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Energie wende
Switch to the Future

Energiewende

Germany‘s energy system, the status of the energy transition and R&D needs

I: The magic triangle

II: Technological challenges

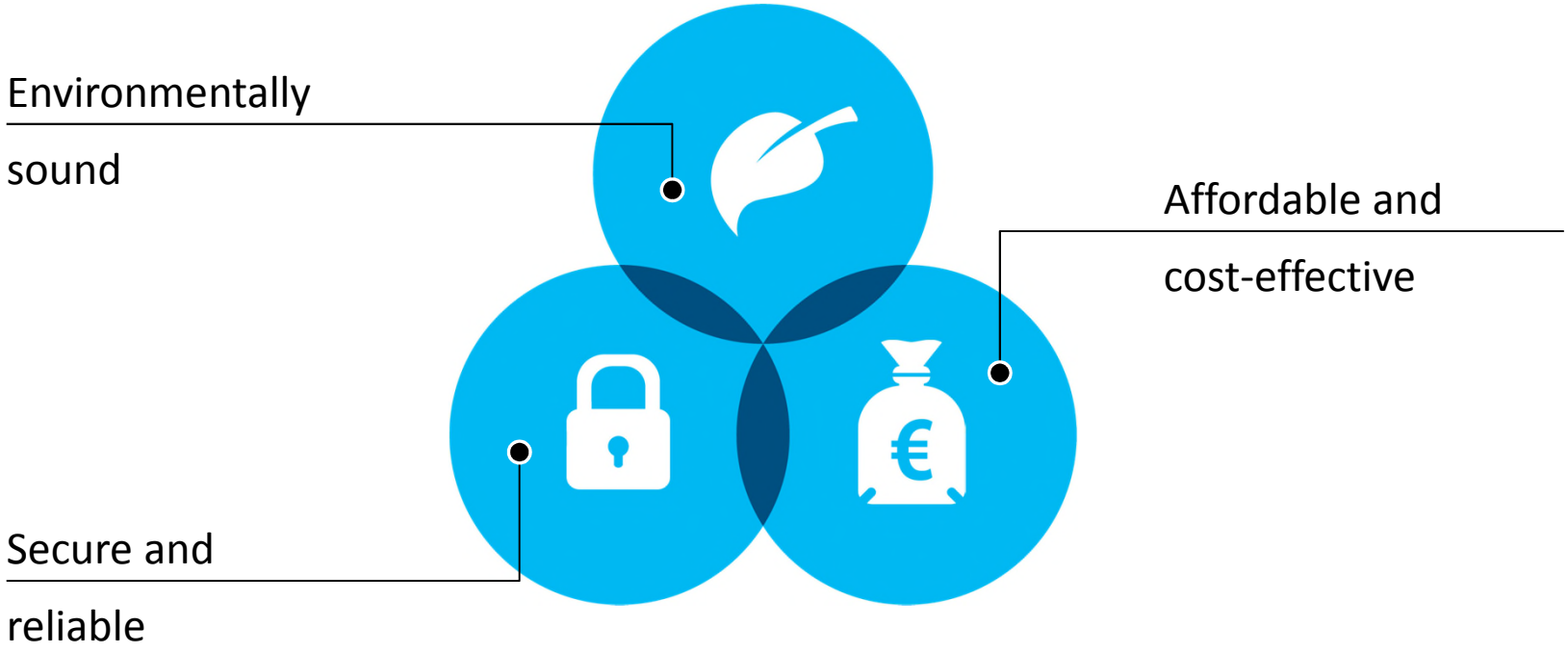
III: National R&D agenda

Johannes Kerner

BMWi IIC6

ACT Workshop Niederaußem Nov 13 2018

I: The *Energiewende* combines security of supply, cost-effectiveness and environmental protection



Source: BMWi

The *Energiewende* is Germany's long-term energy and climate strategy

		Achieved 2017	2020	2025	2030	2035	2040	2045	2050
Climate	% greenhouse gas reduction (vs. 1990)	27.6% (2016)	40		55		70		80 to 95
Renewable Energy	% gross electricity consumption	36.2%	35	40 to 45	65				80
	% gross final energy consumption	14.8% (2016)	18		30		45		60
Energy Efficiency	Primary energy consumption (vs. 2008)	-6.0%	-20						-50
	Final energy productivity (vs. 2008)	1.1% p.a. (2016)	+2.1% p.a. (2008-2050)						
	Primary energy demand in buildings (vs. 2008)	-15.9% (2015)							-80
	Final energy consumption in transport (vs. 2005)	+1.3% (2015)	-10		-15 to -20				-40

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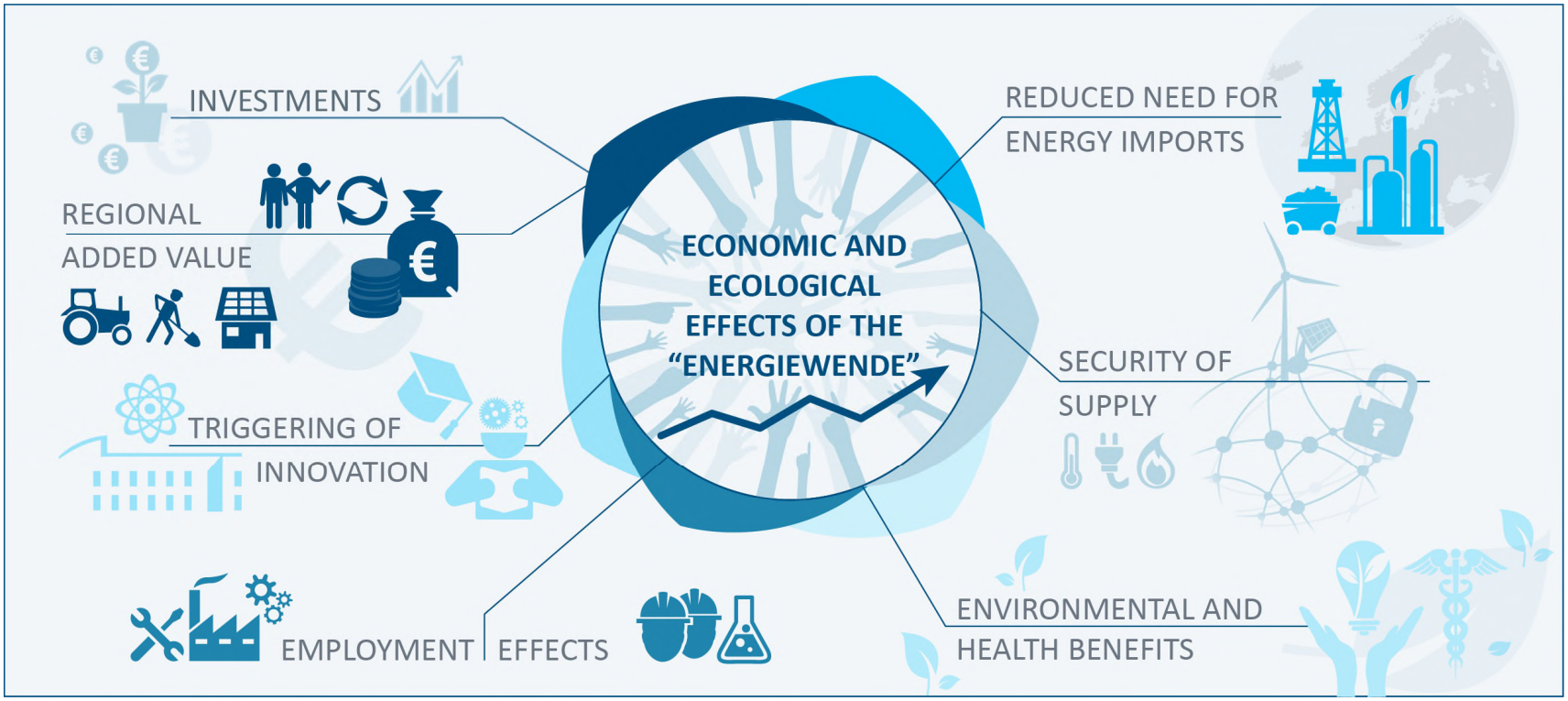
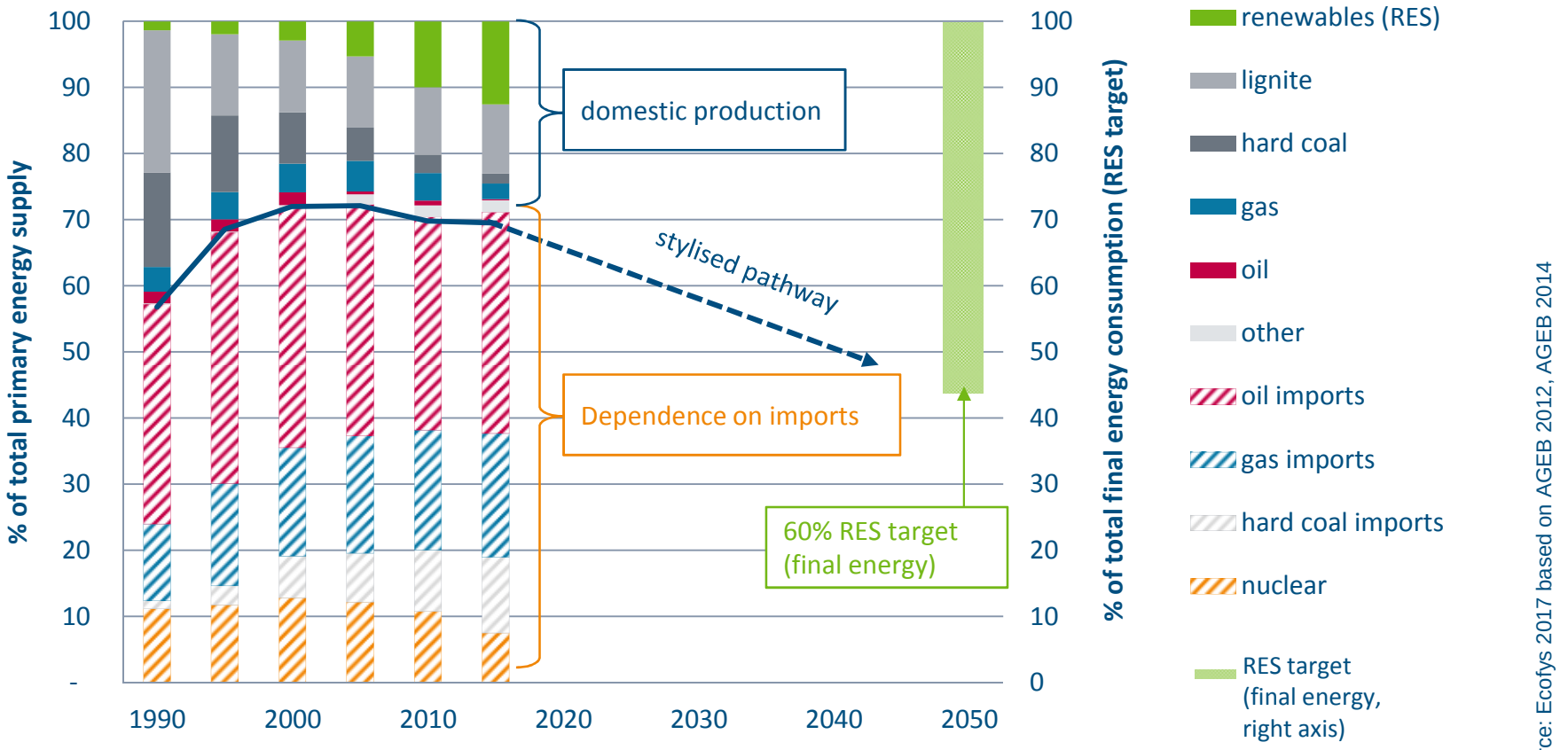
The energy transition is having positive effects at various levels of the economy



Source: Bundesregierung 2016

Renewables reduce dependence on energy imports



Source: Ecofys 2017 based on AGEB 2012, AGEB 2014

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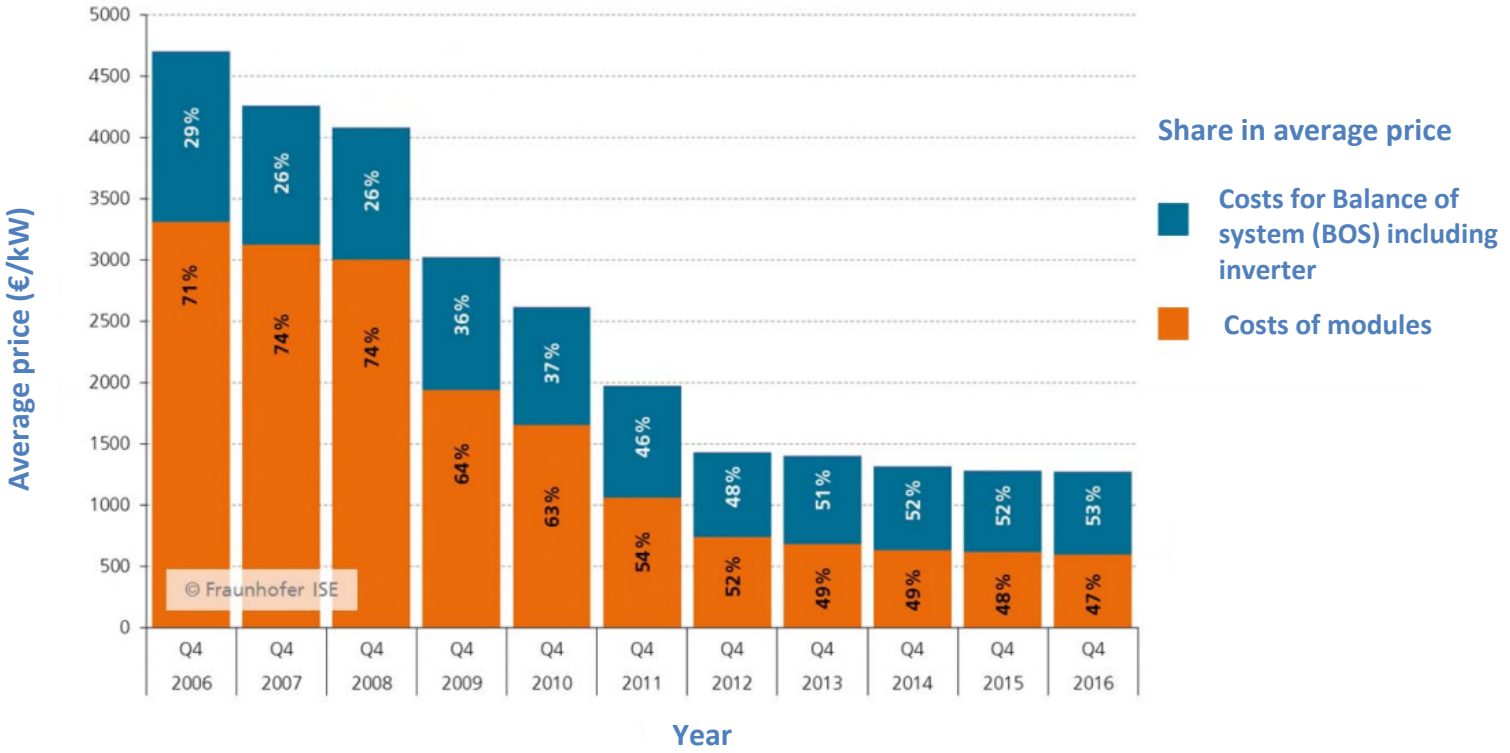
Declining module costs in particular have driven down the price of solar PV systems in Germany



Average retail price for rooftop systems with an installed capacity of 10-100 kW

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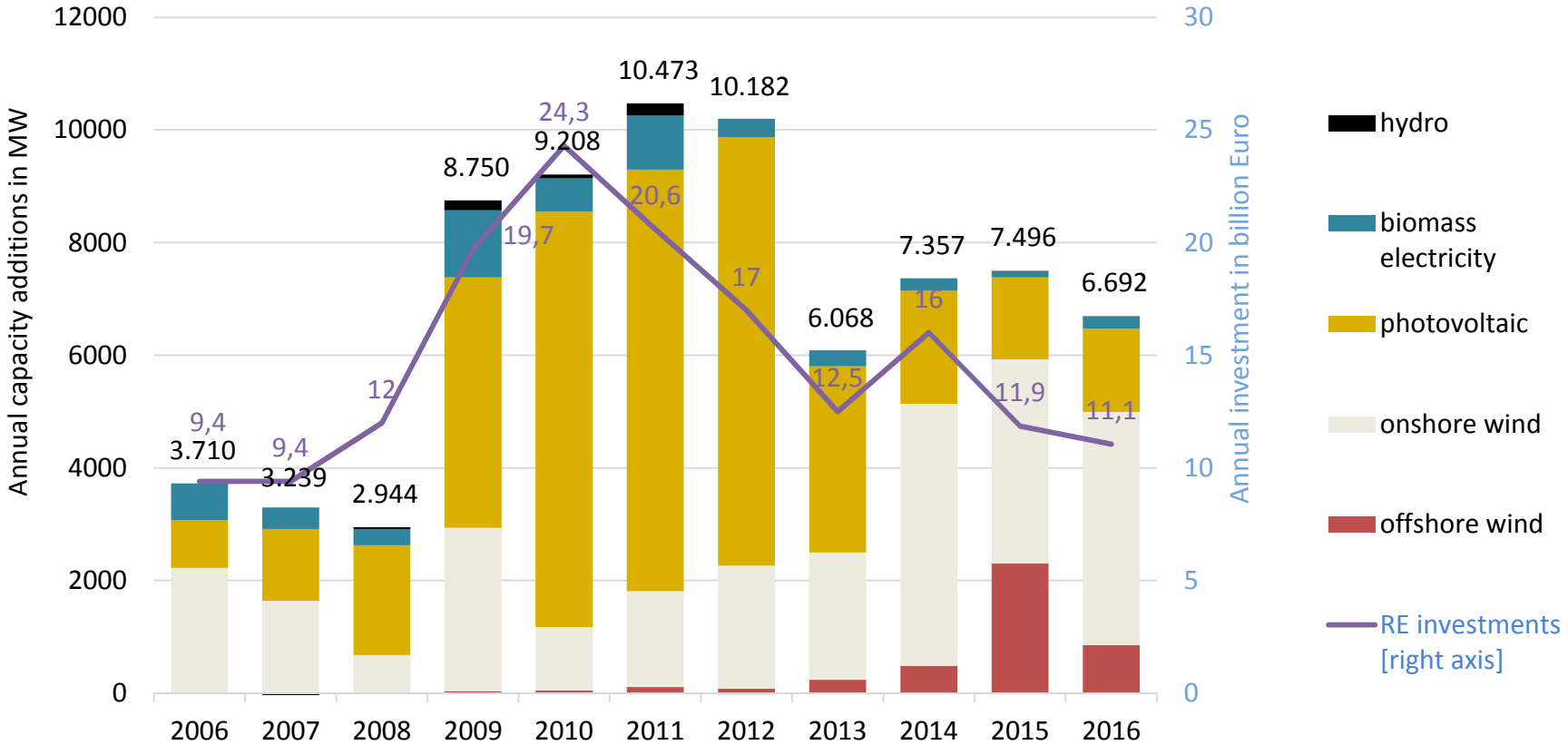
Investments in wind power have overtaken investments in solar PV



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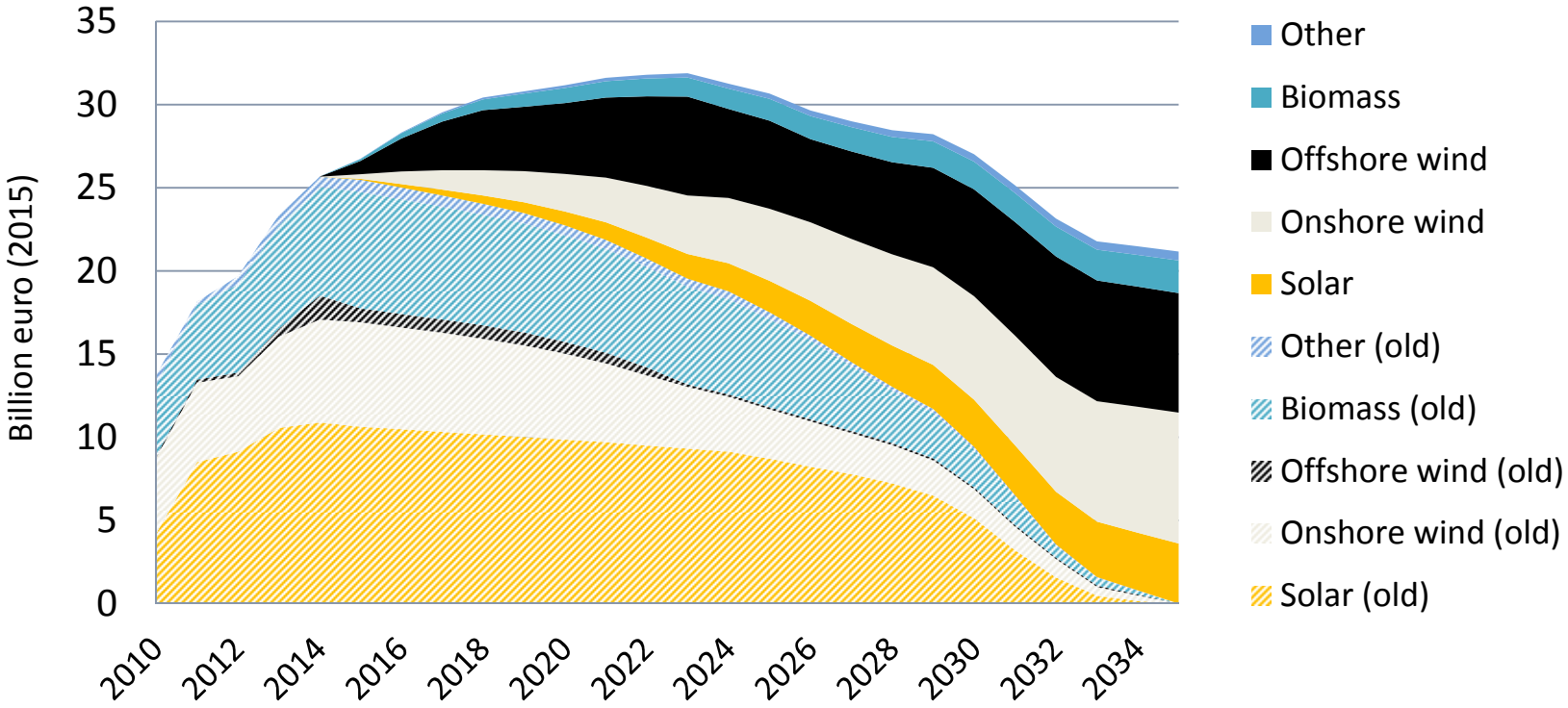
German RES support payments mainly go to existing plants; new installations account for a much smaller share



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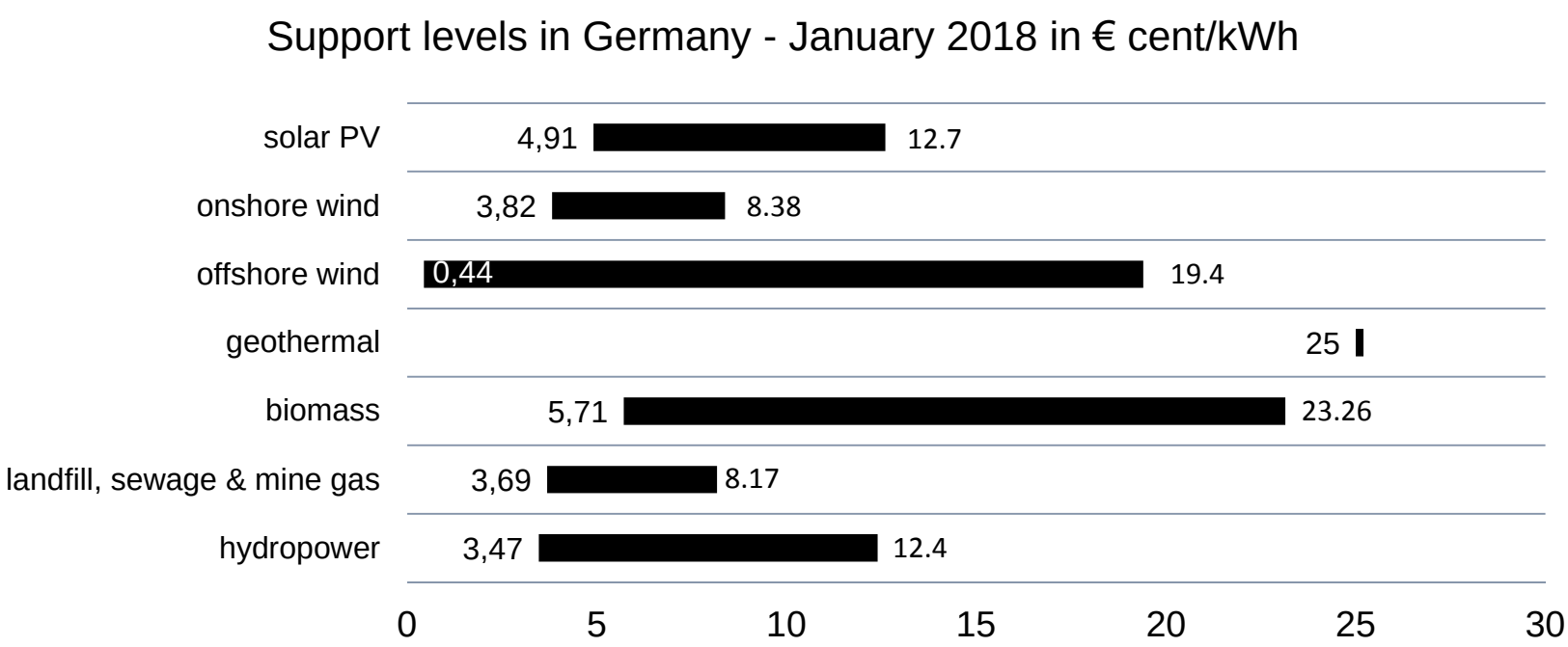
Technology-specific payments reflect the varying cost of different types and sizes of renewables



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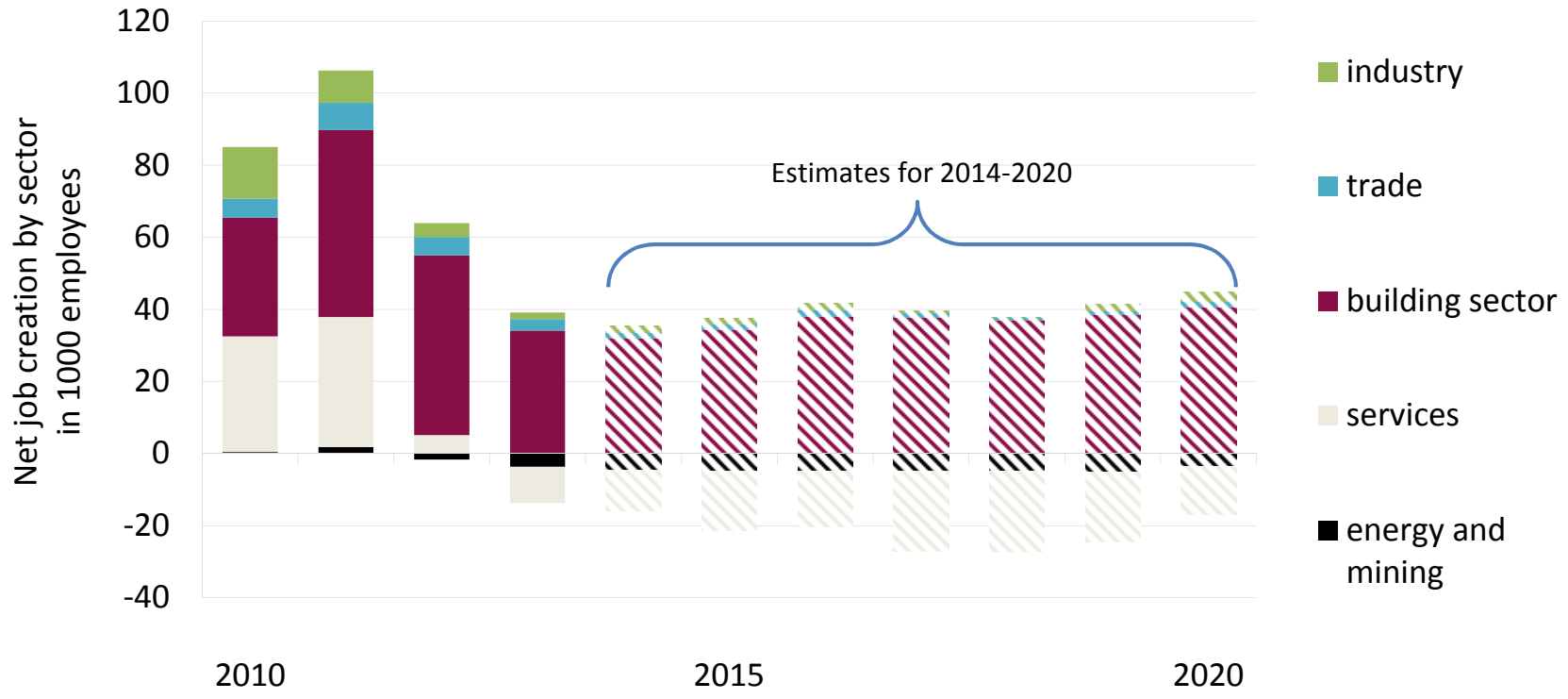
Net job creation shows that the German building sector is benefitting most from the energy transition



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II: The energy transition triad combines efficiency, direct use of renewables and sector coupling

Efficiency first

Direct use of renewables

Sector coupling

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Improved grid connections between northern and southern Germany are required to prevent shortages

Supply

Demand

- solar
- wind (installed)
- wind (planned)
- bottlenecks
- transmission grid
- distribution grid
- high-demand areas

Source: DUH 2011

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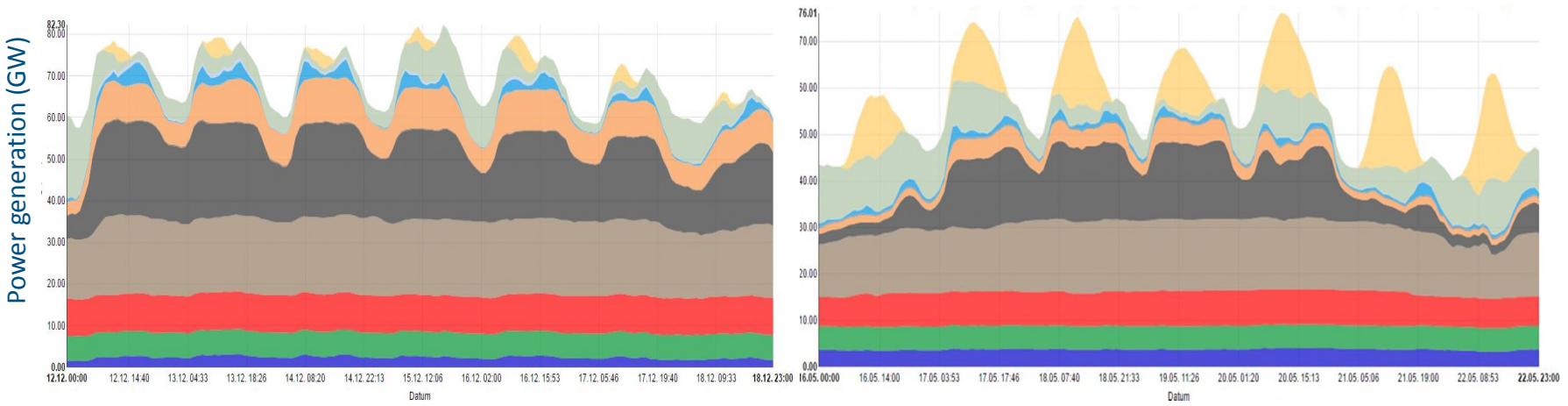
Renewables require high flexibility from the system

Winter 2016
week no. 50 (December)

Summer 2016
week no. 20 (May)



solar | seasonal storage | oil | hard coal | nuclear | hydro

wind | pumped storage | gas | lignite | biomass

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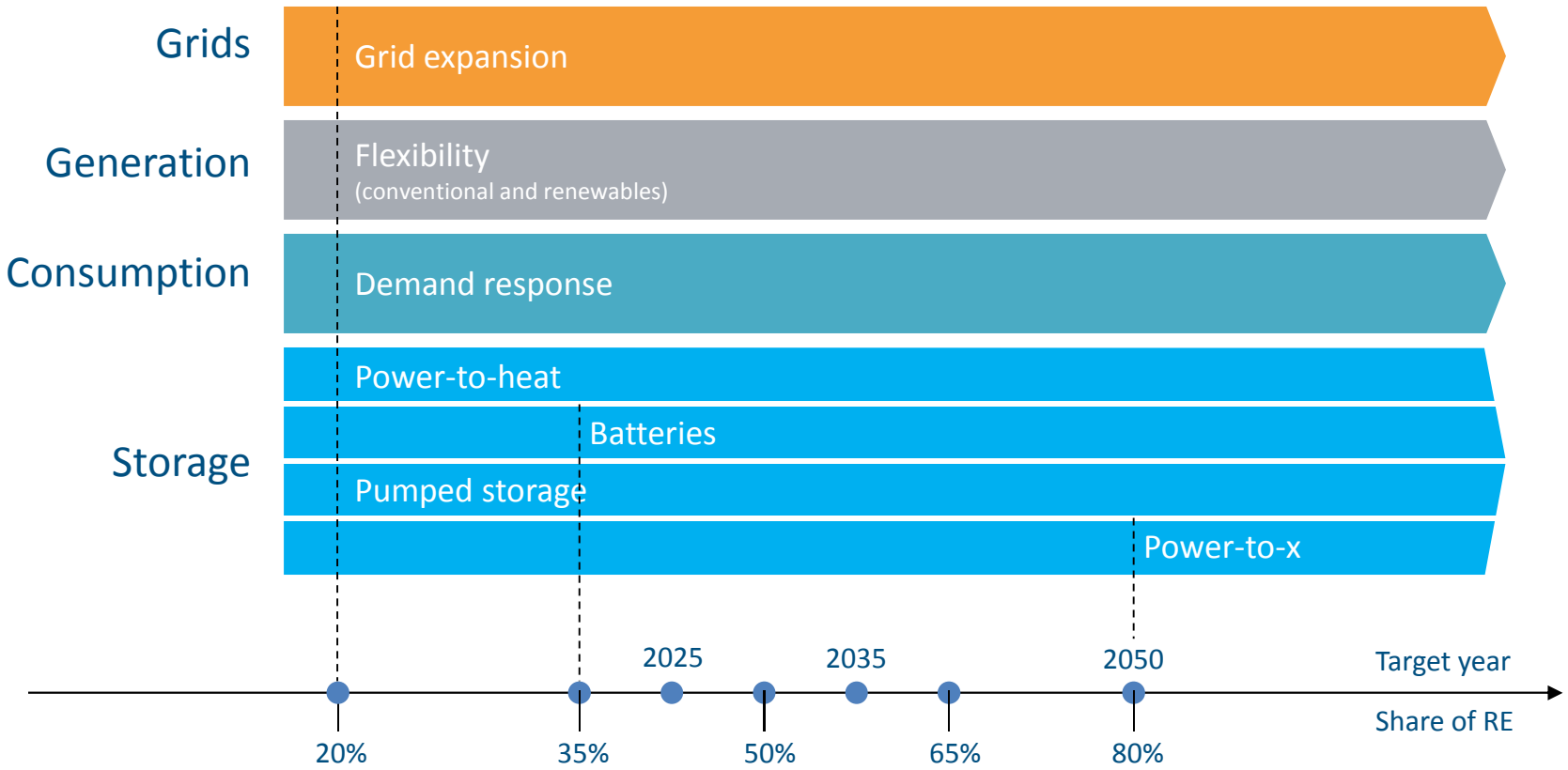
Flexibility options are key to making the system renewables-ready



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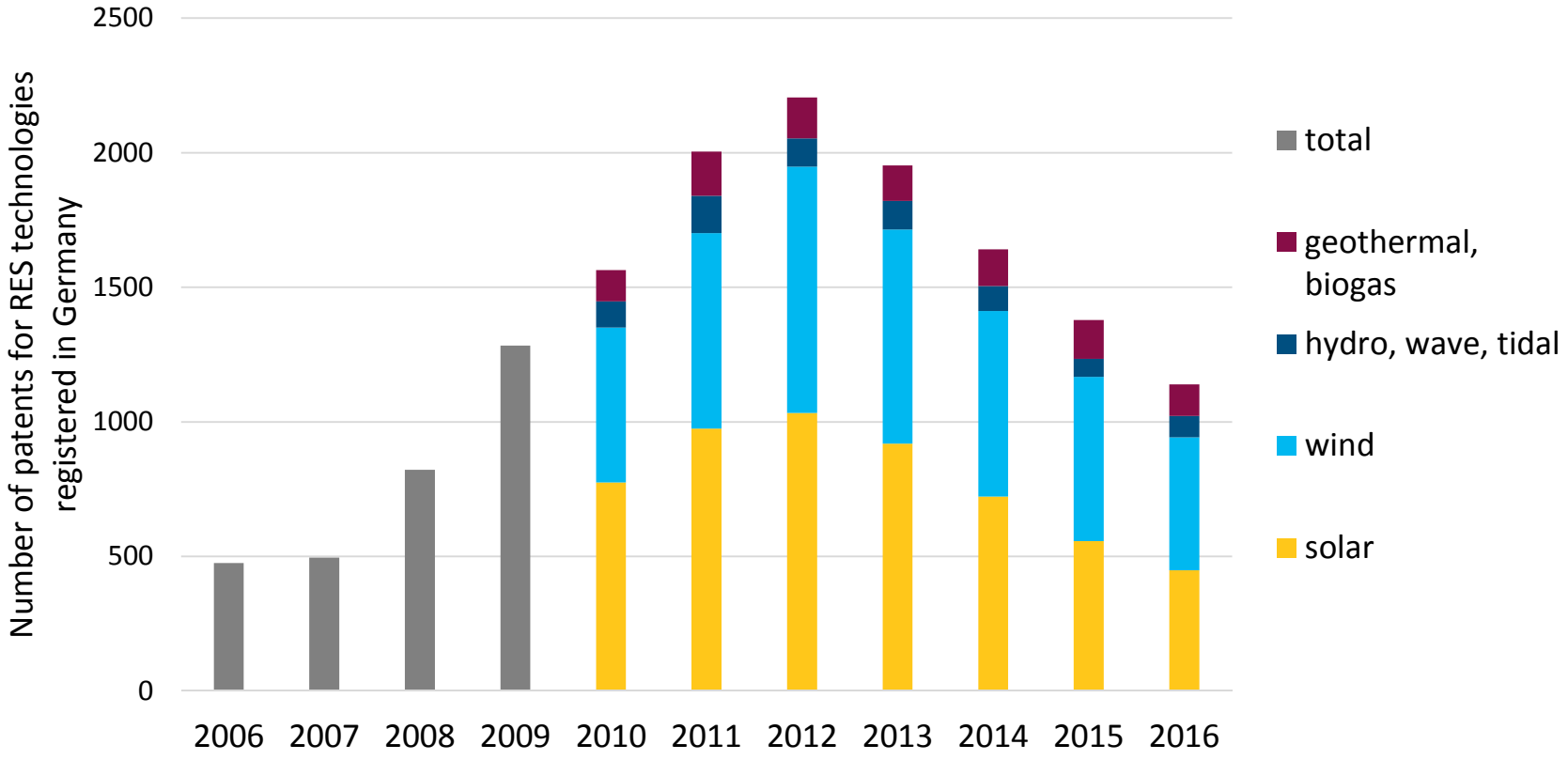
The energy transition is a driver of innovation in Germany



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III: The new energy research programme

- Published end of September 2018
- Replaces 6th programme from 2011
- New focus areas:
  - Sector coupling (PtX)
  - Digitisation
  - From Lab to Market

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Energy Research Programme of the Federal Government (EFP)

- Over 40 years of federal energy research
- Project funding as particularly suited tool
- Average lifetime of a programme cycle 6-7 years
- September 2018, launch of 7th EFP

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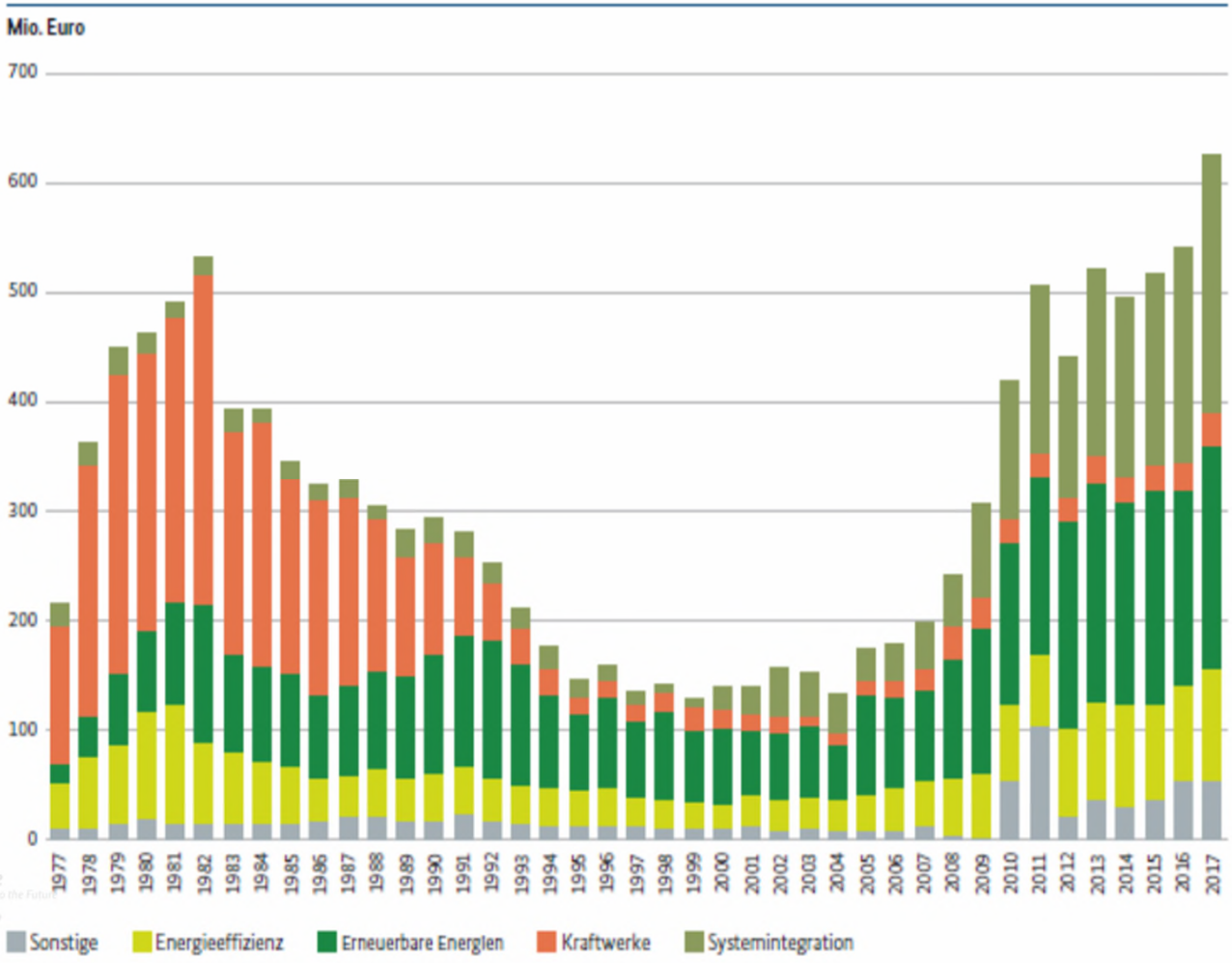
Evolution, not Revolution



jk1

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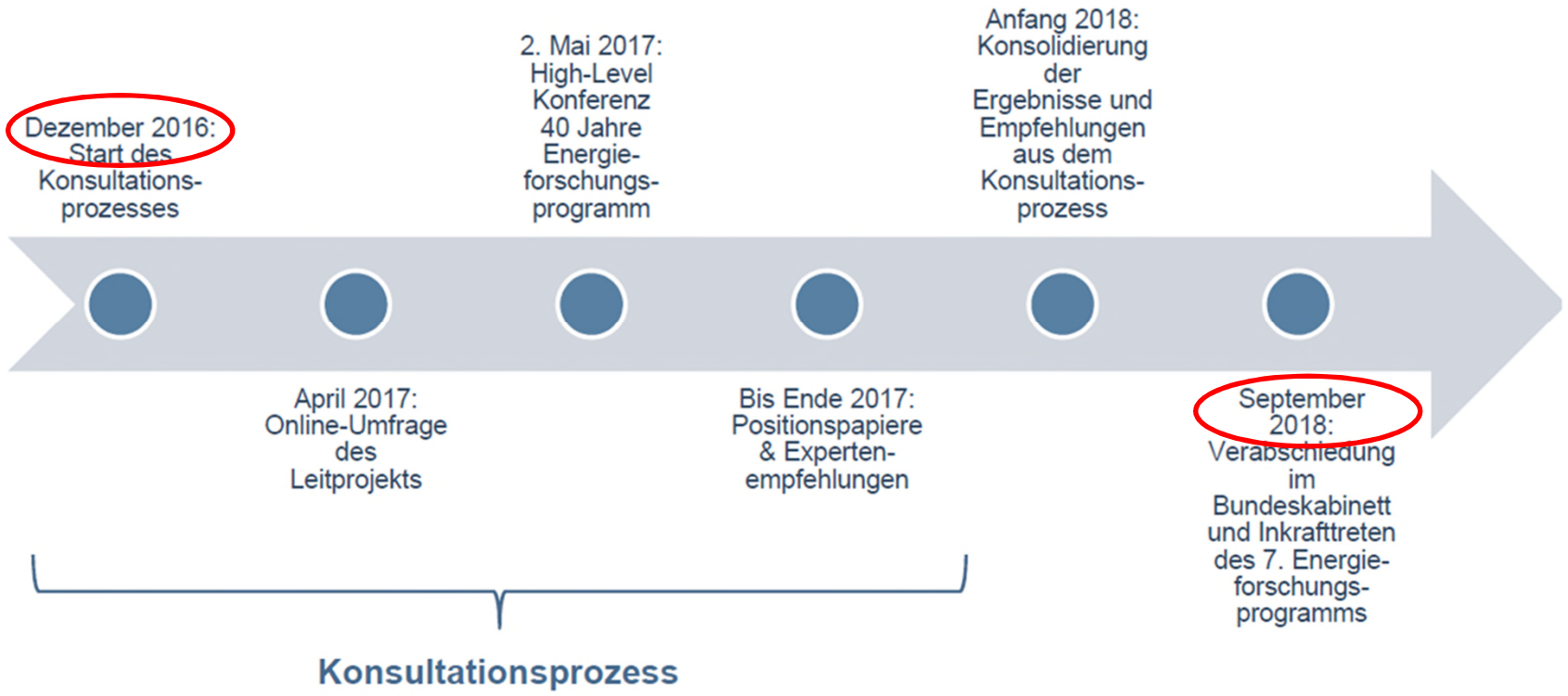
jk1 (inflationsbereinigt – Basisjahr 2010)
johannes kerner; 19.10.2018

Total Federal investment in Energy Research

The Road to EFP7: Public Consultation



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Highlights

New focus on technology und innovation transfer to markets

- „Living labs“ as bridging instrument towards market uptake of technological innovation
- Dynamic product development through better integration of „startup“ companies

More attention to systemic relevant and cross-cutting issues

- Digitisation , Sector coupling (Power-to-X)…

Better coordination between project-based and institutional R&D funding

Closer European and international cooperation.

„Living Labs“ and „Startup culture“

Living Labs: extended versions of previous demonstration projects:

Possible topics:

- **sector coupling**
- large-scale thermal storage
- CO2 technologies
- smart grid, virtual power plants

includes „regulatory learning“

Drawing ***Startups*** into energy research

-Inclusion of non-technical innovation (business models, new services) related to new energy technologies

-Streamlining and accelerating administrative procedures (e.g. revised financial standing requirements)

-New *Startups* networking platform

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Table of Content Research Topics

Cross cutting issues

- Energy System Analysis
- Digitisation
- Resource Efficiency
- CO_2-technologies
- Societal engagement
- Materials research

Consumers

- Buildings and Quarters
- Industry and Commerce
- Link to mobility and transport

System integration

Electricity Grid, Storage

Sector coupling (Power to X)

Energy Production

- Photovoltaics
- Wind
- Bioenergy
- Geothermal energy
- Hydropower
- Fossil power plants

CO_2-Technologies

Some strategically important R&D topics:

- The development of low-CO_2 **industrial processes** and the modification of new CO_2 separation technologies, for use in industrial CO_2 sources (e. g., production processes for the steel, cement and lime industry, waste incineration),
- Robust processes and new, highly flexible catalysers for converting CO_2 into basic chemicals, incl. the demonstration of a complete CCU chain (CCU: Carbon Capture & Utilisation).
- Chemical utilisation of CO_2 to manufacture basic chemicals
- CO_2 separation directly from the atmosphere using technical systems or through the permanent binding of the carbon contained in biomass,
- Direct utilisation of CO_2 (e. g. in air-conditioning units and geothermal applications),
- Direct electro-chemical conversion of CO_2 (e. g. co-electrolysis) into resources,
- CO_2 infrastructure.

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Thank you for your attention

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