

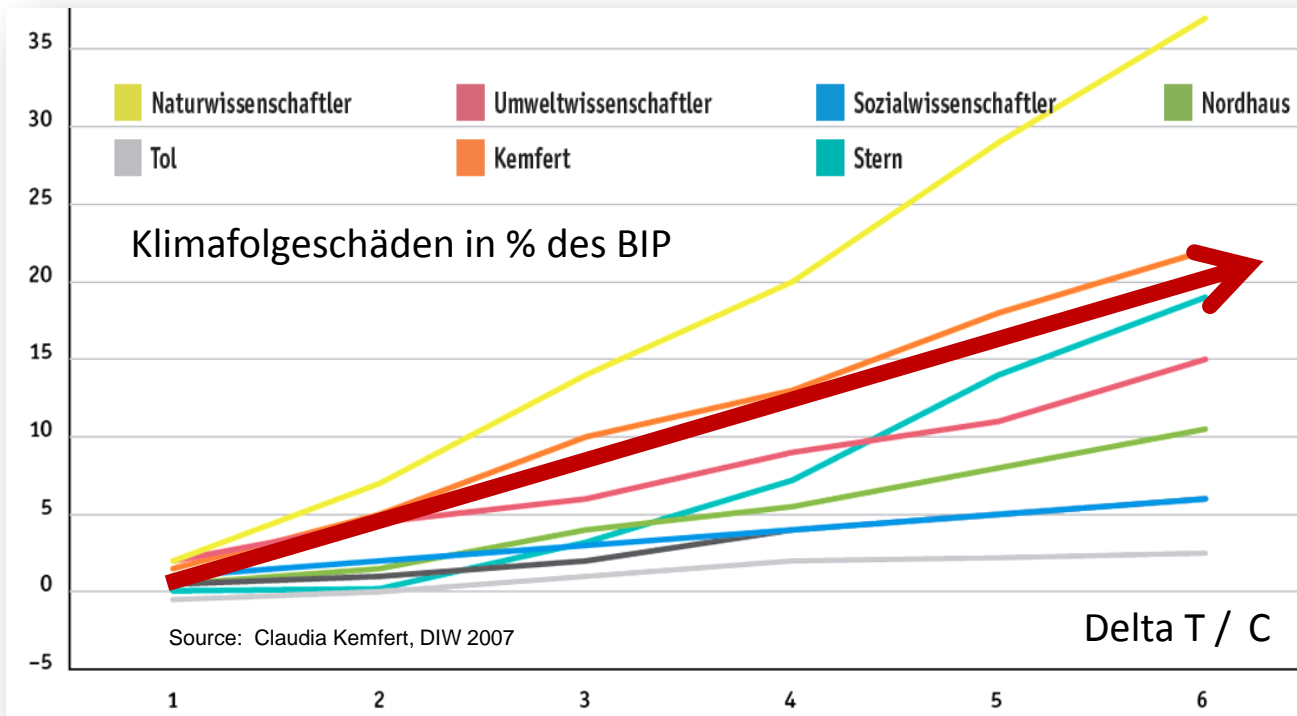
# Callux and other NIP lighthouse projects in stationary fuel cell applications

Brussels | Oct 26, 2009 | FCH JU

Dipl.-Ing. univ Kai Klinder | NOW |

Director Finance and Administration, Program Management Stationary Applications

# Damage by Climate Change



Nicholas Stern

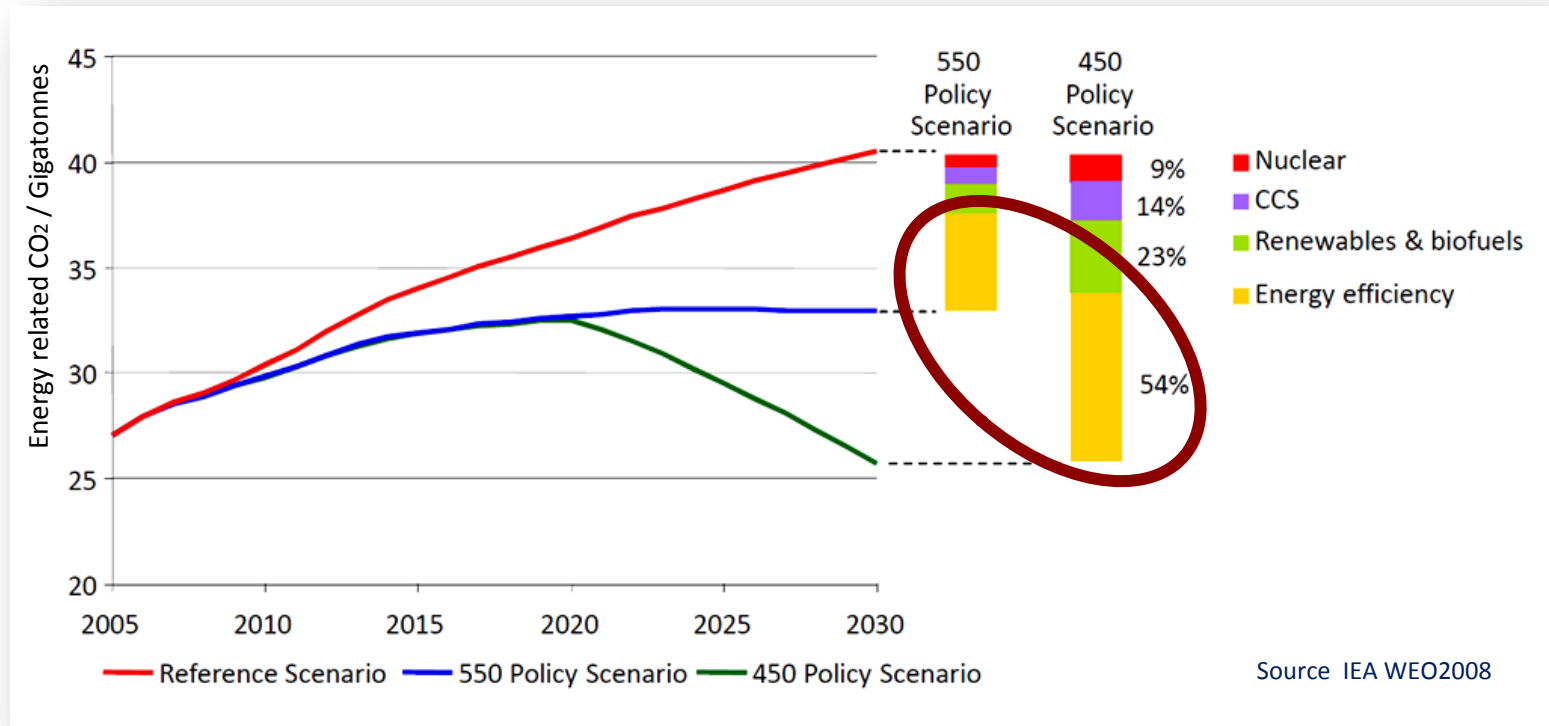


Claudia Kemfert

Sources  
ur.: [www.hm-treasury.gov.uk/sternreview](http://www.hm-treasury.gov.uk/sternreview)  
br.: BMWi 2009

Up to 20% of all incomes have to be spent to overcome damages caused by climate change, if we do not act immediately

# Energy Efficiency Policy Scenarios



CO<sub>2</sub> and climate gas reduction require highly efficient technologies

# Advantages of fuel cells

1. Most efficient energy converter,  $\eta_{el} > 50\%$
2. Optimised for CHP and Trigeneration
3. Fuel flexible ( $\text{CH}_4$ ,  $\text{H}_2$ , Alcohols, ... )
4. Mass production
5. Low emissions
6. Quiet



The Fuel Cell solves energy and environment issues.  
Fuel Cells are a key innovation for mobile and stationary applications.

# Product Development Phases and Financing Case Europe



# German National Innovation Program (NIP) Hydrogen and Fuel Cell Technology

NIP is supported by:



Federal Ministry  
of Transportation, Building  
and Urban Affairs



Federal Ministry  
of Economics  
and Technology



Federal Ministry  
of Education  
and Research



Federal Ministry for the  
Environment, Nature Conservation  
and Nuclear Safety



- **200 M€** funded by Fed. Ministry of Economics. Focus R&D
  - **500 M€** funded by Fed. Min of Transport, Building & Urban Affairs. Focus demonstration with R&D
  - **700 M€** contribution of industry
- 
- **1.400 M€** total budget
  - Duration: 2007-2016

NIP is a strategic alliance between German politics, industry and science



# German National Innovation Program Objectives



- Accelerating market entry of H<sub>2</sub>/FC applications
- Strengthening Europe's global competitiveness
- Enlarging High-Tech competencies in Europe
- Creating sustainable jobs
- ... and last but *not* least:
- Saving energy and protecting the climate

Sources: Baxi, Baxi, MTU, Staxera

# NIP: Preparing various markets

## Transportation 54% €

- Expanding vehicle fleets and the hydrogen infrastructure starting from key-regions

158 projects  
720 million € budget (Sept.2009)



## Stationary Applications 36% €

- FC micro CHP for residential use
- Industrial FC gensets for CHP and trigeneration



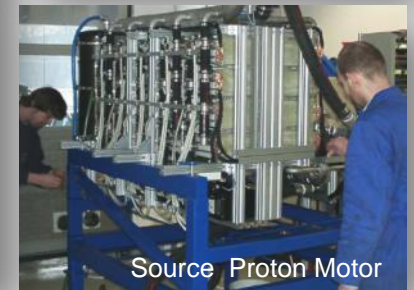
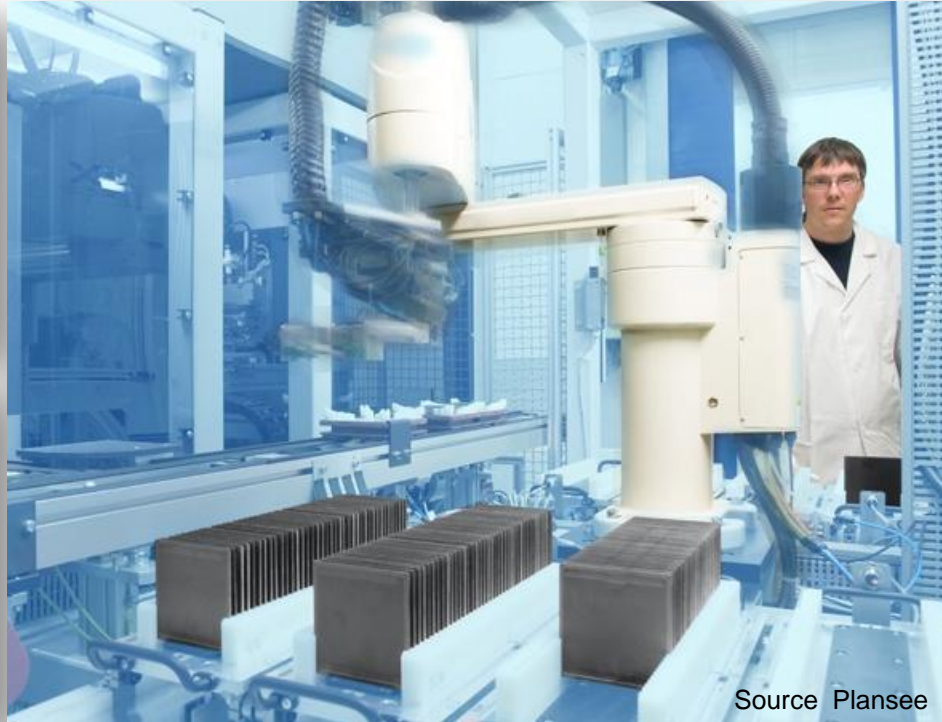
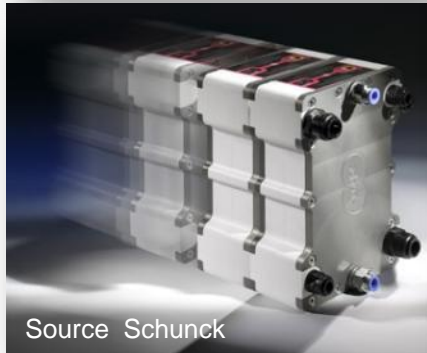
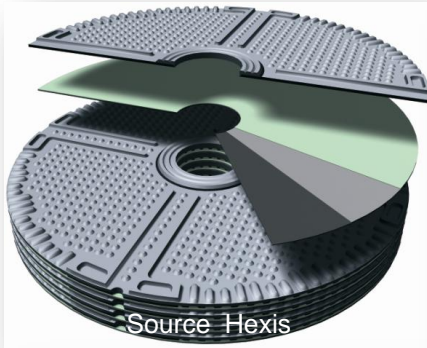
## Special Markets 10% €

- IT, telecommunications
- Logistics, leisure and tourism markets





# Stationary Industry in Germany, Austria and Switzerland (D-A-CH)



Fuel Cell Appliances are on their way out of lab into real markets.  
Fuel Cell Technology is a key innovation for the European Industry.

# FCHA in Germany

## BAXI INNOTECH, HH

- 30 Beta1.5plus in CALLUX installed, base NG
- 1,0 kW-PEM „Gamma“ and serial components (Ballard-Stack) / pilot production

**BAXI INNOTECH**  
fuel cell heating



# FCHA in Germany

## Ceramic Fuel Cells (CFCL)

- SOFC with steam reforming
- 1 - 2 kW<sub>el</sub> base natural gas
- First field tests in 2006
- Production in Heinsberg (NRW)
- Cooperation with several European heating appliance manufactures i.e. De Diedrich, Bruns



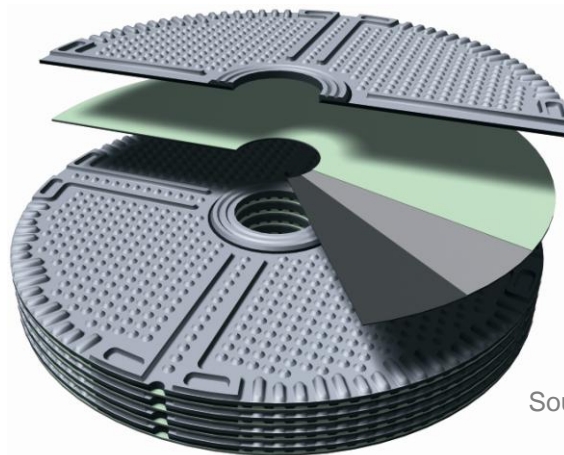
Source: CFCL, NOW



# FCHA in Switzerland/Germany

## Hexis

- SOFC with 1 kW<sub>el</sub>
- 5 Generations of stacks
- 3 small series tests since 1997
- Pilot production startet in 2009
- Market entry in 2012
- Cooperation with Hoval and Stiebel-Eltron



Source Hexis



# FCHA in Germany

## Inhouse / RBZ Glaubitz

- 1. Generation with LT-PEM,
- Successfull test with 4 kW system
- 2. Generation, Type Inhouse 5000, 5 kW in manufacturing
- Field test 2009



Source RBZ GmbH

# FCHA in Germany

## VAILLANT, Remscheid

- 60 LT-PEM FCHAs in 2000 – 2006 getestet
- 2008 in development:
  - 4,6 kW HT-PEM BZH  
Partner PlugPower
  - 1 kW-SOFC for small homes  
Partner Staxera/IKTS



Source Vaillant Group



# FCHA in Germany /USA

## NextGenCell by PlugPower/VAILLANT

- HT-PEM-Stack with 0,5-3 kW<sub>el</sub>
- PBI-MEA by BASF, 160°C
- Heat for 90/60°-Systems.  
Eta<sub>el</sub>=30%
- NG, ATR-Reformer
- F&E-Funds by EU and DoE



Source PlugPower



HT-PEM Stack + BASF MEA  
Source NOW



Reformer and Stack  
Source NOW



	Participant name	Country
1	Vaillant GmbH	Germany
2	Plug Power Holland bv	Netherlands
3	BASF Fuel Cell GmbH	Germany
4	Bulgarian Academy of Science	Bulgaria
5	Gaia Power Oy	Finland
6	Imperial College London	United Kingdom
7	Domel Elektromotorji in gospodinski aparati, d.d.	Slovenia
8	Plug Power Inc.	USA
9	BASF Fuel Cell Inc.	USA

# NIP – Stationary I

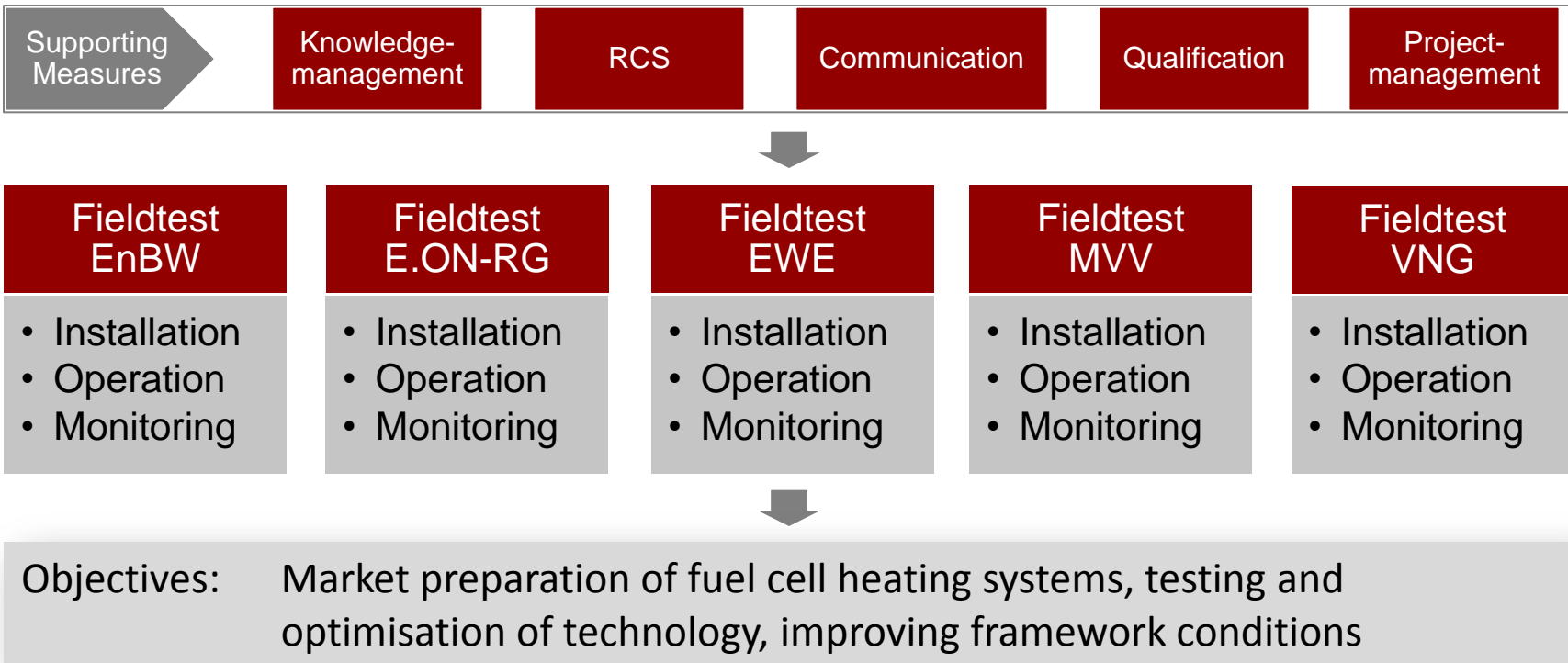
## Residential Applications



- Target: High-efficient co-generation for residential houses
- Lighthouse CALLUX: Start Sept. 2008
  - 5 utilities, 3 appliance suppliers, science and craftsmanship
  - Sept. 2009: 30 units by BAXI Innotech and HEXIS installed in 4 regions
  - Budget 80 Mio € for 800 units to 2015
- 5 Projects with SOFC and LT-PEM
- 1 Project “Desulphurisation Standard”

Sources: E.on , E.on, Staxera, Vaillant, EnBW

EnBW, E.On-Ruhrgas, EWE, MVV, VNG  
Baxi Innotech, Hexis, Vaillant, ZSW, and others



# NIP – Stationary I Lighthouse CALLUX

**Die Projekte**

Energieversorger: Bundesland:

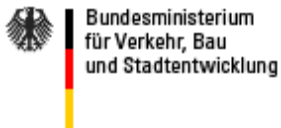
Energieversorger	Bundesland	Ort	PLZ	Start
EnBW	Baden-Württemberg	Schwetzingen	69723	Jun 2009
E.ON Ruhrgas	Hamburg	Hamburg	22609	Mai 2009
EWG	Niedersachsen	Hude	27798	Mai 2009
EWG	Niedersachsen	Hude	27798	Mai 2009
EWG	Niedersachsen	Cuxhaven	27478	Mär 2009
E.ON Ruhrgas	Hamburg	Hamburg	21079	Mär 2009
EWG	Niedersachsen	Cuxhaven-Altbruch	27478	Feb 2009
EWG	Niedersachsen	Papenburg	26871	Feb 2009
EnBW	Baden-Württemberg	Ettenheim	77955	Jan 2009
MVV	Baden-Württemberg	Mannheim	68219	Jan 2009

1 2 3 Next

**Die Brennstoffzelle**  
Heiztechnik der Zukunft  
Der Callux-Film informiert Sie über den Praxistest. Zum Start klicken Sie bitte auf das Bild oben.  
Aktuelles Projekt: Juni 2009, Schwetzingen c'

**Aktuell**  
neue Projekte

Source: <http://www.callux.net/>



EnBW

BAXI INNOTECH

e-on | Ruhrgas

HEXIS

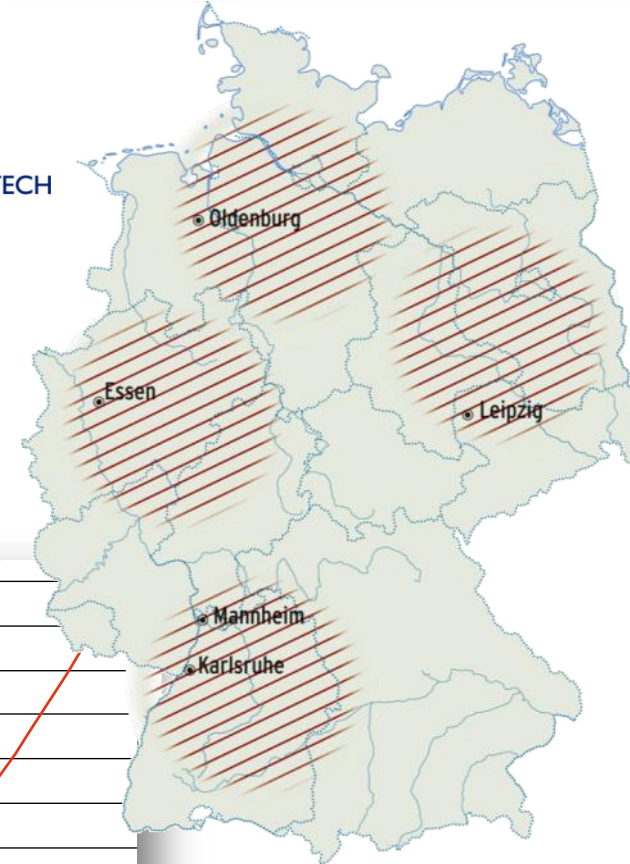
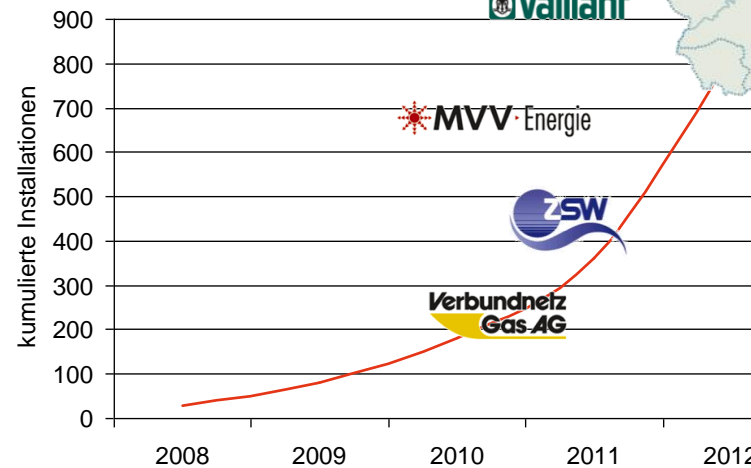
EWG

Vaillant

MVV Energie

ZSW

Verbundnetz Gas AG



### Project status in October 2009

- More than 40 units installed in 4 regions of Germany
- First performance assessment of installed units finished
- Supporting Measures:
  - Development of qualification tools for craftsmen started
  - First qualification tool will be published in March 2010
  - Supporting market research started
  - Bids invited from third parties to develop a standardized communication interface for residential applications



# CALLUX

## Installation examples



Family home in Ötisheim  
(Baden-Württemberg)



Day-care centre in Oberderdingen  
(Baden-Württemberg)

Sources: CALLUX



# CALLUX

## Installation examples



Family home in Mannheim  
(Baden-Württemberg)



Family home in Müncheberg  
(Brandenburg)

Sources: CALLUX

# CALLUX

## Installation examples



Family home in Westoverledingen (Lower Saxony)



Family home in Oldenburg (Lower Saxony)

Sources: CALLUX



# NIP – Stationary II

## Industrial Applications



- Decentralized, highly-efficient supply of power, heat and cold
- Application e.g. in hospitals, office-buildings, large IT infrastructures, waste-removal gasification, decentral district heating, sewage gas usage and many more
- Lighthouse project NEEDS – using biogas

Sources: MTU (1,2,4), Biotech (3)

# NIP – Stationary II

## NEEDS: Supply of CO<sub>2</sub>-free energy

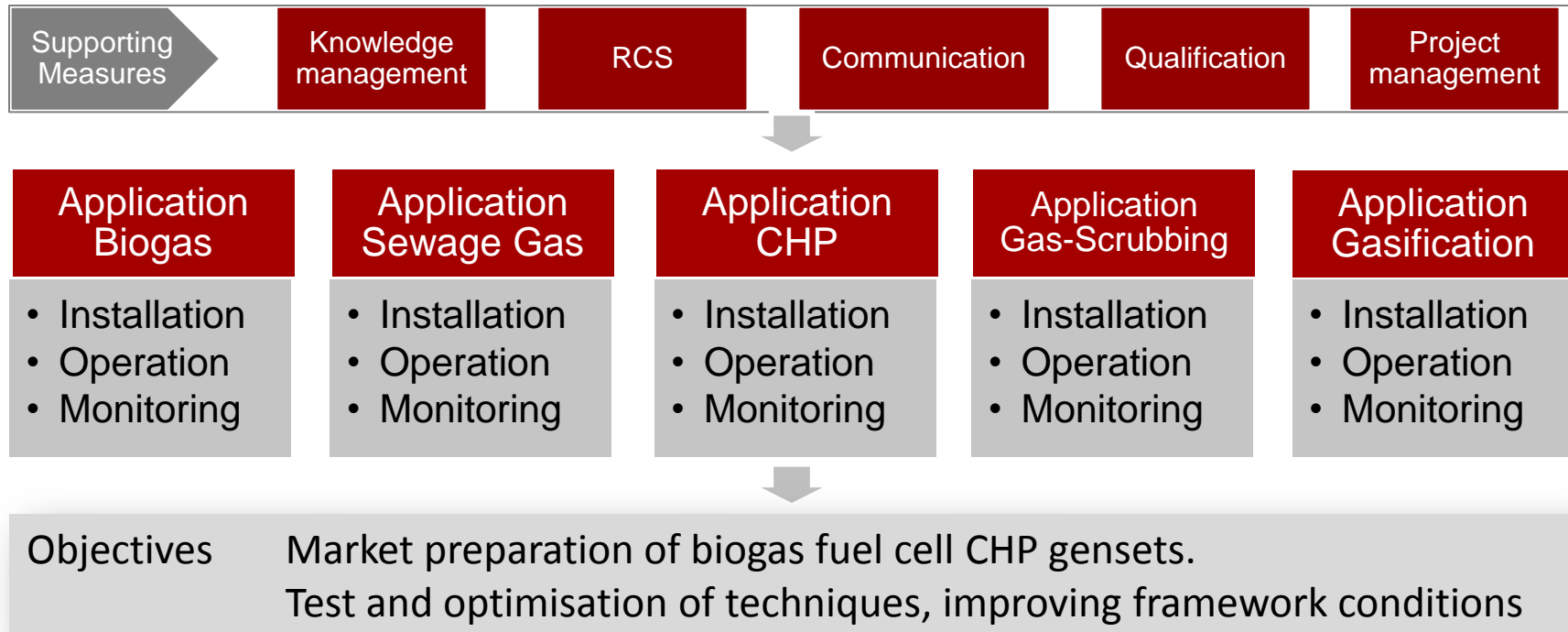
- Up to 60 high-temperature fuel cells, 200-700 kW,  $\text{Eta}_{\text{el}} = 47\%$
- Combined with facilities for biogas, gas scrubbing, organic-rankine (ORC), energy-recovery, cooling
- Cooperation of plant developers and energy providers
- 2 MCFC Installation in preparation (Barth-1, Giessen-1), 1 MCFC (Potsdam-1, Speicherstadt) in planning
- Additional projects in the pipeline; however, finance crisis is a hurdle towards faster progress.



# NIP – Stationary II

## NEEDS-Structure

Dalkia and others  
MTU Onsite Energy and others



# NIP – Stationary III Marine Lighthouse e4ships



- Emission reduction of hotel and harbour operations.
- Electricity, heating, cooling supply; tank-inertisation.
- Ferry, yacht, research und trade vessels; navy vessels supposed to follow.
- Fuels: Sulfur-free diesel, Ethanol, XTL, H<sub>2</sub>.

E4ships Financing	M€
Toplaterne	2,1
SchIBZ	10,5
PaXell	13,8
HyFerry	24,9
Budget	51,3
Funding BMVBS	24,6

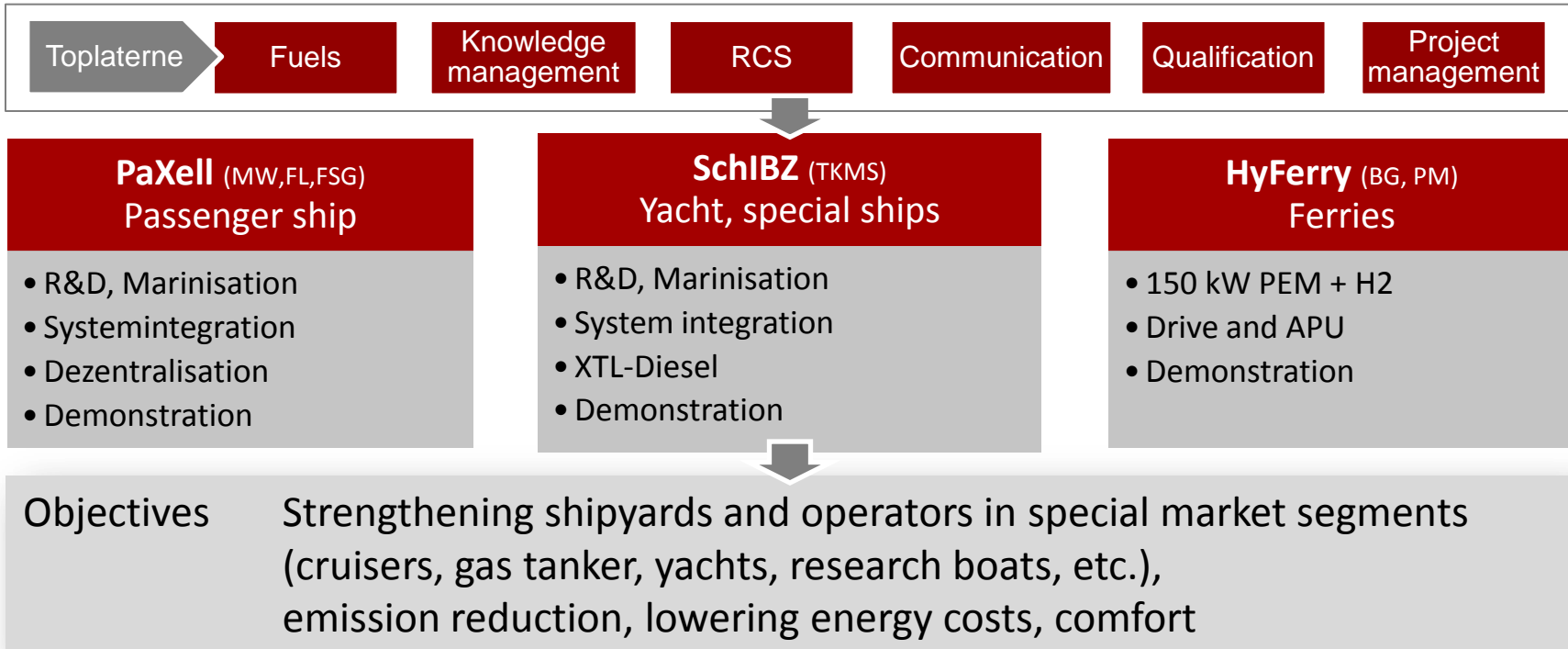
Sources: NOW, Calypso/Aida, e4ships, CMT



# NIP – Stationary III Marine

## e4ships-structure

Aida, Beluga (BG), Calypso, Braren (BR), Meyer-Werft (MW), Lürssen (FL), Flensburger Schiffahrtsgesellschaft (FSG), ThyssenKrupp Marine Systems/Blohm + Voss (TKMS), HDW-Hagenuk, MTU, Proton-Motor (PM), VSM, CMT, DNV, GL ... and others





NOW GmbH  
Nationale Organisation Wasserstoff-  
und Brennstoffzellentechnologie  
Fasanenstrasse 5  
10623 Berlin

Kai Klinder

Fon +49 30 311 6116 60

Cell +49 173 6455 430

Email [kai.klinder@now-gmbh.de](mailto:kai.klinder@now-gmbh.de)

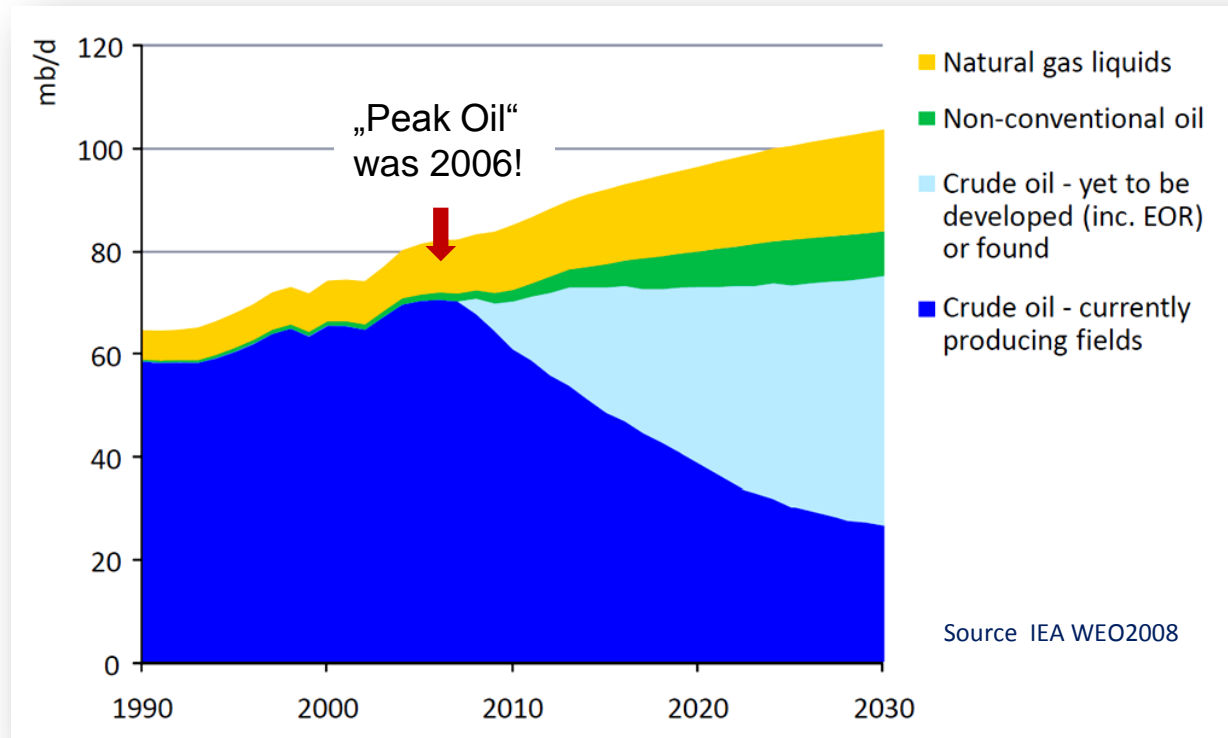
Web [www.now-gmbh.de](http://www.now-gmbh.de)



Vielen Dank !  
Merci !  
Bedankt !  
Thank You !  
Arigatou !

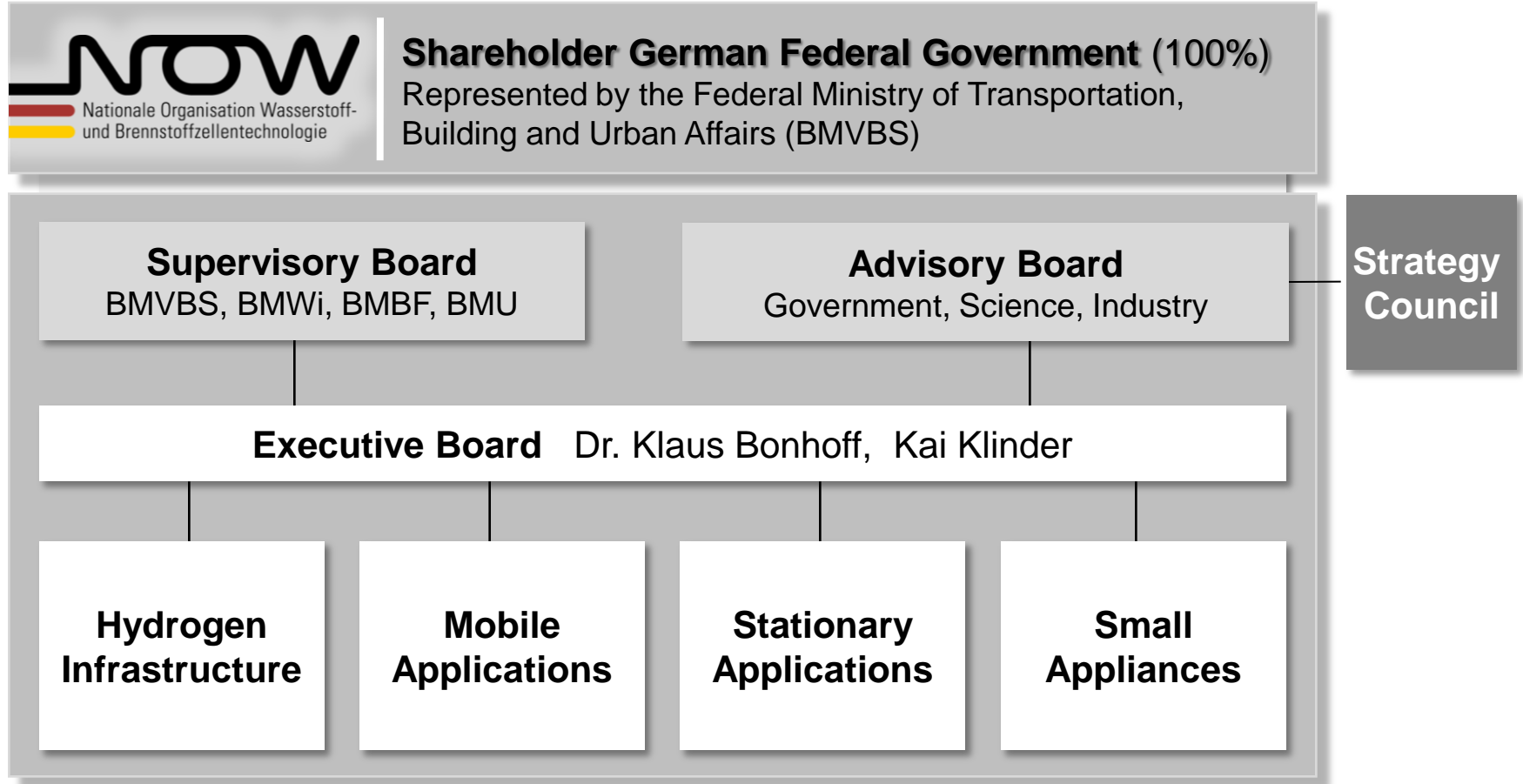
## Back-up Slides

# Megatrend Peak Oil



Shrinking fossil energy resources cause rising prices.  
Continuous use of fossil carbon increases climate crisis

# National Organisation Hydrogen and Fuel Cell Technology



# The NOW Team





# Clean Energy Partnership (CEP)



Ein Projekt im Nationalen Innovationsprogramm  
Wasserstoff- und Brennstoffzellentechnologie 



## CEP-Facts

- Since 2008 in phase II (validating, developing technology)
- Total budget in 2008: 110 Mio. Euro
- Hydrogen bus-fleets and more than 30 hydrogen cars in Berlin and Hamburg
- Several hydrogen fuel-stations in Berlin and Hamburg

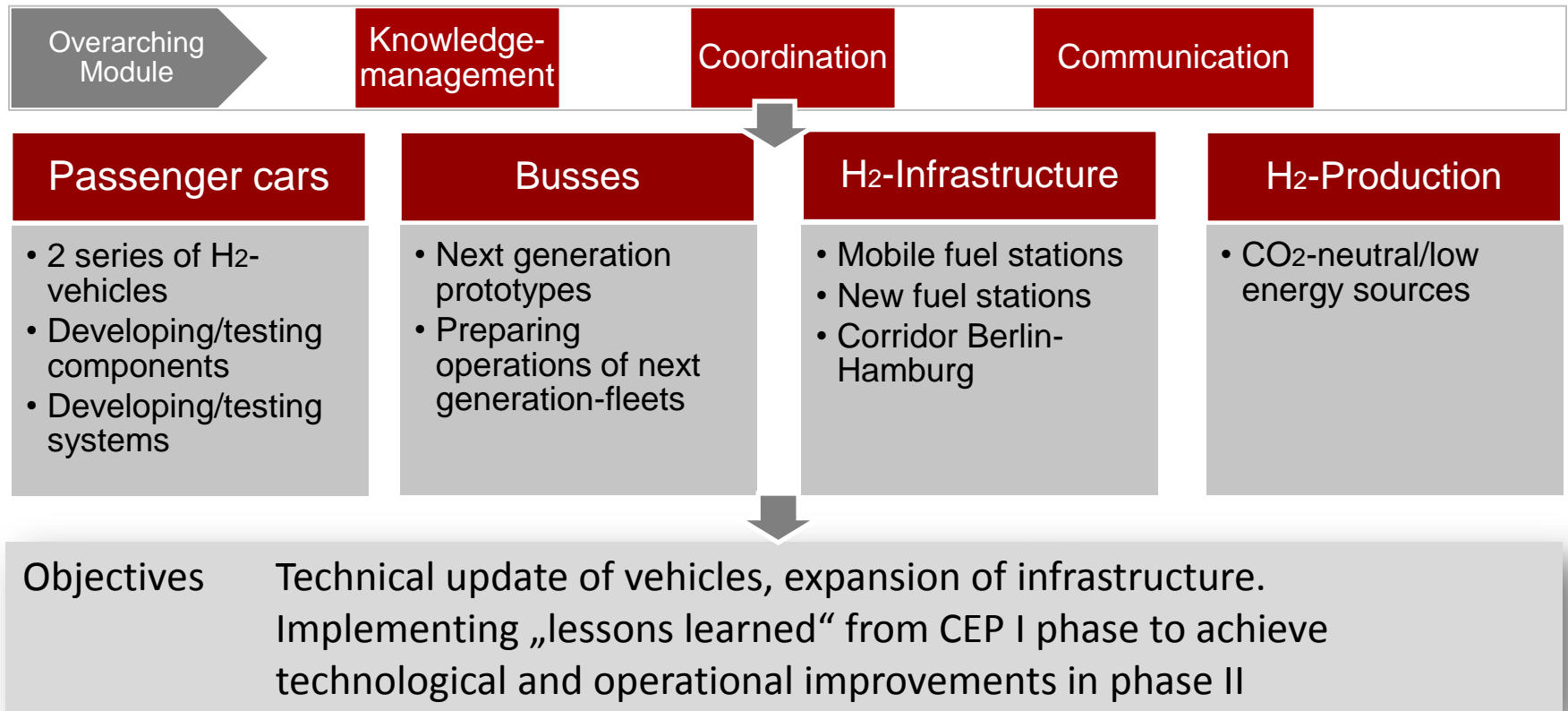


# Clean Energy Partnership II

## Hydrogen in road traffic



Ein Projekt im Nationalen Innovationsprogramm  
Wasserstoff- und Brennstoffzellentechnologie 



# Partners Energy & Technology

- Linde
- Shell Hydrogen
- Vattenfall Europe
- Statoil Hydrogen
- TOTAL





# Partners Mobility

- BMW
- Daimler
- Ford
- GM/Opel
- Volkswagen



# Partners Public Transport

- Berliner Verkehrsgesellschaft  
(14 H<sub>2</sub>-busses in regular service)
- Hamburg Hochbahn  
(9 fc-busses in regular service)

