

The National Innovation Program Hydrogen and Fuel Cell Technologies

10th IPHE Education & Outreach Event
Hamburg | April 26, 2017



Dr. Klaus Bonhoff | Managing Director (Chair)

NOW GmbH - National Organization Hydrogen and Fuel Cell Technology

International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE)



The International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) was established in 2003 as an international institution to accelerate the transition to a hydrogen economy.

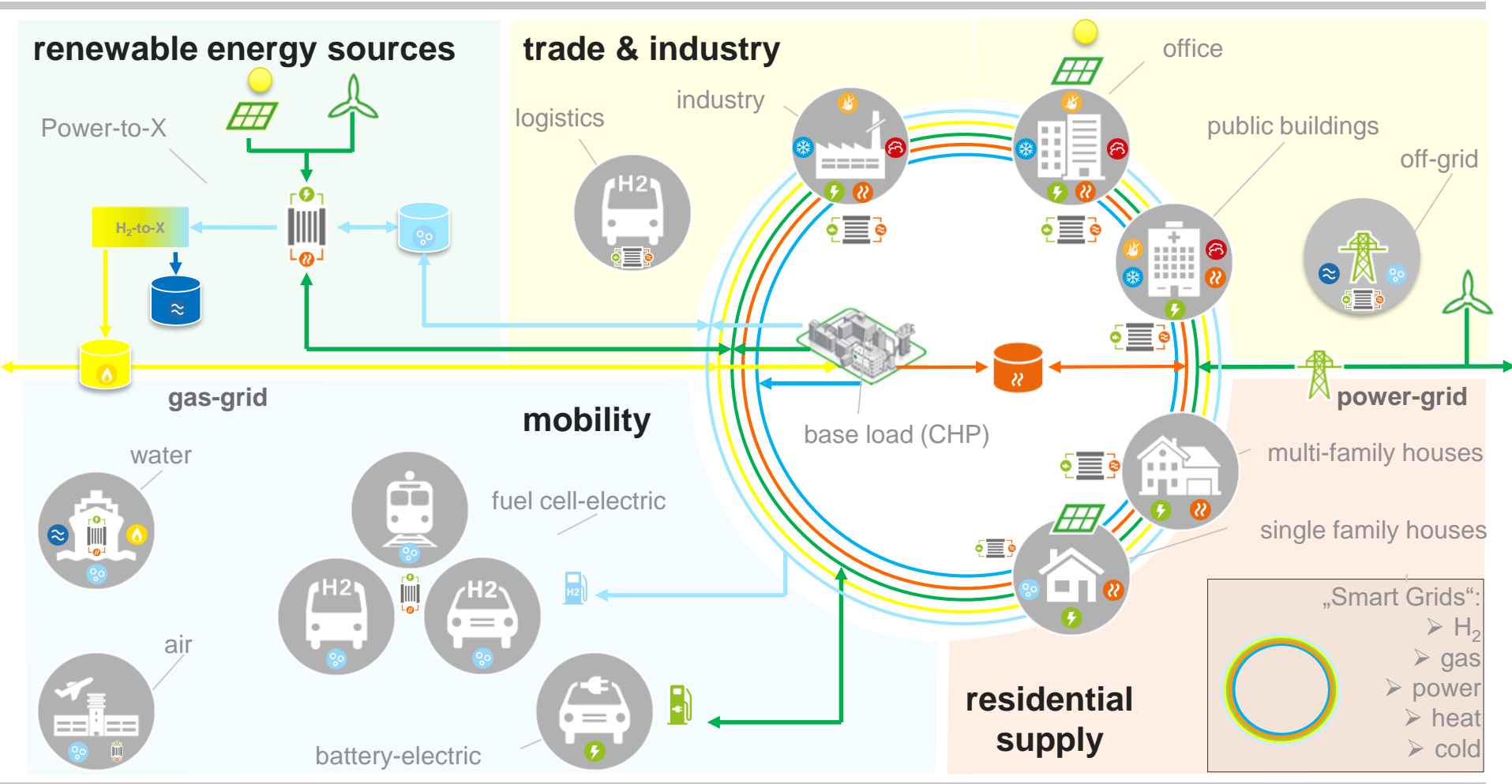


All IPHE members collectively account for over 85% of global GDP, over 75% of the global electricity, and more than 65% of global greenhouse gas emissions.



Hydrogen and Fuel Cell technologies

– efficient – flexible – emission-free – renewable – coupling the energy sectors –



The National Innovation Program Hydrogen and Fuel Cell Technologies (NIP) 2007-2016



– Integrated Approach for Market Preparation



Bosch:
Wasserstoffgas-
Injektor HGI



Technology

- components
- subsystems
- systems and products

Application

- cost
- reliability
- durability

Market

- customer acceptance
- safety
- approval / certification

Duration: 2007 – 2016

Funding: **BMVI** 500 Mio. Euro
BMW 200 Mio. Euro



Bundesministerium
für Verkehr und
digitale Infrastruktur



Bundesministerium
für Wirtschaft
und Energie

overall budget: 1.4 bn. Euro



FCCT:
Gasdiffusionsschicht
(GDL)

Linde:
Ionic H₂-Kompressor



Praxistest Brennstoffzelle fürs Eigenheim
Ein Projekt im Nationalen Innovationsprogramm
Wasserstoff- und Brennstoffzellentechnologie



Brennstoffzellen in Industrie und Business



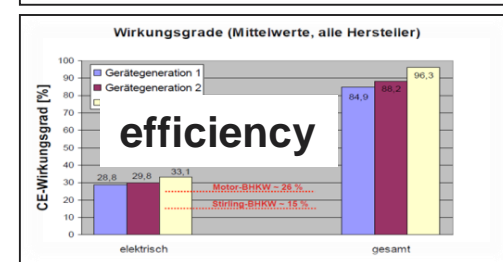
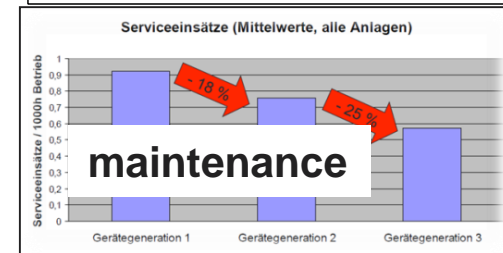
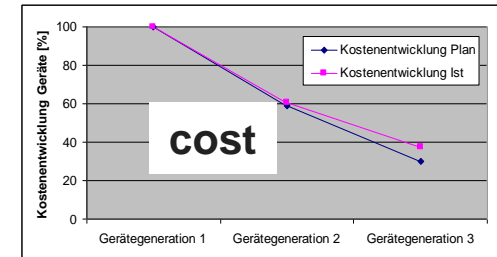
CALLUX

Successful market preparation for residential fuel cells




<http://www.callux.net>

- almost 500 systems
- 4.5 million operating hours
- system availability > 97 per cent
- 2.5 million kWh delivered
- proven stack life time > 20,000 h



Products for residential combined heat and power supply with fuel cells are available

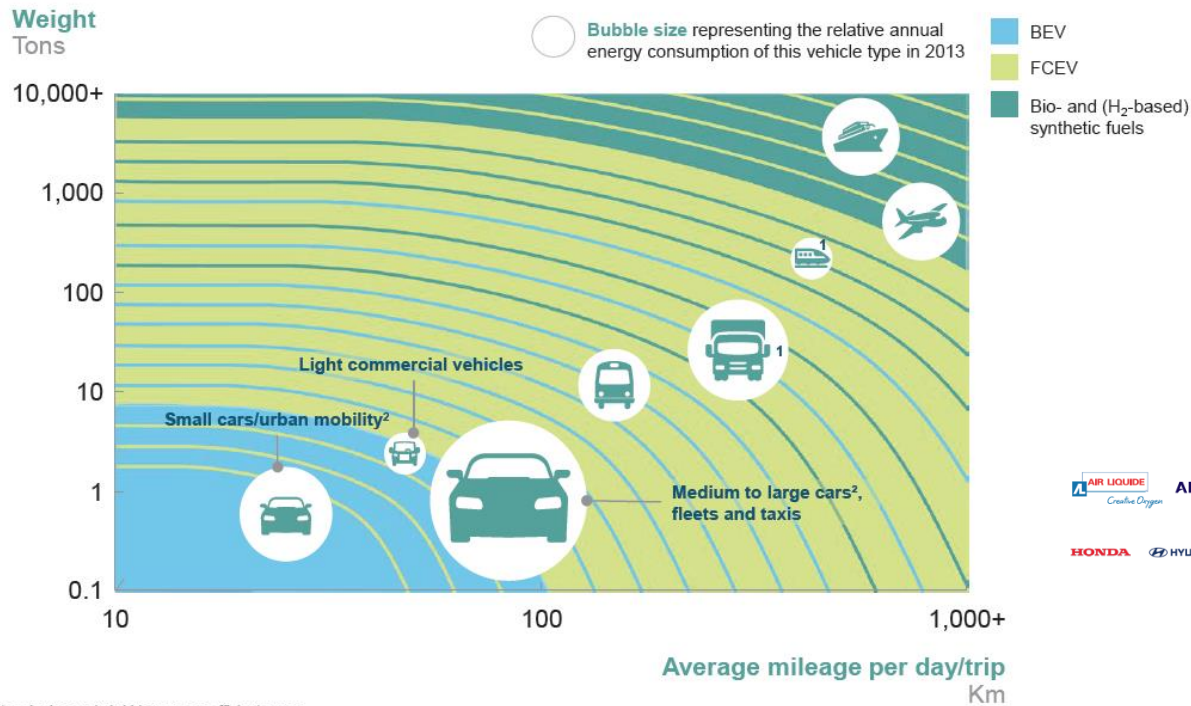
									
Hersteller	Buderus	Elcore	HEXIS	Junkers	SenerTec	SOLIDpower	SOLIDpower	Vaillant	Viessmann
Typ	SOFC	HT-PEM	SOFC	SOFC	NT-PEM	SOFC	SOFC	SOFC	NT-PEM
Modell-bezeichnung	Logapower FC10	Elcore 2400	Galileo 1000 N	Cerapower FC10	Dachs Innogen	EnGen-2500	BlueGEN	G6	Vitavalor 300-P
Leistung (el/th)	0,7/0,62 kW	0,3/0,7 kW	1,0/1,8 kW	0,7/0,62 kW	0,7/0,96 kW (modulierende Anlage)	2,5/2 kW	1,5/0,61 kW	0,8/1,5 kW	0,75/1 kW
Thermische Leistung des Zusatzbrenners	7,3-24 kW	Paketlösungen: 2,8-19,5 kW / 7,8-33,2 kW, oder extern, individuell wählbar	7-21 kW	7,3-21,8 kW	5,2 - 21,8 kW	extern, individuell wählbar	extern, individuell wählbar	5,8-27 kW	5,5-19 kW
Speicher	Warmwasserspeicher 75 l, Pufferspeicher 135 l	Paketlösungen: 500 l, oder extern, individuell wählbar	extern, individuell wählbar	Warmwasserspeicher 75 l, Pufferspeicher 135 l	Pufferspeicher mit Frischwasserstation 300 l	300 l, optional	extern, individuell wählbar	extern, individuell wählbar	Warmwasserspeicher 46 l, Trinkwasserspeicher optional auf 300 l erweiterbar, Pufferspeicher 170 l
Elektrischer Wirkungsgrad	45 %	32 %	35 %	45 %	37 % (Vollast)	50 %	bis zu 60 %	33 %	37 %
Gesamtwirkungsgrad	85 %	104 %	95 %	85 %	90 %	90 %	bis zu 85 %	92 %	90 %
Abmessungen in mm (B x T x H)	1200 x 600 x 1800	600x550x1050	620 x 580 x 1650	1200 x 600 x 1800	Brennstoffzelleneinheit: 453 x 728 x 1054 Systemtechnik: 655 x 1065 x 1800	630 x 830 x 1700	600 x 660 x 1100	599 x 693 x 1640	1085 x 595 x 1998
Gewicht in kg	Gesamtsystem 304 kg in Modulbauweise, max. Modulgewicht 112kg	115	210	Gesamtsystem 304 kg in Modulbauweise, max. Modulgewicht 112kg	115 kg (Brennstoffzellenmodul)	350	ca. 200	150	290 (Brennstoffzellenmodul 125) (Spitzenlastmodul 165)
Feldtests, Kooperationen, Demonstrationsprojekte	ene.field (EU), Kleinserie in Kooperation mit Energieversorgern	ene.field (EU), verschiedene Partner aus der Energiewirtschaft und dem Hausbau	Callux (DE), Pharos (CH), ene.field (EU)	ene.field (EU)	enefield (EU), Callux (DE)	ene.field (EU)	abgeschlossen	Feldtest in Callux (DE), Kleinserie in ene.field (EU)	Januar 2013 Pretest; Juli 2013 bis März 2014 großer Feldtest
Markteinführung	2016	2014	Ende 2013	2016	2016	2016/2017	erfolgt (2012)	2016/2017	April 2014
Kontakt	www.buderus.de	www.elcore.com E-Mail: vertrieb@elcore.com Tel.: +49 89 6780463-77	www.hexis.com	www.junkers.com	www.derdachs.de	www.solidpower.com Tel.: +49 2452 153758	www.solidpower.com Tel. +49 2452 153758	www.vaillant.de	www.viessmann.com

Batteries AND Fuel Cells

- Complementary Technologies for Zero Emission Transportation

FCEVs will play an essential role in decarbonizing transport

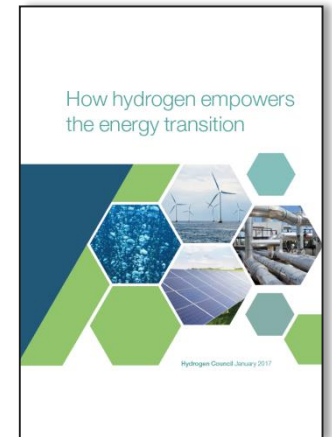
Projected economic attractiveness



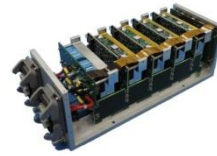
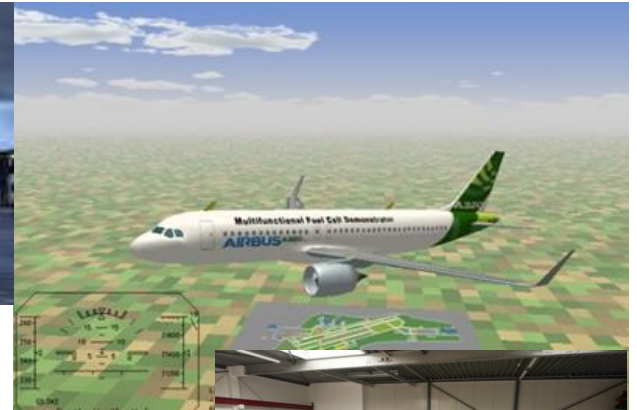
1 Battery-hydrogen hybrid to ensure sufficient power

2 Split in A- and B-segment LDVs (small cars) and C+-segment LDVs (medium to large cars) based on a 30% market share of A/B-segment cars and a 50% less energy demand

Source: Toyota, Hyundai, Daimler



Fuel Cell Applications in the Transport Sector



Clean Energy Partnership

Technology validation with more than 100 fuel cell vehicles (passenger cars and busses) including hydrogen infrastructure



Ein Projekt im Nationalen Innovationsprogramm Wasserstoff- und Brennstoffzellentechnologie



Vehicle Performance efficiency, cold start, range



Fast Refueling 700 bar technology



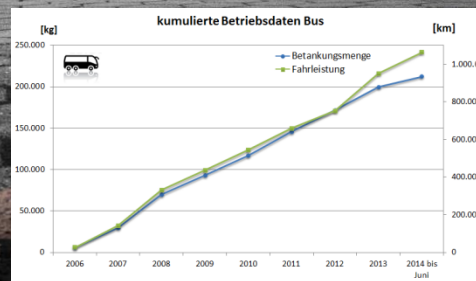
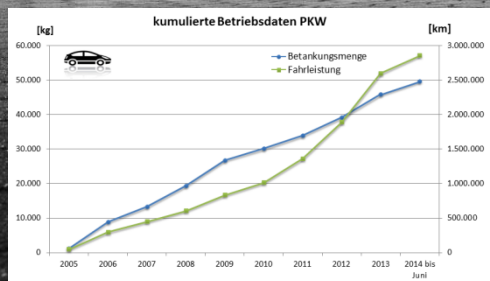
Safety standards defined and tested



Sustainable > 50% green hydrogen



Customer Acceptance



Commercialization of Fuel Cell Vehicles has begun

HYUNDAI NEW THINKING. NEW POSSIBILITIES. MODELLE SERVICES GEWERBEKUNDEN ÜBER UNS MIT HYUNDAI

DER HYUNDAI ix35 FUEL CELL¹

NULL CO₂-EMISSION - FÜR EINE SAUBERE UMWELT

Ab 65.450 EUR²
Ab 599 EUR³ finanzieren

Kraftstoffverbrauch in kg H₂/100 km kombiniert für den Hyundai ix35 Fuel Cell: 0,96 kg H₂. CO₂-Emissionen in g/km kombiniert: 0

ix35 Fuel Cell

HANDLER RÜCKRUF-SERVICE GALERIE

HIGHLIGHTS AUSSEN INNEN TECHNIK SICHERHEIT NEWS UND SERVICES FILME GARANTIE TECHNISCHE DATEN KONTAKT



Menü Home / Toyota kaufen / Neuwagen / Demoschritt bei Toyota / Mirai Mein Toyota TOYOTA NICHTS IST UNMÖGLICH

Der Toyota Mirai
Die erste Wasserstoff-Limousine in Großserie.

HOME KONFIGURIEREN KONTAKT GALERIE

CLARITY FUEL CELL

ZERO EMISSIONS. INFINITE POSSIBILITIES.

Coming Winter 2016

GET EXCLUSIVE UPDATES

Right-hand drive global model shown.

Fuel Cell Buses in Public Transport

Example: Hamburger Hochbahn

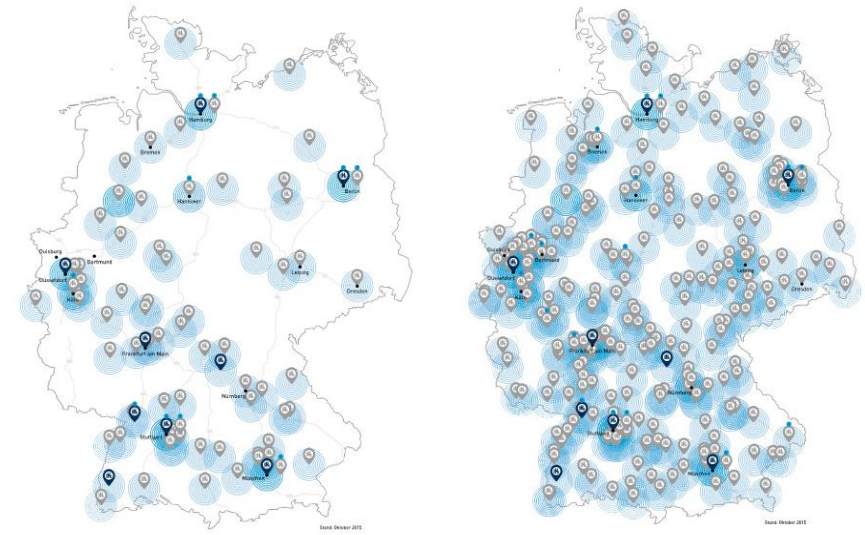


H2 Mobility

A partnership to make refuelling hydrogen possible throughout Germany



Berlin
October 13, 2015



2018

2023

Shareholder



Associated Partners and Advisors



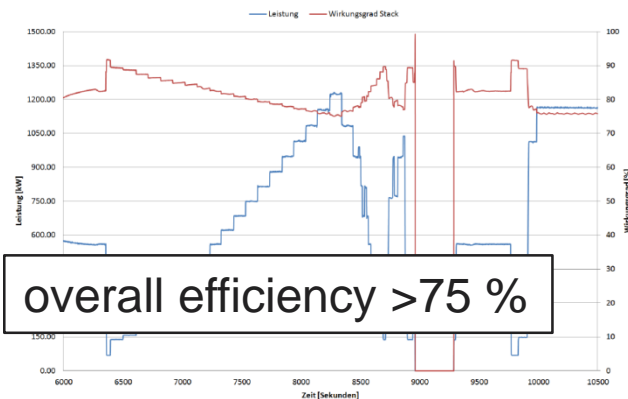
Hydrogen Production based on Renewable Energy Sources



- Development and demonstration of wind-hydrogen systems
- Integration of hydrogen into the energy system (mobility-, power-, heat-sector)
- Hydrogen as a fuel in the context of the federal Mobility and Fuels Strategy

HYDROGENICS
SHIFT POWER | ENERGIZE YOUR WORLD

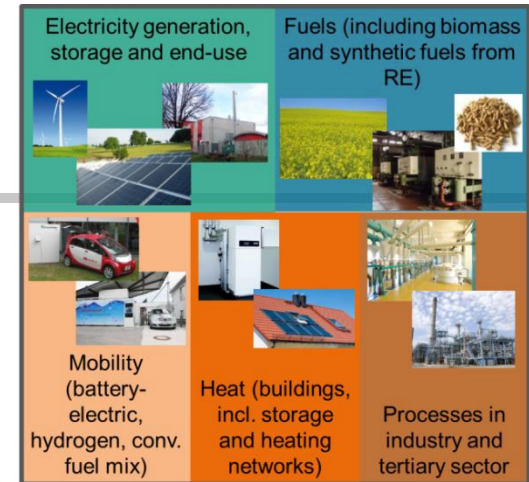
1,5 MW PEM WE Efficiency Achievements (prel.)



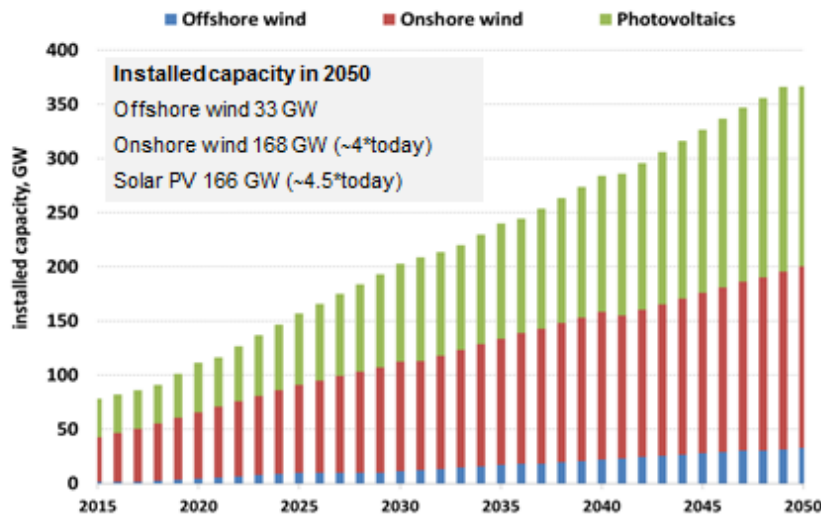
80% reduction of green-house gases until 2050

- increase of PV- and Wind capacity by a factor of > 4
- 75 GW installed electrolyzer-capacity

modelling the energy system in Germany (power - heat - transportation); cost-optimized scenario assuming 80% green-house-gas reduction until 2050



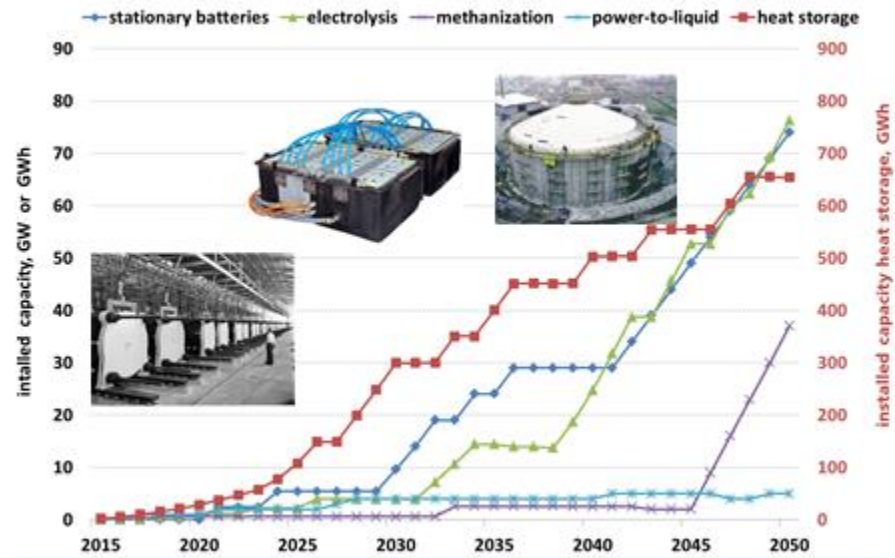
Fluctuating Renewable Energies: Solar, Wind



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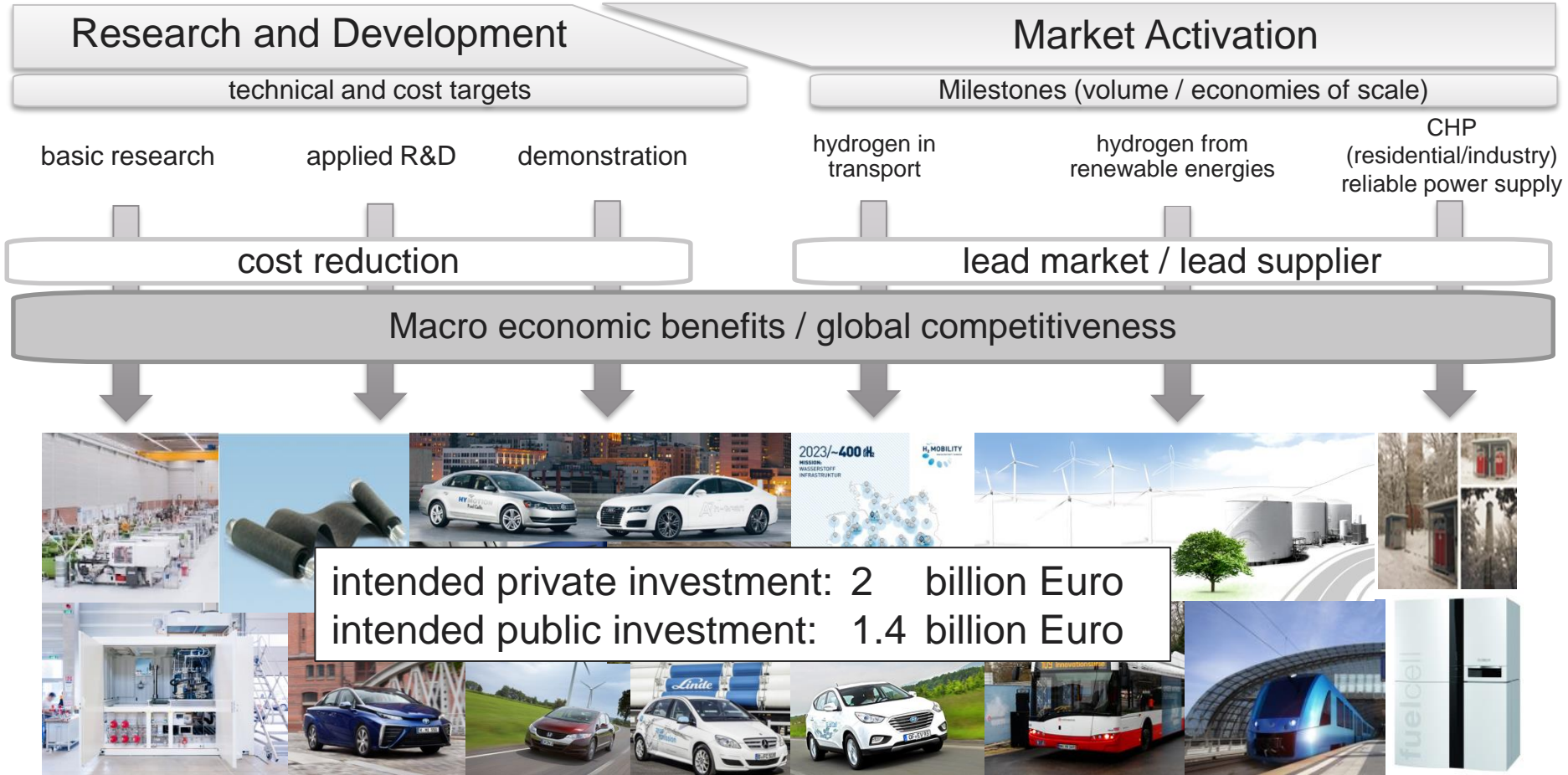
Storage and Power-to-Gas/Fuel Technologies



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The federal Government approved the continuation of the National Innovation Program (NIP) 2016-2026 on Sept. 28, 2016



Thank you very much!

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