HI WEST 15 A (Less-Advanced)

Dunkerque Terminal

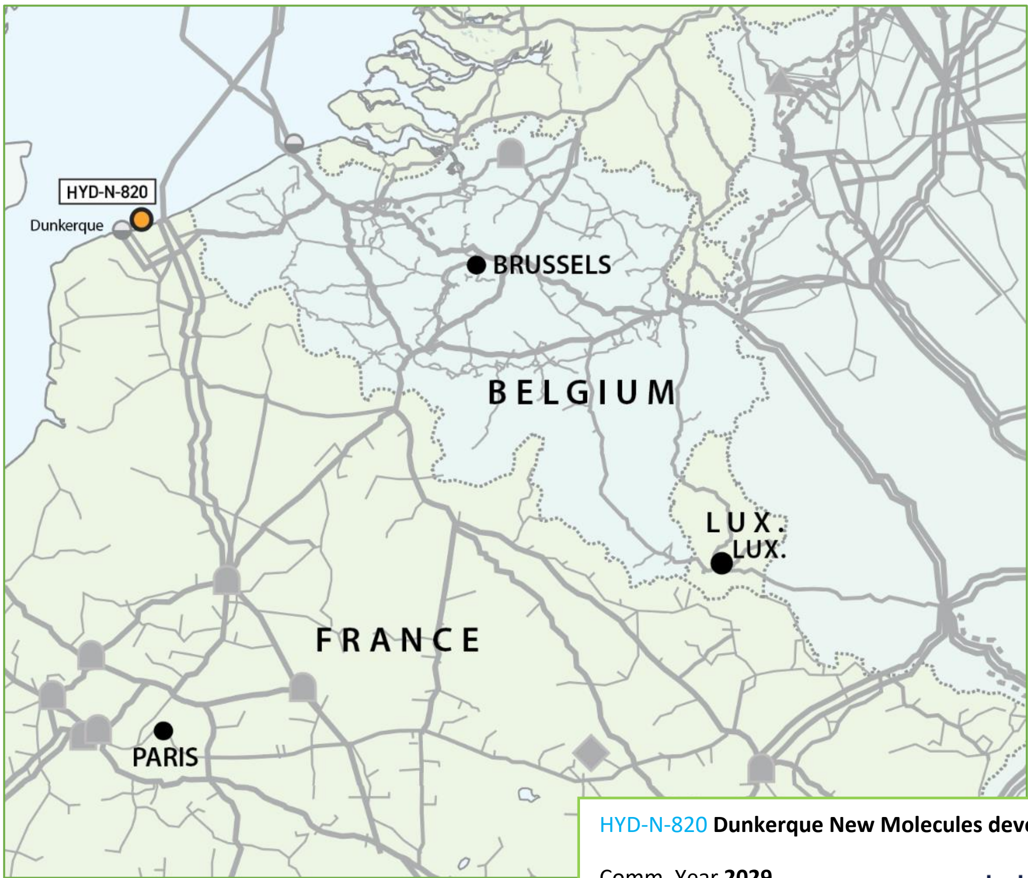
Reasons for grouping [ENTSOG]

The project group is a stand-alone terminal in France. This project will enable imports of hydrogen to Belgium via France from 2029 (HYD-N-820).

Objective of the group [Promoter]

Fluxys has a large-scale LNG terminal in Dunkerque. 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 Dunkerque wants to leverage its knowledge and expertise to support these developments. Dunkerque is a key position for France 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 Dunkerque will enter the European market, leveraged by the future hydrogen networks of Fluxys and GRTgaz. Through this network, imported hydrogen can be used in local French & Belgian demand clusters and be exported towards neighboring countries such as Belgium, Germany and The Netherlands.



HYD-N-820 **Dunkerque New Molecules development**

Comm. Year **2029**

A. Project group technical information [Promoter/ ENTSOG]

Project technical information [Promoter]

Liquified Hydrogen Terminal

TYNDP Project code	Hydrogen carrier	H_2 Import capacity [GWh/d]	Injection capacity [GWh/d]	Storage capacity [m³]
HYD-N-820	Dunkerque LNG	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-820	LH2_Tk_FR	Dunkerque LNG	Terminal France (LH2_Tk_FR)	Transmission France (FR 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-820	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

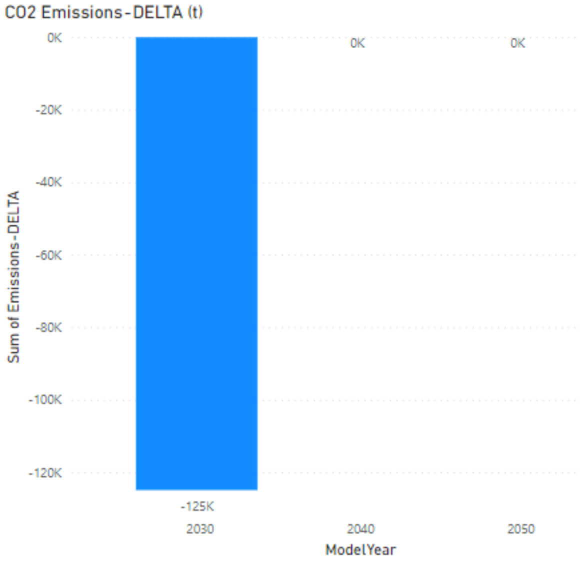
This section provides a summarised analysis by ENTSOG of the main benefits stemming from the realisation of the overall group. More details on the indicators are available in Annex D of TYNDP 2022[1].

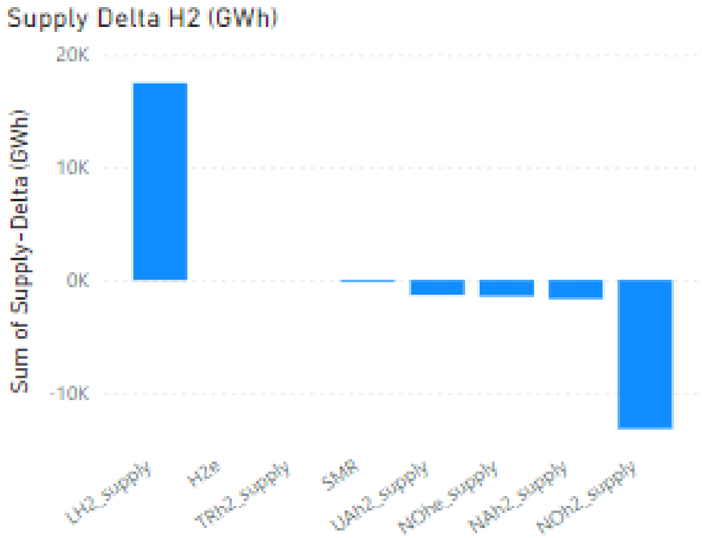
[1] https://www.entsog.eu/sites/default/files/2023-04/ENTSOG_TYNDP_2022_Annex_D_Methodology_230411.pdf

Distributed Energy

Sustainability benefits

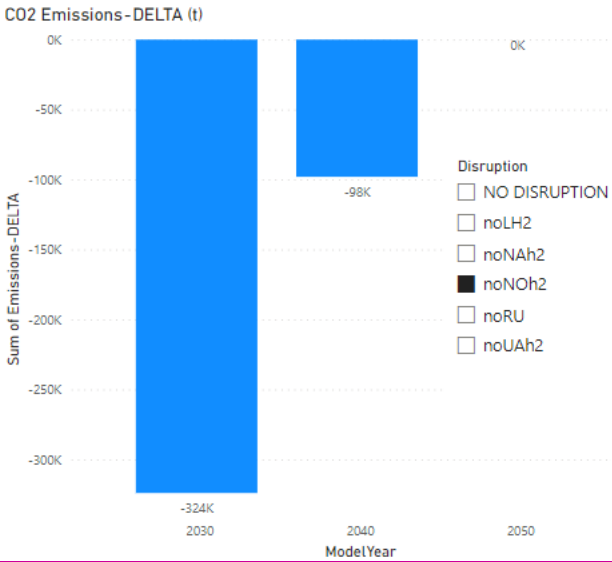
In the reference case, which analyses yearly demand in two periods (average winter and average summer), the project group will contribute to sustainability by reducing overall CO_2 emissions by 125 kt in 2030. The project group enables imports of green hydrogen and so then replacing use of Norwegian supply which is considered as blue hydrogen in 2030.

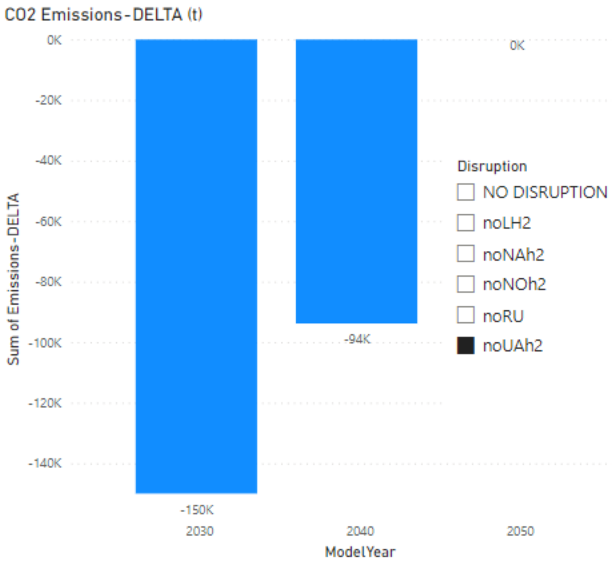


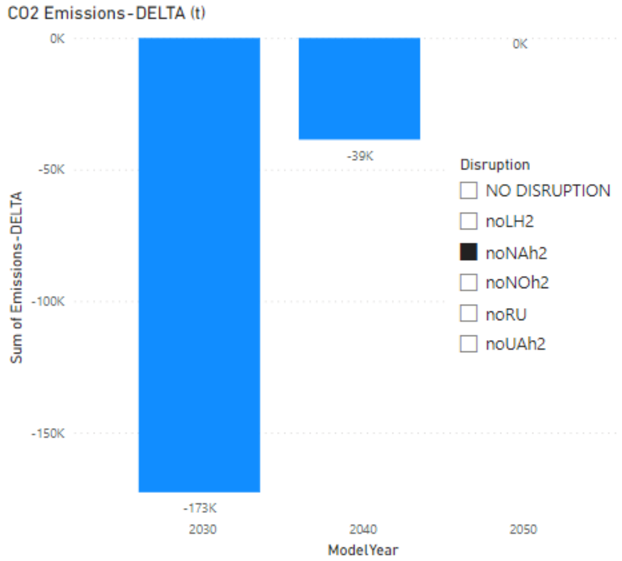


Similar trend is expected under any supply disruption in 2030 with even more benefits, up to 325 kt. In 2040, has some more sustainability by reducing the use of SMRs.

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







Security of Supply:[2]

> Reference case

In the reference case, the project is contributing to further mitigation of hydrogen demand curtailment risk in average summer and average winter a little from 2030, that cannot be displayed on the map.

> 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 demand curtailment by 2% in almost all European countries in 2030.

[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.*

> Disruption cases (S-1):

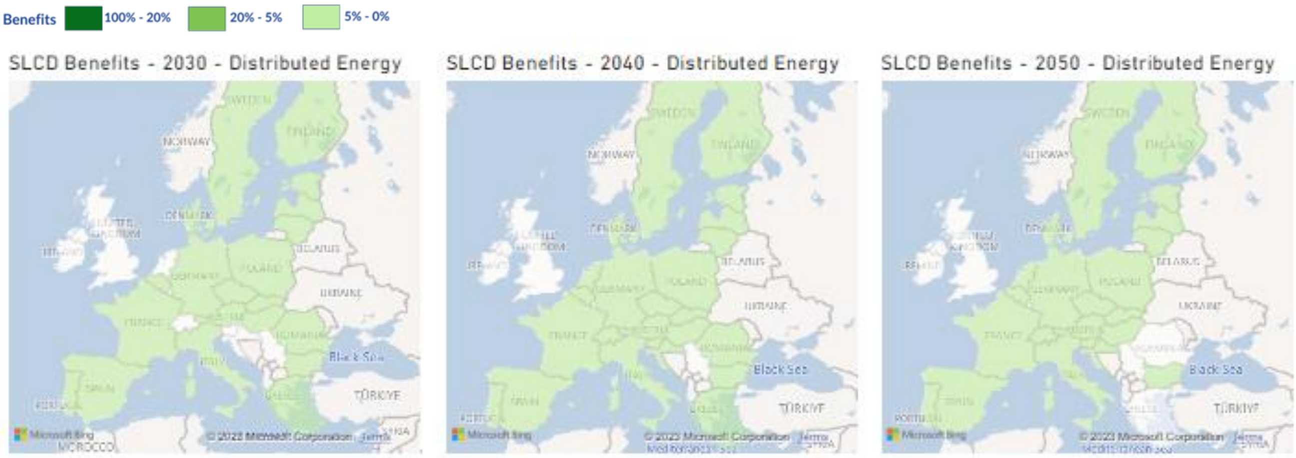
Similarly, under supply disruption cases, the project group mitigates demand curtailment in some European countries, depending of cases, from 2040 by 1-2%.

Maps for specifics disruptions: 1 noNOh2 : Norway disruption / 2 noNAh2 : North Africa disruption

1 noNOh2 : Norway disruption

2 noNAh2 : North Africa disruption

> Single largest capacity disruption (SLCD):

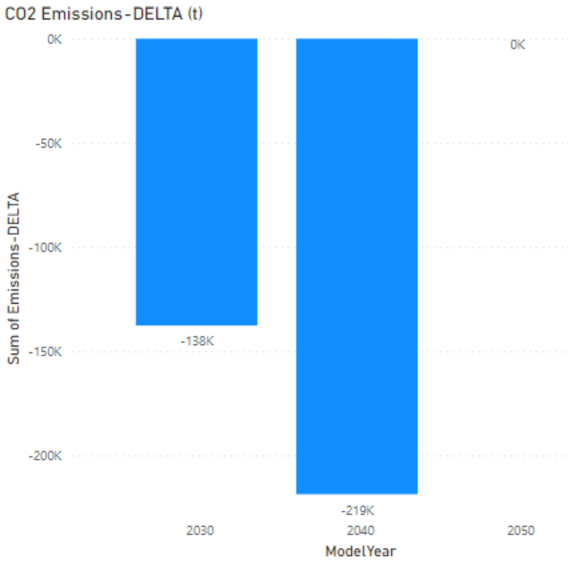


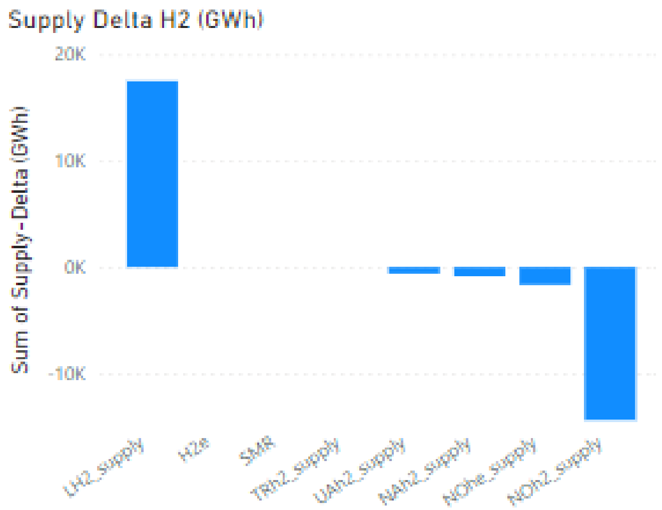
In case of single largest capacity disruption (SLCD), the project group reduces the risk of demand curtailment in all Europe from 2030, by 2-3%. Indeed, imports in France are able to flow to Belgium first and then to reach all Europe.

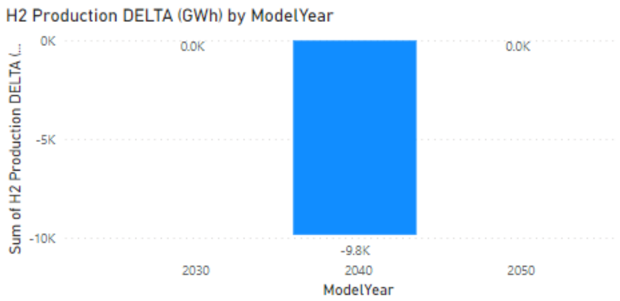
Global Ambition

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 CO_2 emissions by 138 kt in 2030. The project group enables the transport of green hydrogen and so then replacing use of Norwegian supply which is considered as blue hydrogen in 2030. Moreover, in 2040, as the hydrogen demand is higher, the terminal will decrease overall CO_2 emissions by using less SMRs.

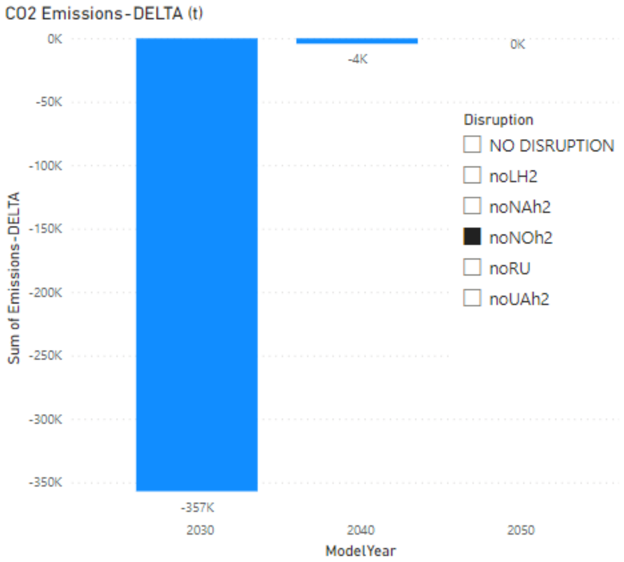


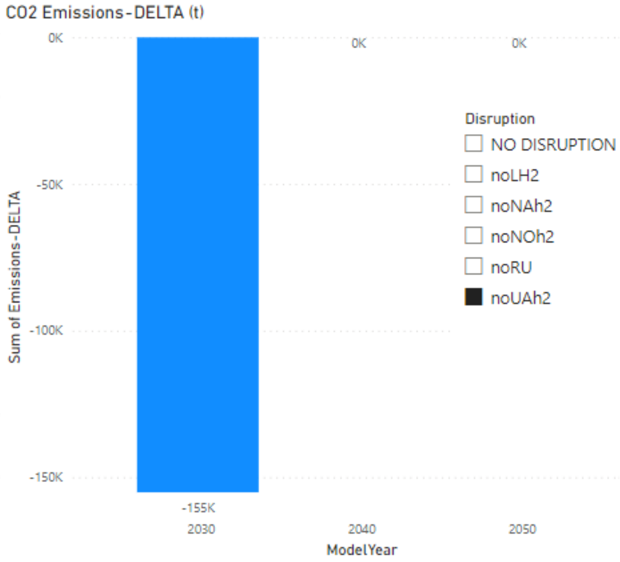


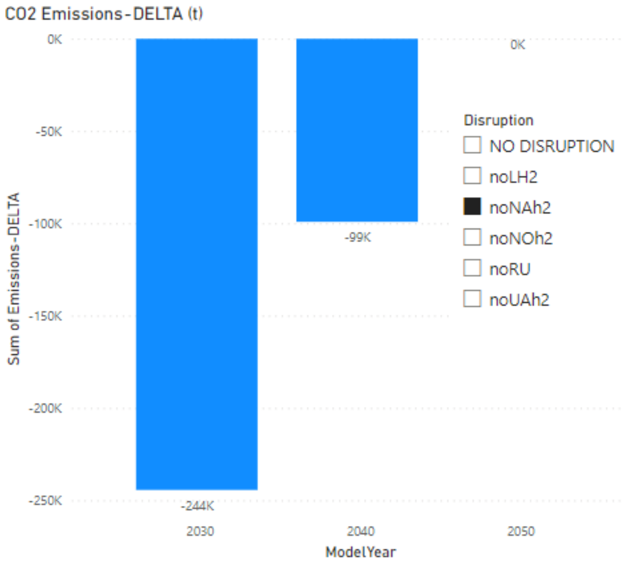


Similar trend is expected under supply disruptions.

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 is contributing to further mitigation of hydrogen demand curtailment risk in average summer and average winter a little from 2030, that cannot be displayed on the map.

2030 DE- Benefits

2040 DE- Benefits

2050 DE- Benefits

> 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 demand curtailment by 2% in almost all European countries in 2030.

2030 GA- Benefits

2040 GA- Benefits

2050 GA- Benefits

> Disruption cases (S-1):

Similarly, under supply disruption cases, the project group mitigates demand curtailment in some European countries, depending of cases, from 2040 by 1-2%.

Maps for specifics disruptions: 1 noNOh2 : Norway disruption / 2 noUAh2 : Ukraine disruption/ 3 noNAh2 : North Africa disruption

1 noNOh2 : Norway disruption

2030 GA- Benefits

2040 GA- Benefits

2050 GA- Benefits

2 noUAh2 : Ukraine disruption

2030 GA- Benefits

2040 GA- Benefits

2050 GA- Benefits

3 noNAh2 : North Africa disruption

2030 GA- Benefits

2040 GA- Benefits

2050 GA- Benefits

> *Single* largest capacity disruption *(SLCD):*

Benefits 100% - 20% 20% - 5% 5% - 0%

SLCD Benefits - 2030 - Global Ambition

SLCD Benefits - 2040 - Global Ambition

SLCD Benefits - 2050 - Global Ambition

In case of single largest capacity disruption (SLCD), the project group reduces the risk of demand curtailment in all Europe from 2030, by 2-3%. Indeed, imports in France are able to flow to Belgium first and then to reach all Europe.

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	-124897,63	538677299	538802196,7
2030	noLH2	DE	tonne	0,00	540175890,2	540175890,2
2030	noNAh2	DE	tonne	-172686,46	539785356,1	539958042,6
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	0,00	594817481,2	594817481,2
2030	noNAh2	GA	tonne	-244330,96	594141433,2	594385764,1
2030	noNOh2	GA	tonne	-357030,51	593310994,3	593668024,8
2030	noUAh2	GA	tonne	-155124,51	593627617,9	593782742,4
2040	NO DISRUPTION	DE	tonne	0,00	392077044	392077044
2040	noLH2	DE	tonne	0,00	392213883,4	392213883,4
2040	noNAh2	DE	tonne	-38621,53	392188097,7	392226719,2
2040	noNOh2	DE	tonne	-98050,17	392144022,6	392242072,8
2040	noUAh2	DE	tonne	-93797,45	392399182,9	392492980,3
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	-99115,93	397301976,6	397401092,6
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	-2%	-2%	-2%	-2%	-2%	-1%
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%	0%	-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):

SimulationPeriod	Country	2030-DE-DELTA	2030-GA-DELTA	2040-DE-DELTA	2040-GA-DELTA	2050-DE-DELTA	2050-GA-DELTA
Average2W	Austria	-2%	-2%	-1%	-1%	-1%	-1%
Average2W	Belgium	-2%	-2%	-1%	-1%	-1%	0%
Average2W	Bulgaria	0%	-2%	-1%	-1%	0%	0%
Average2W	Croatia	0%	0%	-1%	-1%	0%	-1%
Average2W	Cyprus	0%	0%	0%	0%	0%	0%
Average2W	Czechia	-2%	-2%	-1%	-1%	-1%	-1%
Average2W	Denmark	-1%	-2%	-1%	-1%	-1%	-1%
Average2W	Estonia	-2%	-2%	0%	-1%	-1%	-1%
Average2W	Finland	-2%	-2%	-1%	-1%	-1%	-1%
Average2W	France	-2%	-2%	-1%	-1%	-1%	-1%
Average2W	Germany	-2%	-2%	0%	0%	0%	0%
Average2W	Greece	0%	-2%	-1%	0%	0%	0%
Average2W	Hungary	0%	-2%	-1%	-1%	0%	-1%
Average2W	Ireland	0%	0%	0%	0%	0%	0%

Average2W	Italy	-2%	0%	-1%	-1%	0%	0%
Average2W	Latvia	-2%	-2%	0%	-1%	0%	-1%
Average2W	Lithuania	-2%	-2%	-1%	-1%	-1%	-1%
Average2W	Luxembourg	0%	0%	0%	0%	0%	0%
Average2W	Malta	0%	0%	0%	0%	0%	0%
Average2W	Poland	-2%	-2%	-1%	-1%	-1%	-1%
Average2W	Portugal	-2%	-2%	-1%	-1%	0%	-1%
Average2W	Romania	0%	-2%	-1%	-1%	0%	-1%
Average2W	Serbia	0%	0%	0%	0%	0%	0%
Average2W	Slovakia	-2%	-2%	-1%	-1%	0%	0%
Average2W	Slovenia	0%	0%	-1%	-1%	-1%	-1%
Average2W	Spain	-2%	-2%	-1%	0%	-1%	0%
Average2W	Sweden	-2%	-2%	-1%	0%	-1%	-1%
Average2W	Switzerland	0%	0%	-1%	-1%	-1%	0%
Average2W	The Netherlands	0%	0%	-1%	-1%	-1%	0%
Average2W	United Kingdom	0%	0%	0%	0%	0%	0%
Average2WDF	Austria	-2%	-2%	-1%	-1%	-1%	-1%
Average2WDF	Belgium	-2%	-2%	-1%	-1%	-1%	0%
Average2WDF	Bulgaria	0%	-2%	-1%	-1%	0%	0%
Average2WDF	Croatia	0%	0%	-1%	-1%	0%	-1%
Average2WDF	Cyprus	0%	0%	0%	0%	0%	0%
Average2WDF	Czechia	-2%	-2%	-1%	-1%	-1%	-1%
Average2WDF	Denmark	-1%	-2%	-1%	-1%	-1%	-1%
Average2WDF	Estonia	-2%	-2%	-1%	0%	-1%	-1%
Average2WDF	Finland	-2%	-2%	-1%	-1%	-1%	0%
Average2WDF	France	-2%	-2%	-1%	-1%	-1%	-1%
Average2WDF	Germany	-2%	-2%	0%	-1%	0%	0%
Average2WDF	Greece	0%	-2%	-1%	-1%	0%	0%
Average2WDF	Hungary	0%	-2%	-1%	0%	0%	-1%
Average2WDF	Ireland	0%	0%	0%	0%	0%	0%
Average2WDF	Italy	-2%	0%	-1%	0%	0%	0%
Average2WDF	Latvia	-2%	-2%	-1%	0%	0%	-1%
Average2WDF	Lithuania	-2%	-2%	-1%	0%	-1%	-1%
Average2WDF	Luxembourg	0%	0%	0%	0%	0%	0%
Average2WDF	Malta	0%	0%	0%	0%	0%	0%
Average2WDF	Poland	-2%	-2%	-1%	0%	-1%	-1%
Average2WDF	Portugal	-2%	-2%	-1%	-1%	0%	0%
Average2WDF	Romania	0%	-2%	-1%	-1%	0%	-1%
Average2WDF	Serbia	0%	0%	0%	0%	0%	0%
Average2WDF	Slovakia	-2%	-2%	-1%	-1%	0%	-1%
Average2WDF	Slovenia	0%	0%	-1%	-1%	-1%	-1%
Average2WDF	Spain	-2%	-2%	-1%	-1%	-1%	0%
Average2WDF	Sweden	-2%	-2%	-1%	-1%	-1%	0%
Average2WDF	Switzerland	0%	0%	-1%	0%	-1%	-1%
Average2WDF	The Netherlands	0%	0%	-1%	-1%	-1%	0%

Average2WDF	United Kingdom	0%	0%	0%	0%	0%	0%
DC	Austria	-1%	-2%	0%	0%	-1%	-1%
DC	Belgium	-1%	-2%	0%	0%	0%	0%
DC	Bulgaria	0%	-1%	-1%	0%	0%	0%
DC	Croatia	0%	0%	-1%	0%	0%	-1%
DC	Cyprus	0%	0%	0%	0%	0%	0%
DC	Czechia	-1%	-1%	0%	0%	-1%	-1%
DC	Denmark	-2%	-1%	0%	0%	0%	0%
DC	Estonia	-1%	-2%	-1%	0%	-1%	-1%
DC	Finland	-1%	-1%	0%	0%	-1%	0%
DC	France	-1%	-1%	-1%	0%	-1%	0%
DC	Germany	-2%	-1%	-1%	-1%	0%	0%
DC	Greece	0%	-1%	-1%	0%	0%	0%
DC	Hungary	0%	-1%	-1%	0%	0%	-1%
DC	Ireland	0%	0%	0%	0%	0%	0%
DC	Italy	-1%	-1%	0%	0%	-1%	0%
DC	Latvia	-1%	-2%	-1%	0%	0%	-1%
DC	Lithuania	-1%	-2%	-1%	0%	0%	0%
DC	Luxembourg	0%	0%	0%	0%	0%	0%
DC	Malta	0%	0%	0%	0%	0%	0%
DC	Poland	-1%	-2%	-1%	0%	0%	0%
DC	Portugal	-1%	-1%	-1%	0%	0%	0%
DC	Romania	0%	-2%	-1%	0%	0%	-1%
DC	Serbia	0%	0%	0%	0%	0%	0%
DC	Slovakia	-1%	-2%	-1%	0%	0%	0%
DC	Slovenia	0%	0%	-1%	0%	0%	-1%
DC	Spain	-1%	-2%	0%	-1%	-1%	-1%
DC	Sweden	-1%	-1%	0%	0%	-1%	0%
DC	Switzerland	0%	0%	0%	0%	-1%	0%
DC	The Netherlands	0%	0%	0%	-1%	-1%	0%
DC	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-820	n.a	n.a	n.a

Potential impact	Mitigation measures	Related costs included in project CAPEX and OPEX	Additional expected costs

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 France 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: