Usefulness of the Webinar

General summary:

The majority of stakeholders were generally satisfied with both the transparency and level of detail provided by the webinar on July 3 2020. Some stakeholders felt that not enough information was provided regarded the integration of stakeholder/consultation feedback in the report. Furthermore, multiple stakeholders requested more regular webinars throughout the scenario building process in order to keep civil society organisations well-informed.

General response (provided since all answers are very similar in content):

The integration of stakeholder inputs is something that we have tried to highlight during the development of the Draft Storyline Report and the Final Storyline Report. Indeed, the Final Storyline Report has been adjusted as a direct result of feedback received during the consultation. We intend to continue to use stakeholder feedback to shape the scenarios as we enter the modelling phase. Several stakeholders have mentioned that they would welcome more regular webinars/events during the scenario building process. We would be keen to know at which stages the stakeholders feel greater transparency is required. At present, we provide public webinars during both consultation processes as well as at the beginning and end of every scenario cycle. In addition, topic-specific webinars are offered throughout the two-year scenario building process to get stakeholder feedback on individual issues. The next webinar of this type on Energy Imports and will take place in Q2 2021.

Eurelectric

Feedback: Eurelectric has followed the TYNDP process very closely since its beginning and our Association has committed in the meetings and discussions organized on this until then.

Being closely involved in the process, the information presented during the webinar organized in July 2020 did not appear new to our representatives. In particular, the presentation of the general aspects and conditions of the interlinked model. Eurelectric welcomed the additional information regarding the development and the way the ENTSOs would organize the “next steps”.

Nevertheless, more clarity and explanations are welcomed on how ENTSOs will consider and integrate inputs provided by stakeholders along the scenario process. The timeline with the different milestones and deadlines for each work packages could be further explained and simplified.

Response: The Final Storyline report includes updated ranges on key parameters based on stakeholder feedback. The handling of the data will be explained as part fo the Methodology Guidelines to be published along the Draft Scenario report this summer.

Anonymous

Feedback: No opinion because I did not attend the webinar due to summer vacation time. However, I would suggest to offer these kinds of easily accessible updates more often to allow civil society organisations to better understand the progress, the priorities and the results of your scenario building. I recommend recording the webinar so that it can be watched afterwards.

Response: All webinar material is published on our website and we will publish questions and answered as resulting from the event and public consultation on the Draft Storyline report. We will consider your suggestion to make available a video recording of our future events. In the meantime,

you can contact us throught the scenario website[1] to organize a bilateral meeting if deemed necessary.

Oeko Institut

Feedback: Yes. It was very helpful.

Response: We welcome this positive feedback on the process.

Edison S.p.A.

Feedback: Edison follows every year with interest the whole process for the TYNDP building process and welcomes the improvement of TYNDP 2022. Nevertheless, some improvements could still be provided on how the ENTSOs think to consider the input they receive during the process.

Response: The integration of stakeholder inputs is something that we have tried to highlight during the development of the Draft Storyline Report and the Final Storyline Report. Indeed, the Final Storyline Report has been adjusted as a direct result of feedback received during the consultation. We intend to continue to use stakeholder feedback to shape the scenarios as we enter the modelling phase.

Orsted

Feedback: We at Ørsted have been following the TYNDP process very closely since its beginning. We welcome the additional information regarding the development and the way the ENTSOs would organize the "next steps". Nevertheless, more clarity and explanation is welcomed on how ENTSOs will consider and integrate inputs provided by stakeholders along the scenario process. The timeline with the different milestones and deadlines for each work packages could be further explained and simplified.

Response: We welcome this positive feedback. The Final Storyline report includes updated ranges on key parameters based on stakeholder feedback. The handling of the data will be explained as part fo the Methodology Guidelines to be published along the Draft Scenario report this summer.

Anonymous

Feedback: We are content with the level of information shared with us at this meeting.

Response: We welcome this positive feedback on the process.

National Grid Ventures

Feedback: We are content with the way the webinar was structured and provided sufficient information to project promoters regarding the scenarios which will underpin the TYNDP 2022.

Response: We welcome this positive feedback on the process.

E3G

[1] TYNDP 2022 Scenarios – Draft Storyline Report by ENTSOG and ENTSO-E (entsos-tyndp-scenarios.eu)

Feedback: E3G appreciates the transparency improvements achieved via these initiatives. We encourage the ENTSOs to offer access to information and updated more regularly to allow better and broader participation of civil society organisations in the process.

Response: We welcome this positive feedback on the process.

Climate Action Network

Feedback: CAN Europe welcomes the transparent presentation during the webinar on 3 July 2020. We suggest to offer these kinds of easy accessible updates more often to allow civil society organisations to better understand the progress, the priorities and the results of your scenario building.

Response: The process is now in a critical stage of converting storylines and stakeholder feedback into fully-fledged draft scenarios to be published this summer for public consultation. In the meantime, a specific workshop on imports and their impacts on the European carbon budget will be organized in April.

AIGET - Associazione Italiana di Grossisti di Energia e Trader (The Italian Association of Energy Traders & Suppliers)

Feedback: Every year, we follow with interest the whole TYNDP building process, and we welcome the improvement of TYNDP 2022. However, some improvements could still be made on how the ENTSOs evaluate the inputs they receive during the process.

Response: The integration of stakeholder inputs is something that we have tried to highlight during the development of the Draft Storyline Report and the Final Storyline Report. Indeed, the Final Storyline Report has been adjusted as a direct result of feedback received during the consultation. We intend to continue to use stakeholder feedback to shape the scenarios as we enter the modelling phase.

General Transparency

Anonymous

Feedback: Compared to the previous TYNDP processes, the documentation has become more transparent, accessible and reader-friendly. We welcome that a list of stakeholder meetings has been published.

Response: We welcome this positive feedback on the transparency of the process.

Germanwatch e.V.

Feedback: The list is very good for transparency and increases trust in the process. Please continue to update this list and also continue bilateral meetings that allow in-depth discussions. Maybe it would be great to outline as well how such a bilateral meeting can be requested (what the process is for this?).

Response: We are happy to have bilateral meetings with any organisations that feel they have important information to contribute to the scenario reports. The scenario website[2] provides some contact details for both ENTSOG and ENTSO-E, please do not hesitate to use them to further engage with us.

Eurelectric

Feedback: More clarity and explanations are welcomed on how ENTSOs will consider and integrate inputs provided by stakeholders along the scenario process.

The timeline with the different milestones and deadlines for each work packages could be further explained and simplified.

Response: Thank you for this feedback. We will take this into account when preparing this information in future.

Anonymous

Feedback: Anonymous appreciates the efforts made by ENTSOE and ENTSOG to improve the transparency of the TYNDP process, particularly the opportunity to have a bilateral exchange, and also by trying to better take into account stakeholder's comments. Anonymous also appreciates the increase but regrets a lack of homogeneity in the level of detail of the information provided. Anonymous invites the ENTSOs to continue on this path.

Among the axis for improvements, Anonymous suggests TSOs to reduce the width of intervals of the analysis because it is difficult to identify any trend from the graphs provided for the two scenarios when compared to the TYNDP 2020 values. In addition, these intervals/ranges could be better justified and TSOS could be more critical with certain selected sources, in particularly when these reflect the ambition of industry.

Furthermore, Anonymous would like to point out the following: (i) even expert-based determination of market shares calls for some information on the underlying methodology ; (ii) the choice of some parameters appears arbitrary (for example: FCEV) ; (iii) positively, some aspects are more developed than in the previous edition (nuclear for example, though the ranges provided are below the EC's Long Term Strategy – LTS).

Anonymous also suggests providing geographical trends. The Storylines Report indeed provides an overview of trends at European level. However, regional dynamics can be very different. Thus, the dynamic of a sector in particular countries, for example, the development of the electric vehicle, can be drowned in a global vision and impossible to identify.

Response: We are pleased to see that the information on bilateral meetings and stakeholder's questions has been well-received. Regarding intervals for between scenario reports. The TYNDP process obliges a two-year cycle for the development of new scenario reports. During the dedicated webinars throughout the process, the team endeavours to explain difference to previous reports. We are happy to take this into account for future reports. Due to the nature of the TYNDP process,

[2] TYNDP 2022 Scenarios – Draft Storyline Report by ENTSOG and ENTSO-E (entsos-tyndp-scenarios.eu)

analysis related to specific regions within countries is generally avoided by the TYNDPs and left to the national development plans.

Edison S.p.A.

Feedback: The level of transparency has increased for the TYNDP 2022 scenarios, for example the publication of the Q&A document is appreciated and the iteration of the TYNDP with a higher quantification level and the disclosure of information source is positive. However, it still could be improved considering the following: the raw data used to develop the ranges for TYNDP 2022 could be shared with stakeholders at least to a certain extent. In addition, some more data could be provided from the scenario stage:

- for example, regarding imports of methane and hydrogen, some elements of quantification should be provided.

- Edison would also appreciate a more detailed granularity at geographical level. The Storylines Report indeed provides an overview of trends at European level. However, regional dynamics can be very different, and it is very difficult to have a critical point of view on integrated data (for example range of EV, FCEV etc..).

Response: We are pleased to receive the positive feedback on the transparency of the process. The Draft Storyline report includes a section dedicated to imports stating that scenarios will stay below below TYNDP 2020 edition level. At this stage of the process, it is not yet possible to provide exact and regionalized data. This will be published as part of the Draft Scenario report.

Anonymous

Feedback: We are really satisfied with the level of transparency provided by the Scenario Building Team. For example, having the Q&A of the webinar is useful.

However, the inclusion of electricity and gas DSOs earlier in the TYNDP elaboration could be an asset to the process. For instance, when envisioning scenarios relying on a decentralized energy production, DSOs have a role to play and could contribute to the discussion.

Response: The role of DSOs is something we have attempted to address in the 2022 scenario building process. Indeed, as outlined in the bilateral meetings table, the scenario building team met with a group of experts from the DSO networks on multiple occasions, starting at the very beginning of the process.

Anonymous

Feedback: More information on how feedback is incorporated into the process would be beneficial

Response: Thank you for this feedback. We will take this point into account when composing the Final Storyline Report, and then the Scenario Reports later this year.

National Grid Ventures

Feedback: Significant improvements in the way the information is presented. The visualisations which show the differences between 2020 and 2022 in terms of the modelling assumptions is a major improvement.

Response: We are pleased to see that the improvements in transparency has been positively received.

E3G

Feedback: E3G appreciates the increased transparency and accessibility to the documentations. Improvements can still be made, for instance, by publishing all feedback received and not only of those who allowed it. We recall the importance of keeping a balanced approach by consulting all interested stakeholders in this process – including demand-side industries, consumers' organisations, unions, NGOs, etc.

Response: We are pleased to see that the improvements in transparency have been positively received and agree that a balanced approach to stakeholder consultation is of great importance. The list of bilateral meetings should reflect this.

Climate Action Network

Feedback: Compared to the previous TYNDP processes, the documentation has become more transparent, accessible and reader-friendly. CAN Europe welcomes that a list of stakeholder meetings has been published. We thank ENTSO-E and ENTSOG for the opportunities to exchange about scenario building and the TYNDP process bilaterally during the previous months. (We however cannot identify any bilateral CAN Europe/EEB meeting with ENTSO-E and ENTSOG indicated in the list for 23 September 2020.)

Response: We appreciate the positive feedback and are happy to provide further details (bilaterally) of the meeting that took place on 23.09.20.

Eurogas

Feedback: We welcome ENTSOs for the work already done and for taking into account many improvement proposals made during the previous TYNPD in terms of process. The transparency on meeting and bilateral discussions is much appreciated.

They provide a good starting point for discussion, and we welcome the inclusion of a coal to gas switch sensitivity in 2025, but nevertheless identify two distinct issues. On the 2040 side, the national policy scenario is focused on an exclusively bottomtopup down approach building on the NECP´s and other national strategies. of what is being proposed in regulation The expression of these national developments shall be submitted by the and what is being planned bynational TSOs. We think it is very important that this exercise has to be done together with the DSO in electricity and gas. Many developments are based on the local level – production of biomethane, renewable electricity, hydrogen, heating-mobility-industrial development – that have to be included into the national trends. Looking at the answers given to these question (FAQ 3.7.) we are not convinced that this process is really happening in the MS as it depends very much on the willigness of the TSO to include the DSO. Considering that the CEP is all about the local development we don´t think that this is taken into account sufficiently. without taking the DSO level sufficiently into account.

In addition, the 2040 end date can be put into question considering the scope of the challenge between 2040 and 2050 which, if left unmodelled may prove a significant challenge to reach. As the national scenarios are building on the national Governmental plans. Many countries are just starting the discussion on decarbonization of the gas grid with biomethan or the various forms of hydrogen of SNG. It is unclear how the national trends are constructed if the development in the country is not ready yet. In addition, the new 2030 targets just have been decided by the European Council. As

they are still in discussion between the council, the parliament and the commission they logically can´t be implemented in any national plans yet. How should this be addressed by the TSO?

Secondly, the issue of the 2050 scenarios as they are modelled is that one of the scenarios seems to portray an electrified world through a self-sustaining European continent pegged against a global ambition scenario which is "forced" to rely on external imports. This approach may risk being too much of a caricature of pegging electrons vs molecules, where renewable gas is barely needed on the decentralized scenario, even though most renewable and low-carbon gas is produced locally, while the decentralized scenario doesn't see the need for dispatchable generation either, even though the level of electrification is even deeper and therefore would require even higher levels and diversity of flexibility sources. Similar comments can be made on the input vs output approach where DE looks at reducing consumption whilst GA looks at increasing renewable and low carbon energy production; these approaches should often be combined to ensure a coherent and credible approach towards 2050.

We share the fact that scenarios are not able to predict the future and that many intermediate pathways can materialise based on different combinations of drivers.

We appreciate the draft scenarios underlining the technology neutral approach and would therefore welcome the inclusions of a broad and divergent range of assumptions/scenarios/ external models such as the recent studies of Eurogas DNV GL (included in the transparency list) or E-Cube/EWI (https://www.ewi.uni-koeln.de/cms/wp-content/uploads/2020/09/E-CUBE-EWI-2030-Peak-Power-Demand-in-North-West-Europe-vf3.pdf).

E-Cube and EWI published in last September a report analysing in depth the 2030 Peak Power Demand in North-West Europe.

Based on TYNDP 2020 scenarios and data this report shows that "cold spells such as those experienced in 1985, 1997 or 2012 would generate costs up to ~30 bn EUR, or ~0.4% of the annual GDP for North-West Europe (using a Value of Lost Load assumption from RTE for all countries). These costs result from the loss of up to ~0.4% of the annual electricity load of North-West Europe, with up to ~35 to 70 GW of power interruptions during ~100 to 250 hours affecting large industrial sites, and possibly commercial and residential customers." In line with TYNDP 2020 results.

« These results are especially driven by the assumed increased role of heat pump heating. Heat pumps are critical since their performance (COP) and power output significantly decrease with low temperatures, which results in higher electricity demand."

E-Cube and EWI identify many risks, uncertainties as well as ways to mitigate the expected supply-demand gap

Response: We are pleased to note that the improvements in transparency have been positively received. According to EU regulation, scenarios have to reflect both national and European policies. There may be some interim differences in ambition due to the legislative process. For this reason, the scenario report includes both:

- a bottom-up scenario based on national policies and strategies most of them not going further than 2030
- Top-down scenarios reflecting the latest climatic ambition stated at union level

The electricity system adequacy is only addressed at scenario level through market simulations which are not yet available at storyline level. We hope that the upcoming scenarios will address the expressed concern.

Ember

Feedback: Ember have noted an improvement compared to previous TYNDP cycles. The process is more transparent and accessible, and the documentation provides more detail and useful quantitative information. Ember welcomes that a list of stakeholder meetings has been published, and we thank ENTSO-E and ENTSOG for engaging with CAN Europe. Ember is a member organisation of CAN Europe and we intend to work closely with them to provide feedback throughout the TYNDP 2022 process.

Response: We are pleased to note that the improvements in transparency have been positively received.

AIGET

Feedback: The level of transparency has increased for the TYNDP 2022 scenarios, for example we appreciate the publication of the Q&A document and the iteration of the TYNDP with a higher quantification level and the disclosure of information source is positive. However, it could still be improved: the raw data used to develop the ranges for TYNDP 2022 could be shared with stakeholders at least to a certain extent. In addition, more data could be provided from the scenario stage:

- for example, regarding imports of natural gas & hydrogen, some numbers should be provided;

- We would also appreciate a more detailed granularity at geographical level. The Storylines Report provides an overview of trends at European level, but regional dynamics can be very different & it can be difficult to have a reasoned point of view on integrated data (for example range of EV, FCEV etc..).

Response: We are pleased to receive the positive feedback on the transparency of the process. The Draft Storyline report includes a section dedicated to imports stating that scenarios will stay below below TYNDP 2020 edition level. At this stage of the process, it is not yet possible to provide exact and regionalized data. This will be published as part of the Draft Scenario report.

Technology Selection in Global Ambition

Anonymous

Feedback: We agree with the main technology selection for Global Ambition. In hydrid heating solutions, flexible production of district heat should also be included, with heat pumps, electric boilers and heat accumulators used in combination with flexible CHP generation.

For the needed power system flexibility, all existing and new resources should be considered (hydro storage, batteries and other new storage solutions, flexible CHP, fuel cells, downward and upward demand response). Through addtional interconnectors, flexible resources can be increasingly utilised to provide cross-zonal flexibility as well.

Response: Sector coupling offers a wide potential for flexibility options as stated in your feedback. Factoring them in European-wide multi-energy modelling is a continous challenge where stakeholder

expertise is welcomed. Through the investment loop used to build Distributed Eneryg and Global Ambition, interconnectors will be considered as a way to optimise access to flexibility.

WindEurope

Feedback: The main aim of the scenarios is to assess the needed infrastructure build-out in different scenarios. In this aspect we're afraid that building scenarios in the current way, where ENTSO assumes either the global or the distributed way forward will result in undershooting the need for further build-out of infrastructure in the future. While we do understand the methodology for building scenarios and acknowledge that the method has its advantages, it might be more useful to build scenarios that give a wider range of the needed infrastructure build-out. In the current scenarios the effects on the needed infrastructure build-out often cancel each other out e.g. that in the GA-scenario there is an emphasis on centralized offshore wind build-out, but limited hydrogen/e-fuel build-out inside Europe. This will all else equal limit the range of the needed infrastructure build-out although the future that may materialize can be a combination of the DE and the GA scenario where the effect on the needed infrastructure build-out does not cancel each other out.

Despite the clear focus on offshore wind in the GA scenario, the DE scenario results in significantly higher offshore wind capacities due to the high P2X imports in GA. That is inconsistent with the intention of the scenario-building. In addition, the EC clearly aims for prioritizing a European H2 economy, which furthers the case for making P2X imports limited in both scenarios. The current structure risks undershooting the rate of infrastructure buildout that is cost-efficient.

The main problem in our estimation is the outsized impact of the import assumption of P2X-related products. Neither the EC LTS nor the latest 2030 Climate Target Plan scenarios include such an import assumption. This assumption conceals most of the other differences between the scenarios.

We would therefore encourage ENTSOs to add the import assumption as a sensitivity for both scenarios. This will of course have implication e.g. on the suggested heating ranges on hybrid heat pumps, but the downside from this would in our estimation be offset be clearly seeing the differences between the scenarios and seeing a wider range on the needed grid build-out.

Response: The scenarios intend to strike a right balance between differentiation and internal consistency. They also result from the 2-year available for consulting stakeholders and running market simulations in two steps in order to further factor stakeholder feedback. It is true that some scenario drivers may partly mitigate the need of infrastructures. In any case the Distributed Energy will result in a massive roll-out of renewable and associated infrastructures going beyond the latest EC Policy scenarios.

Anonymous

Feedback: The most relevant energy supply technologies all seem to be integrated into the storyline Global Ambition, except ocean energy. Information about energy efficiency technologies and services is missing.

It is however not the technology selection but rather the magnitude of certain technologies that raises questions, in particular the important role of carbon capture and storage (CCS) technologies. The scenario storyline report itself mentions that the materialisation of their fast and broad roll-out

depends on public acceptance. The technical and economic viability of CCS as well as of new nuclear capacities, bio LNG and hybrid heat pumps is far from being guaranteed. Against this backdrop, the Global Ambition storyline appears to be poorly balanced in view of fast decarbonisation.

Response: We intend to take into account the EU Renewable offshore energy strategy including its marine component as far as technical parameters are available.

Global Ambition does rely on low-carbon energy (e.g. CCS in some hard to abate industry) and imports but firstly on the development of European renewable. Therefore, both scenarios have a lot in common, Distributed Energy will seek the maximization of European renewable potential which also bares some acceptability risk, when Global Ambition will include some level of low-carbon technologies (nuclear, CCS) and imports facing other risks. We consider the approach as balanced and reflecting the fact that whatever the path reaching carbon neutrality will be both a technical and societal challenge.

Germanwatch

Feedback: The storyline Global Ambition is quite internally consistent as such. However, we think that the magnitude of how much capacity of each technology is available is highly overstated for some technologies. In particular the important role for carbon capture and storage (CCS) technologies is very doubtful. The technology is not yet proven, and academic studies widely claim that the sequestration capacities available need to be reserved for those sectors which are hardest to decarbonize, especially industrial processes. So, the electricity system should be decarbonized without relying on carbon sequestration resources. Also, the venturing into new nuclear technologies, bio LNG and hybrid heat pumps is highly questionable. The technological and financial viability of new nuclear and bio LNG is not proven. Hybrid heat pumps essentialy mean a lock-in into gas heating systems that will rely on fossil gas into the forseeable future. This is not compliant with meeting ambitious decarbonization targets. Against this backdrop, the Global Ambition storyline appears to be not well balanced in view of fast decarbonisation.

Response: Global Ambition does rely on low-carbon energy but in a limited extent (e.g. CCS in some hard to abate industry) and imports but firstly on the development of European renewable. Therefore, both scenarios have a lot in common, Distributed Energy will seek the maximization of European renewable potential which also bares some acceptability risk, when Global Ambition will include some level of low-carbon technologies (nuclear, CCS) and imports facing other risks.

We consider the approach as balanced and reflecting the fact that whatever the path reaching carbon neutrality will be both a technical and societal challenge. The maturity of technologies is certainly one dimension of the challenge, hybrid heat pumps and CCS are already at commercial stage making them candidates for the scenarios in the extent they are consistent with the storylines. Regarding CCS, the carbon budget of the scenarios does include the residual emission of the process.

Anonymous

Feedback: We accept and welcome that a main difference between DE and GA is whether to aim for balancing energy supply and demand at the local level (Small Scale Green Flexibility: by building stronger distribution networks and using DSR) or balancing on the international level (Large Scale Flexibility: by building large scale transmission and large scale supply). These two scenarios present

”extreme views” on the need for building infrastructure, and we acknowledge that the future of european transmission infrastructure might lie between those two points.

It is also clear why GA probably need to focus less on energy efficiency, since large amounts of central energy production giving larger amounts of central flexibility (contrary to large amounts of decentral production requiring large amounts of decentral flexibility)

However, it is less clear to us why GA need to focus that much on energy imports and disregard large scale European production of green hydrogen based on eg. massive offshore wind power production. We see many advantages coming from the large-scale demand flexibility derived from electrolysis combined with offshore wind power.

Also, it is not clear why the mobility sectors' contribution to flexibility should differ that much between DE and GA. In our view, BEV is the most likely technology for person transport as it combines low costs with great local flexibility. Contrary, we see heavy tranport as more likely to go hydrogen or e-fuels, both because of cost considerations, but also because we dont see much flexibility contribution from very extended electrifying heavy transport. To some extent it is reasonable to weigh FCEV and BEV a bit differently, but not to the extreme.

Anonymous suggests that the GA scenario is realigned towards more electrolysis and offshore wind power with less imports of hydrogen from 3rd countries, as e.g. Russian hydrogen imports might be priced at the cost of producing hydrogen from North Sea offshore wind and electrolysis. We also suggest that assumptions on transport are streamlined and somewhat equalised between the two scenarios with BEV the main carrier for person transport, and FCEV in combination with E-fuels for heavy transport.

Response: The Draft Storyline report may focus too much on the differences between scenarios for illustrative purpose. Most of the ranges for key parameters are now narrower in the Final Storyline Report and electric passenger cars will have at least a 74% market share. The updated report also provides the opportunity to bring further information on the role of hydrogen in mobility targetting first heavy transport.

Global Ambition will first rely on European RES, imports and low-carbon energy will complement the mix. As a result, there will also be some electrolysis based on European offshore wind in this scenario.

Enel S.p.A.

Feedback: The storyline Global Ambition relies excessively on of low carbon solutions and energy imports. Energy and climate targets will be only effectively achieved through a much higher electrification powered by RES.

With a limited contribution from biofuels and other RES sources apart from electricity RES, national commitments to meet the EU energy and climate targets will be only effectively achieved through a much higher electrification of end-uses and the prioritisation of the “energy efficiency first” principle, with increasing deep renovations and phase out of fossil fuels in the buildings sector. Electric vehicles are expected to become competitive vis à vis ICE ones by mid of this decade, thanks to the decrease in the battery costs, lower cost of ownership and higher efficiency. Heat pumps adoption will upsurge, thus increasing RES share in the heating and cooling sector. Also, in the

industrial sector, electricity has the potential to significantly reduce the GHG emissions related to some processes.

The storyline should better detail the "color" of hydrogen for the different scenarios. In the long term, only "green" hydrogen produced via modular and flexible electrolyzers fed by RES power seems to be the most promising pathway, for those parts of the economy that cannot be easily or economically electrified such as the hard-to-abate sectors, once economies of scales are in place. Moreover, the role of Power-to-Gas-to-Power (P2G2P) is substantially missing in the GA scenario. P2G2P will be needed in any EU net-zero ambition scenario by 2050 to balance seasonal electricity production and demand in a situation with large shares of renewables in the power system, by taking advantage of the surplus production of renewables.

Furthermore, in our view the ENTSOs scenarios seem to be overestimating the actual potential of CCS and net-negative technologies. CCS and net-negative emission technologies should be treated with caution when incorporated to long-term decarbonisation scenarios exercises. CCS technologies have been under discussion for years with no material results. CCS may have a role in the heavy industry to pursue net zero emissions by 2050. For the power sector, the societal, safety and cost challenges that CCS faces make it inconvenient to implement, given that other less risky and more cost-effective solutions are already available.

Response: We acknowledge both the efficiency-first principle and role of electrification. As a result, the Distributed Energy scenario of the Final TYNDP 2020 Scenario report had a lower energy demand than EC 1.5 Life scenario and an higher direct electrification. The 2022 version of the scenario will go along the same line.

According to the ranges of the Final Storyline reports, electric vehicles and heat-pumps will be the predominant technology for passenger cars and heating.

Regarding hydrogen, we share the need of transparency on the type of hydrogen, the upcoming Draft Scenario report will provide all the details regarding its origin (low-carbon, renewable, indigenous our imported).

CCS will aim at some hard to abate industry and hydrogen production from natural gas imports (capture being localized in Europe or at the exporting country level).

Eurelectric

Feedback: First of all, Eurelectric welcomes the assumption that the transition will require both centralised and decentralised options in any scenario (although in different proportions).

However, Eurelectric noticed substantial missing pieces in both storylines:

- Existing renewable technologies are missing such as hydro power plants and hydro pumped storages.

- Future potential technologies are missing such as gas-fired generation (for example, CCGT), which could be using renewable and low-carbon gases instead of natural gas. For instance, Power-to-X development shall be considered in combination with Gas-to-power, for example by burning hydrogen or synthetic methane in gas turbines.

- Possible flexible power assets are missing such as e.g. gas-fired power plants, hydro storage and pumped storage, batteries, and others new storage solutions, fuel cells, flexible CHP, Demand Side Response, smart charging; as well as additional interconnectors to utilize cross-zonal flexibility

and to meet the electricity demand in these situations. In this sense, only a serious CBA assessment jointly carried out by power and gas TSOs can illustrate the implications on infrastructure costs for each scenario and give orientations to the regulatory measures and incentives to take.

- Import assumption should in fact be considered in both scenarios. The main issue is the potential impact on the scenarios of the import assumption of Power to X-related products. Neither the EC LTS nor the latest 2030 Climate Target Plan scenarios include such an import assumption.

- One substantial criterion is missing: "security of electricity and gas supply". As the core responsibility of system operators is to ensure security of supply for their networks, the storylines should mention adequacy of installed capacity to meet demand, availability and reliability of power and gas transmission infrastructures, etc.

- Both storylines should consider that the starting points and commercial availabilities of key transition technologies, especially to provide new storage options, are different.

- The effects of market mechanisms and of internal cross-border exchanges are insufficiently discussed or missing in both scenarios.

Moreover, the type of hydrogen used in industrial applications can be further detailed (Steam methane reforming + CCS, pyrolysis, electrolysis…) from both a supply and networks integration perspectives, especially in a TYNDP exercise. The definitions provided by the European Commission's Hydrogen Strategy for a climate-neutral Europe should be used as a starting point.

Furthermore, Global Ambition storyline still considers the shares of methane import in 2050, with "CCS is an option to support decarbonisation of some industrial processes" (p. 11). With regards the assumptions on CCS, it would be interesting to have more details on where carbon capture would take place (i.e. at entry of Europe and/or within Europe), as localization of carbon capture units may have different implications in terms of hydrogen, gas or CO2 infrastructures use and needs. And whether any path would be subject to technology check and CBA assessment which is an inevitable step to support the feasibility and appropriateness of scenarios.

Eurelectric also suggests that the distinction between CCS and CCU becomes clearer, as there is a demand for carbon in both scenarios to process hydrogen into e-fuels. This could affect the projected power generation albeit hydrogen used in e-fuels should be assumed to originate from a sustainable carbon source such as biomass power generation.

In addition, one characteristic of the Global Ambition storyline is the integration of nuclear to "complement the energy mix to a limited extend, largely led by national energy policies" (p. 11) – for electricity generation. Based on a technology neutral approach, this complementarity role would encompass, for instance, the production of Hydrogen through electrolysis of water.

With regards to the methodology, Eurelectric believes that the main aim of the storylines is to assess the needed infrastructure to be build out in different scenarios. In this respect, it may be more realistic to build scenarios that give a wider range of the future and represent alternative paths, within the existing discussions around the future in the energy sector needs for infrastructures.

To conclude, Eurelectric considers that the proposed storylines provide two stress test cases: on one hand, Storyline "Distributed Energy" which is extremely decentralized and based on an utmost focus on "self-sufficiency" and, on the other hand, "Global Ambition" which depicts a strongly centralized system biased to gas. While stress tests can be of interest to assess the resilience of the energy

infrastructure, Eurelectric believes that none of them describes what could be the most probable scenario, which will likely be a combination of the two proposed scenarios.

Response: Thank you for your comments. Regarding Eurelectric's opinion, that the "most probable" scenario will likely be a combination of GA and DE, the Scenario Building team would largely agree with this conclusion. As Eurelectric has correctly perceived, the scenarios are designed to assess the resilience of the energy infrastructure (the task of the TYNDP itself). It is not the goal of these scenarios to provide a (potentially political) statement on the probability or preference for a certain scenario.

Ranges mentioned in the storyline report mostly refer to technologies to be developed according to an investment loop applied to the electricity and hydrogen markets. Hydro and pumped storages are included in our scenarios and used as input parameters for the process based on TSOs projections. The gas-fired power generation and interconnection capacity will be an output of the market-run therefore only available at Draft Scenario stage.

Synthetic fuel production in Europe will consider the availability of biogenic carbon. At the same time the operation of electrolyser will focus on renewable and low-carbon marginal periods.

Oeko-Institut

Feedback: Too high role of CCS and nuclear energy. Both technologies are expensive and have low acceptance compared to alternative decarbonisation technologies. Therefore, the decarbonisation that can actually be realised under this scenario is uncertain.

Response: The role of these technologies will be strongly limited in Distributed Energy scenario. In Global Ambition, the role of CCS will be limited to some hard to abate industry and hydrogen production meaning high added-value sectors able to compensate the additional costs going with. Nuclear capacity will in any case decrease compared to present level.

Iberdrola S.A.

Feedback: The selection of scenarios if reduced to uniquely two options should respond to very consensus approaches. In our view, the key differentiation among the alternatives is based on a dichotomy between "self-sufficiency" and "market openness", that does not represent the current state of discussions among the stakeholders with the EC or with MS regulators. A "self-sufficient" scenario could be assumed as a stress test but not a relevant option in a "binary" scenario discussion.

The scenario "Global Ambition", despite being presented as the overall market openness alternative vs. "Distributed Energy" is not clearly based on a technological neutral approach: the assumptions made on technologies still on development such as, fuel cells, biomethane and CCS, etc. do not represent necessarily an efficient choice and leave aside other proven alternatives (in the path of additional improvements) such as hydro technologies.

In particular, we note the absence of different storage options in the TYNDP 2022 scenarios (critical to allow the integration of new renewable energy), especially pumping storage (the most efficient storage technology able to respond to variable renewable challenges) and utility scale batteries. In general, the role of flexibility assets should be more depicted into the scenarios and assessed in the

CBA. All possible flexible power assets (e.g. hydro storage and pump, batteries, fuel cells, DSR, smart charging) should be considered to meet the electricity demand in these situations.

Moreover, besides the claim of the potential use of hydrogen to meet flexibility challenges, the type of hydrogen used in industrial applications can be further detailed (Steam methane reforming + CCS, pyrolysis, electrolysis…) as well as the bulk of biogases, together with their origin. An assessment about the adoption of CCS/CCUS technologies and the implications in terms of decarbonisation path for the UE seems also necessary to be attached to GA narratives.

Finally, the presentation of any scenario should be linked to, CBA assessment to illustrate the implications on infrastructure costs for each alternative and give orientations on the regulatory measures and incentives to take.

Response: The Storyline reports may too strongly focus on differences between scenarios, Distributed Energy will not actually achieve full energy autonomy. For this reason hydro (including pumped storage) technology is not mentioned as it is anticipated it will play the same role in both scenarios. Battery development will result from the investment loop modelling and therefore not available at this stage.

We share the need of transparency regarding hydrogen production (e.g. low-carbon, renewable, indigenous our imported). This information will be provided at scenario report stage.

Anonymous

Feedback: The report provides too little quantitative information to estimate the real development of technologies (wide interval, trend difficult to estimate, etc.).

Response: Thank you for your response. We would like to highlight that the quantitative data is largely compiled for the subsequent Draft Scenario Report. The Storyline Report is intentionally largely qualitative.

Edison S.p.A.

Feedback: TYNDP scenarios should consider the different starting points, and the technical and commercial availability of key transition technologies, especially to provide new storage options. Edison is aligned with the fact that the transition will require both centralised and decentralised options, that may be adjusted depending on the initial energy mix of the member State as well.

Also, the role of flexibility assets should be more depicted into the CBA and scenarios. All possible flexible power assets (e.g. hydro storage and pump, batteries, fuel cells, DSR, smart charging) should be considered to meet the electricity demand in these situations.

Edison would also welcome more details on the use of LNG / BIO LNG and what it means in term of infrastructure.

The storyline Global Ambition still considers the shares of methane import in 2050 but “CCS is an option to support decarbonisation of some industrial processes”. To reach a carbon neutral Europe in 2050, Edison wonders whether ENTSOs are assuming that CO2 will be removed before it is imported or whether CCS will play a bigger role.

In general, the document is not detailed enough regarding the evolution of the gas consumption in particular considering a substitution by methane of more carbon intensive fuels for heavy transportation or industry process or in sectors where the energy needs to be stored. This would allow to accelerate the transition on a Carbon budget perspective and so would reduce the cost.

It should be useful to clarify the ratio import and indigenous production over the global gas consumption for methane and hydrogen.

Moreover, the type of hydrogen used in industrial applications can be further detailed (Steam methane reforming + CCS, pyrolysis, electrolysis, or import…).

Response: Flexibility – we will consider these. However, they are a result of the modelling instead of an input so no input values were available for the consultation.

LNG – While we have considered LNG as an input parameter for methane. Analysis of LNG infrastructure will occur in the TYNDP document.

CCS- We do not make an assumption about where the CCS will take place (CO2 will be captured and stored). The Scenario Report will identify the different sources of hydrogen production and will also clearly state what share of blue hydrogen (steam methane reforming combined with CCS) derives from imports.

Evolution of gas consumption – This information will be explained in more detail in the Scenario Report later this year. The Scenartio Report will also show in detail the EU gas consumption data. We make no assumptions for global consumption.

Orsted

Feedback: As a general remark, most of the comments that provided in the question 12 apply to Storyline "Distributed Energy".

Anonymous

Feedback: For the most part, the importance/relevance of each technology is appropriate. However, there are some technologies in GA that merit the same classification as DE:

· Small scale all-electric heat pumps – This technology should be classified as higher. Electric heat pumps operate with a significantly higher coefficient of performance than conventional gas-based heating systems.

· Private transport – road transport and private transport will be battery based. FCEVs cannot compete with BEVs. There is no future where FCEVs out number BEVs. When looking at the current market, and future plans of existing car makers, there are very few who are still involved in the development of FCEVs, let alone have a model available in the market. On the other hand, nearly all car manufacturers either have electric models available today or will be available soon. As such, BEVs should be considered higher in both GA and DA scenarios for all road transport. o Fuel cell vehicles (FCEV) have a limited role to play in the future. Simple physics shows that converting energy from one form to another results in energy losses through heat and light. When we look at electric vehicles, their fuel is renewable electricity generated and transported through the electricity grid, which is then stored in a battery in the car, and then used to power an electric motor.

o A fuel cell vehicle requires the same electricity to power an electrolyser to split water into hydrogen and oxygen. This hydrogen is stored and transported (pipeline, ships, trucks) with storage losses, and is then stored in the cars tank. The hydrogen is then converted back to electricity to power an electric motor in the car.

o A fuel cell vehicle will typically have a round trip efficiency of 25% – 30% whereas a BEV will have a round trip efficiency in excess of 75%. What this all means is that a future with FCEV have a significantly higher gross energy demand, requiring higher levels of installed capacities of renewable generation sources to meet this demand.

· FCEV – as above, FCEVs might play a small role, if any, in commercial goods vehicles for long distance travel though with ongoing developments in BEV technology, battery-based solutions are more likely to win this battle in the market. FCEV should be lower for both scenarios.

· Compressed methane cars – CNG cars exist today around the world. They have been around a long time but should not be in any way considered an alternative to ICE vehicles. As has been discussed above, BEVs are the way forward and market trends strongly back this.

· Solar – importance should be increased to higher in the GA scenario. A Clean Planet for All calls for more than 1000 GW of solar capacity in Europe by 2050. This is a significant increase on todays numbers and does not consider the volume of residential solar that could be installed.

· Onshore wind – we agree that the importance of onshore wind in the GA scenario should be lower. A Clean planet for All assumes an operational capacity factor for onshore wind of 50% which is unreasonably high and does not align with market trends. Offshore wind should be promoted in larger scale developments and be prioritized over onshore wind due to its increase in capacity factor and efficiency.

· CSP – CSP has seen little growth to date vs solar PV. This trend will consider and its role in the GA scenario should be lower.

· New nuclear – nuclear is a difficult topic. The realities are that public acceptance, costs, and construction delays will always limit interest in new nuclear unless there is a significant breakthrough. For this reason, Nuclear should be downgraded to similar.

· Thermal generation – It is sad to see thermal generation considered to be at similar importance levels in both scenarios. In the A Clean Planet for All document, it is seen that thermal generation is operating at an assumed 55% capacity factor. If the use case for thermal generation is for load balancing, it is unreasonable to assume that it will operate at a capacity factor this high. Its importance should be downgraded to lower for the GA scenario.

Batteries (behind the meter) – with the growing interest in rooftop PV and storage combined, it is strange to see the GA scenario put a lower importance on behind the meter storage. The costs of storage are dropping rapidly and making combined rooftop PV and storage systems cheaper and more accessible to the market. It should be upgraded to higher for the GA scenario.

Response:

Hybrid Heat Pumps – We want to differentiate between storylines. As can be observed in the Storyline Report, the ranges for EHP are considerably higher than today for both storylines.

Fuel cell-EV – In both scenarios BEV development is far greater than FCEV development. However, for the purposes of differentiation, the GA storyline assumes slightly higher FCEV.

CNG – It should be noted that CNG mobility has not been included at all.

Solar – For purposes of clarification – the term “lower” is in relation to the other storyline, not in rewlation to today’s development levels. Indeed, solar production in both storylines is far higher than today.

Ember

Feedback: The GA scenario appears to include all relevant energy supply technologies. However it is not the presence, but the relative magnitude of these technologies that is important. Our initial assessment is that the GA scenario relies too heavily on carbon capture and storage - the economic viability of which is not guaranteed. The case for fossil CCS in the power sector is growing weaker as proven technologies are bringing 100% renewable systems closer to reality.

The higher use of gas in the scenario also raises important questions about the carbon budget and accounting. It is vital that emissions from gas production, transport, and distribution are accounted for in a transparent way. The published scenario must be clear in its assumptions about the contribution of methane leakage to the carbon budget before 2050, from both imports and domestic production.

Response: We have not included figures on any energy carriers or technologies at this stage – these will be published for consultation in the Scenario Report later this year. It should be noted that CCS technologies are not focused on electricity production, but rather on harder-to-abate sectors like industry.

AIGET

Feedback: TYNDP scenarios should consider the different starting points, and the technical and commercial availability of key transition technologies, especially on storage options. We believe that the transition will require both centralised and decentralised options, that may be adjusted depending on the initial energy mix of the member state as well.

The role of flexibility assets should also be more central into the CBA & scenarios. All possible flexible power assets (hydro storage & pump, batteries, fuel cells, DSR, smart charging…) should be taken into account to meet the electricity demand in these situations.

We would also welcome more details on the use of LNG/Bio LNG and what it means in term of infrastructure.

The storyline Global Ambition still considers the share of natural gas import in 2050 but “CCS is an option to support decarbonisation of some industrial processes”. To reach a carbon neutral Europe in 2050, we wonder whether ENTSOs are assuming that CO2 will be removed before it is imported, or whether CCS should play a bigger role.

In general, the document is probably not detailed enough on the evolution of the gas consumption, especially considering substitution by natural gas of more carbon intensive fuels for heavy transportation or industry process or in sectors where the energy needs to be stored. This would allow an acceleration of the transition on a carbon budget perspective and so would reduce the associated cost.

It can also be useful to clarify the ratio between import and indigenous production over the global gas consumption for methane and hydrogen.

Moreover, the type of hydrogen used in industrial applications can be further detailed (Steam methane reforming + CCS, pyrolysis, electrolysis, or import…).

Response: Many of the points raised here are not addressed in the storyline report. Elements such as flexibility are actually outputs of the modelling process. Therefore, the scenario building team has

deliberately not made any definitive assumptions on this matter beforehand (with the exception of the technology ranges that have been publicly consulted).

Likewise, detailed figures for LNG, gas and CCS are not currently defined but will be addressed in the Draft Scenario Report (autumn 2021), which will also be subject to a full public consultation.

Technology Selection in Distributed Energy

Anonymous

Feedback: We agree with the main technology selection for Distributed Energy. For district heating, it is important to include a wide selection of flexible technologies, enabling the decarbonisation of district heating together with flexibility provided for the power system.

For private and goods transport, there could emerge some role for synthetic petroleum and synthetic diesel besides electric vehicles and biofuels, as it might be profitable to still have a considerable share of traditional vehicle engines.

Response: The Draft Scenario Report will provide a detailed breakdown of energy sources for district heating. Power-to-Methane and Power-to-Liquids are included in the Storylines, in particular for aviation and shipping but also for road transport. These values are higher in GA.

Wind Europe

Feedback: In one scenario we should have a strong uptake of both onshore and offshore wind.

Response: The uptake of onshore and offshore wind in DE will be maximised. The dominance of solar PV and wind in the storylines matrix is expressed in terms of relative market share. Global Ambition will have relatively higher share of offshore wind, Distributed Energy will have higher share of solar PV and onshore wind. However, in terms of absolute value (installed capacity), Distributed Energy will have more of everything (solar, onshore and offshore wind) to enable direct electrification, P2X and further reduce energy imports.

Anonymous

Feedback: The most relevant energy supply technologies all seem to be integrated into the storyline Distributed Energy, except ocean energy. Information about energy efficiency technologies and services is missing. Anonymous welcomes the focus on local optimisation through mobilising domestic renewable energy sources, energy efficiency and other available, mature technological solutions. The Distributed Energy storyline appears to be more realistic in view of achieving fast decarbonisation.

Response: The storylines consider a wide range of energy efficiency technologies such as heat pumps and BEV vehicles.

Germanwatch

Feedback: The technology selection is appropriate overall. The strong reliance on efficiency and sufficiency both on the individual and industrial level as compared to the GA scenario introduces some methodological artefacts that need to be communicated well if kept in the coming TYNDP process, see question 25.

Response: Thank you for your feedback.

Enel S.p.A.

Feedback: The storyline Distributed Energy should consider both centralised and decentralised solutions. We strongly believe that RES will continue to increase across the EU driven by further cost reductions; mixing a centralised and a decentralised approach in the scenario is therefore the good approach.

ENTSOs scenarios should consider the penetration of storage and demand response services through aggregators, and the new role of DSOs in supporting the energy transition connecting DERs to the distribution system and enabling their active participation to energy market through the provision of flexibility services by means of large investments in communication and automation technologies suitable to sharply enhance the grid "smartness". In this sense, both large and small-scale battery storage and power-to-gas-to-power will become contributors to balance the system. Furthermore, electric heat pumps can effectively contribute to implicit demand response, something that is not recognized in the scenario storylines.

Special attention should be put in this scenario regarding to bioenergies and their likely limited availability and competitiveness, particularly for solutions such as biomass conversion and biomethane.

Response: As regards the role of centralisation and decentralisation in the two storylines, the Scenario Building Team have selected this approach in order to explore contrasting demands that may be placed on energy infrastructure in the future. Logically, we would expect the future demands on energy infrastructure to ultimately fall somewhere between these two extremes. The dominance of solar PV and wind in the storylines matrix is expressed in terms of relative market share. Global Ambition will have relatively higher share of offshore wind, Distributed Energy will have higher share of solar PV and onshore wind. However, in terms of absolute value (installed capacity), Distributed Energy will have more of everything (solar, onshore and offshore wind) to enable direct electrification, P2X and further reduce energy imports. DE tends to maximise all RES.

For biomass, we will benchmark the assumptions with other studies to ensure that their role is not overestimated.

Eurelectric

Feedback: As a general remark, most of the comments that Eurelectric provided in Question 12 apply to Storyline "Distributed Energy".

While Storyline "Distributed Energy" is relatively aligned with Eurelectric key positions, as far as compatible with a higher degree of electrification, as well as the Energy System Integration Strategy, Eurelectric regrets the insufficient presence of future and existing technologies such as hydro power plants, hydro pump storage and gas-fired generation (CCGT, GT, engines) capable to use renewable and low-carbon gases in this scenario as well.

However, Eurelectric welcomes the highlight on the role of citizens as well as the use of hydrogen produced from renewable and low-carbon electricity, as well as other low-carbon and renewable gaseous and liquid fuels for the hard-to-decarbonised sectors, with full openness to market solutions and potential energy imports.

Response: Thank you for your feedback. We underline the need for differentiation and contrast between the storylines in order to ensure that a wide range of potential demands on future energy infrastructure are considered. However, hydro-pumped storage will actually be the same in both

scenarios. Exact data on gas-fired generation will be an output of the scenario modelling that will take part in the next phase of the scenario building process. For this reason, no detailed input data was provided at this stage of the process. Hydropower assumptions are based on the data drawn from national energy and climate plans (this will also be used for the "National Trends" scenario).

Oeko-Institut

Feedback: This scenario seems more reliable to achieve its decarbonisation ambitions

The reduction of CCS and nuclear compared to the TYNDP 2020 scenario is an important point here.

Nevertheless, it would be important to consider at least one scenario with a RES share of 100% so that the electricity systems can also be designed for this.

Response: The Scenario Building Team has specifically chosen storylines that stress global/centralisation vs. decentralisation as the main contrasting features. This will provide a more practical analysis of challenges facing EU energy infrastructure. This approach is in line with the developmental paths foreseen by the European Commission.

Iberdrola S.A.

Feedback**:** As addressed in Q12 we do not believe a dichotomy between self-sufficiency and market/external openness is relevant of current discussions on the future EU energy model. In that sense the participation of utility size renewables, pumping storage and large batteries is not contradictory with an important presence of distributed facilities.

In addition to this, the presence of clean, renewable based hydrogen should be part of the future, starting as an industrial feedstock and possibly as a fuel, together with other decarbonised liquids and gases in the hard to abate niches, and subject to technology curve.

Response: The Scenario Building Team agrees fundamentally with the stakeholder's comments on the role renewables, pump-storage and batteries in a distributed system. The aim of the storylines is to analyse contrasting demands on the energy infrastructure, recognising that, most logically, the ultimate design of the future energy system will fall somewhere between these contrasts.

The storylines reflect the same view as the stakeholder with regard to renewable and decarbonised fuels and hard-to-abate sectors.

Anonymous

Feedback: The report provides too little quantitative information to estimate the real development of technologies (wide interval, trend difficult to estimate, etc.).

Response: Please be aware that the Storyline Report is deliberately a largely qualitative document that, first and foremost, examines the general parameters which will subsequently be used for the modelling of fully quantified scenarios. These scenarios will also be made available for consultation the Draft Storyline Report (autumn 2021).

Edison

Feedback: Edison being involved in energy efficiency welcomes the highlight on the role of citizens as key actors of the decarbonisation.

Edison underlines the importance of the use of alternative fuels for the hard-to-decarbonised sectors and would appreciate a more detailed description of the biofuels technologies.

As already mentioned, it seems that hydropower technologies are not clearly considered in both scenarios.

Response: Thank you for your feedback. More detailed information on the role of biofuels will be made available as part of the Draft Scenario Report (autumn 2021) where a public consultation will also be organised. Hydropower assumptions are based on the data drawn from national energy and climate plans (this will also be used for the "National Trends" scenario).

Anonymous

Feedback: In the Decentralised energy scenario, we believe the hybrid heat pumps are not enough considered. Hybrid heat pump is by construction a DSR technology. Combined with renewable gas, it is essential circular economy solutions allowing to integrate decentralised energies and solve local congestion on the grid. We are convinced HHP is totally aligned with DE storylines on several important points:

- DE scenario supposes to maximise wind and solar production in its global electricity mix. If, on average conditions, winds tend to be stronger during winter periods than in summer and could provide part of the seasonal modulation needed in winter to cope with heating demand increase, wind production remains undispatchable.

Rare, but realistic, cases of dunkelflaute and elongated – 2 to 3 weeks – of scarce renewable production have to be considered in order to correctly size the electricity production mix in Europe. During such stress cases, a building stock equipped with Hybrid Heat Pump would bring an added demand-side flexibility, at lower cost and with no overinvestment in network capacities if compared to a scenario relying exclusively on electric heat-pumps. It would also permit to limit the construction of new centralized gas thermal power plants alimented by biogases, including biomethane, for which winter heat supply is not the optimal end-use.

- It could also be noted that an added dispatchable electricity production can also be needed in summer, should the climatization demand rise depending on heat waves, and should the availability of nuclear or offshore wind production be limited due to maintenance.

- With a scenario relying exclusively on electric heat pump, the ambivalent temperature under which an electric resistance is much needed to give additional power should be indicated. Indeed, it impacts heavily the peak efficiency, and the supposed efficiency of the command control of the heat pump, which significantly degrades its efficiency at peak. This would also be the temperature at which HHP functions only with gas. We would like to have the details on the performance of electric heat pumps.

Response: Thank you for your feedback. We will take these points into consideration during the modelling of the scenarios.

E3G

Feedback: The focus on decentralisation, flexibility and mature technologies contributes to the credibility and feasibility of the Distributed Energy storyline. Still, as for previous storylines, the Distributed Energy storyline includes the most relevant energy supply technologies but falls short in providing information about energy efficiency technologies and services.

Response: Thank you for your feedback. The storylines consider a wide range of energy efficiency technologies such as heat pumps and BEV vehicles.

Climate Action Network

Feedback: The most relevant energy supply technologies all seem to be integrated into the storyline Distributed Energy, except ocean energy. Information about energy efficiency technologies and services is missing. CAN Europe welcomes the focus on local optimisation through mobilising domestic renewable energy sources and other available, mature technological solutions. The Distributed Energy storyline appears to be more realistic in view of achieving fast decarbonisation but should become a 100% renewable energy scenario.

Response: The Scenario Building Team has specifically chosen storylines that stress global/centralisation vs. decentralisation as the main contrasting features. This will provide a more practical analysis of challenges facing EU energy infrastructure.

Anonymous

Feedback: Small scale hybrid heat pumps (households – this should be increased to higher.

· Share of P2X – the efficiencies of hydrogen have been discussed already. The realities of hydrogen being a major player in meeting energy demand are slim. Electric alternatives for transport, heating, and even certain industry processes are more efficient. P2X represents a future with low energy efficiencies and requirements for significantly higher installed capacities to produce enough alternative fuels.

· Offshore wind – when looking at how Europe's offshore ambitions have grown, it is clear that there is a growing strength behind the development of offshore grids for the integration of offshore generation. It is difficult to see a future where shared transmission does not exist. For this reason, it is unreasonable for the DA scenario to put a lower importance on offshore wind.

Response: Thank you for your feedback. We have considered the feedback from stakeholders on the ranges for hybrod heat pumps and offshore wind in our Final Storyline Report.

Eurogas

Feedback: Additional focus on gas DSOs in this decentralized scenario is crucial, as a majority of renewable production is connected at that level and will provide flexibility also to the power side.

We note that the understanding and willingness of European citizens to adapt their behaviors in order to minimize energy demand and fully participate to the system adequacy is crucial in this scenario and should therefore be clearly outlined.

In terms of market design, we would like to mention that the existence of liquid markets and price signals are an essential element for ensuring the integrity of the energy system and growing prosumers.

Additional elements on the global efficiency assumed should be beneficial.

The management of peak electricity demand through the various DSM systems and batteries on the one hand and the back-up provided by flexible electricity generation should be further clarified.

We note that the share of heat pump heating is extremely high. The recent report of E-Cube/EWI (https://www.ewi.uni-koeln.de/cms/wp-content/uploads/2020/09/E-CUBE-EWI-2030-Peak-Power-Demand-in-North-West-Europe-vf3.pdf) is instructive on the challenges/risks and costs for managing supply/demand balance with high penetration of heat pumps under cold snaps, particularly without a hybrid system as backup. There is a significant uncertainty concerning the performance of heat pumps: real-life performance being significantly lower than certification test performance, notably because the operating conditions are different.

We note that flexibility options include for instance supermarket switching its fridges off for a short amount of time in the tertiary sector or back-up energy or production adaptation in the industrial sector. We are wondering about the limit of DSM in this scenario and the consequences for various sectors of the economy; clarification about whether these stakeholders were consulted in the lead up to the storyline publication would be welcome.

Are you considering a change in public acceptance for building overground power lines or instead do you foresee the use of cables?

Some explanations are needed on the coexistence of strategies aiming at a strong reduction of energy imports while the EU hydrogen strategy emphasizes the need for H2 imports (2*40 GW).

The advantages in terms of decarbonisation of all type of gas/LNG solutions in mobility should not be underestimated. The role of gas solutions in mobility seems quite absent in this scenario and an analysis of pros/cons of a full electrification of mobility should be added.

Response: Clarifications on DSM and back-up flexibility will be provided after these have been modelled (in the Draft Scenario Report – expected autumn 2021). Public acceptance analysis (with regards to different forms of energy infrastructure) is beyond the scope of the TYNDP Scenarios – bearing in mind that this document considers demands on energy infrastructure across the whole EU-27 and beyond.

Gas-combustion solutions in mobility are largely not included in the report. Instead, a greater emphasis has been placed on battery-EVs and fuel cell-EVs depending on sector.

A full list of stakeholders contacted is available on the Storyline Report website.

Ember

Feedback: The DE scenario appears to include all relevant energy supply technologies. However, it is not the presence, but the relative magnitude of these technologies that is important. Ember welcomes the focus on electrification and energy supply from proven technologies. The narrative of a preference for energy self-sufficiency as a driver for local RES and greater participation of consumers is convincing. The DE scenario appears to be the less risky, more efficient pathway to reaching net zero. However, we would question the justification for slower growth in large RES projects, such as offshore wind, seemingly justified by a public preference for energy self-sufficiency. Rather than being at odds with this, offshore wind will be a crucial technology in achieving it. Renewable electricity from offshore wind is expected to contribute significantly to green hydrogen production - an essential fuel if Europe is to reduce reliance on gas imports. Large-scale RES projects are also less sensitive to public opinion, as they are typically located further from population centres. Development is driven more by political will and economics - both of which are increasingly in favour of offshore wind in Europe. The acceleration of offshore wind in the next ten years is backed by substantial political momentum. The EU offshore wind strategy targets 60GW by 2030, from 12GW today. This is in addition to the UKs commitment to increase capacity to 40GW by 2030, from 5GW

today. The DE scenario should not ignore this reality by artificially restricting large offshore developments, which backed by political tailwinds look set to exceed 100GW in Europe by 2030.

Response: Thank you for your feedback. The mentioned statistics related to offshore wind have been considered in the Final Storyline Report.

AIGET

Feedback: As we are involved in energy efficiency, we welcome the highlight on the role of citizens as key actors of the decarbonisation. We want to underline the importance of the use of alternative fuels for the hard-to-decarbonise sectors, and we would appreciate a more detailed description of the biofuels technologies. As already mentioned, it seems to us that hydropower technologies are not so clearly considered in both scenarios.

Response: Thank you for your feedback. More detailed information on the role of biofuels will be made available as part of the Draft Scenario Report (autumn 2021) where a public consultation will also be organised. Hydropower assumptions are based on the data drawn from national energy and climate plans (this will also be used for the “National Trends” scenario).