Elia's Task Force Scenarios – Call for Evidence "Flexibility options in electricity consumption" Inputs from Fluxys Belgium: Electrolysers

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Purpose

This document aims to provide **inputs to Elia's Call for Evidence on "Flexibility Options in electricity consumption" for time horizons 2040 and 2050** (Task Force Scenarios – Workshop #2 – 24 September 2021).

Multiple publications point at the contributions that Power-to-X technologies can bring to the flexibility of the electric system. In this document, **Fluxys Belgium would like to put the focus on the role of electrolysers for flexibility**, as these are forecast to be an increasingly important electricity consumer in the coming decades. The following sections make reference to a number of recent publications on the contribution of electrolysers to the flexibility of the electric system in Europe and Belgium.

European/International References

In a study ordered by the **European Parliament**, **Trinomics**[1] presents a number of relevant elements:

- the importance of the vector integration to increase the flexibility of the electric system (p7),
- the use of Power-to-X to optimise the integration of renewable electricity supply and prevent curtailments (p7),
- different electrolyser technologies that can be used to provide grid flexibility services (e.g. ancillary services such as frequency control) by ramping up or down their load (p29),
- the fact that electrolysers can combine hydrogen revenues with revenues from energy system flexibility services to improve their business case (p29), and
- the fact that using Power-to-X technologies allows to avoid additional investments in electricity transmission, distribution or storage infrastructure to integrate the total renewable electricity supply (p42).

[1] Trinomics, for the European Parliament, "Sector coupling: how can it be enhanced in the EU to foster grid stability and decarbonise?," 2018.

In 2020 and 2021 the **European Parliament**[2] and the **European Commission**[3] mentioned the benefits of integrating electrolyser technologies to the electricity system: e.g. "integration of large share of variable renewable generation, offloading grids in times of abundant supply, providing long term storage to the energy system".

Other TSO's are considering the advantages that can bring P2X to the flexibility of the electric system in their outlook report for 2050[4] (**Tennet & Gasunie**) or dedicated publication[5] (**RTE**). In Germany, **50hertz**[6] will participate in three projects linked to the production of hydrogen with electrolysers. One of those projects will provide ancillary services to the grid. In the United Kingdom, **National Grid** highlights in its last "**Future Energy Scenarios**" report[7], the important role of electrolysers as source of flexibility. **Gas TSO's**[8] are also mentioning that electrolysers will provide flexibility to the grid alongside batteries and other dispatchable technologies.

In 2018, the **International Renewable Energy Agency** (i.e. IRENA) published a report on "**Hydrogen from Renewable Power**". In this report[9], IRENA:

- explains that electrolysers can provide low-cost balancing services by means of flexible load (up or down) (p16),
- lists electrolyser technologies that are compatible with the provision of grid services on a short time scale (p21), and
- provides key parameters of dynamic operation for two electrolyser technologies able to provide grid services (p23). These parameters are summarized in Table 2 below.

Table 2: Dynamic operation of ALK and PEM electrolysis

	ALKALINE	PEM
Load range	15–100 % nominal load	0–160 % nominal load
Start-up (warm – cold)	1–10 minutes	1 second–5 minutes
Ramp-up / ramp-down	0.2–20 %/second	100 %/second
Shutdown	1–10 minutes	Seconds

Note: Values for 2017.
Source: FCH JU (2017b).

Source IRENA

In a similar way, **Navigant**[10] in a study for "**Gas for Climate**" presents the main electrolyser technologies that can bring flexibility services to the grid.

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[2] European Commission, "Powering a climate-neutral economy: An EU Strategy for Energy System Integration," p4, 2020.

[3] European Parliament, "A European Strategy for Energy System Integration," p12, 2021.

[4] Tennet-Gasunie, "Infrastructure Outlook 2050," 2021.

[5] RTE, "La transition vers un hydrogène bas carbone," 2020.

[6] 50hertz, Press Release: « National hydrogen strategy is good starting point for climate-neutral economy", 2020.

[7] National Grid, "Future Energy Scenarios", p150, 2021.

[8] Guidehouse, for Gas for Climate, "Analysing future demand, supply, and transport of hydrogen", p56, 2021.

[9] IRENA, "Hydrogen from renewable power," 2018.

[10] Navigant, for Gas for Climate, « The optimal role for gas in a net-zero emissions energy system », p169, 2019

Belgian References

In Belgium, the "**Greenports project**" report[11] (2021), coordinated by **WaterstofNet**, with contributions from Elia and Fluxys:

- explains that electrolysers can provide fast flexible balancing services to grid operators by means consumption ramp-up or down (p19),
- explains that electrolysers could play on real-time balancing markets but also day ahead or intraday markets (p19),
- lists the different types of reserves where electrolysers could be used (i.e. FCR, mFRR, aFRR) (p24), and
- explains that the revenues generated from grid services can help the electrolysers' business case (p24).

In its study "**Fuel for the Future**[12]" (2020), the **Federal Planning Bureau** (FPB) sees a significant potential for electrolyser capacity in Belgium by 2050: 10.6 GW in the "Deep Electrification scenario" and 19.1 GW in the "Diversified Energy Supply" scenario (see table underneath).

Electrolysers capacities for 2040 are not directly presented in the BFP report. For the sake of this exercise, it may be assumed for example that half of the 2050 capacity may be reached by 2040.

Scenario	**Electrolyser Capacity in 2040 (GW)** ***Possible interpolation***	**Electrolyser Capacity in 2050 (GW)** **Source: BFP Study 2020**
Diversified Energy Supply	*9.55*	19.1
Deep Electrification	*5.3*	10.6

Further Work

The figures above on electrolyser capacity at horizons 2040 and 2050 are of course potentials, which will not be fully actionable to provide flexibility to the electric system.

An additional source of data regarding the capacity of electrolysers and its utilization at time horizons 2040 and 2050 will be the "**Scenario Report 2022**", due to be published by **ENTSO-E and ENTSO-G** in September 2021 (Draft Version). The report should include electrolyser capacity and utilisation data country by country for the "Distributed Energy" and "Global Ambition" storylines, based on a coupled modelling of the electric and hydrogen system at EU level.

Fluxys suggests to review the "Scenario Report 2022" results from ENTSO-E and ENTSO-G in the Taskforce meeting planned on 24 September 2021, in order to determine the electrolyser capacity which should be included as a mean of flexibility in the electric consumption.

[11] WaterstofNet, "Greenports project," 2021.

[12] Federal Planning Bureau, "Fuel for the Future," p23, 2020.