BEMIP HYD 1 (Less-Advanced)

Hydrogen Storage in Latvia

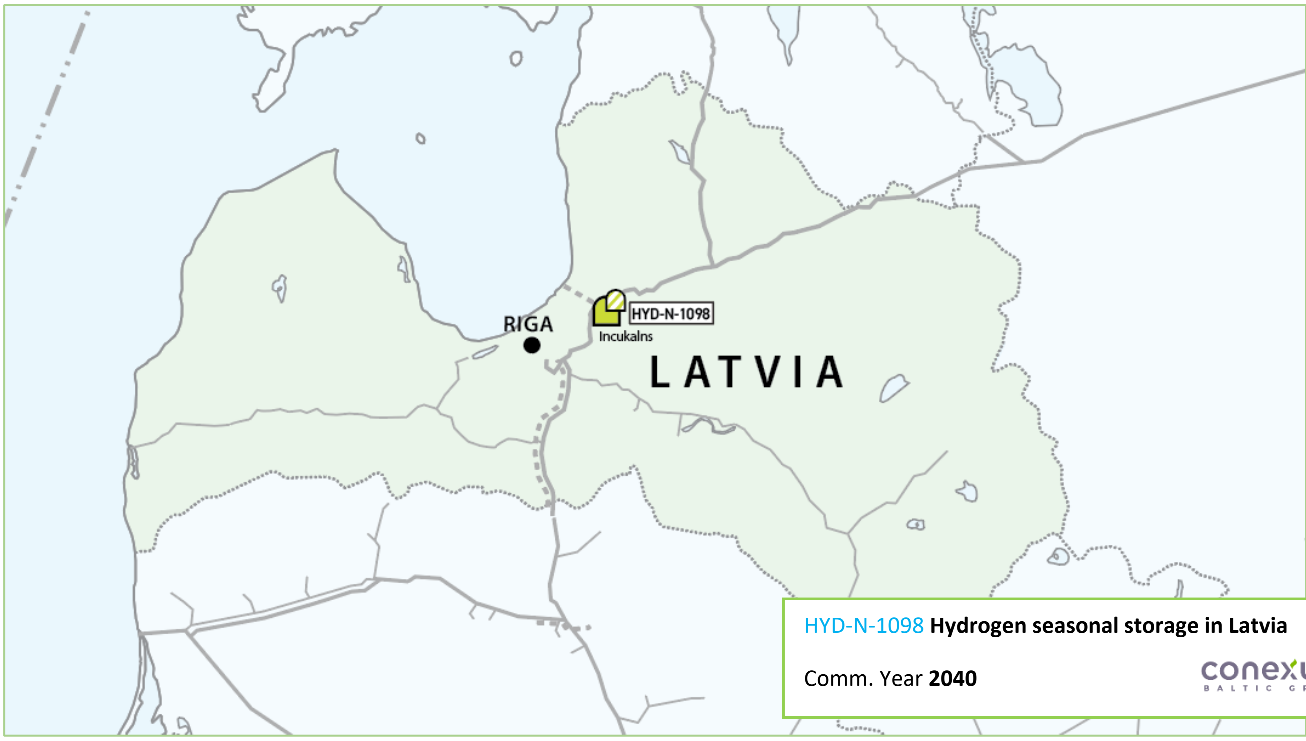
Reasons for grouping [ENTSOG]

The project group is a stand-alone underground storage in Latvia. This project will enable storage of hydrogen in Latvia from 2040 (HYD-N-1098).

Objective of the group [Promoter]

The objective of the project is to serve hydrogen transmission along the Nordic-Baltic Hydrogen Corridor which will transmit hydrogen from Finland to Germany through Estonia, Latvia, Lithuania, and Poland, as well as regional domestic consumption. Operation of the long transmission routes of gas (hydrogen) without storages are insufficient and not stable.

After Nordic-Baltic Hydrogen Corridor will be implemented there will be an increased need for hydrogen gas storage to ensure regional gas supply stability, to provide a balance between demand and supply of the Renewable energy and to serve a strategic reserve in the event of supply disruptions.



HYD-N-1098 **Hydrogen seasonal storage in Latvia**

Comm. Year **2040**

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-1098	9	15	1000	300 Mio

Capacity increment [ENTSOG]

TYNDP Project code	Point name	Operator	From system	To system	Capacity increment [GWh/d]	Comm. year
HYD-N-1098	H2_ST_LV	Conexus Baltic Grid	Transmission Latvia (LV Hydrogen)	Storage Latvia (LV Hydrogen)	9	2040
HYD-N-1098	H2_ST_LV	Conexus Baltic Grid	Storage Latvia (LV Hydrogen)	Transmission Latvia (LV Hydrogen)	15	2040

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-1098	300	30%	20	30%

Description of the cost and range [Promoter]

The total costs compose of the following foreseen project components:

- Geological investigation of suitability of underground reservoirs for hydrogen storing on base of Inčukalns UGS
- Investigations of integrity of Inčukalns UGS reservoir in hydrogen environment (reservoir, wells, cushion gas)
- Investment calculations to re-switch Inčukalns UGS to hydrogen & calculation for another new reservoir
- Construction process of the underground hydrogen storage in Latvia in most suitable place (including necessary geological surveys for new reservoir)

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

In 2040, the new storage in Latvia allows hydrogen to be stored, during low demand period, for climatic stresses or international disruption.

Sustainability

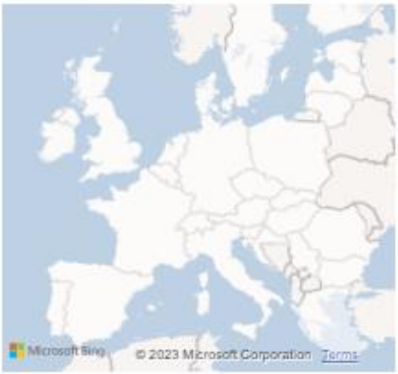
The project group, will increase flexibility of hydrogen supplies, allowing for the replacement of blue hydrogen supplies, with green hydrogen supplies.

[1] https://www.entsog.eu/sites/default/files/202304/ENTSOG_TYNDP_2022_Annex_D_Methodology_230411.pdf

Security of Supply:[2]

> Reference case

2040 DE- Benefits



2050 DE- Benefits

In the reference case, the project is not contributing to further mitigation of hydrogen demand curtailment risk in average summer and average winter.

> 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 rest.

> Single largest capacity disruption (SLCD):

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

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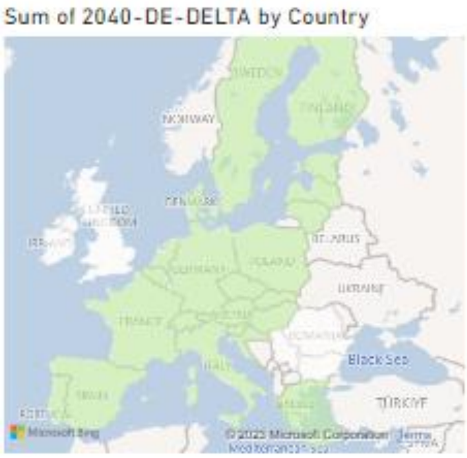
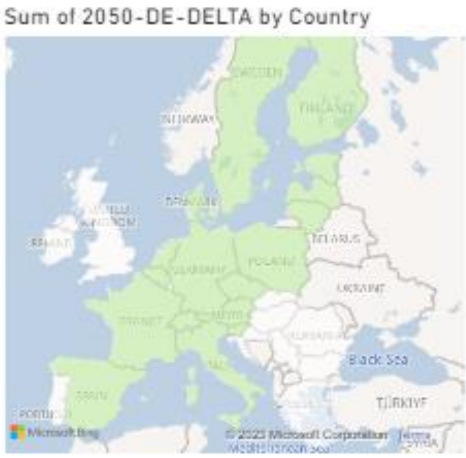
[2] *As for the hydrogen system there is no existing infrastructure level available yet, ENTSOG has identified a possible hydrogen network according to the information provided by promoters in their project submission for the TYNDP/PCI process (i.e., H2 Infrastructure level). Therefore, the System Assessment 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.*





In case of single largest capacity disruption (SLCD), the storage reduces a little (1-2%) the risk of demand curtailment in all European countries from 2040.

Global Ambition

Sustainability

The project group, will increase flexibility of hydrogen supplies, allowing for the replacement of blue hydrogen supplies, with green hydrogen supplies.

Security of supply benefits

> Reference case

In the reference case, the storage is not contributing to further mitigation of hydrogen demand curtailment risk in average summer and average winter.

> 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.

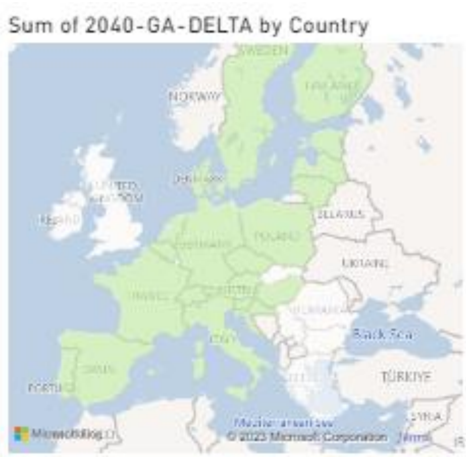
> Disruption cases (S-1)

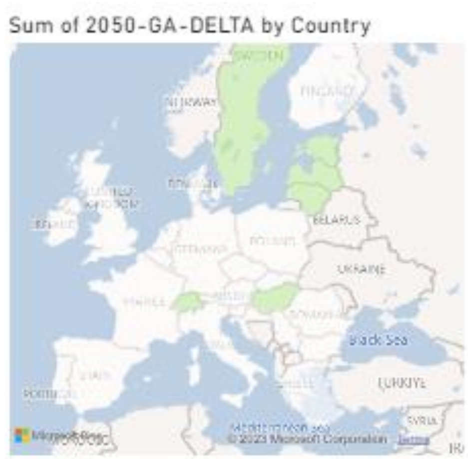
Similar to reference case and climatic stress cases the project is not further mitigating the demand curtailment risk in case of disruption cases.

> Single largest capacity disruption (SLCD)

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

In case of single largest capacity disruption (SLCD), the storage reduces a little (1-2%) the risk of demand curtailment in all European countries in 2040.





C.2 Quantitative benefits [ENTSOG]

The following tables display all the benefits quantified by ENTSOG through specific security of supply and sustainability indicators.

CO2 Emissions:

ModelYear	Disruption	Scenario	Unit	Emissions-DELTA	Emissions-PLUS	Emissions-MINUS
2030	NO 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
2030	NO 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
2040	NO DISRUPTION	DE	tonne	0,00	392077044	392077044
2040	noLH2	DE	tonne	3730,17	392213883,4	392210153,2
2040	noNAh2	DE	tonne	4670,53	392188097,7	392183427,2
2040	noNOh2	DE	tonne	3730,17	392144022,6	392140292,4
2040	noUAh2	DE	tonne	4670,53	392399182,9	392394512,4
2040	NO DISRUPTION	GA	tonne	15542,37	396523251,6	396507709,2
2040	noLH2	GA	tonne	0,00	397455196,7	397455196,7
2040	noNAh2	GA	tonne	18584,24	397301976,6	397283392,4
2040	noNOh2	GA	tonne	6098,62	397450977,1	397444878,5
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
Belgium	0	0	-2%	-1%	-1%	0%
Czechia	0	0	-2%	-2%	-2%	-1%
Estonia	0	0	-2%	-1%	-2%	-2%
Finland	0	0	-2%	-1%	-2%	-1%
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%
The Netherlands	0	0	-2%	-1%	-2%	0%
France	0	0	-2%	-1%	-1%	-1%
Austria	0	0	-2%	-1%	-2%	0%
Croatia	0	0	-1%	-1%	0%	0%
Denmark	0	0	-1%	-1%	-1%	0%
Greece	0	0	-1%	0%	0%	0%
Hungary	0	0	-1%	-1%	0%	-1%
Italy	0	0	-1%	-1%	-2%	0%
Slovakia	0	0	-1%	0%	0%	-1%
Spain	0	0	-1%	-1%	-2%	0%
Romania	0	0	-1%	0%	0%	0%
Bulgaria	0	0	-1%	0%	0%	0%

Curtailment Rate (Climatic Stress):

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

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

Average2WDF	United Kingdom	0%	0%	0%	0%
DC	Austria	0%	0%	0%	0%
DC	Belgium	0%	0%	0%	0%
DC	Bulgaria	-1%	0%	0%	0%
DC	Croatia	0%	0%	0%	0%
DC	Cyprus	0%	0%	0%	0%
DC	Czechia	0%	0%	0%	0%
DC	Denmark	0%	0%	0%	0%
DC	Estonia	0%	0%	0%	0%
DC	Finland	0%	0%	0%	0%
DC	France	-1%	0%	0%	0%
DC	Germany	0%	0%	0%	0%
DC	Greece	-1%	0%	0%	0%
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DC	Slovakia	0%	0%	0%	0%
DC	Slovenia	-1%	0%	0%	0%
DC	Spain	0%	0%	0%	0%
DC	Sweden	0%	0%	0%	0%
DC	Switzerland	0%	0%	-1%	0%
DC	The Netherlands	0%	0%	0%	0%
DC	United Kingdom	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-1098	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]

According to geological investigations conducted in the territory of Latvia, Ordovician era reservoirs that are planned to be used for hydrogen storage, are found to be covered with at least three impermeable geological layers. These layers provide a secure barrier to prevent any interaction or contamination between the hydrogen storage and the drinkable water-bearing layer, ensuring the safety of the water resources.

The status of the project is at the beginning of pre-feasibility phase. Environmental impact assessment for the project has not started as all necessary investigations (geological, geophysical, and other) at this stage of the project are foreseen on the base of the running existing aquifer underground natural gas storage in Latvia – Inčukalns UGS.

The preparation of Environmental Impact documents will be carried out in accordance with the applicable Environmental Law of Latvia, adopted in accordance with EU legislation.

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]

Regarding sustainability, the project will enable the use and storage of pure hydrogen, which is a clean energy source with potential to reduce greenhouse gas emissions.

The project will contribute to the decarbonization of transportation, heating, and industrial sectors, thereby mitigating the impacts of climate change.

The project contributes to the connection of hydrogen markets in the BEMIP region, allowing for the ramp-up of domestic hydrogen markets based on the supply potential generated by Baltic countries.

The project will increase security of supply and flexibility through gas (hydrogen) supply stability, diversification of gas supply sources and will offer energy security independence.

The produced hydrogen can be stored in the UGS to provide necessary flexibility and security of the market participants, especially during peak demand.

F. Useful links [Promoter]

Useful links: www.conexus.lv