

ENTSO-E RESPONSE TO ACER'S CONSULTATION ON ECONOMIC INPUT DATA FOR EUROPEAN ELECTRICITY SYSTEM MODELLING

PC_2026_E_04

10 April 2026, Brussels

Summary

ENTSO-E appreciates ACER's initiative to consolidate economic input data for various European electricity system studies. ENTSO-E has noted in the past that national Cost of New Entry (CONE) datasets have shown considerable divergences between countries. Therefore, ENTSO-E considers a consolidation as an effort to improve data robustness. ENTSO-E thanks ACER for extending the deadline of the consultation upon our request. This has allowed to consolidate the assessment.

This response includes ENTSO-E's evaluation of the consulted data from a pan European perspective and with focus on the methodology and reference sources of the study for computing the consulted data. Complementary to this analysis, some TSOs have performed their own review and submitted responses to ACER through the consultation platform. Moreover, we have also received country comments, which are annexed to this document. We trust that ACER will consider those comments as well.

Generally, the increased level of transparency on the methodology and especially the usage of shared references are appreciated by ENTSO-E. Though we acknowledge the efforts to conclude on economic data for the electricity system modelling from a better structured and methodologically aligned perspective, several concerns remain, that are further elaborated in the document below:

- Mixing various pan-European and national references
- Restrictive expansion constraints
- Extending data for more battery technologies
- DSR expansion cost
- Transparency data and methodology

Concern 1: Mixing various pan-European and national references

Mixing pan-European and national references for some data raises concerns regarding the consistency, coherence and comparability of the resulting dataset. While national validation of the coherence of the used references could partly address this concern, the key issues are that different sources are used, and that the methodology does not transparently show the intermediate steps between the various source values and the final consulted country-specific value.

The usage of different national references may introduce spatial inconsistencies. Furthermore, not cautiously addressing impact of national references being produced in different years and based on diverging assumptions are of concern. While acknowledging that a certain discrepancy may remain for national specificities, ENTSO-E would like to stress the need for improving coherence when using

most “up-to-date” country data as input by ensuring methodology consistency. For example, Variable Operations and Maintenance cost (VOM) is varying significantly between countries. There would be a need of explanations as to why e.g. VOM for CCGT in Latvia is more expensive than in Germany. Methodological coherence requires the definition of a common set of values for the modelling to avoid artificial biases due to different country-specific data.

ENTSO-E acknowledges that an approach from multiple perspectives was used between IEA benchmark values, macroeconomic information, historical project data and interviews with associations and industry to avoid over-reliance on any single source. However, this does not remove the need for greater transparency on how these perspectives have been consolidated in the proposed country-specific values.

Concern 2: Restrictive expansion constraints

We consider a limitation of expansion potential per country should be applied **in an economic viability assessment** with caution only since it constrains future market-driven evolution exogenously. Instead, the EVA should primarily conclude endogenously on the future capacity evolution. Limitations applied to the model should only stem from technical limitations (e.g. lack of hardware / human resources to build new units) or policy restrictions. Generally, the reasoning behind the proposed expansion constraints/potentials should be transparently explained country by country.

In addition, it is not clear against which reference system these expansion constraints are applied to (e.g. current system, expected 2030 system, national plans or other assumptions). Without this information it is not possible to model these constraints adequately.

We understand that, at least in some cases, national policy considerations may also have influenced the proposed expansion constraints/potentials. Specifically, the presence or absence of a capacity market in a Member State can influence significantly the expansion potential in this country. If such policy-related considerations are reflected in the dataset, this should be stated transparently. It should be clear whether the proposed values reflect technical limitations, expected demand growth, replacement of retiring capacity, national policy choices or other assumptions.

Related to batteries we understand that expansion potentials are derived from future RES penetration e. g. potential in Germany exceeds potential in France significantly. However, this should be an outcome of the economic viability assessment. Higher RES penetration leads to more price volatility and thus more battery investment. Expansion potential for battery investment should also consider any available information from connection requests and future plans known to TSO from battery promoters in each country.

Many of the methodological explanations on how the potentials have been assessed point towards a possible target or system need, more than to a real potential of projects that could be delivered under the assumed costs and construction periods. This is important for the representativity of the results, which is based on the coherency of all the assumptions.

Concern 3: Extending data for more battery technologies

ENTSO-E would welcome the fact that economic data could be prepared for more than a single battery expansion candidate. Though ENTSO-E has also used a single expansion candidate in the EVA, that was primarily owed to computational complexity of the investment modelling approach. However, in 2026 ENTSO-E is confident to mitigate this issue with introduction of the revenue-based, iterative EVA.

Concern 4: DSR expansion cost

DSR and Hydrogen-based power generation are not a reference technology (cf. Art. 10(4) of the CONE methodology), given that no “reliable and generic cost information is available”. Therefore, it is very complicated to identify standard values for costs and expansion potential.

DSR expansion costs are significantly higher than in the majority of published VOLL CONE studies. CAPEX for industrial DSRs accounts for ~25% of the cost of building a new OCGT power plant. This seems unreasonably high and should be reduced. Existing national CONE studies may serve as a reference, especially considering that DSR technology is very country specific.

Concern 5: Transparency data and methodology

As a general comment, the platform that has been used for the consultation makes it difficult to access all the data in a simple and convenient manner. Stakeholders need to manually select the country and the technologies and visualize the relevant data. Some kind of summary file available to download all the data and the direct source from where the data is extracted would have helped transparency of all the data and encouraged the participation of a wider range of stakeholders, thus enriching the feedback received and reinforcing the purpose of the consultation.

The “Methodological overview” document is a good summary of the main considerations and particularities for the evaluation of the economic parameters for each technology. However, assessing the more detailed methodological insights file some questions arise regarding some lack of explanations on methodological decisions. For example:

Elevated battery WACC

ENTSO-E understands that the **WACC** applied to **batteries** is increased compared to other technologies to account for additional risks, including lower technology maturity and stronger dependence on raw material imports or other elements. In addition, the WACC should not be considered as an agnostic parameter and could differ depending on the presence or absence of long term capacity mechanisms.

It can be understood that hurdle premiums are not included in the WACC, while battery-specific supply chain and strong dependence on imports may nevertheless have influenced the WACC. It

ENTSO-E Response to ACER's consultation PC_2026_E_04

should be clarified if supply chain-related risks have been reflected in the WACC and, if so, on what methodological basis.

Scaling factor for CAPEX

A **scaling factor for CAPEX** (25%) is introduced to account for cost increases until 2030. It looks like scaling factor shall reflect an assumed annual increase of around 5%, leading cumulatively to 25% by 2030 which may be linked to recent cost developments observed in the industry, including supply constraints from manufacturers and increasing competition for components. ENTSO-E would welcome ACER to provide background information on how these factors were derived and which data were used to calculate them.

For full transparency and comprehension, the detailed excel file should not only contain the methodological approach but also the specific calculations and formulas used for each technology and Member State, step by step. In this file there are also references to other deliverables that do not appear to be available in the consultation.

ENTSO-E has read and acknowledges the clause on Confidentiality¹ provided in the consultation process and hereby certifies that none of the data provided herewith is to be treated as confidential.

¹ From ACER Public Consultation Page: *“Following this consultation, ACER will make public: the number of responses received; company names, unless they should be considered as confidential; all non-confidential responses; and ACER's evaluation of responses. In the evaluation, ACER may link responses to specific respondents or groups of respondents. You may request that the name of your company or any information provided in your response is treated as confidential. To this aim, you need to explicitly indicate whether your response contains confidential information.”*

Annex 1 – Country Comments

Belgium

- Notice that the BE administration emphasizes (as mentioned in the Call for Evidence of ERAA2025 and ERAA2026) that the Belgian data in ERAA must be coherent with the data used in the relevant national adequacy studies. The information submitted to ERAA for BE is based on the latest NRAA and thus presented to the Adequacy Working Group (BE stakeholder group) which includes BE market parties and relevant stakeholders. The assumptions are validated via public consultation prior submission to ERAA.
- It should be clarified to which EURyear the ACER costs refer to. ACER data seems to refer to EUR2030. In any case, the effect of inflation “ i ” $\sim (1+i)^{(\text{yrs})}$ needs to be considered properly on all these costs when applied to a 10 year study.
- Economic Viability in Belgium typically considers units with Economic Lifetime < 25 yrs and ≥ 25 yrs so only one value of Economic Lifetime is not enough to properly consider all economic decisions relevant for Belgium. In this respect, eg there is no information – costs about LifeTime extension options in ACER's proposal, just of New Entry. This is not enough level granularity to properly consider all economic decisions relevant for Belgium.
- A hurdle premium will be still needed, since Hurdle Rate = WACC + Hurdle Premium. Also notice the importance of distinguishing between nominal reference WACC for all technologies and real WACC per technology/country.

Data is provided for different investment candidate sizes in BE national studies, whereas only for a concrete MW size in ACER data. A range of values (Low - Medium – High) is also available within BE national studies.

- Notice that there is no restriction or maximum potential defined a priori for investments in thermal units in BE when performing an EVA in ERAA and/or NRAA.
- Finally H2 CCGT & OCGT are not yet mature technologies, so this should be taken into account more explicitly in ACER figures.
- The Batteries assumptions for BE in ERAA and NRAA are based on detailed information of all connection request known to ELIA from battery promoters in Belgium. This information is presented to the Adequacy Working Group (BE stakeholder group) which includes all BE market parties and relevant stakeholders. The assumptions regarding potential are validated in that Working Group & via public consultation as well (see Fig 3-58 of latest BE NRAA). Notice that in BE NRAA, information is provided for investment candidates corresponding to 1h, 2h, 4h Batteries, whereas ACER only provides data for 4h Large Scale Batteries . Please notice that the potentials defined in BE NRAA and submitted to ERAA follow a rather detailed

ENTSO-E Response to ACER's consultation PC_2026_E_04

methodology considering: i) Batteries in 'realization'; ii) Batteries in 'connection studies'; iii) Batteries in 'feasibility studies'; iv) 'Extra additional' potential.

- For DSR assumptions, these are updated every year by an independent consultant (N-SIDE) and are presented to the Adequacy Working Group (BE stakeholder group) which includes all BE market parties and relevant stakeholders. The assumptions are validated via public consultation (see also Fig 3-11 of latest BE NRAA). Furthermore, there is no clear relationship between the DSR categories used in BE NRAA (which are divided by FOM value following information from BE consultations) and the categories presented by ACER (DSR Commercial, DSR Residential and DSR Industrial DSR1/2/3).
- We strongly advice keeping the BE NRAA figures as main input since those are obtained after interviews with market parties and industries and validated via national consultations, so representing, to ELIA's knowledge, the most up-to-date data for BE. .

Spain

Considering the impact of these assumptions on the results of the adequacy assessments, Red Eléctrica would like to provide the following feedback to ACER's Public consultation on economic input data for European electricity system modelling. According to the information, the aim of this consultation is to ensure that the inputs used in European-level modelling are robust, transparent and properly grounded in national market realities. Stakeholders are therefore encouraged to review the data per their relevant Member State by considering whether the figures reflect current market conditions and technological developments; and suggesting alternative values supported by evidence, if necessary. In this context, and although the authority responsible for determining these values is the national regulator, we consider it relevant to highlight some elements due to their impact on the studies in which we are involved.

Red Eléctrica cited as source to provide investment cost estimates

Red Eléctrica is cited as source to provide estimates for costs for many technologies. Can you provide more details on these sources?

Reference technologies

For Spain, only batteries and DSR are considered as reference technologies in the consulted data. However, this is an important misalignment with the CONE study approved by the Spanish regulator CNMC in October 2024², where:

- Explicit text from the national CONE study reflects the following: "DSR is not considered a reference technology as this technology is still at an early stage of development in the Spanish market and shows limited participation in the provision of system services, except for the participation of some installations in specific balancing services (SRAD). Therefore, it may be considered a technology for which there are no cost data records that can be

² <https://www.cnmc.es/sites/default/files/5650953.pdf>

ENTSO-E Response to ACER's consultation PC_2026_E_04

regarded as generic and representative of the response from the different segments of Spanish demand (residential, commercial, small industry, and large industry). Moreover, the validity for the Spanish system of cost figures observed in other electricity systems is also unknown. The exclusion of DSR as a standard technology was agreed by consensus among stakeholders at the working meeting held on 30 September 2024. Nevertheless, stakeholders argued that demand response is expected to grow in the coming years and, therefore, its treatment will need to be reviewed in future updates of the CONE determination.” The working meeting held on 30 September 2024 included demand and flexibility associations. There are no recent changes that suggest an update.

- Investment in new renewable (solar PV, solar thermal, wind onshore, wind offshore) and storage (batteries, pumped hydro) sources are considered as reference technology by the national CONE study. However, the consulted data only included batteries, with what appear to be inconsistent capacity figures for 2030 (18 GW) compared to 2035 (0 GW).
- Prolongation of existing CCGTs is considered a reference technology by the national CONE study, but this option is not present in the consulted data. This is particularly relevant for the Spanish Peninsular Power System, given that this technology sets the reliability standard as it shows the lowest price and sufficient potential.

DSR parameters

Regarding DSR, which is not considered a reference technology in the national CONE study (as previously explained) the consulted values are highly misaligned with the current expectations of the Spanish system and considering them in any study could lead to non-representative results.

In the last years, the only experience (and current expectations) in DSR in the Spanish system is through the Automatic Demand Reduction Service, a specific balancing product currently in service that is used to compensate DSR in order to be available to reduce their load if there is a lack of manual frequency restoration reserve. In this context:

- DSR industrial bands: the potential is not in the order of magnitude of the parameters derived from the SRAD auctions and additionally, the CAPEX and FOM values underestimate on a ten-fold scale the actual market results of the latest auctions of the service. In the latest auction³, the providers (mostly industrial consumers) requested 65 €/MW per hour of availability. As the number of hours they are required to be available in the semester is 2279 h, the actual annual compensation for their availability is 296270 €/MW per year (assuming same number of hours and price for the second semester auction). Therefore, the consulted FOM value of 8210 €/MW per year is totally unrealistic (36 times lower). On the other hand, the providers of this service normally face neglectable investment costs in order to provide the service. We therefore suggest that only one DSR industrial band is considered, with data based on the latest SRAD auction: 1725 MW potential, CAPEX 0, FOM 296270 €/MW, maximum 2 h activation, activation price 700 €/MWh (based on estimated energy compensation if activation happens, related to the mFRR price).

³ [Gestión de la demanda | ESIOs electricidad · datos · transparencia](https://www.esios.ree.es/es/gestion-de-la-demanda?date=25-03-2026#) <https://www.esios.ree.es/es/gestion-de-la-demanda?date=25-03-2026#>

ENTSO-E Response to ACER's consultation PC_2026_E_04

- DSR commercial and residential bands: there is no data source that allows to provide an estimate of the potential and CAPEX-FOM for the Spanish system. However, the activation price that is consulted (above 4000 €/MWh) is totally out of any current expectation of market actors for the Spanish system. This means that considering these expansion candidates in the model would be a merely theoretical exercise, not grounded in national market realities, and would risk undermining the representativity of the results, as those investments would not happen in reality and the adequacy level expected by the model would be underestimated, putting security of supply at risk. Consequently, we suggest that no commercial and residential DSR is considered.

We hope this feedback is considered useful and is taken into account. Please do not hesitate to reach out if you would need any kind of clarification.

Germany

Feedback from Amprion:

The following paragraph complements the detailed feedback on different technologies and cost assumptions of Amprion already submitted via the official consultation page. It could not be added in the standardized consultation form.

Amprion appreciates the attempt of ACER to standardize the methodology used to derive country specific cost assumptions. However, it should be noted that even though a single source is used (IEA), it is complemented with national studies which have diverging underlying assumptions. For the purpose of a European economic viability assessment, Amprion still supports the use of harmonized average cost assumptions. Otherwise, due to the perfect nature of modelling tools even marginal cost differences between countries can lead to significant shifts in investment. Example: H2 CCGT investment in FR is 21 €/kw cheaper in France than in Germany (1392 vs 1413 €/kw). This would move substantial investment which occurred in Germany in previous ERAA cycles to France (to the extent interconnection restrictions allow). There is a high risk that minor differences in cost estimates, due to different assumptions in national studies, lead to major investment shifts in Europe.

Feedback from TransnetBW:

The assumption for construction time for CCGT is the same as for OCGT, only differing by the fuel type: 3 years for gas, 4 years for hydrogen. CCGT is more complex as OCGT it could be assumed that CCGT units take longer to build than OCGT units.

ENTSO-E Response to ACER's consultation PC_2026_E_04

Portugal

Portugal has set the Reliability Standard value on 13 of February 2026, based on the study “*Determination of Reliability Standard Indicator for Portugal*”⁴. The calculation of the Portuguese Reliability Standard was based on the methodology set out in Article 23(6) of the Regulation, using the Value of Lost Load (VOLL) and Cost of New Entry (CONE), complemented by Cost of Renewal or Prolongation (CORP) approach, in line with the minimum requirements of Article 25(3). We strongly advise keeping the Portuguese values coming from this study as main input for ERAA 2026 since it represents the most up-to-date data for Portugal.

In Portugal, the construction of new gas-fired sources is not considered in the National Energy and Climate Plan (NECP) according to the current views of Portuguese government. The goal regarding thermal units in the NECP is to decommission all the existing CCGT until 2040. In this way the potential identified for Portugal for new CCGT and OCGT does not respect this premise and therefore should not be considered. Hydrogen-based power generation (CCGT and OCGT) cannot be considered a sufficiently mature and standardized technology to allow the definition of unitary costs. This applies to the Portuguese system where this technology is not considered a viable option in the Portuguese “*Determination of Reliability Standard Indicator for Portugal*”.

Regarding batteries data, one notices that the ACER study does not present disaggregated technical-economic parameters for both $e/p = 2$ hours and $e/p = 4$ hours. Regarding ACER batteries values for Portugal, it showed that is more aligned with Portuguese data for $e/p = 2$ hours.

Demand Side Response (DSR) is a customer-specific issue and therefore related to the dynamics of the consumers. Different consumers will have a different sensitivity to prices and predisposition to suspend their consumption. In the Portuguese study “*Determination of Reliability Standard Indicator for Portugal*” it was not possible to identify standard values for different users. The overall volume potential of DSR in Portugal is unclear, and the study did not perform a detailed bottom-up analysis of how much capacity could be made available. In the last years, the only experience (and current expectations) in DSR in the Portuguese system is through the 400 MW of DSR participating in the Portuguese ancillary services, a specific balancing product currently in service that is used to compensate DSR in order to be available to reduce their load if there is a lack of manual frequency restoration reserve. In this way, the 700 MW of potential identified for DSR in Portugal in the study “*Determination of Reliability Standard Indicator for Portugal*” should be considered as main input for ERAA 2026.

⁴ [Determinação da Norma de Fiabilidade para Portugal Continental](#)

ENTSO-E Response to ACER's consultation PC_2026_E_04

Italy

Tecnologia	Voto	Commento
Gas CCGT	Propose correction: (Potential, WACC) Don't know (CAPEX, FOM, VOM)	Both the expansion potential and the WACC are dependent on the contractual arrangements (merchant vs long-term contract). When a Capacity Market is not present, the expansion potential is close to zero, while WACC would be significantly higher, because the CoE, CoD and leverage depend on the project bankability and the predictability of future cash flows. Based on exchanges with investors we propose a WACC of 10-12% + hurdle premium (that would depend on expected running hours) for merchant projects. As regards the expansion potential, we disagree that it could double from 2030 to 2035 and suggest keeping a constant expansion potential. Without a Capacity Market the expansion value should not be higher than 500 MW. Finally, the reported sources are very generic, outdated and based on desktop literature, with no apparent link between the sources and reported values. For this reason, we can neither confirm nor correct the cost values.
Gas OCGT	Propose correction (Potential, WACC) Don't know (CAPEX, FOM, VOM)	Both the expansion potential and the WACC are dependent on the contractual arrangements (merchant vs long-term contract). When a Capacity Market is not present, the expansion potential is close to zero, while WACC would be significantly higher, because the CoE, CoD and leverage depend on the project bankability and the predictability of future cash flows. Based on exchanges with investors we propose a WACC of 10-12% + hurdle premium (that would depend on expected running hours) for merchant projects. As regards the expansion potential, we disagree that it could double from 2030 to 2035 and suggest keeping a constant expansion potential. Without a Capacity Market the expansion value should not be higher than 500 MW. Finally, the reported sources are very generic, outdated and based on desktop literature, with no apparent link between the sources and reported values. For this reason, we can neither confirm nor correct the cost values. Moreover, ARERA determination 199/2024/R/eel considers a CAPEX value for Gas OCGT of around 600 k€/MW (as upper limit), quite different from the ACER proposal.
H2 CCGT	Propose correction	Hydrogen-based power generation cannot be considered a sufficiently mature and standardised technology to allow the definition of unitary costs. It is not a reference technology (cf. Art. 10(4) of the CONE methodology), given that no “reliable and generic cost information is available”. This is even more true for the Italian system where this technology is considered a viable option only in the very long term (way further ERAA time horizon). At the very least, Terna suggest setting the expansion potential to zero in Italy, making all the other parameters irrelevant.

ENTSO-E Response to ACER's consultation PC_2026_E_04

H2 OCGT	Propose correction	Hydrogen-based power generation cannot be considered a sufficiently mature and standardised technology to allow the definition of unitary costs. It is not a reference technology (cf. Art. 10(4) of the CONE methodology), given that no “reliable and generic cost information is available”. This is even more true for the Italian system where this technology is considered a viable option only in the very long term (way further ERAA time horizon). At the very least, Terna suggests setting the expansion potential to zero in Italy, making all the other parameters irrelevant.
Batteries e/p=4	Propose correction	The reported sources are very generic, outdated and based on desktop literature. Moreover, there is no apparent link between the sources and reported values. Based on our work carried out for the storage auction(*) we propose the following correction: Capex = 800 k€/MW FOM = 19.3 k€/MW/year (taking into account uncertainties regarding material costs, geopolitical risks, commodity prices and exchange rates which can heavily influence CAPEX) For WACC, we once again point out that a difference needs to be made between merchant investments and those covered by LT contracts. Merchant investments would have a significantly higher WACC than proposed by ACER (10-12% + hurdle premium that would depend on expected running hours). The same logic applies to the expansion potential. The reported value is not realistic for a merchant case (reference for the EVA of ERAA). Without a dedicated mechanism (Capacity Market, MACSE) the expansion value should not be higher than 500 MW. (*) LINK: https://download.terna.it/terna/Study_on_reference_technologies_for_electricity_storage_January_2025_8de0262c6cf17ee.pdf
DSR	Propose correction	DSR is not a reference technology (cf. Art. 10(4) of the CONE methodology), given that no “reliable and generic cost information is available”. Demand Side Response is customer-specific and therefore related to the dynamics of the load. Different users (and countries) will have a different sensibility to prices and availability to suspend their consumption. Therefore, it is not possible to identify standard values for its costs and expansion potential. Terna suggests setting the expansion potential to zero in Italy, making all the other parameters irrelevant.

ENTSO-E Response to ACER's consultation PC_2026_E_04

Czech Republic

- ČEPS does not comment on the overall level of capex costs across the EU.
- However, it points out that compared to neighbouring countries in the interconnected region (e.g., Germany, Austria) and countries with a significant share of gas-fired generation (e.g., Belgium, the Netherlands, Denmark), the capex costs are set roughly 5–10% lower.
- Such underestimation creates room for unrealistic investment ambitions under the conditions of the Czech market.
- In our region, the construction of gas-fired sources is associated with significant investment risks, and without additional support mechanisms, according to the current views of Czech investors, it cannot be considered realistically feasible.
- We also note that we consider the WACC parameter of 5.6% to be disproportionately low compared with values commonly used for the evaluation of regulated assets.
- In other countries, we have observed the following WACC values: AT 5.1%, BE 5.8%, DK 4.6%, FI 5%, DE 4.9%. Overall, these values are generally low or lower than ours. Methodologically, these values are presented as the minimum required rate of return, so it will be useful to compare this with the NRA's approach to setting regulated parameters, including the consideration of investor risk.