Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie

Hydrogen Activities in Germany-

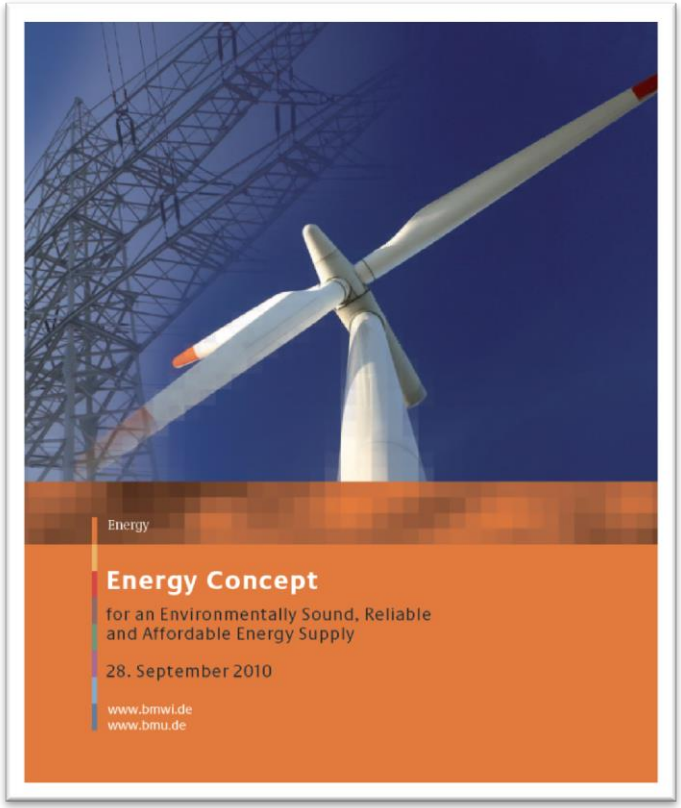
Establishing an integrated energy system

Prague | 06. April 2016

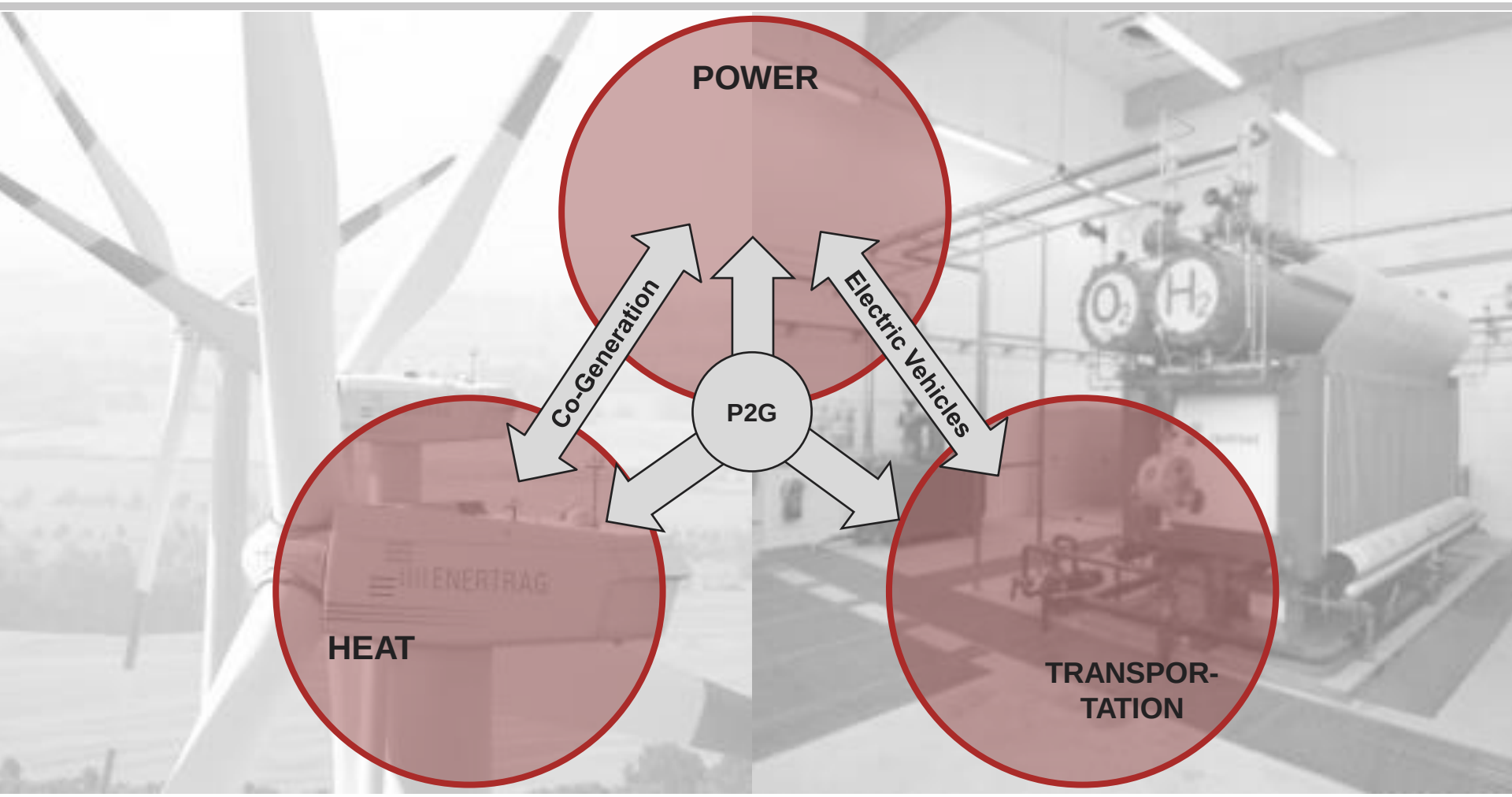
Dr. Hanno Butsch | Head of International Cooperation | NOW GmbH

Political Climate and Energy Targets for Germany

- **Reducing GHG across all sectors (1990 baseline):**
  40% by 2010 ➔ 80% by 2050
- **Share of renewable energies of the gross final energy consumption:**
  18% by 2020 ➔ 60% by 2050
- **The share of renewable energies for the electric power supply:**
  40-45% by 2025 ➔ 55-60% by 2035
- **Reducing primary energy consumption:**
  20% by 2020 ➔ 50% by 2050.
- **Increase of Energy productivity:**
  2.1% per year compared to final energy consumption.
- **Decrease of electricity consumption (baseline 2008):**
  10% by 2020 ➔ 25% by 2050
- **Compared to 2008, heat demand in buildings** is to be reduced by 20% by 2020, while primary energy demand is to fall by 80% by 2050.



Power-to-Gas can facilitate an integrated energy system with renewable energies in all application sectors.



The National Innovation Programme Hydrogen and Fuel Cell Technology (NIP)

Politics	Industry

BMVI / BMWi / BMBF / BMU

€ 500 million for demonstration + **€ 200 million** for R&D + **€ 700 million** Co-financing by the industry

€ 1,4 billion
2007-2016

- Preparing hydrogen & fuel cell markets
- Focus on R&D combined with everyday demonstration
- Hydrogen & fuel cells driven by applications and markets: transport, stationary energy supply, special markets

Cooperation and integration for the market preparation: Showcase projects within the NIP

Mobility/Transport: Operation of FCEV (buses and cars) and deployment of 50 hydrogen refueling stations in Germany

Stationary: Almost 500 installed fuel cell heating in the field of residential energy

Stationary: Testing of fuel cell systems for the electricity supply on board of ships

Special markets: Secure or/and off grid electricity supply systems at more than 250 locations

Implementation and coordination by NOW National Organisation Hydrogen and Fuel Cell Technology

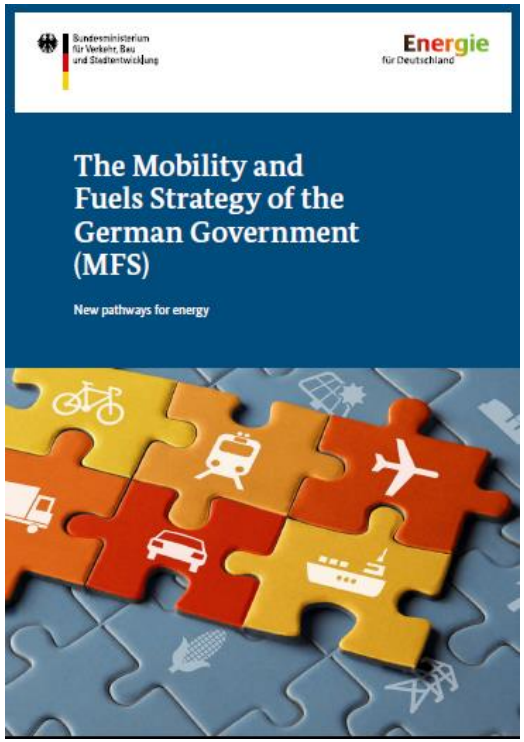
Fuel Cell and Hydrogen Technology for Transport

Political Framework for the Transport Sector

- Share of transport in final energy consumption nearly 30%
- Tripling of energy consumption in transport since 1960, even five-fold increase in road traffic

- Goals of the German Energy Concept (2010) for Transport:
  - -10 % until 2020 of energy consumption
  - -40 % until 2050 of energy consumption (vs. 2005)

The Mobility and Fuels Strategy of the German Government outlines the way how to achieve these objectives



➔ **Electrification of the drive train (BEV's and FCEV's) is a key issue to reach the targets**

➔ **Targets only achievable with PtG-H2 and PtG-Methane**

➔ **Further increase of renewable energies beyond current planning is needed**

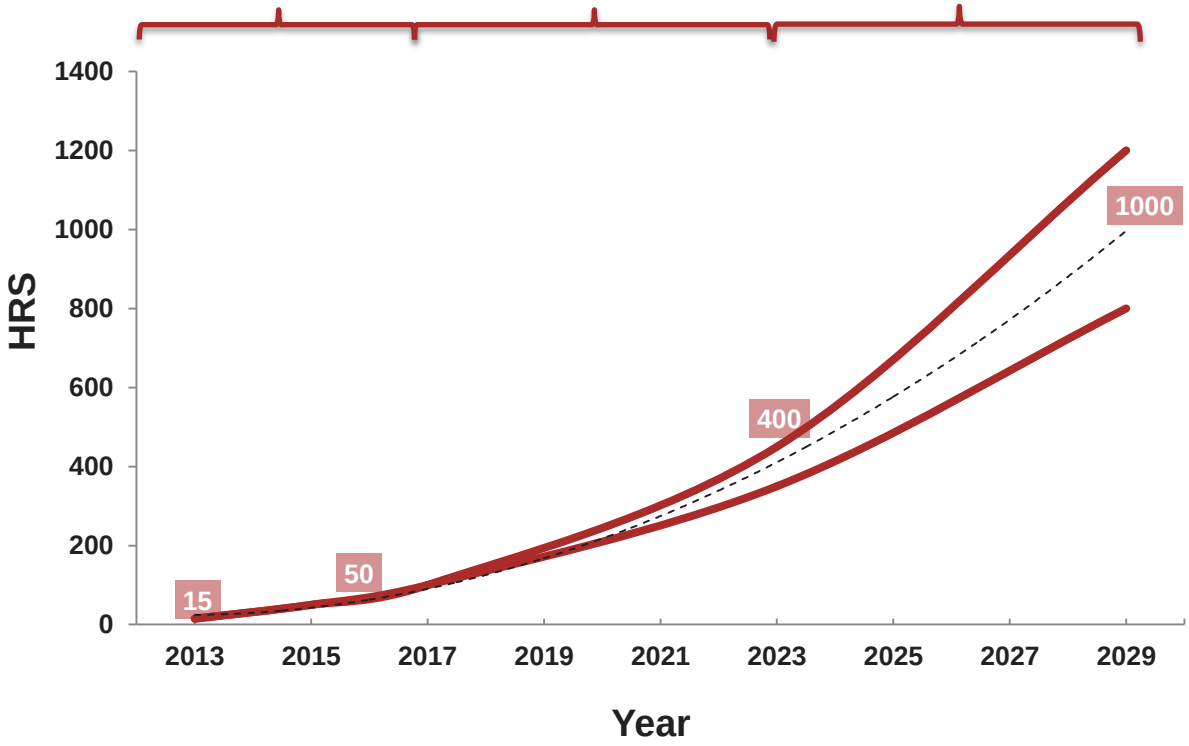
➔ **Large scale storage for hydrogen is inevitable**

Timeline HRS infrastructure build-up

PHASE 1:
Infrastructure build-up **independent** of FCEV‘s

PHASE 2:
Infrastructure build-up dependent of FCEV‘s

PHASE 3:
Free market development



PHASE 1:

- 50 HRS are securely financed by NIP.
- Build-up of a preliminary overcapacity of HRS as basis for an independent market development by H2 Mobility
- Build up is not related to (certified) FCEV numbers

PHASE 2:

- Roll-out of HRS network will depend on (certified) FCEV numbers (internal H2-Mobility allocation key)

PHASE 3:

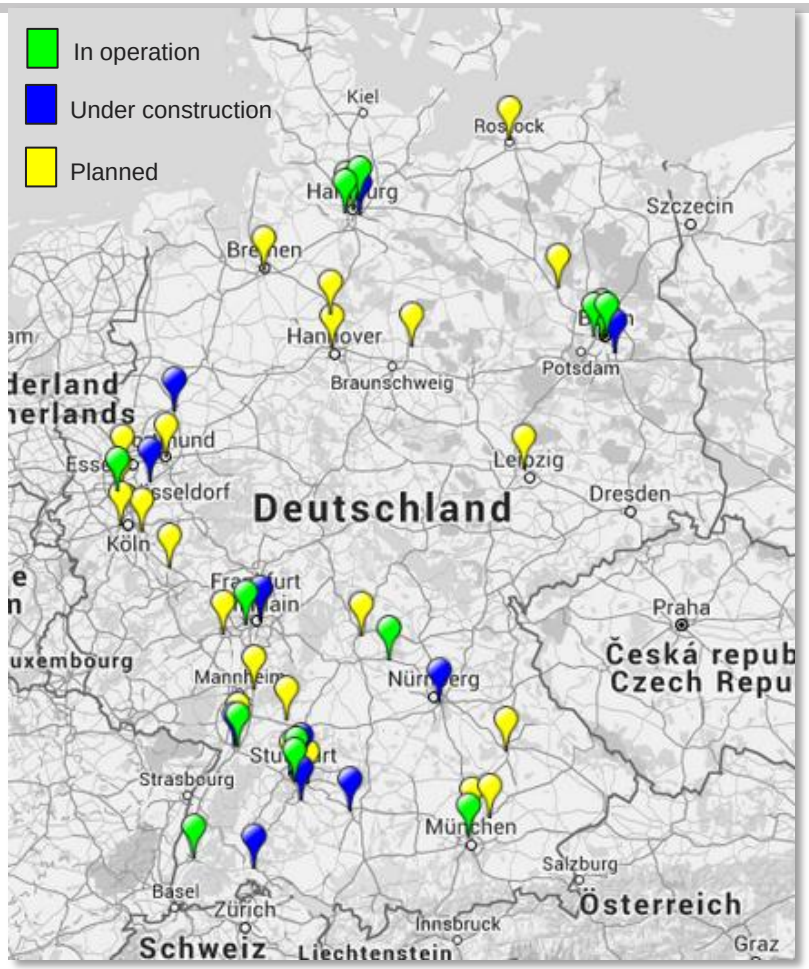
- Free market development

Current HRS deployment status in Germany

Total Station Berlin Jafféstrasse

Shell Station Berlin Sachsendamm

Status

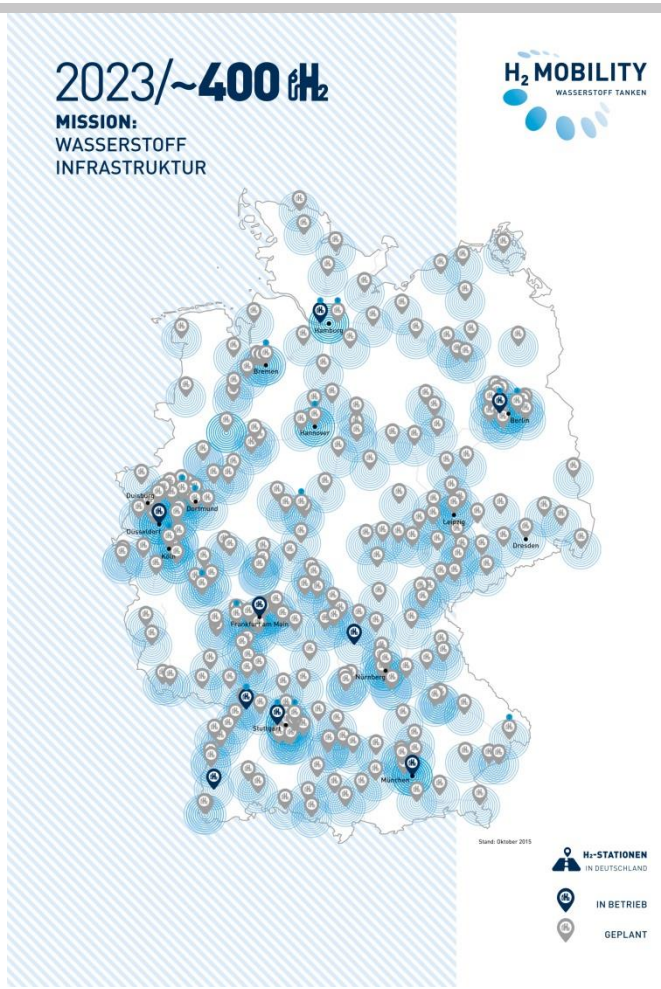


https://www.now-gmbh.de/en/nationales-innovationsprogramm/aufbau-wasserstoff-tankstellennetz

H2-Mobility action plan until 2023

13.10.2015 Berlin

- H_2 MOBILITY Germany, a joint venture of six industry partners, starts operation.
- Kick-off for a gradual deployment of an nation wide hydrogen refueling station network.
- Germany on the way to establish the world wide first nation wide basic service for hydrogen refueling.
- The federal minister for transport and digital infrastructure Dobrindt is considering further support.



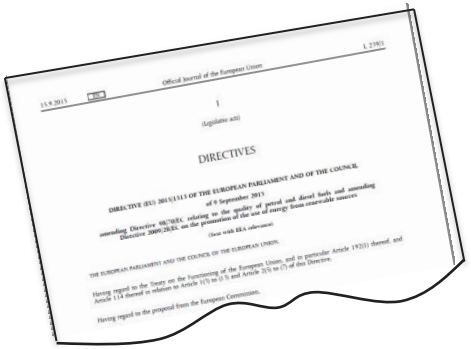
DIRECTIVES OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

22th October 2014: Alternative Fuels Infrastructure Directive (2014/94/EU)


PRESS
EN
Council of the European Union
PRESS RELEASE
ST 13660/14
PRESSE 487
Brussels, 29 September 2014
Clean fuel infrastructure rules adopted by the Council
The Council today adopted a directive on building up minimum infrastructure for alternative fuels across the EU (PE-CONS 79/14; statements: 13287/14 ADD 1).

'Under the directive, each member state has two years to draw up an alternative fuel deployment strategy and send it to the Commission. These strategies or "national policy frameworks" will set out the country's national targets for putting in place new recharge and refuelling points for the different types of "clean fuel", such as electricity, hydrogen and natural gas, as well as relevant supporting actions.'

15th September 2015: Directive 2015/1513 for the amendment of Directives 98/70/EC (FQD*) and 2009/28/EC (RED**)


Official Journal of the European Union
L 239/1
15.9.2015
I
(Legislative acts)
DIRECTIVES
DIRECTIVE (EU) 2015/1513 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 9 September 2015
amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources
(Text with EEA relevance)
THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,
Having regard to the Treaty on the Functioning of the European Union, and in particular Article 192(1) thereof, and Article 114 thereof in relation to Article 3(3) of Directive 98/70/EC,
Having regard to the proposal from the European Commission,

RED:** *[…] the share of energy from renewable sources in all forms of transport in 2020 is at least 10 % […]*

FQD*: *[…] require suppliers of fuel or energy to reduce by at least 6 % by 31 December 2020 the life cycle greenhouse gas emissions per unit of energy of fuels used in the Union by road vehicles, non-road mobile machinery, agricultural and forestry tractors and recreational craft when not at sea. […]*

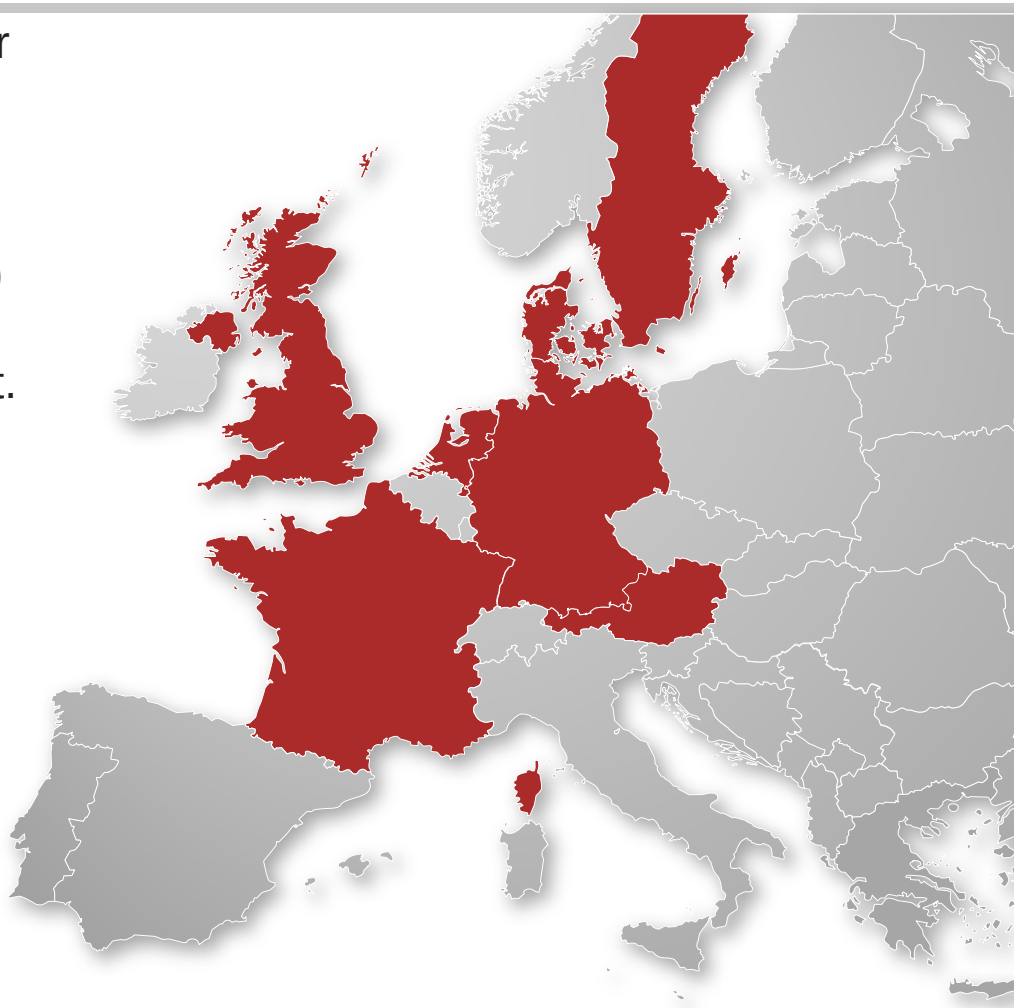
"renewable liquid and gaseous transport fuels of non-biological origin" means liquid or gaseous fuels other than biofuels whose energy content comes from renewable energy sources other than biomass, and which are used in transport;"

*Fuels Quality Directive ** Renewable Energy Directive

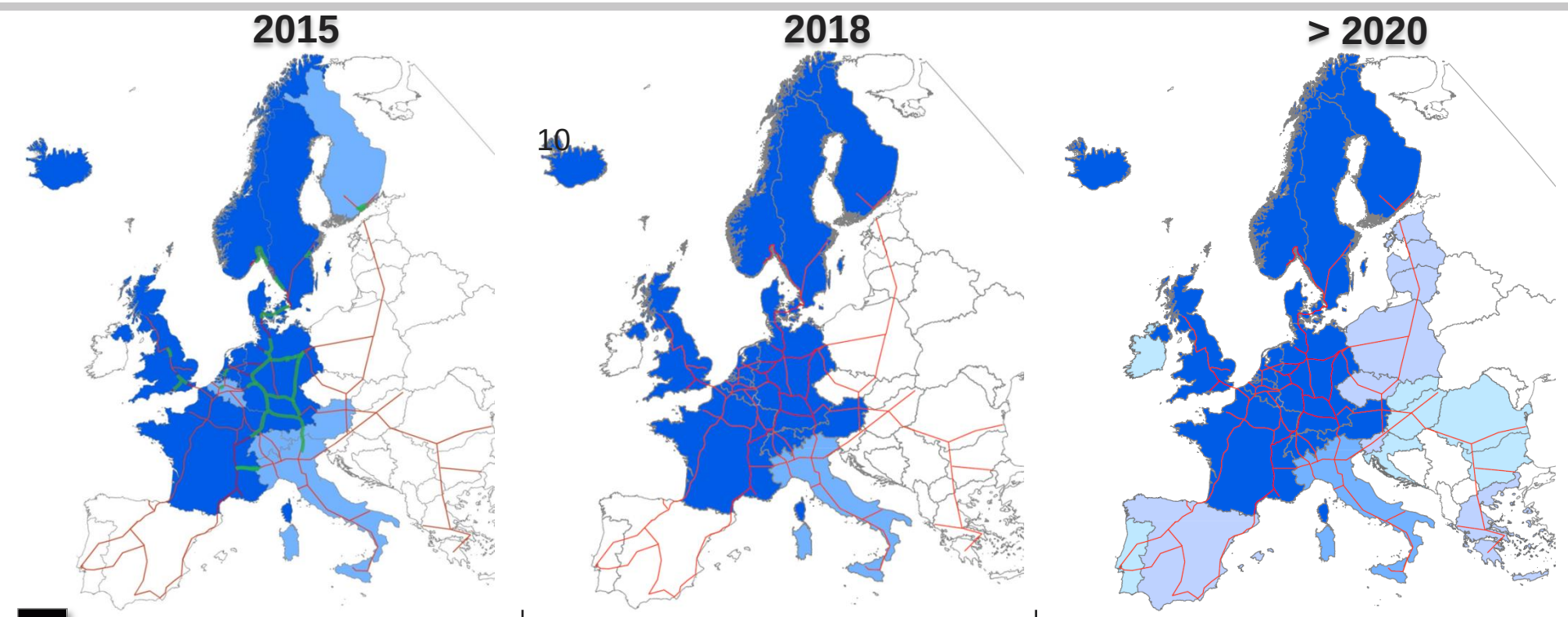
The Government Support Group

Since September 2013

- Informal group of currently 7 EU member states on ministerial level.
  (NL (Chair),UK, F, SWE, DK, AUT, GER)
- Exchange national and international (EU) developments in the field of sustainable mobility and alternative fuels for transport.
- Establishing a dialogue between governments, industry and financing institutions.
- Aligning National Policy Frameworks (NPF) as they are requested in the CPT (e.g. non-discriminatory access) and others.



Scenario for the development of an EU HRS infrastructure



	2015	2018	> 2020
	50	100	400
	2 – 4	10	20
	~6	25	90
	9	30	70
	10	30	40

Nations with H_2Mobility initiatives
Nations with some activity and/or H2Mobility initiatives starting
Nations without H_2Mobility initiatives

Hydrogen Production from Renewable Energies

Power-to-Gas
Demonstration Projects in Germany

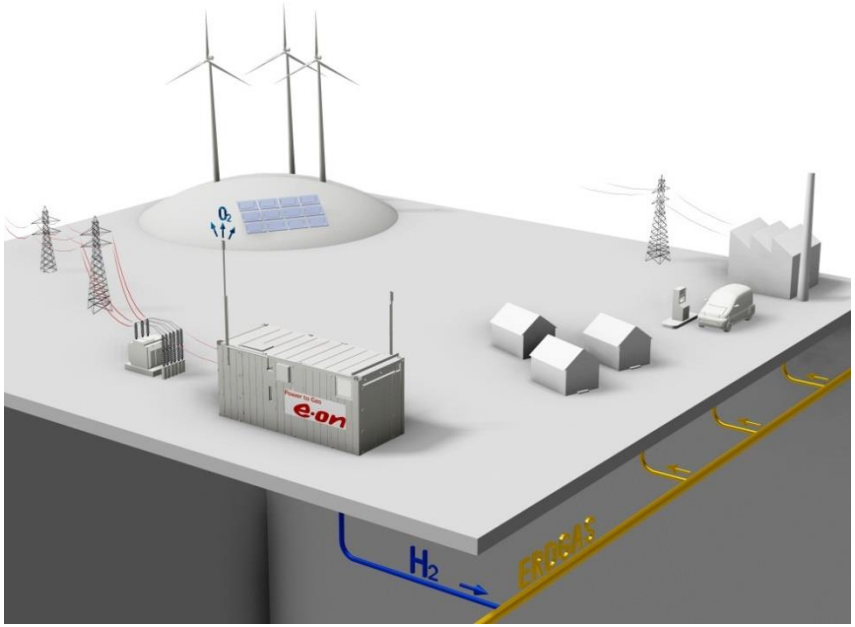
Currently 23 projects in operation, another 3 are in the planning/construction phase.

Scope of demonstrations:

- Production of different fuels:
  - H2
  - CH4
  - Liquids
- Application in different fields:
  - Transport
  - Gas grid
  - Re-electrification

Source: *www.powertogas.info*

Demonstration Project KompElSys: Power-to-Gas fo Hamburg

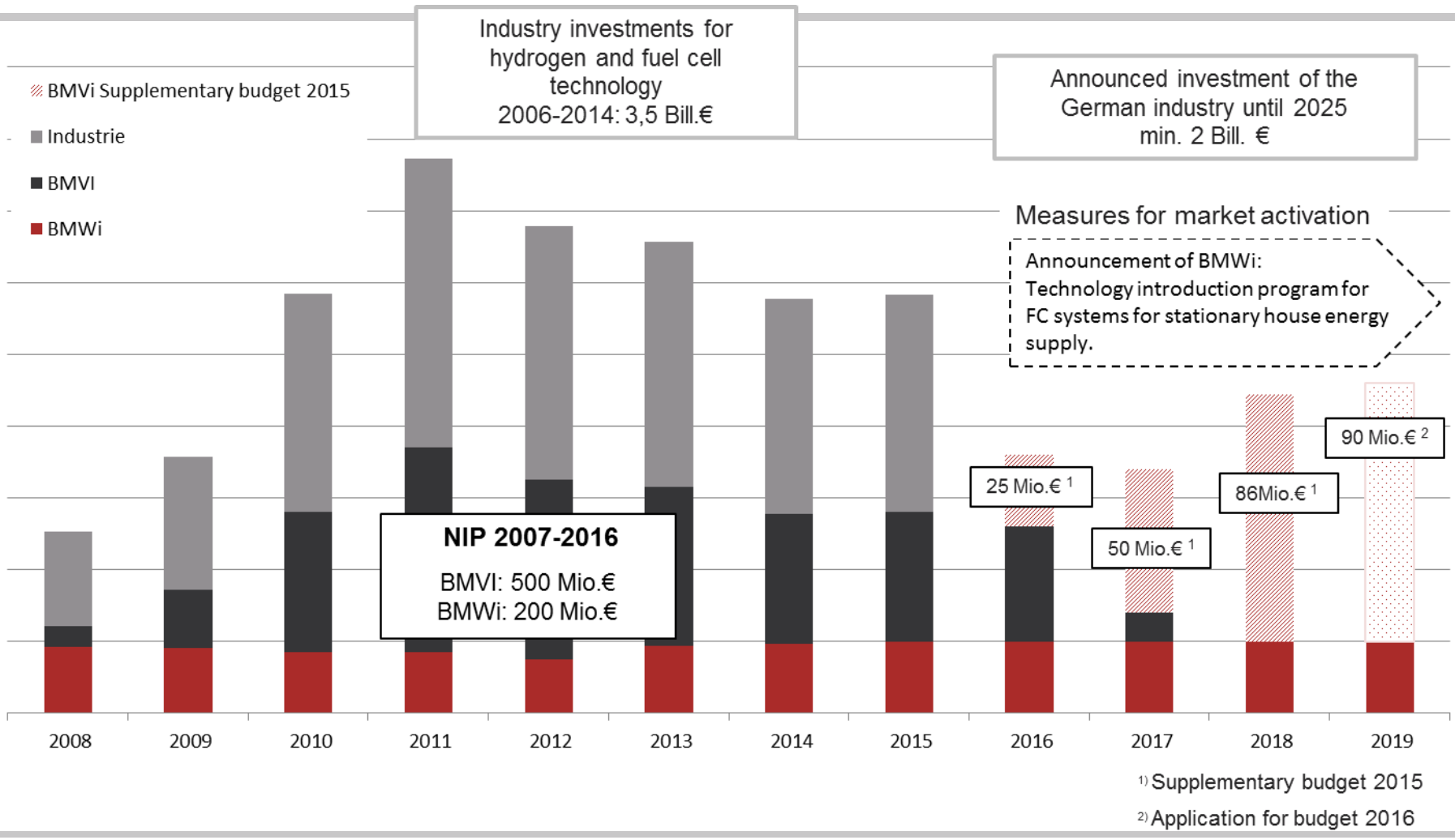


- 1MW PEM-electrolyzer
- injection of H_2 into natural gas grid
- budget 13,789 Mio. €
- 11-2012 to 06-2016

ground-breaking ceremony June 2013

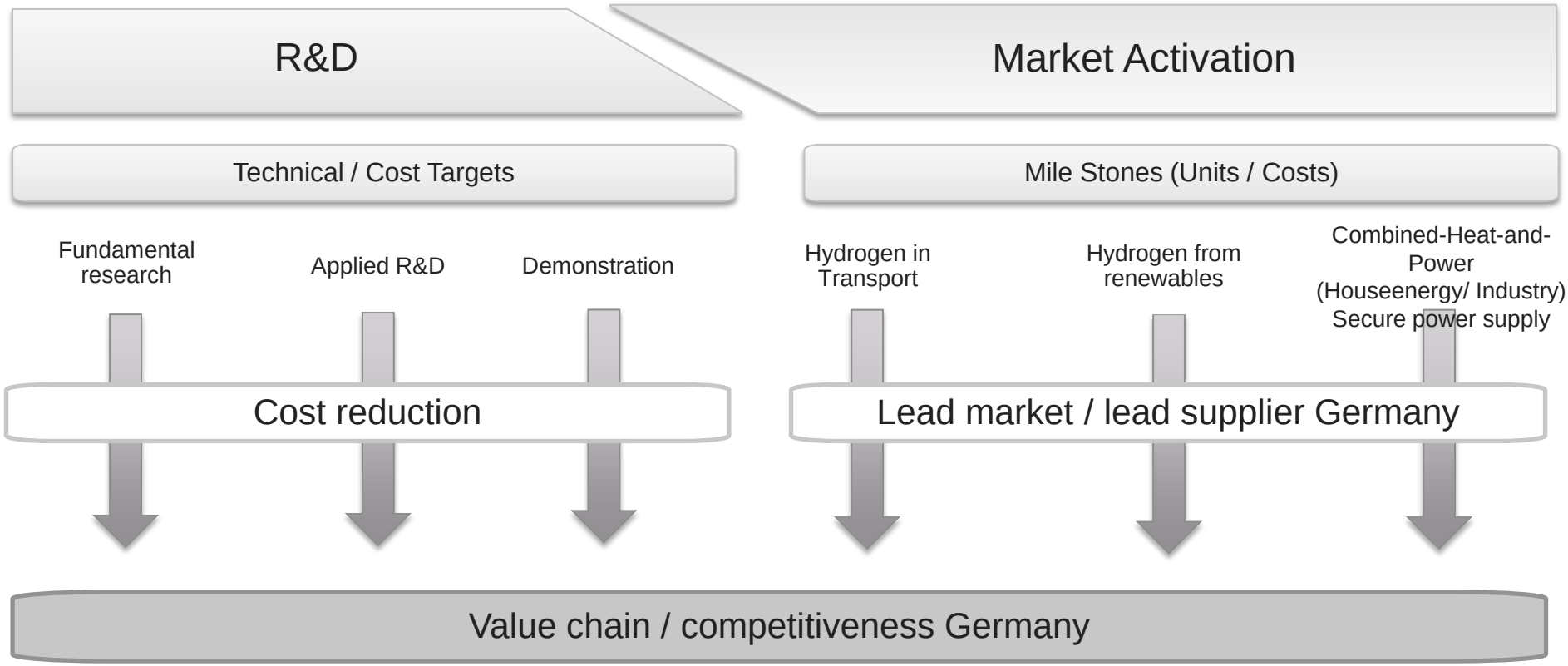
e·on HYDROGENICS SHIFT POWER | ENERGIZE YOUR WORLD SolviCore Fuel Cell Technologies DLR Deutsches Zentrum für Luft- und Raumfahrt Fraunhofer ISE

NIP Continuation



Continuation of the National Innovation Program Hydrogen and Fuel Cell Technology 2016-2025

Program Structure



Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie

Thank you very much!

download:
www.now-gmbh.de