

Governments are shaping their hydrogen ambitions

Many governments across the globe have announced ambitious hydrogen plans to decarbonise economies and increase gas independence. Big money is invested in hydrogen production, infrastructure and demand. Most countries focus on green hydrogen despite the better economics of grey and blue hydrogen



3d rendering of Hydrogen renewable energy production

Source: Shutterstock

Governments across the globe present their hydrogen budgets

The Hydrogen Council, an international organisation created by the CEOs of a number of leading companies, believes that hydrogen could meet 18% of total global energy demand in the long term and create a €2 trillion market. But for the moment, the market is still in its infancy and needs a lot of policy support. According to Bloomberg New Energy Finance, as of July 2021, 43 countries have released or are about to release hydrogen roadmaps.

Some governments have announced big numbers, like Germany, Spain, France and the United States. But these numbers are extremely hard to compare, as time horizons are difficult to interpret, some of the budgets involve private investments too. The amounts are often not yet backed with policy instruments and the numbers might target different parts of the hydrogen value chain (infrastructure only versus stimulation of hydrogen production as well as demand).

Announced hydrogen budgets by governments

Country	Allocated budget for hydrogen projects	Indicative timeline
Italy	€10.5bn*	2021-2030
Germany	€9bn	2021-2030
Spain	€9bn**	2021-2030
France	€7.2bn	2021-2030
The United States	€6.7bn	2021-2030
The Netherlands	€1.1bn	2020-2030
Japan	€340m	2021-2030
Australia	€340m	2021-2022

*Preliminary budget

**Mix of public and private investments

Source: ING Research

In this article we take a closer look at hydrogen policies in Europe, Asia and North America.

The European Union aims for 13-14% of hydrogen in energy mix by 2050

In July 2020, the European Commission revealed its hydrogen strategy with the [Hydrogen Strategy for a Climate-Neutral Europe](#) publication. The European Union wants to have a net-zero carbon economy by 2050 and believes that, while renewables will account for a large part of the energy decarbonisation in the future, hydrogen has an important role to play.

The goal of the plan is to increase hydrogen's share of the market from less than 2% in 2020 up to 13-14% by 2050. The most optimistic scenario forecasts a hydrogen share within the energy mix of up to 24% by 2050.

13-14%

Hydrogen share in the EU energy mix

By 2050 in the main scenario

The European hydrogen plan includes a three phase roadmap

Phase one: from 2020 up to 2024, the objective is to install at least 6 GW of renewable hydrogen electrolyzers in the EU and to produce up to 1 million tonnes of [green hydrogen](#). The European Clean Hydrogen Alliance, which brings together industry, public authorities and civil society, will develop an investment agenda and concrete projects.

Phase two: running from 2025 to 2030, the scale-up of hydrogen production, distribution and use is aiming at the installation of at least 40 GW of renewable hydrogen electrolyzers to produce 10 million tonnes of green hydrogen.

Phase three: from 2030 onwards, green hydrogen should reach maturity and should be

used in all sectors that are currently harder to decarbonise, such as manufacturing, aviation, trucks, shipping and buildings.

The European Commission believes that the scale-up of green hydrogen will require a total investment of €470bn over the next 30 years.

€470bn Investment need for green hydrogen
Up to 2050

The exact budget that will be dedicated to hydrogen is not yet well defined. The approach seems to include a mix of incentives and loans. The European Investment Bank and a number of European programmes could be used. Amongst the programmes that directly mention support to hydrogen projects, the InvestEU and the Horizon Europe programmes are, in our view, amongst the most interesting.

- The **InvestEU program**, dedicated to the pandemic recovery, green growth, employment and well-being across Europe, is one of the funding possibilities. An updated programme was launched in March 2021 with a €372bn budget to boost investment, innovation and job creation in Europe over the period 2021-2027. €26.2bn will be backed by a guarantee and the European Investment Bank will be the main financial partner and should deliver on 75% of the EU guarantee. The remaining 25% of the budget will be shared between other partners which will be selected by the Commission. The first wave of approved financing and investment operations will need to be signed by 31 December 2023.
- **Horizon Europe**, a research and innovation programme, could be used to support research to improve existing technologies. The Horizon Europe programme consists of 3 pillars and had a budget of €2.7bn between 2018 and 2020 for the Pillar 1 phase. Pillar 2, with a budget of €53.2bn, will look into bringing forward the transition towards circular and low carbon industries in applied research clusters. The third pillar, with a budget of €10bn, is 70% dedicated to SMEs, and will promote all project innovations and knowledge transfers, including non-technological innovations.

The European countries' planned budgets for hydrogen projects

The approach taken by European countries in terms of subsidies in regards to hydrogen does not offer a homogenous picture. Looking at a few examples, some countries have taken a top-down approach by estimating how much budget or subsidies will be needed for a successful implementation of the new energy source, others have taken a more bottom-up approach, having not divulged any specific amounts but have rather been looking at projects and examining how they can qualify for financial support.

Germany, France and Italy are amongst the European Union members that announced global specific budgets for their national hydrogen development. In May 2021, **Germany's** Economy and

Transport ministry reaffirmed the country's ambitions. The federal government is ready to dedicate €9bn of its stimulus budget to green hydrogen projects. The country has a 5GW electrolyzer target for 2030, of which 2GW was reserved for transport applications. Earlier this year, more than 200 hydrogen projects applications were received.

In September 2020, **France** published its hydrogen strategy and announced a total of €7.2bn budget to develop a decarbonised hydrogen industry by 2030, with €3.4bn to be implemented by 2023.

Italy published its "National hydrogen strategy. Preliminary guidelines" in November 2020. So far, the plan has not been made final, but the Italian Recovery and Resilience plan is allocating a preliminary €10.5bn budget to hydrogen for the period 2021-2030. This include between €5bn and €7bn dedicated to hydrogen production. Distribution, refuelling stations and transport vehicles such as trucks and trains could benefit from between €2 to €3bn over the next ten years. Another financial effort of c.€1bn could be used to research and promote hydrogen. The plan envisages that half of these investments would be provided by European funds, such as the Horizon Europe, the Innovation Fund and the Next Gen EU fund.

Despite ambitious plans for hydrogen, **the Netherlands'** announced budget for the implementation of the new energy source, is rather modest. On September 21st the government announced a budget of €750m to support the gas transmission system operator Gasunie, in developing a hydrogen backbone by 2030. It would connect the main industrial clusters in the Netherlands (total costs equal €1.5bn). [We discuss that in more detail here](#). Earlier in 2021, the government announced a budget of €338m for hydrogen research and production projects. This amount is part of a €20bn fund dedicated to the Dutch economy, education, infrastructure and sustainable energy projects for the period 2020-2025.

Spain plans to install 4GW of electrolyzers by 2030, 300MW to 600MW of which could be installed by 2024. In practice, Spain aims at 100 to 150 public access hydrogen fuelling stations, 150 to 200 hydrogen buses, 2 hydrogen-powered trains and 5000 to 7500 light- and heavy-hydrogen vehicles. Spain estimated that a budget of €9bn for its Hydrogen Roadmap over the next 10 years is necessary. However, the government expects the majority of the funds to come from the private sector, although the public sector would also play a role. As of today, Spain has received 502 project proposals corresponding to €10bn of investment needs. In May 2021, Spain secured €1.5bn from the Next Generation EU Fund to finance some of these projects.

The Asia-Pacific region: Japan is already a leading player

Japan is already a leader in hydrogen technology and a large scale [green hydrogen plant](#) has already been operating since March 2020 and the country is planning for [more](#). Japan's third and latest version of its hydrogen strategy dates back to 2019. Three main objectives that emerge from the roadmap are:

1. The decarbonisation of the Japanese economy with a net-zero carbon emissions ambition by 2050.
2. The government also sees hydrogen as an energy resource that could increase the country energy self-sufficiency.
3. Reduce hydrogen costs to push the economy's competitiveness and become a hydrogen exporter.

€340m

The Japanese government's budget for hydrogen

Up to 2030

Full-scale hydrogen generation in Japan by around 2030

The plan's expectation is to introduce full-scale hydrogen generation by around 2030. The government has also set a budget of ¥70bn or €340m equivalent, to finance research and development as well as eight pilot projects:

- A hydrogen refuelling station for fuel cell forklifts
- Hydrogen produced from biogas originating from livestock manure to power fuel cell vehicles and fuel cell forklifts
- Using hydrogen to supply electricity to a swimming pool
- A hotel powered by a hydrogen fuel cell
- Hydrogen produced from hydropower used to heat a swimming pool
- Green hydrogen used to power and heat a retail store
- Blending green hydrogen with town gas to fire stoves and other gas devices
- Hydrogen produced using wind power used to generate electricity and heat at a hot spring facility

As far as the transport sector is concerned, Japan has clear objectives, aiming to have 200,000 fuel cell vehicles on the roads by 2025 and 800,000 by 2030. This would be accompanied by 320 hydrogen refuelling stations by 2025 and 900 by 2030. A major investment in fuel cell buses is also planned, with 1,200 of them expected to be operating by 2030.

Australia

In 2016, the Australian government, along with some 20 organisations, started to investigate the challenges and opportunities offered by hydrogen. First of all, Australia has decarbonisation targets that imply cutting carbon emissions by 26%-28% below 2005 levels, by 2030. Secondly, Australia produces natural gas but with depleting reserves, its natural gas production costs have remained high compared to other markets and this poses a challenge for Australian industries to stay competitive.

In 2018, the Australian government published its hydrogen roadmap: "Pathways to an economically sustainable hydrogen industry in Australia". The roadmap looks at the development of a renewable hydrogen supply chain model, a legal framework review and hydrogen storage potentials.

The report also looks at the applications for hydrogen on the Australian territory and the implied economics.

- Stationary electricity: in the Australian context, proton exchange membrane fuel cells are likely to be the most widely used systems due to their global market size due to its, various applications and faster start-up times.
- Hydrogen fuelled transport: passenger hydrogen fuel cell electric vehicles (PFCEVs) are seen

as a complementary technology to battery electric vehicles. As of today, no commercial hydrogen car is for sale in Australia and one of the major obstacles to their development is the lack of hydrogen refuelling points.

- Heat in industrial processes.
- Industrial feedstocks: for the petrochemical industry, treatments of biofuels, glass manufacturing and metal processing.
- Export: the hydrogen roadmap has identified four markets where Australia could take a market share: Singapore, Japan, China and South Korea. However, to be competitive in the Asia Pacific market, Australian hydrogen players would need to be able to produce H2 at under US\$2/kg (€1.70/kg).

A series of strategic investments from both the private and public sectors are expected to be on the table. In April 2021, the Australian Federal Government announced investments in clean hydrogen and carbon capture technologies of up to €340m (AU\$539m) as part of its 2021/2022 budget. By 2030, the Australian government is planning to invest up to €1.1bn to successfully develop the Australian hydrogen roadmap.

The United States: a mix of green, blue and grey hydrogen

The United States started an Energy hydrogen programme in the mid-2000s. In 2006 it already had a budget of US\$153m (€130m) for hydrogen and fuel cell technologies. Led by the U.S. Department of Energy Hydrogen Program, within the Office of Energy Efficiency and Renewable Energy, the programme conducted research and development in hydrogen production, infrastructure, storage, fuel cells, other applications across many different sectors. Between 2006 and 2020, the programme benefitted from an annual budget ranging from between US\$95m and US\$208m (€81m to €177m).

The United States includes hydrogen in their US\$1tr Infrastructure Plan

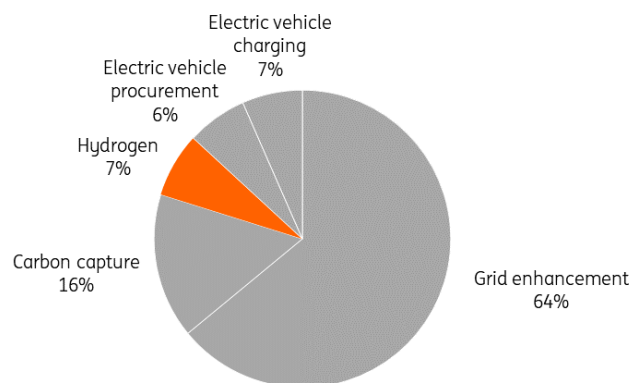
On 28 July 2021, US senators backed by President Joe Biden agreed on a National Infrastructure Plan worth US\$1tr (€841bn) that includes a US\$114bn (€100bn) budget for energy transition according to BNEF estimates. The plan still needs to be transformed into law and will need a minimum of 60 senators in favour, to be passed. The global infrastructure plan would be backed up by a federal budget of US\$550bn (€463bn) while other financing solutions would still remain to be found.

€6.7bn

The United states will dedicate US\$8bn of their infrastructure plan budget to hydrogen

Out of the €100bn dedicated to the country's energy transition plan, €6.7bn will be fully dedicated to hydrogen, representing 7% of the budget for the energy transition.

Hydrogen accounts for 7% of US budget on energy transition



Source: ING Research

Reflecting the country's involvement in energy generation coming from clean and non-clean resources, the United States could include all three types of hydrogen projects into their Infrastructure Plan. The Bipartisan Infrastructure Plan wants to establish a minimum of four regional hydrogen hubs. One hub would use renewable power while the other three would be producing hydrogen from natural gas, fossil fuels and nuclear power. We discuss that in more detail [here](#). Coal is also considered a potential source for hydrogen production.

Reflections on hydrogen strategies

From the many hydrogen plans from governments across the world we conclude:

- There is no shortage of attention for hydrogen. Many countries want to play a leading role in hydrogen. If the hydrogen market remains local, for example, to limit dependence on natural gas, there is room for many players. In a global hydrogen market, not every country can be a market leader and price competition will determine who will be winners and losers.
- Governments bring a lot of money to the hydrogen market. Some start with big numbers and still have to work out the policy instruments and projects (top-down). Others start with projects and instruments and communicate lower numbers as a result (bottom-up).
- Either way, these hydrogen support schemes will scale up the market and bring down costs.
- The main focus in most plans is on green hydrogen. There is relatively little attention to grey and blue hydrogen. That is surprising as [the economics of grey and blue hydrogen](#) are better compared to green hydrogen on word economics. The US program is an exception as it aims for a mix of grey, blue and green hydrogen.

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