CONSULTATION REPORT

Report on the public consultation regarding the *Belgian Electricity Scenario report*

The public consultation was held from 15/11/2021 until 12/12/2021

Contents

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1. Introduction

Elia organized a public consultation from 15/11/2021 to 12/12/2021 regarding the Belgian Electricity Scenario Report that was the result of the Task Force Scenarios.

The submitted document for the public consultation was created based upon the input received from stakeholders throughout a call for evidence, different workshops, questionnaires and Task Force discussions.

The collected data has enabled Elia to create storylines and scenarios, both qualitatively and quantitatively. In turn, a draft of the Belgian Electricity Scenario Report was submitted for a public consultation.

The purpose of this report is to consolidate the feedback received from the public consultation, while at the same time reflecting Elia's position on these reactions. The comments and remarks have been integrated within the final Scenario Report.

This consultation report is publicly available, alongside with the non-confidential received stakeholder contributions and will be presented on 26th of January 2022 to the market parties through the Task Force Scenarios meeting.

2. Overview of the feedback received

In response to the public consultation, Elia received non-confidential replies from the following parties:

- *Bond Beter Leefmilieu (BBL)*
- *Federatie van de Belgische Elektriciteits- en Gasbedrijven (FEBEG)*
- *Fluxys*
- *Federation of Belgian Industrial Energy Consumers (Febeliec)*

In addition, no responses were received that were designated as confidential.

All responses received haven been appended to this report. These reactions, together with this consultation report, are made available on Elia's website.

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3. Instructions for reading this document

This consultation report is structured as follows:

- Section 1 contains the introductory context,
- Section 2 gives a brief overview of the responses received,
- Section 3 contains instructions for reading this document,
- Section 4 compiles the questions that Elia had in order to facilitate the consultation, discusses the various comments received during the public consultation and Elia's position on the matter,
- Section 5 describes the next steps following this public consultation,
- Section 6 contains the annexes of the consultation report.

This consultation report is not a 'stand-alone' document, but should be read together with the proposed scenario report submitted for consultation, the reactions received from the market participants (annexed to this document) and the final scenario report.

4. Facilitating questions, feedback and answers

The scenario report is divided into section by topic. For each of these sections, one or more questions were included in the scenario report in order to facilitate the public consultation. Below, an overview of the questions, feedback from stakeholders and answers by Elia can be found.
For the sake of brevity, some feedback, confirming the Elia hypotheses has been left out but can be found in the original feedback documents in annex.

4.1. Link with the European framework

Question raised by Elia during the consultation (#Q1)

The final storylines proposed, by using the TYNDP storylines as starting point, aim to provide a relevant set of scenarios for the evolution of the energy system with focus on Belgium. Do you know any relevant report or data we should consider for other European countries (besides the TYNDP scenarios), and if yes could you share it with us?

Feedback received from stakeholders

STAKEHOLDER	FEEDBACK RECEIVED
BBL	States they would rely on the national reports the EU Member State have to submit to the EC:

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	• The National Energy and Climate Action plans[1] • The National Long-Term Strategies[2] BBL suggests to use sources of information such as: - The Energy Technology Systems Analysis Program of the International Energy Agency. - The proceedings of the Industrial Efficiency conference of the eceee and its dedicated panel regarding the deep decarbonisation of the industry - The contributions of the Summer Studies on Energy Efficiency of the eceee For heating & cooling specifically, BBL recommend relying on the Comprehensive Assessments on Heating and Cooling which EU Member States have had to submit to the European Commission before the end of 2020[3]. In the future, these assessments will make part of the National Energy and Climate Action plans. Furthermore, BBL would recommend seeking collaboration with the European Energy Research Alliance – especially the Joint Programme Energy Systems Integration.
FEBEG	FEBEG remarks the relevance of the scenarios of the European Commission[4] used for the impact assessments behind the new proposals. Nonetheless, FEBEG states that conflict can exist between European & national scenarios and suggests Elia to deep dive into the following resources: - France: "Futurs énergétiques 2050" – RTE - The Netherlands: "Klimaatneutrale energiescenario's 2050" – Berenschot voor EZK - The United Kingdom: "Future Energy Scenarios" – National Grid

[1] https://ec.europa.eu/info/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-energy-and-climateplans_en#final-necps
[2] https://ec.europa.eu/info/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-long-term-strategies_en#strategies
[3] https://ec.europa.eu/energy/topics/energy-efficiency/heating-and-cooling_en#comprehensive-assessments
[4] https://eur-lex.europa.eu/resource.html?uri=cellar:749e04bb-f8c5-11ea-991b-01aa75ed71a1.0001.02/DOC_2&format=PDF

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	- Germany: “Netzentwicklungsplans Strom 2035” – Netz Entwicklungs Plan

Response by Elia

Elia would like to thank BBL and FEBEG to have provided links to other studies as requested.
Elia confirms that the NECP and long term strategies are the base for the ‘Expected Policies’ scenarios being build up (which is based on the National Trends scenario used by ENTSO-E/G).

Elia will take a close look into the other 2 reports/work mentioned to identify whether there are elements that could be inserted in the scenario quantification. Elia is aware of the Energy Technology Systems Analysis Program of the IEA (using the TIMES energy system model), but prefers to use the reports published by the European Commission as the main reference for constructing long term scenarios[4,5]. The outlined long term scenarios in those studies are based on the PRIMES modeling framework for energy, transport and CO_2 emissions. These scenarios & modeling exercises are more in line with the geographical modeling scope and granularity required as foreseen for the studies to be done (i.e. European focus). The studies performed by the European Commission also integrate the latest policy ambitions or expected ambitions (e.g. FitFor55 …) which are relevant in this exercise.

Furthermore, Elia will have a closer look at the proposed material related to both the proceedings of the Industrial Efficiency conference the Summer Studies on Energy Efficiency of the eceee. In general, a large amount of material is available which at times might be too technical/detailed for the purpose of this exercise. Still, the different papers and presentations present a complementary set of sources which are useful for cross-checking country-specific assumptions (for the different subsectors) and results obtained in the different scenarios defined by the European Commission, National Plans and ENTSO-E/G.

The 4 reports/work mentioned by FEBEG will be taken into account when defining assumptions for our neighbouring countries in the longer run. In addition, more updated ambitions from German[6] and NL[7], IE

[5] https://ec.europa.eu/energy/data-analysis/energy-modelling/policy-scenarios-delivering-european-green-deal_en
[6] https://time.com/6124079/germany-government-green/
[7] https://www.kabinetsformatie2021.nl/documenten/publicaties/2021/12/15/coalitieakkoord-omzien-naar-elkaar-vooruitkijken-naar-de-toekomst

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agreement will be used and reflected in the 'FitFor55' compliant scenario. In addition, other known updates such as coal phase outs plans in Europe or updated projections/scenarios on fuel and carbon prices will be taken into account when defining the scenarios for the other countries.

4.2. Proposed storylines

Question raised by Elia during the consultation (#Q2)

The proposed storylines, by using the TYNDP storylines as a starting point, aim to provide a relevant set of scenarios for the evolution of the energy system with focus on Belgium. These proposed storylines take into account also the Feedback received from stakeholders during the 'TF Scenarios' workshops. Do you consider the methodology followed to define and further refine the proposed storylines robust enough? Why / Why not?

Would you like to propose any additional dimension, driver, assumption, which according to you is missing and is needed to complete the definition of any of the storylines proposed? Please provide detailed arguments on any input you might provide in this respect.

Feedback received from stakeholders

STAKEHOLDER	FEEDBACK RECEIVED
BBL	BBL states the proposed set of scenarios interesting. Yet, BBL wonders whether these scenarios grasp the full variety of potential trends of our energy system. BBL remarks that the axes that were chosen to define the storylines (the level of energy imports of the EU, the level of flexibility of the electricity demand, the degree of decentralization of the electricity generation, the level of electrification) are not fully independent. BBL proposes to limit the storylines to 2 axes: the level of electrification & the central/decentral nature of the energy system (full details in the original BBL response, published as an annex to this report). With this in mind, one can see following similarities between the scenarios as defined by Elia:

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<table>
<tr><td></td><td>
<table>
<tr><th></th><th>Low level of electrification</th><th>High level of electrification</th></tr>
<tr><td>Centralised energy system</td><td>• Global import</td><td>• ~ Large scale RES</td></tr>
<tr><td>Decentral-ised energy system</td><td>• (no analogue defined)</td><td>• e-Prosumers
• Flex +</td></tr>
</table>
Based on this, BBL would suggest adding a low electrification & highly decentral scenario to the narrative.

BBL further states that the proposed axes are missing sector integration as determining factor, and by consequence all the proposed scenarios are very electricity focused with too little differentiation in for example how the heating sector will be organized.
</td></tr>
<tr><td>FEBEG</td><td>FEBEG comments that scenarios being developed “by TSOs for TSOs” is not ideal as the scope of the energy revolution covers society at large. They state sector integration is underdeveloped (natural gas, synthetic gas, …) in current scenarios and that is not sufficiently clear how the proposal fits with the EU’s Energy Efficiency First Principle.

FEBEG underlines the overall appreciation of “risk factors” in the storylines of Elia. However, with respect to the risk factors (namely NIMBY, price of CO2, cost of new technologies, …), FEBEG proposes to also address pessimistic “what ifs” in scenarios. FEBEG also thinks electrification, which is sure to happen, will not 100% translate into the creation of new flexibility offerings and wishes Elia to consider flexibility will depend on the attitudes of the consumers and the evolution of the market.
Lastly, FEBEG wonders why is there no “decentral – low import” scenario. The approach of Elia seems to indirectly assume that a decentral scenario would by definition result in a very high share of import, while FEBEG does not agree with that assumption.</td></tr>
<tr><td>Febeliec</td><td>Febeliec states it is worrisome that Elia does not take costs into account as a main driver on investments in different technologies under a global optimization approach. For Febeliec, this means any assumption can be included without any</td></tr>
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	safeguard towards plausibility under the condition of affordability. For Febeliec this is interesting for what-if analysis but not acceptable for central scenarios. By not integrating cost aspects and thus not including affordability, all trajectory ranges for any component are very broad towards the longer term and combinations are limitless". Febeliec points out absence of any sanity check in terms of feasibility and realism of the outcomes. When Febeliec looks at the very broad ranges (e.g. in 2050 direct electricity demand ranging from potentially 110 to 170 TWh, but also already 106,6 TWh in 2030 with a very large share of 12 TWh increase in electricity demand coming from industry in less than a decade without many clear investment projects in the near future), it can only wonder about the sense of reality of scenarios but also the usability of these scenarios for any meaningful decisions. The same also applies for the values of 20 to 30% energy savings per unit of production output in industry between 2020 and 2050, without any justification or argumentation for such values.

Response by Elia

We thank the comments received on the storylines. Unfortunately, completely changing the framework is not possible at this stage. This is also the reason why early input was asked during the first 'call for evidence' that was made in Q2 2021 or during the workshops. As there were no reactions nor proposals of framework to be used during the first call for evidence, Elia proposed to start from the TYNDP2022 storylines as constructed and consulted upon at ENTSO-E and ENTSO-G level. From the different comments, we understand that the chosen storylines do cover the major uncertainties but that one or two additional variations could be added. It is also important to note that the European aspects are key for this exercise, the scenarios are not only quantified for Belgium but do cover all European countries. Indeed, assessing the impact on the electricity system cannot be done looking at one country only. Such observation is even more valid for a country like Belgium that is very well interconnected and surrounded by big countries.

For this first exercise performed with stakeholders and given the fact that a full quantification at European level takes time and resources (e.g. such process takes more than 2 years at ENTSO-E/G level or several years in some other countries), the choice was made to use the TYNDP scenarios storylines (which are heavily discussed at European level and consulted upon) as the base. Building around those, additional trajectories were added to cope with aspects which are not tackled as uncertainties in that framework. The

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suggestions made by BBL can be taken into account in a future exercise. This is also something that could be voiced at European level to check whether those aspects could be better taken into account.

As a reminder, the scenarios developed at TYNDP level are multi-sector and do take into account the different energy vectors (not only electricity). Their goal is to have divergent trajectories to assess whether the infrastructure requirements are different in those.

A more conservative/pessimistic scenario called 'Expected Policies' will also be considered until 2040. Such scenario was added to the framework following the feedback received during the workshops organized. This will also be quantified and represents a scenario which does not take the recent announcements of countries ' ambitions and the FitFor55 package proposal from the EC. It is based on the final NECPs submitted by each country to the EC which aimed to ensure a reduction of -40% of carbon emissions in 2030. Such scenario somehow reflects the reservations on NIMBY, costs of technologies and carbon prices.

Regarding flexibility options, those are different depending on the scenario and the assumptions were also reviewed downwards taking into account the comments made here and based on the more specific questions concerning flexibility.

As a clarification, given its degree of electrification, the the 'e-Prosumers' scenario will have the lowest level of final energy demand. Indeed, electrification allows to use more efficient end-use devices (e.g. delivering heat or mobility) and hence leads to a lower final energy consumption. Assuming a similar amount of renewable generation in Europe, the imported amounts in such scenario will be lower than in a scenario with a lower electrification rate (where the final energy demand will be higher but also the amount of electricity required to produce the needed molecules).

Concerning the comments made on the costs and 'sanity check', the proposed ranges are based on a large amount of studies performed by Belgian or European entities. There are many uncertainties regarding costs but also regarding economic growth or industrial load. As a matter of comparison regarding electricity consumption, the European Commission 'EC-MIX' scenario (which reflects the FitFor55 package proposal measures for each country in Europe) finds 107 TWh of final electricity demand for Belgium (yet excluding any losses or electricity that would be required for other energy vectors). Given the reservations, the FitFor55 scenario for 2030 will start with a lower value than the one put forward by the European Commission. This is just an assumption given that the regional and federal proposals on the needed measures and their consequences are still to be elaborated and submitted to the European Commission. Once those will be known, a more 'precise' estimation could be elaborated and will be included in the next exercises. In the

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longer term (post 2030), the proposed ranges are in-line with a large amount of studies. The idea of the scenarios is to have scenarios which reflect the possible futures.

4.3. Storylines to scenarios

Question raised by Elia during the consultation (#Q3)

The methodology to transform the proposed storylines into quantified scenarios is presented in the scenario report. These together with the trajectories constitute the building blocks for the creation of the scenarios. Do you consider the methodology proposed to quantify scenarios from the storylines suitable? Why/Why not?

Would you like to propose any additional steps which according to you are missing from the presented methodology and could be needed for a satisfactory quantification of the scenarios? Please provide detailed arguments on any input you might provide in this respect.

Feedback received from stakeholders

STAKEHOLDER	FEEDBACK RECEIVED
BBL	BBL proposes scenarios and the way heat is provided to the end-consumers is one of the main differentiators between the scenarios which BBL proposed. The development of the scenarios would also partially need to start from there.
FEBEG	FEBEG considers that electrification of many parts of the economy will occur. Nevertheless, FEBEG cautions regarding flexibility and urges to take into consideration variables such as attitudes of the consumers, the evolution of the market and the cannibalization effect. FEBEG agrees that in the upcoming 20-30 years, some of the loads will be used in a smart and flexible way but not all of them.

Response by Elia

In the scenario with the highest degree of centralization and lowest degree of electrification, **Global Import**, it is assumed that decarbonized molecules such as bio-gas, hydrogen & e-gasses are deployed at scale.

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This means that traditional (condensing) boilers are assumed to remain in use, but the existing gas infrastructure is re-purposed to transport those fuels. In densely populated areas around industrial clusters, thermal power plants and cogeneration units (running eventually on CO_2-neutral gasses) provide heat through district heating systems, with a larger relative share as compared to the decentral scenarios. Electric heat pumps are installed where most economically viable and/or where gas infrastructure is not available, in the least insulated dwellings these are hybrid types with molecule-based back-up.
In the scenario with high decentralization and high electrification, **E-prosumers** and **Flex+**, the main focus is on large-scale electrification at the end-consumer side in the form of electric heat pumps (mostly all-electric). Molecule-based heating technologies are largely phased-out and only remain in thermal power plants and cogeneration units which supply residual heat through district heating networks to end-consumers. In the more centralized (but high degree of electrification) **large scale e-RES** scenario, district heating systems with large centralized heat pumps and cogeneration units as back-up are also assumed widely installed in favor of more decentrally located heat pumps.

4.4. Photovoltaic

Question raised by Elia during the consultation (#Q4)

Trajectories for the evolution of PV are presented in the scenario report based on recent sources and estimates. These trajectories serve as a guidance of the possible range that PV technology can present in the different scenarios. Do you consider the range provided by these trajectories reasonable, too optimistic or too pessimistic? Why?

Notice the actual values of PV for each of the scenarios will be defined through the modelling exercise upon checking e.g. that the level of e-demand covered by RES is in accordance with each storyline set of assumptions. Do you think that the maximum or minimum ranges provided by the presented trajectories should be used to define a ‘maximum’ and/or ‘minimum’ bound for PV development in each scenario? Why?

Feedback received from stakeholders

STAKEHOLDER	FEEDBACK RECEIVED
BBL	BBL states the range provided by the trajectories is considered reasonable. Nonetheless, higher maxima are proposed for the potential. BBL would increase the potential of solar PV to 60GW, 60% of its theoretical potential, to maintain an appropriate equilibrium between solar and wind production.

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FEBEG	FEBEG is of the opinion that the potential of PV in Belgium is relatively high. FEBEG considers 20-30 GW by 2040-2050 to be more realistic. FEBEG does not think there is a positive business case for more when looking at Belgian peak load & ambitious plans in neighboring countries.

Response by Elia

The trajectories proposed for solar capacity in Belgium are based on various national studies where the available surface is used as a basis to derive the penetration of solar panels (maximum theoretical potential in Belgium being around 100 GW following the latest study by EnergyVille). The penetration of solar capacity remains uncertain and can be illustrated with the comments provided by stakeholders in the public consultation process going in opposite direction. The range of 20-30 GW as proposed by FEBEG for 2040-2050 seems very pessimistic given the ambition foreseen in the FitFor55 package where it is assumed to double the solar capacity in 10 years. On the other hand there might be other constraints that could limit the penetration of PV. Most studies on Belgium use a value of around 50 GW for their maximum PV installed capacity in 2050[8]. Given both opinions provided during this public consultation providing arguments in two opposite directions, we propose to keep the value of 50 GW the maximum solar capacity by 2050 for Belgium. Elia would like to remind that such value will not be used in all the scenarios as it will depend on the storyline.

4.5. Onshore & Offshore wind

Question raised by Elia during the consultation (#Q5)

Trajectories for the evolution of Onshore and Offshore Wind are presented in the scenario report based on recent sources and estimates. These trajectories serve as a guidance of the possible range that Onshore and Offshore Wind technology can present in the different scenarios. Do you consider the range provided by these trajectories reasonable, too optimistic or too pessimistic? Why?

[8] https://www.energyville.be/en/press/how-much-renewable-electricity-can-be-generated-within-belgian-borders-dynamic-energy-atlas

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Notice the actual values of Onshore and Offshore Wind for each of the scenarios will be defined through the modelling exercise upon checking e.g. that the level of e-demand covered by RES is in accordance with each storyline set of assumptions. Do you think that the maximum or minimum ranges provides by the presented trajectories should be used to define a 'maximum' and/or 'minimum' bound for Onshore and Offshore Wind development in each scenario? Why?

Feedback received from stakeholders

STAKEHOLDER	FEEDBACK RECEIVED
BBL	BBL states the range provided by the trajectories is considered reasonable. Nonetheless, higher maxima are proposed for the potential. BBL recommends to increase the potential of wind onshore to 16GW, 80% of its theoretical potential.
FEBEG	FEBEG believes that for offshore, the scenario is realistic and that the offshore capacity for Belgium by 2050 is between 5.8 GW and 8 GW. FEBEG affirms that the former is an ambition of the government whereas 8 GW could be reached by replacement/upgrade of existing parks. FEBEG agrees with Elia and considers that the offshore wind potential cannot exceed 8GW due to space limitations in the North Sea. FEBEG considers that in 2030, the capacity for onshore wind would more likely be about 5GW, when considering the effect of NIMBY behavior on the development of these projects. FEBEG considers NIMBY as the most important barrier for more ambitious scenarios with regards to onshore. FEBEG also inquires as to if and how Elia takes into account "new" offshore technologies like floating PV, tidal energy, wave energy…

Response by Elia

On the comments received on the ranges of wind offshore potentials, going beyond the potential is acknowledged as unreasonable given the limited space available in the Belgian EEZ. The proposed ranges are therefore kept.

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Concerning wind onshore, the comments go in both directions. Most studies use a maximum 'reasonable' potential of around 9 GW. Such value would be reached in the most ambitious scenario for onshore wind but other scenarios would reach lower values. As mentioned, the NIMBY effect is usually the main barrier for further onshore wind expansion. In the future, if more concrete values are available, taking into account public acceptance matters, those could be taken into account.

The development of new offshore technologies in Belgium such as floating solar panels, tidal energy… is currently limited due to the maturity of such technologies and the limited area available in Belgium compared to other countries. There are ongoing studies such as one lead by EnergyVille and RBINS[9] which would assess the potential of solar power in the Belgian sea. When such information will be available it will be possible to be integrated in the scenario framework. We are also aware of the EC offshore strategy aiming for 40 GW of 'ocean energy' to be developed by 2050 although no concrete plans nor quantified assessment was performed. Given those major uncertainties, we propose nevertheless to add some potential in the scenarios and use ranges found in the existing literature.

- **Regarding floating solar panel:** Belgium has today very limited capacity for floating solar panel and are mainly located in small lake mainly located in the Flemish region[10]. Limiting penetration for such technology is foreseen on the short-medium term in Belgium given the important investment costs compared to onshore solar panels. The LCOE of floating PV is currently estimated to be much higher than onshore PV[11] but should could become closer to onshore solar investment costs on long term based on external studies[12,13]. We therefore assume a potential up to 100 MW for BE but only as from 2040. It is yet unclear on the potential that could be installed in Belgium as there is limited space in the Belgian EEZ.

- **Regarding tidal capacity**: such technology is still under pilot phase, but can potentially support the increase of RES penetration in the system on long term at the European scale as described by European Commission in their offshore renewable energy strategy[14]. However, Belgium has very

[9] https://www.energyville.be/en/news-events/energyville-and-rbins-are-teaming-determine-potential-solar-power-belgian-sea
[10] https://www.floatingpv.be/en/
[11] https://www.energyville.be/sites/default/files/downloads/2018/energyville_energy_transition_in_belgium_choices_and_costs_final_27apr2017_pverratum_0_1.pdf
[12] https://www.sciencedirect.com/science/article/pii/S0038092X21007222
[13] https://www.dnv.com/Publications/flexibility-in-the-power-system-103874
[14] https://ec.europa.eu/energy/sites/ener/files/offshore_renewable_energy_strategy.pdf

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limited potential for such technology compared to their neighboring countries due to the limited space available. It is also unclear whether the Belgian sea is the most suited for such kind of technologies (when compared to other places in Europe where wave speed could be higher). It is proposed to include maximum 100 MW in Belgium in the most optimistic scenario regarding offshore RES development only as from 2040.

4.6. Electricity demand

Question raised by Elia during the consultation (#Q6)

Trajectories for the evolution of the electricity demand are presented in the scenario report based on its different underlying drivers, namely i) demographic aspects, ii) macro-economic aspects, iii) energy efficiency and circularity, iv) behavioral changes of the end-costumers and v) fuel switching behaviors. These trajectories serve as a guidance of the possible range that electricity demand which can be present in the different scenarios. Do you consider the range provided by these trajectories reasonable, too optimistic or too pessimistic? Why?

Notice the actual values of electricity demand for each of the scenarios will be defined through the modelling exercise in accordance with each storyline set of assumptions. Do you think that the maximum or minimum ranges provides by the presented trajectories should be used to define a 'maximum' and/or 'minimum' bound for electricity demand development in each scenario? Why?

Feedback received from stakeholders

STAKEHOLDER	FEEDBACK RECEIVED
BBL	As BBL has proposed a different scenario framework, they state in accordance with this that the ranges, especially on heat sources, should be reviewed based on the narrative. BBL has no comments on the proposed minima or maxima. BBL further questions the considered development of the climate as a basis for the scenarios. They recommend to include the cold winters of the 80's given recently observed cold winters in North-America due to weakened jet

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	stream. BBL assumes it is possible that a disturbed jet stream directs polar air to Europe leading to a high electricity demand.
FEBEG	FEBEG considers the presented ranges as reasonable. Regarding heat pumps development in 2050, FEBEG states the very high range seems optimistic whereas the lower range (only 35%) seems a bit too pessimistic considering 'gas phase out' announcements. Secondly, FEBEG thinks the higher range for electric heavy trucks in 2050 (90%) seems too optimistic. Considering stock inertia, to achieve this, all heavy truck sales should be electric in 2035-2040 already.

Response by Elia

Elia reconsiders the range for heat pump penetration to 40%-90%. Indeed, due to reactions which were made during the consultation period it can be expected that the deployment might be accelerated[15], therefore the lower share of heat pumps has been revised upwards to 40% (up from 35%). On the other hand, the upper range of 95% might be considered too extreme when taking into account stock inertia, protected buildings and the fact that a heat pump is not feasible in some buildings.

For road freight, the upper range has been revised downwards from 90% to 80% following the comment regarding the stock inertia. Indeed, even though a share of 90% is technically feasible, this is unlikely to be reached already by 2050.

4.7. Demand side response

Question raised by Elia during the consultation (#Q7)

Trajectories for the evolution of Demand Side Response are presented in the scenario report based on recent sources and estimates. These trajectories serve as a guidance of the possible range that Demand

[15] https://energiesparen.be/vlaams-energie-en-klimaatplan-2021-2030

Side Response can present in the different scenarios. Do you consider the range provided by these trajectories reasonable, too optimistic or too pessimistic? Why?

Notice the actual values of Demand Side Response for each of the scenarios will be defined through the modelling exercise in accordance with each storyline set of assumptions. Do you think that the maximum or minimum ranges provides by the presented trajectories should be used to define a 'maximum' and/or 'minimum' bound for Demand Side Response development in each scenario? Why?

Feedback received from stakeholders

STAKEHOLDER	FEEDBACK RECEIVED
BBL	As BBL has proposed a different scenario framework, they state that flexibility of heating and cooling should be reviewed based on their narrative. BBL has no comments on the proposed ranges, minima or maxima.
FEBEG	FEBEG considers that the flexibility from DSM shedding and shifting is high and that the assumptions are rough. FEBEG invites Elia to have a more-in depth look at the economic viability of the assumptions regarding shifting / shedding demand. FEBEG further questions the source of the input. Moreover, FEBEG states that 'Global import', 'Large-scale e-RES', 'e-Prosumers' and 'Flex+' scenarios – 65-80% are too optimistic. Besides, FEBEG remarks that the forecast to reach 100% by 2050 regarding V1G charging is also too optimistic. FEBEG expresses its optimism regarding V1G and considers its potential significant as more and more "home energy management" systems are present – especially in Flanders. FEBEG states that if everything goes well, Elia's scenario of 50% by 2030 would be possible.

Response by Elia

Response by Elia will be divided into three parts corresponding to the different demand-side response categories proposed. In general, a more prudent approach for flexible demand will be considered given the feedback received, taking into account limited values for the 'Expected Policies' and 'Global Import' scenarios and ambitious values for the 'Flex +' scenario.

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- Regarding the flexibility from appliances and industry after 2030, as there is a lack of sources available, a more prudent approach is proposed in terms of flexible demand. It is proposed to assume that the target fixed in the 'Belgian Energy Pact' for DSM shedding in 2030 can be associated to the total demand minus the demand from electric vehicles, heat pumps and air conditioning, as those are dealt with in an ad hoc section. For the scenarios 'Global import', 'Large-scale e-RES', 'e-Prosumers' and 'Flex+', it is then proposed to keep the same ratio between the DSM installed capacity and the total demand minus the demand from electric vehicles, heat pumps and air conditioning. By applying this methodology, we make sure that we start from the current ambitions but that we also take into account the potential from additional electrification.
- Regarding the flexibility from heating and cooling, it is proposed to add an additional step between the levels from 2030 and the target for 2050 as defined in the document submitted to public consultation. This is summarized in the table below. The values for 2040 and 2050 are presented as percentages of the consumption from heating and cooling that can be shifted intra-daily.
  In addition, the level for 2030 has been updated to take into account the impact of Fit for 55. Additional potential is considered to take into account the additional volume of heat pumps in the scenario.

Scenarios	2030	2035	2040	2050
Expected Policies	1800 MWh (Fit for 55)	Linear Interpolation	20%	-
Global Import			20%	35%
Large-scale e-RES			30%	50%
e-Prosumers			45%	65%
Flex +			60%	80%

- Regarding the flexibility from mobility, we agree that considering 100% of optimized charging might be too optimistic. We therefore proposed to cap the percentage to 90% in the most extreme scenario in terms of flexibility. Therefore, the V1G share in the 'Global import', 'Large-scale e-RES', 'e-Prosumers' and 'Flex+' is respectively equal to 60%, 70%, 80% and 90% from 2040. A linear interpolation is performed between 2030 and 2040 and the same percentages are considered for 2050. The percentages for the Expected Policies scenarios are assumed to be the same as the one from 'Global Import'.

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4.8. Storage

Question raised by Elia during the consultation (#Q8)

Storage encompasses pumped-storage capacity, batteries and vehicle-to-grid. Trajectories for the evolution of these different sources of Storage capabilities are based on recent sources and estimates. These trajectories serve as a guidance of the possible range that storage that can present in the different scenarios. Do you consider the ranges (for pumped-storage capacity, batteries (large and small) and vehicle-to-grid, respectively) in these trajectories reasonable, too optimistic or too pessimistic? Why?

Notice the actual values of storage for each of the scenarios will be defined through the modelling exercise in accordance with each storyline set of assumptions. Do you think that the maximum or minimum ranges provides by the presented trajectories should be used to define a 'maximum' and/or 'minimum' bound for storage development in each scenario? Why? Do you expect any such storage category not to have any maximum bound? Why? Do you expect any such storage category to be near its maximum development potential already? Why?

Feedback received from stakeholders

STAKEHOLDER	FEEDBACK RECEIVED
BBL	BBL states that energy can be stored in the form of heated water, even for periods of multiple months. BBL assumes that this should be incorporated in the scenarios. BBL has no other comments on the proposed ranges, minima and maxima.
FEBEG	FEBEG points out the uncertainties regarding the use of batteries such as the cost evolution, the technological evolutions and the impact of the cannibalization effect. FEBEG states that it is too optimistic to assume a 15-30GW capacity by 2040 / 2050 regarding the use of batteries considering these uncertainties. FEBEG underlines that volume available for V2G will depend on the number of EV in Belgium but also the technology's development in the market. FEBEG remarks that alongside the current non-availability of the technology in the market, a stable regulatory framework and a positive business case are non-existent.

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Response by Elia

Regarding BBL comment, water heating is not considered in the flexibility part. First, its contribution on annual basis is quite limited. Then, it is proposed to not add additional potential from hot water in the storage part as it would mean that this hot water is converted back to electricity and reinjected in the electricity net which has almost no potential regarding the low exergy associated (lot of energy but with limited temperature).
Finally, it should be noted that space heating is taken into account in the demand-side shifting from heating and air conditioning. For the moment, it is considered that it contributes to level out only daily variations but it is proposed to extend its contribution to also a part of weekly variations.

For batteries, Elia agrees that the associated potential might be a bit too ambitious. Therefore, it is proposed to decrease the percentages by 5% for V2G and even a bit more for small-scale batteries. Lower percentages for residential batteries are assumed as it requires additional investment cost to install them while the investment for V2G is already done for transport needs.

Scenarios	V2G [%]		Residential batteries [%]	
	Previous values	Updated proposal	Previous values	Updated proposal
Expected Policies	10	5	10	5
Global Import	10	5	10	5
Large-scale e-RES	15	10	15	5
e-Prosumers	20	15	20	10
Flex +	25	20	25	15

4.9. Electrolyzers

Question raised by Elia during the consultation (#Q9)

Electrolyzers will play a role in the production of green-molecules and hydrogen from renewable electricity production. This will be relevant to decarbonize the hydrogen current consumption itself as well as to decarbonize sectors which cannot be easily electrified and/or which use hydrogen to produce feedstock. Trajectories for the evolution of electrolyzers are based on recent sources and estimates. These trajectories serve as a guidance of the possible range that electrolyzers can present in the different scenarios. Do you consider the ranges provided by these trajectories reasonable, too optimistic or too pessimistic? Why?

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Notice the actual values of electrolyzer capacity for each of the scenarios will be defined through the modelling exercise in accordance with each storyline set of assumptions. Do you think that the maximum or minimum ranges provides by the presented trajectories should be used to define a 'maximum' and/or 'minimum' bound for electrolyzer development in each scenario? Why?

Feedback received from stakeholders

STAKEHOLDER	FEEDBACK RECEIVED
BBL	BBL has no comments on the proposed ranges, minima and maxima.
FEBEG	No major issues or comments. FEBEG refers to a study released last year by the "Fuel Cells and Hydrogen Joint Undertaking"[16] that estimates to 0.4 to 2.3 GW the need for electrolyzers by 2030 based on NECP targets and to the Fluxys consultation Request for Information. FEBEG states that from 2030 onwards, demand for green hydrogen will probably grow markedly.
Fluxys	Fluxys states that hydrogen will be essential to decarbonize hard-to-electrify sectors as stated in the 'Federal Hydrogen Strategy' and studies from the Federal Planning Bureau please refer to annex for graphs and detailed numbers). They believe that Belgium will have to import a large part of the molecules but will simultaneously need to invest in substantial production capacities to support security of supply and deal with intermittency of renewables in the power system. As such, Fluxys proposes to increase the electrolyzer range by 2050 from the current 1-2.4GW to a 3.7-8.8GW range.
Febeliec	Febeliec assumes that by omitting a cost focus, Elia will not be able to validate any values regarding electrolysis for hydrogen production, whereas for this technology due to the massive losses and potentially low load factors of both the input and thus conversion plants could be economically non-optimal. Febeliec states that Elia refers to a recent draft hydrogen strategy of the Belgian government – which indicates little potential for electrolyzers in Belgium

[16] https://www.fch.europa.eu/sites/default/files/file_attach/Brochure%20FCH%20Belgium%20%28ID%209473032%29.pdf

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	due to limited RES potential – but still includes up to several GWs electrolyzers in its storylines.

Response by Elia

Elia takes note of the proposal from Fluxys, comments from Febeliec and studies referred by FEBEG. Elia agrees on the essential role of hydrogen to decarbonize hard-to-electrify sectors. However, the Federal hydrogen strategy states that most of hydrogen required in Belgium will be imported, as Belgium will be short on RES in the future[17]. Moreover, the feedback seems divided between an increase or a decrease of the range regarding electrolyzers.

Therefore, it is proposed to keep the ranges as proposed in the report, leading to a final electrolyzers volume of minimum 1 GW and maximum 2.4 GW in 2050 and between 750 MW and 1500 MW in 2040.

4.10. Dispatchable generation

Question raised by Elia during the consultation (#Q10)

Dispatchable generation will be based on the TYNDP scenarios and then subjected to a dispatchable economic viability assessment. This assessment will ensure that countries are between predefined reliability standard levels. From 2030 onwards, it is proposed that added dispatchable generation will consist only of carbon-free generation in the form of hydrogen turbines. Do you think adding only carbon-free dispatchable generation from 2030 onwards is a good assumption for the dispatchable economic viability assessment? Why? Do you think using hydrogen turbines as the reference technology for carbon-free dispatchable generation from 2030 onwards is a good assumption? Why?

[17] Additional insights on this fact can be found, in Elia's Roadmap to net-zero : link

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Feedback received from stakeholders

STAKEHOLDER	FEEDBACK RECEIVED
BBL	BBL supports the assumption to add only carbon-free dispatchable generation from 2030 onwards. However, they affirm that various modes of carbon-free dispatchable generation should be assumed, including fuel cells & hydrogen-fueled internal combustion engines. Lastly, BBL is wondering whether hydrogen will be the fuel of the future, especially in global import scenario. BBL believes that If hydrogen is sourced from distant regions there is a high likelihood that synthetic methane will be generated from it to optimise the logistic chain. In this case, synthetic methane would replace fossil methane.
FEBEG	FEBEG states that adding only carbon-free dispatchable generation from 2030 onwards is not a good assumption – there could still be economically viable investments (e.g. CCGT on natural gas) which later can be converted. FEBEG suggests to add natural gas & carbon capture and storage as an option to carbon-free dispatchable generation. FEBEG thinks biomass & gas technologies are relevant.
Febeliec	Febeliec regrets that Elia does not include all different technology options and limits the scope to a determined subset of selected technologies. In its choices for dispatchable generation, Elia is not technology-neutral as it considers hydrogen turbines as the only carbon free option, therefore foregoing all possible alternatives for carbon-neutral generation (such as CCS/CCU, nuclear, …).

Response by Elia

Based on the received comments, Elia will consider more technologies when filling the requirements of dispatchable generation capacity. In addition to H2 turbines, synthetic methane and biogas turbines as well as natural gas fueled plants using CCS will be considered for new generation in the investment loop/economic viability assessment (depending on the scenario, in-line with what is done at TYNDP2022 level). The existing fleet will be considered to use a mixture of fossil and green gases in the transition period. The composition of this mixture will be varied between the scenarios, as is done in TYNDP2022 scenarios.

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4.11. General feedback

As always, Elia is interested in hearing honest feedback from stakeholders in how it is handling ongoing and new interactions with stakeholders and how it can improve future operations. General feedback received during the consultation is listed below.

As a main message, FEBEG states they think scenarios should be adapted/fine-tuned in time considering the most recent evolutions.

Elia agrees wholeheartedly. In an ever changing energy landscape, it is important to use data that is as up to date as possible. While there is a certain window before publication where it has become impossible to change assumptions (modelling & drafting phase) Elia will always strive towards updating its assumption as best as possible before this date. Indeed and this is why Elia takes into account all the latest information regarding national ambitions (not included in the TYNDP nor in other studies) such as (not an exhaustive list):

- The recent German coalition agreement;
- The French TSO scenarios up to 2050;
- The Dutch government agreement;
- The Belgian ambitions regarding offshore and the hydrogen strategy;
- The Irish 2021 climate action plan;
- The most recent FES scenario report from the UK;
- The FitFor55 package, impact assessment from the EC on the package;
- …

FEBEG is concerned that a very high level scenario/approach is replacing a forum to discuss very specific scenarios and issues. FEBEG would like to maintain specific efforts, collaborations, scenarios discussions for certain important “short term” issues such as balancing, adequacy, CRM auctions, availability of import and interconnections.

Elia will indeed approach short term differently than long term as they are both very different in nature. Short term issues require modelling that is based upon bottom-up best estimate scenarios and sensitivities. Furthermore, Elia is bound by law to undertake certain communication initiatives to make sure stakeholders are involved in these discussions. As such Elia believes the concerns of FEBEG will be addressed sufficiently.

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5. Next steps

Elia thanks all the stakeholders for their participation to this public consultation. On the basis of the reactions received from market players and its views, as set out in this consultation report, Elia will finalize its note on the *Belgian Electricity Scenario Report*. All documents will be available through the Elia website, on the task force scenarios page.

Elia organizes a meeting for the Task Force Scenarios on the 26th of January in order to cover the overview of the received feedback and to bring further explanations, if required, regarding its responses in this consultation report.

6. Attachments

The reactions Elia received to the document submitted for consultation:

- *Erwin Cornelis – Bond Beter Leefmilieu*
- *Jean-François Waignier – FEBEG*
- *Maxime de Changy – Fluxys*
- *Michaël Van Bossuyt – Febeliec*

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