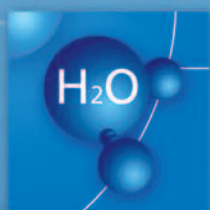


HyWays

The European Hydrogen Roadmap



Roadmap and Action Plan

Synopsis of the European Hydrogen
Roadmap and Action Plan

We have to act now for a sustainable future!

By starting to act now, hydrogen has the potential to reduce total CO₂ emissions from road transport in a cost-effective way by over 50% in 2050.

Why do we need hydrogen?

Hydrogen is an energy carrier with zero carbon content. Just like electricity, hydrogen can be produced from all energy resources, such as biomass, wind and solar energy, nuclear energy and clean fossil fuels¹. It can be converted to power and heat with high efficiency and zero emissions, especially when used in fuel cells. It improves security of supply due to the decoupling of demand and resources, allowing each European member state to choose its own energy sources. The HyWays project has developed a Roadmap and Action Plan for the introduction of hydrogen into the energy system in Europe.

Main conclusions from the HyWays project

- **Emission reduction:** Hydrogen is a cost effective option for the reduction of CO₂ emissions. The costs to reduce CO₂ emissions decrease by 4% in 2030 and 15% in 2050 compared to a baseline scenario without hydrogen. Emissions from road transport can be reduced by over 50% in 2050. Furthermore, the introduction of hydrogen in road transport contributes to a noticeable improvement of air quality in the short to medium term. This holds specifically for the most polluted areas such as city centres where the sense of urgency is greatest.
- **Impact on economic growth and employment:** The transition to hydrogen offers an economic opportunity to strengthen Europe's position in car and energy equipment manufacturing. The net impact on employment, assuming import/export shares do not change, amount to 200,000 - 400,000 labour years by 2030. The major benefit for economic growth is a strong decrease in vulnerability of the economy to shocks and structural high oil prices. A (sudden) increase in the price of oil would have a negative impact on economic growth in the range of -0.20 to -0.40% per year. In contrast, the impacts on GDP of the introduction of hydrogen are expected to be small but positive (around +0.01% per year).
- **Security of supply:** Like electricity, hydrogen decouples energy demand from resources. The total oil consumption of road transport could be decreased by around 40% by the year 2050 as compared to today if 80% of the conventional vehicles were replaced by hydrogen vehicles. The use of hydrogen for electricity production from fossil fuels in large centralized plants will contribute to achieving a significant reduction of CO₂ emissions if combined with CO₂ capture and sequestration processes. The resulting diversification potential leads to a substantial improvement in security of supply.
- **Contribution to targets for renewable energy and energy savings:** The introduction of hydrogen in the energy system offers the opportunity to increase the share of renewable energy. In terms of energy savings, for example, hydrogen produced from biomass allows for substantial efficiency gains over biofuels when used in fuel cell and hybrid vehicles.

¹ Using hydrogen production options equipped with carbon capture and storage (CCS) and state-of-the-art pollutant emission reduction technology.

- **Competitiveness of hydrogen vehicles:** Hydrogen vehicles can be produced and operated cost effectively once initial barriers such as the cost reduction of drive trains and infrastructure build-up have been overcome. In particular in combination with fuel cells, hydrogen can compete with conventional fuels if oil prices remain above 50 – 60 \$ per barrel. Nevertheless, policy support schemes are needed to facilitate cost reduction of the drive train through economy of scale and R&D, in order to prevent severe underutilisation of the hydrogen infrastructure.

Main recommendations

- **We have to act now for a sustainable future!** Immediate action is needed to overcome initial barriers, enabling a substantial and cost effective contribution to both reduction of greenhouse gas emissions and reduction of import dependency while creating economic stability. In addition, the introduction rates of hydrogen and fuel cell vehicles and the build-up rate of a hydrogen fuel infrastructure need to be high to sustain an industrially relevant growth.
- **A European hydrogen-specific support framework is needed:** This should address the following issues:
 - *Support innovation at EU and member state level;* At a European level, the R&D budgets for hydrogen production and its end-use applications need to increase to 80 M€ per year.
 - *Market support;* To overcome initial barriers, a hydrogen-specific deployment support framework needs to be implemented at the member state level. The total costs of a deployment support scheme are of the order of 180 M€ per year. A starting point is to equalise the total costs (€/km) for road transport through financial measures such as tax incentives.
 - *Creation of early markets;* Early markets for e.g. hydrogen vehicles need to be created utilising the advantages offered by hydrogen applications. Examples are city centre access regulations or procurement of zero emission vehicles within governmental services.
- **Establish a public-private partnership:** Production of a small series of vehicles has already started but has to be scaled up further soon. In the early commercialisation phase, technology-specific deployment support and R&D must go hand-in-hand. A European public-private partnership between industry and the EC, such as a Joint Technology Initiative (JTI), is the most suitable framework to meet these conditions.

An executive summary and the full version of the HyWays Roadmap and Action Plan are available for download at www.HyWays.de.

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HyWays

Hydrogen Energy in Europe

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