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Rethinking Scope 2 Accounting Standards

A Path To More Impactful Clean Energy Procurement

The Need for Change to Carbon Accounting Standards

The global transition to clean energy is not moving fast enough to address climate change and keep warming under 2ºC.

Scope 2 emissions (indirect emissions from electricity generation) already account for over a third of emissions[1]. As we move to electrify our world, clean energy can avoid as much as 75% of global emissions[2] (the current percentage of emissions from all forms of energy).

Companies currently set and meet scope 2 targets using either location- or market-based accounting rules without any requirement to demonstrate that their actions are enabling more clean energy generation. Research has uncovered significant challenges with current practices (see Langer et al. 2024; Bjorn et al. 2022; Brander et al. 2018; Mulder & Zomer 2016; Gillenwater et al. 2014).

While the GHG Protocol's guidelines have enabled companies across the world to account for their electricity-related emissions in a standardized way, they have not evolved to ensure corporate actions are leading to more clean energy projects being built. Work is underway right now to correct that.

These updates must be done both with urgency and care. There is a risk of applying solutions that work for 1% of buyers and in academic models to the entire market to ill effect. One solution that has gained a lot of traction is time and geographically matching the generation of clean energy to energy utilization. While this seems reasonable on paper and shows promise in models, it has the potential to wreak havoc on the voluntary market and slow the transition to clean energy.

This paper expands on these risks and recommends how new concepts and rules could be combined to both bolster the credibility of scope 2 accounting and incentivize ambitious actions, putting the world on a better path to address the climate crisis.

[1] This is true of both global emissions and US emissions.
[2] https://ourworldindata.org/ghg-emissions-by-sector

The Current State of Scope 2 Accounting

The current scope 2 guidelines offer two methods for accounting for electricity-related emissions:

1. **Location-based method**: Calculates emissions based on the average emissions factor of the region where electricity is consumed.

2. **Market-based method**: Allows companies to reduce reported emissions by purchasing Energy Attribute Certificates (EACs), also called Renewable Energy Certificates (RECs) or Guarantees of Origin (GOs).

While these methods have provided flexibility and accessibility, they fall short in key areas:

- **The Market-based method may be too flexible:** EAC purchases represent energy that does not align with energy usage in space or time (often stated as not deliverable based on time- or geographic-matching) nor do they necessarily help make more clean energy projects happen.

- **Allocational accounting does not equal consequential impact**: Fundamentally, scope 2 guidelines today are entirely based on ~~attributional~~ allocational accounting[3], which is purely a methodology for allocating the existing clean energy on the grid to different entities. By design, there is no test or requirement for companies to *cause* projects to happen.

- **The empty promise of consequential impact**: While consequential impact is not required or tested for, it is often marketed as the reason to set and meet scope 2 targets. As a result, many companies believe their actions in EAC spot markets (or at least the collective action of the market) is causing more projects to happen.

- **No recognition of consequential impact**: The vast majority of EAC buyers transact in the spot market at low prices. Buying EACs annually from a 10-year old project for $2/EAC is unlikely to enable or sustain a clean energy project. And yet from a carbon accounting standpoint, this action is treated as equivalent to signing a 20-year Power Purchase Agreement (PPA) that very easily can be shown to enable a new project to be funded and built. Since more impactful methods of procurement are considered equal to less impactful ones, there is very little incentive for companies to do more than what is minimally required.

- **No incentive to be more ambitious**: Furthermore, the guidelines do not reward investments in projects that maximize avoided emissions and increase other co-benefits for communities and the planet.

[3] We are using allocational instead of attributional as we think it better describes the intent

- **Erosion of market credibility**: The absence of clear standards differentiating high- and low-impact transactions enables what looks like greenwashing where companies take credit for things that would have happened anyway, thereby undermining confidence in corporate sustainability efforts and claims at large.

A Better Path Forward

Our proposal aims to refine scope 2 accounting guidelines to balance **impact**, **accessibility**, and **accuracy**, ensuring that changes drive meaningful decarbonization without crippling participation. Our proposal was designed to answer these key questions:

- **Accuracy**: Do the calculations, reports, and claims about scope 2 emissions and targets more accurately represent what is happening in the physical world?

- **Impact**: Does setting and meeting scope 2 targets result in more projects being built, thus resulting in the acceleration of the transition to clean energy?

- **Accessibility**: Finally, do the rules and standards at least allow for the majority of the current market to participate and benefit from efforts to set and meet scope 2 targets?

The Location-Based Method: Improve Accuracy

We recommend focusing on making the location-based method a more accurate representation of scope 2 emissions based on the time and location of energy consumption. This improvement can come from using an hourly residual mix emissions factor in place of the annual grid average emissions factor prescribed in today's guidelines.

- **Use the residual mix emission factor where possible.** The residual mix emission factor represents emissions that remain after EACs, contracts, and supplier-specific factors have been claimed and removed from the emissions factor calculation. Using this factor helps lessen double-counting, which happens when the same megawatt-hours of clean energy are attached to EACs claimed by individual companies *and* are used to reduce the region's overall emissions factor.

- **Work towards being more granular in time**: Make and use, when available, an estimate of the residual mix emissions factor for each hour instead of an annual average. While this adds complexity, it will incentivize companies to shift their load to times when the grid is cleaner.

- **Work towards being more granular in location**: Make and use, when available, the residual mix emissions factor for regions (or each utility) based on where power can be delivered instead of political boundaries. In the US, this would result in smaller regions but in other places, it may mean a larger region as power can flow across country boundaries. This would provide a more accurate estimate of the emissions at any given

hour and location, and reward companies that invest in standing up more clean energy in their local community.

The Market-Based Method: Improve Accuracy and/or Impact

We recommend improving the market-based method by creating two distinct pathways for EACs to reduce a company's scope 2 emissions:

Path 1: Allocational EACs: EACs that come from an improved allocational method which better matches deliverability based on time- and geographic-matching of energy usage to energy generation.

- **Tighter geographic-matching.** By defining market boundaries based on deliverability of power and/or focusing on utilities themselves, we can emphasize better geographic matching. We propose these tighter market boundaries be defined where a MWh injected in a different node can be delivered to the customer's node the company is connected to > T% of the time and with < U% of uncertainty.

- **Continue to allow annual matching**: Unlike the location-based method where we recommended hourly data, we are intentionally not recommending requiring hourly time matching EACs between generation and usage for all buyers. We have concerns that requiring hourly matching creates more volatility in the market for EACs and can disincentivize the long-term contracts that are so critical to impact. We expand on these concerns below under "Annual Matching Instead of Hourly Matching."

- **Recognize tighter-time matching for those that choose it.** Despite our concerns about requiring hourly time-matching, we recognize the improved accuracy and possible impact from the practice (especially when paired with instruments like Power Purchase Agreements). Finding a way to recognize those that go further without requiring everyone to do can incentivize ambitious action.

Path 2: Consequential EACs: EACs that maintain today's flexibility in time- and geographic-matching only if they come from a financial investment and/or forward commitment to a project that ensures impact:

- **Continue to allow** both **annual matching** *and* **today's market boundaries** (where deliverability is not ensured) if and only if **the EACs are proven material** to the financial viability of its project. A method for doing this is provided in the next section.

- **A feasible and scalable test:** We hold that it is possible to define a method to test for this impact that is both robust and feasible to scale to a global standard.

- **Long-term contracts are a good start**: To be material to a project, EACs will almost certainly need to be tied to a long-term forward contract (be they bundled or unbundled with the energy). But a long-term contract alone does not make $2 EACs instantly material. We need a clear standard for ensuring additionality.

- **Transferable impact**: Once procured in a manner proven consequential to enabling a new project, EACs can be retired on behalf of other entities or resold in shorter contracts, even annually. What matters is that the EACs were originally procured from the project in a way proven material to the project's success.

A Scalable Additionality Test for the Consequential Method:

We propose allowing additionality to be tested in two ways. One works entirely on public data and the EAC contract terms while the other requires direct inspection of the project economics. In both cases, EAC contracts are expected to enable a **new or renewed project** and be secured before the project is completed.

Outside-in test: To show that an EAC contract (EAC price and term) provides material financial support to a project, its total value, combined with any other investments from the same buyer (such as tax equity), must be at least 10% of the average regional market price for electricity over the project's first 20 years. This helps ensure that the buyer contributes enough additional revenue and/or risk reduction to support the project's financing and construction.

$$Required\ EAC\ Price\ \geq\ \frac{Avg.\ Market\ Price\ x\ 20\ years\ x\ 10\%}{Contract\ Length\ (years)}$$

To take into consideration the time value of money, we apply a discount rate to this formula where T = the length of the EAC contract and r = the discount rate.

$$\sum_{t=1}^{T} \frac{EAC\ Price}{(1+r)^t}\ \geq\ 10\% \times \sum_{t=1}^{20} \frac{Avg.\ Market\ Price}{(1+r)^t}$$

- **Average market price:** The contracted EAC price should be compared to the average wholesale electricity price ($/MWh) in the same region over the past three years. Alternatively, where available, EAC prices can be compared to the average settlement price ($/MWh) for new Power Purchase Agreements (PPAs) in that region over the same period. This ensures a fair benchmark for determining material support.
- **Why 20 years?** Renewable energy projects typically last 20–35 years, and long-term contracts like PPAs (15–20 years) provide enough revenue certainty for financing. We use a 20-year timeframe to ensure a consistent basis for evaluating projects.
- **What about shorter contracts?** In our experience, EAC contracts are typically 5-10 years. The shorter a contract, the higher the price per EAC to provide the same level of support. The total value over the contract's lifetime must still equal at least 10% of the project's estimated market revenue over its first 20 years.

- **Why 10%?** When a clearly defined rule is needed in finance and securities markets, 10% is a common threshold for determining whether something has a "material" impact. Applying this standard helps ensure that EAC contracts meaningfully contribute to project financing without introducing unnecessary complexity. We discuss this test in greater detail in our paper on applying additionality to EACs.
- **How to value buyers lowering the project's risk:** Contracts like Virtual PPAs should easily meet the outside-in test since they guarantee a fixed price per MWh (the strike price), reducing financial risk for the project. Other forms of reducing risk can be tested using the direct test as they should reduce the cost of capital in some way.

Direct test: The EAC contract, along with any other investments by the same entity into the same project, must be material, needed, and attested to in the EAC contract.

1. **Material improvement to the project's economics:** at least a 10% relative factor on one of the following metrics:
    - **Positive impacts**: At least a 10% increase in a metric key to successful project financing such as (a) revenue, (b) internal rate of return (+100 basis points for the IRR), or (c) financial leverage.
    - **Cost reductions**: At least a 10% decrease in a key financial metric such as (a) debt-service coverage ratio (DSCR), (b) cost of capital, or (c) cost of energy.
2. **Needed support:** To avoid over-investing in projects that already have the support they need, buyers should seek to understand factors like the project investor's required return on their investment (e.g., their hurdle rate). We generally see hurdle rates between 8-15%, where a higher rate of return is required on projects with greater risk.
3. **Backed by contractual representations:** When using a direct test, the project developers or owners must represent the above-described material impact and needed support of the EAC contract for the project's financial viability in an enforceable contract, and those representations must be vetted through a reasonable diligence process.

Addressing Common Concerns

"Will this make participation harder?"
The dual-path approach improves accuracy and impact while maintaining accessibility by giving companies options. Companies that wish to use the market-based method can choose a stronger allocational-focused path or invest in high-impact actions proven to be consequential. Smaller buyers benefit from maintained flexibility, while all other buyers are encouraged and able to lead on impact. Making a substantial impact on projects and the transition to clean energy may not be feasible for everyone, nor is that the primary objective. However, it should be incentivized, widely accessible, and appropriately recognized.

“Will existing projects be abandoned?”
Projects that rely on EAC revenue but do not meet additionality criteria can still sell EACs to local utilities or customers under the allocational-focused path, ensuring continued support for operational projects.

“Will this work at scale, globally?”
We believe there are sufficient choices for companies, along with reliable validation methods, to scale and support the global market. While the process may not be easy, every company should have access to solutions, and there should be enough options and incentives to encourage more companies to take ambitious action.

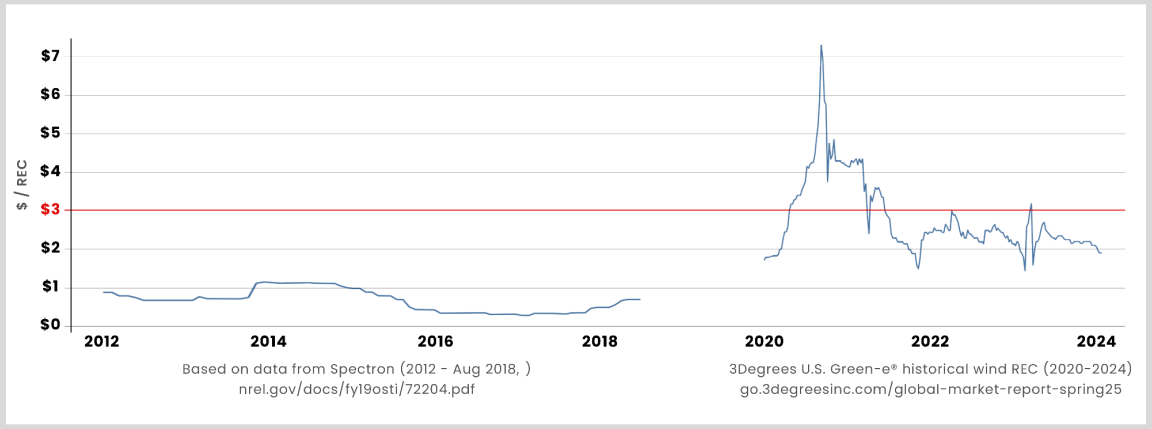
Balancing Simplicity and Impact: Preserving What Works

While our proposal focuses on improving the location-based method and market-based method to align corporate procurement with real-world decarbonization, we deliberately retain several aspects of the current scope 2 framework. These decisions reflect a commitment to balancing accuracy, impact, and accessibility.

Annual Matching Instead of Hourly Matching

Hourly-matched EACs (aka 24/7 carbon-free electricity) have gained attention for their promise of greater accuracy. Models have shown that by constraining supply, EAC prices will go up and therefore so will impact. However, this requires assumptions about how the market will behave and overlooks certain risks.

- **Market prices are unlikely to climb much higher.** Demand exceeding supply only helps projects if prices rise to a level that makes more projects pencil out financially. Historically, in the US, demand falls dramatically once prices go above ~$3 / EAC.



There was a single order for EACs in 2021 that was larger than anything seen before which temporarily spiked prices. Prices came back down thereafter and have never climbed as high again.

- **Economic inefficiencies**: Hourly matching makes procurement inherently more complex. Buyers may need to over-procure clean energy by as much as 300-400% of their actual load to meet hourly matching requirements.

- **Discourage long-term contracts**: Buyers are likely to seek greater flexibility as to which EACs (which hours) they buy as they try to match EACs to their load curves. This is likely to dissuade long-term contracts that lock buyers into buying all of a project's EACs. Fewer long-term contracts will be detrimental to progress.

- **Market illiquidity and uncertainty**: Prices for EACs in hours of abundant supply will be driven even lower. The question remains if the market will pay a high enough price premium in hours of scarcity to not only make up for those losses but also drive the deployment of storage and/or new technology to meet that demand.

- **Spot-market EACs still won't be bankable**: Outside of long-term contracts and compliance spot markets where EACs trade for far more ($35-$300/EAC vs $1-3 in the voluntary spot market), revenue from EAC spot markets are rarely the deciding factor in a project being built. More volatility in the spot-market is unlikely to change that.

By retaining annual matching, we uphold a system that is practical, scalable, and aligned with the realities of grid operations and long-term contract structures.

Give Options: Proven Impact *or* Buy Local (Based on Deliverability)

The current scope 2 guidelines give buyers options. If new guidelines *require* all buyers to purchase within smaller market boundaries based on deliverability, it will severely limit the voluntary market's ability to have an impact.

- **Projects will have a harder time finding buyers to support their projects.** Constraining supply for buyers also means constraining access to demand for sellers. Using state boundaries (which are likely more permissive than boundaries based on deliverability), more than 70 million EACs in the 2024 US market (> 50% of Green-e EACs) would have been unpurchasable just from projects in Texas, Oklahoma, Kansas, Quebec, Florida, North & South Dakota, and Wyoming.[4]

- **Discourage long-term contracts (again)**: One of the barriers to using long-term contracts is insufficient demand as project developers do not want to contract with a large number of counterparties. Buyers commonly aggregate their load across the country and then support one project to meet their needs. Requiring companies with distributed operations to purchase EACs in each of those locations will push them away from long-term contracts to the spot market where they will have far less impact.

- **Clean grids get cleaner, dirty grids are ignored:** Some companies seek to support projects where they are more economical (solar or wind resources are stronger) and/or where the grid is dirtier (new renewables will reduce usage of fossil fuels instead of

[4] Looking at the disparity between demand and supply in the top 10 states for each in CRS' 2024 report.

competing with other renewables). Boston University famously did both when they supported a wind farm in North Dakota that will realize 2-3 times greater avoided emissions than a new project in New England due to the larger percentage of clean power already in the ISO-New England electrical grid. We should encourage these kinds of actions, not ban them.

Matching Megawatt-Hours (MWh), Not tCO_2

Some have proposed shifting purchase volumes from matching MWh to tCO_2, accounting for differences between a company's local grid and the avoided emissions (tCO_2) of a project they support. While this idea has theoretical appeal, it raises concerns about accessibility and accuracy:

- **Complexity and uncertainty**: Emissions modeling requires granular data on grid operations and marginal emissions factors, which can vary widely, are not globally accessible, and have unknown levels of uncertainty. If impact is overestimated, it can erode trust in carbon accounting.

- **Barrier to participation**: Adding this complexity risks discouraging smaller organizations from engaging in clean energy procurement, reducing overall participation.

By continuing to match MWh, we preserve a straightforward and widely understood approach that supports broad adoption while focusing on improvements within the existing framework.

Supporting Granular Certificates Without Requiring Them

The introduction of granular certificates (e.g., location- or time-specific EACs) has opened avenues for new analysis and spurred programs like emissionality and 24/7 CFE. While we support such innovations, we do not believe they should be mandated because:

- **Flexibility**: Requiring granular certificates could overly constrain buyers, especially smaller organizations, adding complexity without proportional benefits.

- **Further reduce adoption of long-term contracts**: Requiring granular certificates could also limit distributed organizations from aggregating their load into a single PPA or other long-term contract if they have to procure energy from each region they have a presence.

- **Broad applicability**: Current annual EACs remain accessible and scalable, enabling widespread corporate participation.

Our approach encourages the continued development of granular certificates as optional tools for companies seeking deeper insights into their impact, without imposing additional requirements on all participants.

Why These Choices Matter

By retaining annual matching, MWh-based accounting, and optionality for granular certificates, we ensure that scope 2 accounting remains:

- **Accessible**: Simplicity enables broad participation across organizations of all sizes and capacities.
- **Practical**: The retained elements reflect the realities of grid operations and market dynamics.
- **Scalable**: The focus on usability ensures continued momentum toward clean energy goals without overburdening stakeholders.

These choices complement the improvements proposed in the market-based method, striking a balance between driving impact and preserving the strengths of the existing system.

Conclusion: Toward a More Impactful Future

This proposal builds on the strengths of the current guidelines while addressing critical shortcomings. By refining the market-based method to prioritize additionality and deliverability, the GHG Protocol can empower companies to drive real-world decarbonization while maintaining accessibility.

This is not just a refinement—it is an opportunity to align scope 2 accounting with the urgency of climate action. Together, we can ensure that every clean energy purchase delivers meaningful progress toward a net-zero future.