

**STRIVE**

by STX

# Understanding the GHG Protocol's New Scope 2 Granularity Proposal



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## Market Context



For the past two decades, voluntary corporate clean electricity procurement has operated on a simple principle: match annual electricity consumption with an equivalent volume of renewable electricity generation, regardless of when during the day or year that energy was produced. This annual matching framework enabled straightforward accounting and mobilized capital for approximately 301 gigawatts of renewable capacity globally – roughly 7% of all solar and wind installations to date<sup>1</sup>.

The voluntary corporate market has evolved through market-led standards, unlike compliance programs. Compliance markets operate under binding regulatory frameworks that establish rules for how renewable electricity can be claimed by utilities and suppliers. In Europe, for example, **the market operates under regulatory frameworks such as the RED III Directive** and emerging initiatives like CBAM.

However, for corporates operating in voluntary markets, renewable electricity claims are guided **by widely adopted frameworks**, most notably the [Greenhouse Gas Protocol](#) (GHG-P). As the global standard for voluntary corporate emissions accounting, GHG-P underpins initiatives including [RE100](#), [CDP](#) and [SBTi](#).

When GHG-P's early guidance was developed, renewable electricity procurement was constrained by limited supply and immature certificate registry infrastructure. GHG-P's annual matching accounting standard was intentionally flexible to account for such challenges, leaving specific best practices to be defined by each broad market region. With limited formal compliance regulation and an initial focus on boosting total renewable consumption, annual matching served its primary purpose of driving renewable energy development.

However, annual matching obscures a critical misalignment: renewable generation and corporate electricity consumption do not necessarily coincide hour-by-hour. A corporate claiming 100% renewable electricity coverage annually may rely heavily on fossil-fueled grid electricity during periods of low renewable generation. This temporal disconnect

– compounded by geographic mismatches where certificates purchased from distant grids bear little relationship to the actual electricity consumed – has called into question the credibility of annual matching as a proxy for emissions reductions.

GHG-P is now proposing revisions to its Scope 2 guidance. Draft guidance was released for public comment in October 2025, and **finalized guidance is expected by the end of 2027**. However, if enforced as proposed, the draft framework would require corporates with annual energy consumption above a yet to be defined threshold level to **match electricity consumption with clean electricity generation on an hourly basis within the same market boundary**.

For corporates committed to reporting under GHG-P standards, the implications are material. For this assessment, we assume that GHG-P's temporal and geographic matching standards are implemented as proposed in draft guidance released October 2025. Final guidance may differ from this proposal and a feedback period is ongoing. If implemented as proposed, our analysis indicates that a shift from annual to hourly matching would result in significant reductions in recognized clean electricity coverage for many corporates under today's procurement strategies. This effect is most pronounced for corporates with unpredictable load profiles and single-technology supply portfolios.

At the same time, the analysis demonstrates that practical pathways exist to improve hourly matching performance without resorting to operational load shifting or capital intensive technologies. Procurement strategies based on aggregated portfolios of load across different companies can achieve meaningfully higher matching scores at lower cost and complexity than single corporate procurement. Further, with or without load aggregation, supply diversification delivers incremental improvements in hourly matching performance but exhibits diminishing returns, often requiring materially higher procurement volumes to achieve comparable gains.

<sup>1</sup>: [IRENA Renewable Energy Capacity Statistics 2025, March 2025](#); [Carbon Saving Redefine Impact of Corporate Energy Deals, Bloomberg NEF, December 2025](#);

# Methodology: A Framework to Test Hourly Matching Across Load Profiles and Markets

To understand how hourly matching affects different load profiles, we modeled three archetypal annual consumption patterns against three European market boundaries<sup>2</sup>, creating a 3x3 framework that isolates the impact of both load shape and resource availability.

## Three Load Archetypes Represent the Spectrum of Corporate Consumption Patterns:<sup>3</sup>



### Baseload:

Continuous, flat electricity consumption (data centers, manufacturing facilities)



### Daytime Peaking:

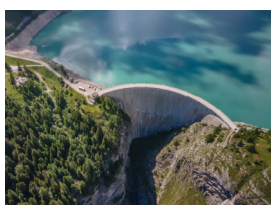
Higher daytime demand with lower nighttime consumption (offices, retail, light industrial)



### Variable:

Unpredictable consumption patterns (mixed-use facilities, batch manufacturing)

## Three European Markets Represent Procurement Environments With Different Resource Availability:<sup>4</sup>



### Baseload Generation (Norway)

Corporates can construct portfolios limited to nuclear or hydropower (in Norway's case, hydropower)



### Variable Generation (Denmark)

Corporates can construct portfolios limited to wind or solar (in Denmark's case, wind)



### Diversified Generation (Spain)

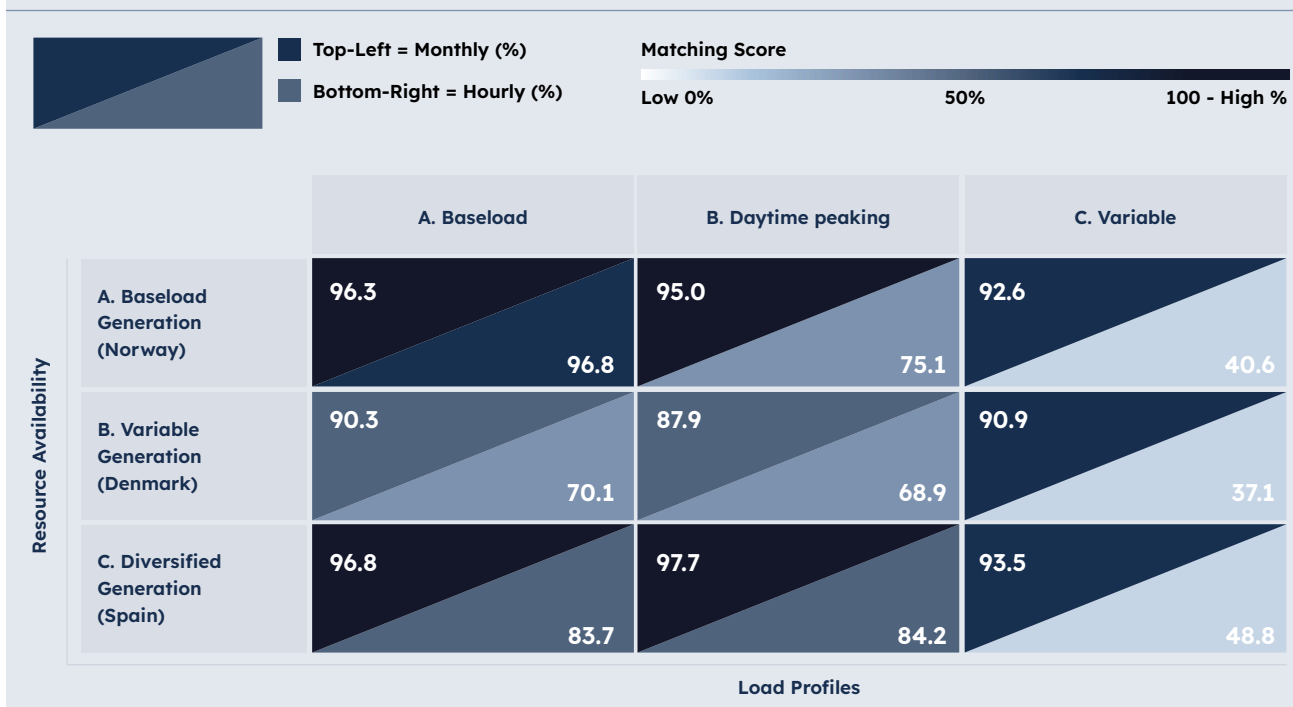
Corporates can construct balanced portfolios of wind, solar and nuclear generation combining both variable and baseload power

<sup>2</sup> Proposed guidance defines deliverable market boundaries according to ENTSO-e electricity bidding zones. This is subject to change pending finalized guidance. [ENTSO-E Bidding Zone Configuration Technical Report, 2021](#)

<sup>3</sup> All load profiles are standardized load profiles published by [EuroStat, 2017](#). All load profiles have been normalized and scaled to 25 GWh annual consumption.

<sup>4</sup> All generation profiles are averages of the specified country's portfolio of that resource. For example, the Norwegian hydropower profile is the aggregate of all Norwegian hydropower profiles, normalized, and scaled to match the target annual consumption. All data from ENTSO-e, 2025.

**Figure 1: Monthly and Hourly Matching Scores**  
Monthly and Hourly Resolution (%)



**Baseload Generation (Row A) Is Valuable for Nearly All Load Profiles**

Baseload generation provides a consistent supply floor regardless of weather, season, or time of day. A baseload-only procurement strategy produces an average hourly matching score 11 points higher than wind-only procurement. The reason is structural. Even operations that appear to have variable or peaking demand carry a persistent baseload. Baseload generation fills this layer efficiently and with minimal excess supply, making it a natural fit even for corporates that don't think of themselves as "always-on" consumers. This consistency also makes baseload generation resilient to changes in consumption patterns over time. As a corporate's operations evolve, a baseload procurement strategy retains its value in a way that generation tied to a specific demand shape may not.

**Sidebar: Additionality**

Additionality is not explicitly addressed in GHG-P's current Scope 2 draft proposal, which focuses on temporal and geographical alignment rather than whether procurement drives new generation to the grid. However, for many corporates, additionality – whether procurement causes new capacity to be built – remains a core consideration in a Scope 2 procurement strategy.

Sourcing hydroelectric power in markets like Norway may materially improve hourly matching performance, but these gains are unlikely to come with additionality claims, as much of the hydro fleet is long-established. How (and whether) GHG-P ultimately incorporates additionality into its framework will be an important area to watch as guidance continues to evolve.

**Monthly Matching Is a Volume Problem; Hourly Matching Is a Shape Problem**

Monthly matching scores are uniformly high - 80-90%+ across every combination of generation type and load profile tested, including variable loads where hourly scores fall below 50%. The reason is structural: monthly accounting allows surplus generation in one hour to offset a deficit in another, smoothing mismatches across the month. Hourly matching removes that flexibility. Generation must be present at the moment consumption occurs; it cannot be shifted, banked, or netted across time.

For corporates with PPAs or monthly supply contracts for unbundled EACs, high annual matching figures may naturally translate into near-equivalent monthly scores. This arithmetic has historically made clean energy procurement a volume problem – buy enough MWh, and the numbers work. Under hourly matching, what matters is whether the shape of contracted generation aligns with the shape of actual consumption, hour by hour. That is a materially harder problem, and one that most current procurement strategies are not designed to solve.

**Variable Load Profiles (Column C) Remain an Unsolved Problem**

For companies with variable loads, procuring from variable generation, baseload power, or a mix does not meaningfully enable hourly matching. Those currently reporting high annual matching scores with such profiles would likely see Scope 2 emissions rise substantially under hourly matching rules. One potential solution is aggregating loads with other corporates to smooth out variability, as explored further in Takeaway 3.

## Takeaway 1: Most Corporates Will Rely on Portfolio Strategies, Not Operational Changes, to Improve Hourly Matching Scores

Corporates seeking to improve their hourly matching score broadly have **two options: modify their load profile (demand-side) or diversify their renewable portfolio (supply-side)**. Both pathways present practical and economic constraints that will force many corporates to accept trade-offs between cost, operational flexibility and hourly matching performance.

### Demand-Side Mechanisms Face Significant Practical Constraints

Shifting energy-intensive activities to hours of peak renewable generation immediately improves hourly matching scores. The approach requires minimal capital investment – mainly software and process redesign – and avoids additional clean energy procurement. However, load shifting only works in practice when corporates can adjust their energy consumption to renewable patterns without economic sacrifice. For most corporates, the operational disruption from subordinating electricity consumption to renewable generation profiles makes load shifting theoretically attractive, but practically infeasible.

For corporates unwilling or unable to change their electricity consumption patterns, **adding battery storage enables the same time-shifting effect without operational disruptions.**<sup>6</sup> Rather than changing when electricity is consumed, batteries change when renewable generation is matched to consumption. Batteries charge during hours of excess renewable generation, then discharge during consumption peaks or low-generation periods. The overall load profile remains unchanged; the hourly matching score improves.

However, the economics of battery storage rarely justify building a battery for hourly matching alone. Average capital costs for utility-scale batteries reached \$334 per kWh of capacity in 2024<sup>7</sup> – a facility seeking to shift 10 MWh of daily load faces a \$3-4 million investment before accounting for costs from integration, increased operational complexity and maintenance. For most corporates, batteries require a broader business case beyond hourly matching benefits. Corporates that can justify batteries for other reasons – accelerating interconnection timelines, avoiding congestion charges, reducing coincident peak demand fees or providing grid services revenue – gain hourly matching as a secondary benefit.



<sup>6</sup>: Importantly, the GHG Protocol has not yet addressed the use of batteries for hourly matching in its proposed changes to Scope 2 guidance. Stored EACs are likely to be part of the second phase of the GHG-P's Scope 2 guidance revisions and will be addressed by the final revised Scope 2 standard.

<sup>7</sup>: NREL Cost Projections for Utility-Scale Battery Storage: 2025 Update

## Takeaway 2: Strategic Renewable Portfolio Design Could Replace Simple Volumetric Procurement

Where demand-side modifications prove impractical, renewable portfolio composition becomes the primary lever for improving hourly matching scores. **Optimal portfolio composition varies by load profile; therefore, effective renewable portfolio construction begins with load profile analysis.** For some corporates, single-technology strategies will be effective. A corporate with daytime-concentrated consumption may be able to achieve high hourly matching scores with solar alone. A pure baseload consumer can reach equivalent scores with hydropower or nuclear. However, for most corporates, load profiles will diverge from single-technology generation profiles.

These corporates will achieve higher hourly matching scores with diversified renewable portfolios. **Different clean resources match different components of consumption: nuclear and hydropower align with steady, always-on loads, while wind and solar cover variable peaks.** In markets where solar and wind are anti-correlated – wind peaking during evening and nighttime hours, solar delivering reliable midday generation – a diversified portfolio covers electricity consumption across the full 24-hour cycle that no single resource can provide while minimizing over procurement.

### Procurement Instruments: PPAs and Unbundled EACs Under Hourly Matching

Corporates constructing their renewable generation portfolio typically rely on two common instruments to achieve their goals: **power purchase agreements (PPAs) and purchases of unbundled energy attribute certificates (EACs).** While corporates may also contract with their utility under green tariffs or other utility green programs, we focus on (v)PPAs and EACs for the sake of this exercise.

For years, PPAs have been a popular clean energy procurement option for credit-worthy buyers with stable, large, predictable loads and tolerance for longer-

term commitments. PPAs deliver fixed-price protection against energy market volatility, demonstrate clear environmental impact with new assets and can simplify combined energy and EAC procurement. However, PPA off-takers also assume volume risk if actual generation underperforms projections and shape risk if load profiles shift or facilities close, among other embedded contractual risks. This exposure is compounded by the 10–15-year term of a traditional PPA.

**Under annual matching, PPA-generated EACs can be applied uniformly regardless of a corporate's load profile. Under hourly matching, generation and consumption must align within the same hour for PPA-generated EACs to produce a reduction in Scope 2 emissions for a corporate.**<sup>8</sup> Consider a solar PPA generating exclusively during daytime hours: for a corporate with nighttime-concentrated load, these EACs cannot be applied to renewable energy use claims. When alignment between a corporate's load profile and the PPA's generation profile is poor, the PPA creates over procurement of EACs during some hours while leaving others uncovered, requiring additional EAC purchases to achieve meaningful hourly matching improvements. While PPAs may retain their value as a price hedge against energy market volatility, whether they can be applied towards GHG-P compliant Scope 2 emissions reductions is now load profile dependent. Corporates with a preference for additionality will also continue to benefit from PPAs with new assets despite the challenge faced from an hourly matching perspective.

**Corporates can use unbundled EAC purchases to procure environmental attributes with more precision and flexibility than PPAs.** Unbundled EACs currently simplify corporate procurement and make the market accessible to small buyers. Because of the difficulty matching a corporate's load profile to a single generation profile, unbundled EAC purchases are expected to continue to be an important procurement mechanism for corporates.



**8:** A proposed legacy clause would allow certain existing long-term contracts (PPAs, VPPAs, long-term EAC agreements) to continue counting in Scope 2 inventories, even if they do not meet new hourly or deliverability requirements. This is expected to apply to contracts signed before a defined cutoff date, require that contracts be registered in existing certificate registry systems, and apply only for the original contract term. Exact details, including eligibility criteria, duration, and disclosure rules are still under consideration.

Corporates pursuing hourly matching today need hourly generation data from source facilities. The GHG-P offers flexibility here: corporates can use actual metering data or representative generation profiles; for example, the average generation shape of all solar facilities within a market boundary. This flexibility means data access is unlikely to be the bottleneck. That said, corporates should confirm that forward contracts include generation data access or verify that representative profiles exist for their target markets.

The bigger near-term constraint is registry infrastructure since most registries can only mint and retire annual or monthly EACs. However, this does not prevent corporates from undertaking hourly matching today as GHG-P does not require hourly EACs to make an hourly matching claim. Instead, corporates can retire monthly or annual EACs, provided they pair them with hourly generation data and have the claim verified by a third-party auditor. In short, **neither data limitations nor registry gaps prevent corporates from pursuing hourly matching now.**

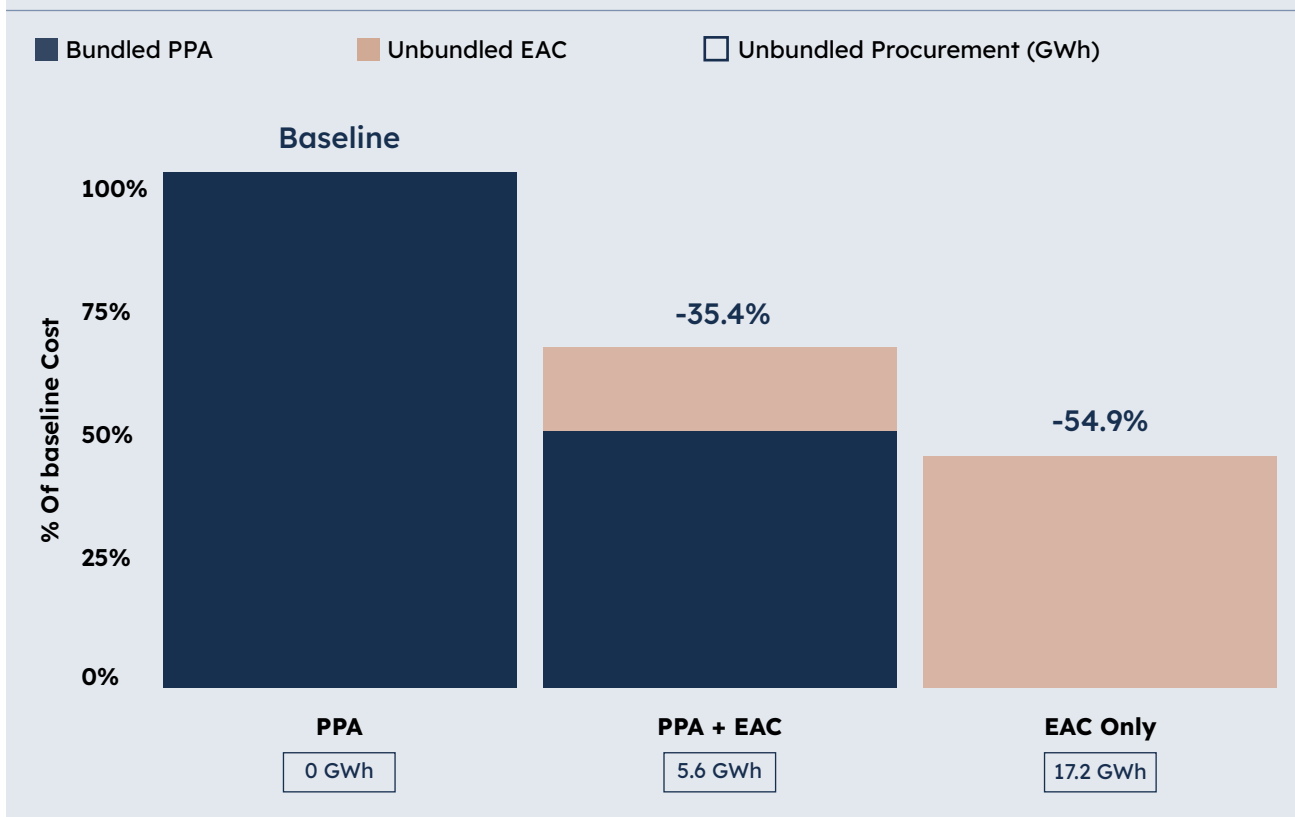
Looking ahead, once registries support trading individual hours of generation, corporates will unlock even more precise procurement, buying and retiring specific hours of output from assets.

Whether corporates choose to procure non-PPA unbundled EACs in forward strips or via spot markets is largely dependent on a corporate's individual mandate. Forward purchasing generally serves as a hedge against EAC price volatility. This may be particularly impactful in early stages of the transition to hourly matching, during which there is limited price discovery about the long-term premium or discount for certain hours of generation in certain regions. Spot purchases provide more flexibility at the expense of greater market exposure.

**For corporates weighing the tradeoffs between PPAs and unbundled EACs, the optimal approach may be to combine both instruments.** Corporates might use PPAs to establish baseload coverage or capture peak renewable generation hours, then layer unbundled EAC purchases to address remaining gaps with more precision. This hybrid strategy balances cost efficiency and certainty with hourly matching performance, though it requires sophisticated portfolio management to avoid redundant procurement as new contracts layer onto existing commitments.



**Figure 2: Cost by Procurement Pathway**  
25 GWh Spanish Daytime-Peaking Load Achieving 70% Hourly Matching



**Analysis of Procurement Instruments**

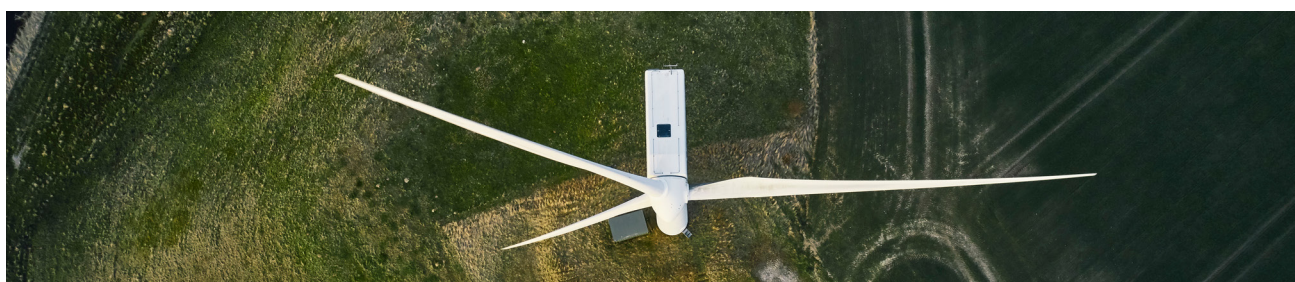
We illustrate the cost implications of supply-side portfolio diversification with instrument diversification in Figure 2. We compare three procurement scenarios, each calibrated to achieve a 70% matching score. In the PPA-only baseline, we procure 25 GWh from a single wind asset via PPA. In the PPA + EAC scenario, we procure 12.5 GWh from the same wind asset via PPA, then backfill remaining unmatched hours with unbundled EACs sourced from a solar asset to achieve the same 70% hourly matching score. In the EAC-only scenario, we optimize procurement across a broad portfolio of assets, using unbundled EACs exclusively to minimize total procurement while meeting the same 70% matching score.

The PPA + EAC pathway reduces costs by reducing procurement and substituting EACs from a PPA with unbundled EACs. The PPA + EAC scenario reduces total procurement from 25 GWh to 18.1 GWh, largely from the benefits of procuring from both wind and solar, whose

complementary output patterns reduce the volume needed to reach a 70% score. Layering unbundled EACs on top of the wind PPA further reduces costs by replacing more expensive EACs with cheaper ones. A similar supply-side effect could be achieved with a multi-technology PPA. However, this approach may add complexity to an already long PPA negotiation process.

In the EAC-only scenario, both effects are magnified. We realize additional volumetric reductions from further supply-side diversification, and we replace remaining PPA EACs with less expensive unbundled EACs.

Taken together, the analysis quantifies two distinct, but complementary levers for cost reduction: supply-side diversification across generation technologies, and instrument diversification across PPAs and unbundled EACs. The magnitude of the savings from each will vary widely depending on a corporate's load profile, available generation technologies, and prevailing market prices for each instrument.



9: STX; Pexapark, 2026. ENTSO-e, 2025, Bloomberg, 2025. PPA-based EAC prices are based on Spanish power futures, closed corporate PPAs, and estimated transactable ranges. PPAs based on 10-yr PAP wind PPA beginning in 2027. Unbundled EAC pricing based on internal data for forward purchases 2027-2037. Hourly matching score assume that the underlying certificate is a monthly EAC. Pricing is not a guarantee and is subject to change. Pricing does not constitute a sale or purchase price.

## Takeaway 3: Renewable Energy Procurement in Aggregation Can Achieve Higher Hourly Matching Scores Without the Tradeoffs of Other Strategies

The constraints on demand-side modifications and the challenges of matching individual load profiles to available generation build a compelling case for an alternative approach: load aggregation. **Our analysis finds that when multiple corporates pool their electricity consumption within the same market boundary, the resulting aggregated load profile can achieve substantially higher matching scores than any individual participant could attain independently.** Pooling will be possible when the underlying EAC is hourly-timestamped; while the underlying certificate is a monthly EAC, GHG-P provides no mechanism for procuring against a pooled load profile.

Aggregation creates artificial load shifting through complementary consumption patterns. A corporate in Norway with high daytime consumption will be largely restricted to purchasing from a baseload hydropower facility, creating over procurement during nighttime hours. However, when paired with a corporation with high nighttime consumption, the aggregated load profile forms a baseload profile. Neither corporate changes its operations, yet both benefit from improved temporal alignment with available renewable generation.



**Figure 3: Pooled Procurement Efficiency<sup>10</sup>**  
 Demand-Side Diversification Can Improve Hourly Matching Scores

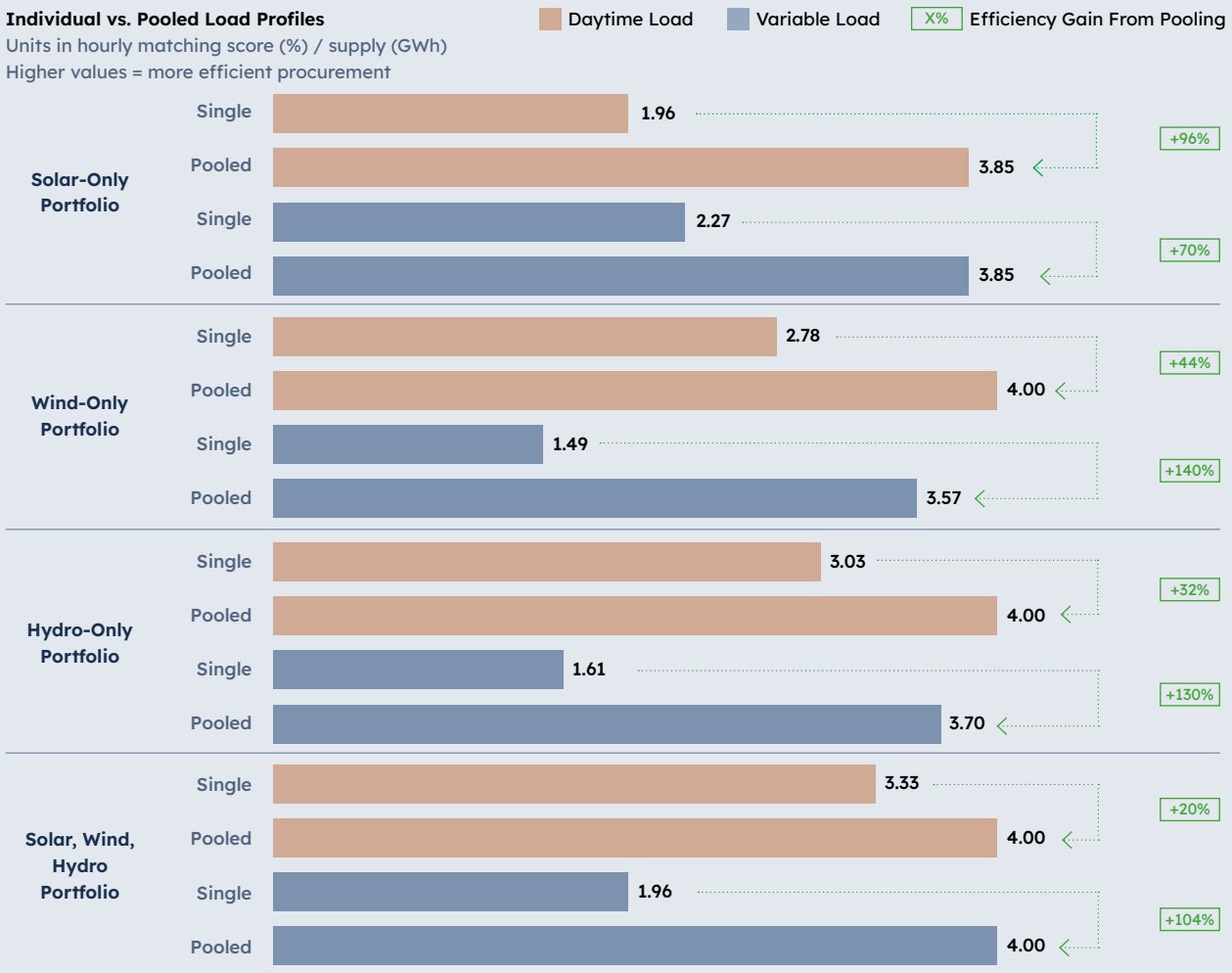


Figure 3 highlights the efficiency of alternative procurement strategies by comparing the ratio of volume procured to the resulting hourly matching score. For example, an efficiency ratio of 2.0 means that each GWh of procurement delivers 2.0 percentage points of hourly matching score.<sup>11</sup> Annual procurement equals annual load of 12.5 GWh per load profile in all scenarios. For the single load profile, the efficiency maximum is 8.0; for the pooled profile, the maximum is 4.0. Importantly, results reflect a market in which the retirement of hourly timestamped EACs is possible.

Pooling the daytime-peaking and variable load profiles consistently improves procurement efficiency across all portfolio types. For daytime-peaking load profiles, efficiency gains range from 20% to 96%; for variable loads, the effect is even stronger, with efficiency increasing 111% on average across portfolio types.

Demand-side pooling can augment the benefits of supply-side portfolio diversification. Even when procuring from a highly diversified solar, wind, and hydro portfolio, procurement efficiency rises 20% for

the daytime-peaking load and more than doubles for the variable load. Concretely, by pooling load profiles, each GWh procured yields an additional 0.7 and 2 percentage point increase in hourly matching score for the daytime-peaking and variable load profiles, respectively.

These results are due in part to the ability of load aggregation to solve the over-procurement problem that plagues individual portfolio construction. A single corporate adding a wind PPA to cover its remaining gaps often creates redundant supply during hours when existing contracts already provide coverage. In an aggregated procurement pool, one corporate's excess generation during solar-heavy hours can be matched to another corporate's consumption during those same periods. Over procurement for one participant becomes gap-filling for another. This mutual absorption of surplus generation means that the aggregated portfolio requires less total procurement to achieve the same collective matching score, reducing costs per participant.

<sup>10</sup>: ENTSO-e, 2025; Eurostat, 2017. Hourly matching scores assume that the underlying certificate is an hourly EAC. Load and generation profiles are identical to those used in Methodology section. Annual load and generation of daytime and variable profiles are each 25 GWh. Diversified portfolio sized with each resource contributing 1/3 of total consumption. Optimization on combined load profile performed with priority allocation to daytime load.

<sup>11</sup>: Note that this ratio will not necessarily scale with increased procurement. Procurement may experience diminishing returns to hourly matching score as hours become increasingly difficult to match.

**Figure 4: Pooled Profile Mechanics<sup>12</sup>**  
Hourly Average Load vs. Flat Hydro Generation

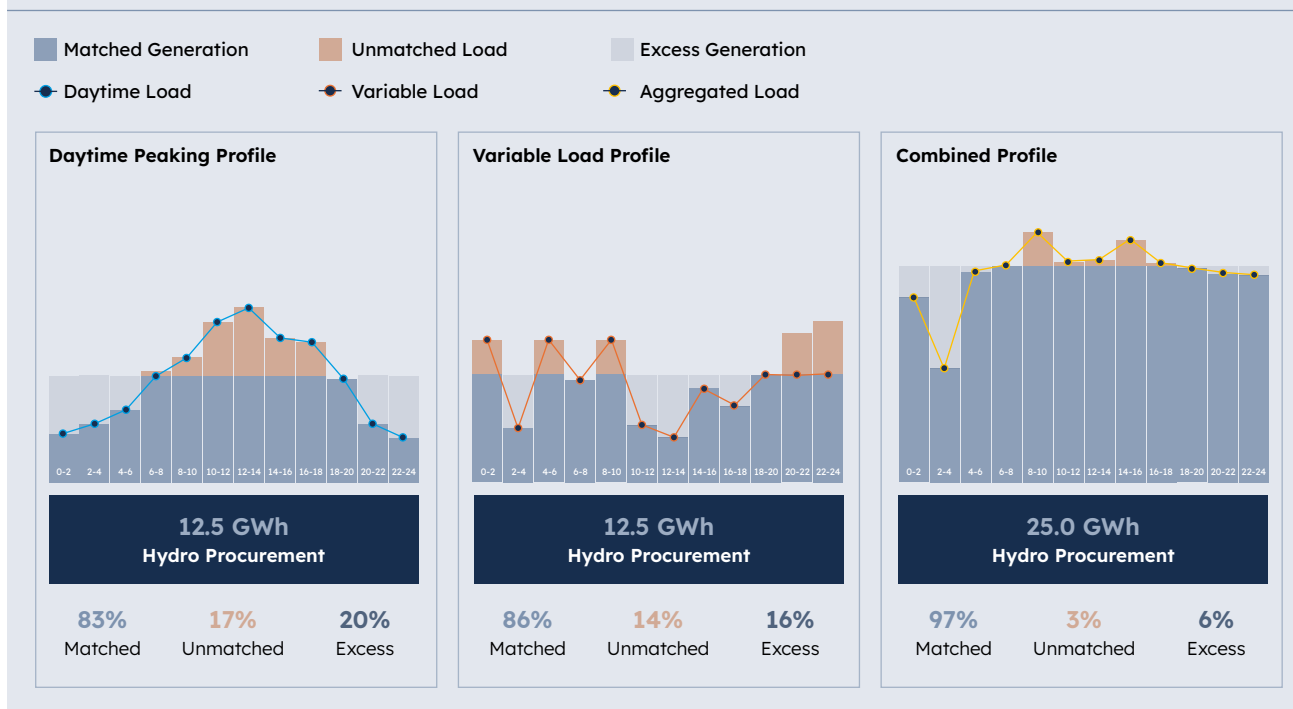


Figure 4 illustrates this mechanism. Two corporates each procure 12.5 GWh of baseload hydropower. When assessed individually, excess consumption over the flat procurement level for both corporates reduces hourly matching performance. When the two load profiles are combined, nighttime surplus generation from the daytime-peaking corporate is absorbed as matched generation by the variable load corporate.

In aggregate, the two corporates procure the **same total volume of generation**, but the complementary timing of their load profiles converts excess supply into matched consumption. This interaction is reflected in **higher hourly matching scores for both corporates** and a **reduction in excess generation**, despite no change in total procurement volume.

Lastly, aggregation delivers procurement advantages through scale. Larger, pooled demand enables access to a broader set of procurement instruments and more favorable commercial terms than are typically available to individual buyers. Aggregated portfolios can support larger PPAs<sup>13</sup>, improve counterparty diversification, and reduce transaction costs by spreading origination, contracting, and management expenses across multiple participants. Scale also mitigates the risks caused by shifting consumption patterns over time.

The principal challenge of aggregation is coordination. Effective aggregation requires identifying corporates with complementary load profiles within the same market boundary and establishing clear allocation rules for a shared supply portfolio. Unless the proposed GHG-P guidance explicitly allows for procurement with aggregated load profiles, aggregation also requires registries to provide hourly EACs to each counterparty.

Entities that manage large, diversified portfolios of both supply and demand are therefore well positioned to intermediate aggregation and deliver benefits at-scale. For many corporates, participation in aggregated procurement pools may represent a pragmatic pathway to high hourly matching performance. Aggregation avoids the operational constraints of load shifting, circumvents the capital intensity of storage, and mitigates the inefficiencies of individual portfolio optimization, while delivering additional cost advantages through scale.

<sup>12</sup>: Load and generation profiles are illustrative. Hourly matching scores assume that the underlying certificate is an hourly EAC.

<sup>13</sup>: [Scope 2 Revisions Should Empower, Not Exclude, Mid-Sized Energy Buyers, 2026](#)

## How We Can Help

At STX Group, through our corporate climate action arm, **STRIVE by STX**, we support corporates in navigating the increasing complexity of clean electricity procurement under evolving Scope 2 requirements. As accounting shifts from annual to hourly matching, procurement outcomes are likely to become more sensitive to load shape, market structure, and instrument design. We help organizations understand these dynamics, assess their exposure under different regulatory and market scenarios, and design procurement strategies that are aligned with their decarbonization ambitions, risk tolerance, and operational realities.

For organizations seeking to understand how proposed changes to Scope 2 guidance could affect their reporting, procurement decisions, and broader energy strategy, our team is available to discuss the implications in detail.

**To explore what these developments could mean for your business, we invite you to book a conversation with our team.**

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