PARTNERS

- Federal Republic of Germany
  - Represented by the Federal Ministry for Economic Affairs and Energy
  - In consultation with:
    - Federal Ministry of Food and Agriculture
    - Federal Ministry of the Environment, Nature Conservation, Construction and Nuclear Safety
    - Federal Ministry of Transport and Digital Infrastructure
- KfW Group

PART OF OUR STATUTE

An important purpose of dena’s work is to support "the design and transformation of energy and climate policy targets considering the goal triangle consisting of sustainability, security of supply and competitiveness."
DENA - OUR FOUR PILLARS

ENERGY EFFICIENCY
Think tank and moderator for the establishment of the energy transition

INTELLIGENT ENERGY SYSTEMS
Integration, optimisation and think tank

STAKEHOLDER PROCESSES
Moderator at the interface between politics, commerce and society

INTERNATIONAL ACTIVITIES
Marketing the energy transition abroad
THE GERMAN ENERGY TRANSITION - STATUS, CHALLENGES, SOLUTIONS
KRISTINA HAVERKAMP, 21.11.2019

THE CHALLENGE OF CLIMATE PROTECTION

Development of greenhouse gas emissions in Germany

1990: 1.251 Mt
2000: 1.043 Mt (= -16%)
2017: 905 Mt (= -27%)
2018: 866 Mt (= -31%)

- 80 % (2050)
- 95 % (2050)

Source: dena / ewi
Mt CO₂ eq
**DENA STUDY INTEGRATED ENERGY:**
THREE PILLARS FOR THE ENERGY TRANSITION

**ENERGY EFFICIENCY**
Re-adjusted energy efficiency strategy with systemic approach needed.

**DIRECT RENEWABLE ENERGIES**
Push RES (Renewable Energy Sources) power generation, define clear RES corridors, coordinate w/ grid expansion.

**POWERFUELS**
Establish a global market, design frameworks open to a range of technologies.
PILLAR ONE: HELPING INDUSTRY REDUCE EMISSIONS
SUCCESS IN INDUSTRY ENERGY EFFICIENCY DESPITE ECONOMIC GROWTH

Source: UBA; Klimaschutzgesetz
* ETS – EU Emissions Trading System
INITIATIVE ENERGY EFFICIENCY NETWORKS (IEEN)

Agreement between the Federal Government of Germany and 22 associations and organizations of the economic sector

500 new Energy Efficiency Networks in Germany from December 3rd, 2014 until December 31st, 2020

- Increase energy efficiency for an international competitive position
- Potential energy saving up to 75 PJ primary energy (German-government assessment)
- Potential greenhouse gas reduction up to 5 million tons (German-government assessment)

German Energy Agency – Head Office of the Initiative
ENERGY EFFICIENCY AWARD

dena’s international energy efficiency competition spotlights private and public sector companies who have been outstandingly successful in reducing their energy consumption. The award, which is under the patronage of the Federal Minister for Economic Affairs and Energy, Peter Altmaier, offers prize money totalling 30,000 euros.

Since 2007, the award has clocked up nearly 900 applications from almost 60 countries. In total, the projects save around 10 TWh of energy and around 12 million tonnes of CO₂, and are readily transferable to other companies.

- **Project term**
  Since 2007

- **2019 Partners**
  Federal Ministry for Economic Affairs and Energy (BMWi), Danfoss, KfW

- **Target groups**
  Industry, commerce, trade, public sector
LIGHTHOUSE PROJECTS, E.G. INDUSTRIAL HEAT

Throughout Germany, 37 million tonnes of climate-damaging emissions could be avoided every year by using industrial waste heat. dena has therefore designated ten industry projects with a particularly innovative or economic technological approach to using the potential of waste heat as lighthouse projects, to serve as role models for other companies.

dena has helped and supported the chosen industry projects both to realise their measures for avoiding and using waste heat and to apply for funding. The results are written up professionally in the form of project profiles and communicated to the general public.

- **Project term**
  2016 to 2018

- **Partner**
  Federal Ministry for Economic Affairs and Energy (BMWi)

- **Target group**
  Companies in industry and commerce
INDUSTRY END ENERGY CONSUMPTION DEPENDS ON PROCESS CONVERSION

- Combustion can be switched to climate friendly energy carriers.
- This can sometimes mean a sharp increase in energy consumption.
- Process emissions are a challenge in the industry sector.
PILLAR TWO: INTEGRATING RENEWABLES INTO THE ELECTRICITY SYSTEM
Phase out plans

- **Decision in 2011:** Until 2022 all of Germany’s 17 reactors will be shut down.
- **Decision in 2019:** Until 2038 shut down of all coal-fired power plants at latest.

The German Energy Agenda: Nuclear and Coal Phase Out

**Share of energy sources in gross German power production in 2018.**

Data: AG Energiebilanzen 2019, preliminary.

- **Natural gas:** 83.4% (12.9%)
- **Hard coal:** 83.2% (12.9%)
- **Lignite:** 14.5% (22.5%)
- **Nuclear:** 7.0% (11.8%)
- **Renewables:** 22.7% (34.9%)
- **Mineral oil:** 5.2% (0.8%)
- **Others:** 27.0% (4.2%)

Power production in terawatt-hours (TWh):

- **Wind onshore:** 92.2 (14.3%)
- **Wind offshore:** 19.3 (3.0%)
- **Hydro power:** 16.6 (2.6%)
- **Biomass:** 45.1 (7.0%)
- **Solar:** 46.2 (7.2%)
- **Waste:** 6.7 (1.1%)
Installed capacity of renewable energy

- Installed capacity will triple or even quadruple.
- In each target scenario, more than 300 GW of RES capacity will be installed in 2050. EL scenarios nearly 400 GW.
- The largest contribution is by onshore wind energy (at least 170 GW in all scenarios) and photovoltaics (at least 114 GW).
ENERGY TRANSITION NEEDS FLEXIBILITY
VOLATILITY OF RES INJECTION

Flexibility potentials
- Generation units
- Storage technologies
- Demand Side Management of industrial loads
- New loads
FLEXIBILITY POTENTIALS
FLEXIBILITY IN GENERATION UNITS

Adaption potential
FLEXIBILITY POTENTIALS
STORAGE TECHNOLOGIES

Battery Storage
- 314 MW large scale storages, 440 MW in households

Pump Storage
- 6.700 MW installed capacity

Power-to-X
- e.g. Powerfuels

Battery storages in Germany

Quelle: BVES, 2019
FLEXIBILITY POTENTIALS
DEMAND SIDE MANAGEMENT

Example: Trimet Aluminium SE

- Contribution to frequency balancing with:
  - Fast and medium fast balancing power
  - Interruptible Loads
    - 60-700 MW within 1 second

The introduction of markets for flexibility is currently in discussion

Quelle: BVES, 2019
FLEXIBILITY POTENTIALS
AGGREGATION OF NEW LOADS

83,000 electric vehicles in Germany

Fossil heating technologies ...

>30% BEV

> 35% until 2050 heat pumps

83,000 electric vehicles in Germany
ENERGY TRANSITION NEEDS GRID CAPACITIES
THE GERMAN CONTEXT

- Large potentials for wind energy in the north (on- and offshore)

- Main industrial loads in the south and south-west

- Increasing energy exchange with EU member states

Transport
Digitalization and technology innovation enable optimized usage of grid capacities

Three different types of potentials can be distinguished:

1: Power flow control
2: Thermal rating
3: Curative n-1 criteria

With optimized usage of grid capacities, monitoring of stability boundaries becomes more and more important.
Limits to Optimised Grid Expansion
Infrastructure Planning in the Future

Future transport requirements will rise

BUT there is a limited acceptance for grid expansion.

Even technical innovations concerning grid expansion as well as the use of flexibility reach technical borders.

In consequence we need to establish an integrated optimisation of the energy system

- To reduce future transport requirements
- And to use grids more efficiently.
ENERGY TRANSITION NEEDS FLEXIBILITY
SOME CHALLENGES OF RES INTEGRATION

Next step: Integrated Infrastructure planning

Flexibility for systemic integration

Time

Power

Example
NEXT GENERATION INFRASTRUCTURE PLANNING

Integrated infrastructure planning

- Generation
- Power-Exchange
- Loads
- Market
- Gas and heating
- Innovation
- New consumers
- Distribution Grids

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DENA GRID STUDY III

In the Grid Study III, the Deutsche Energie-Agentur (dena) – the German Energy Agency – is working with grid operators, politicians and other stakeholders to review development options for grid planning. The study aims to identify measures that can be implemented in the short term and introduce them into the current grid planning process.

In the long term, the study will evaluate the limits of the infrastructure planning and develop a method to update the grid development planning into system development planning.

**Project term**
2018 to 2021

**Partner**
Federal Ministry for Economic Affairs and Energy

**Target groups**
Grid operators, politicians, regulators
PILLAR THREE: ACCELERATING HYDROGEN
FOUR REASONS FOR POWERFUELS

- Powerfuels are climate-friendly solutions to applications with no viable alternatives.

- Powerfuels could reduce the cost of energy transition by utilising existing infrastructures and provide long-term storage.

- “Drop-in” capability allows to the de-fossilization of existing applications since they are green alternatives to fossil fuels.

- Utilization of the worldwide renewable electricity production potential, as powerfuels can be transported and traded globally.
GREEN HYDROGEN PRODUCTION COSTS DIFFER VASTLY ACROSS REGIONS

Hydrogen costs from hybrid solar PV and onshore wind systems in the long term

Source: IEA The future of hydrogen (2019)
Powerfuels are also produced in Germany, but increasingly imported from European and non-European countries.

Considering transport capacity, especially hydrogen will be produced regionally in Germany.
Powerfuels are indispensable in some applications

- Aviation, maritime, industrial heat, chemical industry and heavy duty road transport have little other options

...and provide value in other uses.

- Fuel switch in car or residential heat applications

**Indispensability of Powerfuels**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Indispensability</th>
</tr>
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<tbody>
<tr>
<td>Aviation</td>
<td>High</td>
</tr>
<tr>
<td>Maritime</td>
<td>High</td>
</tr>
<tr>
<td>Industrial heat</td>
<td>Medium</td>
</tr>
<tr>
<td>Chemical industry</td>
<td>Medium</td>
</tr>
<tr>
<td>Heavy duty road transport</td>
<td>Medium</td>
</tr>
<tr>
<td>Residential heat</td>
<td>Low</td>
</tr>
<tr>
<td>Fuel switching in car</td>
<td>Low</td>
</tr>
<tr>
<td>Residential heat</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Global Alliance Powerfuels „Guidelines for Market Development“, 2019
PTX PROJECTS TODAY AND TOMORROW

Existing projects

Field tests started in 2019
GERMAN STRATEGY CONCERNING POWERFUELS

Germany is recalibrating its strategy towards gas and powerfuels

Especially powerfuels are seen as pivotal for the climate targets

- The Gas 2030 dialogue process looked at the importance of natural gas, hydrogen and others in the energy mix of the future together with stakeholders and derived major next steps

- The National Hydrogen Strategy with an action plan is discussed and developed at the moment
In 2018, dena and a group of notable partners formed the Global Alliance Powerfuels to develop global markets for fluid and gaseous fuels and raw materials based on renewable energy sources.

The three main goals of the alliance are to raise awareness of powerfuels as a ‘missing link’ in the global energy transition, encourage the further development of the regulatory framework in Europe as a demand region, and initiate projects around the world.

**Project term**
- Since 2018

**Partners**
- Over 30 companies and associations

**Target group**
- International companies
GLOBAL ALLIANCE POWERFUELS
MEMBERS AND PARTNERS

Corporate partners

International Partners network

ExxonMobil
SCHAEFFLER
Deutsche Post DHL Group
Lufthansa
UniPer
MWV

enertrag
Bosch
Mitsubishi International GmbH
sunfire
BDL

enertrag
Bosch
Mitsubishi International GmbH
sunfire
BDL

International Partners network

CEF NRW
CO2 VALUE EUROPE
Dii
CEF NRW
CO2 VALUE EUROPE
Dii

GLOBAL ALLIANCE POWERFUELS
MEMBERS AND PARTNERS

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CURRENT FOCUS AREAS OF THE GLOBAL ALLIANCE POWERFUELS

- Providing Information on Powerfuels Applications
- Defining Sustainability Criteria
- Fostering International Cooperation, Exchange and Fostering Project Development
- Contributing to the Understanding of Powerfuels in the Global Energy System

More information on www.powerfuels.org
Australia and Germany have different starting positions of the energy transition.

Nonetheless, it shows, that we share the same challenges:
- Integrate renewable energy
- Transform the consumption sectors
- Build a market for powerfuels

Cooperation is key in this regard:
- To learn from each other
- And inspire new thinking
THANK YOU FOR YOUR ATTENTION.

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