I WEST 1 B (Less-Advanced)

Portuguese Hydrogen Backbone with Interconnection to Spain

Reasons for grouping [ENTSOG]

The project group aims at interconnecting future hydrogen infrastructure between Spain and Portugal by partially repurposing existing natural gas infrastructure.

The group includes investments in Spain (HYD-N-1324) and Portugal (HYD-N-978 and HYD-N-1156).

Objective of the group [Promoter]

The Portuguese Hydrogen Backbone linked with the H2Med/CelZa project, include one new Figueira da Foz-Cantanhede hydrogen pipeline with ca. 50 km, and three repurposed (hydrogen) pipelines: Cantanhede-Mangualde (68 km of major trunkline plus 8 km of a branch line); Mangualde-Celorico da Beira (48 km of major trunkline); and Celorico da Beira-Monforte (213 km major trunkline plus 4 km of a branch line). This project creates conditions for the production and integration of green hydrogen, both in the Portuguese central interior region and in the littoral region of Figueira da Foz, benefiting from the proximity to industrial infrastructures and the Atlantic zone of oceanic offshore wind production, within the framework of the objectives pursued by Portuguese Government Dispatch nº 11404/2022, of 23 September.

The H2Med group is one of the major hydrogen import corridors via the Mediterranean identified in the REPowerEU plan. The Green Energy Corridor connecting Portugal, Spain and France with the EU's energy network will guarantee the security of supply and establish a cross-border transport of hydrogen from Iberia towards demand centers in southern Germany.

The project between Portugal, Spain and France will be ready in 2030, enabling the transport of 0.75 Mt/y of H2 from Portugal to Spain and 2 Mt/y of H2 from Spain to France, 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 and one of 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 repurposing and new pipelines and is supported in two new interconnections: A new H2 onshore pipeline between Celorico da Beira (Portugal) and Zamora (Spain) and an offshore maritime pipeline connecting Barcelona (Spain) and Marseille (France). This corridor is considered 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, the three leaders 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 the European Commission President Ursula von der Leyen, on the 9th of December 2022. (https://ec.europa.eu/commission/presscorner/detail/en/statement_22_7616)

HYD-N-978 **Portuguese Hydrogen Backbone**

Comm. Year **2029**

HYD-N-1156 **H2Med/CelZa**

Comm. Year **2029**

HYD-N-1324 **H2Med-CelZa (Enagás)**

Comm. Year **2029**

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-978	Cantanhede-Mangualde	Repurposing	500 and 200	68 + 8	
HYD-N-978	Celorico da Beira-Monforte	Repurposing	300 and 250	213 + 4	
HYD-N-978	Figueira da Foz–Cantanhede	New	700	50	

HYD-N-978	Mangualde-Celorico da Beira	Repurposing	700	48	
HYD-N-1156	Celorico-Spanish border	New	700	162	
HYD-N-1324	Zamora Compressor Station	New			26,4
HYD-N-1324	Celorico-Zamora	New	700	86	

Capacity increment [ENTSOG]

TYNDP Project code	Point name	Operator	From system	To system	Capacity increment [GWh/d]	Comm. year
HYD-N-1156	H2_IP_PT_ES	REN - Gasodutos, S.A.	Transmission Spain (ES Hydrogen)	Transmission Portugal (PT Hydrogen)	81	2029
HYD-N-1156	H2_IP_PT_ES	REN - Gasodutos, S.A.	Transmission Portugal (PT Hydrogen)	Transmission Spain (ES Hydrogen)	81	2029
HYD-N-1324	H2_IP_ES_PT	Enagás Transporte S.A.U.	Transmission Portugal (PT Hydrogen	Transmission Spain (ES Hydrogen)	81	2029
HYD-N-1324	H2_IP_ES_PT	Enagás Transporte S.A.U.	Transmission Spain (ES Hydrogen)	Transmission Portugal (PT Hydrogen	81	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-978	210	40%	3,5	50%

HYD-N-1156	204	40%	2	50%
HYD-N-1324	157	30%	9	40%

Description of the cost and range [Promoter]

On the Portuguese pipeline section, the CAPEX costs considered preliminary values based on the EHB report (Guidehouse, 2021). Therefore, REN considered 1.5 M€/km (for new H2 pipeline) and 0.4 M€/km (for repurposed H2 pipeline), with an uncertainty range of 40%. The estimated OPEX values correspond to historical REN pipeline OPEX values with an uncertainty range of 50%.

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. 40% range in OPEX estimate is driven by the volatility on energy prices witnessed after Russian invasion of Ukraine.

C. Project Benefits [ENTSOG]

C.1 Summary of benefits

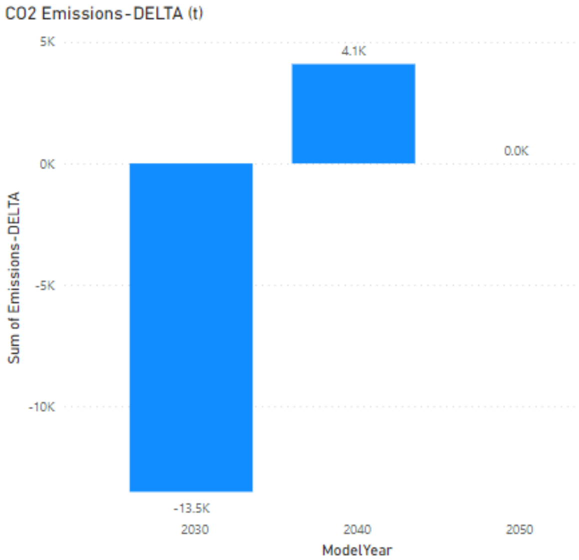
This section provides a summarised analysis by ENTSOG of the main benefits stemming from the realisation of the overall group. More details on the indicators are available in Annex D of TYNDP 2022[1].

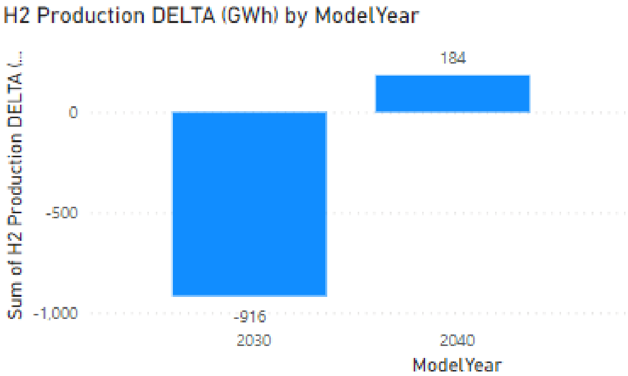
[1] https://www.entsog.eu/sites/default/files/2023-04/ENTSOG_TYNDP_2022_Annex_D_Methodology_230411.pdf

Distributed Energy

Sustainability benefits

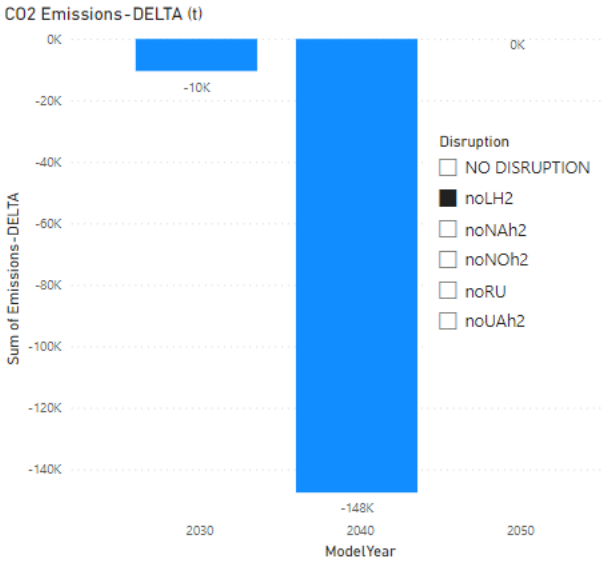
In the reference case, which analyses yearly demand in two periods (average winter and average summer), the project group will contribute to sustainability by reducing overall CO2 emissions by 13,5 kt in 2030. The project group enables the transport of green hydrogen and so then replacing use of SMRs supplies. In 2040, the project shows an increase of CO2. Indeed, as all green hydrogen supply sources 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 reduce demand curtailment.

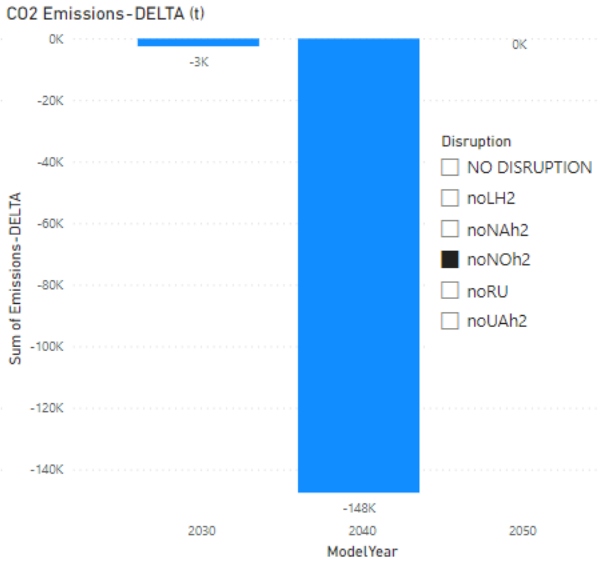


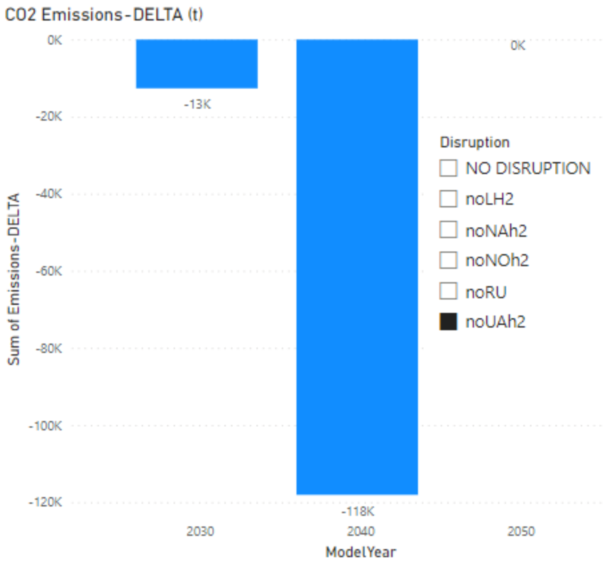


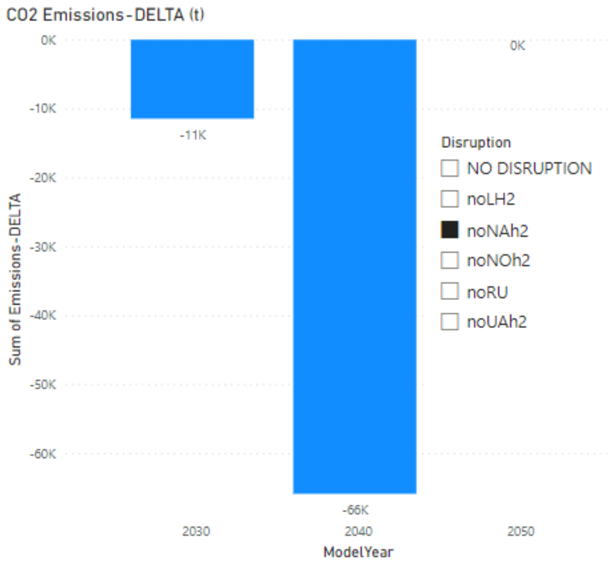
Increased benefits are expected under disruption cases in 2030 and 2040.

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









Security of Supply:[2]

> Reference case:

In the reference case, the project mitigates the risk of hydrogen demand curtailment in Spain and Denmark by 1% in 2040. In 2050 project is mitigating risk in all European countries.

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[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.*

> Climatic stress cases:

Under 2 -week and 2-week dunkelflaute climatic stress case, as well as under peak day climatic case the project group increases mitigation of risk of hydrogen demand curtailment in Portugal by 5% in 2030.

> Disruption cases (S-1):

Under supply disruptions, the project group mitigates from 2040, mainly in Spain, risk of demand curtailment up to 5%. In other countries, in green, it mitigates by 1-3%, depending on the case.

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

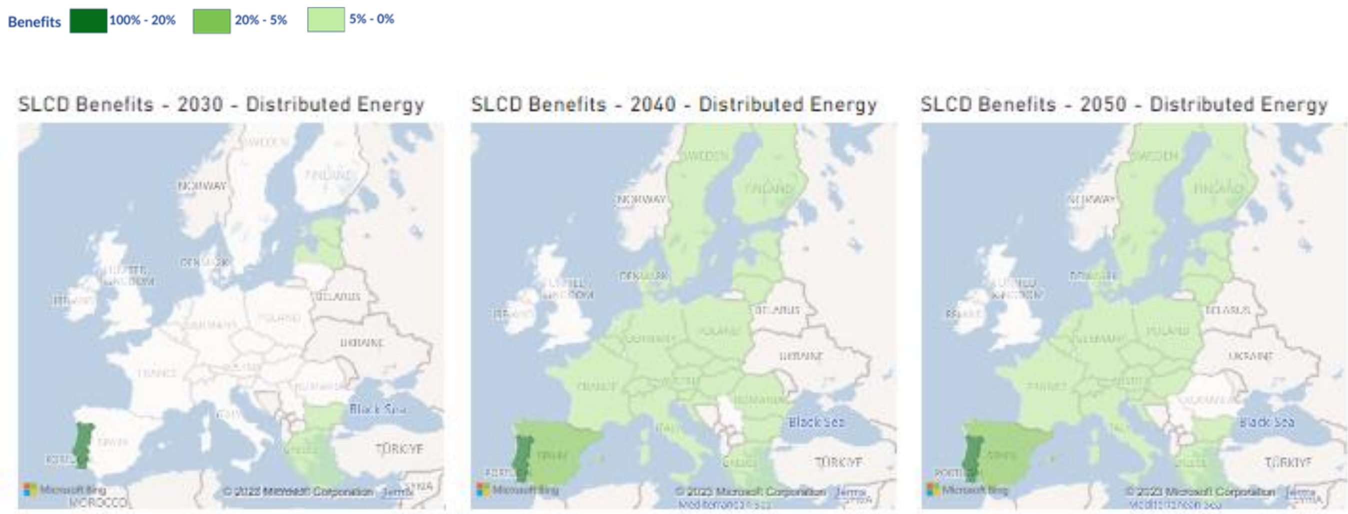
2 noNOh2 : Norway disruption

3 noUAh2 : Ukraine disruption

4 noNAh2 : North Africa disruption

> Single largest capacity disruption (SLCD):

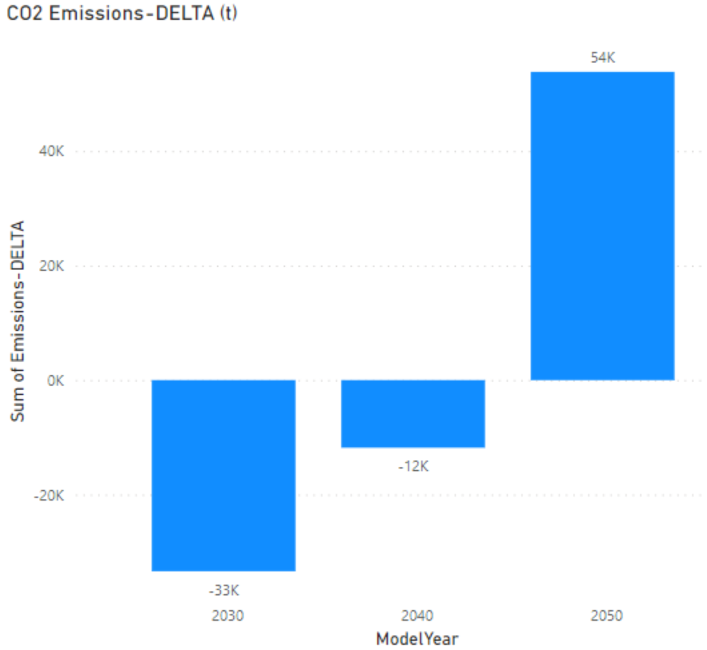
In case of SLCD, Portugal is the first country to benefit from the project, between 55% in 2030 to 49% in 2050. Moreover Spain is concerned from 2040 by 10%. Project is benefiting also all Europe by2-3% from 2030.

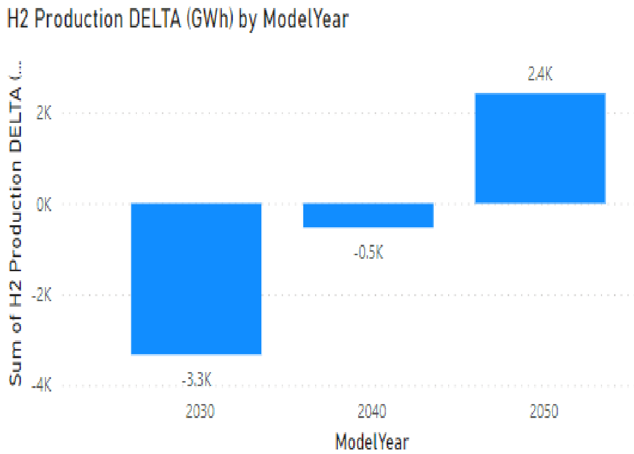


Global Ambition

Sustainability benefits

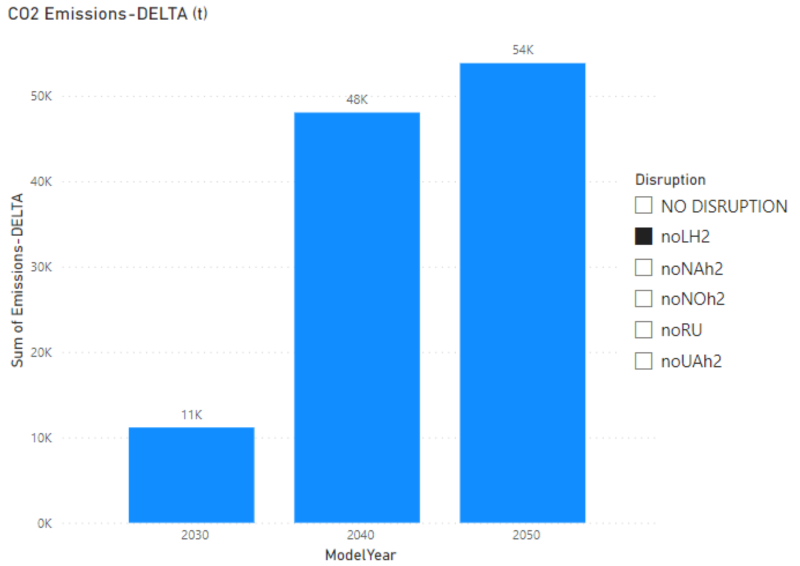
In the reference case, which analyses yearly demand in two periods (average winter and average summer), the project group will contribute to sustainability by reducing overall CO2 emissions by 33,3 kt in 2030 and 11,7 kt in 2040. The project group enables the transport of green hydrogen and so then replacing use of SMRs supplies. In 2050, project shows an increase of CO2. Indeed, as all green hydrogen supply sources 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 reduce demand curtailment.

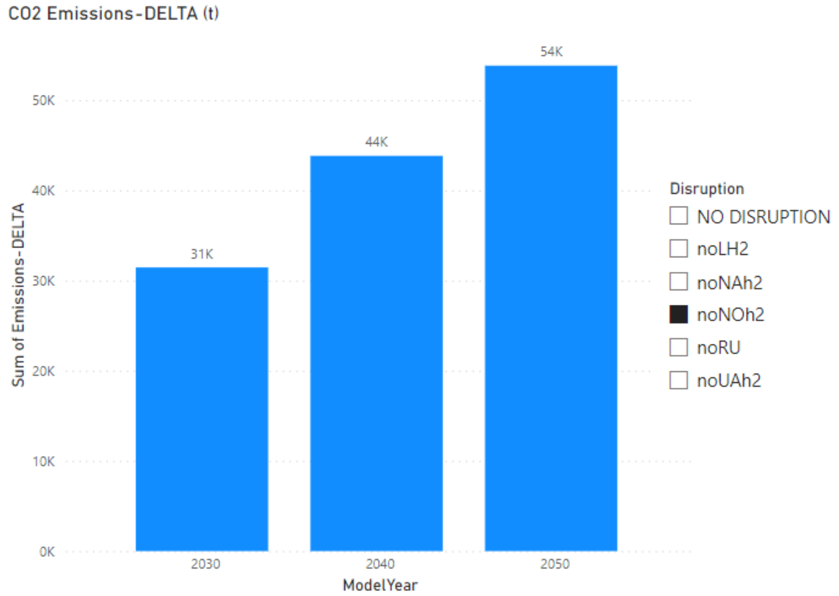


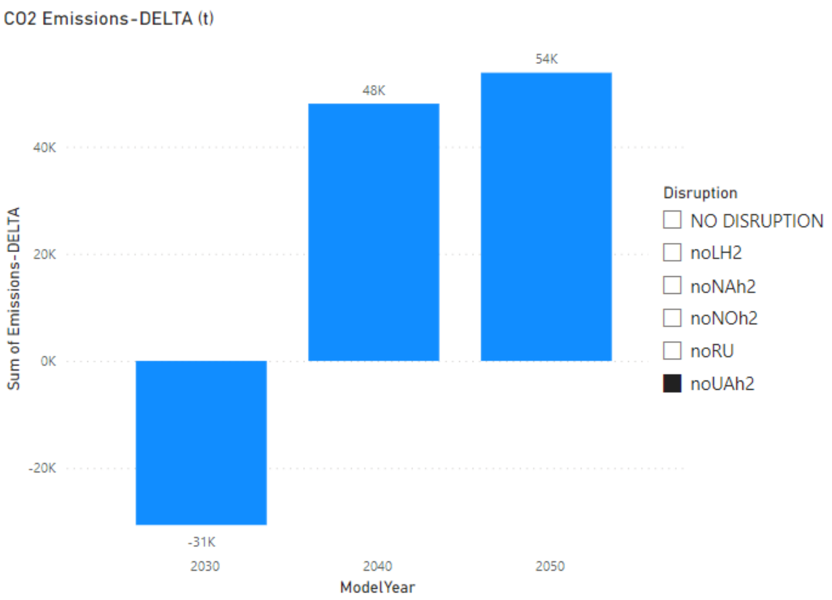


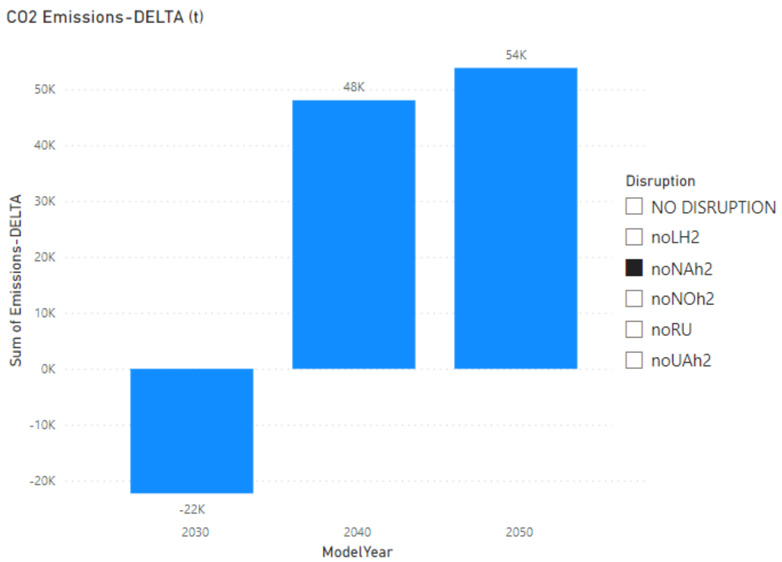
In case of supply disruption, the project groups enables more cooperation and to mitigate hydrogen demand curtailment is using more blue hydrogen produced by SMR.

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


CO2 Emissions-DELTA (t)
Sum of Emissions-DELTA
0K
10K
20K
30K
40K
50K
11K
48K
54K
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
31K
44K
54K
2030
2040
2050
ModelYear
Disruption
NO DISRUPTION
noLH2
noNAh2
noNOh2
noRU
noUAh2





Security of supply:

> Reference case

In the reference case, the project mitigates the risk of hydrogen demand curtailment in Portugal by 12% in 2030. In 2050 project is mitigating risk in Spain and France by 2%.

> Climatic stress cases

Under 2 -week and 2-week dunkelflaute climatic stress case, as well as under peak day climatic case the project group increases mitigation of risk of hydrogen demand curtailment in Portugal by 36% in 2030. And by 1% in Spain and France in 2050.

> Disruption cases (S-1)

Under supply disruptions, the project group mitigates in 2030, mainly in Portugal, risk of demand curtailment by 12%. In other countries, in green, it mitigates by 1-3%, depending on the case.

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

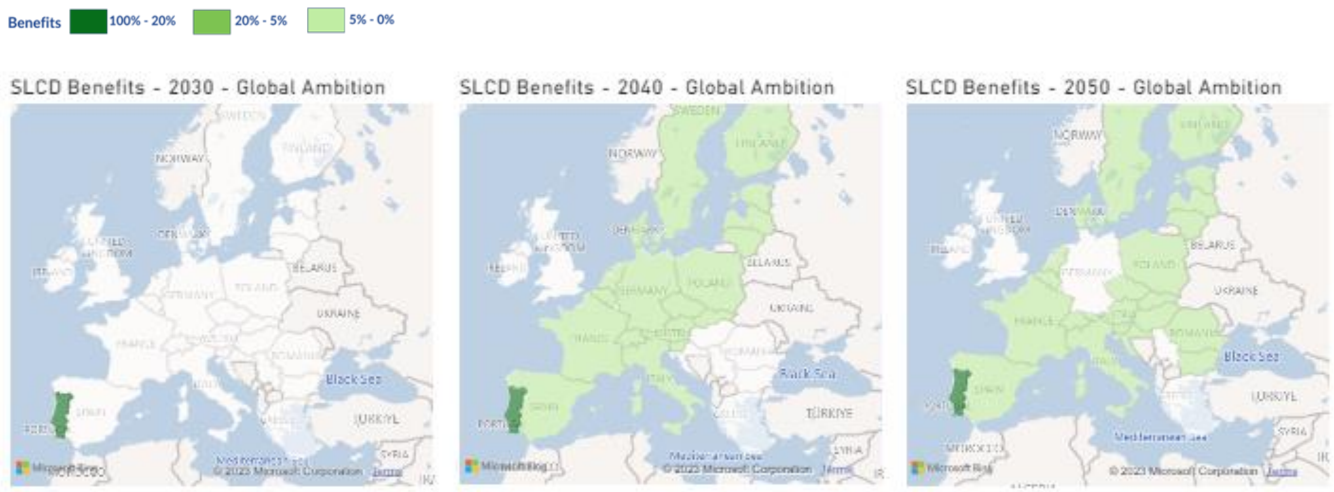
2 noNOh2: Norway disruption

3 noUAh2: Ukraine disruption

4 noNAh2: North Africa disruption

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

In case of SLCD, Portugal is the first country to benefit from the project, between 43% in 2030 to 29% in 2050. Projects group is benefiting also all Europe by 1-2% from 2040.



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	Emission Delta	Emission Plus	Emission Minus
2030	NO DISRUPTION	DE	tonne	-13.518	538.677.299	538.690.817
2030	NO DISRUPTION	GA	tonne	-33.372	592.910.448	592.943.821
2030	noLH2	DE	tonne	-10.453	540.175.890	540.186.344
2030	noLH2	GA	tonne	11.160	594.817.481	594.806.321
2030	noNAh2	DE	tonne	-11.460	539.785.356	539.796.816
2030	noNAh2	GA	tonne	-22.277	594.141.433	594.163.710
2030	noNOh2	DE	tonne	-2.511	538.877.198	538.879.709
2030	noNOh2	GA	tonne	31.453	593.310.994	593.279.541
2030	noUAh2	DE	tonne	-12.657	539.378.772	539.391.429
2030	noUAh2	GA	tonne	-30.642	593.627.618	593.658.260
2040	NO DISRUPTION	DE	tonne	4.091	392.077.044	392.072.953
2040	NO DISRUPTION	GA	tonne	-11.799	396.523.252	396.535.050
2040	noLH2	DE	tonne	-147.559	392.213.883	392.361.442
2040	noLH2	GA	tonne	48.045	397.455.197	397.407.152
2040	noNAh2	DE	tonne	-65.901	392.188.098	392.253.999
2040	noNAh2	GA	tonne	48.045	397.301.977	397.253.932
2040	noNOh2	DE	tonne	-147.559	392.144.023	392.291.581
2040	noNOh2	GA	tonne	43.825	397.450.977	397.407.152
2040	noUAh2	DE	tonne	-118.087	392.399.183	392.517.269
2040	noUAh2	GA	tonne	48.045	397.478.498	397.430.454
2050	NO DISRUPTION	DE	tonne	0	232.557.735	232.557.735
2050	NO DISRUPTION	GA	tonne	53.828	228.306.707	228.252.878
2050	noLH2	DE	tonne	0	232.557.735	232.557.735
2050	noLH2	GA	tonne	53.828	228.306.707	228.252.878
2050	noNAh2	DE	tonne	0	232.557.735	232.557.735
2050	noNAh2	GA	tonne	53.828	228.306.707	228.252.878
2050	noNOh2	DE	tonne	0	232.557.735	232.557.735
2050	noNOh2	GA	tonne	53.828	228.306.707	228.252.878
2050	noRU	DE	tonne	0	232.557.735	232.557.735
2050	noRU	GA	tonne	53.828	228.306.707	228.252.878
2050	noUAh2	DE	tonne	0	232.557.735	232.557.735
2050	noUAh2	GA	tonne	53.828	228.306.707	228.252.878

Curtailment Rate (SLCD):

Country	2030-DE-DELTA	2030-GA-DELTA	2040-DE-DELTA	2040-GA-DELTA	2050-DE-DELTA	2050-GA-DELTA
Portugal	-55%	-43%	-51%	-35%	-48%	-29%
Spain	0%	0%	-10%	-1%	-7%	-4%
Czechia	0%	0%	-3%	-2%	-3%	-1%
Estonia	-1%	0%	-3%	-1%	-2%	-1%
Latvia	-1%	0%	-3%	-1%	-2%	-1%
Lithuania	-1%	0%	-3%	-1%	-2%	-1%
Poland	0%	0%	-3%	-1%	-2%	-1%
Slovenia	0%	0%	-3%	-1%	-2%	-1%
Switzerland	0%	0%	-3%	-1%	-2%	-1%
Germany	0%	0%	-3%	-2%	-2%	-1%
France	0%	0%	-3%	-1%	-2%	-1%
Italy	0%	0%	-2%	-1%	-2%	-1%
Austria	0%	0%	-2%	-1%	-2%	-1%
Belgium	0%	0%	-2%	-1%	-2%	-1%
Denmark	0%	0%	-2%	-1%	-2%	-1%
Finland	0%	0%	-2%	-1%	-2%	-1%
Sweden	0%	0%	-2%	-1%	-2%	-1%
The Netherlands	0%	0%	-2%	-1%	-2%	-1%
Bulgaria	-1%	0%	-1%	0%	-1%	-1%
Croatia	0%	0%	-1%	0%	-1%	-1%
Greece	-1%	0%	-1%	0%	-1%	-1%
Hungary	0%	0%	-1%	0%	-1%	-1%
Romania	0%	0%	-1%	0%	0%	-1%
Slovakia	0%	0%	-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	-1%	0%	-1%	-1%	-1%	0%
Average2W	Belgium	0%	0%	-1%	-1%	-1%	0%
Average2W	Bulgaria	0%	0%	-1%	-1%	0%	0%
Average2W	Croatia	0%	0%	-1%	0%	0%	0%
Average2W	Cyprus	0%	0%	0%	0%	0%	0%
Average2W	Czechia	-1%	0%	-1%	-1%	-1%	0%
Average2W	Denmark	0%	0%	-1%	-1%	-1%	0%
Average2W	Estonia	0%	0%	-1%	0%	-1%	0%
Average2W	Finland	0%	0%	-1%	0%	-1%	0%
Average2W	France	0%	0%	-1%	0%	-1%	0%
Average2W	Germany	0%	0%	-1%	0%	-1%	0%
Average2W	Greece	0%	0%	-1%	0%	0%	0%
Average2W	Hungary	0%	0%	-1%	0%	0%	0%
Average2W	Ireland	0%	0%	0%	0%	0%	0%

Average2W	Italy	0%	0%	-1%	0%	-1%	-1%
Average2W	Latvia	0%	0%	-1%	0%	-1%	0%
Average2W	Lithuania	0%	0%	-1%	0%	-1%	0%
Average2W	Luxembourg	0%	0%	0%	0%	0%	0%
Average2W	Malta	0%	0%	0%	0%	0%	0%
Average2W	Poland	0%	0%	-1%	0%	-1%	0%
Average2W	Portugal	-5%	-36%	0%	0%	0%	0%
Average2W	Romania	0%	0%	-1%	0%	0%	0%
Average2W	Serbia	0%	0%	0%	0%	0%	0%
Average2W	Slovakia	-1%	0%	-1%	0%	0%	0%
Average2W	Slovenia	0%	0%	-1%	-1%	-1%	0%
Average2W	Spain	0%	0%	-1%	0%	-1%	-1%
Average2W	Sweden	0%	0%	-1%	0%	-1%	0%
Average2W	Switzerland	0%	0%	-1%	0%	-1%	-1%
Average2W	The Netherlands	0%	0%	-1%	0%	-1%	0%
Average2W	United Kingdom	0%	0%	0%	0%	0%	0%
Average2WDF	Austria	0%	0%	-1%	0%	-1%	0%
Average2WDF	Belgium	-1%	0%	-1%	0%	-1%	0%
Average2WDF	Bulgaria	0%	0%	-1%	0%	0%	0%
Average2WDF	Croatia	0%	0%	-1%	0%	0%	0%
Average2WDF	Cyprus	0%	0%	0%	0%	0%	0%
Average2WDF	Czechia	0%	0%	-1%	0%	-1%	0%
Average2WDF	Denmark	0%	0%	-1%	0%	-1%	0%
Average2WDF	Estonia	0%	0%	-1%	0%	-1%	0%
Average2WDF	Finland	0%	0%	-1%	-1%	-1%	0%
Average2WDF	France	0%	0%	-1%	0%	-1%	0%
Average2WDF	Germany	0%	0%	-1%	0%	-1%	0%
Average2WDF	Greece	0%	0%	-1%	-1%	0%	0%
Average2WDF	Hungary	0%	0%	-1%	0%	0%	0%
Average2WDF	Ireland	0%	0%	0%	0%	0%	0%
Average2WDF	Italy	0%	0%	-1%	0%	-1%	-1%
Average2WDF	Latvia	0%	0%	-1%	0%	-1%	0%
Average2WDF	Lithuania	0%	0%	-1%	0%	-1%	0%
Average2WDF	Luxembourg	0%	0%	0%	0%	0%	0%
Average2WDF	Malta	0%	0%	0%	0%	0%	0%
Average2WDF	Poland	0%	0%	-1%	0%	-1%	0%
Average2WDF	Portugal	-5%	-36%	0%	0%	0%	0%
Average2WDF	Romania	0%	0%	-1%	0%	0%	0%
Average2WDF	Serbia	0%	0%	0%	0%	0%	0%
Average2WDF	Slovakia	0%	0%	-1%	0%	0%	0%
Average2WDF	Slovenia	0%	0%	-1%	0%	-1%	0%
Average2WDF	Spain	0%	0%	-1%	-1%	-1%	-1%
Average2WDF	Sweden	0%	0%	-1%	-1%	-1%	0%
Average2WDF	Switzerland	0%	0%	-1%	0%	-1%	-2%
Average2WDF	The Netherlands	0%	0%	-1%	0%	-1%	0%

Average2WDF	United Kingdom	0%	0%	0%	0%	0%	0%
DC	Austria	0%	0%	0%	0%	-1%	-1%
DC	Belgium	0%	0%	-1%	0%	-1%	0%
DC	Bulgaria	0%	0%	-1%	0%	0%	0%
DC	Croatia	0%	0%	-1%	0%	0%	-1%
DC	Cyprus	0%	0%	0%	0%	0%	0%
DC	Czechia	0%	0%	0%	0%	-1%	-1%
DC	Denmark	0%	0%	0%	0%	-1%	0%
DC	Estonia	0%	0%	-1%	0%	-1%	-1%
DC	Finland	0%	0%	0%	0%	-1%	0%
DC	France	0%	0%	-1%	0%	-1%	0%
DC	Germany	0%	0%	-1%	-1%	0%	0%
DC	Greece	0%	0%	-1%	0%	0%	0%
DC	Hungary	0%	0%	-1%	0%	0%	-1%
DC	Ireland	0%	0%	0%	0%	0%	0%
DC	Italy	0%	0%	-1%	0%	-1%	0%
DC	Latvia	0%	0%	-1%	0%	-1%	-1%
DC	Lithuania	0%	0%	-1%	0%	-1%	0%
DC	Luxembourg	0%	0%	0%	0%	0%	0%
DC	Malta	0%	0%	0%	0%	0%	0%
DC	Poland	0%	0%	-1%	0%	-1%	0%
DC	Portugal	0%	-27%	0%	0%	0%	0%
DC	Romania	0%	0%	-1%	0%	0%	-1%
DC	Serbia	0%	0%	0%	0%	0%	0%
DC	Slovakia	0%	0%	-1%	0%	0%	0%
DC	Slovenia	0%	0%	-1%	0%	-1%	-1%
DC	Spain	0%	0%	0%	0%	-1%	-1%
DC	Sweden	0%	0%	-1%	0%	-1%	0%
DC	Switzerland	0%	0%	-1%	0%	-1%	0%
DC	The Netherlands	0%	0%	0%	0%	-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-978	H2 network (repurposed and new)	ca. 341 Km of repurposed pipelines (existing above-ground objects or locally limited interferences), and 50 km of new H2 pipeline	Minimal environmental impacts expected due to repurposing of pipeline or locally limited interferences. With regard to the new 50 Km H2 pipeline, there is a need to ensure compatibility with some linear infrastructures (such as roads), with hydro-agricultural uses and with areas of some concentration of archaeological heritage.
HYD-N-1156	H2 network (new)	162 Km	The biggest challenge is crossing the Douro River, not only because of existing environmental and social requirements, but also because of the technical constraints that such a crossing implies.
HYD-N-1324	H2 network (new)	86 Km	The pipeline may pass by protected natural areas and land in urban/industrial

Potential impact	Mitigation measures	Related costs included in project CAPEX and OPEX	Additional expected costs
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).	Information not available at this stage	Information not available at this stage

Environmental Impact explained [Promoter]

Information available in the tables above

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]

H2Med

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.

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