Ten-Year Network Development Plan 2020

TYNDP 2020 Stakeholders Engagement Report

February 2021 · Version for ACER opinion

entsoe

About ENTSO-E

ENTSO-E, the European Network of Transmission System Operators for Electricity, represents 42 electricity transmission system operators (TSOs) from 35 countries across Europe. ENTSO-E was registered in European law in 2009 and given legal mandates since then.

The role of Transmission System Operators has considerably evolved with the Third Energy Package. Due to unbundling and the liberalisation of the energy market TSOs have become the meeting place for the various players to interact on the market place.

ENTSO-E members share the objective of setting up the internal energy market and ensuring its optimal functioning, and of supporting the ambitious European energy and climate agenda. One of the important issues on today's agenda is the integration of a high degree of renewables in Europe's energy system, the development of flexibility, and a much more customer-centric approach than in the past.

ENTSO-E is committed to develop the most suitable responses to the challenge of a changing power system while maintaining security of supply. Innovation, a market-based approach, customer focus, stakeholder focus, security of supply, flexibility, and regional cooperation are key to ENTSO-E's agenda.

ENTSO-E is contributing to build the world's largest electricity market, the benefits of which will not only be felt by all those in the energy sector but also by Europe's overall economy, today and in the future.

Transparency is a key principle for ENTSO-E, and requires a constant listening, learning and improvement.

TYNDP 2020
Stakeholders Engagement Report

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The TYNDP 2020 benefited from the input of a large circle of stakeholders. This includes first and foremost the promoters of transmission and storage projects who submitted their projects for assessment. Other stakeholders, including environmental NGOs, electricity utilities, RES industries, academics, modellers,… were involved via public consultations on the development of scenarios and on the draft TYNDP 2020 package.

How to use this interactive document

To help you find the information you need quickly and easily we have made this an interactive document.

Home button
This will take you to the contents page. You can click on the titles to navigate to a chapter.

Arrows
Click on the arrows to move backwards or forwards a page.

Hyperlinks
Hyperlinks are highlighted in bold text and underlined throughout the report. You can click on them to access further information.

ENTSO-E Technopedia
www.entsoe.eu/Technopedia/

Questions?

Contact us as at **tyndp@entsoe.eu**

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Project promoters in the TYNDP 2020

Project promoters are key stakeholders of the TYNDP process and ENTSO-E has put in place dedicated communication activities to ensure a smooth sharing of information, both from ENTSO-E to promoters and from promoters to ENTSO-E. Figures A4-1 and A4-2 list all engagement activities, divided between collection of data from promoters and communication to promoters including webinars and release of key documents.

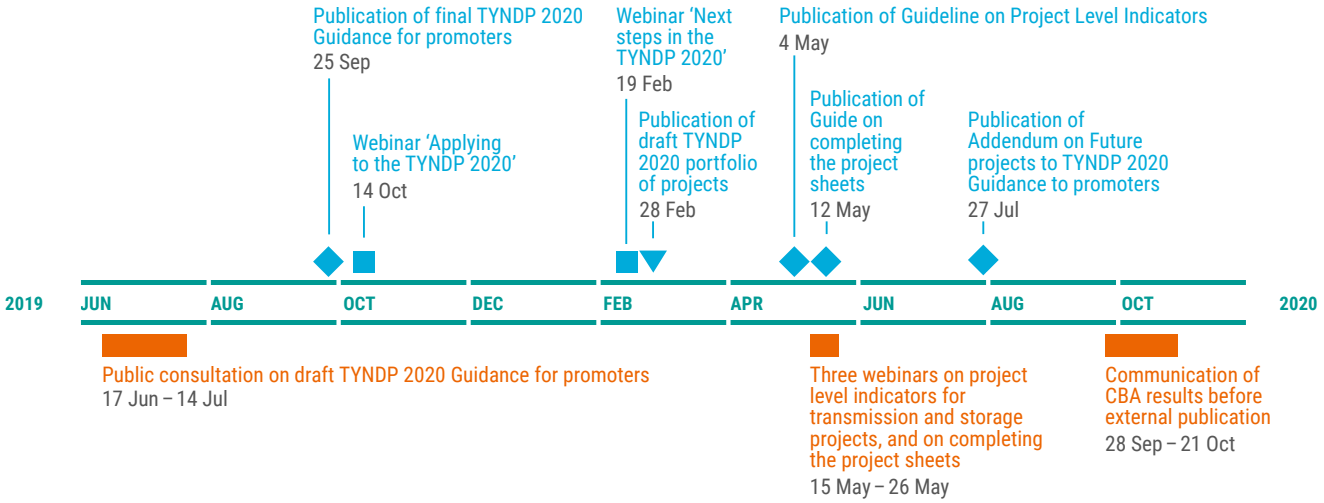

Figure A4-1 – Communication to promoters: release of key documents and webinars

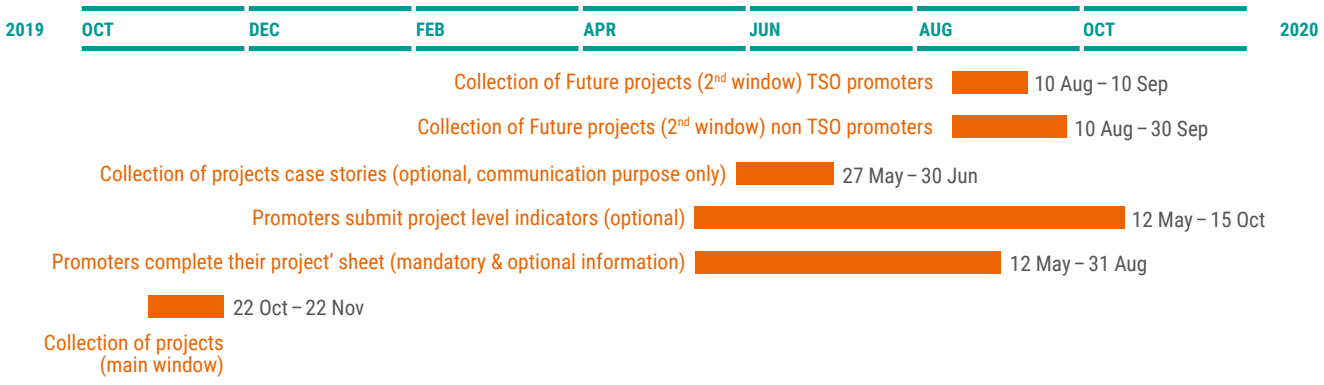

Figure A4-2 – Collection of data from TYNDP 2020 promoters

How were TYNDP 2020 projects selected?

The eligibility of projects to be assessed in the TYNDP obey a number of rules and criteria specified in the Guidance for applicants – Transmission and storage projects promoters – Criteria for applications and their treatment in the TYNDP 2020. Requirements relate to the project promoters seriousness, demonstrated by providing documents relating to the company's legal existence, financial information and technical expertise, but also with the project itself (depending on its status, the project must either feature in the most recent PCI list or in a National Development Plan, or prove the realization of feasibility studies, …). A draft version of the Guidance was first submitted to a public consultation in June-July 2019, before being edited based on the comments received and published in its final version in September 2019. Project promoters were then asked to propose projects in a one-month window opened between 22 October and 22 November 2019.

For the first time in the TYNDP 2020, a second submission window, reserved to Future projects addressing system needs identified in the 2020 system needs study, opened from 10 August to (for TSO promoters) 10 September and (for non-TSO promoters) 30 September. In the TYNDP 2020 all projects were in compliance with the mandatory criteria and therefore all projects were accepted.

TYNDP projects online platform

Collection of projects data is managed via an online platform, accessible at https://tyndp2020-project-platform.azurewebsites.net/. The platform is also used to share CBA results with promoters. Credentials to access the platform can be obtained upon request to ENTSO-E's SPOC to promoters.

Promoters' corner

In December 2019, ENTSO-E launched a new tyndp.entsoe.eu website with a new page called 'Promoters corner' centralising all information and documents of interest to promoters. This page was regularly updated throughout the year with the latest information on project status and ongoing collection of data and the latest documents. It is meant to inform promoters who had a project in the TYNDP 2020 and other promoters. To that end, ENTSO-E has also created a mailing list of project promoters to which all interested promoters can subscribe to be informed of key steps of the TYNDP process. Promoters who contemplate submitting a project to the TYNDP 2022 are encouraged to subscribe to that list to keep up to date.

Documents made available to promoters in the TYNDP 2020 process and where to find them:

On submitting a project to the TYNDP 2020

- Guidance for applicants – Transmission and storage project promoters criteria for applications and their treatment in the TYNDP 2020 LINK
- Practical guide for submitting a project in the TYNDP online platform LINK
- Applying to the TYNDP 2020 – A visual guide to the main steps LINK
- Webinar recording 'Applying to the TYNDP 2020' LINK
- Addendum to the Guidance for applicants – TYNDP 2002 submission window for Future projects LINK

On completing the project sheets

- TYNDP 2020 practical guide on completing the project sheets LINK
- Webinar 'Completing TYNDP 2020 project sheets' – Recording and slides

On submitting Project-level indicators

- TYNDP 2020 Implementation Guideline for project-level indicators LINK
- Webinar 'Project-level indicators for storage projects' – Recording and slides
- Webinar 'Project-level indicators for transmission projects' Recording and slides

Other stakeholders and how they are involved in the TYNDP 2020 process

TYNDP 2020 Scenarios

External stakeholders representing the gas and electricity industries, customers and environmental NGOs, regulators, EU Members States and the European Commission were key in building an ambitious set of scenarios. Two public consultations, on the scenario storylines and draft scenarios, and four workshops and webinars allowed to collect stakeholders' input. The European Commission and ACER contributed via the TYNDP Cooperation Platform and via high-level meetings. The Scenarios will be submitted to ACER for a formal Opinion together with the draft TYNDP 2020 package in Q1 2020.

For a detailed overview of stakeholders engagement in TYNDP 2020 scenario building, see Chapter 10 of the **TYNDP 2020 Scenarios report**.

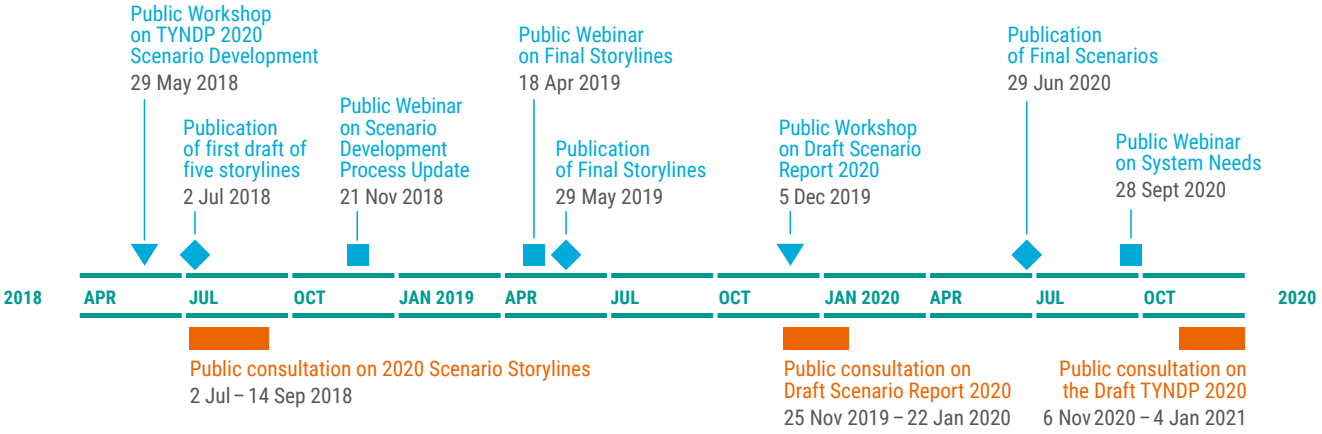

Figure A4-3 – Main stakeholder engagement activities in the TYNDP 2020 scenarios development process

CBA methodology

The '3rd CBA Guideline for the cost-benefit analysis of grid development projects' (CBA 3.0) was drafted by ENTSO-E in compliance with the requirements of the EU Regulation (EU) 347/2013. It is the result of an extensive consultation process, involving the general public, stakeholder organisations, national authorities and their national regulatory authorities, ACER, and the European Commission.

In December 2017 ENTSO-E invited external stakeholders to participate to three work streams dealing with specific aspects of the CBA, including security of supply (divided between adequacy, stability and ancillary services), socio-economic welfare, and storage. The outcome of this work has served as a starting point and as an extended consultation exercise for drafting the CBA 3.0. Additionally, the draft CBA 3.0 was submitted to a public consultation in November – December 2020. For more information on involvement of stakeholders in the development of the CBA 3.0, read Consideration on the inclusion of stakeholders input in the development of the CBA Guideline 3.0.

Related documents:

- Outcome of the 2018 stakeholder workstreams
- Comments received during the public consultation and ENTSO-E's assessment of the comments

Public consultation on the draft TYNDP 2020 package

The draft TYNDP 2020 package is submitted to a public consultation until 4 January 2021. Afterwards, ENTSO-E will consider the comments received and deliver an updated version to ACER for a formal Opinion in Q1 2021. After reception of ACER's Opinion, the TYNDP 2020 package will be further edited considering ACER's comments and will be published in its final form by the beginning of Q2 2021.

TYNDP 2020 package

The draft TYNDP 2020 package was submitted to a public consultation from 6 November 2020 to 4 January 2021. ENTSO-E has considered and answered to the comments received and released in early February 2021 an updated version of the TYNDP 2020 package to ACER for a formal Opinion.

After reception of ACER's Opinion, expected in April 2021, the TYNDP 2020 package will be further edited considering ACER's comments and will be published in its final form in Q2 2021.

Webinars

ENTSO-E organised two public webinars to present the TYNDP 2020 to stakeholders. The first one, focused on system needs identified in the 2030 and 2040 horizons, while the second one presented the overall TYNDP 2020 process and results.

Related documents:

- Webinar on system needs, 28 September 2020: recording | slides
- Webinar on the TYNDP 2020 for consultation & kicking off TYNDP 2022, 4 December 2020: recording | slides

Public consultation on the draft TYNDP 2020 package

Respondents

The public consultation gathered feedback from 22 stakeholders, representing a diverse set of interests and viewpoints (Figure 4). Most respondents consult TYNDP 2020 for information on transmission projects, while smaller but still significant share of respondents look for information on scenarios and future system needs (Figure 5).

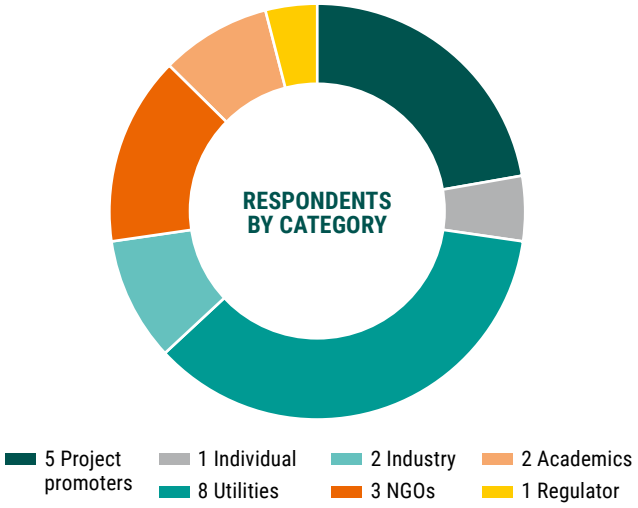

Figure 4 – Respondents to the public consultation on the draft TYNDP 2020 by category

FOR WHAT PURPOSE DO YOU USE THE TYNDP?
(MULTIPLE CHOICE ANSWER)

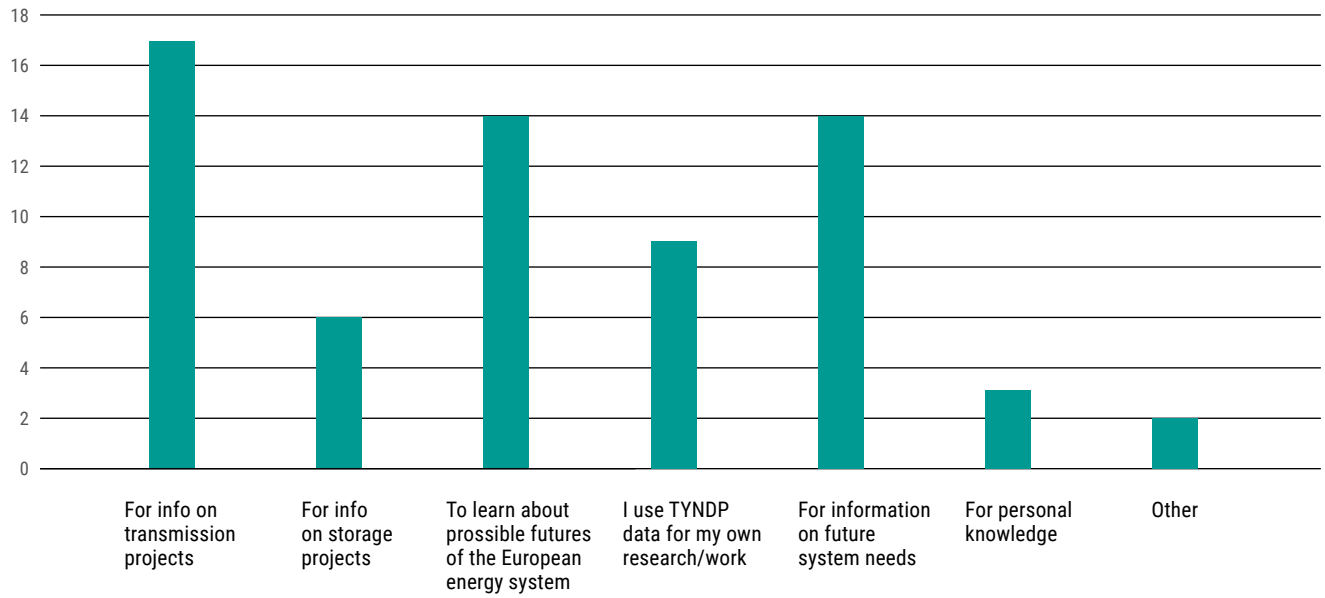

Figure 5 – Respondents answers to the question 'For what purpose do you use the TYNDP?'

Overview of stakeholders comments

Below is an overview of the main comments received during the TYNDP 2020 public consultation process, grouped by topic. Stakeholders' comments cover not only the TYNDP 2020 itself but also the CBA Guideline 3.0, which is distinct from the TYNDP 2020.

On the methodology employed to assess infrastructure projects

Stakeholders appreciate the continuing evolution of the CBA 3.0 methodology and encourage its faster release. The addition of a non-CO_2 emission factor is particularly welcomed because it provides significant clarity on how to calculate savings in volume terms. However, one stakeholder points out that the CBA 3.0 methodology incompletely assesses the full benefits of storage projects by not taking into account potential benefits resulting from a reduction of generation CAPEX or the multi-service dimension of storage.

In addition, some stakeholders claim that additional information should be made available on projects' social and environmental impact. In particular, they advise ENTSO-E to ask projects promoters to provide more meaningful analysis once a project enters the planning phase, in order to avoid inconsistencies in data related to residual impacts of projects (environmental and social).

A future cross-sectoral CBA has also been the subject of comments among stakeholders, that call for a more holistic CBA in line with the EU Green Deal. They propose that the capabilities of the existing CBA methodology should be extended to enable the assessment of multi-purpose interconnectors by introducing an appropriate market design framework and guidance on model configuration. Stakeholders also recommend improving the current CBA methodology by strengthening its capabilities to deal with future system integration challenges and the emergence of innovative concepts and technologies.

On the assessment of system needs

Stakeholders overall welcome the European analysis of system needs, though some stakeholders note that similar studies performed by themselves or other stakeholders have studied European needs and have resulted in more capacity needed compared to ENTSO-E's analysis. Some stakeholders note that, on many borders, the current projects are not enough to cover the identified needs, as detailed in the TYNDP 2020 main report. Others remark that the results seem very different compared to the previous ENTSO-E needs analysis (mainly because of the different scenarios being considered).

Some comments were also expressed on the methodology, mainly regarding the facts that the analysis was performed on only one scenario, with a weather hazard modelling perceived as insufficient. Finally, stakeholders regret that the minimum level of available interconnection capacity of 70% (specified in Regulation (EU) 2019/943) was not implemented in the study and add that the consideration of internal reinforcement costs could be improved.

On offshore grid development

There is general agreement with ENTSO-E's statement that the methodology employed to assess system needs in the TYNDP 2020 does not give a proper representation of offshore system needs, because it fails to recognise the full benefits of hybrid offshore infrastructure. An improved assessment of offshore development needs would make it easier for project promoters to identify the potential value of hybrid projects and guide them towards designs that can increase benefits for the power system as a whole.

Stakeholders acknowledge that the TYNDP Project portfolio includes several offshore hybrids projects – labelled as multi-purpose interconnectors – but that there are still too few. They ask ENTSO-E to develop better tools to evaluate hybrid projects and meshed offshore grids, which the EC in its Offshore Renewable Energy Strategy has identified as an ingredient in more rational grid planning.

On the central scenario approach based on NECPs

Stakeholders expressed diverse views on the central NECP-based scenario. Several consider that this approach provides the best representation of the commitment of each EU Member State to meet the targets set in terms of efficiency and GHG emissions reduction for the energy sector. However, while the central scenario approach should be reproduced in future TYNDPs, a contrasted set of scenarios remains necessary to assess the robustness of the different projects and their interest in a context of uncertain future.

Other stakeholders consider that NECPs should not necessarily be considered as basis for the central scenario, because the EU is now tightening its year 2030 climate targets beyond what was the basis for the current NECPs. They support choosing as central scenario one that is in line with the climate targets set in the Paris Agreement.

On the Current Trends sensitivity

Stakeholders expressed very diverging views, with four stakeholders in favour of reproducing that approach in next TYNDP while three stakeholders think a Current Trends scenario would bring no additional value to the TYNDP.

Among the arguments put forward by stakeholders who think the current trends sensitivity should not be replicated, one is that the Current Trend 2030 sensitivity sends a short-viewed, wrong signal in terms of investment needs. This is because the assessment of socio-economic welfare achieved by TYNDP 2020 projects under the Current Trend 2030 sensitivity is not complete, as it does not integrate the higher external costs (climate damage, environmental damage, health costs) related to the EU's failure to achieve the needed greenhouse gas emission reductions in time.

Additionally, including the Current Trends scenario should not take away resources from a thorough analysis of the main scenarios that are the basis for project evaluation. The Current Trends scenario is perceived by some stakeholders as a distraction from the assessment of future strategic plans of the development of energy production and consumption and network infrastructure development.

On the other hand, stakeholders who see the Current Trends sensitivity favourably argue that the inclusion of a Current Trends scenario in future TYNDPs would make it possible to represent a situation of slower economic growth, which relevance is demonstrated by the current economic context. Additionally, the Current Trends sensitivity appears relevant to evaluate potential deviation from the decarbonization targets in case some non-mature technologies (Power to Hydrogen, CCS, FCEV vehicles, etc) do not develop as fast as anticipated in other scenarios. The Current Trends scenario would then help to identify possible deviations from climate targets requiring the timely implementation of corrective actions. Finally, some stakeholders argued that the Current Trends scenario can serve as a reference case, showing which projects would have socio-economic net benefits even if the climate targets were to be loosened.

On transparency and engagement in the TYNDP 2020

Insufficient participation of stakeholders in the development of the TYNDP is raised as a concern. Despite the public consultation on the draft TYNDP package being welcomed, it is perceived as insufficient to comprehensively inform and involve the general public in the creation and adoption of the TYNDP. Although some environmental associations

were involved in the development of the CBA 3.0 methodology via stakeholder workstreams, some stakeholders see it necessary to reach out to a greater number of environmental associations at national level, to improve the assessment of the impact of projects on the environment and nature.

As regards transparency on the methodology, some stakeholders point out a lack of transparency on modelling assumptions and input data on the projects assessed, with the CBA implementation Guidelines being perceived by some as not comprehensive enough and lacking clarity.

On communication of TYNDP 2020 results

Stakeholders welcomed the clarity and accessibility of the reports, while noting that the TYNDP 2020 package includes many documents and that the interrelation of the various documents is not easy to apprehend at first sight. While some stakeholders welcome the possibility of carrying out a detailed analysis through focused documents (project sheets and sub-reports, including insight reports, regional investment plans,…) others call for shorter, more focused sub-reports.

Regarding the data made available to them, several stakeholders note an improvement in the user-friendliness of projects data, now available in one-click download in spreadsheet format. However, regarding specifically the content of the project sheets, stakeholders call for more details and data on TYNDP projects.

On the inclusion of non-TSO projects

Stakeholders generally stress the importance of assessing non-TSO transmission projects in the TYNDP, in order to have a complete view of future potential network developments. Non-TSO projects may have an essential role to play in meeting some system needs or promoting new approaches or technology.

Regarding their role within the TYNDP process, some stakeholders note that the inclusion of non-TSO projects in the TYNDP has improved compared to previous TYNDP cycles, while another consider they should have an even more active role. One stakeholder points to the fact that non-TSO promoters have less resources than TSOs to perform simulations and that this puts them at a disadvantage when it comes to computing project-level indicators specified in CBA Guideline 3.0. Finally, several stakeholders stress the importance for non-TSO promoters to provide up-to-date information on their projects, and that non-TSO projects should be presented with the same transparency standards as TSO projects.

How did ENTSO-E consider stakeholders' comments?

Stakeholders comments allowed ENTSO-E to implement several improvements to TYNDP 2020 deliverables, mainly in terms of clarity of the documents and availability of data so that it is easier for stakeholders to find. The main improvements implemented in the version of the reports for ACER opinion include for example the addition of capacities in MW and costs to the list of projects in the reference grid (Appendix 2 of the 'Completing the map' report) information which was previously only available in the project sheets. Efforts have also been made to clarify some texts when it appeared from stakeholders comments that there had been misunderstandings, e.g. with the addition on the first page of the 2030 PCI Needs Briefs of a brief text explaining the purpose of these documents.

These add up to the improvements already implemented in the draft TYNDP 2020 for consultation. These include the possibility to download most of projects data featured in the project sheet in spreadsheet format, a complete review of the project sheet format for more user-friendliness, and the overall reduction of the total length of the reports. Content-wise, the assessment of system needs has been extended to the 2030 horizon while a zonal model was used for the first time to assess needs in the 2040 horizon. The TYNDP 2020 also implemented a new cost-benefit analysis methodology (CBA Guideline 3.0).

Most stakeholders' comments, however, can only be taken into consideration in the TYNDP 2022, because they touch upon the methodology or structure of the TYNDP package. The following improvements are currently being investigated for implementation in TYNDP 2022:

- **Assessing offshore needs:** as stated in our system needs study and highlighted by stakeholders, the methodology to identify needs must evolve in order to provide a better account of needs related to offshore infrastructure, and in particular of offshore hybrid infrastructure. ENTSO-E is already investigating how to move forward, with a dedicated team currently considering the various possible approaches varying in scope and complexity.
- **Further improving project's cost-benefit analysis:** It is anticipated that, like the TYNDP 2020, the TYNDP 2022 will follow the CBA 3.0 Guideline. However, new CBA implementation guidelines will be developed applying specifically to TYNDP 2022. ENTSO-E will consider the feedback received on projects assessment, especially from project promoters, who are also welcome to engage with ENTSO-E directly regarding the assessment of their project.

  With regard to smart sector integration, ENTSO-E released in 2020 its Multi Sector Planning Roadmap to be implemented in future TYNDPs, starting with TYNDP 2022. In addition, it is foreseen that alongside the TYNDP 2022 will be released the first results of a pilot dual gas-electricity CBA.

- **Scenarios:** TYNDP 2022 scenarios, currently being developed, follow the same approach as in 2020 with one scenario based on NECPs and two top-down scenarios. Considering the mixed views expressed by stakeholders, no decision has yet been taken on whether the NECP-based scenario will remain the central scenario in the assessment of projects. Whether the Current Trends sensitivity, requested by regulators, will be replicated in 2022 is also still to be decided jointly with ACER and the European Commission.
- **Simplifying the TYNDP package:** ENTSO-E is considering the development of an online interactive platform to present the outcome of the 2022 system needs study. The objective is to make the results easier to comprehend and analyse for stakeholders while reducing the number of documents in the TYNDP package.
- **Transparency and availability of projects data:** The content of projects sheets will be reconsidered so as to investigate the possibility of answering stakeholders' calls for additional technical data on projects, within national data publication rules. The reader-friendliness of project sheets will be further improved and the functionality to download projects data and CBA results in spreadsheet format will be further developed.
- **Further improve the inclusion of projects of non-TSO promoters:** just like in TYNDP 2020, the Projects selection Guidance will be released in draft form well ahead of the projects submission window and will be submitted to a public consultation, to allow non-TSO promoters to share their comments on the rules and requirements for inclusion in the TYNDP. Webinars/workshops will also be organised like in 2020. A new FAQ will be released and maintained on entsoe.eu's Promoters Corner.

The TYNDP 2022 cycle is only just starting and other improvements and changes compared to TYNDP 2020 are likely to be implemented. In addition, Further developments may be considered after reception of ACER Opinion on the TYNDP 2020.

Appendix 1

Stakeholders comments received during the public consultation and ENTSO-E's answer

Anonymous

Thank you for allowing me to comment. Its probably more a comment which would make sense for TYNDP2022 but the question is still valid now I think.

Given the huge intra EU flows expected as a result of the massive RES deployment, on one hand from North Sea / Baltic region with offshore wind, and on the other hand coming from Southern EU for solar, wouldnt it make sense to develop 2 strong HVDC backbones (1,2 million V, and 5000 – 10000 MW capacity each), one North-South from the Baltic to North Africa, and another East to West from UK to Greece (for instance). Each of them with intermediary AC / DC substations every 500 – 1000 km for instance. That would allow to control / manage power flows between regions, thus reducing the need to reinforce / add too many AC interconnectors. This has probably been considered by ENTSOE, sorry if I missed it.

ENTSO-E's answer: ENTSO-E does not consider solutions or recommend projects as part of the TYNDP. If such projects are submitted to the TYNDP, they will be assessed. Your comment is therefore more oriented at National Development Plans, Project Promoters or Regulators.

Aktionsbündnis Trassengegner/Aktionsbündnis gegen die Süd-Ost-Trasse

1 **Das Aktionsbündnis Trassengegner lehnt den Entwurf des TYNDP 2020 ab.**
Aktionsbündnis Trassengegner rejects the draft TYNDP 2020.

Insufficient transparency: The draft does not have the necessary transparency to enable us to examine the proposals of the individual power line projects. The data according to the cost-benefit analysis CBA 3.0 are not comprehensible. Although the guide to the 3rd CBA Guide is available, it is not clear, which input data have been used in the projects. Evaluation data is not available for many projects, e.g. for the SüdLink project (235), there is often a lack of data ("data pending"). This does not provide sufficient justification.

ENTSO-E's answer: Please see our answer to the exact same comment submitted by BUND Bund für Umwelt und Naturschutz Deutschland.

2 Insufficient consideration of reasonable alternatives: The European Environmental Assessment Directive (EIA Directive) and the German EIA Act call for the inclusion of "reasonable" alternatives in order to achieve the appropriate purpose of a measure. In the case of electricity transmission there are many ways of avoiding a measure by taking other measures which may also be more cost-effective and may have a lower environmental impact.

This primarily includes a market design concept, which is not based on the unlimited transmission of electricity throughout Europe ("copper plate power grid") but on a decentralized approach. This is the "cellular approach", developed by the German association VDE. The key point is that in different cells, at the local level or at the country level, electricity from fluctuating power sources (wind and sun) and flexible decentralized generation units is balanced with demand. The result is a high level of security of supply and a minimization of the supra-regional transmission requirements.

ENTSO-E's answer: The TYNDP assesses projects to help identify those that should progress at a given point in time. It does not mean that all projects assessed in the TYNDP should be built.

Aktionsbündnis Trassengegner/Aktionsbündnis gegen die Süd-Ost-Trasse (continued)

3 Insufficient consideration of environmental impacts: An essential criterion for assessing projects is the expected impact on the environment, e. g. landscape impact, damage to tourism and the recreational effect of nature, damage to the forest due to clearing, changes in soil structure, damage to groundwater, interventions in areas of nature conservation and effects of electro-magnetic fields. However, these residual impacts are described in all project data sheets only in a very rough, general and inaccurate way.

Although significant effects on the environment and nature cannot be monetized because of the high value of biodiversity, there are effects of which compensation could be monetized and could be compared with the stated values of social-economic welfare (SEW). Project evaluations are therefore generally and in detail insufficient, as the environmental impacts as well as social and health impacts are not assessed. This assessment would be necessary to carry out a Strategic Environmental Assessment in accordance with EU Directive 2001/42/EC. The TYNDP proposal therefore does not meet the requirements of the EU SEA Directive.

ENTSO-E's answer: The presentation of projects' impact on the environment in the TYNDP 2020 project sheets is in line with the CBA methodology approved by the European Commission.

4 Insufficient public participation: The public consultation of the TYNDP is not sufficient for a comprehensive way of informing and involving the public in the creation and adoption of the TYNDP 2020, as required by the Aarhus Convention.

ENTSO-E's answer: In addition to the public consultation on the TYNDP 2020, to which you provided this answer, the TYNDP process includes a public consultation on the scenarios and on the scenarios storylines. A fourth public consultation was also held on the CBA methodology, separately from the TYNDP process. Stakeholders can also provide their views in the numerous workshops and webinars which are organised throughout the process.
Public consultation in the TYNDP process is organised in line with EU legislation (TEN-E Regulation). As you are probably aware, this Regulation is currently being reviewed and a proposal has been published by the European Commission on 15 December. This proposal is currently undergoing public consultation until March 2021. If you consider that the TEN-E Regulation is in breach of the Aarhus Convention, we encourage you to express your views via the consultation process on the TEN-E proposal.

AQUIND Interconnector

1 AQUIND welcomes an opportunity to respond to ENTSO-E's consultation on the Ten-Year Network Development Plan (TYNDP) 2020. In this response, we focus on the following documents:

1) The Project sheet #247 (AQUIND Interconnector)
2) The Power System Needs 2030 for North Seas Offshore Grid ("NSOG")
3) The Regional Investment Plan Northern Seas ("RIP")
4) The Reference Grid

1. Project sheet
We welcome the quantitative estimates of AQUIND's socio-economic welfare ("SEW") benefits as presented in the TYNDP 2020 Project sheet. This constitutes a significant improvement on the TYNDP 2018 results and, in our view, reflects more accurately the value that AQUIND Interconnector is likely to bring to Europe. By 2030, AQUIND Interconnector is estimated to deliver €137 m – €155 m per year of SEW which is a circa four-fold increase over the highest TYNDP 2018 estimate of €35 m/year. The SEW benefits are estimated to be even higher under the DE and GA scenarios, at €367 m/year and €184 m/year respectively.

The wider impacts of AQUIND on the network are also positive on an overall basis: there is a significant benefit from the reduction in energy not served (€51 m/year), which exceeds by a wide margin the increase in the costs due to network losses (€31 m/year). This confirms that even taking these wider impacts into account, the net impact of AQUIND Interconnector is positive and beneficial for Europe.

ENTSO-E's answer: Congratulations and thank you for your comments.

AQUIND Interconnector (continued)

2. Power System Needs 2030 for North Seas Offshore Grid

We have concerns about the way that the project benefits have been translated into the assessment of the Power System Needs 2030 for North Seas Offshore Grid ("NSOG") and its source document Regional Investment Plan Northern Seas (RIP). The results of future modelling reflected in the document generally seem to focus mainly on future plans of national transmission system operators (see for example Table 3-1 of the RIP), and less so on projects under development by third-party promoters. In the NSOG document, Figure 1 appears to indicate that at the GB-France border, only 1 GW of capacity is expected to be commissioned by 2025, and additional 1.4 GW of capacity is needed by 2030.

This is confusing and potentially misleading for the following reasons:

- The benefits of future interconnection and the need for future investment in interconnection seem to be estimated on the basis of average annual marginal cost on each border (see for example Figure 3-20 of the RIP). However, the TYNDP 2020 documents recognise the fact that the rapid and significant proliferation of RES in all scenarios will have a significant impact on cross border flows and the need for greater flexibility, which cannot be met yet by new technologies. On the other hand, it is unclear whether or how the TYNDP 2020 models recognise the fact that it is the moment to moment volatility of energy prices that actually sends market signals to energy producers and traders to initiate cross-border flows, especially under the implicit trading arrangements. In other words, it is not solely (or even primarily) the average annual marginal cost differential that provides a price signal for additional cross-border infrastructure development, but rather the granular (hourly, half-hourly or even more granular) wholesale prices that do so. We would encourage ENTSO-E to provide more clarity on how the granular price volatility is reflected in its assessment of the needs for further cross-border investment.
- There are additional projects at the GB-France border currently under development, which have been identified as having a strong and positive SEW benefit for Europe. Yet, only 1.4 GW are included in Figure 1 of the NSOG, which corresponds to Figures 4-1 and 4-2 of the RIP.
- Some projects are included in the pre-2025 timeline even though they will not be completed in that timeframe, such as NeuConnect and NorthConnect (see comments below on the Reference Grid). It is therefore inaccurate to draw out any conclusions on the basis of Figure 1 as to the genuine system needs and the required interconnector investments.
- RIP in section 5.1.5 also treats more advanced PINT projects, which are in final stages of permitting, unfairly when bundling them together with less mature projects, which appear on the TYNDP list for the first time. There needs to be further gradation of PINT projects, for example, PINT 1 and PINT 2, where PINT 1 would include more advanced projects (such as AQUIND) and PINT 2 would include newer arrivals that are at a much less advanced permitting stage (such as the last four projects in Table 5-3 of the RIP). It would help audiences to make a distinction between more near-term investments and the need for further investments if the first group (PINT 1) is implemented in addition to the reference grid before PINT 2 group is considered.

Figure 1 of the NGOS is therefore of particular concern to AQUIND, because it indicates that even though the project is highly beneficial (on the basis of the Project sheet data) and judging how the numbers of future interconnectors suit 1.4 GW capacity per project, it has not been included among the projects that are likely to be needed by 2030. This inconsistency between the project sheet information and the NSOG document has not been examined and risks creating a false impression that the development of AQUIND Interconnector is not socially beneficial.

We would therefore strongly encourage ENTSO-E to reconsider the information presented in Figure 1 and Figure 2 of the NSOG document.

In terms of the need for additional interconnection into GB, Figure 15 of the NSOG document clearly indicates that GB (and Ireland) both have an exceptionally low ratio of interconnection relative to the volume of installed renewable generation capacity, and this this is expected to remain the case even with the 2025 grid. Similarly, Figure 20 of the NSOG document clearly indicates that GB (and Ireland) both have an exceptionally low ratio of interconnection relative to the peak load.

In both cases, GB needs to be investigated and reported upon. Figure 15 and Figure 20 therefore appear to be inconsistent with Figure 1. This is because in Figure 1, the additional capacity between 2025 and 2030 is only 1.4 GW between GB and France and 1 GW between GB and Ireland. It seems highly unlikely that 2.4 GW of interconnection capacity would increase the ratio of interconnection-to-renewable capacity sufficiently so that GB (and Ireland) would now meet the thresholds of 30% or 60% of interconnection capacity relative to renewables and/or peak load. Therefore, Figures 15 and 20, in conjunction with Figure 1, imply that even with the additional "needed" capacity to 2030, the GB market would have insufficient volume of interconnection and would need to be investigated. Yet, ENTSO-E does not comment on this result and whether it has investigated the need for additional interconnection capacity.

Again, we would strongly encourage ENTSO-E to reconsider whether the total additional "needed" capacity in 2030, as presented in Figure 1, is in fact sufficient to meet the system needs (including the ratio of interconnection to renewables, as per Figure 15, and the ratio of interconnection to peak load, as per Figure 20). In our view, this is not the case and significantly more interconnection capacity will be needed.

3. Reference Grid

Regarding the Reference Grid, we consider that there are several links that are included which are highly unlikely to be developed over the timeframe suggested.

For example:

- NeuConnect is indicated as being commissioned in 2022, which, given the current state of progress, is not feasible.
- NorthConnect is indicated as being commissioned in 2024, even though it was put on hold in 2020 by the Norwegian authorities.

The overarching concern is that the "PINT" interconnectors have been assessed against an incorrect baseline, and this may have underestimated their benefits. By comparison, AQUIND Interconnector is more likely to be developed ahead of 2025, and should therefore be included in the Reference Grid ahead of some of the other interconnectors.

AQUIND Interconnector

(continued)

ENTSO-E's answer: ENTSO-E has used all the available candidates for the IoSN study including 3rd party projects. ENTSO-E is not using average annual prices for calculation of benefits but hourly prices for the whole simulation year. ENTSO-E uses the commissioning dates that have been provided by project promoters for the studies without any discrimination for each party involved.
Regarding possible gradation of PINT projects. ENTSO-E keeps note of it and will explore further opportunities in this regard.
Regarding the NSOG Power system needs brief: this document does not identify any project as being needed or not. It only gives an overview of needs. In the case of the UK-FR border, needs in the 2030 horizon are estimated in our study at 1400 MW. Determining which project(s) is/are best fit to meet those needs is a different question, which should be tackled by looking at projects' CBA results and other project sheets content. A note has been added on the first page of all 4 PCI Needs Brief to make that point clearer.
We would also like to draw your attention to the fact that the costs of building infrastructure at the UK-FR border is also quite high, which has impacted the results.

3 We consider that the TYNDP scenarios should represent a credible range of scenarios. The central scenarios should reflect, as best possible, the likely market and policy conditions and in the current circumstances this includes, for example, the relevant Net Zero targets. However, the Current Trends scenario distracts from the assessment of future strategic plans of the development of energy production and consumption and network infrastructure development.

ENTSO-E's answer: The Current Trends is a sensitivity analysis requested by Regulators.

4 In general, we consider that the TYNDP documents are well structured. However, as discussed in the comments above, some of the findings appear to be insufficiently justified and potentially inconsistent with other TYNDP 2020 publications. As described above, we are particularly concerned about the apparent inconsistency between the Project sheets findings on the benefits of individual projects and the conclusions that have been reached in the Power System Needs 2030 for North Seas Offshore Grid document.

We have also commented in the previous consultations that all modelling assumptions and data need to be made available well in advance of the start of the consultation as it is not possible to fully assess and comment on the conclusions based only on the fragmented information that is typically made available. This creates an uneven playing field between incumbent TSOs and third-party developers, which is detrimental to the efficient development of transmission infrastructure in Europe.

ENTSO-E's answer: Regarding the NSOG Power system needs brief: this document does not reach any conclusion about projects, it only shows the needs identified by our system needs study. Assessing which projects are best fit to address the 1400 MW need by 2030 on the UK-FR border is a question to be addressed as a second step, by looking at CBA results and other information available in project sheets.
About availability of modelling assumptions and data: Scenarios data has been made available several months before the TYNDP 2020 consultation, it is unclear to us which other data you may be referring to. In any case, all data and documents are made available as early as possible in the TYNDP two-year timeframe.

5 As discussed in our overarching comments, we consider that the CBA results as reported in the TYNDP 2020 Project sheets portray a positive message on a number of interconnector projects, including AQUIND. We welcome this finding, and we believe that it is broadly consistent with our own analysis.

However, we strongly disagree with the way that the Project sheet information has been translated into the NSOG document, where only a very small subset of projects have been identified as being "needed" by 2030, despite many additional projects bringing clear socio-economic welfare benefits to Europe.

The study performed by FTI shows an increasing role of interconnectors in reducing the costs of achieving Net Zero 2050 targets. The Future Energy Scenarios 2020, published by National Grid, also show a greater need for interconnection between GB and Continental Europe, including France, in all scenarios, and especially Net Zero. This has also been reflected in the Energy White Paper published by the UK Department for Business, Energy and Industrial Strategy on 14 December 2020, as well as the report of Aurora (2020) "The impact of interconnectors on decarbonisation."

ENTSO-E's answer: The 2030 Needs Brief for the NSOG region does not identify any project as being needed or not. It only gives an overview of needs. In the case of the UK-FR border, needs in the 2030 horizon are estimated in our study at 1400 MW.
Determining which project(s) is/are best fit to meet those needs is a different question, which should be tackled by looking at projects' CBA results and other project sheets content.

AQUIND Interconnector (continued)

6 The role of non-TSO transmission projects is critical for the integration of the European grid. The reliance of future investment in network development only on the basis of regulated asset base and tariff support will significantly increase the quantum of risk associated with the energy transition that is allocated to network users as opposed to the developers of transmission projects.
Network users may not, in fact, be the optimal parties to bear that risk, and there is likely to be a significant role for other investment models (e.g. outside of the regulated asset base model), which do not place such a risk on network users.

The historical development of interconnection by national TSOs has been slower than may have been optimal for European consumers, and opportunities for third party developers to complement the national TSO investments should be seen as beneficial for the following reasons:

- Attractive projects. Non-TSO developers have a strong commercial incentive to identify the most attractive interconnector developments, and these are also likely to be those where transmission is relatively scarce (and hence these are likely to be projects that generate the highest benefits).
- New sources of skills and capital. Non-TSO developers tap into a wider pool of capital than national TSOs (who often finance projects from their balance sheets), and they also bring new skillset and experiences to the development process.
- Incentives for timely delivery. Non-TSO developers are typically involved only in a small number of projects (often only one) and are therefore highly incentivised to develop them in a timely manner with minimum delays. By contrast, national TSOs do not have such an incentive, as a delay of one transmission project by several years does not have any material impact on the entity's operation, given the much broader national and cross-border portfolio they typically operate.

However, the current processes and regulations do not fully recognise the role of non-TSO project promoters and treat them as a nuisance rather than a valuable source of much needed investment in future European network infrastructure. For example, third-party promoters are excluded from regional group discussions.

ENTSO-E's answer: Thank you for your comments. ENTSO-E strives to continuously improve transparency in particular with respect to non TSO Project Promoters. In this TYNDP, we submitted the Selection Guidelines to the TYNDP to public consultation for the 1st time and we also hold several rounds of webinars for project promoters, to which many non-TSO promoters participated. We left more time to 3rd Party Promoters than to TSOs to propose Future projects, recognising the structural assymetry of infomation between Members and non Members of ENTSO-E.

7 AQUIND has engaged with ENTSO-E on a number of occasions in relation to the TYNDP process, so we briefly repeat our main points here (but are happy to elaborate on those further):

1. Transparency. TYNDP information is often not sufficiently detailed and difficult to analyse by non-TSO parties. Greater data availability and granularity would increase the transparency and credibility of the TYNDP process and recommendations. While we recognise that some steps have been taken in this direction, we hope that TYNDP 2022 can improve on this further.
2. Stakeholder engagement. The development of TYNDP is heavily influenced by incumbent TSOs and it does not adequately represent third parties such as independent interconnector developers. This creates a perception of a potential conflict of interest as the TSOs have an inherent interest in reaching particular conclusions on the basis of the TYNDP scenarios. We hope that TYNDP 2022 could improve on this process to avoid the (perception of; or actual) uneven playing field.
3. Continuity of assumptions and results. There are often large (and, in our view, unjustified) differences in the modelling outcomes from one TYNDP to the next. This is starkly illustrated by the difference in the TYNDP 2018 and TYNDP 2020 SEW estimates for AQUIND and a number of other projects, especially when taking in comparison to TYNDP 2016. This poses significant challenges to developers whose projects were started on the basis of an earlier, more favourable TYNDP results and may come under unfavourable scrutiny in years when the TYNDP results are unfavourable. This issue was recognised in section 5.1.1 of RIP in respect of the inconsistency of assumptions for offshore wind capacity in TYNDP 2018 comparing to TYNDP 2016 and TYNDP 2020. We hope that TYNDP 2022 maintains greater continuity with the TYNDP 2020 results.
4. Consistency of results. It is critical that the multiple TYNDP publications are fully consistent with each other and that any apparent divergences are adequately explained and justified. As discussed extensively above, some of the TYNDP 2020 results are very difficult to reconcile, and they cast doubt on the validity of the recommendations. We hope that TYNDP 2022 can improve on this by ensuring greater clarity and consistency of the publications.
5. Volatility. The benefits of connecting different power markets via interconnectors strongly depend on the underlying wholesale power market volatility, and on the extent to which interconnectors can help balance that volatility. Due to the growing penetration of intermittent renewable generation, the value of managing the volatility in electricity supply (and hence of interconnection) will only increase with time. The future models that ENTSO-E uses to assess the merits of prospective cross-border transmission investments therefore need to more fully and more transparently take into account the value created by interconnectors, including that which is driven by the growing power system volatility.
6. Reference Grid and PINT projects. Since there more and more projects being proposed, there need to be clearer parameters of transferring the projects from the PINT group to the reference grid. There also needs to be a greater differentiation within the PINT group, based on the set of objective criteria such as the permitting stage achieved. The consultations need to be taken not only with national TSO, who are members of the regional groups, but respective third-party project promoters.

AQUIND Interconnector (continued)

ENTSO-E's answer: Thank you for your suggestions for improvements, we will keep them in mind when developing TYNDP 2022. Please view our detailed answers to some of your points in your other comments.

BUND Bund für Umwelt und Naturschutz Deutschland, Friends of the Earth Germany

1 The role of regional transmission networks should be emphasized together with regional electricity markets.

ENTSO-E's answer: Our regional investment plans provide a detailed overview of challenges, needs and ongoing projects at regional level.

2 Suggestions for 2022: many things have to be changed. The TYDP has to be oriented mainly on cost effectiveness and environmental protection. The main scenario should be the scenario of distributed decentralized production. There should be an EU wide strategic environmental assessment and broad public participation. The CBA 3.0 must be made transparent.

ENTSO-E's answer: We believe the central Scenario should be the one as closely as possible aligned with current common goals of the European countries. However, we also believe in the importance of a multi scenario approach, and we agree that at least one scenario with high level of decentralized production in important in the TYNDP. We strive to constantly improve transparency. We work with several external organisations including environmental NGOs to prepare the scenarios and welcome any input. We released the CBA Implementation Guidelines which details every step taken to perform the CBA (technical document aimed at modelling teams, regulators or any other interested party). We welcome any practical input on how we may further improve transparency.

3 Insufficient transparency: The draft does not have the necessary transparency to enable us to examine the proposals of the individual power line projects. The data according to the cost-benefit analysis CBA 3.0 are not comprehensible. Although the guide to the 3rd CBA Guide is available, it is not clear, which input data have been used in the projects. Evaluation data is not available for many projects, e.g. for the SüdLink project (235), there is often a lack of data ("data pending"). This does not provide sufficient justification for the projects.

ENTSO-E's answer: At the time of the publication of the draft TYNDP 2020 for public consultation, only results for scenarios NT2025 and NT2030 were available for P235. The reason is that this internal German project was assessed using the internal redispatch methodology. According to the TYNDP 2020 CBA methodology implementation Guidelines for redispatch assessment, projects assessed with internal redispatch must be assessed in at least the central scenarios NT2025 and NT2030. However, modellers have also performed simulations for scenarios DE2030, GA2030 and CT2030 and these have been published after the end of the consultation period in January 2021.
Regarding your statement' Evaluation data is not available for many projects': this statement is not accurate. Results for some scenarios were only pending for a handful of projects, which were all in the same case as P235 explained just above (use of redispatch methodology for internal German projects), meaning that results were made available for the two compulsory scenarios NT2025 and NT2030, and was later added for other non-compulsory scenarios.
Regarding input data used for the CBA: the projects sheets indeed do not include every single technical detail on the project, because they aim to be synthetic. It would be useful to know exactly which information you think is missing.

4 Insufficient consideration of environmental impacts: An essential criterion for assessing projects is the expected impact on the environment, e.g. landscape impact, damage to tourism and the recreational effect of nature, damage to the forest due to clearing, changes in soil structure, damage to groundwater, interventions in areas of nature conservation, effects of electro-magnetic fields. However, these residual impacts are described in all project data sheets only in a very rough, general and inaccurate way.

Although significant effects on the environment and nature cannot be monetized because of the high value of biodiversity, there are effects whose compensation and compensation could be monetized and can be compared with the stated values of social-economic welfare (SEW). Project evaluations are therefore generally and in detail insufficient, as the environmental impacts as well as social, social and health impacts are not assessed. This assessment would be necessary to carry out a Strategic Environmental Assessment in accordance with EU Directive 2001/42/EC. The TYNDP proposal therefore does not meet the requirements of the EU SEA Directive.

BUND Bund für Umwelt und Naturschutz Deutschland, Friends of the Earth Germany (continued)

ENTSO-E's answer: The aim of the TYNDP CBA is to deliver a common methodology applied to all "participating" projects the same way. It is not the aim of the TYNDP to perform a full Environmental Assessment. This of course has to be carried out carefully within the respective National Plans or within the project itself. However, we appreciate your proposal to use compensations for the environmental impacts in order to compare it with the calculated SEW. We will assess the applicability of this when further improving the CBA methodology for TYNDP22.

5 Insufficient public participation: It is welcomed that a public consultation of the TYNDP is taking place. This is not sufficient for a comprehensive way of informing and involving the public in the creation and adoption of the TYNDP2020, as required by the Aarhus Convention. Some environmental associations, as well as associations that tend to support the development of the electricity grid, were involved in the development of CBA 3.0 as part of the stakeholder participation. However, it would be necessary to allow all environmental associations in the Member States to participate, in particular to assess the impact of the projects on the environment and nature. This has not been done and is therefore contrary to the provisions of the European Public Participation Directive 2003/35/EC, which in turn is based on the Aarhus Convention. For the further decision on TYNDP2020 by EntSOE and by the European Parliament and the Council on the "Projects of Community Interest" (PCI), there is therefore no essential element of participation and legal protection. In particular, since the entire TYNDP affects the electricity grid of the whole of Europe, it is necessary to carry out a Europe-wide participation with legal protection options.

ENTSO-E's answer: On stakeholder involvement in the development of the CBA methodology, if we understand your comment correctly you are referring to the 'workstreams'. From December 2017 to April 2018 external stakeholders were invited to take part in 3 workstreams allowing them to contribute directly to the drafting of the CBA methodology. Please note that a public consultation was also conducted on the CBA methodology, as well as several open stakeholders workshops, allowing all interested stakeholders to participate, not only those involved in the workstreams.

6 No Strategic Environmental Assessment (SEA): The inclusion, assessment and comparison of TYNDP projects with alternatives is a prerequisite for the implementation of an SEA. Since there was no sufficient survey of the respective effects on the environment, nature and health and social effects and no alternatives were taken into account, there is no SEA to the TYDP. The TYDP therefore does not meet the requirements of the EU SEA Directive.

ENTSO-E's answer: Please see our answer to the same comment by Aktionsbündnis Trassengegner / Aktionsbündnis gegen die Süd-Ost-Trasse.

7 It is rather complicated to understand the TYDP. The data in the project data sheets are not fully available, it is not clear how and which data have been input to tht CBA 3.0. The comprehensive way is more hiding scientific information than explaning the context. Is was not easy to find to some of the additional documents. The time for investigating the documents has been to short. The basis, a list and map of supposed power generation unity in europe is missing.

ENTSO-E's answer: Regarding availability of data in the project sheets: if you are referring to availability of results for additional scenarios to NT2025 and NT2030 for projects assessed with the redispatch methodology, please see our answer to your other comment on this topic.
Regarding clarity on which data has been used for the CBA, the projects sheets indeed do not include every single technical detail on the project. It would be useful to know exactly which data you think should be added, you are welcome to contact us at **tyndp@entsoe.eu**
Regarding the length of the public consultation: please note that the consultation period was 2 months, it is more than most ENTSO-E public consultations (4 to 6 weeks).
Regarding list and map of supposed power generation units in Europe: data on generation capacities per country is publicly available as part of the scenarios data.

8 It is meantioned only once (p 38 of consultational document) that the national trends scenario is treated as a "central" scenario. There is confusion about the word "central" because the question is, if scenarios are centralized or decentralised (distributed energy).

ENTSO-E's answer: It is unclear which document you are referring to as the 'consultational' document. That NT is the central scenario of the TYNDP 2020 is mentioned on every single project sheet. It is also explained in the Scenarios report.
Regarding your remark on possible confusion with centralised / decentralised scenarios, we had not considered this point. It will be discussed when developing the TYNDP 2022 scenarios whether it creates a real risk of misunderstanding.

Climate Action Network (CAN) Europe

1 CAN Europe is worried that the TYNDP 2020 is not yet fully aligned to reaching the Paris Agreement's objective of limiting global temperature rise to 1.5 °C. We suggest to assess all available infrastructures and non-infrastructure related solutions in a consistent manner. This would imply that the market and network modelling together with the cost-benefit analysis evolve from the current, electricity sector-based approach to a cross-sectoral optimisation process. The European Commission's Sector Integration Strategy and its Hydrogen Strategy outline key elements of how the interlinkage of sectors can increase environmental and societal benefits. The TYNDP needs to target these benefits by identifying the appropriate energy infrastructure solutions. This means going beyond a separate assessment of pipes and pylons only. The upcoming revision of the TEN-E Regulation is an opportunity to update the modelling methodologies and the cost-benefit analysis to make it fit for sector integration in view of facilitating more ambitious emission reductions.

ENTSO-E's answer: ENTSO-E has released a Roadmap for the development of multi-sectorial planning support towards 2030. With this roadmap, ENTSO-E will improve the consideration of smart sector integration in the infrastructure planning process. Smart sector integration will enhance flexibility across various energy sectors and allows a development towards a more energy- and cost-efficient energy system. We also look forward to the upcoming review of the Ten-E Regulation during which we'll advocate for an ambitious multi sector approach. We are constantly updating our modelling approaches. Our modelling teams are at work to develop robust, fair, informative methodologies.

2 The assessment of socio-economic welfare achieved by TYNDP 2020 projects under the Current Trend 2030 sensitivity is not complete as it does not integrate the higher external costs (climate damage, environmental damage, health costs) related to the EU's failure to achieve the needed greenhouse gas emission reductions in time.

The Current Trend 2030 sensitivity should not become a scenario or guideline for future energy infrastructure planning as it would send a short-viewed, wrong signal in terms of investment needs.

ENTSO-E's answer: We aknowledge that the Current Trend is not a scenario, but only a sensitivity derivated from the National Trends Scenario.

3 Q: In your view, how do proposed transmission and storage infrastructure projects compare to future system needs?

Are the CBA results consistent with the role of the network in achieving the EU Green Deal and in identifying the value of infrastructure projects and the way forward?

In our understanding, the cost-benefit analysis is not yet aligned in a stringent manner with a realistic pathway towards net-zero emissions, be it with a 2040 or with a 2050 horizon. The CBA results neither are complete in the sense of a more holistic cross-sectoral optimisation of all infrastructure and non-infrastructure-related solutions (see submission under 5. Open comments).

We encourage ENTSO-E to strengthen the assessment in view of integrating assumptions and data on demand-side response and prosumer behaviour as well as regards energy efficiency gains and energy savings potentials. It is not clear to what extent solutions such as district heat networks and thermal storage have been taken into account duly.

ENTSO-E's answer: The concerns expressed in this comment are mostly adressed in the Scenarios on which the TYNDP is based. Information on how the scenarios considered demand response, new behaviours, district heating, etc, to build the load profiles is available on the dedicated scenario website. In the future, we plan on collaborating with DSOs to further improve our demand modelling approaches. The CBA assesses individual projects against a common framework. In the future and as new cross sector projects appear, multi sectors CBAs are likely to be delivered (see ENTSO-E Roadmap for the development of multi-sectorial planning support towards 2030)

4 Regarding the TYNDP 2020 Main Report, we welcome its clarity and the reader-friendly format.

ENTSO-E's answer: Thank you.

Commission de Régulation de l'Energie

1 The Commission de Régulation de l'Energie (CRE) appreciates the opportunity given to stakeholders to express their views on ENTSO-E's TYNDP 2020 and stresses the importance of their proper consideration.

CRE wishes to propose adjustments in the perspective of the selection process for Projects of Common Interest. While CRE notes improvements in the process implemented by ENTSOE to build the latest TYNDP, there are still significant biases in terms of methodology and continuity of analysis, which limit the capacity of the TYNDP to effectively select the projects of most value to the community. Transparency, particularly on the assumptions used, should also be enhanced.

ENTSO-E's answer: Thank you for your comments, please see our detailed answers in the next rows.

2 **System needs analysis**

Concerning the analysis of the system's needs, CRE notes that ENTSO-E indicates in its methodological report that the costs associated with losses and reinforcements of internal networks have not been considered. This point is particularly problematic since it leads to an underestimation of the costs associated with the interconnection projects studied and consequently to a risk of a general overestimation of the value of the projects for the community.

CRE also notes that the implementation of the 70% target has not been taken into account, that the analysis does not seem to be based on the usually represented average weather conditions and that the price zones differ between 2030 and 2040. CRE recommends a more detailed justification of these choices.

Furthermore, CRE notes that a reference network has only been elaborated for the year 2025, and not for 2030. This makes it impossible to assess the reduction in project benefits linked to the construction of new interconnections between these two deadlines. As a minimum, and for transparency purposes, CRE would like the costs and capacities associated with each cross-border element of this network to be clearly presented.

ENTSO-E's answer: Internal reinforcements were partially considered: TSO were asked to include internal reinforcement costs within the cross border costs candidates used in the optimization. However those costs were added ex-ante and did not result from a joint internal / cross border optimization. Losses were directly taken into account in the market simulations, however additional losses brought by the project candidates were indeed not taken into account but checked in detailed during CBA phase.
The system needs study was based on the 2007 climate year, which represents the most central climate year among the 3 used for the CBA analysis.
Indeed, 70% has not yet been considered for the study due to no maturity of the methodology to implement it for the long-term time horizons.
The market zone differneces were driven by granularity of the study for 2040 time horizon (Zonal Modelling) and availability of data from the 3rd countries.
Regarding your last point on publishing costs and capacity of projects included in the reference grid: this information has been added to the System Needs main report Appendix 2 following the public consultation. Please note however that this data was already publicly available previously in the project sheets of each individual project.

3 **Scenarios**

Regarding the scenarios, CRE fully endorses ACER's opinion of the 5th November 2020 on the ENTSOs' 2020 joint scenarios' development report and would like to highlight certain aspects of it. The choice to base the central scenario on the national Energy-Climate Plans can be welcomed. However, in order to be able to assess the robustness of the different projects and their interest in a context of uncertain future, it would be necessary that the scenarios chosen represent sufficiently contrasted situations. Moreover, the assumptions used for the Distributed Energy and Global Ambition scenarios are insufficiently precise, especially as regards the orientations for the trajectories for each technology and for the level of demand at the different time horizons. Greater transparency would be desirable to better appreciate the effects of the very significant changes compared to the previous TYNDP.

Finally, CRE notes positively the inclusion of a "Current Trends" scenario, which makes it possible to represent a situation of slower economic growth. This scenario makes it possible to establish a first justified contrast, whose relevance is demonstrated by the current context. CRE considers that this scenario should not be presented as a simple sensitivity analysis and that its assumptions should be publicly available on the ENTSO-E platform.

Commission de Régulation de l'Energie

(continued)

ENTSO-E's answer:
The Distributed Energy and Global Ambition Scenario have been differentiated in several ways;
- Electricity Demand
- SR Capacities
- Battery Capacities
- Nuclear Capacity
- Renewable Capacities

We are very open to feedback on how to differentiate the scenarios further in the 2022 cycle.
There is a wealth of documentation on how the scenarios were constructed on the scenario website, throught the following document;
- Scenario 2020 Storyline Report
- Scenario 2020 Methodology Report
- Scenario 2020 Report

4 Furthermore, the consequences of Brexit on cross border trade are still uncertain and could affect the value of interconnections. The impact of the pandemic on energy consumption and investments also represents a major factor of uncertainty. These uncertainties should be taken into consideration as soon as possible, through adjustments or sensitivity analyses for the selection of Projects of Common Interest.

ENTSO-E's answer: The TYNDP 2022 scenarios currently being developed will consider all factors, include the pandemic impact on the economic situation.
Brexit may have an impact on the selection of PCI process and on the selection of projects in future TYNDPs, but not on the CBA (considering GB would remain in the modeling perimeter and the models consider simplified market rules). Any further analysis applied to all PCI candidates would require careful steps in order to keep the TYNDP's equal treatment and quality standards. Rushed calculations may lead to irrelevant results, unfair treatment and eventually wrong decision by policy makers.

5 **Ensuring greater methodological stability**

With regard to the system needs analysis and cost-benefit analysis, CRE notes that the results are, once again, very different from the previous edition of the TYNDP. The investment needs thus vary greatly at certain borders compared to what was indicated two years ago. Such discrepancies raise questions about the use of these tools to guide investment choices. They highlight the very high sensitivity of the results to the hypotheses. CRE therefore invites ENTSO-E to strengthen the robustness of its evaluations and, in particular, to provide the transparency necessary to understand the evolution of the analyses from one edition of the TYNDP to the next. Although the TYNDP elaboration process is complex, this is an essential aspect of the credibility of the results.

CRE also asks for all scenarios to be modelled in both tools and at all time horizons. The cost-benefit analysis currently only proposes results limited to certain benefits on alternative scenarios to the National Energy-Climate Plans, limiting the relevance of comparisons. Furthermore, CRE considers that some fundamental elements should be explicitly presented, such as the direction of flows on interconnections and the underlying price differentials.

ENTSO-E's answer: Our system needs report includes a comparison of the needs identified in 2020 with those identified in IoSN 2018, and highlights the differences in methodology explaining the difference in results (see page 37). As explained, the main reasons for the differences in the results are the scenarios themselves that affect heavily the results, and the reference grid used that in 2017 was based on the 2027 horizon, while in 2020 is based on the 2025 horizon. Although results show some differences, ENTSO-E considers that they are consistent enough, confirm the usefulness of the zonal methodology approach and require continuous evolution and improvement in future studies.

Commission de Régulation de l'Energie (continued)

6 Non-TSO transmission projects should be adequately integrated in the TYNDP and assessed under the conditions foreseen in the relevant methodologies. CRE notes that non-TSOs transmission projects are considered at French borders. At this respect, it is important that these projects are presented with the same transparency standards than TSOs projects.

ENTSO-E's answer: We take non discriminatory treatment on non TSO project promoters in the TYNDP very seriously. We strive to continuously improve transparency in particular with respect to 3rd Party Project Promoters. In this TYNDP, we submitted the Selection Guidelines to the TYNDP to public consultation for the 1st time. We hold several rounds of webinars for project promoters. We replied to any promoter email within 3 business days. We left more time to 3rd Party Promoters than to TSOs for submitting Future projects, recognising the structural assymetry of infomation between Members and non Members of ENTSO-E.

7 **Cost-benefit analysis**

Concerning the cost-benefit analysis of projects, although some clarifications have been made, notably through a useful correction of the value of losses, CRE remains concerned and identifies several remaining points for improvement, which have already been proposed in the ACER opinion of the 6th May 2020. Thus, the way in which the integration of renewable energies and the reduction of CO_2 emissions contribute to the total value of socio-economic welfare (SEW) could be better explained. In this respect, CRE has noted cases where these components may be higher than the total SEW at certain borders, without this phenomenon being explained. CRE also reiterates its previously expressed reservations regarding an ex-post monetisation of CO_2 costs above market prices only for infrastructures. Evaluating alternatives to networks requires a coherent representation of the assumptions on the cost of CO_2, fuels, and energy mix within the scenarios, with contrasted values of the cost of CO_2.

Concerning the project sheets, it would be important for ENTSO-E to clarify on which basis the whole calculation of the value of projects will ultimately be made, as not all the benefits measured by the CBA 3.0 are presented. Information on the detailed costs of projects and their social and environmental impact should also be published. Finally, CRE would welcome the presentation of additional sensitivity analyses on the major assumptions (fuel prices, CO_2 prices, electricity demand, development of flexibilities). This action, which can be implemented in the short term, would facilitate the understanding of the results.

ENTSO-E's answer: The CO_2 costs – ETS costs – used for the monetisation of the CO_2 emissions (not the B2 indicator which is based on societal CO_2 costs) is already fully internalised within the SEW. As the market simulations – for calculating the SEW – are using the same ETS costs, the monetised CO_2 emissions are consistent with market simulations and can therefore correctly be displayed separately. For the separated expression of monetised RES integration, there is no correct methodology available, nor can it directly be "extracted" from market simulations. This is why ENTSO-E has to assume the monetised value of RES integration by the given method (described in detail within the Implementation Guideline). As this is just an assumption, the sum of monetised CO_2 and monetised RES can exceed the SEW. A short explanation has been added to the Project Sheet Explainer on indicator B1 (accessible by clicking on the ? icon in each project sheet).
If by 'whole calculation of the value of projects' you are referring to NPVs, please note that these are not computed within the TYNDP process. ENTSO-E believes the real value of projects for society cannot be summed up in one single number. If NPVs are required to be computed as part of the PCI process, it is then up to the European Commission to specify the details of their computation.
Detailed costs of projects and their social and environmental impacts are already published in the project sheets.

currENT

1 In the "Highlights" and "Main Report", the RTE example mentions correctly that the curtailment of RES infeed is the most cost-effective option compared with reinforcement, but neglects to mention that the approach is "paired with" Dynamic Line Rating. This is mentioned in the French National Development Plan. The ENTSOE documents point out that the battery storage flexibility will enter the "experimentation phase" in 2021, while it is not mentioned at all that the DLR+limitation of generation is recognized as a key implementation measure in the next 5 years. This would seem an important point, but not highlighted, why? Why are batteries promoted as being the solution to potentially avoid/postpone grid reinforcements when clearly the French 10year development plan identifies that DLR+curtailment is the key technology to do this – compared against batteries!

ENTSO-E's answer: We have added the words 'paired with DLR'. Please note that the purpose of this example is to illustrate a case where a TSOs assessed alternative ways to address a need, not to dive into identified priorities for the French power system.

currENT **(continued)**

2 The Highlights document states that "Cost efficient development is key", but neglects the role of the optimized use of existing grids. Furthermore it state that "The TYNDP, through its unique access to data, stake-holder involvement, and analytical capabilities, provides a transparent picture of the European electricity transmission network. In this way, it supports informed decision-making leading to strategic investment at regional and European level. It also offers unique datasets and analysis." This is exactly why, the TYNDP should be inclusive and consider all options that are fundamental to the future grid, including not only storage and reinforcement projects but also DLR and power flow control solutions.

ENTSO-E's answer: The optimised use of existing grids is of course important. Regarding the categories of projects assessed by the TYNDP, in line with the TEN-E Regulation the TYNDP assesses projects for transmission and storage infrastructure. A public consultation has recently been launched by the European Commission on its proposal for a revised TEN-E Regulation, we encourage you to provide your comments to this consultation.

3 Each document is made short enough to read but having several documents makes it difficult to understand the connection between each. For example, how are the inertia concerns or grid stability concerns raised in the "Insight" documents assessed in the TYNDP? (It appears they may not be, perhaps because teh TYNDP leaves each country to assess those themselves).

ENTSO-E's answer: Thank you for your comment, in future TYNDP we will look into reducing the number and/or to make it easier to navigate between reports.
One of the insight reports looks at the inertia challenge. The analysis of inertia in the TYNDP shows the results of the analysis performed and possible solutions that could be implemented after more detailed analysis at national level

4 **Continued evolution of CBA methodology is appreciated.**
Faster release of the "guidelines" to promoters for calculating benefits B7-B10 would be great.
Please describe better what items are considered "OPEX"? For example, in Germany Congestion Management costs are considered OPEX, but are very large and should be broken down more explicitly as opposed to hidden under a single simple category of "OPEX".
Please consider in future, the benefits of cost reductions for projects if the completion is (likely to be) delayed. Not because the need for them will entirely go away, but there are solutions that "soften" the impact of a delay, like DLR and Power Flow Control. Since it is becoming more and more challenging to complete projects on time, it makes sense to be intelligent about assessing the "bridging" options and optimize the transition to the TYNDP timeline. But this cannot be done without the explicit evaluation or reporting of benefits from DLR or Power Flow Control solutions.

ENTSO-E's answer: For TYNDP 2022 the guidelines for PLI (if they still need to be applied by project promoter directly) it is planned to deliver the respective guidelines earlier in the process.
The TYNDP aims for assessing all projects on a common basis across Europe. It is therefore not always possible to cover all specifics of distinct projects. However, we appreciate your proposal and will assess its applicability within the TNYDP 2022.

5 **Suggestions for 2022:** Grid capacity utilization by Dynamic Line Rating and Power Flow Control ought to be considered in more detail, and – at least on par with storage. (e.g., how much socio-economic welfare does it bring?) Especially when other projects suffer delays, these projects can bring quick relief.
In the Main Report "Step 9" Operation of the new infrastructure" describes analysing the impact on system operation and markets to evaluate whether anticipated benefits have been delivered. Such accountability should be the standard for all projects! For example, DLR has surpassed its original promised benefits but such results are not fully evaluated or promoted by implementing TSOs.
The System Needs report needs more emphasis on flexible GRID operation solutions not only expecting flexibility to be delivered by generation and load.
Organizing the Power system needs per country in the form of fact sheets are an interesting way to present the information, but it needs to describe country specific challenges in more detail to be useful.

ENTSO-E's answer: Thank you for your comments, we will see how to take them into consideration in next TYNDP cycle.
Please note that the system needs report does not consider solutions, but only needs.

Danish Energy

1 The main report in chapter 4 highlights the huge investment scale-up in offshore wind in the coming years. The response in grid efforts is mentioned as the list of offshore projects in the TYNDP 2020. However, most of the offshore projects are traditional interconnection of two onshore areas. That may be sufficient for simple radial connections of offshore wind at a low build-out rate, but interconnection of hybrid assets at a high build-out rate of offshore wind requires a more dedicated focus on regional cooperation. Given the decicated priority of offshore grids in the European Commission's Offshore Renewable Energy Strategy, we would quite rapidly expect to see a more consolidated regional approach to offshore grids with a prioritised focus on reflecting added benefits of hybrid assets in the CBA.

ENTSO-E's answer: As explicitely mentioned in the TYNDP, the offshore approach in the TYDNP will evolve in the next editions to consider more configurations in the System Needs study.

2 While the System Needs study identifies a need for an ambitious build-out of interconnection capacity, it might not be ambitious enough. The System Needs report identifies the need of a total build-out of interconnection capacity between today and 2040 of 128 GW. Compared with the barely 100 GW interconnector capacity installed today, this will more than double the interconnector capacity in Europe over the next 20 years. While this sounds ambitious – especially considering the significant slowdown in transmission build-out in Europe after the turn of the millennium – it might not enough to secure a cost-efficient green transition in Europe. In a study by EA Energianalyse commissioned by Ørsted, EA Energianalyse finds that a cost-efficient pathway to climate neutrality in 2050 necessitates more than double the interconnector capacity by 2040 as TYNDP 2020 finds when comparing the same geographic areas (**www.ea-energianalyse.dk/wp-content/uploads/2020/05/1949_Offshore-wind-and-infrastructure.pdf**)

ENTSO-E's answer: Thank you for your comment. We are aware of the study you mentioned and Ørsted kindly presented the findings to ENTSO-E. We aknowledge that the approach in this TYNDP System Needs study shows limits when it comes to offshore grids. By design of the Study, historically designed for classic interconnectors, only radial connections are considered while the cost of RES connection to shore is assumed in the scenarios. With these assumptions, the need for an offshore wind is indeed smaller than that in the study you mention. This means that the configuration tested does not show viability in this study. In future TYNDPs, we aim at being able to consider more configurations in order to get a proper pictures of the System Needs in offshore regions.

3 In Figure 3.1 in the main report, the increase in interconnection by 2030 between DK and GB is listed as 2800 MW. We can only see projects totaling 1400 MW by 2030.

ENTSO-E's answer: The TYNDP 2020 portfolio includes two UK-DK projects, P127 and 1051, in total 2800 MW of proposed additional capacity.

4 The TYNDP-package is a fairly complex set of documents to get an overview of.
The project sheets are an informative part of the package, but it would be very helpful if they were more consistent and more elborate in their detail/data availability.

ENTSO-E's answer: Thank you for your comments. Regarding the project sheets, it would be good to elaborate further where you see inconsistencies so that we can tackle them in future TYNDPs.
Regarding the level of details and data published in the projects sheets, this is a request that has been made by several stakeholders and we will investigate in TYNDP 2022 whether/how to provide further details on projects.

EDF

1 The information presented in the TYNDP is useful, in particularly the Excel files for each project and EDF appreciates the efforts made ENTSOE to be more transparent and to provide more information.
Compared to the previous TYNDP, there are more information concerning the reference grid and the comparison between 2030 and 2040 seems to be more consistent and more understandable.

However, EDF considers that further improvements are still required for the next TYNDP

- It would be worth to have more information concerning the calculation of NTC increase associated to each project. The methodology to calculate the NTC increase associated to each project could be more transparent. In particular, to challenge the NTC variations obtained by ENTSO-E, it would be necessary to have more transparency on the network model and the methodology used to translate network models into a zonal system with commercial exchange capabilities;
- With respect to the RES development, the proposed geographic breakdown based on bidding zones might not reflect all the needs in further infrastructures. Large TYNDP areas could be divided for TYNDP studies even though they consist of a single bidding zone ;
- The level of NTC depends on the location of generation and consumption whose are linked to meteorological conditions. In the TYNDP 2020 there is a single value for NTC despite the variability in meteorological conditions. For the next TYNDP, introducing an NTC associated to each meteorological condition could be valuable.
- The publication of hourly RES generation is needed to carry out market simulations
- For the previous TYNDP, ENTSOE released the network models and EDF suggests to release again this information.

ENTSO-E's answer: Regarding NTC increases: the methodology for their computation is detailed in the CBA Guideline 3.0.
Regarding bidding zones: Increase of the bidding zones for the studies also is followed by the increase in the complexity and resource intensity. Already during Zonal Modelling process ENTSO-E has been using more bidding Zones compared to the classic configuration.
Regarding NTC and meteorological conditions: NTC is being calculated per hour. However, so far for the matter of simplification, only 1 value has been used, reflecting the rules in CBA Guideline. However for the TYNDP 2022 process, ENTSO-E already considers to improve this matter and add granularity of NTC input to the studies.
Regarding hourly RES generation: some data is available upon requests, and sometimes signature of an NDA.
Feel free to contact us at **tyndp@entsoe.eu** for more information.
Regarding the network model: this data will be released later on (as was also done for TYNDP 2018)

2 We welcome the ENTSOE's efforts to publish more information and to make the document as user friendly as possible.

ENTSO-E's answer: Thank you.

3 The CBA results clearly highlight the projects that are of most added value to the EU as a whole and the projects that should be carried out in priority. Transparency on the different CBA indicators is appreciated as it allows to better understand the effects of a project and as it should be the main input for PCI selection process.

If the methodology to assess both transmission and storage projects has to remain common, it is important that it is without prejudice to storage projects. Indeed, we consider that the current methodology is currently incomplete to assess the full benefits of storage. For example, some elements have not been taken into account: some specificities of storages, such as potential benefits resulting from a reduction of generation CAPEX or the multi-service dimension of storage. Therefore the calculation of the social and economic welfare should include the possibility for other kinds of benefits for storage to be valued in the assessment.

ENTSO-E's answer: We thank you for your comment. Transparency is also a major point for ENTSO-E. Therefore we have added the Implementation Guidelines, as set of additional information, to the TYNDP 2018 for the first time. In TYNDP we give the public the possibility to directly comment on the Implementation Guidelines by using the public consultation. We will also in the future try to alway improve the transparency of the calculations performed within the CBA assessment.
We have spent a lot of effort in improving the assessment of Storage projects during the last years (organisation of a public work-stream, consultations, workshops etc.). We will proceed with the improvements on developing sufficient methodologies for the assessment of storage projects.

Edison S.p.A

1 The Italian TSO Terna, in its biennial report "Rapporto Capacità Obiettivo", provides a technical-economic analysis of the potential for the development of the interconnection capacity with the neighboring countries with the aim to identify the optimal development for each border in 2030.

The scope of the study made by Terna can be comparable with the Power System Needs Study (in particular the SEW based Electricity needs 2030). Therefore, it would be particularly interesting to understand both the reasons behind the two different methodological approach and the rationale that justifies different outcomes. In general, Edison believes that the methodological differences, as well as the potential divergence of the results, between the TYNDP Power System Needs Study and comparable assessments made at national level should be explained in a devoted section in the country fact sheet.

ENTSO-E's answer: Thank you for your comments. ENTSO-E takes note of your proposal.

2 Edison welcomes the "central scenario" approach that focuses the analysis on the National Trends scenario, which should provide the best representation of the climate policy targets pursued by Member States.

The Current Trends sensitivity also seems very relevant in order to evaluate the potential deviation from the decarbonization targets, because all the other scenarios rely on technologies (Power2Hydrogen, CCS, FCEV vehicles, etc) that are not totally mature yet, both under a technological and economic points of view.

Hence, since there is a risk that the development of technologies on a large scale does not occur as described in TYNDP main scenarios, the addition of a Current Trends scenario would help to identify possible deviations from climate targets which need the timely implementation of corrective actions.

For the above-mentioned reasons Edison suggests an extension of the analysis' perimeter for the future editions of the TYNDP by adding a Current Trends scenario besides the existing ones.

ENTSO-E's answer: Thank you for your comment. In line with European Regulation and the intention of ENTSO-E and its Members, all scenarios will reach decarbonisation targets including for non policy based scenario aligning with the Paris Agreement. It is a fact that some of the technologies are unproven, and therefore may never materialize in the scale proposed in the scenarios. We consult with stakeholders, exchange with industry, associations and other experts to figure out the most relevant framework to assess infrastructure.

3 Edison believes that the European Electricity sector will play a central role in the achievement of the decarbonization targets set in the EU Green Deal.

Thus, the estimation of the specific contribution provided by TYNDP projects can be very useful in order to duly assess the impact of the development of transmission and storage infrastructures on European climate targets.

ENTSO-E's answer: We agree with your comment. Beyond the direct contributions seen in the CBA (difference with and without the project in fix scenarios), infrastructure projects are enabler of the energy transition. Some RES also needs projects assessed in the TYNDP to become viable projects.

4 Non-TSO transmission projects play an important role in the development of the European network, contributing to the reinforcement of the existing interconnection capacity where it is much needed.

Non-TSO transmission projects should be evaluated according to the cost-benefit analysis carried out in the TYNDP taking into account the expected evolution of the European electricity markets. For the above-mentioned reasons Edison suggests that the current practice should be maintained in the future editions of the TYNDP.

ENTSO-E's answer: Non discriminatory treatment on non TSO project promoters is a corner stone of the current TYNDP and ENTSO-E will keep making all possible efforts to enforce it. Thank you for your comment.

Edison S.p.A

(continued)

5 Edison appreciates the effort made by ENTSO-e in ensuring a good level of accessibility and synthesis of the Report through the many highlights and summaries but, at the same time, giving the possibility of carrying out a detailed analysis through detailed documents (for example, Online project sheets, Insight Reports, Regional investment plans, etc.).

ENTSO-E's answer: Thank you.

6 The importance of CCS/U should be better detailed. For example, some general principles should be addressed:

- Will the CCS/U be implemented close to the consumption point or at the border?
- How the cost will be allocated?

Some technology substitution can allow to make important carbon saving as it is described in the ENTSOG TYNDP 2020 document recently published (for example substituting carbon intensive fuel like coal or oil with methane). This possibility should be mentioned in the scenarios' development.

ENTSO-E's answer: This comment is relevant for the development of scenarios. Scenarios of the TYNDP 2022 are in the process of being developed, a public consultation on scenarios storylines took place in November-December 2020 and a consultation on the draft scenarios is foreseen to take place in Q3 2021. There will also be workshops and/or webinars providing additional occasions to provide input.

Europacable

1 In order for Europe to meet its ambitious energy and climate objectives, there needs to be a fully interconnected high (HV) and extra high voltage (EHV) electricity grid network. The projects should help deliver future system needs, but there is some uncertainty regarding the viability of some projects without the provision of external financial assistance from the EU or other institutions.

ENTSO-E's answer: The TYNDP checks the economic viability from a societal perpective of projects (please note that not all benefits can be monetised). The TYNDP does not adress redistribution, missing money issues or support schemes, although the information it contains can be used to perform such analysis.

2 Non-TSO transmission projects are helpful in estimating potential cable demand for the period to 2030. However, we recognise that few non TSO projects have reached completion to date and we do not expect all proposed projects to proceed as currently estimated.

ENTSO-E's answer: Non discriminatory treatment on non TSO project promoters is a corner stone of the current TYNDP and ENTSO-E will keep making all possible efforts to enforce it. Your observation on project implementation is however correct.

3 Suggestions for TYNDP 2022: ENTSO-E oversight of the non monetised variables such as environmental and social impacts of projects. As you correctly point out in the Highlight Report, public acceptance is the main challenge for implementing projects and the impacts (and/or proposed mitigation) should be more fully explained.

ENTSO-E's answer: ENTSO-E reviews the data published in the TYNDP. We make sure the figures provided and the justification respect the guidelines we provide to project promoters. We request in relevant cases justifications in the form of studies validated by competent authorities (NRAs, TSOs). The TYNDP is also subject to a review by ACER who may comment on any information published. We'll take your comment into account in our continuous discussions with Regulators, project promoters and stakeholders to further improve the TYNDP.

Europacable (continued)

4 Regarding the central scenario approach: We support this approach as it reflects the commitments of each EU Member State to meet the targets set in terms of efficiency and GHG emissions reduction for the energy sector. It is also aligned with the draft NECPs of the respective Member States, which translate the European targets to country specific objectives for 2030.

ENTSO-E's answer: Thank you for your views, we will take all views into consideration before deciding whether the same approach will be followed in TYNDP 2022.

5 The CBA 3.0 analysis has improved significantly and as the monetised variables are calculated by ENTSO-E, this adds to the consistency and reliability of the analysis

Information on the non monetised variables such as the residual impacts of projects (environmental and social) are provided by the project promoters. We found inconsistencies in this data. In several case where a project is classified as in the "Permitting" phase, there is no data on the environmental or social impacts. In other cases, a km figure is provided, but there is no description of planned mitigation. We believe ENTSO-E should push project promoters to provide more meaningful analysis once a project enters the Plaining Phase.

ENTSO-E's answer: We thank you for your comments on the improvements in the CBA Guideline 3.0, and take note that further improvements could be made to the information provided on residual impacts. We will consider how to further improve the collection of this information from promoters in next cycle.

Fortum Oyj (EU Transparency Register identification number 03501997362-71)

1 Fortum welcomes the TYNDP 2020 reports and the project sheets on the TYNDP projects. We appreciate the continuous development of the TYNDP process and the possibilities for stakeholder input and feedback.

We consider it essential that the system needs are studied in a Europan-wide analysis and presented transparently. We regret that in TYNDP 2020 the comprehensive System Needs study and report is based only on the National Trends scenario, as this scenario does not fulfil the Paris Agreement targets and the new EU climate targets for year 2030. Thus, there are most probably addtional system needs in many borders, and especially on sea cables that could simultaneously serve as hydrid links connecting offshore wind farms, too. In some cases, additional power demand e.g. from flexible hydrogen production might on the other hand reduce the need for export interconnectors. However, it is good that the cost-benefit analyses for the TYNDP 2020 projects are done for all the scenarios.

ENTSO-E's answer: Thank you for your comment and your appreciation of our stakeholder engagement efforts. We indeed see as a critical value in the European Planning the contribution of as many parties as possible.

2 The TYNDP 2020 reports clearly show that on some borders there are major gaps between the future system needs and the proposed projects. The main report says that only slightly more than 50% of the National Trends system needs are covered by the TYNDP projects. According to the TYNDP 2020 results, large marginal cost differences will still remain in 2030 over many borders. For many of these borders no new grid projects are proposed, or the projects are scheduled to be commissioned only after 2030.

The TYNDP process should in the future further analyse the reasons for these gaps and also use stakeholder feedback through European, regional and national stakeholder forums to identify new measures and project ideas to better meet the increasing system needs.

ENTSO-E's answer: We agree and hope that the findings of the TYNDP can be used by Project Promoters throughout Europe to propose relevant infrastructure projects for Europeans.

Fortum Oyj (EU Transparency Register identification number 03501997362-71) (continued)

3 As we commented under point 5, the proposed transmission projects do not for all bidding zones meet the system needs shown in TYNDP 2020 for the National Trends scenarios, and the system needs for the other scenarios are most probably even bigger. It is important that the CBA takes adequately into account the results for the Distributed Energy and Global Ambition scenarios that are based on the Paris Agreement targets.

In order to meet the new EU climate tagrets for year 2030 most cost-effectively, it is necesssary to implement the grid projects as fast as possible, which would require some of the long-term TYNDP 2020 projects to be commissioned already before 2030.

Storage projects are by nature competing with other commercial flexibility resourses. Thus they should not be prioritised by the TYNDP process over other market-based existing and new resources for meeting future power system needs. It is anyway positive that the TYNDP process can show that new storage projects have in many cases positive value in achieving the EU climate and market integration targets.

ENTSO-E's answer: We agree on the critical importance of a multi scenario approach for project assessment, which is the standard also used in every European country. The System Needs provide information on infrastructure gaps and although this information may be used to review the validity of a portfolio of projects, it is not meant to replace the CBA and is not part of the projects assessment.

4 In TYNDP 2022, the gaps between the system needs and the proposed projects should be thoroughly analysed, also utilising stakeholder input. Additional measures to meet the system needs could be found e.g. through a wider consideration of new projects on other borders, including sea cable connections and offshore grids when these give socio-economic net benefits. An analysis of the TSO congestion income and its use on grid projects could also be included in TYNDP 2022.

ENTSO-E's answer: Proposing projects is not part of ENTSO-E's mandate defined in the Regulation. However, we welcome and would be happy to discuss and provide the necessary guidance or information to any initiative aimed at further analysis and use of the data we produce.

5 In the TYNDP 2020 Main report figures 3.20 – 3.25, the legend texts for "Yearly average marginal costs difference >2.00 €/MWh" and "... <2.00 €/MWh" seem to be in wrong order.

Concerning the EU 2030 Interconnection Target indicators, it would be good to mention that the indicators have been confirmed in the European Commission's communication on strengthening Europe's energy networks (Brussels, 23.11.2017, COM(2017) 718 final).

In the TYNDP 2020 main report figure 3.1, an NTC increase of 3000 MW by 2030 is shown for the Swedish bidding zone border SE2-SE3. Although such an increase would be strongly needed, the TYNDP project sheets (project 126) give only a 2000 MW increase in 2030, while the further 1000 MW increase (project 1039) is scheduled for year 2040.

In the Country factsheets on Power System Needs per country, the figure 7.2 on the spreads of marginal costs between neighbouring bidding zones in 2040 is not having all the data visible for some countries (e.g. Sweden). It should also be clarified whether the spreads are calculated based on hourly or annual prices. Some clarification could also be included on the basis of the year 2040 marginal cost forecasts, as such forecasts are naturally quite uncertain depending on the future costs of demand response, new storage technologies, hydrogen and other synthetic fuels, etc.

ENTSO-E's answer: Figures 3.20 to 3.25: indeed, thank you for pointing out this mistake. This is now corrected. Regarding Fig 3.1: the NTC increase value SE internal has been corrected. Regarding the SE country sheet, it is unclear why you state that not all data is visible in the price spreads maps. Spreads were calculated based on hourly data. Obviously, the farther away the time horizon, the higher the uncertainty.

6 It is appropriate that the National Trends scenario is based on the National Energy and Climate Plans (NECP). However, it should not necessarily be considered as "central scenario", as EU is now tightening its year 2030 climate targets beyond what was the basis for the current NECPs. The main approach should be that the grid needs to be developed so that it enables to reach the Paris Agreement climate target.

The Current Trends sensitivity can serve as a reference case showing which grid projects would have socio-economic net benefits even when the climate targets would be loosened. However, including the Current Trends scenario should not take away resources from a throrough analysis of the main scenarios that are the basis for the TYNDP project evaluation.

ENTSO-E's answer: Thank you, we will take all views into consideration before deciding whether the central scenario approach and the current trends sensitivity will be replicated in TYNDP 2022.

Fortum Oyj (EU Transparency Register identification number 03501997362-71) (continued)

7 Non-TSO transmission projects can be essential in meeting the system needs in cases where the TSOs do not have enough resources for all projects or where non-TSO projects can be implemented more smoothly. The TYNDP process for non-TSO projects has been improved and the role of non-TSO projects is now well reflected in TYNDP 2020. It is important that the non-TSO project promoters provide up-to-date information on their projects for the TYNDP project sheets.

ENTSO-E's answer: Thank you, it is important for ENTSO-E and the TYNDP to ensure equal treatment of TSO and non-TSO project promoters.

Hochschule Rhein Main, Wiesbaden, FRG

A. The following questions refer to project sheet, project 130 HVDC SuedOstLink Wolmirstedt to area Isar, Project Assessment.

(1) Increase in socio-economic welfare, central scenario:
(1a) Does B1 (NT2030) = 160 M€/year include B1_CO_2 (NT2030) = 16 M€/year and B1_RES (NT2030) = 79 M€/year or have these values to be added to the 160 M€/year?
I have understood that they are included and have not to be added.
(1b) Please give additional information how you calculated the 160 M€/year? Additional trade? Value of additional trade? Additional RES? Value of additional RES? Etc.

(2) Increase in socio-economic welfare, scenario distributed energy, DE 2030:
Here you give for B1 only 12 M€/year instead of 160 M€/year as above.
(2a) What are the major reasons for this big difference?
(2b) (1b) Please give additional information how you calculated the 12 M€/year? Additional trade? Value of additional trade? Additional RES? Value of additional RES? Etc.

(3) Increase in socio-economic welfare, sensitivity study current trends:
Here you give for B1 only 6 M€/year instead of 160 M€/year as above in (1a).
(3a) What are the major reasons for this big difference?
(3b) Please give additional information how you calculated the 6 M€/year? Additional trade? Value of additional trade? Additional RES? Value of additional RES? Etc.

(4) Using 7%/year of investment cost of 4.220 M€ for capital cost and depreciation and given operating cost of 33,8 M€/year we get annual cost of 329 M€/year. This is around 2 times the annual benefit B1 in central scenario, 27 times the annual benefit B1 in scenario distributed energy and 52 times the annual benefit B1 in sensitivity study current trends.
What is the reason why you nevertheless have included the project 130 HVDC SuedOstLink in the TYNDP?

B. The following questions refer to project sheet, project 313 Isar/Altheim/Ottenhofen (DE) – St.Peter (AT), Project Assessment.

(5) Why are, in contrast, the respective values for the central scenario (average) with 144 M€/year and the scenario distributed energy (DE 2030) with 133 M€/year very similar?

(6) If B1 includes B1_CO_2 and B1_RES, why is for the scenario global ambition the value of B1 (= 140 M€/year) smaller than the sum of B1_CO_2 (= 85 M€/year) and B1_RES (= 70 M€/year)?

ENTSO-E's answer:

A. (1) B1_CO_2 (NT2030) = 16 M€/year and B1_RES (NT2030) = 79 M€/year are considered in the B1, therefore could be double counted if used together.
(2, 2a) For 2030 DE Scenario the benefits related to the internal re-dispatch were not computed, therefore such picture is observed.
(1b, 2b, 3b) Please check the ENTSO-E CBA Guidelines, where detailed explanation ids provided.
(3, 3a) It is a different Scenario with different marginal costs on hourly dimention, which gives different results.
(4) Please consider the NPV calculation according to the CBA Guidelines.

B. The project does not consider internal re-dispatch benefits compared to P130, therefore all Scenario benefits are aligned.

Individual

On IoSN:

Investing in "horizontal" or "vertical" integration of VRE – Variable Renewable Energy

TYNDP 2020 mainly addresses "horizontal" VRE integration, based on network reinforcements and interconnections. It can be seen as an exaggerated focus on this solution and showing results only by country for the National Trends scenario, the most demanding in these investments. In fact, it does not compare it with the benefits/costs of other alternatives.

Indeed, the "vertical" VRE integration solution – using storage – is poorly studied. It is well known that short-term storage is important to avoid VRE curtailment and for daily/intraday balancing. However, the challenge for a net zero CO_2 system is storage for interday/seasonal balancing [1], which can be solved with power-to-hydrogen/gas/liquid (PtX) solutions. Indeed, the cheapest long-term energy storage is a CO_2 neutral fuel, with the added technical advantage of keeping thermal power plants running in the system.

An approach with local storage allows to reduce investments in transmission capacity and an excessive mutual dependence between Member States. In addition, it reduces VRE curtailment and installed capacity. Thus, TYNDP 2020 appears to be lagging behind the most current EU strategies and justifies the use of the announced models for optimizing multi-energy systems.

[1] Jose Allen Lima, Electricity storage as a matching tool between variable renewable energy and load, June 2019. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3389673

Extending electricity interconnection target to 15% by 2030

Suppose two interconnected systems with no losses (or the same system separated into two parts): one with 100% VRE (annual average power equal to the annual average load); the second with 100% thermal production with adequate capacity and constant variable cost. If there is enough interconnection capacity, it is concluded for the aggregate that the fluctuation in import/export power does not correspond to a reduction in fuel or CO_2 costs. The second system acts like a storage for the first. In this condition, investment in interconnection or storage capacity should be based on avoided fixed costs, too. Pure storage shall be seen as equivalent to a thermal power plant (the "fuel" cost is the cost of the energy for charging), which starts being economical in replacing peak power plants with batteries, and as a competitor for investment in interconnection. Assuming a common marginal energy market, both systems converge at the same price (the thermal variable cost), despite having different marginal costs. If the VRE LCOE is lower (or higher) than this value, the market pricing solution raises questions about fair compensation between consumers and producers.

Even in the TYNDP 2020, the increase in interconnection capacity does not contribute significantly to CO_2 reduction in most Member States, as in the previous example, and saying: "This figure illustrates the average marginal cost spread within CSW region and between CSW region and its neighbouring countries (considering the 2025 network), which gives an indication of where it might be worth improving market integration." (Figure 3.29) shows inconsistent perspective between marginal costs and marginal prices.

Marginal price convergence does not depend only on interconnection capacity. As the spot energy market is a competition between generation technologies (and not directly between electricity producers) if the marginal technology is the same, in most hours, great convergence can be achieved (as is the case among markets where CCGTs fulfill this function). In the CSW region, Portugal has had an excellent price convergence with Spain (strongly interconnected and with similar marginal technologies: average annual price difference does not exceed 0.9 €/MWh in the last ten years and does not exceed 0.3 €/MWh in the last five years). In the TYNDP 2020 simulations for 2030 and 2040, at least based on this marginal cost proxy, large differentials are expected, despite the huge investment planned to increase capacity interconnection between Portugal and Spain!

Obviously, due to the low investment cost of VRE nowadays, it may be more economical to allow some curtailment than to invest in storage or network reinforcements to avoid it. The use of a copperplate comparison, that is, a perfect lossless transmission and interconnection network, is a very interesting alternative and in addition to the usefulness of its comparison with the concrete network scenarios, it should be used to check and signal imbalances in the scenarios used for the production portfolio, since the network is no longer a limitation.

If in the previous example, the thermal system has a variable cost increasing with the load, reaching high values due to the use of peak power plants, Demand Side Response and a cost reliability penalty for possible loss of load, the imported energy by the VRE system became more expensive, showing a correct penalty for not having a balanced geographic distribution of structural backup and balancing power. This shows room for improvement in TYNDP 2020. In fact, in addition to the referred reliability asymmetries, this copperplate modeling must identify the reasons for the VRE curtailment (saturation in the other system or simultaneous curtailment probability?). In fact, saying: "However, the value of the copperplate exercise is to reveal the maximum benefits that could be captured by reinforcing the grid." it is an inconsistent view, giving the main problem that it is trying to solve: reduce VRE curtailment. Firstly, the distribution of VRE production is right-skewed, which makes it difficult to justify economically the total prevention of its curtailment by export and the incremental contribution of interconnection reinforcement can have a decreasing impact on the curtailment, as the penetration of VRE increases. Second, the growth of VRE and investments in the grid to reduce or eliminate the curtailment of the VRE can correspond to a benefit only if the variable cost avoided is higher than the VRE LCOE (also depending on the ratio: incremental VRE energy/interconnection capacity increase). In conclusion, with the strong increase in the VRE, with ratios of installed generation capacity/peak load over 4, it soon turns this target of 15% of import capacity over installed generation capacity uneconomic [2].

Saying: "Therefore, further measures would be required to mitigate such curtailed energy, such as storage facilities and power to gas." it is part of the solution that was not considered adequately and the curtailment of the VRE should be taken into account if more economic. In addition, consideration should de given to maintaining more CO_2 neutral thermal plants in operation and limiting the penetration of VRE to give them a reasonable load factor, which brings technical and economic benefits, including in ancillary services, and allows to reduce curtailment levels.

[2] Study on the benefits of additional electricity interconnections between the Iberian Peninsula and the rest of Europe, TRACTEBEL Engineering, January 2016. https://op.europa.eu/pt/publication-detail/-/publication/2ad84365-3451-11e6-969e-01aa75ed71a1/language-en

Individual (continued)

Spot market prices for energy and ancillary services

Even assuming that the yearly average of marginal costs is representative of the spot energy market price, it does not reflect the total generation cost (missing money problem). There are studies [3] that demonstrate a significant increase in ancillary services for high levels of penetration of VRE (they can reach the same magnitude of generation costs – it is not enough to model the system with "known" thermal starts up and ramps, but it is necessary to include some uncertainty in load and VRE power forecast). It is an important point that is not discussed in TYNDEP 2020, where low average marginal costs can give an illusion about the total effective cost of generation and also skew the promotion of the solution based on transmission network and interconnections. Another point is about market splitting: when a systems exports with market splitting (saturation of interconnection capacity) the importing system values the imported energy at its higher marginal price. So, will this benefit shall be used to reinforce interconnection or to invest in storage in the exporter system?

The central issue nowadays is the recovery of fixed production costs, which justifies the contracting of electricity in the long term, even for the renewable production that is intended to be exported. With the reduction in the average annual spot price, interest on the consumption side for long-term contracts is unlikely (unless it is a cherry-picking opportunity). This effect results from the reliability of the electrical system being seen as a public good, which creates a sense of "regulatory paternalism": governments are expected to monitor the reserve margin of production and take exceptional measures if private investors do not. ENTSO-E has published detailed reports on the reliability of the electrical system, but this perspective is absent in the TYNDP 2020 studies and should be included, at least, as a warning sign about the dependence of Member States on others. Why not include a simplified minimum coverage index calculation by country (firm capacity assigned to each generation technology calculated according to its availability to supply the peak load by applying a derating factor to the installed capacity)?

[3] Making Mission Possible: Delivering a Net – Zero Economy, September 2020.
https://www.energy-transitions.org/publications/making-mission-possible/

The systematic exporter dilemma's

Having a systematic exporting Member State (production surplus) it implies the existence of countries with a structurally deficit, in terms of production/consumption. It is understandable that the European Commission agrees to the creation of such mechanisms of mutual dependence, but it is doubtful that the Member States accept a status of almost always with an import balance in the considered scenarios.

Another problem comes from the marginal energy market, where the increase in interconnection capacity of the systematic exporter corresponds to an increase in its average annual spot price, which is good for local producers and not for local consumers. Of course, it can be fully justified by the criteria of social-economic welfare and technological asymmetry. As the transition to a CO_2 neutral energy is being driven by political decisions and technology choices, and not by a free market, it is necessary to clarify who pays the excess installed capacity and who supports the losses in VRE curtailment. These situations in TYNDP 2020 should be better signaled to give the opportunity to make corrections over time and to weigh their consequences if intentional, for example using a quick way to calculate the excess capacity, as the minimum coverage index calculation by country previously mention.

The CSW results of TYNDP 2020 show Portugal in 2030 and 2040 as systematic exporter! Towards the horizon 2030: "Cross-border exchange capacities Europe-wide increases from 2020 to 2030 enable an average increase of marginal cost in France by 7,3 €/MWh, in Spain by 8,2 €/MWh and in Portugal 8,7 €/MWh."

"Curtailed energy resulting from high levels of renewable installed capacity is still expected, especially in Spain and Portugal. Results show 8,8 TWh/year in Spain and 3,2 TWh/year in Portugal."

In the Portuguese case of 2030 (average Portuguese/Spanish marginal cost of 69% – "2020 Grid"), the proposed network reinforcement corresponds to a reduction in the cut of 1.8 TWh VRE, compared to the alternative of maintaining the 2020 Grid. This apparent benefit has an annual disadvantage for Portuguese consumers estimated in € 473 million (for a consumption of 54.4 TWh and 8.7 €/MWh increase), even without consider the increased cost of the transmission system.

Also, from the CSW results for 2040 (average Portuguese/Spanish marginal cost of 46% – "No investments after 2025"): "Cross-border exchange capacities Europe-wide increases from 2025 to 2040 enable an average reduction of marginal cost in France by 1,1 €/MWh and in Spain by 3,8 €/MWh, while in Portugal shows an increase (5,7 €/MWh)."

Now, the Portuguese case of 2040, with the proposed grid "IoSN SEW – based Needs", compared to "No investment after 2025", reduces 10.2 TWh in the cut of VRE (more or less the increase in net annual balance to Spain, between those scenarios).

Again:

- Is it worth it for the Portuguese consumers to be the net exporting country to Spain and France?
- Is it better than avoiding a curtailment in VRE?
- Is it intentional (surplus of installed power) or a data error (for instance, not considering in the model additional consumption of electrolysers for the production of hydrogen, according to the Portuguese development plans)?

Note:

My comments refer to the Ten-Year Network Development Plan 2020: Completing the map – Power system needs in 2030 and 2040 and Regional Investment Plan – Continental South West (August 2020 – Draft versions). ENTSO-E has to be congratulated for these important planning studies. But as a 20 years horizon is quite challenging, in an energy transition period, it justifies deeper analysis and the improvement in scenarios comparison.

Individual (continued)

ENTSO-E's answer: ENTSO-E studies are always based on a Pan-European analysis. IoSN studies try to identify the best combination of potential cross-border network capacities that minimizes the total system costs, considering the total network investments (cross-border and also internal) and also the generation costs in a European perspective. As said, these analyses try to find the optimal grid, always considering a European perspective. The benefits individually obtained from each project are assessed with a cost-benefit analysis (CBA) according to the latest CBA methodology, approved by the European Commission. In spite of being assessed individually, their benefits are always calculated at a Pan-European level, thus integrated into a very extensive system.
In the scenario building process, ENTSO-E tried, as much as possible, to align the National Trends (NT) scenario with the National Energy and Climate Plans (NECPs). Member States had to submit draft NECPs by the end of 2018 and the final plans by the end of 2019, taking into account the EC assessment and recommendations done on the draft NECP. Considering the previous deadlines, NT scenarios were revisited if there were significant changes in the foreseen final version of the NECPs compared to the draft versions, but not all relevant changes could be included in the TYNDP 2020 studies in order to keep the TYNDP deadlines. Scenario building is a continuous process taking into account the most recent information and considers all the mentioned topics such as storage, DSR and P2G. TYNDP 2022 scenarios, which are already being developed and welcome stakeholders feedback, will include the most updated view on the long-term energy supply and demand considering the ongoing energy transition process.
On the other hand, the national and European adequacy aspects are analysed in the past MAF and future ERAA reports.
Last, the energy policy is a responsability of the national governments in cooperation with the European agreements, and generally it also has interrelation with other sectorial policies such as industrial, employment and external affairs, etc….

National Grid Ventures

1 Regarding quality of deliverables: Very presentable and good to apprehend format

ENTSO-E's answer: Thank you.

2 About central scenario approach: Yes, the same approach should be replicated

ENTSO-E's answer: Thank you for your views, we will take all views into consideration before deciding whether the same approach will be followed in TYNDP 2022.

3 First of all, we welcome the opportunity to provide our views on the TYNDP 2020 CBA implementation guidelines which constitutes the cornerstone to evaluate transmission and storage projects on a consistent and transparent basis. We believe that the CBA should incorporate the most recent policy developments and address major challenges posed by the integration of larger influx of renewable sources. To this end, we cite below our recommendations to improve the current CBA with the view to strengthen its capabilities to deal with future system integration challenges and the emergence of innovative concepts and technologies.

The TYNDP 2020 main report recognises "the limitations of the current CBA methodology for hybrid project identification". Undeniably, hybrid or multi-purpose interconnectors (MPI) will play a fundamental role to facilitate the expected growth in offshore wind in the North Sea in an economic efficient way, whilst providing a valuable source of system flexibility. With this in mind, it is plausible that the capabilities of the existing CBA methodology should be extended to enable the assessment of multi-purpose interconnectors. The overriding goal would be for the ENTSOE to lay down the foundations to calculate MPI project indicators underscored by the appropriate market design framework and guidance on model configuration.

The current CBA has been designed to allow clustering of investments, but this is limited to calculating the benefits of transmission projects which can potentially form a cluster and thereby, estimate the combined benefits. ENTSOE's methodology recognises the interdependency between projects and the impact of delay factors as there are cases where the full potential of the main investment can only be achieved after the realisation of the supporting investments. A Multi-purpose interconnector can share its cross-border capacity with a number of offshore wind farms unlocking the opportunity to achieve substantial cost savings relative to a single-purpose connection approach. Consequently, in order to evaluate MPI projects there is a necessity to extend the scope of CBA to include the combination of transmission and offshore generation infrastructure.

National Grid Ventures (continued)

ENTSO-E's answer: For TYNDP 2022 further updates on the methodologies including the assessment of more complex projects like offshore hybrids or multi-purpose interconnectors is planned. This also includes improvements with respect to grid optimisations for projects that highly relate on it.

4 Following on from the previous point, the offshore wind capacity additions in the North Sea have been revised upwards in the recently published TYNDP 2022 scenarios. Notwithstanding, there is no clear indication regarding the preferred grid design option to underpin the projected growth in this area. We believe that the CBA should address the underlying challenge by trying to capture the benefits of a coordinated approach for renewable energy integration and compare the findings with the established ways to connect offshore generation assets. The overarching goal of this recommendation will be to help project promoters, policy makers and grid operators to make more informed decisions on the deployment of necessary infrastructure, vital to meet the climate targets.

In addition, the consultation document refers to the specific climate years that ENTSOE took into account for the TYNDP 2020 exercise. The climate years in the modelling work determine the load factors and by extension, the output of renewable energy sources. In particular, climate years 1982, 1984 and 2007 were factored in the modelling work to simulate the output of intermittent generation. TYNDP 2022 scenarios provide a strong impetus for wind growth to meet the growing demand to decarbonise the transport and heat sector. Obviously, this will infer significant modelling challenges as a result of the substantial increase in variable electricity generation. For this reason, it is important to understand if the underlying climate years fit for purpose, with the possibility to either consider additional climate years or ENTSOE to provide further evidence on the best serving methodology to define the appropriate range of climate years.

Finally, we welcome the addition of non-CO_2 emission ("non-direct greenhouse emissions) factors table which provides significant clarity on how to calculate savings in volume terms. A similar approach has been followed to compute the contribution of each project to lowering CO_2 emissions and the CBA set a price benchmark which is used to extract the equivalent financial value. A viable option would be to publish and include price benchmarks for all non-CO_2 emissions to assist project promoters in monetising the savings and incorporate them in the overall benefits.

ENTSO-E's answer: For TYNDP 2022 further updates on the methodologies including the assessment of more complex projects like offshore hybrids or multi-purpose interconnectors is planned. This also includes improvements with respect to grid optimisations for projects that highly relate on it.
The non-CO_2 indicator has been introduced in the 3rd CBA Guideline for the first time and has been assessed in TYNDP 2020 for the first time. Due to the wide range of possible monetisation factors together with lack of appropriate data for TYNDP 2020, the monetisation has not been carried out. Future improvements, including the possible monetisation of non-CO_2 emissions based on more mature data sets, are planned.

Ørsted A/S

1 **Lack of modelling and cost benefit evaluating capabilities for hybrids must addressed for TYNDP 2022**

In the ECs Offshore Renewable Energy Strategy, offshore hybrids (where offshore wind farms are connected to more than one market) are being dealt a significant role in the journey to climate neutrality in Europe. They will affect future investments in both onshore and offshore interconnectors. Connecting offshore wind to shore while also building out offshore interconnection lowers the cost compared to building them separately and provides higher utilisation of the cables. Furthermore, hybrids can unlock wind potentials in the northern seas previously prohibited by the distance to shore. Getting from vision to reality will at least require that the projects can be properly assessed by the cost benefit analysis. This should be a priority, as it is not the case today.

Hybrids and later a more fully fleshed offshore meshed grid in the North Sea and the Baltic sea will affect the needed onshore interconnector build out. In a yet unpublished study by THEMA commissioned by Ørsted modelling results indicates that investments in an offshore meshed grid is not only favoured by the model but also diminishes the need for investments in onshore interconnector capacity significantly. We'll be happy to present the results in more detail once the study is finished.

The Northern Seas regional investment plan (page 61) states that "What practically can be delivered is often closely linked to time and resources being available for the simulations.". While the statement is correct, Ørsted would encourage that time and resources are being directed to improve the modelling and cost benefit evaluating capabilities for hybrids.

ENTSO-E's answer: ENTSO-E is well aware of the shortcomings you mention regarding hybrid offshore needs, we are already investigating how to better address this problem in next TYNDPs.

Ørsted A/S

(continued)

2 **Low interconnector build-out risks making the green transition unnecessary expensive**

While the System Needs study identifies a need for an ambitious build-out of interconnection capacity, it might not be ambitious enough (in particular since the System Needs study is using national trends as basis). In a study by EA Energianalyse commissioned by Ørsted EA Energianalyse finds that a cost-efficient pathway to climate neutrality in 2050 (based on the EC 1.5 Tech scenario) necessitates more than double the interconnector capacity by 2040 as TYNDP 2020 finds when comparing the same geographic areas. While such analysis is often sensitive to specific assumptions the results do point to a potentially greater role for interconnection as a cheap source of flexibility and market integration for the many hours where renewable power is plentiful and vice-versa. We encourage that future TYNDPs and system needs studies will explore this potential even more rigorously.

ENTSO-E's answer: Thank you for your comments. In next cycle perfoming the system needs assessment on several scenarios will definitely be considered.

3 While the clarity is okay the length and the scope of the TYNDP deliverables is very comprehensive and hard to get through. It's also easy to lose sight of the greater picture, so perhaps a bit more focus even in the sub-reports could be beneficial.

ENTSO-E's answer: Indeed the TYNDP 2020 package includes a lot of documents, some of them quite long, although the total number of pages has significantly decreased compared to TYNDP 2018. We take note of your comment that the sub-reports should be more focused and will seek to implement it in TYNDP 2022.

4 **In your view, how do proposed transmission and storage infrastructure projects compare to future system needs?**

Are the CBA results consistent with the role of the network in achieving the EU Green Deal and in identifying the value of infrastructure projects and the way forward?

The short answer is no; the CBA results in our view are underestimating the need for interconnection and transmission in Europe towards 2040 and 2050. Secondly; we miss tools to evaluate the hybrid projects and meshed offshore grids which the EC in its Offshore Renewable Energy Strategy has identified as an ingredient in more rational grid planning. However, such innovative solutions will have a hard time to mature if they are not part of the TYNDP CBA framework. For more on both points please see answer to question 5.

ENTSO-E's answer: Thank you again, please see our answers to your previous comments.

Public Power Corporation SA

1 While in the "Regional Investment Plan Continental South East" (Chapter 3.2.1, Page 27) it is clearly stated that the central policy scenario (National Trends, NT) of ENTSO-E's study for Continental South East region was based on the Member States' National Energy and Climate Plans (NECPs) and the EU climate targets, the results of the study for Greece do not reflect the above scenario storyline.

In particular, according to the base case scenario (Page 65, Figures 5-8 and 5-9) the forecasted electricity generation from lignite in Greece for 2025 and 2030 is 20 TWh and 16 TWh respectively, despite the provision of the official NECP of Greece (submitted to the European Commission in December 2019) concerning the phase-out of all lignite-fired power plants by 2023, except for one unit of 660 MW, which will also stop operating on lignite by 2028. Please note that the volumes of electricity generation from lignite for 2025 and 2030,as they are assessed by the Greek NECP are 4.5 TWh and 0 TWh respectively.

Please refer to https://ec.europa.eu/energy/sites/ener/files/el_final_necp_main_en.pdf.
Furthermore, the installed lignite-fired generation capacity for Greece in 2030 (Figure 5-14, Page 67), which is shown to be 2.5 GW, is not compatible with the clear provision of the Greek NECP concerning the phase-out of all lignite-fired generation by 2028. Consequently, the comments regarding that "...no cap reduction for Greece..." is foreseen for 2030, does not reflect the official Greek NECP provisions, providing for an accelerated coal phase-out, while also the relevant data included in Fig. 5-16 (page 68) should also be updated accordingly.

ENTSO-E's answer: The National Trends scenario is a bottom up scenario which was aligned with the latest EU targets of 32% RES 32.5% efficiency and 40% CO_2 reduction. The final NECPs were not available in the timeframe therefore the scenario is not an NECP scenario, but a TSO bottom up view of development, which at minimum reach the EU targets at the time.

Public Power Corporation SA

(continued)

2 The hyperlink for the Greek TSO's Ten-Year Development Plan included in Table 3-4 (Page 88) of "Regional Investment Plan Continental South East" corresponds to the Ten Year Development Plan 2018 – 2027. However, updated versions of the Ten Year Development Plans have been announced and approved by the Regulator in the meantime (latest already approved version: TYNDP 2019 – 2028, available at https://www.admie.g./sites/default/files/users/dssas/DPA/DPA%202019-2028/FEK%20B%201048%20APOFASI%201097-2019.pdf, while the latest version of the TYNDP 2021 – 2030 submitted for approval and currently under evaluation by the Regulator is available at https://www.admie.g./sites/default/files/users/dssas/dpa-2021-2030.pdf). To our view, the TYNDP 2021 – 2030, which is compliant to the Greek NECP that was officially submitted to the EC in December 2019, should be taken into account in the context of ENTSO-E's Development Plan.

ENTSO-E's answer: The link to the Greek NDP has been updated, thank you.

Storelectric Ltd

1 **ON IOSN:**

1. Dispatch Models

Dispatch models are not appropriate for determining long-term needs, only short-term ones where the available technologies and costs are known. For longer terms, they require a huge number of assumptions about available technologies and their costs and locations. It is much better, more accurate and simpler to calculate requirements based on energy need and availability, as per the attached document Calculating the Need for Storage.

2. Interconnectors

Reliance on huge numbers of interconnectors for system needs is a very expensive fallacy:

- A reliance on the assumption that if the wind/sun are not generating in one corner of the continent, then they are in others, would require:
- – A network of at least 0.5TW interconnectors along every point and half-point of the compass, as well as north-south and east-west;
- – Vast over-investment in renewable generation as each region would need to invest in sufficient to support a number of other regions' needs;
- – Both of these are prohibitively expensive and environmentally problematical.

- Even that assumption fails: the kalte Dunkelflaute is a continent-wide failure which occurs every couple of years and would lead to continent-wide blackouts lasting a fortnight if we rely on interconnectors; with narrower geography and shorter timescales, it's a frequent occurrence.

Instead, the proper roles of interconnectors are to moderate system operting costs, energy prices and ease of balancing grids. Please see the attached Interconnectors and Imports.

3. Inertia, Stability and Back-up

The first Lockdown provided a dry run of a 1930s grid. Taking National Grid as an example, they forecast a need for £1bn p.a. (€ 1.1 bn) by the 2030s (more by the 2050s) buying balancing, ancillary and stability services. Please see the attached Lockdown document.

The lack of real inertia in the system was the ultimate cause of the black-outs in the UK on 9th August 2019. Interconnectors, wind, solar and batteries don't have real inertia. The reliance on synthetic inertia failed because synthetic inertia is a very fast reaction time; any reaction time is a delay; any delay is a spike on the mains or RoCoF event; it's that event that turned two initial trips into a nation-wide cascade of subsequent trips. Action to loosen RoCoF settings on breakers does help reduce those trips on the grid – but only at the cost of passing on the problem to consumers. Please see the attached Lessons for Europe from the UK Blackouts.

ENTSO-E's answer:

1. Thank you for your comments. ENTSO-E used the most reliable data available for its studies. The dispatch model has been complemented with investment module which allowed to investigate possible future needs taking into account possible uncertainties.

2. ENTSO-E IoSN study indeed identifies only 1 solution to the problem, while there might be multiple ways to address the needs in energy systems and this is stressed in our reports. It is important to understand that our system needs study focuses on identifying needs, not the solutions to those needs. Results of the study are expressed in terms of interconnections needs/cross-border capacity increase, but this does not mean that it is the only solution.

3. ENTSO-E investigates options to address the system stability needs on long-term time horizons. Currently, inertia is addressed in general terms through inertia duration analysis on the base case simulations for ENTSO-E Scenarios.

Storelectric Ltd

(continued)

2 Storage Project Evaluation

Storage projects are evaluated based on their emissions in consideration of the electricity that they buy. Other benefits are measured similarly. This is a false criterion.

All storage projects should be evaluated (B1, B2 and B4) based on the emissions that they add (usually zero), and displace (that of the power station that is no longer needed – use average power station emissions for a project with the relevant MW rating):

- Storage stores electricity for later use, it does not generate it (except for traditional CAES, which is part storage and part generation).
- If it's storing dirty electricity, then that pollution is already counted at the power station; counting it again at the storage is double-counting.
- As the electricity system decarbonises, so the emissions content of the storage plant's output (under the current false method) decreases without any changes in the storage at all.
- The proper role of storage is to displace generation in providing balancing, ancillary, stability and other services at all the grid levels required (for TYNDP, at transmission grid level). Such services include inertia, short-circuit current and Black Start. Therefore the measure of the emissions performance of storage should be the amount of fossil fuelled generation it displaces, minus any emissions of its own (not relating to the input electricity).

Substantial further benefits (B3, B5-10, S1-3) include avoided curtailment and avoided grid reinforcement e.g. by reducing the size of grid connection for renewable generation, if the storage is built in association with the generation. In such configurations they can enable twice as much wind (and up to 6 times as much solar) to be attached to the grid, which should be accounted within B3.

System Inadequacies with respect to Storage

Storage proposals are completely inadequate in number and distribution. This is largely because of the enormous hurdles put in the way of storage, such as:

- Your desperately inadequate ways of evaluating CEF funding applications for storage;
- Favouring narrowly-capable equipment over broadly-capable ones, by salami-slicing contracts (see Issues with Ever-Shortening Contract Durations);
- Lack of long-duration contracts to provide security of revenue for investors;
- Wrong regulatory mis-definition of storage as a sub-set of generation (which it is not – it creates no new electricity) rather than of storage (which it is), such storage definition being based on that of interconnectors which move electricity in place while storage moves it in time.

The principal focus of TYNDP (and, even more so, CEF) appears to be interconnection, to the exclusion (partially, for TYNDP; wholly, for CEF) of storage. This is building up system problems – see Interconnectors and Imports.

ENTSO-E's answer: ENTSO-E evaluated storage projects in similar manner to transmission projects. This is aligned with the CBA guidelines developed by ENTSO-E in close cooperation with stakeholders, the European Commission and ACER. The socio-economic welfare is computed using total generation cost approach. The results depend on marginal costs in the system for each hour of the simulated year. Marginal costs for each unit in the system include the price for emissions. Therefore, benefits are not related to the economic benefits of the project itself but the total benefits for society. The emissions in some cases can even increase in case of project implemented. This is driven by the fact that lower marginal price coal fired units of new technology are activated instead of more expensive old gas technology units. In such case with higher Socio-Economic Welfare you have higher emissions at the same time. Thank you for your input, ENTSO-E will continue to explore ways to cover better the storage infrastructure benefits in its assessment.

3 Inertia and Network Challenges

Network challenges relating in any way to synchronous generation can be supplied by large-scale long-duration storage: all such storage is naturally synchronous. Yet your "measures" don't list synchronour storage as a potential solution. With sufficient roll-out of such storage, the need for all manner of grid-stability installations (e.g. synchronous condensers) is eliminated while deliver a very wide range of services much more cheaply than a system without such sufficient large-scale long-duration storage.

Storelectric's synchronous storage can provide inertia, voltage/frequency regulation, RoCoF protection, short circuit current protection, reactive power/load and other related services 24/7, i.e. whether charging, discharging or neither.

Continental Europe is labelled as not having any inertia challenge. I believe that this is a short-sighted 2030 viewpoint, not tenable in 2040 or 2050 when proportions of renewable generation and reliance on DC interconnectors are both much greater.

Storelectric Ltd (continued)

ENTSO-E's answer: The report provides a wide perspective on dynamic challenges by providing the technical background, an explanation on their impact on the system and focusing on relevant solutions or mitigation needs. This approach provides an objective basis to derive the necessary measures to tackle the challenges, without excluding or advocating on specific generation technologies that can provide an effective contribution to those challenges.
Regarding Continental Europe (CE) the report shows that, at the moment, ROCOF and frequency deviation are not a problem in normal inter-connected operation, because in this case the occurring imbalances are small compared with the available system inertia. CE will not see very large frequency excursions unless a significant disturbance occurs such as a system split (given the impact, a specific analysis is dedicated to such events). However, the trend shows that technical challenges are becoming more and more evident even in areas where the immediate concerns are more mitigated, such as Continental Europe.

4 Storage proposals are completely inadequate in number and distribution. This is largely because of the enormous hurdles put in the way of storage, such as:
- Your desperately inadequate ways of evaluating CEF funding applications for storage;
- Favouring narrowly-capable equipment over broadly-capable ones, by salami-slicing contracts (see Issues with Ever-Shortening Contract Durations);
- Lack of long-duration contracts to provide security of revenue for investors;
- Wrong regulatory mis-definition of storage as a sub-set of generation (which it is not – it creates no new electricity) rather than of storage (which it is), such storage definition being based on that of interconnectors which move electricity in place while storage moves it in time.

The principal focus of TYNDP (and, even more so, CEF) appears to be interconnection, to the exclusion (partially, for TYNDP; wholly, for CEF) of storage. This is building up system problems – see Interconnectors and Imports.

ENTSO-E's answer: As you rightfully note, the TYNDP assesses proposals for storage projects that are submitted to it. Whether promoters have the right incentives to develop storage projects (and then submit them to TYNDP) is a matter to raise with policy-makers.
Please note that ENTSO-E does not evaluate CEF funding applications

5 The role of non-TES transmission projects is being increasingly marginalised and made impossible by the ever-heavier burden of system and CBA analysis that the tYNDP system requires. This year you even introduced a requirements to undertake full system modelling, which non-TSO players don't have the resources to do.

ENTSO-E's answer: If your comment refers to the Project-level indicators foreseen in the CBA methodology 3.0, please note that submitting these indicators was optional. While some of them require to perform system modelling – which several non-TSO promoters have done – it is not an obligation. ENTSO-E has supported promoters in the submission of PLIs as much as possible by providing data upon request and signature of a non-disclosure agreement. The deadline for the submission of PLIs, initially foreseen on 31 August, has been postponed to 15 October to allow more time for computations.

6 The diagramme on p37 is almost impossible to read where the boxes are yellow or light grey, both with white writing.
The diagramme on p39 needs expanding to be legible, by moving the innovation labels and key leftwards, and compacting the left-hand-side labels (rotate them 90 degrees and put them closer to the arrrow). Light grey writing is not easy to read.

ENTSO-E's answer: Thank you for your comments. Regarding the diagramme P37 of the TYNDP 2020 main report we have increased the contrast a little. The other graph however does not need any improvement to be readable in PDF format in our view, it is published in exactly the same format in the scenarios report.

Storelectric Ltd

(continued)

7 You ignore the benefits of large-scale long-duration storage, all technologies for which are naturally inertial. For as long as you continue to ignore it in these analysis, it will be insufficiently prioritised.

For as long as it's insufficiently prioritised, insufficient will be built. For as long as insufficient is built, there will be increases in:

- Capital costs, such as building otherwise-useless synchronous condensers;
- Operational costs, such as expensive contracts procuring dynamic containment, inertia, and other services;
- System coordination costs, as the multiplicity of such narrowly-focused (and usually small-scale, often low-voltage) equipment needs very careful coordination to deliver system-wide control;
- System instability, because they just can't do as good a job as the flexible, inertial, large-scale long-duration storage which delivers everything from real inertia to ulti-hour balancing in a smooth continuum of services that don't need to be switched in carefully controlled sequences.

ENTSO-E's answer: We appreciate the comment as we are always willing to improve our methodologies. We have spent a lot of effort in improving the assessment of Storage projects during the last years (organisation of a public work-stream, consultations, workshops etc.).

8 **On TYNDP 2022:**

A common carbon price needs to be used for all evaluations: currently each developer can choose their own, as long as they justify it. This carbon price should be (because the system considers societal benefits) over $\$240/tCO_2e$, as per current expert evaluations.

Only projects consistent with 2050 targets should be supported, because such infrastructure will remain for 30 – 60 years, sometimes longer. Thus no gas infrastructure should be accepted unless it is built to handle 100 % hydrogen (and, preferably, hydrogen-methane mixes for intermediate stages in the energy transition).

ENTSO-E's answer: The carbon price from the ETS is set within the scenarios – it is applied for all projects and to all promoters the same way. Concerning the societal costs of CO_2, all projects from all promoters are treated the same way, using a range from low over medium to high values.

WindEurope

1 The foreseen need for additional cross-border transmission capacity post 2030 seems incoherently low compared to the need estimated for the period 2025 – 2030. As a result, estimated investment needs for such capacity are low.

The report identifies the need for 35 GW cross-border transmission capacity by 2025, 50 GW between 2025 and 2030 and 43 GW additional capacity between 2030 and 2040. The need for an immediate step-up of additional cross-border capacity in the next decade (~ 7 – 10 GW / year in 2020 – 2030, reflecting the increase in GHG reductions and higher RES) does not seem coherent with a much lower need foreseen for the 2030 – 2040 decade (~ 4.3 GW / year on average, almost half of the one foreseen for the 2020 – 2030 period). Besides, the Green Deal requires ramping up (at least duplicating) RES installation rates in the 2030 – 2040 decade. Considering this one would expect that additional cross-border capacity needs for the same period (2030 – 2040) would not decrease by half compared to the previous decade (2020 – 2030) but would rather remain stable after 2030. Therefore, foreseen investments to increase cross-border transmission capacity in 2030 – 2040 do not seem to be coherent with the Green Deal objectives. As a result, if system needs and the respective projects are underestimated and not identified on time, releasing the necessary investments, and accomplishing the projects will be significantly delayed on its turn.

Here are some points helpful to understand the difference between the estimated grid investment needs in this study and in other sources and the importance of stable (and higher) grid reinforcements and investments after 2030:

1. The latest EC Impact Assessment (2020) presents the investment needs in power grids based on different scenarios and estimates a minimum of € 30 bn / year from 2031 to 2050.
2. The EC long-term decarbonisation strategy (2018) estimates a minimum of € 60 bn / year for investments in power grids (Baseline scenario).
3. WindEurope's 'Our energy, our future' report (2019) estimates an average of € 15 bn / year only for offshore grids up to 2030 and between € 10 – 50 bn / year from 2030 to 2050.
4. WindEurope's 'Breaking New Ground' report (2018) estimates that an average of 12 GW-km / year of additional power lines would be needed up to 2050. This is three times the amount that this study estimates in its current version.

ENTSO-E's answer: ENTSO-E's Identification of the System Needs Study indeed focuses only on one side of the needs in the system. The same needs at the same time can be addressed in many different ways. Therefore, different infrastructure needs may be identified by different studies, where also different Scenario assumptions are being used.

WindEurope (continued)

2 Grid optimisation devices not considered

The study does not seem to consider a wider deployment of grid optimisation technologies (e.g., Dynamic Line Rating, advanced power flow control devices, synchronous condensers …) and their role in grid infrastructure deferral. Synchronous condensers, STATCOMs, HVDC with GFC are mentioned but only as an example to resolve operational issues. It is not clear whether and how the benefits of these solutions are considered when estimating power system needs for 2030 and 2040. Are such solutions part of ENTSO-E vision for the power system in 2030 and 2040? How is this reflected in this study?

ENTSO-E's answer: First of all the DC loadflow is used in the study, therefore such devices might not be fully implementable in the model. However, the needs identified in the system may be eventually addressed by means of such technologies, therefore their use may be relevant in framework of the study.

3 **About non-TSO transmission projects:**

- Some projects are reflected but we consider the projections of the TYNDP for renewables are still very conservative.
- Regarding offshore transmission/ generation assets: In Europe, offshore grid infrastructure owners, developers and operators might be TSO and non-TSO companies. For example, as enabled by the UK Energy Act, the upcoming offshore transmission system will be developed by non-TSO companies and ultimately owned and operated by Offshore Transmission Owner (OFTO) regimes typically owned by financial (non-TSO) investors.

ENTSO-E's answer: The TYNDP maintains and continuously strives to improve a non discriminatory approach between TSO and non TSO projects. The transmission projects presented to the TYNDP are all submitted by Project Promoters. Regarding the Scenarios, we highly value collaboration with the industry to provide input and review and challenge the assumptions we propose, and will take all input into account in the ongoing Scenarios 2022 preparation.

4 **System inertia trends**

The outcomes and published report of ENTSO-E technical group HPoPEIPS (High Penetration of Power Electronic Interfaced Power Sources), which has been done and agreed jointly by the industry, academia and TSOs are ignored

- Even though the study mentions the existence of the technical group the outcomes from the exchanges between the experts and the published report are neither referenced nor considered in the analysis. We strongly recommend that the published report "High Penetration of Power Electronic Interfaced Power Sources and the Potential Contribution of Grid Forming Converters" is referenced and that its definitions, conclusions and the open questions it identified for further investigation are summarized in this study. The two reports (Migrate, Osmose EU Projects) that are referenced in the study are anyway among the many references of the HPoPEIPS technical report. The HPoPEIPS technical report may not estimate power system needs in terms of inertia or dynamic stability, but it is certainly a good first step in identifying the right questions.
- Similarly, the reports "The inertia challenge in Europe present and long-term perspective: insight report" and "System dynamic and operational challenges" seem to not be up to date reflecting the HPoPEIPS technical report outcomes.
- Flexibility from RES not considered

Flexibility can also be provided from renewable power plants and renewable hybrid power plants (wind/solar and potentially storage). In the case of wind turbines new technologies and new capabilities are expected to be brought to the market soon (e.g., grid forming capabilities, storage directly integrated at wind turbine level). Wind farms can today provide local downward flexibility (flexible connections e.g., Belgium, France, Netherlands) balancing or frequency regulation (e.g., Spain, UK, Ireland, Germany, Ireland, Belgium, Denmark) and voltage control and both facts should be considered in the study based on existing market and system data from these countries. Other commodities related to inertia and black start are already on the way in some countries (e.g., stability pathfinder in the UK).

This flexibility can be modelled based on available market data in the respective countries. Inertia and black start services are much more difficult to model as they are in their very early stages in the case of wind. However, there are already some pilot projects that can be considered (Scottish Power/SGRE grid forming project in the UK). In particular in a 2030 – 2040 time horizon, flexibility from RES plants needs to be somehow considered for example in residual load simulations.

ENTSO-E's answer: Thank you for your comment. We will reinforce the references to the "High Penetration of Power Electronic Interfaced Power Sources" work. The IoSN report, covering a large array of topics, takes into account all included references and adds them to facilitate a detailed exploration and reading on such specific topics for the interested readers.
The report highlights the flexibility needs in case RES is not considered. This approach allows to identify the strong need for flexibility provided by various non-conventional sources, including RES with such capabilities.

WindEurope

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5 Intermediate short-term measures

The report "System dynamic and operational challenges" describes the set of operational challenges and only two intermediate short-term measures ((1) Effective use of existing reactive power sources, incl. distribution connected SGUs, (2) Limit RES (!!!), limit bulk power flows and or impose must run conventional units (!!) to ensure the necessary level of short-circuit power. Are these indeed the only short-term mitigation solutions to operational issues in ENTSO-E vision for 2030 and 2040? What about grid optimisation technologies (see above), digitalisation and interoperability?

ENTSO-E's answer: The mentioned short term measures relate solely to the voltage control challenges sub-chapter. An overall view, regarding different short and long term measures is described throughout the report. The limitations on short-term measures highlight the need to quickly enable the wide and effective range of measures that are necessary to tackle the system dynamic challenges.

6 Central Scenario volumes are not in line with the NECP

The National Trends scenario in this study is not in line with the final National Energy and Climate Plans. The National Trends scenario foresees 78 GW of installed wind by 2030 and 131 GW by 2040 in EU27 and the UK. Both are underestimates and should be updated based on the final National Energy and Climate Plans. EU27 and the UK have committed to 111 GW of offshore wind capacity by 2030 in their final NECPs. Power system needs should be estimated based on the final NECPs and not on the draft ones submitted in early 2019 (which indeed foresaw less than 100 GW). In the course of 2019 several Governments increased their offshore wind volume commitments for 2030: the UK by 10 GW; Germany by 5 GW; Ireland by 1.5 GW; Poland by 2.1 GW; France by 2.3 GW, Denmark by 6 GW. Norway will bid next year 4.5 GW and other countries with no on- and offshore breakdown will build offshore wind too. This additional 33 GW takes the total capacity installed to 111 GW.

Also, it is not clear whether and how this study considers the future geographical location of new renewable generation projects.

ENTSO-E's answer: The final NECPs were not available in the timeframe therefore the NT scenario is a TSO bottom up view of development which at minimum reach the EU targets at the time (draft NECPs).

7 TYNDP progress compared to previous years and labels

The study monitors the evolution of each project since the last TYNDP and assigns relevant labels (since 2014 with standard labels). The meaning of labels "rescheduled" and "delayed" and the difference between these needs to be clarified. In most cases the argument for rescheduling a project indicates the change of a commissioning date due to delays in permitting procedures or other. Considering this it would be more consistent to merge the "rescheduled" and "delayed" labels or clearly stating their difference in practical terms.

Additionally, projects might experience a "cumulative misleading progress" label if their status is updated only with respect to their last TYNDP status. For example, let us assume a project that was for the first time identified in TYNDP with expected decommissioning date in 2020. If the project gets delayed or rescheduled it will then be labelled with a 'rescheduled/delayed' status to 2022. Then its commissioning date might change from 2020 to 2021 which will read to labelling it as 'ahead of time' in 2022 even though it will have been delayed by one year compared to the original planning. For this reason, it is important to keep track of changes with respect to the original timeline of each project and not to intermediate timeline updates or to indicate the first year that the project was identified in the TYNDP so that it can be reliably tracked.

ENTSO-E's answer: 'Rescheduled' implies that the promoters and national regulatory authority decided to postpone the commissioning year of the project or investment. On the opposite, the commissioning year of a delayed project or investment is postponed despite the promoters' best effort to keep the schedule (most often due to permitting procedures).

As to your second point, information on whether the project is on time, ahead of time etc is on the responsibility of each promoter to provide. It is true that neither the CBA methodology 3.0 nor the TYNDP 2020 Guideline for promoters specify what is meant by 'ahead of time'. This is probably something to look into.

What is important to note however is that the information provided in the TYNDP must be consistent with information included in the most recent National Development Plan. This applies to all TYNDP projects who are in an NDP, which is the majority of projects. Therefore, a promoter could not indicate that the project is ahead of time if its commissioning year has been postponed in the NDP. The project would have to be labelled as either rescheduled or delayed, depending on the reason for the postponment.

WindEurope

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8 **TYNDP 2020 list of project capacity versus energy system needs figures**

The study has a clear pipeline of cross-border reinforcements leading to additional 35 GW (2025 – 2030), 50 GW (2025 – 2030) and 43 GW (2030 – 2040). The TYNDP 2020 has 154 cross-border transmission projects which add up to 26 – 27 GW (depending on whether the sum of capacity increase is from A – B or B – A) with commissioning dates between 2020 – 2040. Could you please clarify how to compare the different numbers reported in the two processes (TYNDP 2020 versus Power System Needs Report)? Will the TYNDP 2022 be updated to reflect the needs for additional cross-border capacity reported in the Power System Needs study? Otherwise, it is not clear whether and how delays in such grid reinforcements are planned to be mitigated with specific investments.

ENTSO-E's answer: Identifying needs in the system, and identifying infrastructure projects to meet those needs, are two very different questions. The TYNDP proceeded in two steps:

1. Identification of needs, which are expressed in terms of capacity increases in MW per border which you mention in your comment. At this step we do not look into specific projects to address those needs. Please note that our study identifies one solution, expressed as increases in cross-border exchange capacity, but this does not mean that this is the only solution nor that the solution should be based exclusively on transmission infrastructure.
2. Promoters submit a number of transmission and storage projects to the TYNDP. ENTSO-E then conducts a cost-benefit analysis of those projects. The outcome of this cost-benefit analysis for all indicators, and other information provided by promoters such as residual impacts of the project, can then by used by regulators to determine which project(s) best meet the needs identified in step 1.

So no the TYNDP 2020 will not be updated with additional projects to reach the MW increases identified in the needs study. Projects are proposed bottom-up by project promoters and the TYNDP portfolio represents close to all projects that are currently in the pipeline. However, project promoters may take into consideration the results of the Needs as basis to propose additional projects that had not been considered previously. Such an exercise has already taken place on a small scale, with the submission window for future projects which was organised for the 1st time in this TYNDP, and that allowed promoters to propose new projects addressing needs identified in the Needs study. 8 transmission projects and 1 storage project were identified that way.

9 **Hybrid projects – Pipeline of projects and modelling limitations**

Cost-Benefit Analysis for infrastructure projects addresses only point-to-point ("radial") connections and assumes that offshore wind farms only connect with a point-to-point topology to one single market. This is not in line with the 2030 and 2040 vision because that one considers a pipeline of cross-border ("hybrid") projects. Offshore hybrids have been mentioned as a key cornerstone for the execution of the Offshore Renewable Energy Strategy. Offshore hybrids bring together generation and transmission design and planning and can yield significant cost and space savings compared to currently deployed radial connections. There are at least 10 GW worth of projects to be connected using a hybrid configuration. Omitting their value with a simplified CBA could delay or risk their execution and lead to unrealistically high society costs linked to offshore wind integration.

The current TYNDP 2020 list of projects includes some offshore hybrids – labelled as multi-purpose interconnectors – but it is very limited and they do not feature in the power system needs study

You note in your report that factoring in hybrids is outside your mandate: Page 19: [...The study does not focus on the optimal connection of (all types of) generation, as this is not part of the current ENTSO-E mandate. For that reason, so called "hybrid projects", i.e. the combination of interconnections and offshore generation units, are not identified with the current System needs methodology...].

However, It will be crucial that TYNPD 2022 proposed projects and Power system needs studies are better aligned. That would make it easier for project promoter to identify potential value of hybrid projects and guide them towards designs that can increase power system benefits.

WindEurope assessment shows that at least 4 to 9 offshore hybrid projects with high certainty of execution in the next decade are not yet identified in the TYNDP2020 (table below).

WindEurope

(continued)

Generation capacity	Interconnector capacity	Classification	Hybrid project status	TYNDP/PCI status	FiD expected date
Kriegers Flak (600 MW), Baltic 1 (48 MW) and Baltic 2 (288 MW)		Combined Grid Solution	Under construction	TYNDP 2014 (ID 36) / PCI 4.1	
Bornholm area (2 GW) to be tendered in Denmark	1 GW to Denmark and 1 GW to Poland or Germany	Offshore hub (onshore MTDC with offshore generation)	Under permitting procedure	No	2024
Norfolk wind farm (1.8 GW) connected to Ijmuiden Ver (2 GW) wind farm	1.8 – 2 GW between UK and Netherlands	Combined Grid Solution	Under permitting procedure	TYNDP 2020 (ID 260) / PCI 1.16	2025
Gulf of Riga area (1 GW) to be tendered	1 GW split between Estonia and Latvia	Interconnector Tie-In	Planned	TYNDP 2020 (ID 62) / PCI 4.2 (partial)	2026
North Sea area (3 GW) to be tendered in Denmark	3 GW split between Denmark and Netherlands or Germany	Offshore hub	Planned	No	2025/2026
Sørlige Nordsjø II (3 GW) to be tendered in Norway	3 GW to be exported to Europe	Neighbour OWF	Planned	No	2026
Belgian area (2.2 GW) to be tendered	0.9 – 2.2 GW between UK and Belgium	Interconnector Tie-In	Planned	TYNDP 2020 (ID 121) / No PCI	2024 (interconnector) and 2026/2027 (wind farms)
North Sea area (7 GW extension) to be tendered in Denmark	7 GW split between Netherlands, Germany, Denmark and UK (TBC)	Offshore hub	Planned	No	2025/2026
North Sea areas (12 GW)	12 GW split between Denmark, the Netherlands and Germany	Offshore hub	Planned	TYNDP 2020 (ID 335) / PCI 1.19	2030

ENTSO-E's answer: It is not clear to us what you mean by 'these projects are not identified in the TYNDP 2020'. Several of these projects have been submitted to the TYNDP 2020 portfolio of projects and have been assessed. Other projects are not part of the TYNDP 2020 portfolio because they were not submitted.
If by 'not identified in the TYNDP 2020' you meant that these projects do not seem to address a need identified in our system needs study, indeed our study identified very little offshore needs for reasons explained in the report. In TYNDP 2022 we will seek to improve the identification of offshore needs.

10 It is useful to have a project ID and there has been a good improvement on how project file (excel) is organised. However, we have some suggestions:

ENTSO-E records the change of status per project since the last TYNDP (including delays, on time, etc.) but this can lead to a misleading analysis compared to the original timeline. For example: If the original expected commissioning date of a project gets delayed by a few years, in the next TYNDP the progress assessment might read "Ahead of time" or "Investment of time" but is it not a fair comparison because it is still delayed compared to the original schedule. It is important to keep track of changes with respect to the original timeline of each project and not to intermediate timeline updates or to indicate the first year that the project was identified in the TYNDP so that it can be reliably tracked.

A second point related to this cumulative effect: it would be very useful to monetise the gains or losses from a project progress (i.e., being delayed or ahead of time). This can be reflected through KPIs like curtailment or loss of load.

It seems by the analysis tab that both "delayed" and "rescheduled" refer to almost the same status, in most cases a change in timeline due to permitting or investments. It would make sense to merge these labels or to clarify their difference in practical terms.

In the analysis for rescheduled projects sometimes projects are replaced with new investment IDs or they are divided into smaller investment needs. It would make sense to include in a row the ID from the previous TYNDP otherwise it is easy to keep track of the progress of specific projects.

WindEurope (continued)

ENTSO-E's answer: Regarding your points on ahead of time projects, and delayed vs rescheduled: please see our answer to your comment above. Regarding monetising the gains or losses from a projects' progress: this is currently not foreseen in the CBA methodology, but the feasibility and relevance could be investigated in the next review of the methodology.
Regarding tracking projects / investments from one TYNDP to the next: In TYNDP 2020, 3 investments have been taken out of the cluster they were included in in TYNDP 2018 (projects 127, 197 and 346) and moved to separate projects (respectively 1059, 1061 and 1063). While this is mentioned in the project sheets P 1061 and 1063, it was not made clear in P1059. This has now been corrected, thank you for pointing it to our attention. In TYNDP 2022 we will look into better allowing to track the history of each investment.

11 Suggestions for TYNDP 2022:

- Consider the suggestions presented above for the excel file to improve even further the standardisation and analysis of projects (i.e. project labels, tracking of progress and measuring the impact of this progress).
- Make sure to fulfil the system needs ENTSO-E has envisioned in the Power System Needs report with a clear pipeline of transmission projects, including hybrid ones. If it is not possible then also clarify why and where the difference arises from.

ENTSO-E's answer: Thank you for these ideas, we will look into how to make it easier to track the process of one project from one TYNDP to the next. Regarding the projects assessed in the TYNDP, please note that ENTSO-E depends on projects proposed by project promoters. Following the release of our 2020 needs assessment, promoters may identify gaps and design new projects that address these gaps. This has already started with 9 so-called 'Future projects' addressing system needs already added to the TYNDP 2020 portfolio, following the release of the TYNDP 2020 needs assessment.

12 CBA Implementation guidelines

The current process does not allow a fit for purpose assessment of offshore integrated transmission and generation assets (offshore hybrids or multi-purpose interconnectors). The guideline needs to be amended to reflect the benefits of such assets.

The same applies for grid optimisation technologies. The current process needs to evolve to monetise benefits such as TOTEX-savings (including new grid infrastructure deferral) thanks to such devices (Dynamic Line Rating, FACTS, synchronous condensers, large utility-scale storage such as Grid Boosters, …)

Not only CO2 but also non-CO2 emissions should be monetised in the assessment process. The process currently considers only three climate years. We recommend increasing the number of considered climate years.

ENTSO-E's answer: For TYNDP22 further updates on the methodologies including the assessment of more complex projects like offshore hybrids or multi-purpose interconnectors is planned. This also includes improvements with respect to grid optimisations for projects that highly relate on it. The non-CO_2 indicator has been introduced in the 3rd CBA Guideline for the first time and has been assessed in TYNDP20 for the first time. Due to the wide range of possible monetisation factors together with lack of appropriate date for TYNDP20, the monetisation has not been carried out. Future improvements, including the possible monetisation of non-CO_2 emissions based on more mature data sets are planned.

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