ACER

European Union Agency for the Cooperation of Energy Regulators

OPINION No 01/2026

on the Integrated Model for electricity, gas and hydrogen infrastructure planning

28 January 2026

Executive summary

Purpose and scope of the Opinion

This Opinion concerns the consistent and progressively integrated modelling framework ('Integrated Model') report jointly developed by ENTSO-E and ENTSOG and submitted for ACER's opinion. ACER's assessment reflects the requirements set out in Regulation (EU) 2022/869 on guidelines for trans-European energy infrastructure (TEN-E Regulation), its earlier recommendations on TYNDP deliverables, and the progress achieved to date on cross-sectoral integration.

Key remarks by ACER

ACER has the following observations on the submitted Integrated Model report:

- The report shows some progress beyond joint scenario development but still lacks a clear and ambitious blueprint for progressive cross-sectoral integration. Several key steps are deferred to a long-term roadmap, whose actions remain vague in scope, timing and ambition.
- The proposed operational use of the Integrated Model remains largely as a methodological test framework, lacking a clear process, concrete commitments and milestones. This may lead to divergent implementation across sectors and perpetuates the Integrated Model's experimental nature.
- The existing working groups' structure ensures balanced sector representation.
- Stakeholders' involvement only partially meets the legal requirements, as the draft report and roadmap should have undergone broader public consultation before submission.

Overall conclusion and way forward

Cross-sectoral coordination between electricity, gas and hydrogen is widely seen as playing an essential role in supporting the development of a resilient, cost-effective and future-proof energy system. While the existing legal framework allows flexibility in how "progressive integration" is achieved, it sets out a shift from single-sectoral approaches toward more coherent and interlinked planning. Consequently, the proposed roadmap should promote and facilitate the maximum feasible level of integration that can reasonably be implemented, supporting the evolution towards more aligned and cross-sectoral planning.

In this regard, ACER's finds that, despite some progress, the Integrated Model report does not clarify how the Integrated Model will contribute to greater consistency and integration of EU infrastructure planning through concrete milestones. In its present form, it is hard to anticipate how the Integrated Model will improve the assessment of infrastructure needs with a view to optimising overall system costs. ACER acknowledges the complexity of integrated modelling and that a full cross-sectorial integration may not be attainable in the near-term. However, ENTSO-E, ENTSOG and in future ENNOH are expected to define the key building blocks of such integration, clarifying where common assumptions should apply and which steps and deliverables require joint cross-sectoral assessment, rather than sector-specific treatment.

In this Opinion, ACER provides a set of minimum requirements and practical recommendations to strengthen consistency across sectoral planning. It calls on ENTSO-E and ENTSOG, with the involvement of hydrogen network operators, to revise the Integrated Model report and roadmap before submitting them to the European Commission. These revisions should establish clear requirements for cross-sector consistency to be applied in the next TYNDP cycle, incorporate early pilots on cross-sector system-needs assessment and a harmonised project-specific CBA, and be prepared on the basis of an adequate public consultation. ACER also expects continuous early and meaningful stakeholder engagement as the Integrated Model and its roadmap evolve.

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1. Background

1 Regulation (EU) 2022/869 (TEN-E Regulation) establishes guidelines for trans-European energy infrastructure. It mandates the collaboration of European associations for transmission system operators for electricity (ENTSO-E), natural gas (ENTSOG) and hydrogen (ENNOH) to develop a consistent and progressively integrated model (Integrated Model). This model is designed to enhance coordination and coherence across planning exercises for electricity, gas, and hydrogen infrastructures that have, until now, largely been conducted on a single-sector basis.

2 Article 11 of the TEN-E Regulation requires that ENTSO-E, ENTSOG, and ENNOH jointly submit the Integrated Model to ACER and the European Commission by 31 October 2025. The draft of the Integrated Model should undergo an extensive consultation and approval process as outlined in Article 11. ACER has three months to review and provide its opinion to the associations. The associations are required to take ACER's opinion into account when revising the Integrated Model, which will subsequently be submitted to the European Commission for approval. Once approved, the Model will be integrated into the single-sector cost-benefit analyses (CBA) methodologies used for preparing the Union-wide ten-year network development plans (TYNDPs) by the respective associations. Furthermore, the Integrated Model must be updated every five years.

3 Article 11 of the TEN-E Regulation is subject to transitory provisions outlined in Regulation (EU) 2024/1789 (Gas Regulation), taking into account that ENNOH is not yet a legally established association. According to Article 61 of the Gas Regulation, during the transitional period until January 2027, ENTSOG is responsible for developing the 2026 TYNDP for hydrogen instead of ENNOH, fully involving hydrogen transmission network operators and collaborating with ENNOH as soon as it is established.

4 On 31 October 2025, ENTSO-E and ENTSOG jointly submitted the Integrated Model ("Interlinked Modelling Report"), including a forward looking "Future Developments Roadmap" section, for ACER's opinion. The report was developed with the involvement of hydrogen transmission network operators.[1] This Opinion is based on Article 11(c) of Regulation (EU) 2019/942, Article 11, paragraphs (3), (10), (12) and (14), of the TEN-E Regulation, and Article 61 of the Gas Regulation. It is addressed to ENTSO-E and ENTSOG.

2. Procedure

5 ENTSO-E and ENTSOG jointly submitted the Integrated Model report for ACER's opinion on 31 October 2025.

6 ACER's Electricity Working Group provided its advice on 9 January 2026.

7 ACER's Gas Working Group provided its advice on 9 January 2026.

8 The ACER Board of Regulators issued a favourable opinion on 28 January 2026 in accordance with Article 22(5)(a) of Regulation (EU) 2019/942.

[1] Hydrogen network operators were involved in the development of the Integrated Model through their transitory and voluntary cooperative structure of pre-ENNOH, set up to develop the required preparatory works ahead of ENNOH's legal establishment.

3. ACER assessment

3.1. TEN-E requirements on the content of the Integrated Model

9 ACER notes that the TEN-E Regulation does not explicitly define the terms “relevant sectors’ interlinkages” and “progressively integrated model”, as outlined in Article 11, paragraphs (10) and (11). This provides a degree of flexibility as regards the depth and scope of integration that can be achieved.

10 According to Article 11(10) of the TEN-E Regulation, the Integrated Model will provide consistency between single sector methodologies on the basis of common assumptions including electricity, natural gas and hydrogen transmission infrastructure as well as storage facilities, liquefied natural gas and electrolysers, covering the energy infrastructure priority corridors and areas set out in Annex I of the TEN-E Regulation drawn up in line with the principles laid down in Annex V.

11 According to Article 11(11) of the TEN-E Regulation, the Integrated Model shall cover at least the relevant sectors’ interlinkages at all stages of infrastructure planning, specifically scenarios, technologies and spatial resolution, infrastructure gaps identification in particular with respect to cross-border capacities, and projects’ assessment. However, the reference to “interlinkages” inevitably leaves room for interpretation as to the extent of integration required in practice.

12 While Article 12 explicitly requires joint scenario development, no equivalent requirement exists for a joint cost-benefit analysis or a joint cross-sector infrastructure gaps assessment. Instead, the Integrated Model aims to ensure consistency between single-sector methodologies, including through common assumptions and aligned treatment of respective draft infrastructure gaps.

13 In light of the intended purpose of the Integrated Model outlined in Recital (26) of the TEN-E Regulation, ACER considers that the singular reference to an Integrated Model in Article 11 – instead of models – is not merely descriptive. While this wording does not need to be construed as requiring a single software tool or a fully unified modelling architecture across all stages of the TYNDP process, it reflects an expectation for progressively enhanced structural and analytical integration. In practical terms, this implies a transition from parallel and loosely coordinated sectoral models to a more coherent and systematically interlinked modelling framework.

14 In this context, it is worth noting that integrated modelling was already recognised in the first TEN-E Regulation (Regulation (EU) 347/2013) which required ENTSO-E and ENTSOG to develop a consistent and interlinked network and market model for electricity and natural gas. The key outcome of this previous process was the introduction of joint scenario development, which is now legally required by Article 12 of the revised TEN-E Regulation. Thus, the repeated call for a progressively integrated model in the revised TEN-E Regulation reflects the expectation of a further evolution of current planning processes beyond the minimum requirements currently applicable.

15 Therefore, while the TEN-E Regulation does not extensively detail every aspect of the Integrated Model, the fundamental purpose of Article 11 is to establish a trajectory of progressively deeper integration among the planning approaches for electricity, gas and hydrogen. This trajectory aims to achieve more than just consistency in assumptions; it strives for a significantly stronger integration of methodologies, analytical processes, and outputs, as appropriate. The ultimate objective is to enhance the coherence, credibility and system-wide relevance of EU infrastructure planning.

16 Finally, ACER notes a discrepancy in terminology between the wording of the TEN-E Regulation and the language used by ENTSO-E and ENTSOG in their reporting. ACER recognises that describing a framework composed of systematically interlinked models, methodologies and processes, operating on the basis of common assumptions and defined points of integration, may

provide a more accurate and understandable representation of the ENTSOs' intended approach than the term "integrated model".

17 Nevertheless, ACER considers that this change in terminology should not undermine the expectations set forth in the TEN-E Regulation for progressively enhanced structural and analytical integration across sectors and planning stages. In this Opinion, ACER will continue to refer to the submitted deliverable as the Integrated Model report, in line with the terminology established in the TEN-E Regulation.

3.2. Key remarks

3.2.1. Working groups ensure balanced representation of the sectors

18 Since the publication in December 2016 of the first draft consistent and interlinked electricity and gas model, the work on the Integrated Model has been jointly carried out by ENTSO-E and ENTSOG.

19 With regards to hydrogen, Article 61(1) of Regulation (EU) 2024/1789 establishes that, during a transitional period until January 2027, ENTSOG will be responsible for developing the 2026 TYNDP for hydrogen, with the full involvement of hydrogen transmission network operators and together with the ENNOH as soon as it is established.

20 As described in the report submitted on 31 October 2025 to the European Commission and to ACER, a dedicated Integrated Model workstream was established under a clear working groups structure.

21 ACER agrees that the established working group structure (to be adapted once ENNOH is formally established) ensures a balanced representation of the hydrogen, electricity and gas sectors.

3.2.2. Stakeholder engagement partially meets ACER's expectations

22 According to Article 11(10) of the TEN-E Regulation, ENTSO-E and ENTSOG should carry out an extensive consultation process before jointly submitting the Integrated Model to the European Commission and ACER. The required process is further specified in Article 11(2) of the TEN-E Regulation.

23 On 7 May 2024, ENTSO-E and ENTSOG published an early progress report, subject to public consultation. The analysis of the results of the public consultation was included in the Integrated Model report submitted to the European Commission and ACER.

24 Before the submission of the Integrated Model, ENTSO-E, ENTSOG and the hydrogen network operators also had exchanges with the European Commission, ACER and the TYNDP Scenario Reference Group. Three dedicated meetings were held with the European Commission and ACER, and a workshop with the Stakeholder Reference Group took place in September 2025.

25 ACER welcomes the opportunity to exchange ahead of the official submission of the Integrated Model report and positively acknowledges that some of its comments (including the request for a roadmap) were taken on board in the report submitted to the European Commission and ACER.

26 However, overall ACER considers the stakeholder involvement does not fully meet the requirements under Articles 11(10) and 11(2) of the TEN-E Regulation, as the Integrated Model report and the roadmap, should have been subject to a full and extensive public consultation prior to their submission to the European Commission and ACER.

27 Furthermore, while ACER acknowledges that the Stakeholder Reference Group (SRG) was consulted and issued formal recommendations on 16 October 2025, ACER also notes that the SRG considered the consultation deadline too short to provide more than high-level comments[2].

28 ACER recommends that a proper consultation is carried out before the report is submitted to the European Commission for its approval.

3.2.3. Commitment to integration remains limited in scope and pace

29 As also highlighted in ACER's consultancy study on Scenario development for the TYNDP and ERAA[3] processes, while there remains room for further improvement, ENTSO-E and ENTSOG have made notable progress in developing a joint scenario development process that ensures broad consistency between input assumptions provided by national electricity and gas TSOs.

30 By contrast, the further stages of the infrastructure planning process (infrastructure gaps identification and project specific CBAs) have remained single-sector exercises with more modest levels of formal consistency and integration. While assumptions are increasingly drawn from the jointly developed scenarios, ensuring overall consistency between some of the core assumptions, more advanced forms of consistency and integration in the methodological approaches remain limited.

31 As a result, the Integrated Model report submitted to ACER for its opinion, while covering for the first time also the infrastructure gaps and project CBAs layers, provides few concrete examples of improvements to TYNDP 2024. Moreover, the specific objectives of the Integrated Model effort remain mostly unclear and insufficiently detailed to assess its future application.

32 In particular, the proposed Integrated Model report lacks a detailed framework clarifying what ENTSO-E and ENTSOG (and in the future ENNOH) are expected to do consistently, what should be done jointly, and where differences between the respective deliverables are acceptable.

33 Instead, most of the more substantial steps relating to further integration of the CBA and infrastructure gaps assessment are captured in a "Future Developments Roadmap" that has been included in the report – however, often with tentative action points, phased-in across the next 5-10 years.

34 Given the long history of the work on the Integrated Model since the first TEN-E Regulation, the current state of progress since the integration of the scenario development process is considered by ACER insufficient, with progress towards a "consistent and progressively integrated model" remaining limited.

3.2.4. The Integrated Model is limited to a sandbox for experimentation

35 Additionally, the proposed Integrated Model workstream remains primarily designed as a framework for methodological and modelling experimentation, used to test data exchanges and modelling approaches across sectors rather than full coordination or joint implementation.

36 Because the proposed workstream functions primarily as a framework for methodological testing, there is no clear guidance or binding framework to ensure a consistent cross-sector approach and integration.

37 ACER notes that, without clearly defined requirements, ENTSO-E, ENTSOG and in the future ENNOH can decide for themselves which elements of the Integrated Model workstream to adopt, leaving the process open to selective and uncoordinated implementation.

[2] See stakeholder Reference Group for the TYNDP scenarios.

[3] European Resource Adequacy Assessment.

38 In this regard, ACER recommends that the Integrated Model report be amended to indicate which common assumptions must be applied, identify the steps requiring joint cross-sector assessment, and clarify where consistency across sectors is sufficient to allow separate processes and deliverables. To support this, the following section proposes a set of minimum requirements that the Integrated Model report should include to further ensure consistency among the different sectoral planning processes, not only in terms of underlying assumptions.

3.2.5. Minimum requirements towards greater consistency

39 ACER has repeatedly stressed the need for harmonised assumptions, cross-sector modelling consistency and greater transparency to ensure robust and comparable needs and project assessments – including in its Position Paper on the Consistency of CBA Methodologies (2023).

40 Ensuring cross-sector consistency in terms of input and methodological approaches should already be standard practice in today's planning exercises, as it represents a non-negotiable minimum for any comparable assessment across sectors. By contrast, the proposed Integrated Model does not fully clarify how cross-sector consistency is to be ensured. It also largely relies on the same uncoordinated and differentiated methodological approaches as currently applied for infrastructure gaps identification and project-specific CBA.

41 The infrastructure gaps assessments and project specific CBAs carried out for each sector should be based on the same underlying data on demand, supply and infrastructure, as well as on a consistent modelling framework.

42 Therefore, the Integrated Model report should clearly specify:

- The assumptions, data inputs and methodological steps to be used across the sector-specific infrastructure gaps identification assessments and project specific CBAs.;
- How consistency is to be ensured across the scenarios development, infrastructure gaps identification and project-specific CBAs.

43 Concerning the infrastructure gaps identification reports, the Integrated Model should require that, at least:

- The outcome of these exercises, even if still carried out separately by each ENTSO, reflects the results of an optimisation process (network expansion) determining where optimal cross-border capacities are needed;
- The starting grid used for the optimisation process is the same, referring to the short-term time horizon and composed only by projects which are in the construction phase, while the medium- and long-term grids would be the result of the expansion optimisation based on this starting grid;
- The capacity candidates used in the optimisation process should be derived from the projects submitted by promoters and, where no such projects exist, from standard capacities that are centrally and transparently defined based on common guidelines set out in the Integrated Model report; and
- An analysis is carried out in the respective infrastructure gaps identification reports of the internal constraints and the internal reinforcements needed to enable the optimally identified cross-border capacities.

44 Concerning project specific CBAs, the Integrated Model framework should require that, at least:

- The same reference networks representing the electricity, hydrogen and natural gas networks are used when performing project specific CBAs;

- The reference networks include only projects whose timely commissioning by the simulation year is reasonably certain. Stricter criteria should apply when selecting projects for the CBA reference grids representing the short- and mid-term horizon (e.g., only projects under construction or projects that have successfully completed the environmental impact assessment), compared to those used for the long-term horizon (e.g., projects still in permitting). In addition, realistic project commissioning cut-off dates for projects' inclusion in the reference networks should be set to account for delays that are likely to occur;

- To ensure comparability in terms of project maturity and in terms of clustering of projects and investments, where applicable, all single-sector CBA methodologies consider the same project implementation stages;

- All single-sector CBA methodologies apply a uniform methodology for "shared" indicators (e.g. social economic welfare, CO_2 reduction, and GHG reduction) to ensure results are comparable; and

- Externally derived monetary values (e.g., CO2 prices, Value of Lost Load) used as input assumptions are aligned across the scenarios and the CBAs, as well as across the single-sector CBA methodologies.

45 ACER therefore recommends that the Integrated Model report is adjusted accordingly before being submitted to the European Commission for approval, and that the proposed requirements are already applied to the TYNDP 2028 editions.

3.2.6. The roadmap is a welcome step forward, but proposed actions remain open-ended, and sectoral integration should be more ambitious

46 ACER welcomes the introduction of a roadmap, showing a high-level commitment to strengthening the consistency, integration and robustness of the TYNDP framework. ACER also generally agrees with the key focus areas identified in the roadmap.

47 However, some of the proposed steps remain relatively modest in ambition, and several actions are left open-ended in terms of scope and timing. Milestones indicated as occurring "beyond 2030" create considerable uncertainty, with no clear expectation as to when these elements will realistically be delivered. Greater clarity and firmer timelines are, therefore, needed to ensure that the roadmap translates into progress achieved within clearly defined and timely milestones, thereby providing stronger support for investment decisions and facilitating the achievement of EU climate targets.

48 In this respect, the Integrated Model should promote and facilitate the maximum level of integration that can realistically be implemented. In particular, ACER considers that the "cross-sector needs assessment pilot" and the "harmonised CBA approach" mentioned in the roadmap should be brought forward and firmly integrated in TYNDP 2028, for example, as an ad-hoc addendum to the single-sector TYNDP editions.

49 Without limiting the level of integration to be pursued beyond the TYNDP 2028 cycle, the following improvements should be considered in view of the pilot project to be carried out within the TYNDP 2028 framework:

- Infrastructure gaps identification: jointly conduct a high-level, cross-sectoral optimisation to identify optimal cross-border capacities. More detailed network-level analyses could then be performed separately for each sector. This two-step approach balances the complexity of full cross-sectoral optimisation with the differing levels of maturity and modelling readiness of the different energy systems assessed.

- Project-specific CBA: jointly perform a set of shared cross-sector indicators, such as socio-economic welfare and emission reduction.

50 ACER recommends that the roadmap is adapted accordingly before the final submission to the European Commission for the approval of the Integrated Model report.

51 In its Position on improving and simplifying the legal framework for European grids, ACER has also previously stated that it considers infrastructure planning should be based on an integrated assessment of needs and gaps as the default approach (compared with the current practice of single-sectoral assessments supplemented by a separate integrated modelling layer). This objective does not preclude the application in TYNDP 2028 of a pragmatic two-step methodology, as outlined in point 49, whereby a joint, high-level cross-sectoral optimisation is complemented by more detailed sector-specific analyses. Such an approach would add value compared with the current practice of single-sectoral assessments and allow the integrated model to be embedded more effectively in the overall planning framework, while accounting for differing levels of modelling maturity across energy systems.

52 ACER also emphasises that the actions outlined in the roadmap must be developed through early and structured stakeholder engagement in line with Articles 11(10) and 11(2) of the TEN-E Regulation. ACER therefore calls on ENTSO-E and ENTSOG, with the involvement of the hydrogen network operators, to promptly initiate consultations with all relevant stakeholders on how best to implement the roadmap in practice. In this regard, as already noted in section 3.2.2 of this Opinion, ACER also considers that the Integrated Model report should be subject to a broader public consultation process before its submission to the European Commission for approval. Extending the process beyond existing expert and institutional exchanges would also increase transparency, legitimacy and stakeholder buy-in for the proposed roadmap and its methodological implications.

53 Furthermore, ACER recommends that this broad consultation extend beyond the initial adoption of the roadmap to become a structured and recurring element of its implementation. In particular, ACER expects that, on an annual or cycle-based basis, dedicated public consultations are organised on the key methodological innovations triggered by the roadmap, especially those relating to (i) the development of an integrated cross-sector infrastructure gaps assessment and (ii) the evolution towards a more integrated cross-sector cost-benefit analysis process. Consultations should take place sufficiently early to allow stakeholders to meaningfully influence methodological design choices, rather than merely comment on finalised proposals.

54 In this context, to enhance transparency and track measurable progress, ENTSO-E and ENTSOG, with the support of the European Commission, ACER, and stakeholders, should define clear, measurable targets for each TYNDP edition. Regular status reports should be published to monitor achievements and guide further improvements.

4. Conclusions

55 ACER's assessment of the Integrated Model report finds that, despite some progress made, the level of cross-sector consistency and integration in EU infrastructure planning suggested by the report is limited and, to a certain extent, insufficiently detailed to assess its future application and implementation.

56 While today's consistency in TYNDPs is mostly achieved through the joint scenarios development process, cross-sector consistency in terms of input and methodological approaches should already be standard practice in today's infrastructure gaps identification and project-specific CBA exercises, reflecting a non-negotiable minimum for any comparable assessment across sectors.

57 The roadmap on future developments is welcomed, but the proposed actions remain open-ended, and the envisaged sectoral integration should be more ambitious. In this respect, the Integrated Model report should promote and facilitate the maximum level of integration that can be reasonably implemented.

58 The involvement of stakeholders in the preparation of the draft Integrated Model report only partially meets ACER's expectations, as it falls short of the requirements outlined in Articles 11(10) and 11(2) of the TEN-E Regulation. The draft Integrated Model report and the accompanying roadmap should have undergone an extensive public consultation process in full prior to their submission to the European Commission and ACER.

59 Before the formal submission to the European Commission for its approval, ACER recommends that:

- The Integrated Model report should be amended to include a minimum set of requirements for cross-sector consistency beyond the joint scenarios development process, both in terms of input and methodological aspects. These requirements should be applied at the latest to TYNDP 2028.
- The roadmap on future developments should also be updated, with the pilot on cross-sector needs assessment and on the harmonised project-specific CBA to be carried out within the TYNDP 2028 framework.
- A proper consultation should be carried out on the amended draft of the Integrated Model report, including the roadmap. In addition, ACER recommends a continuous process of early and meaningful public consultation in the further development of the innovations described in the roadmap.

This Opinion is addressed to ENTSO-E and ENTSOG.

Done at Ljubljana, on 28 January 2026.

— SIGNED —

V. ZULEGER, *ACER Director ad interim*