

Hyways: the European hydrogen energy roadmap

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HyWays is an EU funded research project employing technological studies and socio-economic assessment to develop a validated and well-accepted Roadmap for the introduction of hydrogen in the European energy system up to 2030 with provision for an outlook to 2050. The research was undertaken by a consortium of industry, research institutes and government agencies and covers ten European countries, Finland, France, Germany, Greece, Italy, Netherlands, Norway, Poland, Spain and the United Kingdom, together representing approximately 80% of the EU land and 70% of the EU population. The Roadmap reflects real life conditions by considering technological as well as institutional, geographic and socio/economic barriers and opportunities at country specific level. Mobile and stationary applications are addressed, including possible synergies between the two.

The presentation describes the methodology used by the consortium which consists of a number of quantitative computational modeling components as well as some qualitative components. The process starts with a vision building exercise for the year 2050 and, using the technique of backcasting, develops selected hydrogen energy chains or pathways for each country based on their specific energy profiles. Factors taken into account are energy markets, including assumption of vehicle penetration scenarios and energy prices, socio-economics including marginal CO₂ abatement costs, employment effects and policy measures. In addition over 50 workshops were conducted with key stakeholders in the ten member states during which inputs for the models were collected. Market scenarios for hydrogen end-use applications, as provided by the HyWays partners and outcomes of the analysis were discussed, leading to further refinement of the member state visions where each country outlined its own preferences.

The models examine hydrogen production in terms of demand allocation, early user centers and early hydrogen corridors as well as infrastructure build-up by forecasting supply requirements. The hydrogen infrastructure analysis also examines the sensitivity of cost factors, distribution options for hydrogen vehicles, infrastructure and cash flow. The final part of the analysis assesses the benefits for all participating stakeholders and countries.

The Roadmap shows that hydrogen can become a cost-effective option for the reduction of CO₂ in the long-term, reducing these emissions from road transport, for example, by about 50% in 2050. The cost of reducing one unit of CO₂ decreases by 4% in 2030 and 15% in 2050 if hydrogen is introduced into the energy system. The introduction of hydrogen could also lead to a substantial improvement in the security of energy supply as a result of the diversification of the energy system. 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 analyses indicate that there are several pathways that can produce hydrogen in sufficient amounts and at comparable price levels ensuring a relatively stable hydrogen production price.

The HyWays project concludes with a systematic description of the future steps to be taken for the large-scale introduction of hydrogen as an energy carrier in the power market, transport sector and as a storage medium for renewable energy. The resulting roadmap provides a way to identify, evaluate and select strategic alternatives that can be used to achieve a transition to a hydrogen-based energy system. An Action Plan derived from this Roadmap highlights the support required for the introduction of hydrogen technologies.