HI WEST 17 (Less-Advanced)

Zeebrugge New Molecules development

fluxys

Reasons for grouping [ENTSOG]

The project group is an ammonia terminal including a cracker in Zeebrugge (HYD-N-1325) and a connection pipe (part of HYD-N-1311).

This project will enable hydrogen imports to Belgium.

Objective of the group [Promoter]

Fluxys Belgium has a large-scale LNG terminal in Zeebrugge. This terminal has today a crucial role in the energy supply of Europe. In order to make the switch to a decarbonised industry, import of green molecules will be needed, and the terminal in Zeebrugge wants to leverage its knowledge and expertise to support these developments. Zeebrugge is a key position for Belgium with ideal sea access on a strategic location.

Fluxys has the ambition to accommodate reliable flows of hydrogen (H2) and hydrogen derivatives such as ammonia (NH3) at scale from ports to industrial hubs across Europe. Imported hydrogen (via NH3) via the terminal in Zeebrugge will enter the European market, leveraged by the future hydrogen network of Fluxys. Through this network, imported hydrogen can be used in local Belgian demand clusters and be exported towards neighboring countries such as Germany, The Netherlands and France.

HYD-N-1325 **Zeebrugge New Molecules development**

Comm. Year **2029**

fluxys

HYD-N-1311 **Belgian Hydrogen Backbone (Part)**

Comm. Year **2029**

fluxys

A. Project group technical information [Promoter/ ENTSOG]

Project technical information [Promoter]

Hydrogen Transmission

TYNDP Project code	Section name	New / Repurposing	Nominal Diameter [mm]	Section Length [km]	Compressor power [MW]
HYD-N-1311 (part)	ZBG Terminal to Maldegem	new/repurposing	tbd	24	n/a

Liquified Hydrogen Terminal

TYNDP Project code	Hydrogen carrier	H_2 Import capacity [GWh/d]	Injection capacity [GWh/d]	Storage capacity [m^3]
HYD-N-1325	Ammonia	3 mtpa of NH3 / year	48	300000

Capacity increment [ENTSOG]

TYNDP Project code	Point name	Operator	From system	To system	Capacity increment [GWh/d]	Comm. year
HYD-N-1325	LH2_Tk_BE	Fluxys Belgium	Terminal Belgium (LH2_Tk_BE)	Transmission Belgium (BE Hydrogen)	48	2029
HYD-N-1311 (part)	LH2_Tk_BE	Fluxys Belgium	Terminal Belgium (LH2_Tk_BE)	Transmission Belgium (BE Hydrogen)	48	2029

B. Project Cost Information

During the TYNDP 2022 Project Data Collection, promoters were asked to indicate whether their costs were confidential or not. The following tables display the non-confidential costs provided by the promoters (as of December 2022, end of PCI project collection). The amounts provided can differ from the figures used by the project promoters in other contexts, where costs can be updated and/or evaluated using different methodologies or assumptions.

[ENTSOG]

TYNDP Project code	CAPEX [M€]	CAPEX range [%]	OPEX [M€]	OPEX range [%]
HYD-N-1311 (part)	50	40%	1.8	40%
HYD-N-1325	500	50%	40	50%

Description of the cost and range [Promoter]

The financial assumptions and business plan build-up is driven by standard ammonia terminal and pipeline projects and specific in-house knowledge. The financial numbers are subject to market conditions and commercial commitments.

C. Project Benefits [ENTSOG]

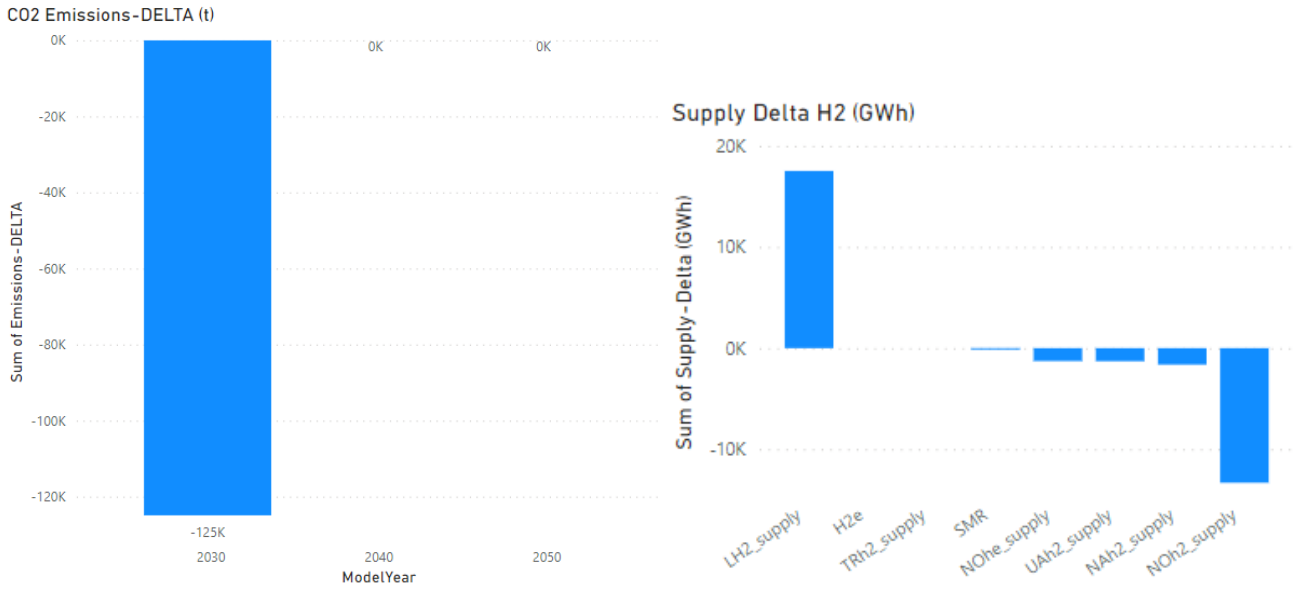
C.1 Summary of benefits

This section provides a summarised analysis by ENTSOG of the main benefits stemming from the realisation of the overall group. More details on the indicators are available in Annex D of TYNDP 2022[1].

Distributed Energy

Sustainability benefits

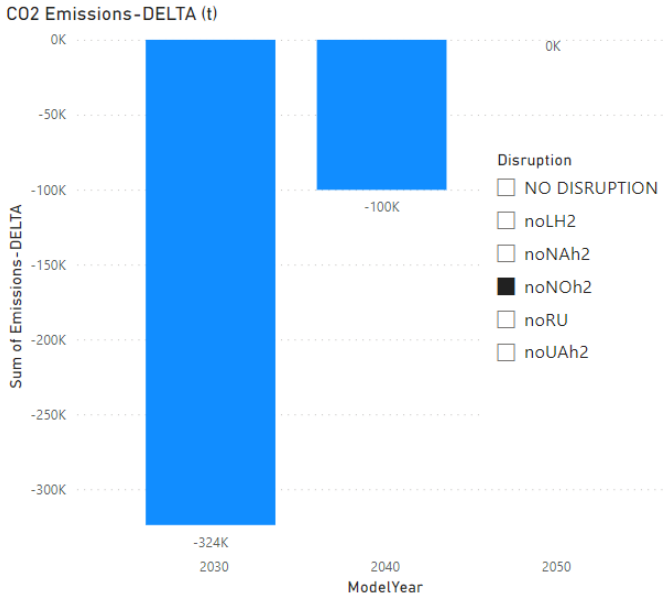
Thanks to the projects group, from 2029, the newly built terminal improves and diversifies hydrogen supply in Belgium. In the reference case, which analyses yearly demand in two periods (average winter and average summer), the project group will contribute to sustainability by reducing overall CO2 emissions by 125 kt in 2030. This can be explained as in 2030 the project group enables mainly the replacement of blue hydrogen imports from Norway with green hydrogen liquid imports.

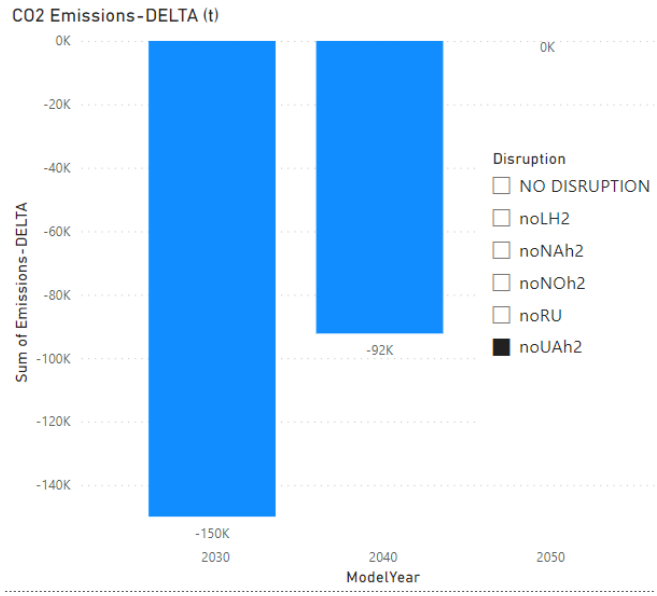


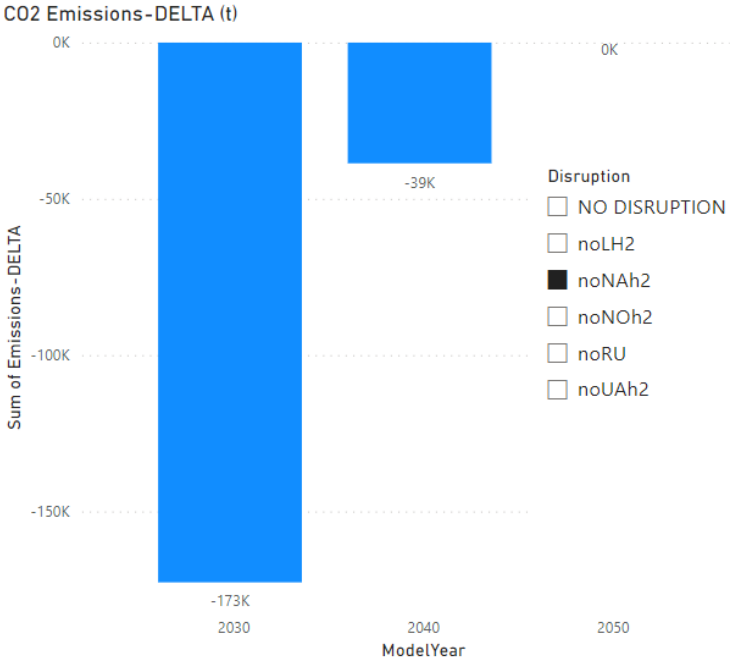
Sustainability benefits are increased under supply disruption cases, such as Norway, Ukraine, or North Africa Disruption for 2030 and 2040. For example, in case of Norway disruption the project group will reduce CO2 emissions by 324 kt in 2030 and by 100 kt in 2040.

1 noNOh2 : Norway disruption / 2 noUAh2 : Ukraine disruption/ 3 noNAh2 : North Africa disruption

[1] https://www.entsog.eu/sites/default/files/2023-04/ENTSOG_TYNDP_2022_Annex_D_Methodology_230411.pdf





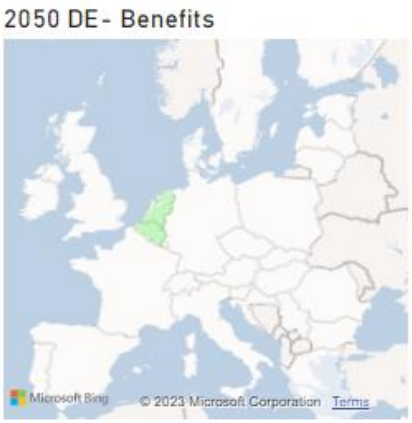


Security of Supply:[2]

> Reference case:

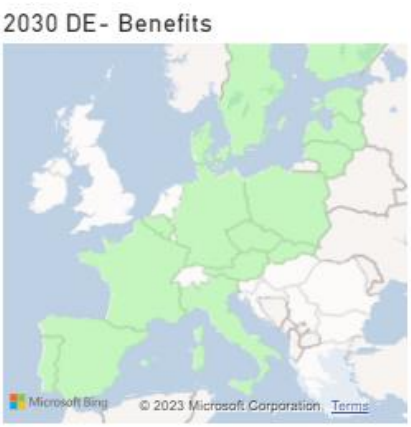
[2] *As for the hydrogen system there is no existing infrastructure level available yet, ENTSOG has identified a possible hydrogen network according to the information provided by promoters in their project submission for the TYNDP/PCI process (i.e., H2 Infrastructure level). Therefore, the System Assessment shows the results that could be reached (for different timestamps) under the hypothesis of a full commissioning of the H2 infrastructure projects that were submitted by project promoters but that are not yet in place. Therefore, even in configurations where no demand curtailment is identified (e.g., average winter in 2030) these results should not be read as an absence of H2 infrastructure needs for the given scenario. On the contrary, the full availability of the planned infrastructures composing the H2 infrastructure level is assumed to avoid the potential demand curtailment.*

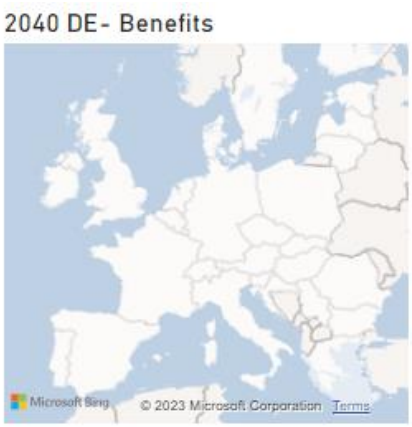
In the reference case, the project is mitigating hydrogen demand curtailment risk in average summer and average winter for Belgium and Netherlands by 1% in 2050. However, it is important to mention that the SoS benefits of this project group could be limited due to a competing(s) project group(s) (such as WEST 15, WEST 16 A, WEST 16 B) located in the same geographical area enabling, as well, liquid import supplies to flow to Belgium.



> Climatic stress cases:

Under 2 -week and 2-week dunkelflaute climatic stress case, as well as under peak day climatic case the project group mitigates the risk of demand curtailment by 2% for many European countries in 2030.

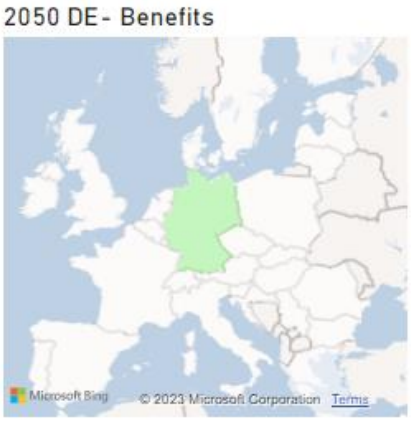




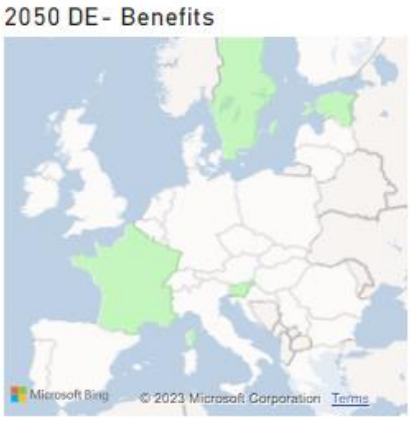
> Disruption cases (S-1):

In case of Norway and North Africa Disruption the project group shows positive Security of supply benefits for 2050. In case of Norway disruption, the project group mitigates the risk of demand curtailment by 1% in Germany for 2050. Under North Africa Supply disruption France, Austria, Sweden, and Lithuania can mitigate the risk by 1% in 2050.

1 noNOh2: Norway disruption

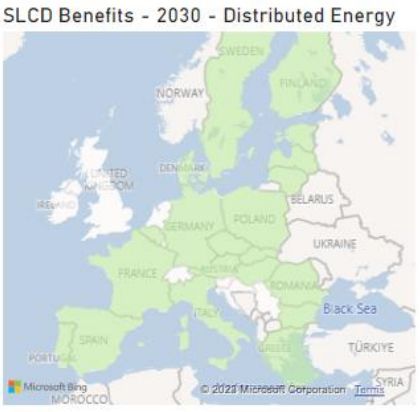


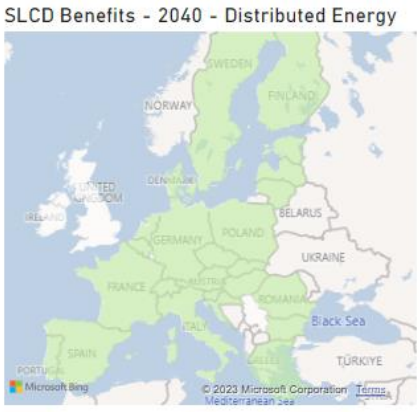
2 noNAh2: North Africa disruption

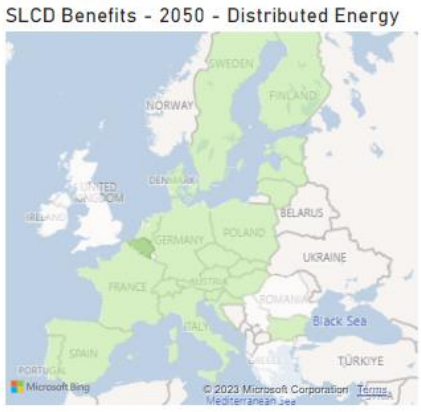


> Single largest capacity disruption (SLCD):

In case of SLCD many European countries benefitting on small scale from this project group by mitigating the risk of demand curtailment from 2030 onward. Thanks to the project group respective countries mitigate the risk of demand curtailment by 1-3%. In 2050 Belgium can mitigate the risk by 9%.



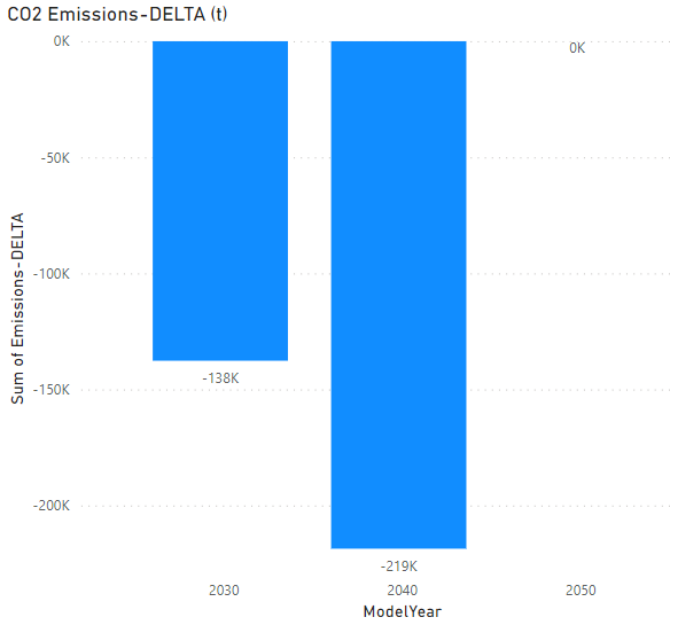


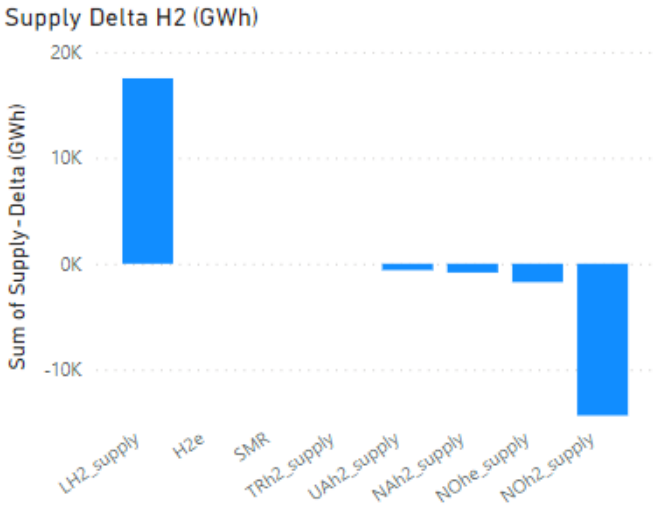


Global Ambition

Sustainability benefits

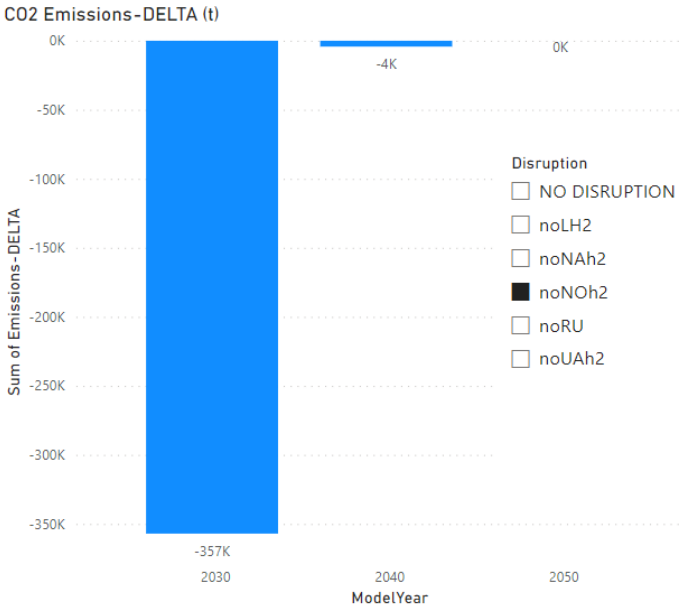
In the reference case, which analyses yearly demand in two periods (average winter and average summer), the project group will contribute to sustainability by reducing overall CO2 emissions by 138 kt in 2030 and by 219 kt in 2040. This can be explained as in 2030 the project group enables mainly the replacement of imports from Norway and in 2040 the project replaces blue hydrogen (I.e SMR).

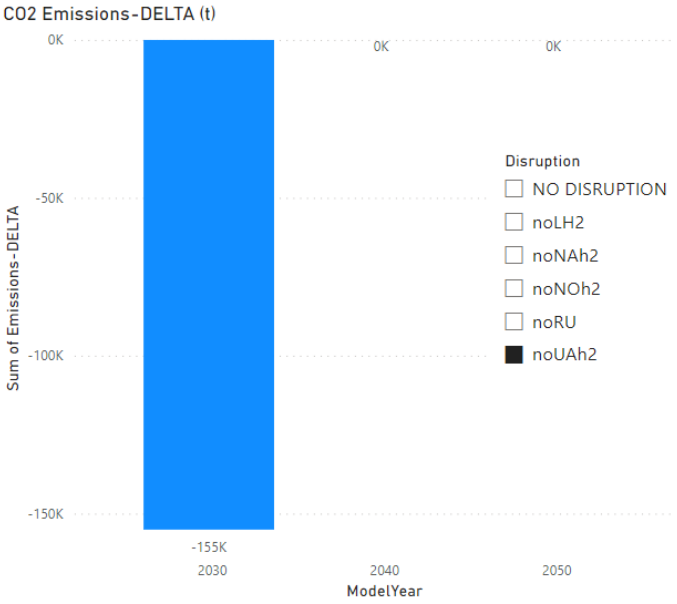


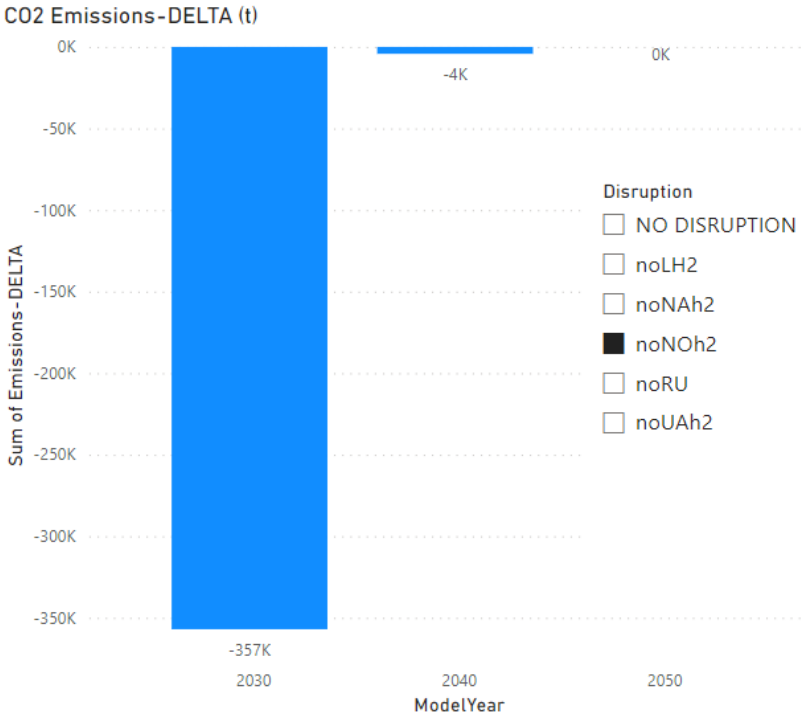


Sustainability benefits are increased under supply disruption cases, such as Norway, Ukraine, or North Africa Disruption for 2030. For example, in case of North Africa disruption the project group will reduce CO2 emissions by 357 kt in 2030.

1 noNOh2 : Norway disruption / 2 noUAh2 : Ukraine disruption/ 3 noNAh2 : North Africa disruption



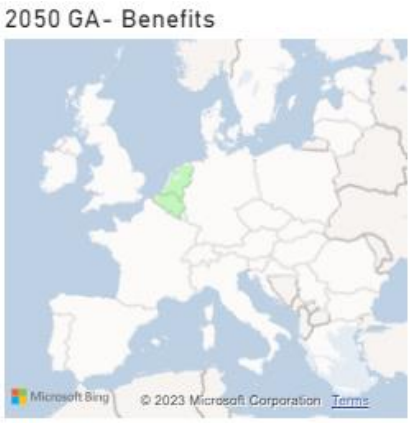




Security of supply benefits

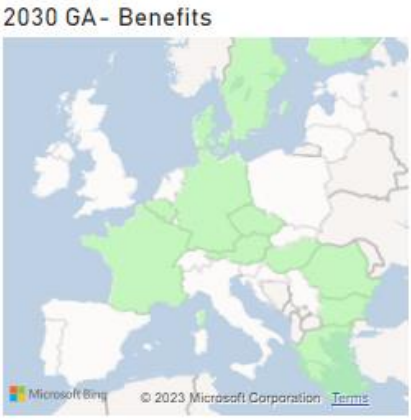
> Reference case

In the reference case, the project group is mitigating hydrogen demand curtailment risk in 2040 for Belgium by 2% and in 2050 for Belgium and Netherlands by 1%.



> Climatic stress cases

Under 2 -week and 2-week dunkelflaute climatic stress case, as well as under peak day climatic case the project group mitigates the risk of demand curtailment by 1-2% for several European countries in 2030.

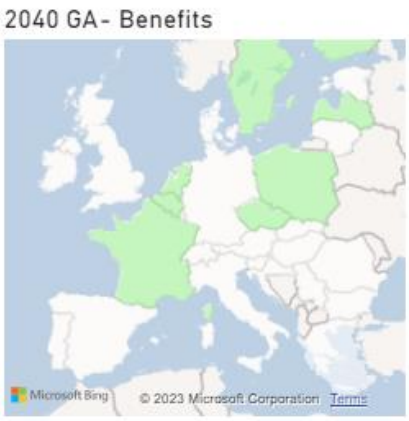


> Disruption cases (S-1)

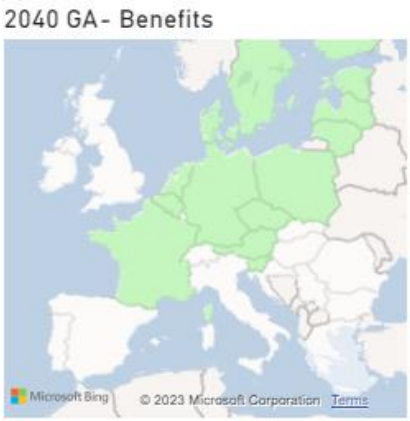
Under hydrogen supply disruption cases and refence yearly demand, such as Norway, Ukraine and North Africa supply disruption, the project group mitigates the risk of demand curtailment many for 2040 in several European countries by 1%

1 noNOh2: Norway disruption

2 noUAh2: Ukraine disruption



3 noNAh2: North Africa disruption



> Single largest capacity disruption (SLCD):

In case of SLCD many European countries benefitting on small scale from this project group by mitigating the risk of demand curtailment from 2030 onwards. Thanks to the project group respective countries mitigate the risk of demand curtailment by 1-2%. In 2030 Belgium can mitigate the risk by 9%.

SLCD Benefits - 2030 - Global Ambition

SLCD Benefits - 2040 - Global Ambition

SLCD Benefits - 2050 - Global Ambition

C.2 Quantitative benefits [ENTSOG]

The following tables display all the benefits quantified by ENTSOG through specific indicators and stemming from the realisation of the considered project group.

CO2 Emissions:

ModelYear	Disruption	Scenario	Unit	Emissions-DELTA	Emissions-PLUS	Emissions-MINUS
2030	NO DISRUPTION	DE	tonne	-124903,80	538677299	538802202,8
2030	noLH2	DE	tonne	0,00	540175890,2	540175890,2
2030	noNAh2	DE	tonne	-172688,86	539785356,1	539958045
2030	noNOh2	DE	tonne	-323975,85	538877197,8	539201173,7
2030	noUAh2	DE	tonne	-149959,32	539378771,9	539528731,3
2030	NO DISRUPTION	GA	tonne	-137634,78	592910448,4	593048083,2
2030	noLH2	GA	tonne	-161,21	594817481,2	594817642,4
2030	noNAh2	GA	tonne	-244330,96	594141433,2	594385764,1
2030	noNOh2	GA	tonne	-357030,51	593310994,3	593668024,8
2030	noUAh2	GA	tonne	-155081,12	593627617,9	593782699
2040	NO DISRUPTION	DE	tonne	0,00	392077044	392077044
2040	noLH2	DE	tonne	-1564,91	392213883,4	392215448,3
2040	noNAh2	DE	tonne	-38621,53	392188097,7	392226719,2
2040	noNOh2	DE	tonne	-100204,35	392144022,6	392244227
2040	noUAh2	DE	tonne	-92232,53	392399182,9	392491415,4
2040	NO DISRUPTION	GA	tonne	-218603,85	396523251,6	396741855,5
2040	noLH2	GA	tonne	0,00	397455196,7	397455196,7
2040	noNAh2	GA	tonne	-99119,02	397301976,6	397401095,7
2040	noNOh2	GA	tonne	-4219,61	397450977,1	397455196,7
2040	noUAh2	GA	tonne	0,00	397478498,3	397478498,3
2050	NO DISRUPTION	DE	tonne	0,00	232557734,8	232557734,8
2050	noLH2	DE	tonne	0,00	232557734,8	232557734,8
2050	noNAh2	DE	tonne	0,00	232557734,8	232557734,8
2050	noNOh2	DE	tonne	0,00	232557734,8	232557734,8
2050	noRU	DE	tonne	0,00	232557734,8	232557734,8
2050	noUAh2	DE	tonne	0,00	232557734,8	232557734,8
2050	NO DISRUPTION	GA	tonne	0,00	228306706,5	228306706,5
2050	noLH2	GA	tonne	0,00	228306706,5	228306706,5
2050	noNAh2	GA	tonne	0,00	228306706,5	228306706,5
2050	noNOh2	GA	tonne	0,00	228306706,5	228306706,5
2050	noRU	GA	tonne	0,00	228306706,5	228306706,5

2050	noUAh2	GA	tonne	0,00	228306706,5	228306706,5

Curtailment Rate (SLCD):

Country	2030-DE-DELTA	2030-GA-DELTA	2040-DE-DELTA	2040-GA-DELTA	2050-DE-DELTA	2050-GA-DELTA
Czechia	-2%	-2%	-3%	-2%	-3%	-1%
Estonia	-2%	-2%	-3%	-1%	-2%	-1%
Latvia	-2%	-2%	-3%	-1%	-2%	-1%
Lithuania	-2%	-2%	-3%	-1%	-2%	-1%
Poland	-2%	-2%	-3%	-1%	-2%	-1%
Portugal	-2%	-2%	-3%	-1%	-1%	-1%
Slovenia	0%	0%	-3%	-1%	-2%	-1%
France	-2%	-2%	-3%	-1%	-2%	-1%
Germany	-2%	-2%	-2%	-2%	-1%	-1%
Austria	-2%	-2%	-2%	-2%	-2%	-1%
Belgium	-3%	-9%	-2%	-2%	-9%	-4%
Denmark	-2%	-2%	-2%	-2%	-2%	-1%
Finland	-2%	-2%	-2%	-1%	-2%	-1%
Italy	-2%	-2%	-2%	-1%	-2%	-1%
Spain	-2%	-2%	-2%	-2%	-2%	-1%
Sweden	-2%	-2%	-2%	-1%	-2%	-1%
Switzerland	0%	0%	-2%	-1%	-1%	-1%
The Netherlands	0%	-4%	-2%	-2%	-2%	-1%
Bulgaria	-2%	-2%	-1%	-1%	-1%	-1%
Croatia	0%	0%	-1%	-1%	-1%	-1%
Greece	-2%	-1%	-1%	-1%	0%	-1%
Hungary	-2%	-2%	-1%	-1%	-1%	-1%
Romania	-1%	-2%	-1%	-1%	0%	-1%
Slovakia	-2%	-2%	-1%	-1%	-1%	-1%

Curtailment Rate (Climatic Stress):

Country	2030-DE-DELTA	2030-GA-DELTA	2040-DE-DELTA	2040-GA-DELTA	2050-DE-DELTA	2050-GA-DELTA
Austria	-2%	-1%	-1%	-1%	-1%	-1%
Belgium	-2%	-6%	-1%	-1%	-1%	0%
Bulgaria	0%	-2%	-1%	-1%	0%	0%
Croatia	0%	0%	-1%	-1%	0%	-1%
Cyprus	0%	0%	0%	0%	0%	0%
Czechia	-2%	-2%	-1%	-1%	-1%	-1%
Denmark	-1%	-2%	-1%	-1%	-1%	-1%
Estonia	-2%	-1%	0%	-1%	-1%	0%
Finland	-2%	-1%	-1%	-1%	-1%	-1%
France	-1%	-2%	-1%	-1%	-1%	-1%
Germany	-2%	-2%	0%	0%	0%	0%
Greece	0%	-2%	-1%	0%	0%	0%
Hungary	0%	-2%	-1%	-1%	0%	0%

Ireland	0%	0%	0%	0%	0%	0%
Italy	-2%	0%	-1%	-1%	0%	0%
Latvia	-2%	-1%	0%	-1%	-1%	-1%
Lithuania	-2%	-1%	0%	-1%	-1%	-1%
Luxembourg	0%	0%	0%	0%	0%	0%
Malta	0%	0%	0%	0%	0%	0%
Poland	-2%	-1%	-1%	-1%	-1%	-1%
Portugal	-2%	-1%	-1%	-1%	0%	-1%
Romania	0%	-1%	-1%	-1%	0%	-1%
Serbia	0%	0%	0%	0%	0%	0%
Slovakia	-2%	-1%	-1%	-1%	0%	0%
Slovenia	0%	0%	-1%	-1%	-1%	-1%
Spain	-2%	-1%	-1%	0%	-1%	0%
Sweden	-2%	-2%	-1%	0%	-1%	-1%
Switzerland	0%	0%	-1%	-1%	-1%	0%
The Netherlands	0%	0%	-1%	-1%	-1%	0%
United Kingdom	0%	0%	0%	0%	0%	0%
Austria	-2%	-1%	-1%	-1%	-1%	-1%
Belgium	-2%	-6%	-1%	-1%	-1%	-1%
Bulgaria	0%	-2%	-1%	-1%	0%	0%
Croatia	0%	0%	-1%	-1%	0%	-1%
Cyprus	0%	0%	0%	0%	0%	0%
Czechia	-2%	-2%	-1%	-1%	-1%	-1%
Denmark	-1%	-2%	-1%	-1%	-1%	-1%
Estonia	-2%	-1%	-1%	0%	-1%	-1%
Finland	-2%	-1%	-1%	-1%	-1%	0%
France	-2%	-2%	-1%	-1%	-1%	-1%
Germany	-2%	-2%	0%	-1%	0%	0%
Greece	0%	-2%	-1%	-1%	0%	0%
Hungary	0%	-2%	-1%	-1%	0%	-1%
Ireland	0%	0%	0%	0%	0%	0%
Italy	-2%	0%	-1%	0%	0%	0%
Latvia	-2%	-1%	-1%	0%	-1%	-1%
Lithuania	-2%	-1%	-1%	0%	-1%	-1%
Luxembourg	0%	0%	0%	0%	0%	0%
Malta	0%	0%	0%	0%	0%	0%
Poland	-2%	-1%	-1%	0%	-1%	-1%
Portugal	-2%	-1%	-1%	-1%	0%	0%
Romania	0%	-1%	-1%	-1%	0%	-1%
Serbia	0%	0%	0%	0%	0%	0%
Slovakia	-2%	-1%	-1%	-1%	0%	-1%
Slovenia	0%	0%	-1%	-1%	-1%	-1%
Spain	-2%	-1%	-1%	-1%	-1%	0%
Sweden	-2%	-2%	-1%	-1%	-1%	0%
Switzerland	0%	0%	-1%	0%	-1%	-1%
The Netherlands	0%	0%	-1%	-1%	-1%	0%
United Kingdom	0%	0%	0%	0%	0%	0%
Austria	-1%	-2%	0%	0%	-1%	-1%
Belgium	-2%	-2%	-1%	-1%	0%	-1%

Bulgaria	0%	-1%	-1%	0%	0%	0%
Croatia	0%	0%	-1%	0%	0%	-1%
Cyprus	0%	0%	0%	0%	0%	0%
Czechia	-1%	-1%	0%	0%	-1%	-1%
Denmark	-2%	-1%	0%	0%	0%	0%
Estonia	-1%	-2%	-1%	0%	-1%	-1%
Finland	-1%	-1%	0%	0%	-1%	0%
France	-1%	-1%	-1%	0%	-1%	0%
Germany	-2%	-1%	-1%	-1%	0%	0%
Greece	0%	-1%	-1%	0%	0%	0%
Hungary	0%	-1%	-1%	0%	0%	0%
Ireland	0%	0%	0%	0%	0%	0%
Italy	-1%	-1%	0%	0%	-1%	0%
Latvia	-1%	-2%	-1%	0%	0%	-1%
Lithuania	-1%	-2%	-1%	0%	0%	0%
Luxembourg	0%	0%	0%	0%	0%	0%
Malta	0%	0%	0%	0%	0%	0%
Poland	-1%	-2%	-1%	0%	0%	0%
Portugal	-1%	-1%	-1%	0%	0%	0%
Romania	0%	-2%	-1%	0%	0%	-1%
Serbia	0%	0%	0%	0%	0%	0%
Slovakia	-1%	-2%	-1%	0%	0%	0%
Slovenia	0%	0%	-1%	0%	0%	-1%
Spain	-1%	-2%	0%	-1%	-1%	-1%
Sweden	-1%	-1%	0%	0%	-1%	0%
Switzerland	0%	0%	0%	0%	-1%	0%
The Netherlands	0%	0%	0%	-1%	-1%	0%
United Kingdom	0%	0%	0%	0%	0%	0%

D. Environmental Impact [Promoter]

Any gas infrastructure has an impact on its surroundings. This impact is of particular relevance when crossing some environmentally sensitive areas. Mitigation measures are taken by the promoters to reduce this impact and comply with the EU and National regulations.

TYNDP Code	Type of infrastructure	Surface of impact	Environmentally sensitive area
HYD-N-1325	n.a	n.a	n.a
HYD-N-1311	n.a	n.a	n.a

Potential impact	Mitigation measures	Related costs included in project CAPEX and OPEX	Additional expected costs
HYD-N-1325	n.a	n.a	n.a
HYD-N-1311	n.a	n.a	n.a

Environmental Impact explained [Promoter]

The infrastructure project is not expected to lead to a significant increase in the emissions of pollutants into air, water or land. The NOx concerns about cracking will be kept at minimum level imposed by the Flanders region and the European Commission.
For pipeline infrastructures: during transport of hydrogen, any leakage from the infrastructure will be prevented. In case of interventions, maintenance... best available techniques will be selected to prevent/reduce losses. Transport by (underground) pipeline is the most sustainable way of transporting molecules and will not have a detrimental impact on biodiversity and ecosystems. Fluxys has also a long outstanding experience with the construction and exploitation of pipelines in good relationship with concerned neighbours/farmers/….
For the terminal and for the pipeline will in line with the EIA Directive an environmental impact assessment or environmental screening be executed and mitigating measures will be foreseen when needed.

E. Other benefits [Promoter]

Missing benefits are all benefits of a project which may be not captured by ENTSOG analysis.

As a necessary condition a missing benefit cannot have discrepancies with the benefits already covered by the assessment run by ENTSOG and this condition needs to be proved and justified.

Description of Other benefits [Promoter]

F. Useful links [Promoter]

Useful links: