CROATIA

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.

CROATIA

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

Onshore Wind
40 - 230 MW
80 - 490 GWh/a

Offshore Wind
4 - 25 MW
14 - 80 GWh/a

Solar Photovoltaic
16 - 90 MW
17 - 100 GWh/a

Electrolysers
26 - 150 MW
72 - 420 GWh_{H2}/a

POWER
1 - 6 GWh/a

TRANSPORT
60 - 182 GWh/a

BUILDINGS
5 - 50 GWh/a

INDUSTRY
6 - 183 GWh/a

30 - 60
Buses

1 - 6
Trains

17 - 34
Refuelling Stations

530 - 1 070
Trucks

8 400 - 16 800
Cars

280 - 2 800 MWh_{H2}/a
Electricity Produced

5 - 46 GWh/a
into Synthetic Fuels

230 - 1 000
Micro-CHP units
in buildings

3 - 34
Commercial-scale
CHP installations

3 - 5 GWh_{H2}/a
in Refineries

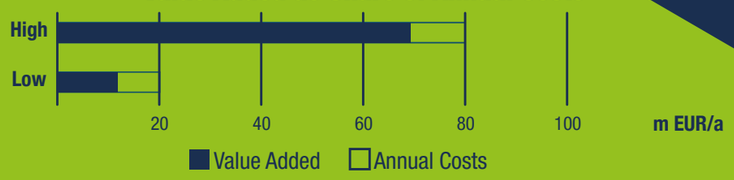
0 - 0.3 kt/a
of Aromatics

0 - 19.4 kt_N/a
of Ammonia

13 - 67
m EUR/a

Value Added
in the domestic economy

Value Added as Share of Annual Costs



New Jobs
180 - 590

Emissions avoided
35 - 140 kt CO_2/a

EXECUTIVE SUMMARY

Croatia's commitment for hydrogen deployment according to its NECP

Croatia is starting to support hydrogen deployment and has in this context recently entered into collaboration with the FCH JU on European projects (research activities started in October 2019).

According to its NECP, Croatia intends to enable the integration of hydrogen in its energy and mobility systems. It expects by 2040 a final hydrogen consumption of 0.01PJ or 2.8 GWh in the transport sector and has the intention to build hydrogen refuelling stations and to develop technical standards to facilitate market uptake.

According to Croatia's NECP, the role of hydrogen in its energy and transport systems is expected to gradually uptake by 2030. A hydrogen technology platform will be set up with national stakeholders.
The NECP also mentions that Incentive measures for the procurement of vehicles primarily fuelled by alternative fuels need to be implemented.

Croatia has an enabling environment to address the deployment of renewable hydrogen, as several national organizations and companies are already active in this domain, and thanks to its involvement in at least one IPCEI project (Green Hydrogen @ Blue Danube[1]).

The scenario assessment shows substantial potential benefits of hydrogen deployment in Croatia 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 Croatia, a limited development of hydrogen demand is assumed in transport, especially for passenger cars, buses, trucks and to a limited extent in aviation (through hydrogen-based liquid fuels or PtL) and navigation[2]. A limited development of hydrogen demand is also assumed in the considered scenarios in industry, especially in the ammonia, refinery and aromatics industries. 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.

A limited use of hydrogen is assumed also for industrial energy production and for CHP applications in buildings. The scenarios assume only a marginal share of electricity generation from hydrogen by 2030, coming from combined heat and power installations.

[1] https://static1.squarespace.com/static/5d3f0387728026000121b2a2/t/5d9b5e81e73c03421d1dd837/1570463369453/Green+HH2+Blue+Danube+poster_print.pdf
[2] 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.

Hydrogen production

To cover the estimated hydrogen demand from new uses and from substitution of fossil-based hydrogen, 60 to 350 MW 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, Croatia estimates an installed capacity in 2030 of 1.36 GW in wind and 0.77 GW in solar PV, generating about 4.5 TWh of renewable electricity in 2030. The technical potential for renewable electricity production in Croatia seems however significantly higher[3]. 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 20 and 80 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[4], the Croatian GHG emissions should be reduced by 7 Mt CO_2 in 2030, compared to 2015. In the scenarios considered, the deployment of hydrogen could contribute 35 – 140 kt CO_2 to this goal, which is equivalent to 1% - 2% of the required emission reduction.

[3] 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).
[4] 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 CROATIA

The role of hydrogen in the Croatian energy and transport systems is expected to gradually take up by 2030. The Croatian authorities deem it necessary to identify the relevant hydrogen end-use opportunities and to explore the possibilities of stimulating hydrogen production and consumption. To this end, a hydrogen technology platform will be established, bringing together national stakeholders from research and industry. The platform will monitor the development of hydrogen applications at EU and international level, in view of applying them at national level.

Croatia is considering the transport sector as a priority for hydrogen use and does not expect a huge potential in the industry. Hydrogen is explicitly included in the definition of alternative fuels as mentioned in the 'Law on the Deployment of Alternative Fuels Infrastructure'. Strengthening the infrastructure for the distribution of alternative fuels, including hydrogen and implementing common technical specifications for this infrastructure should facilitate the uptake of alternative fuels by users. This infrastructure measure will not have a direct contribution to reducing transport fuel consumption, but the development of infrastructure is considered a necessary prerequisite for the market development of hydrogen fuelled road vehicles and vessels in Croatia. There is currently only 1 hydrogen refuelling station in Croatia, but the country plans to develop several stations in the major cities. In view of co-financing cleaner transport projects, it is considered necessary to define dedicated co-financing budgets for specific purposes and to support the purchase of vehicles powered by alternative fuels including hydrogen.

According to its NECP, Croatia has fixed a concrete target for the transport sector: 3.5% of the passenger cars should be electric, hybrid and hydrogen-powered vehicles by 2030.

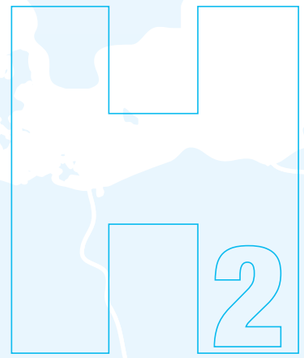
Several policies and measures related to hydrogen in the transport sector are mentioned in the NECP:

- Financial incentives for energy-efficient vehicles, including on hydrogen
- Development of alternative fuels infrastructure and elaboration of the required technical specifications
- Promotion of alternative fuels in the navigation sector (in the frame of the "Alternative Fuels Infrastructure Establishment Act")

Hydrogen is considered as an important topic in the frame of regional cooperation in research.

Several major companies are already active in the field of hydrogen in Croatia. The Zagreb public transportation company is considering the acquisition of hydrogen fuelled buses. The Oil company INA is assessing using its refinery in Rijeka to produce and supply blue/green hydrogen. Some work is ongoing regarding the development of production of low-carbon hydrogen with onshore carbon storage. The possibility of producing hydrogen with offshore carbon storage is being explored as well. Discussions are also ongoing with the natural gas industry regarding hydrogen deployment (Croatia has indigenous natural gas resources that could be used for low-carbon hydrogen production), but so far only at an exploratory stage.

The NECP model-based development path based on the 'with additional measures' scenario expects for 2040 a final hydrogen consumption of 0.01PJ or 2.8 GWh in the transport sector, which is substantially lower than the figures estimated for 2030 in both scenarios presented in this document.



OPPORTUNITY ASSESSMENT

Hydrogen production potential & its role in energy system flexibility

Croatia's technical potential for variable renewable electricity generation is almost seven times higher than its expected electricity demand in 2030; there is thus a strong opportunity to use this abundant resource to produce renewable hydrogen via electrolysers. According to the NECP, Croatia plans to use in 2030 only 4% of its technical potential for renewable electricity generation, so there is a great margin for building up additional dedicated renewable electricity plants whose output can be converted into hydrogen via electrolysis.

Increasing variable renewable electricity production will result in higher needs for flexibility in the energy system. Overall, flexibility needs in Croatia are expected to rise more than in most other EU countries as the installed variable renewable electricity generation capacity in 2030 is expected to be higher than the average network load. Power-to-hydrogen plants could hence be used to convert 'excess' electricity supply into hydrogen, and act as flexibility provider to the Croatian energy system, especially given its lack of significant domestic flexible resources such as pumped-storage hydroelectricity.

With respect to possible domestic production of low-carbon hydrogen via steam reforming combined with CCUS, there is effectively a significant technical potential in Croatia. The indigenous natural gas resources can be used for this purpose; there are also some potential industrial users of captured CO_2 and possibly suitable storage sites. There is however at present limited indication of progress towards effectively utilizing this potential in the short term.

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	
118	669%	4.56	4%	115%	Low

Croatia has limited readiness for wide-scale deployment of CCS. Although it has potentially suitable sites for CO_2 storage and the possibility of using CCS technologies is being explored, there are no concrete indications that this potential will effectively be used.

Energy infrastructure

Croatia could assess the possibility to start injecting limited hydrogen volumes into its existing natural gas infrastructure, and to convert in the longer term (part of) this infrastructure for dedicated hydrogen transport and distribution. However, considering the low density of its natural gas distribution grid, this represents only a limited opportunity for hydrogen deployment.

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)
Not available	0.4	0	NO
MS range 16%-99%			

There are no salt cavern natural gas storage sites in Croatia which could be used for hydrogen storage, neither suitable underground salt layers that could provide short-term or seasonal storage opportunities for hydrogen.

Current and potential gas & hydrogen demand

In Croatia, the opportunities for using hydrogen for decarbonising its energy consumption lie primarily in the replacement of natural gas for heating in the built environment and of natural gas use in industry. Fossil fuel-based hydrogen use as a feedstock in Croatia exists, but is limited. Therefore, the potential for decarbonised hydrogen use in industry to reduce GHG emissions primarily lies in replacing natural gas use related to the production of high temperature process heat. Next to that, there is an opportunity for the use of decarbonised hydrogen in the transport sector, especially in the rail sector - where almost half of the energy use is still fossil-based, and in (heavy-duty) road transport.

Opportunities for hydrogen demand in industry

Croatia has some industrial enterprises on its territory that currently use fossil-fuel based hydrogen, so the switch to decarbonised hydrogen in these industries could substantially reduce GHG emissions from these sectors. It should be noted though, that the production volumes of Croatia's fertiliser industry and refineries are relatively modest compared to the total production volumes at EU-level. However, the Croatian refinery company INA is already investigating the possibilities for using low-carbon or renewable hydrogen. Overall, natural gas accounted for one third of Croatia's industrial energy use in 2017, which represents a significant opportunity for the deployment of renewable or low-carbon hydrogen to decarbonise this part of the energy mix by replacing (part of) this natural gas use.

Presence of ammonia industry / share of ammonia production capacity in EU28 total	Presence of refineries / Share of Croatian refineries in total captive hydrogen production by refineries in the EU28	Share of Croatia 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)
2%	0.3%	0%	33%	40%
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

Fossil fuels account for about one quarter of the energy use for heating and cooling in the country's built environment and natural gas represents with 80% the lion´s share of this. Substitution of this use with renewable or low-carbon hydrogen represents hence an opportunity to decarbonise this energy demand in Croatia.

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)
21%	73%	2%
Average: 34% MS range: 0% - 60%	Average: 74% MS range: 41% - 82%	Average: 3% MS range: 0% - 46%

Opportunities for hydrogen demand in transport

Croatia´s road transport sector is still almost fully dependent on fossil fuels and hydrogen is one of the solutions that can be deployed to decarbonise energy use in this sector, especially in heavy-duty road transport, which accounts for 30% of the energy use in road transport. Croatia's railway sector is still dependent on fossil fuels for half of its energy use. Together with further electrification, deployment of decarbonised hydrogen can be an adequate solution to reduce GHG emissions from Croatia's rail sector. The domestic shipping sector as well as international shipping represent a relatively low share of Croatia's energy use in transport. However, in order to achieve deep emission reductions in the long term, decarbonisation of the energy use in the shipping sector will be needed and hydrogen or derivatives thereof are amongst the few solutions that can be used for the decarbonisation of these applications. 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
30% (1 907 GWh)	48% (209 GWh)	2% (526 GWh)	0.3% (74 GWh)	7% (2 245 GWh)	100% (24 328 GWh)
Average 32% MS range 18%-48%	Average 30% MS range 0%-95%	Average 2% MS range 0%-10%	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

Croatia has started to elaborate an enabling framework for the deployment of hydrogen, mainly focusing on the transport sector; it intends to set up a stakeholder platform, to adopt a hydrogen strategy, to develop projects with the gas sector and the industry (refinery) and to deploy infrastructures for alternative fuels, including hydrogen. Croatia is supporting the involvement of its research and business organizations in regional and European demonstration and development projects. Croatia is also exploring CCS opportunities to complement the use of renewable hydrogen.

Existence of (or concrete plans for) national hydrogen roadmaps or strategies

A new national Energy strategy is expected to be adopted by the Croatian parliament.

Positive environment

Not Yet

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

Croatia has committed to reduce its greenhouse gas emissions in the non-ETS sectors in 2030 by at least 7% compared to the 2005 level, in compliance with the Effort Sharing Regulation. The need for additional measures to achieve this 2030 target is limited, but hydrogen can anyhow contribute to it.

Positive environment

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)

Croatia's National Policy Framework (set in the context of the alternative fuel infrastructure directive (2014/94/EU)) refers to hydrogen but the current policies and measures still mainly focus on CNG, with already existing infrastructure. In order to reduce the CO_2 emissions resulting from fossil fuel use for transport, a switch to decarbonised hydrogen can be considered to reach the decarbonisation targets by 2030 and 2050.
According to the NECP, Croatia considers the transport sector as priority for hydrogen use and the Zagreb public transportation company is considering the acquisition of hydrogen buses.

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
NO	1	1 596 087

Existence of (investment on) hydrogen-related projects

There are at present no operational hydrogen-related industrial projects in Croatia.
The Zagreb public transportation company is considering the acquisition of hydrogen buses.
The Oil company INA is considering the development of infrastructure for hydrogen production, distribution and supply.
Some explorative work is also ongoing in view of the possible development of hydrogen production with onshore or offshore carbon storage.

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)
NO	0	NO	0

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

Croatia has at present no carbon related taxation for vehicles that incentivizes low-carbon fuels, including decarbonised hydrogen.

Positive environment

✖

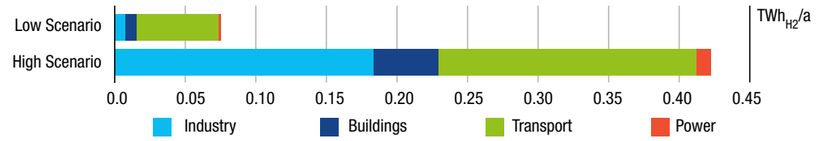
Fossil energy import bill

As Croatia disposes of indigenous gas resources, the relative share of natural gas imports in its overall energy supply is lower than in most other EU Member States. Switching from imported fossil fuels to nationally produced hydrogen for industrial processes and heating applications and promoting the use of hydrogen in the transport sector would anyhow contribute to reducing the energy import bill and energy dependence.

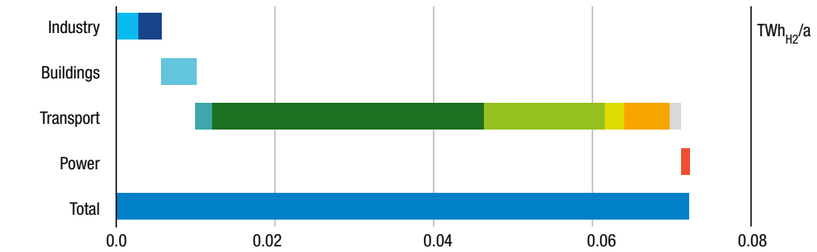
Import bill for natural gas as share of national Gross Value Added	Import bill for all fossil fuels
0.7%	**3.1%**
Average: **0.6%** MS range: 0% - 1.5%	Average: **1.7%** MS range: 0% - 7%

SCENARIO ASSESSMENT
Estimated renewable/low carbon hydrogen demand for Croatia 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).

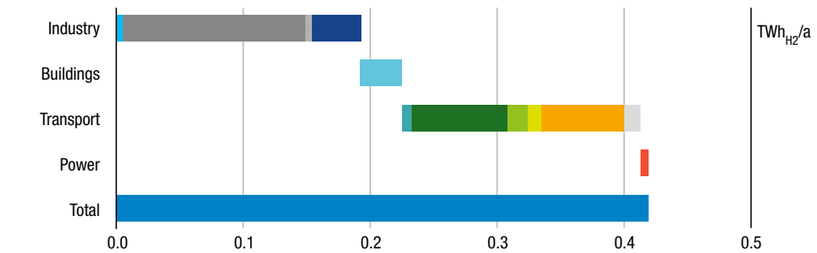


Low scenario

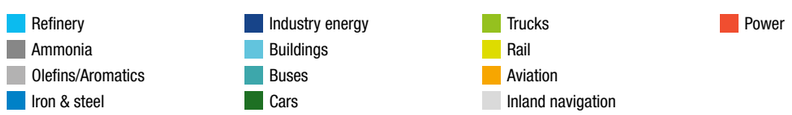


In the low scenario, renewable hydrogen accounts for 0.1% of final total energy demand (i.e. 0.1 out of 63 TWh/a) or 0.6% of final gas demand (11 TWh/a).

High scenario



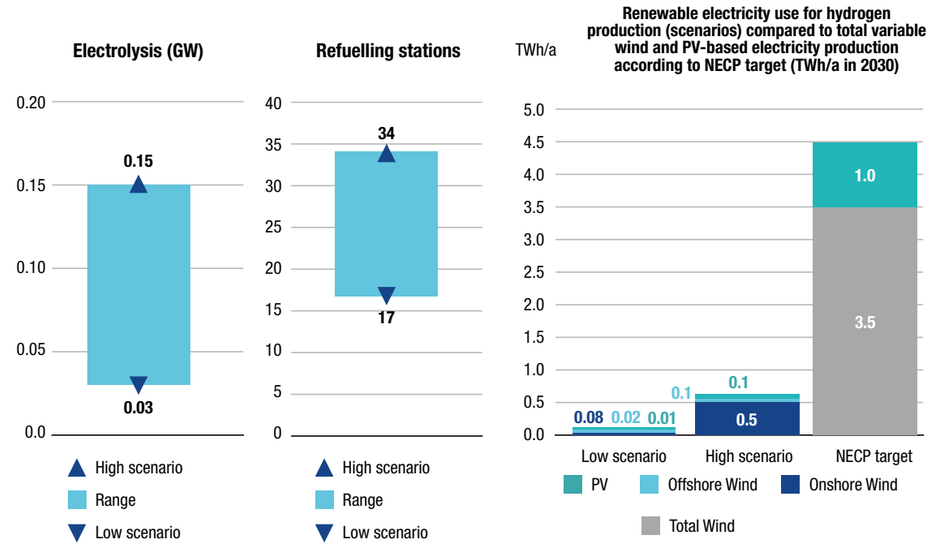
In the high scenario, renewable hydrogen accounts for 0.7% of final total energy demand (i.e. 0.4 out of 63 TWh/a) or 3.7% of final gas demand (11 TWh/a).



Hydrogen generation, infrastructure and end users in Croatia 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 0.2% of the overall technical renewable power potential in the low scenario and for 1.2% in the high scenario.

End users

End user	Unit	Low scenario	High scenario
Passenger cars	Nº	8 400	16 800
Buses	Nº	30	60
Lorries	Nº	500	1 000
Heavy duty vehicles	Nº	30	70
Trains	Nº	1	6
Substituted fuel in aviation	GWh/a	4	35
Substituted fuel in navigation	GWh/a	1.1	10.4
Micro CHP	Nº	230	1 000
Large CHP	Nº	3	34
Iron&Steel	% of prod.	0%	0%
Methanol	% of prod.	0%	0%
Ammonia	% of prod.	0%	5%

According to the estimations, the hydrogen refuelling station network will by 2030 encompass between 20-30 stations for 9 000-18 000 fuel cell vehicles on the road.[5]

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

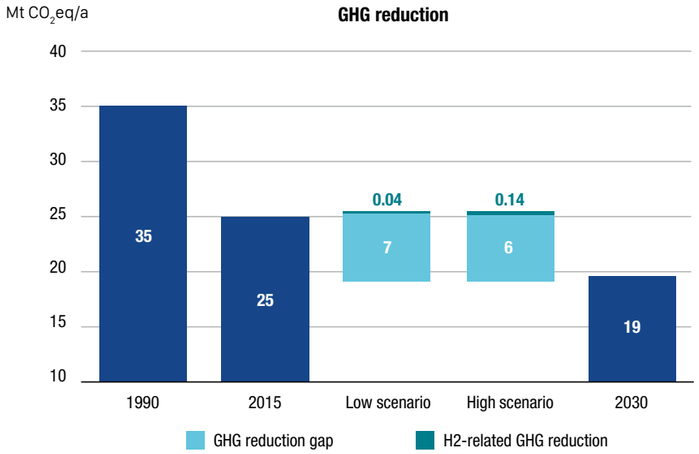
Finally, the introduction of 230-1030 stationary fuel cells for combined power and heat production is estimated.

[5] *In order to ensure a minimum coverage of the country with hydrogen refuelling stations, more stations may be necessary for supplying hydrogen to the vehicle fleet.*

Environmental and financial impact in Croatia 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.

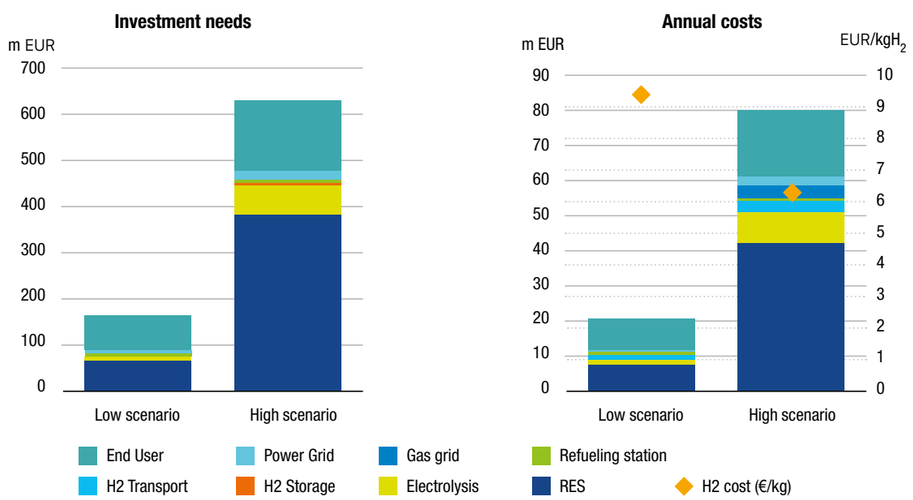
Environmental impact



An additional GHG emission reduction of 0.04-0.14 Mt CO_2 is estimated in 2030 corresponding to 0.5%-2.1% 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 0.2-0.6 billion EUR until 2030, while annual expenditure would amount to 20-80 million EUR (including end user appliances as well as power and gas grids).

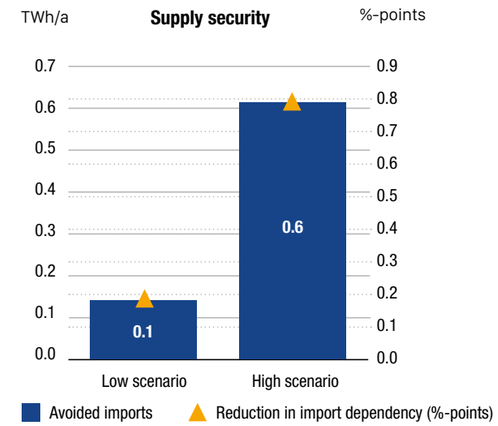


Impact on security of supply, jobs and economy in Croatia by 2030

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

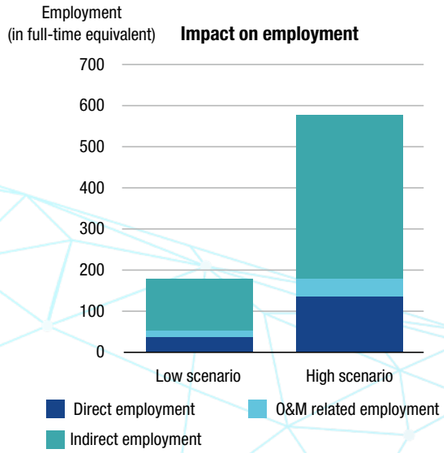
Deployment of renewable hydrogen would lead to 0.1-0.6 TWh/a of avoided imports, and thus reduce import dependency by 0.2-0.8% (in volume terms) in 2030, depending on the scenario.

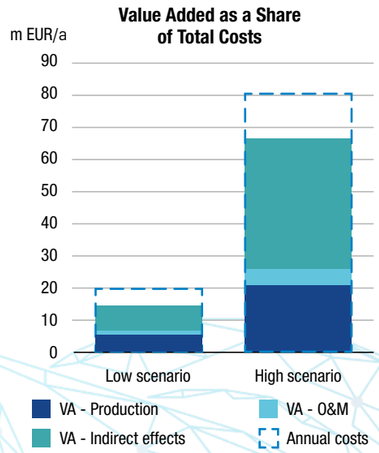


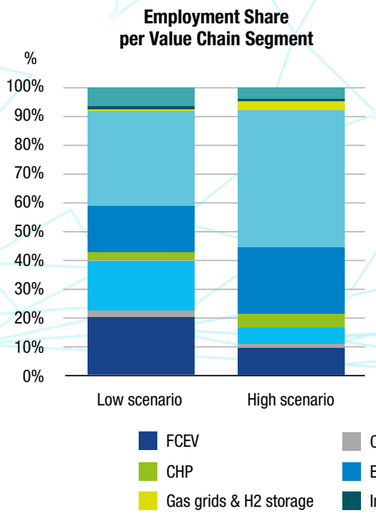
Impact on employment and value added

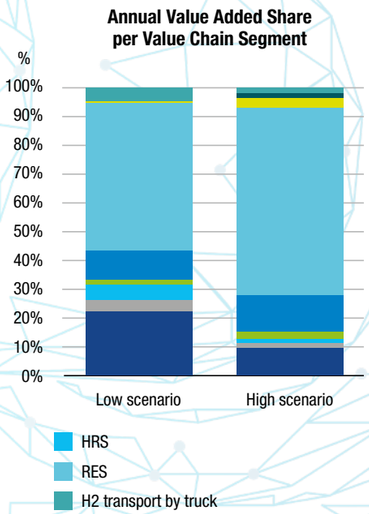
This analysis shows that in the years 2020-2030 more than 5 million EUR can be retained annually in the domestic economy as value added in the low scenario, and around 25 million EUR in the high scenario (value added is defined here as sum of wages for employees, margins for companies and taxes). If the indirect effects induced by the investment in and operation of hydrogen technologies are also taken into account, around 13 million EUR (low scenario) and almost 70 million EUR (high scenario) of value added can be created in the Croatian economy annually, which is equivalent to more than two thirds of annual investment needed in the low scenario and to almost 90% of annual investment in the high scenario. Most of this value added is expected to be created by building and operating dedicated renewable electricity sources for hydrogen production, in investment to fuel cell electric cars and, especially in the high scenario, by building-up and operating electrolysers.

The hydrogen-related expenditures in 2020-2030 are estimated to generate employment of 40 - 200 direct jobs (in production and operations & maintenance) and contribute to a further 130 - 400 indirectly related jobs, depending on the scenario. Most of these jobs are expected to be created in the renewable energy sector, automotive industry, hydrogen refuelling stations and the production and operation of electrolysers. In the high scenario, the renewable energy generation and electrolysers become even more dominant in overall job creation.









CROATIA

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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