



Energy Storage Europe's reply to the European Commission's Public Consultation on the TYNDP 2026 Identification of System Needs Methodology

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INTRODUCTION

The European Commission's public consultation on the TYNDP 2026 Identification of System Needs (IoSN) methodology seeks feedback on the analytical framework used by ENTSO-E to identify cost-efficient and technically robust opportunities for the development of Europe's electricity system, without prescribing specific investment decisions. The methodology underpins the assessment of onshore cross-border transmission, offshore infrastructure, and electricity storage needs across the 2035, 2040 and 2050 horizons, and introduces key evolutions such as a more granular zonal approach and the use of multiple representative weather scenarios to strengthen robustness.

EU SURVEY PUBLIC CONSULTATION QUESTIONNAIRE

Energy Storage Europe Secretariat's draft answers are in blue squares.

Q1: The IoSN methodology states that its purpose is to identify cost-efficient and technically robust system development opportunities, without prescribing investment decisions. Do you consider this framing and the associated scope — covering onshore transmission, offshore infrastructure, and storage across three target years — appropriate and sufficient for assessing Europe's future electricity system needs? If not, what aspects of scope or framing would you suggest, and why?

The scope should more explicitly reflect that flexibility solutions—including diverse storage technologies—can be substitutes or complements to network expansion in different locations and timeframes. In practice, this means:

- Technology-neutral treatment of “storage” (not implicitly “battery-only”), so the resulting “storage needs” can reflect the full set of flexibility options (short-, medium-, and long-duration; daily to multi-day/seasonal where relevant).
- Clearer articulation of how storage competes with (and can reduce) the need for transmission expansion, especially under internal congestion and extreme-weather stress conditions.
- More explicit recognition of energy-efficiency-first and direct electrification pathways alongside sector coupling, as these can materially change both network and storage needs (and avoid lock-in to potentially less efficient vectors). This aligns with concerns previously raised about modelling choices risking an over-reliance on hydrogen assumptions and overlooking direct electrification and storage options.

Q2: The study covers three planning horizons: 2035, 2040, and 2050. Do you consider this choice of target years appropriate and relevant? Do you consider any specific planning considerations associated with any of the assessed horizons missing in the methodology?

Storage solutions can scale faster than grid infrastructure, and therefore near-term (pre-2035) deployment and locational choices can materially affect 2035 system operation and reduce later network needs. Even if 2030 is considered “too close” for major cross-border projects, it is not too close for storage and flexibility.

The methodology currently indicates storage expansion is performed only for 2040 and 2050, while 2035 storage levels are taken from scenario assumptions. We recommend enabling storage expansion already for 2035 (at least as a sensitivity), to avoid missing cost-effective flexibility opportunities that are likely deployable within the 2030s.

Q3: The core of the methodology is a linear programming expansion optimisation that minimises total system costs, encompassing investment costs (CAPEX), fixed operating and maintenance costs, and operational costs, subject to constraints that are power balance, network flow rules, capacity bounds on investment options, operational limits and policy constraints. Do you consider this problem formulation adequate for capturing the economic drivers and trade-offs relevant to pan-European infrastructure planning? Are there cost components or constraints missing or insufficiently represented?

The main risks are structural omissions that can undervalue flexibility and/or mis-rank grid vs storage:

- Operational realism for flexibility: If operational constraints are simplified (e.g., perfect foresight, limited representation of reserves/ancillary services, no explicit ramping constraints), perfect price-reactiveness from flexible generation- or consumption-assets, the model can understate the value of fast-responding and multi-service storage (balancing, congestion management, system stability contributions).
- Storage cost structure and performance constraints: To be technology-neutral, storage related considerations should reflect key drivers such as power vs energy components, efficiency, cycling/degradation (where material), and operational limits that differ by technology and duration. Otherwise, “storage needs” risk being interpreted as “battery needs,” even when the system need may be long-duration or seasonal flexibility.
- Internal congestion and redispatch costs: If internal constraints are largely outside the core optimisation (or only post-processed), the objective function can miss a major value stream for storage: reducing redispatch and congestion management costs and enabling more efficient use of existing infrastructure.

We recommend explicitly documenting which flexibility-relevant constraints are included (e.g., reserve margins, balancing requirements, curtailment treatment, minimum stable generation, etc.), and adding sensitivities to test robustness of storage outcomes to these modelling choices.

Q4: Investment candidates are processed through a two-step linear programming approach: the first step optimises across real candidates only, while the second step adds conceptual and theoretical offshore candidates. Partially expanded candidates from step one are removed before step two. Do you consider this sequential approach appropriate, given that it was identified as a trade off between ensuring result quality and handling the large candidate space along with its computational effort? Which alternative approaches, if any, would you propose and on what basis?

On page 36, the methodology states that “maximum expansion constraints (trajectories) defined by TSO to avoid unrealistic level of expansion that the model might find optimal.” It should not be unilaterally up to the TSO to override economically optimal model outcomes, especially as, under the current regulatory framework that is largely capex based, and thus favouring investment in TSO-owned assets, grid reinforcements are in direct competition to storage. As such, there is a real probability of TSOs being incentivized, by a generally outdated regulatory framework, to allow for less utility scale storage than would be optimal for society. As such, the quoted sentence should be removed from the methodology.

We agree with the linear programming approach for assets like interconnections, but for other assets like batteries it is important that their profitability is reflected correctly despite partially expanded projects being removed.

Q5: A key innovation in TYNDP 2026 is the use of three representative weather scenarios per target year to achieve robust system needs. These scenarios are selected from the Pan-European Climate Database (PECD v4.2) using a structured process based on Principal Component Analysis and K-Means clustering, with each scenario assigned a probability weight. Do you consider the number of representative weather scenarios (three per target year) sufficient to capture the range of climatic uncertainty relevant to long-term infrastructure planning? What are your views on the suitability of the scenario weighting approach for the objective of identifying robust system needs?

We agree with the 3 weather scenario approach, but only if the goal is to have an approximate idea of average situations (in particular for non-peak-focused assets such as interconnections). On the contrary, a robust evaluation of extreme situations (in particular for peak-focused assets such as Long Duration Storage) would require several more scenarios, particularly also for ensuring security of supply and for avoiding to be underprepared for extreme weather events that may occur.

Q6: The methodology employs an advanced zonal clustering and network reduction process, resulting in approximately 102 zones across Europe. This represents a significant change from a single-node-per-country approach used in CBA and aims to better capture internal congestion patterns and physical power flows. Do you consider the resulting zonal granularity — both in terms of the overall number of zones and the distribution across countries — proportionate for the purposes of the IoSN study?

To ensure this granularity is proportionate and credible, we recommend greater transparency on how zone definitions affect storage siting, including how storage assets (existing and candidate) are mapped and how demand/generation are split across zones.

Q7: The methodology describes the treatment of internal network constraints through a combination of load-flow and post-expansion dispatch analysis. The baseline IoSN optimisation is performed in load-flow mode, where cross-border capacities are activated but internal capacities are set to infinity. A subsequent post-processing then assesses the impact of the IoSN portfolio on internal constraints. An additional optimisation can be performed where internal capacity limits are activated, to identify the impact of internal constraints on the resulting IoSN portfolio. Do you consider these approaches adequate for indicating the mutual impact of cross-border expansion and internal network constraints? Do you have further suggestion for internal constraint modelling?

The combination of (i) an initial optimisation with internal capacities set to infinity and (ii) post-processing/optional OPF it risks systematically under-valuing storage and internal reinforcements in the primary optimisation—because storage is often a cost-efficient alternative to internal grid reinforcement and congestion management. We recommend analysing in more detail, within this post processing step, the specific contribution that storage can make to relieving internal congestion and reducing associated costs.

Q8: The methodology considers and explicitly models the hydrogen system — including electrolyzers, pipelines, and storage — and optimises its dispatch alongside the electricity system expansion. The hydrogen infrastructure for each target year is compliant with the TYNDP 2026 Scenarios. Optionally, a sensitivity analysis can be performed with a frozen hydrogen dispatch to assess the impact on the IoSN portfolio. Do you consider this treatment of the hydrogen system appropriate and sufficiently comprehensive for a methodology focused on identifying electricity infrastructure needs? What improvements or additional sensitivities, if any, would you recommend?

Uncertainty around hydrogen scale, timing, and cost assumptions can materially affect grid and storage needs—and there is a risk that modelling could over-rely on hydrogen pathways while overlooking direct electrification paired with storage (including thermal storage).

Q9: Offshore system development is integrated into the IoSN framework through a unified optimisation encompassing onshore cross-border reinforcements, offshore interconnections, and hybrid corridor options. Offshore generation capacities are derived from Member States' non-binding offshore renewable energy targets, which are treated as fixed inputs. Do you consider this top-down approach to offshore system planning appropriate and sufficiently aligned with the national planning processes? What are the key risks or limitations of this approach that the methodology should acknowledge or address?

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Q10: The methodology accounts for environmental protection requirements and other uses of the sea (e.g., marine protected areas, shipping lanes, aquaculture zones) through a simplified approach: a uniform cost and length increase factor in the range of 10–15% is applied to theoretical offshore candidates, reflecting the need for realistic routing, rather than using Maritime Spatial Plans (MSPs) directly. This choice is justified by the variable availability and limited time horizon of MSP data across sea basins. Do you consider this simplified approach adequate, or do you believe that a more granular and spatially differentiated treatment of maritime constraints is feasible and proportionate for credible offshore planning at the pan-European level?

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Q11: The methodology relies on three main databases: the Pan-European Market Modelling Database (PEMMDB), the Pan-European Climate Database (PECD), and the Demand timeseries from TYNDP 2026 scenario. Investment candidate data, including CAPEX, OPEX, and internal reinforcement costs, are collected from TSOs and project promoters. Do you consider the overall data governance process — including the sources used, the data collection requirements, and the validation of data quality and consistency — sufficiently transparent and robust? Are there specific data gaps or quality risks that could materially affect the study's results?

From an energy storage perspective, the main transparency/quality priorities are:

- Full transparency on storage candidate assumptions (CAPEX/OPEX, duration classes, efficiency, lifetime, any degradation treatment) and on the country “trajectories” that cap storage expansion. Because these assumptions materially drive results, they should be clearly documented and consultable.
- Ensure “storage needs” are not inadvertently “battery needs” by default. If batteries are used as a proxy, the methodology should strengthen guidance on interpretation and cross-check results against multiple storage archetypes (short vs medium vs long duration).

Q12: Feedback on anything not directly considered in one of the previous questions.

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About Energy Storage Europe

Energy Storage Europe (previously EASE) is the voice of the energy storage community, actively promoting the use of energy storage in Europe and worldwide. It supports the deployment of energy storage as an indispensable instrument within the framework of the European energy and climate policy to deliver services to, and improve the flexibility of, the European energy system. Energy Storage Europe seeks to build a European platform for sharing and disseminating energy storage-related information and supports the transition towards a sustainable, flexible and stable energy system in Europe.

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Disclaimer

This response was elaborated by Energy Storage Europe and reflects a consolidated view of its members from an energy storage point of view. Individual Energy Storage Europe members may adopt different positions on certain topics from their corporate standpoint.

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