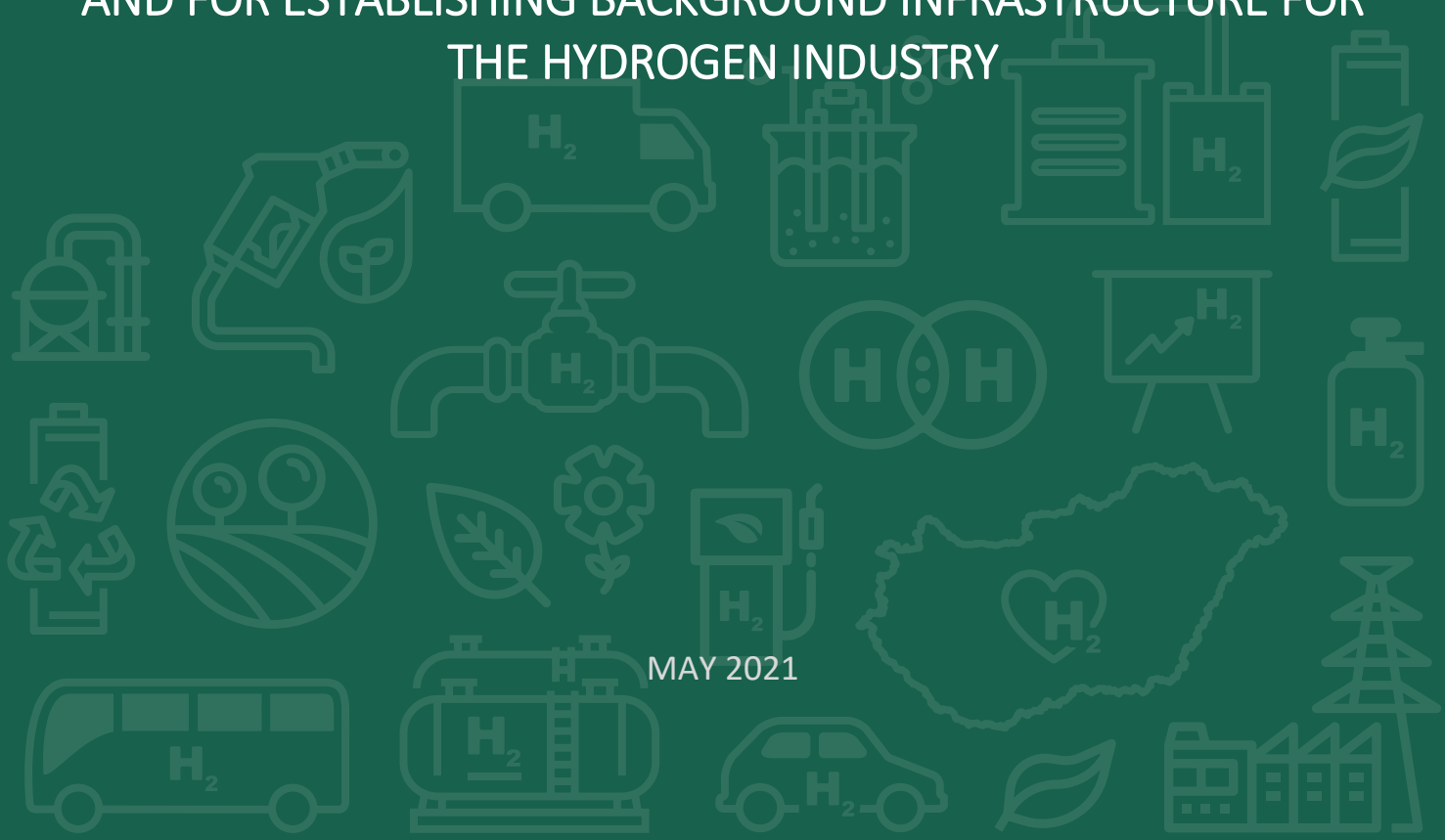
HUNGARY IS ON GREEN PATH

HUNGARY'S NATIONAL HYDROGEN STRATEGY

STRATEGY FOR THE INTRODUCTION OF CLEAN HYDROGEN AND HYDROGEN TECHNOLOGIES TO THE DOMESTIC MARKET AND FOR ESTABLISHING BACKGROUND INFRASTRUCTURE FOR THE HYDROGEN INDUSTRY



MAY 2021

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1. Vision and target system

Hungary's National Hydrogen Strategy (hereinafter referred to as: Strategy) is ambitious, but provides a realistic vision of the future as it opens the way for the establishment of a hydrogen economy, therefore contributing to the achievement of decarbonisation goals and providing an opportunity for Hungary to become an active participant of the European hydrogen sector.

On the long term, the Strategy focuses on "green" hydrogen, but in addition to hydrogen based on electricity generated using renewable resources, primarily solar energy, Hungary does not ignore opportunities for hydrogen production based on carbon-free energy accessed either through a nuclear basis or from the network. Additionally, in the short and medium term, a rapid reduction in emissions and the establishment of a viable hydrogen market will also require low-carbon hydrogen.

VISION OF THE HYDROGEN STRATEGY

We are developing potent competencies with regard to the key elements of the hydrogen value chain, which, supplemented through targeted RDI and economic development activities, will serve to promote the shift towards a carbon-free society and to maintain the competitiveness of the Hungarian economy.

PRIORITY OBJECTIVES - 2030

Production of large volumes low-carbon and decentralized carbon-free hydrogen

Establishing the conditions necessary to produce low-carbon and carbon-free hydrogen that is in compliance with user requirements and is competitively priced.

- **20 thousand tons / year low-carbon hydrogen**
  +
- **16 thousand tons / year "green"* and other carbon-free hydrogen**
- **240 MW electrolyser capacity****

Decarbonisation of industrial consumption, partly with hydrogen

At first, predominantly low-carbon hydrogen will be used to make the industrial processes and product use "more green", with a shift to carbon-free hydrogen usage on the longer term.

- **20 thousand tons / year low-carbon hydrogen**
  +
- **4 thousand tons / year "green"* and other carbon-free hydrogen**
- **avoiding the emission of 95 thousand tons of CO_2**

Green transport

Accelerating the transition to clean modes of transportation by a gradual transition from gas oil usage to clean alternatives. Within this framework, on the 2030 timeline, hydrogen may become a realistic alternative primarily in heavy-duty vehicle traffic.

- **10 thousand tons / year "green"* and other carbon-free hydrogen**
- **20 hydrogen refuelling stations / 40 refuelling points**
- **4.8 thousand HFC vehicle**
- **avoiding the emission of 130 thousand tons of CO_2**

Electricity and (natural) gas support infrastructure

Building sector integration ability - primarily seasonal energy storage ability - by utilising intersectoral synergy, establishing infrastructure that will enable the transition to carbon neutrality, and reconstructing existing infrastructure.

- **60 MW average cut-off capacity**
- **min. 2% per year volume blending ratio in the natural gas system (where appropriate)**

SUPPORT OBJECTIVES

Taking advantage of industrial and economic development opportunities

Enhancing the activities at the intersection of industrial trends and Hungary's domestic strengths in order to promote competitiveness and stimulate domestic penetration.

Horizontal conditionality: establishing a stimulating operational environment

- Establishment of comprehensive regulatory and operational frameworks,
- promoting partnership and international cooperation.

RDI and education to promote the success of hydrogen during the transition

- It is essential for the implementation of strategic objectives to establish a system of scientific, technological and horizontal competencies that can serve as a foundation for the domestic use and development of new technologies and for demonstrating the legitimacy of such technologies on the domestic market.

Figure 1: The target system of the National Hydrogen Strategy

* "Green" hydrogen is "renewable hydrogen", extracted from water via renewable electricity.

** The goal is establishing a primarily PV-based electrolyser capacity not only connected to PV panels, but also able to take advantage of the cheap electricity (e.g. surplus renewable energy, night-time electricity produced by Paks Power Plant, or imported carbon-free electricity from electricity interconnectors) periodically available through the national network. In fact, this may improve the profitability of electrolysis plants.

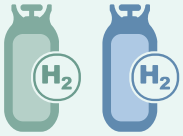
2. Action plan

2.1 Production of large volumes of low-carbon and decentralised carbon-free hydrogen

The hydrogen production goal of the Strategy is establishing the conditions necessary to produce low-carbon and carbon-free hydrogen that is in compliance with user requirements and is competitively priced by promoting the implementation of centralised and low-carbon production methods able to satisfy large volumes of local, industrial demand, and decentralised carbon-free production methods able to satisfy minor demand.

Production of 36,000 t / year "green", other carbon-free and low-carbon hydrogen in 2030

- 20,000 t / year of low-carbon hydrogen
- 16,000 t / year of "green" and other carbon-free hydrogen
- 240 MW electrolyser capacity



The hydrogen produced and utilised in the today's domestic industry is entirely "grey" (high-carbon footprint) hydrogen, created through steam methane reforming (SMR). Replacing this hydrogen with low-carbon hydrogen would significantly reduce the GHG emissions of the industry and the national economy as a whole.

Considering the strategic timeline (by 2030), the most cost-efficient solution for satisfying the industrial demand for low-carbon footprint hydrogen is low-carbon "blue" / "turquoise" hydrogen. At the same time, in addition and parallel to centralised, large volume hydrogen production, the conditions for decentralised, carbon-free hydrogen production with electrolysis must be established, which, in the long term, may become the main basis of hydrogen production.

PRIORITY MEASURES

1) Within the framework of efforts for promoting the development of centralised production methods satisfying large volumes of local, industrial demand, the reconstruction of existing hydrogen production methods will begin with the goal of significantly reducing carbon footprint. As regards the carbon capture and storage technology (CCS) associated with hydrogen production, a stimulating regulatory environment and support system will also be established.
2) Promotion of carbon-free hydrogen production methods satisfying sporadic, small and medium transportation-related and energy requirements.
3) Establishment of electrolysis centers with the purpose of launching photovoltaic (PV) and electricity-grid-mix based generation pilots.
4) Establishing a European system for Guarantees of Origin pertaining to various hydrogen types.
5) Monitoring the development of new production technologies, developing international collaborations in order to employ market-ready solutions domestically as soon as possible.

2.2 Industrial decarbonisation

At first, the reduction of the carbon footprint of industrial processes and product use is to be achieved through the usage of low-carbon hydrogen, with a shift to carbon-free hydrogen usage on the longer term.

24,000 t / year "green", other carbon-free and low-carbon hydrogen to be used for industrial applications in 2030

- 20,000 t / year of low-carbon hydrogen
- 4,000 t / year of "green" and other carbon-free hydrogen

Avoiding the emission of minimum 95 thousand tons of CO^2 per year

The use of carbon-free or low-carbon hydrogen results in no or minimal carbon dioxide emissions, thereby offering a solution for the decarbonisation of industrial processes and product use in areas where the reduction of carbon dioxide emission is becoming increasingly urgent, but where the task of decarbonisation is hard to implement using available technologies and solutions.

Considering the strategic timeline, low-carbon hydrogen may be introduced to the petrochemical and chemical industries (primarily in ammonia production) by gradually replacing carbon-intensive "grey" hydrogen.

Domestic industrial hydrogen production and consumption may develop as follows:

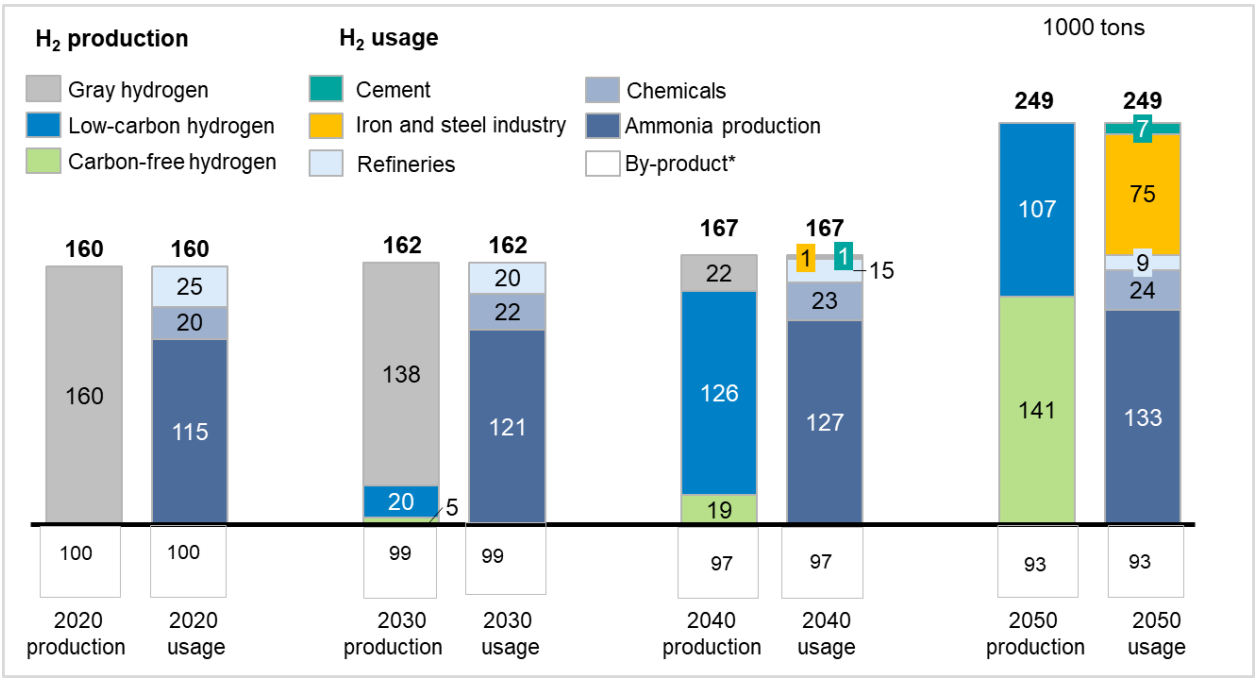


Figure 2: Expected development of domestic industrial hydrogen production and usage

* Byproduct of industrial processes.

By 2030, the first pilot plants, launched in the 2020s and producing carbon-free (or low-carbon) hydrogen, may go live, aimed at reducing the use of "grey" hydrogen. By 2040, we expect a rise in the use of low-carbon hydrogen and electrolysis-based carbon-free hydrogen. By 2050, industrial hydrogen usage may become significantly decarbonised.

The decarbonisation of industrial hydrogen usage is also supported by the creation of hydrogen valleys / hydrogen clusters, which act as a demonstration of an entire hydrogen ecosystem in a region, as a portfolio of interconnected projects.

Hungary plans to establish two new hydrogen valleys by 2030.

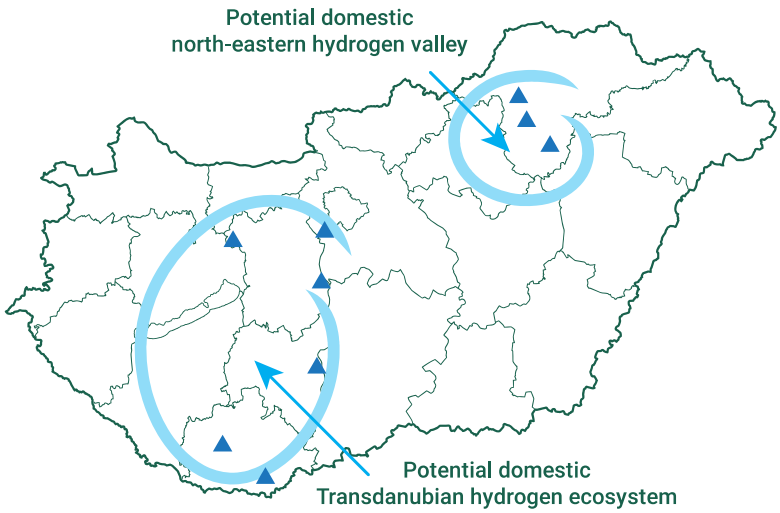


Figure 3: Potential hydrogen valleys of Hungary

1) **Hydrogen ecosystem of the Transdanubia:** The ammonia and refinery industry (Pétfürdő, Százhalombatta) is of exceptional capacity even at the regional level, and, in additional to existing large hydrogen users, there are several sectors that may potentially become new hydrogen users: iron and steel works (Dunaújváros), cement production (Beremend, Királyegyháza). The Paks nuclear power plant may supply a significant amount of carbon-free electricity for the establishment of the hydrogen value chain.
2) **North-eastern hydrogen valley:** A region with a well-developed industry (Miskolc, Tiszaújváros, Kazincbarcika, robust chemical and petrochemical industry, with significant existing hydrogen usage), with a significant demand for hydrogen in a concentrated area. The inclusion of the Mátra Power Plant and its area should also be investigated.

PRIORITY MEASURES

1) Promoting activities aimed at the production and consumption of the low-carbon hydrogen necessary for petrochemical, chemical industry and fertiliser manufacturing processes based on the use of clean resources. Within this context, investigating possibilities for a support system associated with hydrogen's industrial, chemical, energetics and transportation usage, making proposals concerning preferred subsidies and incentives.
2) Promoting the implementation of cooperative centers (hydrogen valleys) established with the purpose of reducing carbon intensity. (Partially within the bounds of the project "Establishing hydrogen valleys in Hungary".)
3) Supporting the research and development of carbon dioxide capture and utilisation solutions and testing within the framework of pilot programmes in the petrochemical and chemical industry (RDI project before 2030).
4) Promoting hydrogen usage conditions necessary to meet the industrial heat demand of the cement industry, and supporting production processes reducing carbon intensity in iron and steel production (primarily after 2030).
5) Investigating the feasibility of a "Contract for Differences" system.
6) Continuous harmonisation of hydrogen strategy directions and the strategic initiatives of dominant state-owned and stakeholder companies.

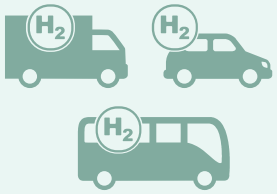
2.3 Green transportation

The general goal of the Strategy as regards transportation is speeding up the transition to clean methods of traffic partly by way of hydrogen usage, which can be implemented parallel to the gradual reduction of gas oil use with a focus on heavy-duty vehicle traffic. A priority sub-target is the reduction of the carbon footprint of truck traffic through the use of hydrogen, the expansion of hydrogen mobility to bus traffic and waste collection, and, at the same time, the construction of a hydrogen refuelling infrastructure based on an island, as well as a corridor logic.

10,000 t / year of "green" and other carbon-free hydrogen to be used for transportation in 2030

- establishment of at least 20 hydrogen refuelling stations (with two refuelling points per refuelling station)
- use of 4.8 thousand hydrogen powered vehicles in total

Avoiding the emission of 130 thousand tons of CO^2 per year



In Hungary, the **hydrogen demand of the transportation sector will grow to 10,000 tons by 2030**, then, following a dynamic spread of fuel cell vehicles, to approximately 65,000 tons by 2040 and an estimated 212,000 tons by 2050.

As regards vehicle fleets, the Strategy focuses on heavy-duty vehicles, for example trucks, waste collections vehicles and city buses. **Fuel cell vehicles may appear on the road as early as the beginning of the 2020s, but the increase will become dynamic in the 2030s, thanks to, in particular, the increasing popularity of hydrogen in the heavy-duty vehicle sector.** (By 2040, the number of hydrogen-fueled vehicles is expected to exceed 40 thousand, and by 2050, there may be more than 130 thousand.)

The establishment of the refuelling network will be critical: in order to satisfy demand, we calculate that by 2030, 20 refuelling stations (with 2 refuelling points per refuelling station) will be needed, and this figure may rise rapidly after 2040. Due to the boom in international hydrogen demand, it is probably that the establishment of publicly available hydrogen refuelling stations will be necessary, taking advantage of European transport corridors.

PRIORITY MEASURES

1) The promotion of the appearance of fuel cell buses and waste collection vehicles in local public transport and communal waste collection will be primarily implemented through the expansion of the Green Bus Programme and the launch of local mobility programmes.
2) Promoting the decarbonisation of heavy-duty traffic through the launching of the "Green Truck" project and – partly as a subset of this project – through the establishment of refuelling infrastructure along corridors (TEN-T corridors, Helsinki corridors).
3) Promoting the introduction of fuel cell buses in interurban public transportation.
4) Promoting hydrogen propulsion technologies in railroad transportation, where the implementation is economically feasible (mainly after 2030).
5) Promoting hydrogen propulsion technologies in water transportation to reduce the environmental impact on our bodies of water (on a larger scale after 2030).

2.4 Electricity and natural gas support infrastructure

Our goal is building sector integration ability - primarily seasonal energy storage ability - by utilising intersectoral synergy, establishing infrastructure that will enable the transition to carbon neutrality, and reconstructing existing infrastructure.

Building sector integration ability – primarily seasonal energy storage ability

- creating an average down-regulation capacity of at least 60 MW
- enabling a volume blending ratio of 2% in the natural gas system on the short term, to be expanded on the medium term in accordance with tests carried out by that point

Since Hungary has fewer locations suitable for the construction of pumped electricity storage facilities, a possible solution for **seasonal electricity storage** could be the production of hydrogen through the electrolysis of water using occassional electricity surpluses.

Considering the increasing popularity of weather-dependent renewables, Power-To-Gas (P2G) plants producing carbon-free hydrogen may play a key role in balancing the electricity system and in treating regional and local network-related problems.

The **natural gas infrastructure** is also affected by the development of the hydrogen economy. It must be considered that, in the foreseeable future, hydrogen may be introduced to natural gas networks in Hungary. In order to establish a foundation for this, the natural gas infrastructure, which is particularly extensive and is considered excellent even at the international level, must be examined with regard to the introduction of hydrogen into natural gas networks. In addition to the utilisation of the natural gas infrastructure, creating connections to the European hydrogen backbone is also considered an important task.

PRIORITY MEASURES

1) Establishing carbon-free energy production, and ensuring that the network development of energy systems enables integration to assist in hydrogen production.
2) Examining the possibility of introducing hydrogen to the natural gas infrastructure, implementing a pilot project. (As part of this measure, implementing the prioritised Hydrogen Highway Project.) The framework of sectoral regulation must be established based on experience gained through fundamental research, pilot projects and regulatory sandbox programs.
3) Drawing up a regional connection to the European Hydrogen Backbone.
4) Gradually preparing the natural gas transportation, storage and distribution network and user systems for the uptake and utilisation of clean hydrogen (where appropriate).
5) Promoting the use of above-ground hydrogen storage solutions and the secure availability of storage technologies for industrial volumes.
6) Initiating combination pilot programmes (co-firing of natural gas and hydrogen) for closed-cycle gas turbines in order to gain experience in the field of hydrogen technologies, and thus be able to make well-founded decisions concerning later large-scale investments.
7) Introducing hydrogen-based applications to the market of electricity-related regulatory and flexibility services.
8) Examining the possible uses of carbon-free hydrogen in the satisfaction of cooling/heating demand and promoting the potential introduction of such technologies (after 2040).

2.5 Taking advantage of industrial and economic development opportunities

Enhancing the activities at the intersection of industrial trends and Hungary's domestic competencies in order to promote competitiveness and stimulate domestic penetration.

Today, in the industrial segment of Hungary, hydrogen technologies are present primarily on the user, consumer side, however, **there is potential in Hungarian companies for the development and manufacturing of various hydrogen-based solutions.**

Medium-term objectives identified within the framework of industrial development are as follows:

Supporting appropriate responses to the main challenges faced by domestic hydrogen economy

- Promoting the adaptation and spread of procedures associated with the production of "blue" hydrogen.
- Increasing electrolyser manufacturing capacity mostly based on licenses, in cooperation with international partners. In addition to the satisfaction of domestic demand, Central European coverage may also be viable.
- Electricity-related applications for the promotion of the integration of renewable energy generation.
- Defense industrial applications within the framework of the *Zrínyi2026* plan.

Turning domestic knowledge into an export (as part of a "high-tech, green and Hungarian" future)

- Enhancement of component development and the process of becoming a supplier. Supporting the SME sector with regard to production and manufacturing development, international cooperation and access to external markets.
- Taking advantage of system integration opportunities in transportation-related applications with the participation of domestic actors in the automotive industry and of bus manufacturers.
- Supporting gazelles on "niche" markets (e.g. drones, laboratory equipment, small fuel cell boats, etc.) in order to promote the introduction of innovative products and market penetration.

As regards industrial development, emphasis must be primarily on (sub-)sectors in line with domestic demand and abilities (industrial development opportunities and RDI abilities). Additionally, it is recommended that industrial development opportunities are utilised in domains where, even though domestic usage is unlikely to become significant in the foreseeable future, the product will have an international market in the near future (meaning that marketability is also an extremely important factor).

PRIORITY MEASURES

1) Promoting the establishment of a domestic manufacturer base of technologies servicing relevant demand, enhancing component development and the process of becoming a supplier. In this context, supporting, particularly, the SME sector with regard to production and manufacturing development, international cooperation and access to external markets.
2) Increasing electrolyser manufacturing capacity in cooperation with international partners. In addition to the satisfaction of domestic demand, we will promote regional market participation, engagement in Central Europe. Another task covers the enhancement of relevant service portfolio.
3) Taking advantage of system integration opportunities, primarily in transportation-related applications, with the participation of domestic actors in the automotive industry and of bus manufacturers.
4) Defense industrial applications within the framework of the *Zrínyi2026* plan and as part of the rising defence industry.

2.6 Horizontal conditionality: regulation and partnership

2.6.1 Building of a supportive regulatory environment

It is necessary to improve legislation concerning hydrogen and hydrogen technologies, the objective being the creation of realistic and holistic European and national regulatory frameworks that are predictable even over the long term and that promote the development of the hydrogen economy.

The **permeability of clean and low-carbon hydrogen markets must be ensured and, in order to promote relevant investment, a regulatory framework that enhances all elements of the value chain must be developed**, partly through a revision of current EU and domestic regulation, partly through the introduction of new regulatory elements.

PRIORITY MEASURES

1) Pursuing national interests in the course of legislative processes (including revisions) being implemented at the European Union level, and implementing duties arising from European legislation.
2) The fabric of sectoral regulation may be established by building on the EU framework, by correcting existing legislation based on experience gained through fundamental research, pilot projects and regulatory attempts, and by developing new regulatory solutions.

2.6.2 Promoting international cooperation

Our goal is to take advantage of economic and industrial development opportunities arising from hydrogen and hydrogen technology by reinforcing international relationships and by creating new markets.

Within the context of the increasing popularity of hydrogen technology, international cooperation is not just advantageous, but necessary. Certain tasks can only be carried out through unified measures at the EU level. Areas that typically require **EU-level cooperation** are the development of rules for the use and market design of the unified natural gas network, the development of a guarantee of origin system for hydrogen, and the establishment of sale and purchase rules for green guarantees of origin that can be applied commonly throughout the continent. **Regional-level cooperation** shall be necessary for the creation of hydrogen corridors and a coordinated hydrogen refuelling infrastructure network; however, it would also be practical to establish a network of relations between hydrogen valleys in a given region.

The foundation of **IPCEI projects**[1] has become one of the current instruments of international engagement in the area of hydrogen economy activities; these projects serve as test grounds for the industrial application of new hydrogen technologies. There are numerous IPCEI[2] projects (Blue Danube @ Green Hydrogen; Black Horse; H2Go; Silver Frog) focused on Central Europe currently being prepared, in which Hungary may play a dedicated role, and from which, at the same time, it may gain significant competitive advantage.

Further IPCEI cooperation may arise from the continuous exchange of information between the Visegrád countries.

[1] The website of the NRDI Office on IPCEI projects: https://nkfih.gov.hu/palyazoknak/innovacios-okoszisztema/ipcei-projekt/ipcei-projektrol
[2] IPCEI (Important Projects of Common European Interest)
In our case, direct state funding, with the lifting of non-compete obligations, is available for certain cost items.

PRIORITY MEASURES

1) Integrating hydrogen, as a theme, into the framework of existing bilateral partnerships, and establishing new partnerships for the purpose of sharing experiences, best practices and launch joint projects (Horizon Europe, Clean Hydrogen For Europe Partnership, IPCEI, others). In this regard, within the framework of international hydrogen technology initiatives, particular attention must be paid to the following:
   a) stimulating Hungarian participation in the strategical and IPCEI projects of the CEE region, particularly to support Hungary joining the hydrogen corridors being established at the EU and the regional level,
   b) defining IPCEI projects launched by Hungary, particularly those in the area of mobility, energetics, the oil and chemical industries.
2) Creating more active cooperation in the hydrogen and hydrogen technology domains, within the framework of multilateral partnerships.
3) Promoting cooperation at the international level with potential suppliers, investors and markets.
4) Enhancing coordination between EU, multilateral and national programmes in order to avoid any duplication of supported activities and to exploit potential synergies.

2.7 RDI and education to promote the success of hydrogen during the transition

Our goal is to establish a system of scientific, technological and horizontal competencies that can serve as a foundation for our participation in the development of new technologies and for demonstrating the legitimacy of such technologies on the domestic market.

At the domestic level, added value is provided primarily through system integration and the design/development/manufacturing of components, which must be supplemented by drawing up models for the energy system.[3]

We have identified R&D potential along the value chain in the following domains.

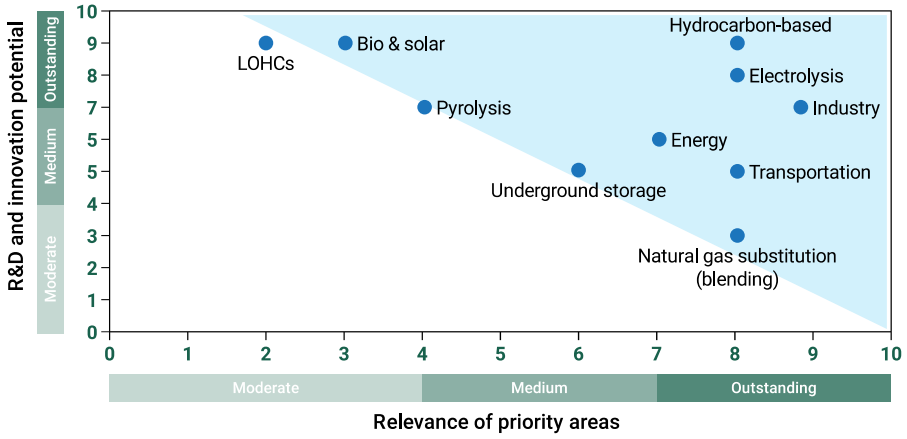


Figure 4: Priority areas based on domestic R&D and innovation relevance and potential

[3] National Hydrogen Technology Platform (2021): White paper study providing the foundation of the Strategy for the development of the domestic hydrogen and hydrogen technology sector.

As regards the increase of knowledge on hydrogen and hydrogen technology, two priority intervention directions can be identified:

1) Education and expert training, and also continuing education.
2) Proper, widespread information of the public.

PRIORITY MEASURES

1) Foundation of the National Hydrogen Technology Laboratory as part of the National Renewable Energy Laboratory. Endeavoring to create a "HorizonEurope Teaming" project in cooperation with a leading foreign partner institution.
2) Pilot programmes produced by the National Laboratory and pilot projects by members of the National Hydrogen Technology Platform within identified focus areas. Typically as part of cooperation between industrial and higher education actors.
3) Applied research projects in the domains of CO2 transportation and storage.
4) Launching of innovation projects (component development, system integration and, potentially, product development) in support of industrial development.
5) Launching of a priority project at the intersection of CCU/petrochemistry. (Blue Hydrogen Project)
6) Supporting the launch of IPCEI[4] projects.
7) Developing educational programmes, improving curricula and/or adapting EU curricula: It is recommended to develop hydrogen technology education and training in a dual system, while providing the necessary laboratory background and establishing focused educational centers and promoting the networking of such centers.
8) Dissemination of basic knowledge on hydrogen among wider society in order to enhance the public acceptability of hydrogen.

[4] Also with regard to international cooperation. Details shall be provided there.

3. Implementation of the Strategy

To implement the Strategy as soon as possible, there are 6 comprehensive, so-called prioritised projects, which, till 2030, are complemented by professional measures scheduled along 3 timelines.

Prioritised projects, which are meant to implement the primary goals of the Strategy and which should be launched as soon as possible, are as follows (with the estimated subsidy requirements in parentheses):

1) **Green Truck Programme** for making freight traffic more green (HUF 35-40 bn)
2) **Green Bus Programme Plus** for making public services, concerning transportation at the local level, more green (HUF 10-20 bn)
3) **Establishment of hydrogen valleys in Hungary** to promote the establishment of interconnected networks of the hydrogen value chains within the given geographical regions (HUF 10-15 bn)
4) **Hydrogen Highway Project** for creating a foundation for carbon-free hydrogen production, transportation and energy storage (HUF 20-30 bn)
5) **Blue Hydrogen Project** for reducing the carbon footprint of industrial hydrogen usage (HUF 20 bn)
6) **Research, development and innovation** in service of the establishment of a hydrogen economy (HUF 10 bn)

The scheduling of policy actions before 2030 can be divided into 3 stages:

2021-2023 ESTABLISHMENT OF FRAMEWORKS	2024-2025 FIRST RESULTS	2026-2030 RISE
The development of the implementation framework of the Strategy and the operational plans of the hydrogen economy, the establishment of the conditions necessary for producing low-carbon hydrogen, the launch of electrolysis-based hydrogen production and prioritised comprehensive projects, and the preparation of associated test projects will be in focus during this stage. In addition to all this, the installation of hydrogen refuelling points, the development of an educational-training background, and the establishment of international cooperative partnerships will also begin. Since hydrogen demand will be satisfied at first near or at the site of production, the need for transportation infrastructure will be limited to a minimum.	Developments concerning all pillars of the Strategy will be launched, with particular attention being paid to the building of domestic manufacturing and service background capacities. The reduction of the carbon footprint of existing hydrogen production and usage will gain momentum in the refinery sector, in the petrochemical industry and in ammonia production. Hydrogen production through electrolysis will expand, and hydrogen-based mobility will be introduced to heavy-duty vehicle traffic. The infrastructural requirements associated with hydrogen transportation will remain limited, as, in the beginning, demand will be satisfied near or at the place of production. However, in certain domains, the small scale blending of hydrogen and natural gas may alreahy occur in certain sectors. Additionally, the drawing up of the concept of regional connection to the European Hydrogen Backbone and the expansion of the hydrogen refuelling infrastructure network will continue.	As the previously initiated developments become productive, the partial decarbonisation of existing industrial hydrogen usage will be realised, industrial production processes will be made more green, and the transition to clean methods of transportation will become more accelerate. The basis for the countrywide network of hydrogen refuelling stations will be established, and the natural gas transportation, storage and distribution network and the user systems will be prepared for the uptake of larger rates of clean hydrogen will begin. The first hydrogen valleys will also serve as proof of the successful implementation of the Strategy. By the end of the period, our hydrogen economy will be integrated into the European hydrogen economy. As regards costs, low-carbon and carbon-free hydrogen is becoming increasingly competitive against “grey” hydrogen. Expanding hydrogen uses to cover additional domains (steel production, cement industry) will require additional intervention.

As a result of innovation activities, the market readiness and market entry level of hydrogen technologies is evolving rapidly, therefore a review of the Strategy in 2025 is justified.

4. Looking beyond 2030

Between 2030 and 2040, with the advancement of technology, we can expect further increase in the use of hydrogen. **In the period after 2040**, the use of hydrogen technology may further expand in the natural gas network and the cooling-heating sector.

Between 2030 and 2040

- Monitoring new production technologies, expanding international collaborations in order to employ market-ready solutions domestically as soon as possible.
- Supporting carbon dioxide capture and utilisation solutions in the petrochemical and chemical industry.
- Facilitating conditions for raw material usage necessary to meet the industrial heat demand (e.g. cement manufacturing).
- Expanding usage in the steel and the cement industries.
- Expanding the use of fuel cell buses in interurban public transportation.
- Promoting hydrogen propulsion technologies in railroad transportation (utilisation), where the implementation is economically feasible.[5]
- Promoting, on a larger scale, the use of hydrogen propulsion technologies in water transportation to reduce the environmental impact on our bodies of water.[6]

After 2040

- Preparing the gas distribution network and user systems for the uptake and utilisation of clean hydrogen.
- Examining the possible uses of carbon-free hydrogen in the satisfaction of cooling/heating demand and promoting the potential introduction of such technologies.

[5] Manufacturing development associated with hydrogen propulsion in railroad transportation may be justified as early as the 2020s, provided that the marketability of the products to be developed can be confirmed.
[6] The development of existing hydrogen-fueled motorboats and hydrogen-fueled ferries may be justified as early as the 2020s, provided that the marketability of the products to be (further) developed can be confirmed.