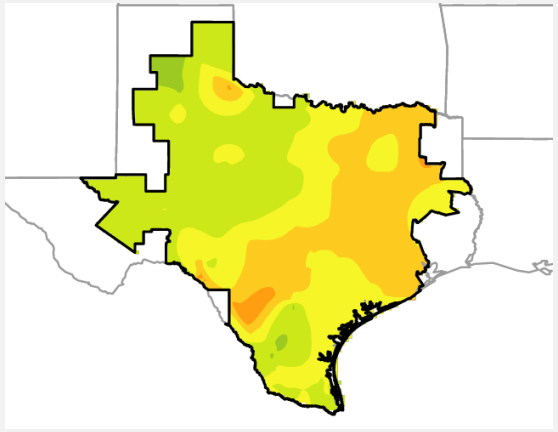
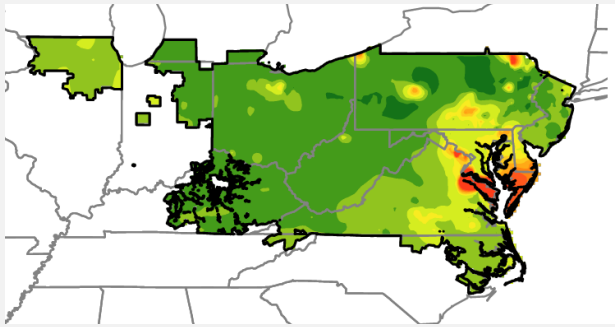
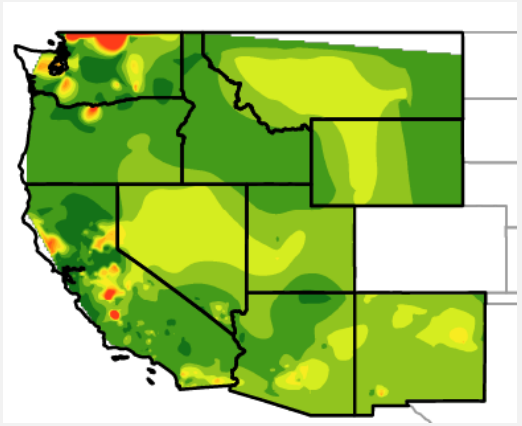
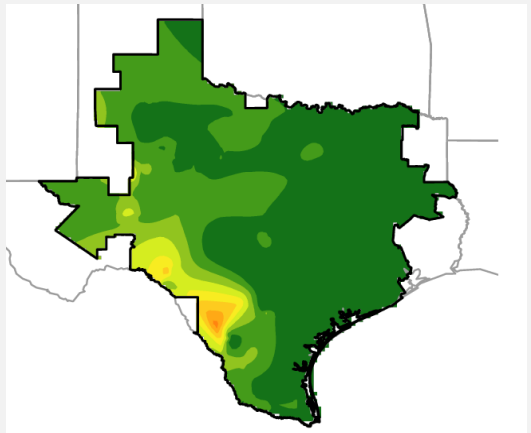


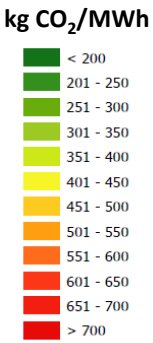
Report link

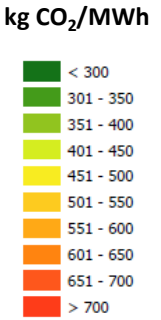
Proposed menu of RTO GHG data support needs

	1 & 2. Average Emissions	3. Marginal Emissions	4. Residual Grid Mix
What is it?	1: Gen-based (by source location), and 2: Consumption-based (by load location, accounting for import/export)	Emissions rate of the marginal generator (last or highest-cost MW turned on to serve demand)	Emissions rate of grid purchases, after subtracting out clean energy resources claimed by others (RECs or otherwise)
Example	 = 925 lbs/MWh over the day (up to 1,220 lb/MWh in peak hour)	 = 1,400 lbs/MWh over the day (up to 1,900 lb/MWh in peak hour)	 = 1,233 lbs/MWh over the day (up to 1,567 lb/MWh in peak hour)
How to use it?	• Track progress on total GHG emissions • Gen-based (who it comes from), for in-state regs & **Scope 1 direct emissions** reporting • Consumption based (who it goes to) for **Scope 2, location-based accounting**	• **Measure GHG that can be avoided** by a specific interventions (build renewable, pursue efficiency, operate a battery)	• Track progress on total GHG emissions, considering who pays for clean energy, i.e., **Scope 2 market-based accounting** • Needed to track state progress relative to GHG and clean energy mandates, including market purchases
Granularity needed	• Hourly or 5 min totals & average rate • System, BAA, state, or zonal granularity (see MISO nodal, 5-min flow tracing)	• Hourly or 5 min, nodal marginal rate • See PJM 5-min, nodal LME reporting; published alongside nodal prices	• Hourly or 5-min. Totals & average rate • Start with entity or BAA, eventually nodal & transaction-specific

Example: LME data shows where the most GHGs can be displaced

	PJM	WEST	ERCOT
Where to locate renewables? **Profile**: Flat production (can be renewable-profile adjusted)	Average MW Profile 	Average MW Profile 	Average MW Profile 
Where to locate batteries? **Profile:** Charge in lowest 4 LME hours daily (discharge in highest 4 LME hours)	4-Hour Battery Profile 	4-Hour Battery Profile 	4-Hour Battery Profile 





Data from REsurety LME data product, year 2022 data.

Allocational GHG and residual mix reporting

The Need: System-wide, self-consistent data confirming allocated GHG emissions responsibility, clean energy claims, and emissions associated RTO energy market purchases

SPP and CAISO efforts are ongoing, will offer first-ever support for allocational GHG reporting and tracking

- **SPP Markets+:** SPP Markets+ GHG Task Force has developed a proposal for entity-specific GHG allocations and reporting and residual mix calculations. Proposal is close to fully specified, with Tariff and protocol language drafted and subject to ongoing refinement (not yet filed before the FERC)*
- **CAISO WEIM/EDAM:** CAISO and stakeholders are beginning to develop a proposed approach to GHG tracking and reporting support in the GHG Coordination Working Group. See initial assessment of potential approach in CAISO December 20 Discussion Paper. Indicative implementation timeline would be 1-2 years after EDAM's 2026 planned go-live date

WEIM = Western Energy Imbalance Market
EDAM = Extended Day-Ahead Market
*For SPP Markets+, we refer primarily to the September 16, 2024 version of the proposed *Tariff Attachment K: Markets + GHG Programs*, subject to ongoing refinement.

In-market dispatch support for GHG pricing & non-pricing states

The Need: Market mechanisms enabling market participants & states to manage GHGs associated with RTO energy market trade. Buyer needs can be described in two ways to:

- Reduce GHG emissions associated with net market purchases, and/or
- Increase ability to procure certified clean energy and specified resources through RTO markets

CAISO WEIM/EDAM

- **GHG Pricing States:** Began support for CAISO GHG cap-and-trade program starting in 2014, with differentiated treatment of in-state GHG emissions and GHGs associated with specified imports. Support will be extended to multiple states with different GHG prices when EDAM is implemented in 2026 (see FERC-approved EDAM Tariff)
- **Non-GHG Pricing States:** Efforts to develop solutions currently deferred. Potential to pursue options such as emissions-constrained dispatch for GHG pricing states with ~2030 approximate implementation timeline (see Dec 20 discussion paper)

SPP Markets+

- **GHG Pricing States:** FERC-approved approach to support GHG pricing states through RTO dispatch. Specified resources in multiple resource classes (treatment of different resource classes aligned with post-market allocational reporting treatment). Implementation along with Markets+, targeted go-live date in 2027

Recommendations for enhanced RTO GHG data & dispatch support

1 Physical System GHG Data

- Expand to a full suite of physical system GHG metrics, improving transparency in grid operations
- Increasing coverage and granularity (hourly, nodal)
- Low-hanging fruit, no need to postpone or extensively debate. (Physical data simply provide transparency into grid realities; they do not pose policy & economic tradeoffs)

2 Allocational GHG & Residual Mix Reporting

- Now: Follow through on plans for residual mix & entity-specific GHG reporting
- Elevate requirement for self-consistency with exclusive RECs & clean energy claims
- Over time: increase precision and granularity. Eventually at the same settlement-quality level supporting energy market purchases & sales (nodal, entity-specific, 5-min/hourly)

3 In-Market Dispatch Support

- Now: Modeling & conceptual support for pricing, non-pricing, and non-participating states to build alignment on long-term vision for dispatch support
- In-market purchases of certified clean energy: prioritize consideration of MWh-based in-market clean energy attribution and voluntary purchases (builds on existing structures to support attribution for GHG pricing states, and ensures alignment with GHG reporting)

Contact Information

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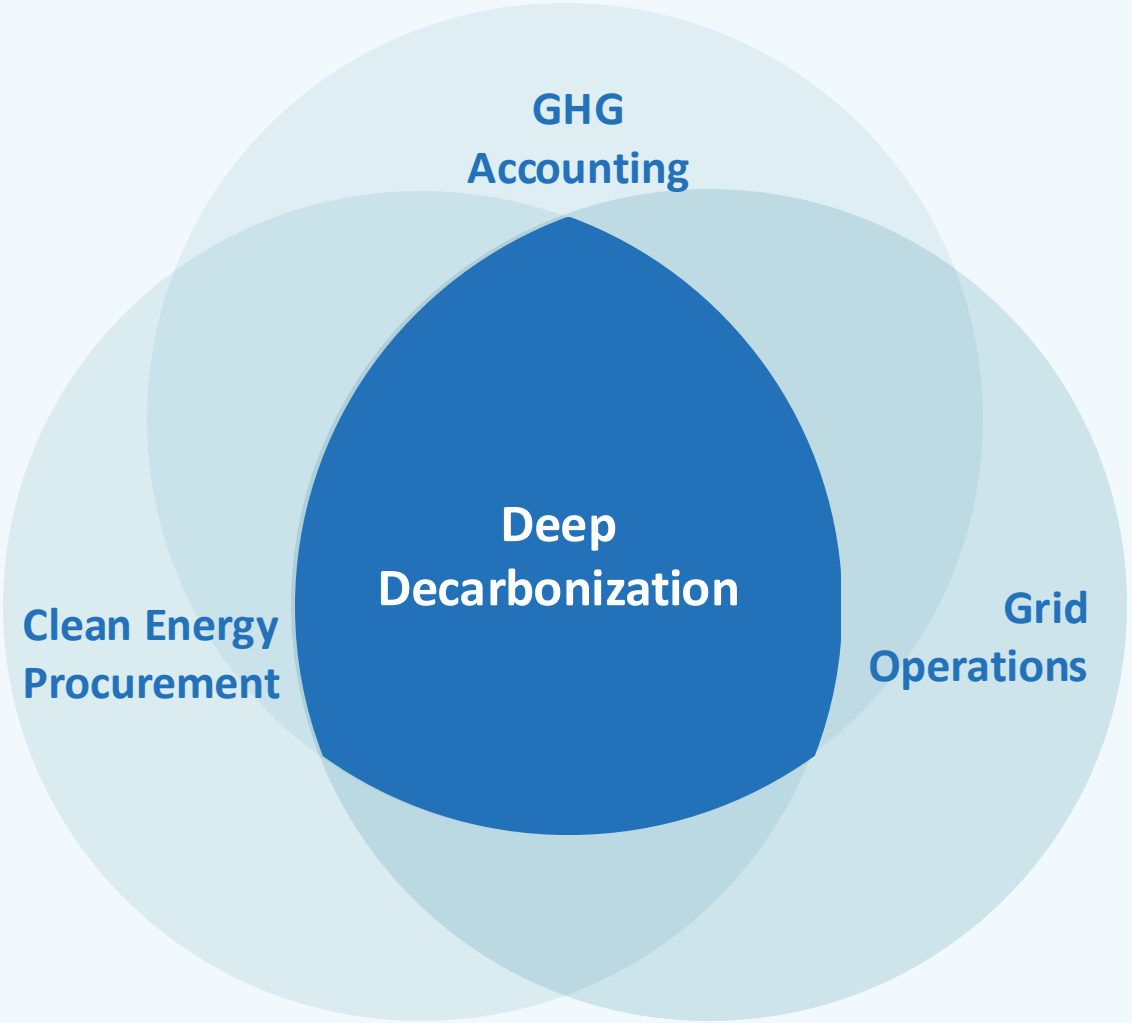
Dr. Lam is a Managing Energy Associate at The Brattle Group with expertise in the development and implementation of decarbonization strategies and in the design and analysis of clean energy policy.

His work for large companies and governments with net-zero commitments and for regulated utilities, market operators, and regulators focuses on several areas, including: (i) emissions reduction strategies and implementation program development for entities pursuing large-scale decarbonization; (ii) granular accounting of Scope 2 emissions and clean energy procurement, including defining future-ready contractual arrangements and policies; (iii) the design and evaluation of smart rates, distributed energy resources, and load flexibility programs; and (iv) development and analysis of pathways for an orderly clean energy transition

Dr. Lam has led projects to develop greenhouse gas abatement cost curves and abatement measure prioritization, analyze programs to effectively integrate clean energy resources, and evaluate the economic benefits of grid modernization and transportation electrification programs.

Systems Integration Will Drive Deep Decarbonization

The systems for accounting for carbon emissions, for ensuring an adequate supply of clean energy, and for providing reliable grid operations are all remarkable achievements, but they operate largely independently from one another



Deep decarbonization will entail merging all three systems into an integrated whole.

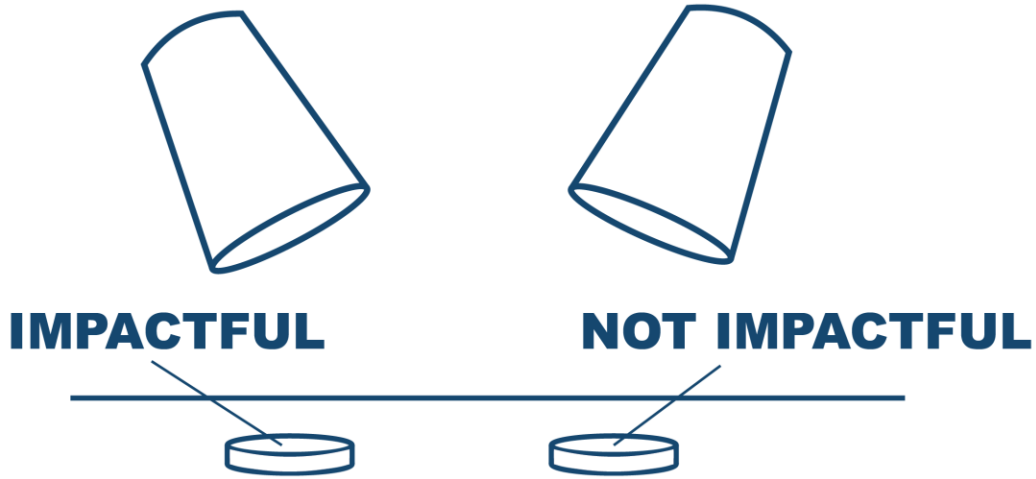
Constellation.

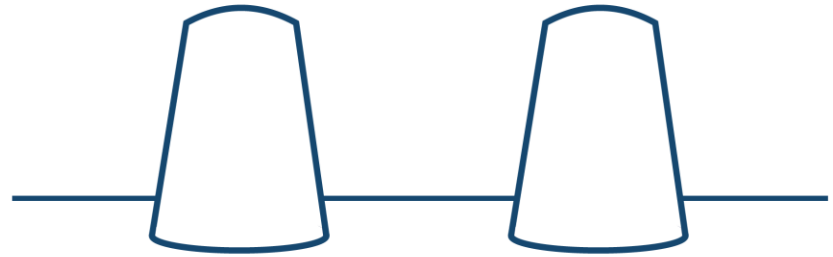
In Defense of Some-Impact RECs

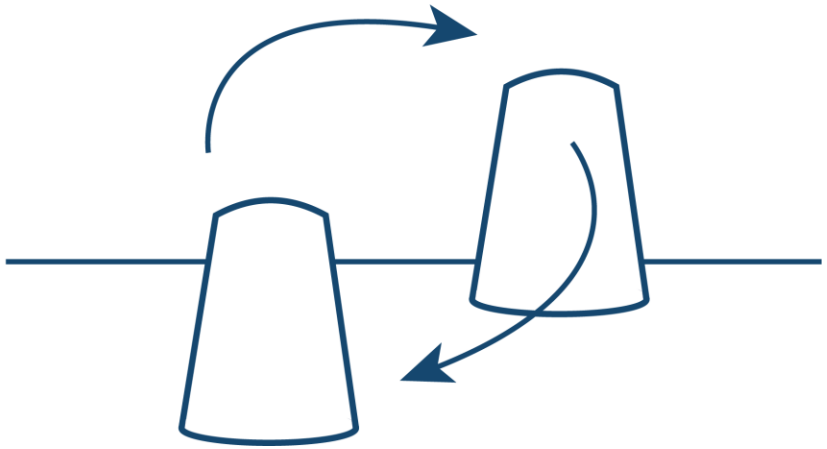
Eric O'Shaughnessy
Clean Kilowatts, LLC
www.cleankws.com

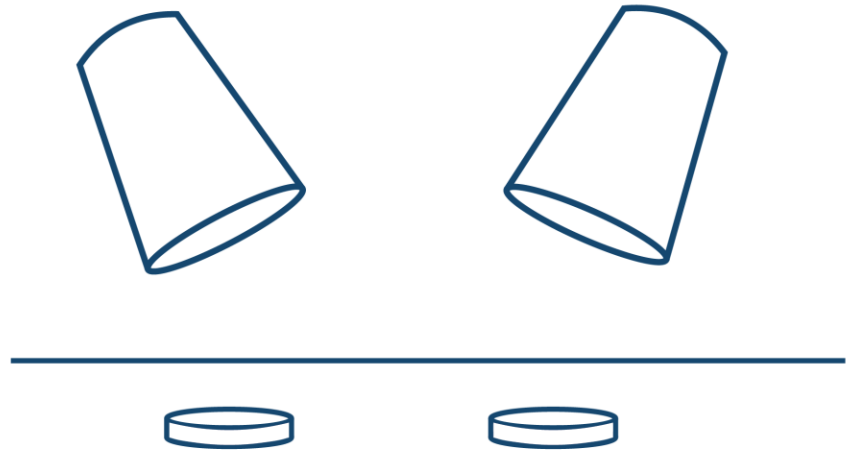
clean kilowatts

FOLLOW THE IMPACTFUL REVENUE!









RECs = project revenues

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project revenues ≈ developer revenues

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more revenues = more projects