HYDROGEN STRATEGY

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1 MANAGEMENT SUMMARY

Hydrogen and hydrogen technologies will be one of the key tools for achieving the goals of decarbonization and transformation of Czech industry. They are an example of innovative production with high added value. The transition to the production of hydrogen technologies necessary for the production, storage, transport, and use of hydrogen represents a major challenge and opportunity for Czech industry, and a number of Czech companies have already achieved concrete results in this area.

Globally, the industrial sector is a traditional consumer of hydrogen. In the Czech Republic, approximately 125,000 tons of hydrogen are produced and consumed annually, primarily produced by partial oxidation of petroleum residues. The transition of companies that have been using hydrogen for decades from gray hydrogen produced from fossil fuels to hydrogen from renewable sources is a challenging and costly process. The industrial sector must undergo gradual decarbonization, and the Czech Republic must use tools that will help make the transition economically and socially viable. EU legislation requires European industry to replace 42% of the gray hydrogen it consumes with renewable hydrogen by 2030. In 2035, this mandatory target will be increased to 60%. In addition to the current consumption of grey hydrogen, mainly in the refining and chemical production sectors, hydrogen is expected to be used to decarbonize iron production.

The transport sector is the only sector where greenhouse gas emissions are increasing due to growing transport performance. Nevertheless, an acceleration in the trend away from fossil fuels towards electricity can already be observed, particularly in road passenger transport and rail freight transport. The number of registered battery electric vehicles is growing steadily across the Czech Republic. Hydrogen also has the potential to contribute to the decarbonization of transport in the future. As in the industrial sector, its use is supported by EU legislation, which requires that by 2030, more than 1% of all energy consumed in transport must come from renewable hydrogen or synthetic fuels of renewable origin([1]). In addition, a mandatory target must be met for synthetic fuels of renewable origin in the aviation sector.

According to the Regulation on the deployment of alternative fuels infrastructure (AFIR), the Czech Republic must establish a network of hydrogen refueling stations along the main routes of the Trans-European Transport Network (TEN-T) at intervals of every 200 kilometers with a cumulative capacity of 1 ton per day by 2031. Filling stations will also have to be located in all urban hubs. Various studies show that, apart from passenger car transport, the expansion of hydrogen in the transport sector will mainly take place in long-distance freight transport, bus transport, and passenger rail transport.

The energy sector is undergoing a transformation from large, stable sources with high emissions to renewable but more complex sources. The future energy mix of the Czech Republic will be based on a combination of nuclear energy and renewable sources, with hydrogen playing a key role as a link between these two energy sources. Its deployment will enable more efficient use of surplus energy generated by both nuclear and renewable sources. At the same time, hydrogen contributes to strengthening the Czech Republic's energy security and resilience through the possibility of diversifying energy sources. Importing hydrogen via pipelines from countries with surplus renewable resources is an effective way to compensate for the lack of domestic renewable resources. Hydrogen also complements electrification and is expected to become more important for seasonal energy storage and accumulation in the coming decade. This deployment will enable more efficient use of existing energy sources and support the transition to a low-carbon economy.

[1] https://eur-lex.europa.eu/legal-content/CS/TXT/PDF/?uri=CELEX:02018L2001-20231120 (Article 25(b))

Due to the legislative definition of supported types of hydrogen production and consumption by the European Union, the hydrogen strategy focuses primarily on supporting renewable hydrogen. Renewable hydrogen is defined in EU legislation as a renewable fuel of non-biological origin (RFNBO) and can only be produced through electrolysis using electricity from renewable energy sources, with the exception of biomass. In addition to renewable hydrogen, RFNBO also includes renewable ammonia, renewable methanol, and synthetic fuels.

In addition to renewable hydrogen, low-carbon hydrogen is also important for the Czech Republic in the context of future hydrogen production from nuclear energy and other low-carbon technologies recognized by the European Commission in the Delegated Act on low-carbon hydrogen/low-carbon fuels currently being prepared. This will specify the method for calculating the carbon footprint, support options, and emission targets that can be met with low-carbon hydrogen. It is therefore essential for the Czech Republic to ensure sufficient flexibility in hydrogen production rules for the future, given the future direction of the energy mix and the use of low-carbon hydrogen to reduce greenhouse gas emissions under the EU ETS in the industry, transport, and energy sectors.

In the field of renewable hydrogen production, the Czech Republic cannot compete with countries with better climatic conditions in terms of the price of electricity from renewable sources. The economic production of renewable hydrogen is primarily dependent on a suitable combination of cheap wind and solar energy. However, the Czech Republic is lagging behind in the construction of wind power sources due to lengthy building permit procedures. Nevertheless, when directing Czech support for hydrogen production, it is necessary to take into account not only the economic framework, but also energy self-sufficiency and the future interconnection of the electricity and gas hydrogen systems. The anticipated adaptation of the gas transmission system to hydrogen, which is expected around 2030, creates space for dividing the Czech Hydrogen Strategy (hereinafter referred to as the "Hydrogen Strategy") into three stages. The first stage is defined as **"Local** Islands," the second is called "**Global** Bridges," and the third envisages the deployment of
"**New** Technologies." The individual stages overlap and are not precisely defined in terms of time. The year 2030 appears to be optimal for completing the repurposing of the gas transmission system, as it is linked to the reconstruction of connecting sections of gas pipelines within the European Hydrogen Backbone.

Local islands (2023-2030) are a stage in which the Czech Republic will support the production of renewable hydrogen in the Czech Republic in accordance with applicable EU legislation and the objectives of the directive on the promotion of the use of energy from renewable sources in the industry and transport sectors (RED Directive). The national target set out in the directive requires that **approximately 20,000 tons of RFNBO be consumed in** industry and transport in **the Czech Republic by 2030**. In order to meet this target, it is necessary **to support the construction of electrolysers with a capacity of at least 400 MWe with** an expected utilization rate of between 30 and 50% in accordance with the applicable rules for the production of renewable hydrogen. In order to meet the target and enable companies affected by the EU directive to produce and consume RFNBO, **the Czech Republic must significantly accelerate the construction of solar and, in particular, wind energy sources. In addition, the rules for RFNBO production envisage stricter conditions for electrolytic hydrogen production after 2027,** and it is therefore in the interest of meeting national decarbonization targets that **the Czech Republic provides sufficient investment and, where necessary, operational support, accelerates the construction of electrolysers, and ensures that a number of projects can be implemented before the end of 2027.** With appropriate support, it is possible to achieve a lower hydrogen production price of **around or below €8 per kilogram.** Although the resulting price is still relatively high compared to grey hydrogen, the support will improve the competitiveness of companies affected by EU requirements to replace grey hydrogen with renewable hydrogen. The lower the final price of hydrogen, the greater the opportunities for industry and transport to switch to hydrogen and thus reduce greenhouse gas emissions. At this stage, no significant use of hydrogen transport and distribution networks is expected, so it is advisable to support electrolysers as close as possible to the point of consumption in order to eliminate transport costs by trailer. The creation of hydrogen clusters is envisaged, and

hydrogen valleys[2], particularly in the Ústí, Moravia-Silesia, and Karlovy Vary regions. The Czech Republic is committed to the concept of "hydrogen valleys" in accordance with the European Union's understanding of this term. In terms of hydrogen use in transport, it is important at this stage to start building the necessary infrastructure and creating the first transport hubs in the areas of bus, rail, and freight transport. This is particularly important in cases where hydrogen transport can demonstrate its advantages, such as stable long range, short refueling times, the ability to drive in rough terrain, and independence from the capacity of the electricity grid. The infrastructure built for refueling hydrogen vehicles will also further promote the use of hydrogen passenger cars. The advantage of using hydrogen in transport is that it is possible to achieve operational parity with fossil fuels at hydrogen prices of around €4–6/kg.

The estimated investment costs for the production, distribution, and consumption of renewable hydrogen range from CZK 18 billion to CZK 115 billion. The wide range of estimates is due to a number of factors that we are currently unable to determine. These include, for example, the possibility of using low-carbon hydrogen to meet decarbonization targets, the possibility of importing renewable ammonia by rail, the availability of technologies, the speed of construction of hydrogen transport infrastructure, the speed of construction of solar and wind farms, and the speed of connecting electrolysers, as different conditions will apply to their use after 2027. The upper cost estimate is based on a study by the SPČR ([4]). It includes a wide range of factors and defines individual areas of investment costs in detail. It shows that in the first stage, it is necessary to focus on meeting the RED targets and creating a basic hydrogen infrastructure that can be further developed once cheap renewable hydrogen imports are secured in the next stage.

The **Global Bridges** phase **(2027–2050)** focuses on supporting imports of renewable hydrogen from countries with cheaper and more abundant renewable energy sources**. This phase envisages the gradual creation of a hydrogen market** similar to the natural gas market. **The price of hydrogen** is expected to be **around €4 per kilogram at the point of exit from the transport system** by around 2030**. The lower price of hydrogen will lead to its expansion into applications beyond legislative requirements.** The price will gradually fall in line with improvements in hydrogen production efficiency and transport efficiency in the coming years. **A key prerequisite is the repurposing of existing and, where necessary, the construction of new transport corridor infrastructure and associated distribution pipelines to end customers.** The main projects currently at various stages of development are the Czech German Hydrogen Interconnector (CGHI) leading from Saxony through the Czech Republic to Bavaria and the Central European Hydrogen Corridor (CEHC), which aims to enable the transport of hydrogen from western Ukraine via Slovakia and the Czech Republic to large areas of demand, particularly Germany. **The advantage of both projects is the possibility of using existing gas pipelines and converting them for hydrogen transport, which represents a cost-optimal solution.** The projects are currently expected to be implemented by the end of 2030. Depending on the development of demand, there are also plans to repurpose one gas pipeline of the northern branch between the border points of Lanžhot and Brandov, or at least part of it. The gas transmission system operator is analyzing the possibility of supplying hydrogen to the northern region.

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[2] "Hydrogen Valley" usually refers to regions or areas where there is significant development, deployment and integration of hydrogen technologies, infrastructure, applications, research, and education. These areas include facilities for hydrogen production, storage, transportation, and utilization, as well as programs aimed at supporting the operation and development of a hydrogen economy. Hydrogen valleys are hubs where different organizations work together to create a hydrogen ecosystem. The term "hydrogen valley" is derived from the concept of "innovation valleys" or "silicon valleys," which are known for their concentration of innovation and technological advancement. Similarly, hydrogen valleys aim to concentrate expertise, resources, and infrastructure to accelerate the adoption of hydrogen as a clean energy carrier and contribute to decarbonization efforts. https://h2v.eu/hydrogen-valleys

[3] https://hydrogeneurope.eu/wp-content/uploads/2023/09/HE-Input-to-H2V-Roadmap_final-version-.pdf

[4] https://www.spcr.cz/pro-media/tiskove-zpravy/16587-cr-se-musi-dukladneji-chystat-na-nastup-vodikove-ekonomiky

Moravia. The Czech Republic considers the reconstruction of the gas pipeline infrastructure to be essential for the import of cheap hydrogen from abroad and, as such, will make every effort to implement it, particularly in cooperation with foreign partners, especially Germany, for which the Czech gas pipeline infrastructure represents a key opportunity to diversify its hydrogen sources. For the Czech Republic, the possibility of importing gaseous hydrogen or its compounds is one of the options for reducing greenhouse gas emissions and increasing the competitiveness of Czech companies. Within this stage, the use of hydrogen is also expected to expand into the energy sector in the context of importing and storing energy in the form of gaseous hydrogen or its compounds.

The estimated investment costs for securing the import of renewable hydrogen via pipelines are between CZK 5 and 25 billion. It appears that importing renewable hydrogen is more economically advantageous than producing it in the Czech Republic.

The **New Technologies** stage **(2040–2060)** is more of a technological stage, which expects the development of new technologies for hydrogen production that will lead to a higher degree of energy independence for the Czech Republic. Examples of such technologies include the use of geothermal energy or new generations of nuclear reactors suitable for the production of cheap hydrogen using high-temperature electrolysis.

Given the complexity of technological, political, and legislative developments, the objectives of the Hydrogen Strategy are primarily focused on the time horizon up to 2030.

The Minister of Industry and Trade has established the National Hydrogen Council and the Hydrogen Coordination Group to coordinate activities related to the introduction of hydrogen technologies. The Hydrogen Coordination Group was involved in updating the Hydrogen Strategy. A Hydrogen Valley Coordination Group will be set up to further support and coordinate the development of the hydrogen valley concept. The development of hydrogen technologies in the Czech Republic has long been supported and coordinated by the Czech Hydrogen Technology Platform HYTEP. The current promoter of the "hydrogen valley" concept in the Czech Republic is the Working Group for Interregional Cooperation of Transforming with coal regions in the field of support application of hydrogen technologies and coordinated development of the "hydrogen valley" concept (hereinafter referred to as the H3 team), which represents the common interests of transforming coal regions piloting the "hydrogen valley" concept.

The main objectives, which are further elaborated in the Hydrogen Strategy and specified in the task cards, include:

- Build at least 400 MWe of electrolyzer capacity with priority by 2027 and ensure appropriate support programs;
- By 2025, simplify and accelerate related processes: environmental impact assessments, building regulations, and acceleration zones;
- By the end of 2024, analyze and adjust the subsidy titles necessary for the development of the hydrogen economy economy;
- By the end of 2024, create conditions for the emergence of hydrogen valleys, especially in transforming coal regions;
- By the end of 2024, in cooperation with emerging hydrogen valleys, especially in transforming coal regions, announce specific calls for support for the development of the hydrogen valley concept and support for the application of comprehensive application chains for hydrogen technologies;
- By the end of 2024, create conditions and ensure full cooperation between all central government bodies with a view to accelerating, in line with the needs of emerging hydrogen valleys, particularly in transforming coal regions, the preparation of development projects and the activation of implementation processes for specific projects;

- By 2025-2026, create a comprehensive legislative and regulatory framework for the hydrogen economy, including a framework for guarantees of origin, certificates, technical standards, etc.;

- By 2030, repurpose two branches of the gas transmission system (Lanžhot – Brandov, Brandov – Waidhaus) and strengthen the Czech Republic's role in hydrogen transit transport;

- By 2025, analyze the method and form of repurposing gas distribution infrastructure.
  infrastructure;

- By 2024-2028, prepare the gas infrastructure for a blend of hydrogen and natural gas.
  gas, in accordance with European legislation and the results of related analyses;

- Between 2026 and 2028, analyze the possibilities and technical feasibility of storing hydrogen
  in existing storage facilities, or other hydrogen storage options;

- Ensure the fulfillment of the NAP CM targets in the area of hydrogen mobility: support the purchase of hydrogen road and rail vehicles , the development of hydrogen public transport, in a coordinated manner with the construction of a backbone network of hydrogen filling stations and the development of mobile filling stations;

- Prepare, as necessary, in the context of the Export Strategy, trade missions for Czech companies and cooperate with foreign partners in the field of hydrogen technologies and hydrogen production. This should be done in cooperation with the CzechTrade agency and its foreign offices, the diplomatic missions of the Czech Republic and, where appropriate, the CzechInvest agency;

- Prepare an awareness campaign for companies and launch related information websites;

- Support education and research in the field of hydrogen technologies, with a particular focus
  on applied research.

The Hydrogen Strategy was prepared in line with other related strategies, including the Update of the National Energy and Climate Plan of the Czech Republic (NKEP), the National Action Plan for Clean Mobility (NAP CM), the State Energy Policy (SEK), and other strategic documents in the field of energy, the environment, and low-emission transport currently being prepared.

The Hydrogen Strategy was prepared by the Ministry of Industry and Trade on the basis of a decision of the National Hydrogen Council on November 15, 2022, in cooperation with the Ministry of the Environment, the Ministry of Transport, the Energy Regulatory Office, the Czech Hydrogen Technology Platform (HYTEP), the Confederation of Industry of the Czech Republic (SPČR), the Czech Gas Association (ČPS), NET4GAS, GasNet, and other important stakeholders.

2 INTRODUCTION AND MAIN OBJECTIVES

2.1 Initial framework

The update of the Hydrogen Strategy follows on from the original Hydrogen Strategy approved by the government in 2021[5]. The decision to update the Hydrogen Strategy was taken at the meeting of the National Hydrogen Council on November 15, 2022, where a report on the implementation of the original Hydrogen Strategy and the fulfillment of the task cards was also presented. At its next meeting on November 14, 2023, the National Hydrogen Council approved the then current version of the Hydrogen Strategy and its discussion with a wide range of relevant stakeholders. The main reason for updating the Hydrogen Strategy was that the original assumption that the Hydrogen Strategy would be implemented through a gradual increase in renewable hydrogen production had not been fulfilled, and it was necessary to divide the Hydrogen Strategy into stages with different objectives and instruments. The first stage focuses on domestic production of renewable and low-carbon hydrogen (as we will not be able to import it from anywhere else) in order to meet the binding indicators for decarbonization targets. The next stage focuses on maximizing imports of cheap renewable hydrogen from countries with surpluses of renewable resources and diversifying these imports as much as possible so that we do not create energy import dependency. The final stage then focuses on strengthening resilience and ensuring cheap domestic hydrogen production using technologies developed in the future.

The update responds to new conditions that have arisen following the approval or discussion of a number of European Union (EU) documents and legal regulations. The documents on which the Hydrogen Strategy is based are the Paris Agreement[6], the EU Hydrogen Strategy[7], the EU Energy System Integration Strategy[8], the Fit for 55 package[9] , the Renewable Energy Directive (RED)[10] , the Delegated Act establishing a Union methodology for detailed rules on the production of renewable fuels of non-biological origin[11] , the Regulation on the internal market for gases from renewable sources, natural gas and hydrogen[12] , Regulation on the deployment of alternative fuels infrastructure (AFIR)[13] , Block Exemption Regulation (GBER)[14] , Guidelines on State aid for climate, environment and energy (CEEAG)[15] , Regulation establishing a framework to strengthen the European ecosystem for the production of zero-emission technology products([16]) ,REPowerEU plan([17]) ,Climate Policy in the Czech Republic([18]) ,Communication on the European Hydrogen Bank([19]) .

[5] https://www.mpo.cz/assets/cz/prumysl/strategicke-projekty/2021/8/Vodikova-strategie_CZ_G_2021-26-07.pdf

[6] https://www.consilium.europa.eu/cs/policies/climate-change/paris-agreement/timeline-paris-agreement/

[7] https://eur-lex.europa.eu/legal-content/CS/TXT/HTML/?uri=CELEX:52020DC0301

[8] https://eur-lex.europa.eu/legal-content/CS/ALL/?uri=CELEX:52020DC0299

[9] https://www.consilium.europa.eu/cs/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/

[11] https://eur-lex.europa.eu/legal-content/CS/TXT/?uri=CELEX:32023R1184

[12] https://eur-lex.europa.eu/legal-content/CS/TXT/?uri=CELEX:52021SC0456

[13] https://eur-lex.europa.eu/legal-content/EN/HIS/?uri=COM:2021:559:FIN

[14] https://competition-policy.ec.europa.eu/state-aid/legislation/regulations_en

[15] https://ec.europa.eu/commission/presscorner/detail/cs/qanda_22_566?fbclid=IwAR0dudeNVxH-7v1qoqR5h0U3o7AOtnVM-8l4-CwZN7jN27jKxW4Q8KGTvW8

[16] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52023PC0161(01)

[17] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

[19] https://eur-lex.europa.eu/legal-content/CS/TXT/?uri=CELEX:52023DC0156

The main aim of the Hydrogen Strategy is to prepare conditions for the development and use of renewable and low-carbon hydrogen in the Czech Republic as a fuel, chemical raw material, and energy carrier.

The fundamental European goal of achieving climate neutrality in the EU by 2050 remains unchanged despite significant changes in the energy market, such as the elimination of import dependence on the Russian Federation and rising energy prices. The importance of the tools for achieving this goal has changed. Hydrogen is becoming increasingly important. Technologies enabling its efficient use in both transport and industry are developing rapidly. In addition to the necessary breakthrough innovations that will enable the use of hydrogen and contribute to the competitiveness of companies, the production and use of hydrogen is essential to ensure resilience in four key dimensions([20]): climate, socio-economic, digital, and geopolitical.

The update of the Hydrogen Strategy was prepared at the same time as the update of the National Energy and Climate Plan (NKEP), the National Action Plan for Clean Mobility (NAP CM) and the State Energy Concept (SEK). The working teams at the Ministry of Industry and Trade preparing these documents worked closely together to ensure maximum consistency between them.

The Hydrogen Strategy seeks ways to achieve decarbonization targets through the use of hydrogen and hydrogen technologies in sectors suitable for its use. The update responds to technological developments and new hydrogen projects in the Czech Republic and abroad. This is reflected in the main strategic objectives of the Hydrogen Strategy:

- **reducing CO_2 emissions in the Czech Republic,**
- **supporting economic growth and increasing the competitiveness of the Czech Republic.**

The Hydrogen Strategy is based on four pillars:

- **production of renewable and low-carbon hydrogen,**
- **use of renewable and low-carbon hydrogen,**
- **import, transport, and storage of renewable and low-carbon hydrogen,**
- **hydrogen technologies.**

Each pillar includes technical, legislative, and commercial aspects. This ensures the creation of a legal framework that enables the effective transformation and implementation of physical assets, while supporting the emergence of a business environment that will promote the production and use of hydrogen in the transition to a low-emission economy.

The pillars of the Hydrogen Strategy are interlinked – hydrogen consumption must be balanced with its production, import, and storage. The update of the Hydrogen Strategy covers the period until 2050. Specific targets **focus primarily on the period between 2024 and 2035, with an emphasis on meeting the targets defined by European legislation (the RED Directive) through the production of hydrogen from domestic renewable energy sources.**

In the next period, the Hydrogen Strategy emphasizes supporting the import and use of renewable hydrogen, primarily by repurposing existing gas pipelines for the transport and distribution of natural gas. It is expected that in the medium term, due to better climatic conditions abroad, imported renewable hydrogen will be cheaper and more readily available than renewable hydrogen produced in the Czech Republic.

[20] https://commission.europa.eu/strategy-and-policy/strategic-planning/strategic-foresight/2020-strategic-foresight-report_en

According to current legislation, renewable hydrogen can be defined as:

Renewable fuels of non-biological origin **(RFNBO)** are liquid and gaseous fuels produced from renewable sources other than biomass. In the case of renewable hydrogen of non-biological origin, this is hydrogen produced by electrolysis of water using electricity from renewable sources. The conditions for the production and certification of this hydrogen are defined in Commission Delegated Regulation (EU) 2023/1184 of February 10, 2023, supplementing Directive (EU) 2018/201 of the European Parliament and of the Council (EU) 2018/2001 by establishing a Union methodology for defining detailed rules for the production of liquid and gaseous fuels from renewable sources of non-biological origin used in the transport sector ([21] ". Hydrogen compounds produced from renewable hydrogen, i.e., renewable ammonia or methanol, or synthetic fuels, also fall under the RFNBO legislation.

RFNBO hydrogen is the only legally recognized type of hydrogen that can be used both to meet sectoral targets under the RED Directive in industry and transport and to count towards the greenhouse gas emission reduction target to which the Czech Republic has committed. In the Hydrogen Strategy, renewable hydrogen is considered synonymous with the abbreviation RFNBO, unless explicitly stated otherwise.

EU legislation also allows the production **of renewable hydrogen from biomass** to be counted as renewable hydrogen of biological origin, which is used to reduce emissions within the overall targets defined by the RED Directive, primarily in transport through the use of advanced biofuels. Although this type of hydrogen is not directly defined in legislation, it is a potential supplement to RFNBO, but is not supported by investment or operating aid.

Due to limitations related to its geographical location and climatic conditions for the use of renewable energy sources, the Czech Republic must consider the use of **low-carbon hydrogen**. Low-carbon hydrogen is defined as hydrogen produced with a maximum of 28.2 g CO2eqv/MJ (= 101.5 g CO2eqv/kWh = 3.38 kg CO2eqv/kg $H2_)$[22] as defined by a 70% reduction in emissions in Commission Delegated Regulation 2023/1185[23] on setting minimum greenhouse gas emission savings values throughout the life cycle of RFNBO and recycled carbon fuels. The European Commission will determine a new methodology for calculating greenhouse gas emissions from the production and consumption of low-carbon hydrogen by 2025 at the latest. The Czech Republic supports a clear and least restrictive definition that will lead to the efficient production and use of low-carbon hydrogen across Europe. Low-carbon hydrogen is a suitable tool for reducing emissions under the EU ETS, but it cannot be used to meet the targets set out in the RED Directive.

Currently, most hydrogen in the Czech Republic is produced by partial oxidation of petroleum residues, which distinguishes the Czech Republic from neighboring countries, where the primary source of fossil hydrogen is steam reforming of natural gas. Production by partial oxidation will gradually decline in line with the decline in gasoline and diesel production. Hydrogen production by partial oxidation is unlikely to disappear completely, given the continuing production of petroleum products such as plastics. It is therefore necessary to continue developing technologies that eliminate the adverse effects of this production using CCU/CCS and to find suitable uses for low-carbon hydrogen produced in this way.

[21] https://op.europa.eu/cs/web/eu-law-in-force/bibliographic-details/-/elif-publication/212fcb15-0f04-11ee-b12e-01aa75ed71a1
[22] Conversion of 101.5 g CO2eqv/kWh= nd 3.38 kg CO2eqv/kg H2 is based on the calorific value of 1 kg of hydrogen
[23] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R1185

2.2 Long-term vision for hydrogen use

The main reason why the Hydrogen Strategy was created is to prepare a long-term plan for reducing CO_2 emissions and decarbonizing transport, industry, services, energy, households, agriculture, and other sectors through the use of hydrogen. In this effort, the Czech Republic coordinates its approach not only within the European Union, but also in cooperation with other countries around the world that are already implementing their hydrogen strategies.

The target state to which this strategy contributes is achieving EU climate neutrality by 2050 and preventing energy shortages in terms of quantity and timing. The Czech Republic must achieve this through a well-thought-out industrial transformation and technological change that does not jeopardize employment, competitiveness, adequate energy independence, and overall living standards. Hydrogen technologies, such as the production of electrolysers, fuel cells, hydrogen vehicles and other components, will also bring a number of growth stimuli and new opportunities for industrial development, thereby supporting overall economic growth.

The hydrogen strategy must reflect the natural conditions and character of the Czech Republic, which is one of the most industrialized countries in Europe, a landlocked country with no access to the sea and limited renewable energy resources. The strengths, weaknesses, opportunities, and threats for the Czech Republic are described in more detail in **the SWOT analysis of the Czech Republic for hydrogen.**

The main role of hydrogen in the decarbonization of the economy is in the following areas:

- replacement of fossil fuels in transport, hydrogen vehicles as an alternative to battery vehicles,
- energy carrier,
- chemical raw material,
- energy storage, including seasonal energy storage, use of surplus electricity from nuclear and renewable sources,
- development of new industries, such as the development and production of hydrogen technologies.

The importance and order of priority of these areas will gradually change in each stage depending on the availability and price of renewable and low-carbon hydrogen, as described below.

Electrification and the use of hydrogen technologies are the main tools for achieving decarbonization goals.

2.2.1 Replacement of fossil fuels

Hydrogen will find application as one of the substitutes for fossil fuels, because its use does not produce CO_2 emissions, but only water vapor. Hydrogen is therefore a carbon-free alternative to fossil fuels. Direct combustion of hydrogen with air produces NOx emissions, which is why hydrogen is preferred for use in fuel cells. The current disadvantage of hydrogen is that, at least until the end of this decade, it will be more expensive than fossil fuels as a heat source.

In order for hydrogen to gradually replace natural gas, its price, at the 2023 price level, will need to be closer to €2/kg, or the price of natural gas and allowances, which we do not expect until the
"New technologies." Fossil fuel prices are expected to rise gradually, so that cost parity can be achieved at a higher, more favorable level for hydrogen in the future. Hydrogen should be a more cost-effective energy source than fossil fuels in the future. This is what the Hydrogen Strategy expects at a time when a functioning hydrogen market will be established and the price of natural gas and other fossil fuels will rise due to increasing emission allowance prices.

The current high price of hydrogen prevents its full economic use in all industry segments. As the price falls, hydrogen will be able to gradually replace increasingly expensive fossil fuels, first

transport to electricity generation (seasonal storage) and heat. For these reasons, hydrogen production and consumption methods that minimize consumer prices and enable the fastest possible development of the hydrogen economy and energy sector in the Czech Republic will be supported.

Hydrogen must be used where it is most economically viable and where the ratio of total costs to CO_2 emissions savings is the best. In line with the requirements of the RED Directive, the first phase of the hydrogen strategy prioritises the use of renewable and low-carbon hydrogen in transport and the chemical industry. The hydrogen strategy is based on current knowledge of available technologies and models for implementing a hydrogen economy in the Czech Republic. At the same time, it is clear that the "hydrogen boom" that is emerging across Europe and worldwide will bring a number of fundamental innovations that are difficult to predict at present. It is therefore necessary to support not only the implementation of a hydrogen economy, but also basic and applied research and development of new materials, technologies, and business models.

2.2.1.1 Transport

Transport is the area where operational cost parity with existing fossil fuels, diesel and gasoline can be achieved first. At the same time, hydrogen must be compared with other zero-emission and low-emission alternatives such as electric battery mobility and biomethane in the form of bioCNG and bioLNG. The domain where hydrogen offers competitive advantages is bus transport, especially intercity and urban transport, long-distance freight transport, passenger rail transport on specific routes, transport in the vicinity of transport hubs, warehouse handling equipment, and light commercial vehicles with the required longer range and short refueling times.

The advantage of hydrogen in transport is its ability to store energy in time and space, especially in the context of gradually increasing demands on the electricity distribution system due to the rapid electrification of transport. Thanks to this and the insufficient energy capacity of batteries, the use of hydrogen vehicles can be expected to be advantageous in certain segments.

Another advantage is the speed of filling hydrogen into vehicle tanks, which achieves similar parameters to traditional liquid fuels, enabling virtually continuous vehicle use and longer range with minimal increase in vehicle weight (this applies in particular to trucks and passenger trains). A significant disadvantage is the cost associated with the need to build the entire chain from production to hydrogen dispensing. Hydrogen vehicles are more expensive than current standard gasoline or diesel vehicles. The investment price will gradually decrease due to the onset of mass production of new vehicles, while operating costs will be reduced with the gradual expansion and higher utilization of hydrogen filling stations.

In the initial phase, the Hydrogen Strategy envisages supplying hydrogen filling stations using trailers with pressurized cylinders or local hydrogen production. In the longer term, in the case of transport hubs and filling stations with expected high hydrogen consumption, where the frequency of trailer deliveries will no longer be sufficient, it will be desirable, where appropriate, to build a connection to the hydrogen distribution or transport system to enable the supply of large quantities of gas.

In road transport, the competitiveness of hydrogen vehicles will depend on the total cost of ownership (TCO) and the availability of refueling infrastructure. Short refueling times, lower added weight for stored energy, and zero tailpipe emissions are key advantages. Another advantage over battery-powered vehicles may be the use of heat for vehicle heating, which can be applied mainly in bus and rail transport, where the need for heating will not reduce the range of vehicles. To increase the use of hydrogen filling stations, it will be important to build

corporate hydrogen fleets, where, for example, hydrogen filling stations can be optimally located for buses.
dimensioned with regard to long-term consumption.

In the Czech Republic, approximately two-thirds (6,000 km) of the rail network currently has no electric traction. Some lines with heavy freight traffic are likely to be electrified in the future. However, there are still many lines where electrification is not economically viable. On these lines, it will be necessary to replace the existing diesel trains with hydrogen, battery, or hydrogen-electric trains. Hydrogen trains are competitive on regional lines where long distances and low network utilization do not justify the high costs associated with electrification, and complicated driving profiles do not allow the use of battery-powered trains. Studies are currently underway to compare the efficiency of different types of rail vehicles under the conditions of the Czech rail network. It is very important for hydrogen trains to start operating on lines where their advantages are indisputable and to gradually prove their superiority over other types of propulsion. For the successful deployment of hydrogen propulsion on railways, it is essential that the relevant actors in the selected area and on the selected lines cooperate, including the Ministry of Transport, the Railway Administration, the relevant transport operators, and the relevant regional and local authorities.

Air transport will gradually transition to e-fuels in line with the ReFuelEU Aviation Regulation[24]. Although the Hydrogen Strategy does not address the direct use of hydrogen in air transport, the development of a hydrogen economy in aviation is an interesting opportunity.

Hydrogen transport and the development of the relevant infrastructure are addressed in more detail in the NAP CM, which specifies programs to support the construction of hydrogen refueling stations and the purchase of low-emission vehicles.

The use of hydrogen in transport is one of the priorities of the Hydrogen Strategy, as it allows operational cost parity with fossil fuels to be achieved at a hydrogen price of around €4–6/kg of hydrogen. Binding targets for the use of renewable hydrogen have also been set for transport, similar to those for the chemical industry. It will therefore be necessary to direct financial support to the transport sector to ensure hydrogen production, the construction of the necessary infrastructure, and the purchase of hydrogen vehicles.

2.2.1.2 *Heat production in industry and building heating*

In 2022, out of the total natural gas consumption of 81.5 TWh, 22 TWh was supplied to households and another 20 TWh to small and medium-sized businesses, which accounts for approximately 50% of the total natural gas consumption for heat and hot water production. Hydrogen, as a substitute for natural gas, can make a significant contribution to the decarbonization of building heating in the medium and long term and reduce the overall carbon footprint. Hydrogen will be used for heat production depending on how cost-competitive the applications are compared to other clean technologies. Given that the seasonality of heat production and the seasonality of RES production (especially from photovoltaics) are at odds with each other, it will not be possible to use hydrogen for heat production until continuous supplies of hydrogen are available throughout all months of the year and cost-effective options for seasonal hydrogen storage are in place. Due to the expected price, the Hydrogen Strategy currently assigns a role for hydrogen in heating only in peak heating plants or, to a limited extent, in cogeneration during the winter months. The use of hydrogen in local heat production for households and for heating buildings will come into play on a larger scale later, depending on its competitiveness with other technologies. Hydrogen as an energy storage medium can help bridge seasonal peaks in energy consumption and contribute to a balanced mix of all heat source alternatives.

[24] https://eur-lex.europa.eu/legal-content/CS/TXT/?uri=CELEX:32023R2405

The initial development of hydrogen use for heat production can be expected in industries that are difficult to electrify, where it will mainly be used in high-temperature industrial processes requiring temperatures above 1000°C. It will be used for heat production in processes where heat production using electricity and heat pumps is not efficient or cannot be used due to other technological limitations.

2.2.2 Energy carrier

Based on various energy consumption scenarios, it appears that a certain amount of energy will need to be replaced by low-emission energy imports to replace the fossil fuels currently in use. In many respects, it would be advantageous to secure the missing energy directly through electricity imports. Electricity imports have a limit for the safe and reliable operation of the Czech transmission system, which is set by ČEPS.
In the Assessment of the Adequacy of the Czech Republic's Electricity Supply System until 2040 (MAF CZ 2022), this import limit is set at 20 TWh. The possibility of higher imports would mean massive investments in the Czech transmission system. Another, even more significant limitation on electricity imports is the fact that, according to the same source, a number of European countries will also have a deficit in electricity production and will therefore be dependent on imports. The possibilities for importing electricity will therefore be very limited and, in all likelihood, also costly. This issue is addressed in more detail in the NKEP and SEK.

Replacing part of the missing energy in the Czech Republic's future energy mix with hydrogen imports appears to be a suitable and acceptable solution. Existing natural gas pipelines can be repurposed for hydrogen transport. In the Czech Republic, NET4GAS, the gas transmission system operator, plans to modify two gas pipelines by 2030. One between the border points of Lanžhot and Brandov, which would be used to import hydrogen from North Africa, Ukraine, and Southeast Europe. The second will be between the border points of Brandov and Waidhaus ([27]) and will be used to import hydrogen from Scandinavia, the Baltic and North Sea regions, or from countries outside the EU. Each of these pipelines will have an initial import capacity of around 1.5 million tons of hydrogen per year (50 TWh/year). This capacity can be used to import hydrogen into the Czech Republic and for its transit to Germany. In the future, import and transport capacity will be increased according to market demand for hydrogen transport. Depending on the development of demand (probably in the period 2030-2035), the repurposing of one gas pipeline of the northern branch between the border points of Lanžhot and Brandov, or at least part of it, is also planned. The gas transmission system operator is also analyzing the possibilities of hydrogen supply in the northern Moravia region. Planning for the repurposing of the distribution system is also already underway in connection with the repurposing of the transmission system.

Hydrogen using a converted gas pipeline network for transport is therefore a very promising form of energy import, as hydrogen is a highly efficient energy carrier thanks to its energy density and low viscosity.

2.2.3 Chemical raw material

Hydrogen is not only a source of energy, but also a chemical raw material used in the chemical industry mainly for the production of fuels, plastics, ammonia, or as a reducing agent. Hydrogen can replace carbon (coke) in metallurgy in the production of pig iron.

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[25] https://www.mpo.cz/assets/cz/energetika/elektroenergetika/2023/5/Hodnoceni-zdrojove-primerenosti-elektrizacni-soustavy-CR-2022.pdf
[26] Central European Hydrogen Corridor www.cehc.eu
[27] Czech German Hydrogen Interconnector www.cghi.eu

2.2.3.1 *Chemical industry*

Hydrogen is already used as a raw material in a wide range of processes. In 2023, approximately 125,000 tons of "gray" hydrogen were consumed in the Czech Republic, but its role will gradually decline and be replaced by renewable and low-carbon hydrogen. The speed of the transition to renewable hydrogen is largely determined by European legislation, see the analytical section. Further expansion will then depend on our ability to produce or import renewable or low-carbon hydrogen at a price that is acceptable to the chemical industry.

2.2.3.2 *Metallurgy*

If the Czech Republic wants to produce pig iron in Europe without using coke, which is a major source of CO_2 emissions, it is necessary to switch to direct reduction of iron ore with hydrogen. This technological process has so far been tested in a single pilot project in Europe and is awaiting industrial deployment. Maintaining the current volume of crude iron production in the Czech Republic using hydrogen would require the construction of low-carbon electricity sources in the order of GW, which would be able to supply a constant output to electrolysers for the production of approximately 250,000 tons of hydrogen per year, or the need to import this amount of hydrogen from abroad.

For the metallurgical industry, the availability of sufficient quantities of renewable or low-carbon hydrogen at competitive prices and the availability of related competitive technologies are key prerequisites for the transition to low-carbon hydrogen technologies in the future.

2.2.4 Energy storage and power balancing services

Hydrogen is a suitable medium for utilizing surplus electrical energy. It enables the conversion of electrical energy into gas, which can be injected into existing natural gas networks (blending), injected into a dedicated hydrogen gas network, used directly in transport, the chemical industry, metallurgy, combined heat and power generation, or stored, provided that the issue of its long-term and economical storage is resolved.

Thanks to its scalable storage options, hydrogen can be a link between renewable and nuclear sources, as it makes good use of energy surpluses from solar and nuclear power plants in connection with fluctuations in electricity consumption and production from renewable sources. Hydrogen produced in this way can be used directly in transport and the chemical industry or stored in capacities of hundreds of GWh. Hydrogen will enable both types of sources to operate in their optimal mode and allow for a gradual increase in the installed capacity of both renewable and nuclear sources without part of their production remaining unused. As with natural gas, it is expected that hydrogen will be stored across Europe in reservoirs connected by a gas transmission network.

The accumulation of excess energy in hydrogen is also used to provide power balancing services to ensure the stability of the power grid. The hydrogen produced in this way can then be used to generate electricity during periods of peak consumption.

If the heat generated in electrolysers and fuel cells can be used efficiently, hydrogen can also be used to store energy produced within community energy systems. The economic viability of such a solution depends largely on the type of renewable energy sources used and the total amount of hydrogen stored, as this solution requires costly infrastructure.

2.2.5 Development of new industries

Research into hydrogen technologies plays a key role in industrial development by providing new knowledge and innovations that enable the improvement of existing technologies and the creation of entirely new, highly innovative applications. Investment in research enables the discovery of more efficient ways to produce hydrogen, the development of advanced hydrogen fuel cells, and improvements in hydrogen storage and distribution infrastructure. This research increases the competitiveness of industry by enabling manufacturers to develop innovative products and services that are energy-efficient and environmentally friendly.

The production of hydrogen technologies then brings concrete benefits to industrial sectors by creating new job opportunities and stimulating economic growth. Production facilities for hydrogen technologies require specialized equipment and know-how, which stimulates innovation and investment in industrial capacity. The production of hydrogen technologies has high added value and also contributes to the diversification of the industrial portfolio and reduces dependence on traditional sectors such as heavy industry or the chemical industry, thereby increasing the resilience of industry to economic turbulence and promoting long-term sustainability.

New high value-added jobs in the development, production, and operation of hydrogen technologies will gradually replace jobs in sectors that will be phased out due to their high emissions and low competitiveness.

Hydrogen technologies are part of the circular economy([28]) in terms of waste utilization and strengthening independence from fossil fuels. Some waste treatment technologies produce low-carbon hydrogen from organic waste that cannot otherwise be recycled. Renewable hydrogen, depending on its price, is a direct substitute for fossil fuels.

2.3 Stages of implementation of the Hydrogen Strategy

The use of hydrogen will depend on the price for end customers, which is derived from the production price. The Hydrogen Strategy anticipates a gradual decline in the price of renewable and low-carbon hydrogen in the coming years. Depending on the decline in the price of renewable and low-carbon hydrogen and the rise in the prices of fossil fuels and emission allowances, the possibilities for the economic use of hydrogen will gradually expand. Initially, hydrogen is expected to be used in transport, the chemical industry, and other industrial sectors where European legislation (the RED Directive) has already set binding targets for 2030.

Further development will take place in three stages, which are characterized by different methods of hydrogen production, distribution, use, and estimated production cost[29] of hydrogen. Prices are relative to the price level in 2023:

- **Local islands** (estimated production price €8/kg)
- **Global bridges** (estimated price at the gas pipeline outlet €2.7-4/kg)[30]
- **New technologies** (estimated production price €2/kg)[31]

[28] https://www.mzp.cz/C1257458002F0DC7/cz/cirkularni_cesko/$FILE/OODP-Cirkularni_Cesko_2040_web-20220201.pdf

[29] When assessing parity with other energy sources, the prices usual for 2023 are used as a basis.

[30] ehb-report-220428-17h00-interactive-1.pdf

[31] Hydrogen Shot| Department of Energy

It should be emphasized that the transitions between the individual stages will not be sudden, as the stages will overlap in time. The stages are characterized, among other things, by the indicative production price of hydrogen. It cannot be assumed that hydrogen will be available at the indicated price from the first day of the relevant stage. This indicative price is an important factor for planning expectations on the part of hydrogen producers and users. Estimates of the price of hydrogen and the creation of conditions for its minimization will be part of studies and analyses, and the resulting support programs, which will aim to supply consumers in the Czech Republic with as much renewable or low-carbon hydrogen as possible at the lowest possible price. Studies used to estimate future hydrogen prices will always be based on a framework that may change in the future (prices of renewable sources, natural gas prices, permit prices, technology prices, etc.). The hydrogen prices listed are therefore only the best estimate currently available.

2.3.1 Local islands

In the period up to 2030, the Hydrogen Strategy does not anticipate massive imports of hydrogen from abroad, except for mixtures with lower percentages of hydrogen blended with natural gas. Therefore, the main source of renewable hydrogen that the Czech Republic anticipates for meeting the targets defined in the RED Directive will be hydrogen produced from RES in the Czech Republic. In order to develop this hydrogen production, it is necessary to use not only solar energy but also wind and, where appropriate, hydro energy to increase the utilization of electrolysers. Further development of RES, including solar and wind power plants, is a prerequisite for the efficient operation of electrolysers. In addition to the use of renewable energy intended solely for hydrogen production, the use of surplus electricity from both renewable sources and nuclear power is also envisaged. Hydrogen production could also help stabilize the electricity grid by making efficient use of surplus electricity.

One of the main objectives in the first stage will be to ensure that the targets defined in the RED Directive are met in transport and industry. Achieving these targets requires the production of approximately 20,000 tons of renewable RFNBO hydrogen by 2030. The long-term goal is to repurpose the gas transmission system so that the Czech Republic is able to import at least part of the renewable hydrogen before the end of 2030. Repurposing can only be accelerated if renewable hydrogen is available at the pipeline inlet before 2023. Most of the required amount of RFNBO hydrogen will have to be produced using RES and electrolysers built in the Czech Republic. Given the strict conditions of the delegated act establishing the EU methodology for detailed rules on the production of renewable fuels of non-biological origin, which tightens the additionality condition after 2027, it is essential that RFNBO production projects are launched by the end of 2027.

In terms of meeting the targets defined in the RED Directive for transport, it is important that RFNBO hydrogen is used directly to power vehicles. This requires the development of a refueling infrastructure and the use of hydrogen-powered vehicles such as buses, passenger trains, and trucks, which can significantly increase hydrogen consumption. The advantage of using RFNBO hydrogen in transport is that it simultaneously fulfills the sectoral target under the RED Directive with the overall target of reducing greenhouse gas emissions in transport. Hydrogen used in this way counts towards the fulfillment of both targets. In addition to the targets defined in the RED Directive, the Czech Republic must build a backbone network of refueling stations on the TEN-T main network and in each urban node by the end of 2030, in accordance with the conditions of the AFIR Regulation.

In order to reduce the price for the end consumer, it is necessary to link hydrogen production and consumption in one place so as to minimize hydrogen transport costs. At this stage, priority is given to the use of hydrogen in transport, where price parity with fossil fuels and battery electric mobility can be achieved despite the higher initial price of hydrogen, and in the chemical industry, where sectoral targets for replacing grey hydrogen with renewable hydrogen must be met in order to achieve decarbonization goals. In both areas, the minimum scope of renewable hydrogen use is defined by European legislation (the RED Directive). In accordance with

The Hydrogen Strategy for 2030 anticipates the possible deployment of 3,000 hydrogen-powered passenger cars, 800 light commercial vehicles, 200 buses, 380 trucks, and 6 regional trains powered by hydrogen. In the field of rail transport, we anticipate the deployment of hydrogen trains on lines where electrification is not planned and where hydrogen trains can demonstrate their advantages over battery trains, i.e., primarily on lines with large gradients and where it is not possible to spend long periods of time recharging batteries due to the timetable.

To support cooperation and create possible synergies within local islands, **an** interactive **Hydrogen Map of the Czech Republic**[32] **has been created**, which includes existing and planned hydrogen production sites, hydrogen filling stations, regional strategic projects, and more.

An important opportunity for supporting the hydrogen economy is the creation of regional "hydrogen valleys," which is currently being implemented through cooperation between transforming coal regions, i.e., in the Karlovy Vary, Moravian-Silesian, and Ústí regions based on the "Memorandum on Interregional Cooperation of Transforming Coal Regions in the Field of Support for the Application of Hydrogen Technologies and Coordinated Development of the Hydrogen Valley Concept" and with the support of, among others, the Just Transition Operational Program ([33])and the Modernization Fund ([34]).

For the first stage, it is also important to develop hydrogen technology know-how, gain operational experience with hydrogen technologies, and strengthen education in the field of hydrogen technologies. Creating a suitable environment for local production and consumption is essential for supporting the growth of competitiveness of companies operating in the Czech Republic and for increasing their export potential. Experience in the construction and operation of hydrogen technologies in the Czech Republic will help companies to export these highly innovative technologies abroad in the future.

At this stage, it is necessary to support the production, distribution, and consumption of hydrogen from various subsidy programs (investment and operating support) to ensure price competitiveness with fossil fuels, at an appropriate and relevant financial level in the allocations under consideration.

At the start of the development of the hydrogen economy, several problems need to be resolved that could slow down the use of hydrogen:

- Situations may arise where sufficient demand cannot be guaranteed for producers or, conversely, where there is insufficient production capacity to meet demand. This risk can be significantly reduced by the creation of so-called hydrogen valleys.
- In order to secure support for repurposing (the transformation of the existing gas transmission system from natural gas to hydrogen) from European funds (typically CEF), it is necessary to have preliminary assurances regarding the production and consumption of renewable hydrogen that will be transported through the gas transmission system.
- Given the topology of distribution networks, it will not be economically viable to build a parallel hydrogen distribution network. The transition to pure hydrogen will only be possible when all end customers in a given area are fully prepared for the transition to pure hydrogen.

If it is not possible to adequately connect the production and consumption of pure hydrogen, blending, or the addition of hydrogen, may be a suitable transitional tool for dealing with the sale of produced hydrogen.

[32] https://www.cistadoprava.cz/mapy/h2/
[33] https://www.mzp.cz/cz/news_20230404-Hejtmani-uhelnych-regionu-podepsali-na-Ministerstvu-zivotniho-prostredi-vodikove-memorandum-Cilem-je-vetsi-mezikrajska-spoluprace-pro-rozvoj-vodikovych-technologii [34]https://www.sfzp.cz/dotace-a-pujcky/modernizacni-fond/

into the existing natural gas network. Without the possibility of blending, no local electrolyzer for the production of renewable hydrogen could be connected to the natural gas distribution network. This ensures that hydrogen producers can secure sufficient hydrogen consumption before it can be transported via a dedicated pipeline. Demand may come from existing natural gas customers (provided that their end-use equipment is technically ready for the blend). The distribution system is already prepared for a blend of up to 20%. Natural gas boilers manufactured after 2003 are suitable for a 20% blend. This means that customers do not need to make any additional investments to use a mixture of hydrogen and natural gas. Blending will enable the partial "greening" of the Czech energy sector and the fulfillment of greenhouse gas emission reduction commitments.

Blend can also ensure the import of renewable hydrogen to the Czech Republic at a time when pipelines for the transport of pure hydrogen have not yet been built. European legislation sets 2% hydrogen in natural gas as the maximum amount of hydrogen that can be imported into the Czech Republic from abroad in a mixture with natural gas, subject to other procedural conditions. Gas transmission system operators must ensure that they are able to accept this mixture of natural gas and hydrogen at their border transfer points.

The import of hydrogen mixed with natural gas can be used by companies and organizations to reduce their carbon footprint. A company or organization would purchase a certificate for renewable hydrogen produced abroad, and the producer who issued the renewable hydrogen certificate would inject the corresponding amount of renewable hydrogen into the gas distribution system. On the consumption side, the relevant company or organization would use the natural gas flowing through the gas distribution network and, based on the certificates, could reduce its carbon footprint without having to change the technologies it uses. This is similar to the purchase of certificates for renewable electricity, which also flows through the electricity distribution network and it is not possible to physically determine whether a given consumer has consumed electricity produced from renewable or fossil fuels. The relevant analysis and creation of the necessary framework for certificates and guarantees of origin in the Czech Republic is addressed in task card No. O5.

Upon reaching a 5% volume limit of hydrogen in natural gas, the Czech gas system would be able to absorb up to 1.5 TWh of annual hydrogen production. In addition to accelerating the development of the hydrogen economy, the use of hydrogen admixtures will also contribute significantly to reducing $_{CO2}$ emissions.

Investment costs

The costs of constructing the required number of electrolysers, renewable energy sources and infrastructure for hydrogen storage, distribution and transport are preliminarily estimated at between **CZK 18 billion and CZK 115 billion.** The wide range of costs is due to many factors that will be gradually clarified. The main factor is the type of hydrogen that will need to be produced. Production focused solely on the production of RFNBO hydrogen is very costly in the Czech Republic due to very strict requirements and the resulting low utilization of electrolysers.

The upper estimate of 115 billion is based on a study[35] prepared by the SPČR. The target amount of renewable hydrogen produced in 2030 is 40,000 tons per year, which is almost double the target value set out in the Hydrogen Strategy, which anticipates the use of all exemptions under the RES Directive. The SPČR study is more conservative in its estimate of the possible exemptions from Article 22a of the RES Directive and therefore assumes a higher amount of hydrogen will be needed. The total cost of producing, distributing, and using 40,000 tons of RFNBO hydrogen per year and meeting the NAP CM and AFIR targets in the transport sector is CZK 115 billion, broken down into the following items:

[35] https://www.spcr.cz/images/media/2024_vodik_v_CR_studie_long.pdf

- electrolysers: CZK 27 billion
- construction of new RES: CZK 57 billion
- hydrogen storage infrastructure: CZK 2 billion
- hydrogen transport vehicles and related infrastructure: CZK 22 billion
- Production of e-fuels (kerosene): CZK 1 billion
- Repurposing of transport and distribution infrastructure: CZK 5.2 billion

The factors that influence the overall costs associated with the production, distribution, and consumption of renewable hydrogen are primarily:

- **How quickly we can build electrolysers and the relevant RES:** Until the end of 2027, simpler conditions apply to the production of RFNBO hydrogen, which can significantly improve the utilization of electrolysers and thus reduce the amount of RES needed to produce hydrogen.
- **Ambitions for hydrogen use:** If, in the first stage, we produce RFNBO hydrogen in "local islands" only to cover the needs defined in the RED Directive, the total costs will be lower.
- **How hydrogen will be used:** Using renewable hydrogen in the chemical industry means replacing one type of hydrogen with another, so no changes in consumption technologies are necessary. If renewable hydrogen is produced at the point of consumption, this reduces overall costs.
- **Delegated act on low-carbon hydrogen:** Costs will also depend on the conditions approved in the delegated act on low-carbon hydrogen and the targets for which low-carbon hydrogen can be used.

Compared to the cost of importing hydrogen from abroad, producing renewable hydrogen in the Czech Republic is a costly business. However, we cannot just wait for renewable hydrogen to be imported from abroad, because we also need to build the infrastructure for its consumption. Even after 2030, it will not be possible to import hydrogen to all consumption sites. It is therefore necessary to start work on the construction of local hydrogen production facilities in parallel with the preparation of import corridors.

We plan to use resources from the Modernization Fund, the Just Transition Fund, the state budget, and commercial loans to finance projects and infrastructure for the production, distribution, and use of hydrogen.

Time frame

This phase has already begun and will continue until imports of renewable hydrogen from abroad are expanded, which, according to gas transporters' plans, is expected to happen around 2030. In order to meet the RED targets by 2030, it is essential to support, above all, the national production of renewable hydrogen close to consumption sites.

Given the ambitious plans for the construction of clean hydrogen infrastructure in Germany (see the German Hydrogen Strategy of July 2023[36]), which envisages the commissioning of 1,800 km of hydrogen pipelines in 2028, it is likely that the Czech Republic will be connected to the German hydrogen network at cross-border points

[36] https://www.bmwk.de/Redaktion/DE/Publikationen/Energie/fortschreibung-nationale-wasserstoffstrategie.pdf?blob=publicationFile&v=3

Waidhaus and Brandov before 2030. Depending on the completion of the German hydrogen infrastructure by 2030, the import of hydrogen via dedicated pipelines cannot be ruled out.

For the construction of local renewable hydrogen production facilities (electrolyzers), it is necessary to make use of exemptions provided by the act delegating powers to establish EU methodology for detailed rules on the production of renewable fuels of non-biological origin. These allow, until the end of 2027, for a period of 10 years, the conclusion of PPAs with renewable energy sources older than 36 months that also receive operating or investment support. After 2027, it will not be possible to conclude PPAs with any source that receives operating and investment support. Another significant exception, valid only until 2030, is the principle of time correlation, i.e., linking electricity production from RES to consumption in the electrolyzer within a single month. After 2030, the time correlation rules are expected to be tightened to one hour. It is therefore necessary to build the maximum number of local electrolysers by 2027 due to future restrictions imposed by EU rules and the resulting restrictions on the financing of electrolysis plant construction.

The limited capacity of renewable sources in the Czech Republic (number of hours of sunshine, lack of water sources for the construction of power plants, and slow construction of wind farms) means that renewable hydrogen produced in the Czech Republic will be more expensive compared to countries with significantly higher hours of sunshine and better use of wind energy.

Once conditions are in place for cheaper imports of renewable and low-carbon hydrogen from abroad, the Hydrogen Strategy anticipates a reduction in the construction of electrolytic hydrogen production plants in the Czech Republic due to their reduced competitiveness compared to foreign sources. However, electrolysers still have potential for future use, primarily in power balancing services for the electricity grid.

Target production price

A number of studies show that the production of renewable hydrogen in the Czech Republic is costly. The price of hydrogen produced in this way can only be reduced if solar and wind power generation capacities are expanded (higher electrolyzer utilization) and appropriate support (investment, operational, or combined) is provided. Initial analyses indicate that, with sufficient investment support, the price of renewable hydrogen would be around € 8 . € s per kg. However, this price is not competitive a n d does not provide sufficient incentive for a transition to hydrogen e v e n outside sectors that do not have to comply with the RED Directive (e.g., for higher penetration of hydrogen-powered trucks). Therefore, the Czech Republic must seek ways to sufficiently motivate market participants through investment or operational support and achieve a price reduction below €8 already during the local island phase. A lower price of hydrogen will lead to its expansion into other sectors, which in turn may create higher demand in the next phase.

Method of production

Electrolysis using electricity produced from renewable energy sources [37](sun, wind, water, etc.), with the exception of biomass, which may be supplemented in certain quantities by low-emission electricity from the grid. Production of low-carbon hydrogen hydrogen depending on the regulations adopted by the EC ( ).

[37] Electricity from renewable sources is defined in Article 2(1) of the revised Directive on the promotion of the use of energy from renewable sources. This is energy from non-fossil sources, namely wind, solar (thermal and photovoltaic), geothermal, osmotic, ambient, tidal and other ocean energy, hydropower, landfill gas, sewage treatment plant gas and biogas, with the exception of biomass that is not supported for the production of renewable hydrogen. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02018L2001-20240606

Transport between production and consumption

Minimising transport means producing directly on the premises where the renewable hydrogen will be further used and transporting it in pressurised storage tanks to hydrogen filling stations located near the production site. To minimize transport costs, the maximum distance for such transport by road should be within 100 km (economic limit for transport on standard road trailers with steel pressure vessels with a capacity of 300 kg of hydrogen).

Use

Use is planned mainly at the point of consumption and in applications that can operate with hydrogen at a price of around €8/kg or absorb additional distribution costs. This includes use in transport, handling equipment, and industry where required by the revised RED directive.

If there is no specific market for the hydrogen produced at the production site, it will be possible to add hydrogen to the gas network with natural gas (blending), where it will partially help to reduce the Czech Republic's overall carbon footprint.

Overall, the goal is to produce and, if necessary, import at least 20,000 tons of renewable hydrogen by 2030 to replace fossil hydrogen in industry and transport. This goal stems from:

- binding requirements of European legislation (RED Directive),
- additional voluntary requirements to reduce $_{CO2}$ emissions in the chemical industry and transport,
- requirements triggered by financial incentives (ETS2 and EU taxonomy).

2.3.2 Global bridges

Conditions for the development of renewable energy sources are better in many countries within and outside the European Union than in the Czech Republic. The production of renewable hydrogen by electrolysis from RES in these countries is therefore cheaper and can offer a lower price for renewable hydrogen. This hydrogen must be transported from the countries of production to the place of consumption. To this end, the creation of a hydrogen pipeline network is planned. The European Hydrogen Backbone initiative([38])proposes a possible form for a future European backbone system for hydrogen transport·The Czech Republic has the advantage that, compared to other countries, it can relatively quickly start repurposing selected lines of the existing gas transmission network, thus enabling the import of large quantities of renewable and low-carbon hydrogen from 2030.

The Czech Republic can be connected to four potential import routes:

- eastern (Ukraine),
- southeast (the Balkans and Turkey),
- south (North Africa) and
- north (Baltic Sea and Scandinavia).

In addition, the Czech Republic will be connected to ports where imported hydrogen in the form of chemical compounds can be transported from other potentially suitable locations (Asia, including the Middle East, Canada, the US, and South America) for hydrogen production. The Czech Republic can be connected to these corridors at two border points: Lanžhot and Brandov, each of which can have an initial transport capacity of up to 1.5 million tons of hydrogen per year. Transport costs are estimated at €0.11–0.21 per 1 kg of hydrogen per 1,000 km.

[38] The European Hydrogen Backbone (EHB)

The operation of a hydrogen transport system is important not only for importing hydrogen into the Czech Republic, but also for the transit hydrogen through the Czech Republic, e.g. to Germany, which could be a significant source of income for the Czech economy.

Hydrogen pipelines are a cost-effective option for importing large amounts of energy into the Czech Republic, exceeding the energy capacity of cross-border electricity connections several times over. In the initial phase, imports will depend on the country where renewable hydrogen is produced. Gradually, with the completion of the European hydrogen backbone network, dependence on a single country will decrease and it will be possible to diversify hydrogen supplies and take advantage of price competition between individual producers. Hydrogen pipelines will be designed to be bidirectional.

At this stage, the Hydrogen Strategy expects the interconnection of selected segments of the hydrogen gas network that were created in the first stage, their connection to the hydrogen transport network, and their gradual expansion.

Hydrogen imports to the Czech Republic are also taken into account in the SEEPIA modeling, which serves as a basis for the NKEP. The modeling parameters are set in accordance with the Hydrogen Strategy, which assumes a gradual ramp-up of renewable hydrogen imports after 2030, with increases in transport capacity expected at all three entry points from 2035 onwards: Waidhaus (6 GW, 1 , 200,000 t/year), Brandov (6 GW, 1,200,000 t/year) and Lanžhot (3 GW, 600,000 t/year), with a gradual ramp-up of available hydrogen
in total from 24 PJ (200,000 t/year) in 2035 to 132 PJ (1,100,000 t/year) in 2050. Based on consultations with the Ministry of Industry and Technology, the price of imported hydrogen is expected to fall f r o m €85/MWh (€3/kg) in 2030 to €58/MWh (€2/kg) in 2050.

The conversion of existing distribution systems to 100% hydrogen can be completed within 10-15 years, depending on the conversion plan and its scope. Gas system conversion plans will be prepared based on economic analyses and in line with the development of renewable hydrogen sources and the gradual conversion of the gas transmission system.

At this stage, it will also be necessary to build domestic or secure foreign storage capacity for hydrogen that will be sufficient to balance the energy production and consumption imbalance between summer and winter. Germany and Poland appear to be particularly suitable areas for hydrogen storage in the GWh to TWh range due to their extensive underground salt cavern systems.

In addition to importing renewable hydrogen via pipelines, we also anticipate importing hydrogen in the form of ammonia for direct consumption in the chemical industry, with the quantity limited by current hydrogen consumption in the chemical industry.

Investment costs

The investment costs for creating a backbone system for hydrogen transport are estimated at **between CZK 5 billion and CZK 25 billion.** The final costs will depend on which gas pipelines in the existing gas transport system will need to be converted (repurposed) or which will need to be built as new.

The cheapest option involves the conversion of two gas pipelines, one connecting the border points of Brandov and Waidhaus and the other connecting the border points of Lanžhot and Brandov and/or Waidhaus. The most expensive option involves the conversion of one existing gas pipeline in each branch (see Figure 2 in 4.2.2), which will connect all border points in a triangular topology. This option also includes the construction of a hydrogen interconnection in the Moravian-Silesian Region in the Ostrava area, or possibly up to the Polish border, depending on where the main demand for hydrogen will be and at which entry point into the Czech Republic there will be a sufficient supply of cheap renewable hydrogen.

Following the repurposing of the transmission system, the necessary parts of the distribution system will be repurposed to ensure the necessary and competitive supply of hydrogen to customers located throughout the Czech Republic. The costs of repurposing the distribution system are expected to be a maximum of CZK 1 billion per year, depending on the scope.

The investment costs will be gradually refined as feasibility studies are prepared and the condition of individual pipelines is checked. The repurposing and construction of the transport network will be financed mainly from the Modernization Fund, the state budget, and commercial loans.

It appears that investing in the conversion of existing gas pipelines to enable the import of large quantities of competitive renewable hydrogen is a significantly cheaper way of securing it than producing it directly from renewable sources in the Czech Republic.

Time frame

Given that the existing gas transmission system needs to be repurposed for hydrogen transport and adequate production capacities need to be built, large-scale hydrogen imports are expected to start around 2030.[39] Preparations for repurposing the gas transmission system must begin as soon as possible so that the conversion of the two branches can be completed by 2030.

At the same time, negotiations on the construction of renewable hydrogen production capacities abroad must begin as soon as possible. A critical point in this phase is to ensure that the production, transport, and consumption of large quantities of renewable hydrogen are planned with the same time horizon.

Target production price

The hydrogen strategy assumes a price for renewable and low-carbon hydrogen of between €2.7 and €4 per kg[40]. This is the price of hydrogen at the exit point of the hydrogen gas transmission system, purified to the purity required for use in fuel cells. For some applications, hydrogen with a lower purity than that required for fuel cells may also be used. Omitting further purification, if the type of use allows, will partially reduce the price.

Method of production

Electrolysis using electricity produced from renewable energy sources [41](sun, wind, water, etc.), with the exception of biomass, which may be supplemented in certain quantities by low-emission electricity from the grid. The production of low-carbon hydrogen using CCUS technologies and the production of low-carbon hydrogen by electrolysis of water using nuclear electricity may be further developed.

Transport between production and consumption

A modified gas transmission system for transport between countries of production and consumption. Within a single country, gradual use of modified transmission and distribution systems, road transport in pressurized storage tanks within a radius of 100 km from the connection point, and rail transport in pressurized transporters for longer distances.

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[39] https://ehb.eu/files/downloads/EHB-initiative-to-provide-insights-on-infrastructure-development-by-2030.pdf
[40] ehb-report-220428-17h00-interactive-1.pdf
[41] Electricity from renewable sources is defined in Article 2(1) of the revised Directive on the promotion of the use of energy from renewable sources. This is energy from non-fossil sources, namely wind, solar (thermal and photovoltaic), geothermal, osmotic, ambient, tidal and other ocean energy, hydropower, landfill gas, sewage treatment plant gas and biogas, with the exception of biomass that is not supported for the production of renewable hydrogen. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02018L2001-20240606

Gradual development of a national hydrogen gas network by connecting and linking island networks created in the first phase to distribution systems and connecting them to the hydrogen transport system.

Use

It is expected to be used in transport, in industry as a raw material, in heat production in industry and buildings, and in metallurgy, depending on the gradual decline in the price of renewable hydrogen.

2.3.3 New technologies

The "New Technologies" stage aims to support the development of innovative types of hydrogen production that will be able to compete on price with hydrogen imported from abroad and at the same time increase the Czech Republic's energy independence.

With lower hydrogen prices, it will be possible to use it in all areas of application. It can also be expected that with the development of mass production, the price of hydrogen technologies such as electrolysers, fuel cells, hydrogen vehicles, etc. will decrease. This will further expand the use of hydrogen in new areas.

In order to effectively replace natural gas and other fossil fuels, the price of hydrogen must be reduced to around €2/kg by 2023. The aim of the Hydrogen Strategy is therefore to complete the development and start the commercial deployment of hydrogen production technologies that:

- use renewable or low-emission sources,
- produce hydrogen at a price of around €2/kg, or at a price that is competitive with fossil fuels,
- can be deployed locally to strengthen the energy security of the Czech Republic and Europe,
- are not dependent on weather or seasonal changes,
- create a stable source of energy.

The development of these technologies will take several more years. For example, as part of the Hydrogen Energy Earthshot research project[42], the United States plans to develop technology for producing hydrogen at a cost of around USD 1/kg by 2030. This research is part of the U.S. National Clean Hydrogen Strategy and Roadmap[43]) .

It should be emphasized that this is a phase that is likely to begin after 2040 or 2045. It is therefore very difficult to determine which technologies will be economically viable at that time. At present, it is necessary to continue research in various areas of hydrogen production and gradually focus development on technologies that prove to be promising. It is even possible that suitable technologies will not be developed by 2045 and that the Czech Republic, together with other European countries, will continue to depend on imports of renewable hydrogen and its own renewable sources.

Alongside the search for new technologies, the development of existing technologies must also continue, with the aim of increasing the performance of electrolysers, reducing their price, increasing the efficiency of solar panels and wind turbines, etc.

Time frame

The technologies on which this stage relies are at various stages of development. None of them are in commercial use in the Czech Republic or anywhere else in the world. They could appear on the market on a larger scale after 2040.

[42] Hydrogen Shot| Department of Energy
[43] U.S. National Clean Hydrogen Strategy and Roadmap: DOE Hydrogen Program (energy.gov)

These technologies will likely be able to produce cheap hydrogen (€2/kg), but will probably require large initial investments. Therefore, the increase in hydrogen production from these technologies will be gradual and will have to be supplemented for some time by imports of renewable hydrogen via the gas transmission system.

These new technologies could play a big role around 2050, in the final phase of decarbonizing industry, transportation, and households, when we'll need to reach total carbon neutrality and hydrogen will be one of the main ways to get there.

The use of these technologies can be expected in the long term, but it is necessary to start research as soon as possible and to participate in international research and development projects at European and global level.

Target production price

The expected price will be around 2,€ /kg of hydrogen in a quality suitable for use in fuel cells, at the point of production at the pressure of the hydrogen transport or distribution system.

Production method

Newly developed technologies that will be independent of weather, season, and location will be capable of continuously supply the energy needed to produce renewable and low-carbon hydrogen.

Transport between production and consumption

Predominantly using modified gas distribution networks, partly road and rail transport in pressurized storage tanks over short distances. At the same time, hydrogen will be imported from abroad to meet the total demand for hydrogen in the Czech Republic.

Use

With the price of renewable or low-carbon hydrogen at €2 or less, hydrogen can be used in all areas such as transport, industry, metallurgy, heat production, and combined heat and power generation.

3 STRATEGIC PART

3.1 Strategic

The main strategic objectives and reasons for preparing the Hydrogen Strategy are:

- reducing $_{CO2}$ emissions,
- supporting economic growth and increasing the competitiveness of the Czech Republic.

In fulfilling these strategic objectives, consideration is also given to strengthening the overall energy, raw material and climate resilience of the EU and the economically sustainable level of self-sufficiency of the Czech Republic.

3.1.1 Reduction of $_{CO2}$ emissions

In the area of greenhouse gas emission reduction, the Czech Republic has committed to joining the EU's joint effort to reduce emissions by 55% by 2030 compared to 1990 levels and to achieve carbon neutrality by 2050. This process is supported by European Union instruments for reducing carbon emissions (ETS1 and ETS2), the creation of sustainable solutions that eliminate the use of fossil fuels (EU taxonomy), and support and mandatory minimums for the use of renewable energy sources (RED Directive). Simply replacing coal and possibly other fossil fuels with RES is not enough, or even possible.

Given the limited potential of domestic renewable energy sources and the need to meet the energy needs of industry, transport, agriculture, and households, it will be necessary to make maximum use of local renewable and low-carbon sources while importing large volumes of renewable energy. In this context, hydrogen will serve both as an energy carrier, ensuring the import of missing energy from abroad, and as a raw material for industrial use. In addition to renewable sources, low-carbon hydrogen produced from nuclear energy or using CCS/U technologies also offers considerable potential for reducing emissions.

3.1.2 Supporting economic growth and increasing the competitiveness of the Czech Republic

Given the rapid change in the energy structure, strong impacts on all consumers can be expected, particularly on industry and transport. Energy-intensive sectors, especially those that are difficult to decarbonize, will face pressure to move to areas with access to cheap renewable energy. At the same time, the EU is striving to reindustrialize and prevent industrial production from moving outside its territory to less developed countries, particularly through the Carbon Border Adjustment Mechanism (CBAM). The Czech Republic will also face pressure to relocate industrial production within the EU.
"dirtier" countries, in particular through the Carbon Border Adjustment Mechanism (CBAM). The Czech Republic will also face pressure to relocate industrial production within the EU. In order to maintain vulnerable segments in the Czech Republic, it is necessary to either secure cheap sources of renewable or low-carbon energy or use the cheapest means of transporting renewable energy from places where it is efficiently produced. Hydrogen and its transport via pipelines can play a significant role here.

In addition to protecting existing industry and adapting it to new trends, the development of hydrogen technologies offers considerable potential for exploiting the industrial and technological potential of the Czech Republic. With the advent of hydrogen technologies in the Czech Republic, innovative companies will expand their know-how, which they can then use to expand abroad.

These two strategic objectives are followed by the following specific and cross-cutting objectives.

3.2 Specific objectives

Specific objectives are defined in greater detail for the period up to 2030, as there is less uncertainty about possible approaches and technologies at this stage than in the following period, and some of the targets for 2030 and 2035 are set by European legislation, e.g. RED, AFIR Regulation, etc.

For the next stages, preparatory and development work must be started as soon as possible. This will ensure that all specific targets are successfully met in the future.

Specific objectives are always set for the relevant stage and the four pillars of the Hydrogen Strategy: production, transport, consumption, and technology. The individual specific objectives are described in detail in the Implementation section and are assigned to the Task Cards listed in the Annex.

No specific objective has been set for the "New Technologies" stage, as it is currently only possible to only work on developing the relevant technologies, as indicated in the cross-cutting objectives.

3.2.1 Local islands

Production pillar:

- O1: Create effective support tools that will enable the completion of the construction of electrolysers for hydrogen production with an installed capacity of at least 400 MWe by 2030 (with priority given to completion by the end of 2027 due to simpler rules), where necessary to meet binding EU targets or where there is a demonstrable contribution to decarbonization, including relevant renewable energy sources, infrastructure for storage, distribution, and consumption of hydrogen as close as possible to the place of production (creation of hydrogen valleys and clusters). Coordinate the construction of electrolysers with the development of acceleration zones.

Hydrogen transport pillar:

- O2: Prepare the gas system for blending hydrogen into natural gas.

Hydrogen consumption pillar:

- O3: By 2030, kick-start demand for renewable and low-carbon hydrogen in transport and industry in the Czech Republic at a minimum volume of 40,000 tons/year (1,320 GWh).
- O4: Analyze the potential for converting gas boilers in households to natural gas blends and later to pure hydrogen, and assess the possibilities for financing the transition.

Technology pillar and other cross-cutting pillars

- O5: Preparation and creation of a comprehensive legislative framework for the hydrogen economy in the Czech Republic, including certification of hydrogen produced

3.2.2 Global bridges

Production/import pillar:

- M1: Create conditions for the internationalization of Czech companies, technology exports, and efficient production of renewable hydrogen in foreign regions.
- M2: Ensure sufficient, predictable, and price-stable supplies of renewable and low-carbon hydrogen depending on demand in the Czech Republic, which is currently estimated at 1,000,000 tons (33 TWh) for 2040.

Hydrogen transport pillar:

- M3: Repurposing selected parts of the gas transmission system in the Czech Republic for hydrogen import for supplying consumers in the Czech Republic from 2030 and ensuring the transit of clean hydrogen through the Czech Republic.
- M4: Economically efficient repurposing of gas distribution systems and their connection to the hydrogen gas transmission system by 2028 and beyond.
- M5: Create conditions for the construction or purchase of storage capacity for seasonal hydrogen storage.

3.3 Cross-cutting objectives

Cross-cutting objectives are important for the effective and successful implementation of the Hydrogen Strategy and cut across all stages and all pillars.

3.3.1 Energy security

One of the EU's main objectives is to reduce energy dependence on sources outside the EU, ensure the Czech Republic's self-sufficiency, and exploit the potential of hydrogen for the stability and development of the Czech Republic's energy network, in particular the electricity grid. Hydrogen will also play an important role in ensuring the energy security and stability of the Czech Republic's electricity grid. The use of hydrogen offers several possibilities:

3.3.1.1 Increasing the production of renewable and low-carbon hydrogen in the Czech Republic

Every country has the potential to use its own renewable resources. The Czech Republic still has room for further development of renewable resources. The aim is to find the cost-optimal amount of renewable hydrogen that can be produced in the Czech Republic.

The achievement of this cross-cutting objective is supported by a number of specific objectives, mainly in the "Local Islands" phase.

3.3.1.2 Increasing renewable hydrogen production in the EU and supporting its transport within the EU

Many countries in southern Europe enjoy a high number of hours of sunshine, and coastal countries, especially in northern Europe, can take advantage of offshore wind farms. Energy from these sources can be used to produce renewable hydrogen. This must then be transported to the country where it will be consumed. Examples of infrastructure development include projects to build a European hydrogen backbone network under the European Hydrogen Backbone initiative. The use of this transport infrastructure will be very important for the Czech Republic, as it will enable the diversification of hydrogen sources, ensure the application of market mechanisms, and create price competition between individual producers of renewable hydrogen.

The achievement of this cross-cutting objective is supported by a number of specific objectives, mainly in the "Global Bridges" phase.

3.3.1.3 Increasing imports of renewable and low-carbon hydrogen from countries outside the EU

A number of countries outside the EU, such as Turkey, Ukraine, the US, Canada, Asia (including the Middle East), North Africa, Chile, Uruguay, and Australia, are interested in producing renewable hydrogen and importing it into the EU. Imports from third countries will not increase the EU's energy self-sufficiency, but will enable diversification of sources and meet the demand of European industry. A major challenge for both the Czech Republic and the EU is to avoid replacing one energy dependency with another. Until a comprehensive European hydrogen backbone network connecting most European countries is built, the Czech Republic will always be dependent to some extent on a small number of hydrogen producers. Geographical balance in the use of resources is imperative here, given the need to maintain an adequate level of resilience.

The achievement of this cross-cutting objective is supported by a number of specific objectives, mainly in the "Global Bridges" phase.

3.3.1.4 *Increasing hydrogen production using new technologies*

Technologies such as geothermal energy and combined heat, electricity, and hydrogen production in new-generation nuclear reactors can significantly increase the EU's energy independence. These technologies are still in the research phase and will take some time to develop. It is not clear today whether these technologies will ultimately work as expected. If the development of new technologies meets the initial requirements, these technologies will provide an efficient source of electricity, heat, and hydrogen in the future and will complement existing intermittent renewable sources. Thanks to its low price, hydrogen produced using these technologies could gradually replace fossil fuels in all areas.

This approach is discussed in more detail in the "New Technologies" section.

3.3.1.5 *Increasing the stability of the power grid by storing energy in hydrogen*

With the development of decentralized energy production, which is currently widely supported (see New Green Savings, Modernization Fund), the importance of hydrogen in balancing fluctuations in the power grid is growing. The development of community energy and the growing share of small local electricity sources will, in the foreseeable future, create opportunities for storing surplus electricity from RES in hydrogen reserves, which can be used in times of energy shortages. First, the possibility of storing large amounts of hydrogen in suitable storage facilities must be effectively resolved.

The fulfillment of this cross-cutting objective is supported by a number of specific objectives, mainly in the "Global Bridges."

3.3.2 Education and awareness

3.3.2.1 *Increasing the number of experts in hydrogen technologies*

Hydrogen technologies are a modern and rapidly developing field that requires many experts and workers with completely new skills combining, for example, electrical engineering with gas engineering. It is necessary to start educating and training these experts and specialists by adapting dedicated study programs, especially at secondary schools and vocational schools. New hydrogen equipment must not only be designed and manufactured, but also serviced and maintained. It is therefore essential to have experts for each stage of the life cycle of hydrogen technologies and hydrogen ecosystems, otherwise a situation may arise where modern innovative hydrogen technologies are deployed but there are no specialists available to operate and maintain them. The Czech Republic should also support the creation of hydrogen-oriented study programs at universities.

By 2030, it is necessary to adapt the framework education programs for existing fields and introduce courses dedicated to hydrogen technologies and certification exams for hydrogen technicians. This applies to gas, electrical engineering, fire safety, and other fields. Hydrogen technologies must also be included in the curriculum of other fields that are only marginally related to hydrogen, primarily for reasons of operational safety of hydrogen equipment.

3.3.2.2 *Improving public awareness of hydrogen technologies*

Public awareness of the advantages and disadvantages of hydrogen plays an important role in the acceptance of new technologies in the transition to climate neutrality. According to a questionnaire survey conducted by the Clean Hydrogen Partnership in spring 2023 in all European countries

In a survey of approximately 1,000 respondents aged 15 and older, more than 82% of respondents are aware of what hydrogen means in practice as an energy medium. Most respondents perceive hydrogen positively in terms of its environmental impact, even better than nuclear energy. Approximately 11% of respondents, for example, mention that they would consider switching to a hydrogen-powered vehicle as a replacement for their current fossil fuel-powered car (approximately 33% are considering batteries). However, the main factor is the price of the technology itself and operating costs. According to a questionnaire survey conducted by the Transport Research Center in the summer of 2023 among fleet managers of key companies in the transport sector, freight forwarders, transport companies, municipal services, logistics parks, maintenance and waste management, 19.6% of respondents have sufficient information and 50.1% have at least basic information about hydrogen mobility. 67.3% of respondents are responding to the demand for zero-emission transport by waiting: for market readiness (21.9%), for more information (30.4%) and for overall price reductions (15.0 %). 32.7 % of companies are not yet responding to the demand for zero-emission transport. A total of 15 respondents are considering building their own electrolyzer for hydrogen production, and 17 respondents are considering building their own hydrogen filling station. The transition to hydrogen is expected by 44.1% of the companies surveyed. The companies surveyed plan to replace 7% of their vehicle fleets with hydrogen vehicles by 2030, 11% by 2035, and 15% by 2024. Forty-six point five percent consider zero increase in operating costs to be acceptable, and 87.8% consider an increase of zero to 20% of operating costs to be acceptable. Companies working for public administration and local government are showing greater interest in hydrogen technologies, regardless of whether they are privately owned (90.2%), municipal, regional or state-owned. Companies whose vehicles operate in built-up areas are also more interested in hydrogen. These include companies that maintain public spaces or operate local freight transport.

Hydrogen is perceived positively in the context of reducing dependence on fossil fuels. Most often, people mentioned hydrogen as a fuel (76%), hydrogen as a raw material for industry (56%), and approximately 42% expressed that they understand hydrogen as a potential source of heat for households. [44]

In the context of hydrogen development primarily in the industrial and transport sectors, it is essential to inform the general public about the real potential of hydrogen use, and communication should be designed in such a way as not to create unrealistic expectations, particularly in the context of replacing natural gas with hydrogen.

It is necessary to provide open information on all aspects of the use of hydrogen and hydrogen technologies and to explain why hydrogen is a suitable alternative to fossil fuels and what advantages it offers.

3.3.3 Development of hydrogen valleys

Hydrogen valleys are an important tool for building hydrogen ecosystems. They play a priority role, especially in the "Local Islands" phase, as they enable the efficient connection of hydrogen production and consumption at a time when the hydrogen transport and distribution infrastructure has not yet been built.

The task cards, especially in the first phase, include a number of tasks related to the development of hydrogen valleys. The importance of hydrogen valleys is also emphasized by the creation of a "Hydrogen Valley Coordination Group," which will ensure the coordination of hydrogen projects, strategic planning, and the involvement of relevant stakeholders to optimize the development of hydrogen technologies in the given locations.

[44] https://www.clean-hydrogen.europa.eu/system/files/2023-07/5359%20PublicOpinionSurvey_executive%20summary_en%20%281%29.pdf

3.3.4 Ensuring a high level of safety when working with hydrogen

In the area of integrated rescue systems, it is necessary to expand knowledge and introduce procedures for accident response and behavior in the vicinity of hydrogen technologies by 2030, and to ensure that employees receive proper safety training. This primarily concerns the police, firefighters, and medical personnel. New regulations for private companies in the field of occupational health and safety can also be expected.

3.3.5 Ensuring the legislative and commercial level

Although each specific objective has its own defined legislative requirements, it is also necessary to create a functional business model covering all segments of hydrogen consumption and linking to the trading and reporting models for other energies. From a commercial point of view, this involves not only trading in pure hydrogen, but also trading in hydrogen blends and their correct reporting in consumption, both for renewable hydrogen and low-carbon hydrogen. For these purposes, it is necessary to use all available certification schemes so that the Czech Republic can exploit all available potential for carbon neutrality and correctly report hydrogen consumption in relation to all obligations (RED, ETS1,2, EU taxonomy, etc.).

3.3.6 Research and development of hydrogen technologies in line with the specific objectives of the Hydrogen Strategy

The development of the hydrogen economy requires ongoing research and development leading to improvements in current and future technologies for the production, storage, distribution, and end use of hydrogen, their applicability in the Czech Republic, and the creation of business models and development scenarios. The general directions of research and development are set out in the Strategic Research Agenda for Hydrogen Technologies in the Czech Republic of the Czech Hydrogen Technology Platform([45]) and in the National Research and Innovation Strategy for Smart Specialization of the Czech Republic (RIS3) 2021-2027([46]). Specific research and development activities in the field of hydrogen, in line with legislative support from the European Union and the objectives of the Hydrogen Strategy, can be broadly divided into hydrogen production, storage, distribution, and transport, and the end use of hydrogen – the creation of hydrogen ecosystems.

1) The clearly preferred technological methods **for producing renewable and low-carbon hydrogen** include water electrolysis technologies, technologies for producing hydrogen from waste, and CO_2 capture technologies, which can be applied in current hydrogen production facilities in the Czech Republic. Research and development should focus primarily on increasing the energy efficiency of production processes, extending the service life of individual technologies, and reducing their cost. In addition, it is necessary to prepare technical and economic analyses of the suitability of specific production technologies in the Czech Republic, taking into account EU legislative conditions and decarbonization potential.

2) The issue **of storage, transport, and distribution** must be viewed in the context of rapid development, initially at the level of local storage, transport in trailers, and distribution to smaller hydrogen filling stations, and then on to the transport, storage, and distribution of large quantities of hydrogen through the gas network. Research and development in this area must focus not only on the technologies themselves, such as compressors, storage equipment, and composite materials, but also on research activities

[45] HYTEP, Strategic Research Agenda for the Development of the Hydrogen Economy in the Czech Republic https://www.hytep.cz/images/dokumenty-ke-stazeni/SVA_HYTEP.pdf

[46] Ministry of Industry and Trade, RIS3 strategy, https://www.mpo.cz/cz/podnikani/ris3-strategie

mapping the possibilities and prerequisites for large-scale storage (underground reservoirs, aquifers, etc.), investigating the effects of hydrogen on materials and equipment in gas transmission and distribution systems for pure hydrogen and blends, and studies on the possibilities of using hydrogen compounds for its transport, for example in the form of ammonia. Furthermore, the creation of technical standards that will enable the storage, transport, and distribution of hydrogen.

3) **The end use of hydrogen** is mainly linked to the mobility sector, sectors using hydrogen as a raw material (ammonia and methanol production, metallurgy, etc.) and the electricity and heat production sectors. Fuel cells are an important technology for the future with the potential to improve overall efficiency, service life, and reduce prices. Improving fuel cells is a key prerequisite for the development of hydrogen mobility. In addition to fuel cells, research and development should also focus on cogeneration units (especially turbines, boilers, and combustion engines). Here, too, there is room for a number of analyses and studies, particularly with regard to the development of hydrogen distribution to filling stations and the achievement of the Hydrogen Strategy's targets in industry and transport.

4) **The creation of hydrogen ecosystems** primarily involves modeling, enabling technical, technological, infrastructural, and price optimization of hydrogen ecosystems, determining critical points, system resilience, and more. An important part is research in the field of education and social change due to the change in the energy mix and the introduction of hydrogen into the energy sector, as well as the adaptation of society to the use of hydrogen. To this end, it is necessary to ensure the effective transfer of knowledge between different disciplines and social groups.

3.3.7 Production of hydrogen technologies

The aim is to continuously support not only research and development, but also the production of hydrogen technologies and individual components in the Czech Republic. Direct investment incentives from the state and a sufficient supply of skilled labor appear to be suitable tools for attracting foreign companies that could produce hydrogen technologies in the Czech Republic. In addition to increasing GDP, the production of related technologies has the potential to create new jobs and build know-how in the Czech Republic. The production of end-use hydrogen technologies is linked to an entire value chain, with a number of companies in the transport sector, for example, looking for new applications in the coming years following the planned phase-out of new combustion engine cars after 2035, where the know-how gained from the production of components used in combustion engine cars could be utilized. Large companies producing key hydrogen technologies in the Czech Republic will also bring know-how and greater pressure to open up new high value-added industries.

Support for the development of key technologies is now also provided by a draft European regulation, the EU Zero Net Emissions Industry Act (NZIA). Among other things, it proposes to improve investment conditions by simplifying the authorisation process (EIA processing, licensing procedures, single point of contact) for selected strategic projects for the production of zero-emission technologies (fuel cells, electrolysers)[47].

4 ANALYTICAL PART

The analytical section focuses on hydrogen consumption and production only until 2030. Analyses of developments for the period up to 2050 have been prepared and are currently being consolidated and compared with the results of broader energy development simulations. These are being carried out in connection with the preparation of the Czech Republic's National Energy and Climate Plan and the State Energy Policy.

Hydrogen valleys play an extremely important role in fulfilling the objectives of the Hydrogen Strategy in the initial period, during the Local Islands stage. They enable the production of hydrogen to be aligned with its consumption in the early stages and minimize hydrogen transport costs by locating production sites very close to consumption sites. Hydrogen valleys will also be important in later stages, as they will create hydrogen islands that will gradually be connected to the construction of the relevant hydrogen transport and distribution network. The creation of hydrogen clusters and hydrogen valleys is planned, particularly in the Ústí, Moravia-Silesia, and Karlovy Vary regions. The Czech Republic has committed to the concept of "hydrogen valleys" in accordance with the European Union's understanding of this term([48]).

4.1 Consumption requirements

Renewable hydrogen consumption requirements by 2030 will mainly be determined by the targets specified in the Renewable Energy Directive (RED) for industry and transport, additional voluntary CO_2 emission reduction requirements in the chemical industry and transport, and requirements triggered by financial incentives (ETS2 and EU taxonomy).

The development of hydrogen mobility will bring further demands on hydrogen used as a fuel. Due to the scarcity and price of renewable hydrogen, some of these demands will be met by low-carbon hydrogen and, for a transitional period, by fossil hydrogen.

No significant demand for hydrogen is expected to arise from sectors other than industry and transport in 2030
for renewable, low-carbon or fossil hydrogen.

The estimated total demand for renewable (RFNBO) hydrogen production in 2030 is 20,000 t RFNBO hydrogen/year. We use this figure in our estimate of the costs required for its production. It is calculated as the sum of the RFNBO hydrogen required in the chemical industry (8,000 tons/year) and transport (13,600 tons/year). The total is rounded to 20,000 tons/year.

4.1.1 Estimated hydrogen consumption in industry in 2030

Member States must ensure, in accordance with Article 22a of the Renewable Energy Directive (RED), that industry uses at least 42% renewable hydrogen, as specified in the RFNBO (renewable fuels of non-biological origin), for final energy and non-energy purposes in 2030. The numerator for calculating the percentage of compliance is the energy value of renewable hydrogen (RFNBO) consumed in the industrial sector for final energy and non-energy purposes, minus renewable hydrogen (RFNBO) used for the production of conventional fuels and other specified exemptions. The denominator is the energy value of hydrogen consumed in the industrial sector for final energy and non-energy purposes, excluding fossil hydrogen used for the production of conventional fuels (as an intermediate product), hydrogen used for the production of biofuels, and hydrogen defined by two other exceptions.

[48] https://hydrogeneurope.eu/wp-content/uploads/2023/09/HE-Input-to-H2V-Roadmap_final-version-.pdf

The Directive mainly targets the decarbonisation of the production of ammonia, methanol or chemicals for which fossil hydrogen is currently used.

In the Czech Republic, this mainly concerns hydrogen used in the production of aniline (BorsodChem MCHZ, s. r. o.). Based on current calculations, it will be **necessary to ensure the use of 8,000 tons of renewable hydrogen per year in 2030.** In our opinion, other hydrogen production falls under the exceptions listed in the RED Directive, as it concerns hydrogen in refineries or as a by-product. This division will have to be clarified in negotiations with the EC.

In 2035, 60% of hydrogen production in the same areas will need to be covered, which will represent approximately 12,000[49] tons of renewable hydrogen per year.

The same European targets for ensuring the percentage share of renewable hydrogen (RFNBO) apply to industry in general, i.e. including metallurgy. In the Czech Republic, current hydrogen consumption outside the chemical industry is minimal.

The obligation to replace fossil hydrogen in industry with renewable hydrogen RFNBO will most likely be transposed into Czech law by updating Act No. 165/2012 Coll. on supported energy sources in a similar way to the rules for biogas.

4.1.2 Estimated hydrogen consumption in transport in 2030

According to the RED Directive, Member States must ensure that fuel suppliers achieve a minimum share of 29% of renewable energy in transport or a 13% reduction in greenhouse gas emissions from transport by 2030. The same article also sets a binding combined target for renewable fuels of non-biological origin (RFNBO) and advanced biofuels produced from specified feedstock. This share must be at least 5.5% of all fuels in transport. The minimum share of renewable hydrogen RFNBO must be at least 1% of all fuels in transport.

Aviation fuels must also be included in the total amount of all fuels used in transport, which, at the planned level for 2030, represents 441,000[50] tons of aviation fuel (kerosene) per year, representing a requirement for the production of approximately 200 tons of synthetic fuel per year.

The minimum amount of renewable hydrogen RFNBO required to meet the 1% RFNBO share target in transport is **13,600[51] tons per year in 2030.**

However, there is a real risk associated with a shortage of advanced biofuels on the European market, which would prevent the common target from being effectively met using advanced biofuels, which are a cheaper option. In that case, it would be necessary to increase the contribution of hydrogen (RFNBO) above the currently planned minimum of 1%.

The above transport target can be achieved in three ways:

1. Introducing renewable hydrogen RFNBO directly to the hydrogen mobility market (sale at hydrogen filling stations). This method is optimal because it allows two binding targets to be met simultaneously

[49] This figure is based on the best current estimate and may be revised after consultation with the EC.
[50] The estimate of aviation fuel consumption in 2050 is based on scenarios from forecasting agencies (IHS Market, Nexant), according to which the aviation fuel market will reach pre-COVID volumes around 2030 and then grow steadily. The projected demand trajectory was consulted with ORLEN Unipetrol, the largest player in the aviation fuel market in the Czech Republic.
[51] This figure is based on the best current estimate, may be revised after discussions with the EC, and assumes that a large part of the emission reduction commitments in transport will be achieved through advanced biofuels.

simultaneously. In this way, the Czech Republic is meeting the RFNBO share targets for transport and also reducing transport emissions. This achievement is limited by the number of vehicles in operation that will refuel with renewable hydrogen. It is therefore necessary to accelerate the introduction of hydrogen vehicles as much as possible.

2. The use of RFNBO hydrogen as an intermediate product for the production of fossil fuels. This essentially involves replacing the grey hydrogen that is currently used. In this case, the only limitation is the availability of renewable RFNBO hydrogen in refinery production. In terms of investment costs, this is the cheapest approach, as there is no need to build infrastructure for the operation of hydrogen vehicles. This solution is also suitable for fuel suppliers who will not have hydrogen filling stations in the Czech Republic. Under current rules, renewable hydrogen used in this way does not count towards the transport emissions reduction target.

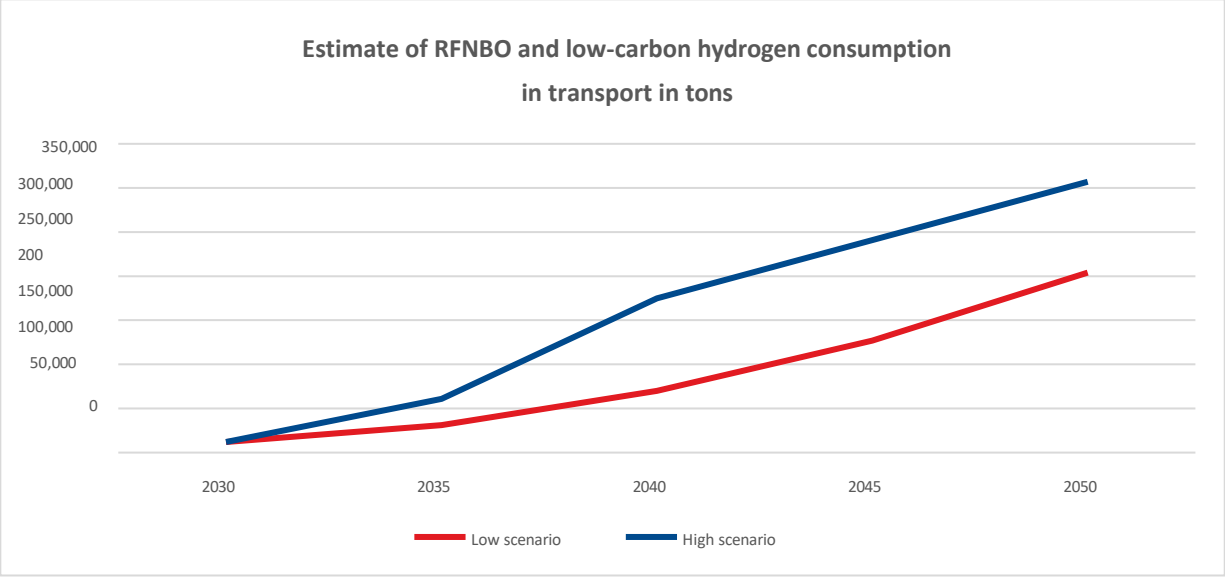
3. Production of e-fuels and their introduction to the market. These fuels can be used in conventional combustion engines. The price of these fuels is currently very high, so it can be expected that by 2030, e-fuels will only be used in aviation. In this case, both the RFNBO share target and the emission reduction target will be met.

From the Czech Republic's perspective, the optimal route is to sell renewable hydrogen at hydrogen filling stations combined with the use of renewable RFNBO hydrogen to green the production of fossil fuels in refineries. Mass production of e-fuels and their sale through a network of filling stations is not expected by 2030.

In line with the NAP CM, the following numbers of hydrogen vehicles are expected to be in operation in 2025–2035 (medium scenario):

Vehicle category	2025	2030	2
Passenger vehicles	2	3,000	8
City and intercity buses	1	200	35
Light commercial vehicles	50	80	3,500
N2 and N3 trucks	10	380	1,500

Estimated hydrogen consumption by 2025 for the mobility sector was calculated in two scenarios and is based on from the total estimate of the amount of different types of hydrogen in various sectors of the national economy, see 4.1.3 Estimated hydrogen consumption by 2050.



Part of the consumption of hydrogen vehicles will be covered by renewable hydrogen (RFNBO) and the rest by low-carbon and fossil hydrogen. The use of fossil hydrogen in transport is only expected in the initial stages to kick-start low-emission mobility, and once cheap renewable hydrogen is available from imports, hydrogen mobility will fully utilize renewable hydrogen.

The AFIR Regulation sets targets for Member States for the deployment of hydrogen mobility infrastructure. By the end of 2030, Member States will have to ensure that publicly accessible hydrogen refueling stations are deployed along the TEN-T core network at a maximum distance of 200 km from each other. This means that hydrogen refueling stations are located directly on the TEN-T (main) network or within 10 km of the nearest exit. Hydrogen refueling stations will have to have a minimum cumulative capacity of 1 ton of hydrogen per day and be equipped with dispensing equipment with a pressure of at least 700 bar.

In accordance with the NAP CM, the following numbers of hydrogen refueling stations in various categories are planned to be built by 2035:

Hydrogen filling station category	**2025**	**2030**	**2035**
Public refueling stations along the TEN-T core network according to AFIR conditions every 200 km	1	1	20
Public stations in urban centers and outside them with lower dispensing capacities (up to 300 kg per day)	4	3	5
Non-public filling stations for business needs and public transport	5	10	30

These hydrogen filling stations will provide sufficient refueling options for planned hydrogen vehicles and ensure compliance with the AFIR regulation. In accordance with the conditions for support under the GBER, these stations will be supplied with renewable hydrogen from 2035 at the latest, if this is economically viable, imported via the gas transmission system, or with low-carbon hydrogen if the relevant legislation has been adopted by that date.

The construction of public and non-public hydrogen refueling stations is addressed in detail by the NAP CM in the following task cards:

- Plan for public hydrogen refueling infrastructure;
- Support for public hydrogen refueling stations on the TEN-T core network;
- Support for non-public hydrogen refueling stations for businesses;
- Support for non-public hydrogen refueling stations for public entities;
- Support for public hydrogen refueling stations in urban centers and beyond.

The methodology for the construction of hydrogen refueling stations, including a plan for the location of hydrogen refueling stations, is being developed by the Czech Technology Agency's project "Progressive Development of the Hydrogen Economy in the Czech Republic." The results will be available in 2024. The National Hydrogen Mobility Center is working on another project, "Modeling the demand for low-carbon and renewable hydrogen in transport in the Czech Republic by 2030." The results of this project will also be available in 2024. Following the results of these projects, discussions will begin at the Ministry of Transport on the appropriate setting of subsidy incentives and calls for the construction of large-capacity and smaller hydrogen filling stations (up to 300 kg daily capacity) for hydrogen, taking into account locations on the TEN-T network and smaller filling stations to be located in or outside urban centers.

The development of a hydrogen vehicle fleet is an important prerequisite for achieving hydrogen infrastructure goals
infrastructure and its sustainable operation. Without a sufficient number of hydrogen vehicles (passenger cars,

buses, commercial vehicles, and trucks) and without significant additional support for infrastructure operators, it will not be possible to ensure the operation of hydrogen filling stations in the numbers necessary to meet the objectives of the AFIR Regulation.

Hydrogen will play a role not only in road transport but also in rail transport. In the Czech Republic, about two-thirds, or 6,000 km, of railways are currently without electric traction. Some lines with heavy freight traffic are likely to be electrified in the future. However, there are still many lines where electrification is not economically viable. On these lines, it will be necessary to replace existing diesel trains with hydrogen, battery, or hydrogen-electric trains. Hydrogen trains are competitive on regional lines where long distances and low utilization do not justify the high costs associated with electrification, and complicated driving profiles do not allow the use of battery-powered trains. Studies are currently underway to compare the efficiency of different types of rail vehicles in the conditions of the Czech rail network.

The "Methodology for the certification of railway lines intended for trains with alternative propulsion systems" [52]was prepared with the aim of establishing general procedures necessary for basic decisions on the deployment of suitable alternative propulsion systems on selected railway lines. The methodology was prepared by the VŠB Technical University of Ostrava in cooperation with the Railway Administration and provides guidance on how to assess the suitability of different types of rail propulsion in the first step.

The assessment of specific selected lines is also being carried out as part of another project, the results of which will be available in mid-2024. This study analyzes in great detail the various types of propulsion on the relevant line, with its elevation profile and specific timetable, which defines the time available for refueling hydrogen or charging batteries in rolling stock.

It is very important for hydrogen trains to start operating on lines where their advantages are indisputable and to gradually prove their superiority over other types of propulsion. For the successful deployment of hydrogen propulsion on railways, it is essential that the relevant actors in the selected area and on the selected routes cooperate, including the Ministry of Transport, the Railway Administration, the relevant transport operators, and the relevant regional and local authorities.

The current and planned status of hydrogen infrastructure for transport is shown on **the** interactive **Hydrogen Map of the Czech Republic**. The data on the map is divided according to the degree of implementation. The map includes actual and planned hydrogen production sites, hydrogen filling stations, regional strategic projects, and more.

4.1.3 Estimated hydrogen consumption by 2050

An estimate of hydrogen consumption (RFNBO, low-carbon and grey) has been prepared for the period up to 2050 in cooperation with ČPS and SPČR. Two scenarios have been prepared: low and high.

[52] https://ceet.vsb.cz/export/sites/ceet/cenet/.content/galerie-souboru/Metodika-pro-pasportizaci-zeleznicnich-trati_vc.-titulky.pdf

Estimated consumption in thousands of tons of hydrogen

		LOW case					HIGH case				
Položka		**2030**	**2035**	**2040**	**2045**	**2050**	**2030**	**2035**	**2040**	**2045**	**2050**
Celkový odhad spotřeby H2	**kt**	**129**	**165**	**385**	**716**	**1160**	**129**	**435**	**1322**	**1579**	**1835**
Z toho H2 v blendu ZP[1]	kt	17	13	8	4	0	17	13	8	4	0
Z toho čistý H2	kt	112	152	376	712	1160	112	422	1314	1574	1835
Z toho RFNBO a nízkouhlíkový	kt	40	152	376	712	1160	40	422	1314	1574	1835
Z toho šedý	kt	72	0	0	0	0	72	0	0	0	0
Celkový odhad spotřeby RFNBO a nízkouhlíkového H2	**kt**	**40**	**152**	**376**	**712**	**1160**	**40**	**422**	**1314**	**1574**	**1835**
Z toho průmysl	kt	28	80	186	344	554	28	150	436	516	595
Z toho doprava	kt	12	31	70	127	204	12	61	175	241	307
Z toho elektřina a teplo	kt	0	40	121	241	402	0	211	702	818	933

1. Blend importovaný ze zahraničí

Estimated hydrogen consumption in TWh

		LOW case					HIGH case				
Položka		**2030**	**2035**	**2040**	**2045**	**2050**	**2030**	**2035**	**2040**	**2045**	**2050**
Celkový odhad spotřeby H2	TWh	**4.3**	**5.5**	**12.8**	**23.9**	**38.7**	**4.3**	**14.5**	**44.1**	**52.6**	**61.2**
Z toho H2 v blendu ZP[1]	TWh	0.6	0.4	0.3	0.1	0.0	0.6	0.4	0.3	0.1	0.0
Z toho čistý H2	TWh	3.7	5.1	12.5	23.7	38.7	3.7	14.1	43.8	52.5	61.2
Z toho RFNBO a nízkouhlíkový	TWh	1.3	5.1	12.5	23.7	38.7	1.3	14.1	43.8	52.5	61.2
Z toho šedý[2]	TWh	2.4	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0
Celkový odhad spotřeby čistého RFNBO a nízkouhlíkového H2	TWh	**1.3**	**5.1**	**12.5**	**23.7**	**38.7**	**1.3**	**14.1**	**43.8**	**52.5**	**61.2**
Z toho průmysl	TWh	0.9	2.7	6.2	11.5	18.5	0.9	5.0	14.5	17.2	19.8
Z toho doprava	TWh	0.4	1.0	2.3	4.2	6.8	0.4	2.0	5.8	8.0	10.2
Z toho elektřina a teplo	TWh	0.0	1.3	4.0	8.0	13.4	0.0	7.0	23.4	27.3	31.1

1. Blend importovaný ze zahraničí

4.2 Possibilities for meeting hydrogen demand through domestic production and imports

4.2.1 Production of renewable RFNBO hydrogen in the Czech Republic

Given that the targets under the revised Renewable Energy Directive must be met by 2030 and that simplified conditions for additionality apply until the end of 2027, it is appropriate to focus on meeting part of the production targets through domestic hydrogen production. This should also lead to increased energy independence. G i v e n the high unit costs of transporting hydrogen by rail or road and the absence of hydrogen infrastructure before 2030, industry will also have to rely on local production within manufacturing plants. This is also due to the fact that high demand for hydrogen is allocated to only a few manufacturing plants.

Summary of rules for the production of renewable hydrogen RFNBO according to the Delegated Act establishing a Union methodology for detailed rules on the production of renewable fuels of non-biological origin[53]:

[53] https://eur-lex.europa.eu/legal-content/CS/TXT/?uri=CELEX:32023R1184

Additionality (renewable electricity consumed must come from new RES):

- Electrolyzers put into operation in 2028 and later must not use electricity from RES put into operation into operation earlier than 36 months before the electrolyzer is put into operation.
- Electrolyzers put into operation by the end of 2027 are exempt from the additionality requirement until December 2038, i.e., these electrolyzers may use electricity from RES that were built less than three years before the electrolyzer was put into operation.
- Electrolyzers commissioned in 2028 and later cannot use electricity from RES sources whose construction was supported by operational or investment aid. Hydrogen produced from such sources will not be recognized as renewable RFNBO hydrogen.

Time correlation (renewable electricity and RFNBO production must take place in the same time blocks):

- Until 2030, monthly correlation will apply; from 2030 onwards, only hourly correlation will apply.
- This rule does not need to be addressed if the daily market price of electricity is below €20/MWh or 36% of the emission allowance price.
- From 2027, Member States may voluntarily choose stricter hourly correlation.

Geographical correlation:

- The electrolyzer must be located in the same trading zone as the RES from which it draws electricity.
- The electrolyzer may use electricity from adjacent trading zones, but only if the price of electricity on the adjacent market is the same or higher than in the trading zone where the electrolyzer is located. (However, this condition leads to significant commercial risks for electrolyzer operators using electricity from neighboring trading zones).
- Member States may voluntarily tighten these rules.

Other general rules:

- The rules apply to the production of renewable hydrogen both within and outside the European Union.
- To calculate emissions savings when using RFNBO and recycled fuels containing carbon, the methodology defined in a separate delegated act must be used. The carbon footprint of RFNBO hydrogen must not exceed 28.2g $_{CO2}$ / MJ after taking into account emissions associated with transport, compression, cooling, etc.
- If the electrolyzer is connected to both the grid and a renewable energy source, it is necessary to demonstrate separately for the hydrogen produced what type of production was used (using a smart metering system) for each unit of electricity used. Similarly, different methods of hydrogen production can be combined, for example through redispatching or production from electricity from a secondary commercial zone. In practice, it will always be necessary to prove the source of the RFNBO.
- In countries where more than 90% of all electricity comes from renewable sources, electricity from the grid is always considered fully renewable, so it is not necessary to comply with the rules of additionality, time correlation, and geographical correlation. Electrolyzers can only run for as many hours as the percentage of renewable electricity in the trading zone. In principle, the number of hours in a year is taken and multiplied by the percentage of renewable electricity for the entire year. For example, if 92% of electricity comes from RES, the electrolyzer will be able to produce up to 8,059 hours per year (=365 days * 24 hours * 92%).
- In zones where total electricity emissions are lower than 18 g CO2/MJ (in France and Sweden in 2023), it is not necessary to comply with the additionality rule; the time and geographical correlation rule still applies. It is therefore necessary to conclude PPAs for renewable electricity sources; RFNBO producers may conclude them with any RES.

- Voluntary national or international schemes approved by the European Commission on the basis of Article 30(4) of the Renewable Energy Directive (EU) 2018/2001 may be used to demonstrate compliance with the rules.
- By July 1, 2028, the European Commission will evaluate the rules for RFNBO production, in particular the time correlation, and submit any changes to the Parliament and the Council.

In view of the above rules, it is desirable to accelerate projects for the construction of electrolysers and associated RES as much as possible so that they can be commissioned by 2027 at the latest and benefit from the time-limited derogations from the RFNBO production rules. These exemptions allow electrolysers to be operated at higher utilisation rates, thereby achieving lower unit prices for hydrogen.

In order to meet the requirements of the RED Directive with an electrolyzer utilization rate of around 30%, the following electrolyzer capacities and associated RES are planned to be gradually brought into operation by 2030. In order to increase utilization and reduce the need for high installed electrolyzer capacity, it is necessary that the RES connected to the electrolyzers be a combination of solar and wind, or possibly also water sources.

Year	2	2	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cumulative installed capacity of electrolysers (MWe)	0	0	0	0	0	2	10	60	160	240	320	400

4.2.2 Renewable hydrogen import options

According to the plans of system operators (current proposals for 10-year development plans for the NET4GAS and ENTSO-G systems), hydrogen infrastructure that would enable the import of large volumes of renewable hydrogen from abroad will be ready by the end of 2030.

Like other Central European countries, the Czech Republic will not be able to effectively meet the expected demand solely through domestic production of low-carbon hydrogen due to limited conditions for domestic production. Importing hydrogen from abroad will therefore be a suitable and economically efficient way to cover the expected excess demand over domestic production. To ensure the import of hydrogen from areas with high potential for cost-effective production of renewable hydrogen, a joint initiative of European energy infrastructure operators has been launched with the aim of creating a pan-European hydrogen transport backbone, known as the European Hydrogen Backbone (EHB)([54]). This initiative envisages five import corridors, with the Czech Republic directly connected to three of them:

- Southern Europe (import of hydrogen produced in North Africa) (A),
- Baltic (import of hydrogen produced in the Baltic Sea and Scandinavia) (D),
- Eastern Europe (import of hydrogen produced in Ukraine and the Balkan Peninsula) (E).

In addition to importing hydrogen produced in these regions, it will be possible to connect the European backbone transport system to planned large-scale supply routes from the Middle East or South America[55].

[54] https://ehb.eu/

[55] Transport of liquid hydrogen compounds (e.g. ammonia) to European port terminals, conversion of liquid hydrogen compounds into gaseous hydrogen and subsequent transport via a pan-European hydrogen pipeline network

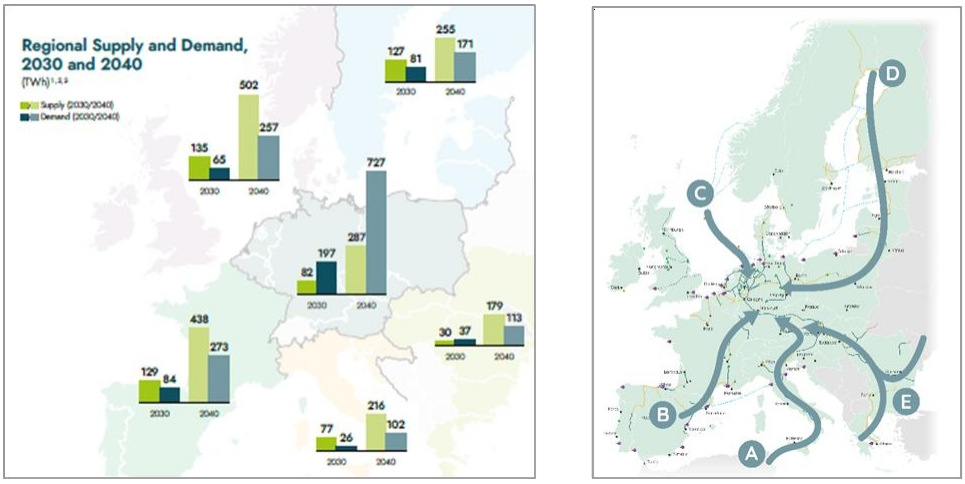


Figure 1: Expected $_{H2}$ balance of EU regions and planned import corridors

The European transport backbone system envisages the possibility of using existing gas infrastructure, which, compared to the reconstruction of a pan-European electricity transmission system, can be relatively quickly and cheaply adapted for hydrogen transport (so-called repurposing). NET4GAS (the gas transmission system operator in the Czech Republic) plans to modify two gas pipelines for this purpose by 2030:

- The northern branch gas pipeline between the border points of Lanžhot and Brandov,
- The western branch gas pipeline between the border points of Brandov and Waidhaus.

If work on the German side is accelerated, it is not out of the question that, in an optimistic scenario, the western branch of the NET4GAS system could be put into operation as early as 2028.

NET4GAS also plans to modify one gas pipeline on the southern branch between the border points of Lanžhot and Waidhaus. The repurposing of this corridor is likely to be completed between 2030 and 2035, depending on demand. This will connect the Czech Republic to three of the five planned European hydrogen import corridors, giving Czech consumers access t o affordable hydrogen([56]) ·Each of the import border points will have an initial (i.e., from 2030) capacity of approximately 1.5 million tons of hydrogen per year (approximately 50 TWh/year). This capacity is more than sufficient to cover the expected consumption inthe Czech Republic andcan be relatively easily increased in subsequent years if necessary.

[56]According to the European Hydrogen Backbone study, the cost of hydrogen production in North Africa, Ukraine, and the Baltic states is expected to range between €2 and €3 per kilogram in 2030. The study also expects that by 2050, hydrogen production costs could fall to between €1 and €2 per kilogram.

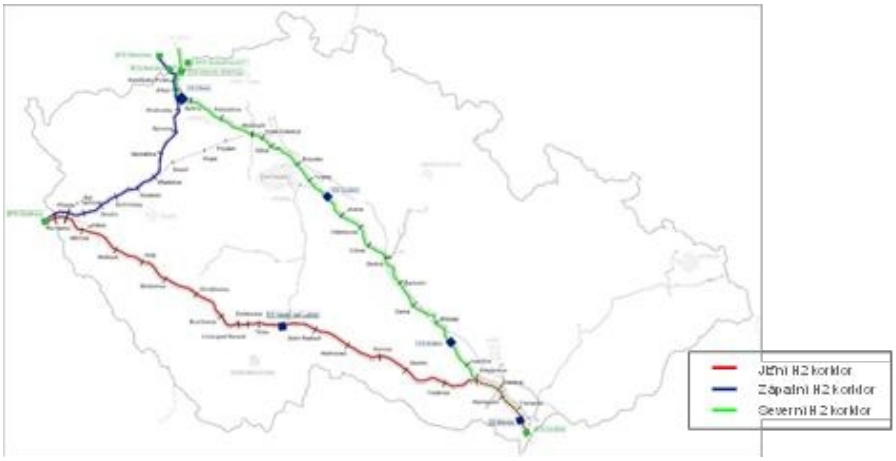


Figure 2: Planned hydrogen corridors in the Czech Republic by 2035

In addition to supplying the Czech Republic, these corridors will be used to transport hydrogen to Germany, which will be the main consumer of hydrogen in the EU. The construction of these corridors will thus significantly contribute to increasing the strategic importance of the Czech Republic and its assets in the future structure of Europe's low-carbon energy infrastructure.

4.3 Current barriers to the development of the hydrogen economy in the Czech Republic

This chapter provides an overview of the barriers currently hindering the development of hydrogen technologies. The aim of the Hydrogen Strategy is not only to identify these barriers, but also to propose possible solutions for their removal. One of the main mechanisms for removing barriers was already included in the first version of the Hydrogen Strategy Task Card.

4.3.1 Legislative and regulatory factors

4.3.1.1 European legislation

The introduction to the Hydrogen Strategy stated that one of the main tasks is to meet the emission reduction targets set by the EC. An overview of European legislation in force at the time of the preparation of the Hydrogen Strategy is provided in Chapter 2.1 Initial framework, which also contains links to the referenced documents. It should be emphasized that this framework is still evolving and that several new documents have been produced during the preparation of the Hydrogen Strategy, with a number of others in preparation for finalization in 2024. The introductory overview therefore reflects the situation at a given point in time.

4.3.1.2 State Energy Policy of the Czech Republic and NKEP

The Czech Republic's State Energy Policy (SEK) from 2015 does not really deal with hydrogen, which makes sense considering when it was written. One of the main things that needs to be added to the SEK and NKEP is the share of hydrogen in the Czech Republic's total energy mix and the possibilities for storing energy in the form of hydrogen. Work is currently underway to update the SEK and NKEP. The relevant teams at the Ministry of Industry and Trade are coordinating the work on the relevant documents with the Hydrogen Strategy.

4.3.1.3 Energy Act

In the current version of the Energy Act (January 2024), hydrogen is already defined as an energy gas.

A further amendment to the Energy Act will be prepared to take into account the requirements arising from the Gas Package, e.g. setting conditions for the development of price regulation principles or, where appropriate, amending the trade licensing regime.

4.3.1.4 *Act No. 165/2012 Coll., on supported energy sources (POZE)*

The Act integrates the promotion and use of renewable energies in the energy sector and, to some extent, in transport. It also defines standards for the issuance, circulation, and use of guarantees of origin for hydrogen. This law is key to establishing a legislative and commercial model and creating a suitable tool for trading and reporting renewable and low-carbon hydrogen in line with European legislation (e.g., the RED Directive). The current setup is also unsuitable for biomethane and will need to be substantially revised for the use of hydrogen.

4.3.1.5 *Decree No. 108/2011 Coll., on gas measurement and the method of determining compensation for damage in the event of unauthorized consumption, unauthorized supply, unauthorized storage, unauthorized transport or unauthorized distribution of gas*

4.3.1.6 *Decree No. 488/2021 Coll., on conditions for connection to the gas system*

4.3.1.7 *Decree No. 349/2015 Coll., on Gas Market Rules*

4.3.1.8 *Decree No. 345/2002 Coll., on the determination of measuring instruments subject to mandatory verification and measuring instruments subject to type approval*

4.3.1.9 *Act No. 224/2015 Coll., on the prevention of major accidents caused by selected dangerous chemical substances or chemical mixtures*

4.3.1.10 *Act No. 61/1988 Coll., on Mining Activities, Explosives and State Mining Administration*

4.3.1.11 *Act No. 224/2015 Coll., on the prevention of major accidents.*

4.3.1.12 *Other similar regulations based on a continuously updated table prepared by the ČPS legislative group:*

- Statistical monitoring of hydrogen;
- Ensuring conditions for blending;
- Measurement of hydrogen quality for hydrogen mobility;
- Discussion on the appropriate setting of the legislative framework (building regulations, EIA, etc.) for the approval of the projects in question with a view to simplifying the construction of electrolysers, hydrogen storage and dispensing facilities, and the connection of hydrogen production to the distribution system;
- Technical standards;
- Rules for the use of hydrogen in households (boilers, small fuel cells) and industry (centralized heat supply (CZT), cogeneration, turbines).

4.3.2 Technical and economic factors

4.3.2.1 *Geographical and climatic conditions for low-carbon hydrogen production*

Unfavorable climatic conditions for hydrogen production from RES lead to lower outputs at comparable investment costs, which ultimately means a higher price for hydrogen produced compared to countries with better climatic conditions.

4.3.2.2 *Current limited readiness of gas infrastructure for the transport, distribution, and storage of higher percentages of hydrogen-methane mixtures, current limited compatibility of the system for the transport, distribution, and storage of pure hydrogen.*

4.3.2.3 *Insufficient capacity of sources for the production of low-carbon hydrogen – very limited RES capacity and nuclear power plant limits*

4.3.2.4 *Absence of pilot projects to acquire technological know-how*

An overview of existing and planned pilot projects applicable to mobility is provided by the Hydrogen Map of the Czech Republic. Important activities in the area of pilot projects are taking place in the Ústí, Moravia-Silesia, and Karlovy Vary regions, following the memorandum signed between these regions and the Ministry of the Environment.

4.3.2.5 *Safety*

Compared to other chemical production processes and the use of fossil fuels, the production and use of hydrogen poses a certain increase in risk to users. On the other hand, the use of hydrogen also brings considerable advantages, as the fuel itself is completely non-toxic in its pure form. Although there is extensive experience with the use of hydrogen in gas mixtures (synthesis gas and coal gas), the use of pure hydrogen is a new and, in some respects, completely different technology, which is always viewed very sensitively by the population in terms of potential hazards. It is therefore essential to ensure compliance with all safety rules from the outset, to create new ones where necessary, and to regularly assess whether any problems or accidents are occurring in connection with the use of hydrogen technologies. It is also necessary to keep the public openly informed about all aspects of the development of hydrogen technologies.

4.3.3 Addressing current barriers to the development of the hydrogen economy in the Czech Republic

In order to ensure the smooth development and use of hydrogen technologies, it is necessary to eliminate the above-mentioned barriers to development or limit their impact. Individual topics are addressed in the relevant task cards listed in the annex. These are mainly the following cards:

O1: Create effective support tools to enable the completion of the construction of electrolysers for hydrogen production with an installed capacity of at least 400 MWe by 2030 (as a priority by the end of 2027 due to simpler rules), where necessary to meet binding EU targets or where there is a demonstrable contribution to decarbonization, including relevant renewable energy sources, infrastructure for storage, distribution, and consumption of hydrogen as close as possible to the place of production (creation of hydrogen valleys and clusters). Coordinate the construction of electrolysers with the development of acceleration zones

O3: Launch demand for renewable and low-carbon hydrogen in transport by 2030
and industry in the Czech Republic in a minimum volume of 40,000 t/year (1,320 GWh)

O5: Preparation and creation of a comprehensive legislative framework for the hydrogen economy in the Czech Republic, including certification of hydrogen produced

M3: Repurposing selected parts of the gas transmission system in the Czech Republic for the import of hydrogen
to supply consumers in the Czech Republic from 2030 and to ensure the transit of clean hydrogen through the Czech Republic

4.4 SWOT analysis of the Czech Republic in the field of hydrogen

4.4.1 Strengths

Rapid transition to blends

The existing gas transmission and distribution system in the Czech Republic can be prepared for hydrogen-natural gas blends (blending) in the short term; the main obstacle is currently the lack of legislation. Any additional costs associated with the use of blends as a commodity are expected to be in the single digits of the final price.

Rapid repurposing of the transmission system

Part of the Czech gas transmission system can be adapted relatively quickly, compared to gas transmission systems abroad, for the transmission of pure hydrogen (repurposing). The transmission system in the Czech Republic consists largely of parallel gas pipelines, and the allocation of certain cross-border gas pipelines for hydrogen will not limit the expected demand for natural gas transmission/transit through the Czech Republic.

Location – the Czech Republic at the crossroads of gas routes

The location of the Czech Republic and its existing gas transport infrastructure (future hydrogen infrastructure) allows connection to multiple hydrogen sources and various transport corridors. The Czech Republic can be connected to four potential import routes: eastern (Ukraine), southeastern (the Balkans and Turkey), southern (North Africa), and northern (the Baltic Sea and Scandinavia). In addition, the Czech Republic will be connected to potential ports where relatively cheap hydrogen imported from non-EU countries from other potentially attractive locations (Asia, including the Middle East, South and North America) can be obtained.

Activities of companies and transforming regions to develop "hydrogen valleys"

In recent years, regional platforms of hydrogen ecosystem actors, i.e., hydrogen and hydrogen technology producers, consumers from the public sector, research, and public administration, have begun to emerge, enabling the creation of "hydrogen valleys." Currently, the Ústí and Moravian-Silesian regions are involved in the European association Hydrogen Europe, there is a Hydrogen Platform of the Ústí Region, and the Moravian-Silesian Hydrogen Cluster has been established. Together with the Karlovy Vary Region, these regions are intensively working to develop local islands – hydrogen valleys in their regions, based on an existing hydrogen strategy (Ústí nad Labem Region) or strategies currently being prepared (Moravian-Silesian and Karlovy Vary Regions). All these strategies will contribute to the fulfillment of the Czech Republic's Hydrogen Strategy. The joint initiative to develop hydrogen ecosystems in coal-transforming regions is significant and feasible, as these regions produce and consume most of the hydrogen currently produced in the Czech Republic. The political representation of the regions is taking steps to use hydrogen in public services, especially in transport. The activities of private companies in the Moravian-Silesian and Ústí regions are also significant, where the first public hydrogen filling stations have been opened and low-carbon hydrogen production has started. The creation of regional hydrogen ecosystems is and must continue to be intensively supported through specific financial resources, including the Just Transition Operational Program, specific allocations from the Modernization Fund, and other financial instruments.

Positive public attitude towards nuclear energy

One way to produce low-carbon hydrogen is to use nuclear energy. Electrolytic hydrogen production can efficiently utilize surplus electricity from both renewable sources and nuclear power generation. To ensure hydrogen production using nuclear energy, it is essential to have the appropriate know-how and support for the use of nuclear energy. The Czech Republic is one of the few countries planning to develop nuclear energy, has a high level of nuclear education, the relevant know-how, and a population that accepts the development of nuclear energy.

4.4.2 Weaknesses

Geographical conditions of the Czech Republic for hydrogen production from RES

The low number of hours of sunshine for photovoltaics in the Czech Republic and the subsequent production of renewable hydrogen is a prerequisite for the low utilization of installed solar power plants. This means that 1 MWp of installed solar power plant capacity generates approximately 1,000 MWh of energy, which is less than half that of countries in southern Europe or North Africa. Given that the prices of production equipment (solar panels, electrolysers, compressors, and hydrogen storage tanks) are roughly the same across Europe, the price of renewable hydrogen produced in the Czech Republic will always be twice as high as the price of renewable hydrogen produced in countries with better conditions.

Limited potential for wind power plants compared to the North Sea and Baltic Sea regions. Lack of coastline for the construction of offshore wind farms. Most countries with an energy mix based on renewable energies use wind power plants, which supply energy throughout the day and do not have seasonal fluctuations like solar power plants.

Countries with the best energy mix in terms of renewable energy sources also have high installed capacity for hydroelectric power plants. This allows them to produce renewable electricity even when there is no wind or sunshine. In the Czech Republic, it is highly unlikely that it will be possible to build additional significant hydroelectric power sources.

The high carbon footprint of the Czech Republic's energy mix and the resulting inability to benefit from exemptions under the EC implementing regulation

The Czech Republic has one of the highest electricity emission footprints in the European Union (148 g CO2/MJ[57]). This reduces the competitiveness of domestic renewable hydrogen producers (RFNBO) compared to countries where the electricity emission footprint is/will be lower than 18 g CO2/MJ in the foreseeable future.

If the electricity carbon footprint in a Member State is lower than 18 g CO2/MJ, producers can take advantage of exemptions from very strict rules on renewable hydrogen production (RFNBO). At the same time, a high electricity carbon footprint puts all entities that further process renewable hydrogen (RFNBO) at a disadvantage. Energy-intensive processes such as hydrogen compression increase the carbon footprint of hydrogen. If the carbon footprint of hydrogen exceeds 28.2 gCO2/MJ([58]), this hydrogen can no longer be declared renewable (RFNBO).

This does not mean that RFNBO hydrogen cannot be produced in the Czech Republic. However, conditions must be created for the production of RFNBO hydrogen in the Czech Republic.

The Czech Republic does not have any seaports.

As a landlocked country, the Czech Republic does not have seaports, which are important for certain methods of importing renewable hydrogen. Coastal countries can build transport terminals for importing renewable hydrogen and renewable ammonia. The Czech Republic will not have such terminals and will be dependent on their construction and connection.

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[57] Calculation based on the Delegated Act "Establishing a minimum threshold for greenhouse gas emissions savings of recycled carbon fuels and specifying a methodology for assessing greenhouse gas emissions savings from renewable liquid and gaseous transport fuels of non-biological origin and from recycled carbon fuels" ---based on emission savings of 70% compared to the fossil benchmark (94 g/MJ).

[58] Calculation based on COMMISSION DELEGATED REGULATION (EU) on establishing a minimum threshold for greenhouse gas emissions savings of recycled carbon fuels and specifying a methodology for assessing greenhouse gas emissions savings from renewable liquid and gaseous transport fuels of non-biological origin and from recycled carbon fuels --- based on emission savings of 70% compared to the fossil benchmark (94 g/MJ).

to the gas hydrogen transport system of other countries. This delays the possibility of using some renewable hydrogen sources, as transport from these terminals to the Czech Republic must be ensured. Transport from coastal terminals also increases the price of renewable hydrogen at the point of use.

Lack of suitable geological structures for hydrogen and $_{CO2}$storage

The Czech Republic does not have suitable salt caverns for the long-term storage of large quantities of hydrogen. Research is underway to determine whether existing natural gas storage facilities can be used effectively for hydrogen storage. Similar to hydrogen, the Czech Republic currently does not have suitable sites with sufficient capacity for the long-term storage of large amounts of CO2 for significant decarbonization of hydrogen production and thus ensuring the relevant amount of low-carbon hydrogen.

Lengthy construction procedures

The building permit process for the construction of renewable energy sources, electrolysers, and hydrogen storage facilities is very time-consuming. A new building law will come into effect to facilitate the granting of building permits, and simplifications are also being prepared within the framework of so-called acceleration zones.

4.4.3 Opportunities

Connection of the Czech Republic to major European hydrogen import corridors

Thanks to its geographical location and robust gas infrastructure, the Czech Republic has the opportunity to quickly and efficiently convert its transmission system to connect to several major European import corridors, which will make it possible to supply the Czech Republic and secure and diversify the supply of affordable renewable hydrogen. In addition to the creation of the transport corridor itself, import projects also depend on the need to build renewable energy sources and hydrogen production facilities in the regions along the transport corridor. The construction of production capacities in regions with high production potential (North Africa, the Balkans, Ukraine, the Baltic Sea, etc.) may be an opportunity for Czech industry and Czech investors.

Connection to hydrogen corridors will also enable the transit of renewable hydrogen through the Czech Republic to other European countries. The possibility of a quick and cost-effective conversion of the transport system by 2030 creates favorable conditions for the integration of the Czech gas infrastructure into the transport of gas to other EU countries where high demand for renewable hydrogen is expected, especially Germany. The transport of renewable hydrogen could thus be another source of income and tax revenue for the Czech Republic.

Development and production of hydrogen technologies

A number of Czech companies are very active in the field of hydrogen technologies. In order for this segment to develop further, it is necessary to put these technologies into practice as soon as possible and build up development, production, and operational know-how that can be used for further development. Hydrogen technologies will be a very strong stimulus for the transformation of Czech industry towards new innovative green technologies.

4.4.4 Threats

Loss of competitiveness due to delayed or poorly chosen transformation

Although Czech industry has made great strides in recent years and achieved significant improvements in energy efficiency, it is still heavily dependent on fossil fuels and energy-intensive. Decarbonization and the use of hydrogen technologies represent a major challenge. If the whole process is done well, it can create a competitive advantage and further strengthen the Czech Republic's position as a highly industrial and export-oriented country. However, if the required developments do not take place and the transformation process is poorly managed, this could pose an immediate threat to some sectors.

Competitive transport routes for renewable hydrogen

Although projects to transport hydrogen from western Ukraine via modified gas transport infrastructure offer a number of competitive advantages, there are other options for transporting hydrogen to Germany. If transport via the Czech Republic is not prepared quickly enough, there is a significant risk that the majority of transport will take place via other countries and the Czech Republic will not benefit from the advantages of its hydrogen transit infrastructure.

Unattractive or unstable legislative and regulatory environment

The current absence of a legislative and regulatory environment for hydrogen creates a degree of uncertainty for industry as to whether future rules will sufficiently stimulate investment in hydrogen production, transport/distribution, and consumption. Otherwise, this would lead to a suspension of the development of the hydrogen economy, with all the negative impacts on the overall decarbonization of the Czech economy and jeopardizing the achievement of decarbonization targets in 2050.

Insufficient coordination between hydrogen ecosystem actors and partners at the national and regional levels This may lead to the uncontrolled development of hydrogen technologies in the Czech Republic, failure to meet the Czech Republic's commitments to the EU, and increased costs for partial solutions, as technically optimal and cost-effective holistic solutions have not been supported through cooperation between all actors.

5 IMPLEMENTATION

The implementation section is divided according to specific objectives in individual stages. The first character of each task card refers to the name of the stage (O refers to the Local Islands stage, M refers to the Global Bridges stage; the New Technologies stage is not broken down into task cards because it relates to the period around 2045 and will depend on the results of the implementation of the Hydrogen Strategy in the first two stages).

The individual tasks are detailed in the Task Cards, see **Appendix 1**.

The following areas are elaborated in more detail for each specific objective:

Time frame

When the specific objective begins and ends. In many cases, it will not be possible to specify an exact date. In such cases, conditions will be determined, such as the availability of the relevant technology, under which work on the objective can be started or completed.

Technology

What technologies are necessary to achieve the given goal?

Legislation

What changes need to be made to legislation, or what regulations, directives, methodologies, or instructions need to be issued so that the goal can be achieved or its achievement can be made as effective as possible?

Organizational arrangements

What needs to be done to achieve the given objective in terms of organization, how the environment needs to be set up so that the relevant organizations can achieve the relevant objective.

Costs and support

What is the estimated cost of the target and what financial instruments can be used to support its achievement?

5.1 O1: Create effective support tools to enable the completion of the construction of hydrogen electrolysers with an installed capacity of at least 400 MWe by 2030 (as a priority by the end of 2027 due to simpler rules), where necessary to meet binding EU targets or where there is a demonstrable contribution to decarbonization, including relevant renewable energy sources, infrastructure for storage, distribution, and consumption of hydrogen as close as possible to the place of production (creation of hydrogen valleys and clusters). Coordinate the construction of electrolysers with the development of acceleration zones([59])

Time frame

By the end of 2030. This timeframe is determined by the requirements for securing sufficient quantities of renewable hydrogen to meet the requirements of the RED Directive. At the same time, imports will also need to be secured.

[59] https://www.mzp.cz/cz/news_20240424_Rozvoj-obnovitelnych-zdroju-energie-urychli-akceleracni-zony

of renewable hydrogen via pipelines, which should be cheaper. At present, it is not possible to guarantee that imported renewable hydrogen will be available in the quantities needed in 2030.

It is necessary to maximize the construction of renewable energy sources and electrolysers before the end of 2027 in order to take advantage of the exemptions set out in the Delegated Act establishing a Union methodology for detailed rules on the production of renewable fuels of non-biological origin, which is part of the Renewable Energy Directive. Specifically, the exemption from the additionality and time correlation rules, which is valid until 2038, but only for projects launched before 2027. It is therefore necessary to complete most of the electrolyzer construction projects in the Czech Republic by the end of 2027.

Technology

In order to ensure the rapid deployment of renewable energy sources, electrolysers and related technologies, only existing and proven technologies will be used. With increasing production of electrolysers and other hydrogen technologies, their prices are expected to fall gradually. On the other hand, high demand for these technologies may limit supply and possibly lead to price increases for a limited period.

Legislation

It is expected that the main efforts will be focused on simplifying the permitting process for the construction of renewable energy sources and the construction of electrolysers and storage infrastructure, in full accordance with the objectives of REPowerEU and the Climate-Neutral Industry Act.

Organizational arrangements

Efforts will be made to launch the production of electrolysers, expand the portfolio of existing production capacities for hydrogen storage and distribution components in the Czech Republic, and create an environment for importing and securing local capacities for servicing and maintaining imported hydrogen technologies.

Costs and support

The need to secure approximately 20,000 tons of renewable hydrogen per year in 2030 will require an installed electrolyzer capacity of at least 400 MWe in the Czech Republic, assuming 30% utilization. This must be a combination of wind and solar power plants, or possibly hydroelectric power plants, as solar power plants alone are not capable of ensuring sufficient utilization of electrolysers.

In order to ensure a production price of around €8/kg, it will be necessary to provide investment or operating support.
support. It is expected that this investment support will mainly come from the Modernization Fund.

After 2030, significantly cheaper renewable hydrogen should be available on the Czech market from imports via the European hydrogen pipeline network. It can be assumed that by that time it will no longer be economically viable to build new electrolysers in the Czech Republic that will only use solar radiation and wind, due to the limited capacity of renewable sources a n d the restrictive conditions resulting f r o m the delegated act o n additionality.

5.2 O2: Prepare the gas system for blending hydrogen into natural gas (blending)

The aim of this measure is to prepare the gas system (transport and distribution) for the blending of hydrogen with natural gas (the analysis of the efficiency of end-use equipment for hydrogen in households is the subject of measure O4).

Today's gas transmission system can handle up to a 5% mixture of hydrogen and natural gas after replacing selected measuring devices. Based on recent analyses and studies, the gas distribution system can be prepared for operation with a mixture of natural gas and hydrogen up to a 20% hydrogen volume share without the need for significant maintenance.

The possibility of preparing and operating the existing system with a hydrogen blend without extensive maintenance is based on internal analyses by the operators concerned, pilot projects, and long-term tests that have already been successfully implemented and verified on hundreds of gas installations in various EU countries.

Time frame

The time frame for preparing the gas transmission system will be based on the final version of the European gas legislation currently being prepared (Hydrogen and Decarbonised Gas Market Package). Gas transmission system operators must be able to accept up to 2% hydrogen blend in natural gas at border transfer points, subject to further procedural steps.

The distribution system in the Czech Republic is already compatible with a 20% blend, but the readiness of gas consumption equipment (OPZ) must be harmonized in accordance with specific target O4 (deadline and blend level) with the planned blend in the transmission system. In some areas, the distribution system will switch to a blend earlier or to a higher blend level than the transmission system, depending on the connection of local hydrogen production to the distribution system.

Technology

In the case of the transmission system, this primarily involves replacing currently incompatible metering equipment at border and domestic transfer stations. In the distribution area, it involves developing blending equipment technology or taking over the blend from the transmission system and the ability to maintain a stable blend in the network. The main emphasis will then be on technologies for OPZ control in line with the specific objective O4.

Legislation

First and foremost, it is necessary to update the relevant legislation and technical standards so that there is a properly established technical, legal, and commercial framework for the transport and distribution of hydrogen blends in natural gas. It will also be important to ensure that hydrogen consumption is reported in line with the Czech Republic's targets under European legislation, such as reducing the carbon footprint and increasing the share of renewable fuels. These tasks need to be accomplished through a functional framework for the certification of renewable and low-carbon hydrogen.

Organizational arrangements

The implementation of measures should be the responsibility of the operators of the existing gas system (transporters and distributors). The relevant ministries and other public authorities will also be involved in the implementation, in particular through the preparation or amendment of the legislative framework and technical standards. The ERÚ will also play an important role in establishing the regulatory framework for the transmission and distribution of blends in natural gas in the Czech Republic, including monitoring and reporting on the use of hydrogen in blends.

Costs and support

The costs of blending will mainly depend on the percentage of hydrogen added to natural gas. While blending at a level of 2-3% will only require relatively low additional costs, 20% blending will require significantly higher costs related to the inspection and replacement of some end-use gas equipment. Before switching to a blend with a higher hydrogen content, a study must be carried out to demonstrate the economic benefits of such a switch.

5.3 O3: By 2030, kick-start demand for renewable and low-carbon hydrogen in transport and industry in the Czech Republic at a minimum volume of 40,000 tons/year (1,320 GWh).

Time frame

The baseline demand values are considered for 2030, in line with the mandatory targets of European regulation (RED Directive). The main task of this specific objective is to create a technological framework for the further development of the hydrogen economy beyond 2030, when foreign imports are expected to make renewable hydrogen significantly cheaper and competitive with fossil fuels in many applications. It is therefore important to focus on measures that will have an impact in the longer term, beyond 2030, and that can have a positive effect on demand in industry, transport, and other sectors.

Impacts on demand

The minimum demand for RFNBO hydrogen in industry and transport is defined by the mandatory requirements of European regulations (RED Directive). These requirements and targets are set for transport, infrastructure development, and industry for 2030 (see Chapter 4.1). Therefore, a sufficient amount of RFNBO hydrogen must be secured each year to meet the demand specified by European regulations.

The estimate for meeting the targets of the European RED Directive for the Czech Republic is approximately 20,000 tons of hydrogen (21,600 tons to be precise). This does not rule out the possibility that demand for low-carbon and RFNBO hydrogen will be higher in 2030. The overall ambition is estimated at 40,000 tons of low-carbon and RFNBO hydrogen. This demand will be determined by current consumption in industry and transport, as well as the current price of hydrogen and, therefore, its competitiveness compared to other fossil fuels and the need to meet decarbonization targets. Details on the consumption estimate are provided in the analytical section. 20,000 tons of RFNBO hydrogen per year is the minimum that industry and transport need to meet European targets.

Infrastructure for hydrogen road and rail mobility and hydrogen vehicle fleet

Another factor influencing demand is the degree of readiness of infrastructure for road and rail mobility. The minimum requirements for the final form of the backbone network of hydrogen refueling stations on roads are defined for 2030 by the AFIR regulation. However, the development of infrastructure for hydrogen road and rail mobility must go hand in hand with the development of a hydrogen vehicle fleet, given that the operating costs of hydrogen refueling stations are high and the private sector will not be willing to subsidize their operation in the long term. For this reason, it is necessary to continuously support the development of a fleet of vehicles powered by hydrogen fuel cells and to ensure the competitiveness of this drive system compared to other low-emission drive systems. Road and rail transporters for compressed and liquefied hydrogen and hydrogen stations for refueling transporters are also an integral part of the chain.

Conditions for domestic production and import of hydrogen

The launch of demand beyond the minimum quantity specified by European legislation will depend on the economic viability of hydrogen. This means the price of domestically produced and imported hydrogen and the price of fossil fuels and allowances.

In order to develop production, subsidy titles need to be set so that as much of the production capacity as possible
capacity is brought into operation by December 31, 2027. When the electrolyzer is put into operation by December 31, 2027, a time-limited exemption from additionality will apply, and it will therefore be possible to achieve higher electrolyzer utilization at lower variable costs.

December 31, 2027, a time-limited exemption from additionality will apply, making it possible to achieve higher electrolyzer utilization at lower variable costs. Electrolyzers put into operation before January 1, 2028, will therefore be able to produce RFNBO hydrogen a t lower costs a n d offer a lower price to the end user. This is a key factor in creating demand (see Task Card O1).

In terms of imports, it is necessary to prepare all conditions so that cheap renewable hydrogen can be imported once the infrastructure in neighboring countries is ready.

Insufficient capacity of the electricity grid may also be a bottleneck in meeting industrial demand through domestic production. For this reason, further measures should be taken specifically in the area of connecting new sources to the grid (simplification of permitting processes, acceleration of connection, building regulations, introduction of acceleration zones, etc.).

Technology

Demand for hydrogen is influenced by all technologies across the value chain that affect the final price of hydrogen. Renewable energy sources (price reduction and efficiency improvement), reduction in the price of electrolysers (economies of scale), increasing their efficiency and extending their service life, reducing the price of transporters (use of new materials), reducing the price of filling stations (economies of scale), etc. This will have a positive effect by reducing the unit price of renewable hydrogen for the end consumer, and thus increasing demand for this zero-emission fuel.

Hydrogen-powered vehicles are a separate issue. While mass-produced hydrogen-powered passenger cars and city buses are already available on the market, trucks and intercity buses are only available as prototypes. It is precisely freight and mass passenger transport that has the greatest potential to offer an alternative to fossil fuel-powered vehicles.

Investment support in the above-mentioned areas will help to significantly accelerate the development of the entire hydrogen economy in the Czech Republic.

Organizational arrangements

Achieving these ambitious goals will require extensive investment and intensive cooperation between the state and the private sector, as well as individual regions and their regional actors. In the industrial sector, this will mainly involve the Ministry of Industry and Trade, the Ministry of the Environment, and the State Environmental Fund. In the transport sector, it will mainly involve the Ministry of Transport, the State Fund for Transport Infrastructure, and the Railway Administration.

Costs and support until 2030

Creating and meeting the demand for renewable hydrogen will entail costs amounting to tens of billions of CZK, which are related to the construction of electrolysers, the development of transport and distribution systems, support for RES needed for hydrogen production, the purchase of vehicles, etc. It is therefore necessary to focus on creating subsidy programs and clearly defining the conditions for supporting domestic production, building import capacities, and rebuilding and, if necessary, constructing infrastructure. The construction of electrolysers should be supported by a subsidy under the Modernization Fund (after its revision, with new rules expected to be published in spring 2024). Further support is planned from the OP ST in the Ústí, Moravia-Silesia and Karlovy Vary regions, following the memorandum signed between these three regions and the Ministry of the Environment.

Economic conditions will accelerate or slow down the development of demand. Appropriate and implementable investment incentives and instruments need to be put in place to attract private sector investment on both the supply (H2 production) and demand sides. The risk of missing out on timely

investment due to uncertainty about returns, investor reluctance to invest in risky areas, or insufficient support for hydrogen use by end customers.

Specifically in the transport sector, it is not possible to quickly ensure a sufficient number of hydrogen refueling stations without a sufficient number of hydrogen-powered vehicles, and a sufficient number of hydrogen-powered vehicles without a sufficient number of hydrogen refueling stations. To start achieving the targets, it is necessary to support both sides of the hydrogen transport economy (demand for hydrogen for vehicles through support for vehicle purchase and supply of hydrogen through support for the construction of hydrogen stations).

5.4 O4: Analyze the potential for converting gas boilers in households to a blend of natural gas and later to pure hydrogen, and assess the possibilities for financing the transition.

If a technical and economic study following on from the gas distribution system transformation plan shows that it is appropriate to support the retention of gas boilers in households that will burn a blend or pure hydrogen, options will be analyzed to support this transformation and thus enable the efficient use of the existing gas infrastructure. The analysis will need to compare the use of biomethane and conversion to heat pumps and electric heating or connection to heat supply systems, in addition to the use of blends and pure hydrogen.

Time frame

The time frame for the transition of domestic gas boilers to blends or pure hydrogen will be determined by the gas distribution system transformation plan.

Technology

H2 Ready appliances for burning hydrogen blends in natural gas/methane and pure hydrogen.

Legislation

It will be important to ensure the reporting of renewable hydrogen consumption in line with the Czech Republic's targets under European legislation, such as reducing the carbon footprint and increasing the share of renewable fuels.

Organizational

Successful completion of this task will require close cooperation between ČPS, MPO, gas distributors and other stakeholders.

Costs and support

Following the gas distribution network transformation plan, scenarios for the use of blends and, in the future, pure hydrogen for combustion in domestic boilers will be assessed. Based on a technical and economic study, a decision will be made on the possibilities of supporting the transition of existing gas boilers to H2 Ready 20% and H2 Ready 100% boilers.

5.5 O5: Preparation and creation of legislative framework for the hydrogen economy in the Czech Republic, including certification of hydrogen produced

Predictable and stable legislation is particularly important for the private sector. In order to kick-start demand for renewable and low-carbon hydrogen in transport and industry at the required volume by 2030, it is absolutely essential to consider and establish, well in advance, a legislative and regulatory framework for the production, import, transport, and consumption of hydrogen that will facilitate the penetration of hydrogen into the market while also

enable coexistence with the use of natural gas. For this reason, it is desirable to implement the RED and ReFuelEU Aviation directives into Czech legislation as soon as possible. There is a risk that the slow pace of legislative amendments, the setting of regulatory conditions and investment incentives (relating to the Hydrogen Strategy, the setting of subsidy titles, amendments to the Energy Act, related decrees, and others) combined with the risk of slow progress in ensuring readiness for production, import of hydrogen from abroad, transport, and use of hydrogen will slow down the development of the hydrogen economy in the Czech Republic. Great attention must also be paid to the creation of technical legislation and technical standards in various parts of the hydrogen economy.

At the same time, the NAP CM is also being updated, which, in line with the Hydrogen Strategy, sets clear objectives in the area of support for hydrogen mobility infrastructure and hydrogen vehicle fleets.

This task is therefore one of the priorities that must be started very soon and that cuts across all other tasks and stages. It will require significant changes to a whole range of laws, regulations, directives, and standards. The successful deployment and operation of hydrogen technologies and the effectiveness of the Czech path to overall decarbonization will depend on the correct and rapid completion of this task.

Time frame

Throughout the implementation of the Hydrogen Strategy. A whole series of changes must be started immediately, some of which will depend on the gradual approval of regulations at the EC level.

Technology

This task card does not relate to any specific technology.

Legislation

Individual legislative acts are described in the relevant sub-tasks.

Organizational arrangements

This is a very complex task requiring cooperation between a large number of organizations. The main ones are the Government Office, the Ministry of Industry and Trade, the Ministry of the Environment, the Ministry of Transport, the Ministry of Regional Development, the Office for the Use of Non-Conventional Energy Sources, the Energy Regulatory Office, the Czech Statistical Office, the Czech Hydrometeorological Institute, the Czech Institute of Mining and Metallurgy, the Czech Institute of Geodesy, Cartography and Photogrammetry, the Czech Institute of Building Research, the Czech Institute of Construction, the Czech Institute of Construction Materials, the Czech Institute of Construction Technology, the Czech Institute of Construction Research and Development, the Czech Institute of Construction Technology, the Czech Institute of Construction Research and Development, the Czech Institute of Construction Technology, the Czech Institute of Construction Research and

Costs and support

The costs will be covered by the legislative costs of the relevant institutions.

5.6 Support the development, research, and production of hydrogen technologies for the production, distribution, and use of hydrogen

Research and development of hydrogen technologies in the Czech Republic aims to contribute to the overall improvement of the fundamental properties of hydrogen technologies (efficiency, durability, price reduction) so that these technologies are fully commercialized by the end of 2030. At the same time, it is necessary to conduct gradual research into a number of aspects of the hydrogen economy (the economics of hydrogen production, storage, transport, and distribution) so that the Czech Republic is prepared for the smooth large-scale rollout of hydrogen by the end of 2029, particularly in view of the next decade, when the transport of renewable hydrogen via pipelines from abroad is expected.

The relevant R&D&I support providers will, within their budgets and based on existing rules, for the allocation of funds, support research and innovation in the field of hydrogen technologies.

The results of hydrogen technology development must be followed by production, which is an important stimulus for the transformation of Czech industry.

No specific task card has been created for this area, as it is a cross-cutting activity and a number of specific research and development activities are already included in other task cards.

Time frame

Throughout the implementation of the Hydrogen Strategy.

Technologies

Electrolysers, fuel cells, storage facilities, filling stations, gas pipelines, cogeneration units, hydrogen appliances, other links in the hydrogen value chain, means of transport using hydrogen fuel cells.

Legislation

Expansion of the list of priority hydrogen technologies within RIS3, inclusion of specific proposals for research into key hydrogen technologies in calls for proposals by the Technology Agency of the Czech Republic, creation of a separate program for applied research and development of hydrogen technologies with the aim of successfully commercializing these technologies.

Investment incentives for the production of hydrogen technologies.

Organizational arrangements

To accomplish this task, it is necessary to ensure coordination between research and testing of new technologies and their rapid and effective introduction into production. Intensive cooperation is expected mainly between: the Ministry of Education, Youth and Sports, the Ministry of Industry and Trade, the Ministry of Transport, HYTEP, TAČR, and the H3 team.

Costs and support

The estimated total funding for R&D&I support until 2030 for all the ministries mentioned is around CZK 1 billion.

5.7 M1: Create conditions for the internationalization of Czech companies, export of technologies and efficient production of renewable hydrogen in foreign regions

Czech companies develop and manufacture a wide range of technologies for the production, storage, and use of hydrogen. The aim is to open up foreign markets to technology suppliers. It is desirable that Czech companies and organizations are not just subcontractors, but also occupy positions at higher levels of global value chains. In foreign territories, Czech companies should act not only as exporters, but also as investors who will build hydrogen infrastructure and technological units abroad independently or in cooperation with other partners/investors.

Given that it will not be possible to produce sufficient quantities of renewable or low-carbon hydrogen directly in the Czech Republic, some renewable hydrogen will have to be imported from abroad. It is therefore essential to create conditions for Czech companies to produce renewable/low-carbon hydrogen in countries where conditions are more suitable for its production. The aim is for Czech companies, as in the case of the construction of solar and wind power plants, to participate in the construction or directly invest in hydrogen infrastructure abroad.

From this perspective, Ukraine, Romania, Bulgaria, Turkey, Germany, Scandinavia, and North Africa are promising countries from which the Czech Republic could import renewable hydrogen via converted gas pipelines. Other promising countries for the construction of RES include **Canada,** Chile and Uruguay **in Latin America**, and countries in Asia, including the Middle East, from which renewable ammonia or liquefied hydrogen could be imported. Other European or non-European countries that have sufficient renewable resources and water and have solved the economic issue of transport could also be considered.

of renewable hydrogen produced in the Czech Republic. Support for hydrogen technologies will then be taken into account in territorial plans, primarily in countries with identified opportunities. It is also important to include support for hydrogen technologies in the agenda of bilateral negotiations with representatives of the relevant countries.

The Czech Republic will support Czech manufacturers and investors in the field of hydrogen technologies in accordance with the Czech Export Strategy 2023-2033, through its tools and services. These include the organization of foreign business missions and incoming missions, **relevant negotiations between intergovernmental and interdepartmental joint bodies for economic cooperation,** the organization of official Czech participation in exhibitions and trade fairs abroad, information, assistance and individual services provided by CzechTrade and CzechInvest agencies, as well as Czech diplomatic missions and other institutions involved in the pro-export ecosystem. Export financing and insurance, including products for Czech investments abroad, must also be an important part of the services provided. Active participation in and organization of international events focused on cooperation in the field of hydrogen technologies is also important. Similarly, opportunities for negotiations with key international players in the sector will be supported in case of their interest in operating in the Czech Republic, for example as investors or partners of Czech companies in the case of sourcing.

Time frame:

Pro-export support will be provided on a continuous basis for technologies ready for commercial export.

The production of renewable hydrogen abroad is mainly planned for the "Global Bridges" phase. In order for Czech companies to start producing renewable hydrogen abroad around 2030, it is necessary to start preparing projects as soon as possible. The preparation of an investment project takes an average of five years.

Technology

Investment plans will cover all technologies for the production of renewable hydrogen and the construction of relevant renewable energy sources, or technologies for transporting hydrogen or renewable ammonia and other hydrogen compounds to the Czech Republic.

Legislation

This task will not require any changes to Czech legislation. Rather, it will require the acquisition of knowledge and detailed information on the relevant legislation and permitting processes in the target country.

Organizational arrangements

Individual instruments for supporting the export and internationalization of companies in the field of hydrogen technologies will be coordinated and provided by the managers defined in the Czech Export Strategy 2023-2033. The above-mentioned instruments will be used in particular, with the Ministry of Industry and Trade, the Ministry of Foreign Affairs, Czech diplomatic missions, the CzechTrade and CzechInvest agencies, the Czech Export Bank, and EGAP (Export Guarantee and Insurance Corporation) among the managers.

Costs and support

Financial support is part of the existing budgets of institutions that provide export support or belong part of the export ecosystem.

5.8 M2: Ensuring sufficient, predictable, and price-stable supplies of renewable and low-carbon hydrogen depending on demand in the Czech Republic, which is currently estimated at 1,000,000 tons (33 TWh) for 2040

The estimate of low-carbon and renewable hydrogen consumption is based on the table in Annex 2 and represents the higher ambition between the minimum (376,000 tons/year) and optimistic (1,314,000 tons/year) estimates.

The Czech Republic will have to import large quantities of renewable hydrogen from abroad, as it will not be possible to produce it locally at an acceptable price. To this end, stable and predictable supplies of hydrogen from EU member states or third countries must be secured. The necessary infrastructure for hydrogen imports must first be built (see Task Card M3).

It will be necessary to create conditions for commodity trading in renewable and low-carbon hydrogen
and to entrust traders with negotiating the conditions for hydrogen imports into the Czech Republic.

It will be necessary to ensure active communication at the interministerial and, where necessary, intergovernmental level with Germany in order to create a future liquid hydrogen market in Germany (for the purchase of short-term hydrogen commodity products for the Czech Republic).

Time frame

Preparatory work must begin as soon as possible. The main conversion of the gas pipeline will take place before 2030. The project will gradually expand and the construction of new production capacities abroad will continue after 2040, depending on the production price of renewable hydrogen.

Technology

To ensure sufficient production of renewable hydrogen, wind, solar, and hydroelectric power plants, electrolysers, storage tanks, and equipment for injecting hydrogen into the transmission system will be necessary.

Legislation

It is necessary to have a functioning single market for hydrogen within the EU and to transpose relevant European legislation enabling cross-border trade and transport of renewable hydrogen at national level.

Organizational arrangements

In order to successfully complete this task, it will be necessary not only to ensure the cost-effective conversion of the main hydrogen corridors in the Czech Republic, but also to connect the Czech hydrogen transport system to the systems in Germany and Slovakia and to create conditions for the import of renewable hydrogen from abroad. This will be a task mainly for the Ministry of Industry and Trade, the Ministry of Foreign Affairs and the Government Office.

Costs and support

The costs are expected to be covered by the budgets of the individual ministries.

5.9 M3: Repurposing selected parts of the gas transmission system in the Czech Republic for the import of hydrogen to supply consumers in the Czech Republic from 2030 and to ensure the transit of clean hydrogen through the Czech Republic.

The import of affordable low-carbon hydrogen is key to successfully meeting the expected demand for hydrogen in the Czech Republic and the associated development of the hydrogen economy. By 2030, it is therefore necessary to establish connections to the planned relevant European import corridors. This means converting two existing natural gas transmission pipelines to transport pure hydrogen. Specifically, this involves one line

connecting the border points of Lanžhot and Brandov (providing a connection to hydrogen supply corridors from North Africa, Ukraine, and the Balkan Peninsula) and one line connecting the border points of Brandov and Waidhaus (providing a connection to the hydrogen supply corridor from the Baltic Sea and Scandinavia). These two lines will be an important part of the planned pan-European hydrogen transport network. Depending on the development of demand (probably in the period 2030-2035), further pipelines or parts thereof on the northern branch of the gas pipeline between the border points of Lanžhot and Brandov will be repurposed.

The year 2030 is the most suitable date for repurposing the gas system, when the conversion to hydrogen can be carried out in a cost-optimized manner. This date also follows from the plans for the transformation of the connecting gas pipelines that are part of the European Hydrogen Backbone. Theoretically, it would be possible to carry out repurposing in the Czech Republic earlier, but this would probably entail higher costs and it would be necessary to coordinate the change of date with other partners on both the input and output sides of the gas pipeline to ensure the smooth import and export of renewable hydrogen.

Time frame

The southern and western lines of the backbone network will be operational at the beginning of 2030. An important milestone is the completion of a detailed feasibility study, which should be ready by 2026 at the latest. The repurposing of the northern branch will depend on the development of demand in the regions concerned.

Technology

This refers to all technologies related to high-volume pipeline transport of hydrogen.

Legislation

The preparation of technical standards for the installation and operation of hydrogen pipeline transport technologies will be very important. At the same time, it is necessary to create the necessary general legislation supporting hydrogen transport in the Czech Republic. Another important point will be the creation of a sufficiently robust framework for hydrogen trading.

Organizational arrangements

Repurposing should be carried out under the auspices of the operator of the existing gas transmission system. In addition, support at the level of the Czech government and relevant ministries will be important in negotiations on the role of Czech hydrogen transport corridors in the future pan-European hydrogen transport network. The role of the ERÚ in setting the regulatory framework for hydrogen transport in the Czech Republic is also important.

Costs and support

The expected investment costs associated with the repurposing of these lines are CZK 5 billion[60]. Given the size and significance of the investment, it is in the Czech Republic's interest to do everything possible to secure financial support from both European (e.g., CEF) and national funds (e.g., the Modernization Fund).

[60] Costs estimated based on initial analysis and price comparison according to European Hydrogen Backbone. Initial results of a detailed feasibility study show that the necessary investment may be up to 50% lower.

5.10 M4: Economically efficient repurposing of gas distribution systems and their connection to the hydrogen gas transmission system by 2028 and beyond

With the development of hydrogen use by end consumers, it is necessary to prepare the transformation of gas distribution systems to pure hydrogen in connection with blending (see Task Card O4). This will affect the technical and economic aspects of the distribution system, as well as end-use gas equipment and consumption. This transition must be planned very carefully in terms of timing, regulation, and legislation. The rights and obligations of the individual entities involved must be defined. An exact timetable or scope cannot be determined at this time. It will likely be specified gradually.

The conversion of gas distribution networks to hydrogen will take place in specific logical units (clusters), as it is not technically possible to ensure the complete transition of the entire network within a short period of time. The transition to pure hydrogen will have to be phased in several stages depending on the readiness of the distribution network, OPZ, customer appliances, and the location of the consumption point in relation to the hydrogen source. It is expected that some customers will switch from natural gas (or a blend of natural gas and hydrogen) to other energy sources in the meantime, particularly in the low-volume heating and household segment, to heat pumps.

For the transformation of the gas distribution system to pure hydrogen, it is important that, in addition to H2 Ready appliances, prototypes of gas appliances for pure hydrogen are already in the production program of many renowned manufacturers. Currently, natural gas fuel cells are already being used in households around the world for the production of heat and electricity. The use of hydrogen in fuel cells will enable them to be significantly cheaper and eliminate the need for technologies that prevent fuel cell degradation when using natural gas (such as the need to remove sulfur).

Time frame

The transition to pure hydrogen can begin during the "Local Islands" stage and will expand more massively with the availability of cheap renewable hydrogen in the "Global Bridges" phase, with the transition completed between 2040 and 2050. Preparations for the transition have already begun, and it is necessary to develop technical details in hand in hand with technical knowledge, for example in the field of end-use equipment (see Task Card O4).

Technology

This concerns all technologies related to both hydrogen distribution and use.

Legislation

The preparation of technical standards will be very important, and legislation supporting the smooth transition must also be developed, such as the principle of installing new equipment in accordance with the H2 Ready standard. An important point will be the creation of a sufficiently robust framework for trading hydrogen.

Organizational arrangements

Defining all technical, regulatory, and legal aspects related to the transformation of distribution systems to hydrogen, including capacity increases or reductions.

Costs and support

Gas distribution companies are already largely capable of distributing hydrogen in a 20% blend with natural gas. At the same time, they are able to prepare most of their networks for pure hydrogen by 2035. The necessary investments would mean an increase in standard investments of approximately 10%, which is very little in the context of total investments in the gas industry and in comparison with investments

in the electricity sector, this is very little. From the perspective of system costs, i.e., the final costs for the state, companies and households, this is a very attractive opportunity in terms of costs.

5.11 M5: Create conditions for the construction or purchase of storage capacity for seasonal hydrogen storage

The storage of large quantities of hydrogen must be ensured both in terms of the commercial availability of the required amount of hydrogen in the Czech Republic at the right time and in terms of the security of its supply. Experience with natural gas and certain events (the interruption of gas flows through Ukraine in 2008 and the current war) show that storing raw materials in the area of consumption, i.e. in the Czech Republic, can be crucial for energy security. With the development of hydrogen use, its quantity and the associated need for storage will also increase. It is therefore necessary to examine possible current and future forms of large-scale hydrogen storage.

The task card also includes an assessment of the possibility of storing large amounts of energy in chemical liquid hydrogen compounds or in the form of liquid hydrogen.

Time frame

Preparatory work should begin as soon as possible. Some current operators of underground natural gas storage facilities have already started this work, although they are mainly focused on storing natural gas blends and hydrogen. Research projects on the possibility of seasonal hydrogen storage in existing or new geological structures are time-consuming (taking several years).

Technology

As part of seasonal storage in geological structures, it is necessary to verify the compatibility of the current above-ground technology of underground gas storage facilities, or to build new technology and verify the suitability of the geological structure itself.

If it is necessary to replace technological components (pipes, valves, compressors, etc.) for hydrogen applications, these have already been developed and are currently used, for example, in the chemical industry. At the same time, a large number of projects are underway to verify the material properties and suitability of currently used technologies, or other technologies, e.g., for gas purification and separation of hydrogen from its impurities during underground storage. The geological structure itself is a key element, which is complicated in the Czech Republic by the absence of salt caverns, which are expected to be used for hydrogen storage abroad. At the same time, there are projects to verify the possibility of storage in porous types of reservoirs, which also offers hope for underground reservoirs in the Czech Republic. Verifying the suitability of the geological structure will be the most demanding part of this task.

Technology for the long-term storage of liquid hydrogen compounds and liquefied hydrogen.

Legislation

In order to test the possibility of using a blend of natural gas and hydrogen effectively and on a larger scale, it is necessary to amend the current legislation. The operation of underground gas storage facilities is also subject to legislation under the authority of the State Mining Administration. Its suitability and applicability to the storage of hydrogen blends/pure hydrogen must be analyzed and, if necessary, updated.

Organizational arrangements

In order to verify the possibility of storing blends/pure hydrogen in natural rock structures, cooperation is needed between underground storage operators, the State Mining Authority, the Ministry of Industry and Trade, and other relevant partners.

Industry and Trade, and other relevant partners. Without a large-scale source of hydrogen,
verify its suitability due to the large volumes of gas stored in the reservoirs.

Costs and support

At present, it is not possible to define the costs precisely. These include the costs of verifying the suitability of current technologies, the costs of any modifications to the technologies, and the definition of a suitable economic model. By its very nature, hydrogen storage will be more expensive in terms of operating costs and the lower amount of energy stored compared to natural gas.

Due to the relatively high costs involved, financial and organizational support from the government is crucial to verify the suitability of storage.

6 FINANCIAL INSTRUMENTS TO SUPPORT THE DEVELOPMENT OF HYDROGEN TECHNOLOGIES

Below is an overview of currently approved support programs. Further programs are in preparation. Several calls for proposals to support hydrogen technologies have already been issued. The schedule for some calls is provided in the task cards; for most calls, it will be published as the scope and focus of the specific call are gradually clarified. Approved call schedules are always published on the websites of the relevant programs.

6.1 Modernization Fund[61]

One of the main programs for supporting the development of hydrogen technologies is the Modernization Fund, which uses funds obtained from emission allowances. The general program document was revised in 2023. The main programs within the Modernization Fund are:

6.1.1 RES+

The program focuses on new renewable energy sources. Its total allocation is CZK 100,037 million.

It is intended for holders of licenses to conduct business in the energy sector (electricity production), energy communities, regions, municipalities and their self-governing units, and natural persons. In the field of hydrogen technologies, it concerns the construction of photovoltaic power plants, including energy storage systems such as electrolysers and hydrogen storage capacities, and elements of active energy management.

6.1.2 ENERG ETS

The program is focused on reducing emissions in industries included in the EU ETS. It has a total allocation of CZK 80,030 million CZK.

It supports projects that contribute to increasing energy efficiency in order to reduce greenhouse gas emissions in the manufacturing and technological processes. In terms of hydrogen technologies, these are projects where fossil fuels can be replaced by renewable hydrogen.

6.1.3 TRANSCom

The sub-program is focused on supporting projects by business entities for the purchase of vehicles with alternative zero-emission propulsion and the construction of the relevant non-public infrastructure. Its total allocation is CZK 7,502 million.

It is intended for legal entities and natural persons engaged in business. Support is provided for clean mobility projects through the acquisition of road or rail vehicles with alternative propulsion (e.g., electric, hydrogen fuel cell), or the purchase of other zero-emission vehicles, taking into account the future development of alternative technologies and their technical and economic availability, the construction of infrastructure – charging/refueling stations for these vehicles, and other measures leading to a reduction in energy consumption in transport and enabling the transition to zero-emission transport.

[61] https://www.sfzp.cz/dotace-a-pujcky/modernizacni-fond/

6.1.4 TRANSGov

The sub-program is focused on supporting projects for public entities, state-owned enterprises, public non-business entities, and business entities with a public service obligation for the purchase of alternative zero-emission vehicles for public transport or for the construction of infrastructure for zero-emission public transport. Its total allocation is CZK 42,516 million.

Support is provided for clean mobility projects through the purchase of road or rail vehicles with alternative propulsion (e.g., electric, hydrogen fuel cell), or the purchase of other zero-emission vehicles, taking into account the future development of alternative technologies and their technical and economic availability, the construction of infrastructure – charging/hydrogen filling stations for these vehicles, and other measures leading to a reduction in energy consumption in transport and enabling the transition to zero-emission transport.

6.1.5 GREENGAS

The program is intended for legal entities and sole traders. Its total allocation is CZK 15,005 million.

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Measures contributing to the introduction and use of renewable gaseous and liquid fuels or raw materials (e.g. hydrogen and biomethane) produced from renewable sources are supported. Support is also provided for the infrastructure necessary for the distribution and storage of these fuels. The measures aim to reduce emissions and accelerate decarbonization in the manufacturing and chemical industries, in energy production and storage, in heating, and in the transport sector. This program can be used, for example, to support the repurposing of transport and gas networks or the creation of hydrogen valleys with priority allocation in transforming coal regions.

6.1.6 I+

The program is designed to support innovative and comprehensive projects. Its total allocation is CZK 10,003 million.
CZK

In terms of hydrogen technologies, this program is designed to finance comprehensive projects that go beyond the scope of individual Modernization Fund programs. These projects will then be submitted to the EIB for individual assessment.

6.2 Innovation Fund [62]

The EU's transition to carbon neutrality by 2050 cannot be achieved without significantly strengthening the innovation potential of European companies. The Innovation Fund is designed to support these highly innovative projects.

The aim of the Innovation Fund is to support large innovative projects demonstrating low-carbon technologies and processes in energy-intensive industries, in the field of renewable energy sources, energy storage, carbon capture and storage (CCS) or industrial carbon capture and utilization (CCU).

Depending on the price of emission allowances between 2020 and 2030, the Innovation Fund will have approximately
10 billion euros.

[62] https://www.sfzp.cz/dotace-a-pujcky/inovacni-fond/

6.3 Operational Program Fair Transition (Just Transition Fund)[63]

This program focuses on addressing the impacts of the transition away from coal mining and use in the most affected regions of the Czech Republic, and is intended for the Karlovy Vary, Moravian-Silesian, and Ústí nad Labem regions. The transition to hydrogen technologies, supported by this program, will help keep skilled workers in the area, cut greenhouse gas emissions, and make sure existing businesses switch to new, highly innovative, low-carbon technologies.

The program is planned for the period 2021–2027 and has a total budget of CZK 42.7 billion.

6.4 National Recovery Plan (Recovery and Resilience Facility, RRF)[64]

The investments and reforms included in the NPO have been divided into six pillars, which are further divided into components and then into reforms and investment actions, and finally into specific milestones and targets. The pillar "2. Physical infrastructure a n d green transition" is important for the field of hydrogen technologies, with CZK 95,013 million allocated to it. Specifically, this is component 2.4 Clean mobility with an allocation of more than CZK 4,884 million.

The areas addressed by the National Recovery Plan in relation to hydrogen technologies are:

- reducing overall dependence on fossil fuels,
- accelerating the introduction of renewable energy sources, streamlining permitting procedures, and facilitating access to energy networks for new sources.

Following the expansion of the National Recovery Plan, the following component is also key for the field of hydrogen technologies
7.5 Decarbonization of road transport, which is part of the so-called REPowerEU.

Given that the projects and reforms under the National Recovery Plan must be completed by 2026, the funds for individual projects have already been allocated and the implementation of selected projects and reforms is underway.

6.5 Operational Program Transport (OPD)[65]

The program is administered by the Ministry of Transport. In the field of hydrogen technologies, it focuses on hydrogen refueling stations. New calls will be designed to support the development of a network of hydrogen refueling stations in accordance with the requirements of the AFIR Regulation.

6.6 Integrated Regional Operational Program (IROP) [65]

The program is administered by the Ministry of Regional Development. IROP focuses on supporting sustainable multimodal urban transport and improving conditions for active mobility. The program supports the purchase of low-emission and zero-emission road vehicles for public transport and rail vehicles, as well as the construction of filling or recharging stations for public transport.

[63] https://www.sfzp.cz/dotace-a-pujcky/operacni-program-spravedliva-transformace/
[64] https://www.planobnovycr.cz/
[65] https://www.opd.cz/stranka/OPD-2021
[66] https://irop.gov.cz/cs/

6.7 EU taxonomy[67]

In addition to direct support programs for the development of hydrogen technologies, bank financing of projects is also important. For new investments, it is crucial to channel capital into sustainable projects, and the EU taxonomy plays a key role in this process for hydrogen projects. The EU taxonomy provides a standardized classification system that defines which activities can be considered environmentally sustainable. By setting clear criteria, it ensures that investments are directed towards projects that genuinely contribute to environmental objectives, such as reducing carbon emissions or increasing energy efficiency. For hydrogen projects, this means that those that produce hydrogen through methods such as electrolysis using renewable energy sources can be clearly identified and distinguished from those that use less sustainable methods.

The implementation of the EU taxonomy can significantly reduce the risk for investors in hydrogen projects. A well-defined framework can give investors greater certainty that their investments comply with environmental regulations and standards, reducing the likelihood of regulatory penalties or reputational damage. This certainty can attract a wider range of investors, including those specifically focused on sustainable finance, such as green bonds or ESG (Environmental, Social, and Governance) funds. As a result, hydrogen projects that meet the taxonomy criteria may find it easier to obtain financing and potentially benefit from lower capital costs due to perceived lower risk and higher demand from the investment community.

The EU taxonomy can also help simplify reporting and compliance requirements by providing a clear benchmark for measuring and verifying the environmental benefits of hydrogen projects. This transparency not only builds trust among stakeholders, but also helps track progress towards broader environmental and climate goals, contributing to a more sustainable and resilient energy sector.

[67] https://faktaoklimatu.cz/infografiky/taxonomie-eu

7 GOVERNANCE STRUCTURES AND ORGANIZATION

The development of hydrogen technologies and their implementation in practice is the responsibility of the Ministry of Industry and Trade, headed by the Minister of Industry and Trade. The Minister has appointed a representative of the Minister of Industry and Trade for hydrogen technologies to coordinate relevant activities, prepare and continuously update the Czech Hydrogen Strategy, create the necessary management structures, cooperate with other organizations, state and local government bodies, and the European Commission, and monitor the development of projects in the field of hydrogen technologies.

The Plenipotentiary of the Minister of Industry and Trade for Hydrogen Technologies receives tasks and main objectives for the field of hydrogen technologies from the Minister of Industry and Trade and provides him with regular reports on the fulfillment of the specified tasks and objectives, the implementation of the Hydrogen Strategy, and submits proposals and suggestions in the field of hydrogen technologies. Three working groups will be used to ensure the implementation and activation of the Hydrogen Strategy:

- National Hydrogen Council
- Hydrogen Coordination Group
- Hydrogen Valley Coordination Group

The Czech Hydrogen Technology Platform has been coordinating activities in the field of hydrogen for a long time.
HYTEP.

7.1 National Hydrogen Council

The National Hydrogen Council acts as an advisory body to the Minister of Industry and Trade on hydrogen technologies and usually meets once a year. It proposes and approves changes to the Hydrogen Strategy and Task Cards. It is informed about developments in the field of hydrogen projects and prepares suggestions and proposals for the Minister of Industry and Trade. The National Hydrogen Council is composed of nominated representatives:

- Ministry of Industry and Trade;
- Ministry of Transport;
- Ministry of the Environment;
- Ministry of Education, Youth and Sports;
- universities active in the field of hydrogen technologies;
- research organizations operating in the field of hydrogen technologies;

- Association of Regions of the Czech Republic;
- Confederation of Industry and Transport of the Czech Republic;
- Czech Gas Association;
- Czech Chemical Industry Association;
- Czech Hydrogen Technology Platform HYTEP;
- TPUE Technology Platform "Sustainable Energy of the Czech Republic";
- Technological Agencies of the Czech Republic;
- Chambers of Renewable Energy Sources;
- Czech Energy Alliance;
- Energy Regulatory Office;
- Transforming Coal Regions.

The National Hydrogen Council is chaired by the Minister of Industry and Trade's representative for hydrogen technologies.

7.2 Hydrogen Coordination Group

The Minister of Industry and Trade's representative for hydrogen technologies heads the Hydrogen Coordination Group, which consists of representatives from:

- Ministry of Industry and Trade;
- Ministry of Transport;
- Ministry of the Environment;
- the Confederation of Industry of the Czech Republic;
- HYTEP (Czech Hydrogen Technology Platform);
- Czech Gas Association;
- H3 team, working group for interregional cooperation of transforming coal regions;
- Energy Regulatory Office.

The main tasks of the Hydrogen Coordination Group are:

- Proposals for updating the Hydrogen Strategy;
- Updating and monitoring the implementation of task cards arising from the Hydrogen Strategy;
- Monitoring the portfolio of hydrogen projects;
- Monitoring the implementation of the Hydrogen Strategy objectives;

The Hydrogen Coordination Group provides support in the field of hydrogen technologies to other ministries, state administration bodies, and local governments. It coordinates with the relevant grant program administrators to ensure that these programs are aligned with the objectives set out in the Hydrogen Strategy in the relevant areas. Together with the individual regions that are developing their own hydrogen strategies, it ensures that the Hydrogen Strategy and regional hydrogen strategies are aligned.

The Hydrogen Coordination Group is headed by the Minister of Industry and Trade's representative for hydrogen technologies.

7.3 Hydrogen Valley Coordination Group

The Minister of Industry and Trade's representative for hydrogen technologies heads the Hydrogen Valley Coordination Group, which is made up of representatives from regions where hydrogen valleys exist or are being developed, as well as representatives from the Ministry of the Environment and the State Environmental Fund.

The concept of hydrogen valleys serves to kick-start changes in the use of hydrogen. These have already been established in some regions and are being prepared in others. The most advanced in this process are the transforming coal regions (Moravian-Silesian Region, Ústí nad Labem Region, and Karlovy Vary Region), which have their own regional organizations for coordinating hydrogen activities. The Hydrogen Valley Coordination Group builds on the cooperation of regions that have already signed a memorandum[68] on cooperation with the Ministry of the Environment.

To further strengthen the development of hydrogen valleys in the Czech Republic, a Hydrogen Valley Coordination Group will be established. The Hydrogen Valley Coordination Group will ensure appropriate conditions and working capacities to provide group members with sufficient background information and technical input, in particular for the tasks defined below, which include:

- **Strategic planning**: The Hydrogen Valley Coordination Group will prepare comprehensive plans and guidelines for the establishment and development of hydrogen valleys, which will be aligned with global, European, and national energy and industrial goals. This includes identifying suitable support frameworks that the Czech Republic does not yet use, as well as strategically important locations in terms of hydrogen production and consumption, assessing the availability of resources, and identifying investment opportunities and opportunities for active cross-border cooperation.
- **Stakeholder involvement:** The Hydrogen Valley Coordination Group will promote cooperation between various stakeholders, including state authorities, industry players, research institutions, regions, and local governments. The coordination group will facilitate mutual dialogue, seek solutions to problems, and ensure that the interests of different groups are aligned in order to support the successful implementation of hydrogen valley projects.
- **Project** management **and legislative support:** The Hydrogen Valley Coordination Group will oversee the implementation of strategic projects, from initial considerations to commissioning. This will include, among other things, preparing the necessary legislative proposals to accelerate the development of hydrogen valleys (e.g., in the form of hydrogen "go-to" zones), coordinating the preparation of feasibility studies, securing financing, providing support during approval processes, and monitoring progress to ensure the timely and effective implementation of implementation projects. The coordination group will regularly inform the relevant ministries and local authorities about the progress of the development of hydrogen valleys and the progress of individual projects, in sufficient detail and to the extent necessary to enable the implementation of, for example, infrastructure construction, linear construction, and similar infrastructure.
- **Technology development:** The Hydrogen Valley Coordination Group will support the implementation of innovative hydrogen technologies within the hydrogen valleys. This includes assessing technological readiness, providing technical support and facilitating knowledge exchange between hydrogen valleys in the Czech Republic and abroad, actively seeking and securing financial support for these activities with the aim of accelerating the deployment and expansion of hydrogen solutions.

The Hydrogen Valley Coordination Group will work closely with local governments, regional organizations, industry associations, and other relevant organizations to leverage resources and know-how to achieve the common goal of strengthening the development of hydrogen valleys and realizing the potential of hydrogen as a clean and sustainable energy carrier.

[68] https://www.mzp.cz/cz/news_20230404-Hejtmani-uhelnych-regionu-podepsali-na-Ministerstvu-zivotniho-prostredi-vodikove-memorandum-Cilem-je-vetsi-mezikrajska-spoluprace-pro-rozvoj-vodikovych-technologii

7.4 Czech Hydrogen Technology Platform HYTEP

The Czech Hydrogen Technology Platform (HYTEP) plays an important role in updating and implementing the Hydrogen Strategy. (HYTEP)[69], which focuses on research, development, and implementation of hydrogen technologies.

HYTEP was established in 2006 at the initiative of the Ministry of Industry and Trade. Its objective is to develop the hydrogen economy in the Czech Republic. It supports mutual information exchange between entities operating in the field of hydrogen technologies and undertakes activities to develop the potential of hydrogen applications in the Czech Republic in line with the European Union's climate ambitions.

Any organization that complies with HYTEP's statutes and is actively interested in the development of the hydrogen economy in the Czech Republic can become a member of the platform. In 2024, HYTEP had over 80 members, and this membership base is growing rapidly with the development of hydrogen technologies in the Czech Republic.

Based on signed memoranda of cooperation, HYTEP creates a platform for international cooperation between technology companies in various countries and in the Czech Republic. HYTEP is a member of European hydrogen associations (Clean Hydrogen Partnership and Hydrogen Europe), in which it represents Czech industry and passes on information from meetings in these associations to its members.

For its members, it prepares comprehensive analyses from international sources focusing on the implementation of hydrogen technologies in the industrial, energy, mobility, and heating sectors. It systematically maps and reports on the development of the hydrogen economy and hydrogen technologies worldwide, with a specific focus on Europe and the Czech Republic.

Provides expertise to state and local government authorities in areas related to the development of the hydrogen economy. It cooperates with on projects in the field of development of hydrogen technologies. It organizes and co-organizes workshops, seminars, and conferences for professionals and the general public on the development of the hydrogen economy, including the largest hydrogen conference in the Czech Republic, Hydrogen Days.

[69] https://www.hytep.cz/

8 OVERVIEW OF ABBREVIATIONS USED

Abbreviation	Meaning
AFIR	Alternative Fuels Infrastructure Regulation
APTT	Association of Heating Technology Companies
BOZP	Occupational Health and Safety
CBAM	Carbon Border Adjustment Mechanism (CBAM) Adjustment Mechanism)
CEEAG	Guidelines on State aid for climate, environment and energy (Climate, Energy and Environmental State Aid Guidelines)
CCU/CCS	Carbon Capture and Utilization/Carbon Capture and Storage
CO_2	carbon dioxide (chemical symbol)
CZT	Centralized heat supply
ČBÚ	Czech Mining Authority
ČEPS	Czech Transmission System (organization)
CGS	Czech Geological Survey
ČMI	Czech Metrology Institute
ČPS	Czech Gas Association
CR	Czech Republic
ČSN	Czech technical standards
DSO	Distribution System Operator
EHB	European Hydrogen Backbone
EGAP	Export Guarantee and Insurance Company a.s.
EIA	Environmental Impact Assessment
EK	European Commission
ENTSO-G ENTSOG	European Network of Transmission System Operators for Gas (The European Network of Transmission System Operators for Gas)
ERÚ	Energy Regulatory Office
ES ČR	Electricity System of the Czech Republic
ETS	Emission Trading System
EU	European Union
EZ	European laws
FCEV	electric car with fuel cells (Fuel Cell Electric Vehicle)
GBER	General Block Exemption Regulation
H_2	Hydrogen (chemical symbol)
H3 team	Working group for interregional cooperation of transforming coal regions in the field of promoting the application of hydrogen technologies and coordinated development of the "hydrogen valley" concept
GDP	gross domestic product
HYTEP	Czech Hydrogen Technology Platform
HZS	Fire and Rescue Service of the Czech Republic
IPPC	Integrated Pollution Prevention and Control (IPPC) Prevention and Control)
LUV	light commercial vehicles
MAF CZ	Assessment of the adequacy of the Czech Republic's electricity system (Midterm Adequacy Forecast)

MD	Ministry of Transport
MF	Ministry of Finance
MMR	Ministry of Regional Development
Ministry of Industry and Trade	Ministry of Industry and Trade
MŠMT	Ministry of Education, Youth and Sports
MFA	Ministry of Foreign Affairs
MŽP	Ministry of the Environment
NAP CM	National Action Plan for Clean Mobility
NKEP	National Climate and Energy Plan (sometimes also referred to as National Energy and Climate Plan)
NV	Government Regulation
NZIA	Net Zero Industry Act
OP ST	Operational Program Fair Transformation
OPZ	gas consumption equipment
OTE	Market Operator
RES	renewable energy sources
PCI	Projects of Common Interest
PPA	Power Purchase Agreement
PROPED	economic diplomacy projects
RAB	Regulated Asset Base
RED	Directive on the promotion of the use of energy from renewable sources (Renewable Energy Directive)
RFNBO	Renewable Fuels of Non-Biological Origin (RFNBO) biological Origin)
RIS3	National Research and Innovation Strategy for Smart Specialization of the Czech Republic for 2021–2027
SEK	State Energy Policy
SFDI	State Fund for Transport Infrastructure
SFŽP	State Environmental Fund of the Czech Republic
SCHP ČR	Chemical Industry Association of the Czech Republic
SRN	Federal Republic of Germany
SPČR	Confederation of Industry of the Czech Republic
SUIP	State Labor Inspection Office
SWOT	analysis of strengths, weaknesses, opportunities, and threats (Strengths, Weaknesses, Opportunities, and Threats)
TRANSCom	Transport modernization program in the business sector. The program supports the purchase and acquisition of alternative fuel vehicles and non-public infrastructure for business entities.
TRANSGov	Public transport modernization program. Program for the acquisition vehicles with alternative fuel systems and infrastructure for public transport intended for public entities, companies with state ownership or public entity ownership, public non-business entities, and business entities with a public service obligation.
Taxonomy	A uniform classification system for sustainable economic activities in terms of climate and the environment. Through objective technical criteria, it establishes a standardized definition of environmentally sustainable economic activities ("green activities") across the EU.
TCO	Total Cost of Ownership

TIČR	Technical Inspection of the Czech Republic

TSO	Transmission System Operator
ÚV	Government Office
Hydrogen strategy	Hydrogen Strategy of the Czech Republic
WACC	Weighted Average Cost of Capital
ZP	natural gas

9 APPENDIX 1 – TASK CARDS

O1: Create effective support tools that will enable the completion of the construction of electrolysers for hydrogen production with an installed capacity of at least 400 MWe by 2030 (with priority given to completion by the end of 2027 due to simpler rules), where necessary to meet binding EU targets or where there is a demonstrable contribution to decarbonization, including relevant renewable energy sources, infrastructure for storage, distribution, and consumption of hydrogen as close as possible to the place of production (creation of hydrogen valleys and clusters). Coordinate the construction of electrolysers with the development of acceleration zones.

Card manager: Ministry of the Environment

Task card	O1.1 Ensure investment and operational support for the production of RFNBO and low-carbon hydrogen by electrolysis in the Czech Republic
Card description	Investment support for the construction of electrolysers is currently provided by only two programmes (RES+ and ENERG ETS announced by the State Environmental Fund). RES+ is not primarily focused on electrolysers, as electrolysis production is supported in connection with the construction of RES for energy storage, and its allocation is insufficient to achieve the ambitions and targets set for 2030 in the area of RFNBO production in the Czech Republic. The Czech Republic must allocate funds for supporting the development of electrolyzer construction from the proceeds of emissions allowance auctions. An alternative source of financing is European regional development funds, cohesion funds, or the Just Transition Fund. Operating support is offered by the Innovation Fund, which the Czech Republic can supplement with national funds (e.g., from auction revenues). Support for ensuring the economic production of water electrolysis in the Czech Republic must be notified to the European Commission through the Guidelines for State Aid in the Climate, Environment, and Energy Sectors for 2022 (CEEAG). Notification may improve the economics of electrolyzer operation by including the possibility of supporting projects targeting both RFNBO production and low-carbon hydrogen production by water electrolysis using nuclear or other low-carbon electricity in accordance with the methodology for calculating the emissivity of low-carbon hydrogen, which is expected to be published in 2025. For the programs listed, it is advisable to consider a combination of investment and operating support in accordance with CEEAG rules to minimize the costs of producing RFNBO and low-carbon hydrogen in the Czech Republic. Support must be prioritized with regard to the tightening of RFNBO hydrogen production rules after 2027. Until then, projects whose have received investment support for renewable electricity production.

	Investment and operating support must take into account the competitiveness of hydrogen production by water electrolysis in the Czech Republic with regard to hydrogen imports from abroad, which are expected to start around 2030. In addition to the construction of electrolysers, the Czech Republic must continue to systematically support the construction of new renewable energy sources, with a priority focus on the use of wind and solar energy supplemented by technologies for energy storage. .
Manager	Ministry of the Environment

Sub-task	O1.1.1 Prepare a technical and economic analysis of RFNBO production for specific model cases in connection with the use of hydrogen in the Czech Republic within individual regions
Responsibility for sub-task	MPO
Cooperation	Ministry of the Environment, HYTEP, SPČR, relevant regions, H3 team
Performance indicator	a) Analysis of predefined parameters with regard to state aid limits b) Proposal for a specific minimum amount of operating and investment aid to cover the difference in costs compared to neighbouring countries and its inclusion in the aid announced in dedicated programmes
Deadline	a) 30 b) September 30, 2024

Subtask	O1.1.2 Prepare a program and announce calls for proposals to support the construction of electrolysers focused on the production of RFNBO and low-carbon hydrogen, with an emphasis on the development of hydrogen valleys and in accordance with current European rules, from the proceeds of emission allowance auctions to meet the target of at least 400 MW of installed electrolysis capacity. The program must take into account, together with other supported activities, the financial allocation for supporting RFNBO production in the context of the Czech Republic's mandatory targets under the Directive on the promotion of the use of energy from renewable sources. The GreenGas program currently being prepared and the OP TAK program appear to be suitable support instruments. GreenGas and OP TAK.
Responsibility for the sub-task	MoE (Modernization Fund), MoI (OP TAK)
Cooperation	MPO, HYTEP, SPČR, H3 team
Performance indicator	a) Discussion and definition of program parameters b) Preparation of two program scenarios with notification to the European Commission (CEEAG) and without notification to the European Commission (GBER) c) Approval of the program according to the selected scenario

	d) Launch of the first call under the program (either in OP TAK or Modernization Fund)
Deadline	a) 30 b) 30 c) 30 d) November 30, 2024

Sub-task	O1.1.3 Assess systematic support for complete or partial island solutions for energy storage for households and businesses, in particular combinations of renewable electricity sources, batteries, electrolysers, fuel cells, storage and use to achieve partial or complete energy self-sufficiency
Responsibility for sub-task	Ministry of the Environment
Cooperation	Ministry of Industry and Trade, Ministry of Transport and Construction, HYTEP, SPČR, H3 team
Performance indicator	a) Discussion on possibilities for supporting hydrogen storage for households and businesses b) Identification of a suitable tool to support such projects c) Implementation of support into a program
Deadline	a) 31 December 2024 b) March 31, 2025 c) September 30, 2025

Task card	O1.2 Simplify the conditions for the construction of electrolysers and related technical equipment
Card description	The current conditions for the construction of electrolysers do not provide for the construction of electrolytic hydrogen production outside the chemical industry. From the point of view of integrated pollution prevention and control (IPPC), they are therefore considered chemical installations which, according to the current interpretation, are subject to IPPC authorisation without exception. Based on an evaluation of the relevant analyses, consider the possibility of amending the Environmental Impact Assessment Act (EIA). The current revision of the Industrial Emissions Directive brings a fundamental change to this area, which consists in the exclusion of activities with the name "electrolysis of water for the production of hydrogen with a production capacity of more than 50 tons per day" from the chemical industry. For new installations of this type that do not exceed the specified capacity threshold (i.e. 50 tons per day), it will not be necessary to apply for an integrated permit. This will simplify the administrative process for such sub-threshold installations. For large installations, on the other hand, the current approach will be maintained, which will ensure proper supervision of their operation. The new regulations will be published in the Official Journal of the EU in the near future and then transposed into the Integrated Prevention Act within 22 months.

	Hydrogen is also now part of the Energy Act (expected from 2024), and companies producing hydrogen (including RFNBO) will be required to obtain a license from the ERÚ, which could potentially bring a number of other challenges. Work on this task is also coordinated with the preparation of the Act on Acceleration Zones and Government Resolution No. 272 of 24 April 2024 o n the document "Establishment of a basic procedure for defining areas necessary for the Czech Republic's contribution to the EU's overall target for renewable energy sources by 2030 and areas for the accelerated introduction of renewable energy sources." The card follows up on the results of task card No. 7 from the previous Hydrogen Strategy. In recent years, an analysis of construction conditions in Germany has been carried out. There is a methodology from NOW, GmbH, as well as a manual from the state government of Schleswig-Holstein and a case study from HYTEP on the construction of electrolysers.
Manager	Ministry of the Environment

Sub-task	O1.2.1 Prepare a methodological interpretation by the Ministry of the Environment for regional authorities to specify the electrolytic production of hydrogen by water electrolysis in terms of its possible classification under specific points in Annex 1 of the on environmental impact assessment (EIA)
Responsibility for sub-task	Ministry of the Environment
Cooperation	regional authorities, H3 team
Performance indicator	a) Methodological interpretation of the classification of electrolysers for hydrogen production in accordance with the wording of the Environmental Impact Assessment Act, prepared and published in the Ministry of the Environment Bulletin. b) Inclusion of the topic on the agenda of the methodological meeting with responsible officials from regional authorities.
Deadline	a) 30 June 2025 b) 30 June 2025

Sub-task	O1.2.2 Review the possibility of amending the Environmental Impact Assessment Act (EIA) and, if such possibilities are found, implement the relevant amendment to the Act, consisting, for example, in separating electrolytic hydrogen production from one of the existing points of Annex 1 to the Environmental Impact Assessment Act so that this hydrogen production has, for example, its own limit value. Existing analyses may also be used for this purpose. The law will only be amended after the possibilities have been examined a n d the relevant analyses evaluated, or only if there is actually scope for amending the Act.

Responsibility for the sub-task	MoE
Cooperation	
Performance indicator	a) Search for specific options for amending the law at the Ministry of the Environment b) Draft amendment to the EIA Act and its submission to the Ministry of Transport and Construction, or decision by the Ministry of the Environment that no amendment is possible.
Deadline	a) September 30, 2024 b) 31.12.2024

Sub-task	O1.2.3 Transposition of the revised Industrial Emissions Directive, including the separation of hydrogen production by electrolysis from a certain production volume into a separate category (based on the revision of the IED, this will most likely be a separation into category 6.6, which will read approximately as follows*: "6.6. Electrolysis of water for the production of hydrogen with a production capacity exceeding 50 tons per* day"
Responsibility for sub-task	MoE
Cooperation	
Performance indicator	a) Schedule for rapid transposition of the revised directive b) Drafting of an amendment to the Act on Integrated Prevention c) Completion of inter-ministerial consultation on the amendment Act on Integrated Prevention and its submission to the Czech Government.
Deadline	a) 30 b) February 28, 2025 c) June 30, 2025

Sub-task	O1.2.4 Assessment of the need to amend the Building Act and its implementing regulationsregulations in connection with the construction of electrolysers and primary hydrogen storage facilities in various storage modes
Responsibility for sub-task	HYTEP
Cooperation	MPO, HYTEP, MMR, H3 team
Performance indicator	a) Based on analyses prepared by HYTEP or other stakeholders, decide whether necessary to amend the Building Act
Deadline	a) 30.08.2024

Task card	O1.3 Acceleration zones for the construction of electrolytic hydrogen production
Card description	In accordance with Article 15c of the Directive on the promotion of the use of energy from renewable sources, the Czech Republic is required to establish acceleration zones to accelerate the construction of RES. As part of the construction of RES, the Czech Republic should support

	the construction of electrolytic production in RES acceleration zones through accelerated processes. The Directive now allows, in accordance with Article 15e, the creation of acceleration zones for projects focused on storage and network energy infrastructure necessary for the integration renewable energy sources (including hydrogen storage).
Manager	Ministry of the Environment

Sub-task	O1.3.1 Include storage (including electrolysers) and the necessary grid infrastructure in acceleration zones for the deployment of renewable energy sources in accordance with Article 15c of the Renewable Energy Directive from renewable sources
Responsibility for sub-task	Ministry of the Environment
Cooperation	Ministry of Industry and Trade, Ministry of Regional Development, HYTEP, H3 team
Indicator Fulfilment	a) Ensure, through cooperation between the Ministry of Industry and Trade and the Ministry of the Environment, the inclusion of electrolytic hydrogen production in RES acceleration zones
Deadline	a) 30 June 2025

Sub-task	O1.3.2 Assess the benefits and costs of introducing areas for the development of storage and network infrastructure in accordance with Article 15e of the Directive to promote the use of energy from renewable sources
Responsibility for sub-task	MoE
Cooperation	Ministry of Industry and Trade, Ministry of Regional Development, HYTEP, H3 team
Performance indicator	a) Evaluation report assessing the benefits of introducing areas for the development of accumulation and network infrastructure b) Creation of a specific plan for such acceleration zones and definition of locations
Deadline	a) 31.12.2024 b) October 30, 2025

Task card	O1.4 Analysis of options for low-carbon hydrogen production by electrolysis using electricity from nuclear power plants
Card description	Currently, the main priority of the Hydrogen Strategy is the production of renewable hydrogen in accordance with RFNBO rules. Countries using nuclear power plants to generate electricity, led by France, have long-term and systematic plans to support the production and consumption of low-carbon hydrogen produced by electrolysis of water using electricity from nuclear power plants power plants. The future use of nuclear power plants for hydrogen production

	will contribute to solving problems with expected surpluses of electricity and the use of waste heat.
Responsible	MPO

Sub-task	O1.4.1 Prepare an analysis of the optimization of hydrogen production using electricity from nuclear power plants and RES. The study will compare different scenarios for the development of RES and nuclear power plants on the supply side and different scenarios for electricity consumption growth in order to estimate the integration and size of electricity surpluses from RES and nuclear power and their effective use for cost-optimal production of low-carbon and renewable hydrogen.
Responsibility for the sub-task	MPO
Cooperation	Selected contractor for the study
Performance indicator	a) Study completed
Deadline	a) 31 December 2025

Subtask	O1.4.2 In connection with and results study from O.1.4.1. prepare a feasibility study with the nuclear power plant operator that will assess the production of low-carbon hydrogen for specific nuclear units from a technical, legislative, and economic feasibility perspective.
Responsibility for the sub-task	MPO
Cooperation	Nuclear power plant operator
Performance indicator	a) Initiation of discussions with nuclear power plant operators b) Preparation of a feasibility study
Deadline	a) January 31, 2026 b) 31 December 2026

Task card	O1.5 Create conditions for the development of "hydrogen valleys" at the regional level
Card description	An important driver of the development of the hydrogen economy is ensuring the temporal compatibility of the start of RFNBO production and low-carbon hydrogen production and its consumption at a short distance from the production site. This requires not only production potential, but also a need to consume hydrogen, which is mainly determined by the willingness of regional and local authorities, as part of their public service obligations to switch to the use of

	hydrogen. Given that these are independent decisions made by local authorities, it is essential that they are familiar with hydrogen issues and willing to actively engage in new solutions. The Association of Regions of the Czech Republic and the initial experiences of coal regions undergoing transformation, which have already begun to take action in this area, can help in this regard.
Manager	MPO

Sub-task	O1.5.1 Support the creation of "hydrogen valleys" in transforming coal regions as an important tool for the development of the hydrogen economy in the Czech Republic, using funds from the OPST and the Modernization Fund.
Responsibility for sub-task	Ministry of the Environment
Cooperation	relevant regions, MIT, H3 team
Performance indicator	a) Implementation of calls for proposals to support the development of "hydrogen valleys" in transforming coal regions from the OPST b) Establishment and systematic work of regional innovation platforms in the field of hydrogen economy c) Preparation and implementation of comprehensive hydrogen projects in transforming coal regions (responsibility: relevant regions)
Deadline	a) 30 August 2024 b) August 30, 2024 c) 31 December 2024, project launch no later than 31 December 2025

Sub-task	O1.5.2 Create a system of consulting, methodological and organizational support for emerging "hydrogen valleys" based on the experience of hydrogen platforms transforming coal regions – these regions will prepare the basis for the system, which will then be recommended by the Ministry of Industry and Technology
Responsibility for sub-task	MPO, MŽP
Cooperation	Ministry of Regional Development, relevant regions, HYTEP, H3 team, cities and municipalities
Performance indicator	a) Published recommendations for the creation and implementation of "hydrogen valleys," including international cooperation b) Regular meetings of interested parties, later creators of "hydrogen valleys" in the Czech Republic (hydrogen forums)
Deadline	a) January 31, 2025 b) August 31, 2024, then at annual intervals

Subtask	O1.5.3 Develop international cooperation in the implementation of "hydrogen valleys" by supporting both existing participating regions (Ústí nad Labem, Moravia-Silesia) and other regions
Responsibility for sub-task	MPO, MŽP
Cooperation	MRD, MD, H3 team, Association of Regions of the Czech Republic, HYTEP
Performance indicator	a) Involvement of other regions in the European "hydrogen valleys" initiative b) Implementation of activities/conferences of the European Hydrogen Valleys initiative in the Czech Republic c) Systematic publication of information on the activities of "hydrogen valleys", examples of good practice, etc. on the HYTEP website and the websites of regions involved in the European "hydrogen valleys" initiative
Deadline	a) 31 b) December 31, 2024 c) August 31, 2024, then every six months

Task card	O1.6 Establishment of a high-level interdepartmental hydrogen coordination group
Card description	By the end of 2024, create conditions and ensure full cooperation between all central government departments with a view to accelerating, in line with the needs of emerging hydrogen valleys, primarily in regions undergoing transformation, the preparation of development projects and the activation of implementation processes for specific projects.
Responsible	MPO
Cooperation	Ministry of the Environment, Ministry of Regional Development, relevant regions, H3 team
Deadline	31 December 2024

O2: Prepare the gas system for blending hydrogen into natural gas (blending)

Card manager: MPO

Task card	O2.1 Readiness of legal regulations and technical rules for the possibility of blending hydrogen into natural gas, its distribution and use of the blend.
Card description	According to the EC proposal in the gas package (specifically the Gas and Hydrogen Market Regulation), the transmission system operator will be obliged to accept a mixture of natural gas and hydrogen of up to 5% at cross-border points, with subsequent transfer to the entire interconnected gas system. At the same time, given the limited resources of renewable energy sources, it appears to be an appropriate tool for integrating surplus production from renewable sources in the form of hydrogen, injecting it into the system up to a 20% blend and using it in final consumption. The tasks include setting rules for the operation of gas systems, inspecting domestic distribution systems, and trading in blended hydrogen. Some of the tasks (in particular, the actual legislative measures) are addressed in card O5.
Manager	MPO

Subtask	O2.1.1 Setting technical rules and procedures for the distribution of hydrogen blends throughout the gas supply chain (measurement, materials, procedures) up to the level specified in the Gas and Hydrogen Market Regulation and up to 20 % in local distribution. Determination of safety aspects when working on gas equipment operated with a mixture of natural gas and hydrogen. Implementation of necessary changes to technical standards and identification of any necessary changes in legislation in connection with card O5.
Responsibility for sub-task	MPO
Cooperation	TIČR, HZS, SUIP, ČBÚ, ČPS, NET4GAS, storage facility operators, gas distributors, ERÚ
Compliance indicator	a) All technical and safety requirements for the operation of the gas transmission system and the gas distribution system with a hydrogen blend are defined and implemented in technical standards. The necessary changes in legislation are identified and the supervisory authorities are prepared to to carry out inspections within their competence with sufficient intensity.
Deadline	a) 31.12.2024 (or depending on the final version of the EC regulation)

Sub-task	O2.1.2 Determination of rights and obligations during inspections of end devices. The owner of the supply point is responsible for domestic distribution systems and end devices. It is necessary to define the rights a n d obligations of owners with regard to the transition to blended and later pure hydrogen, i.e., who will carry out inspections, who will bear the costs, any mandatory access to the premises, and the procedure in the event of non-cooperation by the entity concerned. Identification of necessary changes to laws and regulations (linked to the O5 card).
Responsibility for sub-tasks	MPO
Cooperation	ČPS
Performance indicator	a) There is an approved procedure for reviewing domestic distribution systems and end-use equipment for blended and pure hydrogen (if a difference between the procedure for blended hydrogen and hydrogen is identified during the process, the procedure for hydrogen can be postponed). The responsibilities of individual members of the value chain are defined. The necessary legislative changes have been proposed.
Deadline	a) 31.12.2025

Sub-task	O2.1.3 Establishment of rules for dealing with customers who cannot accept the blend. There are operations for which the chemical composition of the supplied gas is essential and hydrogen in the blend cannot be accepted. It is necessary to decide what the rights and obligations of the individual actors will be (construction and operation of deblanding equipment or disconnection, at whose expense) and to identify necessary changes to legislation and regulations related to the O5 card.
Responsibility for the sub-task	MPO
Cooperation	ERÚ, ČPS, SPČR, gas distributors
Performance indicator	a) Rules have been established for customers who do not accept blends. The responsibilities of supervisory authorities and industry have been defined. The necessary amendments to laws and technical standards have been proposed.
Deadline	a) ERÚ nd 31.12.2025

Sub-task	O2.1.4 Setting rules for the acceptance of hydrogen injection into distribution to a level of 20% blend without financial support from the state. If a hydrogen producer requests injection into the system, additional requirements for distributors and consumers may arise from card O2.1.1. This task sets out the rules under which hydrogen injection can be accepted and who has what obligations. No subsidies from state funds are used under these rules. Preparation of any supporting documents for the creation of legislation in connection with card O5.

Responsibility for the sub-task	ČPS
Cooperation	ERÚ, MPO, gas distributors
Performance indicator	There is an approved procedure for assessing the acceptability of hydrogen injection above the level specified in the Gas and Hydrogen Market Regulation from the perspective of potentially increased economic costs of network modification.
Deadline	31 December 2024 Preparation of background documents for the drafting of legislation 31 December 2025 (or as required by the gas decarbonisation package)

Sub-task	O2.1.5 Analysis of the suitability of supporting hydrogen injection into the distribution system and setting rules for accepting hydrogen injection up to a 20% blend level from the perspective of economic costs for network modification and OPZ. The analysis will determine whether it is appropriate f r o m the state's perspective to support investment subsidies for modifications on the consumer side or, where applicable, on the distributor side (in connection with O2.1.1, O2.1.2, a n d O2.1.3) a n d to reflect the future development of a clean hydrogen network in accordance with M4.1. If the analysis is positive, this task will establish rules, including rules for the economic analysis of the specific injection case, under which conditions hydrogen injection can be accepted, a n d who has what responsibilities. Preparation of any for the creation of legislation in connection with card O5.
Responsibility for the sub-task	MPO and ČPS
Cooperation	ERÚ, gas distributors
Performance indicator	There is an approved procedure for assessing the acceptability of hydrogen injection hydrogen above the level Regulation from the perspective of potentially increased economic costs of network modification.
Deadline	31 June 2025 Preparation of background documents for the creation of legislation June 30, 2026 (or as required by the gas decarbonization package)

Sub-task	O 2.1.6 Consider implementing and enabling the functioning of the Regulatory Sandbox. The Regulatory Sandbox tool allows new technologies to be tested without extensive regulatory changes during a trial phase. The Polish model implemented in the Energy Act (UC74), where the ERÚ can decide on the suitability of submitted applications precisely specified and time-limited exemptions from regulation.
Responsibility for the sub-task	MPO, preparation of background materials ČPS
Cooperation	ERÚ, ČPS, H3 team
Indicator Fulfilment	a) Regulatory Sandbox tool available
Deadline	a) 31 December 2025

Task card	O2.2 Preparation of gas infrastructure for hydrogen blending
Card description	Implementation of preparations for gas infrastructure for blending
Responsible	MPO

Sub-task	O2.2.1 Determination and, where necessary, replacement of incompatible components for the distribution of hydrogen blends in the transmission system and storage facilities in accordance with the blend level specified in European legislation (probably 2-5%, final percentage level according to the outcome of the Trialogue between the EC, EP and the Council) and up to a blend of 20% in local distribution if O2.1.1 sets conditions beyond the current readiness assumptions. The issue of end-use equipment checks will be addressed in line with the results of the study under O.2.1.1 and O2.1.2.
Responsibility for sub-task	ČPS
Cooperation	NET4GAS, gas storage operators, gas distributors
Performance indicator	a) Transmission and distribution system and storage facility equipment ready for blending
Deadline	a) According to the scope of necessary modifications defined in O2.1.1.

Subtask	O2.2.2 Dynamic monitoring of gas quality in the system according to the requirements defined in O2.1.1. Definition, deployment and use of calculation models capable of define the composition of gas in time and space.
Responsibility for sub-task	ČPS
Cooperation	gas distributors, ČMI, ERÚ
Performance indicator	a) Gas distributors have a prepared and approved quality monitoring system and are able to implement it in the required locations
Deadline	a) 31.12.2025 (or depending on the final version of the EC regulation)

Task card	O2.3 Preparation of a concept for a regulatory framework in the Czech Republic enabling the use of hydrogen in blends.
Description	Creation of a stable regulatory environment enabling the development hydrogen infrastructure:

	• Support for retrofitting existing infrastructure when planning the development of the gas industry with a view to transitioning to a hydrogen system in the Czech Republic in accordance with plan M4.1. • Conditions for connecting hydrogen production facilities to the distribution network.
Responsible	MPO

Sub-task	O2.3.1 Amendment of the regulatory framework for wider use of hydrogen blends in the distribution and transmission system. The task includes, for example, reflection on investments and operating costs incurred in connection with the modification of equipment owned by regulated entities (whether existing, e.g. gas meters, or new according to O2.1) and any change in tariffs following a change in the volume/energy ratio. The task does not include an assessment of any support in the form of feed-in tariffs (see O2.5)
Responsibility for sub-task	ERÚ
Cooperation	MPO, ČPS, regulated entities in the gas industry
Performance indicator	a) Regulatory framework functional, volume of cross-border hydrogen sales, implementation of investments in hydrogen and gas infrastructure. Within the current regulatory period, this only concerns the assessment of costs related to blending as costs eligible costs.
Deadline	a) 31.12.2026

Task card	O2.4 Identification of needs for setting the regulatory environment for Sector Coupling – blend part
Card description	Identification of needs for changes to the regulatory environment for the electricity and gas industry for the purposes of stabilizing the electricity system in an environment of increased installed RES capacity for the use of the blend
Responsible	MPO

Sub-task	O2.4.1 Identification of the need for regulatory changes for the storage of unusable electricity generated from RES in the gas system systematically for regulatory period 7 (2031-2035) and according to current needs and the scope declared by the Ministry of Industry and Technology ( ) in the Strategic Plan (Strategický plán) ( ) within the framework of the Methodology for the Preparation of the 2016-2021 Regulatory Framework ( ) ( ) and the Methodology for the Preparation of the 2016-2021 Regulatory Framework for the Gas Sector ( ) ( ) for the 6th regulatory period.
Responsibility for sub-task	ERÚ
Cooperation	ČEPS, NET4GAS, gas and electricity distributors
Performance indicator	a) identified needs changes regulation for production and blending of hydrogen from the perspective of the electricity and gas networks. b) Identification of needs for changes in legislation. c) Identification of needs for setting the regulatory period 7

Deadline	a) 31 December 2025 or later if necessary: Adjustments to the parameters of regulatory period 6 b) December 31, 2025 c) June 30, 2028

Task card	O2.5 Financial support for hydrogen injection into the gas system
Card description	Identify the need, analyze the costs and benefits, and, if necessary, provide operational support for hydrogen injection into the blend
Manager	MPO

Sub-task	O2.5.1 Assess the suitability of support for limited amounts of hydrogen injected into the system (technology start-up, fulfillment of emission and other targets). Assessment of the appropriate support instrument (e.g., feed-in tariff, purchase, operational support), or identification of possible overlap with other subsidy programs. Setting up support.
Responsibility for sub-task	MPO
Cooperation	MoE, ERÚ, ČPS
Performance indicator	a) Preparation of analysis
Deadline	a) 31 December 2025

O3: By 2030, stimulate demand for renewable and low-carbon hydrogen in transport and industry in the Czech Republic in a minimum volume of 40,000 t/year (1,320 GWh)

Card manager: MPO

Task card	O3.1 Support low-carbon hydrogen and RFNBO through tax incentives in accordance with the Energy Taxation Directive
Card description	Through the Fit for 55 package and the revision of the Energy Taxation Directive, the European Commission allows a reduced reference rate to be applied to renewable hydrogen. In order to kick-start the hydrogen economy, the Czech Republic needs to set the tax burden on RFNBO hydrogen as low as possible, at least in the first few years. All predictions assume a relatively high production price for RFNBO hydrogen even after 2030, so it will be in the state's interest, given the increase in demand for hydrogen in transport (fuel cell vehicles) and the fulfillment of the RED Directive targets, that its tax burden does not jeopardize consumer demand itself. At the same time, in order to kick-start the hydrogen economy, the Czech Republic needs to set the tax burden on low-carbon hydrogen as low as possible, at least in the first few years. Given the costs of producing low-carbon hydrogen and its necessity in meeting emission targets and fees in transport, industry, and buildings (RED, EU ETS 1.2), it is in the state's interest that its tax burden does not jeopardize consumer demand. We also propose a reduced rate even if the Energy Taxation Directive does not pass the legislative process within the EU Council, in which case Member States may use their general law to introduce nationally specific conditions in the area of taxation.
Manager	MF

Sub-task	O3.1.1 Introduce tax incentives for RFNBO hydrogen for use in fuel cells
Responsibility for sub-task	MF
Cooperation	MPO, MŽP
Performance indicator	a) Launch a discussion on the long-term approach to tax incentives for hydrogen RFNBOs b) Introduction of tax incentives
Deadline	a) 1 January 2025 b) December 31, 2026

Sub-task	O3.1.2 Following the adoption of the delegated act on low-carbon hydrogen, introduce tax incentives for low-carbon hydrogen for use in fuel cells
Responsibility for sub-task	MF
Cooperation	MPO, MŽP
Performance indicator	a) Initiate a discussion on a long-term approach to tax incentives for low-carbon hydrogen b) Introduction of tax incentives
Deadline	a) 1 January 2025 b) 16 months after the adoption of the delegated act on low-carbon hydrogen

Task card	O3.2 Support for the use of renewable and low-carbon hydrogen in industry
Card description	The RED III Directive requires the use of RFNBO hydrogen in specified operations currently using hydrogen. It is necessary to prepare industry for this transformation and offer optimal solutions. The competitiveness of industry will continue to be influenced by instruments developing direct and indirect pressure on the use of renewable and low-carbon energy sources (ETS 1,2, Green Bonds, corporate ESG, eco-design). The aim is to create an appropriate environment so that industry can adapt to these requirements. Findings from industry associations show that many companies are unaware of their obligations under the RED III Directive. It is therefore necessary to focus on raising awareness and providing companies with specific tools to replace the hydrogen currently used RFNBO with hydrogen (to meet the RED Directive targets) or low-carbon hydrogen (to meet emission targets).
Manager	MPO

Sub-task	O3.2.2 Preparation of tools for the possibility of using renewable and low-carbon hydrogen in terms of reducing the carbon footprint of industrial production (typically guarantees of origin or certification schemes in accordance with Article 29 of EU Directive 2018/2001 for pure hydrogen or in blends, for demonstration purposes for ESG, EU taxonomy, ETS1, 2, etc.), but also to achieve relevant national targets such as the Effort Sharing Regulation. These are mainly tools enabling the certification and use of certified hydrogen by manufacturing companies and other consumers, but also in downstream value chain processes (GHG Protocol and similar schemes). Own commercial supply of hydrogen.

	Link to cards O5, O1, O2, and M4.
Responsibility for sub-tasks	MPO
Cooperation	SPČR, MŽP, ČPS, OTE
Performance indicator	a) Companies using low-carbon or renewable hydrogen have the option to report this hydrogen.
Deadline	a) 30.12.2026

Task card	O3.3 Development of hydrogen mobility in the Czech Republic
Card description	It is necessary to ensure that the individual NAP CM cards relating to hydrogen transport are fulfilled. Specifically: 1. Lower toll rates for zero-emission vehicles, specified according to individual categories N1, N2, N3 in accordance with the conditions contained in the NAP CM. 2. Construction of a backbone network of hydrogen filling stations, in accordance with the AFIR regulation and according to the needs of the Czech Republic, taking into account the possibilities of future import, transport, and distribution of hydrogen through the gas infrastructure. 3. Development of mobile refueling stations, including support for trailers, based on a cost-effectiveness analysis. 4. Development of hydrogen public transport, including hydrogen refueling stations stations for cities and municipalities. 5. Development of hydrogen rail transport.
Responsible	MPO

Sub-task	O3.3.1 Ensure that measures in the field of hydrogen transport are included in the update of the NAP CM hydrogen transport, see above.
Responsibility for sub-task	HYTEP
Cooperation	SPČR, MŽP, MPO, H3 team
Performance indicator	a) Measures are included in the updated NAP CM.
Deadline	a) 31 August 2024

Sub-task	O3.3.2 Proper implementation of individual measures from the NAP CM relating to hydrogen.
Responsibility for sub-task	MPO
Cooperation	SPČR, MŽP, HYTEP, H3 team
Performance indicator	a) Measures are being implemented on time, leading to the development of hydrogen mobility in the Czech Republic.
Deadline	a) ongoing

Sub-task	O3.3.3 Plan for the construction of hydrogen filling stations. The plan for the construction of public hydrogen refueling stations in accordance with the AFIR regulation is set out in the NAP CM. In total, the new regulation will require the mandatory construction of at least six hydrogen refueling stations on the TEN-T networks with a cumulative capacity of 1 ton per day on the main TEN-T networks (or several smaller hydrogen stations that together will have the required hydrogen capacity) and at least 10 hydrogen refueling stations in urban nodes. The capacities and of hydrogen at refueling stations in urban nodes should take into account the expected increase in hydrogen vehicles across segments, especially freight transport.
Responsibility for sub-task	MD
Cooperation	MPO
Performance indicator	a) Construction of hydrogen filling stations in accordance with the plan in the NAP CM
Deadline	a) 31 December 2030

Sub-task	O3.3.4 Support for projects to build hydrogen infrastructure for public services (transport (road and rail), municipal services, etc.). Plan for the construction of hydrogen refueling stations and related infrastructure.
Responsibility for sub-task	MPO
Cooperation	MRD, Railway Administration, regions, H3 team
Performance indicator	a) Construction of hydrogen infrastructure

Deadline	a) 31.12.2030

Task card	O3.4 Expansion of and adaptation of existing tools public support for the field of hydrogen projects
Card description	The rapid and successful launch of the hydrogen economy depends directly on the number of projects implemented. In this regard, the immediate extension of existing areas of public support to hydrogen projects would represent a significant acceleration. The task card is linked to other task cards.
Manager	Ministry of the Environment, Ministry of Industry and Trade

Sub-task	O.3.4.1 Creation of an overview of subsidy programs for the Hydrogen Strategy **Strategy**
Description	Conduct an analysis of available titles for the overall development of the hydrogen economy (i.e., typically for the support of electrolysers, filling stations, infrastructure, etc.).
Responsibility for sub-task	HYTEP
Cooperation	MPO, MŽP, MD, MMR, H3 team
Performance indicator	a) Creation of a website with an overview of subsidy programs for the area Hydrogen strategy b) Regular updates of the overview of subsidy titles on the HYTEP website
Deadline	a) 31 December 2024 b) Ongoing

Sub-task	O.3.4.2 Annual analysis of existing support programs in terms of fulfilling the objectives of the Hydrogen Strategy
Description	Based on an overview of subsidy programs, specific calls for proposals, and their utilization, identify areas of the Hydrogen Strategy that are not sufficiently covered by existing public support programs.
Responsibility for sub-task	HYTEP
Cooperation	MPO, MD, MŽP, MMR, SPČR, ČPS, H3 team
Indicator Fulfilment	a) Annual report "Possibilities for support programs for supporting the objectives of the Czech Hydrogen Strategy"
Deadline	a) Ongoing every year by 31 December

Sub-task	O.3.4.3 Updating subsidy programs

Description	Based on the annual report “Possibilities for using support programs for the objectives of the Czech Hydrogen Strategy”, propose changes to current subsidy programs
Responsibility for sub-task	MPO
Cooperation	MD, MŽP, MMR, MF
Indicator Fulfilment	a) Report with proposals for changes in subsidy programs and proposals gradual steps to implement them
Deadline	a) On an ongoing basis, every year within three months of the publication of the report "Possibilities for using support programs to promote the objectives of the Czech Republic's Hydrogen Strategy."

O4: Analyze the potential for converting gas boilers in households to natural gas blends and later to pure hydrogen, and assess the possibilities for financing the transition.

Card manager: MPO

Task card	Analyze the benefits and costs of the transition of gas boilers in households to a 20% blend and later to pure hydrogen. If these conversions are effective, analyze the possibilities for financing them.
Card description	Currently, gas boilers in households are suitable for burning natural gas. The timeline for these appliances begins with the introduction of natural gas to the market, i.e., before 1990. Gas boilers are differentiated according to their date of introduction to the market and certification tests (conformity assessment) using test gases G22 and G222 for flame failure testing. The latest series of gas boilers are already H2 Ready 20%, which means that they are ready to burn a blend of up to 20% hydrogen in natural gas. In the future, new product series of condensing boilers labeled H2 Ready 100% will allow the combustion of both a 20% blend and pure hydrogen. For the combustion of pure hydrogen, a minor technical modification will be necessary using a conversion kit containing all the components required to convert the boiler to pure hydrogen.
Manager	MPO

Sub-task	O4.1 In accordance with the plan to transition to a blend of up to 20% hydrogen in natural gas, prepare an analysis of the portfolio of appliances in operation, define the specifications for H2 Ready 20% gas boilers, and perform a analysis of the efficiency of the transition of gas boilers in households to a 20% blend.
Responsibility for the sub-task	ČPS
Cooperation	MPO, Distributors, APTT, Manufacturers of gas boilers for households outside APTT, MŽP, ERÚ, H3 team
Compliance indicator	1. Define the conditions for the H2 Ready 20% specification for domestic gas boilers. 2. Conduct an analysis and estimate of the total number of gas boilers in households that are in operation, ideally depending on a timeline from commissioning.

	3. Estimate which gas boilers can be used or retrofitted and which will need to be replaced in order to use the blend in places where the blend will be available and used up to 20%. 4. Following on from the O2 card, carry out a cost-benefit analysis of switching gas boilers in households to a 20% blend in line with the distribution network transformation plan. **If the result is positive, continue with the next steps**. 5. Develop a methodology for checking the readiness of gas boilers in households for a 20% blend. 6. Analyze the possibilities and propose how and from what sources the inspection of the readiness of gas boilers in households for a 20% blend will be financed and who will carry it out. 7. Analyze options for supporting the replacement of gas boilers in households and prepare documentation for notification of the relevant subsidy program to support the replacement of gas boilers with boilers suitable for operation with a blend or pure hydrogen.
Deadline	All completed by 31 December 2026

Sub-task	O4.2 In accordance with the clean hydrogen transformation plan, prepare an analysis of the portfolio of appliances in operation, define the specifications for 100% H2-ready gas boilers, and analyze the effectiveness of the transition of domestic gas boilers to pure hydrogen
Responsibility for sub-task	ČPS
Cooperation	MPO, Distributors, APTT, Manufacturers of household gas boilers outside APTT, Ministry of the Environment, ERÚ
Performance indicator	1. Define the conditions for the H2 Ready 100% specification for gas boilers. 2. Conduct an analysis and estimate the total number of gas boilers in households that are in operation, ideally depending on a timeline from commissioning. 3. Conduct an analysis of how many gas boilers in households will need to be replaced to use pure hydrogen in places where pure hydrogen will be available and used. 4. Following on from card M4, carry out a cost-benefit analysis of the transition of gas boilers in households to pure hydrogen in line with the distribution network transformation plan. **If the result is positive, continue with the next steps.** 5. Develop a methodology for checking the readiness of gas boilers in households to clean hydrogen. 6. Analyze the possibilities and propose how and from what sources the control of the readiness of OZP in households for clean hydrogen will be financed and by whom.

	7. Analyze options for supporting the replacement of gas boilers for households and prepare documentation for the notification of the relevant subsidy program to support the replacement of gas boilers with boilers suitable for operation with clean hydrogen.
Deadline	All completed by 31 December 2035

O5: Preparation and creation of a comprehensive legislative framework for the hydrogen economy in the Czech Republic, including certification of hydrogen produced

Card manager: MPO

Task card	05.1 Transposition of the revised directive on the promotion of the use of renewable energy sources
Card description	The Directive on the promotion of the use of renewable energy sources sets targets for Member States to increase the share of renewable energy sources and reduce greenhouse gas emissions in the industry and transport sectors. The Directive promotes the development of the hydrogen economy through mandatory targets for the replacement of grey hydrogen with renewable hydrogen (RFNBO) in hydrogen consumption in the industrial sector and promotes the development of hydrogen mobility through the mandatory consumption of renewable hydrogen in the transport sector from 2030 onwards. The legislative obligation will mainly affect certain chemical producers a n d fuel suppliers. The opening of the Act on Supported Energy Sources and the Act on Air Protection is expected. The transposition should be approached in a more comprehensive manner and linked, particularly in terms of the terminology used, to purely national laws such as the Fuel Act (issue of the non-existent definition of a supplier of fuels in the Act on fuels). The Directive on the promotion of the use of renewable energy sources only addresses the issue of RFNBO and its consumption. The transposition of the directive on the use of renewable energy sources cannot be a task within the framework of Hydrogen strategy, because it is a legislative requirement. Therefore, this transposition is not listed as a separate task in the task cards, only preparatory work for transposition. The Czech Republic has 18 months from the publication of the directive in the Official Journal of the European Union.
Responsible	MPO

Sub-task	O5.1.1 Launch of the coordination group between the Ministry of Industry and Trade and the Ministry of the Environment on the form of transposition and conditions for the entities concerned at national level
Responsibility for sub-task	MPO
Cooperation	MoE, SPČR, HYTEP, H3 team
Performance indicator	a) Establishment of a coordination group for the transposition of the new form Directive on the promotion of the use of renewable energy sources b) Analysis of the impact of the directive and its implementation into Czech law c) Analysis of the approach of neighbouring countries to the transposition of the directive with regard to the use of RFNBO

Deadline	a) 31.8.2024 b) 30 c) 30

Task card	O5.2 Transposition of the Directive on common rules for the internal market in renewable gas, natural gas and hydrogen and setting conditions for compliance with the Regulation on the internal market in renewable gas, natural gas and hydrogen. Creation of a comprehensive framework for the hydrogen economy in the Czech Republic through the amendment or creation of new decrees mirroring current regulations on natural gas.
Card description	The Directive focuses on common rules for the transmission, distribution, supply, and storage of gas through the gas system, including the establishment of rules for the functioning of this sector, market access, criteria and procedures for granting authorizations for the transmission, distribution, supply, and storage of gas, mandatory acceptance of hydrogen blends at cross-border interconnection points ( ) and interconnection points ( ), as well as and rules for the operation of systems. In connection with the transposition of the directive, a number of laws and decrees need to be updated. The key law that will need to be updated is Act No. 458/2000 Coll., on conditions for doing business and on state administration in the energy sectors and on amendments to certain laws (the Energy Act) and related secondary legislation.
Responsible	MPO

Sub-task	O5.2.1 Launch of a coordination group at the Ministry of Industry and Trade to discuss comprehensive changes to gas legislation in connection with the decarbonization package for the gas market
Responsibility for sub-task	MPO
Cooperation	Ministry of the Environment, ERÚ, OTE, ČPS, HYTEP, SPČR, H3 team
Performance indicator	a) Establishment of a coordination group for comprehensive changes to gas industry legislation legislation with the Ministry of Industry and Trade b) Analysis of the impact of the directive and regulation and its implementation into the Czech legal system c) Analysis of the approach of neighbouring countries to the transposition of the directive
Deadline	a) 30 b) 30 c) December 30, 2024

Subtask	O5.2.3 Amendment to Act No. 458/2000 Coll., on conditions for doing business and on state administration in the energy sectors and on amendments to certain acts (Energy Act)
Responsibility for sub-task	Ministry of Industry and Trade
Cooperation	Ministry of the Environment, Energy Regulatory Office, OTE, ČPS, HYTEP, SPČR
Performance indicator	a) Within the coordination group, initiate an assessment of the comprehensive revision of the Energy Act with regard to the development of the hydrogen economy and identify specific issues b) The law has been adopted in the collection of laws, and the directive on common rules for the internal gas market has been transposed into the Czech legislative framework.
Deadline	a) 31.12.2024 b) 31.12.2025

Sub-task	O5.2.4 Amendment or adoption of new decrees under the responsibility of the Energy Regulatory Office. According to preliminary identification, these could be the following decrees: • Decree No. 349/2015 Coll., on Gas Market Rules, as amended • Decree No. 488/2021 Coll., on conditions for connection to the gas system • Decree No. 401/2010 Coll., on the content requirements for rules for the operation of the transmission system, rules for the operation of the distribution system, rules for the transmission system operator, rules for the distribution system operator, rules for the underground gas storage operator, and the business conditions of the market operator market operator • Decree No. 513/2021 Coll., amending Decree No. 262/2015 Coll., on regulatory reporting, as amended • Decree No. 8/2016 Coll., on details of the granting of licenses for business activities in the energy sectors – if the license for hydrogen production facilities is subject to the rules under the Energy Act • Decree No. 489/2021 Coll., on procedures for registering support with the market operator and the implementation of certain other provisions of the Act on Supported Energy Sources (registration decree)
Responsibility for sub-task	ERÚ
Cooperation	MPO, MŽP, OTE, ČPS, HYTEP, SPČR, H3 team
Performance indicator	a) Within the coordination group, initiate an assessment of the current form of decrees under the ERÚ's remit and, if necessary, initiate amendments

	based on the decarbonization package, initiate an amendment process process.
Deadline	a) Assumption 2025-2026, following the outcome of the assessment and transposition of relevant European legislation (or earlier amendments to the Energy Act).

Sub-task	O5.2.5 Amendment or adoption of new decrees under the responsibility of the Ministry of Industry and Trade, based on the results of the coordination group's work. According to a preliminary analysis, the following decrees should be concerned: • Decree No. 108/2011 Coll., on gas metering and the method of determining compensation for damages in the event of unauthorized consumption, unauthorized supply, unauthorized storage, unauthorized transport or unauthorized distribution of gas • Decree No. 345/2002 Coll., laying down measuring instruments subject to mandatory verification and measuring instruments subject to type approval • Decree No. 344/2012 Coll., on the state of emergency in the gas industry and on the method of ensuring the safety standard of gas supply • Decrees and other regulations concerning gas storage facilities and extraction (44/1988, 61/1988, 62/1988, 71/1988, 104/1988, 71/2002, 85/2012) and safety (133/1985, 239/1998, 100/2001, 246/2001, 76/2002, 392/2003, 224/2015, 226/2015, 277/2015, 250/2021)
Responsibility for sub-task	MPO
Cooperation	MoE, ERÚ, OTE, ČPS, HYTEP, H3 team
Performance indicator	a) Within the coordination group, initiate an assessment of the current form of decrees under the responsibility of the MPO and, if necessary, initiate an amendment process based on the decarbonization package. process.
Deadline	a) Assumption for 2025-2026, based on the results of the assessment and transposition of relevant European legislation (or earlier amendments to the Energy Act).

Sub-task	O5.2.6 Adoption of EU standards and related updates to ČSN standards relating to hydrogen and the hydrogen economy, in particular to enable the repurposing of part of the Czech gas network for hydrogen pipelines and their operation
Responsibility for sub-task	Czech Standardization Agency, ČPS
Cooperation	MPO, HYTEP, TIČR, HZS, SUIP, ČMI, H3 team
Performance indicator	a) Standards adopted into the Czech framework and Czech technical standards enable the repurposing of part of the Czech gas infrastructure for hydrogen pipelines and set clear conditions for the operation of these hydrogen pipelines.

Deadline	a) 30.12.2025

Sub-task	O5.2.7: Amendment of national legislation in accordance with the requirements of Regulation (EU) 2022/869 (TEN-E)
Responsibility for sub-task	Ministry of Industry and Trade, Ministry of Regional Development
Cooperation	Government Office, NET4GAS, Ministry of Transport and Construction
Performance indicator	a) Amendment of national legislation, both at the level of laws and individual decrees, to enable the construction and operation of hydrogen infrastructure and the approval of such constructions by the fastest possible procedure, as required by Regulation (EU) 2022/869 (TEN-E).
Deadline	a) 31.12.2024

Task card	05.3 Licensing and obligations for hydrogen producers in the Czech Republic in relation to where the hydrogen will subsequently be used.
Card description	Once the new Energy Act comes into force, hydrogen will become an energy gas, and a license from the Energy Regulatory Office will be required for its production. In connection with the end use of hydrogen and assuming an island solution, it is appropriate for the state administration to come up with recommendations on how companies targeting hydrogen production in connection with the end use of hydrogen in the transport, industry, or energy sectors should proceed in obtaining the correct licenses. It is possible that a hydrogen producer may also be a dispenser at a filling station, in which case it will be necessary to obtain a trade license for the distribution of motor fuels, as well as a license for the production of hydrogen (gas under the Energy Act). Will it be possible to add an exception to the law for these purposes? What is the procedure for producing hydrogen for chemical purposes as a raw material?
Responsible	MPO

Subtask	O5.3.1 Creation of methodological guidelines/recommendations for the production of hydrogen and its use for transport, industry, and energy in connection with the amended Energy Act
Responsibility for sub-task	MPO
Cooperation	Ministry of the Environment, HYTEP, OTE, ČPS, ERÚ, H3 team
Performance indicator	a) Analysis of the situation arising from the new form of the Energy Act before the Energy Act enters into force

	b) Preparation of methodology/guidelines and publication on the MIT and HYTEP websites
Deadline	a) 30 b) 30

Subtask	O5.3.2 Amendment to the Fuel Act with regard to non-compliance Conditions for hydrogen fuel suppliers – primarily addressed in the task cards in the NAP CM
Responsibility for sub-task	MPO
Cooperation	MoE, HYTEP, OTE, ČPS, H3 team
Performance indicator	a) Completion of the task card within the NAP CM and inclusion of hydrogen mobility representatives in discussions on amending the law
Deadline	a) 30.12.2024

Sub-task	O5.3.3 Opening up the possibility of amending the conditions of the Trade Licensing Act for the production of hydrogen as a chemical substance with regard to the implementation of pilot projects
Responsibility for the sub-task	MPO
Cooperation	HYTEP
Performance indicator	a) a) With regard to the Energy Act, opening a discussion on the appropriateness of using the Trade Licensing Act and linking it to the Energy Act in relation to hydrogen (gas) production
Deadline	a) 30.8.2024

Sub-task	O5.3.4 Exemption from the requirement for an ERÚ licence for production in installations up to 2 MWe (1 ton of hydrogen per day) where hydrogen is not sold to third parties but is used for internal purposes or for pilot testing
Responsibility for sub-task	MPO
Cooperation	HYTEP, SPČR
Performance indicator	a) With regard to the Energy Act, opening a discussion on the appropriateness of granting exemptions for projects (e.g. companies, households) that will implement similar projects b) Ensure that the task card is taken into account in negotiations within the framework of amendment of the Energy Act

Deadline *Deadline*	a) 31 b) 31 December 2025, as part of the transposition of the gas package

Task card	05.4 Certification for the production and consumption of low-carbon hydrogen and RFNBO in the Czech Republic and certification for blending hydrogen into natural gas
Card description	Certification will be a key aspect of emissions reduction reporting for companies that will be required to meet sectoral targets under the Renewable Energy Directive or that will aim to reduce their emissions through the use of low-carbon hydrogen, for example to reduce the burden of the EU ETS1 and 2 emissions trading system. This mainly concerns RFNBO certification under the sustainability certificate system (similar to guarantees of origin) in line with mandatory greenhouse gas emission reduction targets and sectoral targets under the Renewable Energy Directive. The extension of the guarantee of origin system to include guarantees of origin for RFNBO and low-carbon hydrogen will also be a potentially important certification mechanism. In addition, it is necessary to start addressing the issue of sustainability reporting for the blending of natural gas with hydrogen in the gas system.
Responsible	MPO

Sub-task	O5.4.1 Extend the hydrogen guarantee of origin system to include RFNBOs and low-carbon hydrogen
Responsibility for sub-task	MPO
Cooperation	Ministry of the Environment, HYTEP, OTE, SPČR
Performance indicator	a) Extension of the system of guarantees of origin to include RFNBO and low-carbon hydrogen
Deadline	a) 30 December 2025

Sub-task	O5.4.2 Review of certification options for injecting RFNBO and low-carbon hydrogen into the gas system and its consumption in end-use equipment, taking into account both the sustainability certificate system sustainability certificate system and guarantees of origin
Responsibility for sub-task	MPO
Cooperation	Ministry of the Environment, HYTEP, OTE, SPČR
Performance indicator	a) Extension of the system of guarantees of origin to include RFNBO and low-carbon hydrogen

Deadline	a) 30 December 2025

Sub-task	O5.4.3 Amendment of laws and decrees relating to O5.1 to O5.3 (165/2012, 328/2022, 166/2022, 489/2021, 79/2022)
Responsibility for sub-task	MPO
Cooperation	Ministry of the Environment, HYTEP, OTE, SPČR
Performance indicator	a) Revision of individual laws and decrees
Deadline	a) 30 December 2025

M1: Create conditions for the internationalization of Czech companies, export of technologies and efficient production of renewable hydrogen in foreign regions ***Card manager: MIT***

Task card	M1.1 Preparation of trade missions and information seminars for Czech technology suppliers and investors, preparation of a comprehensive product offer
Card description	The Czech Republic develops and manufactures a wide range of technologies for the production, storage, and use of hydrogen. The aim of is to open technological suppliers the way to foreign markets. We will strive to ensure that Czech companies and organizations are not only subcontractors, but also investors who can build independently or in cooperation with other suppliers/investors technological equipment abroad.
Manager	MPO

Sub-task	M1.1.1 Preparation of trade missions for Czech companies in the form of trade missions organized in cooperation with the Ministry of Foreign Affairs and the diplomatic missions of the Czech Republic and the Czech Trade Promotion Agency (or CzechInvest) in the relevant countries, and preparation of the participation of Czech companies in the relevant meetings of joint bodies for economic cooperation with individual countries.
Responsibility for sub-task	MPO
Cooperation	MFA, CzechTrade, CzechInvest, HYTEP, other business partners
Performance indicator	a) Implementation of technology missions focused on hydrogen.
Deadline	a) Interim evaluation in Q2 of the following year

Sub-task	M1.1.2 Information seminars on opportunities for supporting technology exports, preparation of a database and product offerings for hydrogen technologies that can be shared with foreign partners
Responsibility for sub-task	MPO
Cooperation	CzechTrade, HYTEP. CzechInvest
Performance indicator	a) creation of a database of hydrogen technology exporters and a comprehensive product range b) information seminars on export support opportunities to various territories, at least one every two years c) annual evaluation of the success of hydrogen technology exports companies

Deadline	a) 31 December 2025 b) Interim evaluation in Q2 of the following year c) Interim evaluation in Q2 of the following year

Sub-task	M1.1.3 Information for potential Czech investors about the relevant territories so that they have the background information they need to make investment decisions
Responsibility for sub-task	MPO
Cooperation	MFA, CzechTrade, CzechInvest, Czech Export Bank, EGAP
Performance indicator	a) Organization of at least one information seminar for investors per year b) evaluation of the success of investment activities in the field of hydrogen technologies
Deadline	a) interim evaluation in Q2 of the following year b) interim evaluation in Q2 of the following year

Sub-task	M1.1.4 Preparation of incoming missions for potential foreign partners in the field of hydrogen technologies organized in cooperation with the Ministry of Foreign Affairs and the diplomatic missions of the Czech Republic and the export support agency CzechTrade (or CzechInvest) in the relevant countries.
Responsibility for sub-task	MPO
Cooperation	MFA, CzechTrade, CzechInvest, HYTEP, other business partners
Performance indicator	a) Implementation of incoming missions focused on hydrogen.
Deadline	a) Interim evaluation in Q2 of the following year

Task card	M1.2 Support for the launch of commercial hydrogen production in foreign regions
Card description	Due to climatic conditions, it will not be possible to produce sufficient quantities of renewable hydrogen in the Czech Republic. We will have to import large quantities of renewable hydrogen or its compounds. Czech companies could produce renewable hydrogen or its compounds abroad and, if necessary, import it to the Czech Republic.
Responsible	MPO

Sub-task	M1.2.1 Utilize existing programs to support Czech companies that plan to produce renewable hydrogen or its compounds abroad, through tools support , including information

	on support programs for potential investors in hydrogen production abroad, primarily in areas from which we will be able to import hydrogen or its compounds. hydrogen or its compounds.
Responsibility for the sub-task	MPO
Cooperation	Ministry of Foreign Affairs, CzechTrade, CzechInvest, HYTEP, EGAP, ČEB
Performance indicator	a) Number of successful hydrogen production projects abroad
Deadline	a) Interim evaluation in Q2 of the following year of the success of the measures taken

M2: Ensuring sufficient, predictable, and price-stable supplies of renewable and low-carbon hydrogen depending on demand in the Czech Republic, which is currently estimated at 1,000,000 tons (33 TWh) for 2040

Card manager: MPO

Task card	M2.1 Ensuring hydrogen supplies from abroad to the Czech Republic
Card description	The Czech Republic will have to import large quantities of renewable or low-carbon hydrogen from abroad, as we will not be able to produce it at an acceptable price. To this end, it is necessary to ensure stable and predictable supplies of hydrogen from EU Member States or third countries. In order to import hydrogen, it is first necessary to build the relevant infrastructure, which is covered in task card M3.
Responsible	MPO

Sub-task	M2.1.1 Through G2G trade and economic instruments of the Ministry of Industry and Technology (including export support instruments and economic diplomacy of the Czech Republic), support negotiations with countries that are potential exporters of hydrogen to the Czech Republic.
Responsibility for sub-task	MPO
Cooperation	Gas/hydrogen traders, NET4GAS, large hydrogen consumers
Performance indicator	a) Number of meetings and missions focused on the import of renewable hydrogen or its compounds into the Czech Republic.
Deadline	a) Interim evaluation in Q1 of each year

Sub-task	M2.1.2 Authorization of traders to negotiate future supplies to the Czech Republic (from the EU and third countries) with a view to concluding medium- and long-term contracts for hydrogen supplies to the Czech Republic from the year of completion of the repurposing of the necessary sections of the gas transmission system.
Responsibility for sub-task	MPO
Cooperation	NET4GAS, gas/hydrogen traders, large hydrogen consumers
Performance indicator	a) Contracts concluded for hydrogen imports in accordance with the hydrogen import plan.
Deadline	a) Interim evaluation in Q1 of each year

Sub-task	M2.1.3 Active communication at the interdepartmental and, where necessary, intergovernmental level with Germany with a view to creating a future liquid hydrogen market in Germany (for the purchase of short-term hydrogen commodity products for the Czech Republic)
Responsibility for sub-task	MPO (ÚV, other ministries as needed)
Cooperation	Gas/hydrogen traders, NET4GAS, ERÚ. Close cooperation between the MPO and partner organizations in Germany (Ministry of Economic Affairs and Climate Action (BMWK), NRA (BNetzA), etc.) is also expected.
Performance indicator	a) Organization of bilateral meetings, participation in consultations.
Deadline	a) Interim evaluation in Q1 of each year

Sub-task	M2.1.4 Create a "Strategic Plan for the Import, Export, and Transport of Hydrogen" that will be based on concluded and planned contracts for the transport, production, and consumption of hydrogen and will define the flow of hydrogen at the entry points of the gas transmission system into the Czech Republic
Responsibility for the sub-task	MPO
Cooperation	Gas/hydrogen traders, NET4GAS, large hydrogen consumers, regions, H3 team
Performance indicator	a) Strategic Plan approved at the level of the Ministry of Industry and Technology
Deadline	a) 31 December 2026

M3: Repurposing selected parts of the gas transmission system in the Czech Republic for the import of hydrogen to supply consumers in the Czech Republic from 2030 and to ensure the transit of clean hydrogen through the Czech Republic

Card manager: MIT

Task card	M3.1: Active political support for the integration of parts of the Czech gas transmission system into European hydrogen transport corridors.
Card description	Connecting expected production regions of affordable hydrogen (e.g., Ukraine, North Africa, Southeast Europe) with demand centers (e.g., Germany) is theoretically possible even via routes that do not pass through the Czech Republic. These alternative routes (although often several times more expensive than the Czech route) have received significant political support inrecent years (at ministerial and prime ministerial level), which has proved crucial, for example, in the assessment of applications in the PCI (Projects of Common Interest) process. Political support from the Czech government therefore appears to be absolutely essential for the feasibility of task M3.
Responsible	MPO

Sub-task	M3.1.1: Conclusion of intergovernmental agreements/memoranda to support hydrogen corridors running through the Czech Republic with other countries along these corridors.
Responsibility for sub-tasks	MPO
Cooperation	NET4GAS
Performance indicator	a) Concluded intergovernmental agreements/memoranda with all countries along the relevant corridors on support for these projects.
Deadline	a) 31 December 2024 (due to the use of these agreements/memoranda for the next round of PCI applications)

Sub-task	M3.1.2: Active political support for Czech projects for hydrogen transport within strategic infrastructure initiatives and in the next round of the selection process for projects of common interest (PCI)
Responsibility for sub-task	MPO
Cooperation	MFA, ERÚ, Permanent Representation of the Czech Republic to the EU, NET4GAS
Performance indicator	a) Active participation of representatives of the MIT, MFA, ERÚ and Permanent Representation of the Czech Republic to the EU in relevant meetings of regional groups for the selection of PCI projects with the EC. Statement support in consultations for candidate projects for PCI status.

Deadline	a) According to the schedule for the next PCI selection process in 2024/2025.

Task task	M3.2: Creation of a financial and regulatory framework for the repurposing of a selected part of the Czech gas transmission system.
Card descript ion	Effective use of available EU funds – directly managed or under shared management, or national subsidy programs for financing repurposing and setting up a suitable regulatory framework in the context of the gradual rollout of the hydrogen economy (with initial costs shared among only a small number of users) are key to both the economic feasibility of repurposing projects and the economic feasibility of connecting end consumers to the hydrogen transport system.
Manager	MPO

Sub-task	M3.2.1: Enabling the effective use of available EU funds – directly managed or under shared management, or national subsidy titles for financing repurposing and connecting end consumers to the hydrogen transport system.
Responsibility for sub-task	MPO
Cooperation	MoE
Performance indicator	a) Specific programs are approved and available for projects in the areas of repurposing gas transport networks and connection end consumers to the hydrogen transport system.
Deadline	a) December 31, 2025 (to allow for the conclusion of a legal act for the award of a grant no later than in Q1 2026 and the inclusion of a grant for potential FID projects for repurposing in 2026)

Sub-task	M3.2.2: Setting up an appropriate regulatory framework in the context of the gradual roll-out of the hydrogen economy.
Responsibility for sub-task	ERÚ
Cooperation	MPO
Performance indicator	a) Regulatory framework incorporated into the "Price Regulation Principles for the 6th regulatory period". a) The rules laid down provide incentives for the use of regulatory incentives.

Deadline	According to the schedule for the creation of the regulatory framework for the 6th regulatory period.

Task card	M3.3: Proposal for the repurposing of a selected part of the Czech gas transmission system.
Task card	Only a technically feasible and economically efficient option that can be implemented before 2030 and does not disrupt the security of natural gas supplies to the Czech Republic is implementable.
Manager	MPO

Subtask	M3.3.1: Preparation of a feasibility study (technical solution including arguments, costs, schedule) for the initial hydrogen corridors (southern and western branches).
Responsibility for sub-task	NET4GAS
Cooperation	
Performance indicator	a) Feasibility study for the conversion of the southern and western branches within the Czech gas transmission system prepared.
Deadline	a) 31.12.2025

Sub-task	M3.3.2: Repurposing of part of the Czech transmission system (at least provided that the conditions in sub-tasks 3.1 and 3.2 are met)
Responsibility for sub-task	NET4GAS
Cooperation	MPO
Performance indicator	a) Selected part gas transport capable capable of transporting hydrogen
Deadline	a) 31.12.2029

M4: Economically efficient repurposing of gas distribution systems and their connection to the hydrogen gas transmission system by 2028 and beyond

Card manager: MPO

Task card	M4.1 Path of transformation of the gas distribution system
Card description	Prepare a plan for transforming the distribution system to the target state in 2050 2050 from the perspective of the type of distributed gases.
Responsible	MPO

Sub-task	M4.1.1 Prepare a plan for transforming the gas distribution system in scenarios Definition of scenarios for the use of hydrogen, biomethane and natural gas in the Czech Republic – import and consumption locations, types of consumption and volumes over time. The plan will include the following for each scenario: • the target status of the use of individual types of gas in individual locations systems • transformation path to the target state, i.e., preference of areas, logical connections resulting from gas availability and system topology.
Responsibility for the sub-task	MPO – Defining the basic parameters of the gas distribution system transformation plan, member of the Steering Committee, approval of the study ČPS – Preparation of the gas distribution system transformation plan
Cooperation	MPO, ČPS, MŽP, gas distributors, NET4GAS, storage facility operators, ERÚ, SPČR
Performance indicator	a) Are there plans to transform the gas distribution system by 2050 in a defined level of detail
Deadline	a) 31 December 2025+ subsequent interim reviews

Sub-task	M4.1.2 Detailed action plan 2026-2030 Based on the gas distribution system transformation plan defined in M4.1.1, prepare a medium-term action plan for 2026-2030 containing, in particular: • no-regret steps according to individual scenarios, • points on the critical path to the target state, • identify missing points not described in these cards.
Responsibility for sub-task	ČPS
Cooperation	Ministry of Industry and Trade, Ministry of the Environment, gas distributors, NET4GAS, storage operators, ERÚ, SPČR

Performance indicator	a) There is a plan to transform the gas distribution system by 2030 in sufficient detail
Deadline	a) 31 December 2025

Task card	M4.2 Readiness of technical and legislative rules for repurposing gas distribution systems – follow-up to O2.1
Task card	Parts of the distribution system will be transformed for use with pure hydrogen. The task card aims to set rules for this transformation and prepare technical standards and documentation for legislative changes. It is closely linked to task card O2.1 and its individual subtasks, as well as to task card O5.
Task manager	MPO

Subtask	M4.2.1 Setting technical rules for clean hydrogen distribution in the distribution system and at delivery and transfer points (measurement, materials, procedures). Setting safety aspects for working on gas equipment operated with clean hydrogen. Implementation of necessary changes to technical standards and identification of any necessary changes to legislation (link to to O5 and O2.1.1)
Responsibility for sub-task	MPO
Cooperation	TIČR, HZS, SUIP, ČPS, gas distributors, ERÚ
Performance indicator	a) Are established technical and safety requirements for the operation of distribution systems and OPZ with pure hydrogen and implemented in technical standards. Are the necessary changes in legislation identified? Are the supervisory authorities prepared? carry out checks within their powers with sufficient intensity.
Deadline	a) 31.12.2026

Sub-task	M4.2.2 Determination of rights and obligations during inspections of end-use equipment. The owner of the supply point is responsible for domestic distribution systems and end-use equipment. The rights and obligations of owners with regard to the transition to clean hydrogen must be defined, i.e., who will carry out the inspection, who will bear the costs, any mandatory access to the premises, and the procedure in the event of non-cooperation by the entity concerned. Identification of necessary changes to laws and regulations (linked to O5). This can be partially resolved in O2.1.2, using the outputs from O2.1.2.
Responsibility for sub-task	MPO

Cooperation	ERÚ, ČPS
Performance indicator	a) There is an approved procedure for inspecting domestic distribution systems and end-use equipment for blended and pure hydrogen. The responsibilities of individual members of the value chain are defined. The necessary legislative changes have been proposed.
Deadline	a) 31.6.2028

Sub-task	M4.2.3 Establishment of rules for dealing with customers who cannot accept pure hydrogen. Conditions and solutions must be established for situations where existing customers cannot convert their technology and appliances to pure hydrogen. Identification of necessary legislative changes and regulations (linked to O5).
Responsibility for sub-task	MPO
Cooperation	ERÚ, ČPS, SPČR, distribution system operators
Performance indicator	a) Rules have been established for customers who cannot accept pure hydrogen. The responsibilities of supervisory authorities and industry have been defined. The necessary amendments to to laws and technical standards.
Deadline	A) 31.6.2028

Task card	M4.3 Preparation of selected parts of the gas infrastructure for clean hydrogen
Card description	Implementation of the preparation of gas infrastructure for clean hydrogen
Responsible	MPO

Subtask	M4.3.1 Determination of and possible replacement of incompatible elements for the distribution of pure hydrogen in the distribution system.
Responsibility for sub-tasks	ČPS
Cooperation	Gas distributors
Performance indicator	a) Distribution system equipment ready for clean hydrogen.
Deadline	a) Deadlines for the regions according to the gas distribution system transformation plan defined in M4.1

Task card	M4.4 Setting of for for hydrogen distribution infrastructure during the transition period

Card description	Complete setup of control for parts of the system operated on pure hydrogen. Adjustment of control for the transition period. Adjustments will be necessary for control period 7 or control period 8 depending on how the situation develops. Identification of necessary changes in legislation in connection to card O5.
Manager	MPO

Subtask	M4.4.1 Setting rules for the regulation of hydrogen infrastructure Establish rules based on the Gas Package so that they are fair to both gas consumers and producers, both during the transition period and in the target state. Identify necessary changes in legislation (link to card O5, legislative part 2).
Responsibility for sub-task	ERÚ
Cooperation	ČPS, MPO, gas distributors
Indicator Fulfilment	a) Regulatory rules set for the transition period for both for hydrogen and for the natural gas system.
Deadline	a) 30 June 2028 or postponement according to M4.1

Sub-task	M4.4.2 Identification and setting of rules specific to transformation, such as conditions for closing parts of the system. Identification of necessary changes in legislation (link to card O5).
Responsibility for sub-task	ERÚ
Cooperation	ČPS, MPO, gas distributors, SPČR
Performance indicator	a) Specific transformation issues identified and solutions proposed. Background documents for legislative changes prepared.
Deadline	a) 31 June 2028 or postponement according to M4.1

Task card	M4.5 Identification of needs for setting up a tariff model reflecting “Sector Coupling” in the long term – follow-up to O2.4
Card description	Identification of the need to change the regulatory environment for the electricity and gas industries in order to stabilize the electricity grid in an environment of increased installed renewable energy capacity and implementation of these measures – long period for connection to a grid operated on clean hydrogen.
Responsible	MPO

Sub-task	M4.5.1 Identification of the need to change regulations for the absorption of unusable electricity produced from RES by the gas system over a long time period (regulatory period 7). Implementation of regulatory changes.
Responsibility for sub-task	ERÚ
Cooperation	ČEPS, NET4GAS, gas and electricity distributors
Performance indicator	a) Regulation is set so that all potential production of renewable electricity and that cannot be used in the electricity grid is used within the gas network.
Deadline	a) 30.6.2028

M5: ***Create conditions for the construction or purchase of storage capacities for seasonal hydrogen storage***

Card manager: MPO

Task card	M5.1 Assess conditions for the construction or purchase of underground storage capacities for seasonal hydrogen storage
Card description	The storage of large quantities of hydrogen must be ensured both in terms of the commercial availability of the required amount of hydrogen in the Czech Republic at any given time and in terms of the security of its supply. The following must be examined: 1) existing underground natural gas storage facilities in terms of above-ground technology and storage horizons, 2) to investigate other potentially suitable geological structures in the Czech Republic, 3) verify the possibilities of hydrogen storage in neighboring countries and its transport to the Czech Republic, 4) ensure legislative readiness for underground hydrogen storage. It is likely that current underground storage facilities will continue to be needed and used for natural gas storage in the near future, so it is important to also focus on assessing the readiness for blending natural gas and hydrogen and the aspects of repurposing storage facilities for pure hydrogen (time, technical), so that underground storage facilities can be ready when storage is needed.
Manager	MPO

Sub-task	M5.1.1 Assessment of existing underground gas storage facilities/individual storage facilities in terms of above-ground technology and storage horizons for natural gas and hydrogen blends, determination of the maximum percentage of hydrogen in the blend
Responsibility for sub-task	gas storage facility operators
Cooperation	ČBÚ, ČPS, ČGS, MPO
Performance indicator	a) Study with assessment of individual existing underground gas storage facilities operated in the Czech Republic for the storage of hydrogen and natural gas blends.
Deadline	a) 30 June 2026

Subtask	M5.1.2 Assessment of existing underground gas storage facilities/individual storage facilities in terms of above-ground technology and storage horizons for the storage of pure hydrogen, identification of suitable structures and determination of the process for their conversion (repurposing) from natural gas storage facilities natural gas storage facilities
Responsibility for sub-task	gas storage facility operators

Cooperation	Czech Mining Authority, Czech Geological Survey, Czech Geological Survey; Ministry of Industry and Trade
Indicator Fulfilment	a) Study assessing existing underground storage facilities, proposed conversion (repurposing) process.
Deadline	a) 31 December 2027

Subtask	M5.1.3 Assessment currently unused suitable natural rock structures for the storage of pure hydrogen
Responsibility for sub-task	MPO
Cooperation	Gas storage operators, ČPS, ČGS
Indicator Fulfilment	a) Study identifying suitable structures, including their technical parameters
Deadline	a) 30 June 2026

Subtask	M5.1.4 Verify the possibility of hydrogen storage in neighboring countries and the method transporting it to the Czech Republic
Responsibility for sub-task	MPO
Cooperation	Gas storage operators, ČPS
Performance indicator	a) Study with list of suitable foreign storage facilities in terms of sufficient volume, accessibility, and security of supply
Deadline	a) 31.12.2028

Subtask	M5.1.5 Assessment of existing legislation in the field of mining activities and ensuring its compatibility with the objective of storing hydrogen in underground storage facilities
Responsibility for sub-task	MPO
Cooperation	gas storage operators, ČBÚ, ČPS
Performance indicator	a) Study assessing existing legislation in the energy and mining and, in cases of incompatibility, proposing amendments
Deadline	a) 31 December 2025

Sub-task	M5.1.6 Assessment of the possibilities for the effective use of available national and international funds (for financing the repurposing of existing underground gas storage facilities or the construction of new storage facilities
Responsibility for sub-tasks	MPO
Cooperation	Ministry of the Environment
Performance indicator	a) Specific national and international support programmes available for projects involving the repurposing of underground gas storage facilities or the construction of new facilities.
Deadline	a) 31.12.2027

Sub-task	M5.1.7: Based on the analyses carried out, propose optimal options for long-term hydrogen storage in underground storage facilities.
Responsibility for sub-task	MPO
Cooperation	Operators of land-based gas storage facilities, ČPS, ČGS
Performance indicator	a) Study proposing options for hydrogen storage in underground storage facilities
Deadline	a) 31 December 2029

Task card	M5.2 Assess the conditions for enabling long-term (seasonal) surface storage of hydrogen compounds
Card description	In addition to long-term storage of hydrogen in gaseous form in underground reservoirs, it is also advisable to explore the possibilities of storing hydrogen compounds (ammonia, LOHC, methanol, etc.), which offer the advantage of high energy storage capacity at normal temperature and pressure. Existing technologies for the storage of chemical and large-volume storage of chemical raw materials and, in some cases, already built above-ground storage tanks can be used for the storage of hydrogen compounds. It will be necessary to evaluate activities in other countries in this area and assess the economic, technological, logistical, safety, environmental, legal, and regulatory aspects. The the issues of the time feasibility of this type of storage.
Manager	MPO

Sub-task	M5.2.1 Assessment of the possibility for (seasonal) storage of hydrogen compounds ( ) in large-volume containers ( ) and in near-surface storage facilities ( ) – assessment of technological, economic, logistical, safety, environmental and legal aspects. Assessment of

	existing large-volume storage facilities for hydrogen compounds ( ) in near-surface storage facilities (
	storage tanks – assessment of technological, economic, logistical, safety, environmental and legal aspects. Assessment of existing large-volume storage tanks for hydrogen compounds, or identification of sites for the construction of new storage tanks.
Responsibility for sub-task	MPO
Cooperation	Technical universities, relevant project and engineering organizations, ČPS, SCHP CR, HYTEP
Performance indicator	a) Study assessing the possibilities storage hydrogen hydrogen in near-surface storage facilities with regard to the needs of the Czech Republic b) A study identifying the conditions for the storage of hydrogen compounds, assessing existing large-volume storage facilities and analyzing sites for the construction of new storage facilities.
Deadline	a) 30 June 2026 b) 31.12.2028

Task card	*M5.3 Assess options for large-scale and long-term storage of liquid hydrogen.*
Card description	The last option for storing hydrogen is to store it in a liquid state. This method of storage is technologically and economically very demanding. Therefore, it is necessary to carry out in the first step an economic technical feasibility study.
Manager	MPO

Subtask	M5.3.1 Economic and technological feasibility feasibility of large-scale and long-term storage of hydrogen in liquid form based on the current state of technology.
Responsibility for sub-task	MPO
Cooperation	ČPS, HYTEP
Performance indicator	a) Feasibility study
Deadline	a) 31.12.2027