CZECHIA

Opportunities for **Hydrogen Energy Technologies** Considering the National Energy & Climate Plans

2

Contract details
Fuel Cells and Hydrogen 2 Joint Undertaking (FCH 2 JU)
Study on Opportunities arising from the inclusion of Hydrogen
Energy Technologies in the National Energy & Climate Plans
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Introduction

The **Fuel Cells and Hydrogen Joint Undertaking** (FCH JU), in close cooperation with the **European Commission - DG Energy**, has commissioned a study on the "Role of Hydrogen in the National Energy and Climate Plans". This study is being conducted by the consultancies **Trinomics and LBST**.

This fiche represents one of the outputs of the study; it comprises two major parts:

- Analysis of **national opportunities for hydrogen deployment**, based on the national hydrogen production and demand potential, the gas infrastructure and the enabling environment. In this context, the role of hydrogen in the current National Energy and Climate Plan is in particular analysed.
- Assessment of **national economic, environmental and technical impacts of hydrogen deployment** under a high and a low scenario.

This information is expected to provide useful information to EU Member States that are considering to include renewable or low-carbon hydrogen deployment in their decarbonisation policies or roadmaps.

CZECHIA

Main results and impacts of hydrogen deployment in Czechia by 2030 in the two scenarios modelled in the present study

Onshore Wind
280 - 1 140 MW
600 - 2 400 GWh/a

Electrolysers
140 - 560 MW
440 - 1 790 GWh_{H2}/a

Solar Photovoltaic
130 - 520 MW
100 - 410 GWh/a

POWER
0.3 - 3 GWh/a

TRANSPORT
237 - 675 GWh/a

BUILDINGS
28 - 280 GWh/a

INDUSTRY
176 - 829 GWh/a

280 - 980
Buses

5 - 21
Trains

62 - 123
Refuelling Stations

3 520 - 7 040
Trucks

29 600 - 59 200
Cars

10 - 99 GWh/a
into Synthetic Fuels

130 - 1 300 MWh_{H2}/a
Electricity Produced

1 290 - 5 610
Micro-CHP units
in buildings

1 - 10
Commercial-scale
CHP installations

0 - 50 kt/a
of Steel

0 - 5.1 kt/a
of Aromatics

160 - 300 GWh_{H2}/a
in Refineries

0 - 6 kt/a
of Olefins

0 - 9.3 kt_N/a
of Ammonia

77 - 290
m EUR/a

Value Added
in the domestic economy

Value Added as Share of Annual Costs

New Jobs
540 - 1 330

Emissions avoided
0.2 - 0.6 Mt CO_2/a

EXECUTIVE SUMMARY

Czechia's commitment for hydrogen deployment according to its NECP

According to its NECP, the Czech Republic considers using hydrogen for decarbonising its transport sector mainly, replacing partially fossil fuels by renewable hydrogen. New regulatory and incentive measures are announced in the hydrogen infrastructure and transport sector addressing the entire hydrogen value chain covering generation, storage, distribution and end use.

Hydrogen will support the integration of higher volumes of variable renewable electricity in the system, enhance system flexibility, and increase security of supply.

The NECP recalls the National Action Plan on Clean Mobility which is currently being updated. The new target would be to install 80 Hydrogen Refuelling Stations and to operate 40.000 to 50.000 fuel cell cars and 870 fuel cell buses by 2030.

Czechia has a positive environment to address the deployment of renewable hydrogen in the transport sector, given the existing activity of several national organizations and companies in the field (through the Technology Platform[1]), its National Action Plan for Clean Mobility integrating hydrogen as an alternative fuel, its commitment to deploy hydrogen refuelling stations, its involvement in the Green Hydrogen @ Blue Danube[2], the Black Horse[3], and the H2Go[4] IPCEI potential projects, Czechia was not involved in the HyLaw[5] project, and could possibly use the same approach and carry out a similar assessment to identify its own national barriers to the deployment of hydrogen.

The scenario assessment shows substantial potential benefits of hydrogen deployment in Czechia by 2030

Hydrogen demand

Two (high and low) scenarios of hydrogen demand in 2020-2030 were developed, based on different levels of ambition linked to the national context. The resulting values are summarised in the scheme in the previous page. For Czechia, a significant development of hydrogen demand is assumed in the considered scenarios in **transport**, especially for passenger cars, buses and trucks, and to a more limited extent in aviation (through hydrogen-based liquid fuels or PtL) and inland navigation[6]. The development of hydrogen demand is also assumed in the scenarios in industry, especially in refining. Some industries use fossil-based hydrogen as feedstock or reducing agent, which could be replaced by renewable hydrogen. Switching high temperature heat processes fuels to renewable hydrogen could represent another important potential use in the considered scenarios.

In the **building** sector, hydrogen can replace part of the current use of natural gas and can be distributed via existing gas grids through admixture to natural gas. The building sector is expected to have in the Low scenario a limited demand of hydrogen by 2030 but would have a stronger demand in the High scenario.

The scenarios assume only a marginal use of hydrogen for electricity generation by 2030, mainly in combined heat and power installations.

Hydrogen production

To cover the estimated hydrogen demand from new uses and from substitution of fossil-based hydrogen, 0.4 to 1.7 GW of dedicated renewable electricity capacity would have to be installed to produce green hydrogen via electrolysis. While "surplus" electricity might be available in times of high renewable electricity production, the main share will have to be covered by dedicated sources. In the two scenarios, part of the 2030 hydrogen demand would still be covered by fossil-based hydrogen produced via steam-methane reforming of fossil fuels.

In its NECP, Czechia estimates an installed capacity in 2030 of 1 GW in wind and 4 GW in solar PV, generating about 6 TWh of variable renewable electricity in 2030. The technical potential for renewable electricity production in Czechia seems however significantly higher[7]. Building additional renewable electricity capacity dedicated for hydrogen production thus could be a feasible scenario.

Estimated socio-economic and environmental impacts

The annual costs to produce green hydrogen (including the cost of dedicated renewable electricity sources), to develop the transport infrastructure (or adapt the existing one) and end-user applications would in the considered scenarios reach respectively 100 and 340 million EUR. These activities will generate value added in the domestic economy, amongst others by creating jobs in manufacturing, construction and operation of hydrogen technologies and will contribute to greenhouse gas emission reductions. This is in particular important in hard-to-decarbonize industries. According to the European EUCO3232.5 scenario[8], the Czech GHG emissions should be reduced by 26 Mt CO_2 in 2030, compared to 2015. In the scenarios considered, the deployment of hydrogen could contribute 0.2 – 0.6 Mt CO_2 to this goal, which is equivalent to 0.7% - 2.3% of the required emission reduction.

[1] *https://www.hytep.cz/cs/*
[2] *https://static1.squarespace.com/static/5d3f0387728026000121b2a2/t/5d9b5e81e73c03421d1dd837/1570463369453/Green+HH2+Blue+Danube+poster_print.pdf*
[3] *https://static1.squarespace.com/static/5d3f0387728026000121b2a2/t/5d9b5b85f5229f74dc24608b/1570462602872/Black+Horse+poster_print.pdf*
[4] *https://static1.squarespace.com/static/5d3f0387728026000121b2a2/t/5d9b82e03ef63205cf33e4a4/1570472681940/H2Go.pdf*
[5] *https://www.hylaw.eu/*
[6] *Detailed assumptions are available in the methodology annex of the report, that can be consulted via the following link : http://trinomics.eu/project/opportunities-for-hydrogen-in-necps.*
[7] *The technical potential for renewable electricity production is based on the study commissioned by DG ENER Impact of the use of the biomethane and hydrogen potential on trans-European infrastructure (Trinomics, LBST, E3M; 2019).*
[8] *EC, 2019. Technical Note on Results of the EUCO3232.5 scenario on Member States. Available at https://ec.europa.eu/energy/sites/ener/files/technical_note_on_the_euco3232_final_14062019.pdf*

HYDROGEN IN THE NECP OF CZECHIA

The Czech NECP mentions hydrogen, together with other renewable gases, as a potential solution in several areas. An important role for hydrogen is foreseen in the future gas supply, in particular to decarbonise the heating sector. Hydrogen is also considered as one of the possible ways to decrease the energy import dependency of Czechia. According to the NECP, hydrogen production and storage could also play a role as electricity system flexibility provider.

Even though the different hydrogen applications are mentioned quite often in the NECP, their effective implementation is considered only as a future possibility, and it is acknowledged that it would require additional financial and also regulatory support (for example by enabling a higher share of hydrogen in gas infrastructure). Although such support for hydrogen production and use is explicitly mentioned as one of the main goals in the gas sector (p.56), concrete measures or objectives are not mentioned in the NECP.

Hydrogen technologies are however mentioned in the list of priority research areas in the Dimension Research, innovation and competitiveness. Hydrogen technologies are part of the areas “Renewable (alternative) energy sources” and “Transport systems”.

In the Czech NECP, the priority for hydrogen deployment is given to the transport sector. Hydrogen is considered as the long-term solution to decarbonising transport, especially road freight and also passenger cars. There are already targets for passenger cars, buses and hydrogen refuelling stations in the existing National Action Plan for Clean Mobility. An update of this document is currently in progress and according to the NECP, the new goal for 2030 will be 40 000 – 50 000 fuel cell electric vehicles, 870 buses and 80 refuelling stations.

Some concrete measures for supporting the development of hydrogen applications in transport are already being deployed: all vehicles with emission factors lower than 50 g CO_2/km are exempted from registration fees and highway tolls since the beginning of 2020.

OPPORTUNITY ASSESSMENT

Hydrogen production potential & its role in energy system flexibility

The technical potential for variable renewable electricity generation in Czechia is more than twice as high as the estimated electricity consumption in 2030, which constitutes an opportunity for hydrogen production via electrolysers using renewable electricity. According to the NECP, Czechia would by 2030 only use 4% of its technical potential in renewable electricity generation, so there is a great margin for building up these dedicated renewable electricity sources.

The existence of nuclear power generation capacity in Czechia may represent a specific opportunity for deploying hydrogen; as the variable cost of nuclear power plants is very low, they could be used at full load while converting 'excessive' output into hydrogen. This approach would also enhance the load factor of power-to-hydrogen installations, and improve their economic feasibility.

With other flexibility opportunities for the electricity system being currently available (mainly interconnections with neighbouring countries), there are in the time horizon of up to 2030, according to the assessment, limited opportunities to develop power-to-hydrogen plants specifically as a large-scale flexibility provider. Especially since the planned level of variable renewable electricity sources in 2030 seems to be rather low, when compared to expected average load.

Technical variable renewable electricity potential (TWh/yr)	Technical renewable electricity generation potential compared to forecasted gross electricity consumption in 2030 (NECP)	NECP estimate of variable renewable electricity production in 2030 (TWh/yr)	NECP estimate of variable renewable electricity production in 2030 compared to its technical potential	Ratio between variable power generation capacity in 2030 and average load	Readiness for CO_2 storage
				based on NECP	
142	229%	5.98	4%	66%	Low

Czechia has limited readiness for wide-scale deployment of CCS. Although it has potentially suitable sites for CO_2 storage, there is only limited indication of progress towards reusing captured CO_2 in industrial processes and/or utilizing the potential storage capacities.

Energy infrastructure

Czechia could consider using its existing natural gas infrastructure for hydrogen transport and distribution. As the share of polyethylene in its distribution network is relatively high, it could be converted to hydrogen at a relatively low cost. However, conversion of the networks to dedicated hydrogen pipelines would not be needed before 2030, as the hydrogen production volumes are in the short and medium term expected to be relatively low and could hence be blended with methane in the existing grid, without the need for physical adjustments to the network or end-use appliances. In the longer term, (part of) the methane transport and distribution pipelines could be converted into a dedicated hydrogen network, and end-user appliances could at that moment also be adapted.

Technical and economic feasibility of converting gas distribution networks to hydrogen (share of polyethylene pipelines in distribution grid)	Natural gas demand in residential and services sectors / length of gas distribution network (GWh/km)	Existing salt cavern natural gas storage sites (TWh)	Suitable geological formations (potential for future hydrogen storage)
57%	0.6	0	NO
MS range 16%-99%			

There are no salt cavern natural gas storage sites in Czechia which could be used for hydrogen storage, nor suitable underground salt layers that could provide seasonal storage opportunities for hydrogen.

Current and potential gas & hydrogen demand

In Czechia there are opportunities for the use of hydrogen across different end-use sectors. In industry, decarbonised hydrogen can be used in the short term to reduce GHG emissions in industrial enterprises that currently use fossil fuel-based hydrogen. On the longer term, it can also be deployed to decarbonise high-temperature heat processes that are now based on fossil fuels. In the built environment, hydrogen can be one of the solutions to replace existing natural gas use for the provision of heating and cooling. Lastly, there is significant potential in Czechia for the use of hydrogen in the transport sector, especially for the decarbonisation of (heavy-duty) road transport and fossil fuel-based rail transport.

Opportunities for hydrogen demand in industry

There is a significant potential for hydrogen use in industry in Czechia. The country hosts several industrial enterprises that utilise fossil fuel-based hydrogen, namely ammonia plants and refineries. Furthermore, natural gas is currently an important fuel in the country's industry, accounting for 32% of the final energy mix. Replacing fossil fuel-based hydrogen and natural gas by renewable or low-carbon hydrogen, could be an adequate option in the decarbonisation of this part of the industrial energy demand. In Czechia's industry a relatively large share of the energy is used to produce high-temperature process heat and hydrogen is one of the solutions that can be deployed to decarbonise this part of the energy demand. Lastly, Czechia accounts for 5% of the primary steel production in the EU and a switch from the existing coal-based production process to hydrogen-based steel making can drastically reduce the GHG emissions from this sector.

	Presence of ammonia industry / share of ammonia production capacity in EU28 total	Presence of refineries / Share of Czech refineries in total captive hydrogen production by refineries in the EU28	Share of Czechia in total primary steel production in the EU28	Share of natural gas in industrial energy demand (2017)	Share of high-temperature (>200°C) process heat in industrial energy demand (2015)
Czechia	2%	2.7%	5%	32%	43%
EU	MS range 0%-16%	MS range 0%-26%	MS range 0%-30%	Average 32% MS range 0%-43%	Average 38% MS range 9%-60%

Opportunities for hydrogen demand for heating and cooling in the built environment

In the built environment of Czechia, natural gas accounts for 31% of the final energy demand. By gradually replacing natural gas, hydrogen could play a substantial role in the decarbonisation of heating and cooling in Czechia.

	Share of natural gas in the household and service sector energy demand (2017)	Share of heating in the household and service sector energy demand (2015)	Share of cooling in the household and service sector energy demand (2015)
Czechia	31%	72%	1%
EU	Average 34% MS range: 0% - 60%	Average 74% MS range: 41% - 82%	Average 3% MS range: 0% - 46%

Opportunities for hydrogen demand in transport

Like most EU countries, Czechia has a strong opportunity for the use of hydrogen in road transport, in particular for cars used for long distances, buses and trucks. It should be noted that Czechia is a transit country, meaning that a large segment of this road transport is passing through. Therefore, initiatives supporting the use of hydrogen for long distance transport should be prepared in coordination with neighbouring countries. Additionally, the country's rail sector is still dependent on fossil fuels for 38% of its energy use. Hydrogen could be one of the solutions to decarbonise this sub-sector, by replacing the existing diesel trains. On the medium to long run, hydrogen and derived fuels can also be deployed to decarbonise the aviation sector.

	Share of heavy transport (trucks, buses & vans) in total energy demand in road transport in 2020	Share of fossil fuels in energy use of rail transport (and absolute consumption) in 2017	Share of inland shipping in overall energy demand for transport in 2017	Energy use by international shipping relative to total (domestic) final energy use in transport in 2017	Share of domestic and international aviation in overall energy demand for transport (incl. energy use int. aviation) in 2017	Share of fossil fuels in energy use of road transport in 2017
Czechia	42% (27 877 GWh)	37% (966 GWh)	0.1% (48 GWh)	0.0% (0 GWh)	6% (4 173 GWh)	95% (69 809 GWh)
EU	Average 32% MS range 18%-48%	Average 30% MS range 0%-95%	Average 2% MS range 0%-9.8%	Average 14% MS range 0%-1011%	Average 14% MS range 1%-25%	Average 95% MS range 79%-100%

Enabling environment: national hydrogen policies and plans, projects and industry

Czechia has started to elaborate an enabling framework for the deployment of hydrogen, mainly focusing on the transport sector. It intends to deploy infrastructures for alternative fuels, including hydrogen and to set up the required measures to incentivise the use of fuel cell vehicles.

However, it would be appropriate to go one step further and to mainstream hydrogen across all sectors where it can offer added value. In the meantime, continued support for dedicated hydrogen related research and implementing pilot and demonstration projects would be appropriate measures.

Existence of (or concrete plans for) national hydrogen roadmaps or strategies — Positive environment ✓

The use of hydrogen in fuel cells and the development of refuelling stations for hydrogen fuelled vehicles have been included as a priority area of research, development and innovation in Czechia's NECP. Czechia intends to support the deployment of publicly accessible hydrogen refuelling stations and has set specific targets for hydrogen refuelling stations, cars & buses by 2030.

Czechia has declared its intention to include hydrogen in its national policy framework. A broad approach would be appropriate addressing all sectors, namely the industry (use of hydrogen as energy vector and as feedstock), buildings, energy and transport sub-sectors (next to the road sector, also the maritime, aviation & rail sectors).

Czechia has not yet developed an overarching hydrogen roadmap. Such a comprehensive roadmap would support the country in mainstreaming hydrogen within the whole energy system. The Hydrogen Technology Platform could provide support in structuring such roadmap, in close collaboration with the neighbouring countries.

GHG mitigation gap in non-ETS sectors (need for additional GHG reduction measures) — Positive environment

In March 2017, the Czech government adopted the climate protection policy for the Czech Republic, which is the long-term strategy for the transition to a low-carbon economy and the contribution of the Czech Republic to the achievement of the objectives of the Paris Agreement.

It defines key objectives and climate actions and contributions at national level to reduce its overall greenhouse gas emissions (all sectors included) by 2030.

The Czech Republic is expected to meet the non-ETS GHG reduction target (-13%) and probably to overachieve it with the planned policies and measures. From this perspective, the interest to implement new measures based on the further deployment of hydrogen would remain limited.

Existence of (active) hydrogen national association — Positive environment ✓

Current and planned hydrogen refuelling infrastructure for the transport sector

Alternative fuels infrastructure directive (2014/94/EU)

Czechia's National Policy Framework (or NPF set in the context of the alternative fuel infrastructure directive (2014/94/EU)) establishes targets for hydrogen refuelling stations. The Czech NPF contains a comprehensive list of measures which would help to overcome the barriers for building and operating refuelling stations.

Inclusion of hydrogen in national plans for the deployment of alternative fuels infrastructure (2014/94/EU)	Existence of hydrogen refuelling stations (2019)	which is equivalent to 1 refuelling station per … cars	
YES	1	5 538 222	
	Total 156	Average 1 677 543	

Existence of (investment on) hydrogen-related projects

There are currently no hydrogen-related industrial projects in Czechia

Existing R&D and pilot projects directly related to hydrogen	RD&D annual expenditure on hydrogen & fuel cells (m EUR) (average 2013-2017)	Activities and projects in industry to use hydrogen as feedstock	Number of power-to-gas projects (existing and planned)	
Yes	0.9	No	0	

Existence of national tax incentives (CO_2 pricing mechanisms & car taxation)

Positive environment

✖

Czechia has currently no CO_2 pricing mechanism.
Czechia has however introduced a carbon related taxation for vehicles, which constitutes a key incentive to shift progressively to the use of low carbon vehicles (including on hydrogen): FCEV and other vehicles with an emission factor lower than 50 g CO_2/km are exempted from registration fees and highway tolls since the beginning of 2020.

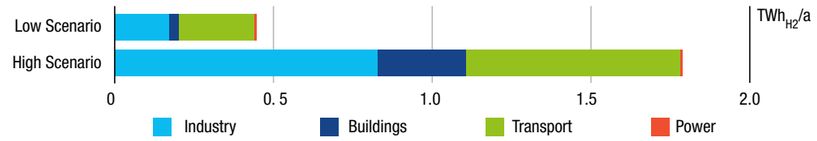
Fossil energy import bill

Like many EU Member States, Czechia is highly dependent on imports for its natural gas as well as its oil consumption. Switching from fossil fuel to nationally produced hydrogen for industrial processes and heating applications and promoting the use of hydrogen in the transport sector would contribute to reducing the energy import dependence and bill.

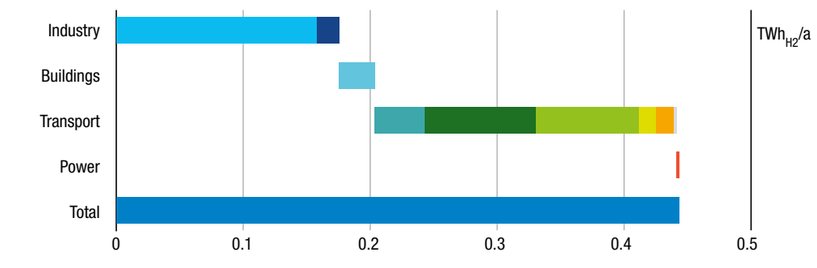
Import bill for natural gas as share of national Gross Value Added	Import bill for all fossil fuels
1.0%	**2.9%**
Average: **0.6%** MS range: 0% - 1.5%	Average: **2%** MS range: 0% - 7%

SCENARIO ASSESSMENT
Estimated renewable/low carbon hydrogen demand for Czechia by 2030

Hydrogen demand in the year 2030 has been estimated in a low and a high scenario covering the range of uncertainty. Today, conventional hydrogen mainly used in industry is produced from fossil fuels (e.g. through steam methane reforming) or is a by-product from other chemical processes. Both scenarios assume that in 2030 renewable hydrogen will be provided to partially substitute current conventional production and to cover additional demand (e.g. from transport sector).

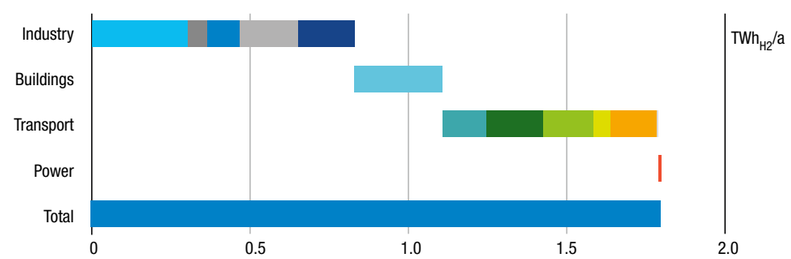


Low scenario

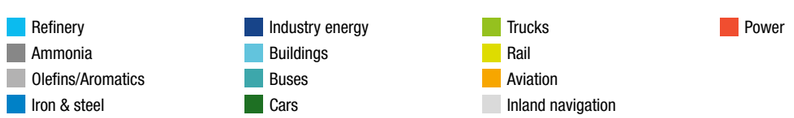


In the low scenario, renewable hydrogen accounts for 0.2% of final total energy demand (i.e. 0.4 out of 257 TWh/a) or 0.8% of final gas demand (56 TWh/a) according to EUCO3232.5.

High scenario



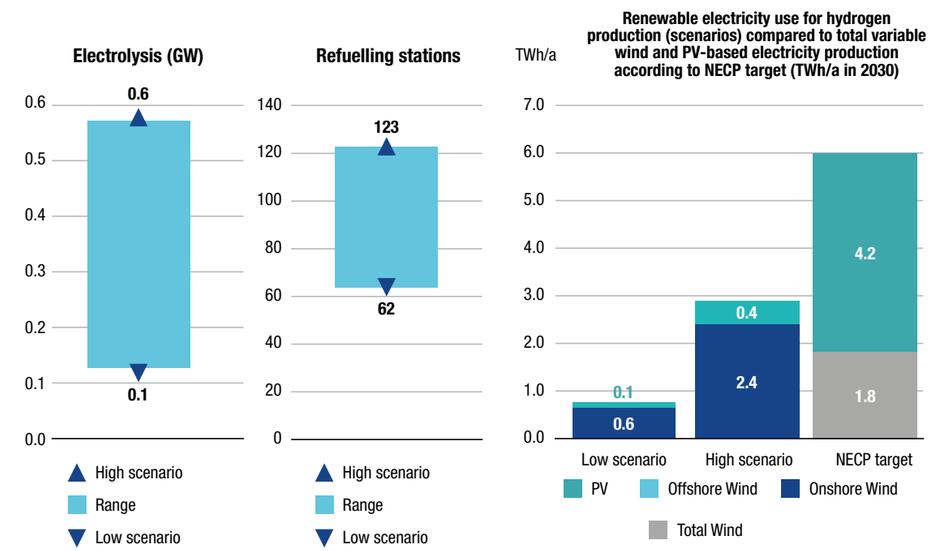
In the high scenario, renewable hydrogen accounts for 0.7% of final total energy demand (i.e. 1.8 out of 257 TWh/a) or 3.2% of final gas demand (56 TWh/a) according to EUCO3232.5.



Hydrogen generation, infrastructure and end users in Czechia by 2030

The analysis of renewable hydrogen generation, infrastructure and end use is based on the demand estimates presented above. Renewable hydrogen is generated from variable renewable power using electrolysis. The analysis covers only national hydrogen production to satisfy domestic demand and does not take into account any cross-border trade of hydrogen (i.e. hydrogen imports and exports are not included in this analysis).

Renewable hydrogen generation and infrastructure



The required renewable power production accounts for 0.5% of the overall technical renewable power potential in the low scenario and for 2.1% in the high scenario.

End users

End user	Unit	Low scenario	High scenario
Passenger cars	Nº	29 600	59 200
Buses	Nº	280	980
Lorries	Nº	3 500	7 000
Heavy duty vehicles	Nº	20	50
Trains	Nº	5	21
Substituted fuel in aviation	GWh/a	10	98
Substituted fuel in navigation	GWh/a	0.1	1.1
Micro CHP	Nº	1 291	5 610
Large CHP	Nº	1	10
Iron&Steel	% of prod.	0%	1%
Methanol	% of prod.	0%	0%
Ammonia	% of prod.	0%	5%

According to the estimations, the hydrogen refuelling station network will by 2030 encompass between 60-120 stations for 33 000-67 000 fuel cell vehicles on the road.

In addition, the analysis estimates substitution of up to 1% of the conventional steel production by renewable hydrogen-based steelmaking.

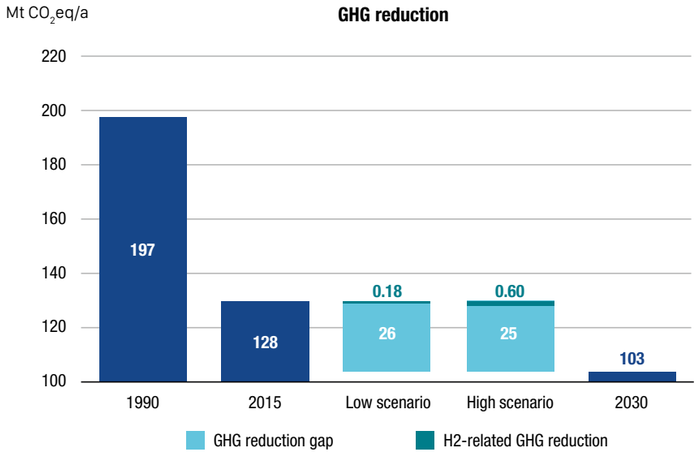
Further use of renewable hydrogen is foreseen in ammonia production (up to 5%).

Finally, the introduction of 1 291-5 620 stationary fuel cells for combined power and heat production is estimated.

Environmental and financial impact in Czechia by 2030

Greenhouse gas (GHG) emission reductions were calculated by estimating the fuels replaced by hydrogen, and their respective greenhouse gas footprint. Comparing these to the 2030 GHG reduction targets results in the contribution of hydrogen to achieving these targets.

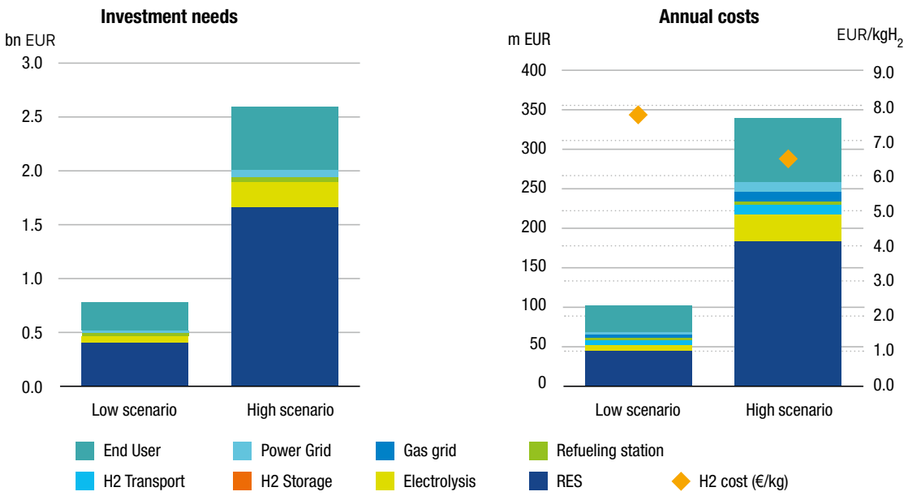
Environmental impact



An additional GHG emission reduction of 0.2-0.6 Mt CO_2 is estimated in 2030 corresponding to 0.7%-2.3% of the overall GHG emission reduction gap towards 2030 target (based on EUCO3232.5).

Financial impact

The financial scenario assessment includes investments (CAPEX) until 2030 and operating expenses (OPEX) per year in 2030. Cumulative investments in hydrogen technologies are estimated at 0.8-2.6 billion EUR until 2030, while annual expenditure would amount to 100-340 million EUR (including end user appliances as well as power and gas grids).

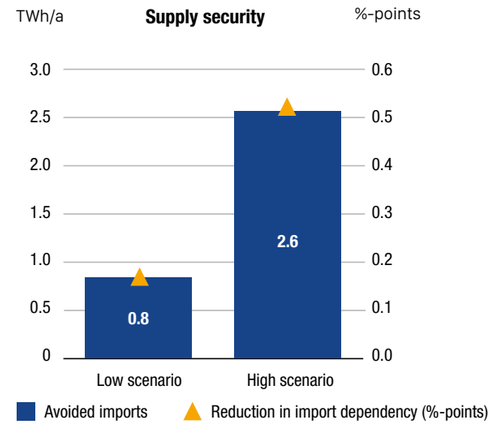


Impact on security of supply, jobs and economy in Czechia by 2030

Hydrogen contributes to the security of energy supply security objective by reducing fossil energy import dependence and enhances energy supply diversification by facilitating deployment of renewable energy sources. This is assessed by estimating imported fossil fuels that will be replaced by hydrogen based on domestic renewable sources.

Security of energy supply

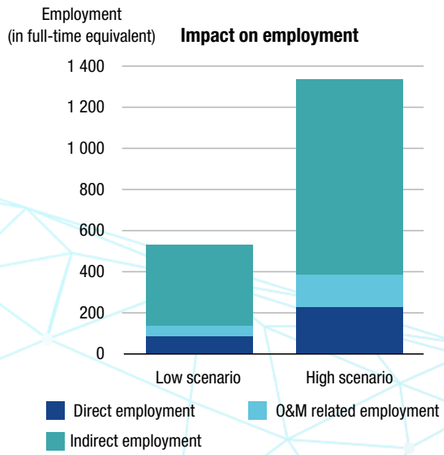
Deployment of renewable hydrogen would lead to 0.8-2.6 TWh/a of avoided imports, and thus reduce import dependency by 0.2-0.5% (in volume terms) in 2030, depending on the scenario.

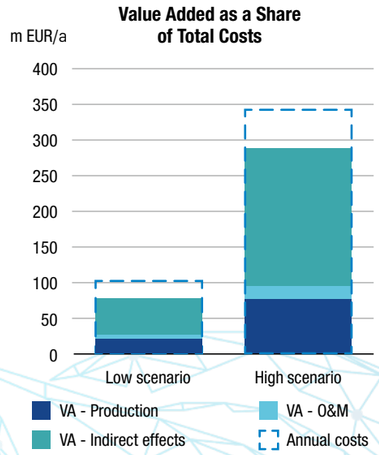


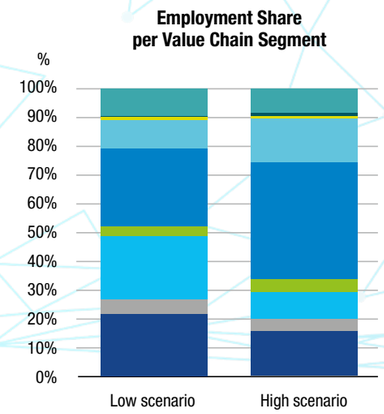
Impact on employment and value added

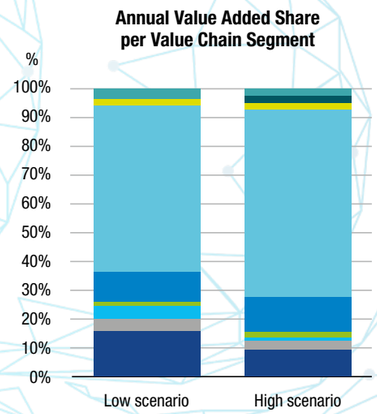
This analysis shows that in the years 2020-2030 around 30 million EUR can be retained annually in the domestic economy as value added in the low scenario, and almost 100 million EUR in the high scenario (value added is defined here as sum of wages for employees, margins for companies and taxes). If the indirect effects induced by the investment in and operation of hydrogen technologies are also taken into account, around 80 million EUR (low scenario) and almost 290 million EUR (high scenario) of value added can be created in the Czech economy annually, which is equivalent to more than three quarters of the annual amount of investment needed. Most of this value added is expected to be created by building dedicated renewable electricity sources and electrolysers for hydrogen production, and in automotive industry.

The hydrogen-related expenditures in 2020-2030 are estimated to generate employment of 140 - 400 direct jobs (in production and operations & maintenance) and contribute to a further 400 – 950 indirectly related jobs, depending on the scenario. Most of these jobs are expected to be created by building up and operating the dedicated renewable electricity sources and electrolysers for hydrogen production, followed by jobs the automotive industry. In the low scenario, a more significant share of employment generated by investment in hydrogen refuelling stations and by hydrogen transport via trucks is estimated.









FCEV
CHP
Gas grids & H2 storage
Other transport
Electrolysers
Industry
HRS
RES
H2 transport by truck

CZECHIA

Opportunities arising from the inclusion of **Hydrogen Energy Technologies** in the National Energy & Climate Plans

FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

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