TYNDP 2024

The Hydrogen and Natural Gas TYNDP

Hydrogen Infrastructure Gaps Identification Report

Draft for public consultation

entsog

Content

Abbreviations

Annex C2	TYNDP 2024 Hydrogen Infrastructure Capacities
Annex D1	TYNDP 2024 Implementation Guidelines
Annex D2	TYNDP 2024 Hydrogen Infrastructure Gaps Identification methodology
d	Day
DGM	Dual Hydrogen/Natural Gas Model or Dual Gas Model
DHEM	Dual Hydrogen/Electricity Model
ENTSOG	European Network of Transmission System Operators for Gas
ENTSO-E	European Network of Transmission System Operators for Electricity
EU	European Union
ETS	European Union Emissions Trading System
FEED	Front-End Engineering Design
FID	Final Investment Decision
GCV	Gross Calorific Value or Higher Heating Value (25℃/0℃)
GWh	Gigawatt Hour
HCR	Hydrogen demand Curtailment Rate
H_2	Hydrogen
IGI	Hydrogen Infrastructure Gaps Identification
IGI indicator 1	Hydrogen Infrastructure Gaps Identification indicator for hydrogen market clearing price spreads
IGI indicator 2.1	Hydrogen Infrastructure Gaps Identification indicator for hydrogen demand curtailment for reference weather year
IGI indicator 2.2	Hydrogen Infrastructure Gaps Identification indicator for hydrogen demand curtailment for stressful weather year
IL	Infrastructure Level
IoSN	ENTSO-E's Identification of System Needs
MW	Megawatt
MWh	Megawatt Hour
NCV	Net Calorific Value or Lower Heating Value (25℃/0℃)
NT+	TYNDP 2024 National Trends+ scenario
PCI	Project of Common Interest
PMI	Project of Mutual Interest
RES	Renewable Energy Source(s)
TEN-E Regulation	Regulation (EU) 2022/869
TWh	Terawatt Hour
TYNDP	Ten-Year Network Development Plan
Union list	Union list of PCIs and PMIs
VoLL	Value of Lost Load
WTP_{H2}	Willingness To Pay
y	Year

1. Introduction

The TYNDP 2024 Hydrogen Infrastructure Gaps Identification report (IGI report) aims at identifying regional infrastructure gaps within the assessed sets of hydrogen infrastructure assumed to be in place in a given year (i.e., hydrogen infrastructure level). IGI indicators are used for this identification.

This document is established in line with Article 13 of the TEN-E Regulation. Further details about its legal background, assumptions, modelling tools, and methodologies are provided in the TYNDP 2024 IGI methodology (Annex D2)[1] that is cross-referencing to the TYNDP 2024 Implementation Guidelines (Annex D1)[2] as well as to the TYNDP 2024 scenarios[3].

Infrastructure gaps identified in ENTSOG's hydrogen-related TYNDP 2024 IGI report may in some cases also be addressable by energy infrastructure solutions in other sectors like the electricity sector or the natural gas sector. This is the case for any infrastructure gaps identification that is focused on a specific energy vector. For electricity, ENTSO-E prepares the Identification of System Needs (IoSN) report, which is the equivalent to ENTSOG's IGI report.

This document is the draft version for public consultation. The results of the IGI indicators 2.1 and 2.2 may be updated in the final version once the results of the Dual Hydrogen/Natural Gas Model (Dual Gas Model, DGM) are available. The results presented in this document are solely based on the Dual Hydrogen/Electricity Model (DHEM).

There are two hydrogen infrastructure levels analysed as part of the IGI report (see section 1.1):

- A **PCI/PMI hydrogen infrastructure level** containing existing hydrogen infrastructure, FID hydrogen projects, and hydrogen projects on the Union list[4], modified by requests of the European Commission concerning import corridors.
- An **Advanced hydrogen infrastructure level** containing the PCI/PMI hydrogen infrastructure level as well as advanced hydrogen projects, modified by requests of the European Commission concerning import corridors.

The electricity infrastructure level considered in the IGI reflects the reference grid including generation and storage assets used in the NT+ scenario. Depending on time horizon (i. e., 2030 or 2040) different

[1] Link to TYNDP 2024 Annex D2: https://www.entsog.eu/sites/default/files/2024-12/TYNDP%202024%20Annex%20D2%20-%20Infrastructure%20Gaps%20Identification%20methodology_0.pdf
[2] Link to TYNDP 2024 Annex D1: https://www.entsog.eu/sites/default/files/2024-12/TYNDP%202024%20Annex%20D1_Implementation%20Guidelines_0.pdf
[3] Link to TYNDP 2024 scenarios: https://2024.entsos-tyndp-scenarios.eu/
[4] 6th Union list of Projects of Common Interest (PCI) and Projects of Mutual Interest (PMI) (i.e., 1st Union list under the revised TEN-E Regulation) as detailed in section B of Annex VII to the TEN-E Regulation.

electricity projects will be considered to be part of the reference grid (as described in the Annex D1 section 2.3.2).

The analysis is performed for 2030 and 2040 for the TYNDP 2024 National Trends+ (NT+) scenario. Thereby, three indicators are used to identify regional hydrogen infrastructure gaps (see section 1.2).

1.1. Hydrogen infrastructure levels

1.1.1. PCI/PMI hydrogen infrastructure level

Projects conforming the PCI/PMI hydrogen infrastructure level are shown in the Figure 1 and are listed in Annex I of the TYNDP 2024 Annex D1[5]. The hydrogen production assets available in both hydrogen infrastructure levels are identical and stated in Annex I of this report.

This IGI report focusses the analysis on two assessed simulation years (i.e., 2030 and 2040). Not all projects included in the PCI/PMI hydrogen infrastructure level will be fully implemented in the 2030 timeframe. It might be the case that projects are composed by several phases with different commissioning years and that the commissioning year of some projects and/or phases is 2030 or later and therefore not considered in the 2030 assessment[6]. Whereas, in the 2040 assessment, full deployment of PCIs and PMIs is assumed.

Regarding intra-EU transmission infrastructure, in the PCI/PMI hydrogen infrastructure level, some Southern European countries are not connected to the European network, as visible in Figure 1. More specifically, the Greek and Bulgarian hydrogen systems are interconnected by PCIs, but remain isolated from other neighbouring countries. Countries and regions that are isolated without any cross-border hydrogen infrastructure in this hydrogen infrastructure level are Hungary, Romania, Slovenia, Switzerland, Croatia, Ireland, the United Kingdom, Cyprus, Malta, Luxembourg, the France-Southwest region, the Poland-North-region and the Poland-South region. Slovakia is isolated in 2030 and connected with Czechia and Austria only in 2040.

Regarding storage infrastructure in the PCI/PMI hydrogen infrastructure level, only Denmark, Germany, the Netherlands, France, and Spain have hydrogen storage capacities (see Table 1).

Table 1: Hydrogen storage capacities considered in the PCI/PMI hydrogen infrastructure level for the assessed years (unit: GWh/d for injection and withdrawal and GWh for working gas volume).

Storage capacities	Direction	2030	2040
Denmark	Injection	3.16	3.16
Denmark	Withdraw	9.5	9.5

[5] See Annex II of TYNDP 2024 Annex D1 Implementation Guidelines : https://www.entsog.eu/sites/default/files/2024-12/TYNDP%202024%20Annex%20D1_Implementation%20Guidelines_0.pdf

[6] Hydrogen infrastructure capacities of the PCI/PMI hydrogen infrastructure level as well as the Advanced hydrogen infrastructure level for 2030 and 2040 are published as part of the TYNDP 2024 Annex C2 (https://www.entsog.eu/sites/default/files/2024-12/TYNDP%202024_AnnexC2_Hydrogen%20Infrastructure%20Capacities.xlsx).

Denmark	Working Gas Volume	100	100
France	Injection & Withdraw	10.0	10.0
France	Working Gas Volume	250	250
Germany	Injection & Withdraw	4.25	21.25
Germany	Working Gas Volume	154	359
Netherlands	Injection & Withdraw	3.3	13.2
Netherlands	Working Gas Volume	206	850
Spain	Injection & Withdraw	62.0	62.0
Spain	Working Gas Volume	708	2728
Sum	Injection	82.71	109.61
Sum	Withdraw	89.05	115.95
Sum	Working Gas Volume	1418	4287

Regarding extra-EU supplies, the PCI/PMI hydrogen infrastructure level has limited access to extra-EU supply potential. This is particularly relevant when considering the 2030 assessment:

- Regarding pipeline imports from extra-EU sources (see Table 2): PCIs and PMIs are considered to unlock North African, Norwegian and Ukrainian supply potential only from 2040.
- Regarding hydrogen import terminals (see Table 3): In 2030, extra-EU imports will be limited to the PCI import terminals in Belgium, Germany, and the Netherlands. In 2040, higher capacity of PCI import terminals will be considered in these countries due to the planned full implementation of the multiple phases of the PCIs. In 2040, also an additional PCI import terminal located in France will be considered to be connected to the Belgian hydrogen network.

Table 2: Extra-EU import capacities via pipelines considered in the PCI/PMI hydrogen infrastructure level and extra-EU supply potential for the assessed years (unit: GWh/d).

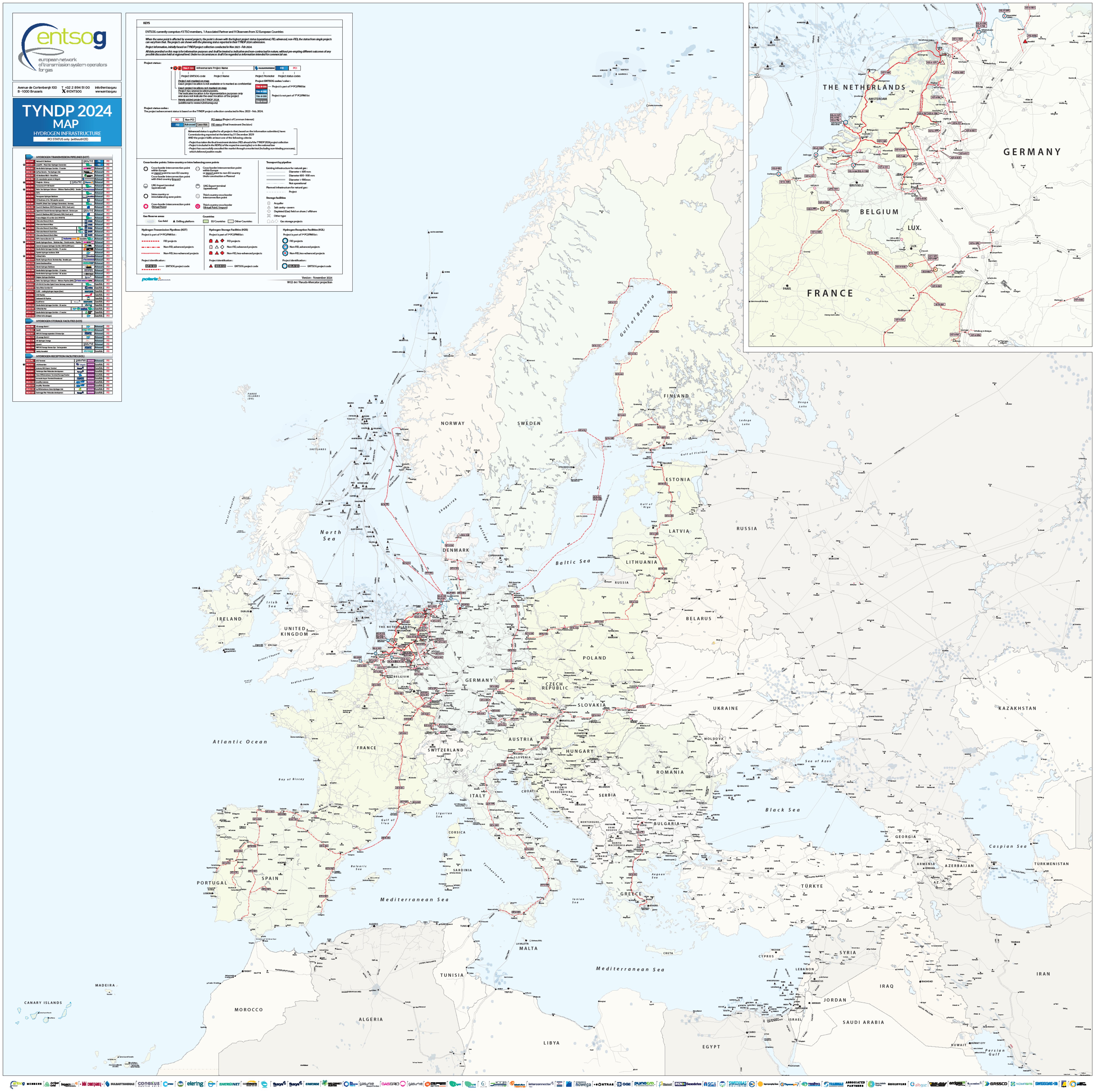
From Country	To Country	Hydrogen import capacity		Extra-EU hydrogen supply potential		Effective hydrogen import potential	
		2030	2040	2030	2040	2030	2040
Algeria	Italy	0.0	448.0	136.4	1318.4	0.0	448.0
Morocco	Spain	0.0	106.0	0.0	125.0	0.0	106.0

Norway	Germany	0.0	432.0	170.4	848.7	0.0	432.0
Ukraine	Slovakia	0.0	218.4	98.6	878.9	0.0	218.4

Table 3: Extra-EU import capacities via terminals considered in the PCI/PMI hydrogen infrastructure level and extra-EU supply potential by ship for the assessed years (unit: GWh/d).

Import capacities by ship To Country	2030	2040
Belgium	59.3	193.6
France	0.0	48.0
Germany	44.2	67.7
The Netherlands	90.8	177.1
Sum	194.3	486.4
Shipped supply potential	**2030**	**2040**
Extra-EU to EU	227.8	1561.0
Effective hydrogen import potential	**2030**	**2040**
Minimum of import capacities by ship and shipped supply potential	194.3	486.4

Figure 1: Representation of the PCI/PMI hydrogen infrastructure level.



1.1.2. Advanced hydrogen infrastructure level

The Advanced hydrogen infrastructure level is by definition more ambitious than the PCI/PMI hydrogen infrastructure level, as it contains not only the PCIs and PMIs, but also advanced hydrogen projects, which can involve countries without PCIs and PMIs.

Projects conforming the Advanced hydrogen infrastructure level are shown in the map in Figure 2 and are listed in Annex I of the TYNDP 2024 Annex D1. The hydrogen production assets available in both hydrogen infrastructure levels are identical and stated in Annex I of this report.

Regarding intra-EU transmission infrastructure, the Advanced hydrogen infrastructure level has a higher level of interconnections in Southern Europe, as visible in Figure 2. More specifically, Slovakia, Hungary, Romania, Croatia and Bosnia are interconnected in the Advanced hydrogen infrastructure level. Countries and regions that are isolated without any cross-border hydrogen infrastructure in this hydrogen infrastructure level are Luxembourg, Slovenia, Switzerland, Ireland, the United Kingdom, Cyprus, Malta, the France-Southwest region, the Poland-North and the Poland-South region.

Regarding storage infrastructure, the Advanced hydrogen infrastructure level has higher storage capacities in Germany and in the France-Southwest region (see Table 4).

Table 4: Hydrogen storage capacities considered in the Advanced hydrogen infrastructure level for the assessed years (units: GWh/d for injection and withdrawal and GWh for working gas volume).

Storage capacities	Direction	2030	2040
Denmark	Injection	3.16	3.16
Denmark	Withdraw	9.5	9.5
Denmark	Working Gas Volume	100	100
France[7]	Injection & Withdraw	19.3	19.3
France	Working Gas Volume	750	750
Germany	Injection & Withdraw	63.25	80.25
Germany	Working Gas Volume	1532	1737
Netherlands	Injection & Withdraw	3.3	13.2

[7] Some storage capacity in France is connected to the France-South region and some is connected to the France-Southwest region.

Netherlands	Working Gas Volume	206	850
Spain	Injection & Withdraw	62.0	62.0
Spain	Working Gas Volume	708	2728
Sum	Injection	151.01	173.91
Sum	Withdraw	157.35	184.25
Sum	Working Gas Volume	3296	6165

Regarding extra-EU supplies, the Advanced hydrogen infrastructure level has additional access to extra-EU supply potential compared to the PCI/PMI hydrogen infrastructure level:

> Regarding pipeline imports from extra-EU sources (see Table 5): The Advanced hydrogen infrastructure level includes access to North African (Algerian and Tunisian) supply in 2030 thanks to a project connecting Italy with this import source.

> Regarding hydrogen import terminals (see Table 6): The Advanced hydrogen infrastructure level has higher import capacity in the Netherlands and in Poland due to the inclusion of advanced hydrogen import terminals.

Table 5: Extra-EU import capacities via pipelines considered in the Advanced hydrogen infrastructure level and extra-EU supply potential for the assessed years (unit: GWh/d).

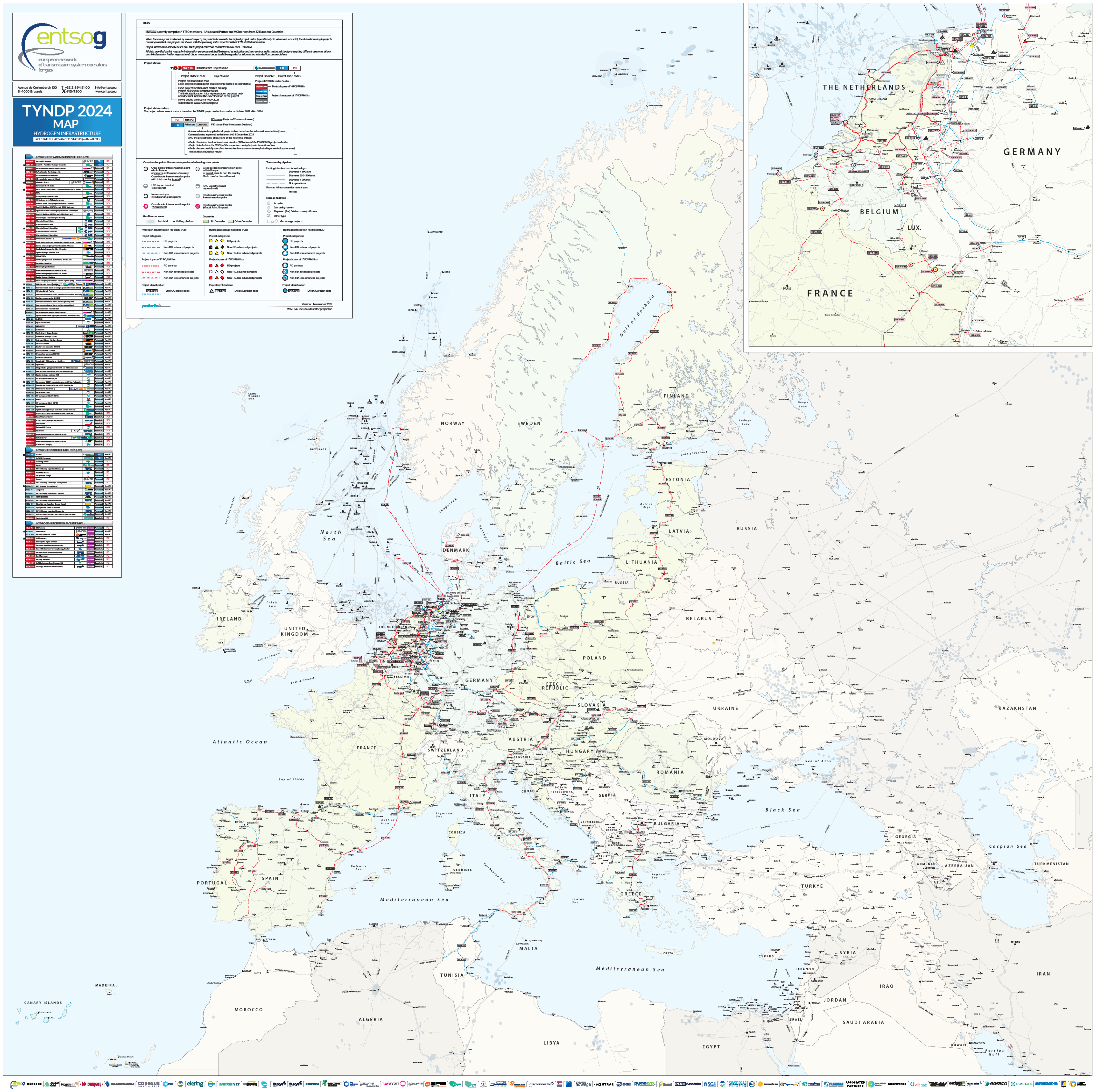
From Country	To Country	Hydrogen import capacity		Extra-EU hydrogen supply potential		Effective hydrogen import potential	
		2030	2040	2030	2040	2030	2040
Algeria	Italy	448.0	448.0	136.4	1318.4	136.4	448.0
Morocco	Spain	0.0	106.0	0.0	125.0	0.0	106.0
Norway	Germany	0.0	432.0	170.4	848.7	0.0	432.0
Ukraine	Slovakia	0.0	218.4	98.6	878.9	0.0	218.4

Table 6: Extra-EU import capacities via terminals considered in the advanced hydrogen infrastructure level and extra-EU supply potential by ship for the assessed years (unit: GWh/d).

Import capacities by ship to Country	2030	2040
Belgium	59.3	193.6
France	0.0	48.0

Germany	44.2	67.7
The Netherlands	136.3	222.6
Poland	17.7	17.7
Sum	257.5	549.6
Shipped supply potential	2030	2040
Extra-EU to EU	227.8	1561.0
Effective hydrogen import potential	2030	2040
Minimum of import capacities by ship and shipped supply potential	227.8	549.6

Figure 2: Representation of the Advanced hydrogen infrastructure level.



1.2. Infrastructure Gaps Identification (IGI) indicators

The analysis is performed for 2030 and 2040 as simulation years for the TYNDP 2024 National Trends+ scenario. It covers both hydrogen infrastructure levels. Thereby, three indicators are used to identify regional hydrogen infrastructure gaps. IGI indicator 1 and IGI indicator 2.1 thereby use a reference weather year (i.e., 1995), while IGI indicator 2.2 uses a stressful weather year (i.e., 2009). The application of these IGI indicators is explained in the following paragraphs. Additional justifications and examples are available in section 5 of TYNDP 2024 Annex D2.

The IGI indicators identify the existence of an infrastructure gap through the existence of effects of such infrastructure gap. The non-identification of a certain infrastructure gap may be related to the infrastructure considered in the infrastructure levels of the energy sectors considered in the models. The effect of this infrastructure gap is either expressed at a border for IGI indicator 1 (see section 1.2.1) or at a country for IGI indicators 2.1 and 2.2 (see section 1.2.2 and section 1.2.3).

The reason for an infrastructure gap is an infrastructure bottleneck. An infrastructure bottleneck is a physical congestion of the network that can be observed based on full utilization rates of all relevant transmission infrastructure during certain periods of time. As a limited cooperation mode is used among countries in situations of hydrogen scarcity (see section 3.2.4 of the TYNDP 2024 Annex D1), the dominant infrastructure bottleneck is not necessarily located at a border of the country through which the IGI indicators demonstrated the existence of an infrastructure gap (see examples in section 5 of TYNDP 2024 Annex D2). Also, besides the dominant bottleneck, non-dominant bottlenecks may exist at other locations that only unfold their effect once the dominant bottleneck is addressed. Additionally, an infrastructure bottleneck can in principle be solved by different projects and via different routes. Therefore, the infrastructure gaps identified by the IGI indicators identify regional infrastructure gaps, as the potential solution to it is not limited to the border of IGI indicator 1 or the country of IGI indicator 2. Potential solutions may in principle involve import projects, production projects, transmission projects, and storage projects.

1.2.1. IGI indicator 1: Hydrogen market clearing price spreads in DHEM

This IGI indicator aims at identifying hydrogen infrastructure gaps by assessing Zone 2 nodes of different countries based on differences in hydrogen market clearing prices between these nodes. Zone 2 nodes are areas of hydrogen production and/or storage and/or consumption within a country that are considered to be connected to the national hydrogen backbone. The hydrogen market clearing price spread is thereby based on the hourly hydrogen market clearing prices in the DHEM simulations. It is calculated for each combination of simulation year and hydrogen infrastructure level.

The hydrogen prices and flows in the DHEM are linked to the merit order of hydrogen supply options as well as hydrogen demand associated with end users' willingness to pay for hydrogen (i.e., WTP_{H2} as defined in TYNDP 2024 Annex D1). The merit order of hydrogen production has the following elements:

> **Hydrogen imports** have specific costs as defined in the TYNDP 2024 NT+ scenario;

- **Electrolytic hydrogen production** costs are linked to the price of the used electricity and the water price in the respective country as well as the process efficiency;
- **Hydrogen production from natural gas** within the EU is based on the TYNDP 2024 NT+ scenario and depends on the natural gas price, operating and maintenance costs, process efficiency, and Emissions Trading System (ETS) costs (thereby being differentiated between low-carbon and unabated hydrogen production from natural gas).

Especially the electrolytic hydrogen production thereby depends on the availability of RES and nuclear energy. Electrolysers that are connected to an electricity bidding zone or dedicated RES may be limited in their load factor by this availability. Also, the electricity price is subject to a merit order of electricity production as well as the end users' willingness to pay for electricity (e.g., VoLL). The electricity price is thereby influencing the cost of electrolytic hydrogen production.

As the DHEM aims at maximising the joint market rents in the electricity sector and in the hydrogen sector, it dispatches the European electricity and hydrogen supply options in an optimised way while respecting hard constraints like production and transport capacities. Thereby, the most expensive hydrogen supply source is usually defining the hydrogen market clearing price in a perfectly interconnected area. However, in case of hydrogen undersupply, the end users are competing for this supply up to their willingness to pay for hydrogen, thereby setting the hydrogen market clearing price at this level. From this dispatch of production options result hydrogen (and electricity) flows.

If countries are well connected, they share the same hydrogen market clearing price. If countries are not connected at all, the interdependency of their hydrogen market clearing prices is limited as these prices then depend on their own hydrogen supply options and hydrogen demand. A certain correlation may still be observed, e.g., due to one or several of the following reasons:

- The price and availability of electricity used for electrolytic hydrogen production may be correlated (e.g., due to similar weather conditions in these countries and/or sufficient cross-border capacity in the electricity system).
- The reliance on the same means of hydrogen production from natural gas may be correlated.
- The frequency of hydrogen demand curtailment may be correlated.

When countries are connected but the sum of connections between them is a bottleneck during certain periods of time, the hydrogen market clearing price is the same during periods of time when the interconnection is not acting as a bottleneck and is detached when the interconnection is acting as a bottleneck. Then, a limited price correlation can be observed. The less often the bottleneck is observed and the lower the resulting price spread during these periods of detachment is, the lower is the average price spread.

To define which hydrogen market clearing price spreads are a significant indication of a hydrogen infrastructure gap, one of the following thresholds must be passed:

- Threshold 1: This refers to a hydrogen market clearing price difference. It is calculated as the yearly average of the absolute hourly price differences between two Zone 2 nodes. The threshold is exceeded if this average difference is greater than 4 €/MWh.
- Threshold 2: A hydrogen market clearing price spread as the absolute average daily hydrogen market clearing price spread between two Zone 2 nodes of different countries of more than 20 €/MWh for more than 40 days per year.

If there is a hydrogen market clearing price spread above one of the thresholds, this indicates an infrastructure gap for the given assumptions.

More details are provided by TYNDP 2024 Annex D1 and TYNDP 2024 Annex D2.

1.2.2. IGI indicator 2.1: Curtailed hydrogen demand in DHEM and DGM for reference weather year

This IGI indicator identifies infrastructure gaps by measuring the hydrogen demand curtailments of individual nodes during the reference weather year (i.e., 1995), and without infrastructure or source disruptions. The following simulation logic is applied for each combination of simulation year and hydrogen infrastructure level:

1. A DHEM simulation is run with the reference weather year data (i.e., the same simulation is used for IGI indicator 1).
2. Certain DHEM outputs from step 1 that influence the natural gas demand, hydrogen production, and hydrogen consumption are transferred into the DGM (see sections 2.4.5 and 2.4.6 of the TYNDP 2024 Annex D1).
3. A DGM simulation is run on the basis of step 2.
4. Per node, the combined hydrogen demand curtailment from the DHEM simulation and the additional hydrogen demand curtailment from the DGM are provided.

To define which hydrogen demand curtailments are a significant indication of a hydrogen infrastructure gap, the following threshold must be passed:

- Threshold: A yearly average hydrogen demand curtailment rate of more than 0 %.

If there is a hydrogen demand curtailment above the threshold, this indicates an infrastructure gap for the given assumptions.

In this draft TYNDP 2024 IGI report, the IGI indicator 2.1 is only based on the hydrogen demand curtailment from the DHEM simulations.

1.2.3. IGI indicator 2.2: Curtailed hydrogen demand in DHEM and DGM for stressful weather year

This IGI indicator identifies infrastructure gaps by measuring the hydrogen demand curtailments of individual nodes under stressful weather conditions (i.e., 2009).

The following simulation logic is applied for each combination of simulation year and hydrogen infrastructure level:

1. A DHEM simulation is run with the stressful weather year data.
2. The DHEM outputs from step 1 that influence the natural gas demand, hydrogen production, and hydrogen consumption are transferred into the DGM (see sections 2.4.5 and 2.4.6 of the TYNDP 2024 Annex D1).
3. A DGM simulation is run on the basis of step 2.
4. Per node, the combined hydrogen demand curtailment from the DHEM simulation and the additional hydrogen demand curtailment from the DGM are provided.

To define which hydrogen demand curtailments are a significant indication of a hydrogen infrastructure gap, one of the following thresholds must be passed:

- Threshold 1: A yearly average hydrogen demand curtailment rate of more than 3%.
- Threshold 2: A hydrogen demand curtailment rate of more than 5% for at least one calendar month per year.

If there is a hydrogen demand curtailment above one of the thresholds, this indicates an infrastructure gap for the given assumptions.

In this draft TYNDP 2024 IGI report, the IGI indicator 2.2 is only based on the hydrogen demand curtailment from the DHEM simulations.

2. Disclaimers

The results of the TYNDP 2024 IGI report are only related to infrastructure gaps that are based on the considered infrastructure levels. Therefore, the TYNDP 2024 IGI report cannot find that an infrastructure that is part of the smallest considered infrastructure level (i.e., the PCI/PMI hydrogen infrastructure level) is not addressing any infrastructure gap. Therefore, all the projects constituting the PCI/PMI hydrogen infrastructure level are to be treated as equally and jointly necessary for addressing the infrastructure gaps considered in the analysis.

The results of the TYNDP 2024 IGI report are related to the assessed scenario (i.e., NT+) and years (i.e., 2030 and 2040).

The lines depicted in the grid flow maps are derived from simulations used to identify infrastructure gaps within the assessed infrastructure levels and assessed years. These indicative lines do not reflect ENTSOG's expectations on how the European network will evolve during the simulated years. The report's primary objective is to identify gaps, not to predict the development of European infrastructure neither the future flows. Additionally, many projects included in the TYNDP are not part of the analysed infrastructure levels. Their commissioning could complement network flows compared to those presented in the report and potentially address some of the identified infrastructure gaps.

The term *"bottleneck"* in this report refers to situations where two conditions are met: (1) the capacity is being utilized to its maximum potential, and (2) no alternative routes are available. When a capacity is identified as a bottleneck, it signals the need for potential enhancements to that capacity at the specific fully utilized route and/or the development of new projects following other interconnections.

No generic hydrogen infrastructure projects are used in this TYNDP 2024 IGI report. Instead, only real projects that were submitted by project promoters are considered.

The representation of grid flows in the maps of this report is based on a schematic representation from capital to capital.

All values that refer to the energy content of molecules (e.g., GWh/d, €/MWh or TWh/y) are stated in terms of their Gross Calorific Value (GCV) in this IGI report. For hydrogen, the conversion factor from NCV to GCV is 1.176.

3. Assessment for 2030

This section describes the evolution of the IGI indicators for the reference weather year (i.e., 1995) and the stressful weather year (i.e., 2009) for the analysed infrastructure levels (i.e., PCI/PMI and Advanced hydrogen infrastructure levels) for the simulation year 2030.

3.1. Infrastructure Gaps Identification

In 2030, the PCI/PMI hydrogen infrastructure level's extra-EU imports are limited to shipped imports through the PCI reception terminals in Belgium, Germany and the Netherlands. The overall contribution of shipped hydrogen imports are rather limited when compared to the overall EU hydrogen demand. Therefore, in this infrastructure level, European hydrogen demand is mostly met by indigenous production through electrolysis or hydrogen production using natural gas which are not enough to fully cover the hydrogen demand. Therefore, curtailed hydrogen demand is significant.

In 2030, in the Advanced hydrogen infrastructure level, Europe will receive imports also from North Africa contributing to the reduction of hydrogen demand curtailment via higher utilisation rates of interconnected supply corridors.

3.1.1. Assessment of PCI/PMI hydrogen infrastructure level

High-level results for reference weather year

The overall yearly demand-supply balance for the PCI/PMI hydrogen infrastructure level in 2030 for the reference weather year is presented in Table 7. As detailed in Table 7, electrolytic hydrogen production is the main source of hydrogen in Europe. This assessment results in an approximate share of 8.3% of hydrogen demand curtailment in Europe.

Table 7: Supply and demand balance in the PCI/PMI hydrogen infrastructure level in 2030 for reference weather year (unit: TWh/y).

Yearly hydrogen supply-demand balance	PCI/PMI IL
H_2 produced via electrolysis	310
H_2 produced using natural gas	229
H_2 shipped imports	29
H_2 pipeline imports	0
Curtailed H_2 demand	52
H_2 demand for power production	2
Total H_2 demand	620

Figure 3 shows the hydrogen production via electrolysis in the different European countries for the PCI/PMI hydrogen infrastructure level in the 2030 assessment. The countries with highest electrolytic hydrogen production are Spain, Finland, Sweden, and Germany. Some countries have more than one source of electrolytic hydrogen production. This is related to the intra-country assumptions, which can be summarized as it follows:

- Consideration of electrolytic hydrogen production from dedicated RES in Spain.
- Consideration of dedicated electrolytic production to satisfy regional hydrogen demand within the country (i.e., Zone 1). This is the case for Austria, Spain, Finland, Croatia, Ireland, Sweden, Slovenia, and the United Kingdom.
- Consideration of multiple production sub-zones within the main system of a country to reflect different geographical production areas and/or demand areas and/or storage areas stemming from internal transport bottlenecks. This is the case for Denmark, Italy, France, Finland, Sweden, and the United Kingdom.

Figure 3: Distribution of hydrogen production via electrolysis in the PCI/PMI hydrogen infrastructure level in 2030 for reference weather year (unit: GWh/y).

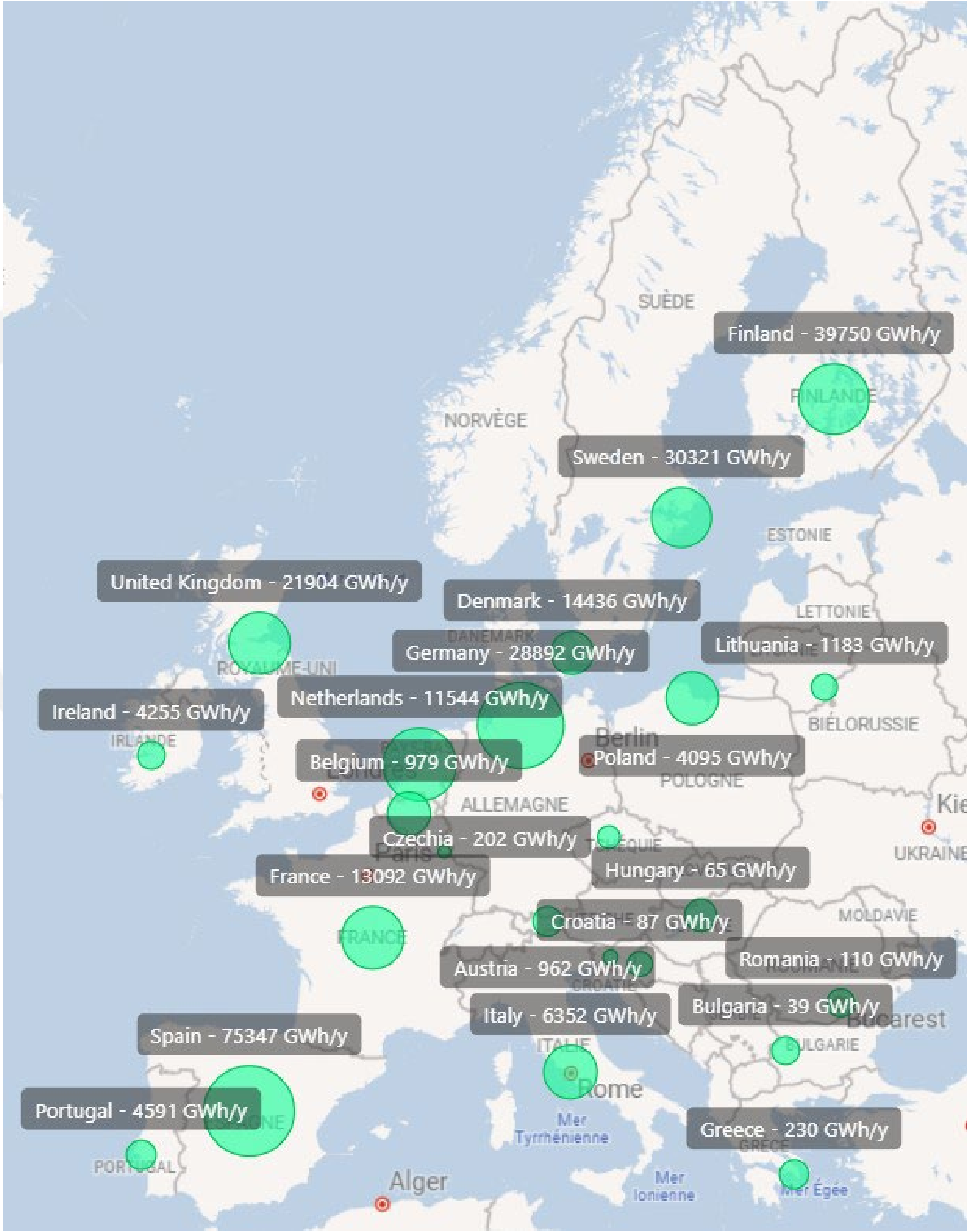


Figure 4: Distribution of hydrogen production from natural gas in the PCI/PMI hydrogen infrastructure level in 2030 for reference weather year (unit: GWh/y).

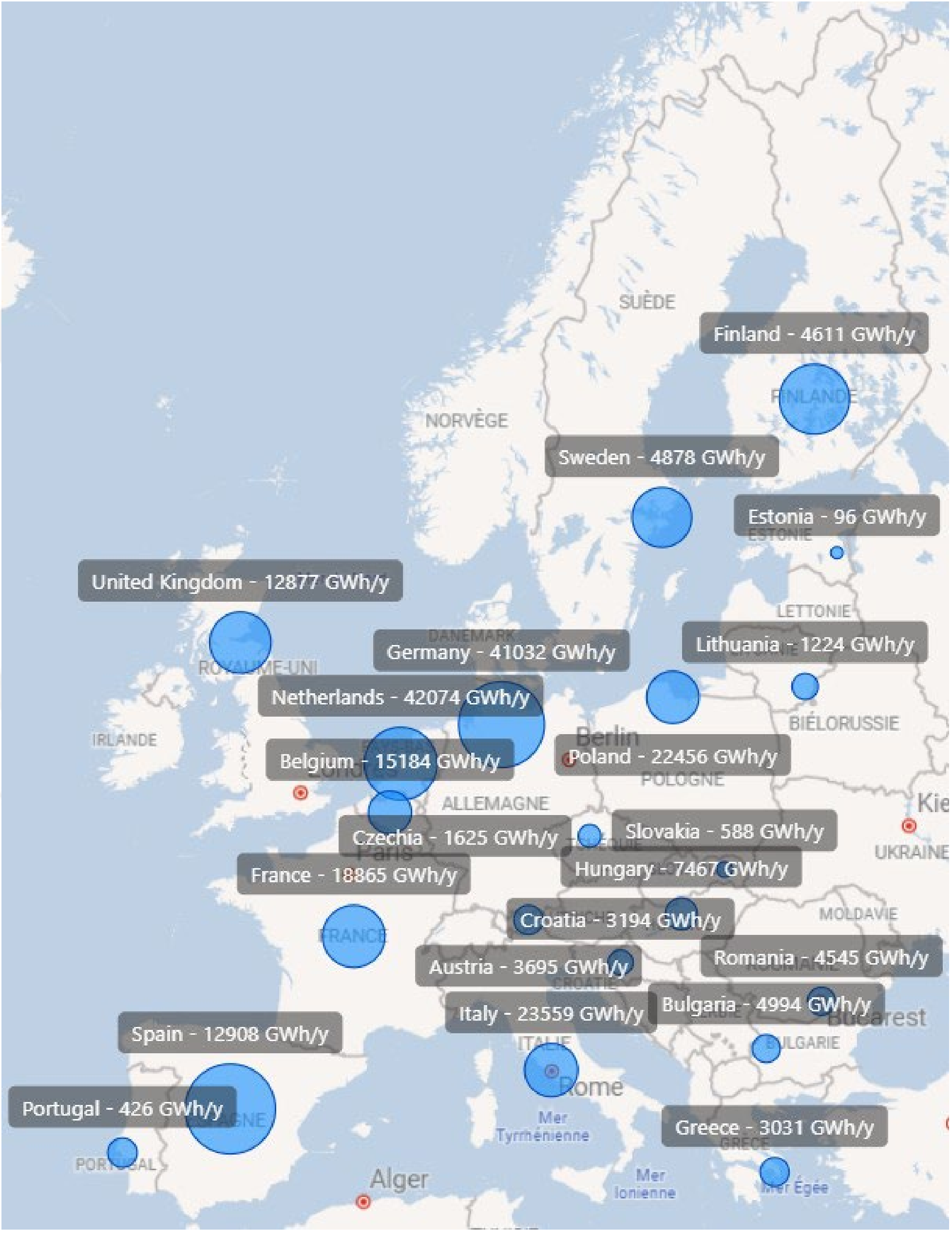


Table 8: Distribution of hydrogen production, demand and hydrogen imports per country in the PCI/PMI hydrogen infrastructure level in 2030 for reference weather year (unit: GWh/y).

Country	**H_2 Production** via electrolysis	**H_2 Production** using natural gas	**H_2 extra-EU imports** by pipeline & ship	**H_2 demand**

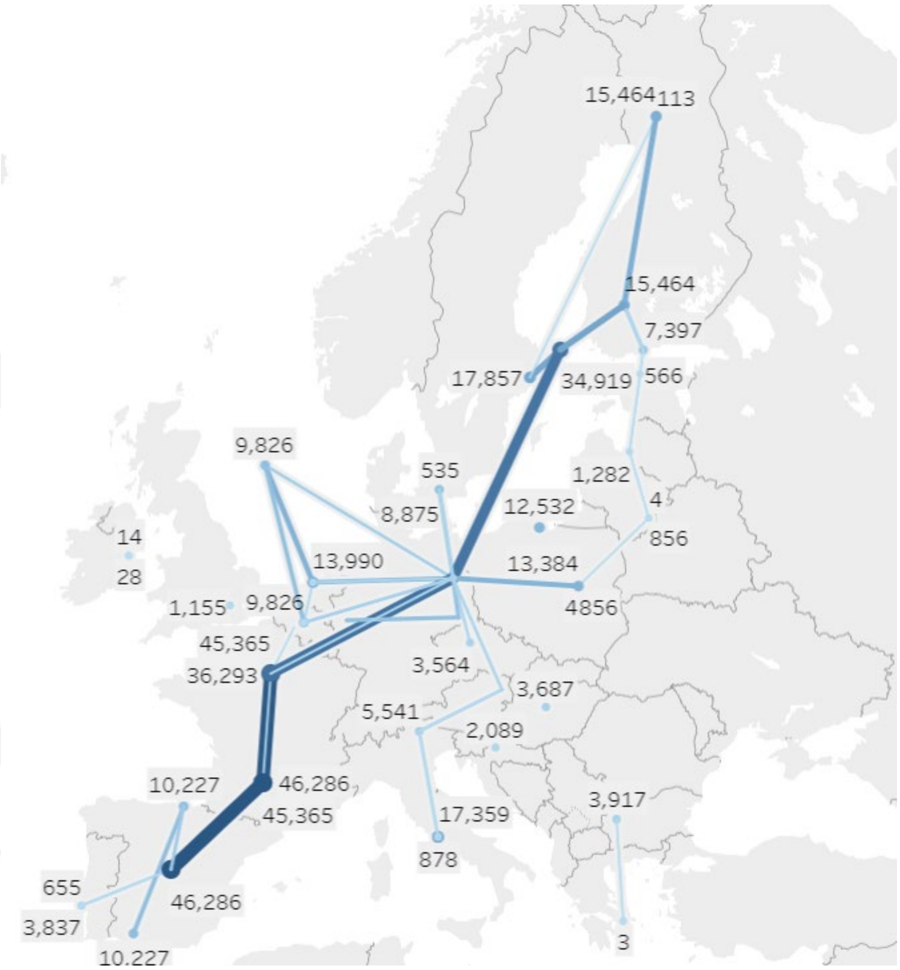
AT	961	3695	0	10901
BE	1042	15184	9793	30970
BG	34	4994	0	3768
CZ	197	1625	0	6849
CY	0	0	0	329
DE	30267	41032	5255	154829
DK	14975	0	0	13241
EE	0	96	0	540
ES	75690	12908	0	61128
FI	39880	4611	0	34184
FR	13799	18865	0	47735
GR	226	3031	0	6482
HR	76	3194	0	3283
HU	207	7467	0	9312
IE	4253	0	0	6222
IT	6921	23559	0	26504
LT	1200	1224	0	3977
LU	168	0	0	2695
LV	0	0	0	997
MT	0	0	0	284
NL	11916	42074	13943	59194
PL	4098	22456	0	52416
PT	4639	426	0	2922
RO	608	4545	0	12359
SE	30552	4878	0	23107
SI	291	0	0	1544
SK	0	588	0	2767
UK	21867	12877	0	41537

Intra-EU cross-border flows emerge between different European countries due to limitations of available supplies and associated costs. Figure shows these flows.

Two main transport corridors emerge in the PCI/PMI hydrogen infrastructure level in the 2030 assessment, one from the Iberian Peninsula towards Germany through France and one from Nordic countries to Germany. This result is explained by the fact that these corridors are connecting countries with high availability of supply with other countries where hydrogen supplies might be limited or more expensive.

In addition, among the interconnected countries within the PCI/PMI hydrogen infrastructure level, Germany shows the highest demand and at the same time enables transport of supply to its neighbouring countries, acting as a hydrogen hub.

Figure 5: Grid flows(*) in the PCI/PMI hydrogen infrastructure level in 2030 for reference weather year (unit: GWh/y).



(*) Grid flows refer to simulations results and do not intend to represent how the European infrastructure is expected to evolve in the simulated years, being just outcomes of a modelling tool. The values are provided as a table in Annex II and as monthly values in Annex III.

In the 2030 PCI/PMI hydrogen infrastructure level assessment for the reference weather year, countries can be grouped in four different categories according to their supply-demand balance on a yearly basis:

1. Countries that export more than they import: Sweden, Finland, Denmark, Italy, Spain, Portugal and Bulgaria.
2. Countries that import more than they export: Belgium, Poland, Czechia, Greece, Lithuania.
3. Transit countries that import more than they consume: Germany, Austria, France, Belgium , The Netherlands, Estonia, Latvia and Lithuania.

4. Isolated countries: the United Kingdom, Ireland, Luxembourg, Hungary, Romania, Slovakia, Slovenia, Croatia, Malta, Cyprus, Switzerland[8] and the cluster Bulgaria-Greece.

While on a yearly basis some countries are net exporters and some countries are net importers, net exporters may be relying on net imports during certain shorter periods of time and net importers may be providing net exports during certain shorter periods of time. This can result in bidirectional flows at interconnections. This situation is caused by the seasonality of electrolytic hydrogen production and to some extent by the seasonality of hydrogen demand.

High-level results for stressful weather year

The overall yearly demand-supply balance for the PCI/PMI hydrogen infrastructure level in 2030 for the stressful weather year is presented in Table 9. As detailed in Table 9, electrolytic hydrogen production is the main source of hydrogen in Europe but it is reduced in comparison with the reference weather year. This assessment results in an approximate share of 11.1% of curtailed hydrogen demand at European level. This represents an increase by 3 percentage points in comparison with the reference weather year.

Table 9: Supply and demand balance in the PCI/PMI hydrogen infrastructure level in 2030 for stressful weather year (unit: TWh/y).

Yearly hydrogen supply-demand balance	PCI/PMI IL
H_2 produced via electrolysis	270
H_2 produced using natural gas	245
H_2 shipped imports	36
H_2 pipeline imports	0
Curtailed H_2 demand	69
H_2 demand for power production	2
Total H_2 demand	619

Figure 6 shows the hydrogen production via electrolysis in the different European countries for the PCI/PMI hydrogen infrastructure level in the 2030 assessment. The countries with highest electrolytic hydrogen production are Spain, Finland, Sweden, and Germany. Some countries have more than one source of electrolytic hydrogen production. This is related to the intra-country assumptions, which is explained in section 3.1.1.

[8] IGI report does not consider hydrogen demand in Switzerland (based on TYNDP 2024 Draft Scenario report). However, there is no hydrogen infrastructure connecting Switzerland to any of its European neighbouring countries in the assessed infrastructure levels.

Figure 6: Distribution of hydrogen production via electrolysis in the PCI/PMI hydrogen infrastructure level in 2030 for stressful weather year (unit: GWh/y).

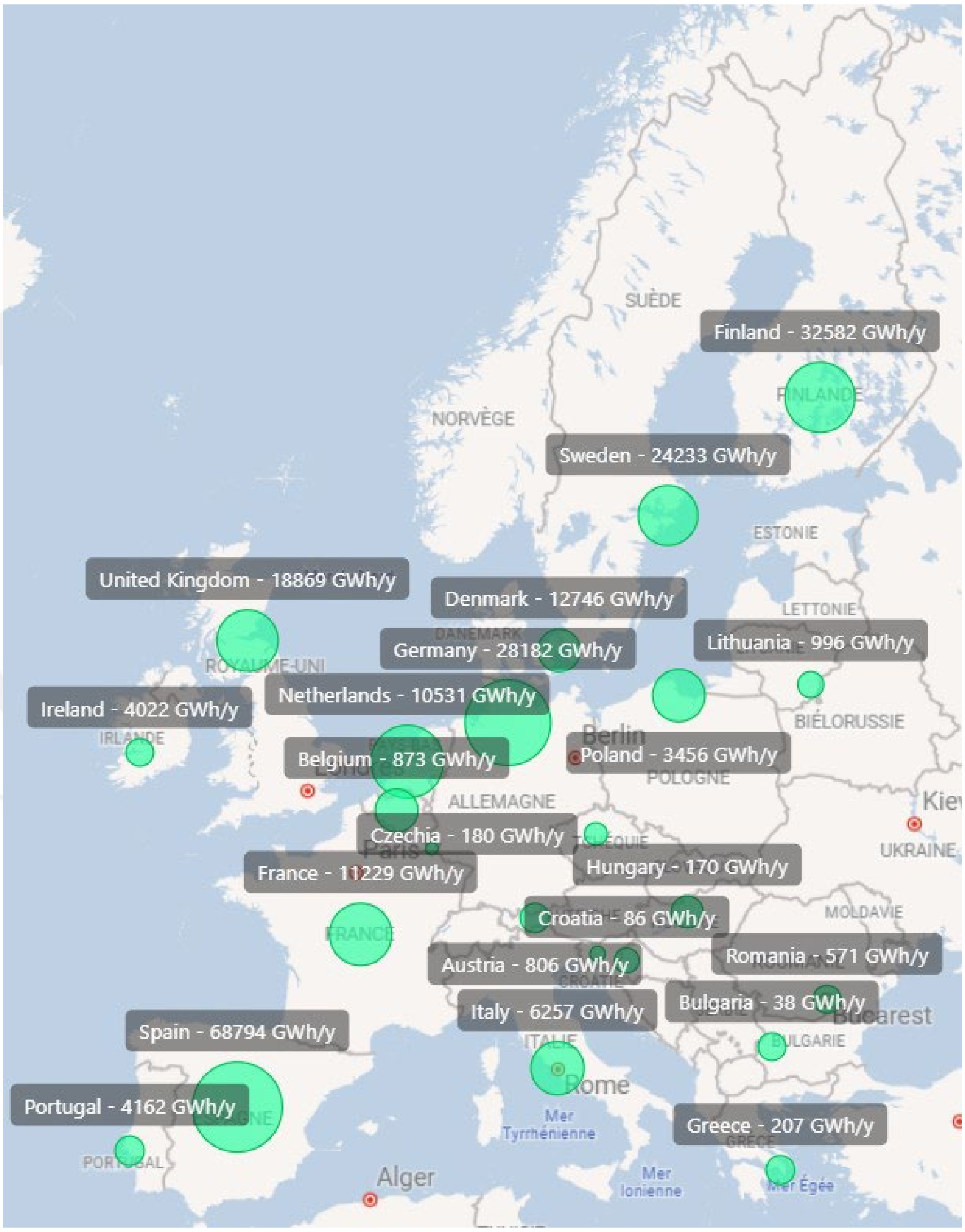


Figure 7: Distribution of hydrogen production from natural gas in the PCI/PMI hydrogen infrastructure level in 2030 for stressful weather year (unit: GWh/y).

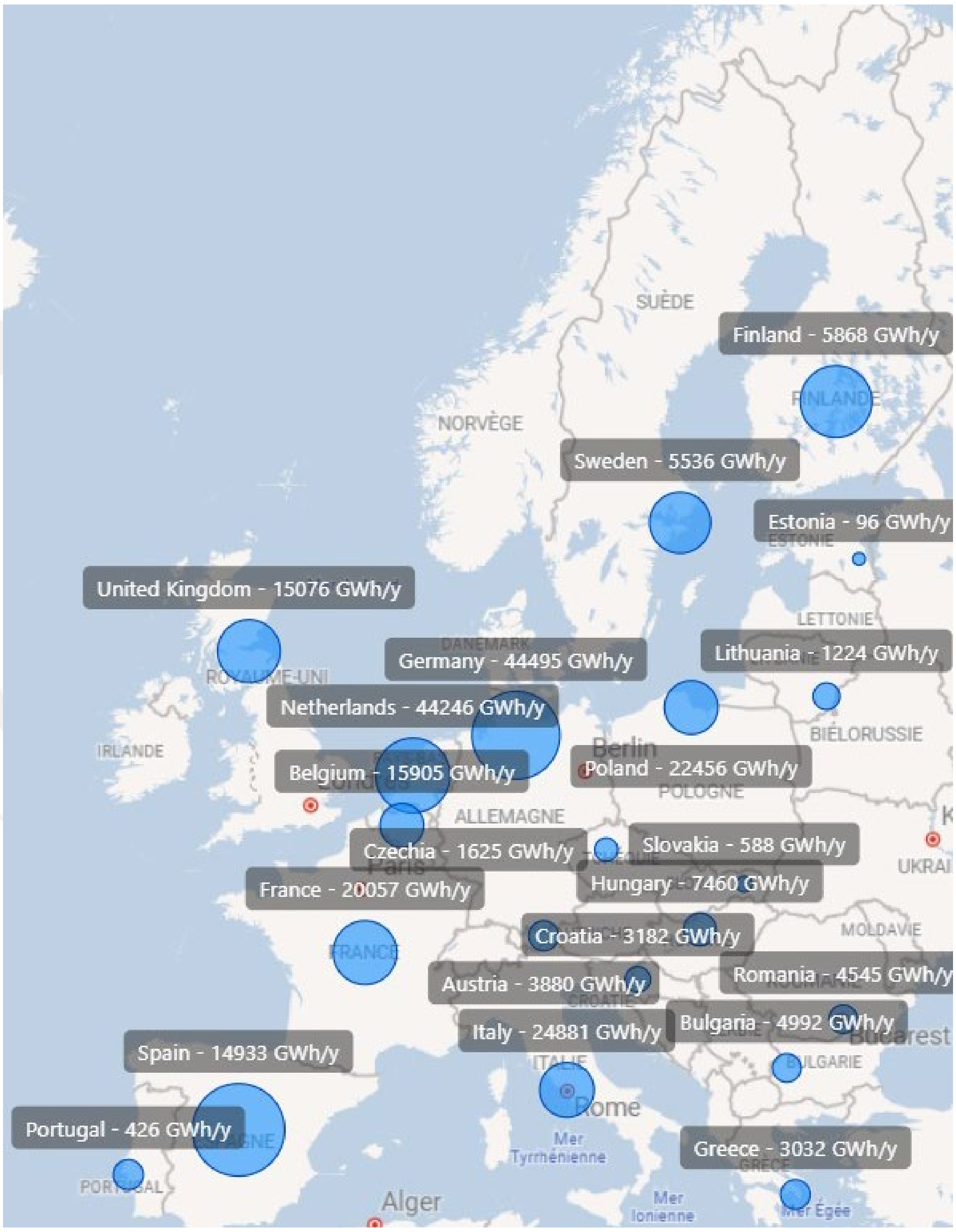


Table 10: Distribution of hydrogen production per country in the PCI/PMI hydrogen infrastructure level in 2030 for stressful weather year (unit: GWh/y).

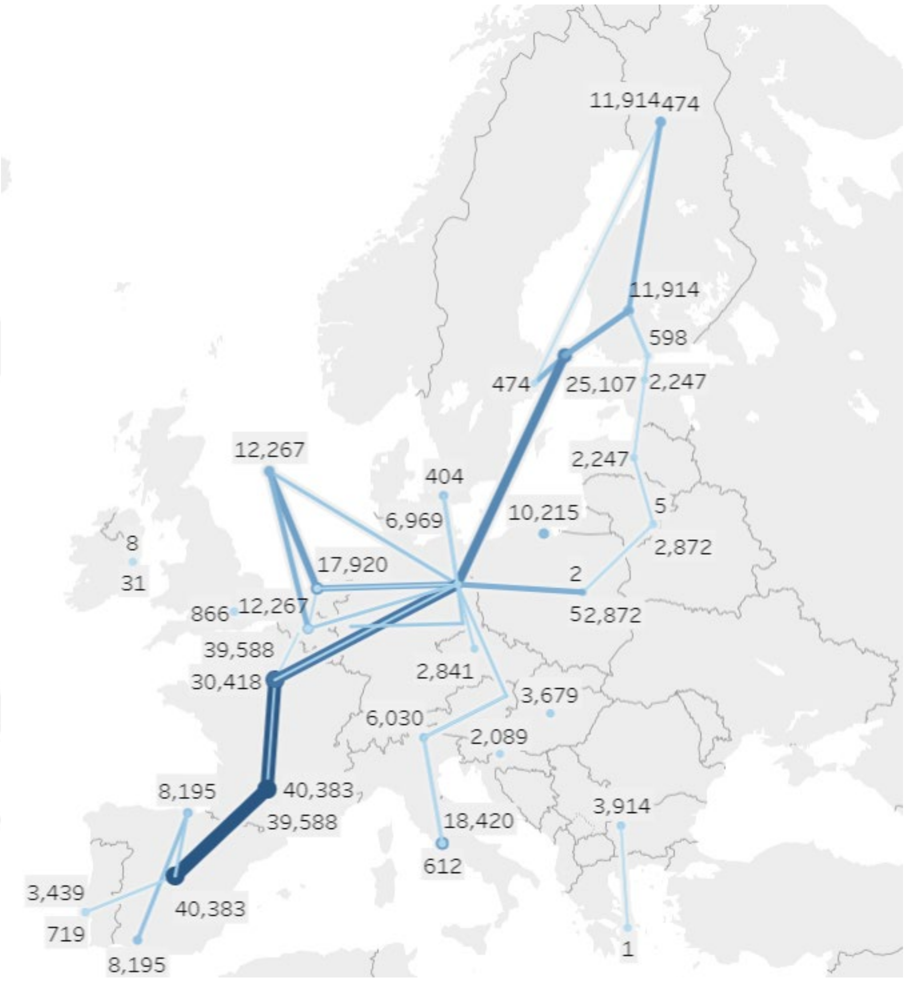
Country	H_2 Production via electrolysis	H_2 Production using natural gas	H_2 extra-EU imports by pipeline & ship	H_2 demand
AT	806	3880	0	10901
BE	873	15905	12226	30970

BG	38	4992	0	3768
CH	0	0	0	0
CZ	180	1625	0	6849
CY	0	0	0	329
DE	28182	44495	6548	154501
DK	12746	0	0	13241
EE	0	96	0	540
ES	68794	14933	0	61128
FI	32582	5868	0	34184
FR	11229	20057	0	47735
GR	207	3032	0	6482
HR	86	3182	0	3283
HU	170	7460	0	9312
IE	4022	0	0	6222
IT	6257	24881	0	26504
LT	996	1224	0	3977
LU	147	0	0	2695
LV	0	0	0	997
MT	0	0	0	284
NL	10531	44246	17859	59020
PL	3456	22456	0	52271
PT	4162	426	0	2922
RO	571	4545	0	12359
SE	24233	5536	0	23107
SI	257	0	0	1544
SK	0	588	0	2767
UK	18869	15076	0	41537

Intra-European cross-border flows emerge between different European countries due to limitations of available supplies and associated costs. Figure 8 shows resulting yearly average flows under stressful weather conditions.

In comparison with the reference weather year, the export from countries that to a large extent base their hydrogen production on RES is reduced. This reduces the usage of the Iberian and of the Nordic corridor. At the same time, the import terminals must be used to a higher extent, increasing exports of countries and regions with such terminals. Germany maintains its role as hydrogen hub. Despite the overall reduction of electrolytic hydrogen production, under stressful weather conditions the countries with the highest electrolytic hydrogen production follow the same distribution as in the PCI/PMI hydrogen infrastructure level in 2030 for the reference weather year.

Figure 8: Grid flows(*) in the PCI/PMI hydrogen infrastructure level in 2030 for stressful weather year (unit: GWh/y).



(*) Grid flows refer to simulations results and don't intend to represent how the European infrastructure is expected to evolve in the simulated years, being just outcomes of a modelling tool. The values are provided as a table in Annex II and as monthly values in Annex III).

In the 2030 PCI/PMI hydrogen infrastructure level assessment for the stressful weather year, countries can be grouped in four different categories according to their supply-demand balance on a yearly basis:

1. Countries that export more than they import: Sweden, Finland, Denmark, Italy, Spain, Portugal.
2. Countries that import more than they export: Poland, Czechia, Greece, Lithuania.
3. Transit countries that import more than they consume: Germany, Austria, France, Belgium, The Netherlands, Estonia, Latvia, and Lithuania.

4. Isolated countries: the United Kingdom, Ireland, Luxembourg, Hungary, Romania, Slovakia, Slovenia, Croatia, Malta, Cyprus, Switzerland[9] and the cluster Bulgaria-Greece.

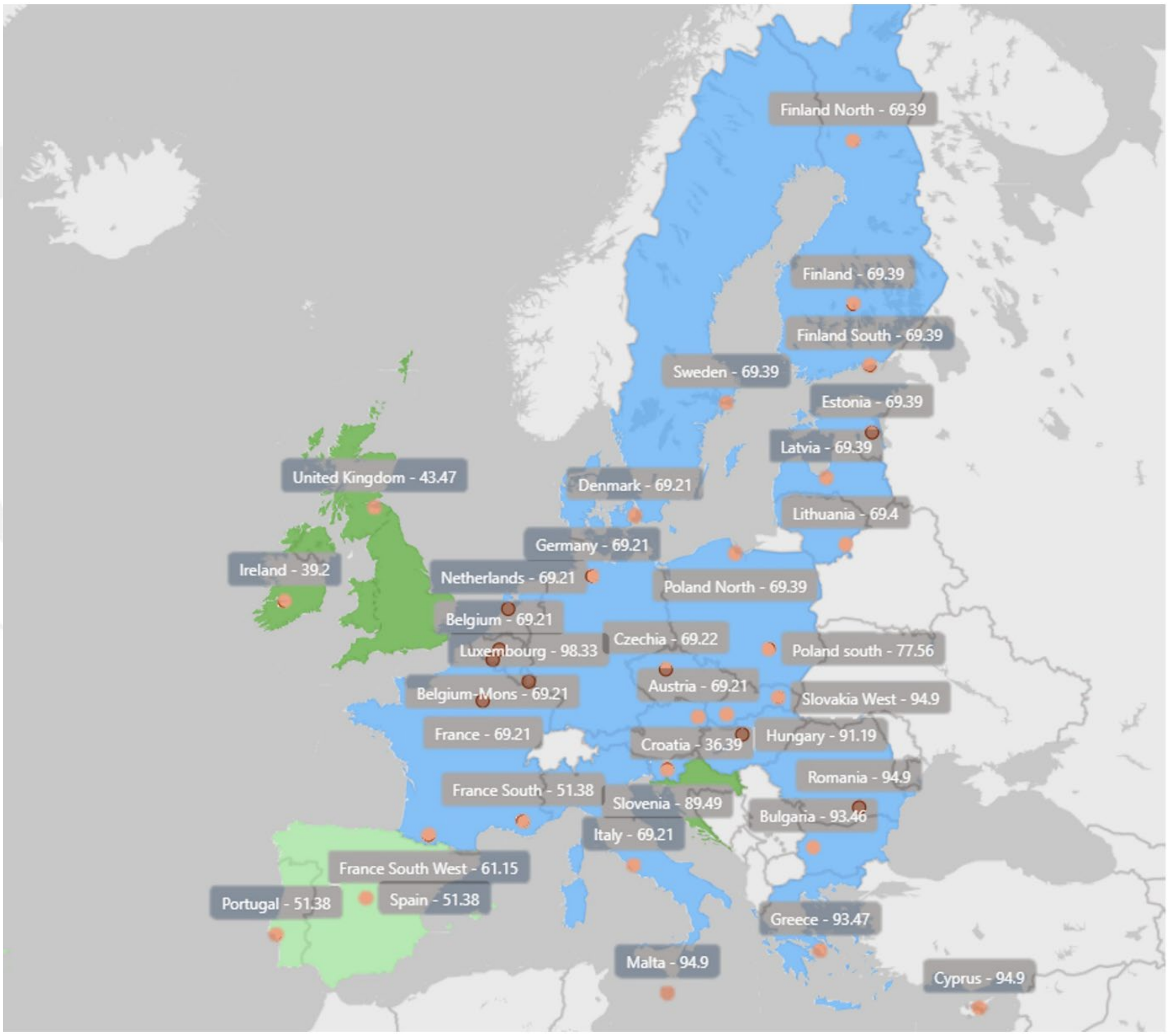
While on a yearly basis some countries are net exporters and some countries are net importers, net exporters may be relying on net imports during certain shorter periods of time and net importers may be providing net exports during certain shorter periods of time. This can result in bidirectional flows at interconnections. This situation is caused by the seasonality of electrolytic hydrogen production and to some extent by the seasonality of hydrogen demand.

[9] IGI report does not consider hydrogen demand in Switzerland (based on TYNDP 2024 Draft Scenario report). However, there is no hydrogen infrastructure connecting Switzerland to any of its European neighbouring countries in the assessed infrastructure levels.

3.1.1.1. IGI indicator 1: Hydrogen market clearing price spreads for reference weather year

Overview: Hydrogen market clearing prices per country

Figure 9 : Average of the hourly hydrogen market clearing prices per country in the PCI/PMI hydrogen infrastructure level in 2030 (unit: €/MWh).



The price formation in the DHEM is based on the merit order of hydrogen production (see section 1.2.1). Several price groups stand out, while a signification correlation is understood here as a correlation above 0.7:

1. Portugal, Spain, France-South region: Portugal and Spain are producers and net exporters of electrolytic hydrogen from RES to other countries. While the France-South region is sufficiently connected to the Iberian Peninsula, price spreads appear with other groups of countries due to

an internal bottleneck in France. The prices in this group show a significant correlation with the prices in groups 2, 3 and 4.

2. France-Southwest region: Local undersupply and isolated from other French regions. The prices in this group show significant correlations with prices in groups 1, 3 and 4.
3. Belgium, the Netherlands, Denmark, Germany, Czechia, Austria, Italy: Well interconnected countries that as group have own import terminals and national hydrogen production and are in the centre of two main supply corridors. The prices in this group show a nearly perfect correlation with the prices in group 4 and a significant correlation with the prices in groups 1 and 2.
4. Sweden, Finland, Estonia, Latvia and Lithuania: Composed of net exporting countries Sweden and Finland as well as countries that are well interconnected without bottlenecks. The prices are very similar to the prices in group 3 as the bottlenecks between the two groups play a minor role. The prices in this group show a nearly perfect correlation with the prices in group 3 and a significant correlation with the prices in groups 1 and 2.
5. Ireland, the United Kingdom, Croatia, Poland-South region: Isolated (regions of) countries without significant price correlations but with average prices below 100 €/MWh.
6. Greece, Bulgaria: Countries showing significant price correlation, jointly isolated from the other European countries.
7. Slovenia, Hungary, Romania, Luxembourg, Cyprus, Slovakia, Malta: Isolated countries without significant price correlations (except for Hungary and Slovenia due to a similar national hydrogen production constellation) and with average prices above 100 €/MWh.

The price correlations listed above are enabled by the infrastructure projects already considered in this hydrogen infrastructure level. However, price differences that led to the identification of the groups listed above are not necessarily describing an infrastructure gap. For this identification of infrastructure gaps, the thresholds of IGI indicator 1 are used.

Hydrogen market clearing price spreads

If one of the two thresholds of IGI indicator 1 is passed, a regional hydrogen infrastructure gap is assumed to be identified (see section 1.2.1). Table 11 lists the borders for which Threshold 1 and/or Threshold 2 were passed. In this case, both thresholds were always passed at the same borders.

Table 11: List of borders in the PCI/PMI hydrogen infrastructure level that exceed (at least one of) the thresholds defined for IGI indicator 1 in 2030.

Border	Threshold 1: Absolute average hourly hydrogen market clearing price spread above 4 €/MWh	Threshold 2: More than 40 days with hydrogen market clearing price spread above 20 €/MWh
DEh2-PLh2S	26	169

FRh2-FRh2S	26	168
FRh2-FRh2SW	12	66
FRh2S-FRh2SW	19	99
HUh2-ATh2	32	233
HUh2-HRh2	80	365
HUh2-ROh2	5	43
HUh2-SKh2E	5	43
ITh2-HRh2	50	293
NLh2-UKh2	42	228
PLh2N-PLh2S	25	167
PLh2S-CZh2	26	169
PLh2S-SKh2E	25	143
SIh2-HRh2	78	364
SKh2E-PLh2S	25	143
SKh2W-ATh2	38	266
SKh2W-CZh2	38	266
UKh2-BEh2	42	228
UKh2-IEh2	19	111

3.1.1.2. IGI indicator 2.1: Hydrogen demand curtailment for reference weather year

As explained in section 1.2.2, this IGI indicator assesses infrastructure gaps by quantifying hydrogen demand curtailments at individual nodes during the reference weather year, assuming no disruptions of infrastructures or of supply sources. It involves a multi-step simulation process integrating DHEM and DGM[10] outputs to evaluate the combined curtailments across nodes. The assessment is performed for the PCI/PMI hydrogen infrastructure level in 2030.

Figure 10 and Table 12 show yearly average curtailment rates of hydrogen demand in the Zone 2 nodes of different European countries. For countries where the hydrogen market is divided into several sub-zones (i.e., nodes), the curtailment rate in the different sub-zones is presented. The yearly average hydrogen curtailment rates are thereby colour-coded in the map to indicate levels relative to the set threshold: blue signifies curtailment above the threshold, while green represents rates that are not above it.

[10] This draft TYNDP 2024 IGI report only includes the simulation results of the DHEM.

Figure 10: Yearly average hydrogen demand curtailment rate at country/sub-zone level in the PCI/PMI hydrogen infrastructure level in 2030 for reference weather year (unit: %).

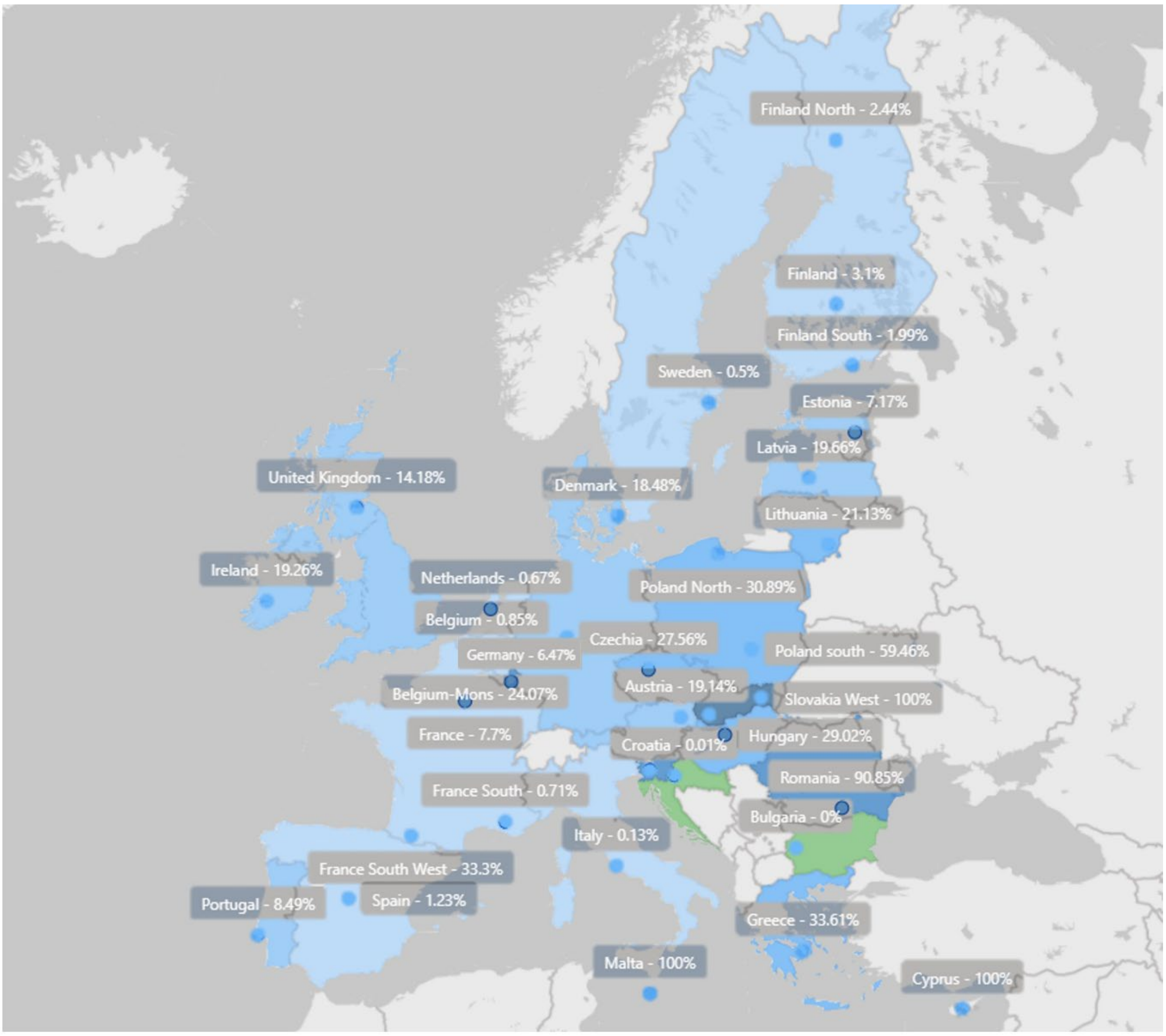


Table 12: Yearly average hydrogen demand curtailment rate at country/sub-zone level in the PCI/PMI hydrogen infrastructure level in 2030 for reference weather year and check of the threshold of IGI indicator 2.1 (unit: %).

H_2 Demand Zone	Yearly average curtailment rate (%)	Threshold passed
ATh_2	19.1	YES
BEh_2	0.9	YES
BEh_2Mo	24.1	YES
BGh_2	0.0	NO
CYh_2	100.0	YES

CZh2	27.6	YES
DEh2	6.5	YES
DKh2	18.5	YES
EEh2	7.2	YES
ESh2	1.2	YES
FIh2	3.1	YES
FIh2N	2.4	YES
FIH2S	2.0	YES
FRh2	7.7	YES
FRh2S	0.7	YES
FRh2SW	33.3	YES
GRh2	33.6	YES
HRh2	0.0	NO
HUh2	29.0	YES
IEh2	19.3	YES
ITh2	0.1	YES
LTh2	21.1	YES
LUh2	92.7	YES
LVh2	19.7	YES
MTh2	100.0	YES
NLh2	0.7	YES
PLh2N	30.9	YES
PLh2S	59.5	YES
PTh2	8.5	YES
ROh2	90.9	YES
SEh2	0.5	YES
SIh2	76.7	YES
SKh2E	100.0	YES
SKh2W	100.0	YES
UKh2	14.2	YES

In the 2030 assessment of the PCI/PMI hydrogen infrastructure level, hydrogen demand is curtailed all over Europe. However, differences in the hydrogen curtailment rates between nodes are related to the level of infrastructure development and supply availability.

As explained in the description of the PCI/PMI hydrogen infrastructure level (see section 1.1 and Figure 1), with limited availability of extra-EU supplies, hydrogen demand is satisfied mainly with electrolytic hydrogen production and hydrogen production from natural gas. Countries with higher availability of supply from those sources or from imports show lower curtailment rates. Only Bulgaria and Croatia hydrogen demand is completely undisrupted and the hydrogen demand curtailment in Italy is very low. All other countries including strong net exporters face (weather-induced) disruptions. In comparison with IGI indicator 1, this IGI indicator focusses on the availability of supplies.

As detailed in Table 12, (regions of) countries can be aggregated in six different groups according to their average yearly hydrogen demand curtailment rates:

1. Rates below 0.1%: Bulgaria, Croatia.
2. Rates between 0.1% and 5%: Italy, Belgium, Finland, France-South region, the Netherlands, Spain, Sweden.
3. Rates between 5% and 20%: France, Austria, Denmark, Estonia, Germany, Ireland, Latvia, Portugal, the United Kingdom.
4. Rates between 20% and 50%: Belgium-Mons region, Czechia, France-Southwest region, Hungary, Lithuania, Poland-North region, Greece.
5. Rates between 50% and 100%: Slovenia, Romania, Poland-South region, Luxembourg.
6. Full curtailment of 100%: Slovakia, Cyprus, Malta.

Without the infrastructure already considered in the hydrogen infrastructure level, the overall hydrogen demand curtailment would be higher.

All countries of group 1 have high shares of hydrogen produced from natural gas to cover national demand.

Among the countries of group 2, Spain, Sweden and Finland receive a significant share of their supply from national electrolytic hydrogen production, while Belgium, and the Netherlands, have access to extra-EU import capacities. The France-South region benefits from potential supplies from the Iberian Peninsula but also from other parts of France. At the same time, while the average demand curtailment is comparably low, all relevant nodes at certain hours of the year hit very high curtailment rates between 84% in Spain, 89% in Germany, and 100% in the other nodes.

Among the countries of group 3, some countries like Denmark, Portugal, the United Kingdom and Ireland, despite having significant electrolytic hydrogen production compared to the national demand, still cannot cover all demand when RES are not available. In the case of Denmark and Portugal, being peripheric countries, their neighbouring countries (i.e., Germany and Spain) can help to mitigate demand curtailment, whereas in the case of the United Kingdom and Ireland, being isolated from Europe leads to higher curtailment rates. Among the countries of group 3, some countries such as Austria, Estonia, Germany and Latvia, despite being well interconnected, show demand curtailment mainly due to the limited availability of supplies for the EU in general that are then rather consumed closer to the location of production or import. For France, different curtailment rates are observed between the different hydrogen nodes. The France-Southwest region is the area with higher curtailment (i.e., 33.3%) as it is isolated and strictly depends on local production. Between the other two demand nodes in France (i.e., France and France-South regions) there is 7% of difference in the demand curtailment due to privileged access of the France-South region to supply from the Iberian Peninsula.

Among the countries of group 4, some countries like Czechia and Lithuania show high curtailment rates (i.e., 27.6% and 21.1%), despite being connected to Germany, in case of Czechia and other Baltic Sea countries, in case of Lithuania. This is because both countries need significant imports from their neighbouring countries to satisfy demand while the neighbouring countries at certain periods of time do not have access to surplus supplies for export. In addition, national production in Lithuania represents a higher share of the demand in comparison with the Czech Republic. Greece shows a curtailment rate of 33.3%, which can be explained by the fact that despite being interconnected with Bulgaria, both countries are isolated from the rest of Europe (see section 1.1 and Figure 1). Lastly, the Belgium-Mons region is designed to be an individual cluster only connected to France (Valenciennes production cluster) and not interconnected to the remaining Belgian grid in the PCI/PMI hydrogen infrastructure level in 2030. Due to this isolated situation, curtailment is significantly higher (i.e., 24.1%) than in the rest of the country (i.e., 0.9%).

Group 5 includes countries with very high curtailment rates of up to nearly 100%. All the countries in this group are fully isolated and rely on national hydrogen supplies, mainly produced from natural gas. This is also the case for the Poland-South region that shows a curtailment rate of almost 60%, whereas the Poland-North region has a curtailment rate of around 31% due to higher hydrogen generation in that region.

Group 6 includes only isolated countries that have hydrogen demand but no national hydrogen production assets connected to Zone 2.

In Denmark, Finland, Ireland, Sweden, and Slovenia, on top of the hydrogen demand curtailments observed in Zone 2 nodes as described in the paragraphs above, hydrogen demand curtailments can be observed in Zone 1. While these curtailments are limited to a few months in Sweden and Finland, it is of relevance in every month in Ireland and reaches up to 86% in December in Denmark and up to 96% in December in Slovenia.

3.1.1.3. IGI indicator 2.2: Hydrogen demand curtailment for stressful weather year

Threshold 1: Average yearly hydrogen demand curtailment rate above 3 %

Figure 11 and Table 13 show the yearly average hydrogen demand curtailment rates in the Zone 2 nodes of various European countries for 2030, simulated under a stressful weather year. This weather scenario assumes adverse conditions, such as reduced wind and solar energy availability, which directly impacts hydrogen production. For countries with hydrogen markets divided into multiple sub-zones (i.e., nodes), curtailment rates are depicted individually for each sub-zone on the map. The yearly average hydrogen curtailment rates are thereby colour-coded to indicate levels relative to the set threshold 1: blue signifies curtailment above the threshold, while green represents rates that are not.

Figure 11: Yearly average hydrogen demand curtailment rate at country or node level in the PCI/PMI hydrogen infrastructure level in 2030 for stressful weather year (unit: %).

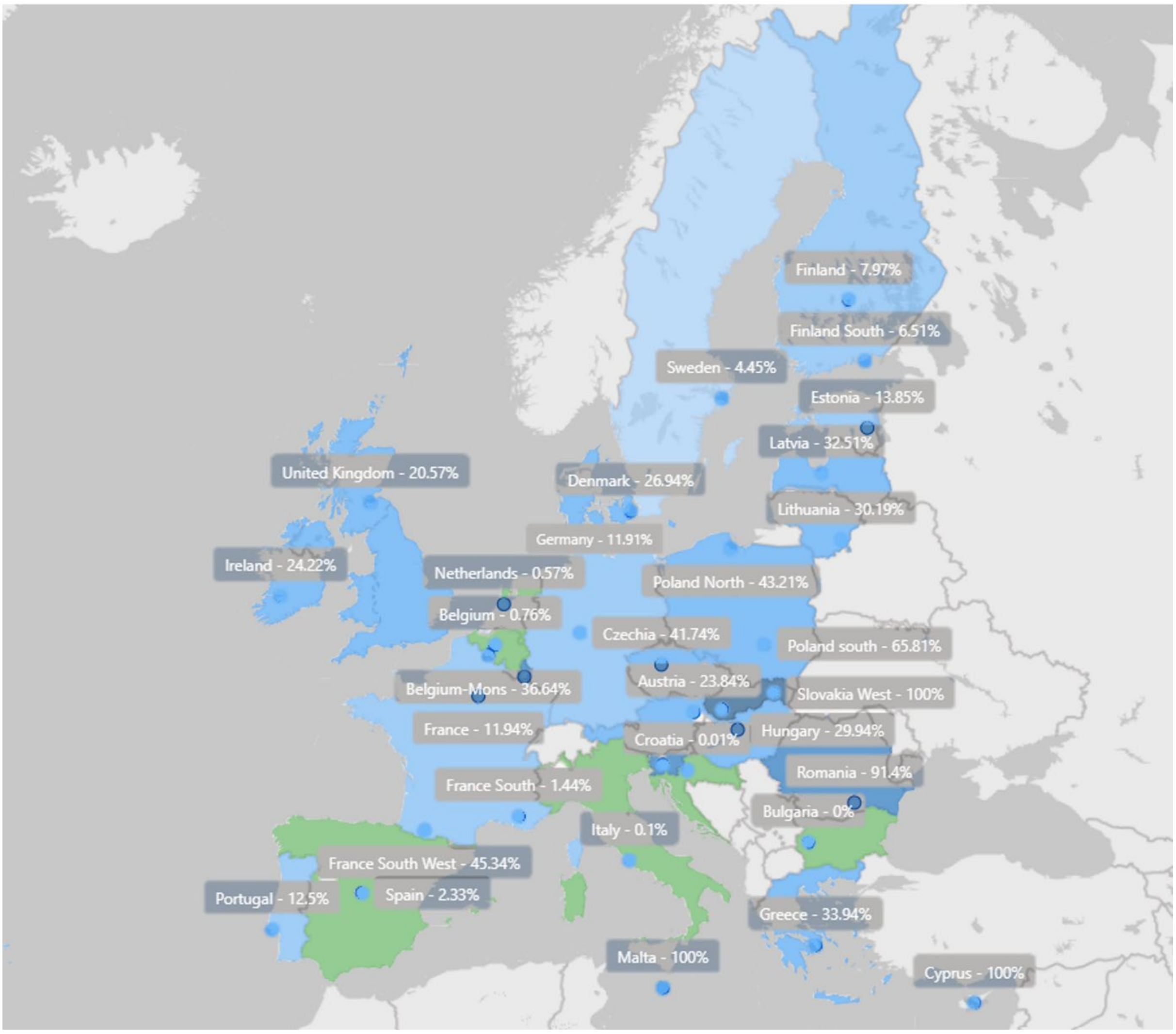


Table 13: Yearly average hydrogen demand curtailment rate at country/sub-zone level in the PCI/PMI hydrogen infrastructure level in 2030 for stressful weather year and check of threshold 1 of IGI indicator 2.2 (unit: %).

Country Node	Average yearly hydrogen demand curtailment (%)	Threshold 1 passed?
ATh2	23.84	YES
BEh2	0.76	NO
BEH2Mo	36.64	YES
BGh2	0	NO

CYh2	100	YES
CZh2	41.74	YES
DEh2	11.91	YES
DKh2	26.94	YES
EEh2	13.85	YES
ESh2	2.33	NO
FIh2	7.97	YES
FIh2N	7.71	YES
FIh2S	6.51	YES
FRh2	11.94	YES
FRh2S	1.44	NO
FRh2SW	45.34	YES
GRh2	33.94	YES
HRh2	0.01	NO
HUh2	29.94	YES
IEh2	24.22	YES
ITh2	0.1	NO
LTh2	30.19	YES
LUh2	93.59	YES
LVh2	32.51	YES
MTh2	100	YES
NLh2	0.57	NO
PLh2N	43.21	YES
PLh2S	65.81	YES
PTh2	12.5	YES
ROh2	91.4	YES
SEh2	4.45	YES
SIh2	79.46	YES
SKh2E	100	YES
SKh2W	100	YES
UKh2	20.57	YES

As detailed in Table 13, countries can be aggregated in different groups according to their average yearly hydrogen demand curtailment rates:

1. Rates below 3%: France-South region, Spain, the Netherlands, Croatia, Italy, Belgium, Bulgaria.
2. Rates between 3% and 20%: Sweden, Portugal, France, France-North region, Finland, Estonia, Germany.
3. Rates above 20% and below 50%: Belgium-Mons, Latvia, Lithuania, Ireland, Hungary, Greece, Denmark, Czechia, Austria, Poland North.
4. Rates above 50% and below 100%: Slovenia, Romania, Poland South, Luxembourg.
5. Full curtailment of 100 %: Slovakia, Cyprus, Malta.

Based on Table 13, the countries that have a yearly average hydrogen demand curtailment rate below 3% in the stressful weather year are Spain, France-South region, the Netherlands, Croatia, Italy, Belgium, and Bulgaria.

The second group of countries includes Sweden, Portugal, France, the France-North region, Finland, Estonia, and Germany. These nations exhibit demand curtailment rates exceeding the defined threshold 1 but remaining at or below 20%. This trend can be attributed to the composition of the composition of their hydrogen production means. For instance, Sweden, with a demand curtailment rate of 4.95%, leverages a substantial share of wind and hydropower, ensuring greater stability in its hydrogen supply. Finland is comparable to Sweden, while France demonstrates a 12% demand curtailment rate, where its reliance on nuclear energy mitigates dependence on fluctuating climatic conditions, enhancing supply availability. Germany benefits from its proximity to multiple supply options as it is in the centre of the Iberian and the Nordic corridor, has own import terminals, and has access to terminals in neighbouring countries.

The third group encompasses Belgium-Mons, Latvia, Lithuania, Ireland, Hungary, Greece, Denmark, Czechia, and Austria. This cohort includes countries like Greece (33.94%) and Denmark (26.94%) alongside others such as Czechia and Ireland, which face challenges stemming from their relative isolation within the hydrogen production and distribution topology. Geographic and infrastructural isolation increases reliance on domestically produced hydrogen, particularly from RES. Furthermore, dependency on imports from a single connected country—similarly affected by climatic stress—limits the availability of external hydrogen supplies. In such cases, countries prioritize domestic needs over exports, further constraining the import options for these isolated or peripheric regions.

The fourth group contains Slovenia, Romania, Poland and Luxembourg that show annual average hydrogen demand curtailment rates that exceed 50% but remain below 100% under the stressful weather year. The high curtailment rate observed in Luxembourg can be primarily attributed to the absence of interconnections with the neighbouring countries in the PCI/PMI hydrogen infrastructure level in combination with low national hydrogen production options. In Poland, which is divided into a northern region and a southern region, the southern region experiences notably higher curtailment rates under the stressful weather year due to lower hydrogen generation in the Poland-South region than in the Poland-North region. This disparity arises also due to a lack of sufficient PCI infrastructure which, combined with intensified weather impacts, significantly limits the ability to meet hydrogen demand. Romania and Slovenia also encounter substantial curtailments. In both countries, limited infrastructure in the PCI/PMI hydrogen infrastructure level in 2030 results in considerable hydrogen demand curtailment, regardless of weather variability. Consequently, while weather conditions play a role, they are not the primary factor in the persistently high curtailment rates observed in these countries.

Full demand curtailment under the stressful weather year has been identified for Slovakia, Malta and Cyprus, as has been the case for the reference weather year. These countries are fully isolated in the

PCI/PMI hydrogen infrastructure level in 2030 and have no national hydrogen production assets connected to Zone 2.

Threshold 2: hydrogen demand curtailment rate of more than 5 % for at least one month per year

All the countries and regions that exceed threshold 1 also exceeded threshold 2.

3.1.2. Assessment of Advanced hydrogen infrastructure level

High-level results for reference weather year

In 2030, compared to the PCI/PMI hydrogen infrastructure level, the advanced infrastructure level considers several new infrastructures (see section 1.1.2): Besides a connection between Algeria and Italy, Slovakia, Hungary and Romania are connected to Germany, Poland and Czechia instead of being isolated.

The overall yearly demand-supply balance for the advanced infrastructure level in 2030 for the reference weather year is presented in Table 14. As detailed in Table 14, electrolytic hydrogen production is the main source of hydrogen in Europe. This assessment results in an approximate share of 4.3% of hydrogen demand curtailment in Europe. This is a significant decrease compared to the curtailment rate of 8.3% for the PCI/PMI hydrogen infrastructure level. Thereby, electrolytic hydrogen production, hydrogen production from natural gas and imports via terminals are all slightly reduced on yearly average as Algerian supply is partially replacing these supplies due to the merit order besides decreasing the hydrogen demand curtailment.

Table 14: Supply and demand balance in the Advanced hydrogen infrastructure level in 2030 for reference weather year (unit: TWh/y).

Yearly hydrogen supply-demand balance	Advanced IL
H_2 produced via electrolysis	304
H_2 produced using natural gas	224
H_2 shipped imports	24
H_2 pipeline imports	42
Curtailed H_2 demand	27
H_2 demand for power production	2
Total H_2 demand	620

Figure 12 shows the hydrogen production via electrolysis in the different European countries for the Advanced hydrogen infrastructure level in the 2030 assessment. The countries with highest electrolytic hydrogen production are Spain, Finland, Sweden, and Germany. Some countries have more than one source of electrolytic hydrogen production. This is related to the intra-country assumptions, which is explained in section 3.1.1.

Figure 12: Distribution of hydrogen production via electrolysis in the Advanced hydrogen infrastructure level in 2030 for reference weather year (unit: GWh/y).

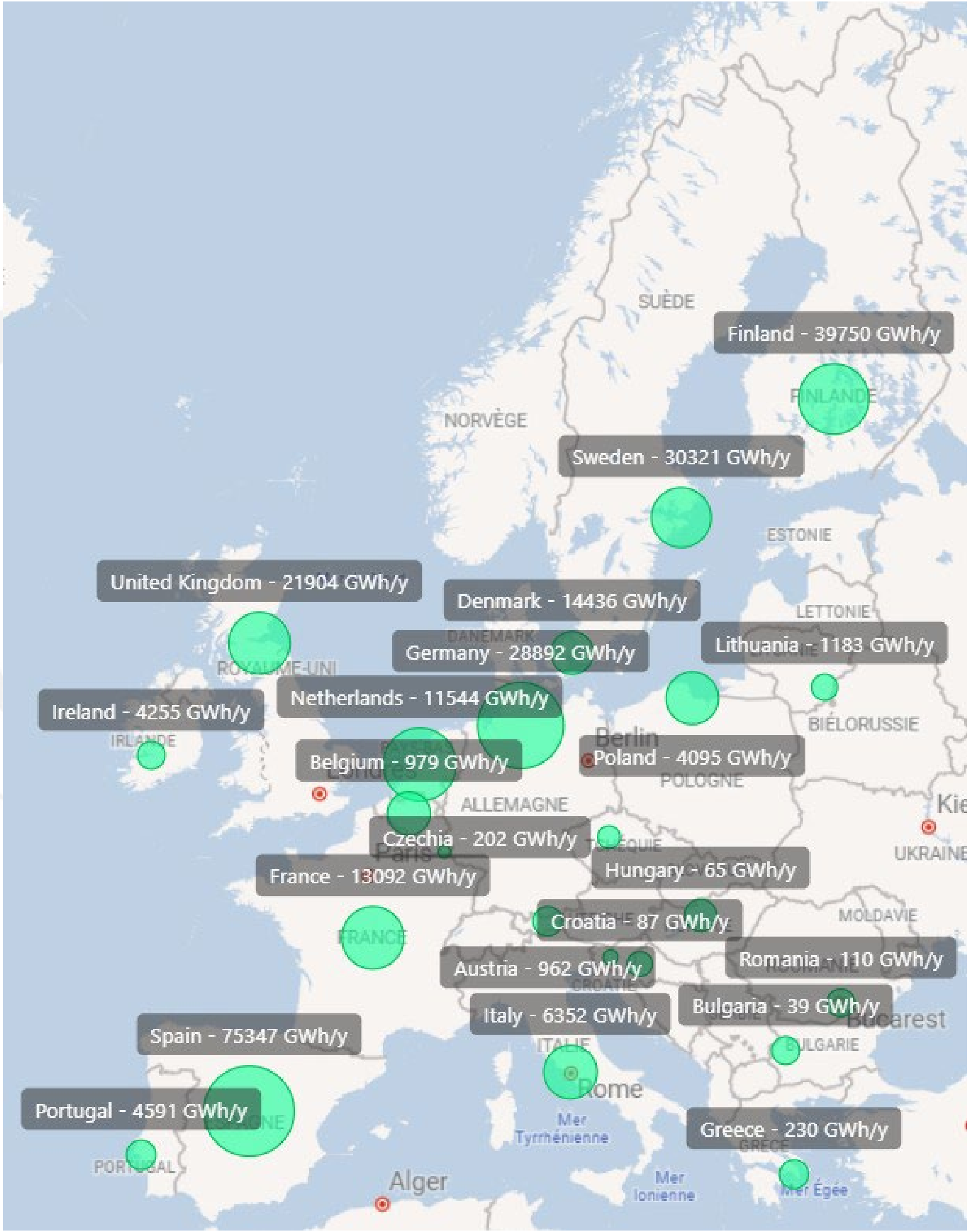


Figure 13: Distribution of hydrogen production from natural gas in the advanced infrastructure level in 2030 for reference weather year (unit: GWh/y).

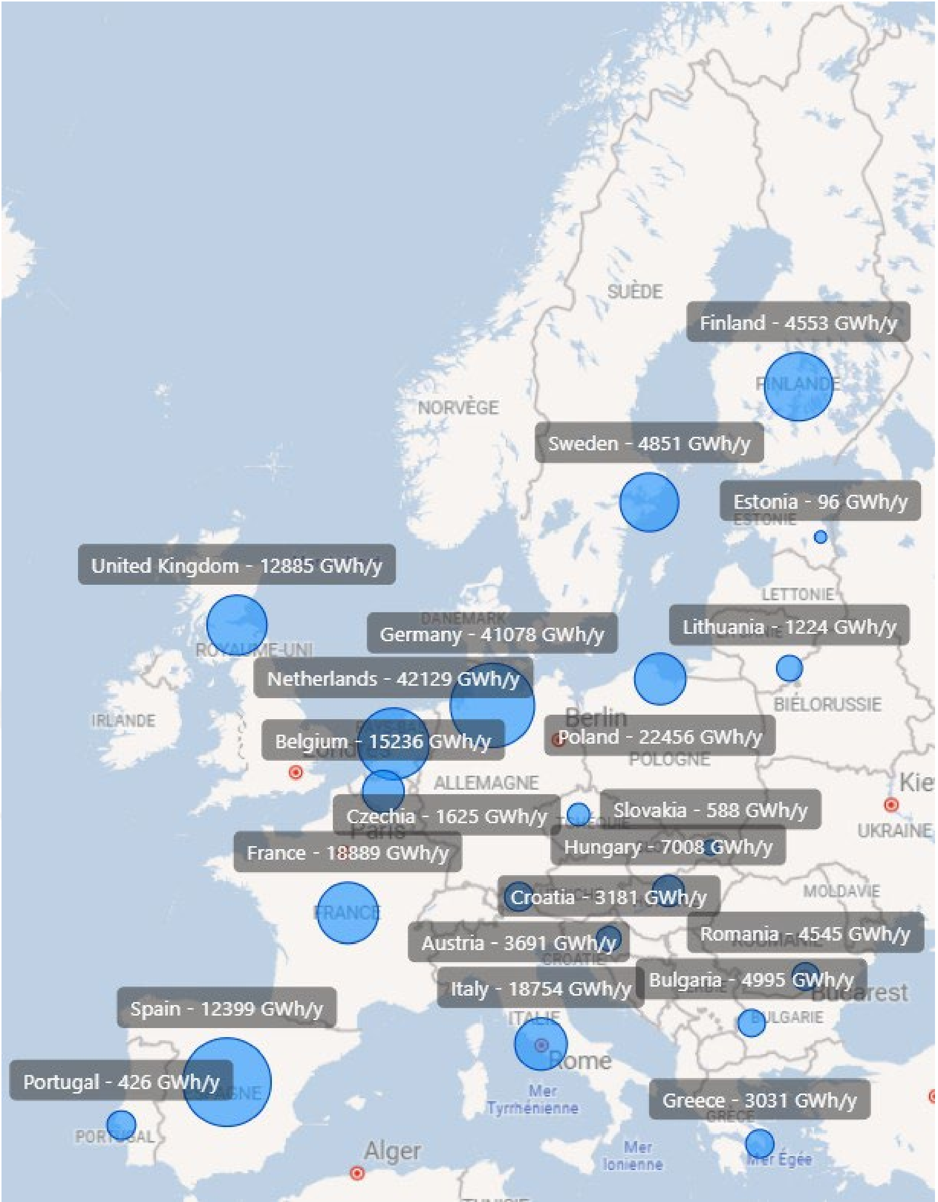


Table 15: Distribution of hydrogen production, demand and hydrogen imports per country in the Advanced hydrogen infrastructure level in 2030 for reference weather year (unit: GWh/y).

Country	H_2 Production via electrolysis	H_2 Production using natural gas	H_2 extra-EU imports by pipeline & ship	H_2 demand
AT	962	3691	0	10901
BE	979	15236	5057	30970
BG	39	4995	0	3768
CZ	202	1625	0	6849
CY	0	0	0	329
DE	28892	41078	5443	154844
DK	14436	0	0	13241
EE	0	96	0	540
ES	75347	12399	0	61128
FI	39750	4553	0	34184
FR	13092	18889	0	47735
GR	230	3031	0	6482
HR	87	3181	0	3283
HU	65	7008	0	9312
IE	4255	0	0	6222
IT	6352	18754	41799	26504
LT	1183	1224	0	3977
LU	172	0	0	2695
LV	0	0	0	997
MT	0	0	0	284
NL	11544	42129	10392	59245
PL	4095	22456	2633	52434
PT	4591	426	0	2922
RO	110	4545	0	12359
SE	30321	4851	0	23107
SI	279	0	0	1544
SK	0	588	0	2767
UK	21904	12885	0	41537

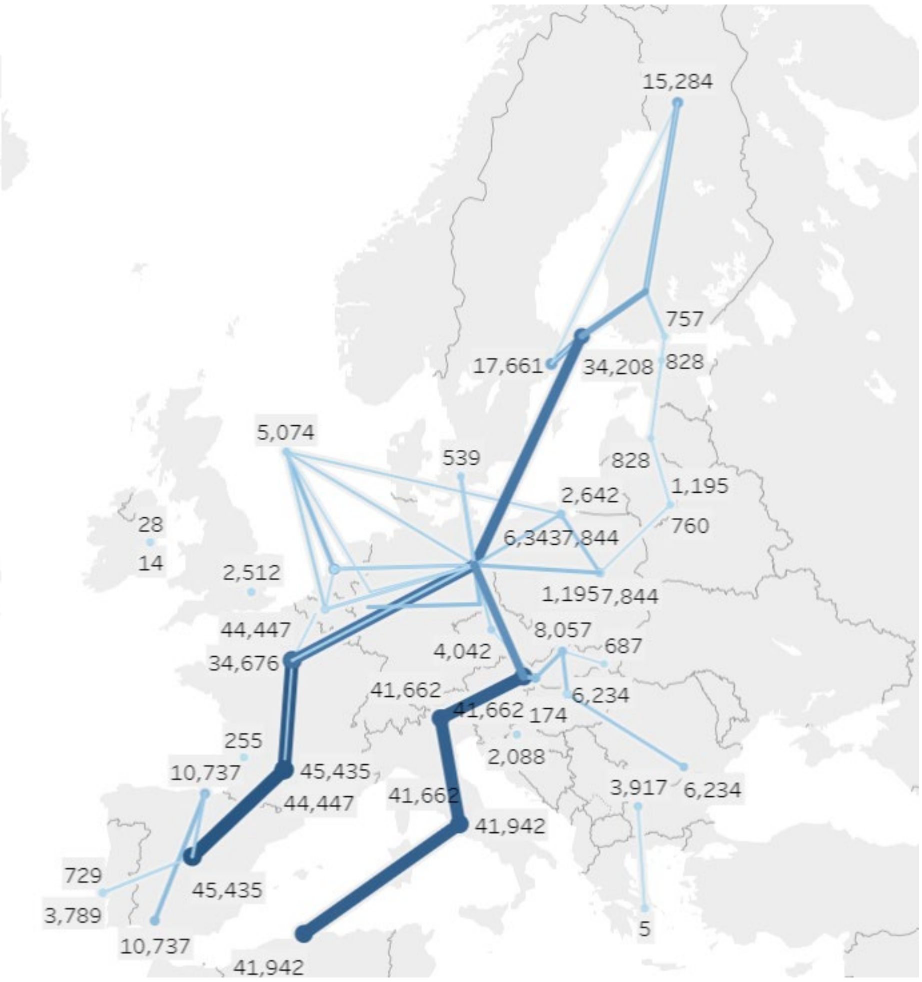
Intra-EU cross-border flows emerge between different European countries due to limitations of available supplies and associated costs. Figure 14 shows these flows.

Compared to the PCI/PMI hydrogen infrastructure level, which contains the Iberian and the Nordic corridor, a new main corridor emerged in the advanced infrastructure level:

> North African corridor, transporting e.g. Algerian supplies to Italy, Austria, Germany and other countries.

In addition, among the interconnected countries within the advanced infrastructure level, new interconnections with Slovakia, Hungary and Romania enable new flows to these countries from German/Czechian and Austrian hubs.

Figure 14: Grid flows(*) in the advanced infrastructure level in 2030 for reference weather year (GWh/y).



(*) Grid flows refer to simulations results and don't intend to represent how the European infrastructure is expected to evolve in the simulated years, being just outcomes of a modelling tool. The values are provided as a table in Annex II and as monthly values in Annex III).

In the 2030 Advanced infrastructure level assessment countries can be grouped in four different categories according to their supply-demand balance on a yearly basis:

1. Countries that export more than they import: Sweden, Finland, Denmark, Spain, Portugal and Bulgaria.
2. Countries that import more than they export: Poland, Czechia, Greece, Romania and Belgium.

3. Transit countries that import more than they consume: Germany, Italy, Austria, France, Netherlands, Estonia, Latvia, Lithuania, Slovakia, Hungary.
4. Isolated countries: The United-Kingdom, Ireland, Luxembourg, Slovenia, Croatia, Malta, Cyprus, Switzerland[11] and the cluster Bulgaria-Greece.

In comparison with the PCI/PMI hydrogen infrastructure level, Italy will change from exporting role to transit country due to the availability of North African supplies. In addition, Slovakia, Romania and Hungary could overcome isolation, and Austria changed from group 2 to group 3.

While on a yearly basis some countries are net exporters and some countries are net importers, net exporters may be relying on net imports during certain shorter periods of time and net importers may be providing net exports during certain shorter periods of time. This can result in bidirectional flows at interconnections. This situation is caused by the seasonality of electrolytic hydrogen production and to some extent by the seasonality of hydrogen demand.

High-level results for stressful weather year

The overall yearly demand-supply balance for the Advanced hydrogen infrastructure level in 2030 for the stressful weather year is presented in Table 16. As detailed in Table 16, electrolytic hydrogen production is the main source of hydrogen in Europe but it is reduced in comparison with the reference weather year and is partially compensated by increase used of SMR. This assessment results in an approximate share of 6.1% of curtailed hydrogen demand at European level. This represents an increase by 2 percentage points in comparison with the reference weather year.

Table 16: Supply and demand balance in the advanced infrastructure level in 2030 for stressful weather year (unit: TWh/y).

Yearly hydrogen supply-demand balance	Advanced IL
H_2 produced via electrolysis	265
H_2 produced using natural gas	241
H_2 shipped imports	35
H_2 pipeline imports	42
Curtailed H_2 demand	38
H_2 demand for power production	2
Total H_2 demand	620

[11] IGI report does not consider hydrogen demand in Switzerland (based on TYNDP 2024 Draft Scenario report). However, there is no hydrogen infrastructure connecting Switzerland to any of its European neighbouring countries in the assessed infrastructure levels.

Figure 15: Distribution of hydrogen production via electrolysis in the advanced infrastructure level in 2030 for stressful weather year (unit: GWh/y).

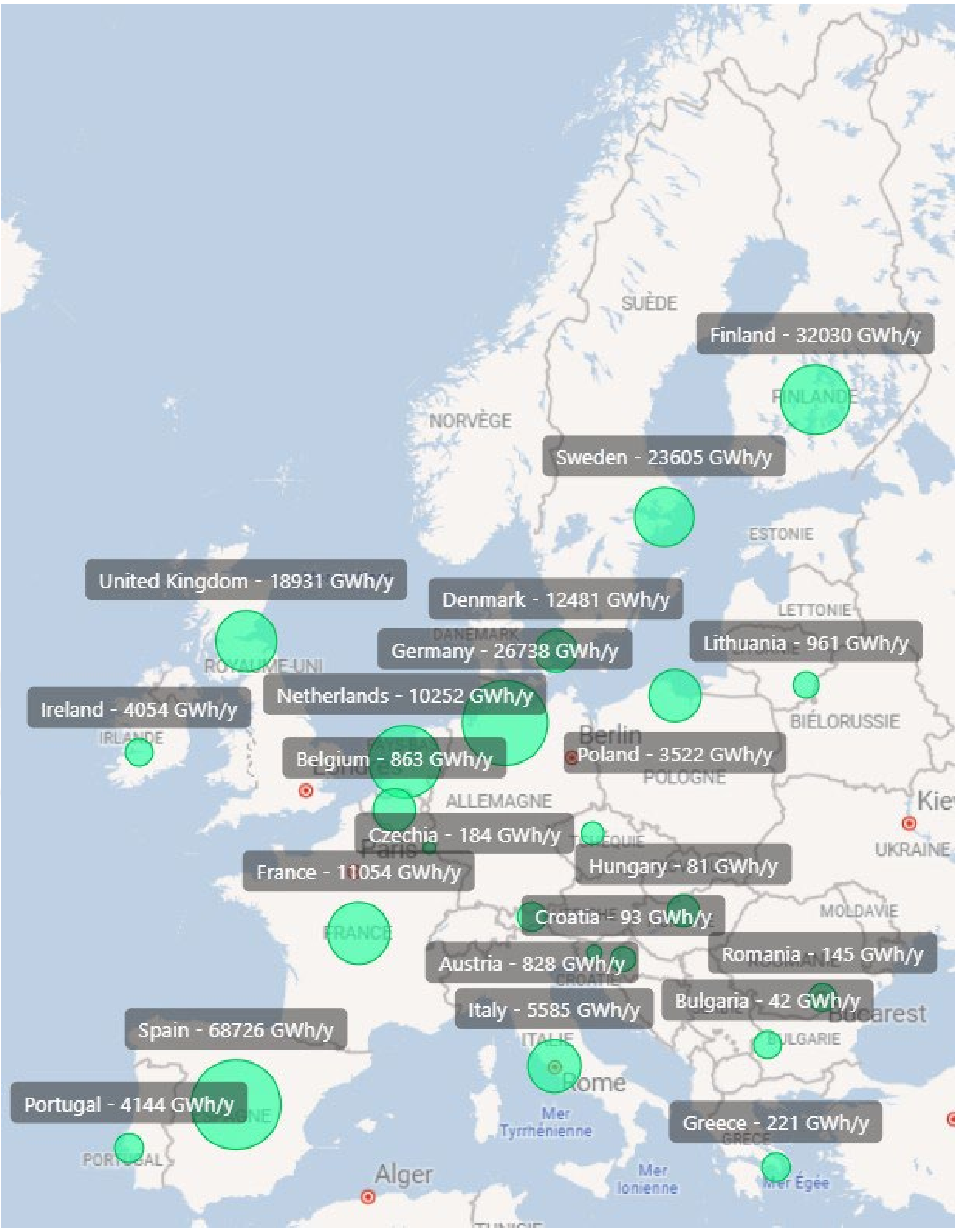


Figure 16: Distribution of hydrogen production from natural gas in the Advanced hydrogen infrastructure level in 2030 for stressful weather year (unit: GWh/y).

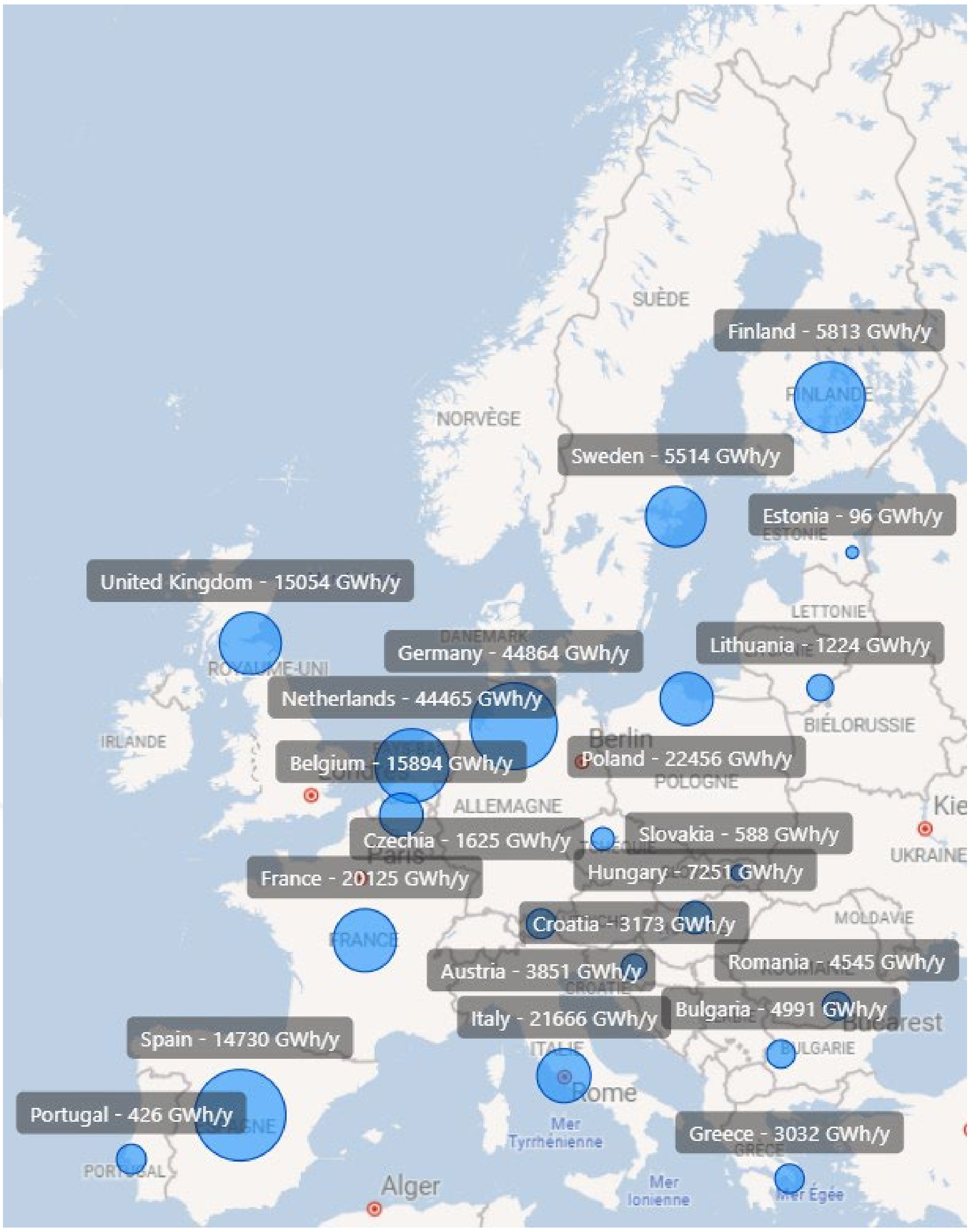


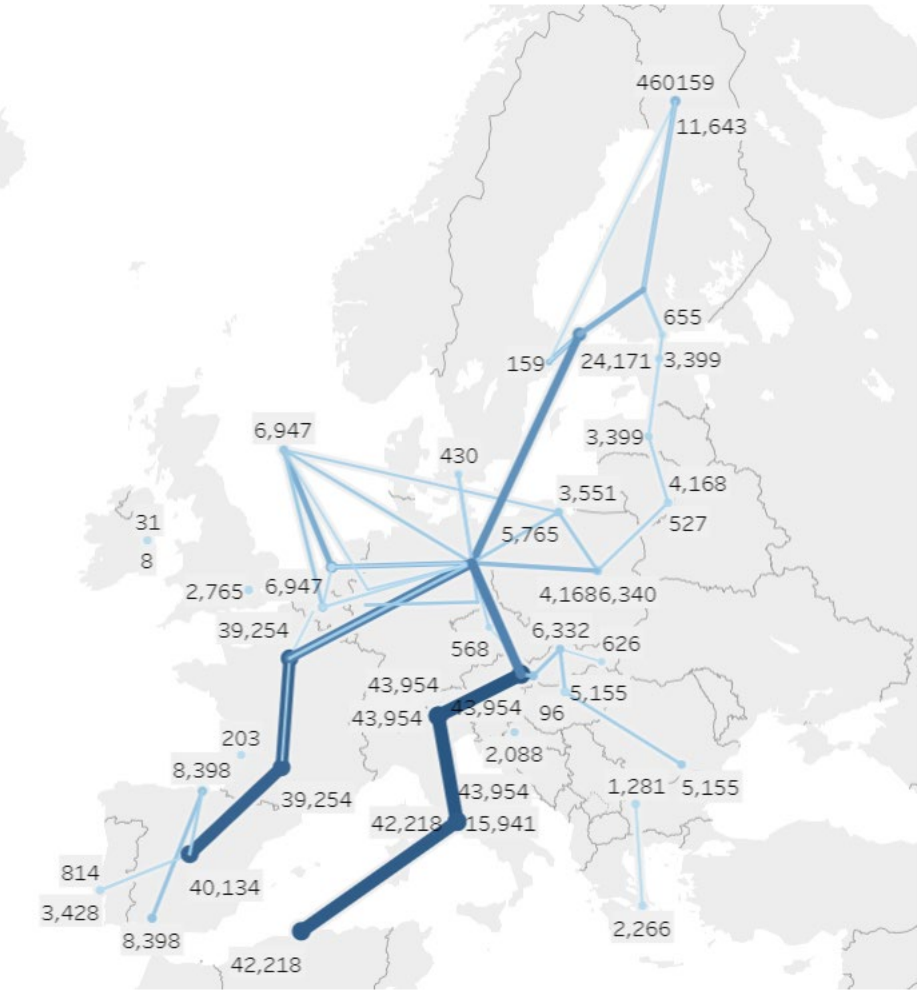
Table 17: Distribution of hydrogen production, demand and hydrogen imports per country in the Advanced hydrogen infrastructure level in 2030 for stressful weather year (unit: GWh/y).

Country	**H_2 Production** via electrolysis	**H_2 Production** using natural gas	**H_2 extra-EU imports** by pipeline & ship	**H_2 demand**

AT	828	3851	0	10901
BE	863	15894	6924	30970
BG	42	4991	0	3768
CZ	184	1625	0	6849
CY	0	0	0	329
DE	26738	44864	7847	154500
DK	12481	0	0	13241
EE	0	96	0	540
ES	68726	14730	0	61128
FI	32030	5813	0	34184
FR	11054	20125	0	47735
GR	221	3032	0	6482
HR	93	3173	0	3283
HU	81	7251	0	9312
IE	4054	0	0	6222
IT	5585	21666	0	26504
LT	961	1224	0	3977
LU	156	0	0	2695
LV	0	0	0	997
MT	0	0	0	284
NL	10252	44465	15342	59027
PL	3522	22456	3539	52283
PT	4144	426	0	2922
RO	145	4545	0	12359
SE	23605	5514	0	23107
SI	266	0	0	1544
SK	0	588	0	2767
UK	18931	15054	0	41537

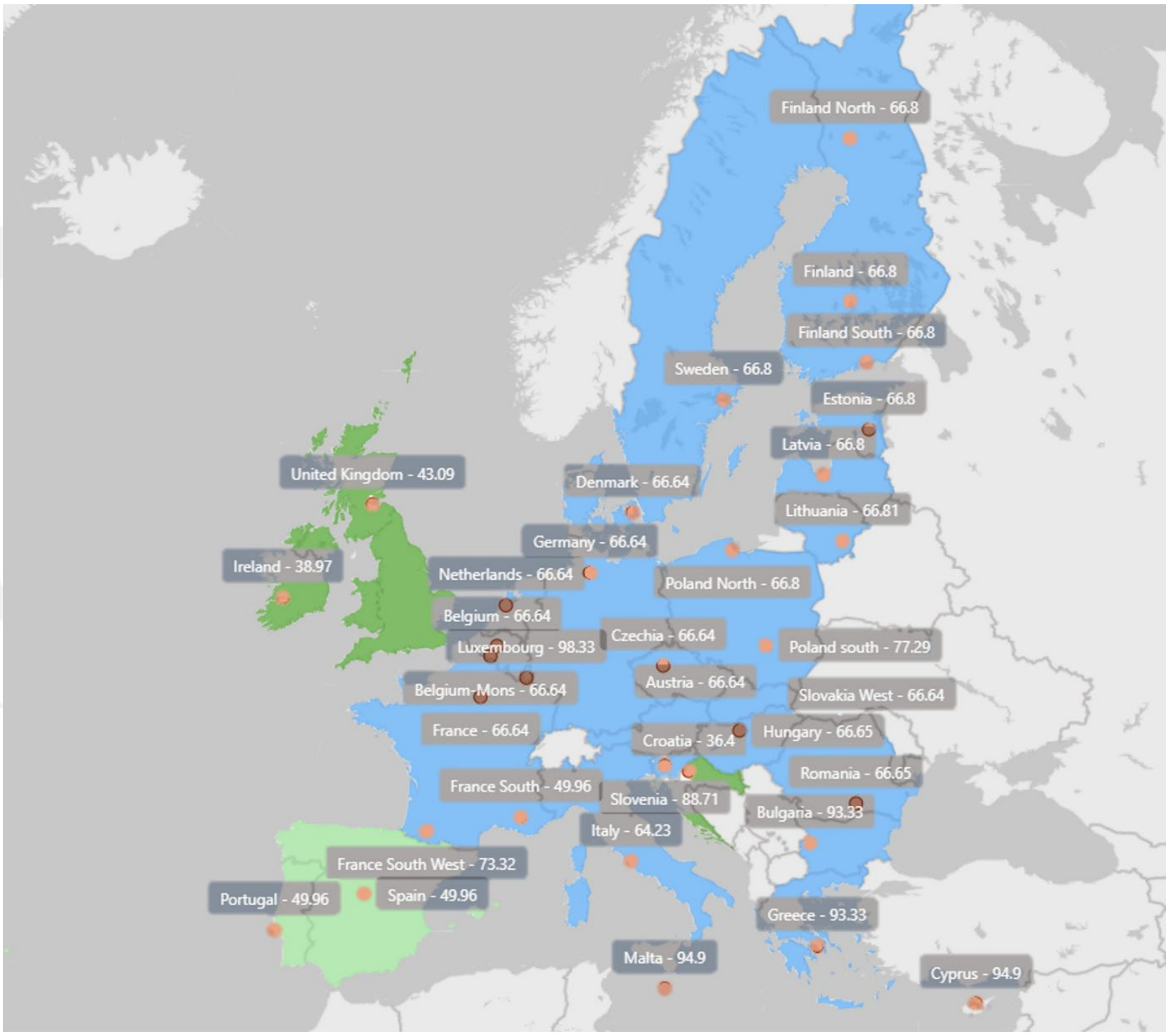
As shown in Figure 17, flow characteristics are the same as for the reference weather year. Less availability of RES for electrolytic hydrogen production reduces flows from European exporting countries.

Figure 17: Grid flows in the Advanced hydrogen infrastructure level in 2030 for stressful weather year (GWh/y).



3.1.2.1. IGI indicator 1: Hydrogen market clearing price spreads for reference weather year

Figure 18: Average of the hourly hydrogen market clearing prices per country in the Advanced hydrogen infrastructure level in 2030 (unit: €/MWh).



The price formation in the DHEM is based on the merit order of hydrogen production (see section 1.2.1). Several price groups stand out, while a signification correlation is understood here as a correlation above 0.7:

1. Portugal, Spain, France-South region: Portugal and Spain are producers and net exporters of electrolytic hydrogen from RES to other countries. While the France-South region is sufficiently connected to the Iberian peninsula, price spreads appear with other groups of countries due to an internal bottleneck in France. It has a significant correlation with prices of groups 3 and 4.
2. France-Southwest region: Local undersupply and limited supply from other regions due to internal bottlenecks in France.

3. Belgium, the Netherlands, Denmark, Germany, Czechia, Austria, Slovakia, Hungary Romania, Sweden, Finland, Estonia, Latvia, Lithuania, Poland-North region: Well interconnected region within Europe. It represents a merger between group 3 and group 4 of the PCI/PMI hydrogen infrastructure level assessment with the exception of Italy. It has significant correlation with prices in group 1 and group 4.
4. Italy: Due to its access to Algerian imports and a capacity between Italy and Austria that sometimes acts as a bottleneck, meaning that capacity at this interconnection point is utilized at its maximum potential not allowing further exports (therefore, signalling needs for potential enhancements), Italy is an own price region. It has significant correlation with prices in group 1 and group 3.
5. Ireland, the United Kingdom, Poland-South region: Isolated (regions of) countries without significant price correlations but with average prices below 100 €/MWh.
6. Greece, Bulgaria: Countries showing significant price correlation, jointly isolated from the other European countries.
7. Slovenia, Luxembourg, Croatia, Cyprus, Malta: Isolated countries without significant price correlations and with average prices above 100 €/MWh.

The price correlations listed above are enabled by the infrastructure projects already considered in this hydrogen infrastructure level. However, price differences that led to the identification of the groups listed above are not necessarily describing an infrastructure gap. For this identification of infrastructure gaps, the thresholds of IGI indicator 1 are used.

Hydrogen market clearing price spreads

If one of the two thresholds of IGI indicator 1 is passed, a regional hydrogen infrastructure gap is assumed to be identified (see section 1.2.1). Table 18 lists the borders for which Threshold 1 and Threshold 2 were passed. In this case, both thresholds were always passed at the same borders.

Table 18: List of borders in the advanced infrastructure level that exceed (at least one of) the thresholds defined for IGI indicator 1 in 2030.

Border	Threshold 1: Absolute average hourly hydrogen market clearing price spread above 4 €/MWh	Threshold 2: More than 40 days with hydrogen market clearing price spread above 20 €/MWh
DEh2-PLh2S	29	182
FRh2-FRh2S	24	158
FRh2-FRh2SW	58	322
FRh2S-FRh2SW	72	346
HUh2-HRh2	44	277
ITh2-HRh2	41	260

NLh2-UKh2	41	230
PLh2N-PLh2S	29	178
PLh2S-CZh2	29	182
PLh2S-SKh2E	29	182
ROh2-BGh2	39	273
SIh2-HRh2	77	364
SKh2E-PLh2S	29	182
UKh2-BEh2	41	230
UKh2-IEh2	19	112

In comparison with the PCI/PMI hydrogen infrastructure level, the price spreads at the following borders decreased below the thresholds through the additional infrastructure of the Advanced hydrogen infrastructure level (see Figure 2):

> Hungary: Borders with Austria, Romania, Slovakia.
> Slovakia: Borders with Austria and Czechia.

3.1.2.2. IGI indicator 2.1: Hydrogen demand curtailment for reference weather year

As explained in section 1.2.2, this IGI indicator assesses infrastructure gaps by quantifying hydrogen demand curtailments at individual nodes during the reference weather year, assuming no disruptions of infrastructures or of supply sources. It involves a multi-step simulation process integrating DHEM and DGM[12] outputs to evaluate the combined curtailments across nodes. The assessment is performed for the Advanced hydrogen infrastructure level in 2030.

Figure 19 and Table 19 show yearly average curtailment rates of hydrogen demand in the Zone 2 nodes of different European countries. For countries where the hydrogen market is divided into several sub-zones (i.e., nodes), the curtailment rate in the different sub-zones is presented. The yearly average hydrogen curtailment rates are thereby colour-coded in the map to indicate levels relative to the set threshold: blue signifies curtailment above the threshold, while green represents rates that are not above it.

[12] This draft TYNDP 2024 IGI report only includes the simulation results of the DHEM.

Figure 19: Yearly average hydrogen demand curtailment rate at country or node level in the advanced infrastructure level in 2030 for reference year (unit: %).

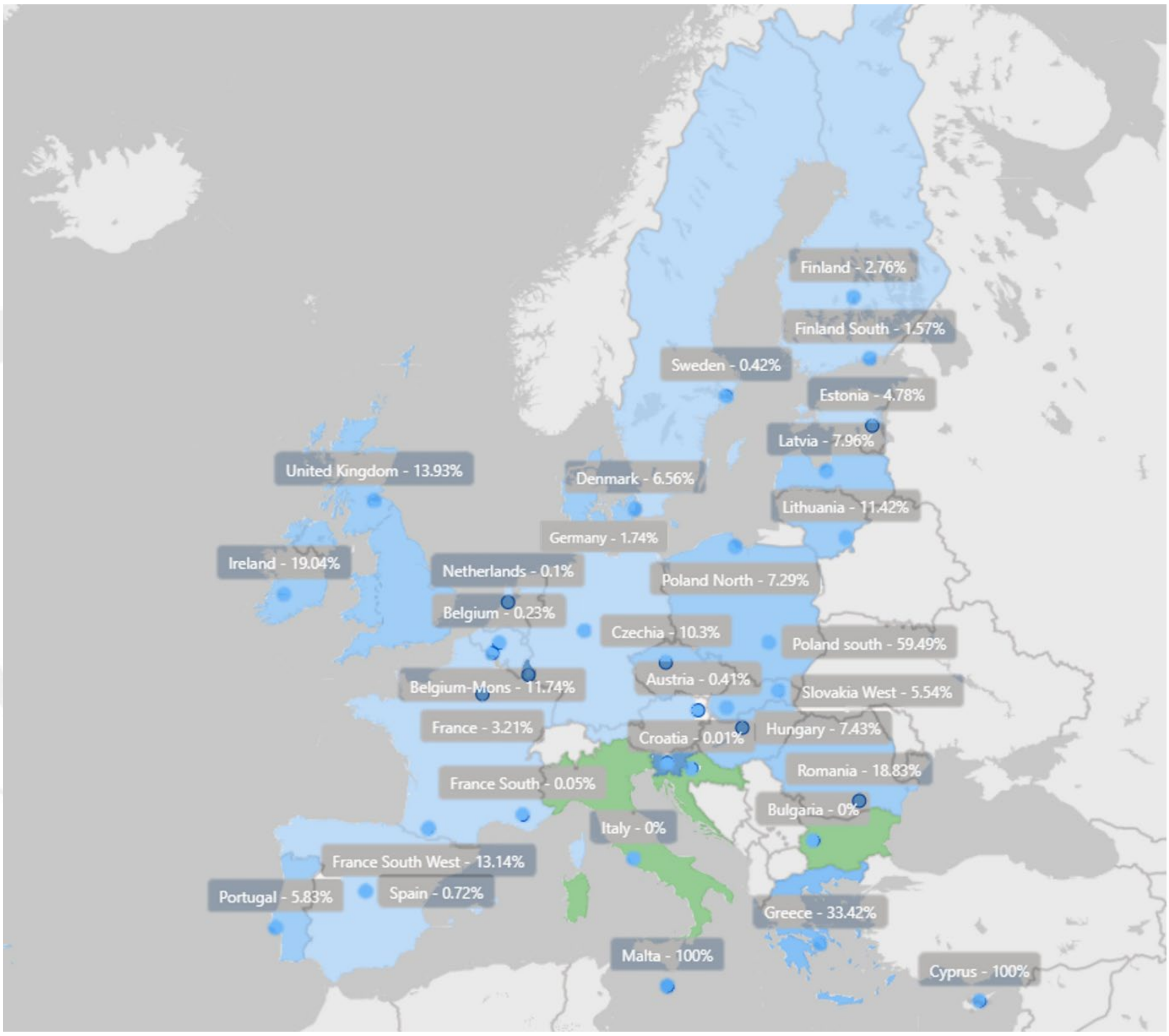


Table 19: Yearly average hydrogen demand curtailment rate at country/sub-zone level in the advanced infrastructure level in 2030 for reference weather year (unit: %).

H_2 Demand Zone	Yearly average curtailment rate (%)	Threshold passed
ATh_2	0.4	NO
BEh_2	0.2	NO
BEh_2Mo	11.7	YES
BGh_2	0.0	NO
CYh_2	100.0	YES

CZh_2	10.3	YES
DEh_2	1.7	YES
DKh_2	6.6	YES
EEh_2	4.8	YES
ESh_2	0.7	YES
FIh_2	2.8	YES
FIh_2N	2.3	YES
FIH_2S	1.6	YES
FRh_2	3.2	YES
FRh_2S	0.0	NO
FRh_2SW	13.1	YES
GRh_2	33.4	YES
HRh_2	0.0	NO
HUh_2	7.4	YES
IEh_2	19.0	YES
ITh_2	0.0	NO
LTh_2	11.4	YES
LUh_2	92.5	YES
LVh_2	8.0	YES
MTh_2	100.0	YES
NLh_2	0.1	NO
PLh_2N	7.3	YES
PLh_2S	59.5	YES
PTh_2	5.8	YES
ROh_2	18.8	YES
SEh_2	0.4	NO
SIh_2	77.6	YES
SKh_2E	5.8	YES
SKh_2W	5.5	YES
UKh_2	13.9	YES

In the 2030 assessment of the advanced infrastructure level, hydrogen demand is curtailed in most European countries.

As explained in the description of the Advanced hydrogen infrastructure level (see 1.1.2), with limited availability of extra-EU supplies, hydrogen demand is satisfied mainly with electrolytic hydrogen production and hydrogen production from natural gas. Countries with higher availability of supply from those sources or from imports show lower curtailment rates. Most countries including strong net exporters face (weather-induced) disruptions. In comparison with IGI indicator 1, this IGI indicator focusses on the availability of supplies.

As detailed in Table 19, (regions of) countries can be aggregated in six different groups according to their average yearly hydrogen demand curtailment rates:

1. Rates below 0.1%: Bulgaria, Croatia, Italy, France-South region, the Netherlands.
2. Rates between 0.1% and 5%: Belgium, Austria, Finland, Germany, Spain, Sweden, France, Estonia.
3. Rates between 5% and 20%: Denmark, Poland-North region, Hungary, Ireland, Latvia, Lithuania, Portugal, Belgium-Mons region, Czechia, Slovakia, France-Southwest region, Romania, the United Kingdom.
4. Rates between 20% and 50%: Greece.
5. Rates between 50% and 100%: Slovenia, Poland-South region, Luxembourg.
6. Full curtailment of 100%: Cyprus, Malta.

Without the infrastructure already considered in the hydrogen infrastructure level, the overall hydrogen demand curtailment would be higher.

Compared with the PCI/PMI hydrogen infrastructure level, group 1 also includes the France-South region and the Netherlands. All countries in this group do not face any hydrogen demand disruption (i.e., 0% curtailment rates). The very low curtailment of Italy in the PCI/PMI infrastructure level (i.e., 0.1%) is completely removed due to the additional imports from North Africa. The France-South region can benefit from privileged access to Iberian supply. The Netherlands benefit from additional import capacities. Furthermore, Bulgaria, Croatia have high shares of hydrogen produced from natural gas to cover nation demand.

Compared to the PCI/PMI hydrogen infrastructure level, group 2 grows by France and Estonia. Among the countries of group 2, Spain, Sweden and Finland receive a significant share of their supply from national electrolytic hydrogen production, while Belgium, the Netherlands, Austria and Germany have their curtailment reduced thanks to (indirect) access to the extra-EU import capacities in North Africa unlocked in the Advanced level. Austria and Germany have (indirect) access to extra-EU import capacities. France benefits both from Iberian supply as well as imports to countries in its East, Estonia benefits from its proximity to Finland, and Austria benefits from its connections with both Germany and Italy.

Compared to the PCI/PMI hydrogen infrastructure level, group 3 grows by the Poland-North region, Hungary, the Belgium-Mons region, Czechia, Slovakia, the France-Southwest region, and Romania due to non-PCI projects with advanced status that provide additional capacities to supply these countries/regions. Among the countries of group 3, some countries like Denmark, Portugal, the United Kingdom and Ireland, despite having significant electrolytic hydrogen production compared to the national demand, still cannot cover all demand when RES are not available. In the cases of Denmark and

Portugal, being peripheric countries, their neighbouring countries (i.e., Germany and Spain) can help to mitigate hydrogen demand curtailment. Lithuania and Latvia can receive hydrogen from Finland via Estonia and from Poland to mitigate demand curtailment. Estonia and Poland will both only provide hydrogen to Lithuania and Latvia when having access to surplus hydrogen quantities. In the case of the United Kingdom and Ireland, being isolated from Europe leads to higher curtailment rates due to limited options for cross-border balancing.
Within the same group 3, Slovakia, Hungary and Romania are benefiting from new interconnections. Thereby, Slovakia is the transit country to Hungary and Hungary is the transit country to Romania. While the France-Southwest region is still isolated and strictly depends on local production, the hydrogen demand curtailment is reduced compared to the PCI/PMI hydrogen infrastructure level. This is enabled by the additional hydrogen storage capacities in the France-Southwest region in the advanced infrastructure level. In addition, Czechia benefits from the fact that its western neighbours can share more hydrogen surplus.

In group 4, Greece shows a curtailment rate of 33.4%, which can be explained by the fact that despite the new interconnections in the advanced infrastructure level in Eastern Europe, Greece and Bulgaria remained isolated and therefore their situation is not improved compared to the PCI/PMI hydrogen infrastructure level.

Group 5 includes countries with very high curtailment rates. All the countries in this group are fully isolated and rely on national hydrogen supplies mainly produced from natural gas.

Group 6 includes only isolated countries that have hydrogen demand but no national hydrogen production assets connected to Zone 2.

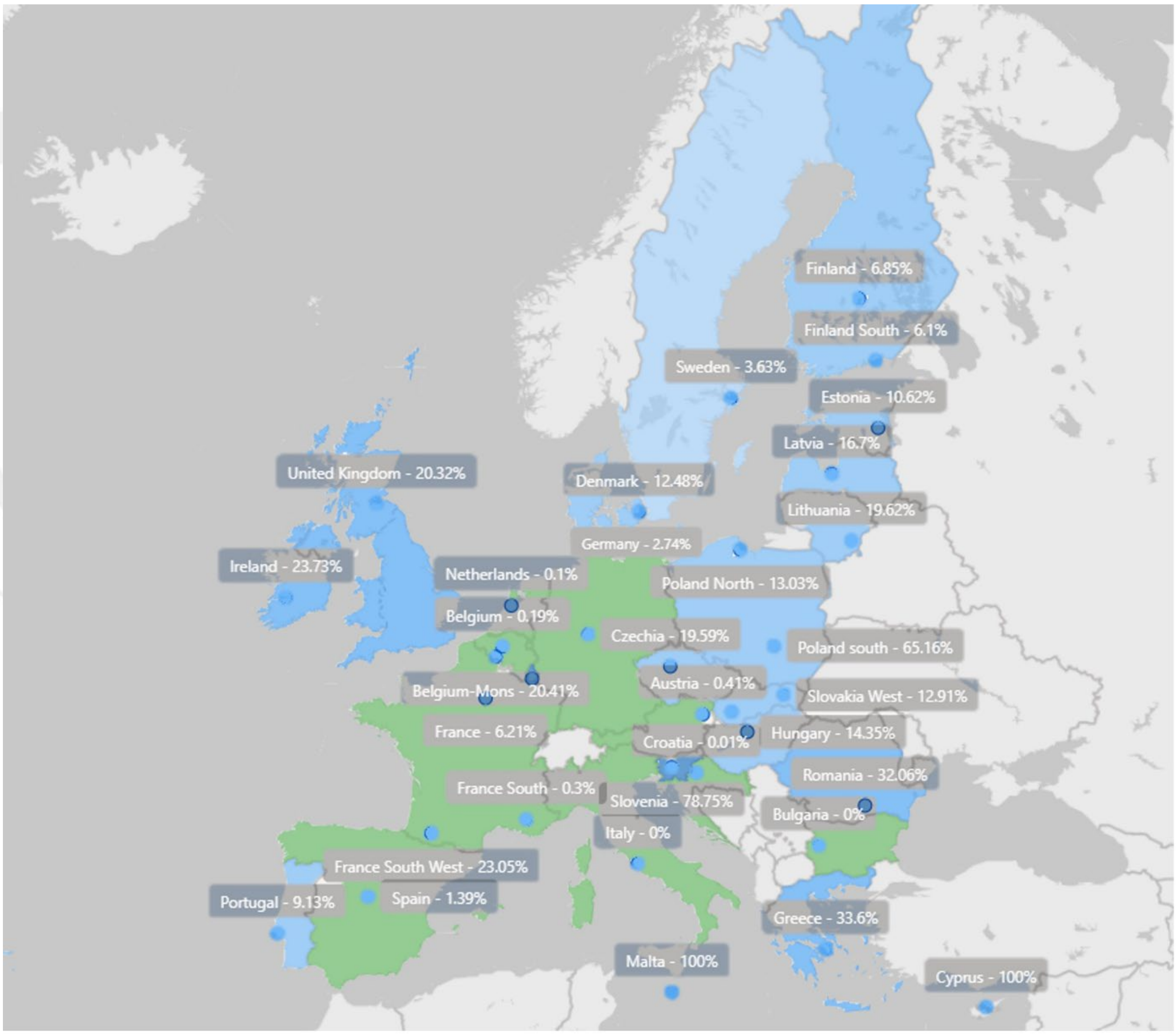
In Denmark, Finland, Ireland, Sweden, and Slovenia, on top of the hydrogen demand curtailments observed in Zone 2 nodes as described in the paragraphs above, hydrogen demand curtailments can be observed in Zone 1. While these curtailments are limited to a few months in Sweden and Finland, it is of relevance in every month in Ireland and reaches high levels in Denmark and Slovenia. Compared to the PCI/PMI hydrogen infrastructure level, these curtailments are slightly reduced due to higher availability of electricity for electrolytic hydrogen production due to additional imports (i.e., new availability of North African imports and import terminals).

3.1.2.3. IGI indicator 2.2: Hydrogen demand curtailment for stressful weather year

Threshold 1: Average yearly hydrogen demand curtailment rate above 3 %

Figure 20 and Table 20 show the yearly average hydrogen demand curtailment rates in the Zone 2 nodes of various European countries for 2030, simulated under a stressful weather year. This weather scenario assumes adverse conditions, such as reduced wind and solar energy availability, which directly impacts electrolytic hydrogen production. For countries with hydrogen markets divided into multiple sub-zones (i.e., nodes), curtailment rates are depicted individually for each sub-zone on the map. The yearly average hydrogen curtailment rates are thereby colour-coded to indicate levels relative to the set threshold 1: blue signifies curtailment above the threshold, while green represents rates that are not.

Figure 20: Yearly average hydrogen demand curtailment rate at country or node level in the advanced infrastructure level in 2030 for stressful weather year (unit: %).



In interconnected countries, the average hydrogen demand curtailment rates in Zone 2 are more or less doubled compared to the reference weather year as less hydrogen is available during stressful weather conditions.

Table 20: Yearly average hydrogen demand curtailment rate at country/sub-zone level in the advanced infrastructure level in 2030 for stressful weather year (unit: %).

H_2 Demand Zone	Yearly average curtailment rate (%)	Threshold 1 passed
ATh_2	0.4	YES
BEh_2	0.2	NO
BEh_2Mo	20.4	YES
BGh_2	0.0	NO
CYh_2	100.0	YES
CZh_2	19.6	YES
DEh_2	2.7	YES
DKh_2	12.5	YES
EEh_2	10.6	YES
ESh_2	1.4	NO
FIh_2	6.9	YES
FIh_2N	6.3	YES
FIH_2S	6.1	YES
FRh_2	6.2	YES
FRh_2S	0.3	NO
FRh_2SW	23.1	YES
GRh_2	33.6	YES
HRh_2	0.0	NO
HUh_2	14.4	YES
IEh_2	23.7	YES
ITh_2	0.0	NO
LTh_2	19.6	YES
LUh_2	93.2	YES
LVh_2	16.7	YES
MTh_2	100.0	YES
NLh_2	0.1	NO
PLh_2N	13.0	YES
PLh_2S	65.2	YES
PTh_2	9.1	YES
ROh_2	32.1	YES
SEh_2	3.6	YES
SIh_2	78.8	YES

SKh_2E	14.2	YES
SKh_2W	12.9	YES
UKh_2	20.3	YES

As detailed in Table 20, (regions of) countries can be aggregated in different groups according to their average yearly hydrogen demand curtailment rates:

1. Rates below 3%: Bulgaria, Croatia, Italy, the Netherlands, Belgium, Austria, Germany, Spain France-South region.
2. Rates between 3% and 20%:, Sweden, France, Denmark, Finland, Poland-North region, Hungary, Latvia, Lithuania, Estonia, Portugal, Czechia, Slovakia.
3. Rates between 20% and 50%: Belgium-Mons region, France-Southwest region, Greece Ireland, Romania, the United Kingdom.
4. Rates between 50% and 100%: Slovenia, Poland-South region, Luxembourg.
5. Full curtailment of 100%: Cyprus, Malta.

Compared with the PCI/PMI hydrogen infrastructure level, group 1 grows by Germany and Austria, reducing these countries' hydrogen demand curtailment below the threshold of IGI indicator 2.2.

Threshold 2: hydrogen demand curtailment rate of more than 5 % for at least one month per year

All the countries and regions that exceed threshold 1 also exceeded threshold 2.

3.2. Comparison between PCI/PMI hydrogen infrastructure level and advanced infrastructure level

3.2.1. Maximum utilisation of interconnections

Table 21 displays the maximum utilisation rates of hydrogen interconnections for both hydrogen infrastructure levels in 2030 for the reference weather year. Table 22 shows this information for the stressful weather year.

As stated in section 1.1, some countries are completely isolated from the hydrogen infrastructure:

> Countries and regions that are isolated in both hydrogen infrastructure levels: Slovenia, Ireland, the United Kingdom, Cyprus, Malta, France-Southwest region, Poland-South region, Luxembourg, Bulgaria and Greece are interconnected with each other but isolated from the main backbone.

> Countries that are only isolated in the PCI/PMI hydrogen infrastructure level: Slovakia, Hungary, Romania, Bosnia, Croatia and Poland-North region are interconnected with each other in the Advanced hydrogen infrastructure level but isolated from the main backbone.

When interpreting the tables, the strategic dimensioning of interconnections becomes more evident when also considering the data for 2040 as presented in section 4.2.1. As hydrogen pipelines have significant economies of scale, one early investment with a large pipeline diameter can represent an anticipatory investment.

Table 21: Maximum utilisation rates of interconnections in the PCI/PMI hydrogen infrastructure level and in the Advanced hydrogen infrastructure level in 2030 for the reference weather year (unit: %).

Interconnection	Stated direction		Reverse direction		Comments
	PCI/PMI IL	ADV IL	PCI/PMI IL	ADV IL	
ATh2 => DEh2	60	86	24	10	As DZ supply is added in the ADV IL, flows from AT to DE increase as AT has more access to North African H2 through Italy
ATh2 => IB-ITh2	16	1	63	100	As DZ supply is added in the ADV IL, the max. utilisation rate is reached.
ATh2 => IB-SKh2W		40		0	As no UA supply is available, AT supplies SK.
BAh2 => HRh2		0		0	The low utilisation is caused by low hydrogen supply to these jointly isolated countries, so BA and HR always need hydrogen supply themselves if the other country needs it.
BEh2 => DEh2	63	13	60	63	With additional supply options in ADV IL, DE's dependence on BE's supplies decreases.
BEH2Mo => FRh2Va	0	0	15	15	The flow direction is from FR to BE.
BEh2 => NLh2	0	0	81	80	The flow direction is from NL to BE.
BGh2 => GRh2	6	6	3	3	The low utilization is caused by the isolation of these countries along with the relatively low supply of hydrogen
CZh2 => DEh2	0	0	6	7	The flow direction is from DE to CZ as no UA supply is available.
DEh2 => DKh2	31	35	59	57	
DEh2 => FRh2	50	43	98	98	
DEh2 => NLh2	26	16	50	34	With additional supply options in ADV IL, the offered import flexibilities reduce max. utilisation.
DEh2 => PLh2N		100		0	The flow direction is from DE to PL.
DEh2 => PLh2nbc	87	76	0.4	0	The flow direction is from DE to PL. New terminal in PL and new connection from DE to PL (supplied by new supply options) in ADV IL reduce max. utilisation.
DEh2ba => DEh2		0			
DEh2bp => DEh2ba		0			
EEh2 => FIh2S	30	41	6	6	New terminal in PL and new connection from DE to PL (supplied by new supply options) in ADV IL increase max. utilisation.

EEh2 => LVh2	5	5	31	42	With additional supply options and connection from DE to PL in ADV IL West of LV, max. utilisation from LV to EE can be increased.
ESh2 => FRh2S	95	95	34	31	Capacity from ES to FR-South would be a bottleneck if FR-South to FR was not already restricting flows.
ESh2 => PTh2	8	8	22	22	
FIh2 => FIh2Al	18	16	10	10	
FIh2 => FIh2N	0	0	1	1	Very high capacities set in the model as this arc is not representing a bottleneck.
FIh2 => FIh2S	0.3	0.3	0.4	0.3	Very high capacities set in the model as this arc is not representing a bottleneck.
FIh2Al => DEh2	60	60			Flow direction is from FI to DE.
FIh2Al => SEh2	0	1	15	15	
FIh2N => SEh2	8	9	2	2	
FRh2 => FRh2S	42	38	100	100	Capacity from FR-South to FR is a bottleneck that limits supplies from ES.
FRh2 => FRh2Va	11	15	7	7	
HUh2 => IB-SKh2C		0		49	Flow direction is SK to HU. The max. utilisation would be higher if there was more hydrogen supply to Europe, allowing SK to transit more hydrogen to HU and downstream countries which remain having HCR.
HUh2 => ROh2		39		0	Flow direction is HU to RO. The max. utilisation would be higher if there was more hydrogen supply to Europe, allowing HU to transit more hydrogen to RO which remains having high HCR.
IB-ITh2 => ITh2	0	0	63	84	
IB-SKh2C => SKh2E		2		0	The max. utilisation would be higher if there was more hydrogen supply to Europe as countries in the area remain having HCR.
IB-SKh2C => SKh2W		0		36	The max. utilisation would be higher if there was more hydrogen supply to Europe as countries in the area remain having HCR.
IB-SKh2E => SKh2E		0		0	The max. utilisation would be higher if there was more hydrogen supply to Europe as countries in the area remain having HCR.
IB-SKh2W => CZh2		10			SK supplies hydrogen received from AT to CZ.
IB-SKh2W => SKh2W		40		0	The max. utilisation would be higher if there was more hydrogen supply to Europe as countries in the area remain having HCR.
LTh2 => LVh2	33	44	4	4	With additional supply options and connection from DE to PL in ADV IL West of LT, max. utilisation from LT to LV can be increased.

LTh2 => PLh2nbc	0.4	0	38	49	With additional supply options and connection from DE to PL in ADV IL West of LT, max. utilisation from PL to LT can be increased.
PLh2nbc => PLh2N	54	23			New terminal in PL-North and new connection from DE to PL (supplied by new supply options) in ADV IL reduce max. utilisation.
DEh2bp => DEh2		100			Allows import through DEbp terminal in ADV IL.
DZh2 => ITh2		26			The max. utilisation is limited by the hydrogen supply potential of DZ as defined in TYNDP 2024 scenarios.
LH2_Tk_BE => BEh2	100	71			In PCI/PMI IL, terminal capacities are bottleneck for hydrogen imports as not reaching supply potentials as defined in TYNDP 2024 scenarios. Bottleneck is lifted in ADV IL.
LH2_Tk_DE => DEh2	100	100			In PCI/PMI IL, terminal capacities are bottleneck for hydrogen imports as not reaching supply potentials as defined in TYNDP 2024 scenarios. Bottleneck is lifted in ADV IL.
LH2_Tk_DEbp => DEh2bp	0	100			New connection allows utilisation of DEbp terminal in ADV IL.
LH2_Tk_NL => NLh2	100	82			In PCI/PMI IL, terminal capacities are bottleneck for hydrogen imports as not reaching supply potentials as defined in TYNDP 2024 scenarios. Bottleneck is lifted in ADV IL.
LH2_Tk_PLN => PLh2N		100			New terminal in ADV IL.

Table 22: Maximum utilisation rates of interconnections in the PCI/PMI hydrogen infrastructure level and in the Advanced hydrogen infrastructure level in 2030 for the stressful weather year (unit: %).

Interconnection	Stated direction		Reverse direction		Comments on significant deviations from the maximum utilization rates compared with the reference weather year
	PCI/PMI IL	ADV IL	PCI/PMI IL	ADV IL	
ATh2 => DEh2	56	97	23	3	
ATh2 => IB-ITh2	15	0	60	100	
ATh2 => IB-SKh2W		36			
BAh2 => HRh2		0		0	
BEh2 => DEh2	53	18	71	71	
BEh2 => NLh2	0	0	80	80	
BEH2Mo => FRh2Va	0	0	15	15	
BGh2 => GRh2	6	6	5	5	
CZh2 => DEh2	0	0	6	6	
DEh2 => DKh2	33	34	57	57	
DEh2 => FRh2	51	53	95	97	
DEh2 => NLh2	26	16	52	39	
DEh2 => PLh2N		100		3	
DEh2 => PLh2nbc	100	100	1	0	Dependence of Nordic hydrogen production on RES and lower RES availability increase max. utilisation from DE to PL to decrease HCR in the Baltics.
DEh2ba => DEh2		0			
DEh2bp => DEh2ba		0			
EEh2 => FIh2S	39	76	5	6	Dependence of Nordic hydrogen production on RES and lower RES availability increase max. utilisation from EE to FI to decrease HCR in the Baltics.
EEh2 => LVh2	5	5	41	77	Dependence of Nordic hydrogen production on RES and lower RES availability increase max. utilisation from LV to EE to decrease HCR in the Baltics.
ESh2 => FRh2S	95	95	44	46	Dependence of Iberian hydrogen production on RES and lower RES availability increase max. utilisation from FR to ES to decrease HCR in ES and PT.
ESh2 => PTh2	8	8	22	22	
FIh2 => FIh2Al	20	16	7	6	
FIh2 => FIh2N	0	0	1	1	
FIh2 => FIh2S	0.2	0.2	0.4	0.4	
FIh2Al => DEh2	61	60			
FIh2Al => SEh2	0	5	16	16	
FIh2N => SEh2	20	21	2	2	

FRh2 => FRh2S	54	56	100	100	
FRh2 => FRh2Va	15	15	7	7	
HUh2 => IB-SKh2C		0		43	
HUh2 => ROh2		38		0	
IB-ITh2 => ITh2	0	0	60	84	
IB-SKh2C => SKh2E		2		0	
IB-SKh2C => SKh2W		0		32	
IB-SKh2E => SKh2E		0		0	
IB-SKh2W => CZh2		8			
IB-SKh2W => SKh2W		36		0	
LTh2 => LVh2	44	80	3	4	Dependence of Nordic hydrogen production on RES and lower RES availability increase max. utilisation from LT to LV to decrease HCR in the Baltics.
LTh2 => PLh2nbc	1	0	51	88	Dependence of Nordic hydrogen production on RES and lower RES availability increase max. utilisation from PL to LT to decrease HCR in the Baltics.
PLh2nbc => PLh2N	53	23			
DEh2bp => DEh2		100			
DZh2 => ITh2		26			
LH2_Tk_BE => BEh2	100	71			
LH2_Tk_DE => DEh2	100	100			
LH2_Tk_DEbp => DEh2bp	0	100			
LH2_Tk_NL => NLh2	100	75			
LH2_Tk_PLN => PLh2N		100			

3.2.2. Analysis with hypothetical infrastructure approach

This section will be produced after the public consultation of the TYNDP 2024 Infrastructure Gaps Identification report in line with the methodology described by steps 2 to 3 in section 6 of the TYNDP 2024 Annex D2

3.2.3 Identification of projects that solved or mitigated infrastructure gaps

Solved infrastructure gaps in Advanced hydrogen infrastructure level compared to PCI/PMI hydrogen infrastructure level

The additional projects of the advanced infrastructure level could solve the following indications of regional hydrogen infrastructure gaps:

- Borders as captured by IGI indicator 1: Hungary-Austria, Hungary-Romania, Hungary-Slovakia, Slovakia-Austria, Slovakia-Czechia.
- Countries and regions as captured by IGI indicator 2.1: France-South region, the Netherlands.
- Countries and regions as captured by IGI indicator 2.2: Austria, Germany.

Nevertheless, not all IGI indicators could be solved from a regional perspective even if the advanced hydrogen projects provide benefits.

Identification of advanced, non-PCI/PMI projects responsible for solving hydrogen infrastructure gaps by addressing hydrogen infrastructure bottlenecks

The following advanced, non-PCI/PMI projects contributed to mitigate the identified infrastructure gaps in the 2030 assessment:

- Pipeline imports
  - North African hydrogen corridor to Italy (North Africa hydrogen corridor)
- Intra-EU connections:
  - Austria to Slovakia (Slovak Hydrogen Backbone)
  - Netherlands to Germany (H2Coastlink, IP Elten/Zevenaar – Cologne, Hyperlink and H2ercules Network North-West)
  - Germany to Poland (Pomeranian Green Hydrogen Cluster)
  - Slovakia to Hungary (HU/SK hydrogen corridor and SK-HU H2 corridor)
  - Hungary to Romania (Giurgiu Nădlac hydrogen corridor and HU/RO hydrogen corridor)
- Import terminals
  - New Ammonia terminal in Gdansk and Hydrogen Highway – Northern Section
  - Increased terminal capacity in the Netherlands (Eemshaven H2)
- Hydrogen storages
  - Hydrogen storage projects in Germany (RWE H2 Storage Gronau-Epe, UST Hydrogen Storage Krummhörn, RWE H2 Storage Xanten, EWE Hydrogen Storage Huntorf, EWE Hydrogen Storage Jemgum, RWE H2 Storage Staßfurt, EWE Hydrogen Storage Huntorf)
  - Hydrogen storage project in the France-Southwest region (HySoW storage)of France

Besides the projects listed above, the projects included in the PCI/PMI hydrogen infrastructure level also contribute to the solving and mitigation of infrastructure gaps.

4. Assessment for 2040

This section describes the evolution of the IGI indicators for the reference weather year (i.e., 1995) and the stressful weather year (i.e., 2009) for the analysed infrastructure levels (i.e., PCI/PMI and Advanced hydrogen infrastructure levels) for the simulation year 2040.

4.1. Infrastructure Gaps Identification

4.1.1. Assessment of PCI/PMI hydrogen infrastructure level

High-level results for reference weather year

The overall yearly demand-supply balance for the PCI/PMI hydrogen infrastructure level in 2040 is presented in Table 23. As detailed in Table 23, the overall hydrogen demand triples compared to the 2030 hydrogen demand level, leading to a yearly hydrogen demand of 1936 TWh/y in Europe. Electrolytic hydrogen production remains the main source of hydrogen in Europe, satisfying 56% of the yearly hydrogen demand of Europe.

Despite i) the infrastructure development foreseen in the PCI/PMI hydrogen infrastructure level for 2040 (see section 1.1), ii) the increase of extra-EU supply potentials via terminals and pipelines, and iii) the significant increase of electrolytic hydrogen production (by approximately 246%), this is not sufficient to satisfy the hydrogen demand in many European countries. Therefore, overall hydrogen demand curtailment rises compared to the 2030 values leading to an average hydrogen curtailment rate of 15% in Europe.

Table 23: Supply and demand balance in the PCI/PMI hydrogen infrastructure level in 2030 and 2040 for reference weather year (unit: TWh/y).

Yearly hydrogen supply-demand balance	PCI/PMI IL 2030	PCI/PMI IL 2040
H_2 produced via electrolysis	310	1074
H_2 produced using natural gas	229	162
H_2 shipped imports	29	83
H_2 pipeline imports	0	316
Curtailed H_2 demand	52	294
H_2 demand for power production	2	77
Total H_2 demand	620	1929

Figure 21: Distribution of electrolytic hydrogen production per country in the PCI/PMI hydrogen infrastructure level in 2040 for reference weather year (unit: GWh/y).

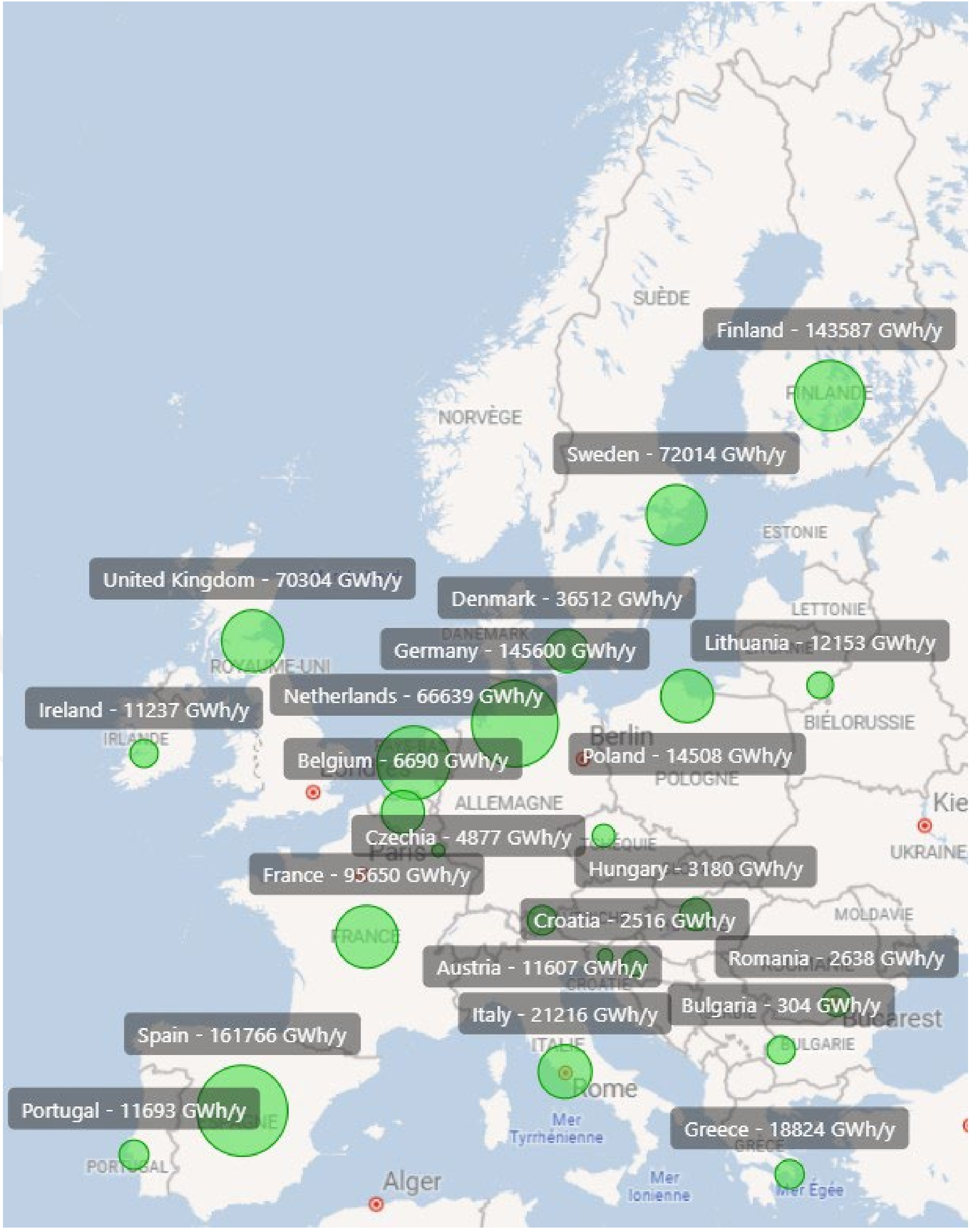


Figure 21 shows the hydrogen production via electrolysis in the different European countries for the PCI/PMI hydrogen infrastructure level in the 2040 assessment. European electrolytic production significantly increased compared to 2030 in most European countries. The countries with the highest electrolytic hydrogen production are Spain, Germany, Finland, France and Sweden. Some countries have more than one source of electrolytic hydrogen production. This is related to the intra-country assumptions that are detailed in the description of the reference weather year in section 3.1.1.

Figure 22 shows the distribution of hydrogen production from natural gas in 2040. There is a reduction in hydrogen production from natural gas compared to 2030 as presented in Table 23. This reduction is explained by i) the 50% reduction in the installed capacities for hydrogen production from natural gas as defined in the TYNDP 2024 NT+ scenario, ii) the higher electrolytic production as well as iii) the availability of new hydrogen supplies through imports from North Africa, Norway, Ukraine, and via terminals.

Figure 22: Distribution of hydrogen production from natural gas in the PCI/PMI hydrogen infrastructure level in 2040 for reference weather year (unit: GWh/y).

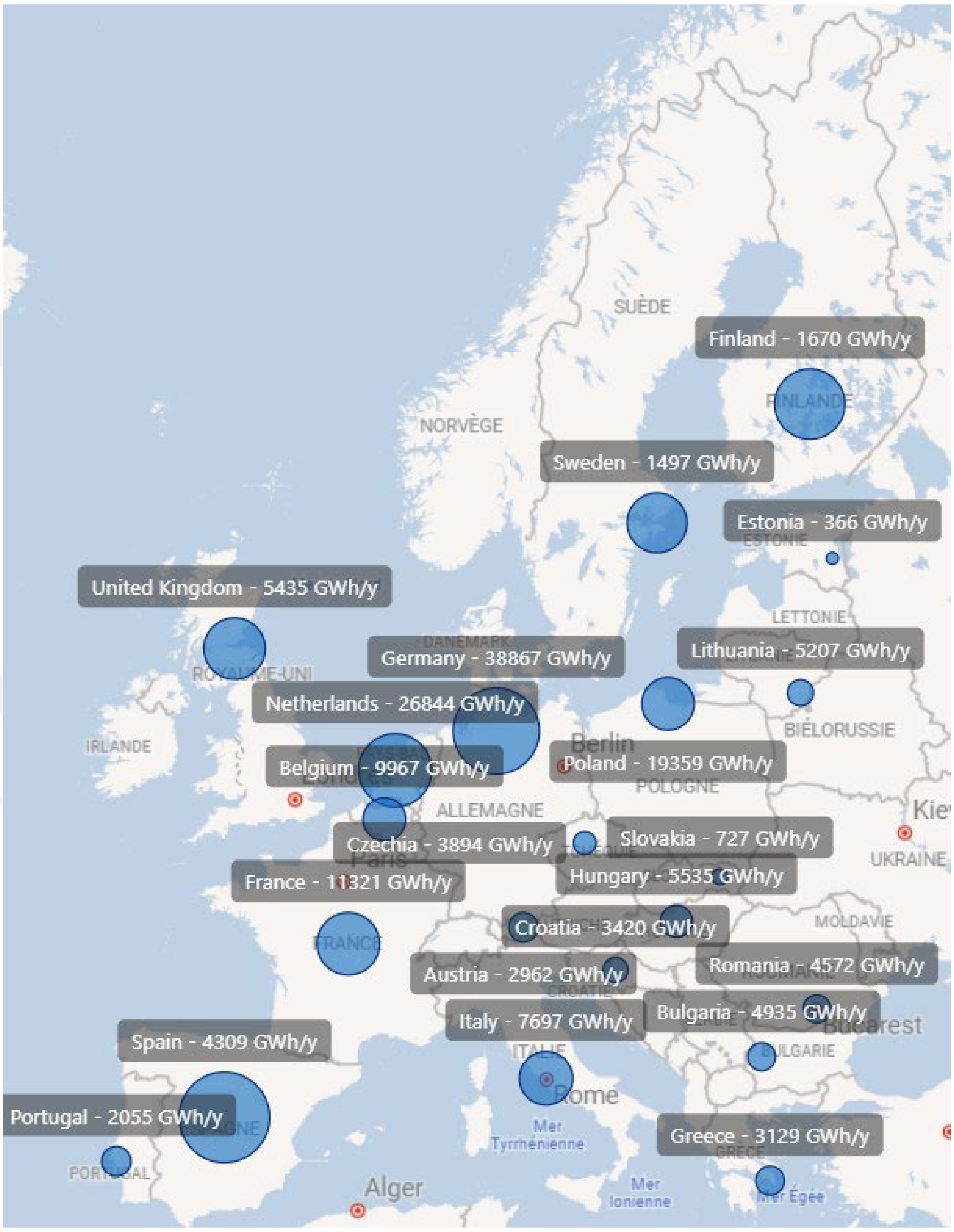


Table 24: Distribution of hydrogen production, imported hydrogen and demand per country in the PCI/PMI hydrogen infrastructure level in 2040 for reference weather year (unit: GWh/y).

Country	**H_2 Production** via electrolysis	**H_2 Production** using natural gas	**H_2 extra-EU imports** by pipeline & ship	**H_2 demand**
AT	11607	2962	0	45033

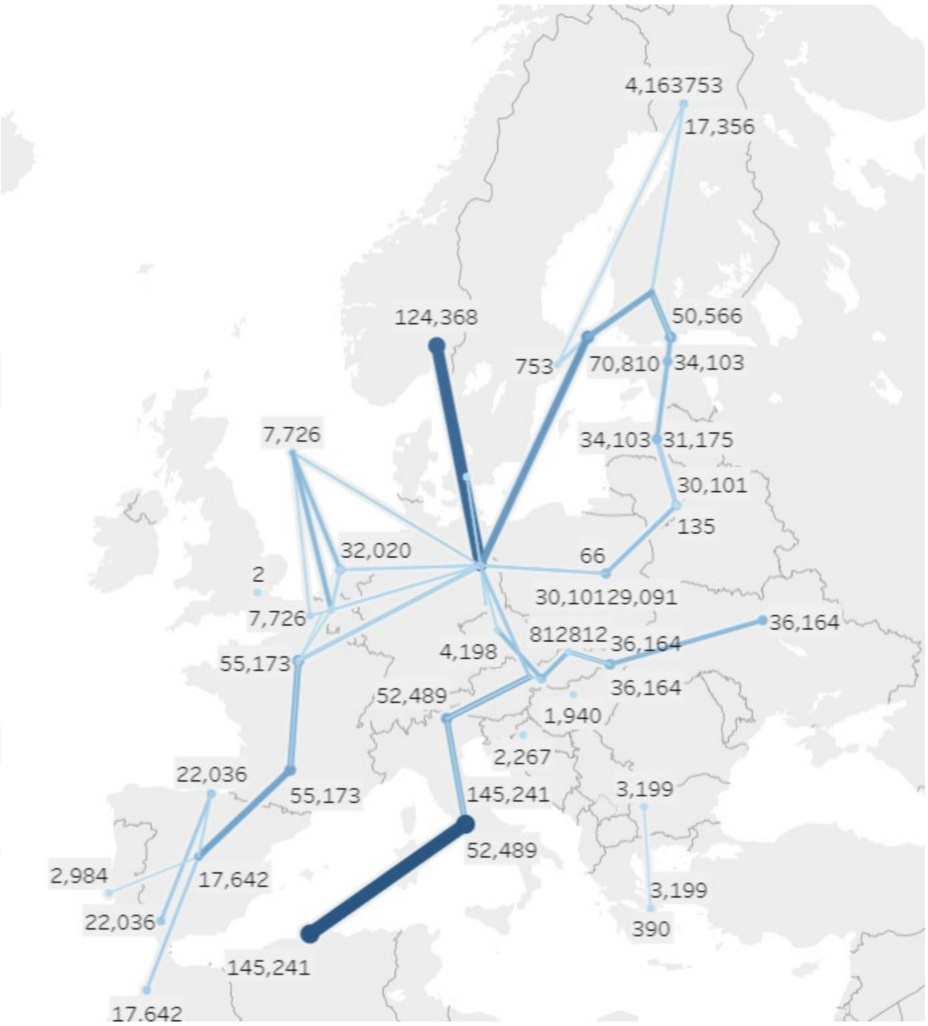
BE	6690	9967	37649	85037
BG	304	4935	0	12712
CZ	4877	3894	0	46404
CY	0	0	0	2614
DE	145600	38867	134345	549477
DK	36512	0	0	31337
EE	0	366	0	3128
ES	161766	4309	17582	156348
FI	143587	1670	0	85318
FR	95650	11321	7700	166471
GR	18824	3129	0	38538
HR	2516	3420	0	8168
HU	3180	5535	0	26496
IE	11237	0	0	14439
IT	21216	7697	144749	127210
LT	12153	5207	0	22242
LU	321	0	0	9772
LV	0	0	0	4042
MT	0	0	0	1475
NL	66639	26844	31912	128840
PL	14508	19359	0	133928
PT	11693	2055	0	19628
RO	2638	4572	0	37722
SE	72014	1497	0	71263
SI	2280	0	0	5822
SK	0	727	36042	9549
UK	70304	5435	0	91428

Considering the supply and demand distribution presented in Table 24, the intra-EU transport corridors that already emerged in 2030, connecting the electrolytic hydrogen supply produced in the Iberian Peninsula and in the Nordic countries with the main European hydrogen hub in Germany, are even more needed in the 2040 PCI/PMI assessment due to the increase of hydrogen demand between 2030 and 2040. The Iberian corridor is thereby supported by imports from Morocco.

In addition, as presented in Figure 23, other intra-EU transport corridors emerge, mainly driven by the availability of extra-EU supplies in the 2040 assessment. Namely, the new corridors identified for 2040 are:

- North African corridor, transporting Algerian supplies to Italy, Austria, Germany and other countries.
- Norwegian corridor, transporting Norwegian supplies to Germany.
- Ukrainian corridor, transporting Ukrainian supplies to Slovakia and Czechia and other countries.

Figure 23: Grid flows(*) in the PCI/PMI hydrogen infrastructure level in 2040 for reference weather year (unit: GWh/y).



(*) Grid flows refer to simulations results and do not intend to represent how the European infrastructure is expected to evolve in the simulated years, being just outcomes of a modelling tool. The values are provided as a table in Annex II and as monthly values in Annex III).

In the 2040 PCI/PMI hydrogen infrastructure level assessment for the reference weather year, countries can be grouped in four different categories according to their supply-demand balance on a yearly basis:

1. Countries which export more than they import: Sweden, Finland, Denmark, Spain and Greece.
2. Countries that import more than they export: Poland, Bulgaria and Portugal.
3. Transit countries that import more than they consume: Italy, Germany, Slovakia, Austria, Estonia, Latvia, Lithuania, France and Netherlands.
4. Isolated countries: the United Kingdom, Ireland, Luxembourg, Hungary, Romania, Slovenia, Croatia, Malta, Cyprus, Switzerland[13] and the cluster Bulgaria-Greece.

[13] IGI report does not consider hydrogen demand in Switzerland (based on TYNDP 2024 Draft Scenario report). However, there is no hydrogen infrastructure connecting Switzerland to any of its European neighbouring countries in the assessed infrastructure levels.

While on a yearly basis some countries are net exporters and some countries are net importers, net exporters may be relying on net imports during certain shorter periods of time and net importers may be providing net exports during certain shorter periods of time. This can result in bidirectional flows at interconnections. This situation is caused by the seasonality of electrolytic hydrogen production and to some extent by the seasonality of hydrogen demand.

High-level results for stressful weather year

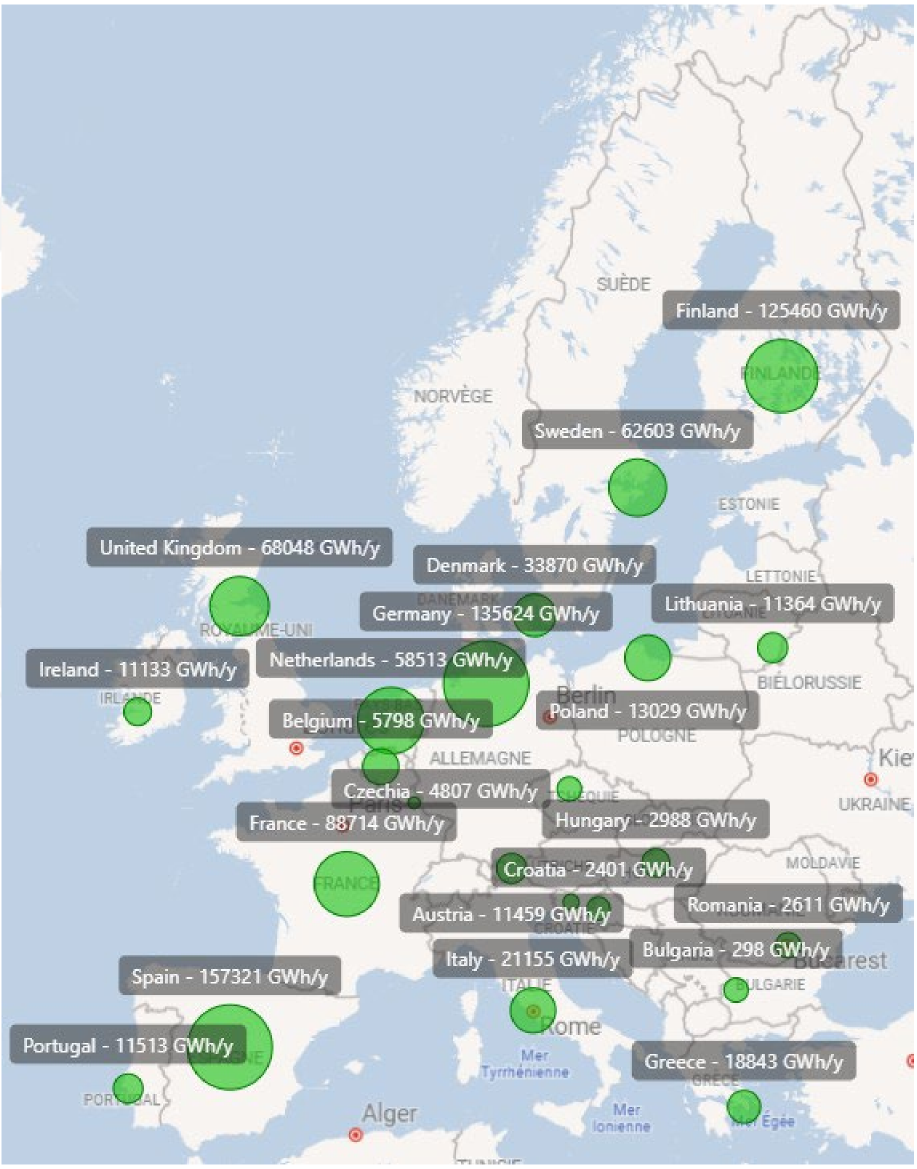
The overall yearly demand-supply balance for the PCI/PMI hydrogen infrastructure level in 2040 for the stressful weather year is presented in Table 25. As detailed in Table 25, electrolytic hydrogen production is the main source of hydrogen in Europe but it is reduced in comparison with the reference weather year. To compensate the reduction of electrolytic hydrogen production, hydrogen import sources, both via ship and pipeline, increase in comparison with the reference weather year. The imports via terminals increase by 15%. The consideration of a stressful weather year leads to an approximate rate of 18% of hydrogen demand curtailment at European level. This represents an increase by 3% in comparison with the reference weather year.

Table 25: Supply and demand balance in the PCI/PMI hydrogen infrastructure level in 2030 and 2040 for stressful weather year (unit: TWh/y).

Yearly hydrogen supply-demand balance	PCI/PMI IL 2030	PCI/PMI IL 2040
H_2 produced via electrolysis	310	1000
H_2 produced using natural gas	229	165
H_2 shipped imports	29	96
H_2 pipeline imports	0	320
Curtailed H_2 demand	52	352
H_2 demand for power production	2	75
Total H_2 demand	620	1933

Figure 24 shows the distribution of hydrogen production via electrolysis in the different European countries for the PCI/PMI hydrogen infrastructure level in the 2040 assessment under stressful weather conditions. Despite the overall reduction of electrolytic hydrogen production, under stressful weather conditions the countries with the highest electrolytic hydrogen production follow the same distribution as in the PCI/PMI 2040 assessment for the reference weather year (see Figure 21). Some countries have more than one source of electrolytic hydrogen production. This is related to the intra-country assumptions that are detailed in the description of the reference weather year in section 3.1.1.

Figure 24: Distribution of hydrogen production via electrolysis in the PCI/PMI hydrogen infrastructure level in 2040 for stressful weather year (unit: GWh/y).



The distribution of hydrogen production produced from natural gas in the different European countries for the PCI/PMI hydrogen infrastructure level in the 2040 assessment under stressful weather conditions is presented in Figure 25. No significant change was observed in comparison to the reference weather year presented in Figure 22.

Figure 25: Distribution of hydrogen production from natural gas in the PCI/PMI hydrogen infrastructure level in 2040 for stressful weather year (unit: GWh/y).

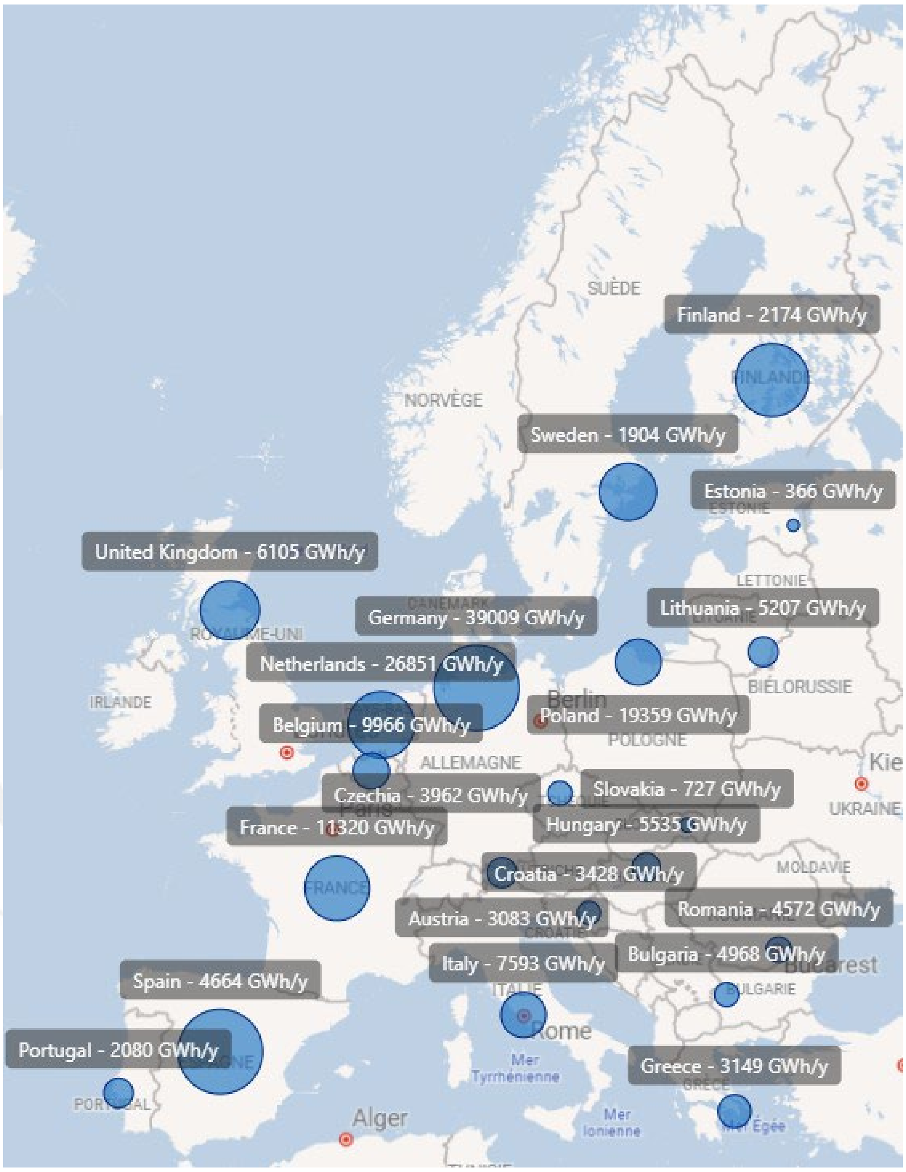


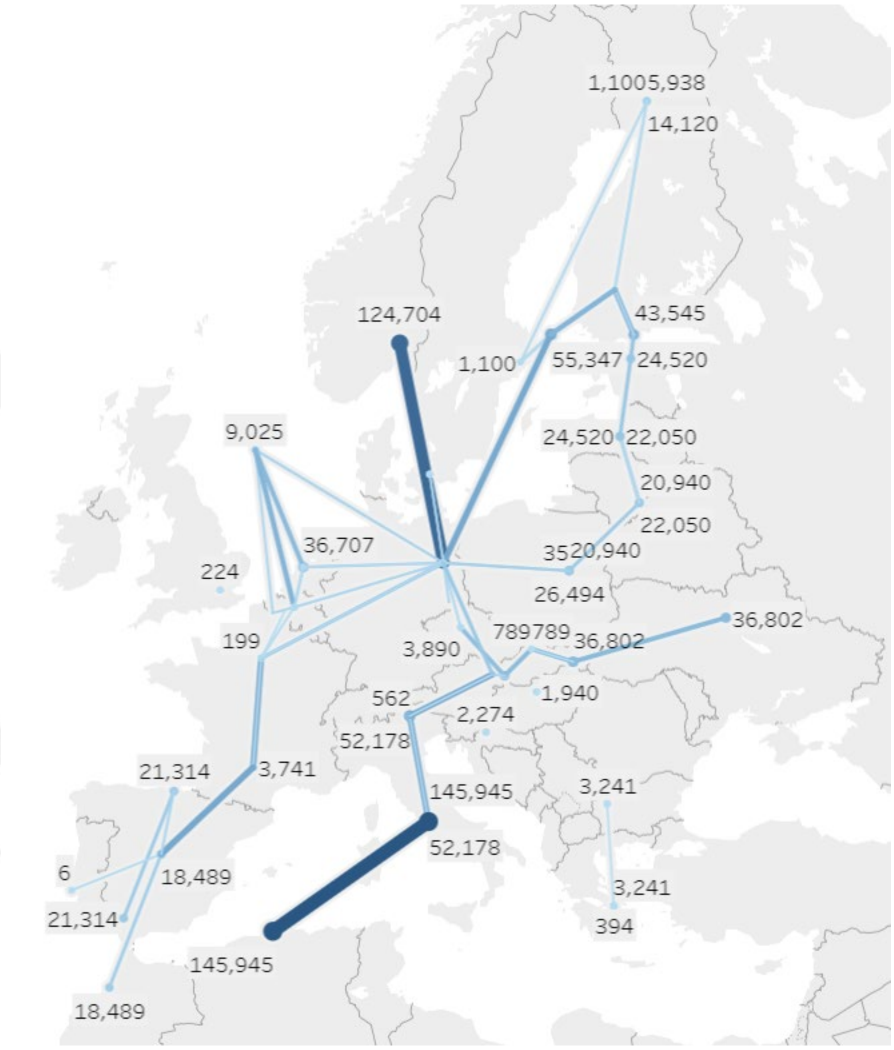
Table 26: Distribution of hydrogen production, imported hydrogen and demand per country in the PCI/PMI hydrogen infrastructure level in 2040 for stressful weather year (unit: GWh/y).

Country	**H_2 Production** via electrolysis	**H_2 Production** using natural gas	**H_2 extra-EU imports** by pipeline & ship	**H_2 demand**
AT	11459	3083	0	45757
BE	5798	9966	42160	85434
BG	298	4968	0	12712
CZ	4807	3962	0	46404

CY	0	0	0	2614
DE	135624	39009	135897	548373
DK	33870	0	0	31337
EE	0	366	0	3128
ES	157321	4664	18427	156348
FI	125460	2174	0	85318
FR	88714	11320	8994	166517
GR	18843	3149	0	38538
HR	2401	3428	0	8168
HU	2988	5535	0	26496
IE	11133	0	0	14439
IT	21155	7593	145450	127210
LT	11364	5207	0	22242
LU	298	0	0	9772
LV	0	0	0	4042
MT	0	0	0	1475
NL	58513	26851	36582	126032
PL	13029	19359	0	134035
PT	11513	2080	0	19628
RO	2611	4572	0	37722
SE	62603	1904	0	71263
SI	1885	0	0	5822
SK	0	727	36677	9549
UK	68048	6105	0	91428

As presented in Figure 26 and ,Table 26 the flows through the two corridors connecting electrolytic supply with German and European demand reduced in the stressful weather year assessment, driven by the overall reduction of available RES. This affects the Iberian and the Nordic corridor. The flows through intra-EU transport corridors that are supplied by Norway, North Africa and Ukraine therefore increase if possible.

Figure 26: Grid flows(*) in the PCI/PMI hydrogen infrastructure level in 2040 for stressful weather year (unit: GWh/y).



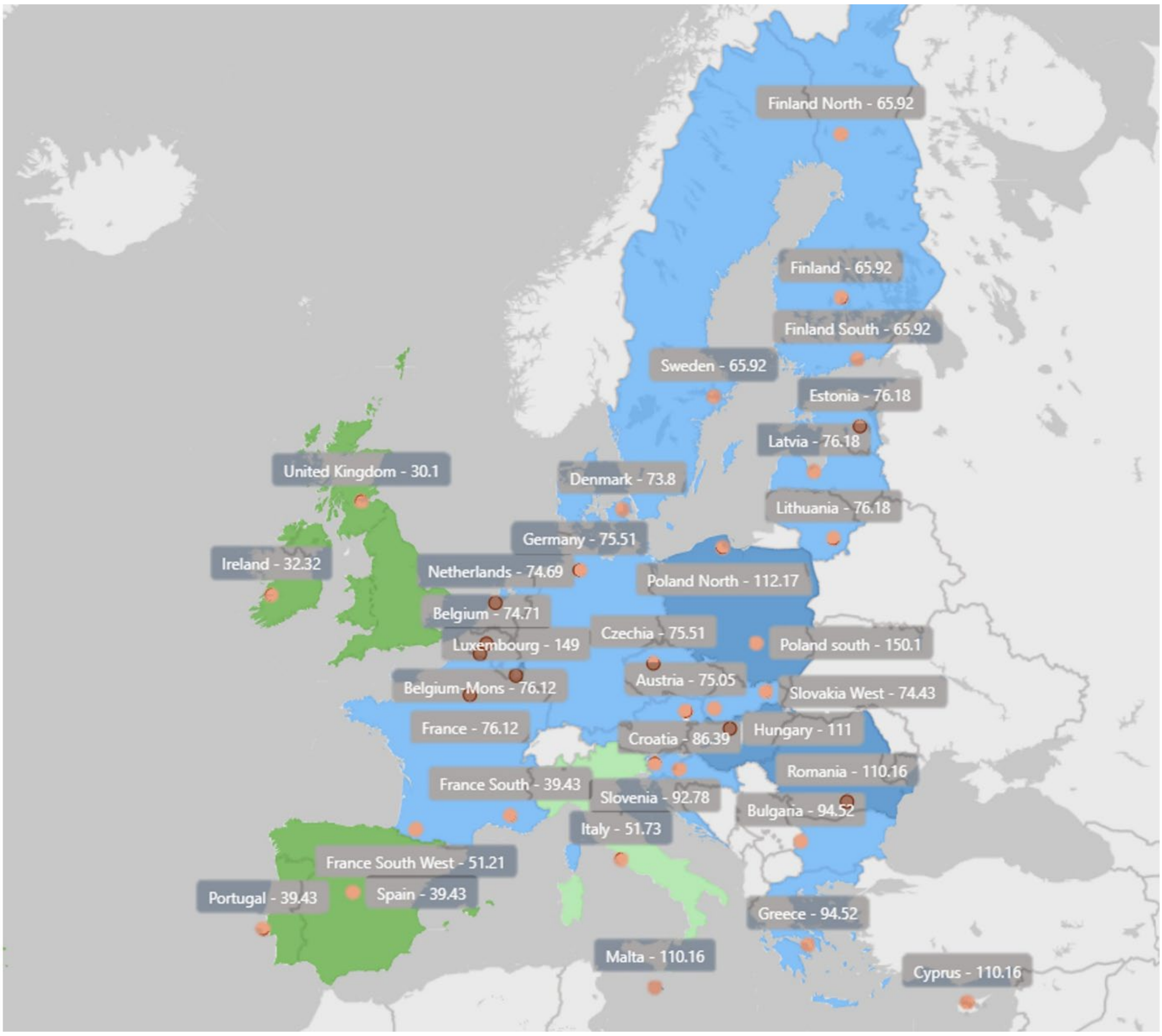
(*) Grid flows refer to simulations results and do not intend to represent how the European infrastructure is expected to evolve in the simulated years, being just outcomes of a modelling tool. The values are provided as a table in Annex II and as monthly values in Annex III).

When comparing Figure 26 with Figure 23, most European countries show the same behaviour in terms of being a net exporter, a net importer or a transit country for the stressful as for the reference weather year. As expected under stressful climatic conditions, corridors based mainly on electrolytic production will see their exporting role slightly reduced due to the lower availability of RES (i.e., Iberian and Nordic corridors). Consequently, also the transit through countries along these routes is reduced (e.g., transit through Baltic countries). On the contrary, both liquid imports and import corridors via pipeline, will maximize their flows to compensate the reduction on European electrolytic supplies.

4.1.1.1. IGI indicator 1: Hydrogen market clearing price spreads for reference weather year

Overview: Hydrogen market clearing prices per country

Figure 27: Average of the hourly hydrogen market clearing prices per country in the PCI/PMI hydrogen infrastructure level in 2040 (unit: €/MWh).



The increase of hydrogen demand considered in the 2040 assessment leads to a general increase of average hydrogen market clearing prices in Europe when compared to the 2030 assessment, as represented in Figure 27. This increase is connected to the higher rates of curtailed demand across Europe, and to a lesser extent to the use of more expensive hydrogen import sources to satisfy the hydrogen demand in the different European countries.

In South-Eastern Europe, where most of the countries have limited connection to the European hydrogen network and rely on the local hydrogen production, the increase of hydrogen prices is more pronounced. This steep increase is explained by the increase of demand curtailment, as well as the use of more expensive hydrogen sources to satisfy hydrogen demand in order to avoid curtailment. As presented in Figure 27, this is particularly important as these countries are isolated in the PCI/PMI hydrogen infrastructure level. In addition, the cost of hydrogen production from natural gas increases significantly in the 2040 assessment due to the increase of the ETS price as stipulated in the TYNDP 2024 NT+ scenario.

Despite the increase of hydrogen market clearing prices in many countries in the 2040 assessment, there are other countries or areas where the average hydrogen market clearing price decreases compared to 2030:

- Due to higher availability of electrolytic hydrogen production: Spain, Portugal, France-South region, Finland, Sweden, the United Kingdom, Ireland.
- Due to new interconnections:
  - Italy, mainly driven by the availability of North African hydrogen supplies.
  - Slovakia, mainly driven by the connection to the European hydrogen network and the availability of Ukrainian hydrogen supplies.

The price formation in the DHEM is based on the merit order of hydrogen production (see section 1.2.1). Several price groups stand out, while a signification correlation is understood here as a correlation above 0.7:

1. Portugal, Spain, France-South region: Portugal and Spain are producers and net exporters of electrolytic hydrogen from RES to other countries. While the France-South region is sufficiently connected to the Iberian peninsula, price spreads appear with other groups of (regions of) countries due to an internal bottleneck in France. The prices in this group show no significant correlation with the prices in other groups.
2. France-Southwest region: The prices in this group show no significant correlation with the prices in other groups. The group exists due to bottlenecks within France.
3. France-North region: The prices in this group show significant correlations with prices in groups 4, 5, 6, 7, 11, 12. The group exists due to bottlenecks within France.
4. France, Belgium-Mons region: The prices in this group show significant correlations with prices in groups 3, 5, 7, 10, 11, 12. The group exists due to bottlenecks within France and Belgium.
5. Belgium, the Netherlands: The prices in this group show significant correlations with prices in groups 3, 4, 7, 10, 11, 12. The group exists due to bottlenecks with France and Germany.
6. Denmark: The prices in this group show significant correlations with prices in groups 3, 4, 5, 7, 10, 11, 12. The group exists due to a bottleneck from Denmark to Germany.
7. Germany, Czechia, Austria: Well interconnected countries. The prices in this group show significant correlations with prices in groups 3, 4, 5, 6, 10, 11, 12.
8. Italy: While being connected to Austria, the bottleneck between Italy and Austria is so dominant that Italy has no significant price correlation with any other (region of a) country.

9. Poland-North region: While being connected to Germany and Lithuania (via the Nordic-Baltic Hydrogen Corridor), the Poland-North region has no significant price correlation with any other (region of a) country due to the bottlenecks associated with both connections.
10. Sweden, Finland: The prices in this group show significant correlations with prices in groups 3, 4, 5, 6, 7, 11, 12. The group exists due to a bottleneck between Sweden/Finland and Germany and a bottleneck between Finland and Estonia.
11. Estonia, Latvia, Lithuania: The prices in this group show significant correlations with prices in groups 3, 4, 5, 6, 7, 10, 12. The group exists due to a bottleneck between Finland and Estonia as well as bottlenecks from Lithuania to Poland and within Poland.
12. Slovakia: The prices in this group show significant correlations with prices in groups 3, 4, 5, 6, 7, 10, 11. The group exists due to a bottleneck from Austria to Slovakia and a bottleneck from Slovakia to Czechia.
13. Ireland, the United Kingdom: Isolated countries without significant price correlations but with average prices below 100 €/MWh.
14. Greece, Bulgaria: Countries showing significant price correlation, jointly isolated from the other European countries.
15. Romania, Hungary: The group exists due to a bottleneck between Slovakia and Hungary (and no connection between Romania and Bulgaria).
16. Croatia (only connected to Bosnia), Slovenia, Luxembourg, Cyprus, Malta, Poland-South region: Isolated countries without significant price correlations (except for Croatia and Slovenia due to a similar national hydrogen production constellation) and with average prices above 100 €/MWh.

The price correlations listed above are enabled by the infrastructure projects already considered in this hydrogen infrastructure level. However, price differences that led to the identification of the groups listed above are not necessarily describing an infrastructure gap. For this identification of infrastructure gaps, the thresholds of IGI indicator 1 are used.

The IGI indicator 1 reveals in the 2040 assessment of the PCI/PMI hydrogen infrastructure level an increase of the price spreads at many European borders when compared to the 2030 assessment.

At the following borders, IGI indicator 1 identified additional significant price spreads in comparison with the 2030 assessment due to bottlenecks:

- Finland/Sweden and Germany: With the increase of electrolytic hydrogen production in Finland and Sweden, market clearing prices are reduced in these countries and the utilisation of the transport route to Germany increases. Thereby, the interconnection acts as a bottleneck.
- Finland and Estonia: With the increase of electrolytic hydrogen production in Finland, the utilisation of the interconnection between Finland and Estonia increases. Thereby, the interconnection acts as a bottleneck.
- Italy and Austria (and France and Germany): The availability of Algerian imports significantly increases the utilization of the Italy-Austria-Germany route. Thereby, the interconnection

between Italy and Austria acts as a bottleneck. Besides, the hydrogen market clearing price spread between Italy on the one side and Germany or France on the other side is increasing over the threshold. No direct connection between Italy and Germany or France is available.

> Germany and Poland-North region: The net demand increase in the Poland-North region increases the utilisation of the interconnection between them. Thereby, the interconnection acts as a bottleneck.
> Lithuania and Poland-North region: The net demand increase in the Poland-North region increases the utilisation of the interconnection between them (via the Nordic-Baltic Hydrogen Corridor). Thereby, the interconnection acts as a bottleneck.

In the 2040 PCI/PMI assessment, there are some borders where the price spread has decreased compared to the 2030 assessment. At the following borders, the IGI indicator 1 therefore does not identify a significant price spread anymore:

> Slovakia, Austria, Czechia: The connection of Slovakia in the 2040 PCI/PMI hydrogen infrastructure level to Austria and Czechia allows the market clearing prices to converge in these countries.

Countries and regions that are isolated in 2040 in the PCI/PMI hydrogen infrastructure level, such as Hungary, Romania, cluster Greece-Bulgaria, Slovenia, Croatia, Luxembourg, Poland South, France South West, Ireland, the United Kingdom, Malta and Cyprus, remain showing significant price spreads with their neighbouring countries and regions, as identified by IGI indicator 1 in Table 27.

Table 27: List of borders in the PCI/PMI hydrogen infrastructure level that exceed (at least one of) the thresholds defined for IGI indicator 1 in 2040.

Border	Threshold 1: Absolute average hourly hydrogen market clearing price spread above 4 €/MWh	Threshold 2: More than 40 days with hydrogen market clearing price spread above 20 €/MWh
DEh2-DKh2	21	140
DEh2-FIh2	16	101
DEh2-ITh2	29	190
DEh2-PLh2N	50	274
DEh2-PLh2S	100	325
DEh2-SEh2	16	101
FIh2-EEh2	13	88
FRh2-FRh2S	46	283
FRh2-FRh2SW	31	197
FRh2-ITh2	30	197
FRh2S-FRh2SW	29	132
HUh2-ATh2	51	278
HUh2-HRh2	32	205

HUh2-SKh2E	51	277
ITh2-ATh2	29	188
ITh2-HRh2	50	282
LTh2-PLh2N	49	270
NLh2-UKh2	56	305
PLh2N-PLh2S	50	60
PLh2S-CZh2	100	325
PLh2S-SKh2E	101	325
ROh2-BGh2	22	127
SIh2-HRh2	11	42
SKh2E-PLh2S	101	325
UKh2-BEh2	56	305
UKh2-IEh2	25	133

4.1.1.2. IGI indicator 2.1: Hydrogen demand curtailment for reference weather year

As explained in section 1.2.2, this IGI indicator assesses infrastructure gaps by quantifying hydrogen demand curtailments at individual nodes during the reference weather year, assuming no disruptions of infrastructures or of supply sources. It involves a multi-step simulation process integrating DHEM and DGM[14] outputs to evaluate the combined curtailments across nodes. The assessment is performed for the PCI/PMI hydrogen infrastructure level in 2040, showing the effects of matured infrastructure in 2040.

Figure 28 and Table 28 show yearly average curtailment rates of hydrogen demand in the Zone 2 nodes of different European countries. For countries where the hydrogen market is divided into several sub-zones (i.e., nodes), the curtailment rate in the different sub-zones is presented. The yearly average hydrogen curtailment rates are thereby colour-coded in the map to indicate levels relative to the set threshold: blue signifies curtailment above the threshold, while green represents rates that are not above it.

[14] This draft TYNDP 2024 IGI report only includes the simulation results of the DHEM.

Figure 28: Yearly average hydrogen demand curtailment rate at country or node level in the PCI/PMI hydrogen infrastructure level in 2040 for reference year (unit: %).

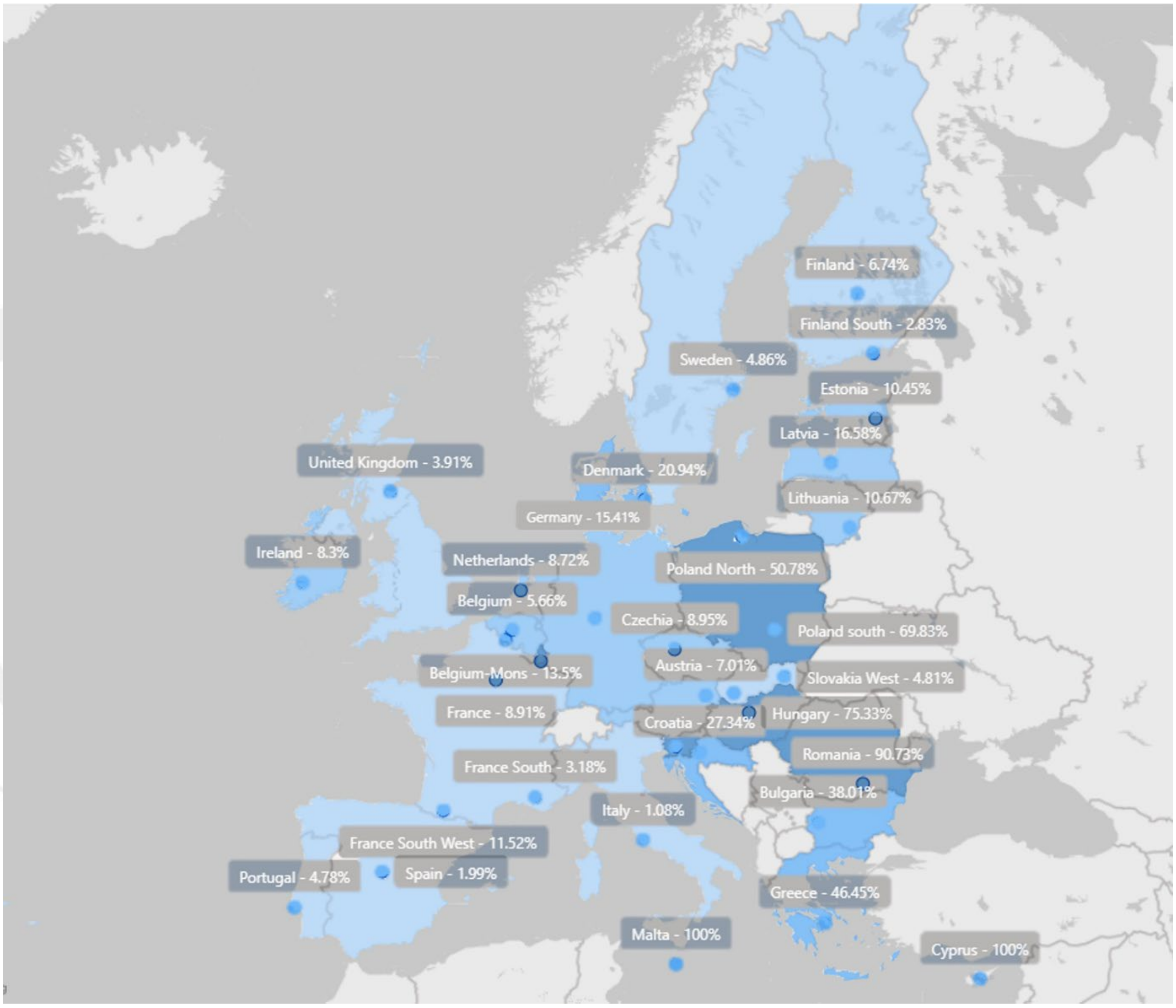


Table 28: Yearly average hydrogen demand curtailment rate at country/sub-zone level in the PCI/PMI hydrogen infrastructure level in 2040 for reference weather year (unit: %).

Node	Demand curtailment rate (%)
ATh2	7.01
BEh2	5.66
BEH2Mo	13.5
BGh2	38.01
CYh2	100
CZh2	8.95

DEh2	15.41
DKh2	20.94
EEh2	10.45
ESh2	1.99
FIh2	6.74
FIh2N	3.36
FIh2S	2.83
FRh2	8.91
FRh2S	3.18
FRh2SW	11.52
GRh2	46.45
HRh2	27.34
HUh2	75.33
IEh2	8.3
ITh2	1.08
LTh2	10.67
LUh2	95.54
LVh2	16.58
MTh2	100
NLh2	8.72
PLh2N	50.78
PLh2S	69.83
PTh2	4.78
ROh2	90.73
SEh2	4.86
SIh2	54.94
SKh2E	3.61
SKh2W	4.81
UKh2	3.91

All European countries and regions overshoot the threshold of 0% of IGI indicator 2.1 in the PCI/PMI hydrogen infrastructure level in 2040. However, differences in the hydrogen curtailment rates between nodes are related to the level of infrastructure development and supply availability. In comparison with IGI indicator 1, this IGI indicator focusses on the availability of supplies.

As detailed in Table 28, (regions of) countries can be aggregated in different groups according to their average yearly hydrogen demand curtailment rates:

1. Rates below 5%: Portugal, Spain, Italy, the United Kingdom, Sweden, Finland-North region, Finland-South region, France-South region, Slovakia-West region, Slovakia-East region.

2. Rates between 5% and 20%: Finland, Austria, Belgium, Belgium-Mons region, Czechia, Germany, Estonia, France, France-Southwest region, Ireland, Lithuania, Latvia, the Netherlands.
3. Rates between 20% and 50%: Bulgaria, Denmark, Greece, Croatia.
4. Rates between 50% and 100%: Slovenia, Romania, Poland-North region, Poland-South region, Hungary, Luxembourg.
5. Full curtailment of 100%: Cyprus, Malta.

Without the infrastructure already considered in the hydrogen infrastructure level, the overall hydrogen demand curtailment would be higher.
Even though the threshold has been surpassed, countries and regions of group 1 exhibit hydrogen demand curtailment rates below 5% average yearly curtailment rate, meaning that for a large share of the year their demand is fully covered. Portugal, Slovakia and the United Kingdom show decreased curtailment rates compared to the PCI/PMI hydrogen infrastructure level assessment for 2030. This is particularly evident for Slovakia due to its connection to the European backbone and to Ukrainian hydrogen supplies in 2040. For the other countries and regions in this group, hydrogen curtailment rates increase with the general trend of increased hydrogen curtailment rates in 2040. The primary driver behind this increase is the rising demand for hydrogen within these individual countries, which surpasses the current capacity of available infrastructure. Despite advancements in PCI/PMI hydrogen infrastructure level, the rapid growth in hydrogen consumption highlights the need for further investment and development to meet the increasing demand. This trend underlines the evolving challenges of balancing infrastructure enhancements with accelerating demand.

Group 2 of countries and regions also contains those that show decreased hydrogen curtailment rates, i.e., Austria, the Belgium-Mons region, Czechia, the France-Southwest region, Ireland, Lithuania, and Latvia. Additionally, countries such as Lithuania and France not only benefit from improved import infrastructure but also experience increased their electrolytic production in 2040, which further mitigates curtailment rates. These developments highlight the effectiveness of infrastructure expansion and technological advancements in reducing hydrogen demand curtailment. At the same time, there is slight increases of hydrogen curtailment rates in Germany, Finland and France caused by increases of hydrogen demand in 2040.

Group 3, comprising Bulgaria, Denmark, Greece and Croatia, shows demand curtailments greater than 20% but below 50%. Within this category, curtailment rates are observed to rise from 2030 to 2040, driven by the increase of hydrogen demand in these countries and limited cross-border interconnections. The growing demand outpaces infrastructure improvements, leaving national markets unable to fully satisfy their hydrogen demand.

Group 4, experiencing hydrogen demand curtailment rates exceeding 50% but remaining below 100%, includes Slovenia and Romania, which have managed to reduce their hydrogen curtailment rates compared to 2030 while remaining isolated. Slovenia achieves a notable reduction from 76.6% to 54.9%, whereas Romania shows only a marginal reduction of 0.2%. Conversely, the Poland-North region, the Poland-South region and Hungary experience increases in hydrogen demand curtailment rates, as significant growth in national demand outstrips the available capacity of the PCI/PMI hydrogen infrastructure as well as hydrogen production options in 2040. Luxembourg remains as isolated in 2040 as in 2030 in the PCI/PMI hydrogen infrastructure level.

Finally, Malta and Cyprus, due to their geographically isolated locations, continue to experience a demand curtailment of 100% at the PCI/PMI hydrogen infrastructure level in 2040. The absence of connections with broader European hydrogen infrastructure underscores the challenges faced by island nations in integrating into the continental hydrogen network.

In the Poland-North Region, France and Czechia, on top of the curtailments observed in Zone 2 nodes as described in the paragraphs above, hydrogen demand curtailments can be observed in Zone 1 that increase during the winter months.

4.1.1.3. IGI indicator 2.2: Hydrogen demand curtailment for stressful weather year

Threshold 1: A yearly average hydrogen demand curtailment rate of more than 3 %

Figure 29 and Table 29 show the yearly average hydrogen demand curtailment rates in the Zone 2 nodes of various European countries for 2040, simulated under a stressful weather year. This weather scenario assumes adverse conditions, such as reduced wind and solar energy availability, which directly impacts hydrogen production. For countries with hydrogen markets divided into multiple sub-zones (i.e., nodes), curtailment rates are depicted individually for each sub-zone on the map. The yearly average hydrogen curtailment rates are thereby colour-coded to indicate levels relative to the set threshold 1: red signifies curtailment above the threshold, while green represents rates that are not.

Figure 29: Yearly average hydrogen demand curtailment rate at country or node level in the PCI/PMI hydrogen infrastructure level in 2040 for stressful weather year (unit: %).

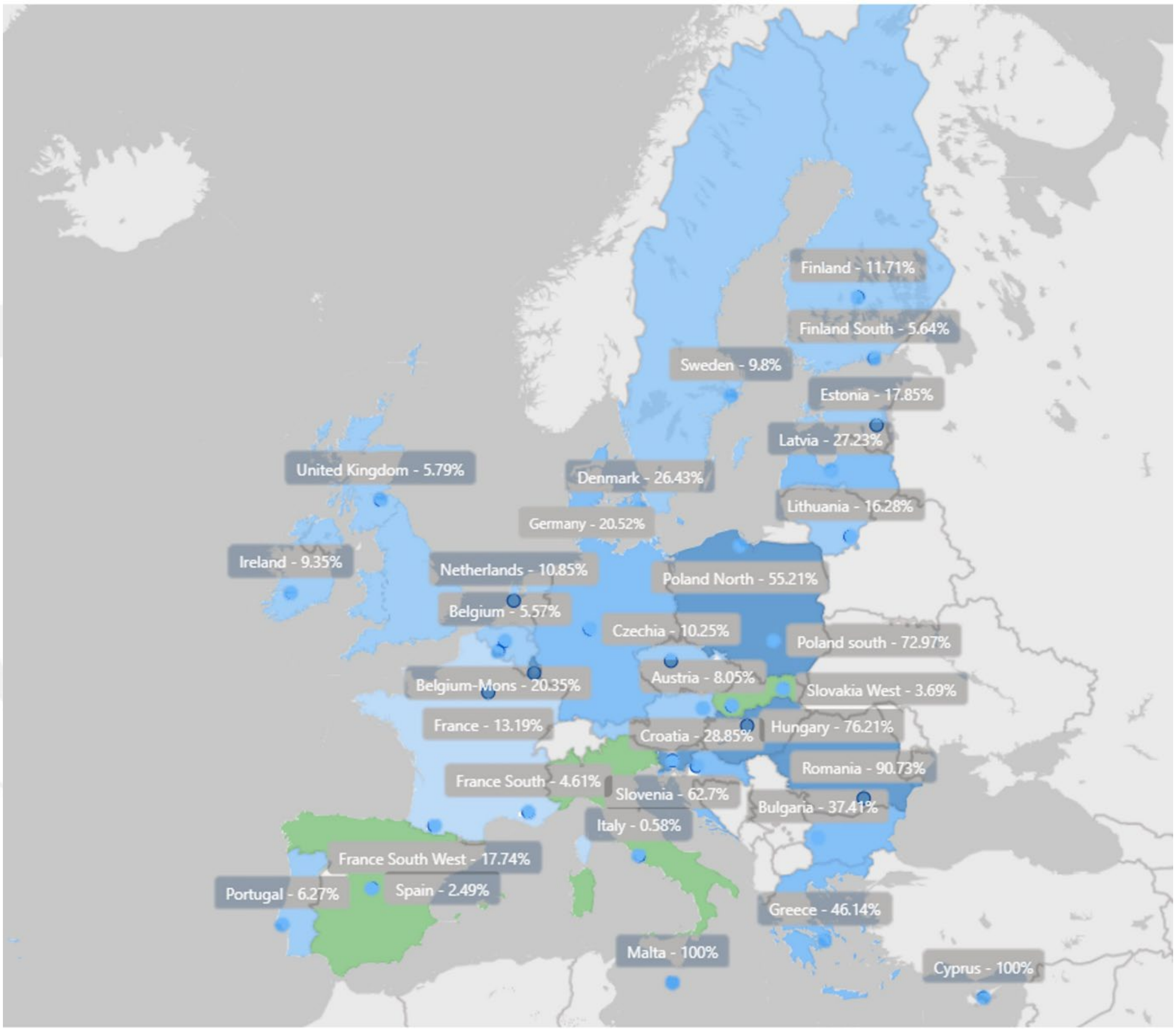


Table 29: Yearly average hydrogen demand curtailment rate at country/sub-zone level in the PCI/PMI hydrogen infrastructure level in 2040 for stressful weather year (unit: %).

Node	Demand curtailment rate (%)
ATh2	8.05
BEh2	5.57
BEH2Mo	20.35
BGh2	37.41
CYh2	100.00
CZh2	10.25
DEh2	21.37

DKh2	26.43
EEh2	17.85
ESh2	2.49
FIh2	11.71
FIh2N	6.26
FIh2S	5.64
FRh2	13.19
FRh2S	4.61
FRh2SW	17.74
GRh2	46.14
HRh2	28.85
HUh2	76.21
IEh2	9.35
ITh2	0.58
LTh2	16.28
LUh2	95.87
LVh2	27.23
MTh2	100.00
NLh2	10.85
PLh2N	55.21
PLh2S	72.97
PTh2	6.27
ROh2	90.73
SEh2	9.80
SIh2	62.70
SKh2E	2.51
SKh2W	3.69
UKh2	5.79

Countries are grouped into five categories based on their average yearly hydrogen demand curtailment rates:

1. Rates below 3%: Italy, Spain, Slovakia-East region.
2. Rates between 3% and 20%: Belgium, Slovakia-West region, Portugal, Sweden, Ireland, Finland, Estonia, the Netherlands, Austria, Czechia, Lithuania, France, France-North region, France-South region, France-Southwest region, Latvia.
3. Rates above 20% and below 50%: Belgium-Mons region, Greece, Denmark, Croatia, Germany, Bulgaria.

4. Rates above 50% and below 100%: Slovenia, Romania, Luxembourg, Poland-North region, Poland-South region, Hungary.

5. Full curtailment of 100%: Cyprus, Malta.

Countries and regions with hydrogen curtailment rates below 3% in 2040 include Italy, Spain, Slovakia East Region. These countries and regions demonstrate remarkable resilience even under stressful weather conditions. For instance, Spain achieves a low curtailment rate of 2.5%, owing to its robust hydrogen production and storage system. The Slovakia-East region, at 2.5%, benefits from enhanced import capabilities from Ukraine that effectively mitigates supply disruptions during adverse weather.

Group 2 includes the Belgium, Slovakia-West region, Portugal, Sweden, Ireland, Finland, Estonia, the Netherlands, Austria, Czechia, Lithuania, France, France-North region, France-South region, France-Southwest region, Latvia. Their curtailment rates exceed the 3% threshold but remain below 20%. Slovakia-West, for example, reports a curtailment rate of 3.7%, reflecting its reliance on imports to bridge domestic production gaps. Similarly, Finland's regions show slight variations, driven by reduced wind and hydropower outputs during the stressful weather year.

Belgium-Mons region, Greece, Denmark, Croatia, Germany, Bulgaria are part of group 3, exhibiting more significant curtailment challenges. Greece, with a curtailment rate of 46.1%, struggles due to its limited domestic production and dependency on solar energy, which is significantly affected by the stressful weather year. The Belgium-Mons region, at 20.4%, reflects the localised nature of its hydrogen supply challenges, as this region operates as a distinct hydrogen cluster. Germany, with a hydrogen demand curtailment rate of 21.4%, faces increasing hydrogen demand in its industrial and transportation sectors, exacerbated by reduced renewable output in a stressful weather year.

Countries in group 4 experience severe curtailment challenges under adverse weather conditions. Slovenia's hydrogen demand curtailment rate improves slightly from 76.6% in 2030 to 62.7% in 2040 but remains high due to inadequate infrastructure and limited renewable energy supply. Poland shows a clear regional disparity, with the Southern region exhibiting a higher curtailment rate (73%) compared to the Northern region (55.2%). Hungary, at 76.2%, faces significant constraints driven by its growing hydrogen demand and insufficient cross-border capacity to meet needs during stressful weather periods. Luxembourg's hydrogen demand curtailment rate of 95.9% underscores its continued need for connection and lack of domestic production, which are further impacted during adverse weather.

Malta and Cyprus experience full curtailment of 100% in 2040, as these countries remain entirely isolated and have no hydrogen production assets.

Threshold 2: hydrogen demand curtailment rate of more than 5 % for at least one month per year

All the countries and regions that exceed threshold 1 also exceeded threshold 2.

4.1.2. Advanced hydrogen infrastructure level

High-level results for reference weather year

The overall yearly demand-supply balance for the advanced hydrogen infrastructure level in 2040 is presented in Table 30. As detailed in Table 30, overall hydrogen demand more than triples compared to the 2030 hydrogen demand level, leading to a yearly hydrogen demand of 1936 TWh/y in Europe.

Whereas the overall foreseen hydrogen demand does not vary between the analysed infrastructure levels, there are significant differences between them in terms of i) hydrogen demand curtailment and ii) availability of the different supplies.
The advanced infrastructure level shows a lower overall hydrogen demand curtailment rate in Europe. The reduction in the demand curtailment in this infrastructure level is related to the higher availability of hydrogen shipped imports and the maximization of the use of pipeline imports, more specifically Norwegian, North African and Ukrainian imports. The maximization of imports is possible thanks to the consideration of non-PCI/PMI advanced infrastructure that enables transport to countries that were isolated in the PCI/PMI infrastructure level, through the SK/HU/RO hydrogen corridor, as well as, the maximization of national production (both from electrolytic and natural-gas based) through a higher utilization of PCI/PMI infrastructure

Despite i) the infrastructure development foreseen in the Advanced hydrogen infrastructure level for 2040 (see section 1.1.2), ii) the increase of extra-EU supply potentials via terminals and pipelines, and iii) the significant increase of electrolytic hydrogen production (by approximately 250% compared to 2030), this is not sufficient to satisfy the hydrogen demand in many European countries and therefore, overall hydrogen demand curtailment rises compared to the 2030 values leading to an average hydrogen curtailment of 12% in Europe. This is lower than the 15% average hydrogen demand curtailment in Europe in the PCI/PMI hydrogen infrastructure level. This reduction is related to the higher availability of hydrogen terminals and the maximization of the use of pipeline imports from Norway, North Africa and Ukraine. The maximization of imports is possible thanks to the consideration of non-PCI/PMI advanced infrastructure that enables transport to countries that were isolated in the PCI/PMI hydrogen infrastructure level. This relates to the transit route through Slovakia, Hungary and Romania as well as the maximisation of national hydrogen production enabled by increased capacities.

Table 30: Supply and demand balance in the Advanced hydrogen infrastructure level in 2030 and 2040 for reference weather year (unit: TWh/y).

Yearly hydrogen supply-demand balance	Advanced IL 2030	Advanced IL 2040
H_2 produced via electrolysis	304	1080
H_2 produced using natural gas	224	168
H_2 shipped imports	24	110

H_2 pipeline imports	42	335
Curtailed H_2 demand	27	237
H_2 demand for power production	2	77
Total H_2 demand	620	1929

Figure 30: Distribution of electrolytic hydrogen production in the Advanced hydrogen infrastructure level in 2040 for reference weather year (unit: GWh/y).

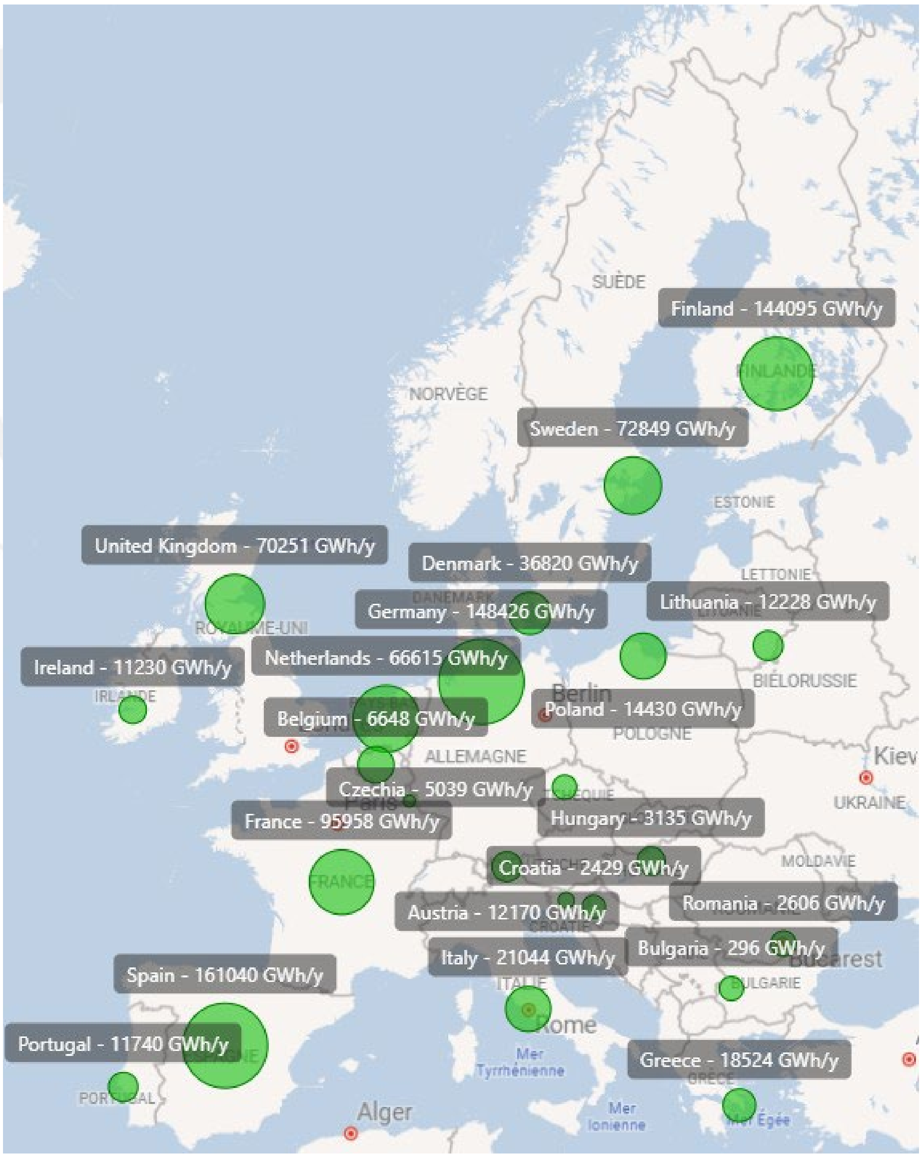


Figure 30 shows the electrolytic hydrogen production in the different European countries for the Advanced hydrogen infrastructure level in the 2040 assessment. The European electrolytic production significantly increased compared to 2030 in most European countries. The electrolytic production slightly varies country to country in comparison to the PCI/PMI hydrogen infrastructure level, being slightly higher for the Advanced hydrogen infrastructure level in 2040. However, the overall distribution across Europe is rather similar.

Figure 31 shows the distribution of hydrogen production from natural gas in 2040. There is a reduction in hydrogen production from natural gas compared to 2030. The reasons for this are explained in section 4.1.1.

Figure 31: Distribution of hydrogen production from natural gas in the Advanced hydrogen infrastructure level in 2040 for reference weather year (unit: GWh/y).

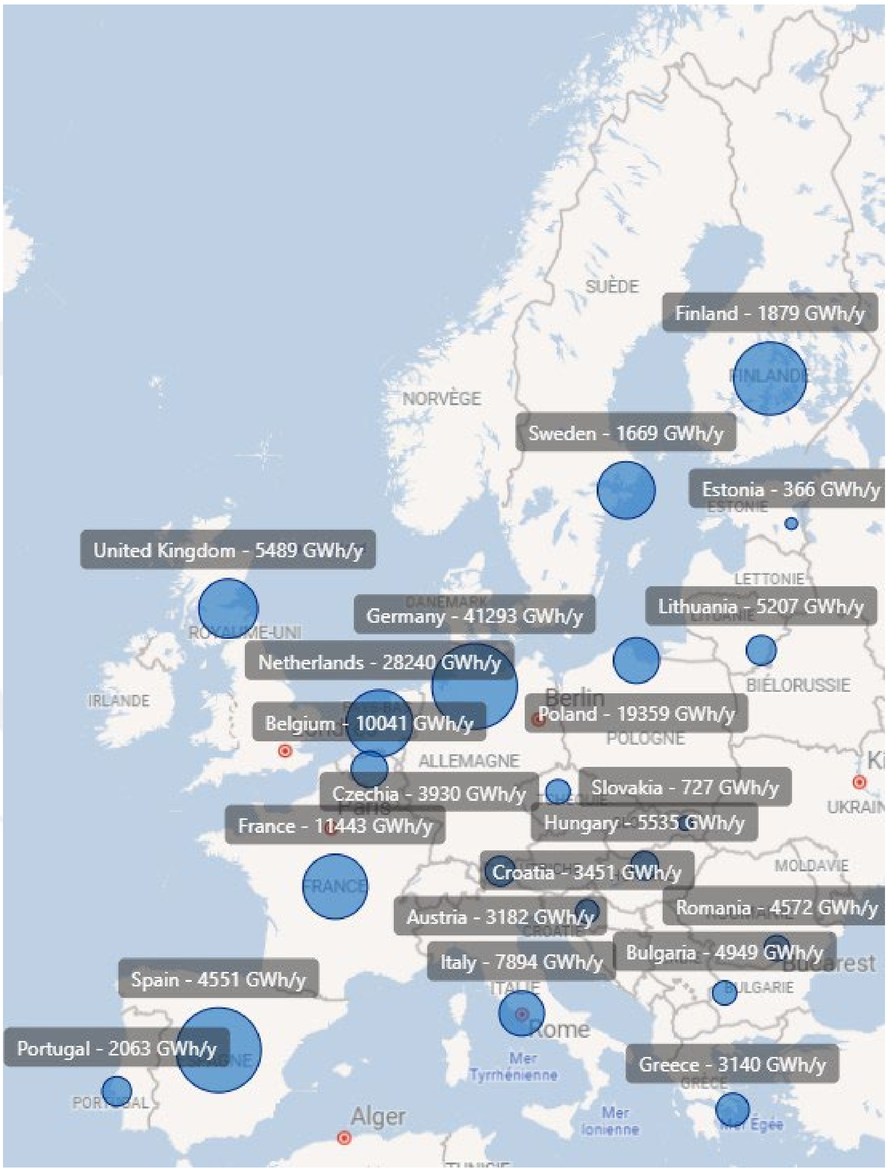


Table 31: Distribution of hydrogen production, imported hydrogen and demand per country in the advanced hydrogen infrastructure level in 2040 for reference weather year (unit: GWh/y).

Country	**H_2 Production** via electrolysis	**H_2 Production** using natural gas	**H_2 extra-EU imports** by pipeline & ship	**H_2 demand**
AT	12170	3182	0	44579
BE	6648	10041	42050	85026

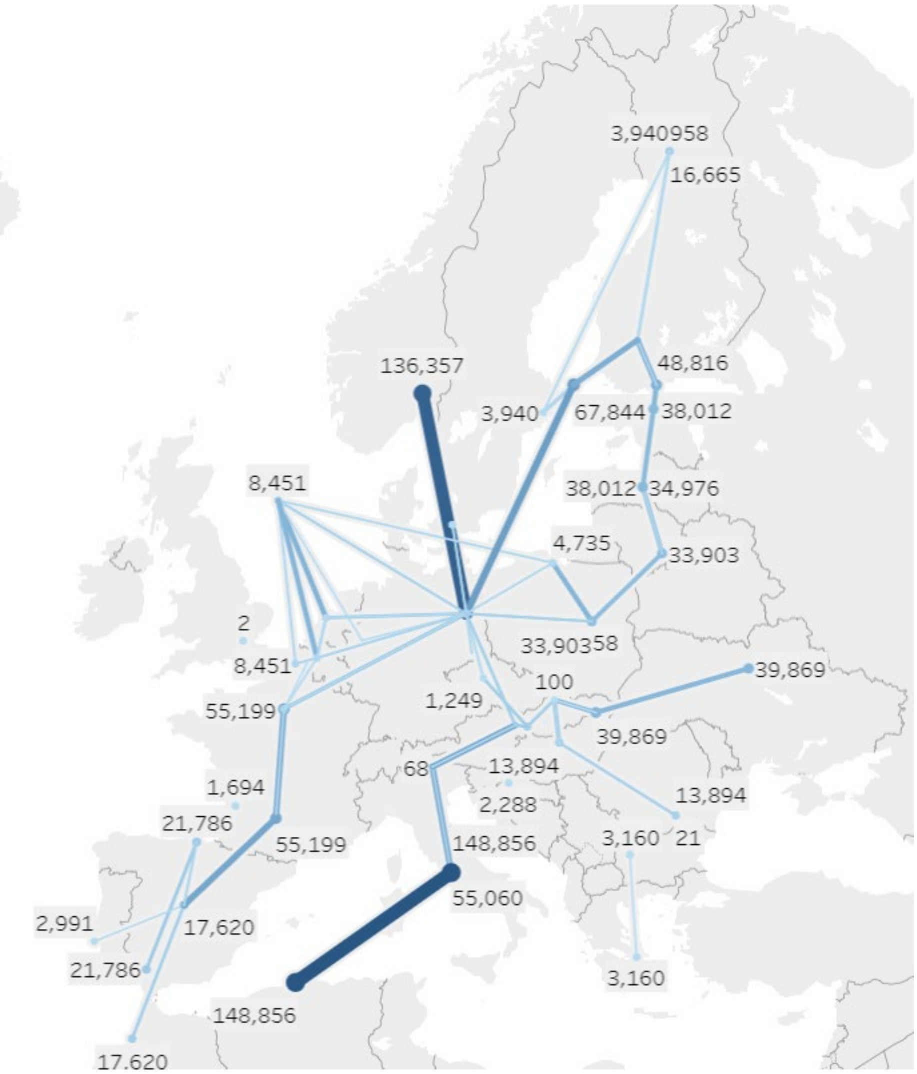
BG	296	4949	0	12712
CZ	5039	3930	0	46404
CY	0	0	0	2614
DE	148426	41293	150490	549450
DK	36820	0	0	31337
EE	0	366	0	3128
ES	161040	4551	17561	156348
FI	144095	1879	0	85318
FR	95958	11443	8422	166556
GR	18524	3140	0	38538
HR	2429	3451	0	8168
HU	3135	5535	0	26496
IE	11230	0	0	14439
IT	21044	7894	148351	127210
LT	12228	5207	0	22242
LU	321	0	0	9772
LV	0	0	0	4042
MT	0	0	0	1475
NL	66615	28240	43589	128932
PL	14430	19359	6365	133930
PT	11740	2063	0	19628
RO	2606	4572	0	37722
SE	72849	1669	0	71263
SI	2166	0	0	5822
SK	0	727	39734	9549
UK	70251	5489	0	91428

Considering the supply and demand distribution presented in Table 31, the intra-EU transport corridors that already emerged in the 2030 assessment of the Advanced hydrogen infrastructure level as well as new supply corridors are even more needed in the 2040 assessment due to the increase of hydrogen demand between 2030 and 2040. These corridors are the Iberian and the Baltic corridors as well as the North African corridor with the main European hydrogen hub in Germany,

In addition, as presented in Figure 32, other intra-EU transport corridors emerge, mainly driven by the availability of extra-EU supplies in the 2040 assessment. Namely, the new corridors identified for 2040 are:

- Norwegian corridor, transporting Norwegian supplies to Germany.
- Ukrainian corridor, transporting Ukrainian supplies to Slovakia and Czechia and other countries.

Figure 32: Grid flows(*) in the Advanced hydrogen infrastructure level in 2040 for reference weather year (unit: GWh/y).



(*) Grid flows refer to simulations results and do not intend to represent how the European infrastructure is expected to evolve in the simulated years, being just outcomes of a modelling tool. The values are provided as a table in Annex II and as monthly values in Annex III).

In the 2040 Advanced hydrogen infrastructure level assessment for the reference weather year, countries can be grouped in four different categories according to their supply-demand balance on a yearly basis:

1. Countries which export more than they import: Sweden, Finland, Denmark, the Netherlands, Spain, Portugal, Greece.
2. Countries that import more than they export: Belgium, Poland, Czechia, Bulgaria and Romania.
3. Transit countries that import more than they consume: Italy, Austria, Germany, Slovakia, Estonia, Latvia, Lithuania and France.
4. Isolated countries: the United Kingdom, Ireland, Luxembourg, Slovenia, Croatia, Malta, Cyprus, and the cluster Bulgaria-Greece.

With the exception of Hungary and Romania, that are integrated in the European hydrogen network through the Slovakia-Hungary-Romania hydrogen route, among the previously interconnected countries, the exporting/importing and transit roles did not change significantly in comparison to the PCI/PMI hydrogen infrastructure level assessment for 2040 (see Figure 26).

High-level results for stressful weather year

The overall yearly demand-supply balance for the Advanced hydrogen infrastructure level in 2040 for the stressful weather year is presented in Table 32. Electrolytic hydrogen production is the main source of hydrogen in Europe but it is reduced in comparison with the reference weather year. To compensate the reduction of electrolytic hydrogen production, hydrogen import sources, mainly via ship, increase in comparison with the reference weather year. The imports via terminals increase by 10%. Pipeline imports however hardly increase as the effective import potential is limited by the import capacities of import pipelines (see Table 5) and by EU-internal bottlenecks (see section 4.2.1), there already were high utilisations in the reference weather year, and there is missing hydrogen storage infrastructure.

The consideration of a stressful weather year leads to an approximate rate of 15% of hydrogen demand curtailment at European level. This is an increase compared to the 12% for the reference weather year with the Advanced hydrogen infrastructure level and a reduction compared to the 18% for the stressful weather year with the PCI/PMI hydrogen infrastructure level.

Table 32: Supply and demand balance in the advanced infrastructure level in 2030 and 2040 for stressful weather year (unit: TWh/y).

Yearly hydrogen supply-demand balance	Advanced IL 2030	Advanced IL 2040
H_2 produced via electrolysis	264	1002
H_2 produced using natural gas	241	170
H_2 shipped imports	35	121
H_2 pipeline imports	42	336
Curtailed H_2 demand	38	298
H_2 demand for power production	2	75
Total H_2 demand	620	1927

Figure 33: Distribution of electrolytic hydrogen production from natural gas in the Advanced hydrogen infrastructure level in 2040 for stressful weather year (unit: GWh/y).

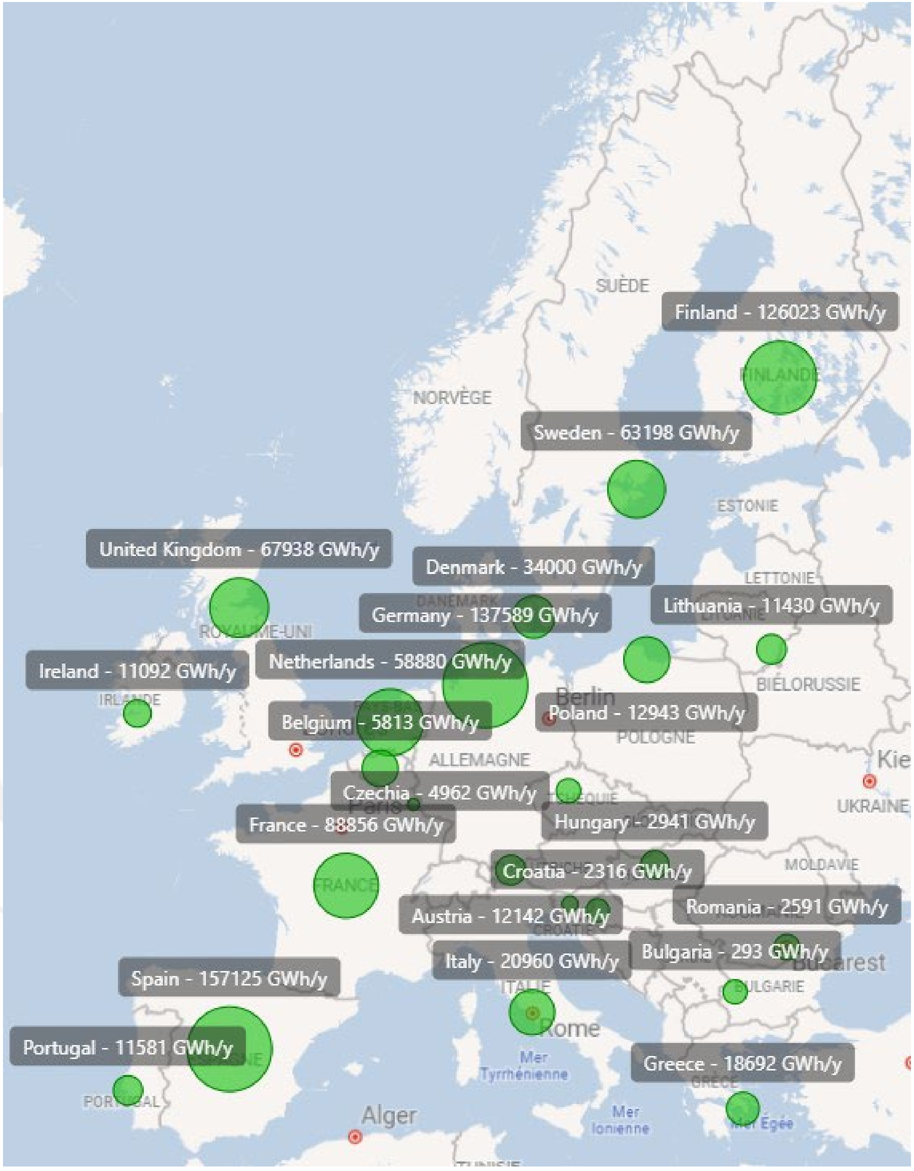


Figure 33 shows the distribution of electrolytic hydrogen production in the different European countries for the Advanced hydrogen infrastructure level in the 2040 assessment under stressful weather conditions. While keeping the same overall distribution as in the reference case, the electrolytic production was reduced all over Europe.

Figure 34: Distribution of hydrogen production from natural gas in the advanced infrastructure level in 2040 for stressful weather year (unit: GWh/y).

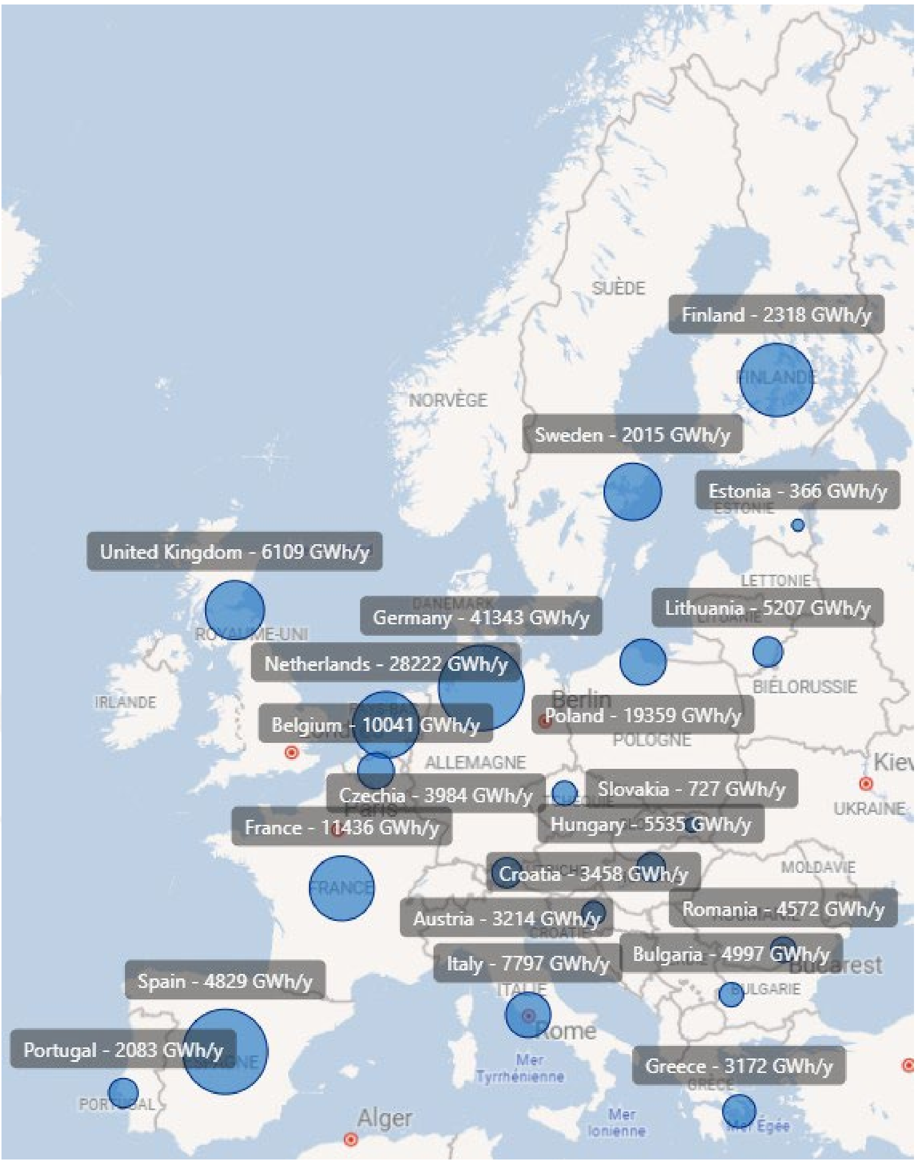
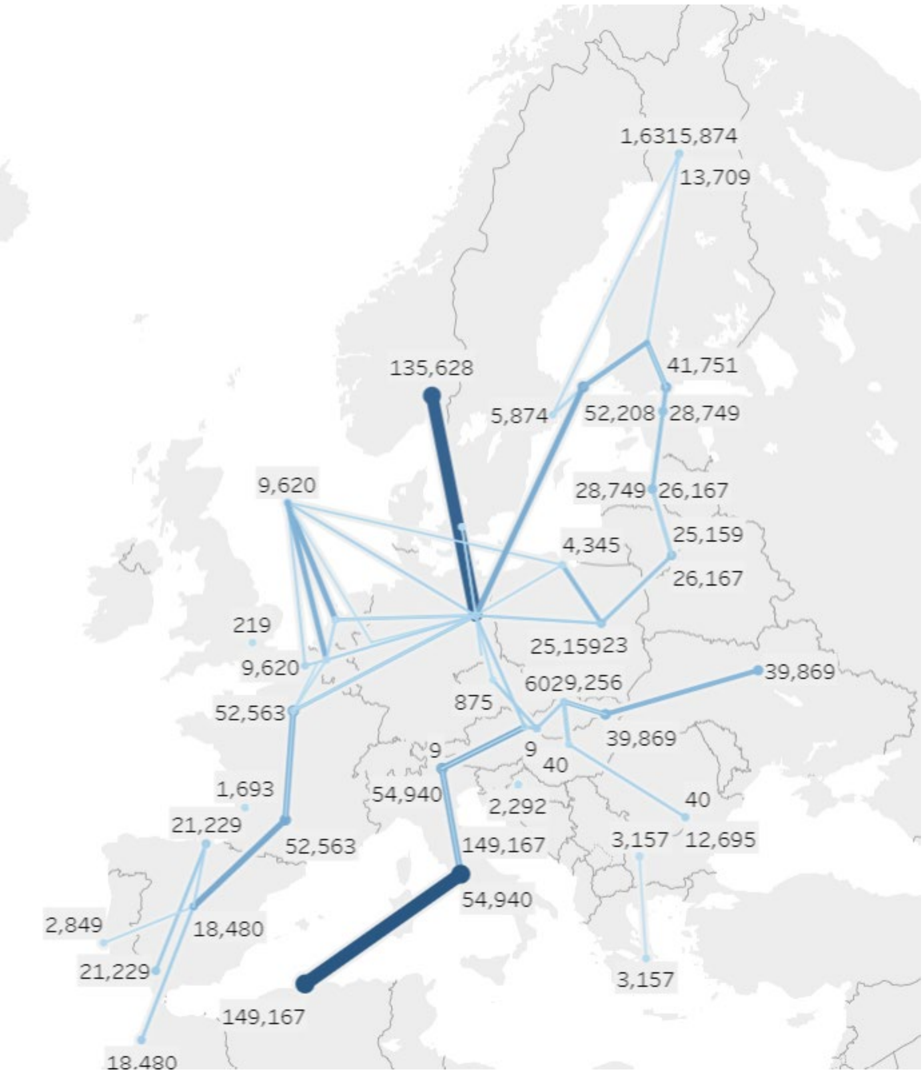


Figure 34 show the distribution of natural-gas based hydrogen production in the different European countries for the Advanced hydrogen infrastructure level in the 2040 assessment under stressful weather conditions. No significant change was observed in comparison to the reference weather year presented in Figure 31.

Table 33: Distribution of hydrogen production, imported hydrogen and demand per country in the Advanced hydrogen infrastructure level in 2040 for stressful weather year (unit: GWh/y).

Country	H_2 Production via electrolysis	H_2 Production using natural gas	H_2 extra-EU imports by pipeline & ship	H_2 demand
AT	12142	3214	0	45507
BE	5813	10041	45166	85412
BG	293	4997	0	12712
CZ	4962	3984	0	46404
CY	0	0	0	2614
DE	137589	41343	50180	548412
DK	34000	0	0	31337
EE	0	366	0	3128
ES	157125	4829	18417	156348
FI	126023	2318	0	85318
FR	88856	11436	9587	166517
GR	18692	3172	0	38538
HR	2316	3458	0	8168
HU	2941	5535	0	26496
IE	11092	0	0	14439
IT	20960	7797	148661	127210
LT	11430	5207	0	22242
LU	296	0	0	9772
LV	0	0	0	4042
MT	0	0	0	1475
NL	58880	28222	48650	126535
PL	12943	19359	6370	134039
PT	11581	2083	0	19628
RO	2591	4572	0	37722
SE	63198	2015	0	71263
SI	1802	0	0	5822
SK	0	727	39734	9549
UK	67938	6109	0	91428

Figure 35: Grid flows(*) in the Advanced hydrogen infrastructure level in 2040 for stressful weather year (unit: GWh/y).



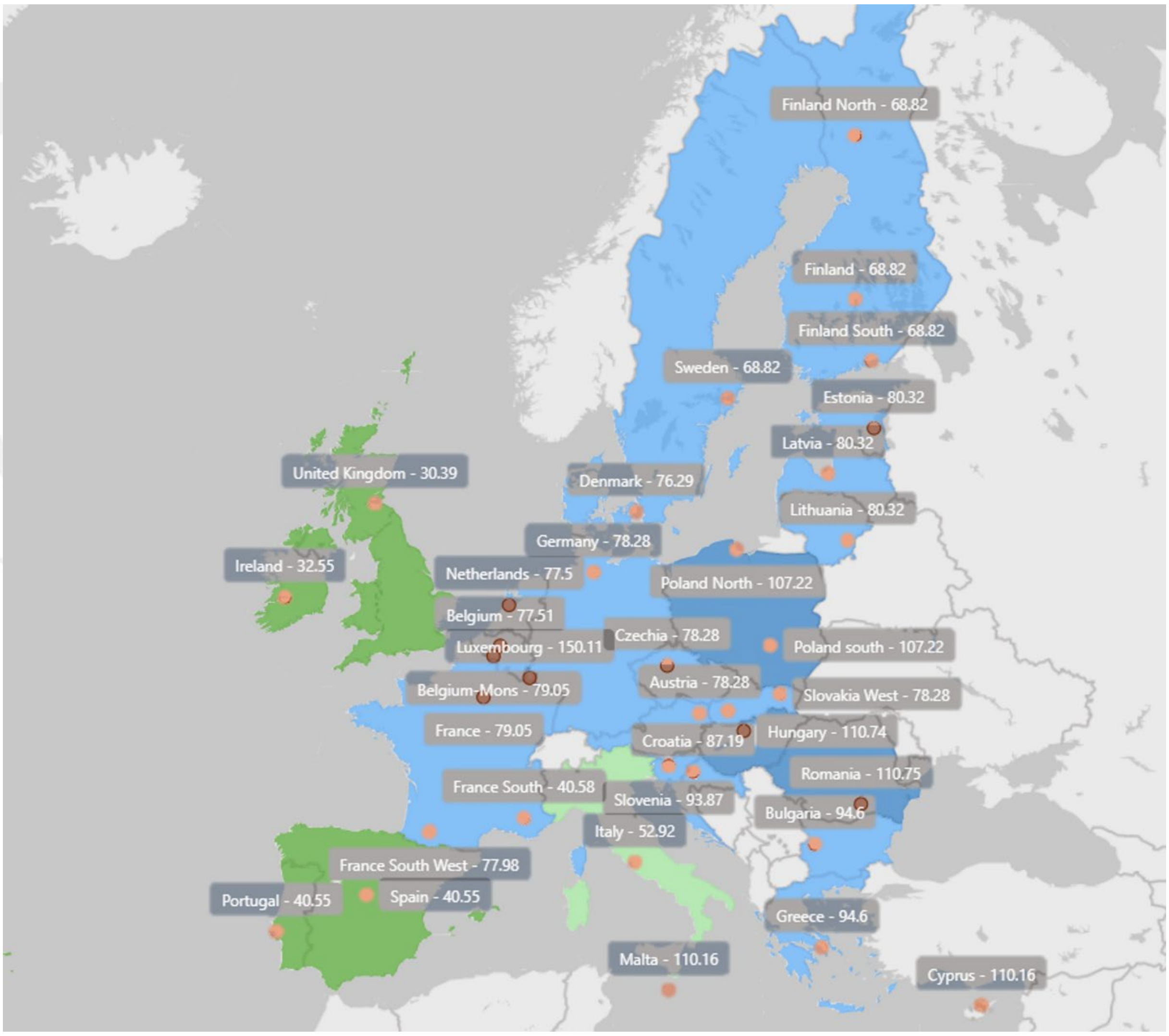
(*) Grid flows refer to simulations results and do not intend to represent how the European infrastructure is expected to evolve in the simulated years, being just outcomes of a modelling tool. The values are provided as a table in Annex II and as monthly values in Annex III).

When comparing Figure 32 with Figure 35, most European countries show the same behaviour in terms of being a net exporter, a net importer or a transit country for the stressful as for the reference weather year. As expected under stressful climatic conditions, corridors based mainly on electrolytic production will see their exporting role slightly reduced due to the lower availability of RES (i.e., Iberian and Nordic corridors). Consequently, also the transit through countries along these routes is reduced (e.g., transit through Baltic countries). On the contrary, countries with access to import terminals will increase imports via ship for own consumption and transit. In addition, imports via pipeline from Ukrainian and North African corridors slightly increase their imports up to the maximum capability, determined by supply potentials and infrastructure bottlenecks.

4.1.2.1. IGI indicator 1: Hydrogen market clearing price spreads for reference weather year

Overview: Hydrogen market clearing prices per country

Figure 36: Average of the hourly hydrogen market clearing prices per country in the Advanced hydrogen infrastructure level in 2040 (unit: €/MWh).



The increase of hydrogen demand considered in the 2040 assessment leads to a general increase of average hydrogen market clearing prices in Europe when compared to the 2030 assessment, as represented in Figure 36. The fundamental reasons are explained in section 4.1.1.1 The Advanced hydrogen infrastructure level considers a significant increase of import terminal capacities (see Table 6 in section 1.1.2), increasing the overall availability of shipped hydrogen imports.

Despite having lower overall hydrogen demand curtailment in the Advanced hydrogen infrastructure level, hydrogen market clearing prices in most European countries are higher than in the PCI/PMI hydrogen infrastructure level for 2040 and lower in some countries like Poland. This relates to the improved connectivity that enables more countries to compete for the hydrogen supply options, maximising the overall socio-economic welfare that includes (among others) the surplus of all the hydrogen consumers as well as the surplus of the hydrogen producers.

The price formation in the DHEM is based on the merit order of hydrogen production (see section 1.2.1). Several price groups stand out, while a signification correlation is understood here as a correlation above 0.7:

1. Portugal, Spain, France-South region: Portugal and Spain are producers and net exporters of electrolytic hydrogen from RES to other countries. While the France-South region is sufficiently connected to the Iberian peninsula, price spreads appear with other groups of (regions of) countries due to an internal bottleneck in France. The prices in this group show no significant correlation with the prices in other groups.
2. France-Southwest region: The prices in this group show no significant correlation with the prices in other groups. The group exists due to bottlenecks within France.
3. France-North region: The prices in this group show significant correlations with prices in groups 4, 5, 6, 7, 11. The group exists due to bottlenecks within France.
4. France, Belgium-Mons region: The prices in this group show significant correlations with prices in groups 3, 5, 6, 7, 10, 11. The group exists due to bottlenecks within France and Belgium.
5. Belgium, the Netherlands: The prices in this group show significant correlations with prices in groups 3, 4, 6, 7, 10, 11. The group exists due to bottlenecks with France and Germany.
6. Denmark: The prices in this group show significant correlations with prices in groups 4, 5, 7, 10, 11. The group exists due to a bottleneck from Denmark to Germany.
7. Germany, Czechia, Austria, Slovakia-East region, Slovakia-West region: The group grew by Slovakia-East and Slovakia-West regions in comparison with the PCI/PMI hydrogen infrastructure level. The prices in this group show significant correlations with prices in groups 3, 4, 5, 6, 10, 11. The group exists due to bottlenecks from France to Germany, from Belgium to Germany, from Denmark to Germany, from Italy to Austria, from Slovakia to Hungary, from Germany to Finland and Sweden, and from Germany to Poland.
8. Italy: While being connected to Austria, the bottleneck between Italy and Austria is so dominant that Italy has no correlation with the prices in other groups.
9. Poland-North region, Poland-South region: This group grew by the Poland-South region in comparison with the PCI/PMI hydrogen infrastructure level.
10. Sweden, Finland: The prices in this group show significant correlations with prices in groups 3, 4, 5, 6, 7, 11. The group exists due to a bottleneck between Sweden/Finland and Germany and a bottleneck between Finland and Estonia.

11. Estonia, Latvia, Lithuania: The prices in this group show significant correlations with prices in groups 3, 4, 5, 6, 7, 10. The group exists due to a bottleneck between Finland and Estonia as well as bottlenecks from Lithuania to Poland and within Poland.
12. Ireland, the United Kingdom: Isolated countries without significant price correlations but with average prices below 100 €/MWh.
13. Greece, Bulgaria: Countries showing significant price correlation, jointly isolated from the other European countries.
14. Croatia (only connected to Bosnia), Slovenia, Luxembourg, Cyprus, Malta: Isolated countries without significant price correlations (except for Croatia and Slovenia due to a similar national hydrogen production constellation) and with average prices above 100 €/MWh.

The IGI indicator 1 in the 2040 assessment of the Advanced hydrogen infrastructure level reveals the same borders that were identified in the PCI/PMI hydrogen infrastructure level assessment for 2040.

Table 34: List of borders in the advanced hydrogen infrastructure level that exceed (at least one of) the thresholds defined for IGI indicator 1 in 2040.

Border	Threshold 1: Absolute average hourly hydrogen market clearing price spread above 4 €/MWh	Threshold 2: More than 40 days with hydrogen market clearing price spread above 20 €/MWh
DEh2-DKh2	24	155
DEh2-FIh2	18	114
DEh2-ITh2	31	206
DEh2-PLh2N	45	271
DEh2-PLh2S	45	271
DEh2-SEh2	18	114
FIh2-EEh2	15	97
FRh2-FRh2S	49	319
FRh2-FRh2SW	31	183
FRh2-ITh2	32	214
FRh2S-FRh2SW	57	265
HUh2-ATh2	44	271
HUh2-HRh2	31	207
HUh2-SKh2E	44	271
ITh2-ATh2	31	206
ITh2-HRh2	49	288
LTh2-PLh2N	42	263
NLh2-UKh2	58	309
PLh2S-CZh2	45	271
PLh2S-SKh2E	45	271

ROh2-BGh2	22	129
SIh2-HRh2	11	45
SKh2E-PLh2S	45	271
UKh2-BEh2	58	309
UKh2-IEh2	25	133

4.1.1.1. IGI indicator 2.1: Hydrogen demand curtailment for reference weather year

As explained in section 1.2.2, this IGI indicator assesses infrastructure gaps by quantifying hydrogen demand curtailments at individual nodes during the reference weather year, assuming no disruptions of infrastructures or of supply sources. It involves a multi-step simulation process integrating DHEM and DGM[15] outputs to evaluate the combined curtailments across nodes. The assessment is performed for the advanced hydrogen infrastructure level in 2040, showing the effects of matured infrastructure in 2040. Figure 34 and Table 35 show yearly average curtailment rates of hydrogen demand in the Zone 2 nodes of different European countries. For countries where the hydrogen market is divided into several sub-zones (i.e., nodes), the curtailment rate in the different sub-zones is presented. The yearly average hydrogen curtailment rates are thereby colour-coded in the map to indicate levels relative to the set threshold: red signifies curtailment above the threshold, while green represents rates that are not above it.

[15] This draft TYNDP 2024 IGI report only includes the simulation results of the DHEM.

Figure 37: Yearly average hydrogen demand curtailment rate at country or node level in the advanced hydrogen infrastructure level in 2040 for reference year (unit: %).

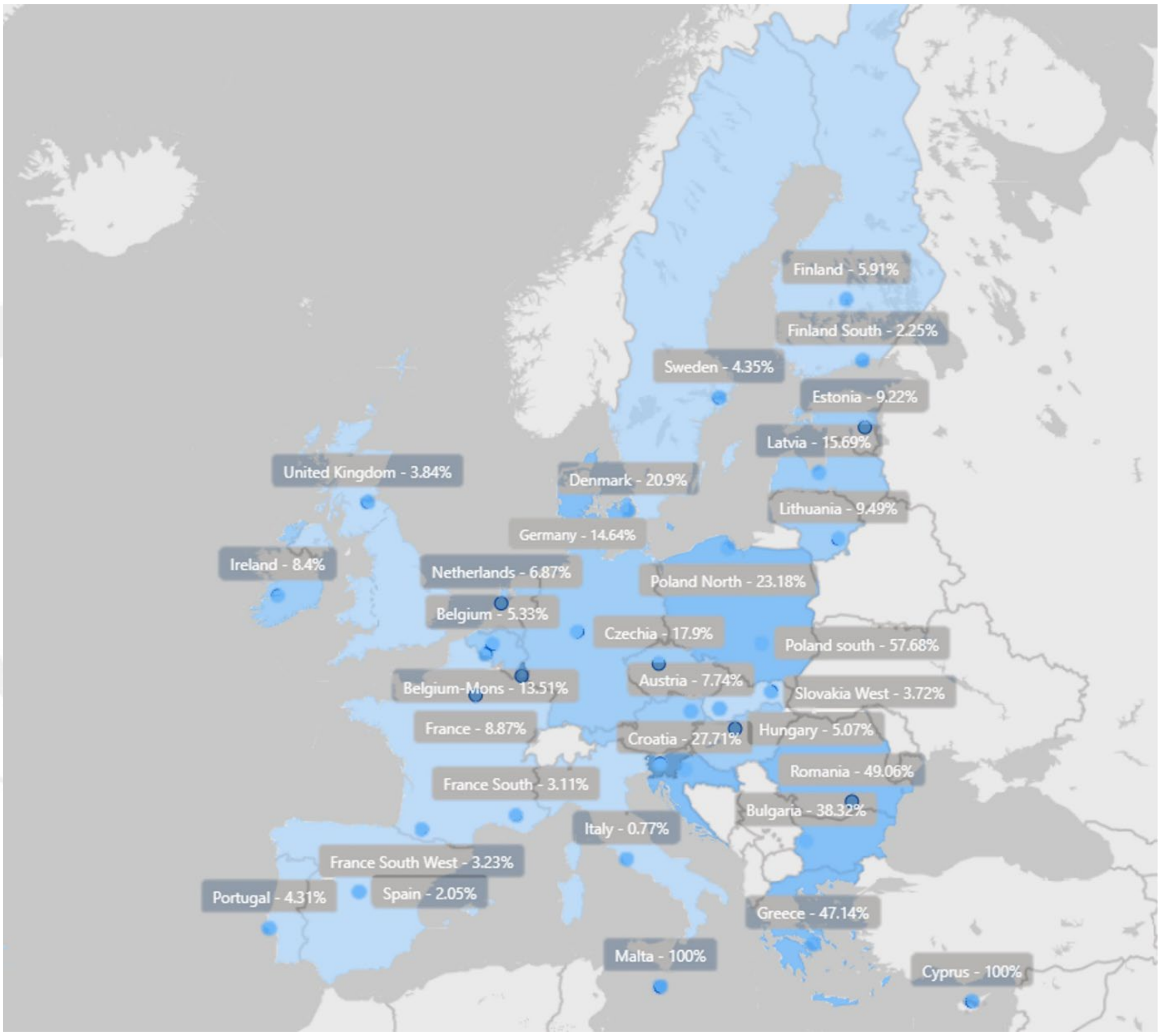


Table 35: Yearly average hydrogen demand curtailment rate at country/sub-zone level in the Advanced hydrogen infrastructure level in 2040 for reference weather year and check of the threshold of IGI indicator 2.1 (unit: %).

Country / Region	Demand Curtailment (%)	Threshold passed
ATh2	7.74	YES
BEh2	5.33	YES
BEH2Mo	13.51	YES
BGh2	38.32	YES

CYh2	100	YES
CZh2	17.9	YES
DEh2	14.64	YES
DKh2	20.9	YES
EEh2	9.22	YES
ESh2	2.05	YES
FIh2	5.91	YES
FIh2N	2.75	YES
FIh2S	2.25	YES
FRh2	8.87	YES
FRh2S	3.11	YES
FRh2SW	3.23	YES
GRh2	47.14	YES
HRh2	27.71	YES
HUh2	5.07	YES
IEh2	8.4	YES
ITh2	0.77	YES
LTh2	9.49	YES
LUh2	95.56	YES
LVh2	15.69	YES
MTh2	100	YES
NLh2	6.87	YES
PLh2N	23.18	YES
PLh2S	57.68	YES
PTh2	4.31	YES
ROh2	49.06	YES
SEh2	4.35	YES
SIh2	56.82	YES
SKh2E	1.82	YES
SKh2W	3.72	YES
UKh2	3.84	YES

All European countries and regions overshoot the threshold of 0% for IGI indicator 2.1 under the Advanced hydrogen infrastructure level in 2040. However, differences in the hydrogen curtailment rates between nodes are related to the level of infrastructure development and supply availability. In comparison with IGI indicator 1, this IGI indicator focusses on the availability of supplies.

As detailed in , (regions of) countries can be aggregated in different groups according to their average yearly hydrogen demand curtailment rates:

1. Rates below 5%: Spain, Finland-North region, Finland-South region, France-South region, France-Southwest region, Italy, Portugal, Sweden, Slovakia-East, Slovakia-West, the United Kingdom.
2. Rates between 5% and 20%: Austria, Belgium, Belgium-Mons region, Czechia, Germany, Estonia, Finland, France, Hungary, Ireland, Lithuania, Latvia, the Netherlands.
3. Rates between 20% and 50%: Bulgaria, Denmark, Greece, Croatia, Poland-North, Romania.
4. Rates between 50% and 100%: Slovenia, Luxembourg, Poland-South.
5. Full curtailment of 100%: Cyprus, Malta.

Without the infrastructure already considered in the hydrogen infrastructure level, the overall hydrogen demand curtailment would be higher.

While hydrogen demand curtailment rates decrease in newly connected countries and regions and the overall hydrogen demand curtailment in Europe decreases compared to the PCI/PMI hydrogen infrastructure level, the curtailment rates in several countries and regions increase slightly, as other, newly connected countries and regions are supplied instead.

Considering group 1, in comparison with the PCI/PMI hydrogen infrastructure level, improved infrastructure could especially enhance the curtailment situation of the France-Southwest region (11.5% to 3%).

Within group 2, especially Hungary could benefit from its new interconnection in the Advanced hydrogen infrastructure level (75% to 5%).

Countries and regions of group 3 see the most significant reduction in the Poland-North region (50% to 23%) due to additional capacities in the Advanced hydrogen infrastructure level as well as in Romania (90% to 49%) due to its new interconnection with Hungary. Here, Hungary is acting as a transit country for hydrogen it receives from Slovakia.

In group 4, advanced infrastructure projects mitigate curtailment in Poland-South.

Malta and Cyprus, representing group 5, remain fully curtailed due to their geographic isolation within the European hydrogen market and have no hydrogen production assets.

In the Poland-North Region, France and Czechia, on top of the curtailments observed in Zone 2 nodes as described in the paragraphs above, hydrogen demand curtailments can be observed in Zone 1 that increase during the winter months.

4.1.1.2. IGI indicator 2.2: Hydrogen demand curtailment for stressful weather year

Threshold 1: Average yearly hydrogen demand curtailment rate above 3%

The 2.2 IGI indicator shows the yearly average hydrogen demand curtailment rates in the Zone 2 nodes of various European countries for 2040, simulated under a stressful weather year. This weather scenario assumes adverse conditions, such as reduced wind and solar energy availability, which directly impacts hydrogen production. For countries with hydrogen markets divided into multiple sub-zones (i.e., nodes), curtailment rates are depicted individually for each sub-zone on the map. The yearly average hydrogen curtailment rates are thereby colour-coded to indicate levels relative to the set threshold 1: red signifies curtailment above the threshold, while green represents rates that are not.

Figure 36: Yearly average hydrogen demand curtailment rate at country or node level in the Advanced hydrogen infrastructure level in 2040 for stressful weather year (unit: %).

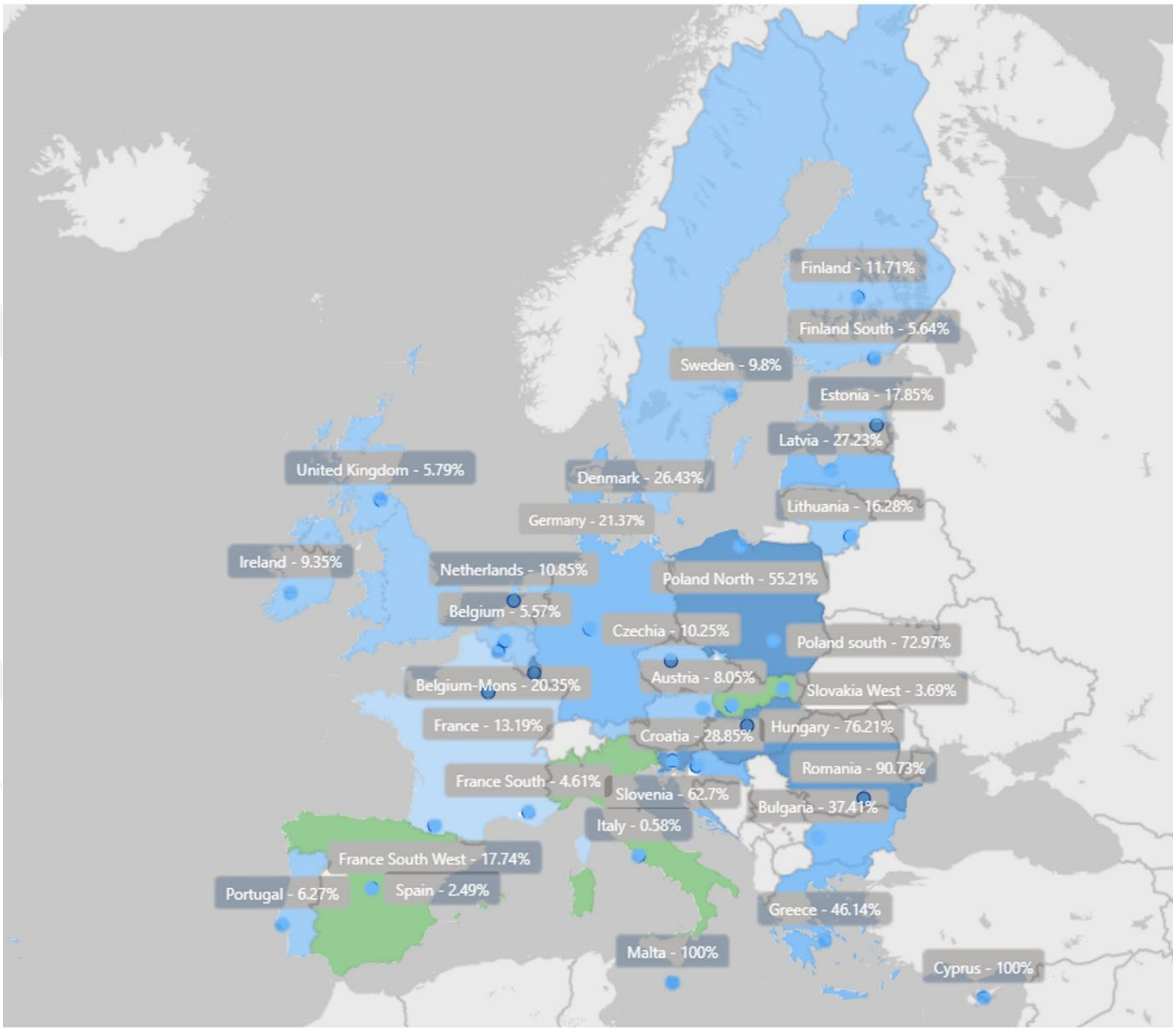


Table 37: Yearly average hydrogen demand curtailment rate at country/sub-zone level in the advanced infrastructure level in 2040 for stressful weather year and check of threshold 1 of IGI indicator 2.2 (unit: %).

Country node	Demand Curtailment (%)
ATh2	9.09
BEh2	5.41
BEH2Mo	20.87
BGh2	37.97
CYh2	100.00
CZh2	22.83

DEh2	20.52
DKh2	26.57
EEh2	17.79
ESh2	2.29
FIh2	11.38
FIh2N	5.94
FIh2S	4.97
FRh2	13.67
FRh2S	4.86
FRh2SW	4.99
GRh2	46.53
HRh2	29.54
HUh2	5.19
IEh2	9.54
ITh2	0.43
LTh2	15.65
LUh2	95.89
LVh2	26.98
MTh2	100.00
NLh2	7.84
PLh2N	31.93
PLh2S	61.94
PTh2	6.10
ROh2	52.78
SEh2	9.41
SIh2	64.42
SKh2E	1.06
SKh2W	2.39
UKh2	5.97

Countries and (regions of countries) can be aggregated in different groups according to their average yearly hydrogen demand curtailment rates:

Rates below 3%: Slovakia-East, Slovakia-West, Spain, Italy.

Rates between 3% and 20%: Austria, Belgium, Estonia, Finland, Finland -North region, Finland-South region, France, France-South region, France-Southwest region, Hungary, Ireland, Lithuania, the Netherlands, Portugal, Sweden, the United Kingdom.

Rates between 20% and 50%: Belgium -Mons Region, Bulgaria, Czechia, Germany, Denmark, Greece, Croatia, Latvia, Poland-North region.

Rates between 50% and 100%: Luxembourg, Poland-South region, Romania, Slovenia.

Full curtailment of 100%: Malta, Cyprus.

Compared with the PCI/PMI hydrogen infrastructure level, group 1 grows by the Slovakia-West region, reducing its hydrogen demand curtailment below the threshold of IGI indicator 2.2.

Threshold 2: hydrogen demand curtailment rate of more than 5 % for at least one month per year

All the countries and regions that exceed threshold 1 also exceeded threshold 2.

4.2. Comparison between PCI/PMI hydrogen infrastructure level and Advanced hydrogen infrastructure level

4.2.1. Maximum utilisation of interconnectors

Table 38 displays the maximum utilisation rates of hydrogen interconnections for both hydrogen infrastructure levels in 2040 for the reference weather year. As stated in section 1.1, some countries are completely isolated from the hydrogen infrastructure:

- Countries and regions that are isolated in both hydrogen infrastructure levels: Slovenia, Ireland, the United Kingdom, Cyprus, Malta, France-Southwest region, Poland-South region, Luxembourg. Bulgaria and Greece are interconnected with each other but isolated from the main backbone.
- Countries that are only isolated in the PCI/PMI hydrogen infrastructure level: Hungary, Romania. Bosnia and Croatia are interconnected with each other in the Advanced hydrogen infrastructure level but isolated from the main backbone.

Table 38: Maximum utilisation rates of interconnections in the PCI/PMI hydrogen infrastructure level and in the Advanced hydrogen infrastructure level in 2040 for the reference weather year (unit: %).

Interconnection	Stated direction		Reverse direction		Comments
	PCI/PMI IL	ADV IL	PCI/PMI IL	ADV IL	
ATh2 => DEh2	100	100	47	52	No bottleneck, as alternative route (e.g., through SK and CZ) still has free capacities.
ATh2 => IB-ITh2	36	11	100	100	Capacity from IT to AT is a bottleneck.
ATh2 => IB-SKh2W	93	98	90	87	

BAh2 => HRh2		0		0	The low utilisation is caused by low hydrogen supply to these jointly isolated countries, so BA and HR always need hydrogen supply themselves if the other country needs it.
BEh2 => DEh2	98	98	94	83	
BEh2 => FRh2	75	79	100	100	Capacity from FR to BE is a bottleneck.
BEh2 => FRh2N	0	0	100	100	Capacity from FR-North to BE is a bottleneck.
BEh2 => NLh2	100	100	100	100	No bottleneck, as alternative route (e.g., through DE) still has free capacities.
BEH2Mo => FRh2Va	0	0	36	36	The flow direction is from FR to BE.
BGh2 => GRh2	0	0	46	46	The flow direction is from GR to BG.
CZh2 => DEh2	48	50	26	40	
DEh2 => DKh2	59	58	100	100	Capacity from DK to DE is a bottleneck.
DEh2 => FRh2	89	63	100	100	Capacity from FR to DE is a bottleneck.
DEh2 => NLh2	84	61	92	99.9	
DEh2 => PLh2N		100		93	Capacity from DE to PL is a bottleneck.
DEh2 => PLh2nbc	100	100	85	60	Capacity from DE to PL is a bottleneck.
DEh2ba => DEh2		0			
DEh2bp => DEh2		100			Allows import through DEbp terminal in ADV IL.
DEh2bp => DEh2ba		0			
EEh2 => FIh2S	0	0	100	100	Capacity from FI to EE is a bottleneck (as alternative route via DE is also congested at the same time).
EEh2 => LVh2	96	96	0	0	
ESh2 => FRh2S	99	99.8	38	44	Capacity from FR-South to other nodes in FR is the dominant bottleneck.
ESh2 => PTh2	24	24	0	0	The flow direction is from ES to PT.
FIh2 => FIh2AI	52	52	16	20	
FIh2 => FIh2N	0.3	0.3	1	1	Very high capacities set in the model as this arc is not representing a bottleneck.
FIh2 => FIh2S	1	1	3	3	Very high capacities set in the model as this arc is not representing a bottleneck.
FIh2AI => DEh2	100	100			Capacity from FI/SE to DE is a bottleneck (as alternative route via EE is also congested at the same time).
FIh2AI => SEh2	6	5	43	43	
FIh2N => SEh2	55	55	28	39	
FRh2 => FRh2S	45	54	100	100	Capacity from FR-South to FR is a bottleneck that limits supplies from ES.
FRh2 => FRh2Va	1	1	13	13	
HUh2 => IB-SKh2C		31		100	Capacity from SK to HU is a bottleneck.
HUh2 => ROh2		87		14	Utilisation rate from HU to RO is affected by bottleneck from SK to HU.
IB-ITh2 => ITh2	0	0	100	100	
IB-SKh2C => SKh2E	6	3	100	50	
IB-SKh2C => SKh2W	100	53	6	38	

IB-SKh2E => SKh2E	100	50	0	0	
IB-SKh2W => CZh2	98	100			
IB-SKh2W => SKh2W	20	43	100	54	
LTh2 => LVh2	5	3	94	91	
LTh2 => PLh2nbc	95	94	0	0	
PLh2N => PLh2S		28			
PLh2nbc => PLh2N	100	100			Capacity from PLnbc to PL-North is a bottleneck.
PLh2S => PLh2nbc	49	48			
DZh2 => ITh2	100	100			
LH2_Tk_BE => BEh2	100	100			
LH2_Tk_DE => DEh2	100	100			
LH2_Tk_DEbp => DEh2bp	0	100			Pipeline in ADV IL allows usage of import terminal.
LH2_Tk_FRn => FRh2N	100	100			
LH2_Tk_NL => NLh2	100	100			
LH2_Tk_PLN => PLh2N		100			New terminal in ADV IL.
MAh2 => ESh2	100	100			
UAh2 => IB-SKh2E	100	100			
Y-NOh2 => DEh2	100	100			

Table 39: Maximum utilisation rates of interconnections in the PCI/PMI hydrogen infrastructure level and in the Advanced hydrogen infrastructure level in 2040 for the stressful weather year (unit: %).

Interconnection	Stated direction		Reverse direction		Comments on significant deviations from the maximum utilisation rates compared with the reference weather year
	PCI/PMI IL	ADV IL	PCI/PMI IL	ADV IL	
ATh2 => DEh2	100	100	80	100	Increase of max. utilisation from DE to AT.
ATh2 => IB-ITh2	31	7	100	100	
ATh2 => IB-SKh2W	78	100	79	71	Max. utilisation from AT to SK reaches 100%.
BAh2 => HRh2		0		0	
BEh2 => DEh2	100	100			Max. utilisation from BE to DE reaches 100%.
BEh2 => FRh2	92	100	100	100	Max. utilisation from BE to FR reaches 100%.
BEh2 => FRh2N	0	0	100	100	
BEh2 => NLh2	99	100	100	100	
BEH2Mo => FRh2Va	0	0	34	34	
BGh2 => GRh2	0	0	41	41	
CZh2 => DEh2	32	50	36	36	
DEh2 => DKh2	67	56	100	100	
DEh2 => FRh2	69	68	100	100	

DEh2 => NLh2	84	63	99.9	100	Max. utilisation from NL to DE reaches 100%.
DEh2 => PLh2N		100		79	
DEh2 => PLh2nbc	100	100	87	81	
DEh2ba => DEh2		0			
DEh2bp => DEh2		100			
DEh2bp => DEh2ba		0			
EEh2 => FIh2S	0	0	100	100	
EEh2 => LVh2	96	96	0	0	
ESh2 => FRh2S	99.7	99.5	52	51	Dependence of Iberian hydrogen production on RES and lower RES availability increase max. utilisation from FR to ES to decrease HCR in ES and PT.
ESh2 => PTh2	22	10	8	8	
FIh2 => FIh2Al	52	53	27	26	
FIh2 => FIh2N	0.3	0.3	1	1	
FIh2 => FIh2S	1	1	3	3	
FIh2Al => DEh2	100	100			
FIh2Al => SEh2	9	9	40	41	
FIh2N => SEh2	70	73	29	53	
FRh2 => FRh2S	59	58	100	100	
FRh2 => FRh2Va	9	9	13	13	
HUh2 => IB-SKh2C		41		100	
HUh2 => ROh2		87		14	
IB-ITh2 => ITh2	0	0	100	100	Max. utilisation reaches 100%.
IB-SKh2C => SKh2E	6	3	100	50	
IB-SKh2C => SKh2W	100	64	6	38	
IB-SKh2E => SKh2E	100	50	0	0	
IB-SKh2W => CZh2	93	100			
IB-SKh2W => SKh2W	18	43	100	64	
LTh2 => LVh2	5	3	92	92	
LTh2 => PLh2nbc	94	94	0	0	
PLh2N => PLh2S		28			
PLh2nbc => PLh2N	100	100			
PLh2S => PLh2nbc	27	22			
DZh2 => ITh2	100	100			
LH2_Tk_BE => BEh2	100	100			
LH2_Tk_DE => DEh2	100	100			
LH2_Tk_DEbp => DEh2bp	0	100			
LH2_Tk_FRn => FRh2N	100	100			
LH2_Tk_NL => NLh2	100	100			
LH2_Tk_PLN => PLh2N		100			

MAh2 => ESh2	100	100			
UAh2 => IB-SKh2E	100	100			
Y-NOh2 => DEh2	100	100			

Concerning pipelines connecting offshore electrolysers, the following observations are made:

- Offshore electrolyser node in the Netherlands: A share of the national electrolyser capacity of the Netherlands is allocated to an offshore node. It is connected only by capacity from a less-advanced project (HyONE). Therefore, this connection is not considered in either of the two hydrogen infrastructure levels. Thus, the offshore electrolysers are never used in the simulations as the hydrogen pipeline is missing. This leads to unused renewable hydrogen production offshore. The order of magnitude of unused renewable hydrogen production offshore would have led to a maximum utilisation rate of 100% of the less-advanced connection capacities in 2040.
- Offshore electrolysis in Germany: The offshore electrolysis in Germany (namely in the Northern Sea) is connected to the mainland through the PCI AquaDuctus. Therefore, the project capacity foreseen for national production is included in the PCI/PMI hydrogen infrastructure level, as well as in the Advanced hydrogen infrastructure level. Maximum utilisation rate will be calculated in the final IGI report as described in the TYNDP 2024 Annex D2 based on the enabled electrolyser capacity.

4.2.2. Analysis with hypothetical infrastructure approach

This section will be produced after the public consultation of the TYNDP 2024 Infrastructure Gaps Identification report in line with the methodology described by steps 2 to 3 in section 6 of the TYNDP 2024 Annex D2.

4.2.3. Identification of projects that solved or mitigated infrastructure gaps

Solved infrastructure gaps in Advanced hydrogen infrastructure level compared to PCI/PMI hydrogen infrastructure level

The additional projects of the advanced infrastructure level could solve the following indications of regional hydrogen infrastructure gaps:

- Borders as captured by IGI indicator 1: None.
- Countries and regions as captured by IGI indicator 2.1: None.
- Countries and regions as captured by IGI indicator 2.2: Slovakia-West.

Not all IGI indicators could be solved from a regional perspective even if the advanced hydrogen projects provide benefits.

Identification of advanced, non-PCI/PMI projects responsible for solving hydrogen infrastructure gaps by addressing hydrogen infrastructure bottlenecks

The following advanced, non-PCI/PMI projects contributed to mitigate the identified infrastructure gaps in the 2040 assessment:

- Pipeline imports: All pipeline imports available in both infrastructure levels.
    - Slovakia to Hungary (HU/SK hydrogen corridor and SK-HU H2 corridor)
    - Hungary to Romania (Giurgiu Nădlac hydrogen corridor and HU/RO hydrogen corridor)
    - Netherlands to Germany (H2Coastlink, IP Elten/Zevenaar – Cologne, Hyperlink and H2ercules Network North-West)
    - Germany to Poland (Pomeranian Green Hydrogen Cluster)
    - Hungary to Romania (Giurgiu Nădlac hydrogen corridor and HU/RO hydrogen corridor)
    - Romania to Hungary (Giurgiu Nădlac hydrogen corridor and HU/RO hydrogen corridor)
- Import terminals
    - New Ammonia terminal in Gdansk and Hydrogen Highway – Northern Section
    - Increased terminal capacity in the Netherlands (Eemshaven H2)
- Hydrogen storages
    - Hydrogen storage projects in Germany (RWE H2 Storage Gronau-Epe, UST Hydrogen Storage Krummhörn, RWE H2 Storage Xanten, EWE Hydrogen Storage Huntorf, EWE Hydrogen Storage Jemgum, RWE H2 Storage Staßfurt, EWE Hydrogen Storage Huntorf)
    - Hydrogen storage project in the France-Southwest region of France (HySoW storage)

Besides the projects listed above, the projects included in the PCI/PMI hydrogen infrastructure level also contribute to the solving and mitigation of infrastructure gaps.

5. Conclusions

This IGI report provides the following main insights:

- Observed hydrogen demand satisfaction and hydrogen price convergence in Europe are enabled by the projects that are included in the respective hydrogen infrastructure levels.
- Every simulation showed hydrogen demand curtailments in Europe, especially in winter.
- Supply and infrastructure in the two hydrogen infrastructure levels are not sufficient on European level. This is indicated by the IGI indicators.
- All European hydrogen corridors considered in the assessments are needed to satisfy hydrogen demand.
- Hydrogen pipelines and storages help to mitigate hydrogen demand curtailments.
- Hydrogen infrastructure bottlenecks exist and are explained in the report.
- Due to the effect of the weather on the demand/supply balance of hydrogen, the European hydrogen backbone benefits from flexibilities in the supply, storage, and transit infrastructure.
- Several countries, especially islands and countries in South-East Europe, are not connected to the European hydrogen backbone in one or both hydrogen infrastructure levels.
- Isolated countries benefit from new connections with the European hydrogen backbone.
- Many projects represent anticipatory investments. They are not fully utilised in 2030 but show high utilisation in 2040. This allows to unlock the significant economies of scale of hydrogen infrastructure projects.
- Even projects that are currently defined as less advanced, especially if increasing exports towards curtailed countries, will be needed.

Thereby, this IGI report is based on the TYNDP 2024 NT+ scenario and the projects submitted to the TYNDP 2024.

Annex I: Node-specific hydrogen production capacities

Node	Category	Year	Installed capacity[16] [MW_{H2}]	Data sources besides TYNDP 2024 NT+ scenario[17] with specifications of TYNDP 2024 Annex D1[18]
AT Z1	SMR/ATR	2030	996	
AT Z1	SMR/ATR	2040	498	
AT00 Z1	Electrolyser Z1	2030	797	
AT00 Z1	Electrolyser Z1	2040	1091	
AT00 Z2	Electrolyser Z2	2030	14	
AT00 Z2	Electrolyser Z2	2040	4797	
BE Z1	SMR/ATR	2030	2298	
BE Z1	SMR/ATR	2040	1149	
BEh2	Electrolyser Z2	2030	303	
BEh2	Electrolyser Z2	2040	1367	
BG Z1	SMR/ATR	2030	1331	
BG Z1	SMR/ATR	2040	665	
BG00 Z2	Electrolyser Z2	2030	53	
BG00 Z2	Electrolyser Z2	2040	72	
CH00 Z2	Electrolyser Z2	2030	213	
CH00 Z2	Electrolyser Z2	2040	1135	
CZ Z1	SMR/ATR	2030	988	
CZ Z1	SMR/ATR	2040	494	
CZ00 Z1	Electrolyser Z1	2040	574	
CZ00 Z2	Electrolyser Z2	2030	228	
CZ00 Z2	Electrolyser Z2	2040	1494	
DE Z1	SMR/ATR	2030	9748	
DE Z1	SMR/ATR	2040	4874	
DE00 Z2	Electrolyser Z2	2030	10378	

[16] The electrolyser efficiency is 69% in 2030 and 71% in 2040 in terms of NCV. Therefore, from the perspective of the electricity system, the installed capacity of electrolysers is higher. Here, the installed capacities are stated from the perspective of the hydrogen system and in terms of GCV.

[17] Each country's total electrolyser and SMR/ATR capacities are specified in the TYNDP 2024 NT+ scenario. In the scenario documentation, the NCV is used to align with EC scenarios. The TYNDP 2024 however uses the GCV as this is commonly used in the gas markets.

[18] TYNDP 2024 Annex D1 explains i) that project promoters can split Zones into sub-Zones, ii) that a country's electrolyser capacity can undergo a redistribution methodology to allocate electrolyser capacities to (sub-)Zones, and iii) that SMR/ATR capacities for hydrogen production from natural gas are only connected to Zone 1.

DE00 Z2	Electrolyser Z2	2040	32555	
DK Z1	SMR/ATR	2030	0	
DK Z1	SMR/ATR	2040	0	
DKh2	Electrolyser Z2	2030	2596	
DKh2	Electrolyser Z2	2040	3553	
DKW1 Z2	Electrolyser Z2	2030	1359	
DKW1 Z2	Electrolyser Z2	2040	11709	
EE Z1	SMR/ATR	2030	167	
EE Z1	SMR/ATR	2040	83	
ES Z1	SMR/ATR	2030	2891	
ES Z1	SMR/ATR	2040	1446	
ES00 Z2	Electrolyser Z2	2030	7822	
ES00 Z2	Electrolyser Z2	2040	14298	
ES00_DRES ES	DRES	2030	12009	
ES00_DRES ES	DRES	2040	21584	
ESh2Z1a Z1	Electrolyser Z1	2030	1007	
ESh2Z1a Z1	Electrolyser Z1	2040	1378	
FI00 Z1	Electrolyser Z1	2030	1567	Project promoter specifications
FI00 Z1	Electrolyser Z1	2040	2623	Project promoter specifications
FIh2N	Electrolyser Z2	2030	2863	Project promoter specifications
FIh2N	Electrolyser Z2	2040	3919	Project promoter specifications
FIh2S	Electrolyser Z2	2030	2652	Project promoter specifications
FIh2S	Electrolyser Z2	2040	20207	Project promoter specifications
FIS Z1	SMR/ATR	2030	785	Project promoter specifications
FIS Z1	SMR/ATR	2040	393	Project promoter specifications
FR Z1	SMR/ATR	2030	2635	Project promoter specifications
FR Z1	SMR/ATR	2040	1317	Project promoter specifications
FRh2	Electrolyser Z2	2030	3010	Project promoter specifications
FRh2	Electrolyser Z2	2040	12981	Project promoter specifications
FRh2SW	Electrolyser Z2	2030	167	Project promoter specifications
FRh2SW	Electrolyser Z2	2040	754	Project promoter specifications
FRh2Va	Electrolyser Z2	2030	212	Project promoter specifications
FRh2Va	Electrolyser Z2	2040	412	Project promoter specifications
GR Z1	SMR/ATR	2030	785	
GR Z1	SMR/ATR	2040	393	
GR00 Z2	Electrolyser Z2	2030	974	

GR00 Z2	Electrolyser Z2	2040	6513	
HR Z1	SMR/ATR	2030	917	
HR Z1	SMR/ATR	2040	459	
HR00 Z1	Electrolyser Z1	2030	990	
HR00 Z1	Electrolyser Z1	2040	1355	
HR00 Z2	Electrolyser Z2	2030	43	
HR00 Z2	Electrolyser Z2	2040	2914	
HU Z1	SMR/ATR	2030	1264	
HU Z1	SMR/ATR	2040	632	
HU00 Z2	Electrolyser Z2	2030	195	
HU00 Z2	Electrolyser Z2	2040	686	
IE Z1	SMR/ATR	2030	0	
IE Z1	SMR/ATR	2040	0	
IE00 Z1	Electrolyser Z1	2030	266	
IE00 Z1	Electrolyser Z1	2040	364	
IE00 Z2	Electrolyser Z2	2030	625	
IE00 Z2	Electrolyser Z2	2040	3122	
IT Z1	SMR/ATR	2030	3158	
IT Z1	SMR/ATR	2040	1579	
ITCA Z2	Electrolyser Z2	2030	1311	
ITCA Z2	Electrolyser Z2	2040	1794	
ITCN Z2	Electrolyser Z2	2040	1453	
ITCS Z2	Electrolyser Z2	2040	747	
ITN1 Z2	Electrolyser Z2	2040	1560	
ITS1 Z2	Electrolyser Z2	2030	2323	
ITS1 Z2	Electrolyser Z2	2040	3179	
ITSI Z2	Electrolyser Z2	2030	424	
ITSI Z2	Electrolyser Z2	2040	991	
LT Z1	SMR/ATR	2030	1469	
LT Z1	SMR/ATR	2040	734	
LT00 Z2	Electrolyser Z2	2030	243	
LT00 Z2	Electrolyser Z2	2040	1963	
LU Z1	SMR/ATR	2030	0	
LU Z1	SMR/ATR	2040	0	
LUG1 Z1	Electrolyser Z1	2040	46	
LUG1 Z2	Electrolyser Z2	2030	41	
LUG1 Z2	Electrolyser Z2	2040	56	
LV Z1	SMR/ATR	2030	0	

LV Z1	SMR/ATR	2040	0	
NL Z1	SMR/ATR	2030	6736	
NL Z1	SMR/ATR	2040	3368	
NL00 Offshore	Electrolyser Offshore	2040	9737	Project promoter specifications
NL00 Z2	Electrolyser Z2	2030	3246	
NL00 Z2	Electrolyser Z2	2040	16385	
PLh2N	Electrolyser Z2	2040	158	Project promoter specifications
PLh2nZ1a Z1	Electrolyser Z1	2040	694	Project promoter specifications
PLh2S	Electrolyser Z2	2030	1623	Project promoter specifications
PLh2S	Electrolyser Z2	2040	3038	Project promoter specifications
PLN Z1	SMR/ATR	2030	2255	Project promoter specifications
PLN Z1	SMR/ATR	2040	1127	Project promoter specifications
PLS Z1	SMR/ATR	2030	2255	Project promoter specifications
PLS Z1	SMR/ATR	2040	1127	Project promoter specifications
PT Z1	SMR/ATR	2030	542	
PT Z1	SMR/ATR	2040	271	
PT00 Z1	Electrolyser Z1	2040	82	
PT00 Z2	Electrolyser Z2	2030	1014	
PT00 Z2	Electrolyser Z2	2040	1538	
RO Z1	SMR/ATR	2030	1834	
RO Z1	SMR/ATR	2040	917	
RO00 Z2	Electrolyser Z2	2030	406	
RO00 Z2	Electrolyser Z2	2040	567	
SE Z1	SMR/ATR	2030	664	
SE Z1	SMR/ATR	2040	332	
SE01 Z1	Electrolyser Z1	2030	74	
SE01 Z1	Electrolyser Z1	2040	101	
SE01 Z2	Electrolyser Z2	2030	1201	
SE01 Z2	Electrolyser Z2	2040	1644	
SE02 Z1	Electrolyser Z1	2030	474	
SE02 Z1	Electrolyser Z1	2040	2035	
SE02 Z2	Electrolyser Z2	2030	1163	
SE02 Z2	Electrolyser Z2	2040	1592	
SE03 Z2	Electrolyser Z2	2040	8936	
SE04 Z1	Electrolyser Z1	2030	109	
SE04 Z1	Electrolyser Z1	2040	149	
SE04 Z2	Electrolyser Z2	2030	2388	

SE04 Z2	Electrolyser Z2	2040	3268	
SI Z1	SMR/ATR	2030	0	
SI Z1	SMR/ATR	2040	0	
SI00 Z1	Electrolyser Z1	2030	45	
SI00 Z1	Electrolyser Z1	2040	142	
SI00 Z2	Electrolyser Z2	2030	186	
SI00 Z2	Electrolyser Z2	2040	1772	
SKE Z1	SMR/ATR	2030	311	Project promoter specifications
SKE Z1	SMR/ATR	2040	155	Project promoter specifications
SKW Z1	SMR/ATR	2030	621	Project promoter specifications
SKW Z1	SMR/ATR	2040	311	Project promoter specifications
UK Z1	SMR/ATR	2030	3528	
UK Z1	SMR/ATR	2040	1764	
UK00 Z1	Electrolyser Z1	2030	1919	
UK00 Z1	Electrolyser Z1	2040	7280	
UK00 Z2	Electrolyser Z2	2030	1900	
UK00 Z2	Electrolyser Z2	2040	12038	
UKNI	Electrolyser Z2	2030	2405	
UKNI	Electrolyser Z2	2040	3292	
UKNI Z1	Electrolyser Z1	2030	282	
UKNI Z1	Electrolyser Z1	2040	386	

Annex II: Yearly energy flows (in EU-27 and UK) for reference weather year and stressful weather year in 2030 and 2040 assessment cases

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	30334	29993	32156	30032	3012	27321	3288	27152
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	21398	13736	24702	14597	2755	19733	3071	20063
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	1	58	0	8	257	575	217	476
ATh2 => IB-SKh2W	8935	16200	7454	15428	0	7014	0	6613
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	256	12241	270	12420	3359	11801	4246	12149
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	256	8281	270	8943	3359	6448	4246	7107
BEh2 => FRh2	0	1802	0	1872	0	1686	0	1893
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	2157	0	1605	0	3667	0	3148
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	1086	0	1086	0	1082	0	1083	0
BGh2 => GRh2	1086	0	1086	0	1082	0	1083	0
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	1058	0	742	0	4889	0	4991
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	1058	0	742	0	4889	0	4991

CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0
DE	41330	44517	35868	42602	35333	35602	28784	36182
DEh2 => ATh2	174	1310	52	1244	2490	1333	2104	1359
DEh2 => BEh2	5267	3287	3117	3043	4238	5148	2702	4738
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	3425	9040	2907	7338	3020	3557	2408	3296
DEh2 => DKh2	3238	4639	3048	4423	1682	4801	1340	4566
DEh2 => FRh2	4205	4831	4804	5086	2363	5310	2799	5660
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	2679	4039	1464	2772	2138	5591	1227	4431
DEh2 => PLh2N	5375	4226	4885	3876	0	0	0	0
DEh2 => PLh2nbc	7660	10882	8905	12380	11342	9862	11089	12132
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	1283	2263	1883	2439	0	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	8022		4802		8061		5116	
DK	7177	6501	5710	5296	7522	6408	5906	5291
DKh2 => DEh2	7177	6501	5710	5296	7522	6408	5906	5291
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	2036	32213	3780	24364	1544	28901	2521	20780
EEh2 => FIh2S	675	0	2806	0	457	0	1837	0
EEh2 => LVh2	1360	32213	975	24364	1087	28901	685	20780
ES	39122	52749	34701	50340	39780	52765	34832	50658
ESh2 => FRh2S	38504	50214	34012	47926	39225	50236	34223	48194
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	618	2535	690	2415	555	2529	610	2464
FI	67162	197241	52218	162975	68104	198785	52129	163867
FIh2 => FIh2AI	15340	41736	12122	34077	15717	43524	12224	35795
FIh2 => FIh2N	20	86	86	230	0	137	0	259
FIh2 => FIh2S	641	1544	555	2083	653	849	507	1238
FIh2AI => DEh2	28990	57495	20484	44244	29592	60008	21277	46904
FIh2AI => FIh2	1234	2976	1188	3616	1258	1918	1214	2596
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	83	227	485	454	0	256	0	465
FIh2N => FIh2	12952	14123	9867	11617	13105	14709	10097	11966
FIh2N => SEh2	115	3339	390	4978	96	3528	402	5032
FIh2S => EEh2	1694	34345	1237	26294	1414	31003	943	22709
FIh2S => FIh2	6092	41370	5804	35382	6269	42852	5467	36903

FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0
FR	72264	90297	64229	86161	73539	90135	63986	86567
FRh2 => BEh2	0	3860	0	3296	0	4744	0	3872
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	29387	24010	25177	21789	30757	23221	25778	21661
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	1866	3020	2248	3073	1595	3190	1901	3171
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	322	0	336	3	160	0	151	3
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	7162	0	8152	0	6548	0	7648
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	1844	2748	2151	2814	1522	2965	1726	2927
FRh2S => FRh2	37667	46779	33266	44545	38445	46757	33550	44789
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	960	1973	866	1806	826	1974	689	1818
FRh2Va => FRh2	219	744	186	683	235	736	191	679
GR	4	2678	3	2675	5	2711	3	2747
GRh2 => BGh2	4	2678	3	2675	5	2711	3	2747
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	5283	11860	4369	10857	0	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	85	0	98	0	0	0	0
HUh2 => ROh2	5283	11775	4369	10759	0	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	51652	146637	50599	146455	4953	137889	5327	138540
IB-ITh2 => ATh2	35307	46661	37249	46560	4696	44482	5111	44219
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	1	58	0	8	257	575	217	476

IB-SKh2C => HUh2	6828	25531	5366	24678	0	0	0	0
IB-SKh2C => SKh2E	582	516	530	510	0	688	0	669
IB-SKh2C => SKh2W	0	13746	0	14578	0	28926	0	29419
IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	33788	0	33788	0	30648	0	31188
IB-SKh2W => ATh2	0	1499	0	1806	0	2192	0	2463
IB-SKh2W => CZh2	358	15772	481	15473	0	28298	0	28083
IB-SKh2W => SKh2W	8577	9068	6972	9055	0	2080	0	2024
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	35307	46661	37249	46560	4696	44482	5111	44219
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	35307	46661	37249	46560	4696	44482	5111	44219
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	765	28783	3058	21405	541	25624	2068	17917
LTh2 => LVh2	765	51	3058	84	538	115	2064	171
LTh2 => PLh2nbc	0	28732	0	21321	4	25510	4	17746
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	1345	29641	3327	22176	943	26420	2176	18686
LVh2 => EEh2	701	0	2880	0	480	0	1904	0
LVh2 => LTh2	644	29641	447	22176	464	26420	272	18686
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	8527	31330	12401	28765	11524	24798	14525	23180
NLh2 => BEh2	1962	13373	2102	11886	1945	14461	1871	12338
NLh2 => DEh2	6565	17957	10298	16879	9579	10337	12654	10843
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	7660	43860	8906	37547	11346	35483	11092	29937
PLh2N => DEh2	0	136	0	125	0	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2Al	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	4013	0	3682	0	0	0	0
PLh2nbc => DEh2	0	4330	0	3079	1	10773	2	7455
PLh2nbc => LTh2	1013	0	3532	0	725	0	2434	0
PLh2nbc => PLh2N	6648	35332	5373	30642	10620	24654	8657	22452
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0

PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0
PLh2S => PLh2nbc	0	49	0	20	0	56	0	30
PT	3211	0	2905	5	3252	0	2915	5
PTh2 => ESh2	3211	0	2905	5	3252	0	2915	5
RO	0	18	0	34	0	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	18	0	34	0	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	15093	19774	10169	15619	15262	19297	10441	15102
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	14967	18962	10034	14236	15133	18658	10267	14170
SEh2 => FIh2N	127	812	135	1382	128	638	174	932
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	7410	49847	5896	50574	0	55171	0	56044
SKh2E => IB-SKh2C	0	31848	0	31824	0	28926	0	29419
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	7410	7860	5896	7844	0	688	0	669
SKh2W => IB-SKh2W	0	10138	0	10906	0	25556	0	25957
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

Annex III: Monthly energy flows (in EU-27 and UK) for reference weather year and stressful weather years in 2030 and 2040 assessment cases

JANUARY

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	2634	1606	4240	918	918	342	1512	1854
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	1541	908	2450	774	774	342	1278	1620
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	0	0	0	0	0	0	0	0
ATh2 => IB-SKh2W	1093	698	1790	144	144	0	235	235
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	25	1046	1071	1782	1782	261	1003	1264
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	25	861	886	1159	1159	261	774	1035
BEh2 => FRh2	0	118	118	189	189	0	119	119
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	66	66	434	434	0	110	110
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	84	0	84	0	0	84	0	84
BGh2 => GRh2	84	0	84	0	0	84	0	84
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	32	32	286	286	0	140	140
CZh2 => ATh2	0	0	0	0	0	0	0	0

CZh2 => DEh2	0	32	32	286	286	0	140	140
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0
DE	3031	2114	5145	1116	1116	2548	1041	3589
DEh2 => ATh2	25	128	153	70	70	158	92	249
DEh2 => BEh2	404	33	436	1	1	280	89	369
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	380	871	1251	246	246	338	359	697
DEh2 => DKh2	159	42	201	27	27	80	43	123
DEh2 => FRh2	39	20	59	15	15	18	32	50
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	99	23	122	77	77	54	32	86
DEh2 => PLh2N	473	284	757	136	136	0	0	0
DEh2 => PLh2nbc	621	456	1077	211	211	984	394	1378
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	87	258	345	334	334	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	744		744			637		637
DK	751	1826	2577	842	842	781	1826	2607
DKh2 => DEh2	751	1826	2577	842	842	781	1826	2607
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	126	3568	3695	2140	2140	97	3376	3473
EEh2 => FIh2S	2	0	2	0	0	2	0	2
EEh2 => LVh2	125	3568	3693	2140	2140	95	3376	3470
ES	4414	5350	9764	4182	4182	4448	5398	9846
ESh2 => FRh2S	4377	5144	9521	4029	4029	4411	5195	9605
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	37	206	243	153	153	37	204	241
FI	7019	21322	28341	18772	18772	7070	21488	28558
FIh2 => FIh2AI	1661	4818	6479	4648	4648	1702	4938	6640
FIh2 => FIh2N	0	0	0	21	21	0	0	0
FIh2 => FIh2S	43	12	54	5	5	39	0	39
FIh2AI => DEh2	3076	6244	9320	5239	5239	3080	6397	9477
FIh2AI => FIh2	76	57	132	14	14	71	16	87
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	0	0	0	24	24	0	0	0
FIh2N => FIh2	1415	1652	3068	1224	1224	1419	1696	3115
FIh2N => SEh2	7	261	268	671	671	11	251	262
FIh2S => EEh2	158	3763	3921	2302	2302	128	3570	3698

FIh2S => FIh2	584	4514	5098	4624	4624	620	4619	5239
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0
FR	8233	8136	16369	7093	7093	8331	8274	16605
FRh2 => BEh2	0	160	160	78	78	0	289	289
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	3722	2269	5991	2002	2002	3823	2263	6087
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	22	12	34	1	1	13	23	36
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	21	0	21	0	0	8	0	8
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	744	744	1209	1209	0	654	654
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	20	11	31	0	0	11	22	33
FRh2S => FRh2	4336	4713	9049	3696	3696	4372	4802	9173
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	88	179	267	83	83	76	174	251
FRh2Va => FRh2	26	47	73	22	22	27	46	73
GR	0	173	173	144	144	0	174	174
GRh2 => BGh2	0	173	173	144	144	0	174	174
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	573	612	1186	184	184	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	0	0	51	51	0	0	0
HUh2 => ROh2	573	612	1186	133	133	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	5048	12066	17114	12221	12221	582	12564	13146
IB-ITh2 => ATh2	3043	3355	6397	3028	3028	582	3355	3938
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0

IB-ITh2 => ITh2	0	0	0	0	0	0	0	0
IB-SKh2C => HUh2	843	2165	3008	1495	1495	0	0	0
IB-SKh2C => SKh2E	69	5	74	1	1	0	22	22
IB-SKh2C => SKh2W	0	1329	1329	2106	2106	0	3053	3053
IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	3637	3637	3764	3764	0	3271	3271
IB-SKh2W => ATh2	0	103	103	582	582	0	145	145
IB-SKh2W => CZh2	42	1356	1397	1230	1230	0	2650	2650
IB-SKh2W => SKh2W	1051	118	1169	15	15	0	68	68
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	3043	3355	6397	3028	3028	582	3355	3938
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	3043	3355	6397	3028	3028	582	3355	3938
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	3	3162	3165	1839	1839	5	2982	2987
LTh2 => LVh2	3	1	4	1	1	4	1	5
LTh2 => PLh2nbc	0	3161	3161	1838	1838	1	2981	2983
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	61	3305	3366	1956	1956	43	3113	3156
LVh2 => EEh2	2	0	2	0	0	3	0	3
LVh2 => LTh2	59	3305	3364	1956	1956	40	3113	3154
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	696	3684	4380	2616	2616	1013	2850	3863
NLh2 => BEh2	188	678	866	221	221	195	1222	1418
NLh2 => DEh2	508	3005	3514	2394	2394	818	1627	2446
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	621	3666	4287	2101	2101	985	3376	4361
PLh2N => DEh2	0	6	6	38	38	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2AI	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	42	42	10	10	0	0	0
PLh2nbc => DEh2	0	530	530	583	583	1	1252	1253
PLh2nbc => LTh2	13	0	13	0	0	12	0	12
PLh2nbc => PLh2N	608	3087	3695	1468	1468	973	2124	3096
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0

PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0
PLh2S => PLh2nbc	0	0	0	2	2	0	0	0
PT	332	0	332	0	0	332	0	332
PTh2 => ESh2	332	0	332	0	0	332	0	332
RO	0	0	0	16	16	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	0	0	16	16	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	1499	1495	2994	631	631	1455	1478	2933
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	1491	1482	2974	629	629	1449	1476	2924
SEh2 => FIh2N	8	12	20	2	2	6	2	8
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	913	4377	5290	5234	5234	0	5703	5703
SKh2E => IB-SKh2C	0	3401	3401	3539	3539	0	3053	3053
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	913	97	1009	12	12	0	22	22
SKh2W => IB-SKh2W	0	879	879	1683	1683	0	2628	2628
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

FEBRUARY

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	2252	1799	4052	1448	1448	278	1682	1959
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	1192	951	2144	1217	1217	278	1244	1522
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	0	52	52	1	1	0	56	56
ATh2 => IB-SKh2W	1060	796	1856	229	229	0	382	382
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	4	903	907	1464	1464	73	791	864
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	4	620	624	968	968	73	444	516
BEh2 => FRh2	0	202	202	174	174	0	194	194
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	81	81	322	322	0	154	154
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	73	0	73	0	0	73	0	73
BGh2 => GRh2	73	0	73	0	0	73	0	73
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	40	40	192	192	0	138	138
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	40	40	192	192	0	138	138
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0

DE	3002	3467	6469	1487	1487	2743	2306	5050
DEh2 => ATh2	43	432	475	35	35	198	372	570
DEh2 => BEh2	393	56	449	3	3	274	215	489
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	379	1284	1663	284	284	373	445	818
DEh2 => DKh2	85	3	88	61	61	72	6	78
DEh2 => FRh2	242	561	803	279	279	140	633	774
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	127	69	196	97	97	79	210	289
DEh2 => PLh2N	456	368	824	127	127	0	0	0
DEh2 => PLh2nbc	749	491	1240	297	297	1178	425	1603
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	12	205	216	304	304	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	515		515			429		429
DK	997	2053	3050	614	614	1000	2054	3053
DKh2 => DEh2	997	2053	3050	614	614	1000	2054	3053
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	170	3413	3583	1331	1331	149	3242	3392
EEh2 => FIh2S	62	0	62	0	0	47	0	47
EEh2 => LVh2	108	3413	3522	1331	1331	102	3242	3344
ES	3346	4279	7625	3814	3814	3454	4323	7777
ESh2 => FRh2S	3299	4069	7368	3628	3628	3413	4110	7523
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	46	210	257	186	186	41	213	254
FI	5944	17858	23802	13681	13681	5963	17937	23901
FIh2 => FIh2AI	1377	3626	5002	3423	3423	1390	3706	5096
FIh2 => FIh2N	3	0	3	5	5	0	0	0
FIh2 => FIh2S	46	40	85	51	51	38	19	58
FIh2AI => DEh2	2601	5523	8124	3769	3769	2629	5654	8283
FIh2AI => FIh2	83	131	214	78	78	72	74	146
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	12	0	12	10	10	0	0	0
FIh2N => FIh2	1167	1383	2550	844	844	1183	1366	2549
FIh2N => SEh2	6	128	134	565	565	8	128	136
FIh2S => EEh2	139	3600	3739	1455	1455	132	3429	3561
FIh2S => FIh2	513	3427	3940	3480	3480	510	3561	4072
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0

FR	6663	7366	14028	6511	6511	6824	7211	14036
FRh2 => BEh2	0	159	159	40	40	0	311	311
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	2903	1914	4818	1737	1737	3126	1716	4841
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	198	383	581	52	52	109	415	524
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	10	0	10	0	0	8	0	8
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	450	450	1107	1107	0	323	323
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	213	367	580	45	45	122	399	521
FRh2S => FRh2	3227	3860	7087	3413	3413	3350	3814	7164
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	83	180	263	93	93	82	180	261
FRh2Va => FRh2	27	53	80	24	24	28	52	81
GR	0	192	192	263	263	0	193	193
GRh2 => BGh2	0	192	192	263	263	0	193	193
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	609	797	1406	225	225	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	26	26	30	30	0	0	0
HUh2 => ROh2	609	771	1380	196	196	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	4590	10609	15198	11313	11313	465	10866	11331
IB-ITh2 => ATh2	2602	2708	5310	3073	3073	465	2700	3165
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	0	52	52	1	1	0	56	56
IB-SKh2C => HUh2	866	2149	3015	1479	1479	0	0	0
IB-SKh2C => SKh2E	63	7	69	0	0	0	27	27

IB-SKh2C => SKh2W	0	1025	1025	1757	1757	0	2628	2628
IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	3250	3250	3417	3417	0	2815	2815
IB-SKh2W => ATh2	0	56	56	350	350	0	107	107
IB-SKh2W => CZh2	7	1226	1233	1235	1235	0	2448	2448
IB-SKh2W => SKh2W	1053	138	1191	0	0	0	86	86
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	2602	2708	5310	3073	3073	465	2700	3165
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	2602	2708	5310	3073	3073	465	2700	3165
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	70	3151	3220	1099	1099	56	2955	3011
LTh2 => LVh2	70	0	70	2	2	56	0	56
LTh2 => PLh2nbc	0	3151	3151	1097	1097	0	2955	2955
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	112	3166	3278	1200	1200	93	2995	3088
LVh2 => EEh2	64	0	64	0	0	50	0	50
LVh2 => LTh2	48	3166	3213	1200	1200	44	2995	3039
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	486	3691	4177	1661	1661	693	2909	3602
NLh2 => BEh2	289	859	1148	174	174	329	1369	1698
NLh2 => DEh2	197	2832	3029	1487	1487	364	1540	1904
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	749	3680	4430	1469	1469	1178	3380	4558
PLh2N => DEh2	0	0	0	42	42	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2Al	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	38	38	10	10	0	0	0
PLh2nbc => DEh2	0	472	472	204	204	0	1217	1217
PLh2nbc => LTh2	82	0	82	0	0	67	0	67
PLh2nbc => PLh2N	668	3170	3837	1202	1202	1111	2163	3274
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0

PLh2S => PLh2nbc	0	0	0	12	12	0	0	0
PT	284	0	284	5	5	287	0	287
PTh2 => ESh2	284	0	284	5	5	287	0	287
RO	0	12	12	12	12	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	12	12	12	12	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	1327	2050	3377	461	461	1319	2030	3349
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	1319	2029	3347	434	434	1311	2021	3332
SEh2 => FIh2N	8	21	29	28	28	8	9	16
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	928	3777	4705	4562	4562	0	4914	4914
SKh2E => IB-SKh2C	0	3043	3043	3206	3206	0	2628	2628
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	928	112	1040	0	0	0	27	27
SKh2W => IB-SKh2W	0	623	623	1356	1356	0	2259	2259
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

MARCH

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	2821	2942	5763	2752	2752	515	2668	3183
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	1801	1355	3157	1848	1848	515	1679	2195
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	0	0	0	0	0	0	0	0
ATh2 => IB-SKh2W	1019	1587	2606	904	904	0	989	989
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	9	471	480	1181	1181	108	431	538
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	9	296	305	922	922	108	261	369
BEh2 => FRh2	0	127	127	169	169	0	91	91
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	49	49	90	90	0	79	79
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	84	0	84	0	0	83	0	83
BGh2 => GRh2	84	0	84	0	0	83	0	83
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	0	0	0	0	0	233	233
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	0	0	0	0	0	233	233
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0
DE	3650	4192	7841	2622	2622	3365	3029	6395

DEh2 => ATh2	26	94	120	13	13	170	165	335
DEh2 => BEh2	557	380	937	37	37	421	542	963
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	352	1251	1603	384	384	354	448	802
DEh2 => DKh2	141	140	281	151	151	121	129	250
DEh2 => FRh2	241	613	853	251	251	204	558	762
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	239	170	409	55	55	129	366	496
DEh2 => PLh2N	500	471	971	297	297	0	0	0
DEh2 => PLh2nbc	801	990	1791	1165	1165	1302	820	2122
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	15	83	98	268	268	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	778		778			665		665
DK	940	2153	3094	1215	1215	974	2130	3104
DKh2 => DEh2	940	2153	3094	1215	1215	974	2130	3104
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	190	3591	3782	1671	1671	167	3201	3368
EEh2 => FIh2S	53	0	53	0	0	42	0	42
EEh2 => LVh2	137	3591	3728	1671	1671	124	3201	3325
ES	4025	4524	8548	4428	4428	4077	4767	8844
ESh2 => FRh2S	3993	4316	8310	4245	4245	4048	4548	8596
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	31	207	239	183	183	29	219	248
FI	6112	19179	25292	12733	12733	5961	19212	25174
FIh2 => FIh2AI	1353	3922	5275	2517	2517	1331	4040	5371
FIh2 => FIh2N	2	9	12	70	70	0	5	5
FIh2 => FIh2S	63	90	153	106	106	80	47	127
FIh2AI => DEh2	2715	5796	8511	3251	3251	2602	6051	8653
FIh2AI => FIh2	113	207	320	205	205	141	141	282
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	10	6	16	106	106	0	10	10
FIh2N => FIh2	1158	1475	2633	713	713	1143	1486	2629
FIh2N => SEh2	7	147	153	850	850	8	168	176
FIh2S => EEh2	170	3797	3966	1839	1839	156	3406	3562
FIh2S => FIh2	521	3732	4253	3074	3074	501	3858	4359
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0
FR	7432	7466	14897	7056	7056	7537	7595	15132

FRh2 => BEh2	0	544	544	145	145	0	608	608
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	3104	1702	4806	1659	1659	3204	1749	4952
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	190	394	584	153	153	166	332	498
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	22	0	22	0	0	20	0	20
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	230	230	839	839	0	205	205
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	184	348	532	132	132	160	298	459
FRh2S => FRh2	3815	3987	7802	3928	3928	3871	4143	8013
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	91	195	286	154	154	91	195	286
FRh2Va => FRh2	25	67	91	46	46	26	66	92
GR	2	346	347	307	307	2	349	352
GRh2 => BGh2	2	346	347	307	307	2	349	352
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	608	1248	1857	720	720	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	0	0	0	0	0	0	0
HUh2 => ROh2	608	1248	1857	720	720	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	5136	12203	17339	13064	13064	774	10845	11620
IB-ITh2 => ATh2	3231	3989	7220	4075	4075	774	3914	4688
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	0	0	0	0	0	0	0	0
IB-SKh2C => HUh2	826	2531	3356	2048	2048	0	0	0
IB-SKh2C => SKh2E	60	40	100	7	7	0	81	81
IB-SKh2C => SKh2W	0	758	758	1440	1440	0	1999	1999

IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	2864	2864	3564	3564	0	2142	2142
IB-SKh2W => ATh2	0	8	8	72	72	0	50	50
IB-SKh2W => CZh2	13	1240	1253	1676	1676	0	2408	2408
IB-SKh2W => SKh2W	1006	773	1780	181	181	0	252	252
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	3231	3989	7220	4075	4075	774	3914	4688
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	3231	3989	7220	4075	4075	774	3914	4688
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	60	3128	3189	1323	1323	53	2737	2790
LTh2 => LVh2	60	0	60	3	3	53	1	54
LTh2 => PLh2nbc	0	3128	3128	1320	1320	0	2736	2736
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	125	3303	3428	1484	1484	105	2913	3019
LVh2 => EEh2	55	0	55	0	0	45	0	45
LVh2 => LTh2	69	3303	3372	1484	1484	60	2913	2973
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	438	3163	3601	2800	2800	639	2881	3520
NLh2 => BEh2	284	2049	2333	570	570	270	2200	2470
NLh2 => DEh2	154	1114	1268	2230	2230	369	681	1050
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	801	4237	5038	2532	2532	1302	3556	4858
PLh2N => DEh2	0	0	0	1	1	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2AI	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	119	119	46	46	0	0	0
PLh2nbc => DEh2	0	355	355	168	168	0	1034	1034
PLh2nbc => LTh2	74	0	74	0	0	68	0	68
PLh2nbc => PLh2N	726	3763	4489	2317	2317	1234	2522	3755
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0
PLh2S => PLh2nbc	0	0	0	0	0	0	0	0

PT	370	0	370	0	0	375	0	375
PTh2 => ESh2	370	0	370	0	0	375	0	375
RO	0	0	0	0	0	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	0	0	0	0	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	1496	2124	3620	1121	1121	1425	2194	3620
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	1486	2087	3572	1046	1046	1412	2162	3574
SEh2 => FIh2N	10	38	48	74	74	13	32	45
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	886	3763	4649	4520	4520	0	3802	3802
SKh2E => IB-SKh2C	0	2680	2680	3347	3347	0	1999	1999
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	886	649	1534	148	148	0	81	81
SKh2W => IB-SKh2W	0	435	435	1025	1025	0	1721	1721
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

APRIL

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	2579	3500	6079	3019	3019	258	3236	3493
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	1859	1429	3287	1426	1426	238	2124	2362
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	0	0	0	0	0	20	8	28
ATh2 => IB-SKh2W	720	2071	2792	1593	1593	0	1104	1104
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	11	564	574	681	681	118	525	643
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	11	388	399	506	506	118	226	343
BEh2 => FRh2	0	140	140	114	114	0	123	123
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	36	36	61	61	0	177	177
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	93	0	93	0	0	92	0	92
BGh2 => GRh2	93	0	93	0	0	92	0	92
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	1	1	6	6	0	373	373
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	1	1	6	6	0	373	373
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0
DE	4305	4212	8517	3841	3841	3892	3343	7235

DEh2 => ATh2	2	28	30	49	49	206	7	213
DEh2 => BEh2	746	498	1244	315	315	557	770	1327
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	285	862	1147	560	560	268	270	538
DEh2 => DKh2	234	146	380	433	433	165	194	359
DEh2 => FRh2	247	577	824	160	160	164	553	717
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	453	433	886	462	462	326	569	895
DEh2 => PLh2N	483	417	900	365	365	0	0	0
DEh2 => PLh2nbc	795	1138	1933	1338	1338	1202	981	2183
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	29	113	142	161	161	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	1031		1031			1003		1003
DK	746	1697	2443	1167	1167	797	1625	2422
DKh2 => DEh2	746	1697	2443	1167	1167	797	1625	2422
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	166	2803	2969	1780	1780	144	2396	2540
EEh2 => FIh2S	64	0	64	0	0	51	0	51
EEh2 => LVh2	102	2803	2905	1780	1780	93	2396	2489
ES	3323	3963	7286	4456	4456	3452	4146	7598
ESh2 => FRh2S	3278	3712	6990	4231	4231	3410	3897	7308
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	45	250	296	225	225	42	249	291
FI	5429	16288	21717	12356	12356	5606	16307	21913
FIh2 => FIh2AI	1188	3289	4477	2484	2484	1231	3466	4697
FIh2 => FIh2N	1	49	50	67	67	0	59	59
FIh2 => FIh2S	97	129	225	112	112	100	76	176
FIh2AI => DEh2	2357	4816	7172	3104	3104	2458	4972	7430
FIh2AI => FIh2	169	245	414	209	209	164	169	333
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	5	14	19	81	81	0	4	4
FIh2N => FIh2	1002	1067	2068	856	856	1037	1199	2236
FIh2N => SEh2	4	256	260	677	677	4	265	269
FIh2S => EEh2	130	2987	3117	1940	1940	120	2580	2700
FIh2S => FIh2	477	3437	3913	2827	2827	491	3517	4008
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0
FR	6055	6685	12740	6810	6810	6424	6944	13368

FRh2 => BEh2	0	464	464	416	416	0	556	556
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	2474	1471	3945	1652	1652	2700	1453	4153
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	121	375	497	90	90	129	374	503
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	22	0	22	0	0	15	0	15
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	349	349	530	530	0	321	321
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	132	348	479	79	79	135	354	488
FRh2S => FRh2	3198	3434	6632	3824	3824	3338	3641	6979
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	88	174	261	157	157	83	175	258
FRh2Va => FRh2	21	70	91	62	62	24	70	95
GR	0	252	252	245	245	0	265	265
GRh2 => BGh2	0	252	252	245	245	0	265	265
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	478	1328	1806	1191	1191	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	0	0	0	0	0	0	0
HUh2 => ROh2	478	1328	1806	1191	1191	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	4352	11750	16102	12088	12088	462	9696	10158
IB-ITh2 => ATh2	3000	4238	7239	4118	4118	442	4016	4458
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	0	0	0	0	0	20	8	28
IB-SKh2C => HUh2	590	2284	2874	2155	2155	0	0	0
IB-SKh2C => SKh2E	42	89	131	62	62	0	103	103
IB-SKh2C => SKh2W	0	706	706	989	989	0	1516	1516

IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	1842	1842	2433	2433	0	1606	1606
IB-SKh2W => ATh2	0	1	1	3	3	0	15	15
IB-SKh2W => CZh2	4	1049	1054	1289	1289	0	2116	2116
IB-SKh2W => SKh2W	716	1541	2257	1038	1038	0	316	316
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	3000	4238	7239	4118	4118	442	4016	4458
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	3000	4238	7239	4118	4118	442	4016	4458
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	75	2568	2643	1514	1514	62	2168	2230
LTh2 => LVh2	75	6	82	11	11	62	13	75
LTh2 => PLh2nbc	0	2562	2562	1503	1503	0	2155	2155
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	108	2548	2656	1585	1585	89	2149	2238
LVh2 => EEh2	67	0	67	0	0	54	0	54
LVh2 => LTh2	40	2548	2589	1585	1585	35	2149	2184
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	294	2261	2555	1805	1805	512	1823	2335
NLh2 => BEh2	154	1554	1707	1102	1102	173	1454	1627
NLh2 => DEh2	140	707	848	703	703	339	369	708
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	795	4070	4865	3102	3102	1202	3136	4338
PLh2N => DEh2	0	0	0	0	0	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2Al	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	370	370	261	261	0	0	0
PLh2nbc => DEh2	0	249	249	135	135	0	769	769
PLh2nbc => LTh2	94	0	94	0	0	76	0	76
PLh2nbc => PLh2N	701	3451	4151	2706	2706	1126	2366	3493
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0
PLh2S => PLh2nbc	0	0	0	0	0	0	0	0

PT	310	0	310	0	0	321	0	321
PTh2 => ESh2	310	0	310	0	0	321	0	321
RO	0	0	0	0	0	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	0	0	0	0	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	1358	1873	3231	1040	1040	1407	1749	3156
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	1342	1785	3127	911	911	1392	1680	3072
SEh2 => FIh2N	16	88	103	130	130	15	69	84
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	632	3599	4230	3944	3944	0	2962	2962
SKh2E => IB-SKh2C	0	1737	1737	2302	2302	0	1516	1516
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	632	1341	1973	905	905	0	103	103
SKh2W => IB-SKh2W	0	520	520	738	738	0	1343	1343
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

MAY

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	2667	3247	5913	3997	3997	249	2824	3073
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	1941	1343	3284	1332	1332	220	1942	2162
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	0	2	2	0	0	29	59	88
ATh2 => IB-SKh2W	725	1902	2627	2665	2665	0	824	824
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	18	812	830	457	457	196	779	976
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	18	560	578	259	259	196	398	595
BEh2 => FRh2	0	145	145	147	147	0	95	95
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	106	106	51	51	0	286	286
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	98	0	98	0	0	98	0	98
BGh2 => GRh2	98	0	98	0	0	98	0	98
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	0	0	1	1	0	428	428
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	0	0	1	1	0	428	428
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0

DE	4331	4575	8906	5286	5286	4103	3711	7814
DEh2 => ATh2	7	110	117	71	71	245	70	315
DEh2 => BEh2	680	353	1033	529	529	554	593	1147
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	315	821	1136	1262	1262	304	307	611
DEh2 => DKh2	292	402	694	249	249	217	426	643
DEh2 => FRh2	226	565	791	788	788	134	495	629
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	388	411	799	283	283	286	501	788
DEh2 => PLh2N	501	415	917	486	486	0	0	0
DEh2 => PLh2nbc	788	1339	2127	1538	1538	1253	1318	2571
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	51	159	211	80	80	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	1082		1082			1110		1110
DK	618	1395	2013	1910	1910	677	1337	2014
DKh2 => DEh2	618	1395	2013	1910	1910	677	1337	2014
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	205	2335	2540	2638	2638	169	1675	1843
EEh2 => FIh2S	84	0	84	0	0	57	0	57
EEh2 => LVh2	121	2335	2456	2638	2638	112	1675	1786
ES	3803	4269	8073	4381	4381	3976	4342	8318
ESh2 => FRh2S	3760	4031	7792	4143	4143	3941	4112	8053
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	43	238	281	238	238	35	230	265
FI	5214	12165	17379	14529	14529	5340	11719	17059
FIh2 => FIh2AI	1072	1941	3013	2805	2805	1097	2128	3225
FIh2 => FIh2N	4	1	4	25	25	0	13	13
FIh2 => FIh2S	59	412	471	160	160	71	170	242
FIh2AI => DEh2	2408	3611	6019	4103	4103	2487	3813	6300
FIh2AI => FIh2	117	690	807	266	266	133	418	552
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	11	0	11	24	24	0	8	8
FIh2N => FIh2	896	942	1838	1141	1141	915	876	1791
FIh2N => SEh2	3	70	73	292	292	4	156	160
FIh2S => EEh2	148	2508	2657	2826	2826	140	1847	1986
FIh2S => FIh2	496	1990	2486	2889	2889	494	2289	2783
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0

FR	6952	7498	14450	7650	7650	7386	7359	14744
FRh2 => BEh2	0	422	422	534	534	0	478	478
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	2935	1790	4725	1681	1681	3169	1727	4897
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	99	383	482	563	563	105	276	380
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	25	0	25	0	0	17	0	17
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	558	558	248	248	0	531	531
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	92	331	422	536	536	100	248	349
FRh2S => FRh2	3690	3748	7437	3825	3825	3884	3832	7716
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	90	188	279	186	186	86	188	275
FRh2Va => FRh2	22	78	100	76	76	23	78	101
GR	2	366	368	261	261	2	387	390
GRh2 => BGh2	2	366	368	261	261	2	387	390
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	477	1309	1786	1543	1543	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	0	0	0	0	0	0	0
HUh2 => ROh2	477	1309	1786	1543	1543	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	4456	12332	16788	11754	11754	454	10788	11241
IB-ITh2 => ATh2	3100	4365	7466	4377	4377	425	3999	4423
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	0	2	2	0	0	29	59	88
IB-SKh2C => HUh2	586	2343	2929	2530	2530	0	0	0
IB-SKh2C => SKh2E	44	77	121	126	126	0	88	88

IB-SKh2C => SKh2W	0	831	831	424	424	0	1977	1977
IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	2213	2213	1344	1344	0	2090	2090
IB-SKh2W => ATh2	0	0	0	0	0	0	26	26
IB-SKh2W => CZh2	6	1170	1176	877	877	0	2286	2286
IB-SKh2W => SKh2W	719	1332	2051	2076	2076	0	264	264
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	3100	4365	7466	4377	4377	425	3999	4423
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	3100	4365	7466	4377	4377	425	3999	4423
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	95	2053	2148	2334	2334	65	1401	1466
LTh2 => LVh2	95	9	104	7	7	65	19	84
LTh2 => PLh2nbc	0	2044	2044	2327	2327	0	1381	1381
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	144	2097	2241	2375	2375	108	1447	1555
LVh2 => EEh2	87	0	87	0	0	59	0	59
LVh2 => LTh2	56	2097	2154	2375	2375	49	1447	1495
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	263	2029	2292	2798	2798	659	1617	2276
NLh2 => BEh2	134	1265	1399	2040	2040	134	1215	1349
NLh2 => DEh2	129	764	893	757	757	525	402	926
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	788	3741	4529	4246	4246	1253	2700	3953
PLh2N => DEh2	0	0	0	0	0	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2AI	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	358	358	381	381	0	0	0
PLh2nbc => DEh2	0	191	191	269	269	0	507	507
PLh2nbc => LTh2	127	0	127	0	0	90	0	90
PLh2nbc => PLh2N	661	3192	3853	3597	3597	1163	2193	3356
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0

PLh2S => PLh2nbc	0	0	0	0	0	0	0	0
PT	317	0	317	0	0	341	0	341
PTh2 => ESh2	317	0	317	0	0	341	0	341
RO	0	0	0	0	0	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	0	0	0	0	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	1479	2552	4030	1755	1755	1537	2229	3767
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	1464	2361	3824	1587	1587	1524	2112	3635
SEh2 => FIh2N	15	191	206	168	168	13	118	131
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	631	3850	4481	3368	3368	0	3817	3817
SKh2E => IB-SKh2C	0	2089	2089	1270	1270	0	1977	1977
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	631	1161	1792	1810	1810	0	88	88
SKh2W => IB-SKh2W	0	600	600	288	288	0	1752	1752
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

JUNE

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	2144	3232	5376	3533	3533	108	2676	2784
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	1447	1200	2646	1495	1495	70	1619	1689
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	0	0	0	8	8	38	170	208
ATh2 => IB-SKh2W	697	2033	2730	2031	2031	0	888	888
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	18	606	624	507	507	211	569	780
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	18	465	484	368	368	211	328	539
BEh2 => FRh2	0	108	108	127	127	0	77	77
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	33	33	12	12	0	165	165
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	94	0	94	0	0	93	0	93
BGh2 => GRh2	94	0	94	0	0	93	0	93
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	0	0	2	2	0	293	293
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	0	0	2	2	0	293	293
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0
DE	4280	4769	9049	5341	5341	4011	4144	8155

DEh2 => ATh2	7	48	55	71	71	340	167	507
DEh2 => BEh2	636	453	1088	637	637	518	651	1169
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	315	922	1237	814	814	285	454	739
DEh2 => DKh2	258	328	586	261	261	175	341	516
DEh2 => FRh2	430	568	998	837	837	242	589	831
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	376	470	846	592	592	308	599	907
DEh2 => PLh2N	486	424	909	416	416	0	0	0
DEh2 => PLh2nbc	708	1434	2142	1608	1608	1078	1343	2421
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	60	121	181	105	105	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	1004		1004			1065		1065
DK	668	1369	2037	1623	1623	686	1332	2019
DKh2 => DEh2	668	1369	2037	1623	1623	686	1332	2019
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	147	2233	2379	1989	1989	126	1679	1805
EEh2 => FIh2S	14	0	14	0	0	9	0	9
EEh2 => LVh2	132	2233	2365	1989	1989	117	1679	1796
ES	3276	4407	7683	3841	3841	3441	4435	7876
ESh2 => FRh2S	3226	4172	7398	3617	3617	3396	4201	7598
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	50	235	285	224	224	45	233	278
FI	5216	11936	17152	10249	10249	5362	11785	17147
FIh2 => FIh2AI	1032	1931	2963	1698	1698	1075	2124	3200
FIh2 => FIh2N	0	4	5	14	14	0	0	0
FIh2 => FIh2S	80	449	529	240	240	60	268	327
FIh2AI => DEh2	2467	3447	5914	2739	2739	2584	3830	6414
FIh2AI => FIh2	155	778	933	421	421	127	478	605
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	0	9	9	25	25	0	16	16
FIh2N => FIh2	868	850	1719	884	884	892	880	1772
FIh2N => SEh2	1	101	102	226	226	1	90	91
FIh2S => EEh2	160	2404	2565	2155	2155	145	1852	1997
FIh2S => FIh2	451	1963	2414	1846	1846	478	2247	2725
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0
FR	6263	7442	13704	6668	6668	6409	7552	13961

FRh2 => BEh2	0	445	445	391	391	0	495	495
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	2500	1818	4318	1545	1545	2682	1806	4488
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	247	372	619	402	402	166	369	535
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	24	0	24	0	0	14	0	14
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	385	385	350	350	0	372	372
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	248	354	602	349	349	161	358	519
FRh2S => FRh2	3134	3815	6949	3388	3388	3282	3899	7181
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	88	177	265	173	173	80	177	258
FRh2Va => FRh2	22	76	98	70	70	24	75	99
GR	0	164	164	247	247	0	165	165
GRh2 => BGh2	0	164	164	247	247	0	165	165
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	454	1329	1783	1326	1326	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	0	0	0	0	0	0	0
HUh2 => ROh2	454	1329	1783	1326	1326	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	3865	11801	15666	11994	11994	186	9638	9824
IB-ITh2 => ATh2	2564	4189	6752	4209	4209	148	3608	3756
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	0	0	0	8	8	38	170	208
IB-SKh2C => HUh2	562	2297	2859	2295	2295	0	0	0
IB-SKh2C => SKh2E	42	76	118	78	78	0	98	98
IB-SKh2C => SKh2W	0	713	713	749	749	0	1657	1657

IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	1982	1982	2084	2084	0	1752	1752
IB-SKh2W => ATh2	0	0	0	0	0	0	35	35
IB-SKh2W => CZh2	10	1137	1147	1241	1241	0	2024	2024
IB-SKh2W => SKh2W	688	1408	2096	1331	1331	0	295	295
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	2564	4189	6752	4209	4209	148	3608	3756
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	2564	4189	6752	4209	4209	148	3608	3756
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	19	1925	1944	1726	1726	12	1357	1368
LTh2 => LVh2	19	6	25	15	15	12	17	29
LTh2 => PLh2nbc	0	1919	1919	1711	1711	0	1339	1339
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	80	1996	2076	1759	1759	62	1454	1516
LVh2 => EEh2	16	0	16	0	0	10	0	10
LVh2 => LTh2	64	1996	2060	1759	1759	53	1454	1506
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	392	2037	2429	1753	1753	758	1760	2519
NLh2 => BEh2	147	1381	1528	1342	1342	147	1396	1542
NLh2 => DEh2	245	656	901	411	411	612	365	977
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	708	3744	4452	3705	3705	1078	2683	3761
PLh2N => DEh2	0	0	0	0	0	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2Al	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	391	391	385	385	0	0	0
PLh2nbc => DEh2	0	193	193	144	144	0	521	521
PLh2nbc => LTh2	60	0	60	0	0	38	0	38
PLh2nbc => PLh2N	648	3160	3808	3175	3175	1040	2162	3202
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0
PLh2S => PLh2nbc	0	0	0	0	0	0	0	0

PT	262	0	262	0	0	264	0	264
PTh2 => ESh2	262	0	262	0	0	264	0	264
RO	0	0	0	0	0	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	0	0	0	0	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	1605	2504	4108	1765	1765	1650	2376	4025
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	1589	2304	3893	1487	1487	1635	2200	3835
SEh2 => FIh2N	15	200	215	278	278	14	176	190
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	604	3599	4203	3662	3662	0	3221	3221
SKh2E => IB-SKh2C	0	1865	1865	1969	1969	0	1657	1657
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	604	1222	1825	1153	1153	0	98	98
SKh2W => IB-SKh2W	0	513	513	541	541	0	1466	1466
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

JULY

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	2217	2804	5021	3598	3598	98	2229	2327
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	1631	900	2531	1362	1362	41	1519	1560
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	0	0	0	0	0	56	152	209
ATh2 => IB-SKh2W	586	1904	2490	2236	2236	0	558	558
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	43	632	675	502	502	328	562	890
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	43	458	501	345	345	328	249	576
BEh2 => FRh2	0	166	166	155	155	0	164	164
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	8	8	2	2	0	150	150
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	96	0	96	0	0	96	0	96
BGh2 => GRh2	96	0	96	0	0	96	0	96
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	0	0	2	2	0	464	464
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	0	0	2	2	0	464	464
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0
DE	3950	5417	9367	5881	5881	3097	5075	8172

DEh2 => ATh2	13	170	183	86	86	286	205	491
DEh2 => BEh2	411	633	1043	597	597	387	949	1336
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	277	770	1048	1011	1011	188	550	738
DEh2 => DKh2	337	413	750	339	339	101	397	498
DEh2 => FRh2	695	700	1395	942	942	264	890	1154
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	198	914	1112	483	483	225	1029	1254
DEh2 => PLh2N	485	433	918	445	445	0	0	0
DEh2 => PLh2nbc	653	1255	1908	1882	1882	837	1055	1892
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	151	130	282	95	95	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	730		730			809		809
DK	562	1359	1921	1471	1471	589	1342	1931
DKh2 => DEh2	562	1359	1921	1471	1471	589	1342	1931
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	214	2602	2816	1710	1710	154	2213	2367
EEh2 => FIh2S	94	0	94	0	0	72	0	72
EEh2 => LVh2	120	2602	2722	1710	1710	82	2213	2295
ES	2501	3993	6494	3708	3708	2494	3974	6467
ESh2 => FRh2S	2421	3739	6160	3481	3481	2426	3728	6153
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	80	254	334	226	226	68	246	314
FI	5381	14851	20233	8867	8867	5299	15036	20335
FIh2 => FIh2AI	1182	2884	4067	1132	1132	1178	3048	4226
FIh2 => FIh2N	3	0	3	4	4	0	13	13
FIh2 => FIh2S	43	117	160	633	633	55	40	94
FIh2AI => DEh2	2387	4519	6906	2061	2061	2349	4897	7245
FIh2AI => FIh2	105	267	372	978	978	125	141	266
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	11	28	39	7	7	0	25	25
FIh2N => FIh2	997	1011	2008	714	714	974	1196	2169
FIh2N => SEh2	10	224	234	171	171	10	230	240
FIh2S => EEh2	146	2791	2937	1877	1877	105	2400	2505
FIh2S => FIh2	497	3010	3507	1290	1290	505	3048	3552
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0
FR	4442	6863	11304	6676	6676	4366	6940	11307

FRh2 => BEh2	0	434	434	479	479	0	520	520
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	1687	1528	3215	1322	1322	1716	1492	3208
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	109	409	518	593	593	74	471	545
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	39	0	39	0	0	11	0	11
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	428	428	306	306	0	350	350
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	121	374	495	546	546	73	429	502
FRh2S => FRh2	2391	3431	5822	3182	3182	2424	3421	5845
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	81	180	261	171	171	56	179	234
FRh2Va => FRh2	13	79	92	76	76	14	78	91
GR	0	283	283	296	296	0	284	284
GRh2 => BGh2	0	283	283	296	296	0	284	284
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	406	1316	1721	1407	1407	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	0	0	0	0	0	0	0
HUh2 => ROh2	406	1316	1721	1407	1407	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	3726	12538	16265	11932	11932	141	10547	10687
IB-ITh2 => ATh2	2648	4338	6986	4352	4352	85	3763	3847
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	0	0	0	0	0	56	152	209
IB-SKh2C => HUh2	453	2366	2819	2430	2430	0	0	0
IB-SKh2C => SKh2E	40	71	111	98	98	0	82	82
IB-SKh2C => SKh2W	0	860	860	621	621	0	2035	2035

IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	2382	2382	1748	1748	0	2148	2148
IB-SKh2W => ATh2	0	0	0	0	0	0	14	14
IB-SKh2W => CZh2	15	1336	1350	970	970	0	2108	2108
IB-SKh2W => SKh2W	572	1185	1756	1713	1713	0	245	245
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	2648	4338	6986	4352	4352	85	3763	3847
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	2648	4338	6986	4352	4352	85	3763	3847
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	105	2335	2439	1440	1440	84	1954	2038
LTh2 => LVh2	105	9	113	11	11	83	19	103
LTh2 => PLh2nbc	0	2326	2326	1429	1429	1	1934	1935
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	157	2342	2499	1487	1487	106	1963	2070
LVh2 => EEh2	97	0	97	0	0	75	0	75
LVh2 => LTh2	60	2342	2402	1487	1487	31	1963	1994
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	732	2053	2785	2520	2520	1036	1565	2601
NLh2 => BEh2	136	1254	1390	1669	1669	119	1197	1316
NLh2 => DEh2	595	799	1394	851	851	917	368	1285
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	653	4040	4693	3756	3756	838	2990	3828
PLh2N => DEh2	0	0	0	0	0	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2AI	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	460	460	445	445	0	0	0
PLh2nbc => DEh2	0	223	223	94	94	0	684	684
PLh2nbc => LTh2	125	0	125	0	0	99	0	99
PLh2nbc => PLh2N	529	3358	3886	3216	3216	739	2306	3045
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0
PLh2S => PLh2nbc	0	0	0	0	0	0	0	0

PT	190	0	190	0	0	184	0	184
PTh2 => ESh2	190	0	190	0	0	184	0	184
RO	0	0	0	0	0	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	0	0	0	0	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	1332	1995	3327	2215	2215	1310	2052	3362
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	1320	1930	3250	1913	1913	1296	2014	3310
SEh2 => FIh2N	12	65	77	301	301	15	37	52
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	492	3914	4407	3596	3596	0	3926	3926
SKh2E => IB-SKh2C	0	2259	2259	1651	1651	0	2035	2035
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	492	1039	1531	1498	1498	0	82	82
SKh2W => IB-SKh2W	0	617	617	447	447	0	1809	1809
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

AUGUST

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	2161	3002	5163	2930	2930	137	2352	2489
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	1517	965	2482	958	958	59	1613	1672
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	1	0	1	0	0	79	204	283
ATh2 => IB-SKh2W	642	2037	2680	1972	1972	0	534	534
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	24	781	805	708	708	279	752	1031
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	24	628	652	480	480	279	426	705
BEh2 => FRh2	0	130	130	203	203	0	96	96
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	23	23	25	25	0	230	230
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	101	0	101	0	0	100	0	100
BGh2 => GRh2	101	0	101	0	0	100	0	100
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	3	3	2	2	0	441	441
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	3	3	2	2	0	441	441
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0

DE	4242	4494	8735	5491	5491	3604	4031	7635
DEh2 => ATh2	35	159	194	126	126	303	271	574
DEh2 => BEh2	529	425	954	494	494	510	548	1058
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	248	877	1125	736	736	191	678	870
DEh2 => DKh2	376	467	843	376	376	142	473	615
DEh2 => FRh2	489	253	743	837	837	165	426	591
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	300	372	672	634	634	308	426	733
DEh2 => PLh2N	484	428	912	436	436	0	0	0
DEh2 => PLh2nbc	738	1362	2100	1719	1719	910	1210	2120
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	132	150	282	131	131	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	909		909			1075		1075
DK	507	1495	2003	1478	1478	536	1484	2020
DKh2 => DEh2	507	1495	2003	1478	1478	536	1484	2020
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	234	2489	2722	1855	1855	147	2028	2175
EEh2 => FIh2S	110	0	110	0	0	56	0	56
EEh2 => LVh2	123	2489	2612	1855	1855	91	2028	2119
ES	2860	4460	7320	3720	3720	2854	4392	7246
ESh2 => FRh2S	2802	4225	7027	3486	3486	2803	4153	6956
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	58	235	293	234	234	52	239	291
FI	5214	14596	19810	9879	9879	5422	14774	20197
FIh2 => FIh2AI	1156	2977	4133	1506	1506	1205	3236	4441
FIh2 => FIh2N	3	5	8	8	8	0	10	10
FIh2 => FIh2S	90	225	315	434	434	94	130	224
FIh2AI => DEh2	2183	4050	6232	2575	2575	2335	4340	6675
FIh2AI => FIh2	177	431	608	843	843	186	321	507
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	12	20	32	10	10	0	19	19
FIh2N => FIh2	981	1057	2038	764	764	1009	1102	2112
FIh2N => SEh2	2	219	221	148	148	0	232	232
FIh2S => EEh2	147	2663	2811	2012	2012	115	2202	2317
FIh2S => FIh2	464	2949	3413	1578	1578	478	3182	3660
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0

FR	4991	7268	12259	6836	6836	5021	7342	12363
FRh2 => BEh2	0	425	425	413	413	0	476	476
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	1924	1896	3820	1387	1387	2009	1750	3759
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	85	110	195	547	547	58	230	288
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	37	0	37	0	0	10	0	10
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	527	527	444	444	0	524	524
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	90	95	186	534	534	59	213	272
FRh2S => FRh2	2755	3953	6708	3263	3263	2808	3891	6698
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	83	180	263	173	173	61	180	241
FRh2Va => FRh2	16	81	98	76	76	17	79	95
GR	0	257	257	267	267	0	242	242
GRh2 => BGh2	0	257	257	267	267	0	242	242
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	409	1314	1723	1340	1340	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	0	0	0	0	0	0	0
HUh2 => ROh2	409	1314	1723	1340	1340	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	3738	12250	15989	12500	12500	195	10143	10338
IB-ITh2 => ATh2	2567	4285	6852	4336	4336	116	3607	3724
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	1	0	1	0	0	79	204	283
IB-SKh2C => HUh2	488	2343	2831	2415	2415	0	0	0
IB-SKh2C => SKh2E	40	79	118	73	73	0	87	87

IB-SKh2C => SKh2W	0	805	805	797	797	0	1939	1939
IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	2107	2107	2347	2347	0	2046	2046
IB-SKh2W => ATh2	0	0	0	0	0	0	32	32
IB-SKh2W => CZh2	35	1218	1253	1321	1321	0	1965	1965
IB-SKh2W => SKh2W	608	1413	2020	1211	1211	0	262	262
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	2567	4285	6852	4336	4336	116	3607	3724
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	2567	4285	6852	4336	4336	116	3607	3724
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	123	2088	2212	1634	1634	64	1632	1696
LTh2 => LVh2	123	7	130	21	21	64	16	80
LTh2 => PLh2nbc	0	2082	2082	1613	1613	0	1616	1616
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	179	2245	2424	1649	1649	95	1795	1890
LVh2 => EEh2	114	0	114	0	0	59	0	59
LVh2 => LTh2	65	2245	2310	1649	1649	36	1795	1832
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	695	2043	2738	2202	2202	900	1601	2500
NLh2 => BEh2	111	1265	1376	1386	1386	116	1206	1322
NLh2 => DEh2	584	778	1362	816	816	784	395	1179
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	738	3865	4603	3731	3731	910	2825	3736
PLh2N => DEh2	0	0	0	0	0	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2AI	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	421	421	400	400	0	0	0
PLh2nbc => DEh2	0	184	184	165	165	0	555	555
PLh2nbc => LTh2	162	0	162	0	0	92	0	92
PLh2nbc => PLh2N	576	3260	3836	3166	3166	818	2270	3088
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0

PLh2S => PLh2nbc	0	0	0	0	0	0	0	0
PT	240	0	240	0	0	246	0	246
PTh2 => ESh2	240	0	240	0	0	246	0	246
RO	0	0	0	0	0	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	0	0	0	0	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	1232	1616	2848	2103	2103	1332	1498	2831
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	1215	1524	2739	1922	1922	1316	1444	2760
SEh2 => FIh2N	17	92	109	182	182	17	54	71
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	528	3821	4349	3845	3845	0	3751	3751
SKh2E => IB-SKh2C	0	1991	1991	2225	2225	0	1939	1939
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	528	1236	1764	1060	1060	0	87	87
SKh2W => IB-SKh2W	0	594	594	559	559	0	1725	1725
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

SEPTEMBER

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	2331	2861	5191	2569	2569	177	2486	2663
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	1703	1010	2713	674	674	152	1639	1790
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	0	0	0	0	0	26	14	39
ATh2 => IB-SKh2W	628	1851	2479	1896	1896	0	833	833
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	19	660	679	480	480	227	638	865
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	19	562	581	368	368	227	422	649
BEh2 => FRh2	0	98	98	86	86	0	112	112
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	0	0	26	26	0	104	104
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	100	0	100	0	0	98	0	98
BGh2 => GRh2	100	0	100	0	0	98	0	98
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	3	3	0	0	0	422	422
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	3	3	0	0	0	422	422
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0
DE	4046	5140	9186	4204	4204	3623	4239	7862

DEh2 => ATh2	2	144	147	167	167	270	34	305
DEh2 => BEh2	555	540	1095	545	545	428	679	1106
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	279	814	1093	837	837	238	389	627
DEh2 => DKh2	266	349	615	79	79	167	359	526
DEh2 => FRh2	599	472	1070	645	645	486	554	1040
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	332	800	1132	447	447	265	839	1104
DEh2 => PLh2N	475	415	889	412	412	0	0	0
DEh2 => PLh2nbc	701	1487	2188	958	958	1028	1385	2413
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	75	119	195	114	114	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	762		762			741		741
DK	568	1312	1880	1842	1842	619	1297	1917
DKh2 => DEh2	568	1312	1880	1842	1842	619	1297	1917
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	170	2009	2178	3207	3207	140	1518	1658
EEh2 => FIh2S	51	0	51	0	0	35	0	35
EEh2 => LVh2	118	2009	2127	3207	3207	105	1518	1623
ES	3018	4351	7369	3984	3984	3079	4267	7346
ESh2 => FRh2S	2961	4147	7108	3764	3764	3028	4057	7086
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	57	204	261	220	220	51	210	260
FI	5455	11399	16854	17117	17117	5477	11841	17319
FIh2 => FIh2AI	1162	2130	3292	3547	3547	1171	2424	3596
FIh2 => FIh2N	2	8	9	9	9	0	11	11
FIh2 => FIh2S	94	137	232	165	165	83	103	186
FIh2AI => DEh2	2429	3176	5605	4645	4645	2477	3508	5985
FIh2AI => FIh2	165	269	434	271	271	159	236	395
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	6	33	39	53	53	0	43	43
FIh2N => FIh2	979	891	1871	1280	1280	987	833	1820
FIh2N => SEh2	1	313	314	301	301	1	378	379
FIh2S => EEh2	143	2166	2309	3390	3390	130	1676	1806
FIh2S => FIh2	474	2276	2750	3455	3455	469	2630	3099
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0
FR	5765	7406	13171	6736	6736	6028	7271	13299

FRh2 => BEh2	0	441	441	435	435	0	483	483
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	2130	1874	4004	1411	1411	2237	1737	3974
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	346	308	655	404	404	429	356	786
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	32	0	32	0	0	14	0	14
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	424	424	347	347	0	388	388
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	326	282	608	381	381	389	330	719
FRh2S => FRh2	2828	3827	6655	3526	3526	2860	3729	6589
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	85	176	260	168	168	77	176	252
FRh2Va => FRh2	18	74	92	65	65	21	73	94
GR	0	204	204	212	212	0	207	207
GRh2 => BGh2	0	204	204	212	212	0	207	207
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	427	1253	1680	1243	1243	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	0	0	0	0	0	0	0
HUh2 => ROh2	427	1253	1680	1243	1243	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	3924	12046	15971	12035	12035	286	10351	10637
IB-ITh2 => ATh2	2755	4265	7020	4160	4160	260	4059	4319
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	0	0	0	0	0	26	14	39
IB-SKh2C => HUh2	502	2249	2750	2306	2306	0	0	0
IB-SKh2C => SKh2E	40	70	110	70	70	0	87	87
IB-SKh2C => SKh2W	0	816	816	795	795	0	1820	1820

IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	2196	2196	2242	2242	0	1923	1923
IB-SKh2W => ATh2	0	0	0	18	18	0	7	7
IB-SKh2W => CZh2	7	1230	1237	1244	1244	0	2180	2180
IB-SKh2W => SKh2W	621	1220	1841	1200	1200	0	260	260
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	2755	4265	7020	4160	4160	260	4059	4319
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	2755	4265	7020	4160	4160	260	4059	4319
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	59	1704	1763	2848	2848	40	1208	1248
LTh2 => LVh2	59	7	67	1	1	40	16	56
LTh2 => PLh2nbc	0	1697	1697	2846	2846	0	1192	1192
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	112	1790	1902	2952	2952	84	1309	1392
LVh2 => EEh2	54	0	54	0	0	37	0	37
LVh2 => LTh2	58	1790	1849	2952	2952	47	1309	1356
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	479	2121	2599	1966	1966	867	1730	2597
NLh2 => BEh2	165	1306	1471	1384	1384	173	1246	1419
NLh2 => DEh2	314	814	1129	582	582	693	484	1178
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	701	3569	4270	4248	4248	1028	2577	3605
PLh2N => DEh2	0	0	0	0	0	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2AI	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	385	385	444	444	0	0	0
PLh2nbc => DEh2	0	153	153	408	408	0	426	426
PLh2nbc => LTh2	88	0	88	0	0	62	0	62
PLh2nbc => PLh2N	613	3031	3643	3396	3396	966	2151	3117
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0
PLh2S => PLh2nbc	0	0	0	0	0	0	0	0

PT	245	0	245	0	0	258	0	258
PTh2 => ESh2	245	0	245	0	0	258	0	258
RO	0	0	0	0	0	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	0	0	0	0	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	1453	1471	2924	1519	1519	1480	1438	2919
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	1438	1349	2787	1422	1422	1465	1362	2827
SEh2 => FIh2N	15	122	137	96	96	15	76	91
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	541	3734	4276	3738	3738	0	3522	3522
SKh2E => IB-SKh2C	0	2077	2077	2122	2122	0	1820	1820
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	541	1058	1600	1049	1049	0	87	87
SKh2W => IB-SKh2W	0	599	599	567	567	0	1615	1615
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

OCTOBER

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	2584	1798	4382	2136	2136	123	1597	1720
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	1887	766	2654	1144	1144	112	1178	1290
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	0	24	24	1	1	11	35	45
ATh2 => IB-SKh2W	697	1007	1704	992	992	0	385	385
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	20	1052	1072	1472	1472	348	1002	1351
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	20	620	639	1030	1030	348	522	870
BEh2 => FRh2	0	199	199	251	251	0	182	182
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	233	233	192	192	0	299	299
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	94	0	94	0	0	93	0	93
BGh2 => GRh2	94	0	94	0	0	93	0	93
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	107	107	11	11	0	324	324
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	107	107	11	11	0	324	324
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0
DE	2928	3298	6226	2752	2752	2314	2730	5044

DEh2 => ATh2	9	338	347	100	100	215	214	430
DEh2 => BEh2	241	228	469	123	123	213	461	674
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	275	853	1128	456	456	231	384	615
DEh2 => DKh2	232	43	276	154	154	65	53	118
DEh2 => FRh2	635	431	1066	348	348	329	512	841
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	122	286	408	141	141	119	548	667
DEh2 => PLh2N	438	312	749	292	292	0	0	0
DEh2 => PLh2nbc	514	605	1119	871	871	805	558	1363
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	153	202	355	266	266	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	309		309			336		336
DK	570	1619	2188	1314	1314	589	1639	2227
DKh2 => DEh2	570	1619	2188	1314	1314	589	1639	2227
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	134	3324	3458	1930	1930	103	3145	3249
EEh2 => FIh2S	21	0	21	0	0	18	0	18
EEh2 => LVh2	113	3324	3437	1930	1930	85	3145	3231
ES	2345	3801	6146	4116	4116	2355	3744	6099
ESh2 => FRh2S	2273	3622	5895	3937	3937	2296	3561	5857
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	72	179	251	178	178	59	183	242
FI	6952	19203	26155	11952	11952	7018	19457	26475
FIh2 => FIh2AI	1633	4296	5929	2463	2463	1660	4423	6083
FIh2 => FIh2N	0	20	21	2	2	0	20	20
FIh2 => FIh2S	24	24	48	151	151	30	4	34
FIh2AI => DEh2	3121	5408	8529	3134	3134	3153	5597	8750
FIh2AI => FIh2	53	57	110	314	314	58	27	84
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	2	12	14	30	30	0	28	28
FIh2N => FIh2	1383	1532	2915	922	922	1384	1464	2848
FIh2N => SEh2	0	313	313	316	316	0	337	337
FIh2S => EEh2	143	3508	3651	2084	2084	115	3329	3444
FIh2S => FIh2	592	4032	4625	2535	2535	619	4228	4848
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0
FR	4805	6940	11744	7184	7184	4640	6859	11499

FRh2 => BEh2	0	304	304	156	156	0	376	376
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	1843	1730	3573	1877	1877	1865	1628	3493
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	317	322	638	208	208	229	354	583
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	20	0	20	2	2	9	0	9
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	661	661	902	902	0	605	605
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	296	301	597	202	202	208	345	553
FRh2S => FRh2	2242	3418	5660	3639	3639	2253	3346	5599
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	70	149	218	146	146	59	150	209
FRh2Va => FRh2	17	54	71	52	52	17	55	72
GR	0	201	201	186	186	0	206	206
GRh2 => BGh2	0	201	201	186	186	0	206	206
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	382	826	1208	679	679	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	14	14	0	0	0	0	0
HUh2 => ROh2	382	811	1194	679	679	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	4250	12272	16521	12731	12731	222	12204	12425
IB-ITh2 => ATh2	3015	3676	6691	3848	3848	211	3587	3798
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	0	24	24	1	1	11	35	45
IB-SKh2C => HUh2	488	2118	2606	2010	2010	0	0	0
IB-SKh2C => SKh2E	51	29	80	19	19	0	44	44
IB-SKh2C => SKh2W	0	1298	1298	1437	1437	0	2771	2771

IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	3168	3168	3367	3367	0	2932	2932
IB-SKh2W => ATh2	0	126	126	129	129	0	296	296
IB-SKh2W => CZh2	56	1316	1372	1573	1573	0	2408	2408
IB-SKh2W => SKh2W	640	515	1155	346	346	0	131	131
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	3015	3676	6691	3848	3848	211	3587	3798
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	3015	3676	6691	3848	3848	211	3587	3798
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	24	2990	3014	1653	1653	22	2808	2830
LTh2 => LVh2	24	0	24	6	6	22	2	23
LTh2 => PLh2nbc	0	2989	2989	1648	1648	1	2806	2807
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	68	3071	3139	1746	1746	54	2892	2946
LVh2 => EEh2	22	0	22	0	0	19	0	19
LVh2 => LTh2	47	3071	3118	1746	1746	35	2892	2927
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	1073	2608	3681	2766	2766	1257	1993	3250
NLh2 => BEh2	212	1127	1339	661	661	184	1238	1422
NLh2 => DEh2	861	1481	2342	2105	2105	1073	755	1828
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	514	3774	4289	2635	2635	805	3364	4170
PLh2N => DEh2	0	12	12	5	5	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2AI	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	168	168	111	111	0	0	0
PLh2nbc => DEh2	0	419	419	241	241	0	1161	1161
PLh2nbc => LTh2	31	0	31	0	0	29	0	29
PLh2nbc => PLh2N	483	3175	3658	2277	2277	777	2204	2980
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0
PLh2S => PLh2nbc	0	0	0	0	0	0	0	0

PT	179	0	179	0	0	177	0	177
PTh2 => ESh2	179	0	179	0	0	177	0	177
RO	0	5	5	0	0	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	5	5	0	0	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	1549	1210	2758	1081	1081	1558	1240	2798
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	1543	1181	2724	1014	1014	1551	1229	2780
SEh2 => FIh2N	6	29	34	67	67	7	11	19
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	539	4381	4920	4523	4523	0	5265	5265
SKh2E => IB-SKh2C	0	2987	2987	3171	3171	0	2771	2771
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	539	444	982	295	295	0	44	44
SKh2W => IB-SKh2W	0	950	950	1057	1057	0	2450	2450
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

NOVEMBER

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	2931	1961	4892	1721	1721	396	1975	2371
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	2323	1164	3487	704	704	396	1577	1973
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	0	0	0	3	3	0	2	2
ATh2 => IB-SKh2W	608	797	1405	1014	1014	0	397	397
ATh2 => SIh2	0	0	0	0	0	0	0	0
BE	44	1617	1661	992	992	524	1664	2188
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	44	1133	1177	827	827	524	997	1521
BEh2 => FRh2	0	115	115	78	78	0	125	125
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	369	369	87	87	0	543	543
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	87	0	87	0	0	87	0	87
BGh2 => GRh2	87	0	87	0	0	87	0	87
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	163	163	10	10	0	567	567
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	163	163	10	10	0	567	567
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0
CZh2 => PLh2S	0	0	0	0	0	0	0	0

DE	2267	2161	4428	3901	3901	1468	1506	2974
DEh2 => ATh2	4	56	60	762	762	70	105	175
DEh2 => BEh2	97	131	228	179	179	85	174	259
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	212	489	700	1148	1148	169	129	298
DEh2 => DKh2	443	110	553	78	78	219	123	342
DEh2 => FRh2	349	154	503	304	304	211	170	381
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	41	190	231	103	103	32	288	321
DEh2 => PLh2N	366	212	578	321	321	0	0	0
DEh2 => PLh2nbc	377	564	941	834	834	520	516	1036
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	232	255	487	173	173	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	147		147			162		162
DK	218	805	1023	1634	1634	226	820	1046
DKh2 => DEh2	218	805	1023	1634	1634	226	820	1046
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	160	2366	2526	2280	2280	89	2234	2323
EEh2 => FIh2S	57	0	57	0	0	28	0	28
EEh2 => LVh2	102	2366	2469	2280	2280	61	2234	2295
ES	2709	4591	7300	4887	4887	2725	4651	7376
ESh2 => FRh2S	2636	4422	7058	4689	4689	2655	4488	7144
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	73	170	243	198	198	70	162	232
FI	5227	20083	25310	15030	15030	5425	20426	25851
FIh2 => FIh2AI	1431	5052	6483	3337	3337	1511	5204	6715
FIh2 => FIh2N	2	13	15	6	6	0	25	25
FIh2 => FIh2S	0	0	0	135	135	0	0	0
FIh2AI => DEh2	1845	5314	7158	4271	4271	1957	5448	7404
FIh2AI => FIh2	3	0	3	236	236	4	0	4
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	9	71	79	30	30	0	77	77
FIh2N => FIh2	1212	1106	2318	1092	1092	1244	1094	2338
FIh2N => SEh2	53	785	839	193	193	40	825	865
FIh2S => EEh2	128	2539	2667	2435	2435	86	2402	2488
FIh2S => FIh2	545	5204	5748	3295	3295	583	5352	5935
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0
FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0

FR	4847	7913	12760	8542	8542	4854	8103	12956
FRh2 => BEh2	0	189	189	323	323	0	236	236
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	1885	2467	4352	2537	2537	1928	2583	4511
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	133	16	149	230	230	116	17	133
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	31	0	31	0	0	20	0	20
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	884	884	612	612	0	861	861
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	122	16	138	222	222	102	14	116
FRh2S => FRh2	2608	4181	6789	4374	4374	2630	4229	6859
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	59	119	178	175	175	49	120	169
FRh2Va => FRh2	9	42	50	69	69	9	42	51
GR	0	132	132	133	133	0	138	138
GRh2 => BGh2	0	132	132	133	133	0	138	138
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	304	459	763	735	735	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	5	5	0	0	0	0	0
HUh2 => ROh2	304	454	759	735	735	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	4409	12403	16812	11414	11414	617	12730	13347
IB-ITh2 => ATh2	3342	3800	7143	3585	3585	617	3836	4452
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	0	0	0	3	3	0	2	2
IB-SKh2C => HUh2	410	1695	2105	2063	2063	0	0	0
IB-SKh2C => SKh2E	49	28	77	26	26	0	35	35

IB-SKh2C => SKh2W	0	1633	1633	1102	1102	0	2871	2871
IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	3153	3153	2816	2816	0	3031	3031
IB-SKh2W => ATh2	0	424	424	181	181	0	493	493
IB-SKh2W => CZh2	51	1231	1281	955	955	0	2360	2360
IB-SKh2W => SKh2W	557	439	996	684	684	0	104	104
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	3342	3800	7143	3585	3585	617	3836	4452
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	3342	3800	7143	3585	3585	617	3836	4452
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	64	1996	2060	2089	2089	34	1913	1947
LTh2 => LVh2	64	3	66	5	5	34	3	37
LTh2 => PLh2nbc	0	1994	1994	2085	2085	1	1910	1911
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	110	2146	2257	2078	2078	58	2019	2077
LVh2 => EEh2	59	0	59	0	0	30	0	30
LVh2 => LTh2	51	2146	2197	2078	2078	28	2019	2047
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	1375	2307	3681	2634	2634	1515	1791	3305
NLh2 => BEh2	120	631	750	1310	1310	88	716	804
NLh2 => DEh2	1255	1676	2931	1325	1325	1427	1075	2501
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	377	2672	3049	3106	3106	520	2427	2948
PLh2N => DEh2	0	28	28	15	15	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2AI	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	84	84	172	172	0	0	0
PLh2nbc => DEh2	0	374	374	274	274	0	789	789
PLh2nbc => LTh2	77	0	77	0	0	43	0	43
PLh2nbc => PLh2N	300	2185	2484	2645	2645	478	1638	2116
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0
PLh2S => PLh2N	0	0	0	0	0	0	0	0

PLh2S => PLh2nbc	0	1	1	0	0	0	1	1
PT	166	0	166	0	0	157	0	157
PTh2 => ESh2	166	0	166	0	0	157	0	157
RO	0	0	0	0	0	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	0	0	0	0	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	426	332	758	1245	1245	451	320	772
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	425	332	757	1199	1199	450	320	770
SEh2 => FIh2N	1	0	1	45	45	1	0	1
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	459	4648	5107	3996	3996	0	5466	5466
SKh2E => IB-SKh2C	0	2974	2974	2631	2631	0	2871	2871
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	459	377	836	560	560	0	35	35
SKh2W => IB-SKh2W	0	1296	1296	805	805	0	2561	2561
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

DECEMBER

	INFRASTRUCTURE LEVEL							
	ADVANCED				PCI/PMI			
	CLIMATE YEAR							
	Reference weather year		Stressful weather year		Reference weather year		Stressful weather year	
	SIMULATION YEAR							
COUNTRY	2030	2040	2030	2040	2030	2040	2030	2040
	Unit: GWh/y							
AT	3015	1207	4223	1358	1358	334	1621	1955
ATh2 => CZh2	0	0	0	0	0	0	0	0
ATh2 => DEh2	2555	995	3550	952	952	334	1531	1864
ATh2 => HUh2	0	0	0	0	0	0	0	0
ATh2 => IB-ITh2	0	0	0	0	0	0	0	0
ATh2 => IB-SKh2W	460	213	672	407	407	0	90	90
ATh2 => SIh2	0	0	0	0	0	0	0	0
BA	0	0	0	0	0	0	0	0
BAh2 => HRh2	0	0	0	0	0	0	0	0
BE	29	2270	2299	1722	1722	684	2426	3110
BEh2 => BEH2Mo	0	0	0	0	0	0	0	0
BEh2 => DEh2	29	961	990	1289	1289	684	956	1640
BEh2 => FRh2	0	141	141	150	150	0	153	153
BEh2 => FRh2N	0	0	0	0	0	0	0	0
BEh2 => LUh2	0	0	0	0	0	0	0	0
BEh2 => NLh2	0	1168	1168	284	284	0	1318	1318
BEh2 => UKh2/INT	0	0	0	0	0	0	0	0
BEH2Mo => BEh2	0	0	0	0	0	0	0	0
BEH2Mo => FRh2Va	0	0	0	0	0	0	0	0
BG	85	0	85	0	0	85	0	85
BGh2 => GRh2	85	0	85	0	0	85	0	85
BGh2 => MKh2	0	0	0	0	0	0	0	0
BGh2 => ROh2	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0
CHh2 => DEh2	0	0	0	0	0	0	0	0
CHh2 => FRh2	0	0	0	0	0	0	0	0
CHh2 => IB-ITh2	0	0	0	0	0	0	0	0
CY	0	0	0	0	0	0	0	0
CYh2 => GRh2	0	0	0	0	0	0	0	0
CZ	0	636	636	126	126	0	685	685
CZh2 => ATh2	0	0	0	0	0	0	0	0
CZh2 => DEh2	0	636	636	126	126	0	685	685
CZh2 => IB-SKh2W	0	0	0	0	0	0	0	0

CZh2 => PLh2S	0	0	0	0	0	0	0	0
DE	1301	1262	2563	1564	1564	562	1218	1780
DEh2 => ATh2	1	8	9	32	32	25	16	41
DEh2 => BEh2	17	28	45	20	20	17	46	63
DEh2 => CHh2	0	0	0	0	0	0	0	0
DEh2 => CZh2	100	173	272	335	335	83	6	89
DEh2 => DKh2	420	57	477	126	126	159	92	251
DEh2 => FRh2	7	24	31	0	0	0	33	33
DEh2 => LUh2	0	0	0	0	0	0	0	0
DEh2 => NLh2	2	441	443	69	69	2	864	865
DEh2 => PLh2N	244	91	335	210	210	0	0	0
DEh2 => PLh2nbc	215	116	330	447	447	244	162	406
DEh2 => Y-NOh2	0	0	0	0	0	0	0	0
DEh2ba => DEh2	0	0	0	0	0	0	0	0
DEh2bp => DEh2	284	325	610	324	324	0	0	0
DEh2bp => DEh2ba	0	0	0	0	0	0	0	0
DEZ1a => DEZ1b	11		11			31		31
DK	33	507	540	666	666	49	527	575
DKh2 => DEh2	33	507	540	666	666	49	527	575
DKh2 => PLh2N	0	0	0	0	0	0	0	0
DKh2 => SEh2	0	0	0	0	0	0	0	0
EE	120	1533	1653	1936	1936	57	2107	2165
EEh2 => FIh2S	62	0	62	0	0	38	0	38
EEh2 => LVh2	58	1533	1591	1936	1936	20	2107	2127
ES	3507	4599	8106	4870	4870	3422	4693	8116
ESh2 => FRh2S	3481	4448	7930	4690	4690	3397	4543	7939
ESh2 => FRh2SW	0	0	0	0	0	0	0	0
ESh2 => ITh2	0	0	0	0	0	0	0	0
ESh2 => PTh2	26	151	176	180	180	26	150	176
FI	4001	17651	21652	17010	17010	4159	17889	22048
FIh2 => FIh2AI	1094	4597	5691	4187	4187	1167	4537	5704
FIh2 => FIh2N	1	1	2	22	22	0	4	4
FIh2 => FIh2S	3	5	9	0	0	3	2	5
FIh2AI => DEh2	1403	5040	6443	4673	4673	1481	5062	6543
FIh2AI => FIh2	19	15	34	5	5	18	7	25
FIh2AI => PLh2N	0	0	0	0	0	0	0	0
FIh2AI => SEh2	7	6	13	39	39	0	9	9
FIh2N => FIh2	885	1105	1991	1037	1037	912	1163	2075
FIh2N => SEh2	20	607	627	684	684	11	514	525
FIh2S => EEh2	81	1673	1754	2086	2086	41	2227	2269
FIh2S => FIh2	487	4602	5089	4276	4276	526	4363	4890
FIh2S => FIh2SZ1	0	0	0	0	0	0	0	0

FIh2SZ1 => FIh2S	0	0	0	0	0	0	0	0
FR	5833	8689	14523	8461	8461	5708	8963	14671
FRh2 => BEh2	0	196	196	82	82	0	226	226
FRh2 => CHh2	0	0	0	0	0	0	0	0
FRh2 => DEh2	2289	2970	5259	2608	2608	2293	3099	5392
FRh2 => FRh2N	0	0	0	0	0	0	0	0
FRh2 => FRh2S	0	0	0	0	0	0	0	0
FRh2 => FRh2SW	0	0	0	0	0	0	0	0
FRh2 => FRh2Va	41	0	41	0	0	14	0	14
FRh2 => LUh2	0	0	0	0	0	0	0	0
FRh2N => BEh2	0	1186	1186	1146	1146	0	1182	1182
FRh2N => FRh2	0	0	0	0	0	0	0	0
FRh2S => ESh2	0	0	0	0	0	0	0	0
FRh2S => FRh2	3446	4233	7679	4449	4449	3371	4354	7724
FRh2S => FRh2SW	0	0	0	0	0	0	0	0
FRh2SW => ESh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2	0	0	0	0	0	0	0	0
FRh2SW => FRh2S	0	0	0	0	0	0	0	0
FRh2Va => BEH2Mo	54	82	136	133	133	27	80	107
FRh2Va => FRh2	4	23	26	43	43	4	22	26
GR	0	100	100	117	117	0	100	100
GRh2 => BGh2	0	100	100	117	117	0	100	100
GRh2 => CYh2	0	0	0	0	0	0	0	0
GRh2 => ITh2	0	0	0	0	0	0	0	0
HR	0	0	0	0	0	0	0	0
HRh2 => ALh2	0	0	0	0	0	0	0	0
HRh2 => BAh2	0	0	0	0	0	0	0	0
HRh2 => HUh2	0	0	0	0	0	0	0	0
HRh2 => RSh2	0	0	0	0	0	0	0	0
HRh2 => SIh2	0	0	0	0	0	0	0	0
HU	156	199	355	409	409	0	0	0
HUh2 => ATh2	0	0	0	0	0	0	0	0
HUh2 => HRh2	0	0	0	0	0	0	0	0
HUh2 => IB-SKh2C	0	38	38	18	18	0	0	0
HUh2 => ROh2	156	161	317	391	391	0	0	0
HUh2 => RSh2	0	0	0	0	0	0	0	0
HUh2 => SIh2	0	0	0	0	0	0	0	0
IB	4159	12908	17066	12333	12333	572	13988	14560
IB-ITh2 => ATh2	3438	3279	6717	3225	3225	572	3516	4088
IB-ITh2 => CHh2	0	0	0	0	0	0	0	0
IB-ITh2 => ITh2	0	0	0	0	0	0	0	0
IB-SKh2C => HUh2	217	1142	1359	1609	1609	0	0	0

IB-SKh2C => SKh2E	44	5	48	6	6	0	7	7
IB-SKh2C => SKh2W	0	2453	2453	1928	1928	0	3498	3498
IB-SKh2E => PLh2S	0	0	0	0	0	0	0	0
IB-SKh2E => SKh2E	0	3676	3676	3636	3636	0	3660	3660
IB-SKh2W => ATh2	0	819	819	524	524	0	1058	1058
IB-SKh2W => CZh2	111	1443	1554	1280	1280	0	2226	2226
IB-SKh2W => SKh2W	349	91	440	124	124	0	22	22
IE	0	0	0	0	0	0	0	0
IEh2 => UKh2	0	0	0	0	0	0	0	0
IT	3438	3279	6717	3225	3225	572	3516	4088
ITh2 => ESh2	0	0	0	0	0	0	0	0
ITh2 => GRh2	0	0	0	0	0	0	0	0
ITh2 => IB-ITh2	3438	3279	6717	3225	3225	572	3516	4088
ITh2 => MTh2	0	0	0	0	0	0	0	0
ITh2 => SIh2	0	0	0	0	0	0	0	0
LT	68	1419	1487	1720	1720	42	2120	2162
LTh2 => LVh2	68	4	73	1	1	42	4	46
LTh2 => PLh2nbc	0	1414	1414	1718	1718	0	2116	2116
LU	0	0	0	0	0	0	0	0
LUh2 => BEh2	0	0	0	0	0	0	0	0
LUh2 => DEh2	0	0	0	0	0	0	0	0
LUh2 => FRh2	0	0	0	0	0	0	0	0
LV	90	1406	1497	1766	1766	45	1996	2042
LVh2 => EEh2	64	0	64	0	0	39	0	39
LVh2 => LTh2	26	1406	1433	1766	1766	6	1996	2002
MT	0	0	0	0	0	0	0	0
MTh2 => ITh2	0	0	0	0	0	0	0	0
NL	1587	1667	3254	2208	2208	1672	1279	2951
NLh2 => BEh2	25	251	276	284	284	17	297	314
NLh2 => DEh2	1563	1416	2978	1923	1923	1656	982	2638
NLh2 => UKh2	0	0	0	0	0	0	0	0
PL	215	1746	1960	2234	2234	244	2404	2649
PLh2N => DEh2	0	97	97	15	15	0	0	0
PLh2N => DKh2	0	0	0	0	0	0	0	0
PLh2N => FIh2AI	0	0	0	0	0	0	0	0
PLh2N => PLh2S	0	15	15	53	53	0	0	0
PLh2nbc => DEh2	0	794	794	279	279	0	1574	1574
PLh2nbc => LTh2	78	0	78	0	0	48	0	48
PLh2nbc => PLh2N	136	788	924	1887	1887	196	767	964
PLh2nbc => PLh2S	0	0	0	0	0	0	0	0
PLh2S => CZh2	0	0	0	0	0	0	0	0
PLh2S => IB-SKh2E	0	0	0	0	0	0	0	0

PLh2S => PLh2N	0	0	0	0	0	0	0	0
PLh2S => PLh2nbc	0	52	52	0	0	0	63	63
PT	316	0	316	0	0	310	0	310
PTh2 => ESh2	316	0	316	0	0	310	0	310
RO	0	1	1	5	5	0	0	0
ROh2 => BGh2	0	0	0	0	0	0	0	0
ROh2 => HUh2	0	1	1	5	5	0	0	0
ROh2 => MDh2	0	0	0	0	0	0	0	0
ROh2 => RSh2	0	0	0	0	0	0	0	0
SE	338	470	809	533	533	337	547	884
SEh2 => DKh2	0	0	0	0	0	0	0	0
SEh2 => FIh2AI	335	463	798	530	530	333	541	874
SEh2 => FIh2N	4	7	11	2	2	4	7	10
SI	0	0	0	0	0	0	0	0
SIh2 => ATh2	0	0	0	0	0	0	0	0
SIh2 => HRh2	0	0	0	0	0	0	0	0
SIh2 => HUh2	0	0	0	0	0	0	0	0
SIh2 => ITh2	0	0	0	0	0	0	0	0
SK	261	5702	5963	5047	5047	0	6721	6721
SKh2E => IB-SKh2C	0	3485	3485	3420	3420	0	3498	3498
SKh2E => IB-SKh2E	0	0	0	0	0	0	0	0
SKh2W => IB-SKh2C	261	77	338	105	105	0	7	7
SKh2W => IB-SKh2W	0	2140	2140	1522	1522	0	3216	3216
UK	0	0	0	0	0	0	0	0
UKh2 => BEh2	0	0	0	0	0	0	0	0
UKh2 => IEh2	0	0	0	0	0	0	0	0
UKh2 => NLh2	0	0	0	0	0	0	0	0
UKh2 => UKh2/INT	0	0	0	0	0	0	0	0
UKh2/INT => BEh2	0	0	0	0	0	0	0	0
UKh2/INT => UKh2	0	0	0	0	0	0	0	0

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