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The German Energy Storage RD&D Initiative

IEA Expert Group on Energy R&D and Priority Setting (EGRD)
22/23 October 2014, BMWi Berlin, Germany

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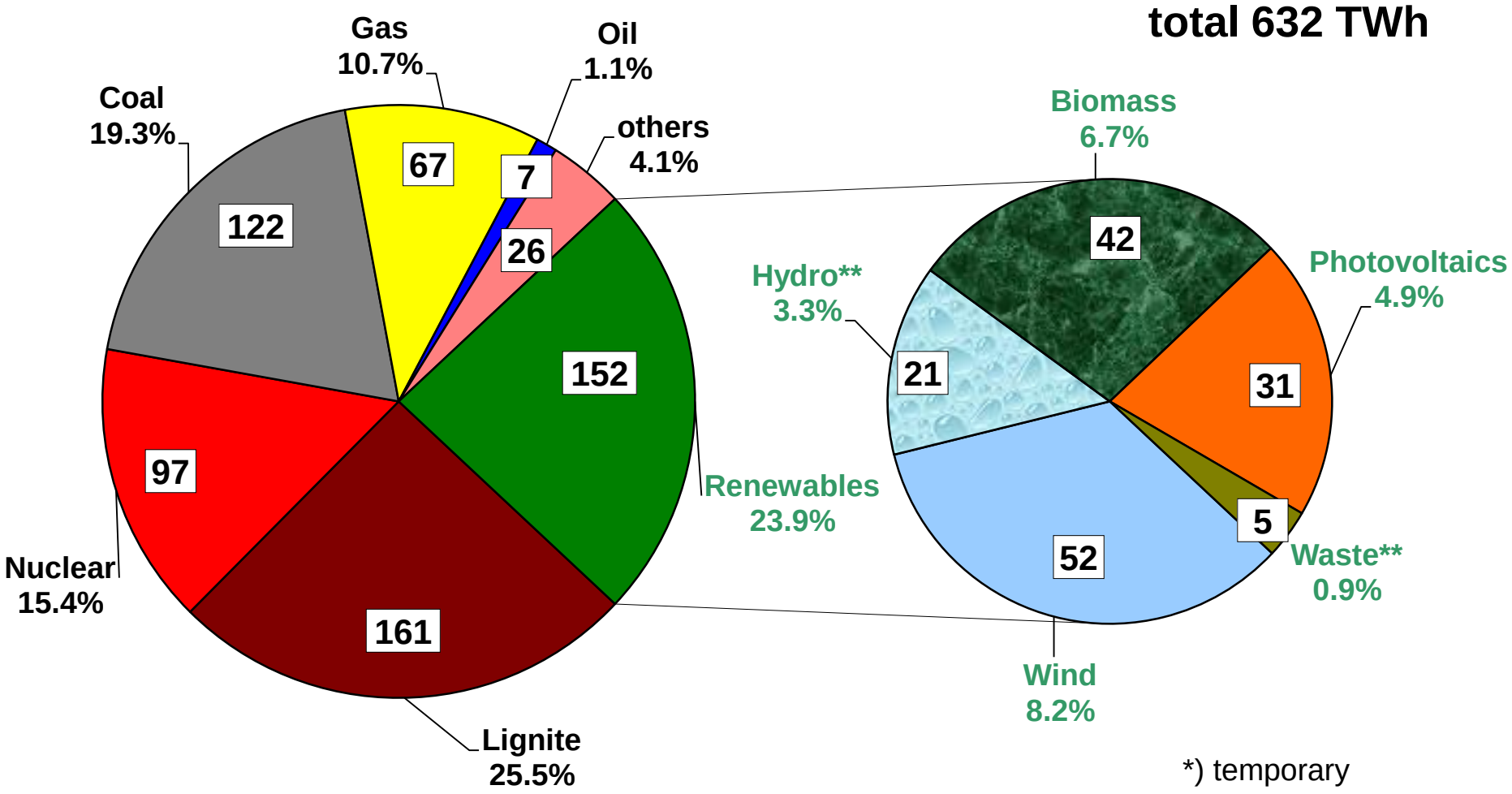
Outline

- Energy policy– the German *Energiewende*
- Energy research as an important instrument of energy policy – the German Energy Research Programme
- German research activities in the area of energy storage and grids
- Summary

Gross Electricity Production in Germany 2013*



*) temporary
**) renewable amount

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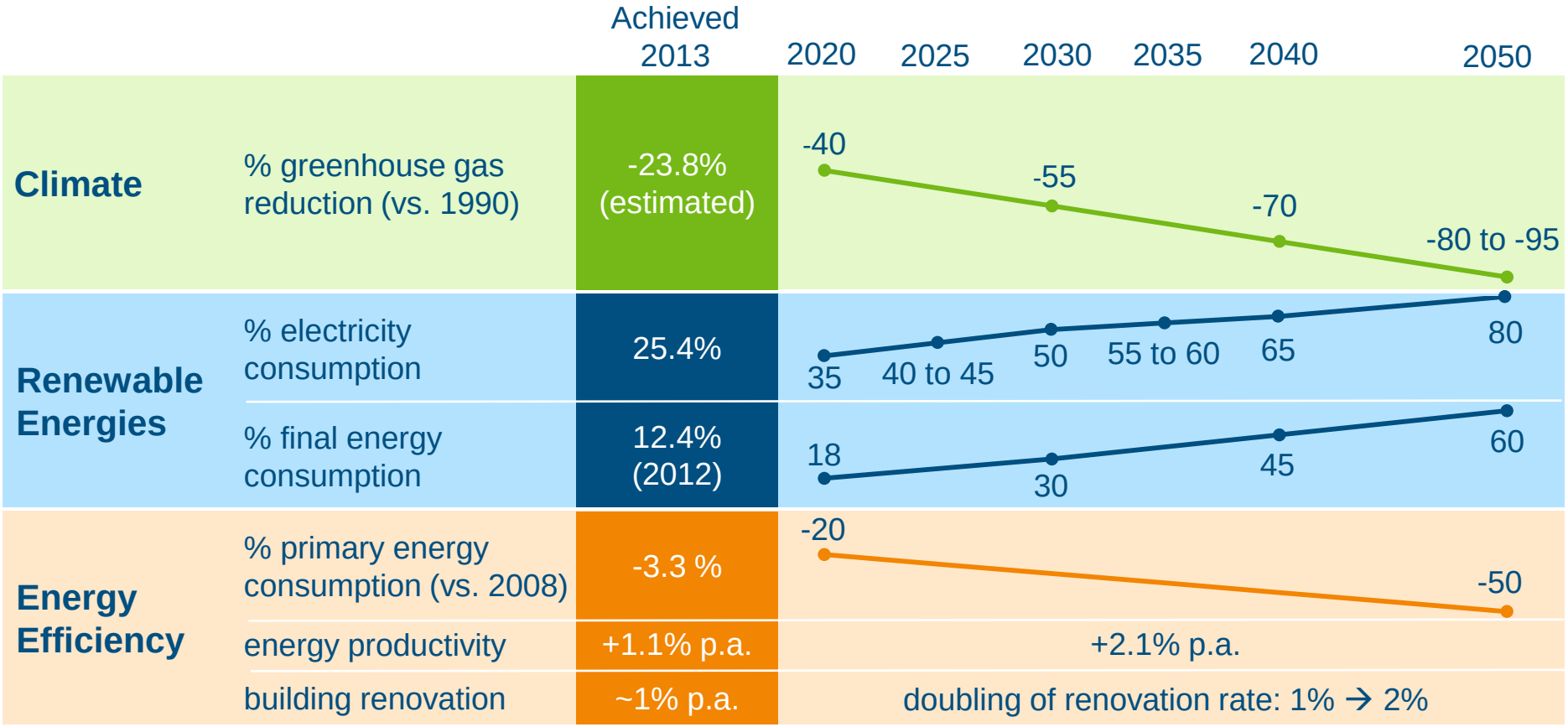
Source: Arbeitsgemeinschaft Energiebilanzen (AGEB)

Energiewende targets until 2050



Targets are complemented by additional sector-specific targets

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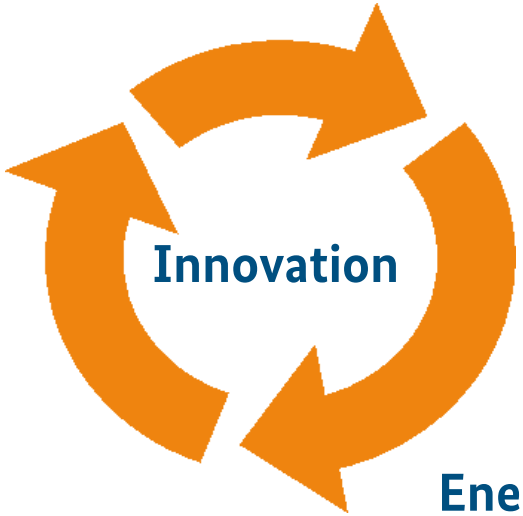
Focus of Energy Policy

Renewable energies

- Cost and quantity control
- Market integration

Energy security

- Thorough assessment
- National and European issues



Grid infrastructure

- New planning process (participation)
- Smart grids

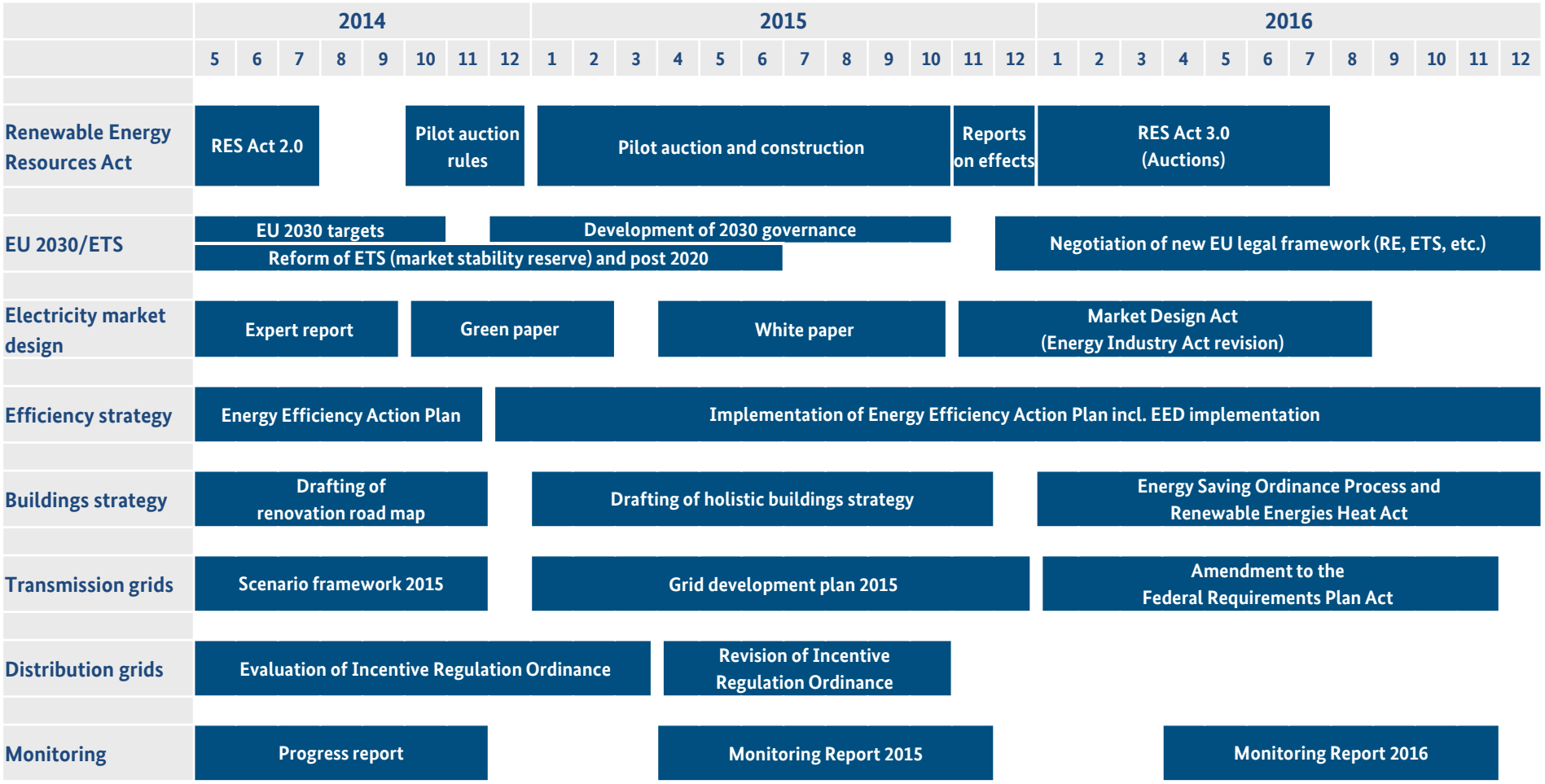
Flexibilisation of the Whole system

- Flexibilisation of generation as well as demand is key

Energy efficiency

- Lacking behind
- Implementation of EU EED
- Energy Efficiency Action Plan

Key Projects of the 18th Legislative Term



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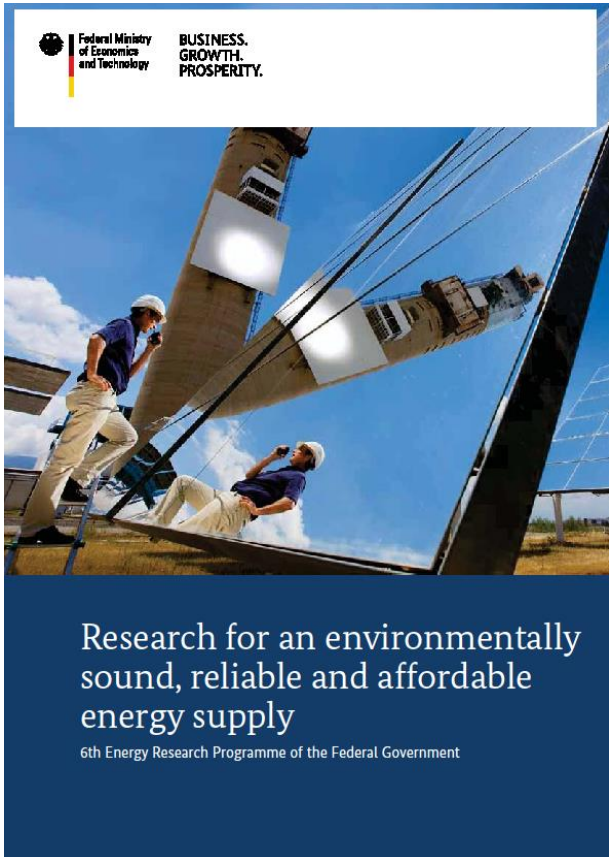
The energy transition: key projects of the 18th legislative term:
10-point energy agenda of the Federal Ministry for Economic Affairs and Energy
www.bmwi.de

Energy Research Programme, August 2011

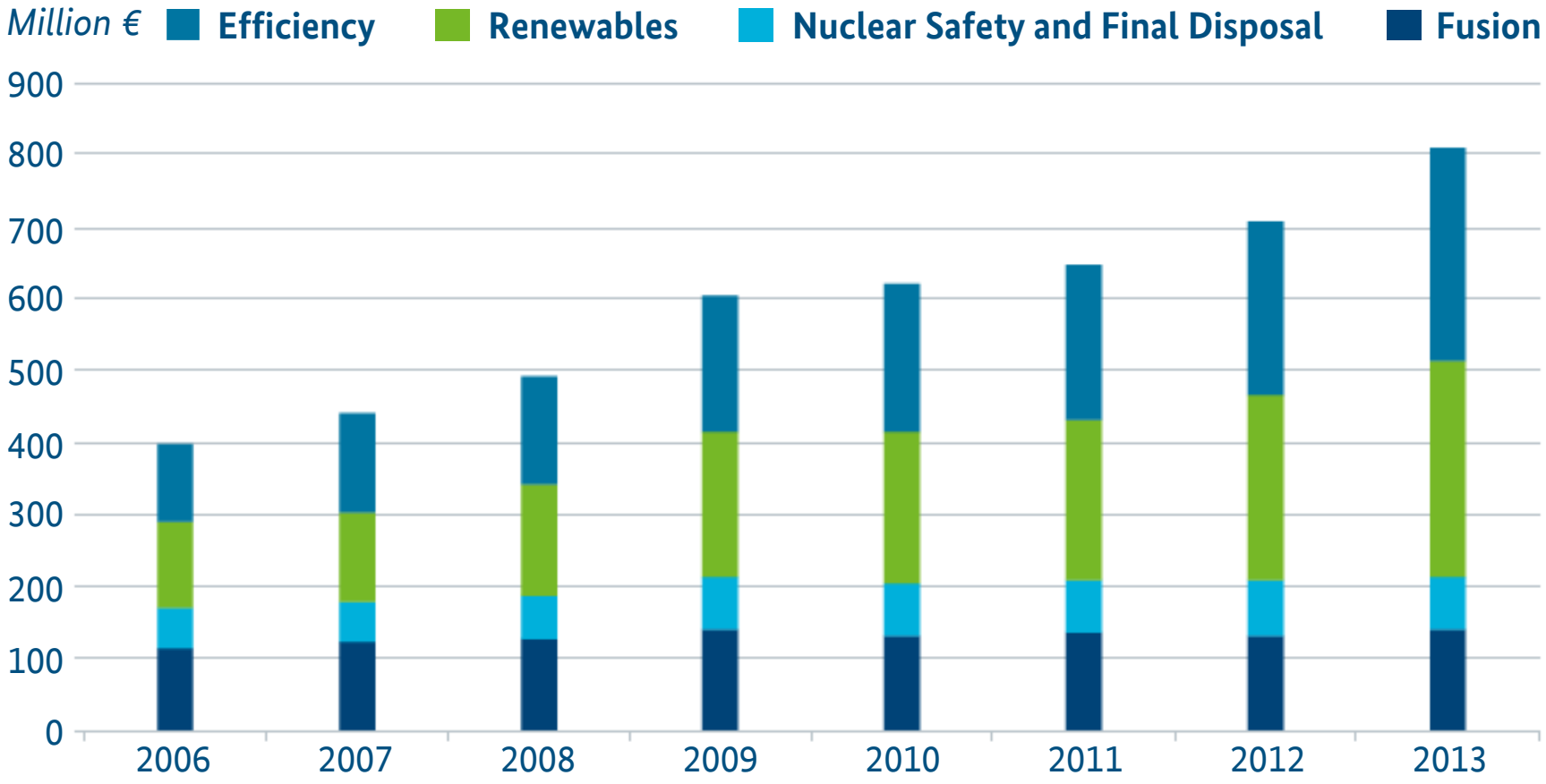
Energy Research Policy
is an important Instrument of the
Energy Policy

Main Objectives:

1. Contribute to achieving the targets of energy and climate policy
2. Enhance the leading position of companies in the field of modern energy technologies
3. Secure and enhance technological options



Energy Research Programme: Overview of Topics and Funding



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Report of the Federal Government on Energy Research 2014, www.bmwi.de

Joint RD&D Initiative *"Energy Storage Technologies"*

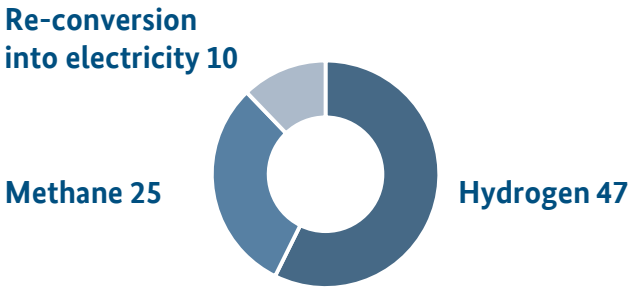
(http://forschung-energiespeicher.info)

- Call for proposals in 2011: 402 proposals, 925 Mio. € funding requested
- Coordinated approach by 3 ministries; one-stop-shop for applicants
- Objectives of the initiative:
    - Develop medium-term and long-term solutions to cope with the increasing electricity feed-in from volatile renewable energy sources
    - Address short fluctuations as well as long-term variations
    - Stationary energy storage for: electricity and heat storage including energy conversion into different material energy carriers
    - Address basic and applied research, demonstration, fabrication processes, aspects of further education
    - Integration and management of storage systems, "smart technologies", system services, simulation and planning tools, socio-economic aspects

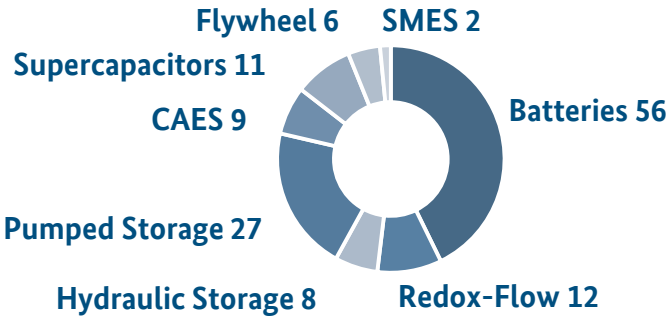
Joint RD&D Initiative *"Energy Storage Technologies"*

- Generating synergies by cross-linking projects
- Assigning developments to flagship projects (project cluster)

Combined Wind-Hydrogen



Batteries in Distribution Grids

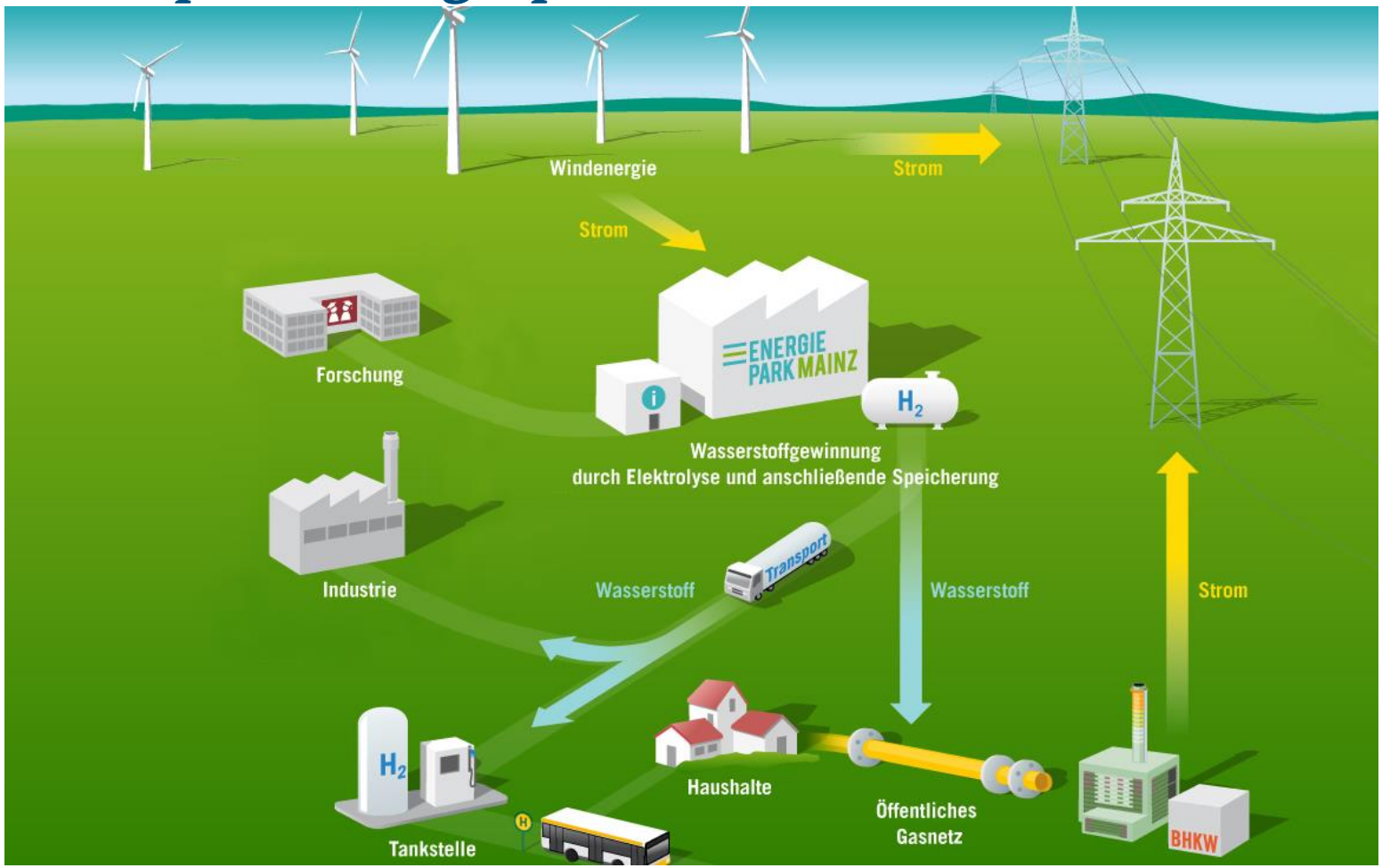


- Additional research topics: thermal storage, young researcher groups, smart grid related storage aspects, system studies
- Total number of projects: 273; approved total funding: 196 Mio. €

Combined Wind-Hydrogen
Example: Energiepark Mainz

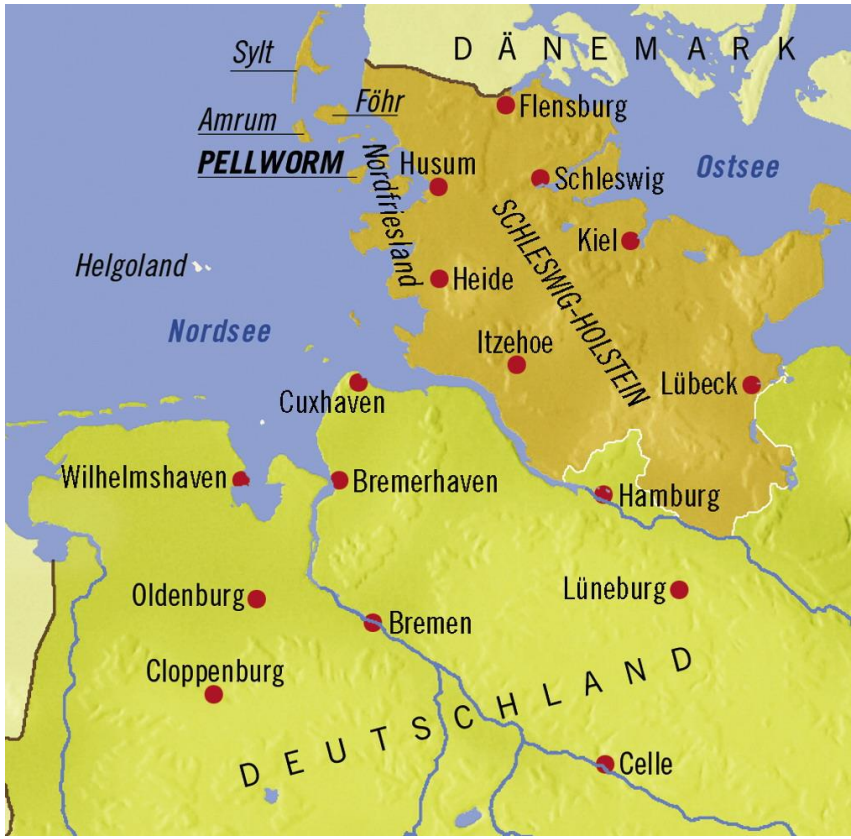
- PtG-project adjacent to an existing 8 MW wind park in Mainz
- Project Partners: Stadtwerke Mainz, Linde, Siemens, Hochschule Rhein-Main
- Major objectives:
    - Peak-Shaving in distribution grids
    - Demonstrate ways to avoid grid expansion by producing, storing and using hydrogen in different ways
    - Bridge the gap between existing small scale electrolyser (100kW) to large scale devices (100 MW); here 2 MW PEM-electrolyser
    - Large-scale ionic compressor
    - Accompanying research activities
- Total funding: 8.9 Mio. € (total costs: 17.6 Mio. €)

Combined Wind-Hydrogen
Example: Energiepark Mainz



Batteries in Distribution Grids
Example: Hybrid Storage System based on RES

- Smart Region Pellworm
- Small island (37 km^2, 1161 inhabitants)
- Hybrid power plant:
  772 kW PV and 300 kW wind power system
- Coordinator: E.ON Hanse AG
- Research aspects, e.g.:
  - Hybrid Storage System
  - Energy management system
  - Business cases
  - Customer interaction and technology acceptance



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Batteries in Distribution Grids
Example: Hybrid Storage System based on RES

	Lithium-Ion	Redox-Flow
System Size Energy [MWh]	0.56	1.6
System Size Output [MW]	0.56	0.2
Efficiency AC/AC	95%	55-65%
Storage loss [1/d]	0.1%	0.0027% (<1% p.a.)
Cycle durability (80% discharge level)	9,200 by 0.5 lmax	>20,000
Service life of the system (1 cycle/day)	20	25
Typical discharge time [h]	1-2	5-10
Response time [ms]	10	4 (50 power electronics)
Typical period between storage and withdrawal [h]	0.5 – 5	2-24

Demonstration of Large-Scale Battery Storage WEMAG

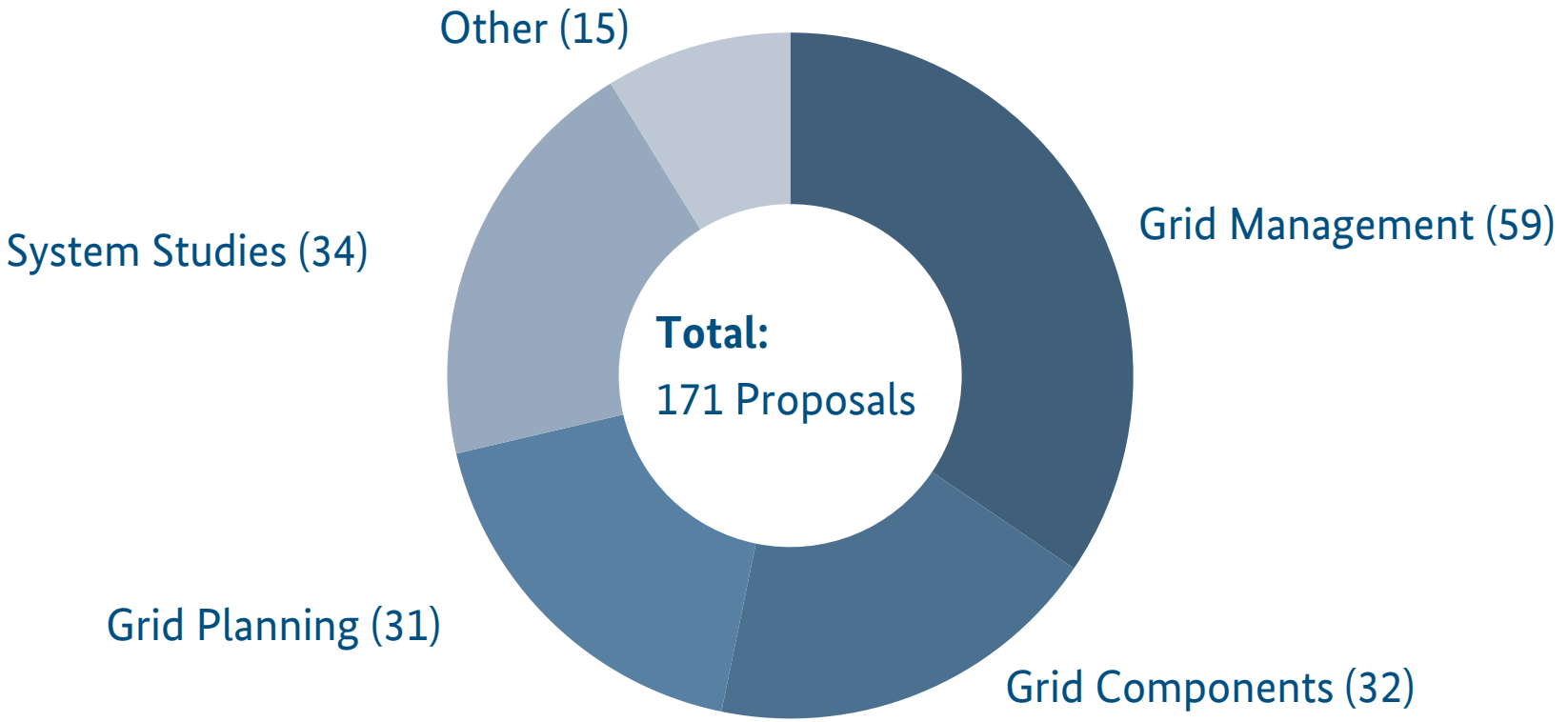
- WEMAG: electricity provider in the north-east part of Germany (specific region that could cover electricity demand completely from RES if sufficient storage would be in place)
- 5 MW / 5 MWh battery storage plant in Schwerin
- Lithium-Manganese-Oxide-Battery (Samsung)
- Integration into a WEMAG-transformer station (20-kV-level)
- Frequency driven primary control
- Official start-up: 16 September 2014
- Total investment: 6.6 Mio. €

Joint Initiative „*Future-Proof Power Grids*“

- Call for proposals in 2012, similar process as storage initiative
- Topics addressed, e.g.:
    - **Transmission- & distribution grids:**
      components, Smart Grids, IT Solutions, Offshore grid connections, new materials, ...
    - **Grid planning:**
      simulating future power supply systems, modular and interconnected grids, analysing the demand for grid extensions, ...
    - **Grid operation:**
      system services , load management, analysing critical grid conditions, decentralized automation, grid control, security of the supply system
- Status quo: 116 projects (grouped into 54 collaborative projects) selected with a budget of 48 Mio. € (36 large enterprises, 24 SME, 34 universities, 21 research institutes)

Joint Initiative „*Future-Proof Power Grids*“

Number of proposals submitted



Requested Funding: 318 Mio. € / Available Funding: 150 Mio. €

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Summary

- RD&D and innovation is key in order to implement the *Energiewende*
- A broad technological approach is needed for the short-term as well as for the long-term
- Joint funding initiatives in key areas such as energy storage and grids can generate the momentum needed to push relevant developments
- BUT: more effort is needed to better crosslink the comprehensive research landscape in Germany and internationally