ENTSOs 2020 TYNDP Scenarios Consultation

A Eurelectric response paper

January 2020

Eurelectric represents the interests of the electricity industry in Europe. Our work covers all major issues affecting our sector. Our members represent the electricity industry in over 30 European countries.

We cover the entire industry from electricity generation and markets to distribution networks and customer issues. We also have affiliates active on several other continents and business associates from a wide variety of sectors with a direct interest in the electricity industry.

We stand for

The vision of the European power sector is to enable and sustain:
- A vibrant competitive European economy, reliably powered by clean, carbon-neutral energy
- A smart, energy efficient and truly sustainable society for all citizens of Europe

We are committed to lead a cost-effective energy transition by:

investing in clean power generation and transition-enabling solutions, to reduce emissions and actively pursue efforts to become carbon-neutral well before mid-century, taking into account different starting points and commercial availability of key transition technologies;

transforming the energy system to make it more responsive, resilient and efficient. This includes increased use of renewable energy, digitalisation, demand side response and reinforcement of grids so they can function as platforms and enablers for customers, cities and communities;

accelerating the energy transition in other economic sectors by offering competitive electricity as a transformation tool for transport, heating and industry;

embedding sustainability in all parts of our value chain and take measures to support the transformation of existing assets towards a zero carbon society;

innovating to discover the cutting-edge business models and develop the breakthrough technologies that are indispensable to allow our industry to lead this transition.

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KEY MESSAGES

- **Eurelectric supports the ambition of net-zero emission in the European Economy by 2050**. As an industry, we are committed to deliver carbon neutral power supply well before 2050 and to make a key contribution to the decarbonisation of transport, buildings and industry through electrification.[1]

- **The TYNDP should ensure a future-proof energy grid sustaining such ambition.** To do so, TYNDP scenarios should ensure that long-term projections for the overall electricity and gas demand are Paris Agreement compliant and duly take into account the level of maturity of all technologies. As underlined by the European regulatory framework, the TYNDP has to remain a technical planning tool anticipating future grid investments.

- **Therefore, Eurelectric is strongly concerned that the electricity and gas demand projected for the coming decades in all three TYNDP 2020 scenarios strongly diverge from other forecasts,** and especially from the European Commission Long-Term Strategy. In particular:

    - **The scenarios report foresees a very low electrification rate (40-50%) based on a low gross electricity generation forecast** (max 5500 – 6000 TWh compared to EC LTS scenarios – 6700 TWh for LIFE scenario and 8000 TWh for TECH scenario). This is striking when the EC Long-Term Strategy clearly recognizes the key contribution that carbon neutral electricity supply will play in the transition towards a climate neutral Europe.

    - **The gas demand assumed by the scenarios should be thoroughly questioned in light of long-term climate objectives and other studies projections.** In particular, the assumption of importing almost 3000 TWh of decarbonised gas in Global Ambition 2050 (out of 4000 TWh) is not aligned with the EU decarbonisation agenda. It would imply that the gas sector' decarbonisation efforts would essentially depend on significant imports from third countries.

[1] Eurelectric's Polish member association PKEE supporting the need for a transformation towards innovative and low-emission economy, could be able to support the EU 2050 Climate ambition assuming that prior to establishing EU climate-neutrality binding measures, a fair burden-sharing mechanism will be created taking into account compensations for Member States with different starting points.

- **The Cost-Benefit Analysis (CBA) for transmission and storage projects will be fully performed for the National Trend scenario only – i.e. not Paris Agreement compliant.** This is not acceptable given that the CBA is the sole basis for the selection of Project of Common Interests which benefit from accelerated permitting procedures and funding. **The main scenario for a CBA should be compliant with the EU 2050 decarbonisation objectives.**

- **To ensure a coordinated, cost-effective and future-proof approach to electricity and gas infrastructure requirements and investments,** Eurelectric recommends the following:

  - **TYNDP's scenarios should provide a wider range of possible futures to test the energy infrastructure under more extreme circumstances**. Indeed, a greater spread in scenarios (at least the "COP 21 scenarios") to illustrate potential stress situations would provide more insight as well as a sensitivity analysis of key risks factors (mentionned in details in our response).

  - **TYNDP scenarios should consider the different starting points and commercial availability of key transition technologies, especially to provide new storage options.** We welcome that the ENTSOs have correctly assumed that the transition will require both centralised and decentralised options. The related investment needs in the distribution grid should be aknowledged.

  - **A revised governance for the elaboration of the TYNDP should be accomplished during the review of TEN-E regulation.** Going forward, the European Commission, Members States should ensure a close oversight of the process. Moreover, stakeholders – including market parties and DSOs - should be proactively consulted, especially when assumptions on demand and supply are being defined.

1 to 3. Identification questions

Not relevant

4. Are you satisfied with the format and level of explanation?

- **Satisfied**
- **Unsatisfied**

If unsatisfied, please comment

To ensure a cost-efficient transition for European citizens and businesses, future energy needs and the related system development must be analysed in a consistent and future-proof manner. To do so, **TYNDP scenarios should ensure that long-term projections for the overall electricity and gas demand are Paris Agreement compliant and duly take into account the level of maturity of all technologies**.

As a general comment, Eurelectric believes that all scenarios should take into account:

- technology costs and competitive alternatives for clean energy carriers;
- demand side flexibility potential including the impact of the grid digitalisation;
- energy efficiency and conversion losses;
- impact of the overall volumes of electricity and gas demand on bio resources;
- foreseen imports and their implications, as well as infrastructure requirements (e.g. for different types of gases and blends);
- overall cost for the consumers and the need to ensure their security of supply.

The TYNDP scenario methodology should first aim at defining the possible scenarios in term of energy demand in order to 1) integrate the decarbonisation objective and 2) identify energy-specific needs (electricity specific uses, gas specific uses, district heating, etc.).

In this context, **we are particularly concerned with the low electrification level/rate foreseen by the TYNDPs 2020 scenarios** (40-50%) **and the rather low electricity demand in general** (for the transport sector in particular)

TYDNP scenarios assume a direct electricity demand in 2050 of 3500 – 4100 TWh. This is comparable to the European Commission Long-term Strategy figures (e.g. 3600 TWh for LIFE scenario and 4000 TWh for TECH scenario)[2]. However, exact information on the gross electricity generation (including electricity demand of the transformation sector, power-to-gas generation and distribution losses) assumed in the TYNDP scenarios is missing. Considering the graphs and tables of the scenario report, gross electricity generation seems to be around 5500 – 6000 TWh and, hence, significantly lower than the European Commission Long-Term Strategy figures (e.g. 6700 TWh for LIFE scenario and 8000 TWh for TECH scenario). **Eurelectric strongly recommends to undertake some additional work to get a sound European scenario framework.**

For an economic and resilient transition, **the growing interactions between 1) all sectors** (i.e. sector integration), 2) **electricity and gas** (i.e sector coupling) **and 3) the replacement of fossil fuels by zero-emission alternatives need to be taken into account**. To this end, co-ordination

[2] European Commission, In-depth analysis in support of the Commission Communication COM(2018) 773 'A Clean Planet for all'.

between ENTSO-E and ENTSOG (requested in the European regulatory framework) is an opportunity for reaching such a goal.

The matrix showing the differences among scenarios should include numbers regarding capacities and/or generation in order to facilitate comparison between scenarios**. More extreme scenarios (e.g. less ambitious scenario, high ambition scenario) should be considered** as there is relatively little difference between the three scenarios proposed.

5. Are you satisfied with the level of stakeholder engagement during the joint ENTSO scenario building process?

- **Satisfied**
- **No opinion**
- **Unsatisfied**

If unsatisfied, please make suggestions how we can improve for the next process

Eurelectric welcomes the efforts made by the ENTSOs to ensure an inclusive TYNDP process and has actively contributed to all stakeholder workshops held.

In line with the regulatory obligations, **Eurelectric encourages the ENTSOs to continue and strengthen the extensive consultation process involving all the relevant stakeholders, national regulatory authorities and other national authorities**. In particular, we found extremely useful the workshop organised by ENTSO-G on 10 July 2019. Such workshop allowed stakeholders to exchange with ENTSO-G on the gas supply potential and market related assumptions in a transparent and well-informed manner. Indeed, **it is crucial for stakeholders to have the opportunity to actively contribute to the definition of the ENTSOs' assumptions and hypothesis ahead of the final consultation on the draft TYNDP scenarios**. Going forward, at least one similar workshop should be organised by ENTSO-E to discuss more in details their assumptions on the electricity side.

Going forward, a thorough revision of the governance for the elaboration of the TYNDP should be undertook during the review of TEN-E regulation. This will ensure acoordinated, cost-effective and future-proof approach to electricity and gas infrastructure requirements and investments. It will also ensure that solutions proposed took advantage of synergies between sectors so as to ensure a resilient and economically optimal suite of possible solutions. In particular, Eurelectric recommends the following:

- The European Commission and Members States should ensure a close oversight of the process to ensure that scenarios are based on electricity and gas demand forecasts that are compliant with the Paris agreement, in close cooperation with market players.
- ACER and NRAs should play a major role, in particular for the approval of CBA methodologies and PCI assessment.

6. Among the different engagement options, rank them in the order of your preference (rank from 1 to 4)

- Physical Workshops (1 – 2 – 3 – 4)
- Webinars (1 – 2 – 3 – 4)
- Consultations (1 – 2 – 3 – 4)

- Bilateral Discussions (1 – 2 – 3 – 4)

7. Are you satisfied with the format and the level of explanation provided in the Scenario Main Report?

- **Unsatisfied**
- **No opinion**
- **Satisfied**

If unsatisfied, please comment

Eurelectric is in general satisfied with the format used by ENTSOs to present this draft scenario report.

Combining within the same document a clear, transparent and exhaustive analysis of possible European energy future is a complex task and should be rigorously designed. We note the improved organisation of the document compared to previous TYNDP scenario reports. This makes it much more user-friendly to dive into the messages. The Main Scenario report, the Methodology Report and the Visualisation Platform reflect the important background work performed by ENTSOs teams.

In our view, the weakest area in the report is the assumption that all the technologies required to meet the assumptions made will be available. There does not seem to be any consideration of alternatives 'Plan B' if such technologies are unavailable.

Therefore, **Eurelectric calls on the ENTSOs to include some additional sensitivities in the scenario to assess any change in technological solutions.** In particular the following risks need to assess:

- **Electrification of heat and transport:**
  - The evolution of the networks regarding electrification of heat and transport must be subject to strengthened cooperation between TSOs and DSOs.
  - The Building Stock will require significant levels of insulation to introduce heat pumps. This will require funding and skilled workforce.
- **Centralised Renewable Energy Source (e.g. wind farms):**
  - Will the needed transmission infrastructure be able to be built? Has any provision been made to facilitate the construction of such infrastructure and improve their public acceptance?
- **Conversion of power-to-gas using electrolysers:**
  - What happens if this technology is not sufficiently mature on time? This alongside other non-mature technologies should be captured and presented as sensitivities where the price is higher.

Furthermore, we would welcome further information on the assumptions used. In particular:

- **The forecasts for electricity demand** given the key contribution of electrification is in the decarbonisation of the economy in the years to come. For instance, we would welcome:

- **More emphasis on how the increasing electrification of transport, residential/heating sectors and industry will impact the evolution of the electricity demand**. The same comment can be applied regarding the electricity demand for electrolysis (power-to-hydrogen / power-to-gas) as well as for power uses in industry and services sectors (as the Storyline Central Matrix suggests demand decreases);
- **Additional details on the ENTSOs' assumptions resulting in surprisingly low electrification rates** (and the low electric demand in general) in particular for the transport sector, compared to other studies, e.g. the EC LTS and Eurelectric Decarbonisation Study. Regarding transport, the assumptions regarding direct electrification of passenger vehicles and commercial vehicles should be explained in more detail.

- T**he gas demand in general is high in all scenarios compared to other studies.** In particular, the assumption to import almost 3000 TWh of decarbonised gas in GA 2050 (out of 4000 TWh) seems questionable given the EU climate ambitions. Such assumptions also imply that the decarbonisation efforts in the gas sector would depend on significant imports from non-EU countries. Eurelectric urges the ENTSOs to further explain the rationale behind such assumptions.

- **The gas demand for power generation** and especially what are the parameters and underlying assumptions which drive gas demand for gas-fired electricity generation.

- **The way data from NECPs were aggregated:** the NECPs are combining many assumptions based on different data forecasts concerning fuel and CO2 prices. Such assumptions may not be compatible with PRIMES prices predictions for these. The European Commission should ensure the consistency between the different sources used to elaborate the NECPs.

- **Cost inputs and cost expectations for technologies**: Eurelectric would welcome additional elements on system costs (i.e. cost of using electricity and gas infrastructures) and the potential impact on end-consumers. A specific section on gas technology costs should also be added to the report. Eurelectric would like to emphasize that the electricity costs go far beyond the electricity market prices (based on system marginal prices) mentioned in the report.

- **Characteristics of the assets and, in particular, the role that flexible resources will have to play in an increasingly renewable-based energy system**: all possible flexible power assets (e.g. hydro storage and pump, batteries, CCGTs, OGCTs, fuel cells, DSR, smart charging) should be considered to meet the electricity demand in these situations (ex : daily peak demand, 2-week cold snap demand, kalte Dunkelflaute scenarios[3]). The advantages in terms of flexibility obtained by coupling the electricity and gas sectors should not be overlooked in the analysis (e.g. power-to-X).

- **Peak demand and reserve margin/flexible capacity needs** should also be made available, taking market-based demand response possibilities and different technical capabilities of generation resources available across Europe fully into account.

[3] Where the system faces a cold snap event with very low availablity of intermittent RES generation (wind & PV

- **Assumptions made for heat pumps:** no detail is provided in the breakdown per technology (e.g. air-air electric heat pump, hybrid heat pump) neither on their impact on infrastructure. This could also be presented in the methodology report.

Last but not least, we noticed inconsistencies in data presented in the TYNDP 2020 draft scenario report and the TYNDP 2020 Methodology Report. For instance, the draft Scenario Report says that CO2 price for NT scenario for 2040 is 75 EUR/t (p. 46), while the Scenario Methodology Report same price is claimed to be set at 50 EUR/t level (p.85).

8. Are you satisfied with the format and the level of explanation provided in the Methodology Report?

- **Unsatisfied**
- **No opinion**
- **Satisfied**

If unsatisfied, please comment

Eurelectric welcomes the publication of a Methodology Report alongside the Main Scenario Report. This provides additional background and context to understand correctly the figures provided in the results of the Scenario Report.

However, we would like to underline the following elements:

- **Assumptions behind technology hypothesis in GA and DE scenarios** should be further explained, especially regarding electricity demand and generation.
- **The investment costs for the various technologies** needs to be covered in more details. In particular, further details would be welcome such as;
    - How were technology costs modelled (e.g. discount rate used, marginal cost of electricity per annum)?
    - Where are the boundaries of the system a drawn from a cost perspective? For example, if it costs €5,000 for a heat Pump and €50,000 to insulate each house on a retrofit basis, then the cost of retrofit building work are many times the cost of any electrical/network impact. Have such costs been included or excluded?
- **Comprehensive cost information on hydrogen/synthetic methane and on infrastructures implications** should be provided.
- A **methodology for data aggregation** should be presented.

9. Are you satisfied with the format and the level of information provided in the Visualisation Platform/Data set?

- **Unsatisfied**
- **No opinion**
- **Satisfied**

If unsatisfied, please comment

The publication of the Visualisation Platform and the corresponding data is a good step towards more clarity and transparency. This is an interesting tool that should be promoted and upgraded. Going forward, it would be highly relevant to dig more into the details. For instance:

- **Provide more information on demand and the impact of flexible demand**: This could be done via detailed data sets in xls. format provided especially for demand, generation, cross border capacities, etc. A visualisation by sector for (electricity) demand as well as further details on the assumptions (e.g. number of EVs, heat pumps for example) would also have been appreciated. Moreover, information on the electricity demand for electrolysis should be added.
- **Clarify whether figures are at transmission level with embedded generation already offset, or otherwise**.
- **Provide sources for the figures indicated in the graphs** as this is currently missing.
- **Provide additional information on costs** - especially regarding decarbonised gases, CCS/CCU and biomethane.
- **Avoid rounding figures** as this makes harder the comparisons across the scenarios.

10. The ENTSOs scenarios are built to be compliant with EU-28 2030 and 2050 targets as a minimum standard. Do you agree that ENTSO scenario should be built with a minimum standard?

- **Yes**
- **Neutral**
- **No**

If no, please comment why.

Minimum Standard Comment

Eurelectric agrees that ENTSO's scenarios should be built with a minimum standard.

In particular, we welcome that the GA and DE scenarios are built in line with the Paris Agreement and are cognisant of the efforts of the EU-28 to reduce emissions to net-zero by 2050. However, the NT scenario -based on the draft NECPs - is by definition in line with the EU's 2030 Climate and Energy Framework. However, it is not compliant with the Paris Agreement and the ambition of net-zero emission in the European Economy by 2050. **For upcoming TYNDP editions, we would welcome additional scenarios. For example, an "ambitious scenario" that is going beyond the minimum standard or a "less ambitious scenario"** (e.g. reaching the EU-28 2030 and 2050 targets but at a later stage).

In our understanding, a CBA for transmission and storage projects will be fully performed for the NT scenario only but not necessarily for alternative scenarios such as the GA or DE scenarios. We find this particularly worrying given that:

- the NT scenario is not Paris Agreement compliant;
- the CBA is the sole basis for the selection of Project of Common Interests that benefit from accelerated permitting procedures and funding.

Eurelectric believes that the main scenario for a CBA should be compliant with the EU 2050 decarbonisation objectives.

The TYNDP is intented to identify the gas and electricity infrastructures needed to achieve the EU long term climate ambition. Therefore, **we call on the ENTSOs to provide further explanations regarding the approach on CBA that will be developed.** More specifically, we would like to better understand what are the ”subset of CBA parameters” mentionned in page 52 of the Scenario Report that will be determined for DE and GA scenarios.

11. The ENTSOs introduced National Trends as the central policy scenario. National Trends is aligned with the draft member state National Energy Climate Plans (NECPs). Do you agree that member state NECPs should be used to develop National Trends?

- **Yes**
- **Neutral**
- **No**

If no, please comment why

Eurelectric advocates for ambitious and coherent NECPs to ensure that EU reaches its 2030 targets. This will provide investors with more certainty across sectors and ensure consistent reporting under the United Nations Framework Convention on Climate Change.

NECPs can be a strong basis for ENTSOs scenarios but only if the key elements are adequately defined and reflected in the final plans. However, the current versions of NECPs are not complete and not sufficiently robust. Indeed, the forecasts lack sufficient level of information regarding cost analysis, policies needed to ensure their implementation and hurdles to be cleared. To be effective, **the NECPs should provide confidence to investors that the regulatory framework is fit for purpose to deliver the needed investments**, and flexible capacity in particular.

If the NECPs do not meet this ambition, any NT scenario based on them would then devolve to ‘business as usual’ alternative Scenario.

12. Do you agree that the scenarios are consistent with their respective storyline central matrix?

- **Yes**
- **No opinion**
- **No**

If no, please comment why

Although not very straightforward, the central matrix is an interesting way to summarise the various drivers and the similarities/differences of each scenario storyline.

13. Scenario diversity is essential when it comes to the assessment of the future gas and electricity infrastructure needs. In your opinion do the 3 scenarios cover a broad enough range of plausible pathways aiming to achieve 2050 EU-28 targets?

- **Yes**
- **No opinion**
- **No**

If no, please comment why

The Scenario Report should highlight the differences between the three scenarios much more clearly. There should ideally be a greater strategic distance between scenarios in order to assess the impacts on each scenario of variations in the assumptions used.

In particular, the main Scenario Report does not sufficiently draw out the distinctions between DE and GA, except in terms of generation:

- **These scenarios have other impacts which were not described:** the likelihood of their happening also depends on other factors which were not described/analysed.
- **The absence of key differences between the scenarios does not really "stress" the system:** it does allow to illustrate the potential "weakest links" in the reasoning behind the system development.

For upcoming TYNDP editions, Eurelectric calls on the ENTSOs to ensure greater spread in scenarios – complemented by sound sensitivity analyses – to illustrate potential grid issues/weaknesses. More specifically, we would suggest the following:

- **An analysis to compare technology costs complemented by an assessment of the risks and the feasibility of the scenarios:** indeed, we are worried by the assumption that all the technologies required to meet the assumptions made will be available. There does not seem to be any consideration of alternatives 'Plan B' if such technologies that are not fully mature yet such as CCS/CCU, electrolysis and biomethane are unavailable.
- **A wider range of possible futures to test the energy infrastructure under more extreme circumstances**: for instance, we would welcome more extreme scenarios – even one including non-compliance with carbon neutrality by 2050 – to test the infrastructure accordingly. Indeed, there is no scenario assuming not reaching EU-28 2030 and 2050 goals or achieving it with a delay in time. Therefore, it does not allow to pin point the weak parts in the system.
- **An additional sensitivity analysis around each of the scenarios retained**.
- **A test on the robustness of each scenario:** what are possible variations of the main drivers for grid extensions (e.g. what are realistic differences in the exploitation of RES potentials in the EU-28/in the various regions)?

14. The COP21 Paris Agreement and IPCC Special Report 1,5°C provides evidence on the need for a carbon budget in the global effort to tackle the climate change. This is the first time ENTSOs have developed a carbon budget approach for the Distributed Energy and Global Ambition scenarios. Do you agree that using a carbon budget approach to scenarios is appropriate?

- Yes
- No opinion
- No

If no, please comment why

15. The Distributed Energy and Global Ambition scenarios aim at achieving a carbon-neutral EU-28 economy by 2050. Do you think the scenarios are helpful in identifying / assessing those challenges?

- **Yes**
- **No Opinion**
- **No**

If no, please comment why

In principle, this scenario exercise could be a very useful tool for identifying future grid challenges. However, as mentioned previously, **the scenarios are too similar to be able to really test the energy infrastructure under more extreme circumstances.**

Indeed, as mentioned in our previous answers:

- **It is not possible to assess the challenges without cost information or a clear analysis of risks and hurdles that need to be cleared to ensure the necessary investments:** for the NT scenario, the main objection is how ENTSOs' hypotheses are developed compared with EU long term scenarios now in review. On the contrary, the cost level for the electric generation technologies in the GA and DE scenarios seem rather arbitrary and triggered by the results expected. Given the large role expected for these technologies by the scenarios and the infrastructures attached to them, these information flaws seem serious.
- **The choice of some 'breakthrough' technologies doesn't look credible** without carrying out a CBA or sensitivity analysis.
- **There does not seem to be any consideration of alternatives 'Plan B' if some assumptions in the scenarios do not materialise:** forecasts are just an indication of what might occur in the future, while a strategy to meet those forecasts is then derived. The robustness and resilience of the strategy chosen depends on its ability to be altered to meet changing circumstances and reflect those changes in the forecast. The flexibility of the strategy is therefore critical. Going forward, we recommend the ENTSOs to opt for a 'real options' approach to allow changes in approach at critical junctures.

Something that we have not mentioned previously but that is key is the **urgent need for a thorough analysis of possible upcoming resource adequacy issues** (e.g. availability of firm capacity to meet peak demand) **and their consequences for the grid.**

Last but not least, - a thorough **evaluation of potential bioresources available for energy needs** should be held to assess the credibility of some of the hypotheses on green gases.

What do you believe is the 1st biggest challenge? (50 Characters)

Achieving the net-zero emission target by 2050 on time based on an ambitious and cost-effective development of carbon neutral generation. This should be made possible by reinforced and more flexible transmission and distribution grids that are socially accepted and developed in a cost-efficient way vis-a-vis other alternatives.

What do you believe is the 2nd biggest challenge? (50 Characters)

Develop a future proof energy market design to ensure the correct legislative framework for long-term investments. Indeed, some of the technologies needed to achieve the sustainability targets are CAPEX intensive and there is no adequate price signal for long-term investments in the markets. See Eurelectric's recommendations in the E-invest report from September 2019. ,

What do you believe is the 3rd biggest challenge? (50 Characters)

Ensure and foster the development of technologies that will provide flexibility to the energy system (hydro pump storage, batteries, networks digitalisation, Demand Side Response, Power-to-gas…). In this context, a comprehensive approach will help to identify the breakthrough technologies and their economic insertion/feasibility right in time.

16. The ENTSOs scenarios have for the first time used a total energy balance tool to build the scenarios. The energy balance method allows a holistic overview of the future EU-28 energy pathways in a comprehensive and consistent manner. The total energy model provides an opportunity to capture the impact of sector coupling between the gas and electricity sectors. Do you agree that the ENTSOs' approach to sector coupling is sufficiently captured?

- **Yes**
- **No opinion**
- **No**

Using a total energy balance tool to quantify energy inputs and outputs in order to build the scenario is a good approach.

During the public stakeholder workshop (5th December 2019), the ENTSOs indicated that Eurostat data and "other studies" (e.g. Navigant for biomethane, TRAPUNTA for demand profile) provided the basis for this Ambitious Tool. **However, to be fully in line ENTSOs transparency commitments, we call on the ENTSOs to publish the full list of studies that supported the elaboration of the total energy balance tool.** Moreover, we would also welcome the disclosure of data that are included in the methodology used, e.g TRAPUNTA.

When it comes to ENTSO-E approach to sector coupling, our main comments would be the following:

- **The hypothesis that electrolysers use only curtailed electricity or off-grid electricity from dedicated RES is quite restrictive:** other uses could be possible depending on market signals.
- **The scenarios place particular emphasis on hydrogen and power-to-gas.** But what about the contribution of power to district heat (electricity demand in the transformation sector) and power to liquid (especially for aviation, shipping and heavy duty vehicles)?
- **The methodology used for assessing the gas demand for power generation, as well as the electricity demand for electrolysis, remains quite unclear**: the reflections about the technology development indicated in the reports are far from capturing the many implications of sector coupling (which covers technologies that are not fully mature yet). In such condition, it seems difficult to build credible CBA for the scenarios.

- **Further information would be needed on how the sector coupling approach will be used for identification of infrastructures investments needs** (and how sector coupling may avoid some of these investments).

17. The ENTSOs scenarios use external data on LULUCF (Land Use, Land Use Change and Forestry) to provide input to the scenarios on carbon sinks. The scenarios also consider the development of "game-changer" net negative emission technologies, such as, Bioenergy Carbon Capture and Storage (BECCS). Do you agree that including external LULUCF and net-negative emission technologies within the scenario is appropriate?

- **Yes**
- **No opinion**
- **No**

If unsatisfied, please comment

We do not oppose to their inclusion, however there should be an expectation of economic viability if they are indeed considered. Further detail on forecasts and cost references would be needed.

18. To reach carbon neutrality by 2050, ENTSOs scenarios consider the deployment of Carbon Capture and Sequestration (CCS) for pre- and post-combustive processes. Do you consider CCS is an appropriate technology within the scenarios?

- **Yes**
- **No**

If no, please comment why

CCS technologies have been under discussion for years with no material results and face significant public acceptance issues in many countries. **We do not expect CCS or CCU to be competitive in the medium term.**

However, **it does make sense to include CCS technology (at least for one of the two COP21 scenarios) from a point of view of assessing additional scenarios, with steeper cost reductions and technology disruptions.**

In any case, groundwater protection has to be ensured. This may require to refrain from CCS in densely populated areas.

Changes are possible in the 2050 horizon and the CCS/CCU technology could show better adaptation to the applications of the future. Nevertheless, we find neither these reflections in the reports nor any justified approach to technology costs.

Last but not least, a sensitivity approach would be useful to model the different cost assumptions impact on the results. CCS/CCU should only be applied where it is economically efficient compared to a fossil-free alternative production.

19. The Distributed Energy and Global Ambition scenarios consider different technology pathways to decarbonisation. The Distributed Energy is a scenario where renewable technology is deployed in a decentralised way. The Global Ambition scenario assumes a more globalised

and centralised approach to development of renewables. One impact is the potential for more energy imports from outside of the EU. Do you agreed with how renewable energy deployment is applied?

- **Yes**
- **No opinion**
- **No**

If no, please comment why

Infrastructure (distribution and transmission) development and adaptation will be pivotal to reach the full decarbonisation of the power sector but other sectors as well.

This transition will require both centralised and decentralised solutions. For instance, looking at storage solutions, hydro reservoir and pumped storage have been the backbone of storage for over a century and will remain a key player in the future. However, emerging technologies like batteries or power-to-gas could have the potential to transform and complement the way we do business and foster the services we provide to consumers. **Mixing a centralised and a decentralised approach in a same scenario is therefore the good approach. TYNDP scenarios should however take better into account the different starting points and commercial availability of key transition technologies.**

Careful considerations should be taken into account when talking about energy imports. Indeed, it covers a strategic dimension about the EU dependency to third country imports that should be decided at political level. It also embarks a dimension related to infrastructures. On this point, additional details should come from the TYNDP. **The final TYNDP report should be really clear on the infrastructures implications depending on the levels of energy imports within the EU.** For instance, it would be interesting to know if the ENTSOs see a need for additional gas infrastructure when looking at imports of gases (abated or unabated) to build additional links between the EU and third countries (pipelines, LNG terminals…).

Moreover, we would like to raise the following issues:

- An approach type GA could also incorporate other utility scale RES technologies, such as onshore wind and PV.
- DE scenario needs to give a detailed focus on D-grid deployment in electricity and possibly also in gas (to adapt for new sector coupling realities).
- RES prices seem high (DE scenario offshore wind LCOE seems higher than the LCOE (Bloomberg) today in north-western Europe).

20. As a stakeholder, do you intend to use our scenarios, or do you see opportunities for further use of these outside the TYNDPs?

- **Yes**
- **No Opinion**
- **No**

If yes, how would you consider them?

Some of Eurelectric's members are building their own internal energy scenarios for strategy-purposes and are constantly challenging their vision with others'. TSOs – and by extension TYNDP's vision and scenarios – are very important for us when it comes to carry out

benchmarking practices. They also use them for their external communications and internal discussions.

More specifically, for Distribution System Operators, there is a need to coordinate the planning with other Distribution operators and associated TSOs. To be effective both should coordinate e.g. if Distributed Energy based on connections to Distribution Network this must be feasible.

21. If you have any further comments on the scenarios, please state them here.

We would have welcome **more emphasis on the assumptions on Electric Vehicles** (TCO analysis, charging profiles in the future, battery costs, etc…).

- Example from France: Since France possesses one of the biggest Electric Vehicles fleet in Europe[4] , the French TSO RTE has published a study to address the key issues for the power system given the foreseen development of electro mobility.[5] According to the report - in a standard projection where EV development were to be "high"- the electrical system could accommodate up to 15 million EVs by 2035 without any particular difficulty. Moreover, regarding the potential impact during peak demand (e.g at night during winter), the study stresses that the ability to absorb the arrival of a massive fleet of EVs is guaranteed as long as basic steering solutions such as peak / off-peak periods are in place. In its scenario, RTE estimated that, as the overall impact of EVs on peak demand could only oscillate between 2.2 and 8 GW, it would enhance the value of carbon-free electricity and would therefore be in line with the carbon neutrality objective.

  However, the future power system will not just be confronted with the development of electro mobility. Another component to take into account is the fact that deployment of heat pump in the building sector will indubitably rise. As a matter of fact, in its Adequacy Report "Balance of Energy Generation and Demand"[6] , the French TSO highlighted that the sole replacement of electric convectors by heat pumps (300.000 within 3 years) could lead to noticeable changes that would improve the overall electricity demand by generating margins (0.3 GW) for the peak period. Moreover, positive impact on peak demand could also be triggered thanks to the renovation of electric-heated buildings (0.4 GW) or the replacement of poorly electric convectors (0.1 GW) according to the report. Therefore, it is compulsory to take into account all those "new uses" when it comes to establishing the TYNDP.

We identified **several inconsistencies in the excel file data that was provided.** A non-exhaustive list is as follow:

- Portugal and Spain:

[4] In its 2018 brochure on e-mobility, UFE stresses the fact that 150 000 EV were already in circulation in 2018.

[5] Enjeux du développement de l'électromobilité pour le système électrique, RTE, Mai 2019.

[6] Bilan prévisionnel de l'équilibre offre-demande d'électricité en France, édition 2019.

- The load factor for solar in Portugal drops from 21% in 2020 to 10% in 2030 before climbing to 18% in 2040
- Solar Thermal in 2040 has generation even though installed capacity is zero (this is also present in other countries) and batteries have similar installed capacity/generation discrepancies
- Total Generation in 2040 is the same as 2030, even though we had a 28% increase in installed capacity
- Considering the historical average of the onshore wind assets as well as the build up through the next decade, the average load factors for wind are very different for Portugal and Spain, which does not make sense – curtailment cannot justify these differences
- By 2030 Portugal has virtually no thermal generation, which is not possible and also not aligned with the NCEP or the TSOs expectations
- While there are ambitious targets for electrification, generation post curtailment increases 50% in a decade (2030-2040), which is very steep.
- Since the NCEPs were defined individually by each country, the import-export flows do not always add up. Giving a specific example, Portugal, Spain and France all forecast that they will be net exporters by 2030. Spain's NCEP implies net exports of 40 TWh, with total exports of 48 TWh, 13 TWh for Portugal and 35 TWh for France. It is not clear for us how these issues were addressed when the plans were combined, since we also have incomplete data regarding generation in the Portuguese NCEP for example.

- Czech Republic:
  - There is a high variation in nuclear output in Czech Republic both in time and between scenarios. In 2030, nuclear output ranges from 30 TWh to 35 TWh, representing a utilization rate of 87% up to 100% (too optimistic). Additionally, in 2040, nuclear output ranges between 21 TWh and 30 TWh. Does this mean that nuclear is being curtailed by high share of RES output?
  - TYNDP seems to be missing 1GW of hydro capacity for Czech Republic (in 2030).

- Denmark:
  - There seems to be a mistake in figure 39 Total gas demand. The EC – LTS 1.5TECH gas demand seems set at 3250 TWh but it is only 255 MToe which equals 2965 TWh. See figure 33 in LTS.
  - Figure 42 states that the LTS 1.5TECH scenario imports around 1000 TWh, but how does this align with the fact that LTS states that all decarbonized energy carriers are produced in the EU (p. 87)?
  - In the DE scenario gas imports are way lower and EU production of e-gas and hydrogen is higher (around 600 TWh). Producing this should require around 850 TWh electricity, but it is not obvious that these are accounted for when comparing to the GA-scenario.

- Sweden:
  - The phase-out of one nuclear power unit before 2025 and a full phase-out of the remaining five units before 2040 is assumed and addressed as a "best estimate" assumption. However, this is not in line with current

operation plans of the nuclear plant owners. Current plans incorporates the operation of six units beyond 2020 without a clearly defined stop date. In addition, operation beyond 60 years is under investigation. There is today no plan to close any of the six nuclear power units in operation beyond 2020 before 2040. Thus, the range of scenarios for the Nordic grid may be too narrow and there is a risk that the TYNDP scenarios lead to false conclusions regarding investment needs in the Nordic grid.

Moreover, the climate scenarios (ex : peak demand, 2-week cold snaps, Dunkelflaute) considered by ENTSOG should be mirrored by ENTSOE, in order to ensure consistency of the assumptions made between electricity and gas and to ensure that the TYNDP 2020 is performed via an effective joint methodology. It is notably needed for a proper identificaction of gas-to-power and power-to-gas interactions and of the investments needs in terms of P2G or G2P infrastructures or assets.

Eurelectric pursues in all its activities the application of the following sustainable development values:

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- Growth, added-value, efficiency

Environmental Leadership

- Commitment, innovation, pro-activeness

Social Responsibility

- Transparency, ethics, accountability

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