«Κλιματική Αλλαγή, Ενέργεια και Ελληνικό Περιβάλλον: Ποιες οι επιλογές ?»
28 Ιανουαρίου 2020, Μουσείο Ακρόπολης

Οι προοπτικές του υδρογόνου ως ενεργειακού φορέα

ΘΑΝΟΣ ΣΤΟΥΜΠΟΣ

ΔΗΜΟΚΡΙΤΟΣ
DEMOKRITOS

CYRUS

Hydrogen as Energy Carrier I

- Storage of Renewable Energy (solar, wind…) in the Form of Hydrogen via Electrolysis
- Use of Hydrogen in NG grids and Industry
- Re-electrification of Hydrogen for Stationary and Mobile (Transport) Applications via the Use of Fuel Cells…

Hydrogen as Energy Carrier II

- The technology (Hydrogen & Fuel Cells) exists (production, storage, safety, use in stationary applications and vehicles (FCEVs, buses, trucks, trains…))
- The issue of infrastructures remains open…

Hydrogen Fueling and Electric Charging of Vehicles in Germany

2018, JULY, 12TH | JOCHEN LINSSEN, MARTIN ROBINIUS, THOMAS GRUBE, MARKUS REUSS, PETER STENZEL, KONSTANTINOS SYRNANIDIS, DETLEF STOLTEN

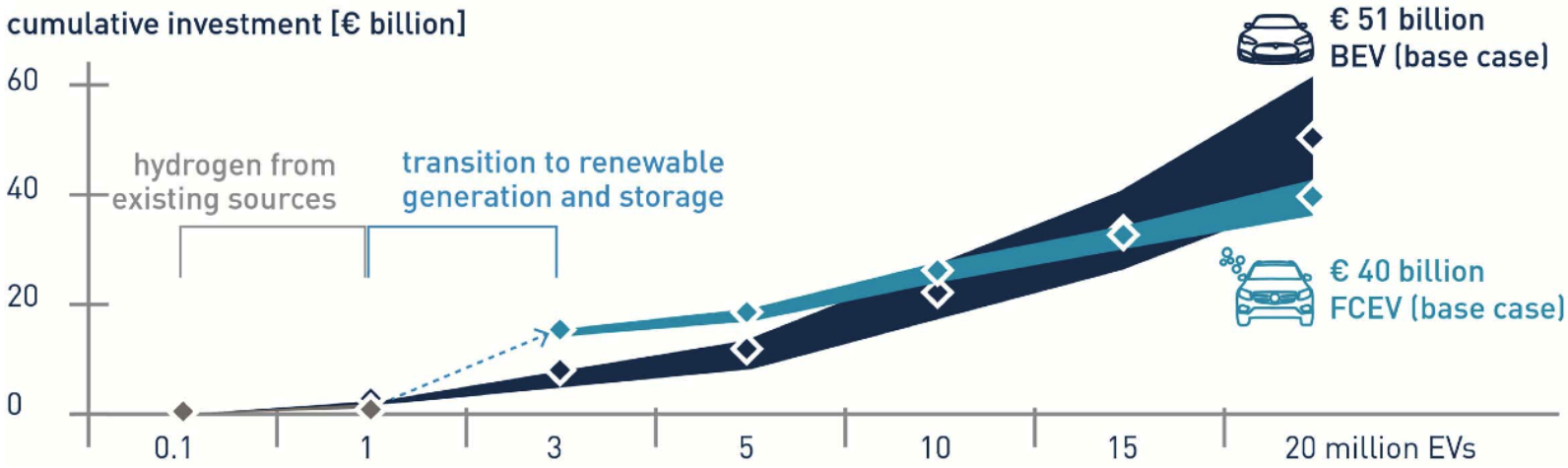
6th Hellenic Forum for Science Technology and Innovation, Athens Greece

j.linssen@fz-juelich.de

Institute of Electrochemical Process Engineering (IEK-3)

Cumulative Investment

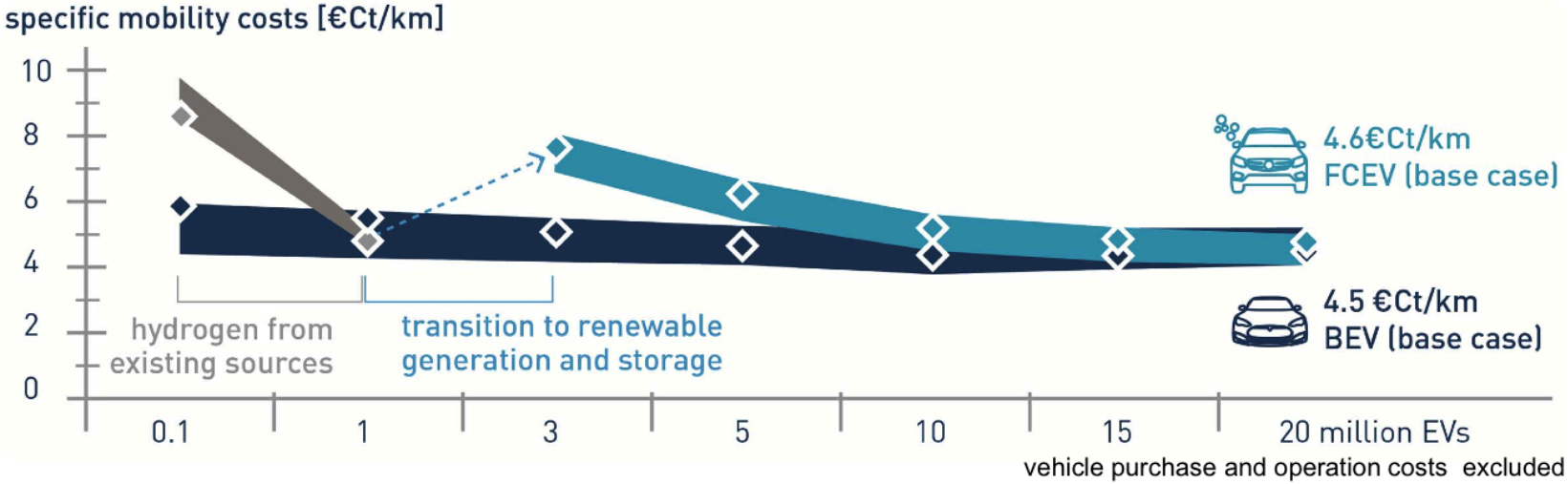
Infrastructure Roll-Out



- Hydrogen more expensive during the transition period to renewable electricity-based generation
- High market penetration: battery charging needs more investment than hydrogen fueling
- For both infrastructures investment low compared to other infrastructures

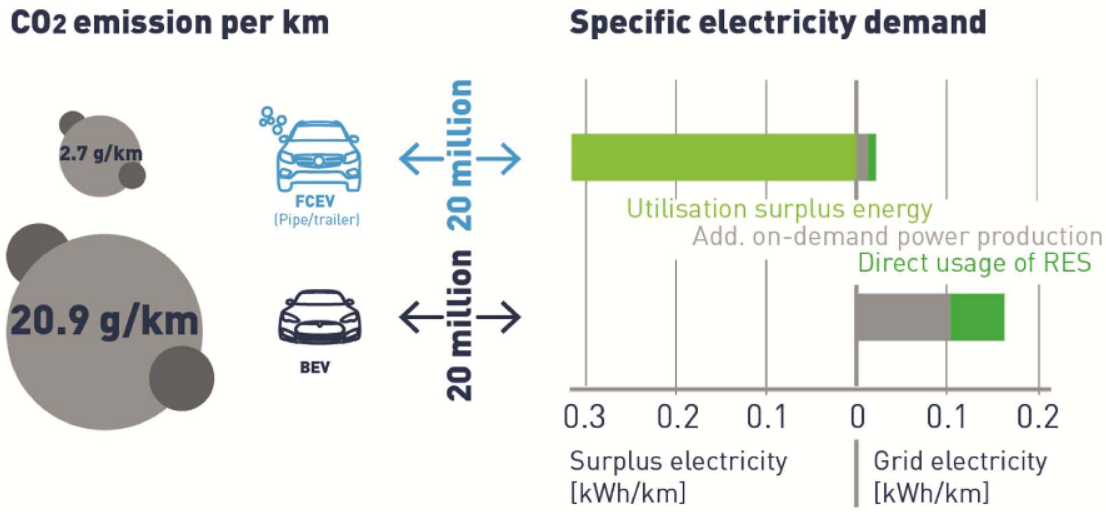
	Investment [€ billion]
Renewable electricity generation scenario	374
Electric grid enhancement plan 2030	34
Federal transport infrastructure plan 2030	265
Hydrogen fueling infrastructure	40
Electric charging infrastructure	51

Comparison of Mobility Costs



- For small vehicle fleets, i.e. 0.1 million cars, BEV fuel costs are significantly lower compared to FCEVs.
- Increase for hydrogen between 1 and 3 million cars results of switching to exclusive utilization of renewable energy for hydrogen production via electrolysis
- Mobility costs per kilometer are roughly same in the high market penetration scenario at 4.5 €ct/km for electric charging and 4.6 €ct/km → the lower efficiency of the hydrogen pathway is offset by lower surplus electricity costs.

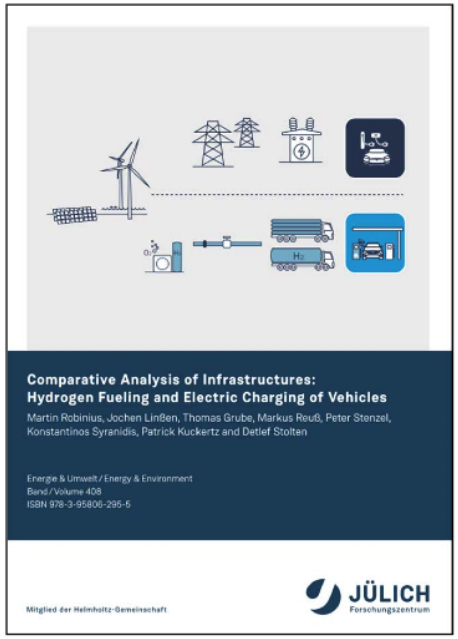
CO_2 Emissions & Electricity Demand



- Efficiency of charging infrastructure is higher, but limited in flexibility and use of surplus electricity
- Fueling infrastructure for hydrogen with inherent seasonal storage option
- Low specific CO2 emissions for both options in high penetration scenarios with advantage for hydrogen, well below the EU emission target after 2020: 95 g_{CO2}/km

Full Report Available

http://hdl.handle.net/2128/16709



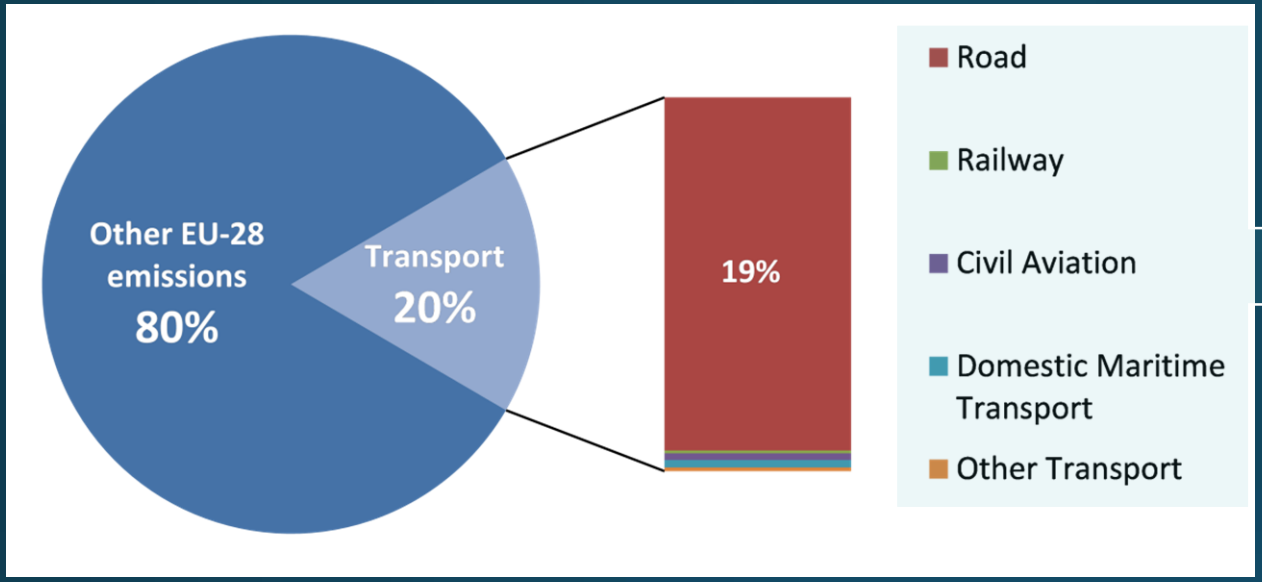
Project team:

Martin Robinius, Jochen Linßen, Thomas Grube, Markus Reuß, Peter Stenzel, Konstantinos Syranidis, Patrick Kuckertz and Detlef Stolten

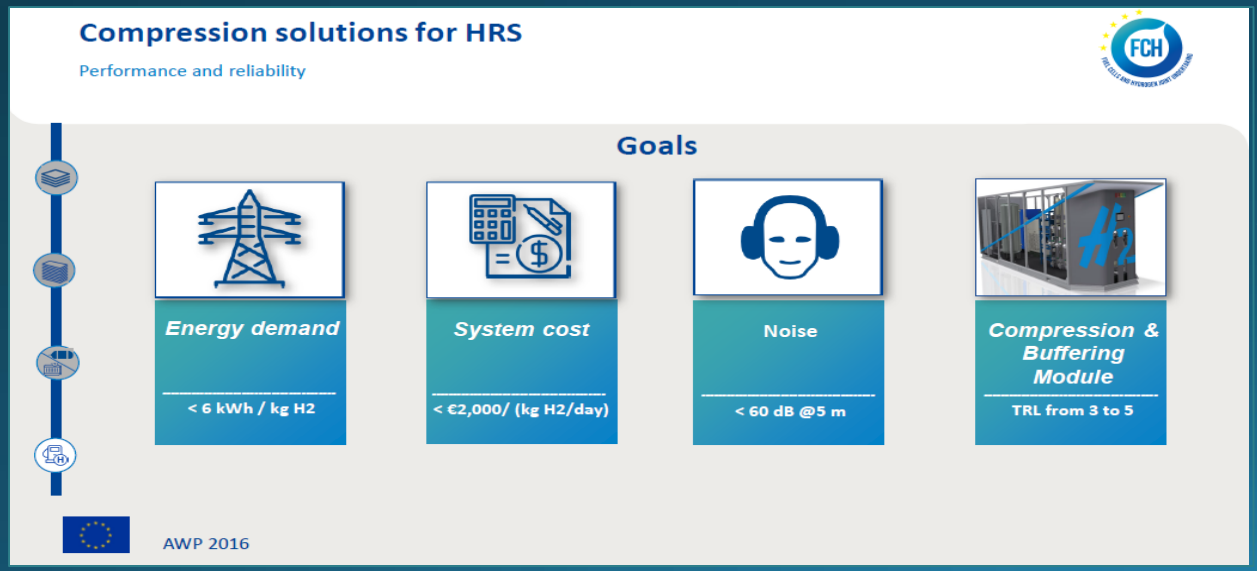
Funded by

H2 MOBILITY
FUELLING HYDROGEN

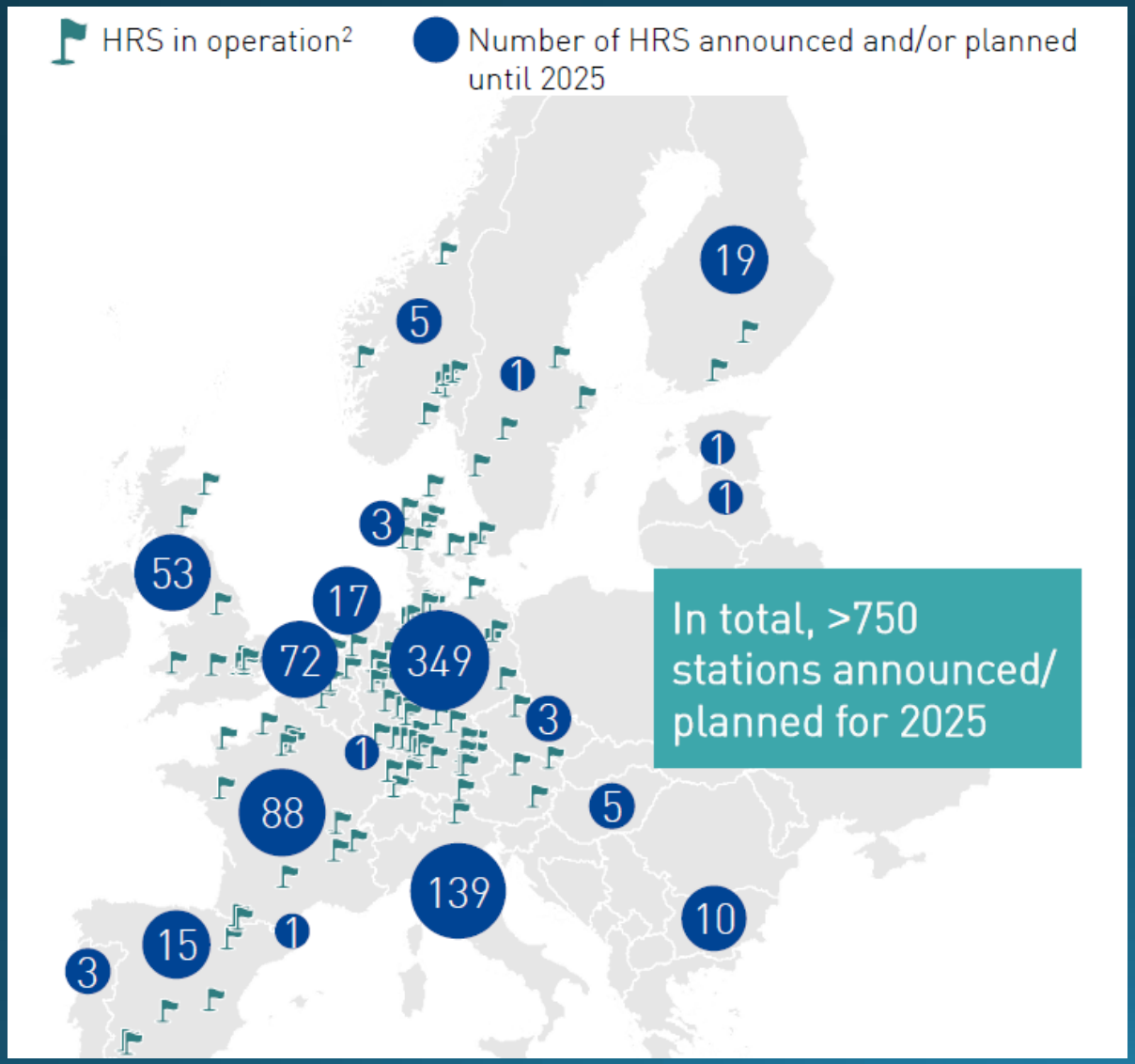
NEED FOR NEW INFRASTRUCTURES

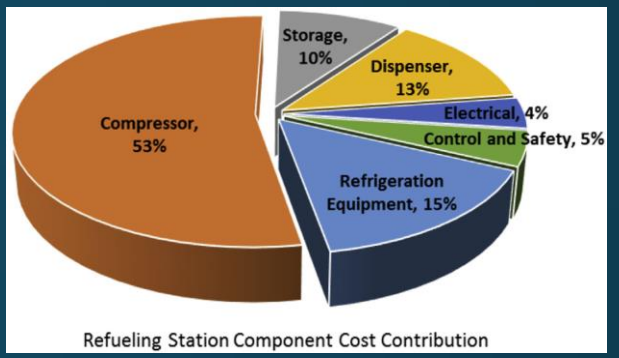


Need of compression



The market



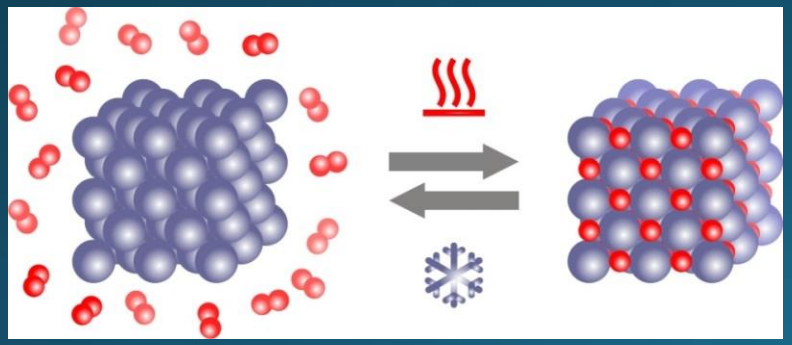


The envisaged main market for the MHHC is the one of Hydrogen Refuelling Station (HRS):

The size of the Total Addressable Market in Europe for HRS and Hydrogen Vehicles has been assessed by the European Commission in the COM (2017) 652 final document

A NEW TECHNOLOGY FOR H_2 COMPRESSION

A noise free hydrogen compression system based on metal hydrides using only water as the cooling / heating medium achieving hydrogen pressures > 350 bar



Metal hydrides basic principle

UNIQUE ADVANTAGES

ZERO NOISE LEVELS

ability to install Hydrogen Refueling Stations (HRS) in residential areas

VERY LOW O&M COSTS

use only cheap, low-grade thermal energy; do not include mechanical parts

LOW ENVIRONMENTAL IMPACT

no use of Critical Raw Materials; can be driven only by RES or/and Waste Heat

MODULARITY, AVAILABILITY & RELIABILITY

modular product with hgh availability and reliability

The authors wish to acknowledge the partial support by the H2TRANS Greek National project (T1EDK-05294), as well as the Industrial Research Fellowship Program funded by the S. Niarchos Foundation at NCSR "Demokritos" (SHESAM project)