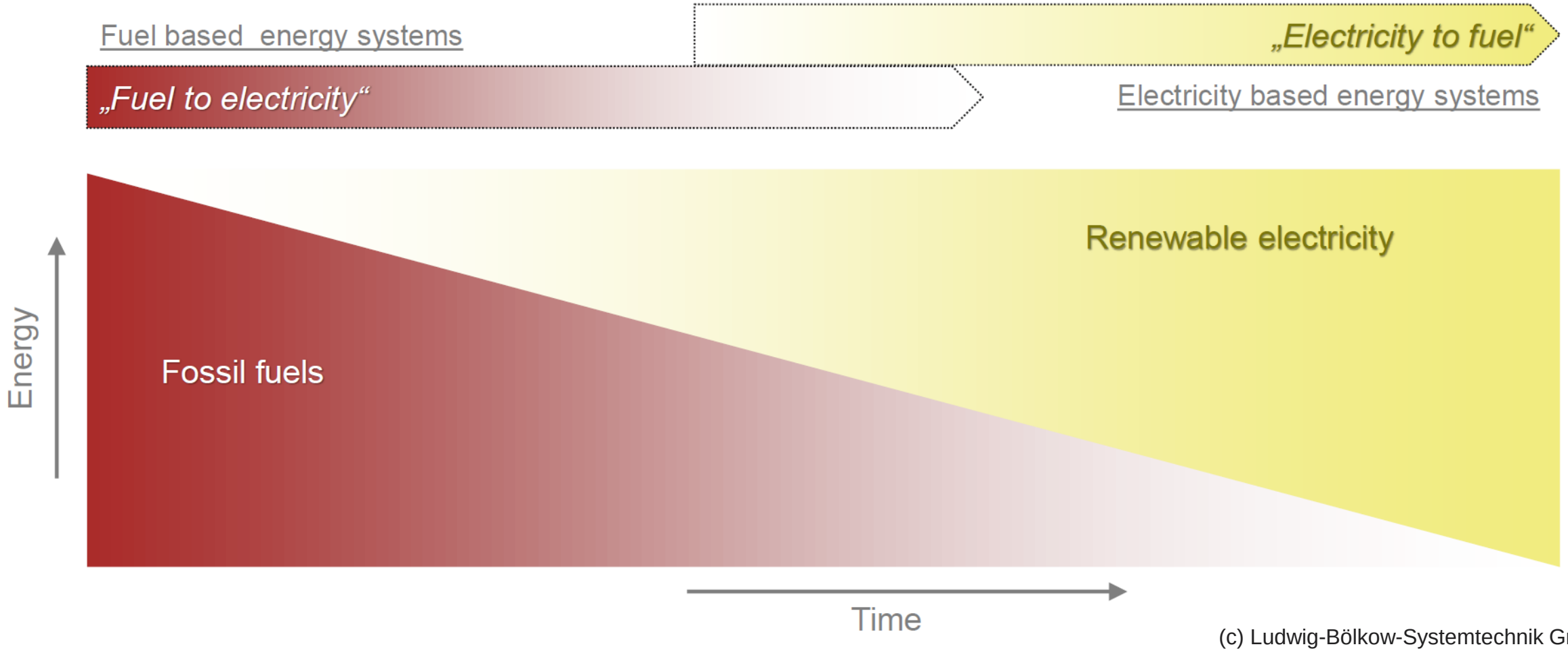
Nationale Organisation
Wasserstoff- und Brennstoffzellentechnologie

The Role of Hydrogen in the Energy Transition

IPHE | Koriyama City | 09. May 2018

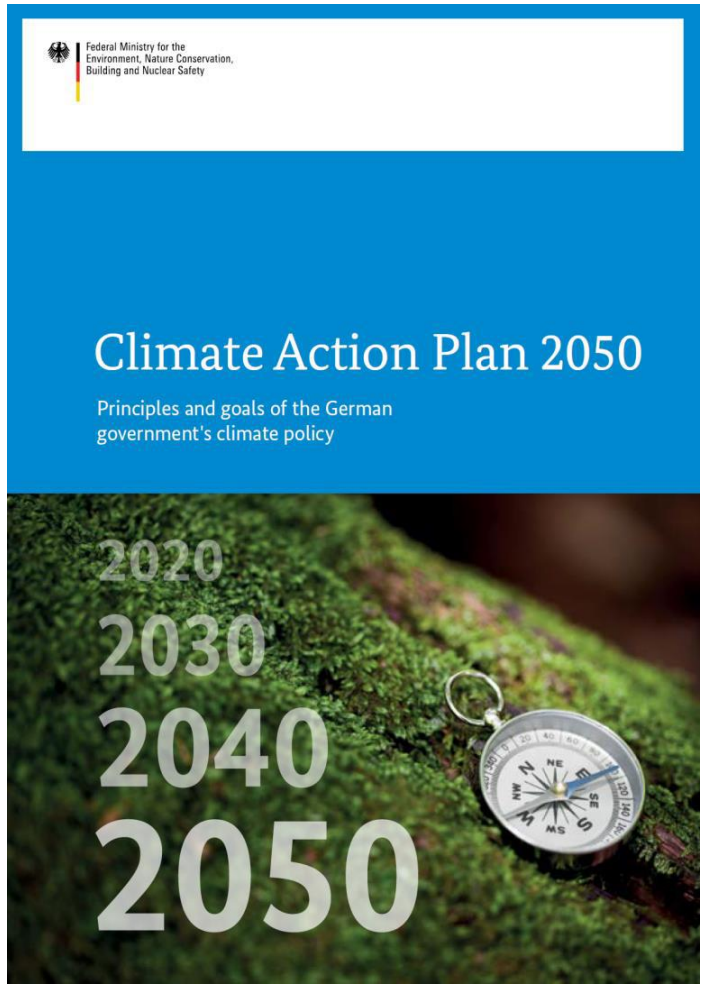
Lucia Seißler | Programme Manager Asia |
NOW National Organisation Hydrogen and Fuel Cell Technology

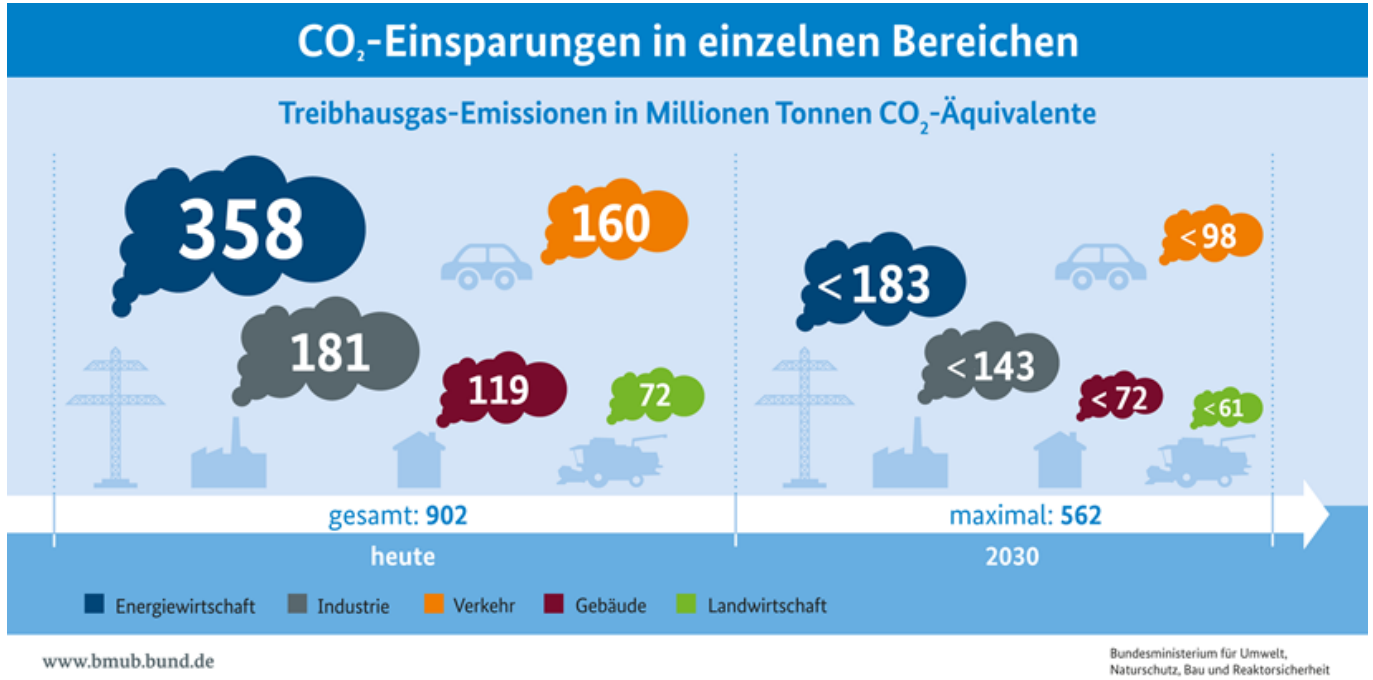
WHERE DO WE COME FROM AND WHERE DO WE HAVE TO GO
FROM A FOSSIL BASED TO A RENEWABLE ELECTRICITY BASED SYSTEMS



(c) Ludwig-Bölkow-Systemtechnik GmbH

GERMAN CLIMATE ACTION PLAN 2050 – SECTOR GOALS FOR CO_2-EMISSIONS REDUCTION

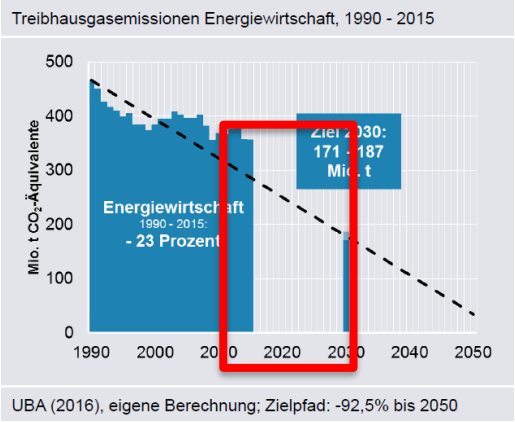




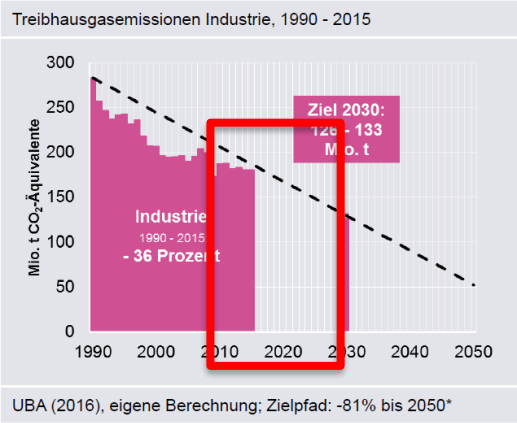
40 to 42 % of CO_2-emission reductions in the transport sector by 2030

CO_2-REDUCTION TARGETS ARE DEMANDING MASSIVE CHANGES IN THE ENERGY SYSTEM

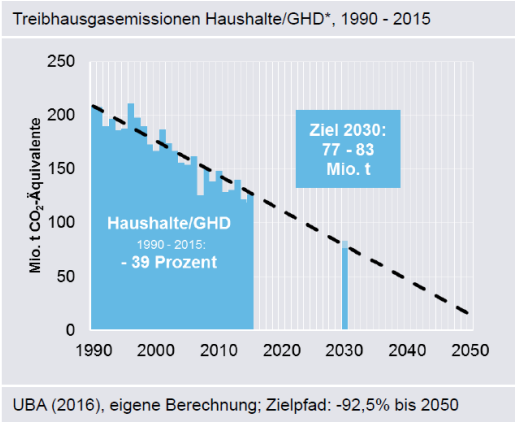
Energy (Target: -92.5%)



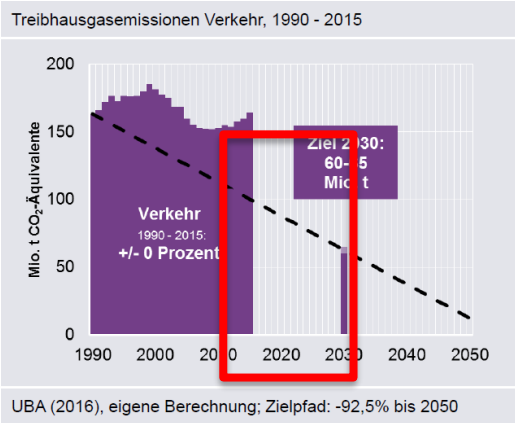
Industry (Target: -92.5%)



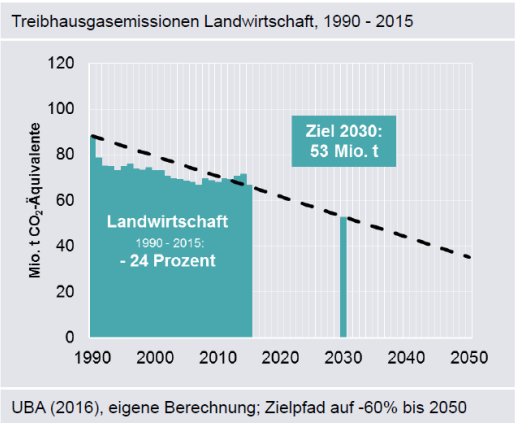
Homes (Target: -92.5%)



Transport (Target: -92.5%)

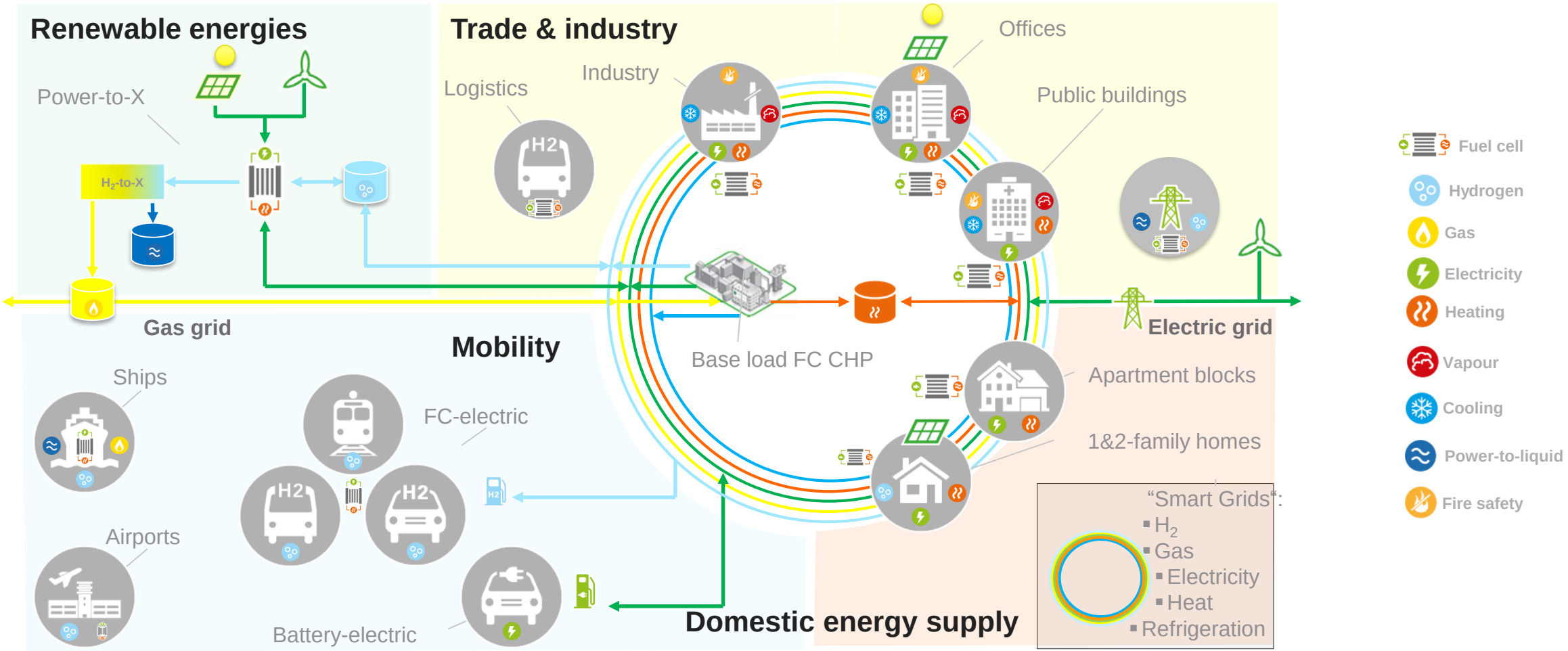


Agriculture (Target: -60%)



Graphs: G. Rosenkranz, Agora Energiewende, 20.09.2016

THE ROLE OF FUEL CELLS AND HYDROGEN IN TOMORROW'S INTEGRATED ENERGY SYSTEM



NATIONAL ORGANISATION HYDROGEN AND FUEL CELL TECHNOLOGY GOVERNMENTAL PARTNER FOR SUSTAINABLE MOBILITY AND ENERGY

Electro Mobility in Regions

- Research and development
- Communal mobility concepts
- Procurement, concepts

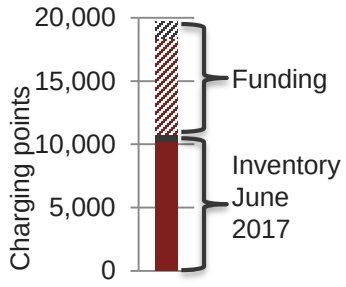
Bundesministerium für Verkehr und digitale Infrastruktur

Charging Infrastructure Subsidy-Programme

Nationwide buildup

- normal charging points
- fast charging points

Bundesministerium für Verkehr und digitale Infrastruktur



NOW
Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie

coordination and implementation

National Innovation Programme

- Research & development and demonstration
- Market activation (procurement, environmental aid)

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Mobility and Fuels Strategy

- Alternative fuels (efficient, emission-free)
- Pilot projects

Export Initiative Environmental Technology

- German-Japanese cooperation with regards to Power-to-Gas
- H_2/Fuel cell technology in international cooperation (together with GIZ)

GOVERNMENT PROGRAMME 2016 – 2026
CONTINUING THE NATIONAL INNOVATION PROGRAMME HYDROGEN AND FUEL CELL TECHNOLOGIES (NIP)

Research and development			Market activation		
Technical/cost targets			Milestones (quantities/costs)		
Fundamental research	Applied research and development	Demonstration	Hydrogen in transport	Hydrogen from renewable energy sources	Cogeneration (domestic energy supply/ industry) Secure power supply
Cost reductions			Lead market / lead supplier Germany		

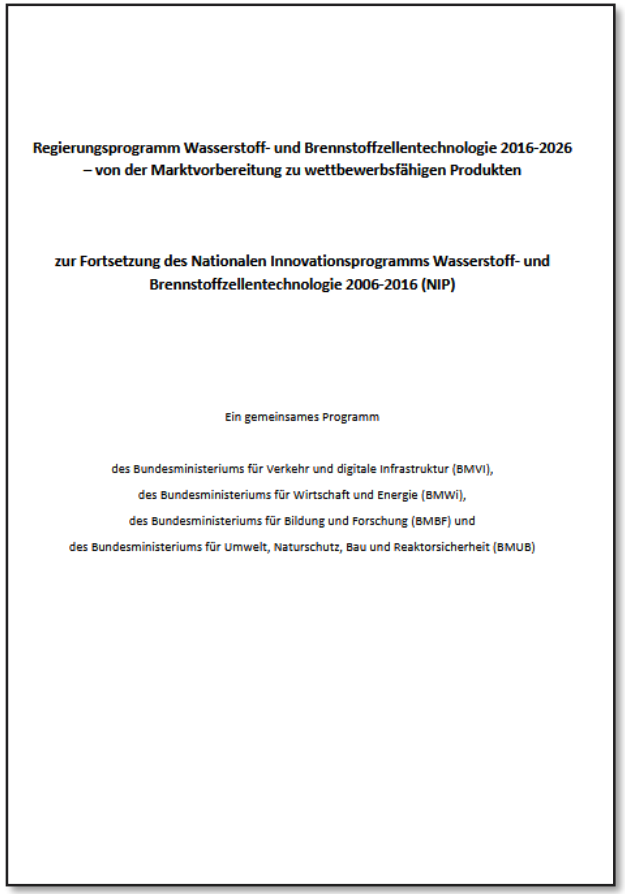
Energy research framework programme, BMWi

Funding guideline September 2016 BMVI

Funding guidelines 2017

Technology introduction programme, BMWi

Value creation / Competitiveness Germany



Regierungsprogramm Wasserstoff- und Brennstoffzellentechnologie 2016-2026 – von der Marktvorbereitung zu wettbewerbsfähigen Produkten

zur Fortsetzung des Nationalen Innovationsprogramms Wasserstoff- und Brennstoffzellentechnologie 2006-2016 (NIP)

Ein gemeinsames Programm

des Bundesministeriums für Verkehr und digitale Infrastruktur (BMVI),
des Bundesministeriums für Wirtschaft und Energie (BMWi),
des Bundesministeriums für Bildung und Forschung (BMBF) und
des Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit (BMUB)

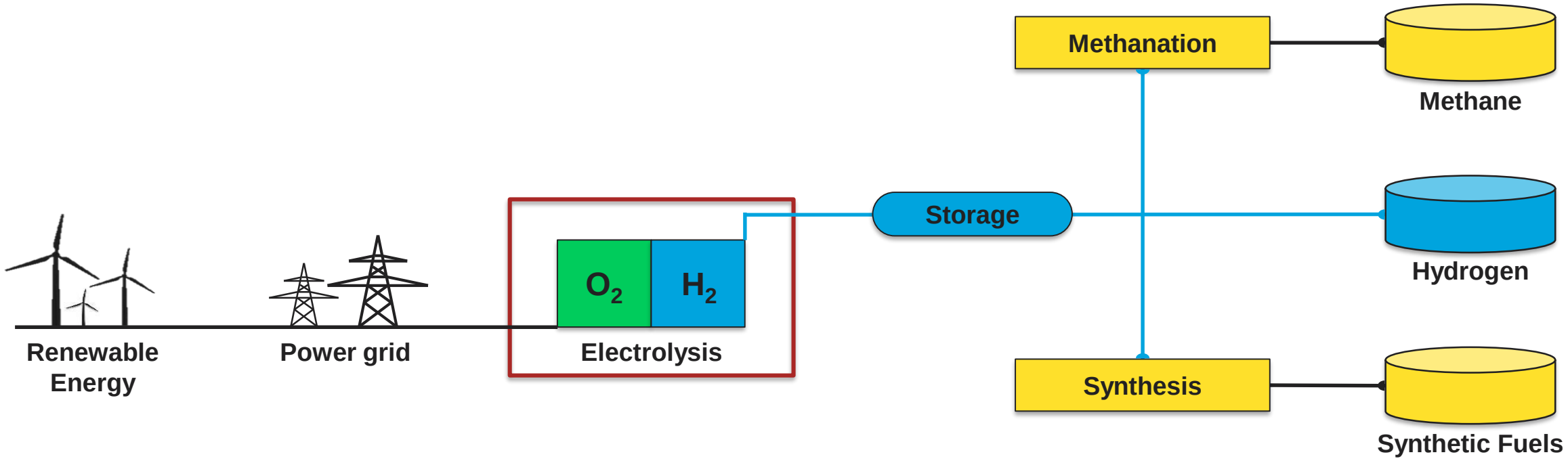
ELECTROLYSIS AND PTX

SITUATION IN GERMANY
PRODUCTION AND CONSUMPTION ARE GEOGRAPHICALLY SEPARATED

- Main share of renewable energy is produced by wind in the north of Germany.
- The industry which needs the energy is located mainly in the south of Germany
- The transport of energy from north to south is one of the main challenge for the energy transition

ELECTROLYZER TECHNOLOGY
HYDROGEN PRODUCTION AND FUEL PATHWAYS

Power-to-Gas: Hydrogen, Methane
Power-to-Liquid: Synthetic fuels (e.g. Kerosene, Methanol, Gasoline)



Water electrolysis as key technology is addressed in the National Innovation Program for Hydrogen and Fuel Cell Technologies

GREEN HYDROGEN REQUIRES A SUPPORTIVE REGULATORY FRAMEWORK

Low-cost electricity

- (Partial) exemption from grid fees, taxes or levies
- Access to curtailed electricity

Access to grid service revenues

- Remuneration for grid frequency control

Recognition of green hydrogen

- Level playing field for the injection of carbon lean gas into the gas grid
- Recognition of green hydrogen as option to reduce carbon intensity of conventional fuels

Business case for green hydrogen

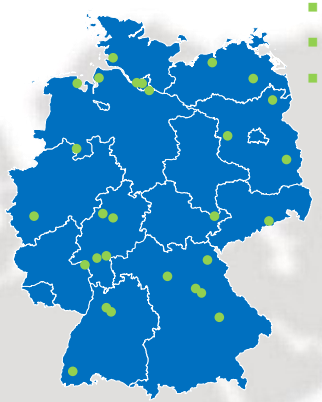
PtG for hydrogen production – Projects in Germany and worldwide

Germany

>30 Pilot projects

43 H2 fueling stations

>20 over 20 MW installed



2 MW

Canada

- 2 MW PtG plant in Mississauga for injection into the gas grid
- 200 kW plant in Quebec

1500

USA

- 1500 fuel cell cars and 33 buses
- 73 fuel cell stations
- 225 MW fuel cells for stationary applications
- 2600 km of hydrogen grid

1,4 MW

Argentina

- 1,4 MW PtG plant from Hychico
- Pilot project for hydrogen storage

17

Great Britain

- 17 fueling stations
- Project of EasyJet for hybrid planes

1 MW

France

- 1 MW PtG in Jupiter 1000 project
- 185 fuel cell cars and 100 forklifters

20 MW

Scandinavia

- Norway: 20MW PtL in 2020 for Blue Crude production
- Norway: Utsira Wind power hydrogen project
- Denmark: Hydrogen community Vestenskov
- 23 Fueling stations

4 MW

China

- 4 MW PtG plant for hydrogen production
- Goal of 5000 fuel cell buses until 2020
- 5 Fueling stations

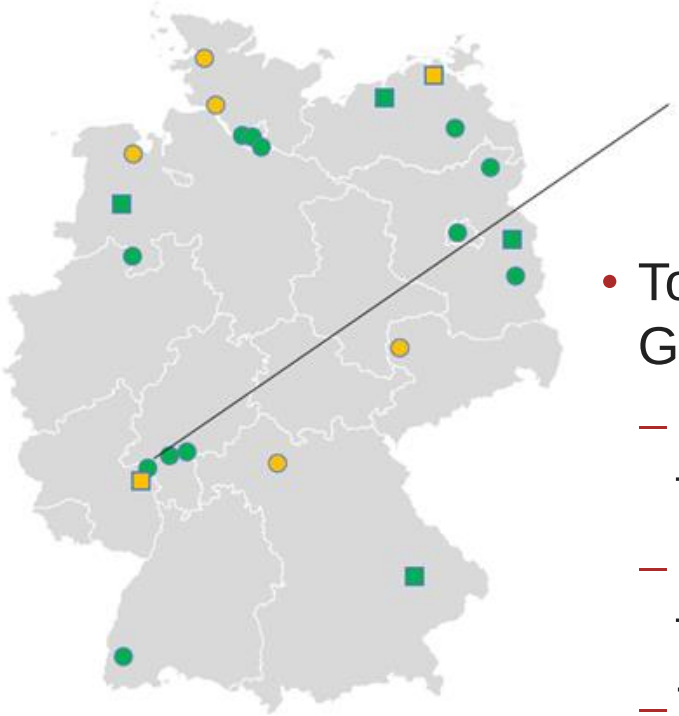
200.000

Japan

- 200000 fuel cell systems for domestic homes
- 90 fueling stations
- 2800 fuel cell cars and 2 buses
- Goal of 100 buses in Tokyo until 2020

Source: Roadmap Power-to-Gas of strategy platform Power-to-Gas, Dena 2017

RENEWABLE HYDROGEN PRODUCTION
ENERGIEPARK MAINZ



ENERGIE PARK MAINZ

- To date biggest PtH_2 Project in Germany
  - Electricity Supply via wind park with four 2MW wind mills
  - PEM-Electrolyser (Siemens Silyzer) for H_2 production (max. 6 MW Input)
  - 780 kg H_2 storage at max. 80 bar
  - Injection into the NG grid up to 15 %
  - Trailer transport (300 – 600kg per Trailer)

WATER ELECTROLYZER IN THE ENERGY SYSTEM– ONGOING STUDIES

Industrialization of water electrolyzer in Germany

Chances and challanges for sustainable hydrogen in transport, electrizity and heat

Fraunhofer ISE | Fraunhofer IPA | E4tech Strategy | Energy | Sustainability

Integrated Energy Concept 2050

Regulative environment for an intergrated energy concept 2050 and the role of renewable fuels

bbh BECKER BÜTTNER HELD | IKEM | Fraunhofer ISE | ludwig bölkow systemtechnik

On behalf of

Bundesministerium für Verkehr und digitale Infrastruktur

Coordinated by

NOW Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie

SPOTLIGHT ON LATEST PROJECTS AND ACTIVITIES – TRANSPORT

R&D-PROJECTS ADDRESS KEY COMPONENTS OF AN AUTOMOTIVE FUEL CELL DRIVE TRAIN (EXAMPLES)

700 bar Hydrogen Storage

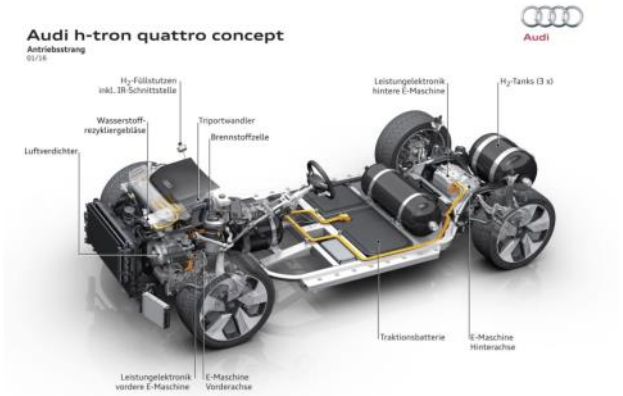
- improving the manufacturing process
- 04/01/2017 - 03/31/2019
- public funding (BMVI): 1.432 Mio. Euro

Fuel Cell Stack

- joint specifications
- preparing mass production
- 05/01/2017 - 09/30/2019
- public funding (BMVI): 18.548 Mio. Euro

System Development

- next generation automotive fuel cell
- 03/01/2017 - 08/31/2019
- public funding (BMVI): 4.842 Mio. Euro



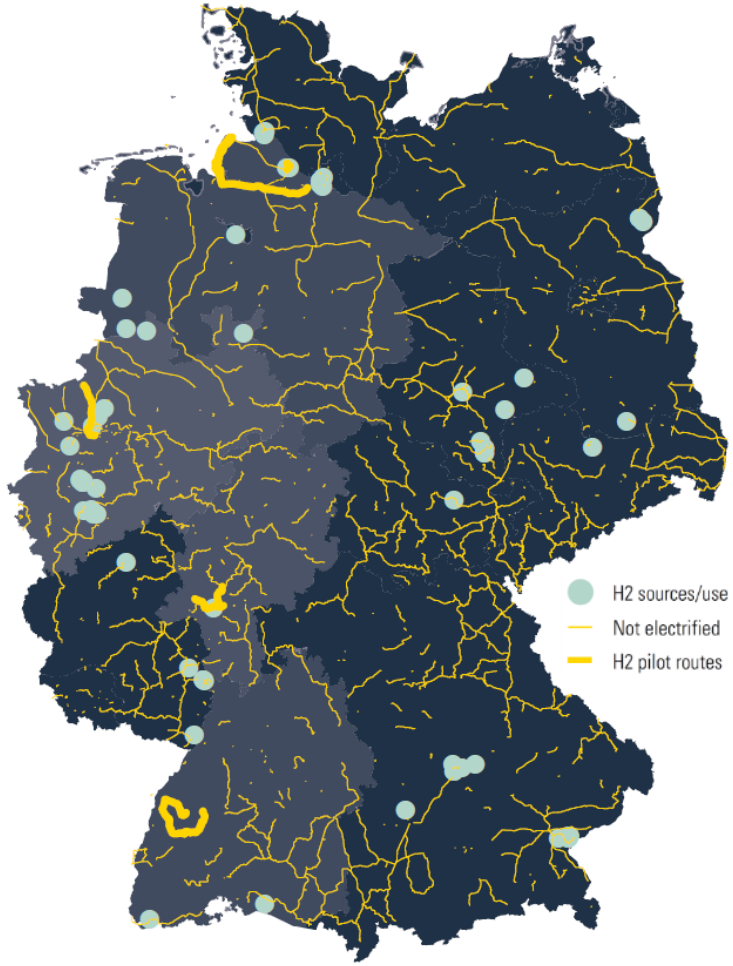
NIP – MARKET ACTIVATION SUCCESSFUL FIRST FUNDING CALLS

51 FC-Buses / 3 Refueling stations at bus depots
- Regional public transport operator in Cologna orders 30 FC-Buses

235 FC-Cars
- More than 200 Toyota Mirai
- 20 + 15 at Clever Shuttle (German ride sharing provider)
- 30 at Alphabet (large leasing company)

14 FC-Trains / 1 Refueling station at train depot
- Call open until March 31st, 2018

NIP SUCCESS STORY – REGIONAL TRAINS WITH FUEL CELLS FOR NON-ELECTRIFIED RAILWAYS



SPOTLIGHT ON LATEST PROJECTS AND ACTIVITIES – INFRASTRUCTURE

DIRECTIVE ON THE DEPLOYMENT OF ALTERNATIVE FUELS INFRASTRUCTURE (2014/94/EU)

The national strategic framework covers electricity, CNG/LNG and hydrogen

- Assessment of the state of play and future market developments
- National targets and objectives
- Measures to reach targets and objectives
- European coordination

GERMANY'S NATIONAL STRATEGIC FRAMEWORK - HYDROGEN INFRASTRUCTURE (PASSENGER CARS)

	2006-2016	until 2020	until 2025	until 2030
TASKS	Secure technological basis, meet conditions for ramp up	Basic coverage for Germany	Support market roll-out	Commercial roll-out
GOAL	**50 stations**	**100 stations**	**400 stations**	**1000 stations**

INDEPENDENT OF VEHICLES | **DEPENDENT OF VEHICLES**

FILLING UP WITH HYDROGEN WILL SOON BE POSSIBLE GERMANY-WIDE

Bundesministerium für Verkehr und digitale Infrastruktur

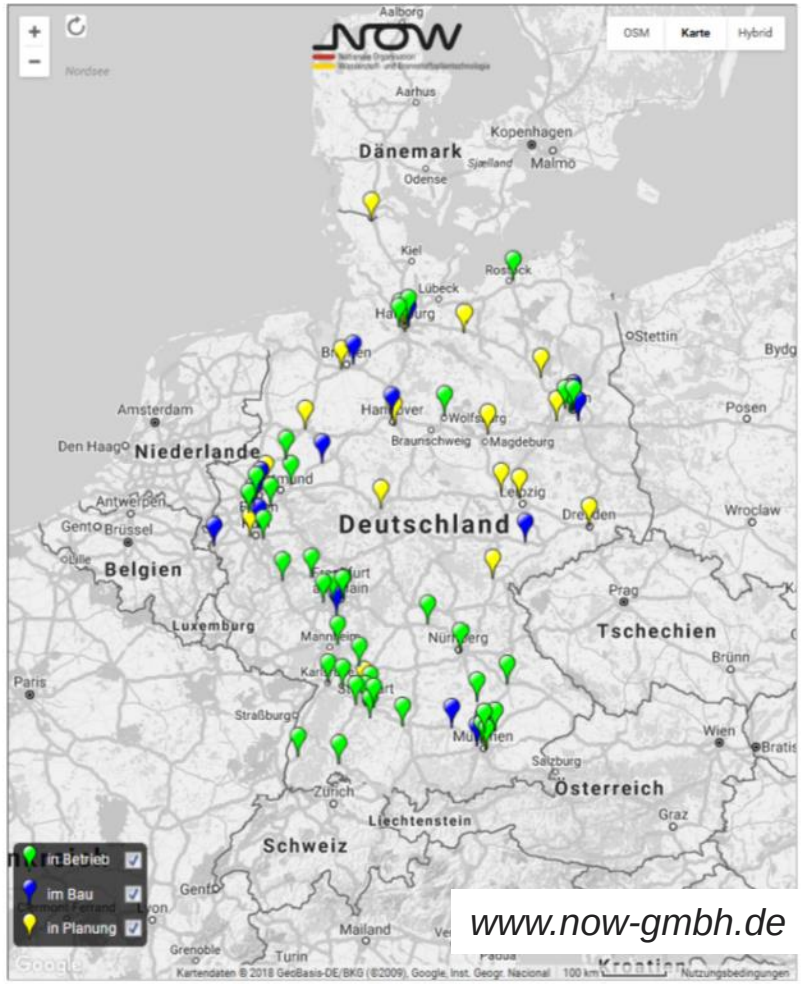
Berlin, October 13, 2015

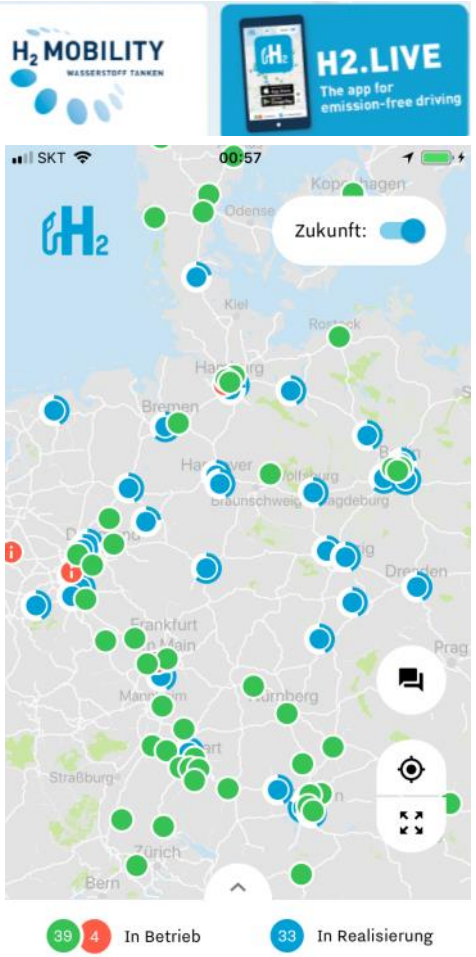
Shareholders

AIR LIQUIDE, DAIMLER, THE LINDE GROUP, OMV, Shell, TOTAL

Associated partners and advisors

BMW, HONDA The Power of Dreams, HYUNDAI, TOYOTA, VOLKSWAGEN, NOW





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http://www.now-gmbh.de/de/service/publikationen

Thank you very much for your attention!

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