RENEWABLE ENERGY AND ENERGY EFFICIENCY – GERMAN BEST PRACTICES

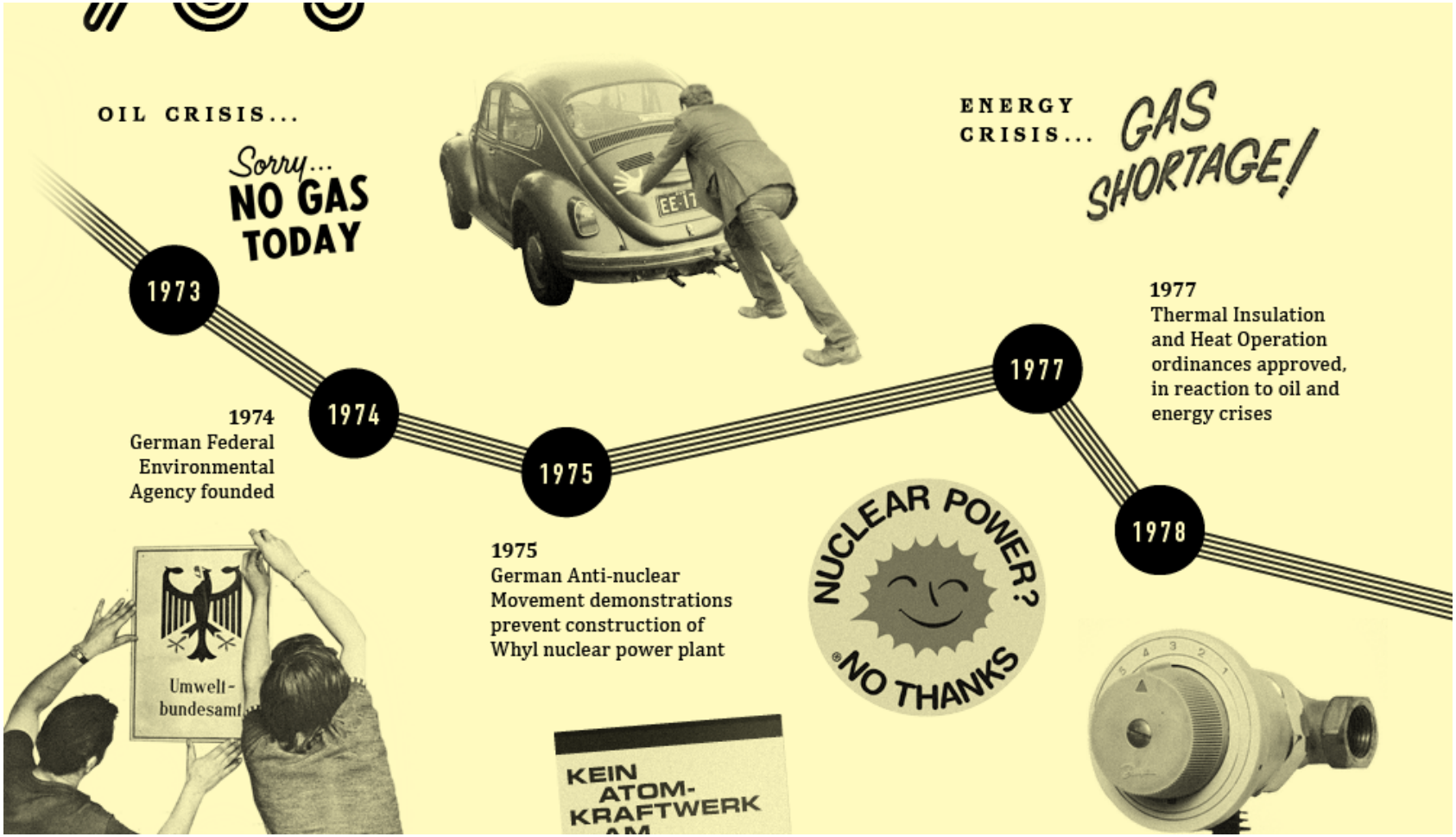
APO 3RD. WORLD CONFERENCE ON GREEN PRODUCTIVITY

NOVEMBER 4-6, 2014

UWE JUERGEN BAUER - BC VISION PTE LTD, SINGAPORE

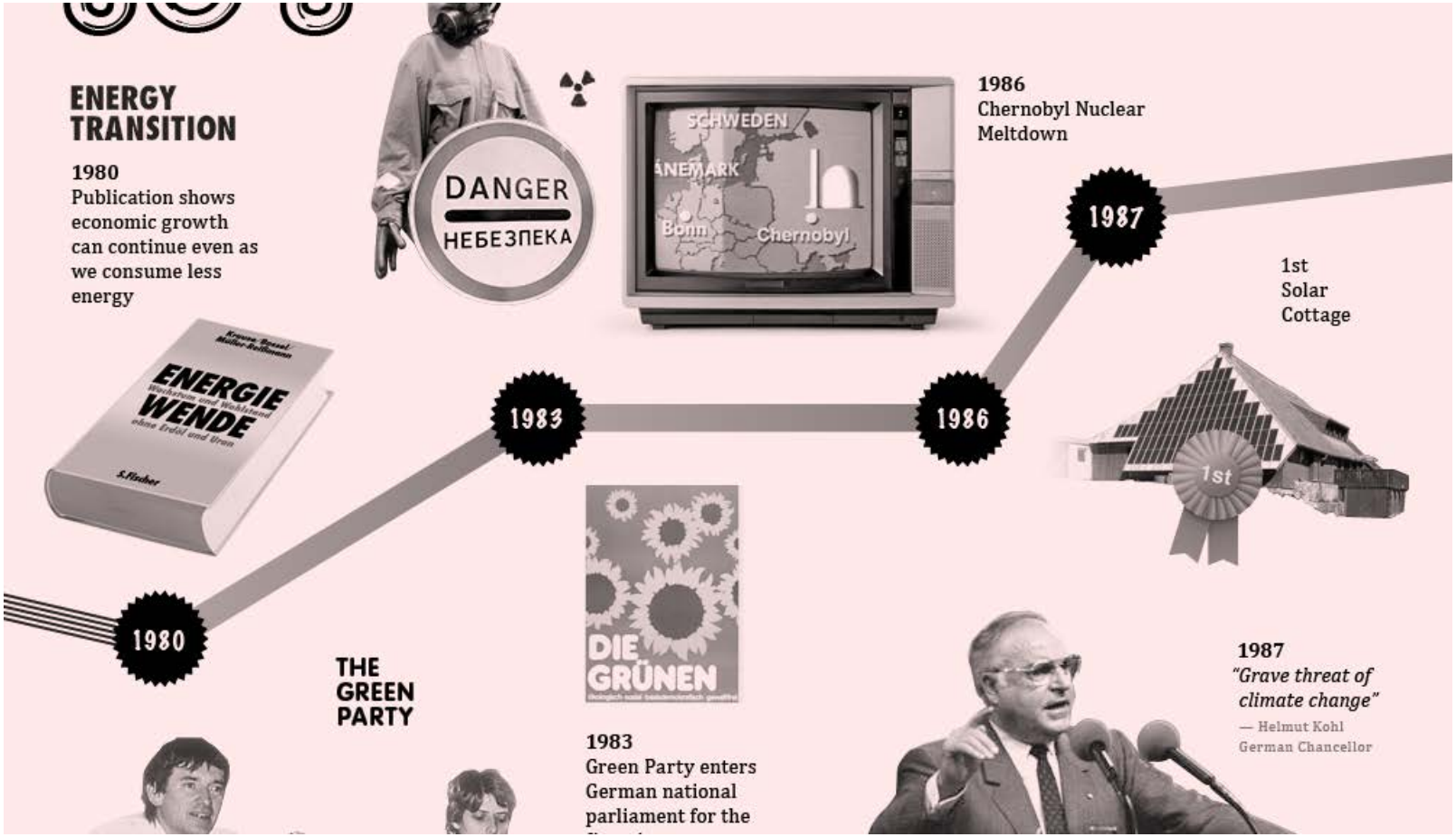
1. HISTORY AND FRAMEWORK
2. ENERGY TRANSITION
3. STATUS OF RENEWABLE ENERGY (RE)
4. RENEWABLE ENERGY SOURCING ACT
5. ENERGY EFFICIENCY (EE)
6. FINANCE

HISTORY: 1970’S
NUCLEAR POWER? NO THANKS



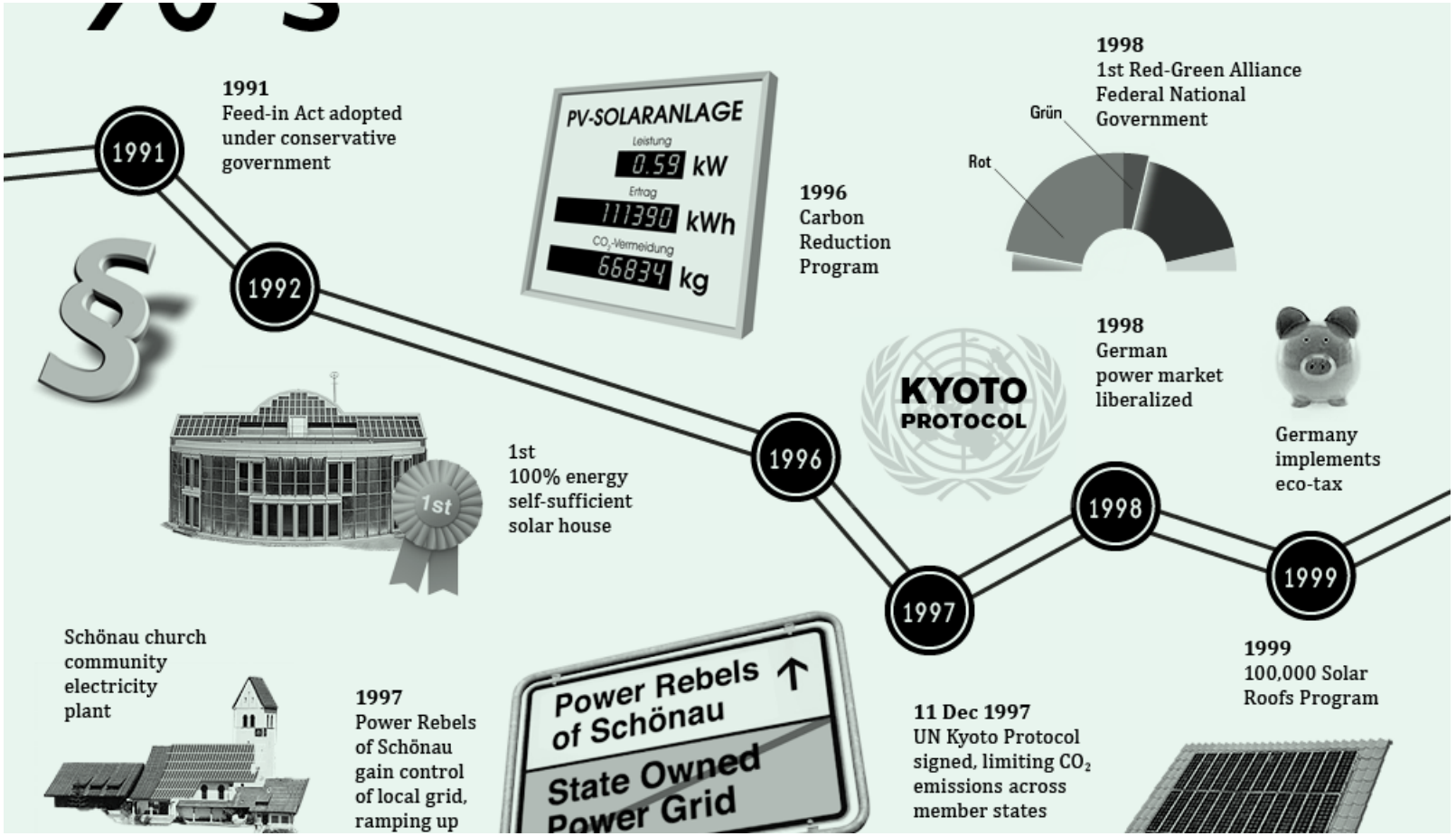
Source: www.energytransition.de

HISTORY 1980'S GREEN PARTY



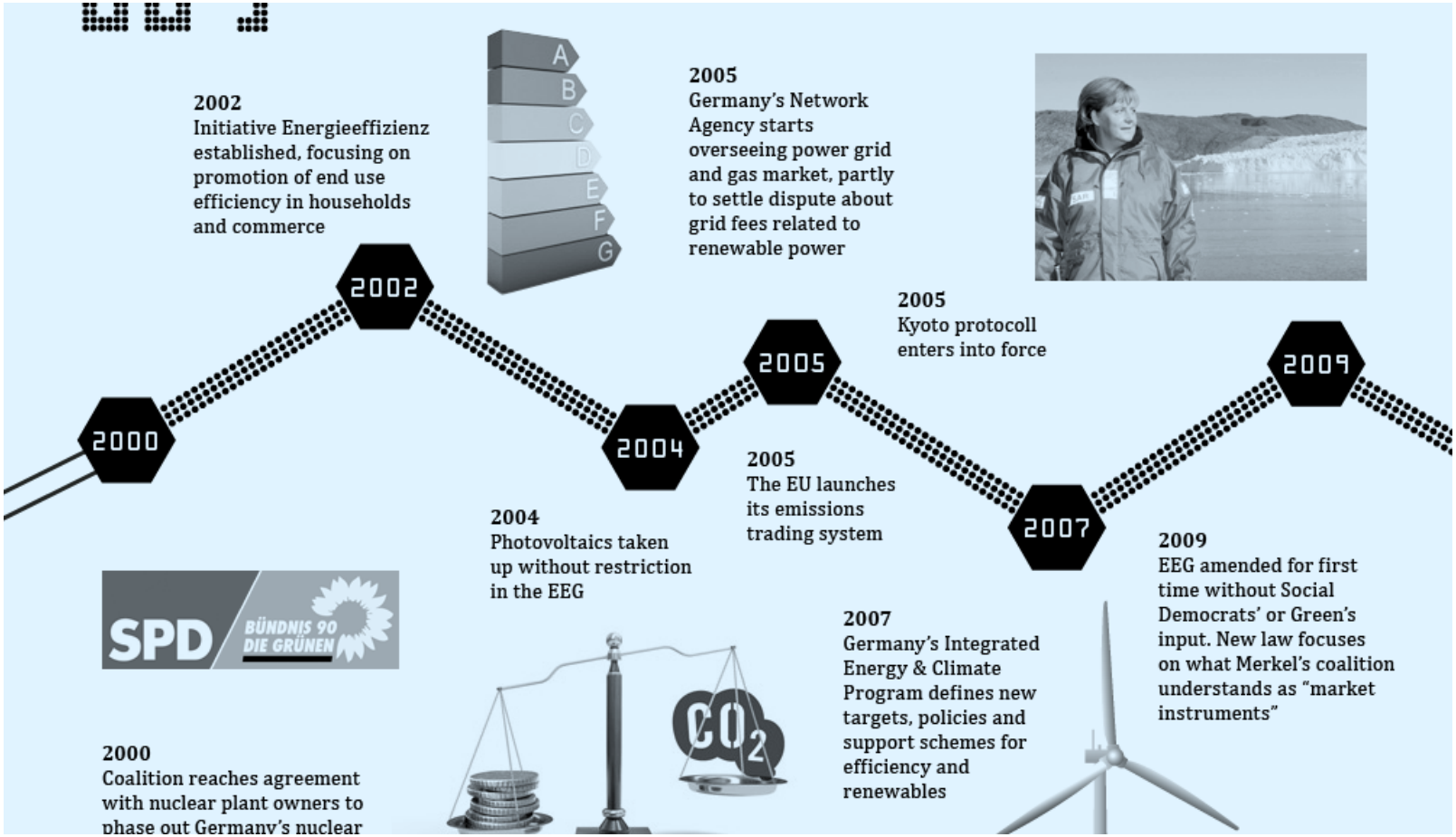
Source: www.energytransition.de

HISTORY 1990'S
KYOTO & RED-GREEN GOVERNMENT



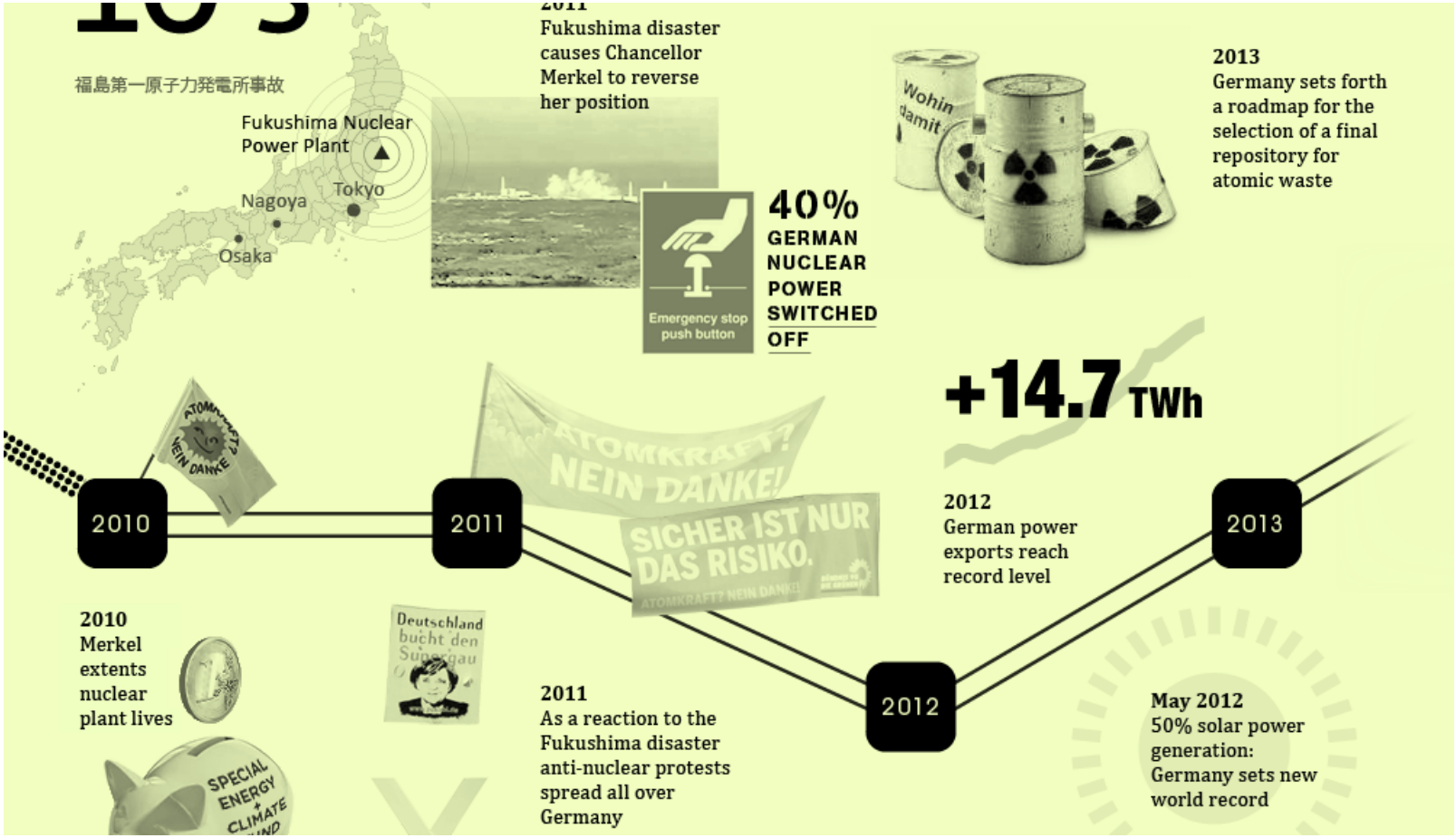
Source: www.energytransition.de

HISTORY 2000'S
RENEWABLE ENERGY SOURCES ACT



Source: www.energytransition.de

HISTORY: 2010'S ENERGY TRANSITION



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ENERGY TRANSITION = ENERGIEWENDE

Overall transition of the German energy sector and its structure.

OBJECTIVES OF THE GERMAN GOVERNMENT

- Become the most energy efficient economy
- Sustainable and environmentally friendly energy production
- Safe and affordable energy supplies
- Competitive energy prices

ACTIONS

- Energy portfolio dominated by RE
- Shift from demand to supply
- Shift from centralized to distributed generation ("democratization of energy")
- Phase out of nuclear power
- Final goal: abolition of coal and other non-renewable-sources.

REASONS FOR THE ENERGY TRANSITION

- Political will to phase-out nuclear power
- Independence of oil- and gas imports

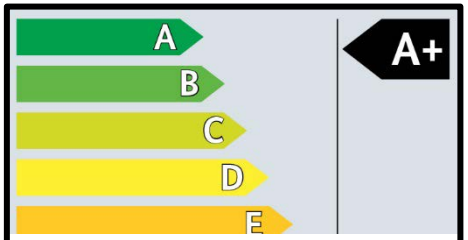
  Imports in 2012:

  Hard Coal 81%, Petroleum 98%, Natural Gas 86% and Uranium 100%
- Motor for progress, growth and employment
- Reduction of greenhouse gas emissions
- Role model: "sustainable energy policy can be economically successful"

Source: BMWI (Federal Ministry for Economic Affairs and Energy)

THREE PILLARS OF THE ENERGY TRANSITION

Renewable energy



Energy efficiency

Future grid

Renewable Energy Sources Act

National Climate Initiative

Market Incentive Programme

Energy Saving Ordinance

Grid Expansion Acceleration Act

Federal Requirement Plan

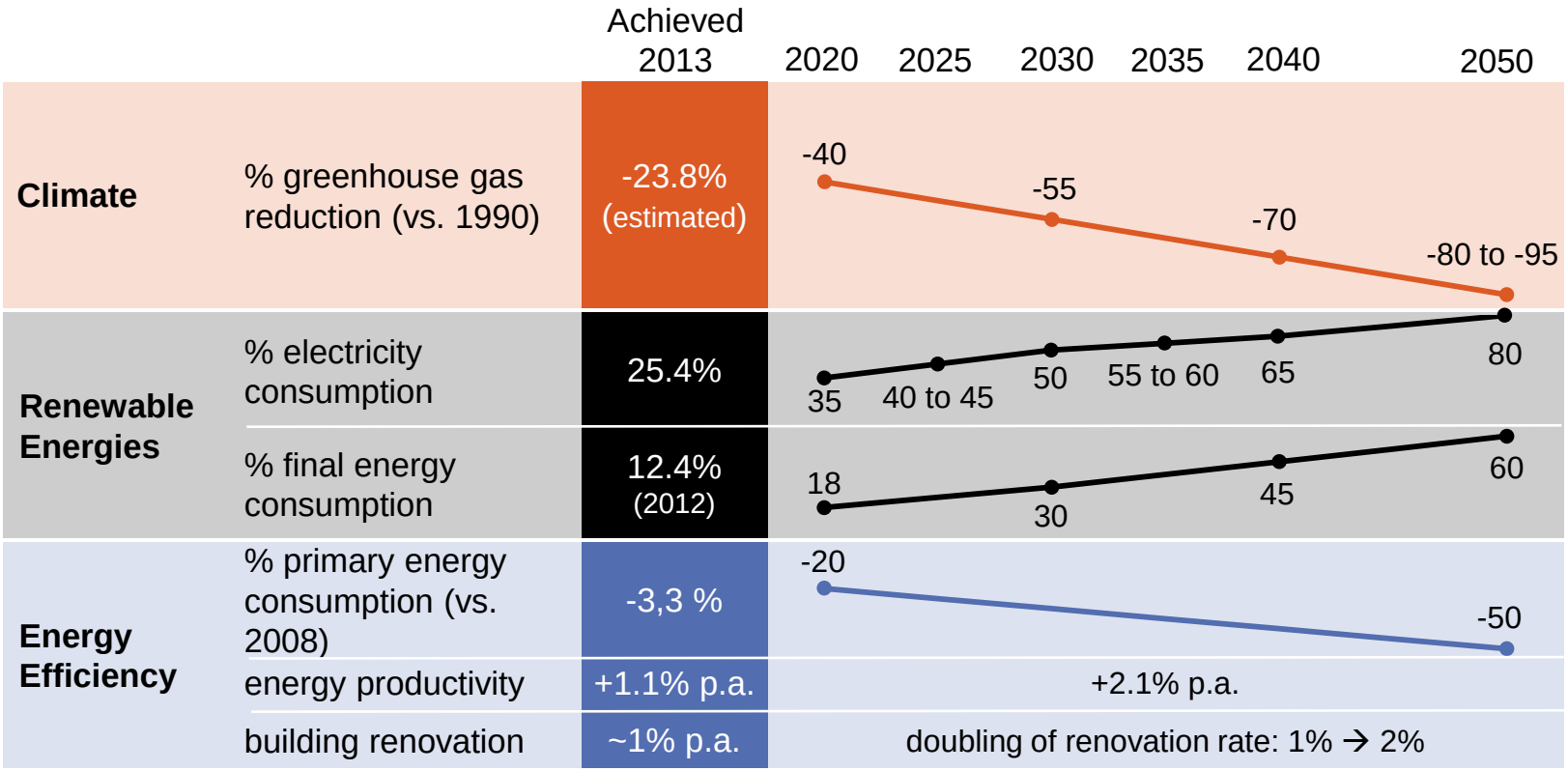
- Steady growth
- Cost-efficient
- Environmentally friendly

- Reduce energy consumption
- Improve efficiency

- Increase flexibility
- Enlarge capacities
- Integrate renewables

BMU 2010, BMWI 2014

TARGETS OF THE ENERGY TRANSITION UNTIL 2050



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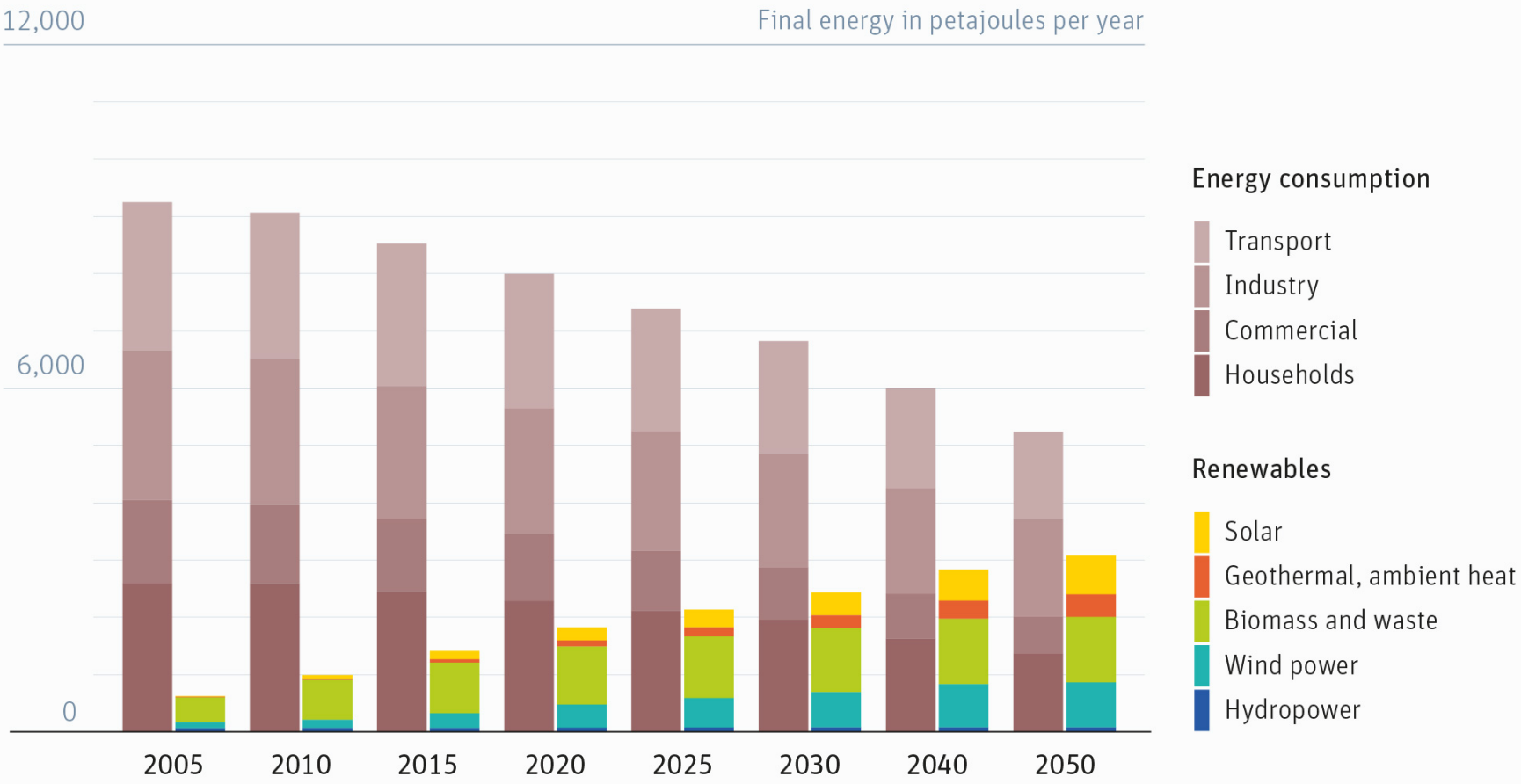
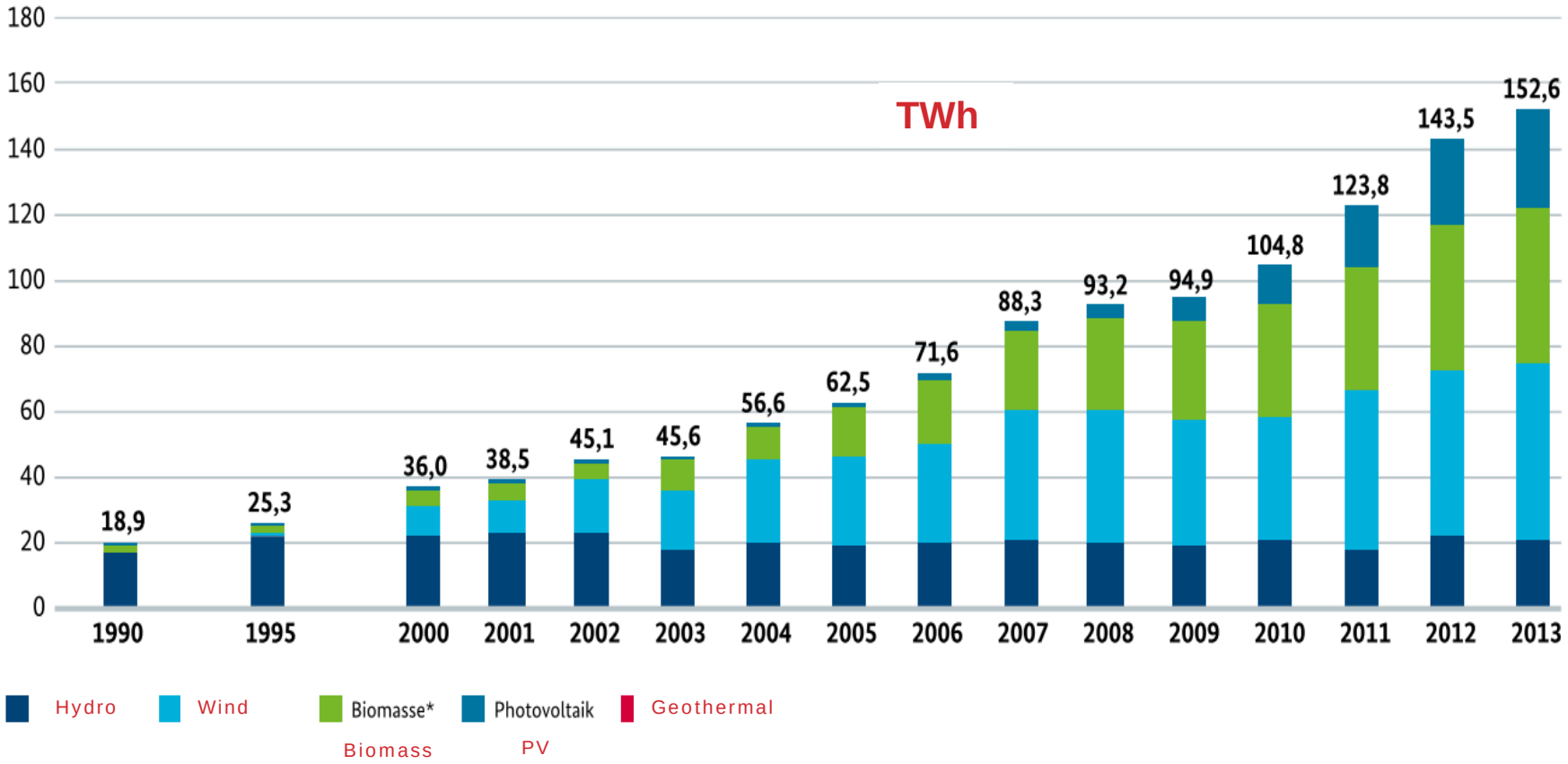
Germany's plan: ramp up renewables, drive down energy consumption

Final energy supply and demand in Germany 2005–2050, scenario

Source: DLR Lead Study, scenario A



EVOLUTION OF RE PRODUCTION



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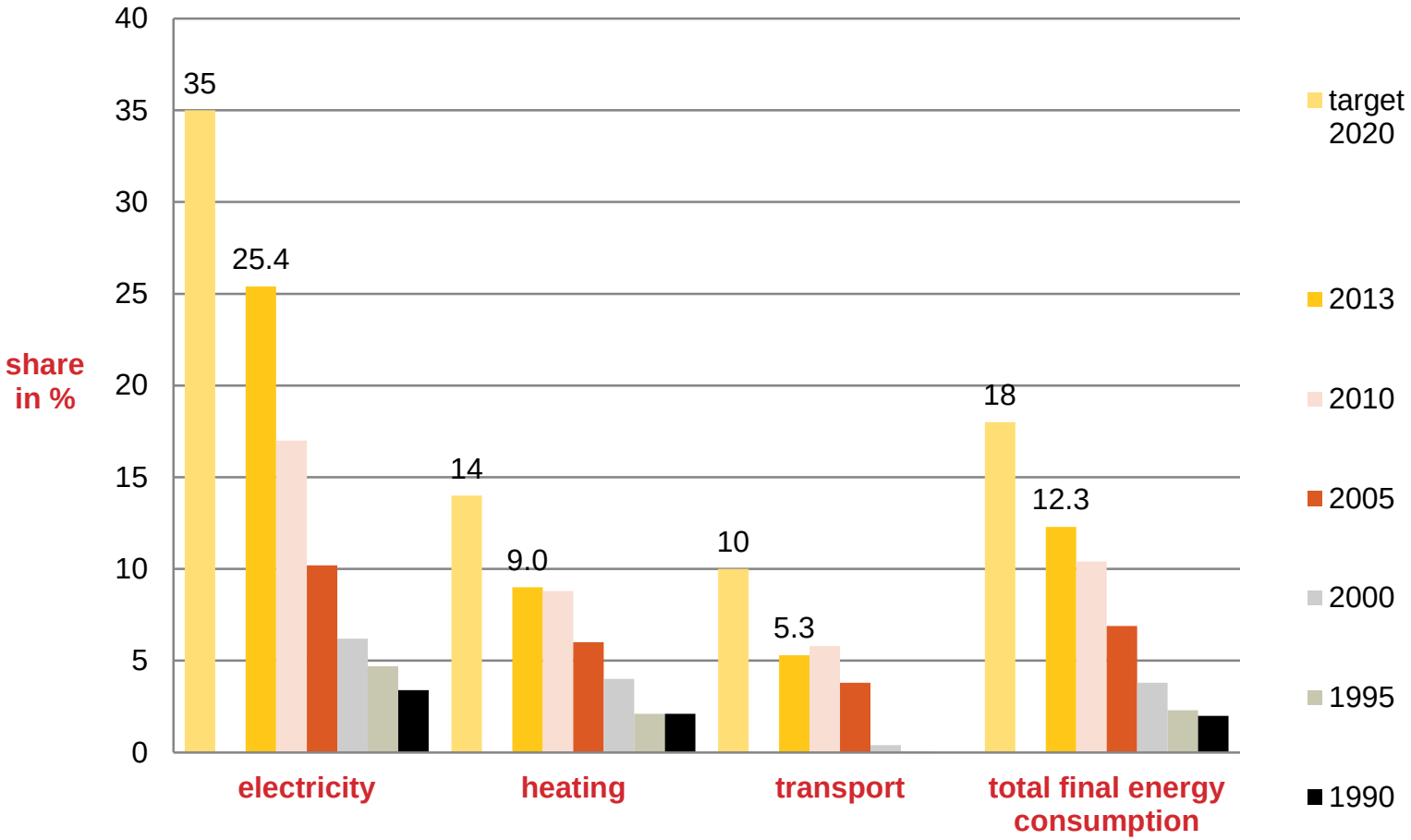
RE DEPLOYMENT AND TARGETS



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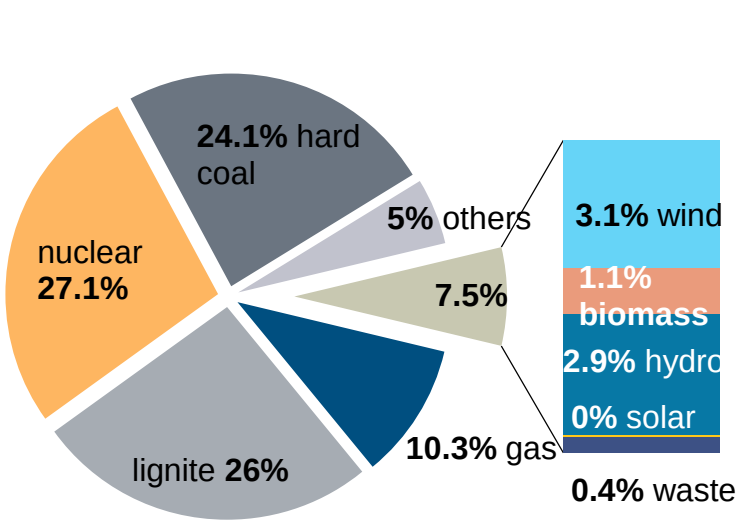
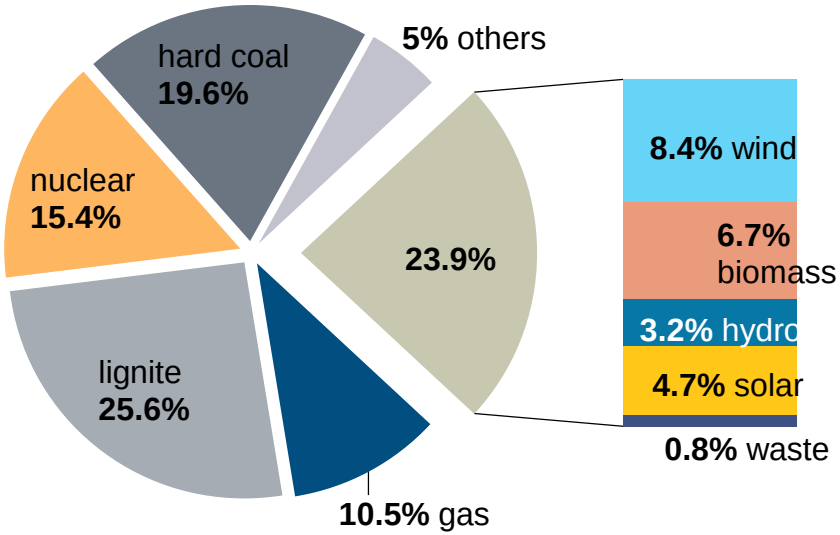
SHIFT IN ELECTRICITY PRODUCTION

2003 total: 608.8 TWh
renewables share: 45.6 TWh



2013 total: 634 TWh
renewables share: 152,6 TWh



Source: Statistisches Bundesamt, BDEW /AGEB 2014

The renewables share in electricity production tripled within ten years.

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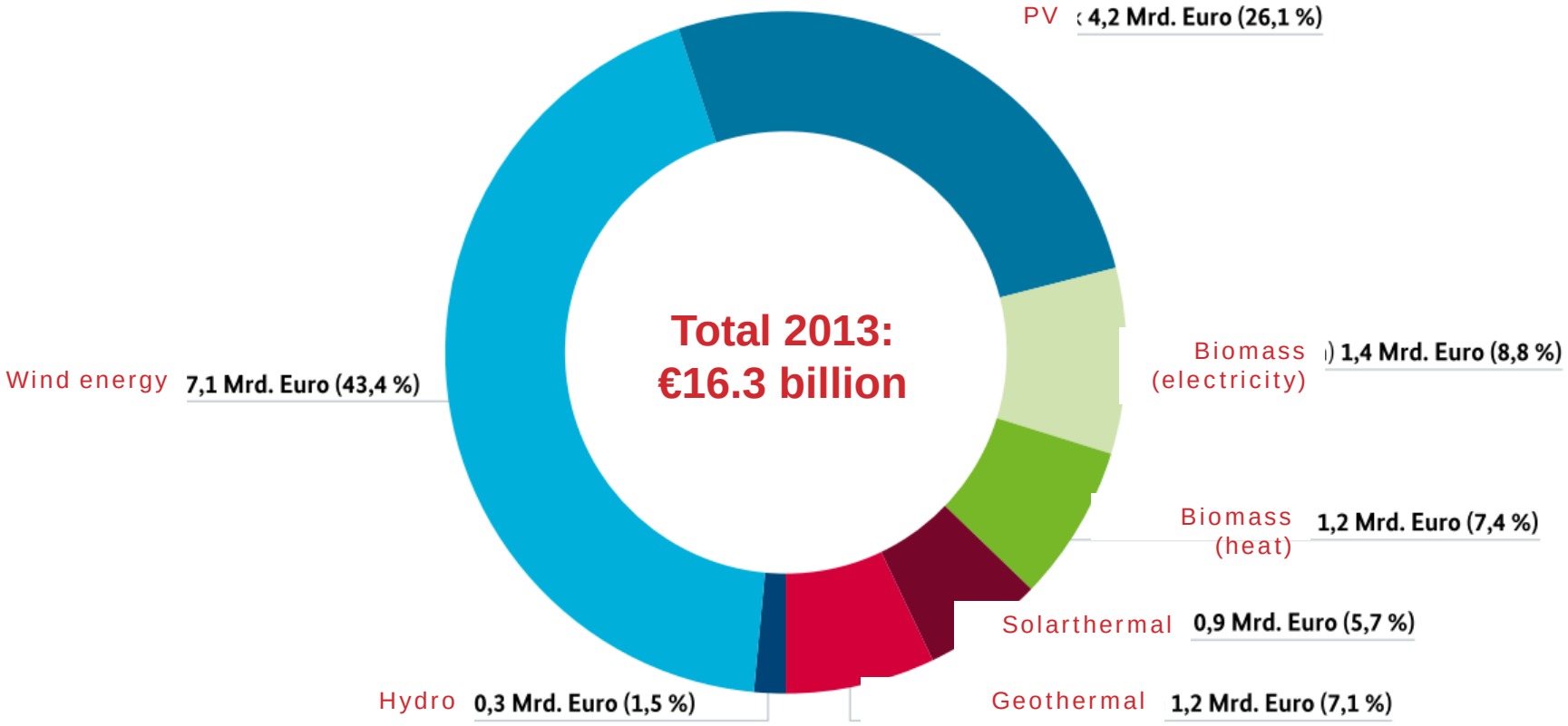
GERMAN POWER SYSTEM – INSTALLED CAPACITY

Total Installed electrical capacity	ca. 160,000 MW
Total installed renewable electricity capacity	84,338 MW(4/2014):
Wind	35,389 MW (6/2014) (incl. 900 MW offshore)
Photovoltaic	37,843 MWp (9/2014) (largest in the world)
Solar thermal	16,5 million m2 (12,3 GWth) (largest in EU)
Hydropower	5,613 MW (small and large hydro)
Solid biomass	8,086 MWel (including biogas)
Biogas	2,900 MWel (largest in EU)
Geothermal	31 MW
Ground source heat pumps	< 240.000

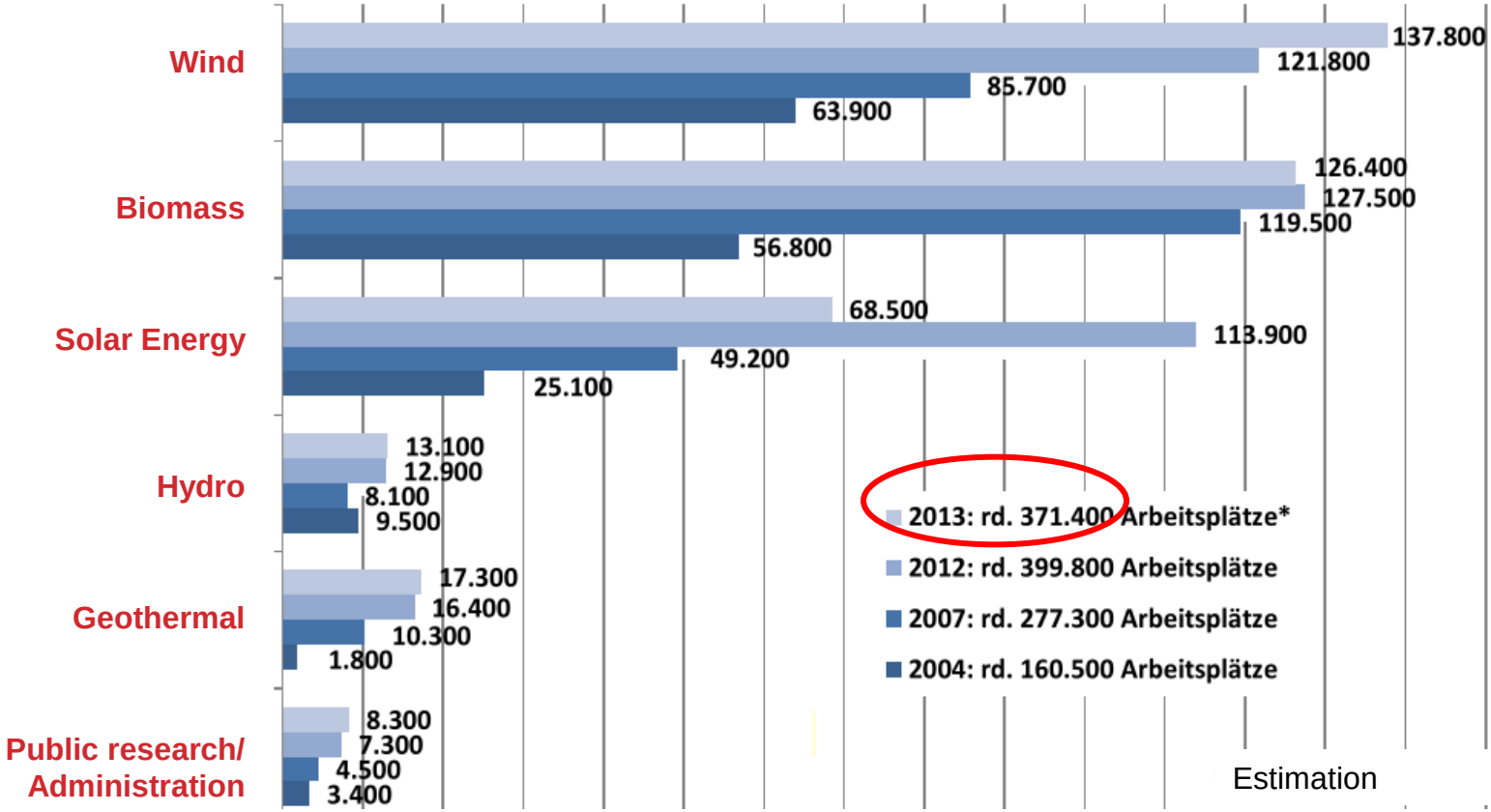
Sources: BMWI 2014, BMU 2013, AGEE Stat 2014, FvB 2012, EurObserv‘ER 2014. Compilation by RENAC

INVESTMENT IN RE



AGEE-STAT 2014

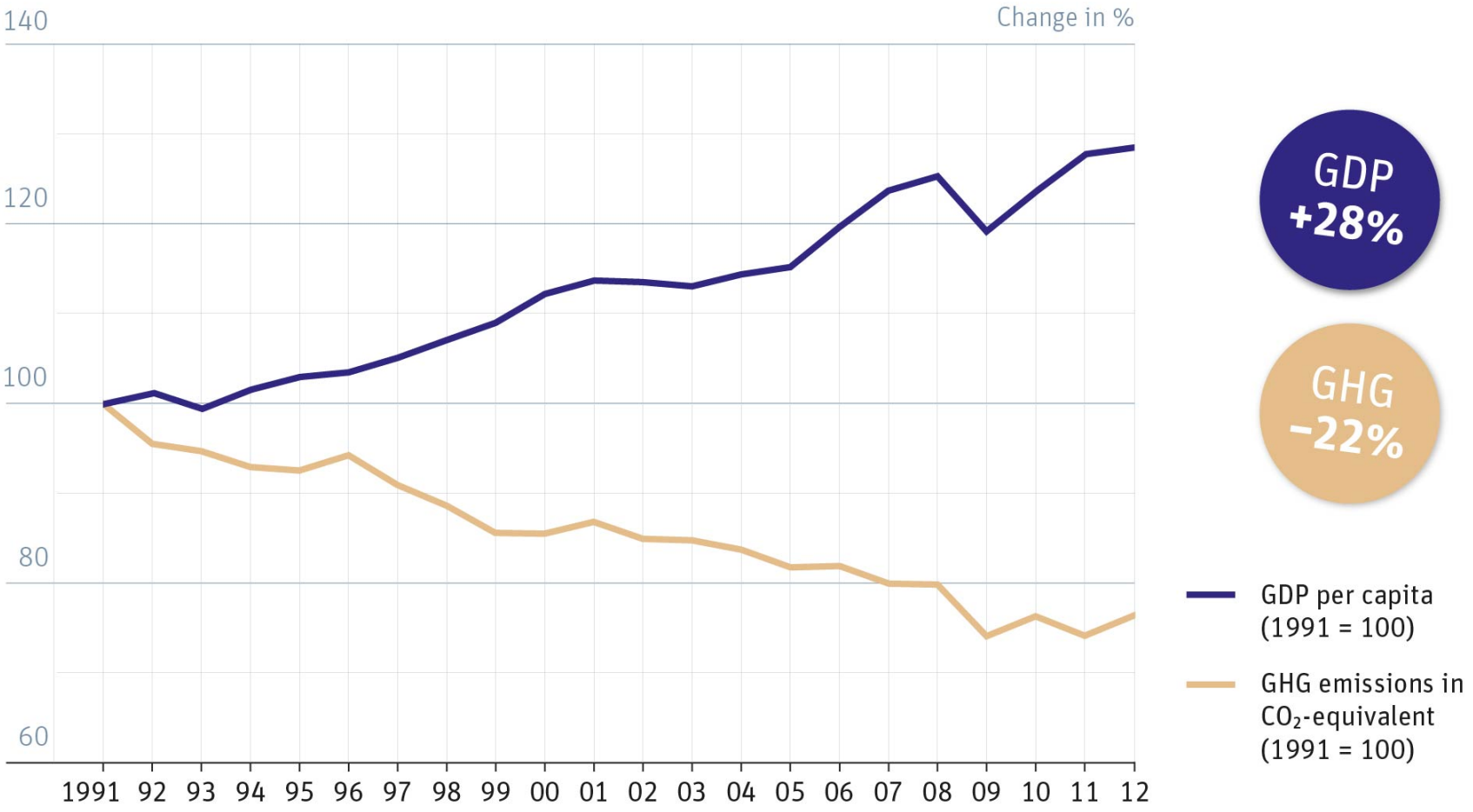
EMPLOYMENT IN RE SECTOR 2013



Germany: growing economy, declining emissions

Change of Gross Domestic Product (GDP) and Greenhouse Gas (GHG) emissions in Germany, 1991–2012

Source: BMU, BMWi, Destatis



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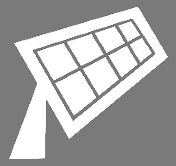
INTEGRATED POLICY PACKAGE

Electricity



- Guaranteed feed-in tariffs for renewable energies
- Priority access for renewable energies
- Nuclear phase-out

Heating

- Renewable Energies Heat Act
- Market Incentive Programme (MAP)

Transport

- Biofuel quota and tax incentives for biofuels
- Governmental plan on e-mobility

Research & Development

- (Sixth) Energy Research Programme (Federal Government)
- Public research funding > €150 million in 2012

The German energy system is being transformed in all sectors.

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RENEWABLE ENERGY SOURCES ACT "EEG"

EEG = Renewable Energy Sources Act (electricity)

The major support instrument and success factor over the past 14 years!

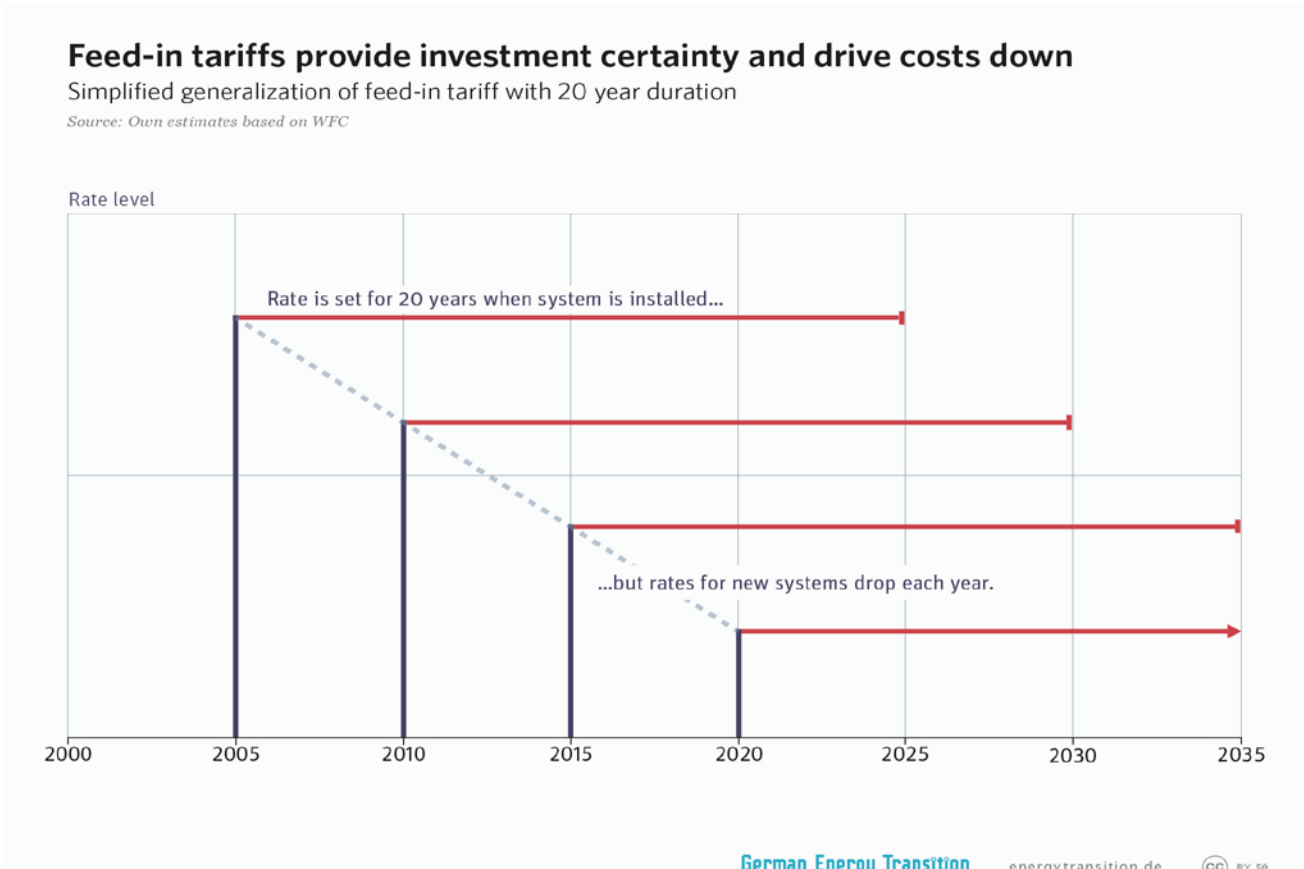
<u>Two principles:</u>

- Guaranteed grid access, priority transmission and distribution for RE plants
- Fixed Feed-in tariff, paid over 20 years
  - SECURITY OF INVESTMENT

- Regular monitoring and evaluation ensures affordability.

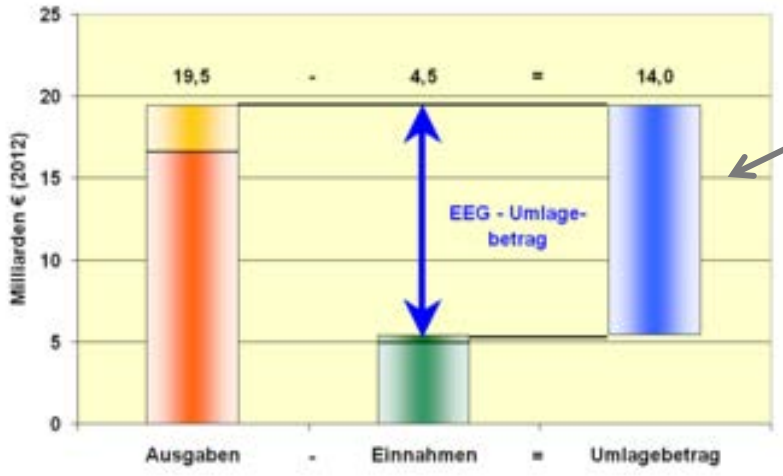
FEED-IN-TARIFF

- Guaranteed price for feed-in of RE ($/kwh)
- Tariff is set to ensure a modest ROI
- Tariff depends on year of completion/grid connection
- Annual degression to boost new technologies and innovation



FEED-IN-TARIFF

- Different tariffs for different technologies & system sizes
- NO subsidy! Additional costs will be shared among consumers



Expense Income

EEG levy

2014: ~ 6,24 ct/kWh

2015: ~ 6,17 ct/kW

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WHAT IS ENERGY EFFICIENCY?

- Energy is used to achieve a specific benefit, ie warm/cool living room, illuminate walkway at night, travel from A to B….
- Energy efficiency is a means of measuring the energy-expenditure required to achieve this specific benefit.
- The lower the losses in energy to achieve a specific purpose are, the higher is the degree of energy efficiency.

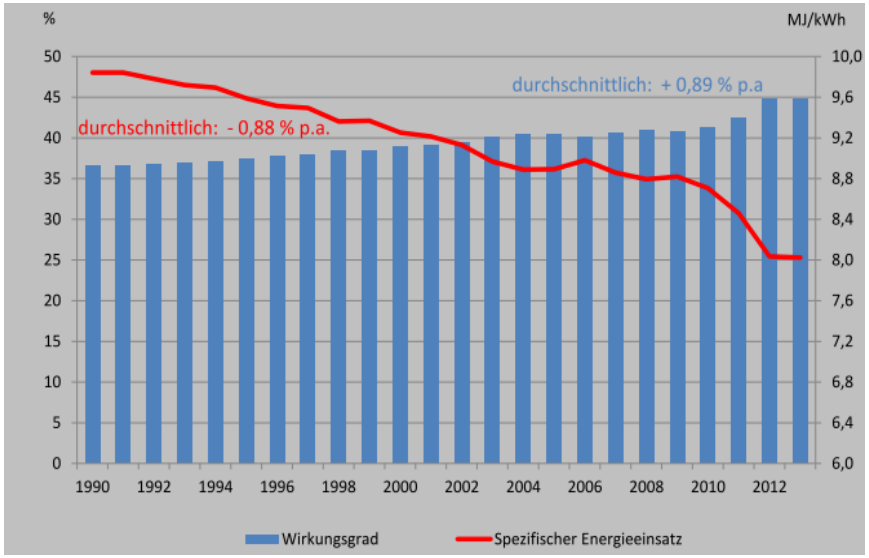
(Federal Ministry of Environment, Nature Conservation, Building and Nuclear Safety)

"The world's most important fuel"

International Energy Agency

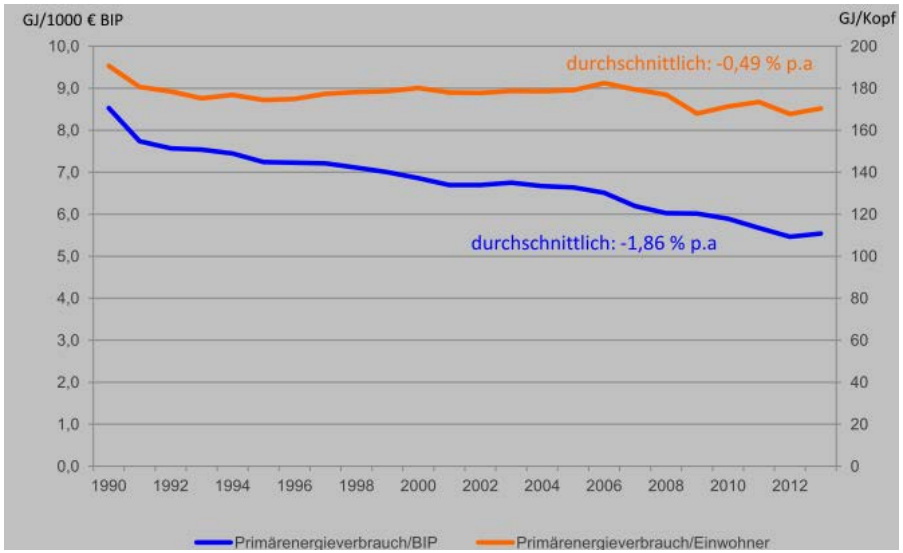
ENERGY EFFICIENCY MEASUREMENTS

ENERGY PRODUCTIVITY



GDP output per Primary Energy Consumption unit – 1990 to 2013

ENERGY INTENSITY



Primary Energy Consumption per GDP unit and per pax. 1990 – 2013

Source: AGEB 2014

ENERGY EFFICIENCY MEASURES

Buildings

- Energy Saving Ordinance (building codes) and on-site consultations
- Low-interest loans for renovations
- Heat Metering Ordinance
- Energy performance certificates

Appliances and lighting

- Electricity tax
- Energy Efficiency Labelling Ordinance
- Guidance on energy
- (Campaign: Climate Seeks Protection)

Industry and business

- Grants for cross-cutting technologies
- On-site consultations
- European emissions trading
- Efficiency classification (Ecodesign Directive)

Transport

- Motor vehicle taxation
- Fuel taxes
- Federal fuel strategy
- (Measures by Deutsche Bahn)

A balance of incentives, regulations and consultation/information.

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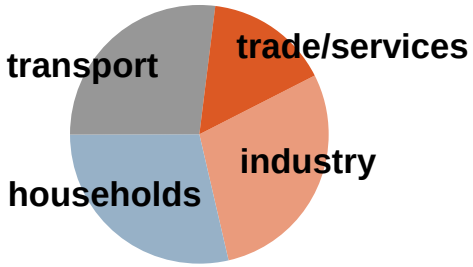
EE IN TRADE/SERVICES & INDUSTRY

Sector relevance

45% **of final energy consumption in 2012**



Sector measures

- Market-driven improvements arising from research and development
- Incentive programmes for cross-cutting technologies
- Voluntary agreements in some sectors
- Electricity and fuel tax (“eco tax”)

National efficiency targets

Primary energy demand

20% less by 2020

50% less by 2050

Sector effects achieved

34 PJ/a final energy (-0.85%) saved in 2012 vs. 2008

Source: AGEB 2013; prov.

Some gains, but the contribution to the overall target is still low.

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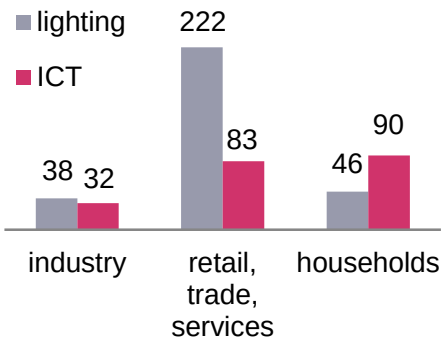
EE APPLIANCES AND CONSUMER PRODUCTS

Sector relevance
Energy demand (PJ) 2011



Sector measures

- Energy-using Products Act (EBPG), eco-design directive
- Energy Consumption Labelling Directive
- Energy advice in consumer advice centres
- Electricity tax

National efficiency targets
Primary energy demand

- 20% less by 2020
- 50% less by 2050

Sector effects achieved
Energy consumption of typical appliances in 2010 vs. 2000

- -50% fridges
- -30% washing machines
- -60% dryers

Source: AGEB, dena 2011

Labelling and cost savings are key points for households.

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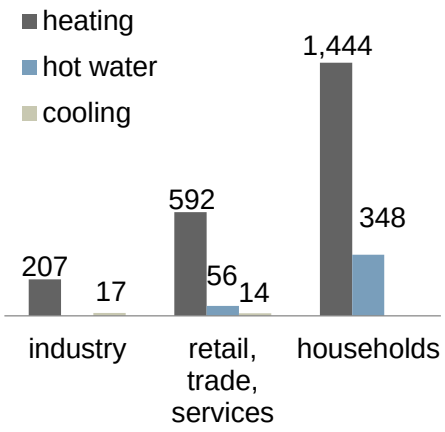
EE IN BUILDINGS

Sector relevance
Building-relevant energy demand (PJ) 2011



Sector measures

- Energy Saving Ordinance (EnEV) (building codes) and other regulatory measures
- Funding for renovations
- On-site consultations
- Market incentive programme and regulations on renewables use

Sector efficiency targets

20% reduction in heating requirements by 2020

80% reduction in primary energy by 2050

Sector effects achieved

2,500,000

renovation projects funded between 2006 and 2012

Source: AGEB, KfW

The current rate of energy-efficient renovation (0.9% per year) needs to be doubled in order to achieve a climate-neutral building sector by 2050.

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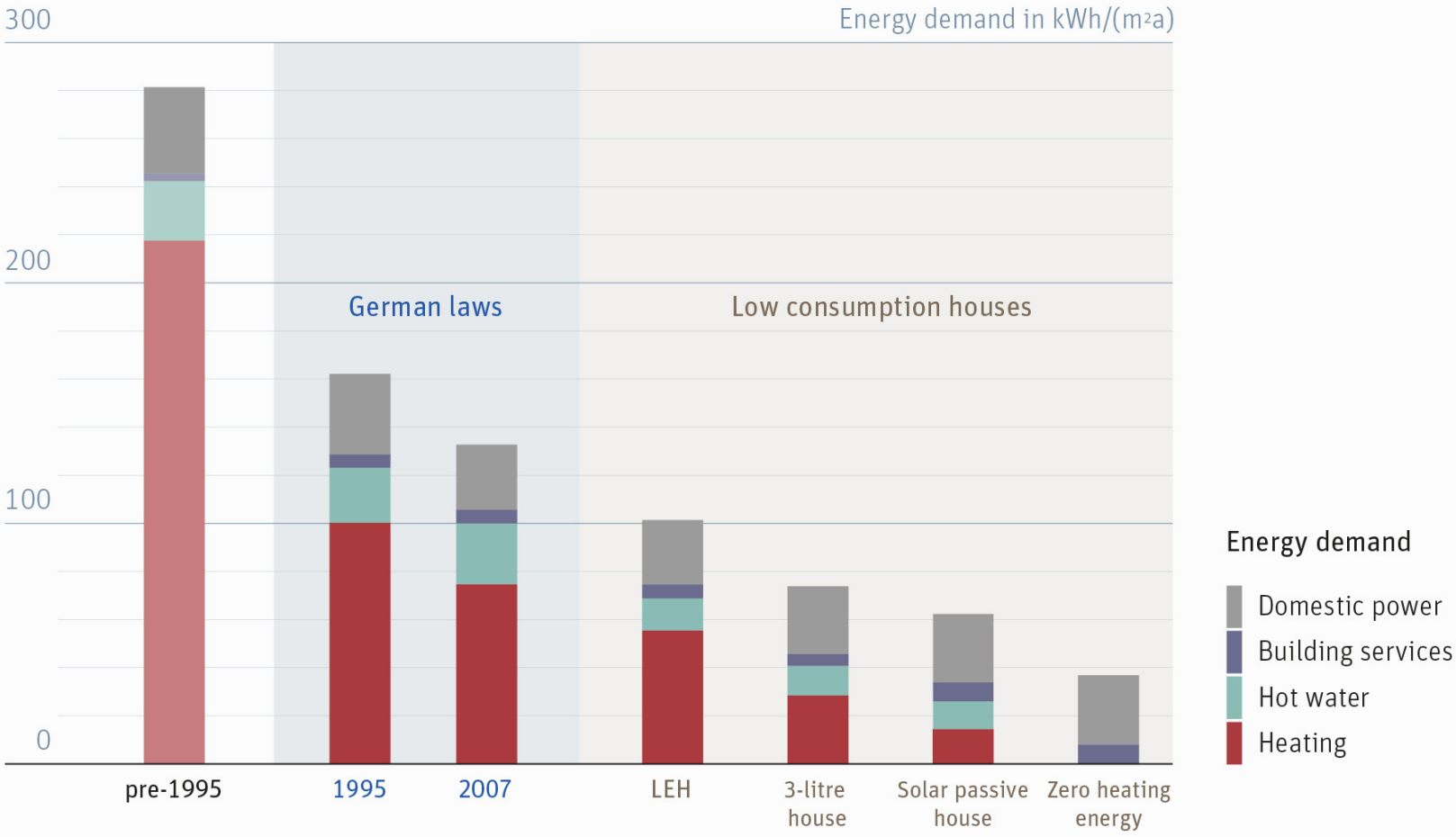
The housing sector offers large potential for energy savings

Characteristic energy demand of buildings

Source: IFEU 2011



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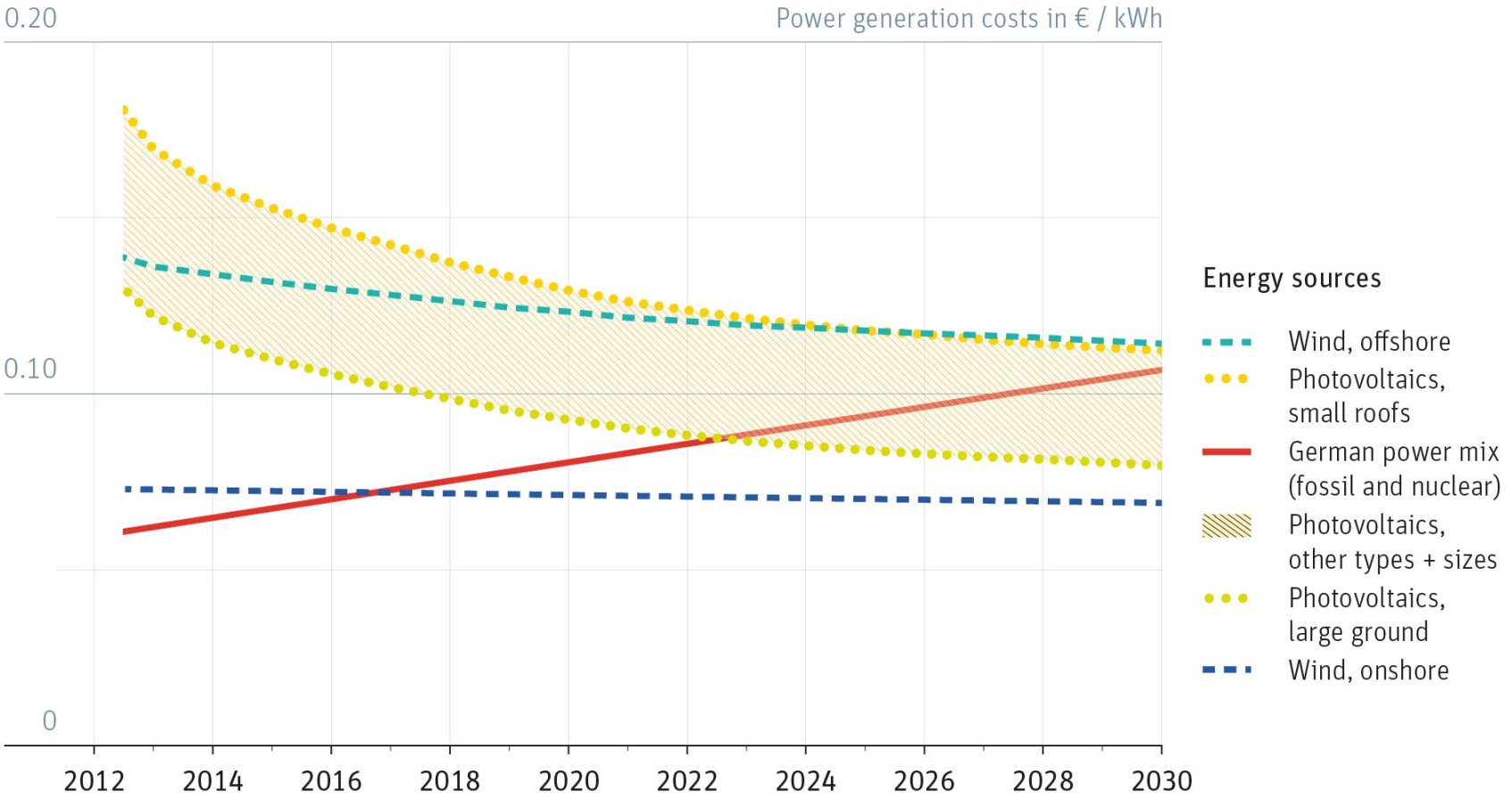
FINANCE

Renewables are becoming competitive

Forecast of power generation cost in Germany up to 2030

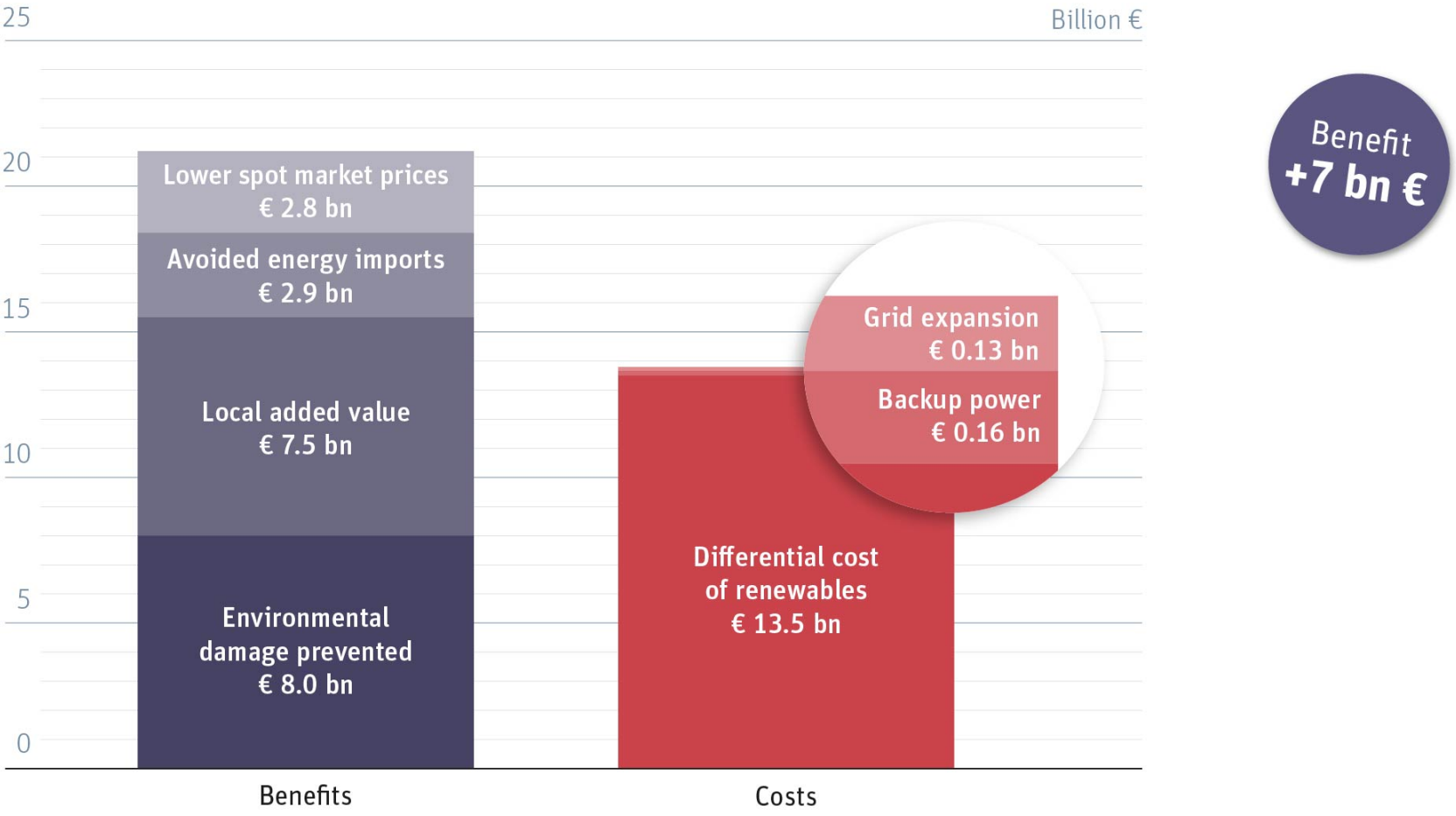
Source: Fraunhofer ISE



Renewables save Germany more than 7 billion euros per year

Costs and benefits of renewables in energy use, Germany, 2011

Source: www.unendlich-viel-energie.de

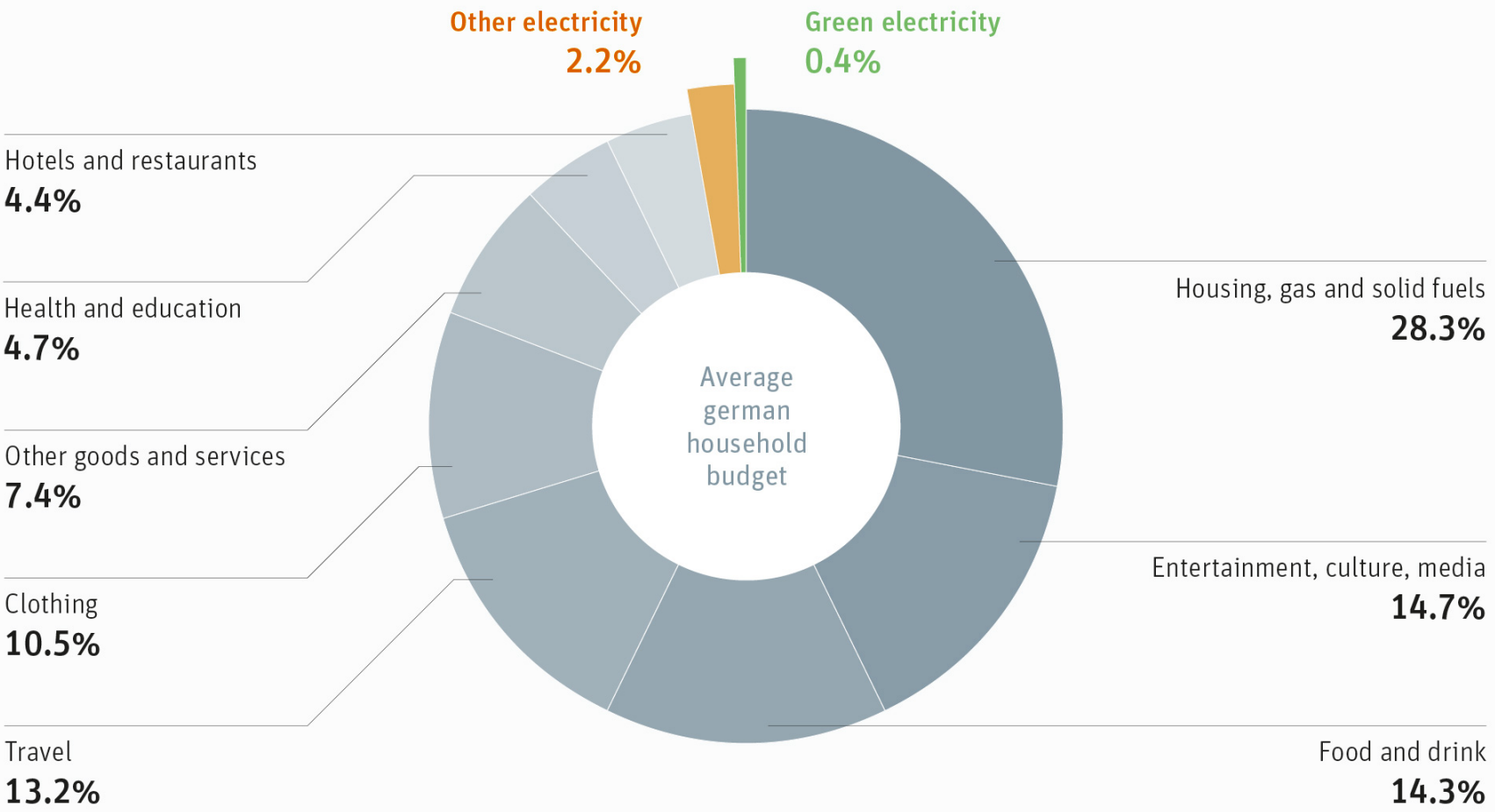


Benefit
+7 bn €

Green electricity less than one percent of average household budget

Expenses of an average household in Germany at a renewables surcharge of five cents

Source: www.unendlich-viel-energie.de



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