

Türkiye Hydrogen Technologies Strategy and Roadmap

Yasemin Polat¹, Celal Erbay¹

¹Turkish Energy, Nuclear and Mineral Research Agency

Ministry of Energy and Natural Resources have declared that hydrogen as one of the priority areas for building a carbon-neutral economy model by using hydrogen. By achieving this vision, “Türkiye Hydrogen Technologies Strategy and Roadmap” was developed by TENMAK and announced by the Minister on January 2023. It has been emphasized that the green hydrogen will be an important element for the country's net zero emission targets. It was aimed to establish a nationally guided research, technology development support and application program for the domestic development of hydrogen technologies and to determine a strategic action plan beforehand. Within the scope of the report, 20 needs are determined and 31 solutions are offered in terms of production and usage, storage and distribution, industry usage, non-technological needs. The targets of the Türkiye for the hydrogen production are determined as follows:

1. To reduce the cost of green hydrogen production below 2.4 USD/kgH₂ by 2035 and below 1.2 USD/kgH₂ by 2053,
2. To ensure that the installed power capacity of the electrolyzer reaches 2 GW in 2030, 5 GW in 2035 and 70 GW in 2053.

The vision of the report is to play a leading role in the world in the production and use of green hydrogen by developing the most advanced domestic and national technologies. Some policies in the report are determined as follows:

1. By reviewing the current legislation, to make it suitable for “hydrogen production, transportation storage and use.
2. To encourage R&D and P&D for the development and production of domestic and national technologies (electrolyzer, fuel cell etc.).
3. To collaborate internationally on issues related to industry, technology, standards, certification, and development, supply chain and trade opportunities.
4. To export surplus green hydrogen or ammonia to the world and especially to the European Market with our domestic technologies.
5. To use domestic resources especially boron mine in hydrogen storage.

In order to support decarbonization, TENMAK also developed Technology and Product Development Projects Support Program (TUGEP). Hydrogen Technologies and The Fuel Cell Call was opened in 2022 with prioritising the need of our country in the hydrogen technologies field. The three main topics listed below were primarily targeted in the hydrogen technologies call;

1. Clean hydrogen production technologies (with a production capacity of at least 100 kg per day)
2. Storage and liquefaction technologies (high pressure storage tanks, tanks to be produced with new generation materials, sodium

boro hydride storage, metal hydride-based absorbent storage, new generation chemical storage systems)

3. Fuel cell technologies (a modular package with a power output of at least 10 kW depending on the application area)

As part of the Roadmap, the R&D and innovation priorities have been elaborated and are summarized by the following areas:

1. H₂ production: development of electrolyser and mass production of hydrogen (boron technologies) in integrated facilities covering safety standards. R&D activities will be carried out for the production of hydrogen and synthetic gas from lignite and organic wastes. In order to increase the production of green hydrogen, it is planned to increase the production and share of renewable energy.

2. H₂ storage and distribution: production of storage facilities such as pressurized tanks for land vehicles, metal hybrids, and cryogenic tanks in the aviation, space and defence industries. Production of H₂ storage systems for stationary and mobile marine and aerospace applications. It is aimed to use domestic resources, especially boron, in hydrogen storage.

3. H₂ use:

- 3.1. Mobility applications: hydrogen refuelling stations will be installed and expanded in Türkiye to meet the fuel needs. Some of these studies are:

- Storage analysis for pressurized and liquid hydrogen transport vehicle;

- Demonstration studies for hydrogen transport at sea;

- 20 kW, 100 kW and 100-300 kW Fuel Cell (FC) land vehicle applications; 20 kW and 200-300 kW FC sea vehicle applications; 10 kW and 100-300 kW FC rail vehicle applications; 5 kW, 20 kW, 50-100 kW and 100-200 kW FC UAV and aircraft applications; 5-50 kW and 50-100 kW fuel cell airport application

- 3.2. Heat and power: the goals are to achieve 1-20% and 20-100% of a hydrogen natural gas turbine, boiler, etc technology and to blend a quantity of 5-20% and 20-100% of hydrogen in the natural gas grid for domestic and industrial use.

References

- [1] Türkiye Hydrogen Technologies Strategy and Roadmap (2023)



Yasemin Polat is with the Department of Energy and Technology Policies, TENMAK. Having graduated from Hacettepe University, Physics Engineering in 2016. Yasemin Polat obtained her M.SC in 2021 from The University of Manchester, Nuclear Science and Technology. Currently, doing her Ph.D. at Hacettepe University, Physics Engineering.

Presentating author: Yasemin POLAT e-mail: yasemin.polat@tenmak.gov.tr tel:+90 312 295 87 00 (4687)