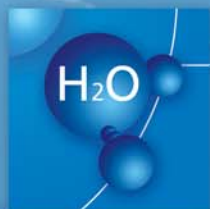


# HyWays

A European Roadmap



Assumptions, visions  
and robust conclusions  
from project Phase I



## HyWays Overview

HyWays aims to develop a validated and well-accepted Roadmap for the introduction of hydrogen into the European energy system until 2030 and to provide an outlook to 2050.

The Roadmap will reflect real life conditions by considering technological as well as institutional, geographic and socio/economic barriers and opportunities at a country specific level. Both mobile and stationary applications are addressed, including possible synergies between the two.

HyWays comprises two phases of 18 months each. In the first phase, an analysis of the introduction of hydrogen was performed for six countries (France, Germany, Greece, Italy, the Netherlands and Norway). In the second phase, the analysis will be carried out for another four countries.

The results produced in HyWays Phase I are of a preliminary nature and are subject to change. Therefore *no validated Roadmap* can be presented at this time. Nevertheless some robust conclusions can be drawn at this stage of the project.

## This Document

This flyer gives **the headline conclusions** that can be drawn from Phase I of the HyWays project.

Further details, including background references and key assumptions can be found in the full report "*HyWays: a European Roadmap. Assumptions, visions and robust conclusions from project Phase I*". This can be downloaded from the section 'publications' at the HyWays website [www.HyWays.de](http://www.HyWays.de)

## Phase II

The second phase of HyWays is due to start on 1st January 2006. In the second phase of HyWays, a priority topic will be the development of the price gap between fossil fuel based hydrogen and hydrogen produced from renewable resources, in order to identify and discuss the opportunities for an accelerated introduction of renewable hydrogen.



## Feedback

The HyWays consortium invites *feedback* from readers on this flyer and the full report. Feedback is requested on both the key assumptions as well as the Phase I conclusions. Please direct any feedback to the project co-ordinator:

### L-B-Systemtechnik

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## Acknowledgement/Preface

HyWays is an integrated project, co-funded by research institutes, industry, national agencies and by the European Commission (EC) under the 6th Framework Programme [contract N° 502596].

## HyWays Phase I Conclusions

1. Until 2030, hydrogen production from fossil fuels with carbon capture and sequestration (CCS) is expected to be the most important production source in Europe, with renewable hydrogen slowly being phased in.
2. Hydrogen infrastructure build-up will likely comprise both central and on-site hydrogen provision.
3. Hydrogen vehicles will need to show cost competitiveness in the marketplace. Four major drivers will influence this:
  - 3.1 The crude oil price
  - 3.2 The price of hydrogen (infrastructure costs)
  - 3.3 Internalisation of CO<sub>2</sub>-emissions
  - 3.4 Costs of hydrogen drive systems

The cost development for the *hydrogen drive system* has the biggest impact on cost-competitiveness, followed by the variation of *crude oil price*.

These drivers determine both the *pace* at which a cost-competitive level is reached and also the *total investments* needed to achieve market entry.

4. Impacts on employment have been assessed for a number of scenarios. Each tells a story of a possible future for the competitiveness of hydrogen technologies produced within the EU:
- 4.1 The replacement of conventional vehicles by fuel cell vehicles (FCV's) induces a sectoral employment shift away from traditional car manufacturing.
- 4.2 The preparation for expected mass production by 2015 will require a build-up of manufacturing capacity and a skilled labour force. Early political action will be needed to support this.
- 4.3 First calculations show that the impact of the transition to a hydrogen based energy system on overall welfare is likely to be relatively small. Whether the impact on welfare is positive or negative depends strongly on the cost reduction potential of hydrogen vehicles.
5. Introduction of hydrogen is shown to reduce emissions from the transport sector. In addition to its role in decreasing CO<sub>2</sub>-emissions from the transport sector, the use of hydrogen in vehicles is paramount in reducing emissions of regulated pollutants and specifically of particulate matter.

## END-VISIONS For a Hydrogen Based Energy System

An important aspect in the discussion with the stakeholders is the development of **end-visions** of the energy system. The development of these end-visions will lead to a clear indication of possible hydrogen production locations (where to build new power plants and of what type) and also allow for the identification of early markets. End-visions have been derived for each of the member states participating in HyWays Phase I and can be found in the full report.

### Industry

Air Liquide  
Air Products  
BMW Group  
BP plc  
DaimlerChrysler AG  
Det Norske Veritas (DNV)  
Electricité de France  
Acciona Energía  
GE Oil & Gas Nuovo Pignone  
HyGear  
Hydro ASA  
Infraserv Hoechst  
Linde AG  
GM / Opel  
Repsol YPF S.A.  
Statkraft  
Hydrogenics Europe  
Total  
Vattenfall Europe

### Institutes

French Atomic Energy Commission (CEA)  
Energy Research Centre of the Netherlands  
Italian National Agency for New Technologies, Energy and Environment (ENEA)  
Fraunhofer Institute for Systems and Innovation Research (FHG-ISI)  
Imperial College of Science, Technology and Innovation  
Instituto de Engenharia Mecânica (IST)  
L-B-Systemtechnik (LBST) [Coordinator]  
Université Louis Pasteur (BETA)  
Zentrum für Europäische Wirtschaftsforschung

### Member State Representatives

French Atomic Energy Commission (CEA)  
Italian National Agency for New Technologies, Energy and Environment (ENEA)  
German Energy Agency (dena)  
Hellenic Institute of Transport (HIT)  
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# HyWays

Hydrogen Energy in Europe

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Project Website: <http://www.HyWays.de>

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