

HI WEST 29 (Less-Advanced) H2 Storage Staßfurt, Germany

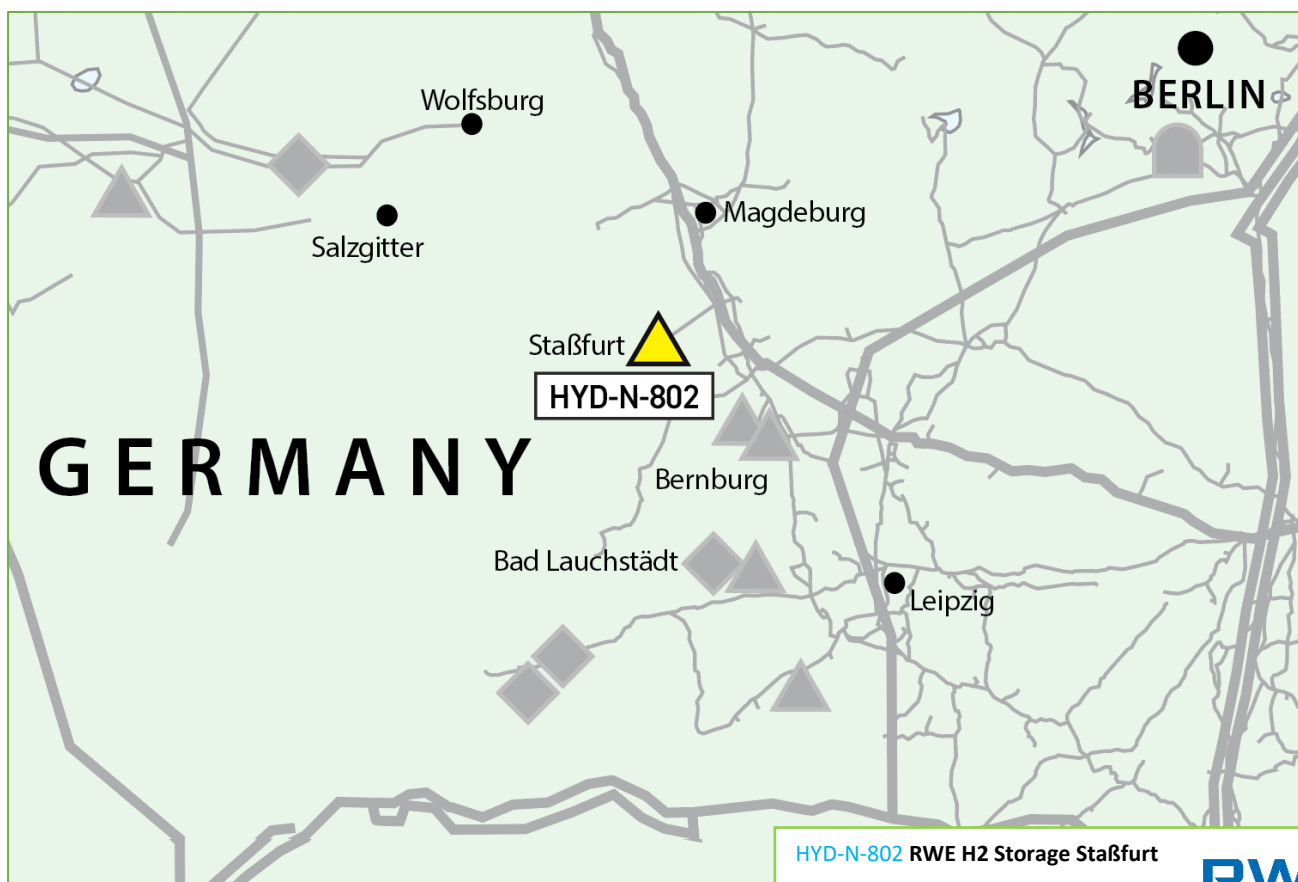


Reasons for grouping [ENTSOG]

The project group is a stand-alone underground storage in Germany. This project will enable storage of hydrogen in Germany from 2031 (HYD-N-802).

Objective of the group [Promoter]

The project deals with the development of a H2 storage including planning, permission, construction, commissioning and operation of H2 storage capacities. The H2 storage will be located at RWE Gas Storage West's existing natural gas cavern storage site Staßfurt in Germany in the Middle German Chemical Triangle. Commercial start is supposed to be in 2030. The connection to a natural gas storage gives the advantage of a step-by-step approach in repurposing caverns and a timely limited parallel operation of the H2 and natural gas storage. The construction of large-scale H2 storage facilities will complete the H2 value chain and H2 infrastructure, supporting the growth of interconnected H2 clusters in Europe and enable market parties to balance and structure the increasing H2 flows matching the needs of the end users. The connection of the H2 storage with the planned H2 grid project called GO! will ensure the connection of the H2 storage with the German and European H2 grid which increases resilience, flexibility and security of the H2 supply.



HYD-N-802 RWE H2 Storage Staßfurt

Comm. Year 2031



A. Project group technical information [Promoter/ ENTSOG]

Project technical information [Promoter]

Storage

TYNDP Project code	Maximum Injection rate [GWh/d]	Maximum Withdrawal rate [GWh/d]	Working gas volume [GWh]	Geometrical Volume [m3]
HYD-N-802	5.4	5.4	209	795,976

Capacity increment [ENTSOG]

TYNDP Project code	Point name	Operator	From system	To system	Capacity increment [GWh/d]	Comm. year
HYD-N-802	H2_ST_DE	RWE Gas Storage West GmbH	Transmission Germany (DE Hydrogen)	Storage Germany (DE Hydrogen)	5.4	2031
HYD-N-802	H2_ST_DE	RWE Gas Storage West GmbH	Storage Germany (DE Hydrogen)	Transmission Germany (DE Hydrogen)	5.4	2031

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-802	340.9	15%	9.8	30%

Description of the cost and range [Promoter]

RWE Gas Storage West GmbH is developing a first H2 storage in Gronau-Epe and has applied for IPCEI funding (Project consortium GET H2 IPCEI — IPCEI funding and FID is pending) with an expected start of the commercial operation as of 01.01.2027. The learnings from this project - including information on costs - will be used for the planned development of the H2 storage in Staßfurt (HI WEST 29 / HYD-N-802). The H2 storage in Staßfurt will co-exist to the natural gas storage until storage of natural gas is phased out.

The planned project in Staßfurt will consist of a sub-surface installation – mainly two salt cavern currently used for storing natural gas that will be rededicated to the usage for H2 — and a newly developed above surface installation consisting of injection and withdrawal facilities and general installation as buildings, metering stations etc.. It is planned to connect this project to the planned pipeline system of ONTRAS (TYD-N-996) which is expected to be connected to the evolving Western H2 clusters via Salzgitter and thereby also to the GET H2 and H2ercules pipeline system.

The following table shows the essential trades of the investments to be made.

Asset group	Details – main installations
General installations (part of the above surface facility)	(1) energy supply (2) control & instrumentation (MSR) (3) civil and noise protection (4) safety installations (5) metering and gas quality assurance for the grid connection to the H ₂ -grid
Injection facilities (part of the above surface facility)	(1) compressors (2) cooling (3) filters

Withdrawal facilities (part of the above surface facility)	<ul style="list-style-type: none"> (1) H₂ purification (2) H₂ dehydration (3) H₂ cooling, pressure and volume control systems
Caverns	<ul style="list-style-type: none"> (1) caverns (2) well completion and well head (3) control instrumentation (4) cushion hydrogen gas (5) temporary equipment for debrining (6) well-services
Pipeline	<ul style="list-style-type: none"> (1) pipeline construction (2) power and control cables

The estimates of the investment costs in this project are based on the findings from the H₂ storage IPCEI project Gronau-Epe (further on IPCEI project), which is scheduled to go commercially operational in 2027. Thereby, some approaches still come from a feasibility study which was carried out in 2019 in combination with an engineering report in 2021. Significant parts, however, come from current, concrete offers from manufacturers and service companies that were received in tenders for the IPCEI project.

Current developments on the procurement markets, supplemented by experience in the construction and operation of large-volume gas storage facilities, lead to the understanding that new construction projects cause unexpected measures that lead to additional investment costs. A range for these unplanned investments is usually 30-40%. Against the background of the findings from the IPCEI project, some risks can already be avoided, so that according to current estimates the range can be halved and therefore the CAPEX range is 15%.

OPEX

No significant findings from the current IPCEI project can be used with regard to operating costs (OPEX), as the IPCEI project will not go into operation until 2027. Therefore, the estimate of OPEX is generally derived from figures relevant to the operation of a natural gas storage facility which is the core business of RWE Gas Storage West over decades. They represent a sufficient approximation to the OPEX for a H₂ storage facility, as it is assumed that the salt caverns for H₂ have comparable requirements. This is especially relevant for the cost items materials and services and H₂ consumption as well as personnel / administrative costs. In contrast, energy costs of operating a H₂ storage facility do show significant variance to a natural gas storage facility. This is due to expected differing cycle patterns for the injection and withdrawal of H₂, which mainly determines the costs mentioned. It is expected that H₂ storage facilities show, unlike natural gas storages, which have to meet seasonal variation in natural gas demand, regular injection and withdraw operations as they are meant to balance and structure fluctuating supply and demand conditions of H₂.

With regard to OPEX, no significant findings from IPCEI can be transferred, so the full range für unplanned measures must be taken into account for OPEX especially against the background of the large share of electricity costs in the OPEX and their developments in the recent past.

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 2022¹.

Distributed Energy

In 2031, the new storage in Germany allows hydrogen to be stored, during low demand period, for climatic stresses or international disruption.

Sustainability benefits

In the reference case, which analyses yearly demand in two periods (average winter and average summer), the project group is not showing CO₂ benefits. It is important to highlight that however not calculated as part of the reference case and supply disruption cases, higher sustainability benefits might stem from stress cases, such as 2-week dunkleflaute as project group will enable transport of green supplies while coping with high variability of RES sources.

Under any supply disruption in 2040, triggered by the higher hydrogen demand project group will increase overall CO₂ emissions by using more SMRs to reduce demand curtailment.

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



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 in 2040, 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 is also not showing security of supply benefits.

> Disruption cases (S-1):

Similarly, under supply disruption cases, the project group is not further contributing to the mitigation of hydrogen demand curtailment risk.

> Single largest capacity disruption (SLCD):

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

² As for the hydrogen system there is no existing infrastructure level available yet, ENTSG 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.

SLCD Benefits - 2030 - Distributed Energy



SLCD Benefits - 2040 - Distributed Energy



SLCD Benefits - 2050 - Distributed Energy

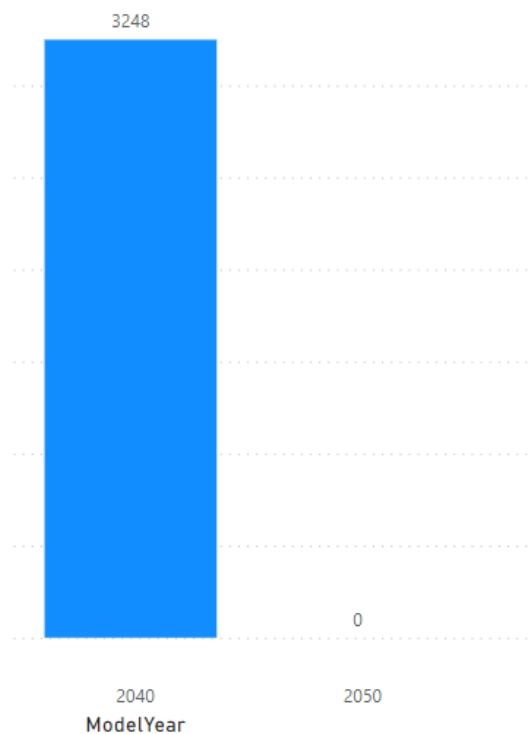


In case of single largest capacity disruption (SLCD), the project group reduces the risk of demand curtailment in almost all European countries from 2040, by 1-2% due to the increase of storage capacity in Europe.

Global Ambition

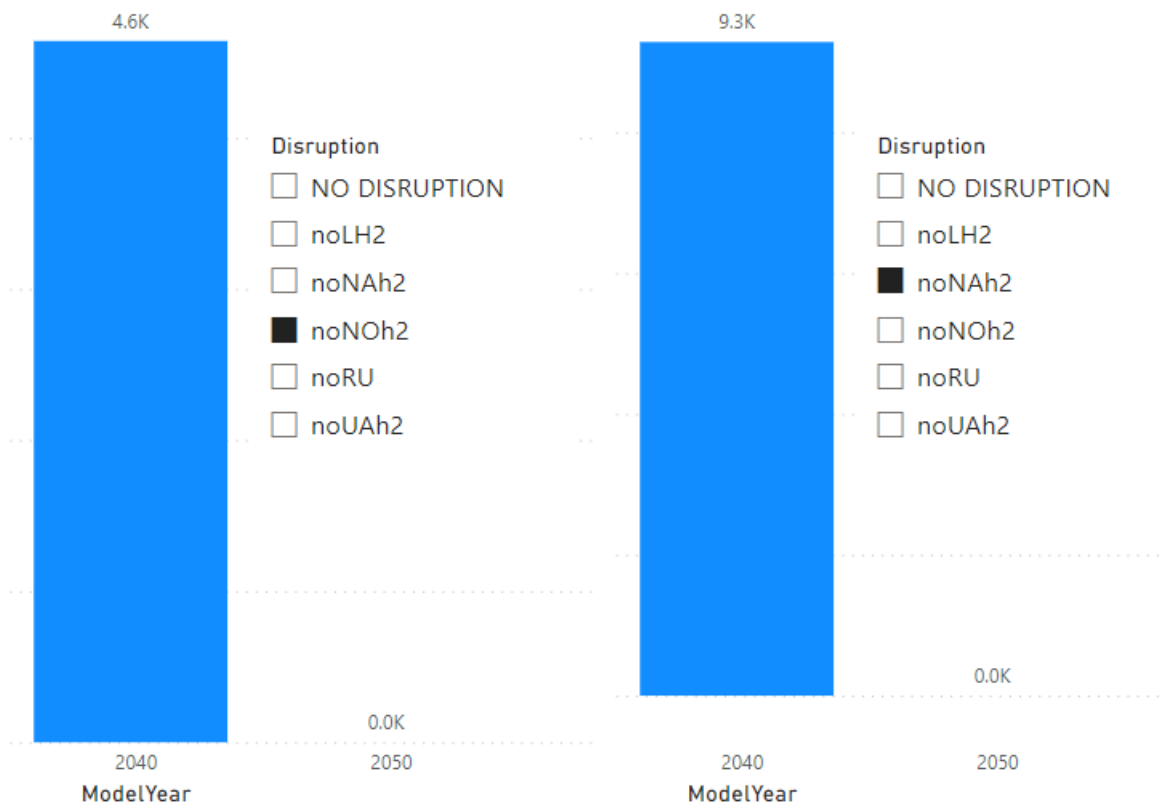
Sustainability benefits

In the reference case, triggered by the higher hydrogen demand project group will increase overall CO₂ emissions by using more SMRs to reduce demand curtailment.



Similar trend is expected under Norway and North Africa supply disruptions.

1 noNOh2 : Norway disruption / 2 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 in 2040, 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 is also not showing security of supply benefits.

> Disruption cases (S-1):

Similarly, under supply disruption cases, the project group is not further contributing to the mitigation of hydrogen demand curtailment risk.

> 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 most countries in 2040, by 1%, due to the increase of storage capacity in Europe by 1%.

C.2 Quantitative benefits [ENTSO-G]

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
NO						
2030	DISRUPTION	DE	tonne	0,00	538677299	538677299
2030	noLH2	DE	tonne	-117,45	540175890,2	540176007,7
2030	noNAh2	DE	tonne	-2,40	539785356,1	539785358,5
2030	noNOh2	DE	tonne	16,01	538877197,8	538877181,8
2030	noUAh2	DE	tonne	0,00	539378771,9	539378771,9
NO						
2030	DISRUPTION	GA	tonne	-5,21	592910448,4	592910453,7
2030	noLH2	GA	tonne	-51,90	594817481,2	594817533,1
2030	noNAh2	GA	tonne	-78,45	594141433,2	594141511,6
2030	noNOh2	GA	tonne	0,00	593310994,3	593310994,3
2030	noUAh2	GA	tonne	0,00	593627617,9	593627617,9
NO						
2040	DISRUPTION	DE	tonne	0,00	392077044	392077044
2040	noLH2	DE	tonne	1392,15	392213883,4	392212491,2
2040	noNAh2	DE	tonne	1392,15	392188097,7	392186705,5
2040	noNOh2	DE	tonne	1392,15	392144022,6	392142630,5
2040	noUAh2	DE	tonne	1392,15	392399182,9	392397790,7
NO						
2040	DISRUPTION	GA	tonne	3248,36	396523251,6	396520003,3
2040	noLH2	GA	tonne	0,00	397455196,7	397455196,7
2040	noNAh2	GA	tonne	9281,02	397301976,6	397292695,6
2040	noNOh2	GA	tonne	4640,51	397450977,1	397446336,6
2040	noUAh2	GA	tonne	0,00	397478498,3	397478498,3
NO						
2050	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
NO						
2050	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

Curtailement Rate (SLCD):

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

Curtailement 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%	0%	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%	-1%
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%	0%	0%	0%	0%
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	0%	0%	0%	0%	0%	0%
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%	-1%	0%	0%
Average2W	Spain	0%	0%	0%	0%	0%	0%
Average2W	Sweden	0%	0%	0%	0%	0%	-1%
Average2W	Switzerland	0%	0%	0%	0%	0%	0%
Average2W	The Netherlands	0%	0%	0%	0%	0%	0%
Average2W	United Kingdom	0%	0%	0%	0%	0%	0%
Average2WDF	Austria	0%	0%	0%	0%	0%	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%	-1%	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%	0%	0%	0%	0%
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	0%	0%	0%	0%	0%	0%
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%	0%	0%
Average2WDF	Spain	0%	0%	0%	0%	0%	0%
Average2WDF	Sweden	0%	0%	0%	0%	0%	0%
Average2WDF	Switzerland	0%	0%	0%	0%	0%	0%
Average2WDF	The Netherlands	0%	0%	0%	0%	0%	0%
Average2WDF	United Kingdom	0%	0%	0%	0%	0%	0%
DC	Austria	0%	0%	0%	0%	0%	0%
DC	Belgium	0%	0%	0%	0%	0%	0%

DC	Bulgaria	0%	0%	0%	0%	0%	0%
DC	Croatia	0%	0%	0%	0%	0%	0%
DC	Cyprus	0%	0%	0%	0%	0%	0%
DC	Czechia	0%	0%	0%	0%	0%	0%
DC	Denmark	0%	0%	0%	0%	0%	0%
DC	Estonia	0%	0%	0%	0%	0%	0%
DC	Finland	0%	0%	0%	0%	0%	0%
DC	France	0%	0%	-1%	0%	0%	0%
DC	Germany	0%	0%	0%	0%	0%	0%
DC	Greece	0%	0%	0%	0%	0%	0%
DC	Hungary	0%	0%	0%	0%	0%	0%
DC	Ireland	0%	0%	0%	0%	0%	0%
DC	Italy	0%	0%	0%	0%	0%	0%
DC	Latvia	0%	0%	0%	0%	0%	0%
DC	Lithuania	0%	0%	0%	0%	0%	0%
DC	Luxembourg	0%	0%	0%	0%	0%	0%
DC	Malta	0%	0%	0%	0%	0%	0%
DC	Poland	0%	0%	0%	0%	0%	0%
DC	Portugal	0%	0%	0%	0%	0%	0%
DC	Romania	0%	0%	0%	0%	0%	0%
DC	Serbia	0%	0%	0%	0%	0%	0%
DC	Slovakia	0%	0%	0%	0%	0%	0%
DC	Slovenia	0%	0%	0%	0%	0%	0%
DC	Spain	0%	0%	0%	0%	0%	0%
DC	Sweden	0%	0%	0%	0%	0%	0%
DC	Switzerland	0%	0%	0%	0%	-1%	0%
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-802	H2 Storage	H2 storage site - no new impact - H2 storage will be installed on an existing natural gas storage site and neighboring areas	Surrounding of the H2 storage plant, further explanations please see below
HYD-N-802	H2 Storage	pipeline routes between H2 storage site and caverns – at the moment it is not expected that sensitive areas are affected	

Potential impact	Mitigation measures	Related costs included in project CAPEX and OPEX	Additional expected costs
HYD-N-802	N/A	N/A	N/A

Environmental Impact explained [Promoter]

The project complies with the principle of 'do no significant harm' (DNSH) within the meaning of Article 17 of Regulation (EU) 2020/852, please find below further explanations:

GHG emissions - Emissions from the planned H2 storage facility are limited to the secondary emissions from the use of electrical energy. The usage of electrical energy is necessary for the systems for injection (compressors with electric drive) and withdrawal (gas-cleaning with electrically-driven heaters and refrigeration-systems).

The plant is specially designed for the minimization of emissions and to the possible use of renewable energies, e.g.:

- Compressors with electric drive and optimized efficiency will be used instead of compressors with combustion drive and standard efficiency
- Heating of the process gas during gas-cleaning is done by the immediate effect of electric heaters instead of combustion heat
- Appearance of tail-gas is avoided due to the use of appropriate techniques; related to that, utilization or dissipation of the tail-gas is not necessary.

Climate change adaptation - An adverse impact on the climate is not to be seen. Contrary to that, the project leads secondary to significant positive impacts on the climate due to structuring of the production and usage of renewable H2.

Negative effects to nature, people and assets are taken into account with the environmental impact study as a part of the permit procedure.

The permission for the operation will only be given, if only minor negative effects are evaluated by external experts.

The sustainable use and protection of water and marine resources – planned project does not involve the use of water

The transition to a circular economy, including waste prevention and recycling - The planned facility only leads to a narrowed amount of hazardous waste which will be incinerated (if not recyclable) or exploited (if recyclable) by accredited disposal contractors and in accordance to the guidelines of circular economy laid down in the national waste regulations.

Pollution prevention and control - direct emissions to the environment are reduced to a minimum level by design of the plant.

Emission of pollutants is prevented, on the one hand, by the renouncement of combustion compressor-drives or heating processes and, on the other hand, by the absence of tail-gas.

Emissions of pollutants are strictly limited to the mandatory requirements for the emergency-handling (e.g. emergency-flare).

The activity complies with Directive 2012/18/EU of the European Parliament and of the Council. The Directive has been implemented in national law which is applicable for the approval process before building and getting the facility into operation and the operational process itself.

protection and restoration of biodiversity and ecosystems - Based on the evolvement of cavern storage since the 1990s at the cavern field Staßfurt, the environmental obligations regarding the implementation and operation of new caverns are high.

The H2 storage will be built on an existing storage site and is subject to an environmental impact assessment under national legislation during the permitting process.

By building the new H2 storage the following aspects have to be handled:

- Minimization of direct emissions due to the plant-operation (see explanations above)
- Prevention of direct H2-emissions related to the normal operation (tail-gas)
- Selection of components, which are as quiet as possible
- Having a sound concept for the whole storage site, not only the H2 storage, but also including the natural gas storage by creating an added value also for the natural gas storage
- Compensative measures for the necessary interventions into the landscape
- Construction of biotopes in the region of the storage site to ensure species development
- Keeping light emissions as small as possible by having a lighting concept – lighting only when necessary and usage of light sources, which are light scattering
- The used cooling medium will only be used in closed loops and is state of the art
- By building the H2 storage on the site of the existing natural gas storage and neighboring areas the interventions into the landscape will be kept as small as possible
- If possible, already existing pipeline routes will be used and will also keep the intervention into the landscape as small as possible.
- Having a concept for the construction works to ensure species protection and keep the measures environmentally compatible.

E. Other benefits [Promoter]

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

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

Description of Other benefits [Promoter]

The H2 storage Staßfurt is designed for the starting European H2 system. A larger investment will generate higher investment costs. If the H2 storage is not used entirely, the total costs have to be borne by a few customers. This would lead to very high specific costs for these few customers and thus generate a barrier for a market entry - since there is no willingness to bear these high "start" specific costs. Depending on the market evolution – which cannot be foreseen yet – a H2 storage expansion will be required. Having the H2 storage close to an existing natural gas storage will offer the opportunity to extend the H2 storage depending on the development of an increasing flexibility demand in the H2 market and the decreasing natural gas demand. The planned size is expected in 2030 to be appropriate to (a) balance H2 in an industrial scale, (b) generate no entry barriers - facility is not oversized - and (c) provide incentives to other potential H2 market parties as they can get access to a balancing possibility which may help them to use green H2.

Comment RWE Gas Storage West – request for explanation – to the benefit analysis (please see C1/Distributed Energy/Sustainability benefits and C1/Global Ambition/Sustainability):

We doubt the results of the sustainability benefits analysis. From our point of view the project group decreases the overall CO2 emissions instead of increasing the emissions. We cannot understand that result as H2 storages are offering the possibility to optimize the generation of renewable hydrogen to avoid CO2 emissions. If the renewable H2 production will be interrupted H2 storages and the delivery of H2 stored in theses H2 storages shall be used to avoid using additional SMRs.

F. Useful links [Promoter]

Useful links:

<https://www.rwe-gasstorage-west.com/en/hydrogen/>

<https://www.ontras.com/en/go>

<https://get-h2-netz.de/leitung-hep-2/>

<https://www.h2ercules.com/en>