ENTSO-E responses to consultation feedback on the 4th CBA Guideline

The 4th ENTSO-E Guideline for Cost Benefit Analysis of Grid Development Projects was subject for public consultation 15 December 2022 – 15 February 2023. Eight stakeholders provided feedback in the consultation, where three of them chose to remain anonymous and not to publish their feedback publicly. The feedback from the remaining five stakeholders, together with ENTSO-E's responses can be found below.

1. Would you consider the proposed methodology (or part of it) as a useful tool for your assessment? Does it meet your needs?

EDF (Électricité de France)
Copenhagen School of Energy Infrastructure
The proposed CBA does not include a suitable indicator to assess criteria on market integration, (Art. 4, 3. a) (i)) "including through lifting the isolation of at least one Member State and reducing energy infrastructure bottlenecks; competition and system flexibility" Taking inspiration from ENTSO-G this could be measured as difference in dominance (largest market share in x consecutive time steps) of a single source (incl. imports) or technology, incl. through access to storage per concerned country, or as sustained (in x consecutive time steps), the significant price difference between two neighbouring countries.
Thank you for your input. We are always trying to improve the methodologies and will review ENTSOG's CBA methodology on this. We believe that market integration is already partly covered by the SEW indicator which is a direct result of interconnecting markets (when based on market simulations). The aim of the CBA Guideline is to deliver a common approach for assessing pre-defined projects submitted to the respective study (mainly the TYDNP). We believe that project promoters assesses possible competition before submitting projects to the TYNDP. Flexibility is a complex issue to be simulated and during the last years we have made constant progress, e.g. by developing the B7.1 indicator.
Ørsted
The hybrid asset assessment methodology section is a very welcome addition. However, crucial aspects thereof still need further refinement and clarification. Also, Anticipatory Investments (hereby understood as investment in offshore transmission infrastructure that not only supports the initial needs, but also later connection needs of a specific or prospective offshore development or developments) are emerging as a crucial element needed in order to deliver the net-zero targets on time and at the scale required. (See e.g. position of Ofgem: https://www.ofgem.gov.uk/publications/decision-anticipatory-investment-and-

implementation-policy-changes). However, presently certain facets of the CBA 4.0 would be prohibitive / strongly disadvantageous to offering a fair evaluation for investments that would qualify as Anticipatory Investments (e.g. restrictions on clustering investments across more than one stage of maturity apart; uniform 25-year evaluation period). Certainly, it would not be fair to expect explicit methodology for the assessment of Anticipatory Investments at this stage; however, CBA 4.0 could future-proof its applicability and relevance by taking the first steps in identifying the main hurdles, and if possible, removing the most pressing obstacles.
Thank you for your feedback. Further details on the hybrid project assessment will be included in the TYNDP 2024 Implementation Guideline. If you have specific aspects in mind that needs further refinement or clarification, please feel free to reach out to us with more details. The clustering criteria set out in the CBA 4 Guideline are set to avoid excessive clustering of investments, since investments only shall be clustered if one investment contributes to the realisation of the full potential of another (main) investment. The respective clustering rule was included to define "realistic" projects. Further, not allowing to cluster investments further than one stage apart does not mean that the respective investment cannot be assessed. It is of course possible to create a new project including the respective investment. The 25 years need to be seen as the maximum assessment period (not the lifetime) - of course where the lifetime of a project is below 25 year, this needs to be considered as well.
currENT Europe
Overall, currENT commends ENTSO-E on the good metrics that have been developed for the TYNDP CBA Guidelines 4.0, while acknowledging the complexities of developing a methodology that takes all factors into account. However, there are still two main areas in which this methodology does not meet the needs of currENT members. First of all, the benefits of solutions that can be delivered in the next 1-2 years. Using a scenario 5 years in the future as a basis for a CBA is not adequate for fast-acting solutions. This is because it does not take into consideration the benefits that can be delivered before the given year of the scenario. In all likelihood congestion will be higher in earlier years, while awaiting traditional solutions to be developed, and the value provided in these earlier years much greater. At the same time, given past experience (e.g. ACERs appraisal report on PCI progress and development) the scenarios are likely to be overly optimistic about the completion of projects by the given year, and do not sufficiently factor in the likelihood of delays. Given this uncertainty, the methodology needs to find a way to compensate for the inherent lack of information when dealing with future scenarios. For example, if there is no information on the early years 0-5, this will negatively distort the NPV overall. Secondly, the methodology does not fully take into consideration the challenges of a fully decarbonised European economy in 2050, and therefore does not give enough weight to innovative grid technologies that can address these challenges. At the end of January 2023, Member States have submitted their offshore development plans for each sea basin. From these plans, it logically follows that continuing with only existing technologies would result in an excessive amount of landing points by 2040, and new technologies will be needed. At the same time, it will be a challenge to access all the raw materials for this kind of grid expansion. This

scarcity of raw materials needs to be factored into the CBA methodology and their impact on lead-time for development[s]. For example, meeting the capacity needs with existing cable/line solutions will require a multiplicity of circuits and materials that is likely to be unsustainable, socially acceptable or that be timely delivered.

currENT recommends that the CBA should have overall more flexibility to deal with new technologies, so they can be fairly assessed against conventional technologies.

The CBA Guideline mainly applies to the Ten-Year Network Development plan which focuses on the mid-term and long-term horizons and not the short-term horizon. Such short-term solutions in this framework would need to be included in the scenarios for the assessment - which is not part of the CBA Guideline, which focuses on the assessment methodologies and definition of indicators. Scenarios are developed within a different process in a collaboration between ENTSOG and ENTSO-E, following the ACER guidelines and input/comments from the EC.

Regarding your comment on offshore, please note that what Member States have delivered in January are only offshore generation targets, not grid development plans. By January 2024 ENTSO-E will release Offshore Network Development Plans per sea basins which will provide a high-level view on the potential development of the offshore transmission system integrating the RES potential in each European basin. They will not refer to specific infrastructure technologies, projects, or landing points. To stay informed on our work on offshore, we encourage you to visit this page https://tyndp.entsoe.eu/offshore

WindEurope

We welcome the introduction of the "Methodology for the assessment of Hybrid Projects" as part of the CBA 4.0 in line with the EU Regulation 2022/869 (TEN-E Regulation).

Hybrid projects have a key role in a future meshed offshore grid and an integrated European energy system. Their dual functionality, combining generation and transmission, brings a unique set of costs and benefits. Therefore, a robust methodology is needed to assess such projects and facilitate investment decisions.

In this regard, we consider the introduction of the methodology for the assessment of hybrid projects in the CBA 4.0 as an important step in this direction. But there is also need for further clarifications on how the proposed methodology captures the costs and benefits related to the dual functionality of the asset.

Thank you for this positive feedback. More details regarding the methodology will be specified in the TYNDP 2024 Implementation Guideline that will be released later this year.

2. In your view, is CBA 4 an improvement over previous methodologies and why (not) ?

EDF (Électricité de France)

EDF welcomes this ENTSO-E consultation on its Cost-Benefit Analysis (CBA) methodology 4.0 for assessing infrastructure projects. EDF would like to recall that the CBA is a tool to objectively assess a project from an economical point of view on the basis of all the potential costs and benefits that can be monetized. The CBA delivers an assessment of the net social welfare of a

project.

The aim of the methodology should be to ensure that the assessments of infrastructure projects within Europe are carried out in a consistent way on the basis of shared and supported principles and scenarios as well as keeping in mind the economic rationale. EDF would also like to recall that CBA and multi-criteria assessments are different by nature. From a theoretical point of view, they are different in terms of objective pursued and different in terms of methodology to perform the analysis. The ENTSO-E methodology relates to a multi-criteria assessment.

EDF notes that the ENTSO-E methodology 4.0 keeps on mixing both, while trying to catch and integrate further indicators leading to less transparency, complex assessments, risks of double-counting and sometimes biases. For example, (i) the non-mature indicators : first, some are more relevant than others ; second, they are all very difficult to monetize ; third, they are presented at the same level of importance as already impartially objectified indicators (as RES fuel savings or Emission costs savings – see p. 43) which is very questionable, as it is very hard to know how these non-mature indicators can be integrated into the final CBA or multi-criteria assessments including in parallel monetized major criteria ; and it could also be noted that several proposed evaluations of the new indicators do not seem to be based on consensus approaches (ii) the “European Targets” indicators, like the interconnection target that is implicitly already taken into account in the market integration and security of supply existing indicators bear the risk of double-counting.

EDF still misses the generation CAPEX, still not addressed by ENTSO-E in this new version (not captured by the VoLL calculation). We stand to the point that not taking into account potential benefits resulting from a reduction of generation CAPEX makes the analysis incomplete and much less relevant.

So far, the information provided does not enable to assess if these proposals provide real improvements.

We thank you for sharing your general view on the CBA framework with which we mainly agree. However, our aim is to address the most complete picture of the project's benefits. Therefore the inclusion of monetised and non-monetised indicators is required.

We always carefully treat the risk of double-counting and we believe that in CBA 4 no indicators are addressing the same benefits.

On i) As within the CBA 3 we re-included the clear indication whether an indicator is non-mature or not.

On ii) the European Targets are introduced based on requirements from the Regulation (EC) 2022/869 and are referred to as "European Targets" and not "benefits" exactly to avoid any double-counting. They are to be seen as specific information contributing to the defined targets.

The aim of the ENTSO-E CBA Guideline is to assess distinct projects to give a transparent and consistent way and not to assess potential future energy systems. We believe that the projects influence on e.g. generation must be assessed by the promoters before applying the project to the TYNDP.

Copenhagen School of Energy Infrastructure
This does not fit to any of your questions: Regarding the assumptions postulated in section 3.2.5 we would like to comment that if the assessment period is 25 years max and the residual value at the end of that is to be zero, this should inadvertently mean that the costs are overestimated significantly for many projects by cramming all cost into the first 25 years of an asset's lifetime. If the benefits on the other hand are calculated realistically, this means that especially for projects with a long lifetime the balance as assessed by ENTSO-E's CBA is off.
The definition of the assessment period was the result of discussions with both the EC and ACER. It needs to be noted that the assessment period is not equal to the lifetime of a project. However, we believe that a project most probably needs to be refinanced even before these 25 years. But we agree that room for further discussions on this topic after the NPV calculation needs to be given.
Ørsted
Dedicated approach to assessing hybrid projects is a very value-adding development.
We thank you for this positive feedback.
currENT Europe
Yes, this version is a step in the right direction, as it includes many of the requirements from the TEN-E regulation, Annex 5. However, some of the fundamental issues (as described above) with previous versions have not been addressed.
We thank you for this positive feedback.
WindEurope

3. Is the CBA 4.0 methodology easy to understand and apply? If possible, mention which element and/or section/annex could be improved.

EDF (Électricité de France)
The CBA methodology 4.0 is not that easy to understand and to apply. A focus at the beginning of the document (or in an explanatory document) would be appreciated on the latest evolutions vs the methodology 3.0. This has been addressed during the webinar but should be integrated in the document itself. Draft Implementation Guidelines (where more information is to be provided) should ideally be published alongside the draft methodology as, the Implementation guidelines for TYNDP 2024 will only be published in 2024, alongside the TYNDP results. EDF rather considers that confusion is being introduced with the methodology 4.0 as the present "CBA + multi criteria analysis" approach seems to have evolved further in less transparent

processes. Indeed, one of the main principals of the CBA methodology – the principal of indivisibility of the monetary indicator – was not respected (the economic performance of the project is split in three indicators: B1, B2 and B5). EDF regrets this separation, considering that there is no consensual and transparent reason to weight differentially the different aspects of the project's economic performance. For example, why the monetary benefit resulting from the reduction of grid losses may be differently weighted than the one resulting from more efficient reserves redispatching? EDF acknowledges ENTSO-E's efforts to try and integrate new sub indicators to reflect more detailed aspects in indicators B1 and B2, or to take into account hybrid systems but, based on the information provided, many of these new indicators are non-mature, notably lacking consensual monetization approaches to assess the impacts, which is in turn questioning the real improvements of the proposed methodology. Some of these are even non monetizable by nature, for example the contribution to the stability of the system. Furthermore, it raises the issue of how the results from the non-mature indicators will be treated and compared to results from the more mature ones that can be monetized.
We thank you for your feedback. We will add an overview of the changes from the CBA 3 to CBA 4 within the accompanying documents to be published together with CBA 4. The draft TYNDP 2024 Implementation Guideline will be published in 2023 before the CBA assessment starts, not in 2024 along side with the results. The reason for why the CBA 4 Guideline and the TYNDP 2024 Implementation Guidelines were not published at the same time is due to the fact that ENTSO-E has a strict deadline from the TEN-E regulation to deliver a draft methodology by 24 April 2023, so the process of updating the CBA 3 Guideline had to start much earlier than the TYNDP 2024 cycle could start. The CBA results are not weighted differently. For transparency reasons ENTSO-E is giving the monetary values under different indicators where they apply (SEW, reduction of CO2 and Network losses). This does not mean that the values are weighted differently, and they could be added up to get the total monetary number [M€/year] of the project. There are no new indicators, or sub-indicators, for B1 and B2 in the CBA 4. The CBA 4 does however include non-mature indicators where there is not yet the possibility for ENTSO-E to centrally calculate the benefits, or where there is currently not a mature methodology. Nonetheless, none of these indicators are new compared to the CBA 3, even though some of them have been updated. The CBA 4 Guideline, just as the third, is a combined multi-criteria and cost-benefit analysis assessment, which allows for an evaluation of both qualitative indicators and quantified and monetised indicators. Such approach recognises that, in the context of evaluating power system infrastructure, a fully monetised approach is not practically feasible. Furthermore, many of the benefits and criteria specified in Annex IV and V of the Regulation 2022/869 cannot be economically quantified in an objective manner.

Copenhagen School of Energy Infrastructure
The section on redispatch merits refining: The methodology described in the document leaves too much room for interpretation as to what extent the determination of the congestion-solving dispatch adheres to market-based redispatch including demand-side offers. The requirement to include demand-side options when calculating this benefit should be made more explicit to prevent promoters from overestimating this benefit when cheaper alternatives are not considered. Even if this is not yet standard practice in some member states currently, this will likely change within the timespan of the assessment due to the requirements embedded in European legislation.
The main aim of the CBA guideline is to give the main principles of the methodologies. For the TYNDP process we are preparing specific Implementation Guidelines (which will also run through an extensive consultation) which will give much more detail to the redispatch calculations. If in the future the redispatch calculations are becoming more standard, we might think about adding some more detail to the CBA Guideline itself.
Ørsted
Additional explanation and elaboration of the newly added hybrid project assessment section would be very welcome (further details provided in the respective question below).
Thank you for this feedback. More details on the methodology will be available in our TYNDP 2024 Implementation Guidelines that will be published later this year.
currENT Europe
WindEurope
We suggest that the CBA Guideline should stick to the TEN-E Regulation definitions for consistency purposes. The TEN-E Regulation uses the term "hybrid project" as it is used in the EU strategy on offshore renewable energy i.e. projects that combine offshore generation and transmission assets (See recital 22 and Article 14 paragraph 2). Furthermore, according to the TEN-E Regulation, CBA methodologies shall be drafted for projects falling under the energy infrastructure categories of Annex II (Article 11). In Annex II, category (1)(f) refers to projects "(...) having dual functionality: interconnection and offshore grid connection system from the offshore renewable generation sites to two or more Member States and third countries participating in projects on the Union list (...) ". In the "General definitions" section of the CBA Guideline, a hybrid project is defined as a "project which enables an interconnector function between bidding zones (either onshore or offshore) while simultaneously facilitating a client connection with a certain technology (RES or non-RES; generation or load; AC or DC) ". Then there is a section for the assessment of the hybrid projects (section 6.2) which only refers to offshore hybrid projects (combining offshore generation and interconnecting bidding zones). In sub-section 6.2.2, there is a distinction between hybrid projects

and "hybrid interconnectors", but the methodology outlined refers only to what is called "hybrid interconnector". We would also like to have more clarity regarding how the benefits of RES integration will be measured with the "sanity check". It is stated in sub-section 6.2.3.2 (p.108) that sanity check will be described in the Implementation Guidelines, but since it is mentioned in the methodology, we would like to request that it is written in the CBA as well.
Thank you for your feedback. We decided to use a general definition for hybrid projects not only focusing on offshore RES, as in principle the same concepts can also be applied onshore - and even for non-RES generation. We thank you for pointing to the mentioned abstracts and will have a review on consistency on that. More details regarding the sanity check will be specified in the TYNDP 2024 Implementation Guideline that will be released later this year.

4. The CBA 4 guideline gives the option to assess projects on an energy system-wide scope by introducing the global socio-economic welfare (SEW). This requires multi-energy system models that would integrate the interaction of multiple sectors and enable to run multi-sectorial CBAs. Do you see this as a valuable and reasonable approach to work towards multi-sectorial CBAs for future editions of the TYNDP?

EDF (Électricité de France)
A multisectoral approach obviously results from good intentions (from the broader perspective of sector coupling and sectoral integration) but it would also bring in a lot of complexity in the methodology. It would require a rather streamlined approach among sectors that have sometimes very different characteristics. First a consensual approach would have to be found with many different stakeholders, starting with scenarios. These should at least be opposable.
We believe that the complexity can be managed. Existing models are able to incorporate multiple sectors (hydrogen, heat, etc.) In future we will apply a stepwise approach i.e. incorporating the hydrogen system before we will include other sectors.
Copenhagen School of Energy Infrastructure
Yes. In general, it is the right approach, however, we have two comments on this indicator: o The assumption of inelastic demand as expressed in this section does not seem justified. o The approach of differentiated scenarios discussed on the top of page 52 does not seem feasible within the TYNDP framework where there are likely only 3 scenarios with similar flexibilities.
Thank you for your feedback. We differentiate between inelastic and elastic demands. Flexibilities can be modelled as elastic demands.

Ørsted
Yes
We thank you for this positive feedback.
currENT Europe
Yes
We thank you for this positive feedback.
WindEurope

5. If you answered yes to the previous question, which sector(s) do you think needs to be specifically modelled/integrated and with what priority?

EDF (Électricité de France)
Copenhagen School of Energy Infrastructure
Hydrogen, heat, transport, CO2
Thank you for your feedback. We take note of your suggestions. In particular, the hydrogen sector will be part of the TYNDP.
Ørsted
Highest priority: P2X production (electrolysis), e-fuel refining/synthesis, hydrogen infrastructure, district heating (surplus heat from electrolysers). Secondary priority: P2X product end-use sectors (transport, especially shipping and aviation etc.)
Thank you for your feedback. We take note of your suggestions. We also believe that P2X production is one of the biggest drivers. For this reason, P2X will be part of the TYNDP.
currENT Europe
currENT believes the global socio-economic welfare (SEW) is a step in the right direction. However, many of the impacts are missing from the methodology as it is currently proposed. For example, it only looks at CO2 emissions, and does not include a robust approach for valuing the impact of other emissions such as NOx, SOx, etc. Additionally, when considering CO2, it only looks at the market price of CO2, and not all other

environmental impacts of transporting fossil fuels. Not needing to build another pipeline, for example, would not be counted toward the SEW as it stands now.
Thank you for your feedback. We also capture non-CO2 emissions with the indicator B4. However, a monetisation of the non-CO2 indicator is currently not proposed in this methodology. This is because it is unlikely that future improvements in emission reductions, because of filters or increases in efficiency, will have a comparable effect at lower costs.
WindEurope

6. As an enhanced and alternative approach, cross-sector rents are an option to capture cross-sector impacts. They represent an extension of the standard SEW decomposition and can be regarded as an additional component that describe welfare movements along sectors. They can also be applied in a single sector methodology framework. Do you think this concept can provide a basis to harmonise the CBA methodology with methodologies from other sectors?

EDF (Électricité de France)
I don't know. EDF welcome the reflections on the cross-sector CBA methods. EDF also considers that the cross-sector rents is a major issue of the cross-sector CBA methodology. However, it appears premature to make methodological choices in this field. A more detailed and more argumentative discussion is needed to justify the choice.
Thank you for your feedback. The approach presented in the guideline is general. Further details will be given in the respective implementation guidelines.
Copenhagen School of Energy Infrastructure
No. The methodology is not well explained and leaves a lot of room for interpretation. Also, it will be very difficult due to come up with the required assumptions (regarding accepted prices of the technology in the respective sectors) and to model an actual equilibrium. In any case a global SEW is definitely superior. Specific concerns with the methodology as explained in the Annex are the following: • If marginal costs are not constant (as to be expected and as depicted in Figure 17) then the formula given in footnote 58 for surplus delta is incorrect, this definition of change in consumer surplus also does not align with the following definition of producer surplus. • Documentation of the concept of cross-sectoral rents is behind the paywall of IEEE Xplore (doi: 10.1109/EEM54602.2022.9921010) • Both CBA 4 and the IEEE paper employ the concepts of surplus and welfare in a rather unorthodox and in some respects incorrect manner. The underlying framework of this welfare construction is not in equilibrium. If demand and supply change with cross-sectoral activities, this will affect prices and quantities in the equilibrium quantities. In other words, if there is an additional demand for electricity for P2G with a willingness to pay below current market price (as assumed in the paper) then the electricity price goes up due to scarcity. Correspondingly, if there is an additional supply of H2 below current market price (as assumed in the paper) the price for

H2 should fall. Furthermore, the parameter b which the paper defines as an external parameter should in reality derive from either the electricity or the hydrogen price.
Thank you for your feedback. So far, we have presented a general approach that will be further detailed in the implementation guidelines. Marginal cost here refers to the clearing prices, the change in consumer surplus for an inelastic demand, is then the price difference times the demand in terms of power. For the modelling, we do not use macro-economic top-down models such as CGE. Instead we use bottom-up models that relies on optimization price formation is dealt within an optimization problem. Standard tools such as PLEXOS make use of this technique. Referring to the paper, under an integrated modelling approach b is not any longer required since it is endogenously determined and corresponds to the clearing price for electricity.
Ørsted
Partially No; the simplified approach could be a viable option in the short- to medium- term while an integrated modelling framework combining multiple sectors is being developed. However, in the medium- to long-term perspective, where sectors become increasingly interlinked and interdependent, a modelling framework that is fully capable representing that, would also be needed.
Thank you for your feedback. We also believe that the interlinkage and interdependence of sectors must be modelled. For this reason, we proposed an integrated modelling approach in the guideline.
currENT Europe
I don't know
WindEurope

7. Another option for harmonisation could be to specify indicators that combine sectors in the sense of a combined multi-sector methodology framework. Do you think indicators such as the global socio-economic welfare could provide a basis for a common indicator framework?

EDF (Électricité de France)
As specified previously, EDF considers that a more detailed and more argumentative discussion on this issue is needed to justify the choice.
Thank you for your feedback. Again, we will clarify further details in the implementation guidelines.

Copenhagen School of Energy Infrastructure
Yes
We thank you for this positive feedback.
Ørsted
Yes
We thank you for this positive feedback.
currENT Europe
I don't know
WindEurope

8. The 4th CBA Guideline describes a methodology for the assessment of Hybrid projects (acting as both interconnection and integration of generation) and radial projects. What are your views on the proposed methodology? Is it clearly presented, are there any element, information or guidance missing from the proposed methodology?

EDF (Électricité de France)
This methodology dedicated to hybrid projects is welcomed given the emergence of several projects but a more detailed and more argumentative discussion on this issue and information is needed to progress. Here are some questions : About the CBA Option 1: • The CAPEX scope is unclear, especially the part related to the “potential deltas of the targeted client connection”. • How is the “reduced NTC” assessed? How parameters affecting the NTC are considered (natural variability of wind production, impacts of zero prices, management policy of the wind farm, organization of the 'home market' or 'dedicated bidding zone', etc.)? About the CBA Option 2: • There is a lack of clarity on (2) and (3) use cases. • There is a need for more detailed information about the “sanity check” that needs to be applied to consider the benefits of RES integration. It is unfortunate that only two cases are illustrated in this version of the methodology. A clear table with an illustration of each use case, and the corresponding project costs, benefits (with the exhaustive list of criteria considered for each case), and assessment type (with a detailed description and justification of the methodology) is needed to improve the understanding of the different categories. More precisions about how the “relevant indicators” are chosen would be appreciated.
Thank you for your feedback. First, we would like to point that the approach presented in the guideline is general. Further

details will be given in the respective implementation guidelines.

- Regarding your questions about Option 1 :
• The CAPEX scope is defined as the asset of the 2nd leg and potential deltas of the targeted client connection (In fact, it refers to the changes in the targeted client connection (radial) that could take place to become a hybrid interconnection. As it is mentioned in Figure 12, *"substation delta's if it is applicable"*).
• Regarding your question of NTC, the value of NTC will depend on the market setup of the RES (Home Market (HM) setup or Offshore Bidding Zone (OBZ)). Further details will be given in the respective implementation guidelines.

- Regarding your questions about Option 2 :
As it is explained on 6.2.3.2, in Option 2 the ***project builds the necessary leg(s)*** and ***simultaneously enables additional RES*** onto the resulting link, thereby enabling the dual function together i.e., the interconnection function and RES integration function
• Option 2 setup (2) : in this use case, a radial connection is already planned (*project 1*). And a second leg including new RES is added on top (*project 2*). The project to be assessed become a hybrid project. Because of *project 2* is including new RES, this RES needs to be added on top of *project 1*.
NB : If *project 1* is not included in the reference grid, a sequential assessment needs to be performed.
• Option 2 setup (3) : in this use case, an interconnection is already planned (*project 1*) and a radial connection is then connected on top (*project 2*). The project to be assessed become a hybrid project.

• Regarding your question about sanity check for hybrid projects. The approach presented in the guideline is general. Further details about the sanity check and how it will be applied will be given in the respective implementation guidelines.

- Regarding your general comment about the tables and illustrations. We take note of your suggestion. Nevertheless, there are two figures (Figure 12 and Figure 13 that explain the approaches and cost for each option). The relevant indicators are explained in Section 6.3.2.1 and 6.3.2.2.

Copenhagen School of Energy Infrastructure

It seems like a good start. Future improvements of this methodology should address which part of cost and benefits are attributed to the private venture section and which to the interconnection.

Thank you for your feedback. The approach presented in the guideline is general. Further details will be given in the respective implementation guidelines.

Ørsted

* Overall, very positive that hybrid projects now have a dedicated approach included in the CBA; it both highlights their prospective major importance in the construction of future zero-carbon European energy system, and streamlines understanding and analysis thereof by providing a common frame of reference.
*An important benefit of hybrid projects currently does not appear to have a clear way to be quantified/presented: namely, the space-efficiency benefits of hybrid assets in relation to cable routing space and landing points. A clear-cut approach to consider and quantify this benefit

should be included so as to ensure a fair and comprehensive evaluation of hybrid assets. *Regarding the proposed assessment approaches, Option 1 currently does not allow for quantification of one of the main benefits of hybrid assets, namely, grid construction cost savings. The radial (only) vis-à-vis hybrid setup comparison does illustrate e.g. RES integration and lower curtailment benefits, but does not necessarily represent true alternatives. An offshore wind farm envisioned within a hybrid setup would not have realistically be considered in a stand-alone radial setup; rather, a more representative alternative would be hybrid vis-à-vis 'radial + transmission line' configuration. Potentially, this mismatch also illustrates the shortcomings of exclusively applying PINT method in the case of hybrid asset assessment. *Regarding Option 2, the sanity check for hybrid projects should be laid out in much more detail, and the elements/approach explained more thoroughly. At present, the proposed application of a weighted Producer Surplus (PS) and offshore wind investment cost estimate as a proxy for the costs of the RES installed capacity gives rise to many questions and its fitness for the envisioned purpose. Since this is a value that would be subtracted from the Project Benefits side of equation, and hence directly affect the eventual evaluation of the hybrid project, its estimation approach should be rigorously evaluated. If the application of PS, however, is being proposed as a 'correction mechanism' for imbalanced modelled system / unrealistic modelled power price levels, improved approach towards investment optimisation in the overall modelled system should perhaps be pursued instead. *In addition, Option 2 should be supplemented with an illustration of how it specifically would be applied to meshed grid setup *Overall comment: hybrid vis-à-vis reference system – the comparison is only meaningful if reference system also fulfils Paris Agreement / EU decarbonization goals. Hybrids (and any projects) should not necessarily be bringing lots of SEW; they should be undertaken if they are a part of the least-cost solution to reach net-zero goals.Y8
We thank you for your extensive feedback. - Regarding your suggestion about to consider the space-efficiency benefits of hybrid assets in relation to cable routing space and landing points. The CBA 4.0 consulted does not include specific environmental benefits for hybrid projects, but we take note of your suggestion. Nevertheless, this benefit could be submitted by project promoters within the ***Other Residual Impact (S3) indicator***, and will be included as a list in the TYNDP assessment results. - Regarding your comment about Option 1. We think that the quantification of grid construction cost savings is included in the CAPEX and OPEX of the second leg added on top of a radial existing project (for example, only one converter station is considered). Regarding the benefit comparing hybrid to radial + interconnection, this seems not to be the counterfactual applicative in all cases. Indeed, TYNDP CBA analysis should analyse the benefits for a certain project setup, compared to an expected reference grid applicative for all other projects. The comparison with other variants is the task of project promoters in the phase prior to TYNDP project submission. - Regarding your comment about Option 2 and the sanity check for hybrid projects. The approach presented in the guideline is general. Further details about the sanity check and how it will be applied will be given in the respective implementation guidelines. The proposed application consists of considering the Producer Surplus (PS) as a proxy of RES investment cost. We assess the benefits of a dual-purpose projects (RES and the new interconnector), and in order to be coherent, we need to compare these benefits with the costs of

the dual-purpose project (RES costs and the interconnector costs).

- Regarding your second comment about Option 2, we will assess whether further illustrations could be added in CBA IG.

- Regarding your overall comment about the reference system to hybrid projects. The scenarios are built within the Scenarios Building process and those will be fulfilling the EU targets (in particular EU decarbonization goals.

currENT Europe

While the methodology is logical for the two situations proposed, the CBA needs to measure the benefits of projects in larger, high-capacity, meshed grids.

If we are to move around the power that is targeted in the European Sea Basins (North Seas Energy Cooperation nations target at least 260GW by 2050), we need to rethink our approach to grid planning. Any radial point-to-point interconnectors will be required to transfer huge amounts of power, 5-10GW. It is too great a risk for this level of power to be point-to-point with no alternate routes to supply.

A meshed grid will have built in redundancy with multiple routes to market, while also having fewer landing sites and require less infrastructure.

It is essential that we do not assume a 'fixed-technology' world. There are many novel grid technologies that are being developed that will enable and optimise a meshed grid approach, such as the capability to carry up to 10GW of power in a single cable. For example, Strathclyde University released a study in 2022 showing the greater benefits and cost savings, approximately €55 billion, offered by a meshed offshore DC grid using superconducting transmission cables compared to conventional cables.

Thank you for your feedback.

Regarding your comments about rethinking our approach of grid planning, we would like to respond that the aim of the TYNDP is to assess the cost and benefits for projects submitted by project promoters using a same basis. The approach that you suggest is interesting, but it is not in the scope of TYNDP.

We think that the ONDP (Offshore Network Development Plan) which is a legal mandate for ENTSO-E from TEN-E regulation (Art. 14 and Art. 15) will answer to your questions. The first "high-level strategic integrated offshore network development plans for each sea-basin" (SB-ONDPs) will be published by 24/01/2024.

WindEurope

We agree with ENTSO-E that, given the dual functionality of hybrid projects, "(...) additional clarifications are needed for proper calculations to be performed in the framework of the European TYNDP" (See sub-section 6.2.1). This should be highlighted more prominently in the methodology. Further analysis should be performed on interdependencies, cost benefit allocation

and coordination issues between the generation and the transmission part of the hybrid project. A reference case per project should be part of the CBA methodology assessing hybrid projects. The only way to effectively and accurately assess the costs and benefits related to a hybrid project is to assess it against its reference case. In the reference case, there is an offshore wind farm radially connected and an interconnector as separate assets, each of them with the same capacity as in the hybrid project. We also recommend that CBA rules on clustering investments for hybrid projects take into consideration the possible impacts on anticipatory investments. The need for anticipatory investments related to hybrid projects is highlighted in the TEN-E Regulation (recital 49).
Thank you for your comment. The methodology has already a separate section, so this should cover the prominent highlighting suggestion made. Regarding the reference case, the counterfactual is defined by the overall reference grid which is being assessed per market scenario. The PINT / TOOT methodology should be applied in the same way for all TYNDP projects to ensure coherent & fair CBA analysis. For a hybrid project that adds RES and interconnection function (CBA option 2 case), the counterfactual is hence not an interconnector and radial link as they are not existing projects are straightforwardly defined. Moreover, such approach could make any project artificially beneficial, by having an artificial long radial and interconnector assumption as counterfactual. For these reasons, we believe the proposed CBA method does adequately assess the hybrid benefits, moreover the scenarios are built and satisfy EU decarbonisation goals.

9. The 4th CBA Guideline describes a methodology for assessing the commissioning years delivered by project promoters in order to deliver a tool to compare the input given by project promoters. The aim is to only encourage discussions where needed. Do you in general find an assessment of commissioning years necessary in the CBA Guideline?

EDF (Électricité de France)
No. The commissioning years of projects in the TYNDP are based on the Commissioning Year estimated by the promoter. Therefore, the trajectory of commissioning of new projects might sometimes be very ambitious. As the TYNDP has been published every two years since 2010, EDF believes that with view to the CBA and before designing complex tools in the methodology, it would be interesting and valuable to have a look back and compare the estimated trajectory of commissioning of projects in previous exercises with the reality. This historical review might give a hint on how to better design a tool to take commissioning dates into account. EDF believes there would be more rationale in imposing upon project promoters to apply the approach developed/presented by ENTSO-E when preparing the submission file of their project, in order to provide from the start a more accurate vision of the commissioning date, rather than including this aspect in the CBA.

While updating the CBA guideline and during the development of the "assessment of commissioning years" we were also applying statistical approaches by considering historical input on commissioning year versus submitted years. All approaches failed in delivering a reasonable assessment methodology. The given methodology that is mainly also based on ACER's comments on the TYNDP 2022 Implementation Guidelines, must now be seen as a simple approach in getting information on possible commissioning year which will be used as additional information for discussions - rather than concrete approval or disapproval.
Copenhagen School of Energy Infrastructure
I don't know
Ørsted
Yes
We thank you for this positive feedback
currENT Europe
Yes
We thank you for this positive feedback
WindEurope
Yes
We thank you for this positive feedback

10. In regard to the previous question. Do you find the proposed methodology fit for purpose?

EDF (Électricité de France)
Copenhagen School of Energy Infrastructure
I don't know
Ørsted
Yes
We thank you for this positive feedback.

currENT Europe
No. While currENT believes that there is a sound logic behind the current formula, which combines various parameters, and multiplies them by a number of factors. However, planning, permitting, and construction can differ strongly for different technologies. There should therefore not just be one standard mean time for each parameter that makes up the commissioning formula, but this needs to be based on the type of technology and the scale of the project. In addition, certain factors have not been taken into account, such as whether it is a brown field or virgin territory. Also to allow for transparency, the commissioning times calculated for each technological type (e.g. AC, DC - overhead lines, underground cables, GIS or AIS substations, various FACTs, Dynamic Line Rating, superconducting system, etc.) should be consulted upon and published. Ideally these will be compared to recent practical deployment experience of these technologies.
For the planning and permitting stages we propose to use standard times, while any technology dependencies will be applied by the technology dependent factors. For the construction time we plan for applying times dependent on the length of the projects. In general the assessment of commissioning years needs to be interpreted as starting point for further discussions in case the results deviate from the promoter's submission.
WindEurope

11. The methodology for assessing the commissioning years is based on a simplified approach defining some standard times and factors for specific project types. Do you think this simplification is sufficient in order to define a reasonable approximation for a possible commissioning year? - If no, please explain why below

EDF (Électricité de France)
Copenhagen School of Energy Infrastructure
No. The proposed methodology assumes that the given factors influence the 3 project phases homogenously. This is likely not true and weakens the effectiveness of the assessment. However, since project promoters get to justify their estimates even if they deviate from the prediction based on this formula, the only effect of this imprecision would be a temporarily increased communication between project promoters and ENTSO-E and the formula can be subsequently improved based on this experience.

We acknowledge your comment and are constantly going to improve the CBA Guidelines, which also includes the assessment of commissioning years
Ørsted
No. Overall, the simplifications might be needed in order to arrive at an objective common frame of reference for obtaining the most realistic estimate for the commissioning year. One element could be value-adding to add, namely, some estimate of a typical duration of transmission project completion in a given country. There might be some national variations that affect the completion time considerably, and omission thereof might lead to systematic misrepresentation of a realistic timeframe of project completion.
We thank you for this constructive feedback. However, we have not yet found uniform country factors that would well describe such effects. In general the assessment of commissioning years needs to be interpreted as starting point for further discussions in case the results deviate from the promoter's submission.
currENT Europe
See previous answer
See previous answer
WindEurope

12. In the CBA 4.0 Guideline several options for sensitivity analyses are proposed to increase the validity of the CBA results. Do you consider these options as sufficient, or is a critical parameter missing?

EDF (Électricité de France)
EDF agrees with the importance of sensitivity analyses but considers that all the items proposed should primarily be better integrated/developed in the model used (for example climate years, if too few are taken into account as in the ERAA model). Developing multiple sensitivity analyses will not cover for the shortcomings of the modelling itself. Furthermore, the document states that sensitivity analyses are in theory to be carried out on all the projects to be assessed but that in fact different sensitivities would be carried out according to the project. This will not contribute to increased transparency and relevance in the selection process.
Thank you for your feedback. The sensitivities are not meant to "cover the shortcomings", but to give insights of how the results can change when modifying one or more parameter(s) of the input data set. The proposed sensitivities are on parameters that are already included in the models.

In general, sensitivity analysis should be performed on a uniform level. We allow for project specific application of sensitivities as we believe that not all sensitivities are relevant for all projects the same way. However, if a sensitivity would be applied only to specific projects, ENTSO-E will be transparent with this, and provide a justification for this choice.

Copenhagen School of Energy Infrastructure

In general, it means a great improvement to consider sensitivities for the cost-benefit analysis and the parameters mentioned seem relevant. Other parameters of interest could be the VOLL and for energy prices, CO2 & and technology cost a sensitivity to an alternative cost path, rather than a constant value would be interesting.
Many of the parameters identified critically affect the energy balance underlying the scenarios as well. Analysing the effect of a change in fx H2 price from the market simulation onwards, but using a scenario-based hydrogen demand that corresponds to a lower price (and is therefore unrealistically high for the now increased price assumption) is problematic.
To enable project promoters to analyse these sensitivities, ENTSO-E needs to provide the scenario data with variations for the given parameters where applicable.

Finally, the sensitivity should not be optional: the indicators need to be compared and discussed between diverse scenarios and in view of their main sensitivities. This is important to explore the robustness of a project's assessment and to assess its contribution to the long-term flexibility of the energy system. Thus, for example, a project that adds significantly to overall welfare in only one scenario can be assessed justly against another one adding slightly less welfare but does so robustly in all possible futures considered within the analysis.

Thank you for your positive feedback!

ENTSO-E recognises that many parameters are interlinked in one way or another and if one parameter is changed, others would also need to be adjusted to really reflect the most realistic scenario. However, the aim of a sensitivity analysis is not to define complete and new sets of scenarios but to give a quick insight in the system behaviour with respect to a single (or a few) changes in specific parameters.

The aim of the TYNDP CBA assessments is to have results for all three scenarios (both top-down scenarios, and bottom-up), so the indicators can indeed already be compared between different scenarios.

Ørsted

Relevant and value-adding variations listed in the current proposal.

Regarding sensitivity applying the long-term societal cost of CO2 emissions – a scenario setup where the societal costs of CO2 are directly used in the simulation (and not as an ex-post calculation) should also be considered as it would be more in line with illustrating an energy system fully on decarbonisation trajectory. The ex-post calculation would yield the extra cost estimation to society without any true (e.g. merit-order dispatch, or more meaningfully, investment) implications.

The sensitivity varying commissioning date of various projects could have a critical role in the

assessment of Anticipatory Investments. In order to achieve the exceedingly ambitious and rapid decarbonisation envisioned in the EU, extensive build-out of transmission is crucial, and any delays can have a profound impact on the ability of the Member States to successfully deploy and utilize RES. Conversely, existence of future-proof transmission infrastructure that can not only accommodate the immediate RES integration needs, but also account for the medium- to long-term additional transmission needs, would be a strong facilitating element in helping reach the decarbonised energy system faster. The commissioning date sensitivity analyses could play a role in analysing the SEW of an Anticipatory Investment for transmission infrastructure vis-à-vis incremental approach; and identify the societally most beneficial solution.
Thank you for the valuable feedback. In general the societal costs were introduced as addition to the ETS cost for CO2 which is directly included within the simulations. For the moment we do not see that the ETS cost already incorporate all the societal cost assumptions. When it comes to future scenarios, we are already considering higher ETS cost reflecting also increasing societal costs to be included. Ideally the societal costs should be fully included within the ETS costs - in this case no additional societal costs would be needed. Besides of this we already allow for sensitivities on the CO2-Price (ETS costs).
currENT Europe
WindEurope

13. The 4th CBA Guideline includes as 'Supplemental methodologies' the contribution to Union Energy Targets through the assessment of different targets. Do you find the addition of these new methodologies for the assessment of projects useful?

EDF (Électricité de France)
No. EDF considers that there is a high risk of double counting when taking into account such a new indicator. Indeed, if we consider the interconnection target, this objective is implicitly already taken into account when considering the market integration (B1) and security of supply (B2) indicators. It has been said during the webinar that this qualitative indicator only assesses the theoretical target set by the EC and that it does not assess the same thing as the other indicators mentioned above. This again raises the issue of integrity and consistence of the CBA methodology, especially with regard to the lack of transparency of the indicator's weighting procedure (i.e., how the results of such new indicators will be weighed against the others - that are either monetized or not - and taken into account).

The introduced indicators on showing the impact on the EU targets must be seen as non-monetized complementary indicators, which is why no double counting can occur. Additionally, ENTSO-E applies a multi-criteria approach to describe the indicators but none of the indicators are weighed against the others.
Copenhagen School of Energy Infrastructure
No. There is some overlap between the benefit indicators and the energy targets, (for example in the sense that a shift towards renewable energy necessarily means a reduction in primary energy and thereby improves energy efficiency). The methodology does not address or even discuss this.
These benefits are not monetised so there is no risk in overlapping the benefit. Nevertheless some aspects of one of the indicator can be covered in the other but at the end these indicators are providing complementary information
Ørsted
Yes
We thank you for your positive feedback
currENT Europe
No. These methodologies are useful; however, they need to be in line with the latest targets. For example, the efficiency target of 32.5 is based on old targets from 2018, which is not in line with the Fit for 55 Package.
ENTSO-E thanks you for this valuable feedback. The concrete targets set by the commission were included as additional information. We changed the text to a more general statement.
WindEurope

14. What other indicators would be of interest to be considered for the assessment of Union Energy Targets contribution?

EDF (Électricité de France)

Copenhagen School of Energy Infrastructure
This should include an explicit account of the energy efficiency first principle in line with the Commission's recommendation and guidelines for EE1st – in addition to the proposed account of energy efficiency as such.
ENTSO-E thanks you for this valuable feedback. The European Target indicators aim for evaluating the impact on the European targets. It is not the aim to account for the EE1st itself.
Ørsted
currENT Europe
Other indicators that would be of interest is the smartness of the grid, as well as the raw materials intensity. For the smartness of the grid, indicators are currently being developed around asset observability, controllability etc., as laid out in the Commission's Digitalisation of the Energy Sector Action Plan. It would be useful to include this indicator in the CBA methodology. With regards to the raw materials, the efficient use of materials is an integral part of the Energy Efficiency First Principle. By all accounts, there will be a shortage of materials in order to carry out all the ambitions of Net Zero. Going forward, this is going to become an increasingly important indicator. Are the materials available to feasibly build this project?
ENTSO-E thanks you for this valuable feedback. We will further analyse your proposals.
WindEurope

15. The non-mature indicator B8.2 on Black start services previously included a methodology that was limited only to projects in the Baltic states. This has now been updated to a more general guidance that is applicable for all projects. However, the impact that a project might have on the black start services available in the energy system is heavily dependent on national-specific factors, which makes it difficult to have a pan-European methodology to quantify or monetise the benefits through CBA calculations. The high risk of obtaining results which are not reflecting the real benefits of the assessed projects, and the low number of projects themselves delivering these services might justify the deletion of this indicator from the methodology. Do you see the B8.2 indicator as an important and potentially beneficial CBA indicator for projects, and that ENTSO-E should continue the effort to improve it?

EDF (Électricité de France)
No. Black start services are rather of rare use (hopefully) and therefore maybe not of the most relevance for the CBA compared to the other ancillary services. Indeed, interconnections are not the main solution to re-energize the system after a black-out, especially in case of a simultaneous black-out over many neighbouring countries. That is why, in case of black-out, each TSO will want to have means at his own hand to re-energize the system step by step. If kept, EDF considers that the assessment of this item would require high quality and robustness in the methodology, in order not to be detrimental to the relevance of the CBA. What is proposed is not clear enough and not satisfactory. EDF therefore considers that this indicator could be left aside.
ENTSO-E thanks you for this valuable feedback.
Copenhagen School of Energy Infrastructure
I don't know
Ørsted
I don't know
currENT Europe
Yes
ENTSO-E thanks you for the feedback
WindEurope

16. If your answer was yes to the previous question, do you find the guidance helpful and sufficient? If not, what could be further elaborated?

EDF (Électricité de France)
Copenhagen School of Energy Infrastructure
Ørsted

currENT Europe
There needs to be a clearer explanation on how to implement this indicator.
ENTSO-E agrees and thanks you for your feedback.
WindEurope