HI WEST 2 B (Less-Advanced)

H2Med-BarMar – Spanish Hydrogen Backbone

Reasons for grouping [ENTSOG]

The project group aims at interconnecting future hydrogen infrastructure between Spain and France through an offshore hydrogen pipeline. The group includes also the Spanish backbone in order to flow green hydrogen from Spain.

The project group includes H2Med-BarMar project conformed by the investments from the three operators (HYD-N-1153 Enagas, HYD-N-819 Terega HYD-N-1151 Grtgaz),

Objective of the group [Promoter]

The corridor connects the potentials of green and affordable hydrogen of the Iberian Peninsula via France to the demand clusters in Germany, especially in Southern Germany. It is planned to forward the first available hydrogen volumes along the route starting from 2030 onwards. The group is one of the major hydrogen import corridors via the Mediterranean identified in the REPowerEU plan. The project H2Med-BarMar between Spain and France will be ready in 2030, enabling the transport of 2 Mt/y of hydrogen and contributing to the emergence of one of the major hydrogen import corridors via the Mediterranean Sea identified in the REPowerEU plan. The project will be a key enabler of the uptake of renewable and low carbon hydrogen at market scale for various uses, allowing to achieve decarbonisation of many strategic industrial sectors, counting with support of German Government as one of the main off-taker market. It is part of the announcement made on the 20th of October 2022 in Brussels by the President of France, Emmanuel Macron, Spain's President of the Government, Pedro Sánchez, and Portugal's Prime Minister António Costa. The three leaders agreed to develop a coordinated pipeline infrastructure, which combines repurposed and new pipelines. Two new interconnections are foreseen: A new hydrogen onshore pipeline between Celorico da Beira (Portugal) and Zamora and an offshore maritime pipeline connecting Barcelona and Marseille. This corridor is designed as the most direct and efficient option to connect the Iberian Peninsula to Central Europe, as part of a Green Energy Corridor connecting Portugal, Spain and France with the EU's energy network. In Alicante on 9th of December 2022, they confirmed the launching of this corridor, newly called H2Med and whose contours were specified in the presence of the European Commission President, Ursula von der Leyen. A support statement has been issued by Ursula von der Leyen the European Commission President, on the 9th of December 2022 (https://ec.europa.eu/commission/presscorner/detail/en/statement_22_7616)

HYD-N-1151 **H2Med-BarMar (GRTgaz)**

Comm. Year **2029**

HYD-N-1153 **H2Med-BarMar (Enagás)**

Comm. Year **2029**

HYD-N-819 **H2Med-BarMar (Teréga)**

Comm. Year **2029**

HYD-N-1149 **Spanish hydrogen backbone**

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]	Maximum depth [m]
HYD-N-1151 HYD-N-1153 HYD-N-819	Compressor Station in Barcelona	New	-	-	144	
HYD-N-1151 HYD-N-1153, HYD-N-819	Interconnector Barcelona-Marseille	New	700	455		2560
HYD-N-1149	Axis-1 Route: Gijón-Torrelavega-Vizcaya-Álava-La Rioja-Zaragoza-Teruel, Teruel-Tarragona, Tarragona-Barcelona, Teruel-Castellón-puerto Sagunto, Puerto Sagunto-Cartagena	New and repurposed		Length: 1500 km (aprox. 225 km repurposed)		
HYD-N-1149	Axis- 2 Route: Gijón-Musel, Gijón-Avilés, Gijón-Salamanca, Salamanca-Mérida, Mérida-Huelva, Mérida-Vegas Altas-Saceruela-Puertollano	New and repurposed		Length: aprox. 1250 km		

Capacity increment [ENTSOG]

TYNDP Project code	Point name	Operator	From system	To system	Capacity increment [GWh/d]	Comm. year
HYD-N-1151	H2_IP_FR-ES	GRTgaz	Transmission Spain (ES Hydrogen)	Transmission France (FR Hydrogen)	216	2029
HYD-N-1151	H2_IP_FR-ES	GRTgaz	Transmission France (FR Hydrogen)	Transmission Spain (ES Hydrogen)	216	2029
HYD-N-1153	H2_IP_FR-ES	Enagás Transporte S.A.U.	Transmission France (FR Hydrogen)	Transmission Spain (ES Hydrogen)	216	2029
HYD-N-1153	H2_IP_FR-ES	Enagás Transporte S.A.U.	Transmission Spain (ES Hydrogen)	Transmission France (FR Hydrogen)	216	2029
HYD-N-819	H2_IP_FR-ES	TERÉGA	Transmission Spain (ES Hydrogen)	Transmission France (FR Hydrogen)	216	2029
HYD-N-819	H2_IP_FR-ES	TERÉGA	Transmission France (FR Hydrogen)	Transmission Spain (ES Hydrogen)	216	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.

TYNDP Project code	CAPEX [M€]	CAPEX range [%]	OPEX [M€/y]	OPEX range [%]
HYD-N-1151, HYD-N-819, HYD-N-1153	2135	40%	22	40%
HYD-N-1149	3500	30%	122,5	30%

Description of the cost and range [Promoter]

H2Med-BarMar:

CAPEX and OPEX estimates are based on pre-feasibility study results. Given the state of the studies to date and the information gathered at this stage CAPEX and OPEX cost estimate are class 5 cost estimates, in the 40% cost range for CAPEX and 40 % for OPEX.

HYD-N-1149 Spanish Hydrogen Backbone: Enagás is expecting a 30% CAPEX range based on some degree of uncertainty at this stage coupled with Enagás' cost estimates on how equipment and materials related might evolve overtime due to potential impact of inflation on prices. 30% range in OPEX estimate is driven by the volatility on energy prices witnessed after Russian invasion of Ukraine. Combined CAPEX range will result around 35% while OPEX range is about 30%.

C. Project Benefits [ENTSOG]

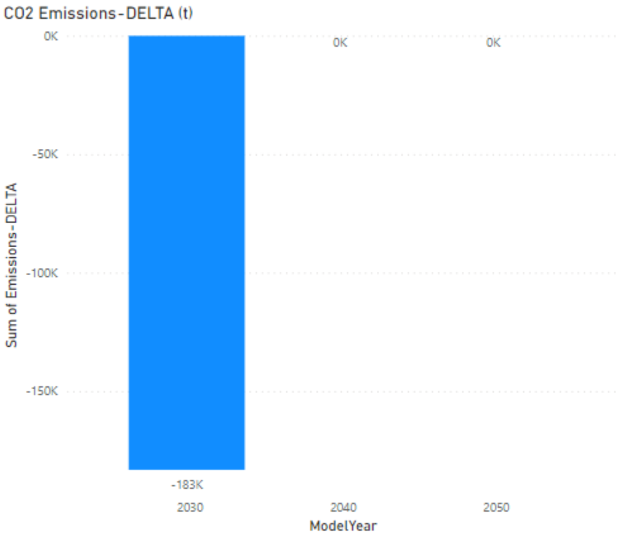
C.1 Summary of benefits

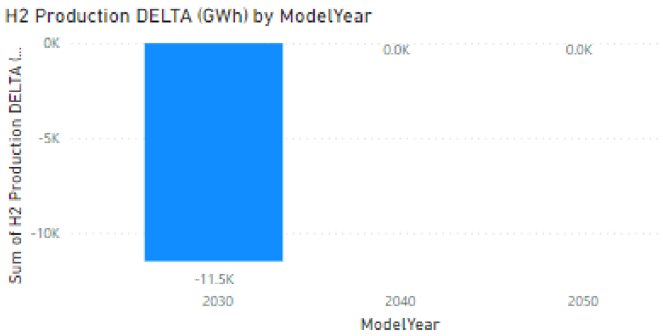
This section provides a summarised analysis by ENTSOG of the main benefits stemming from the realisation of the overall group. More details on the indicators are available in Annex D of TYNDP 2022[1].

Distributed Energy

Sustainability:

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 183 kt in 2030. This is explained as the project group will enable replacement of blue hydrogen supplies and, therefore, will reduce natural gas imports, with different hydrogen supply sources.

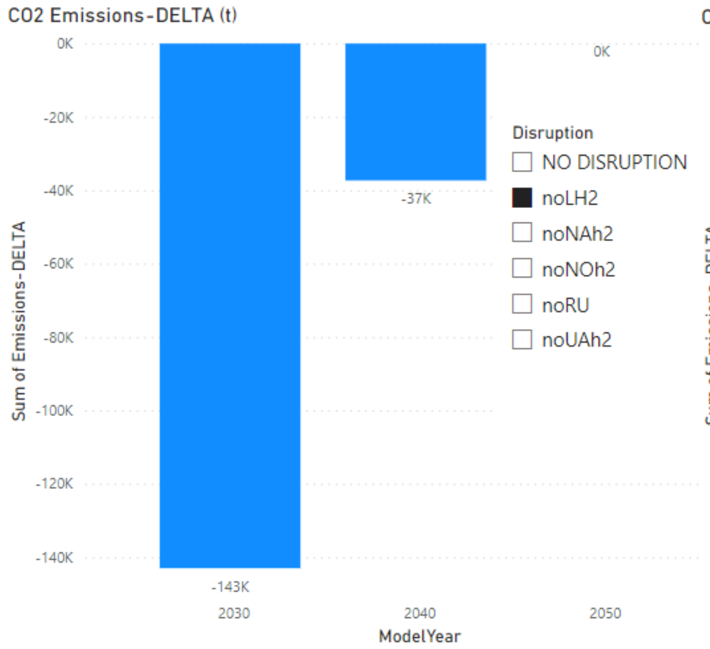


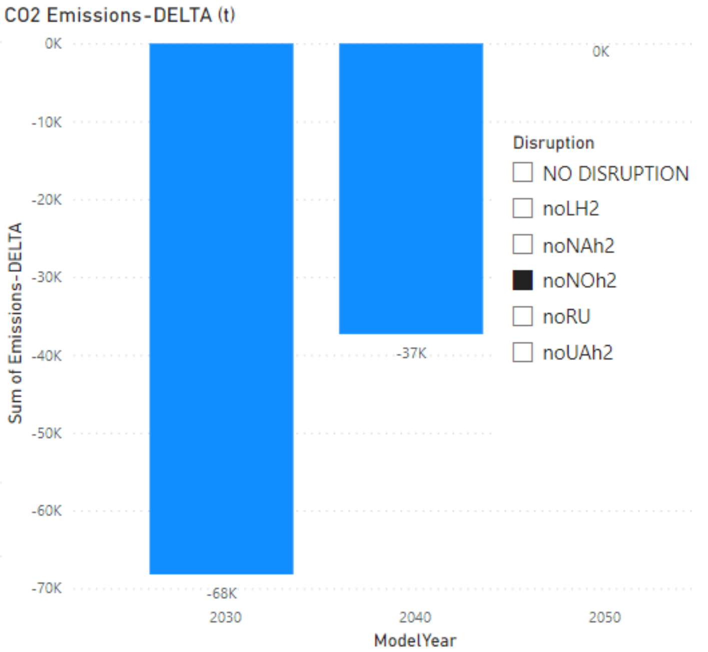


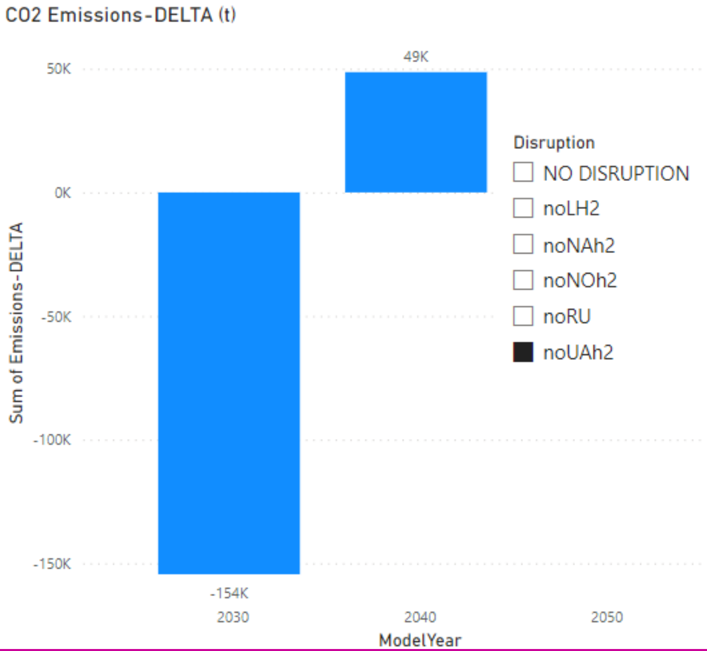
Enhanced sustainability benefits are expected under supply disruption cases (such as LH2, North African or Norwegian imports), as lower availability of hydrogen supplies will allow the project group to contribute to the reduction of CO2 emissions also in 2040, where higher hydrogen demand is expected in all European countries compared to 2030, and also, a more developed European transmission network, will enable the cooperation of the Iberian Peninsula with northern European countries.

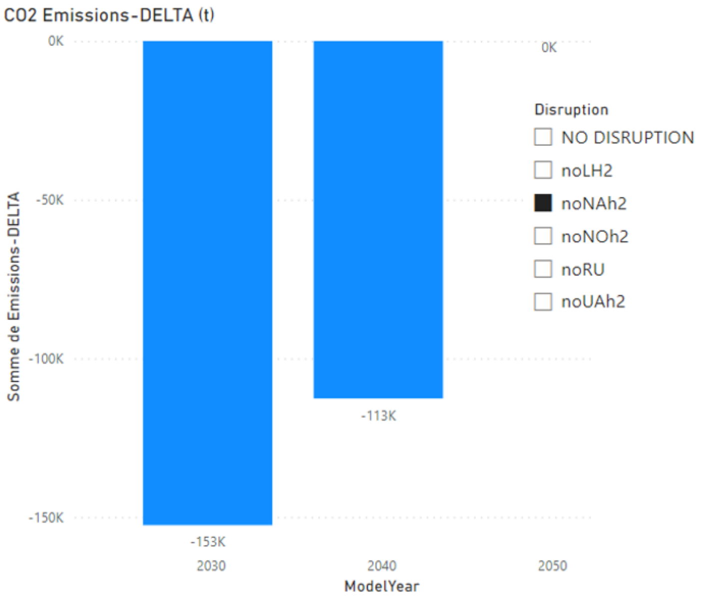
1 noLH2 : LH2 disruption / 2 noNOh2 : Norway disruption / 3 noUAh2 : Ukraine disruption/ 4 noNAh2 : North Africa disruption

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


CO2 Emissions-DELTA (t)
Sum of Emissions-DELTA
0K
-20K
-40K
-60K
-80K
-100K
-120K
-140K
-143K
-37K
0K
2030
2040
2050
ModelYear
Disruption
NO DISRUPTION
noLH2
noNAh2
noNOh2
noRU
noUAh2


CO2 Emissions-DELTA (t)
Sum of Emissions-DELTA
0K
-10K
-20K
-30K
-40K
-50K
-60K
-70K
-68K
-37K
0K
2030
2040
2050
ModelYear
Disruption
NO DISRUPTION
noLH2
noNAh2
noNOh2
noRU
noUAh2


CO2 Emissions-DELTA (t)
Sum of Emissions-DELTA
50K
0K
-50K
-100K
-150K
49K
-154K
2030
2040
2050
ModelYear
Disruption
NO DISRUPTION
noLH2
noNAh2
noNOh2
noRU
noUAh2



Security of Supply:[2]

> Reference case

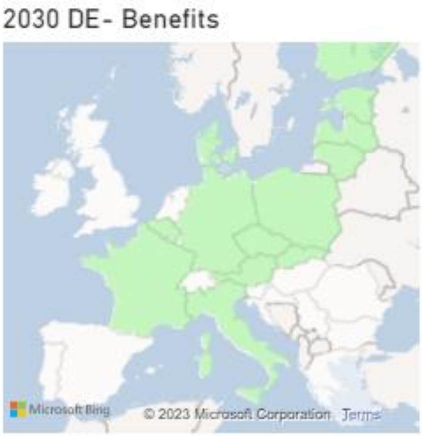
In the reference case, the project group mitigates the risk of hydrogen demand curtailment in Spain and Portugal from 2030 in average summer and average winter. The new interconnection improves cooperation between European countries and the Iberian Peninsula.

> Climatic stress cases

[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.*

Similar security of supply benefits than for reference case are expected under 2-week and 2-week dunkelflaute climatic stress cases.

In addition, under peak day climatic case, enhanced security of supply benefits is expected in 2030, as with higher hydrogen demand, the project group will allow for cooperation between Iberian Peninsula and Europe, and will allow to reduce the risk of demand curtailment in most European countries (France, Italy, Belgium, Germany, Austria, Denmark, Czech Republic, Slovakia, Poland, Baltic states and Finland).



> Disruption cases (S-1):

Similarly, under supply disruption cases, the project group will enable cooperation between the Iberian Peninsula and the rest of Europe, allowing hydrogen supplies to reach Northern European countries in the case of LH2 or Norwegian supply disruptions, or Italy in case of North African supply disruptions.

Maps for specifics disruptions: 1 noLH2 : LH2 disruption / 2 noNOh2 : Norway disruption / 3 noUAh2 : Ukraine disruption/ 4 noNAh2 : North Africa disruption

1 noLH2 : LH2 disruption

2 noNOh2 : Norway disruption

2030 DE- Benefits

2040 DE- Benefits

2050 DE- Benefits

3 noUAh2 : Ukraine disruption

2030 DE- Benefits

2040 DE- Benefits

2050 DE- Benefits

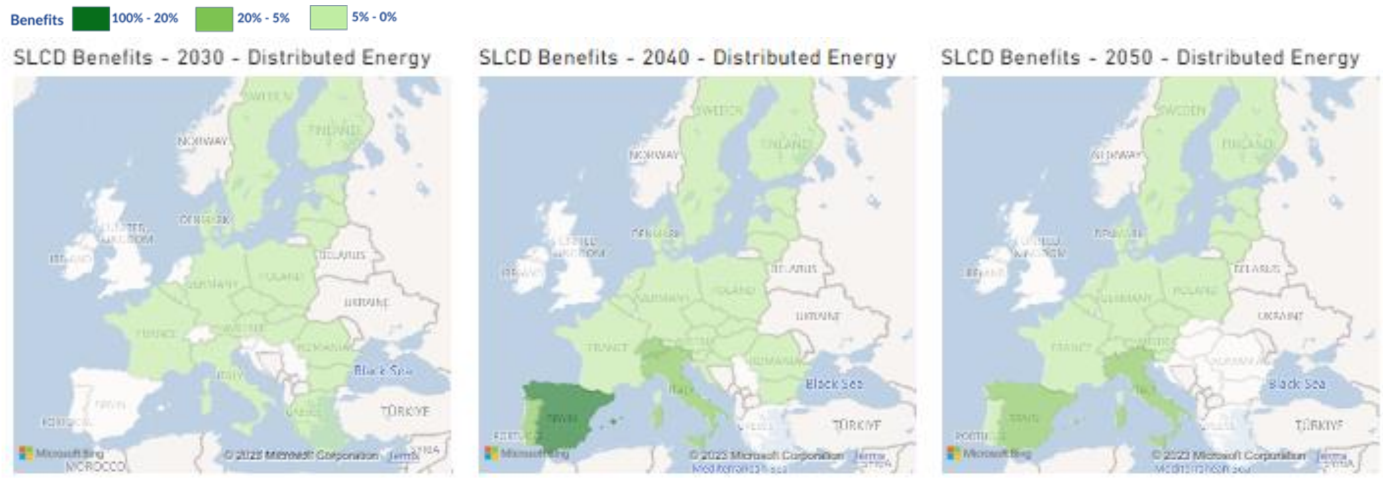
4 noNAh2 : North Africa disruption

2030 DE- Benefits

2040 DE- Benefits

2050 DE- Benefits

> Single largest capacity disruption (SLCD):

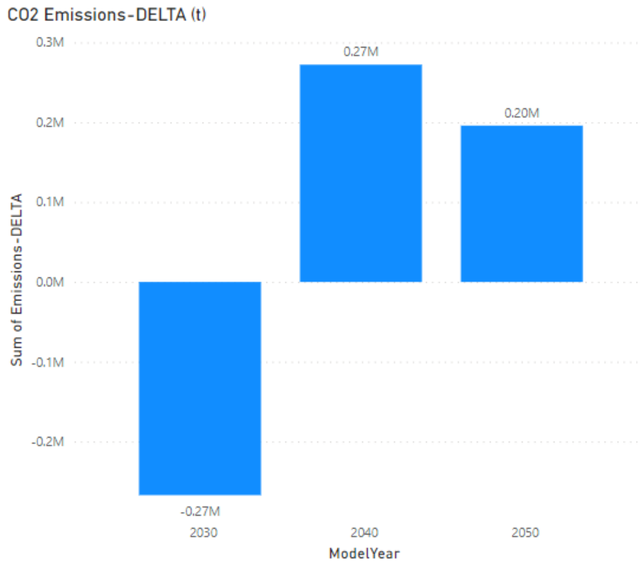


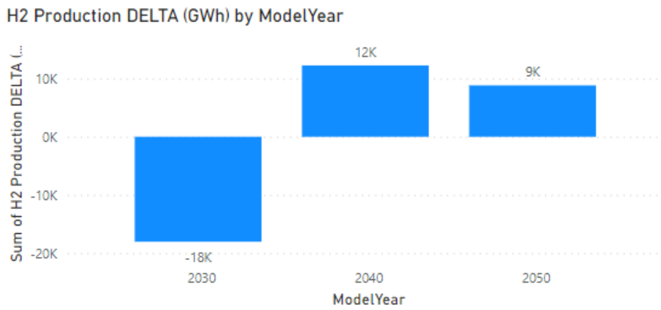
In case of single largest capacity disruption (SLCD), the project group significantly reduces the risk of demand curtailment in the Iberian Peninsula from 2040, by 29% in Spain and 10% in Portugal. In addition, also from 2040, under single largest capacity disruption in Italy (Import capacity with North Africa) the project group helps to mitigate the risk of demand curtailment due to the increase cooperation between Portugal and Spain with the rest of Europe.

Global Ambition

Sustainability benefits

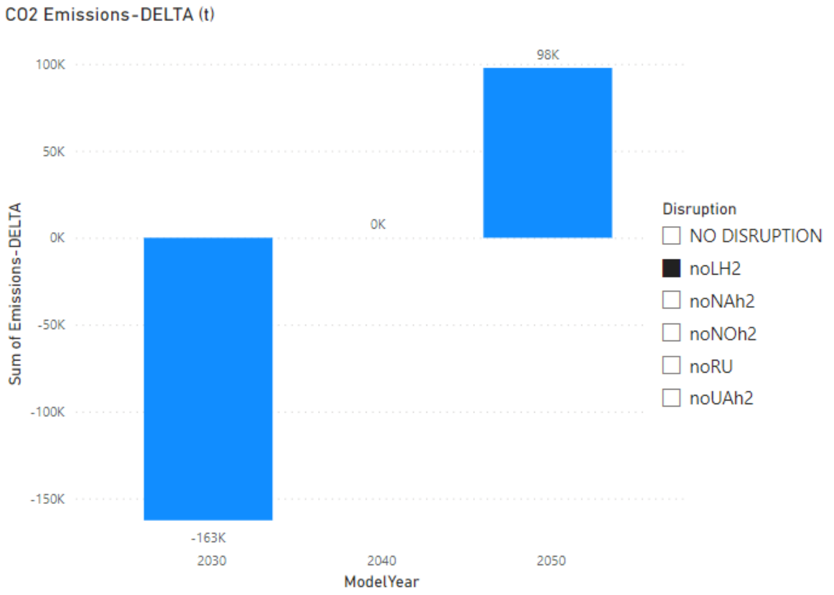
In the reference case, the project group will contribute to sustainability by reducing overall CO2 emissions by 270 kt in 2030. The project group will enable replacement of blue hydrogen supplies and, therefore, will reduce natural gas imports, with different hydrogen supply sources. However, from 2040, triggered by the higher hydrogen demand assumed for Global Ambition Scenario project group will increase overall CO2 emissions. The new interconnection between Iberian Peninsula and France enables these countries to further cooperate avoiding demand curtailment. As all green hydrogen supply sources (both locally produced and imported) are already used at their maximum capacity, an increase in blue hydrogen (i.e. SMR) is needed to satisfy the hydrogen demand in 2040 and 2050 and avoid demand curtailment.

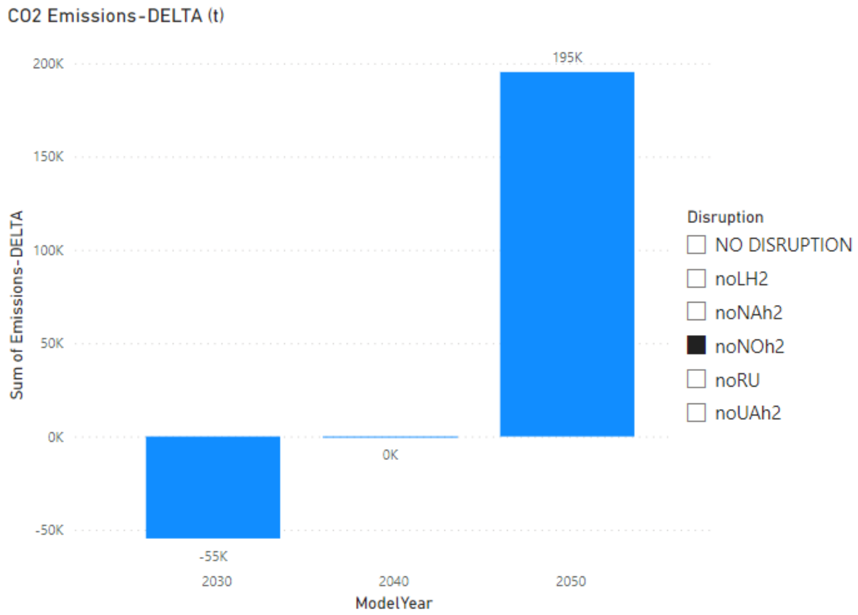


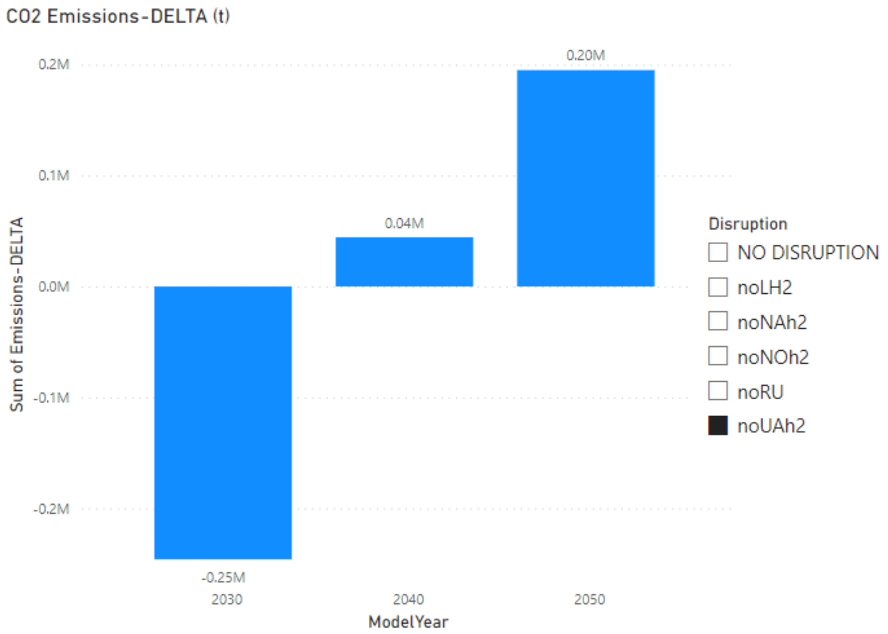


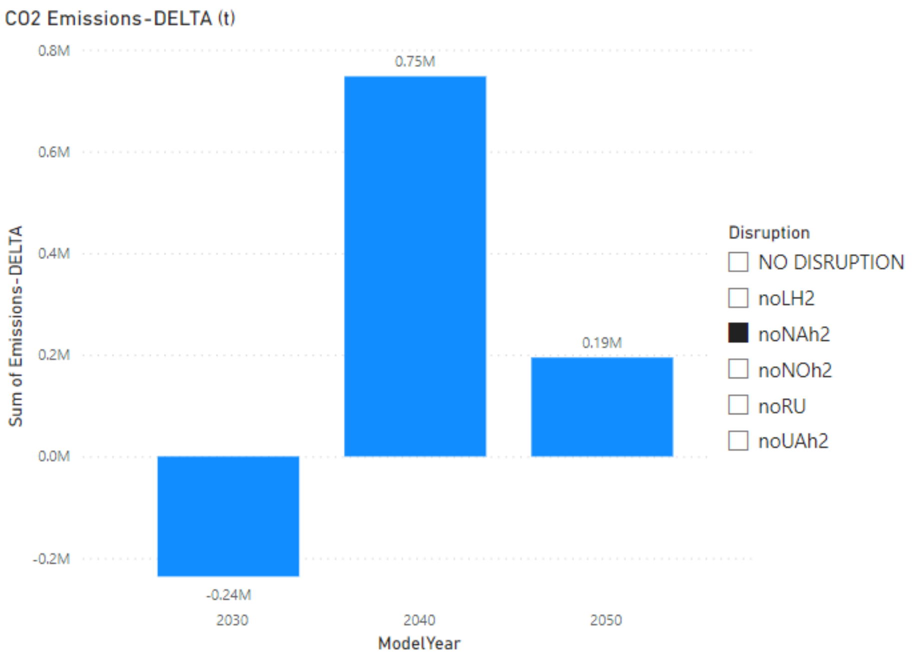
Similar trend for sustainability benefits is observed under different supply disruption cases.

1 noLH2 : LH2 disruption / 2 noNOh2 : Norway disruption / 3 noUAh2 : Ukraine disruption/ 4 noNAh2 : North Africa disruption


CO2 Emissions-DELTA (t)
100K
50K
0K
-50K
-100K
-150K
Sum of Emissions-DELTA
98K
0K
-163K
2030
2040
2050
ModelYear
Disruption
NO DISRUPTION
noLH2
noNAh2
noNOh2
noRU
noUAh2


CO2 Emissions-DELTA (t)
200K
150K
100K
50K
0K
-50K
Sum of Emissions-DELTA
195K
0K
-55K
2030
2040
2050
ModelYear
Disruption
NO DISRUPTION
noLH2
noNAh2
noNOh2
noRU
noUAh2





Security of supply benefits

> Reference case

In the reference case, the project group mitigates the risk of hydrogen demand curtailment in Spain and Portugal from 2040 in average summer and average winter. The new interconnection improves cooperation between European countries and the Iberian Peninsula. In addition, from 2050, the project group also reduces the risk of demand curtailment in Italy and Switzerland.

> Climatic stress cases

In addition, under peak day climatic case, enhanced security of supply benefits is expected due to the increased hydrogen demand compared to the yearly average demand. The project group will allow for cooperation between Iberian Peninsula and Europe and will allow to reduce the risk of demand curtailment in most of the European countries in 2030 and in Spain, Portugal, Italy and Switzerland in 2040 and 2050.

Similar security of supply benefits than for reference case are expected under 2-week and 2-week dunkelflaute climatic stress cases.

> Disruption cases (S-1)

Similar security of supply benefits than for reference case are expected for most supply route disruptions. In addition, in 2040 under Ukrainian supply route disruption, the implementation of the project group will allow for further cooperation between Iberian Peninsula and Eastern European countries.

1 noLH2 : LH2 disruption

2030 GA- Benefits

2040 GA- Benefits

2050 GA- Benefits

2 noNOh2 : Norway disruption

2030 GA- Benefits

2040 GA- Benefits

2050 GA- Benefits

3 noUAh2 : Ukraine disruption

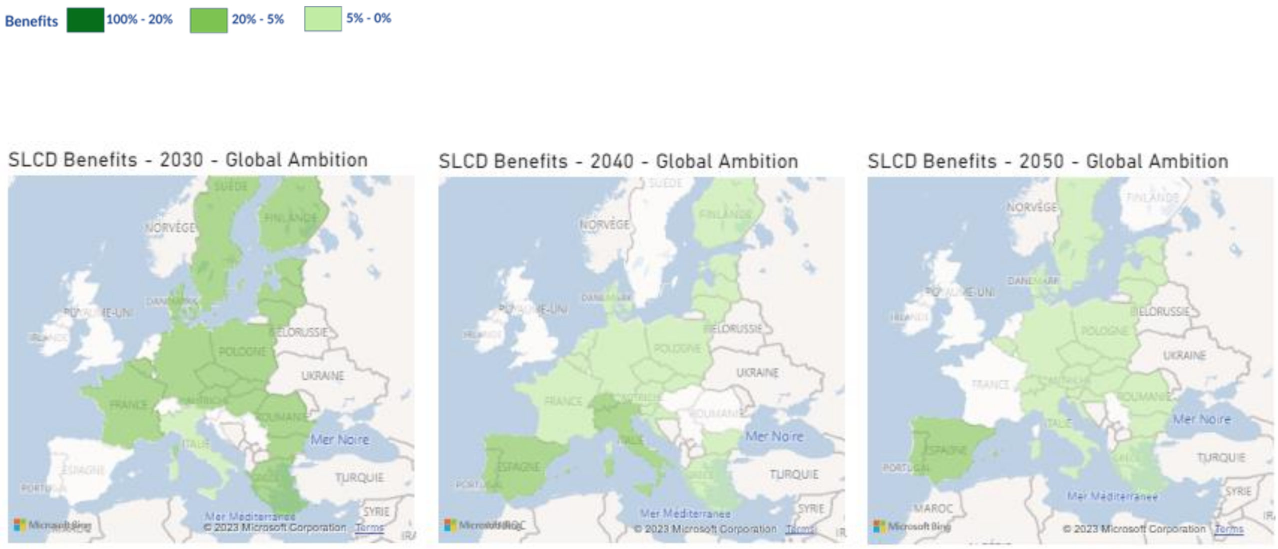
2030 GA- Benefits

2040 GA- Benefits

2050 GA- Benefits

4 noNAh2 : North Africa disruption

> Single largest capacity disruption (SLCD)



In case of single largest capacity disruption (SLCD), the projects group significantly reduces the risk of demand curtailment in most of the European countries in Europe by 7% in 2030 and the Iberian Peninsula by 19%) from 2040. In addition, also from 2040, under single largest capacity disruption in Italy (import capacity with North Africa) the project group will help to mitigate the risk of demand curtailment due to the increase cooperation between Portugal and Spain with the rest of Europe. As Global ambition scenario considers higher hydrogen demand the contribution of the hydrogen supply enabled by the project group is lower than in Distributed Energy scenario.

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	-183180,77	538677299	538860479,8
2030	noLH2	DE	tonne	-143003,30	540175890,2	540318893,5
2030	noNAh2	DE	tonne	-152507,43	539785356,1	539937863,5
2030	noNOh2	DE	tonne	-68200,20	538877197,8	538945398
2030	noUAh2	DE	tonne	-154426,88	539378771,9	539533198,8
2030	NO DISRUPTION	GA	tonne	-267085,98	592910448,4	593177534,4
2030	noLH2	GA	tonne	-162590,49	594817481,2	594980071,7
2030	noNAh2	GA	tonne	-236162,73	594141433,2	594377595,9
2030	noNOh2	GA	tonne	-54655,53	593310994,3	593365649,8
2030	noUAh2	GA	tonne	-246032,67	593627617,9	593873650,6
2040	NO DISRUPTION	DE	tonne	0,00	392077044	392077044
2040	noLH2	DE	tonne	-37325,19	392213883,4	392251208,5
2040	noNAh2	DE	tonne	-112608,05	392188097,7	392300705,7
2040	noNOh2	DE	tonne	-37325,19	392144022,6	392181347,8
2040	noUAh2	DE	tonne	48644,15	392399182,9	392350538,7
2040	NO DISRUPTION	GA	tonne	272207,55	396523251,6	396251044,1
2040	noLH2	GA	tonne	0,00	397455196,7	397455196,7
2040	noNAh2	GA	tonne	747674,18	397301976,6	396554302,5
2040	noNOh2	GA	tonne	-289,03	397450977,1	397451266,1
2040	noUAh2	GA	tonne	44421,66	397478498,3	397434076,7
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	195884,15	228306706,5	228110822,4
2050	noLH2	GA	tonne	97762,80	228306706,5	228208943,7

2050	noNAh2	GA	tonne	194516,22	228306706,5	228112190,3
2050	noNOh2	GA	tonne	195330,95	228306706,5	228111375,6
2050	noRU	GA	tonne	195739,48	228306706,5	228110967,1
2050	noUAh2	GA	tonne	195098,92	228306706,5	228111607,6

Curtailment Rate (SLCD):

Country	2030-DE-DELTA	2030-GA-DELTA	2040-DE-DELTA	2040-GA-DELTA	2050-DE-DELTA	2050-GA-DELTA
Spain	0%	0%	-29%	-19%	-19%	-12%
Portugal	0%	0%	-10%	-18%	-5%	-8%
Switzerland	0%	0%	-9%	-6%	-5%	-4%
Italy	-2%	-1%	-9%	-7%	-6%	-4%
Belgium	-2%	-7%	-2%	-1%	-1%	-1%
Czechia	-3%	-6%	-2%	-2%	-2%	-1%
Estonia	-3%	-7%	-2%	-1%	-2%	-1%
Finland	-3%	-7%	-2%	-1%	-1%	0%
Germany	-2%	-7%	-2%	-1%	-1%	-1%
Latvia	-3%	-7%	-2%	-1%	-1%	-1%
Lithuania	-3%	-7%	-2%	-1%	-1%	-1%
Poland	-2%	-7%	-2%	-1%	-1%	-1%
Slovenia	0%	0%	-2%	-2%	-1%	-4%
Sweden	-2%	-7%	-2%	0%	-2%	-1%
France	-2%	-7%	-2%	-1%	-1%	0%
The Netherlands	0%	0%	-1%	-1%	-2%	-1%
Austria	-2%	-6%	-1%	-2%	-1%	-3%
Bulgaria	-3%	-6%	-1%	-1%	0%	-3%
Croatia	0%	0%	-1%	-1%	0%	-2%
Denmark	-2%	-7%	-1%	-1%	-1%	-1%
Hungary	-3%	-6%	-1%	0%	0%	-2%
Romania	-2%	-7%	-1%	0%	0%	-3%
Slovakia	-2%	-6%	-1%	-1%	0%	-2%
Greece	-3%	-6%	-1%	-1%	0%	-3%

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	0%	0%	0%	0%	-1%	0%
Average2W	Belgium	0%	0%	0%	0%	0%	0%
Average2W	Bulgaria	0%	0%	0%	0%	0%	0%
Average2W	Croatia	0%	0%	0%	0%	0%	0%
Average2W	Cyprus	0%	0%	0%	0%	0%	0%
Average2W	Czechia	0%	0%	0%	0%	0%	0%
Average2W	Denmark	0%	0%	0%	0%	0%	0%
Average2W	Estonia	0%	0%	0%	0%	0%	0%
Average2W	Finland	0%	0%	0%	0%	0%	0%
Average2W	France	0%	0%	0%	0%	0%	0%

Average2W	Germany	0%	0%	0%	0%	0%	0%
Average2W	Greece	0%	0%	0%	0%	0%	0%
Average2W	Hungary	0%	0%	0%	0%	0%	0%
Average2W	Ireland	0%	0%	0%	0%	0%	0%
Average2W	Italy	0%	0%	-1%	0%	0%	-3%
Average2W	Latvia	0%	0%	0%	0%	0%	0%
Average2W	Lithuania	0%	0%	0%	0%	0%	0%
Average2W	Luxembourg	0%	0%	0%	0%	0%	0%
Average2W	Malta	0%	0%	0%	0%	0%	0%
Average2W	Poland	0%	0%	0%	0%	0%	0%
Average2W	Portugal	-13%	-18%	0%	-13%	0%	-7%
Average2W	Romania	0%	0%	0%	0%	0%	0%
Average2W	Serbia	0%	0%	0%	0%	0%	0%
Average2W	Slovakia	0%	0%	0%	0%	0%	0%
Average2W	Slovenia	0%	0%	0%	0%	-1%	0%
Average2W	Spain	-13%	-18%	-1%	-13%	-1%	-7%
Average2W	Sweden	0%	0%	0%	0%	0%	0%
Average2W	Switzerland	0%	0%	-1%	0%	0%	-3%
Average2W	The Netherlands	0%	0%	0%	0%	0%	0%
Average2W	United Kingdom	0%	0%	0%	0%	0%	0%
Average2WDF	Austria	0%	0%	0%	0%	-1%	0%
Average2WDF	Belgium	0%	0%	0%	0%	0%	0%
Average2WDF	Bulgaria	0%	0%	0%	0%	0%	0%
Average2WDF	Croatia	0%	0%	0%	0%	0%	0%
Average2WDF	Cyprus	0%	0%	0%	0%	0%	0%
Average2WDF	Czechia	0%	0%	0%	0%	0%	0%
Average2WDF	Denmark	0%	0%	0%	0%	0%	0%
Average2WDF	Estonia	0%	0%	0%	0%	0%	0%
Average2WDF	Finland	0%	0%	0%	0%	0%	0%
Average2WDF	France	0%	0%	0%	0%	0%	0%
Average2WDF	Germany	0%	0%	0%	0%	0%	0%
Average2WDF	Greece	0%	0%	0%	0%	0%	0%
Average2WDF	Hungary	0%	0%	0%	0%	0%	0%
Average2WDF	Ireland	0%	0%	0%	0%	0%	0%
Average2WDF	Italy	0%	0%	-1%	0%	0%	-4%
Average2WDF	Latvia	0%	0%	0%	0%	0%	0%
Average2WDF	Lithuania	0%	0%	0%	0%	0%	0%
Average2WDF	Luxembourg	0%	0%	0%	0%	0%	0%
Average2WDF	Malta	0%	0%	0%	0%	0%	0%
Average2WDF	Poland	0%	0%	0%	0%	0%	0%
Average2WDF	Portugal	-13%	-18%	0%	-12%	0%	-6%
Average2WDF	Romania	0%	0%	0%	0%	0%	0%
Average2WDF	Serbia	0%	0%	0%	0%	0%	0%
Average2WDF	Slovakia	0%	0%	0%	0%	0%	0%
Average2WDF	Slovenia	0%	0%	0%	0%	-1%	0%
Average2WDF	Spain	-13%	-18%	-1%	-12%	-1%	-7%
Average2WDF	Sweden	0%	0%	0%	0%	0%	0%

Average2WDF	Switzerland	0%	0%	-1%	0%	0%	-4%
Average2WDF	The Netherlands	0%	0%	0%	0%	0%	0%
Average2WDF	United Kingdom	0%	0%	0%	0%	0%	0%
DC	Austria	-1%	-2%	0%	0%	0%	0%
DC	Belgium	-1%	-1%	0%	0%	0%	0%
DC	Bulgaria	0%	-1%	0%	0%	0%	0%
DC	Croatia	0%	0%	0%	0%	0%	0%
DC	Cyprus	0%	0%	0%	0%	0%	0%
DC	Czechia	-1%	-1%	0%	0%	0%	0%
DC	Denmark	-2%	-1%	0%	0%	0%	0%
DC	Estonia	-1%	-1%	0%	0%	0%	0%
DC	Finland	-1%	-1%	0%	0%	0%	0%
DC	France	-2%	-1%	0%	0%	0%	0%
DC	Germany	-2%	-1%	0%	0%	0%	0%
DC	Greece	0%	-1%	-1%	0%	0%	0%
DC	Hungary	0%	-1%	0%	0%	0%	0%
DC	Ireland	0%	0%	0%	0%	0%	0%
DC	Italy	-1%	-1%	0%	-1%	-1%	-3%
DC	Latvia	-1%	-1%	0%	0%	0%	0%
DC	Lithuania	-1%	-1%	0%	0%	0%	0%
DC	Luxembourg	0%	0%	0%	0%	0%	0%
DC	Malta	0%	0%	0%	0%	0%	0%
DC	Poland	-1%	-1%	0%	0%	0%	0%
DC	Portugal	0%	0%	0%	-1%	0%	-3%
DC	Romania	0%	-1%	0%	0%	0%	0%
DC	Serbia	0%	0%	0%	0%	0%	0%
DC	Slovakia	-1%	-2%	0%	0%	0%	0%
DC	Slovenia	0%	0%	0%	0%	0%	0%
DC	Spain	0%	0%	0%	-1%	-1%	-3%
DC	Sweden	-1%	-1%	0%	0%	0%	0%
DC	Switzerland	0%	0%	0%	-1%	-1%	-3%
DC	The Netherlands	0%	0%	0%	0%	0%	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-819 **HYD-N-1151** **HYD-N-1153**	Hydrogen network	455 km	The pipeline may pass by protected natural areas and land in urban/industrial zone
HYD-N-1149	New and repurposed pipeline	Approx. 1.250 km	The routing is designed according to division 1 and 2 ASME B-31.12 (rural and very low populated areas)

Potential impact	Mitigation measures	Related costs included in project CAPEX and OPEX	Additional expected costs
Industrial Safety Measures **Environmental Impacts (ecological, humans, society, industrial and economical)**	Specific design and studies about safety with their impacts and mitigations measures to avoid or accept them. (Maintenance equipment, mechanical protections, monitoring systems) Specific study by independent consultant to analyze and propose the best corridor (minimum impact). Measuring all the impact and looking for solutions to avoid or compensate. (animals, flowers, water, protected aeras…)	The costs related to industrial safety measures and environmental impact studies are included in the project CAPEX and OPEX.	

Environmental Impact explained [Promoter]

GRTgaz, *Teréga and Enagás* have a strong track record concerning limitation of the impact on environment due to new pipelines. Mitigations measures are included in the costing and respect the Avoid / Reduce / Compensate principle. The specific study led by an independent consultant at the very beginning of the FEED allow to adapt the project's layout (to Avoid sensitive areas) and identify needed measures to reduce or compensate.

In France, the specific environmental requirements defined by this study will be followed by French authorities all along the pipeline's life. Teams within GRTgaz and Teréga are dedicated to the follow-up of this topic.
In Spain, the specific environmental requirements defined by this study will be followed by Spanish authorities all along the pipeline's life. A team within Enagás is dedicated to the follow-up of this topic.

Moreover, explicit support from the region and main stakeholders will further allow to reduce the risk from public and local opposition.

The impact of works will be reduced with the maximum effort by selecting the most suitable technology during the implementation of the project. In order to avoid air and water pollution, respective measures will be taken during the construction phase. The construction sites will be equipped with technical means for the possible remediation of leakage of fuel or other harmful substances that may endanger the quality of surface or underground water. All produced waste will be collected, disposed of, or recycled in accordance with applicable regulation. Waste collection containers will be placed in designated places and marked accordingly. Further detailed measures will be described in the building permit design and agreed with the concerned environmental authority.

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]

<u>**H2Med-BarMar (CelZa, Spanish Backbone, BarMar)**</u>

Due to time constraints and the dynamics of the energy situation in Europe, the scenarios used for the TYNDP2022 system assessment and PS-CBA simulations to assess the benefits of the PCI candidate projects are not based on the most recent available data and do not include, for example, agreements between countries at the European level.

This is the case, especially for Spain and Portugal in terms of hydrogen supply and demand, a situation that led Member States (MS) to provide in their system needs' assessment updated values. TSOs have provided updated supply and demand hydrogen data for the TYNDP2024 process on-going, but NECPs have not even been updated yet. The timing issue might remain in the long term, but in the case of H2Med, the input data used for the assessment of the project under TYNDP22 is particularly inappropriate.

Also, a difficulty inherent in the process is the infrastructure level against which to assess the project, as there is no current hydrogen network. The option chosen by ENTSOG is to assess against the projects submitted for PCI status, but different options would have been equally valid and valuable to enlarge the scope of the analysis. For instance, the project could be assessed against the cost-optimal infrastructure to connect the assumed demand and supply figures, or conversely in the absence of a developed infrastructure as is the case today. To our knowledge, the value of the project has not been tested against this major uncertainty.

Also, the project should be considered as a whole to unveil its potential, therefore we advise referring to HI WEST 2A and BARMAR Celza (1A).

To deliver first insights based on these suggestions, the project promoters performed an integrated model-based analysis of the project, according to the methodology proposed by the JRC. An integrated capacity expansion and dispatch optimization tool simulating methane, hydrogen and electricity has been used to assess the benefits of hydrogen model for the full EU system and not only between a few member states.

The corridor projects have been assessed by taking it out of the infrastructure level and quantifying their impact on the KPIs suggested by the JRC (the benefits highlighted in the table show the differences between the configuration "with case" and "without case", as per the Harmonised system-wide CBA for candidate hydrogen projects). Two sets of input data for demand and supply have been tested, and for one of these scenarios, the robustness towards the infrastructure level has also been assessed. In a nutshell, the competitive Iberian hydrogen production leads the model to deliver massive hydrogen flows through France to reach the northern EU markets, even in the presence of alternative routes and H2 origins in all scenarios considered.

Our first insights show that the societal benefits related to **GHG emission savings would be up to 40 B€** (considering only the direct CO2 emissions reduction). In addition, the corridor allows an optimal market integration, by connecting three Member States through this corridor to the centre of Europe.

The project saves up to 26B€ on operational costs between 2030 and 2055, which is much more than the project costs. The TSOs scenario analysis demonstrates **positive impacts on all the assessed KPIs across all sensitivities, and already in 2030.**

F. Useful links [Promoter]

Useful links:

https://www.grtgaz.com/en/our-actions/renewable-gas-circular-economy/barmar

H2Med agreement:

https://www.lamoncloa.gob.es/presidente/actividades/Documents/2022/091222-H2MED.pdf

https://www.enagas.es/en/energy-transition/gas-network/energy-infrastructure/hydrogen-transmission/

https://www.terega.fr/en/our-activities/hydrogen-energy-carrier-for-the-future