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Where matters: Integrating deliverability into voluntary clean energy market boundaries

Executive Summary

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Executive Summary

Background

The voluntary clean energy market continues to play a growing and essential role in grid decarbonization. Voluntary procurement by corporate buyers has accounted for over 68 GW of clean energy capacity added to the U.S. grid since 2014, and voluntary purchases comprised about 6% of U.S. retail electricity sales in 2021, growing at a rate of about 20% year over year.[1] Standards and initiatives such as the Greenhouse Gas (GHG) Protocol, CDP, and RE100 all broadly incentivize voluntary procurement and influence the specific types of procurement decisions that are made. In addition to encouraging procurement from specific types of energy technologies, these standards and initiatives also importantly define the geographic boundaries within which a buyer can procure energy to comply with the standard. The extent to which the location of procured electricity matches the location where a buyer consumes electricity has an impact both on the credibility of an individual buyer's claim to be consuming the clean energy it procures, and on the aggregate impact of the voluntary market on the long-term success of the energy transition and full grid decarbonization.[2]

Given the important role that standards play in shaping where voluntary buyers procure energy and the degree to which their procurement contributes to grid decarbonization, it is critical that standards setters define procurement boundaries using a process that is structured, transparent, and grounded in the reality of how electricity markets and electric power systems function. Today, boundaries are often poorly defined, unclear in their rationale, and not reflective of power markets and operations. They are often interpreted inconsistently, resulting in double-counting and the weakening of voluntary demand signals.

This is particularly true for the GHG Protocol's Scope 2 Guidance on market-based accounting. This accounting approach, which allows companies to use market-based instruments to calculate their emissions from consumed electricity, lacks clear or robust guidance on the geographic boundaries within which clean energy can be purchased in order to match consumption and reduce market-based scope 2 inventories. Specific weaknesses of the current guidance include:

- The current guidance focuses on aligning with energy attribute certificate (EAC) markets, rather than electricity markets themselves. While electricity markets are designed to reflect the underlying power system and ensure that market transactions contribute to

1 Clean Energy Buyers Association Deal Tracker (https://cebuyers.org/deal-tracker/); NREL "Status and Trends in the Voluntary Market (2021 Data) https://www.nrel.gov/docs/fy23osti/84419.pdf

2 Ricks *et al.*, "Minimizing emissions from grid-based hydrogen production in the United States," Environmental Research Letters (2023); Xu *et al.*, "System-level Impacts of 24/7 Carbon-free Electricity Procurement," Princeton University (2021); Riepin and Brown, "System-level Impacts of 24/7 Carbon-free Electricity Procurement in Europe," TU Berlin (2022); International Energy Agency, "Advancing Decarbonisation Through Clean Electricity Procurement" (2022).

the efficient and reliable operation of the grid, today's voluntary energy attribute markets are often completely disconnected from the underlying electricity markets and thus do not necessarily advance the same goals. This disconnect can also undermine the credibility of the claims made by voluntary market participants.

- The current guidance does not require companies to report which boundaries they are using, making it difficult to compare carbon accounting across companies and over time.

- The current guidance, by ignoring electricity market and physical grid boundaries, provides no incentive for the voluntary market to advance electricity market expansion and regionalization, transmission buildout, and greater interconnection of different synchronous grids, all of which will be important for grid decarbonization.[3]

These issues are amplified by the fact that most decarbonization policies and standards for clean energy procurement refer back to the GHG Protocol Scope 2 method. As voluntary procurement continues to contribute to a larger share of total clean energy deployment, uncoordinated action that is divorced from grid dynamics could result in more significant unintended and negative consequences, slowing the clean energy transition.

The voluntary market boundary framework

This paper introduces a framework for how standards setters, such as the GHG Protocol Secretariat, can thoughtfully and intentionally approach the process of defining voluntary market boundaries. The premise of this framework is that voluntary energy markets and market-based carbon accounting should resemble actual electricity markets and reflect some level of physical deliverability while remaining practical enough to encourage broad participation. Thus, this framework is centered around three key considerations that should be evaluated when determining voluntary clean energy market boundaries:

1. **Structural Relevance:** The boundaries should align voluntary actions with the needs of the grid and complement existing market and regulatory structures, which are increasingly organized around grid decarbonization in addition to their traditional roles of ensuring the safe, reliable, and affordable delivery of electricity.

2. **Physical Deliverability:** The boundaries should seek to ensure that clean energy procured anywhere within the boundary is deliverable to a buyer anywhere within the same boundary in order to improve credibility of matching claims and avoid greenwashing.

3 See NREL's Interconnections Seam Study and this MIT study on Facilitating Transmission Expansion to Support Efficient Decarbonization of the Electricity Sector.

3. **Practicality:** The boundaries should help enable the participation of all voluntary actors in voluntary markets, regardless of their energy procurement capabilities.

The framework introduced in this paper is designed to be flexible enough to evaluate different types of boundary definitions, to evaluate the suitability of existing boundaries, or to help draw completely new, custom boundaries. In order to support standards setters in evaluating boundaries, the framework includes specific evaluation criteria for each consideration. The criteria within a given consideration are intended to be used in combination to provide a full picture of how well a proposed set of boundaries perform.

Structural Relevance	Physical Deliverability	Practicality
Electricity market alignment: Are voluntary buyers participating in their local electricity markets? Does the boundary allow voluntary buyers to procure from generally the same pool of resources that other market participants can procure from? **Regulatory alignment:** Does the boundary support reliable grid operations? Does the boundary support the effective functioning of emissions regulations (*e.g.*, cap-and-trade)?	**Synchronous grid boundaries:** Does the voluntary market boundary exist within one synchronous grid, or rather allow for procurement across multiple synchronous grids? **Transmission congestion:** Is the uniform deliverability of new generation within a boundary limited by transmission congestion? **Delivery distance:** How large is the market boundary relative to the average distance power flows travel from generators within the boundary? **Expected deliverability:** What fraction of generators within a boundary deliver some amount of electricity to load in the same boundary? **Regional connectivity:** Do boundaries reflect regions with relatively high delivery between generators and loads?	**Achievability:** Can participants achieve the program goals by only procuring resources from within the boundary? If not, do buyers have any pathways to expanding access? **Understandability:** Is the boundary definition conceptually simple enough and explained sufficiently clearly for voluntary buyers of all abilities to understand and act upon? **Universality:** Is the boundary definition consistent across all geographies where the standard will be used? **Stability:** Are the boundaries stable over time to reduce the risk of "stranded" voluntary purchases?

The importance of deliverability for voluntary energy markets

Today, physical deliverability has been largely ignored in voluntary clean energy markets, which treat clean energy purchases more like offsets by allowing a MWh of electricity generated anywhere to offset a MWh of local electricity consumption, even if it is not physically deliverable to the buyer. Deliverability may not matter in the context of carbon offset markets, but is important in voluntary clean energy markets where a buyer claims to "consume" the clean energy they purchase. Under the current guidance, a voluntary buyer could buy credits from across the country and claim to have zero scope 2 emissions, even if their local electricity consumption continues to perpetuate demand for local fossil-fuel powered generation.

> ### Defining "deliverability"
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> Physical deliverability refers to the ability of the electricity generated at a specific power plant to be "delivered" to a specific consumer or purchaser. Deliverability can be determined based on two different types of metrics:
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> - Flow-based deliverability metrics trace the flow of power through the transmission and distribution network from a specific generator to a specific load. These metrics are robust and precise, but require using sophisticated analytical techniques.
> - Fungible deliverability metrics are less-precise generalizations that evaluate the ability of the consumer's load to be balanced by generation in another part of the grid. These metrics are straightforward, but their results are subject to more exceptions and caveats and are less definitive for determining deliverability of a specific project.

Better aligning voluntary clean energy markets with electricity markets through enhanced deliverability requirements can support the continued and long-term success of voluntary grid decarbonization efforts. Specifically, it will:

- Ensure that clean energy capacity growth matches load growth in a rapidly electrifying economy.
- Promote efficient electricity markets and support grid reliability needs.
- Align voluntary buyers' market-based demand signals with both their physical consumption-based demand signals, and the demand signals of other regional electricity market participants, thus providing stronger aggregate demand signals for clean energy.
- Enhance the credibility of claims and reduce the risk of perceived greenwashing.
- Limit the risk of shifting the cost of decarbonizing a buyer's local grid to other grid users.

Case Study: Takeaways for the GHG Protocol

The evaluation of boundaries for a global standard, like the GHG Protocol, can be particularly challenging since no single boundary definition may work universally in all regions. To illustrate the application of the framework, we present a limited case study that evaluates how well several boundary options for market-based scope 2 accounting perform according to the three framework considerations in the U.S.

and EU.[4,5] We apply a potential scoring scheme that can be tailored to help voluntary market designers weigh different criteria and quantitatively score each option as an input to their decision-making.

> ### Proposed steps for implementing the framework:
>
> 1. Create stakeholder group
> 2. Establish program objectives or principles
> 3. Assign weightings to considerations and evaluation criteria to align with program objectives
> 4. Select the possible boundary options to evaluate
> 5. Evaluate how each boundary performs for each criterion (*i.e.*, assign a score)
> 6. Calculate total scores to compare boundary options and inform stakeholder discussion

Key takeaways from this case study include:

A single boundary definition may not work well in all global contexts. For example, national boundaries are structurally relevant in Europe, but not in North America. In a global context where it's hard to consistently evaluate the same boundary across geographies, another valid approach is to craft different, yet *specific* boundary definitions for each geography, such as balancing areas in one region and synchronous grid boundaries in another.

Region size within an existing boundary type can range widely, complicating the evaluation of deliverability and practicality. Individual regions within a single boundary type may be very different sizes, which can affect their practicality and physical deliverability. For example, the PJM balancing area in the U.S. covers over 386,000 square miles and includes 13 states within its boundaries.[6] On the other hand, the Tampa Electric Company balancing area covers a single city in a single U.S. state.

Drawing new, program-specific boundaries could help balance priorities. Existing boundaries are convenient because they are already defined and understood, but these boundaries may be defined by historical happenstance or structural needs that have little relevance to the needs of the voluntary program being designed. Defining custom grid boundaries for a specific purpose is not without precedent. For example, in the U.S., the Environmental Protection Agency created

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4 The boundary options considered include: 1) current interpretation of GHGP (U.S.-wide and EU-wide), 2) synchronous grids, 3) state (interpreted as nation-state in EU), 4) balancing area.

5 The geographic scope of our case study is limited to these two geographies based on the grid models we had available at the time of writing to evaluate some of the flow-based physical deliverability metrics.

6 "PJM At a Glance," https://www.pjm.com/~/media/about-pjm/newsroom/fact-sheets/pjm-at-a-glance.ashx

"eGRID subregions" to meet the specific needs of location-based GHG accounting.[7]

Consistency with other program-specific requirements should be considered. For example, the GHG Protocol defines "residual mix" emissions factors as part of its market-based emissions factor hierarchy. For the sake of consistency and to avoid double-counting, it may be necessary for the voluntary procurement boundaries to match the boundaries used for calculating residual mix emission factors.

The intent of this illustrative case study was not to identify a "best" boundary option; however, it is clear that the current market-based scope 2 boundaries are not sufficient. While today's broad boundaries support achievability and hold some level of structural relevance, the interpreted boundaries perform poorly across nearly all criteria, and particularly for physical deliverability.

Although the case study in this paper focuses on the GHG Protocol Scope 2 market-based accounting standard, the framework is equally applicable to other standards and initiatives seeking to encourage or regulate voluntary procurement of clean energy, including RE100, the 24/7 Carbon-free Energy Compact, the U.S. EPA Green Power Partnership, the U.S. FTC Green Guides, the Science-Based Targets Initiative (SBTI), corporate climate disclosure regulations, building energy performance standards, and green hydrogen regulations. In each of these examples, the use of the framework could be tailored to the specific geographic scope of the program (from subnational, to national, to global), or the specific aims of the program (*e.g.*, energy accounting, credible and accurate claims).

Putting the framework into practice

The path toward global decarbonization will involve voluntary efforts by companies, and well-designed procurement and accounting frameworks are critical to harness the power of corporate purchases to spur the growth of clean energy. The voluntary market boundary framework introduced in this paper is a flexible and powerful tool that can be used by standards setters to identify or design credible, impactful, and practical boundaries for voluntary energy procurement. The framework enables a critical evaluation of the impact of a standard's design choices on electricity markets, power system needs, the users of a standard, and electricity decarbonization. The framework is intended as a starting point for a broader, more robust conversation on the topic of deliverability in voluntary clean energy markets, and we invite others to apply the framework and put it to the test to help refine it over time.

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7 Specifically these boundaries were designed to balance between the limitations of balancing areas and interconnects for location-based accounting.