DEVELOPMENT OF HYDROGEN VALUE CHAIN

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RELEVANCE

Paris agreement in 2015 united the nations from 196 countries to commit to keep global warming “well below 2°C above pre-industrial levels, and to pursue efforts to limit the temperature increase even further to 1.5°C” within this century.

More governments and industry players worldwide recognise hydrogen as a future energy source.

Hydrogen might reshape the power of countries that have no fossil resources; now is a possibility to become producers of energy. (E.g., Morocco, Chile).

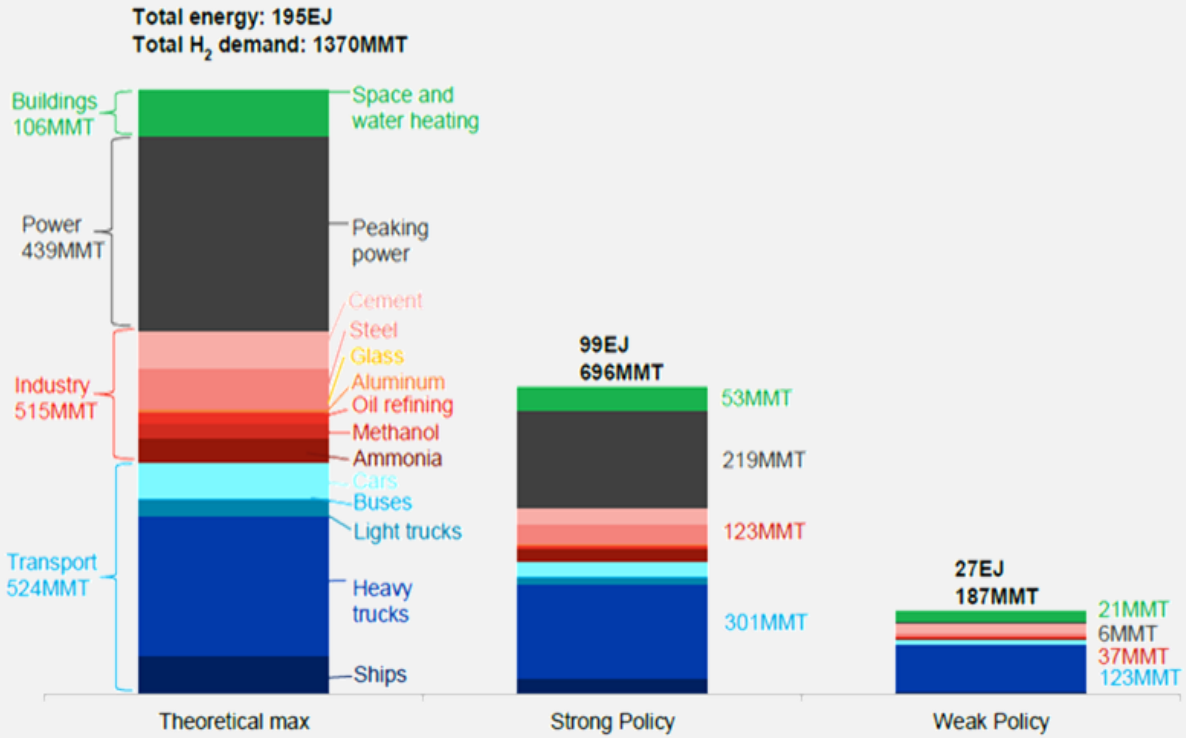
Hydrogen can contribute in net zero emissions goals as it emits... water.

If 24% of the world's energy needs by 2050 quantity was hydrogen produced from renewable electricity, around 31 320 TWh would be needed, which is more than is currently produced worldwide from all sources.

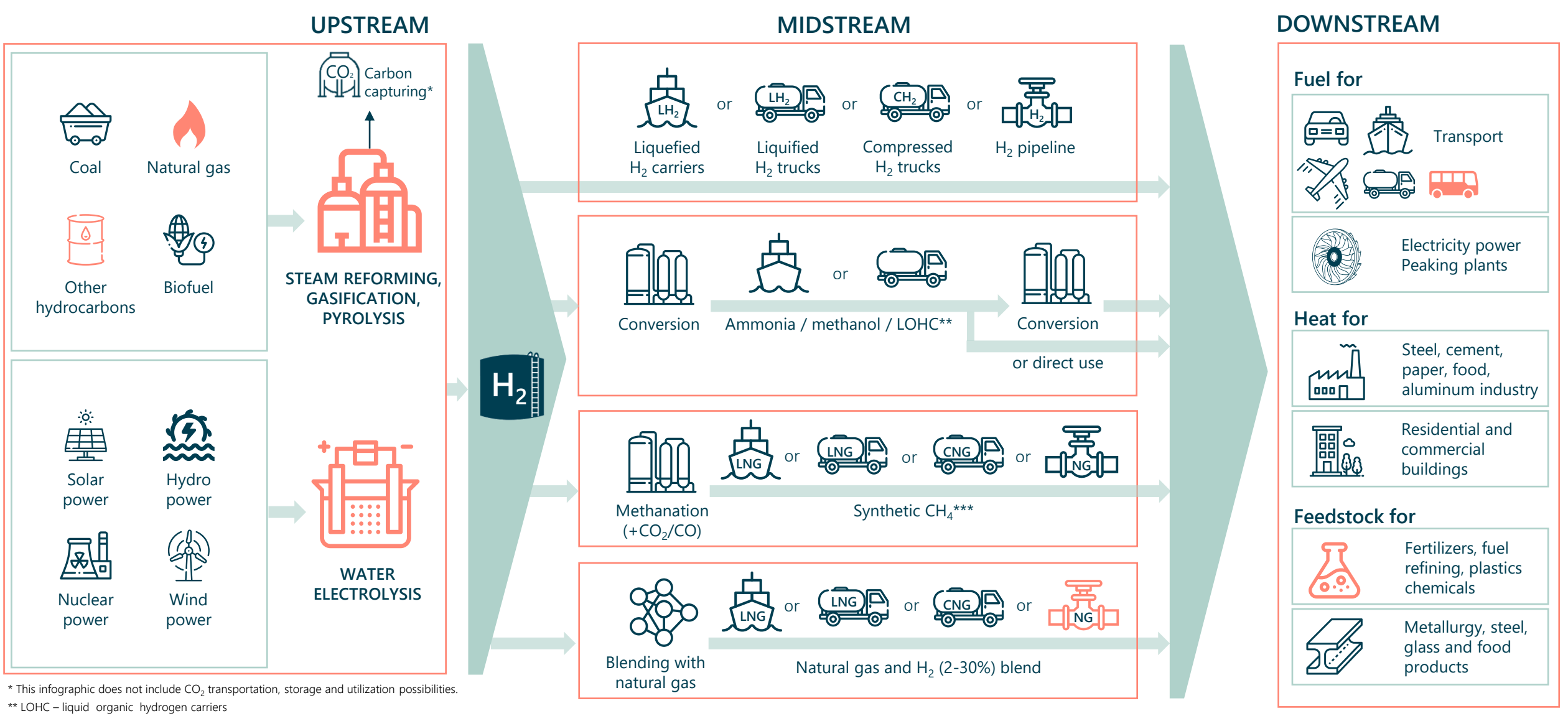
Though litany of challenges are attached and therefore, there are relatively few hydrogen projects, and the development of the value chain is in the early stage.

POTENTIAL DEMAND FOR H2 IN DIFFERENT SCENARIOS, 2050

(BloombergNEF)



HYDROGEN VALUE CHAIN



* This infographic does not include CO_2 transportation, storage and utilization possibilities.

** LOHC – liquid organic hydrogen carriers

*** Synthetic methane (CH_4) – same chemical compound as methane in conventional natural gas.

Sources: developed by author based on IHS Markit and BloombergNEF data

Level of value chain development enhancement in Lithuania

The level of hydrogen value chain development enhancement in Lithuania is in a low and medium level.

Policy, infrastructure and standards and regulations are at the low level.

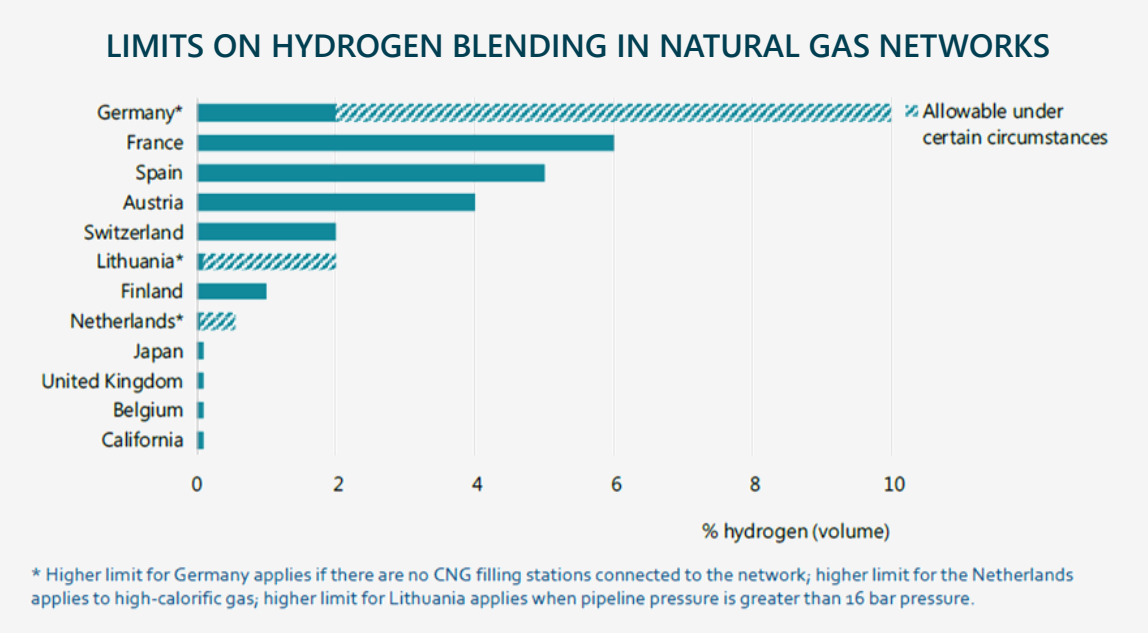
Meanwhile Competence building and Financial subsidies could be assessed as developing or medium level as some background is in place.

Existing infrastructure in Europe and development tendencies

Currently - 143 stations in operation, 47 in diverse stages of progress. Germany as a leader - 92 stations opened & plans to reach 100 by the end of 2022, 400 by the end of 2023.

Hydrogen can be injected into the natural gas grid by blending up to 10 % with certain conditions.

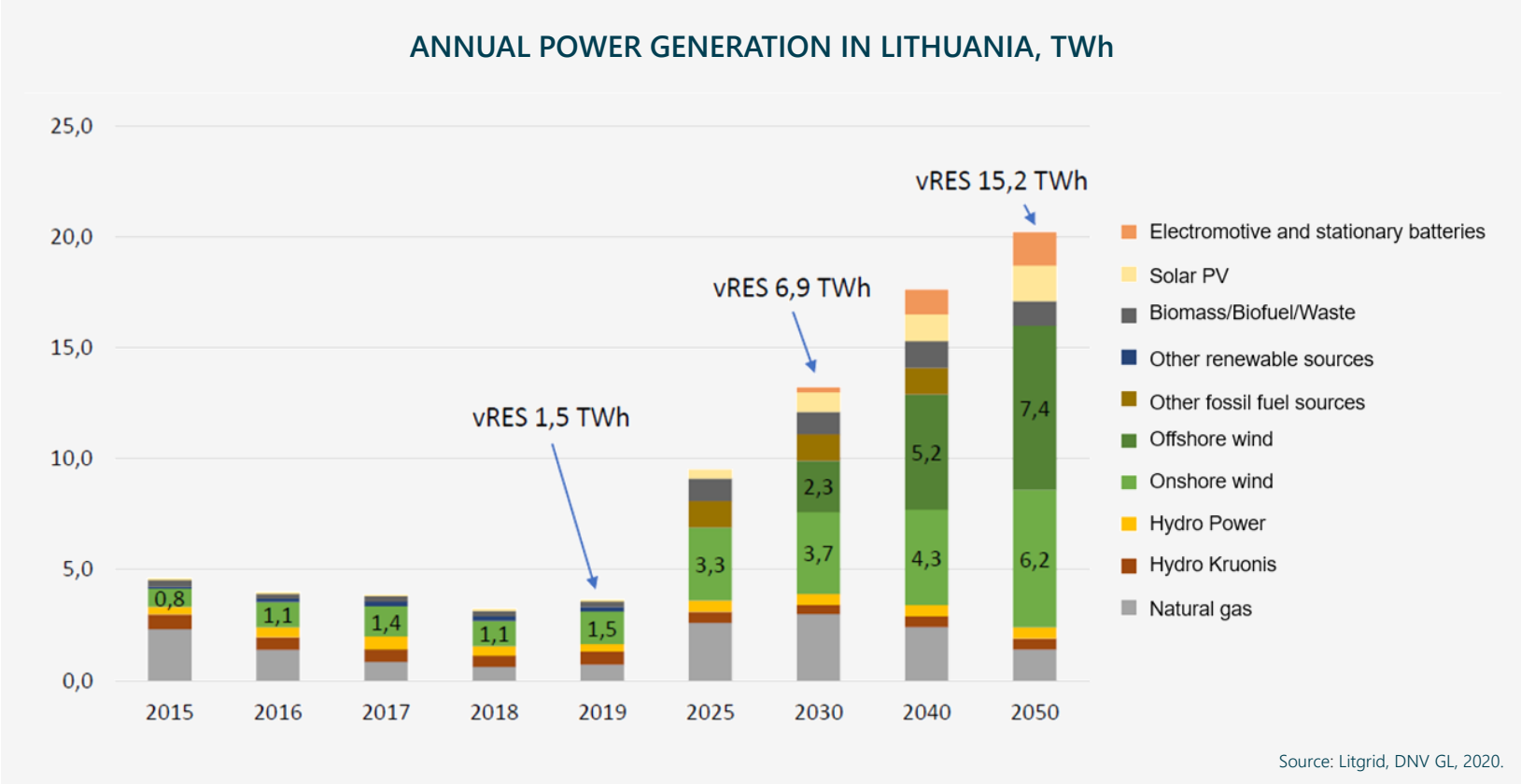
In Lithuania 2 % can be reached in pipelines with the pressure higher than 16 bar. Otherwise, the limit is 0.1 %. (Energy Ministry, 2020). Only additional investments could lead injections of hydrogen to reach 10 % or higher.



OPPORTUNITIES FOR HYDROGEN IN LITHUANIA – PERSPECTIVE OF RAIDA 2050

Lithuania consumed a total of 13.0 TWh of electricity over 2019 (11.1 TWh without grid losses and hydro pump load) but only generated about 3.6TWh domestically. Domestic generation up around 30%. Envisioned to increase to 70% 2030 and to 100% by 2050.

Green hydrogen production as a P2G solution to increase after 2030 (for renewable energy balancing). P2G through electrolysis is rational in 2050 when the price for power drops below 20 Eur/MWh. As a result up to 1.7 TWh would be possible to consume for P2G, which at the average efficiency of 80% of electrolysers could produce up to 34 kt of hydrogen.

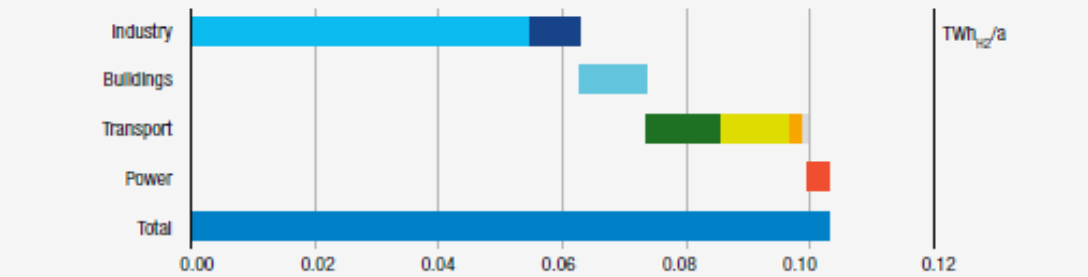


Source: Litgrid, DNV GL, 2020.

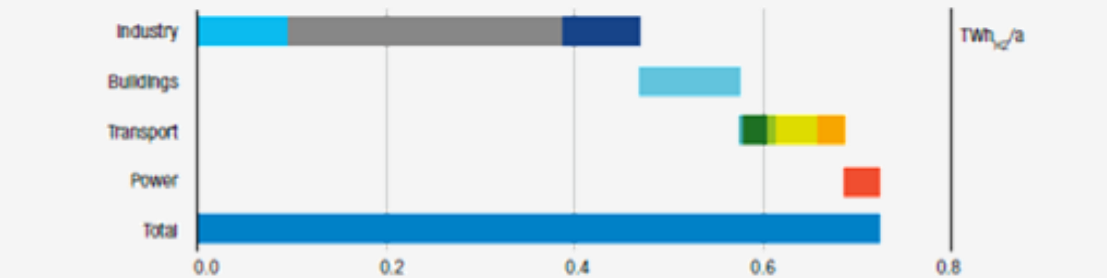
OPPORTUNITIES FOR HYDROGEN IN LITHUANIA – PERSPECTIVE OF FCH JU

Fuel Cells and Hydrogen Joint Undertaking (FCH JU) estimated National Energy and Climate Plan period from 2020 to 2030 for green hydrogen production.

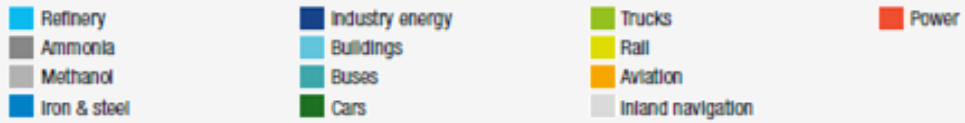
- Low and high hydrogen demand scenarios outlines the potential of 100-720 GWh/a (approx. 3-22 kt) of hydrogen. In this case at least 0,1 to 0,5 GW of renewable electricity would need to be dedicated to produce green hydrogen via electrolysis.
- It is planned to reach 4 GW of renewable power by 2030, which makes it feasible to dedicate certain quantities of energy purposefully for hydrogen production



In the low scenario, renewable hydrogen accounts for 0.2% of final total energy demand (i.e. 0.1 out of 47 TWh/a) or 2.2% of final gas demand (5 TWh/a) according to EUCO3232.5.

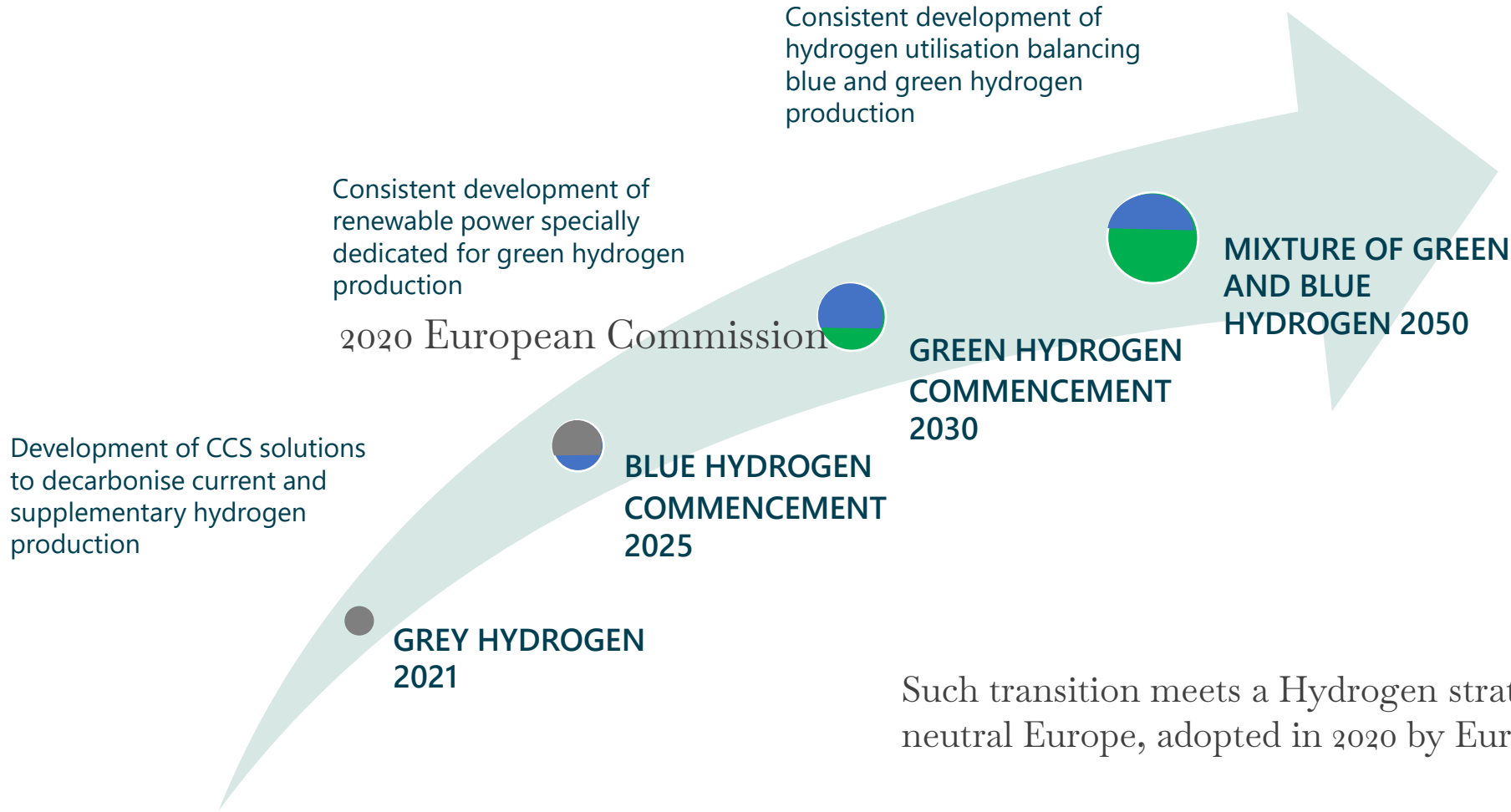


In the high scenario, renewable hydrogen accounts for 1.5% of final total energy demand (i.e. 0.7 out of 47 TWh/a) or 15.3% of final gas demand (5 TWh/a) according to EUCO3232.5.



Source: FCH JU,
Opportunities for Hydrogen Energy Technologies in Lithuania

GREY – BLUE – GREEN HYDROGEN TRANSITION IN LITHUANIA



Such transition meets a Hydrogen strategy for a climate-neutral Europe, adopted in 2020 by European Commission

PROPOSED STRUCTURE OF THE LITHUANIAN HYDROGEN ROADMAP 2030

LITHUANIAN HYDROGEN ROADMAP 2030

STRATEGIC GOAL

To develop capacities of the country in global hydrogen value chain.

UPSTREAM

1ST PRIORITY

To develop renewable and low-carbon hydrogen production capacities

1.1 measure. To employ offshore wind for hydrogen production as power balancing and energy storage measure.
1.2 measure. To dedicate 0.5 GW of renewable electricity to produce green hydrogen until 2030.
1.3 measure. To assure low-carbon hydrogen production in Lithuania.
1.4 measure. To develop carbon capture, utilisation and storage.

MIDSTREAM

2ND PRIORITY

To develop hydrogen transmission, distribution and storage.

2.1 measure. To develop infrastructure for pure hydrogen transportation and distribution via pipeline.
2.2 measure. To foster hydrogen transportation by road, railway and inland water.
2.3 measure. To ensure hydrogen import and export facility in Klaipeda port.
2.4 measure. To explore geological layers for hydrogen storage in Lithuania.
2.5 measure. To ensure hydrogen transmission and distribution in the natural gas grid.

DOWNSTREAM

3RD PRIORITY

To enhance end-use of hydrogen in Lithuania.

3.1 measure. To develop hydrogen refuelling infrastructure.
3.2 measure. To foster hydrogen fuelled vehicles and other means of transport growth in Lithuania.
3.3 measure. To enhance hydrogen blend into the natural gas power transport means.
3.4 measure. To foster hydrogen utilisation as a feedstock for different application.
3.5 measure. To employ hydrogen in heat generation for industries as well as households.
3.6 measure. To apply hydrogen in gas-to-power solutions.

PROPOSED STRUCTURE OF THE LITHUANIAN HYDROGEN ROADMAP 2030

LITHUANIAN HYDROGEN ROADMAP 2030

STRATEGIC GOAL

To develop capacities of the country in global hydrogen value chain.

DEVELOPMENT RECOMMENDATIONS

4TH PRIORITY

To enhance hydrogen value chain development in Lithuania.

4.1 measure. To develop clear national policy on hydrogen development in Lithuania.
4.2 measure. To build up competence in the hydrogen value chain related areas.
4.3 measure. To develop standards and regulations to assure safe and reliable hydrogen production, handling and utilization.
4.4 measure. To assure financial instruments to finance and subsidise elements of hydrogen value chain.

FINANCIAL SOURCES RELEVANT FOR HYDROGEN TECHNOLOGIES ON EU AND NATIONAL LEVEL

No	Financial source	Period	Goals relavant for hydrogen technologies	Total fund, billion Eur	Fund for the mentioned goal, billion Eur
1	Innovation fund	2020-2030	Demonstration of innovative low-carbon technologies	10	10
2	Horizon Europe	2021-2027	To foster climate-neutral economy, adaptation, societal transformation, smart cities, etc.	95.5	15
3	Connecting Europe Facility (CEF) programme	2021-2027	For future investments energy infrastructure	22	22
4	Recovery and Resilience Facility (RRF)	2021-2026	For climate change measures	2.6	1.1
5	EU funds	2021-2027	For climate change measures	6	1.6
6	Modernisation fund	2021-2030	For climate change measures	0.2	0.2
7	National Climate Change Plan	2021-2030	For climate change measures	0.8	0.8
	Total available funding			**137.1**	**50.7**
	Total LT funding			**9.6**	**3.7**

THANK YOU FOR YOUR ATTENTION