NYS - Delegation Trip to Germany 21.06.2017 Berlin

DENA – PARTNER, INFLUENCER, IMPLEMENTER

AGENDA

- INTRODUCTION TO DENA – THE GERMAN ENERGY AGENCY
- ENERGY TRANSITION – CURRENT CHALLENGES IN A NUTSHELL
- DENA – ACTIVITIES IN THE FIELD OF DIGITALISATION AND SECTOR COUPLING
- TIME FOR EXCHANGE – Q&A

INTRODUCTION TO DENA

partner, influencer, implementer

dena
Deutsche Energie-Agentur

WE'RE MAKING THE ENERGY TRANSITION HAPPEN

CENTRE OF EXPERTISE
for energy efficiency, renewable energy sources and intelligent energy systems

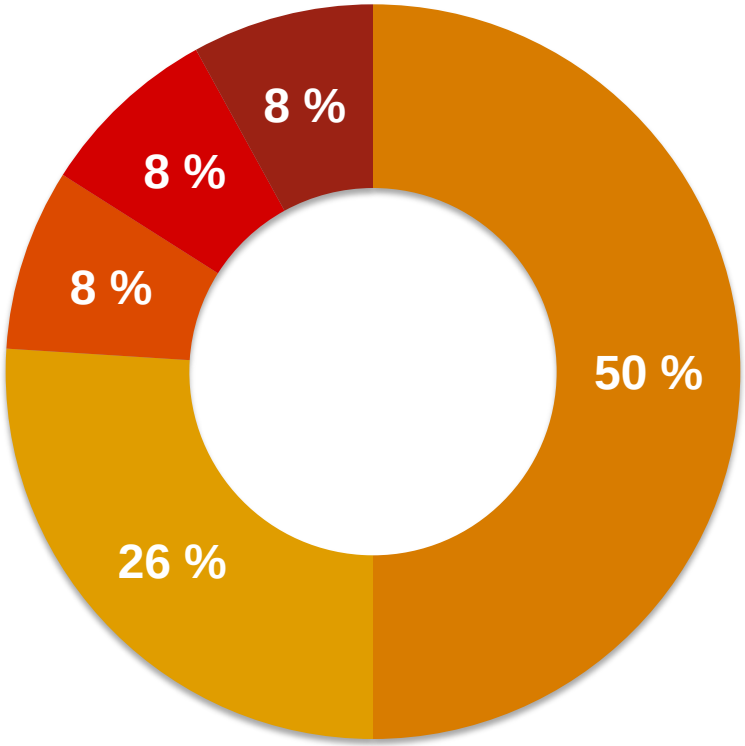
INTERMEDIARY
between politics, industry and science

SERVES MULTIPLE MINISTRIES
and is in constant dialogue with market stakeholders

WITH CLEAR OBJECTIVES:

- Support for the Federal Government in its energy policy strategy
- Communication focusing on issues concerning end users and suppliers
- Realisation of energy efficiency and renewable energy potential, including system integration

OUR SHAREHOLDERS



MANAGEMENT:
Andreas Kuhlmann (Chief Executive)
Kristina Haverkamp

FEDERAL REPUBLIC OF GERMANY

- Represented by the Federal Ministry of Economic Affairs and Energy

in consultation with:

- Federal Ministry of Food and Agriculture
- Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
- Federal Ministry of Transport and Digital Infrastructure

FINANCIAL SERVICE PROVIDERS:

KFW GROUP

ALLIANZ SE

DEUTSCHE BANK AG

DZ BANK AG

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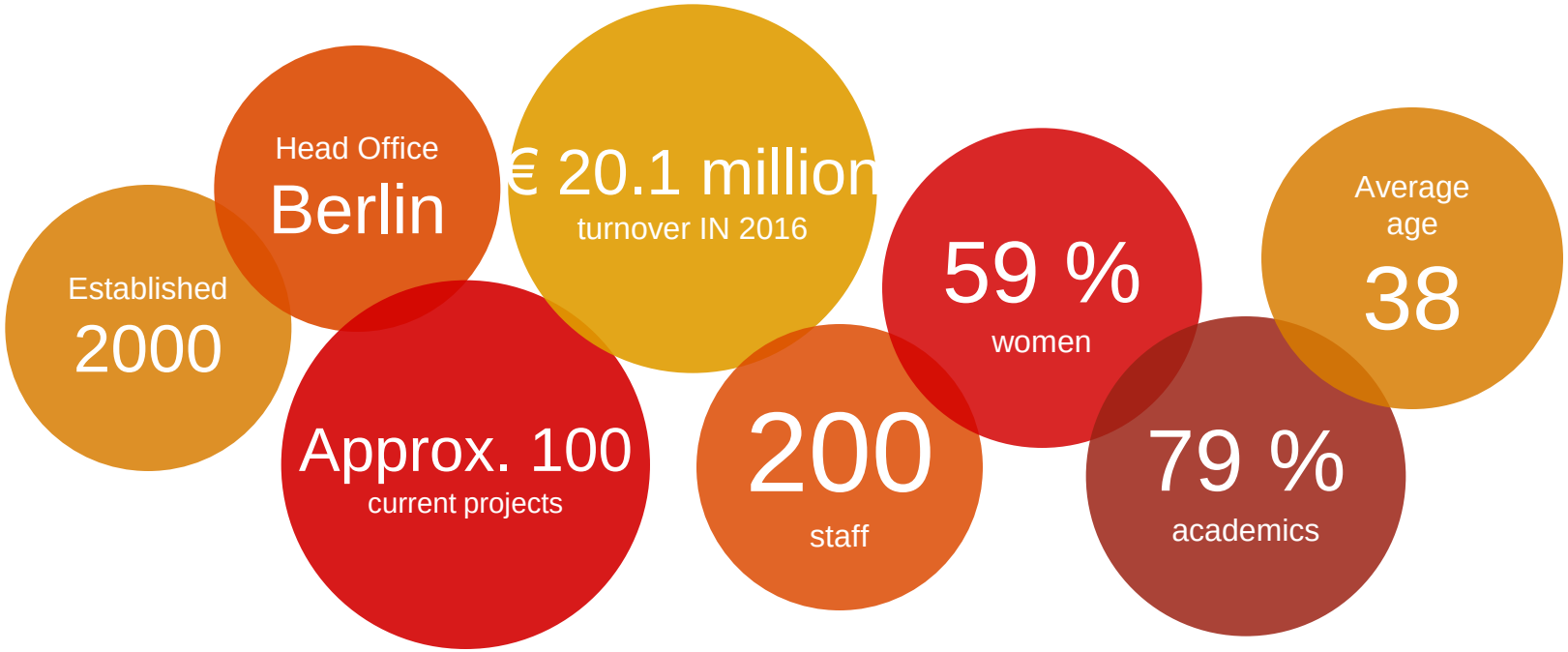
FACTS, FIGURES AND DATES



dena in dialogue in 2016:

- 6.5 million page visits on dena websites
- Distribution of 225,000 publications
- Over 3,400 printed articles and around 1,100 articles in online media
- Around 4,800 visitors to dena events

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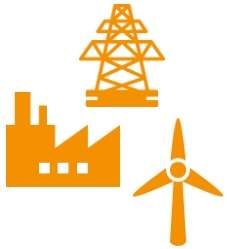
OUR FOUR PILLARS

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

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SAMPLE PROJECT COMMUNICATION IN INTERNATIONAL ENERGY TRANSITION

Devising a comprehensive strategy for international communication around the energy transition. Specific measures are proposed and implemented. The aim is to share Germany's experience and enable an international exchange of ideas and information through dialogue.

- **PROJECT LAUNCH**
  2016
- **PARTNERS**
  BMWi, Edelmann.ergo
- **TARGET GROUPS**
  government institutions, politics, industry and associations, science & research, the media, NGOs, networks and international organisations

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SAMPLE PROJECT
BERLIN ENERGY TRANSITION DIALOGUE

The Federal Government's annual international energy transition conference brings political decision-makers from all over the world together with experts from industry, science, administration and society in general, and supports the development of international cooperation. With a comprehensive programme (guided tours, workshops and B2G dialogues) it tackles current and future issues and provides impetus for a practical, worldwide energy transition.

- **PROJECT LAUNCH**
  2015
- **PARTNERS**
  BMWi, Foreign Office, industry associations
- **TARGET GROUPS**
  high-ranking representatives from politics and the energy industry, science & research, and society in general

www.energiewende2017.de

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SAMPLE PROJECT
START-UP ENERGY TRANSITION AWARD

Backed by a global partnership network, dena held an event on 20 March 2017 which, for the first time, brought the best start-ups in the field of renewable energy together with interested investors. The purpose was to promote new ideas on the implementation of the energy transition and bring the most successful projects to the fore in the political arena.

- **PROJECT LAUNCH**
  2016
- **PARTNERS**
  BMWi, Foreign Office and more than 100 partners worldwide, sponsors, ambassadors and speakers from industry, politics and public organisations
- **TARGET GROUPS**
  start-ups, investors, the energy industry, industry & commerce, politics, science & research

www.startup-energy-transition.com

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SAMPLE PROJECT GERMAN-UKRAINIAN ENERGY-EFFICIENT HOUSES

In the Ukraine dena is running a pilot project as a model for the energy-efficient refurbishment of 20 apartment buildings. On the basis of this, recommendations are being drawn up for refurbishments across the whole area.

- **PROJECT LAUNCH**
  2015
- **PARTNERS**
  BMWi, specialists from Germany and the Ukraine
- **TARGET GROUPS**
  homeowners, decision-makers, construction industry

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SAMPLE PROJECT ENERGY-EFFICIENT BUILDING IN CHINA

Cutting-edge technology and Germany's experience, combined with local expertise, are adapted and transferred to suit the conditions in the respective regions. The aim is to improve market conditions for technology aimed at improving efficiency, share know-how, and develop ideas that can be mass-marketed for energy efficiency in China.

- **PROJECT LAUNCH**
  2006
- **PARTNERS**
  BMUB, MoHURD (Chinese building ministry), German & Chinese companies in the energy efficiency market
- **TARGET GROUPS**
  regulatory and financial decision-makers, specialist stakeholders in China

ENERGY TRANSITION – CURRENT CHALLENGES IN A NUTSHELL

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Deutsche Energie-Agentur

2020 & 2050 TARGETS OF THE GERMAN FEDERAL GOVERNMENT

ENERGY CONCEPT (2010)

Goal	2020	2050
Reduction in greenhouse gas emissions (reference year 1990)	40%	80%*
Reduction in primary energy consumption (reference year 1990)	20%	50%
Reduction in electricity consumption (reference year 2008)	10%	25%
Reduction of heat requirement in buildings (reference year 2008)	20%	80%
Increase in the share of renewable energies of total energy consumption	18%*	60%
Doubling of the energy refurbishment rate to 2% in order to achieve an almost climate neutral building stock by 2050		

***Climate Action Plan 2050 (2016)**

- 80-95%

***Renewable Energy Act (2014)**

by 2025 40 – 45 %

by 2035 55 – 60 %

(gross electricity consumption)

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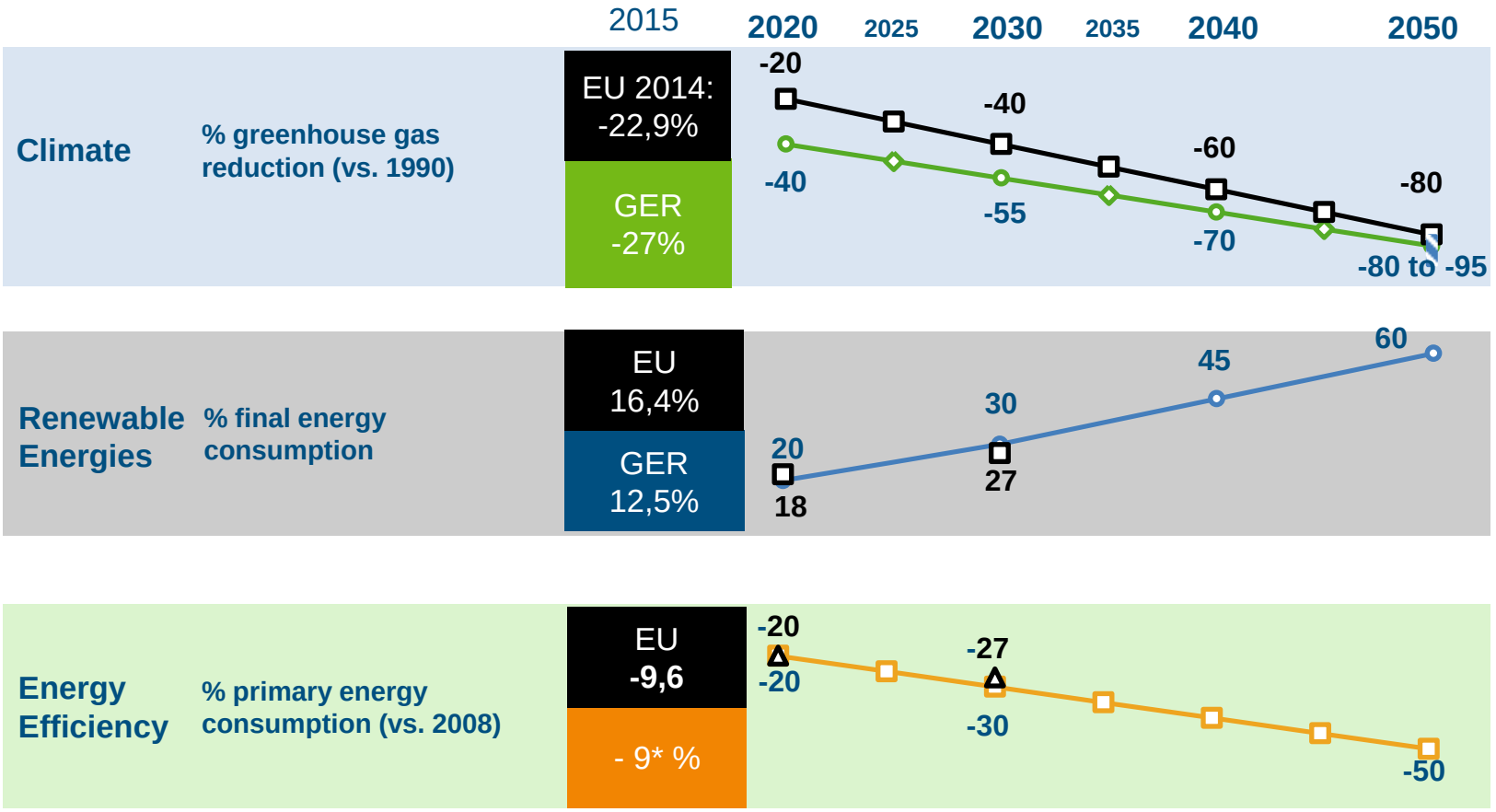
- **GERMANY HAS A LONGSTANDIG TRADITION OF „GREEN MOVEMENTS“ ROOTED IN THE OPPOSITION TO NUCLEAR POWER**
- **DOUBLE ENERGY TRANSITION = DECARBONIZATION WITHOUT NUCLEAR ENERGY**
- **FIRST PHASE: ESTABLISHING RES AS THE MAIN SOURCE OF ELECTRICITY SUPPLY**
- **SECOND PHASE: TACKLING RES SYSTEM INTEGRATION, ENERGY EFFICIENCY, DECARBONIZATION OF HEATING, COOLING & MOBILITY…**

WHERE DO WE STAND?



* 2013

Source: Federal Government 2010, BMU/BMWi 2014, AGEE-Stat 2014, AGEB 2015, updated 2016, EU 2050Roadmap, Eurostat

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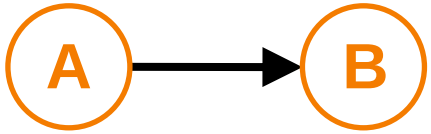
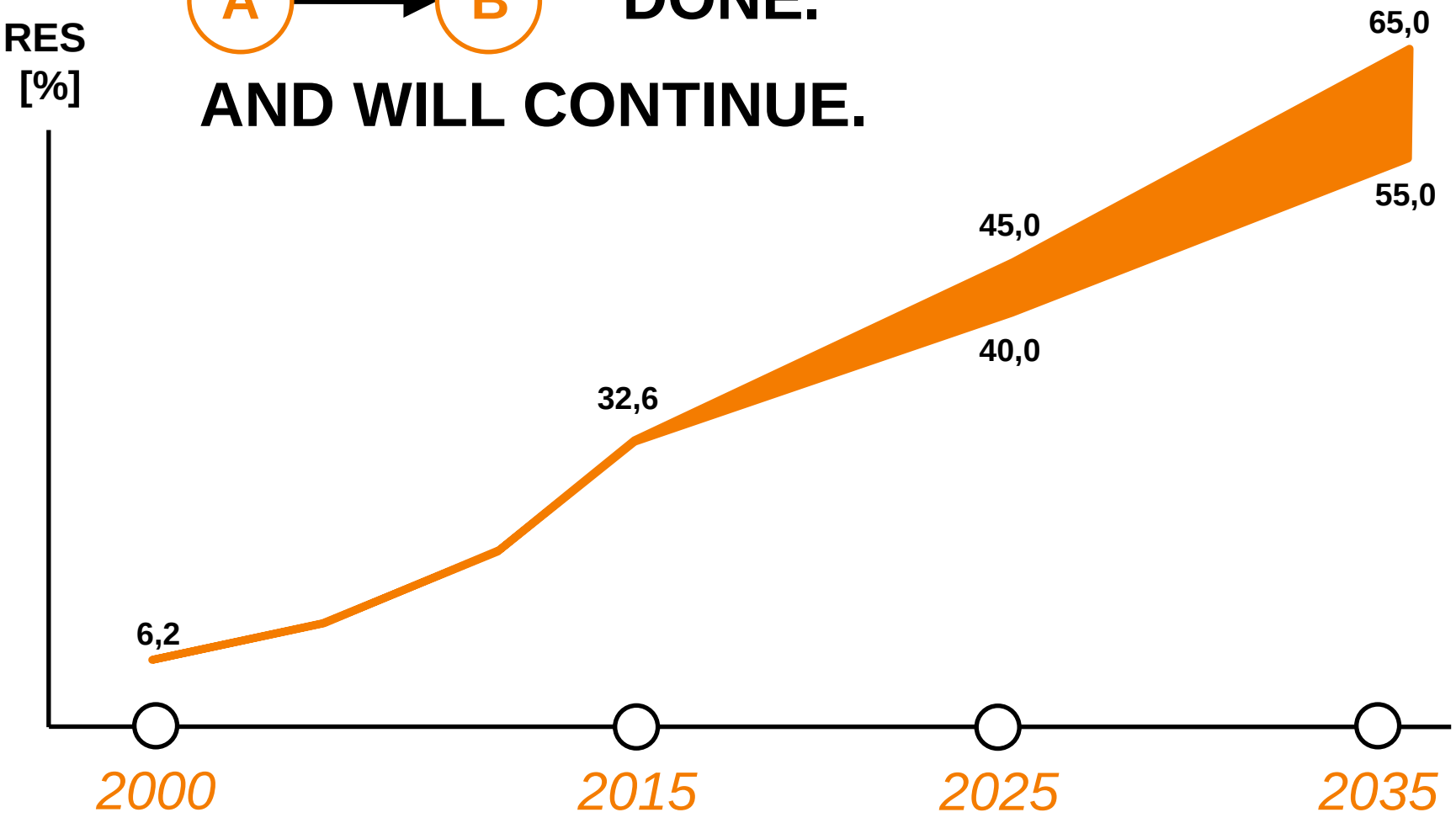


DONE.

AND WILL CONTINUE.



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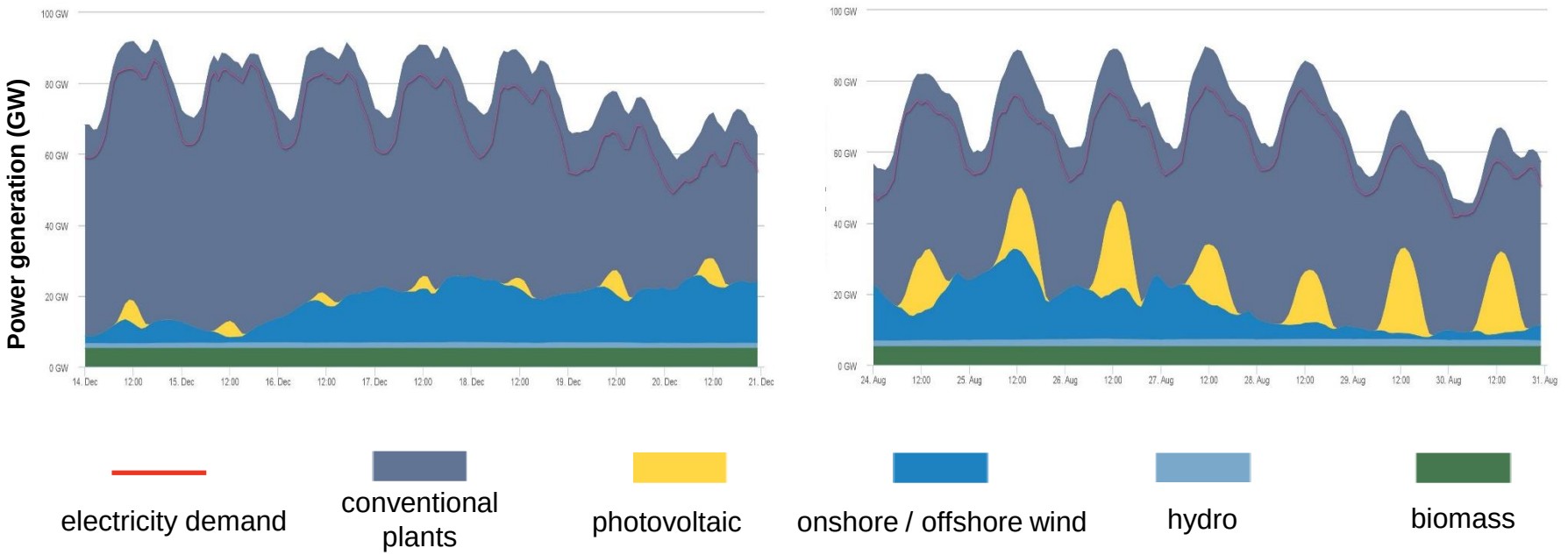
CHALLENGE: VOLATILITY

German electricity system volatility today

Winter 2015 - week no. 51 (December)

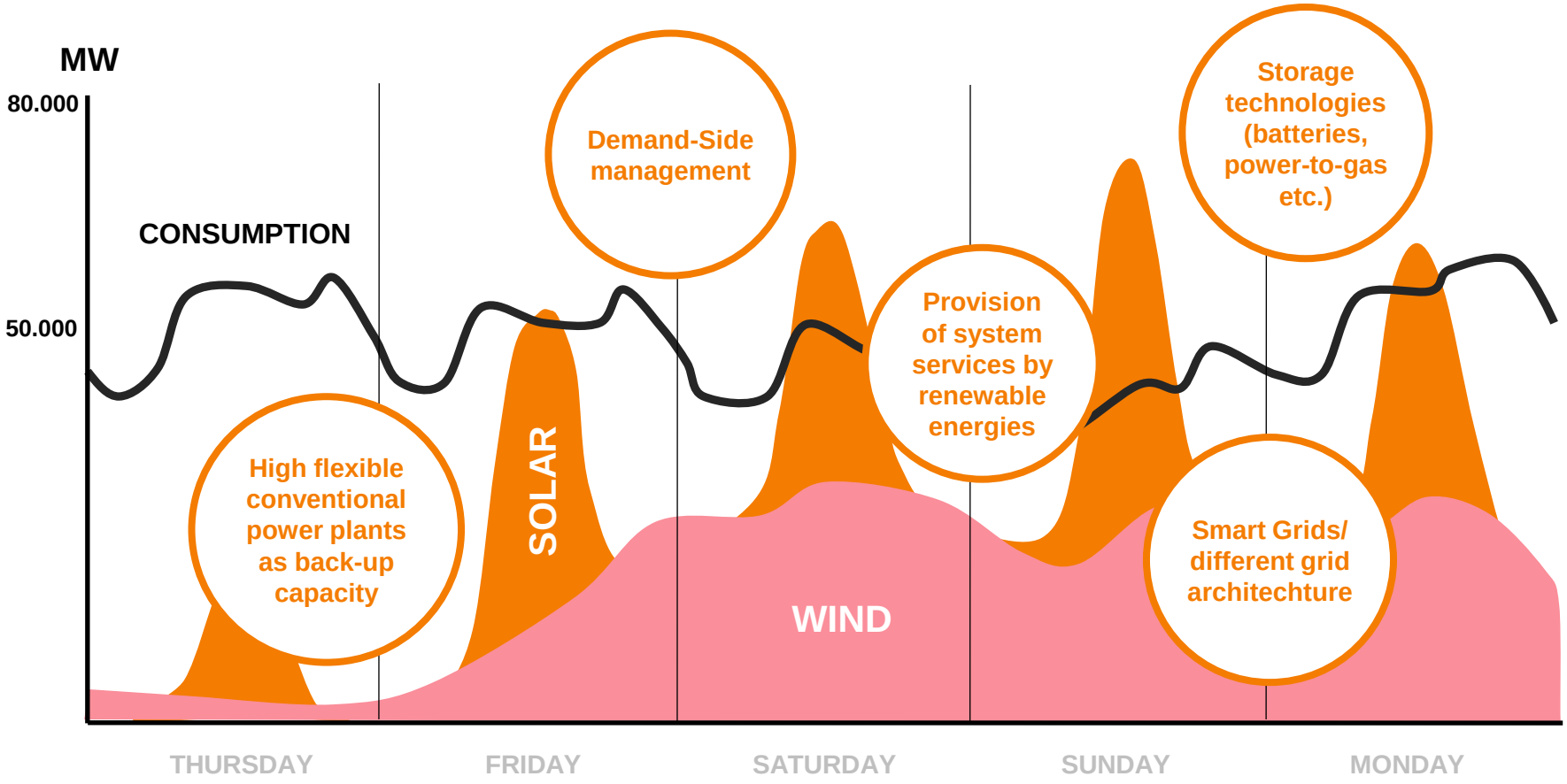
Summer 2015 - week no. 35 (August**)**



Source: Agora Energiewende 2015

THE CONTRIBUTION OF RENEWABLES TO THE ELECTRICITY SYSTEM VARIES WIDELY DEPENDING ON THE SEASON.

WHAT‘S NEW?
EXPECTED SITUATION IN 2030



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KEY CHALLENGES IN PHASE TWO.

- **PHASE ONE: GETTING RES OUT OF A NICHE.**
- **PHASE TWO:**
  - Connection of decentral units/capacities
  - Efficient coupling of electricity, heating and mobility
  - Regional and time-related optimization/synchronisation of energy generation and consumption
  - Increase in energy efficiency and integration of new electricity applications

Integrated Energy

- **SOLUTIONS FOR AN INTEGRATED ENERGIEWENDE THAT INCLUDES ALL SECTORS HAVE TO BE DEVELOPED**
- **DIGITIZATION IS AN ENABLER FOR THE ENERGY TRANSITION**

DIGITIZATION AS ENABLER

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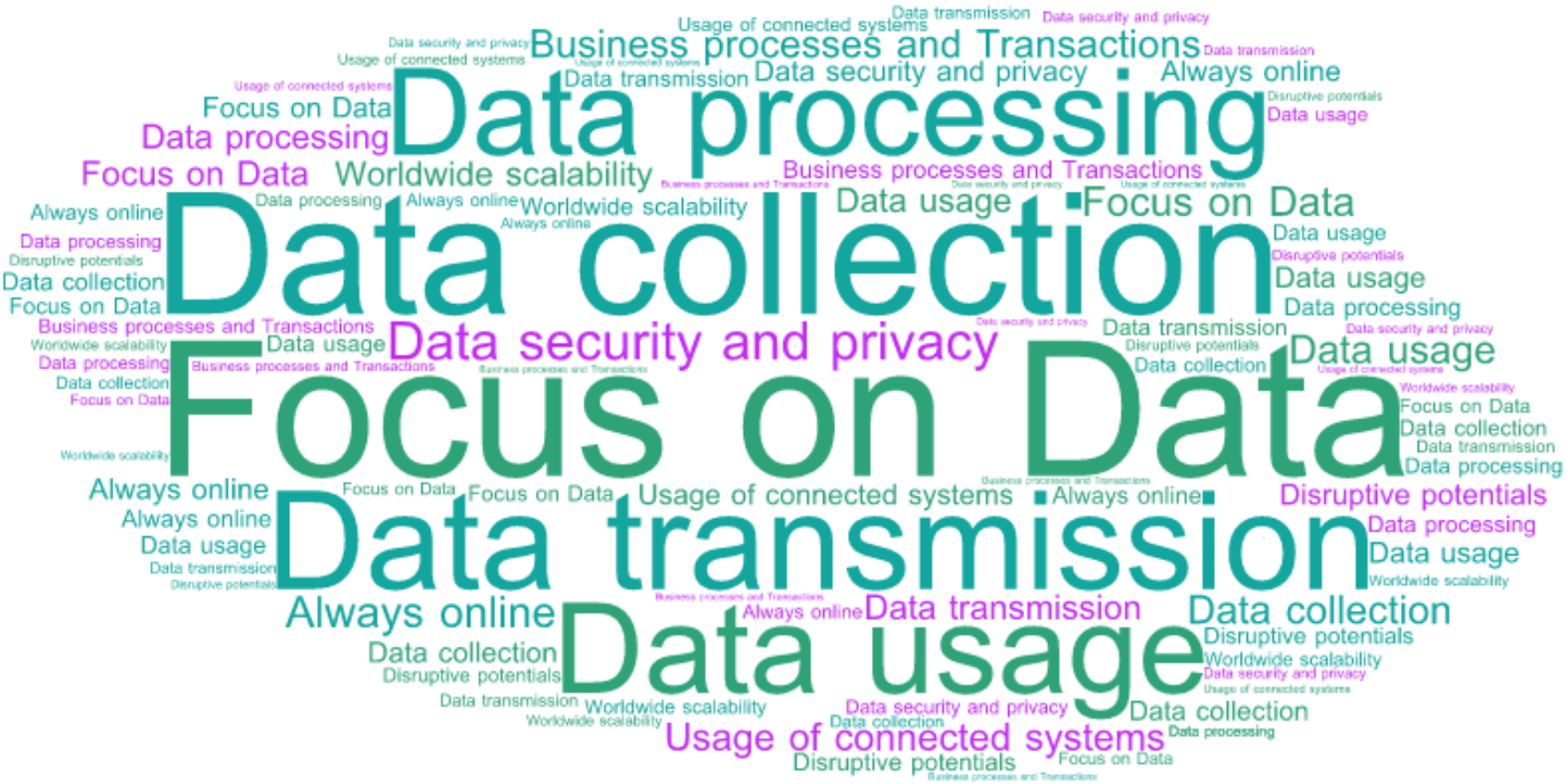
DIGITAL IS…



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DIGITAL IS…

Empowerment

Governance

Autonomous Systems

DIGITAL IS…
THE ENABLER OF THE ENERGIEWENDE 2.0

DIGITAL TRANSFORMATION OF THE ENERGY SECTOR

New technologies

New players

New business models

Enabler of the Energiewende 2.0

Connect, monitor and control billions of new controllable local systems

Flexibility: Optimize energy flows, generation and demand

Increased cost efficiency and economic advantages

Better service and higher values for customers

DENA – ACTIVITIES

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SAMPLE PROJECT SAVING MONEY THROUGH CLEVER HEATING PILOT PROJECT

Investigation into the potential for optimising heating in rented accommodation through transparency in consumption by digital means, in collaboration with an energy service provider, tenants' representatives and the building ministry.

TERM OF PROJECT
2013 to 2016

PARTNERS
ista Deutschland, German Tenants' Association, BMUB

TARGET GROUPS
politics, industry & consumers

www.bewusst-heizen.de

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SAMPLE PROJECT
dena's FLEXIBLE GRID STUDY

In its 'Flexible Grid Study', dena is investigating how storage systems and other flexible systems can be used optimally in the energy transition. At the forefront: usage that is market-orientated, while at the same time beneficial to the grid.

- **PROJECT LAUNCH**
  2016
- **PARTNERS**
  23 partners from industry (incl. operators of electricity grids and flexible systems)
- **TARGET GROUPS**
  politics & industry

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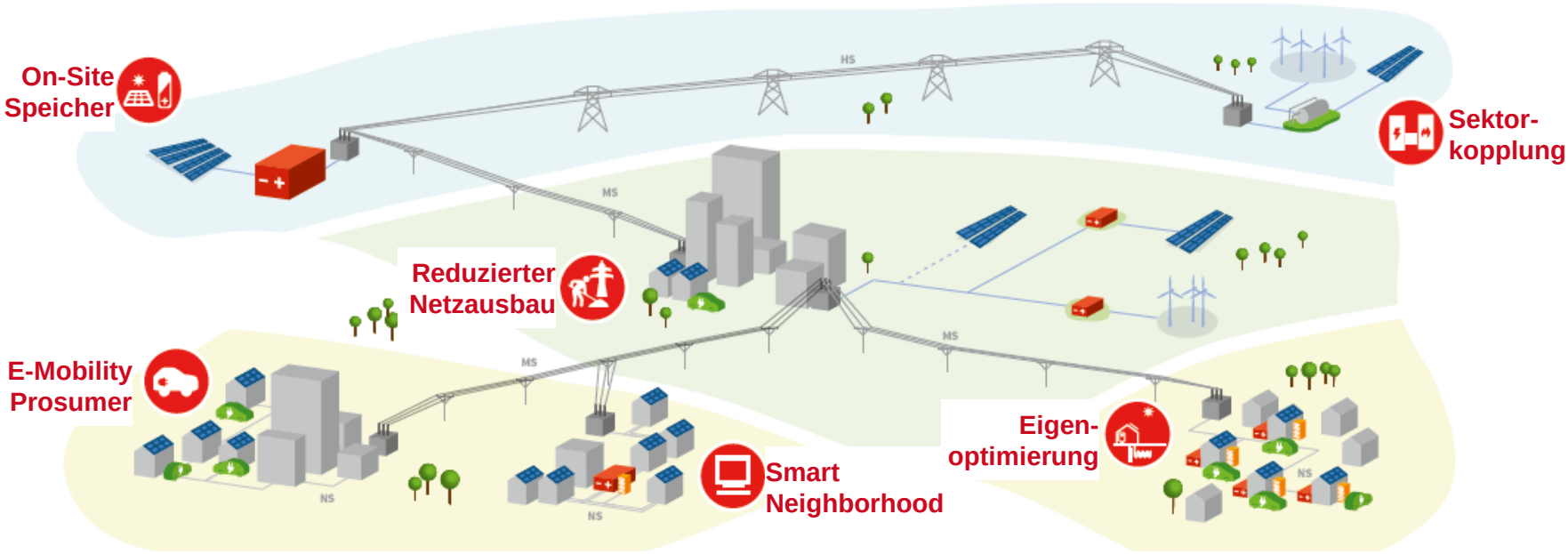
SAMPLE PROJECT
dena's FLEXIBLE GRID STUDY

- **6 representative case studies**
- **Comparative analysis of different boundary conditions:**
  - Economic optimization without grid constraints or legislative restrictions
  - Usage of flexibility for grid purposes
  - Usage of flexibility with the current legislative constraints



SAMPLE PROJECT dena PILOT STUDY – INTEGRATED ENERGY TRANSITION

Multi-stakeholder study for the creation of a reliable orientation framework for industry, politics and society to achieve the 2050 climate protection targets by adopting an integrated view of the whole energy system:
– developing realistic transformation pathways
– creating a solid data foundation for social discussion and political decisions
– deriving specific recommended courses of action for the creation of essential frameworks

PROJECT LAUNCH
2017

PARTNERS
around 50 companies from all industries in four study modules (energy production and distribution, buildings, industry, mobility)

TARGET GROUPS
politics & industry

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SAMPLE PROJECT
DIGITAL ENERGY WORLD PLATFORM

dena is driving the digitalisation of energy across industries, and in doing so is shaping the second phase of the energy transition. To achieve this, it is networking with those involved in the energy sector, grids, infonomics, building construction and industry. Together they are analysing developments and trends in the energy industry, creating synergies and deriving recommended courses of action for politicians.

- **PROJECT LAUNCH**
  2016
- **PARTNERS**
  around 25 partners and consultants with both theoretical and practical experience
- **TARGET GROUPS**
  politics & industry

www.digitale-energiewelt.de

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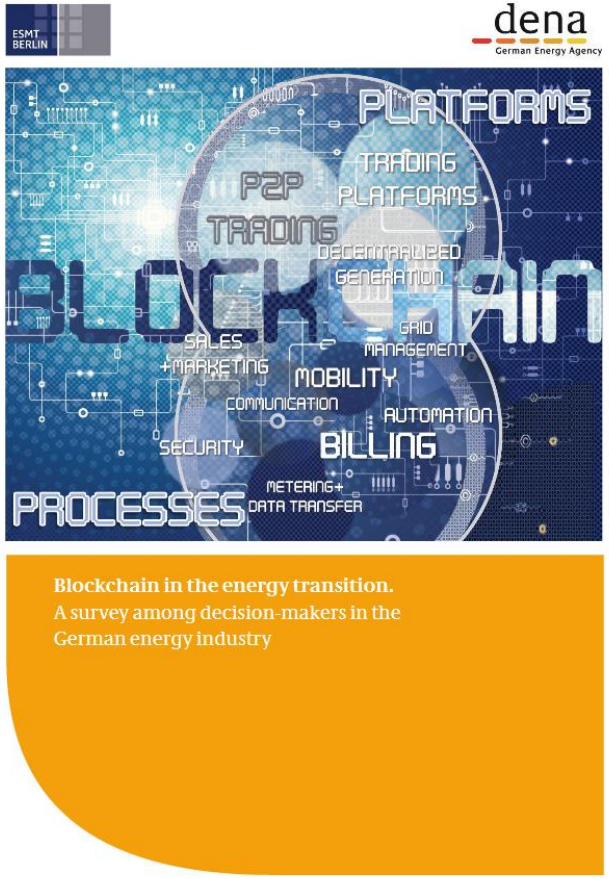
SAMPLE PROJECT
STUDY ON BLOCKCHAIN IN THE ENERGY TRANSITION



A study by dena and ESMT shows that pioneers are already looking for business models/potential areas of application for blockchain, including for trading platforms, billing, metering, mobility and network management.

Nearly two-thirds of the decision-makers surveyed as part of the study think a wider dissemination of blockchain is probable. 21% even perceive this technology as key to fundamental market change – a game changer.

- **PROJECT LAUNCH**
  2016
- **PARTNERS**
  European School of Management and Technology (ESMT)
- **TARGET GROUPS**
  politics and energy industry

www.dena.de

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ENERGY EFFICIENT BUILDINGS

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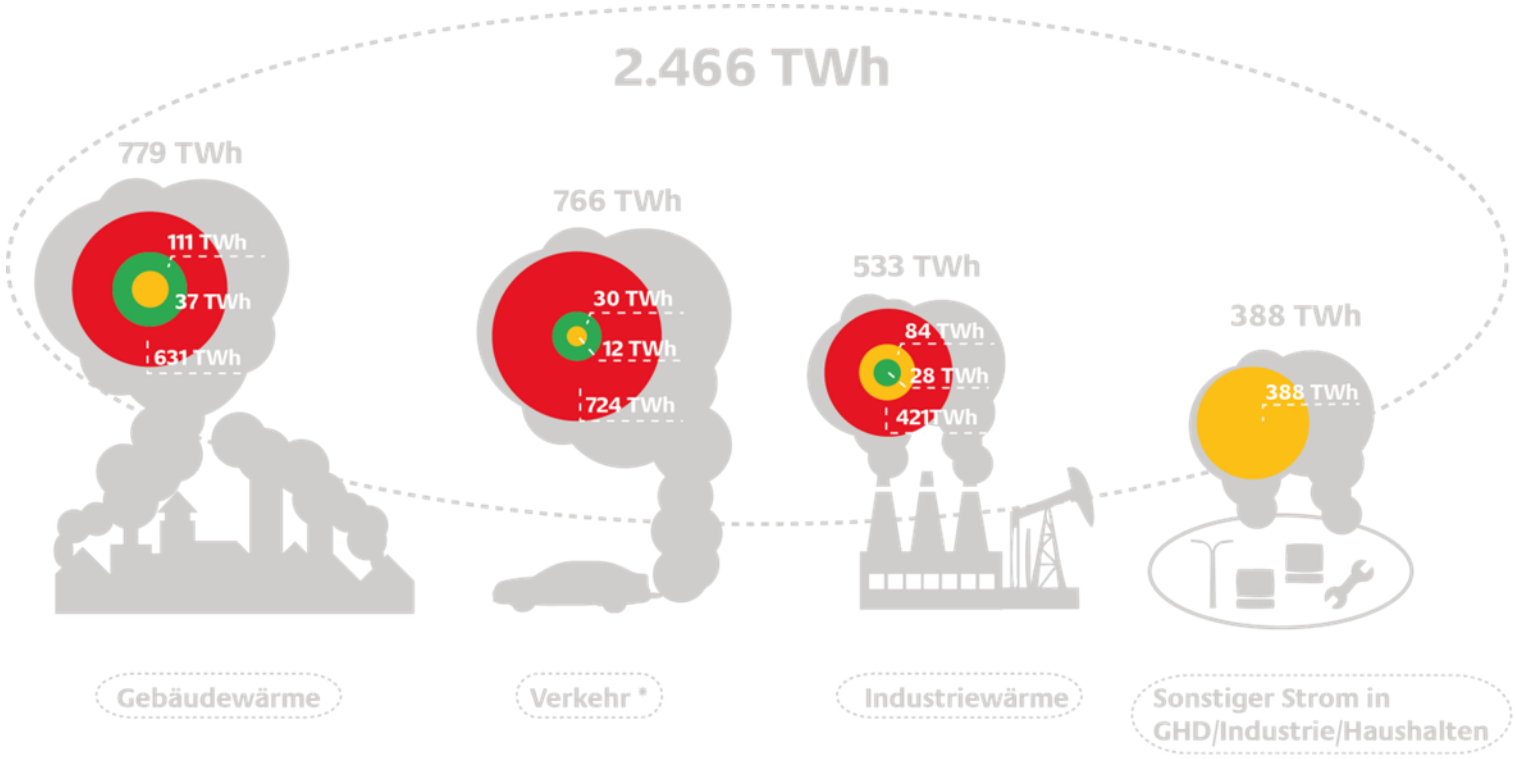
WHY ACTING?
GREENHOUSE GAS EMISSIONS IN 2016



Quelle: dena-Gebäudereport 2016
nach (BMWi, 2016c), eigene Berechnung

* inkl. kleinem Anteil kraftstoffbetriebener Industriemaschinen

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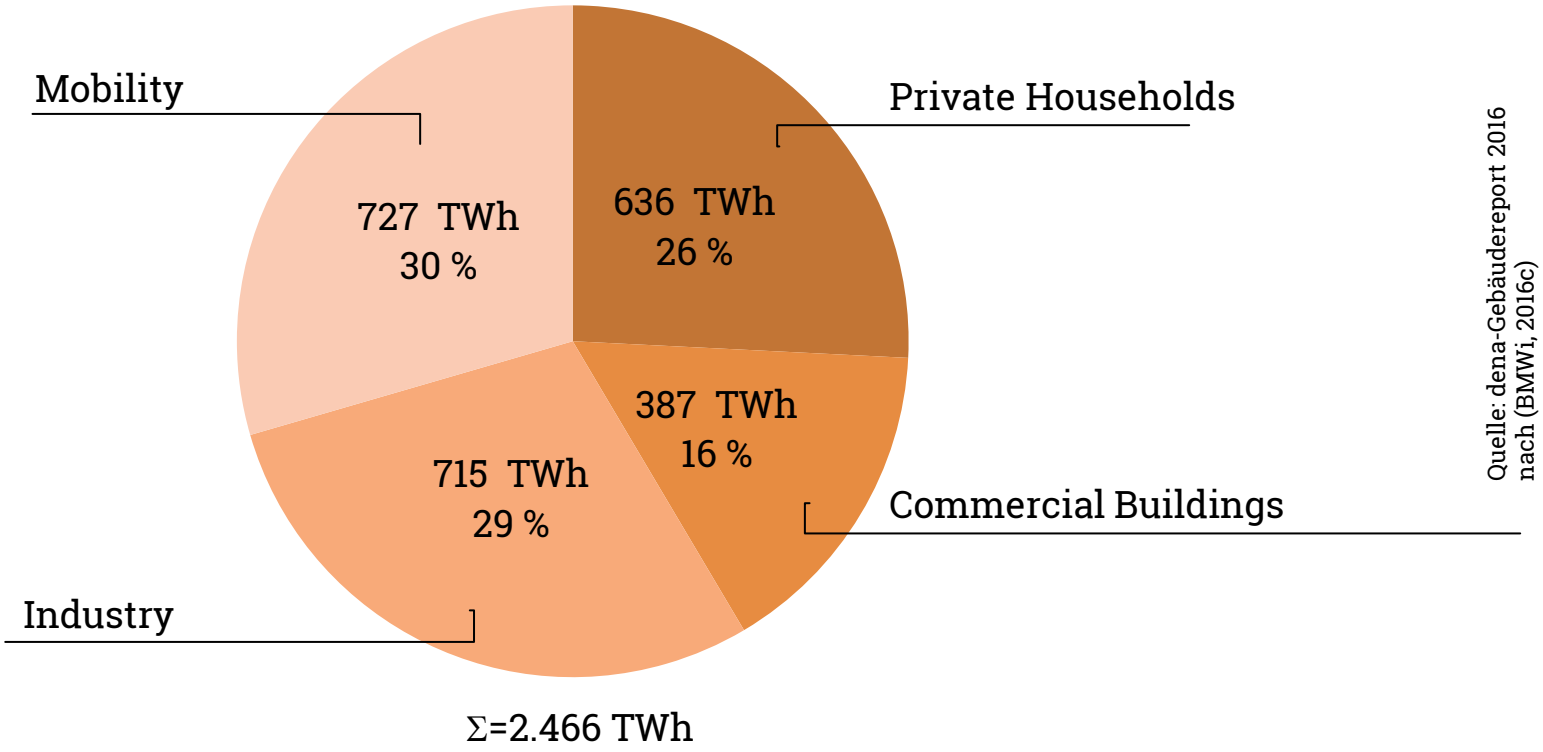
BUILDINGS: PART OF THE ENERGY SYSTEM



Quelle: dena-Gebäudereport 2016 nach (BMWi, 2016c)

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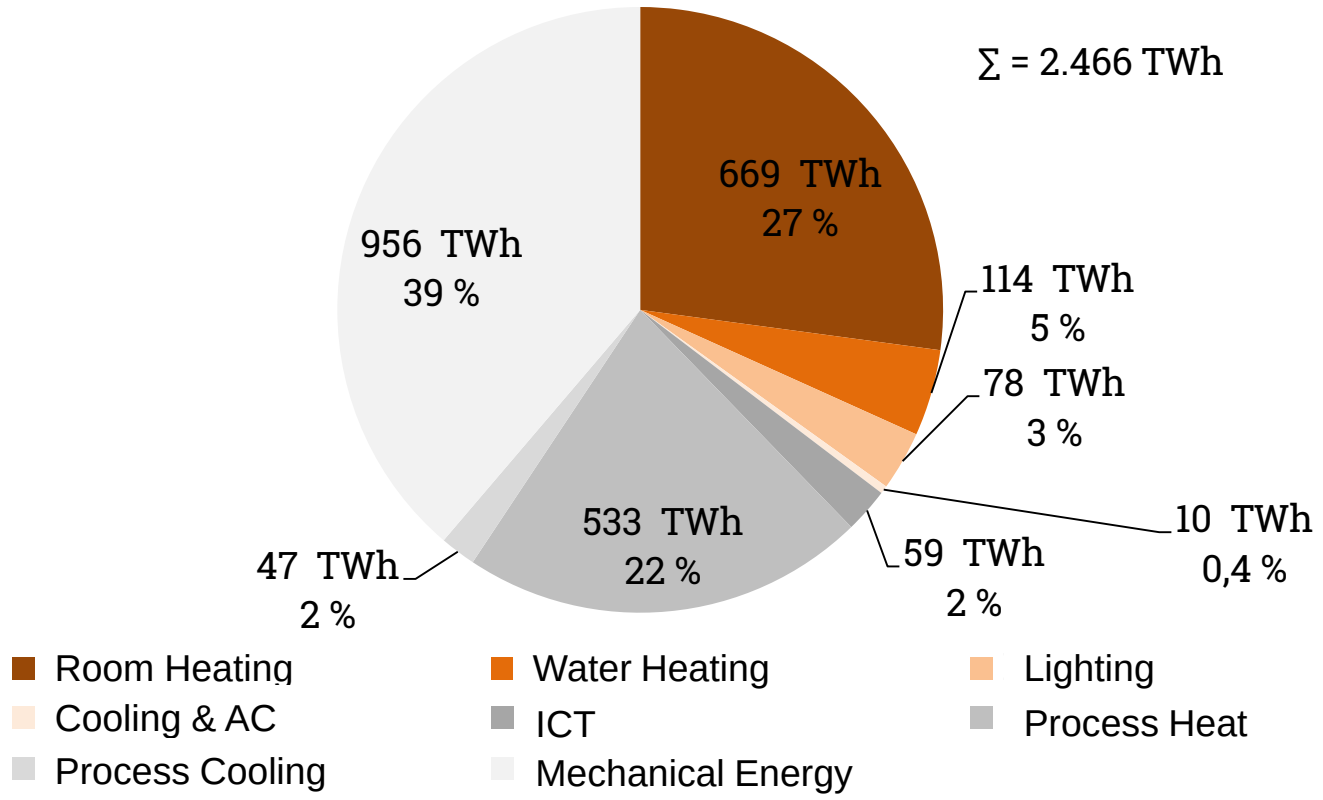
FINAL ENERGY CONSUMPTION IN BUILDINGS



Quelle: dena-Gebäudereport 2016 nach (BMWi, 2016c)

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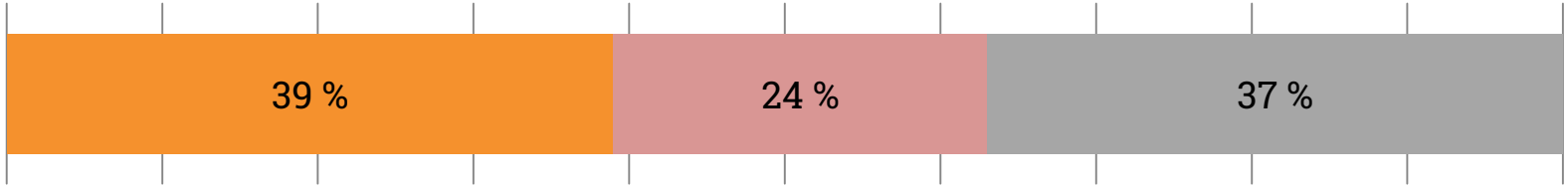
BUILDING STOCK IN GERMANY – SHARE OF FINAL ENERGY CONSUMPTION

Single Family Homes

Multi Family Homes

Commercial Buildings

Share of Final Energy Consumption



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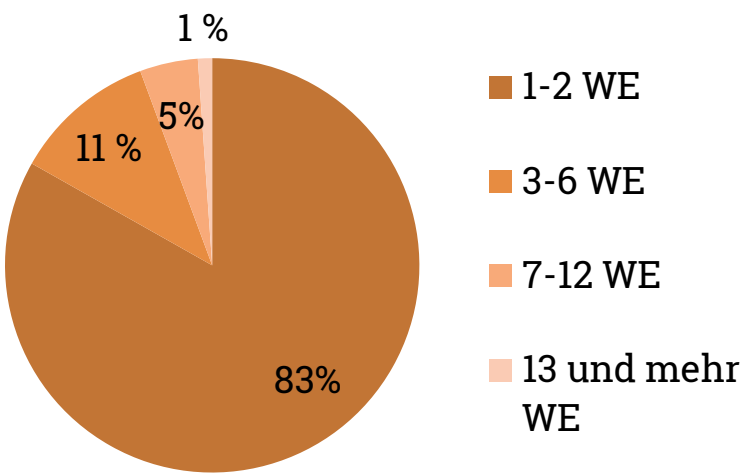
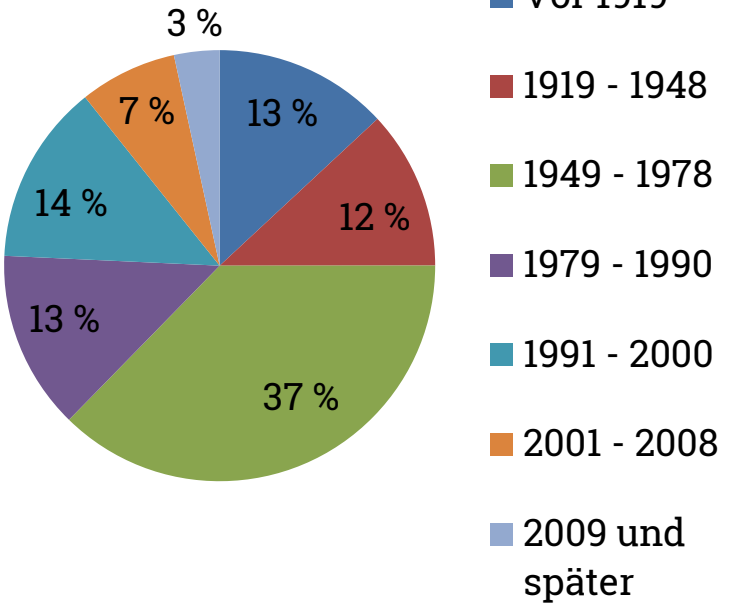
CATEGORIZATION OF BUILDING STOCK

Share of total number of buildings / residential units



Share of total number of buildings / building age



Quelle: dena-Gebäudereport 2016
nach (DESTATIS, 2014a), (DESTATIS, 2012), (DESTATIS, 2016d)

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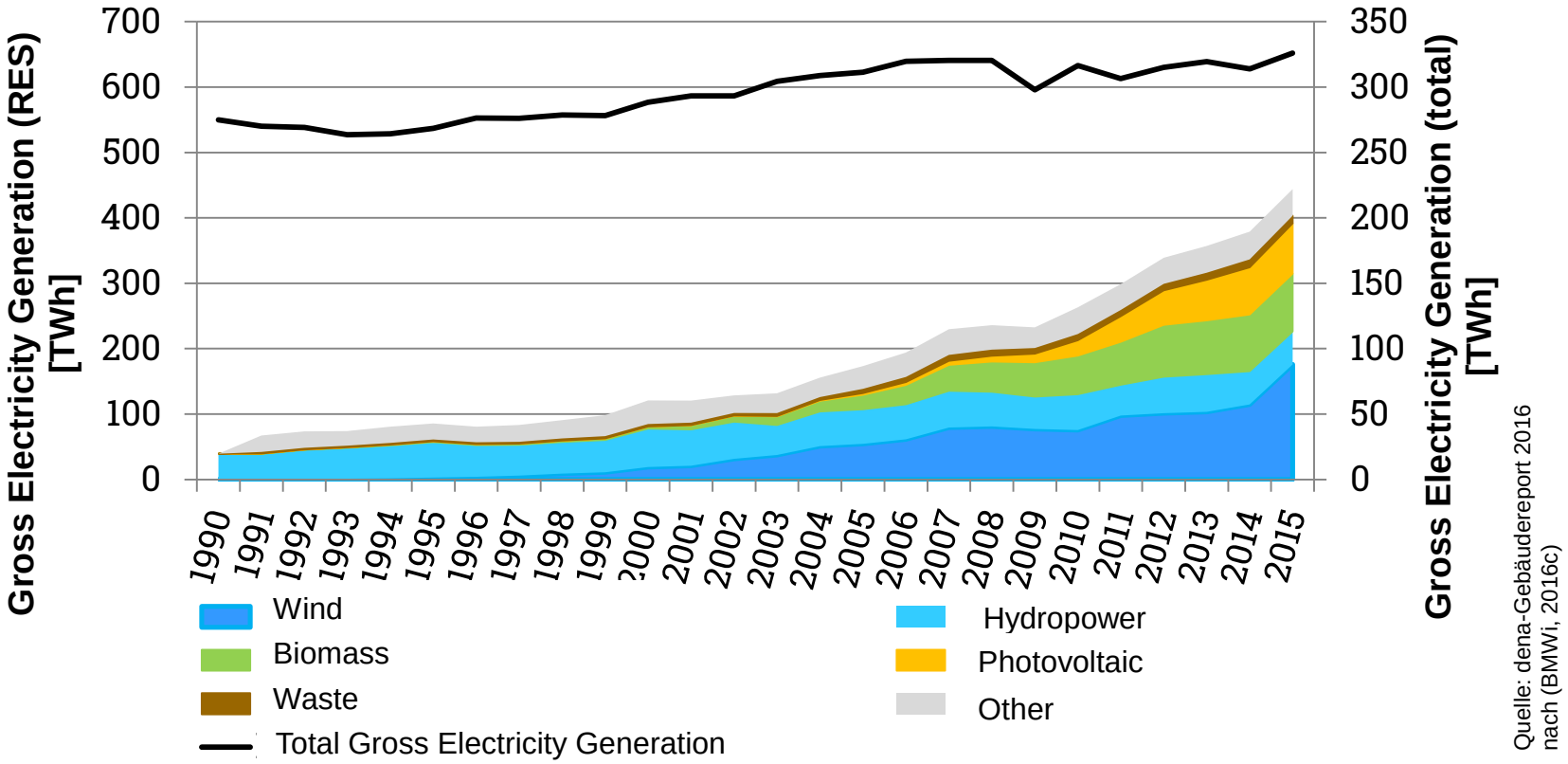
GROSS ELECTRICITY GENERATION



Quelle: dena-Gebäudereport 2016 nach (BMWi, 2016c)

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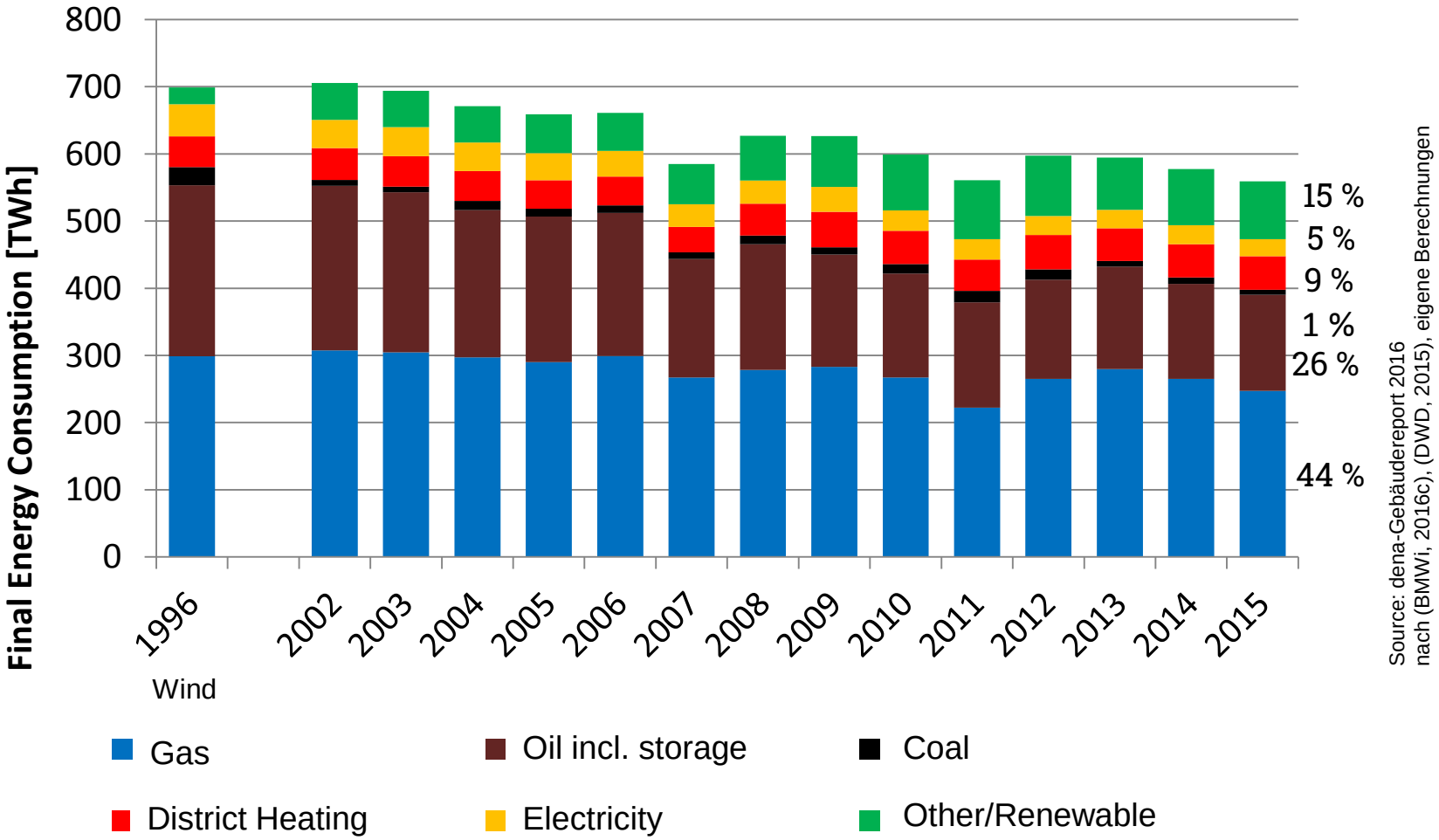
BUILDING STOCK ENERGY CONSUMPTION



Source: dena-Gebäudereport 2016
nach (BMWi, 2016c), (DWD, 2015), eigene Berechnungen

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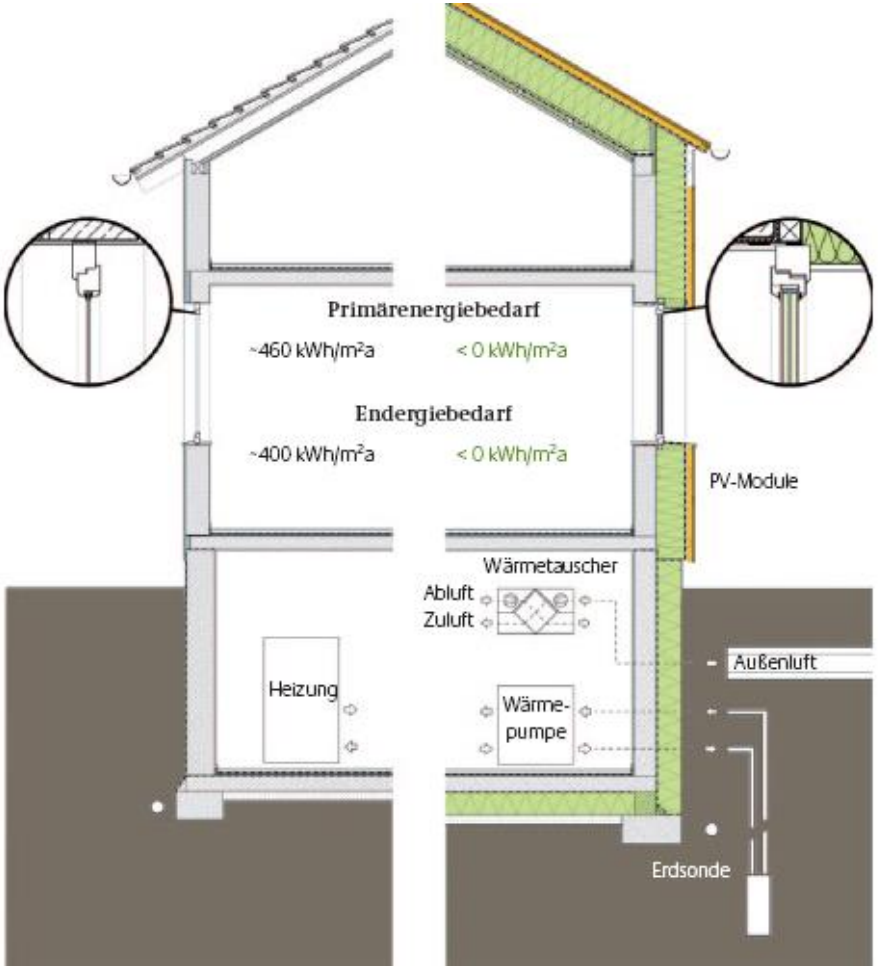
HOW TO APPROACH BUILDINGS AS A SYSTEM

- **QUALITY OF THE BUILDING ENVELOPE**
  - **THERMAL INSULATION OF WALLS**
  - **TRIPLE GLAZING**
  - **AIRTIGHT ENVELOPE**
- **EFFIZIENTE SYSTEMS ENGINEERING**
  - **HEATING SYSTEM & PUMPS**
  - **VENTILATION SYSTEM**
- **USE OF RENEWABLE ENERGY CARRIERS**



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GERMANY‘S ACTION LEVELS FOR ENERGY EFFICIENCY IN BUILDINGS

FEDERAL REGULATORY FRAMEWORK

- Energy Saving Ordinance (EnEV)
- Renewable Energy Heat Act (EEWärmeG)
- Renewable Energy Law (EEG)
- European Regulatory Framework: EPBD (2010) → nZEB by 2019/2021

FEDERAL PROMOTION SCHEME

- KfW Banking Group
- Federal Office für Economic Affairs and Export Control

INFORMATION & CUSTOMER AWARENESS CAMPAIGNS

DENA MODELLVORHABEN / PILOT PROJECTS 2003-2015

- **MORE THAN 400 RESIDENTIAL AND COMMERCIAL BUILDINGS**
  - 60 schools, gyms and Museums
  - > 150 Single Familiy Houses and 200 Multi Family Houses
  - Realized Final Energy Reduction: 80 %
- **DEVELOPMENT OF LARGE DATA SET**
- **ASSESSMENT OF ENERGY CONSUMOPTION /MONITORING**
- **USE FOR CONSULTING PROJECTS**





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ENERGY CONCEPT FOR A NEW URBAN DISTRICT

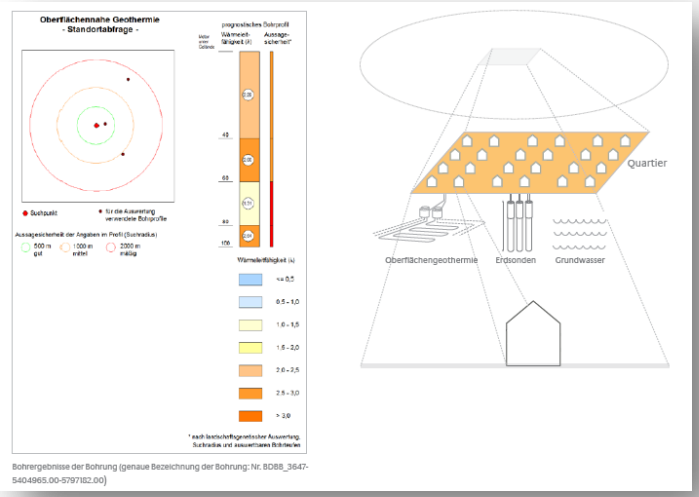
INTEGRAL PLANNING APPROACH

- Real Estate Developers
- Architects, Urban Planners & Energy Consultants

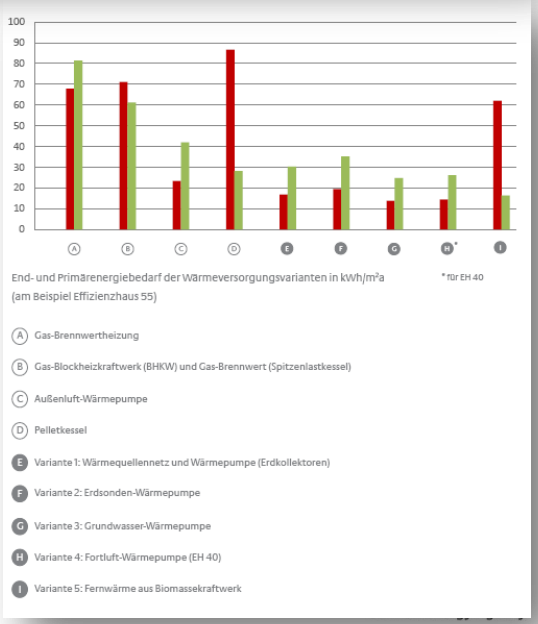
ANALYSIS AND OPTIMIZATION

- Building Hull
- Heat Supply / District Approach
- Cost Optimization
- Electricity Concept / PV & Storages

PREPARING FOR URBAN ENERGY TRANSITION



Bohrergebnisse der Bohrung (genaue Bezeichnung der Bohrung: Nr. BD88_3647-5404965.00-5797182.00)



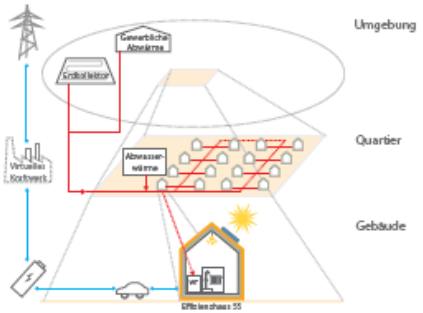
End- und Primärenergiebedarf der Wärmeversorgungsvarianten in kWh/m²a (am Beispiel Effizienzhaus 55)

* für EH 40

(A) Gas-Brennwertheizung
(B) Gas-Blockheizkraftwerk (BHKW) und Gas-Brennwert (Spitzenlastkessel)
(C) Außenluft-Wärmepumpe
(D) Pelletkessel
(E) Variante 1: Wärmequellennetz und Wärmepumpe (Erdkollektoren)
(F) Variante 2: Erdsonden-Wärmepumpe
(G) Variante 3: Grundwasser-Wärmepumpe
(H) Variante 4: Fortluft-Wärmepumpe (EH 40)
(I) Variante 5: Fernwärme aus Biomassekraftwerk

ENERGY CONCEPT FOR A NEW URBAN DISTRICT

Variante	Gewichtung (%)	Variante 1 EFH 55 WQN + WP	Variante 2 EFH 55 Geo + WP	Variante 3 EFH 55 GrW + WP	Variante 4 EFH 40 FoL + WP	Variante 5 EFH 55 FW
Wirtschaftlichkeit	40	165	120	140	160	115
Investitionskosten (1-5: am höchsten = 1)	15	4	3	3	3	5
Fördermöglichkeiten (1-5: am geringsten = 1)	15	5	3	3	5	2
Energiekosten (über 20 Jahre) (1-5: am höchsten = 1)	10	3	3	5	4	1
Energiebilanz	30	90	75	120	90	90
Aufwand für Klimaneutralität (1-5: höchster Primärenergiebedarf = 1)	15	2	1	3	2	5
Aufwand für Plus-Energie im Quartier (1-5: höchster Endenergiebedarf = 1)	15	4	4	5	4	1
Umsetzung	20	80	80	70	60	100
Robustheit des Konzepts (1-5: hohe Komplexität = 1)	10	3	3	2	4	5
Integrierter Quartiersansatz (1-5: geringe Verknüpfung = 1)	10	5	5	5	2	5
Presse und Marketing	10	50	45	45	25	35
geeignet für Presse (1-5: am wenigsten geeignet = 1)	5	5	4	4	2	4
geeignet für Marketing (1-5: am wenigsten geeignet = 1)	5	5	5	5	3	3
Summe		385	320	375	335	340



Bevorzugte Variante 1
Wärmequellennetz + WP

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ENERGY CONCEPTS IN CHINA: THE BIGGER SCALE

HARBIN, CHINA

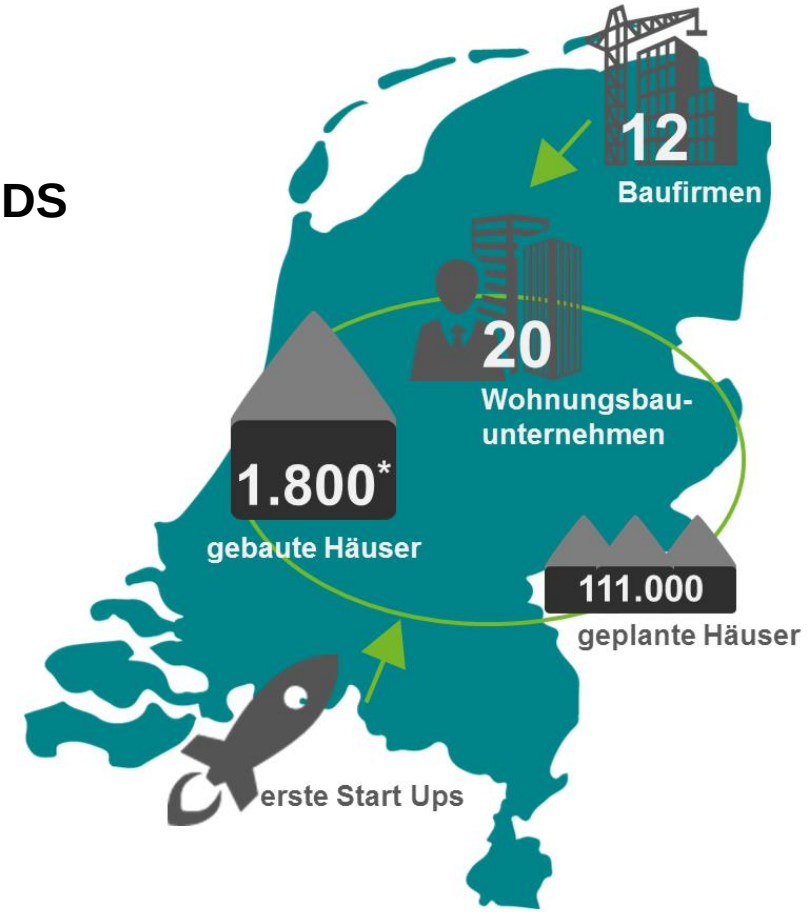
- **Project volume: 5.8 Mio. USD**
- **First operation: October 2014**

KEY CHARACTERISTICS:

- **Residential building with 7,800 m² of living area, 11 floors, 66 apartments**
- **Technology**
  - building envelope: 30cm EPS
  - central ventilation with waste heat recovery
  - concrete core activation as 2nd heat/cooling transfer system, energy source: wood pellet boiler + geothermal heat pump

ENERGIESPRONG GERMANY

- **INITIATIVE FROM THE NETHERLANDS**
- **ADAPTATION IN GERMANY AND CREATING PROTOTYPES**
- **SERIAL REFURBISHMENT**
  - quicker
  - cheaper
  - more precise construction
  - reliable energy performance
  - digital construction and assembly chain



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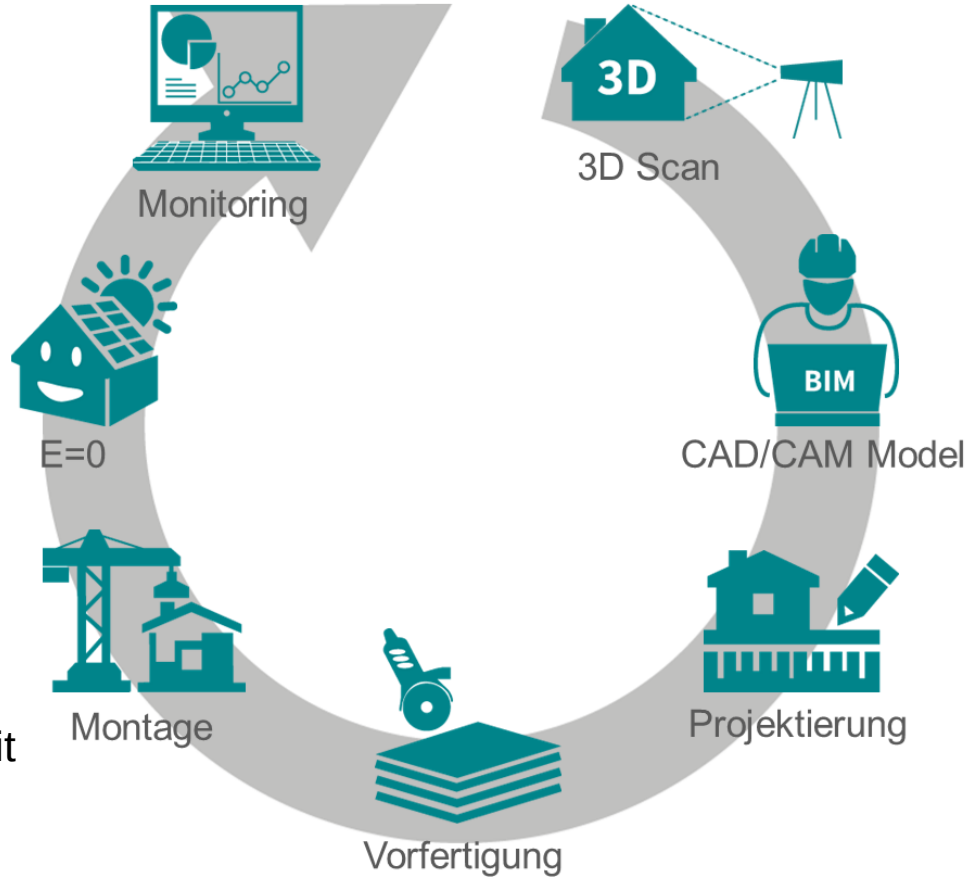
INDUSTRIALIZATION AND DIGITIZATION OF THE REFURBISHMENT PROCESS

TODAY

- 95% of modernization is being implemented on site
- No innovation: Construction sector still acts like 100 years ago.

SOLUTION

- Digitized tacheometric building survey
- High degree of standardization and prefabrication
- Decreasing refurbishment costs per unit
- High accuracy and qualtiy



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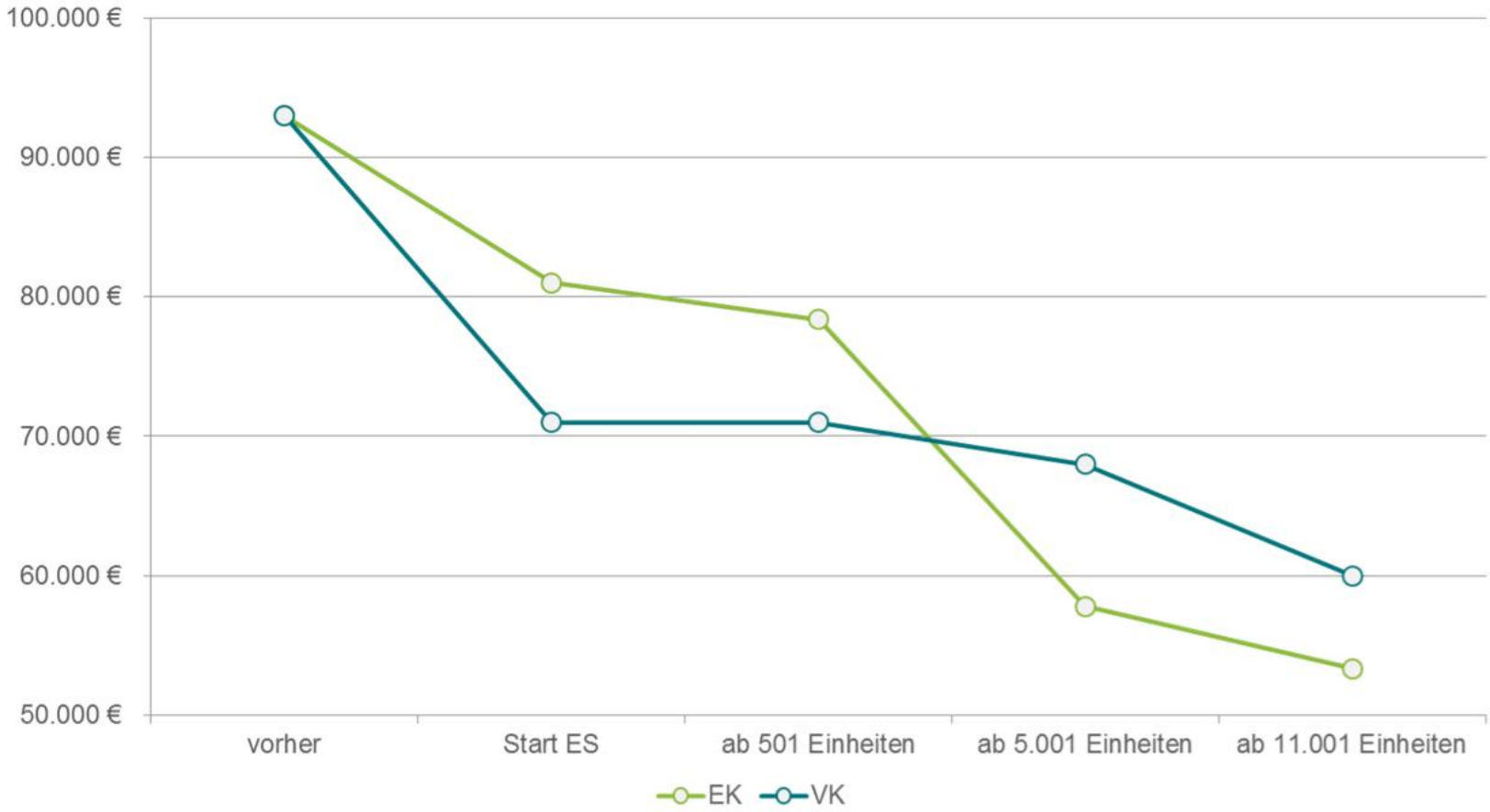
COST REDUCTION THROUGH PREFABRICATION



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PREFABRICATION LEARNING CURVE: FROM 2 WEEKS TO 1 DAY ONLY!

V1: 2 Wochen

V2: 1 Woche

V3: 1 Tag

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DENA‘S PILOT STUDY INTEGRATED ENERGY

- CLIMATE GOALS: GHG REDUCTION BY 80-95% BY 2050
- PILOT STUDY DESIGN FOR AN INTEGRATED CONSIDERATION OF THE ENTIRE ENERGY SYSTEM
- PRIVATE STAKEHOLDERS FROM ALL SECTORS
- TRANSFORMATION PATH TOWARDS THE ACHIEVEMENT OF GLOBAL CLIMATE GOALS
- BALANCING REGIONAL OPTIMIZATION AND SUPRA-REGIONAL ENERGY COMPENSATION

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PROJECT PARTNERS

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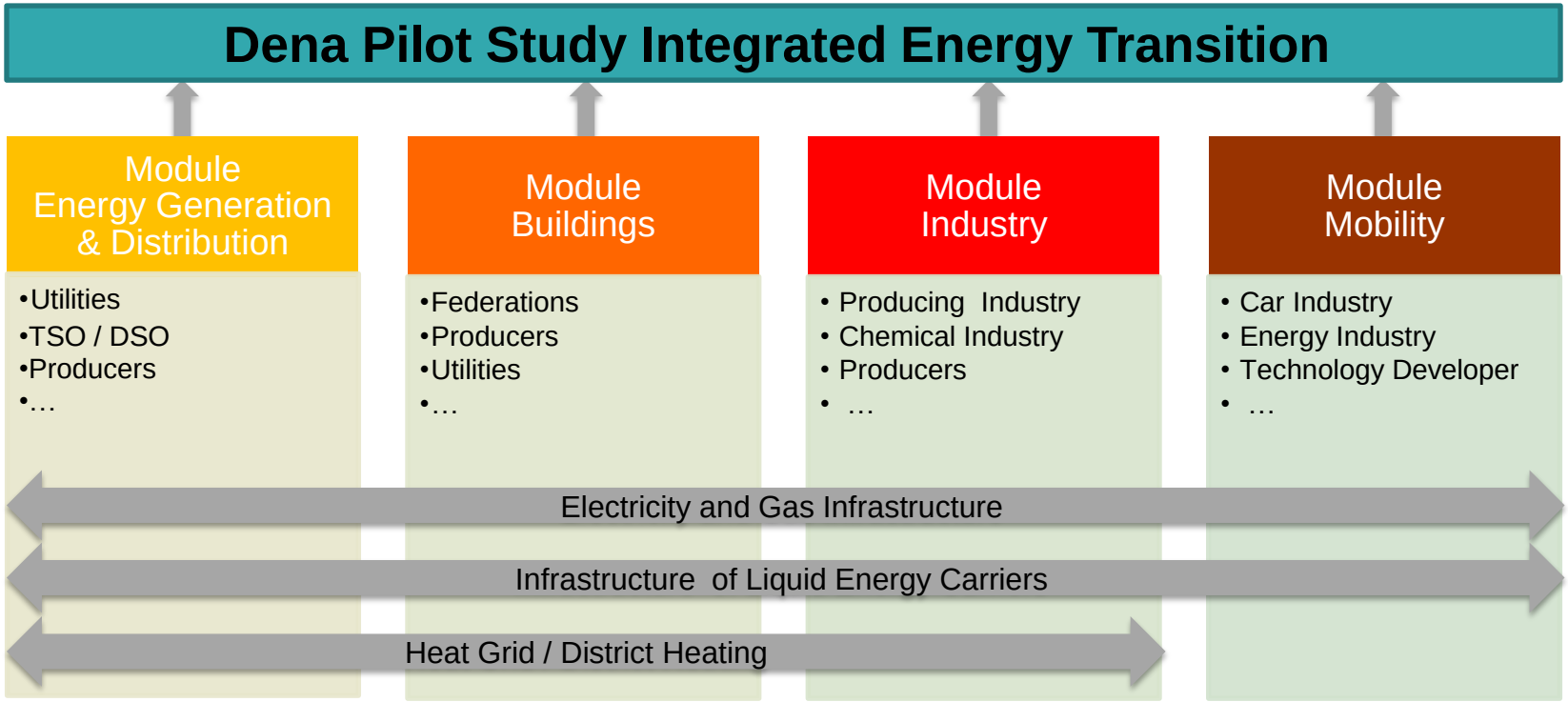
MODULAR STUDY DESIGN FOR AN INTEGRATED CONSIDERATION OF THE ENTIRE ENERGY SYSTEM



TIME FOR EXCHANGE – Q&A

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dena
German Energy Agency
THANK YOU
schachtschneider@dena.de
www.dena.de