For our Environment

Umwelt Bundesamt

Germany's Efforts in Climate Policy and the German Energiewende

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Head of Department I 2:
Climate Protection and Energy

Dessau, 19 October, 2016

Introducing the German Environment Agency (UBA)

TASKS

Scientific Work

Collecting Data

UBA supports the Federal Government, esp. the Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)

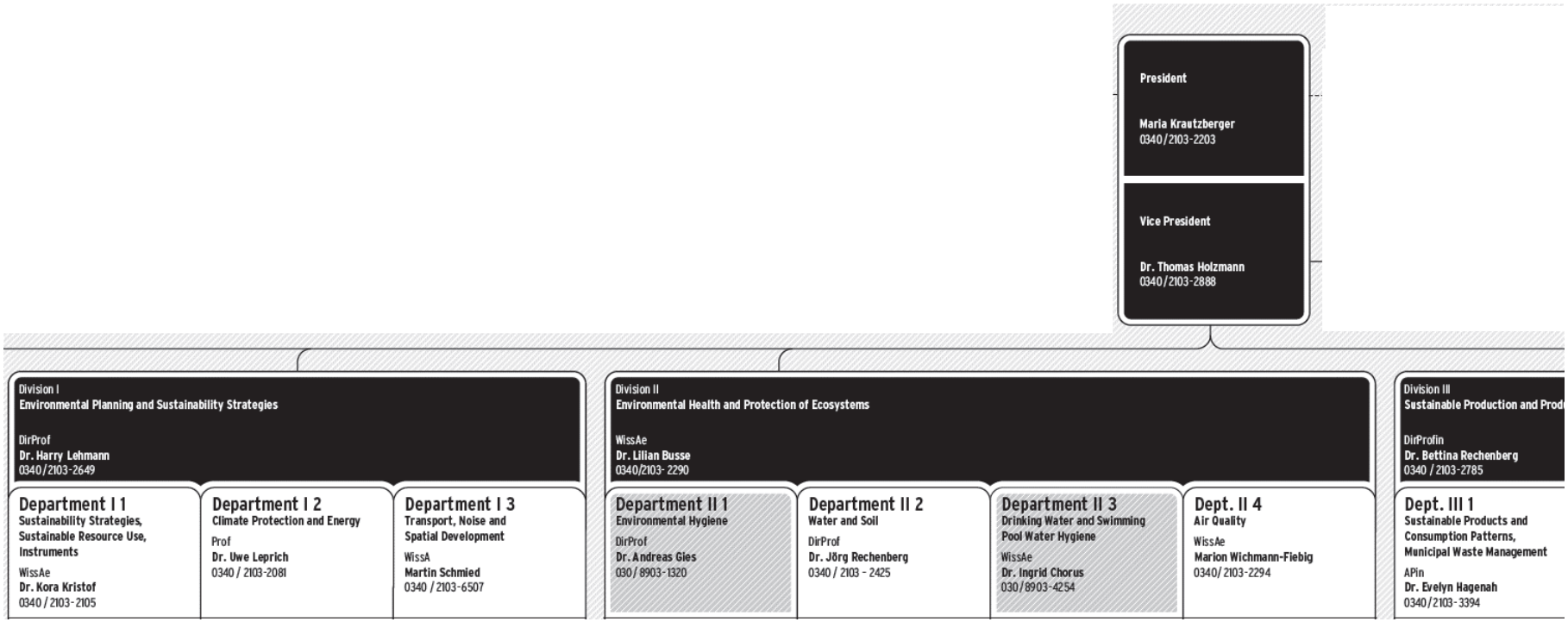
Information to the Public

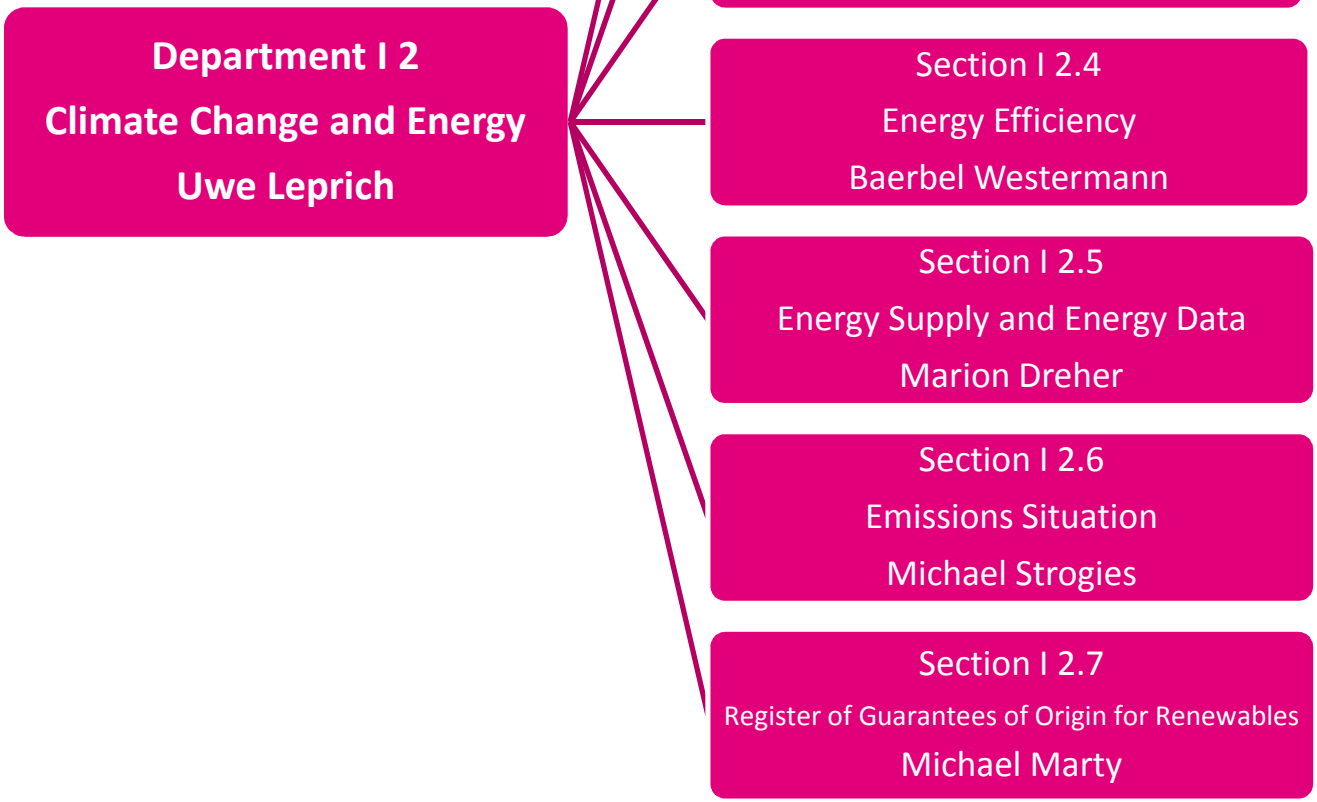
International Co-operation

Implementing environmental legislation: such as EEG

Since 2014 the UBA has also been supporting the Federal Ministry of Economy and Energy (BMWi) by providing scientific knowledge on energy questions and issues such as renewable energy sources.

THE GERMAN ENVIRONMENT AGENCY (UBA)

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Energy Strategies and Scenarios
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Section I 2.3
Renewable Energies
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Energy Efficiency
Baerbel Westermann
Section I 2.5
Energy Supply and Energy Data
Marion Dreher
Section I 2.6
Emissions Situation
Michael Strogies
Section I 2.7
Register of Guarantees of Origin for Renewables
Michael Marty

PARIS AGREEMENT

The Paris Agreement

SIGNAL FOR GREAT TRANSFORMATION

- First ever universal, legally binding global climate agreement of 195 parties
- **Ambition**: Global goal (Art. 2):
  - To limit temperature increase **„well below 2° C“** and to pursue efforts to limit it to 1.5° C above pre-industrial levels
  - **Rapid emission reductions** (all GHG, all sectors covered!)
  - Global peaking as soon as possible
  - **Net zero emissions** in the 2nd half of the century
  - Parties to formulate long-term (2050) low emissions strategies by 2020

➔ Strong signal to policy makers, investors and businesses: Decarbonisation of our economies on global scale!

COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

The Paris Agreement

COP21 · CMP11
PARIS 2015
UN CLIMATE CHANGE CONFERENCE

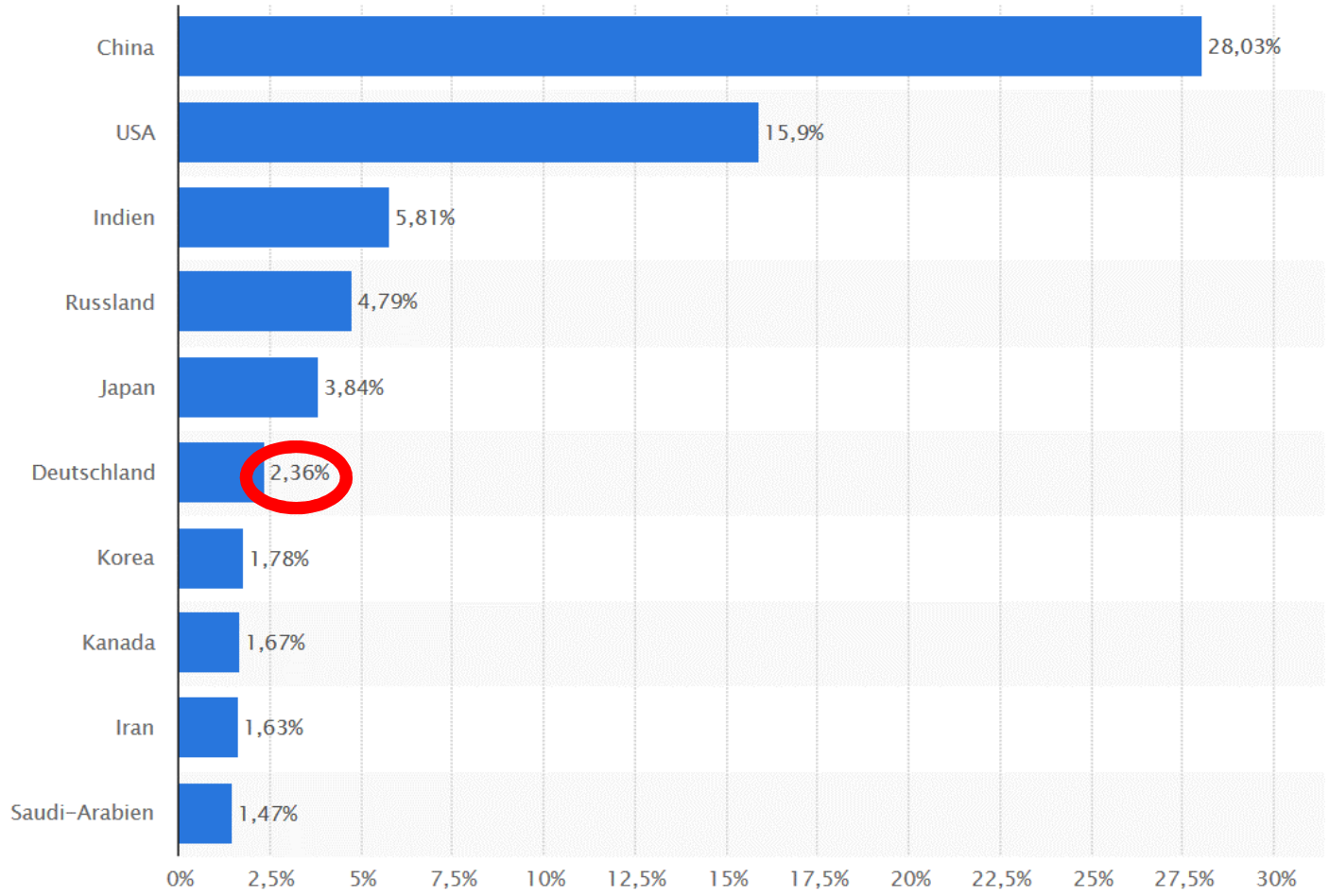
Consequences (Article 4):

- *“decarbonization” of all societies…*
- *Germany has to increase goals ….*

- *-95 % Greenhouse Gas Emission in 2050 (industrialized countries)*

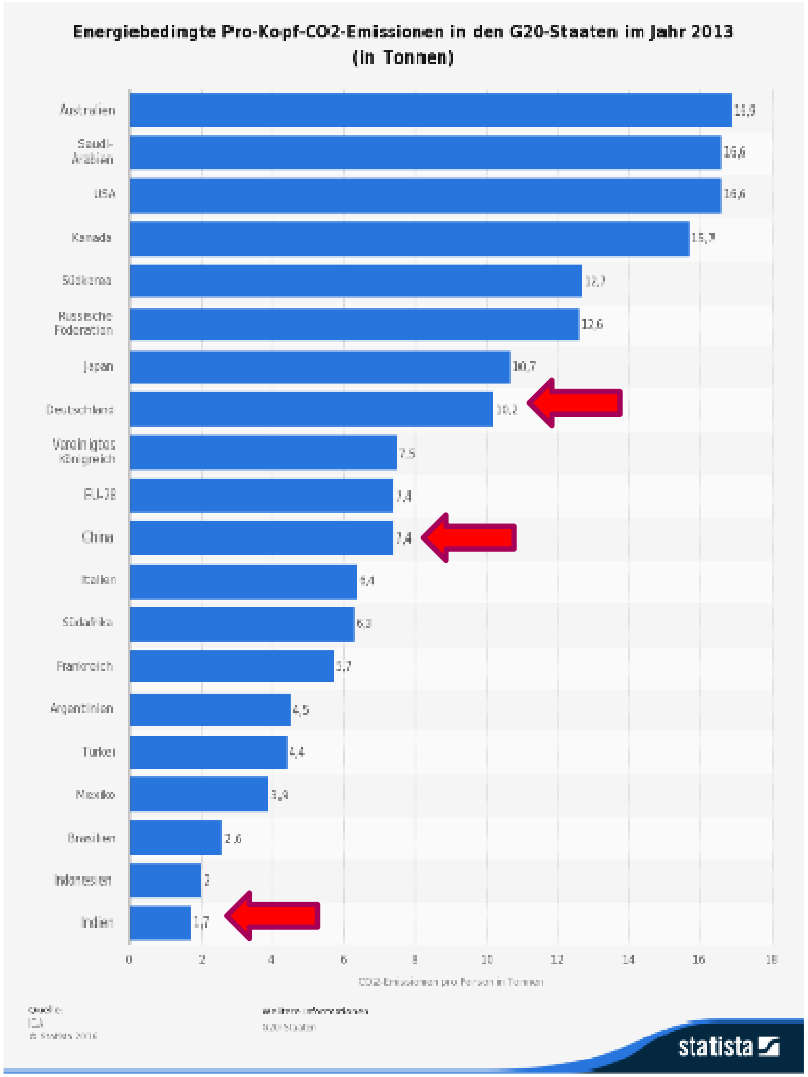
CLIMATE PROTECTION AND ENERGY POLICY IN GERMANY

Global Shares of CO2 emissions



Source: statista.de

Per Capita CO2 Emissions



We do not have (yet) a model for the world!

Source: statista.de

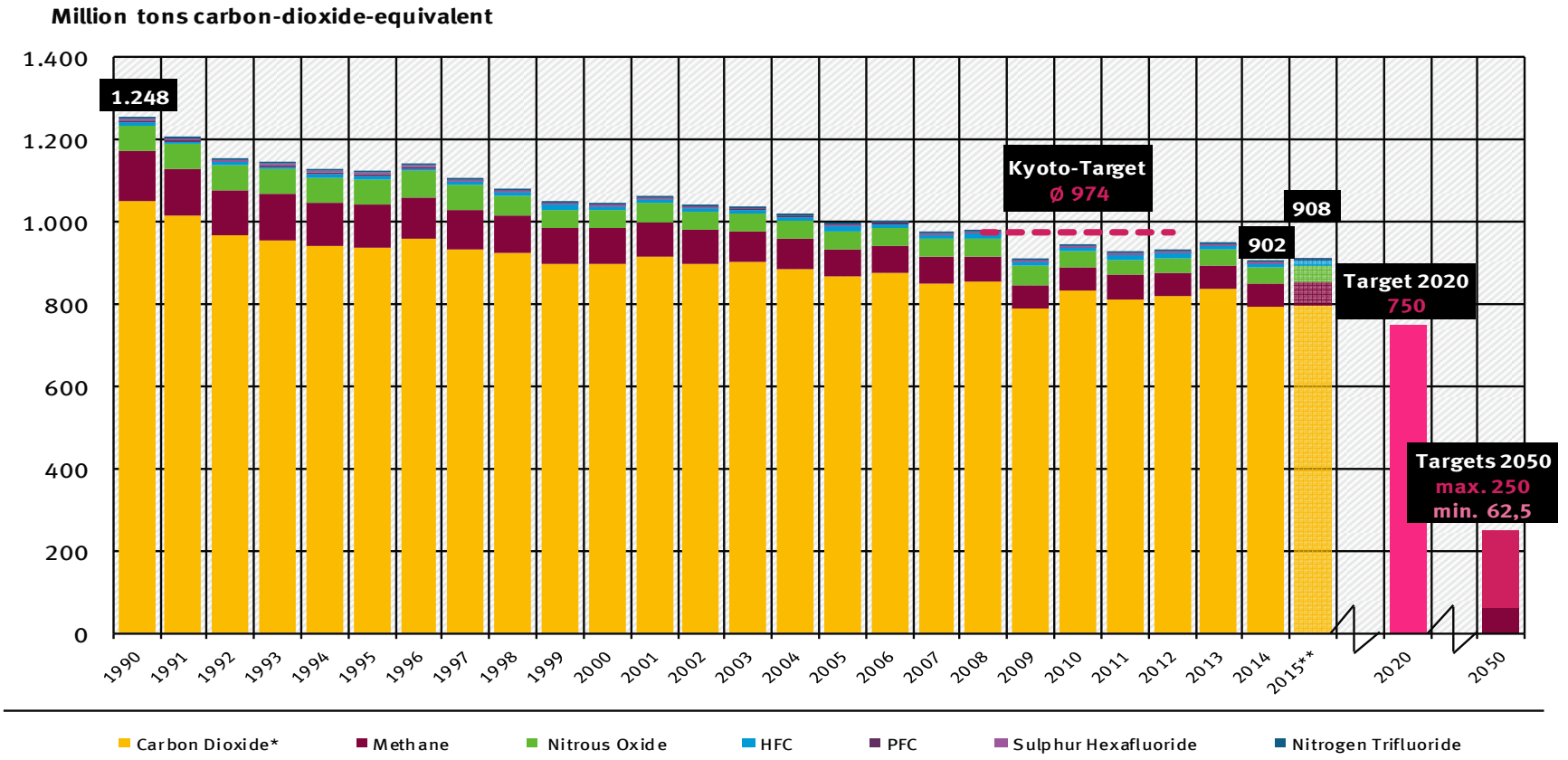
National GHG Reduction & Energy targets in Germany

	Climate Action	Renewable Energies		Efficiency		
	GHG (vs. 1990)	Electric power	Total schare	Primary energy	Energy productivity	Building insulation
2020	- 40 %	35%	18%	- 20%	increase to 2.1% / a	double rate 1% ➡ 2%
2030	- 55 %	50%	30%			
2040	- 70 %	65%	45%			
2050	- 80-95 %	80%	60%	- 50%		

GHG trend description – overview

Greenhouse Gas emissions in Germany since 1990, by gas

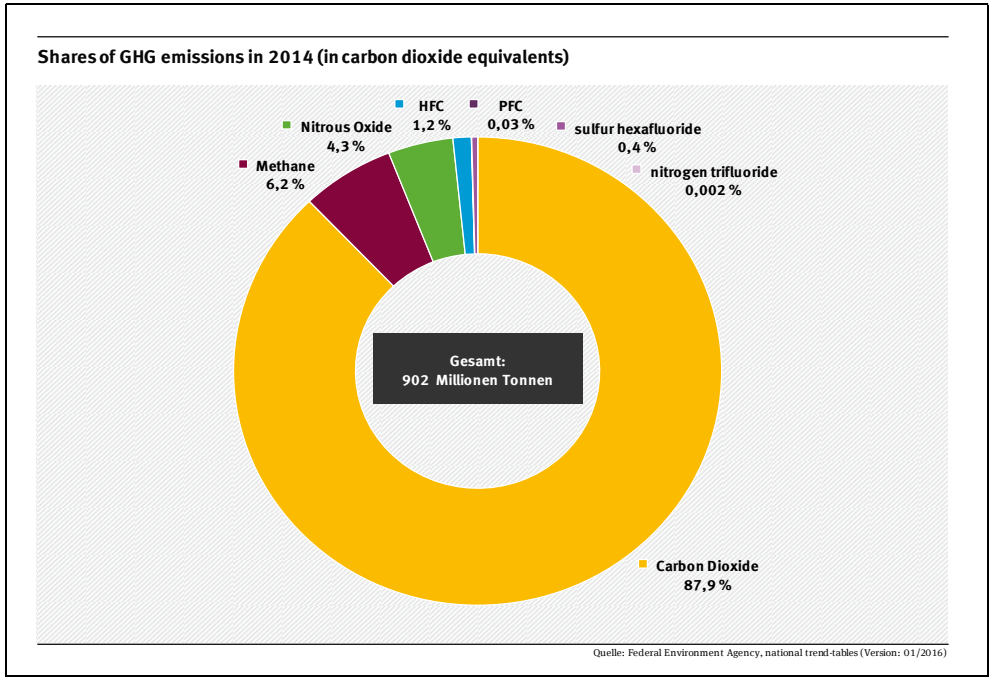
and targets for 2008-2012 (Kyoto-Protokoll), 2020 and 2050 (federal government)



* w/o carbon dioxide from LULUCF
** short-term prognosis for 2015

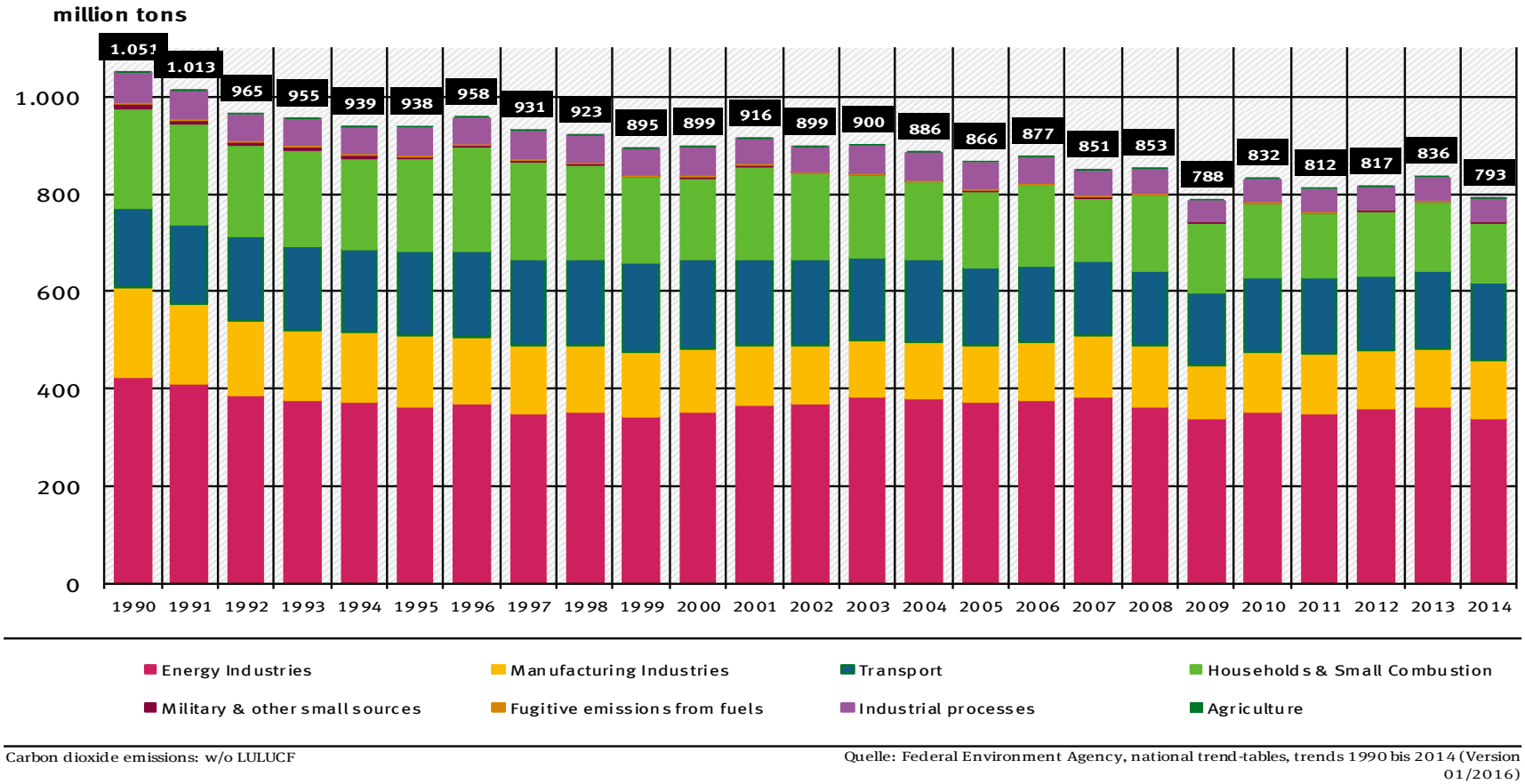
Quelle: Federal Environment Agency 2015, National Greenhouse-Gas-Inventories 1990 to 2014 (Version: 01/2016) and short-term prognosis 03/2016

Share of GHG emissions



GHG Emission Fractions	1990	2014
	(%)	
CO_2 emissions (without LULUCF)	84,2	87,9
CH_4	9,5	6,2
N_2O	5,2	4,3
HFCs	0,5	1,2
PFCs	0,2	0,0
SF_6	0,4	0,4
NF_3	0,0	0,0

Carbon dioxide emissions by category

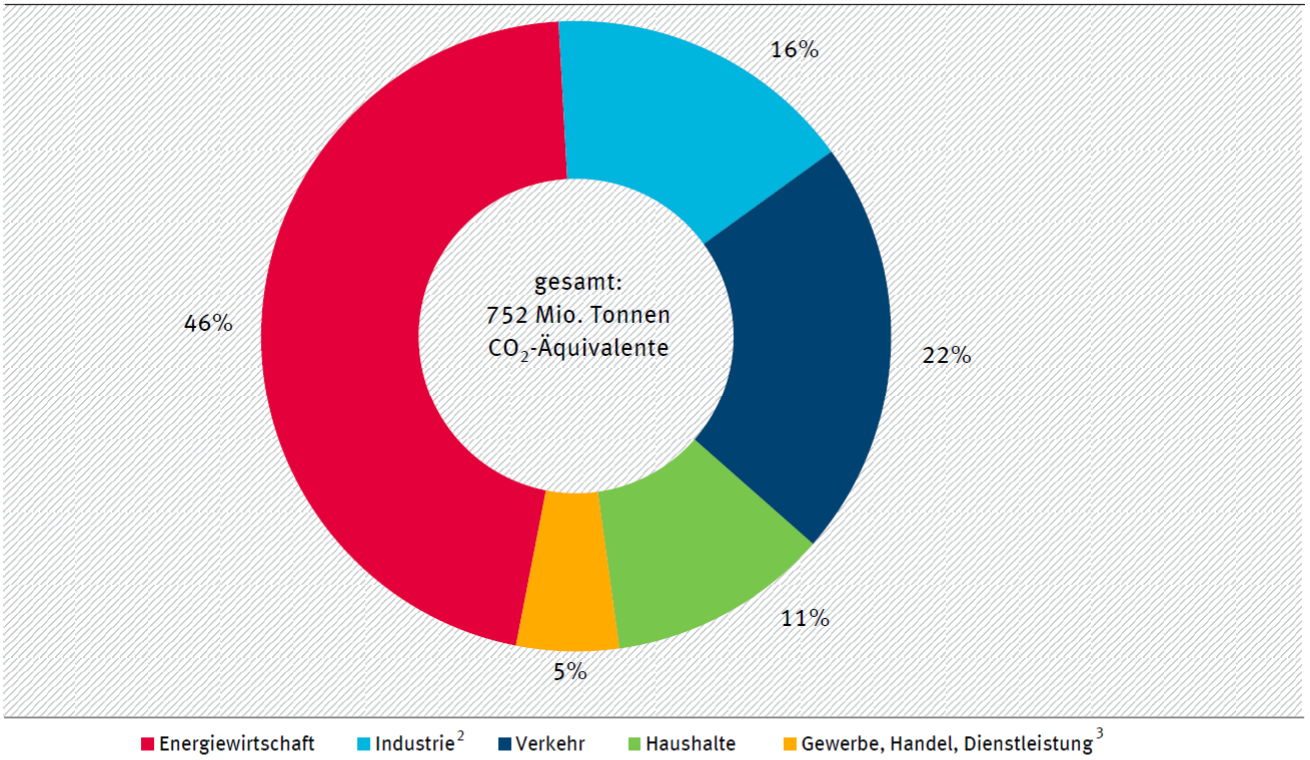


Carbon dioxide emissions: w/o LULUCF

Quelle: Federal Environment Agency, national trend-tables, trends 1990 bis 2014 (Version 01/2016)

Why is the electricity sector so important?

Anteile der Quellgruppen an den energiebedingten THG-Emissionen[1] im Jahr 2014



Angaben ohne diffuse Emissionen bei der Gewinnung, Umwandlung und Verteilung von Brennstoffen.
1 in CO_2-Äquivalenten, berücksichtigt CO_2, CH_4, N_2O
2 enthält nur Emissionen aus Industriefeuerungen, keine Prozessemissionen
3 einschließlich Militär und Landwirtschaft (energiebedingt)

Quelle: Umweltbundesamt: Nationale Trendtabellen für die deutsche Berichterstattung atmosphärischer Emissionen 1990-2014, Stand Januar 2016

WHAT WAS ACHIEVED?

Emissionen in den Handlungsfeldern (in Mio. t CO_2 Äq.)

Handlungsfeld	1990	2014	
Energiewirtschaft	466	358	**-23%**
Gebäude	209	119	**-43%**
Verkehr	163	160	**-2%**
Industrie	283	181	**-36%**
Landwirtschaft	88	72	
Teilsumme	**1209**	**890**	**-28%**

Quelle: Klimaschutzplan 2050, S.20

THE GERMAN ENERGIEWENDE

Our Strategy: „Energiewende“ in Germany

The four main goals:

- Total **phase-out of nuclear** energy by 2022
  (further 8 plants by 2017, 2019, 2021 & 2022)
  2015: 11 GW remaining nuclear capacity (=14.1% of power generation)
- Increase **renewable energies**
- Increase **energy efficiency**
- **GHG-neutral** society/economy by 2050 (-95% GHG vs. 1990)

➔ A new Climate Action Plan 2050 will be adopted in the course of this legislative period “in light of the results of the 2015 Paris Agreement”!

Federal Republic of Germany
Foreign Office

Integrated policy package for the Energiewende

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.

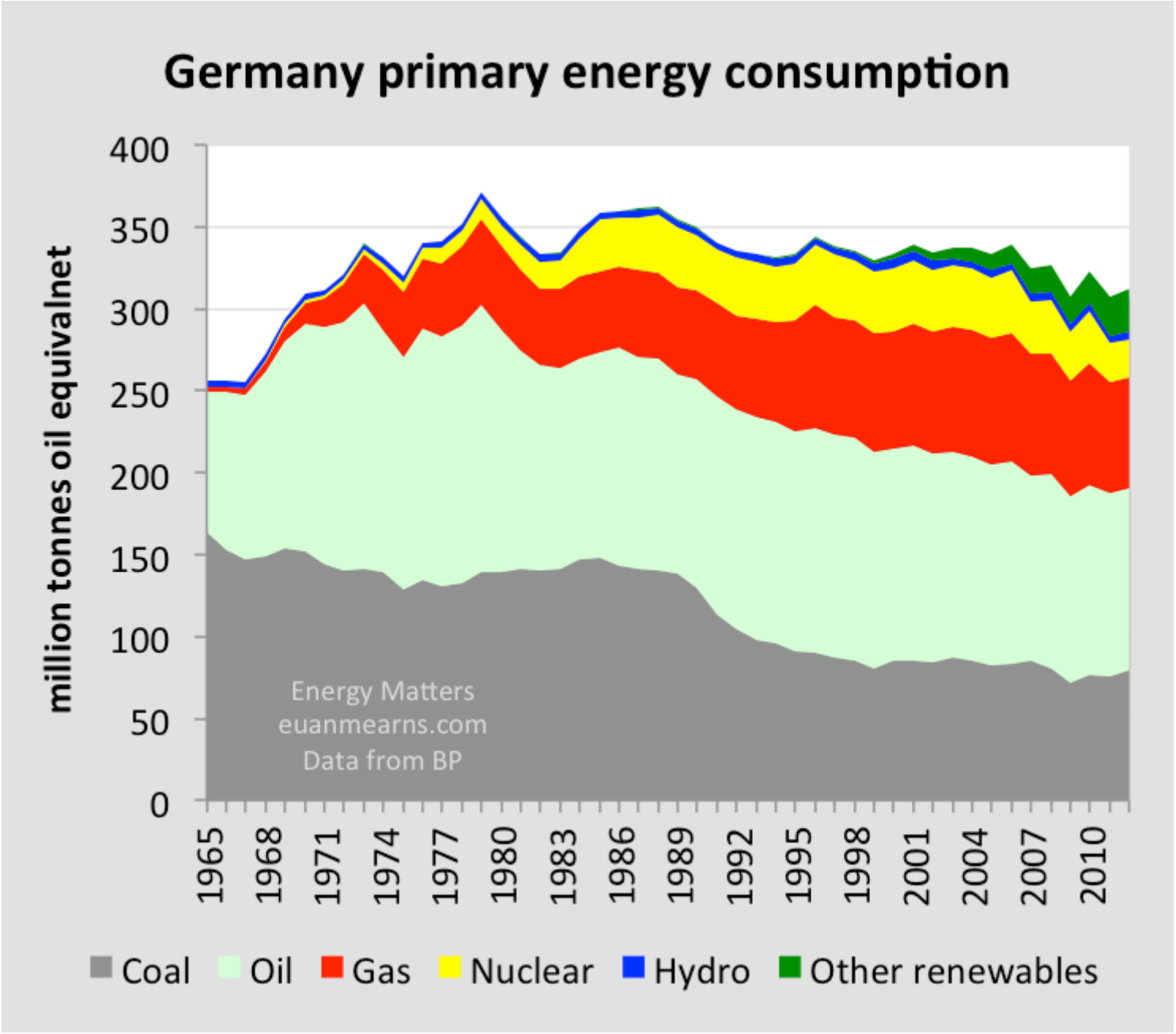
Source: BMWi 2014

Evaluation of the Energiewende by an expert group

Tabelle 1: Trend-Bewertung der Zielerreichung im Monitoring-Bericht (Entwurf vom 05.11.2015)

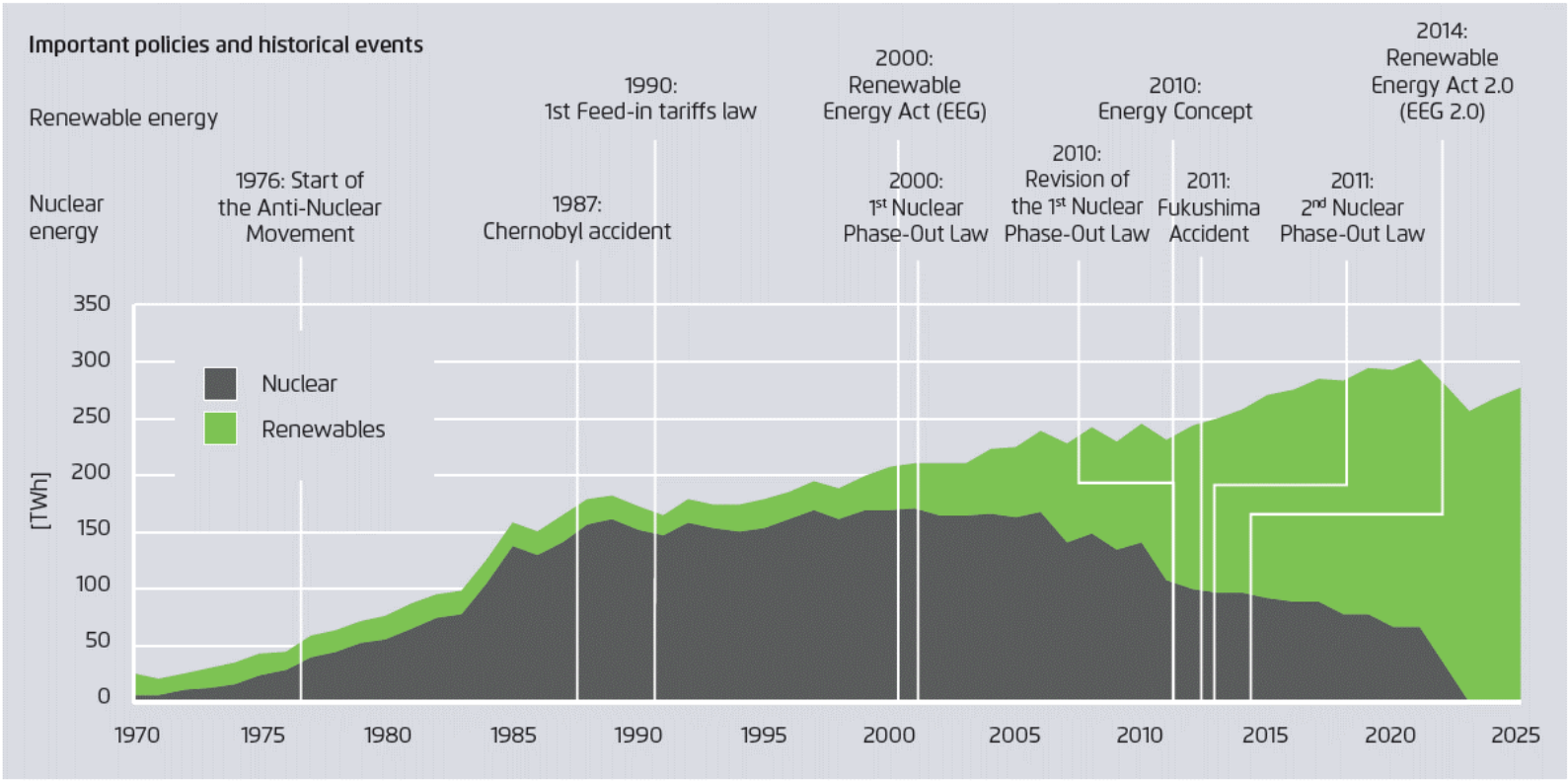
Indikator	Ist 2014	Ziel in 2020	Trend
Erneuerbare Energien am Bruttoendenergieverbrauch	13,5 %	18 %	●●●●●
Erneuerbare Energien am Bruttostromverbrauch	27,4 %	mindestens 35 %	●●●●●
Erneuerbare Energien am Wärmeverbrauch	12,2 %	14 %	●●●●●
Erneuerbare Energien im Verkehrsbereich	5,6 %	10 %	●○○○○
Primärenergieverbrauch (unbereinigt)	-8,7 %	-20 % ggü. 2008	●●●○○
Endenergieproduktivität	1,6 % p. a.	2,1 % p. a. ab 2008	●●●○○
Bruttostromverbrauch	-4,6 %	-10 % ggü. 2008	●●○○○
Wärmebedarf Gebäudesektor	-12,4 %	-20 % ggü. 2008	●●○○○
Endenergieverbrauch Verkehrssektor	1,7 %	-10 % ggü. 2005	●○○○○
Treibhausgasemissionen	-27 %	-40 % ggü. 1990	●●●○○

Quelle: Eigene Darstellung entsprechend BMWi (2015a)


Germany primary energy consumption
million tonnes oil equivalnet
400
350
300
250
200
150
100
50
0
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010
Energy Matters
euanmearns.com
Data from BP
Coal
Oil
Gas
Nuclear
Hydro
Other renewables

Major political events important for the Energiewende

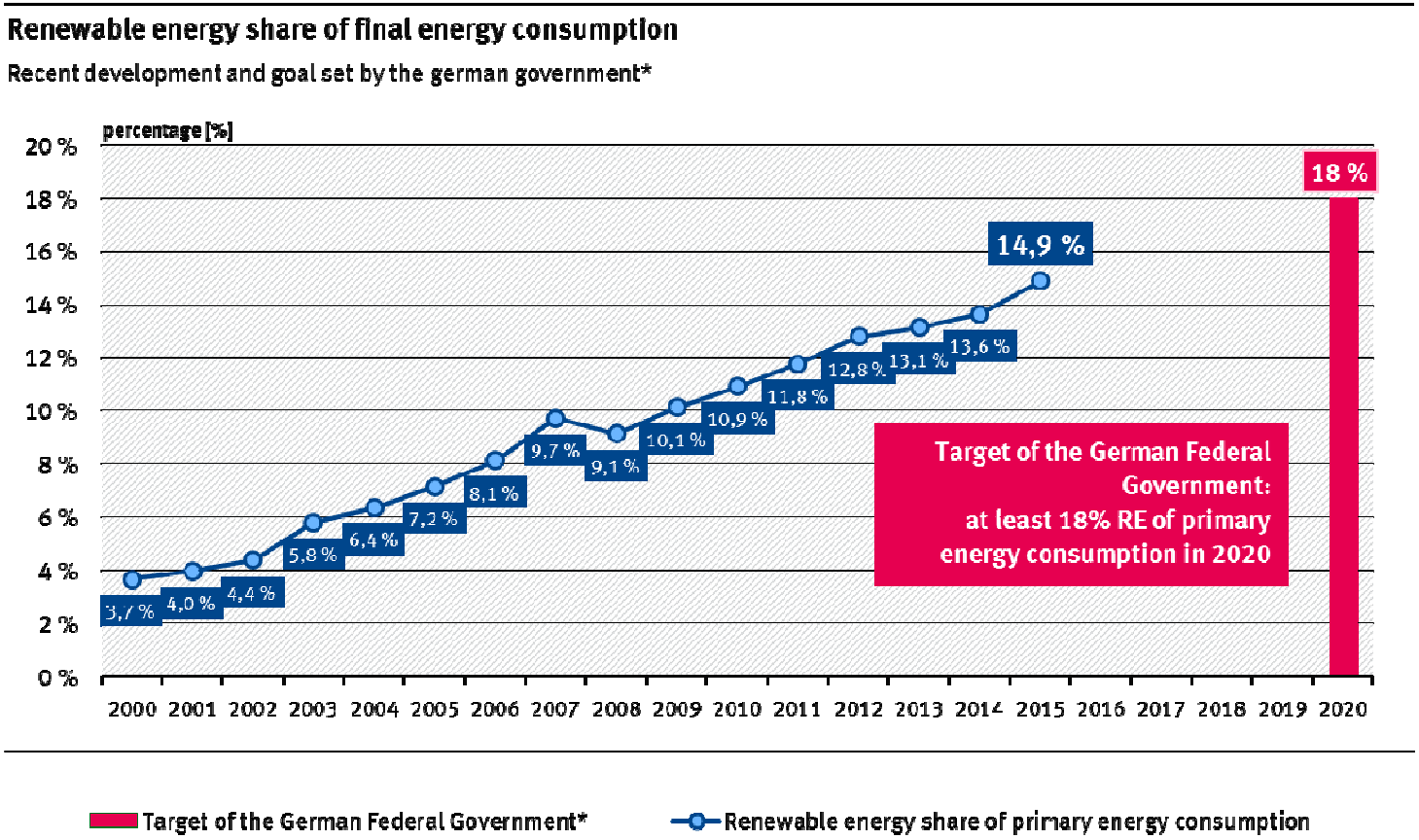
Nuclear and renewable electricity generation and major political events, 1970 – 2025 Figure 2



AGEB (2015), AGEE (2015), BNetzA (2014), BNetzA (2015), Statistical Yearbook of the GDR (1973 - 1988), own calculations

Source: Agora 2016

Renewable energy share of final energy consumption



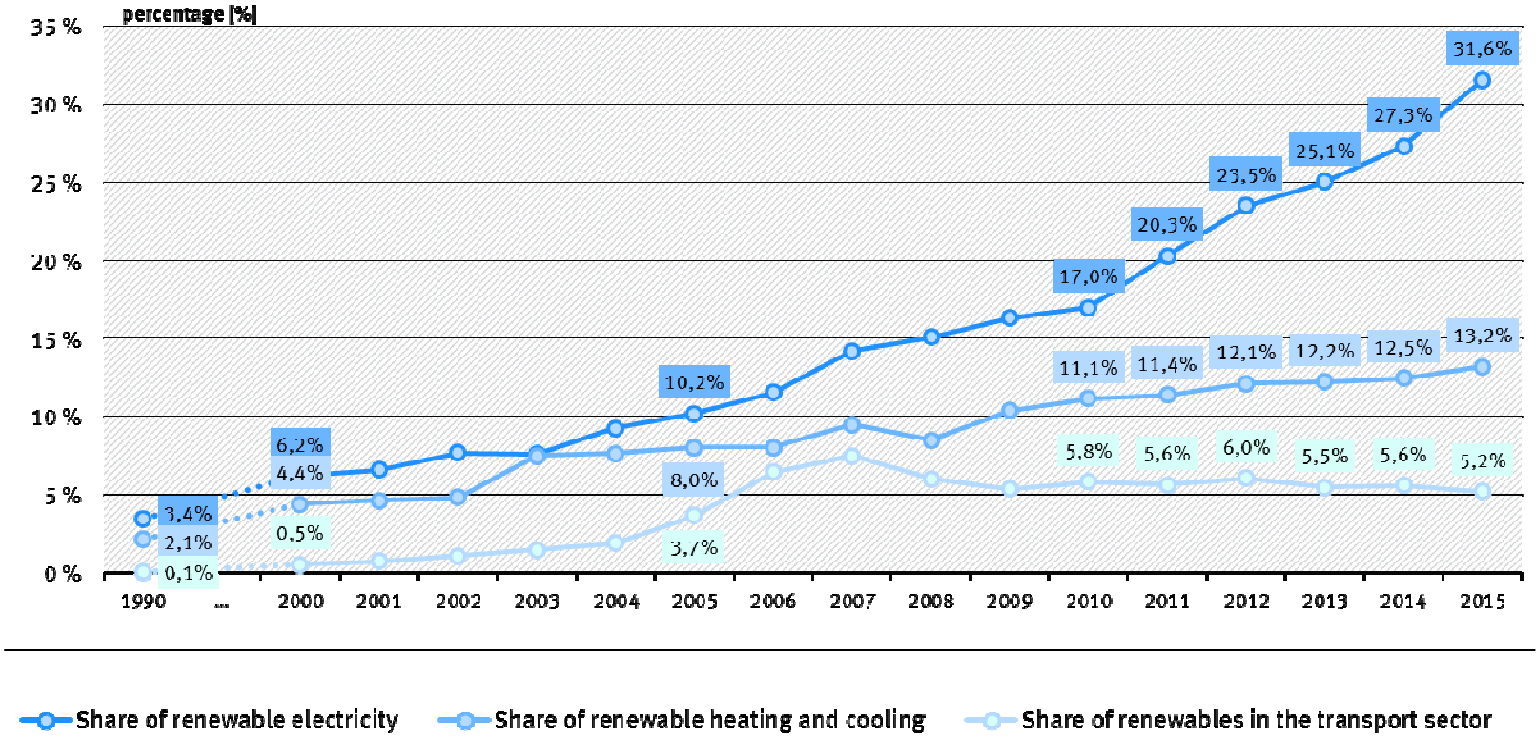
*Within the framework of the "Energiekonzept" the federal government has established targets for the years 2020, 2030, 2040 and 2050. Here only the target for 2020 is illustrated, targets for 2030, 2040 and 2050 are 30%, 45% and 60% respectively.

Source: Federal Ministry for Economic Affairs and Energy based on AGEE-Stat, Time series of the the development of renewable energies in Germany, August 2016

Renewable energy share of gross electricity consumption, final energy supply for heating and for transport

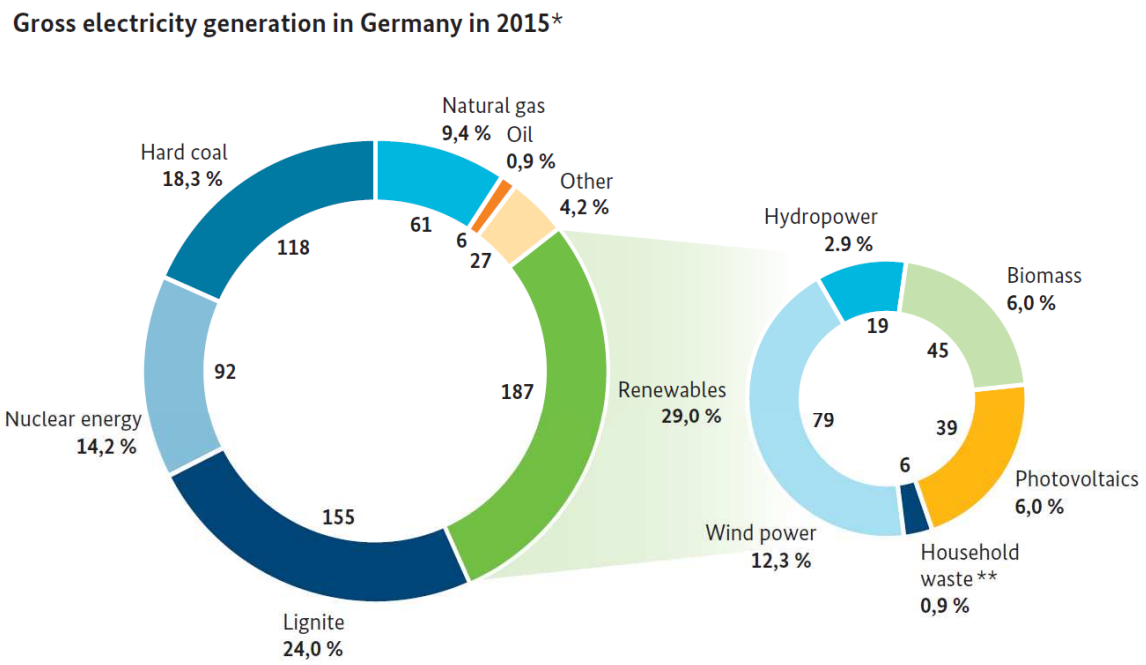
Renewable energy share of gross electricity consumption, final energy supply for heating and for transport

Development between 1990 and 2015



Source: Federal Ministry for Economic Affairs and Energy based on AGEE-Stat, Time series of the the development of renewable energies in Germany, August 2016

Gross Electricity generation in Germany 2015



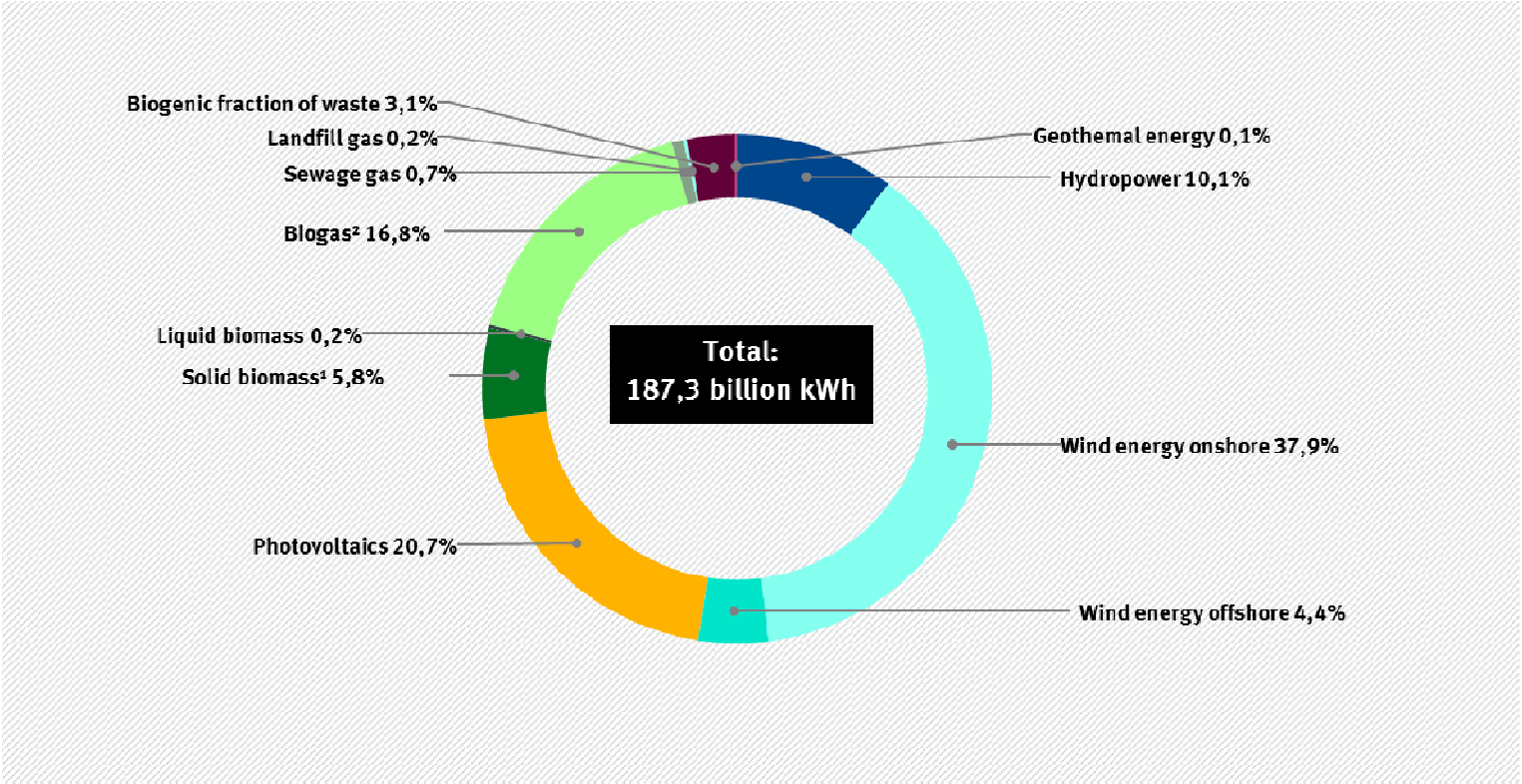
* Preliminary figures ** Regenerative part

Source: Working Group on Energy Balances, status: August 2016

Electricity production from renewable energy sources in 2015

Electricity production from renewable energy sources in 2015

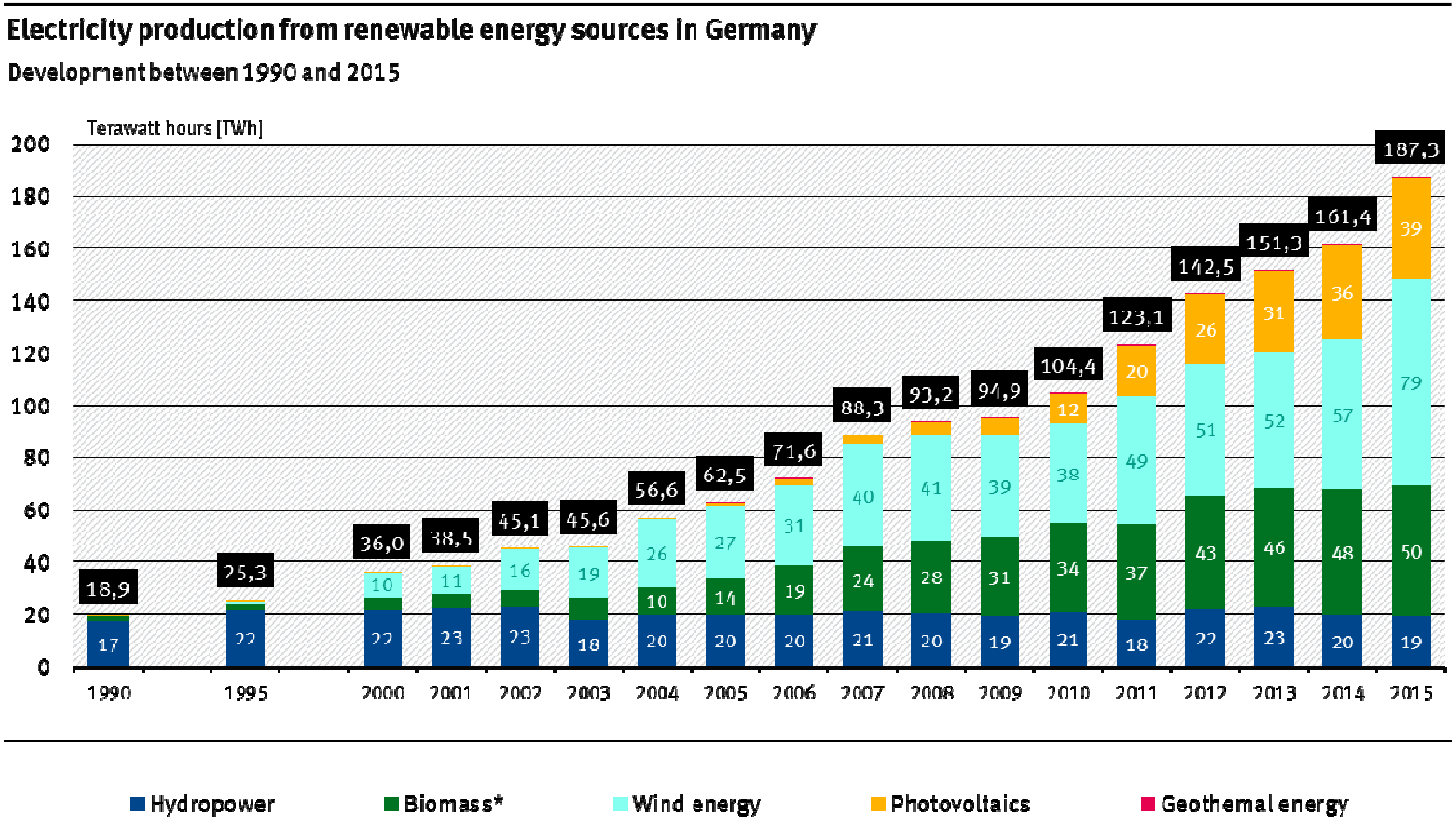
Shares [%]



¹ since 2010 incl. sewage sludge
² incl. Biomethane

Source: Federal Ministry for Economic Affairs and Energy based on AGEE-Stat, Time series of the the development of renewable energies in Germany, August 2016

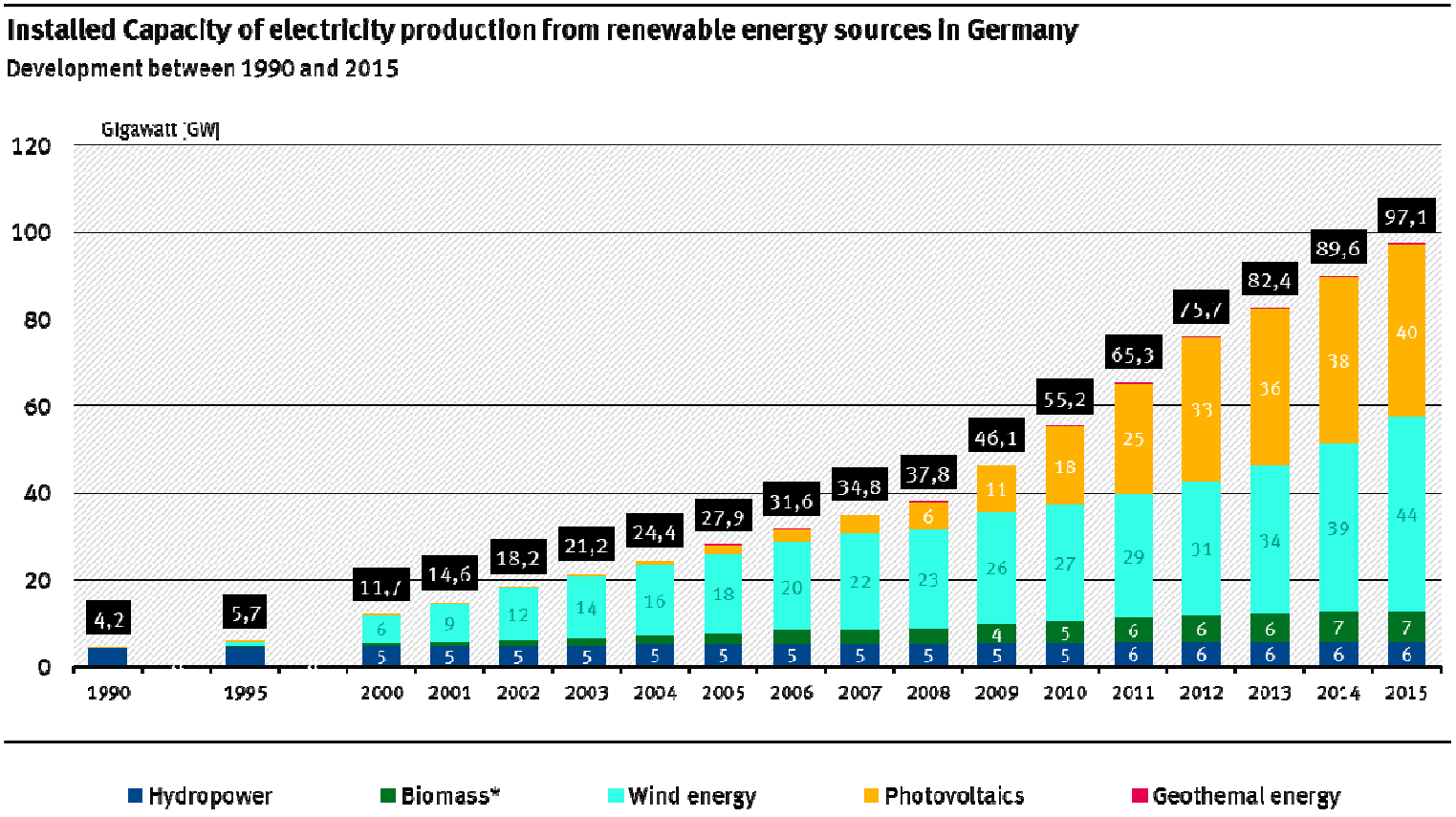
Electricity production from renewable energy sources in Germany



* Including solid and liquid biomass, biogas, biomethan, landfill- and sewagegas and the biogenic fraction of waste, from 2010 onwards incl. sewage sludge

Source: Federal Ministry for Economic Affairs and Energy based on AGEE-Stat. Time series of the the development of renewable energies in Germany, August 2016

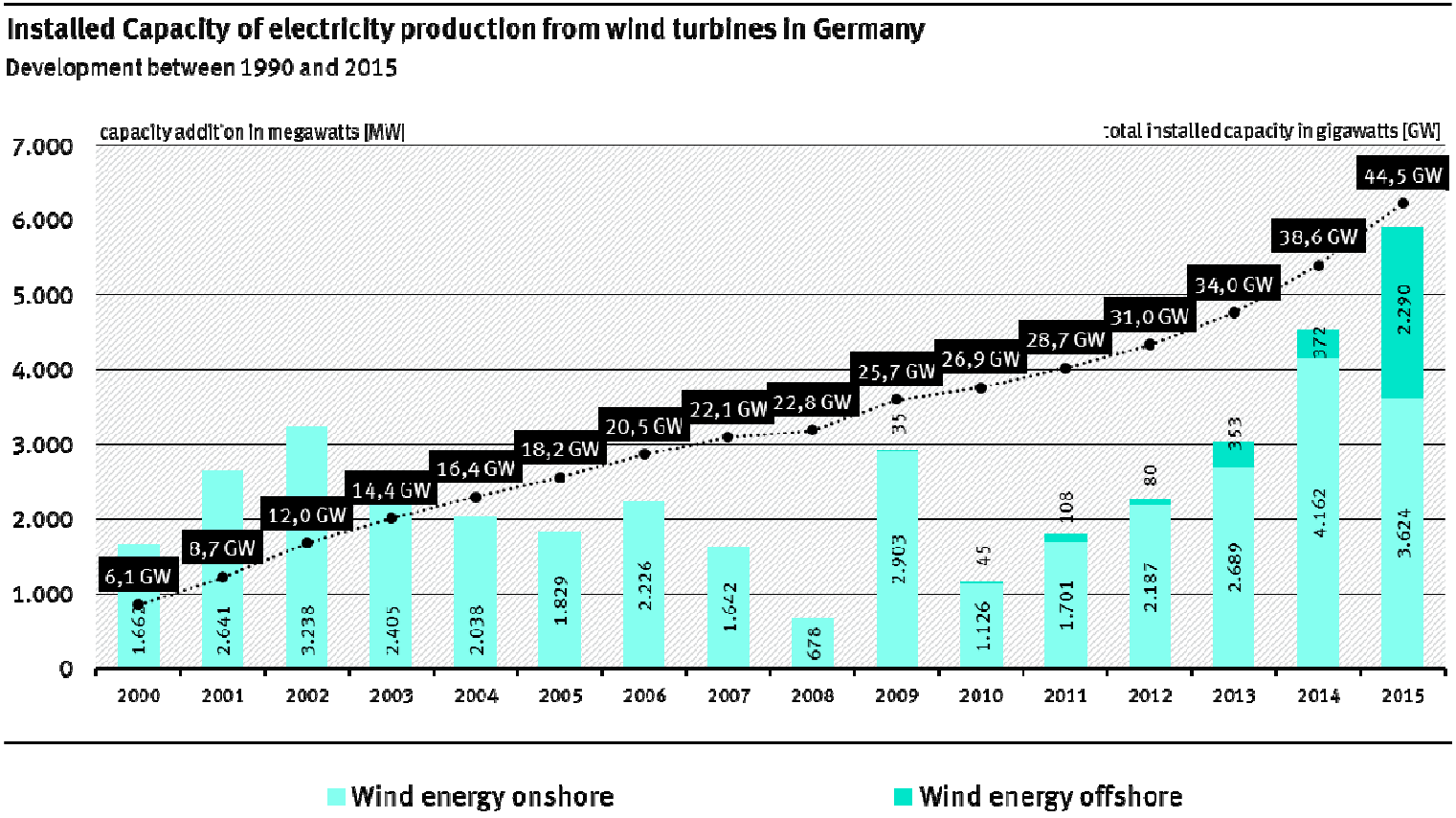
Installed Capacity of electricity production from renewable energy sources in Germany



* including solid and liquid biomass, biogas, biomethan, landfill- and sewagegas without the biogenic fraction of waste

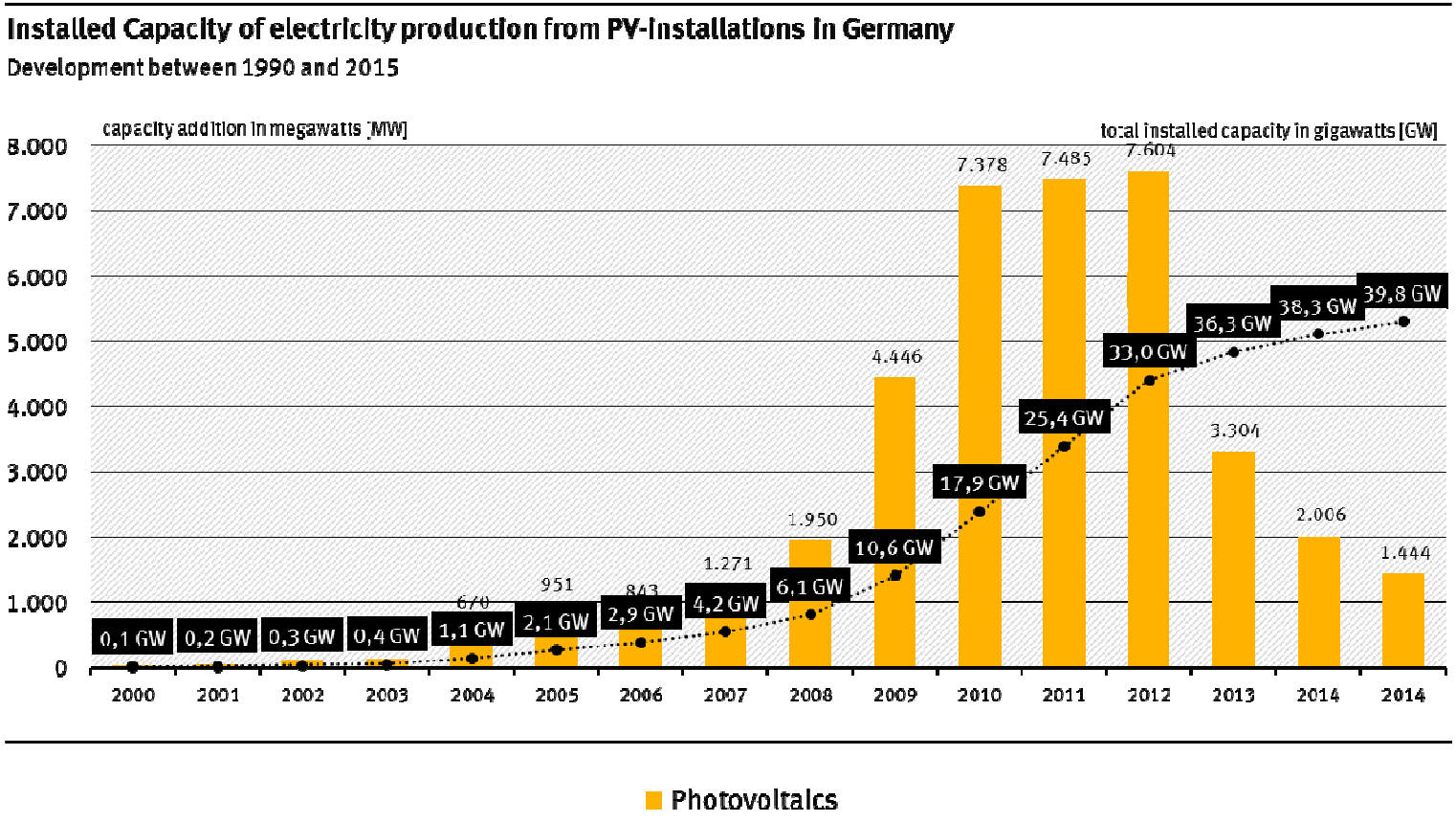
Source: Federal Ministry for Economic Affairs and Energy based on AGEE-Stat, Time series of the the development of renewable energies in Germany, August 2016

Installed Capacity of electricity production from wind turbines in Germany



Source: Federal Ministry for Economic Affairs and Energy based on AGEE-Stat, Time series of the the development of renewable energies in Germany, August 2016

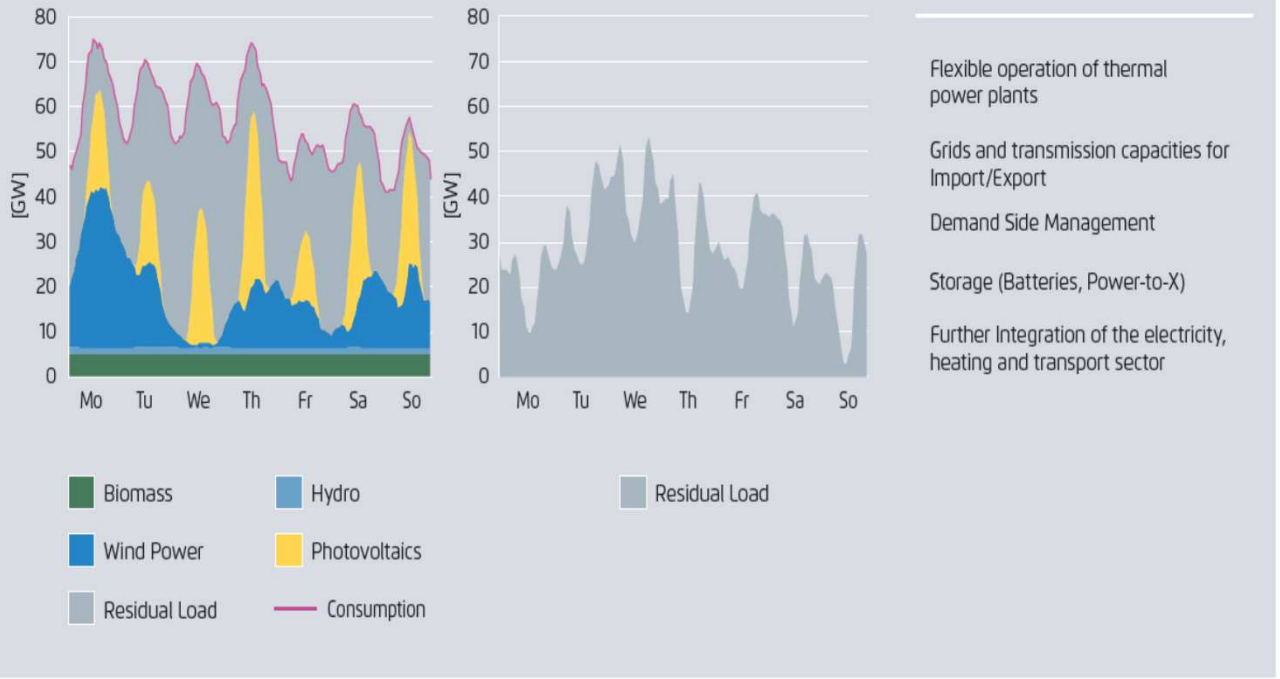
Installed Capacity of electricity production from PV-installations in Germany



Source: Federal Ministry for Economic Affairs and Energy based on AGEE-Stat, Time series of the the development of renewable energies in Germany, August 2016

The “residual” load needs flexibilities

Gross electricity generation and residual load in Germany in a sample week in April 2022 with 50% renewables Figure 8



Own calculation

Source: Agora 2016

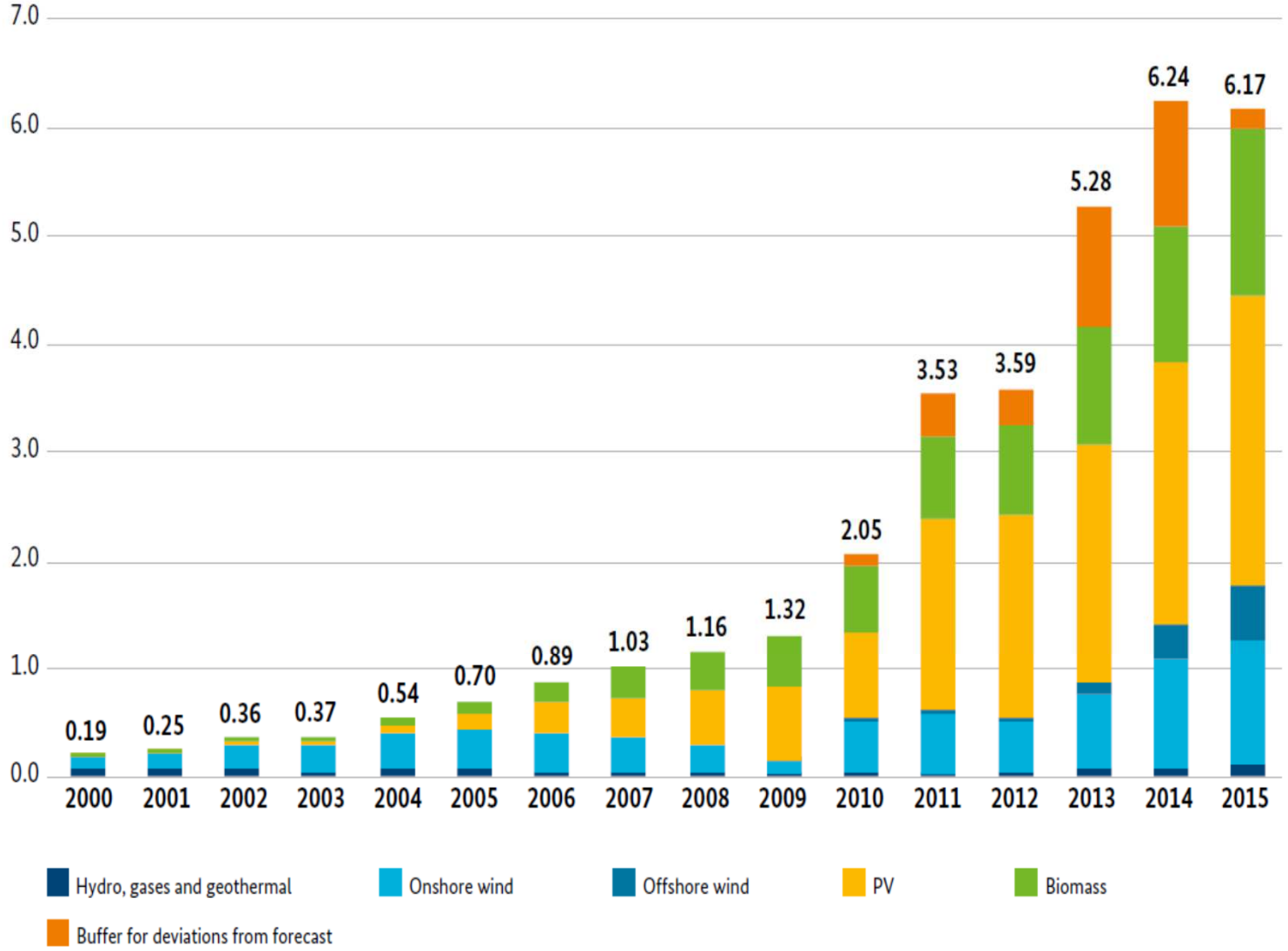
Wholesale electricity prices 2007-2015

Wholesale electricity prices (1-year future) in Germany, 2007 - 2014 Figure 15

EEX (2015)

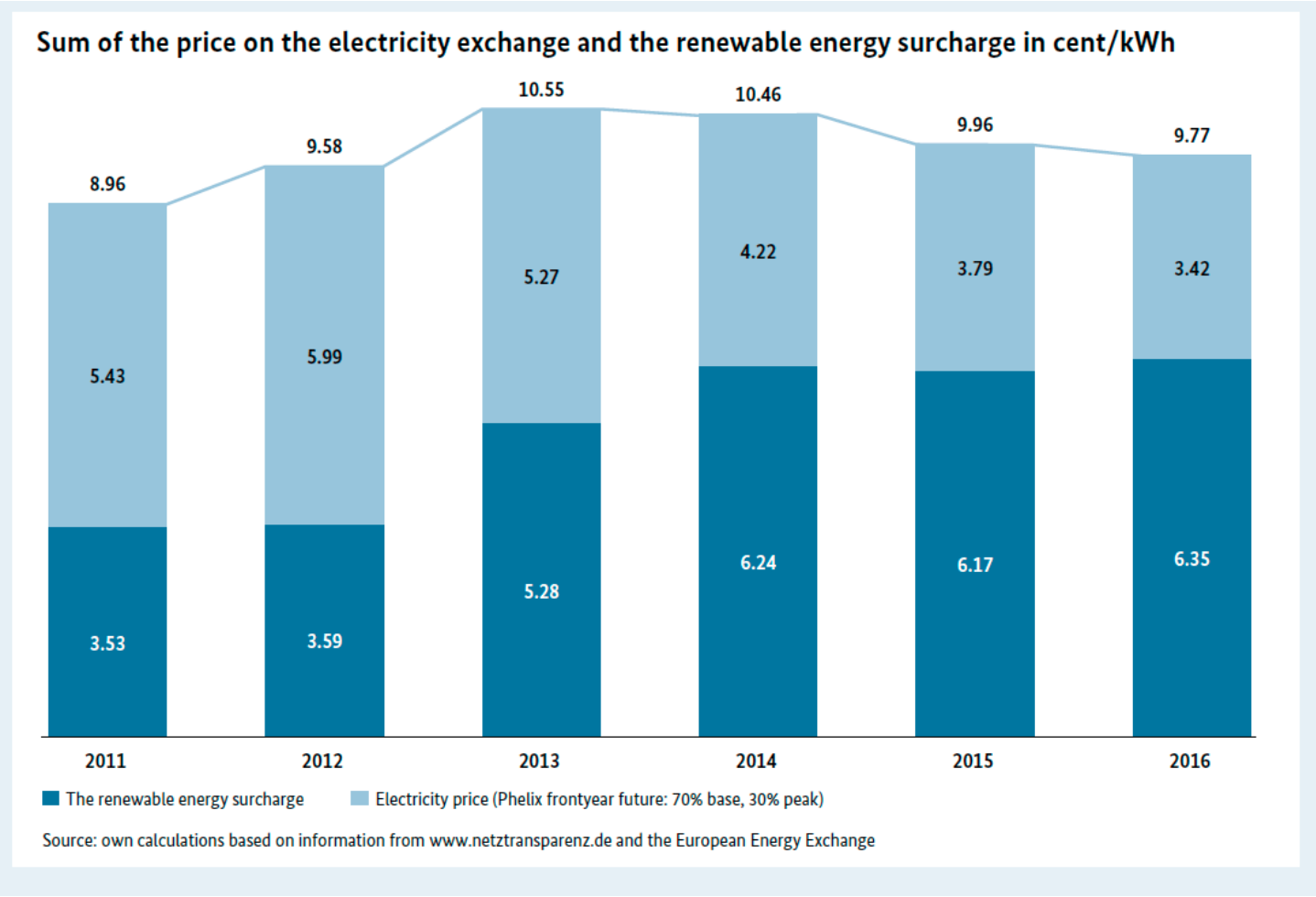
Source: Agora 2016

EEG surcharge in eurocents per kilowatt-hour



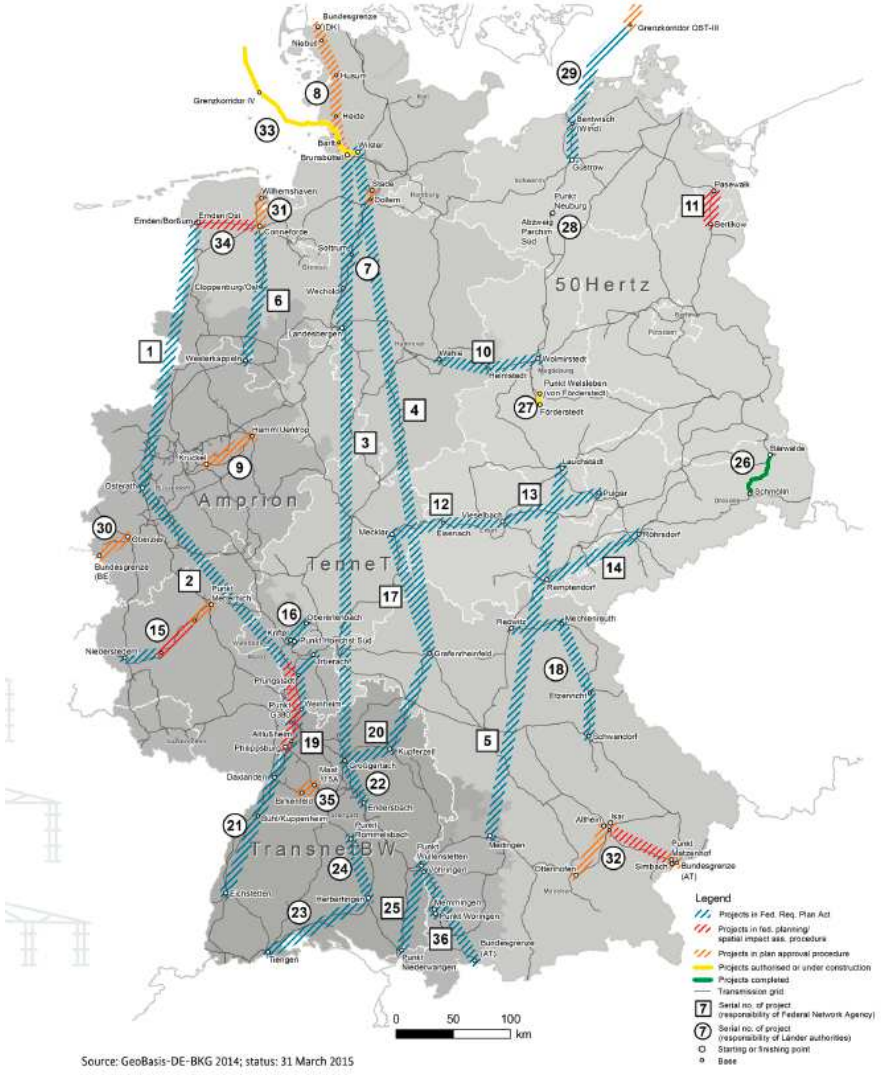
Source: Federal Ministry for Economic Affairs and Energy

Composition of electricity prices



Source: BMWi 2016

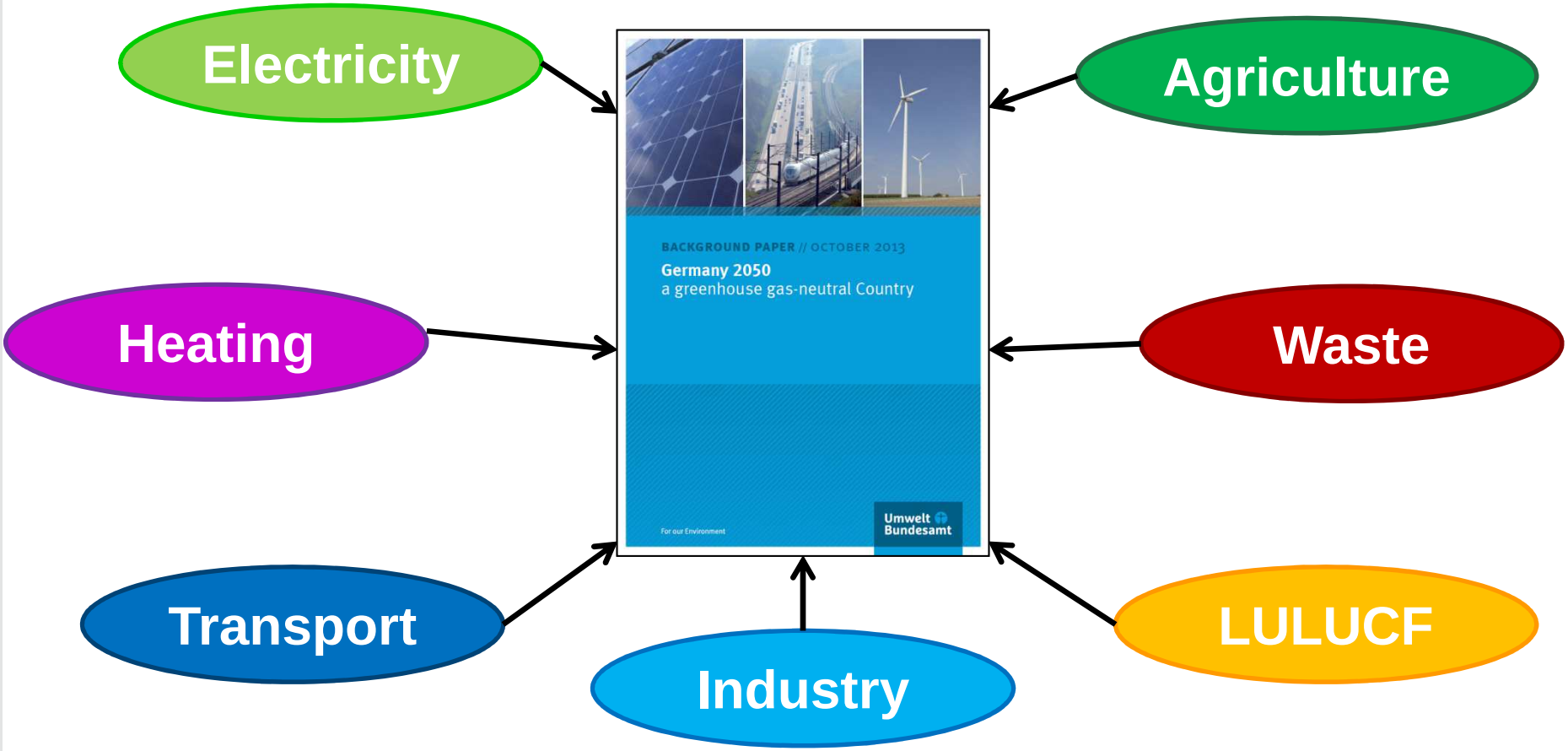
Renewable electricity is intermittent and could be balanced through a regional mix



Source: BMWi 2016

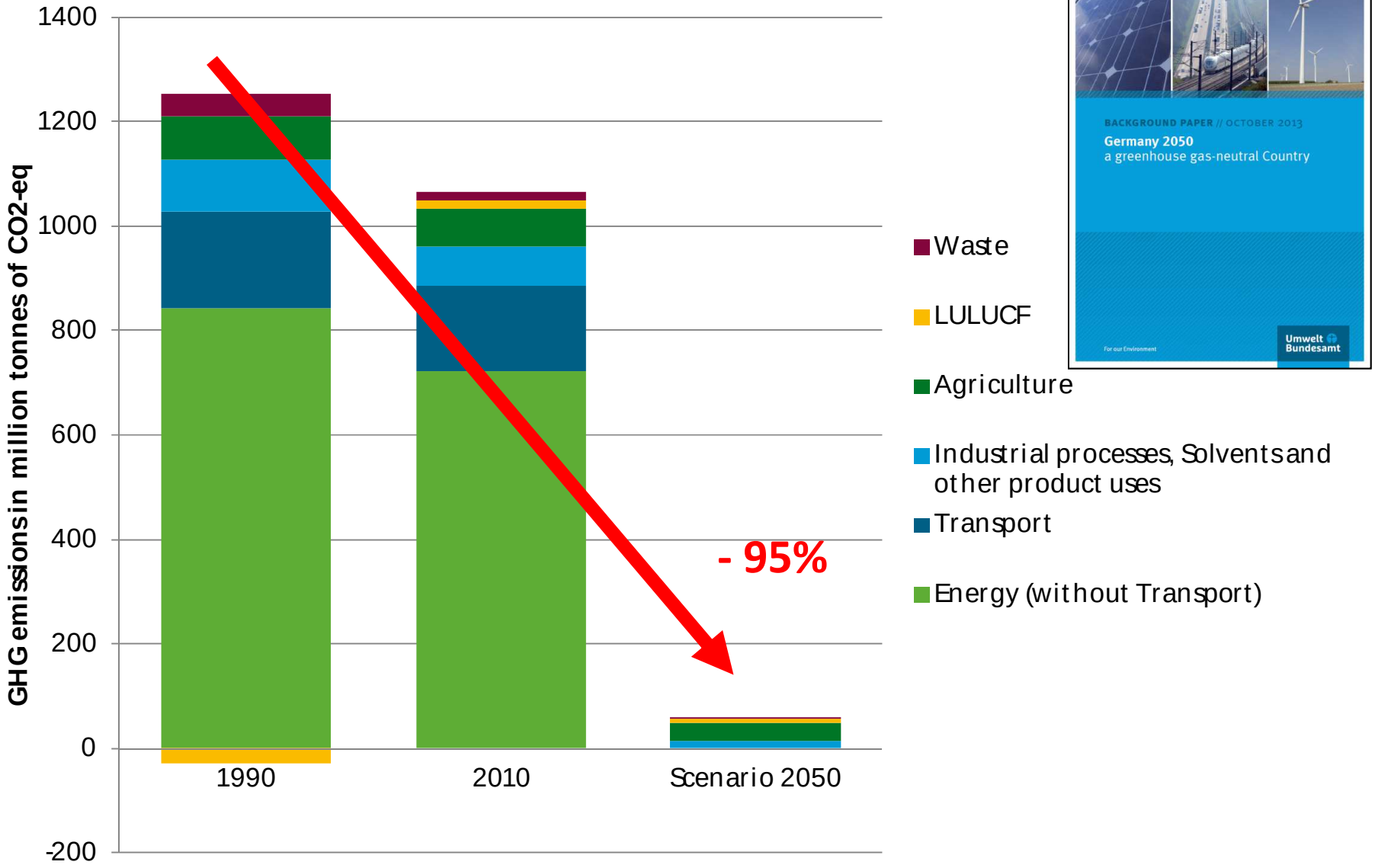
A GREENHOUSE GAS NEUTRAL SOCIETY

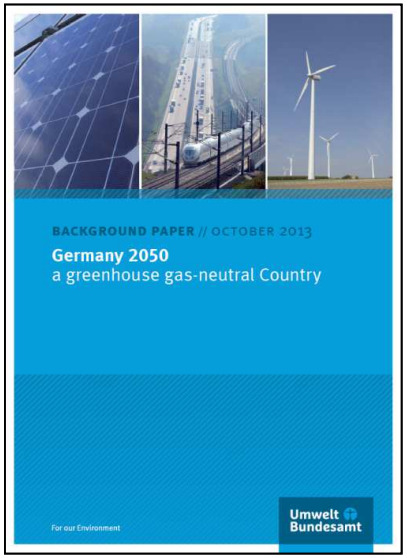
Germany as a Greenhouse Gas Neutral Society is much more than 100% renewable energy!



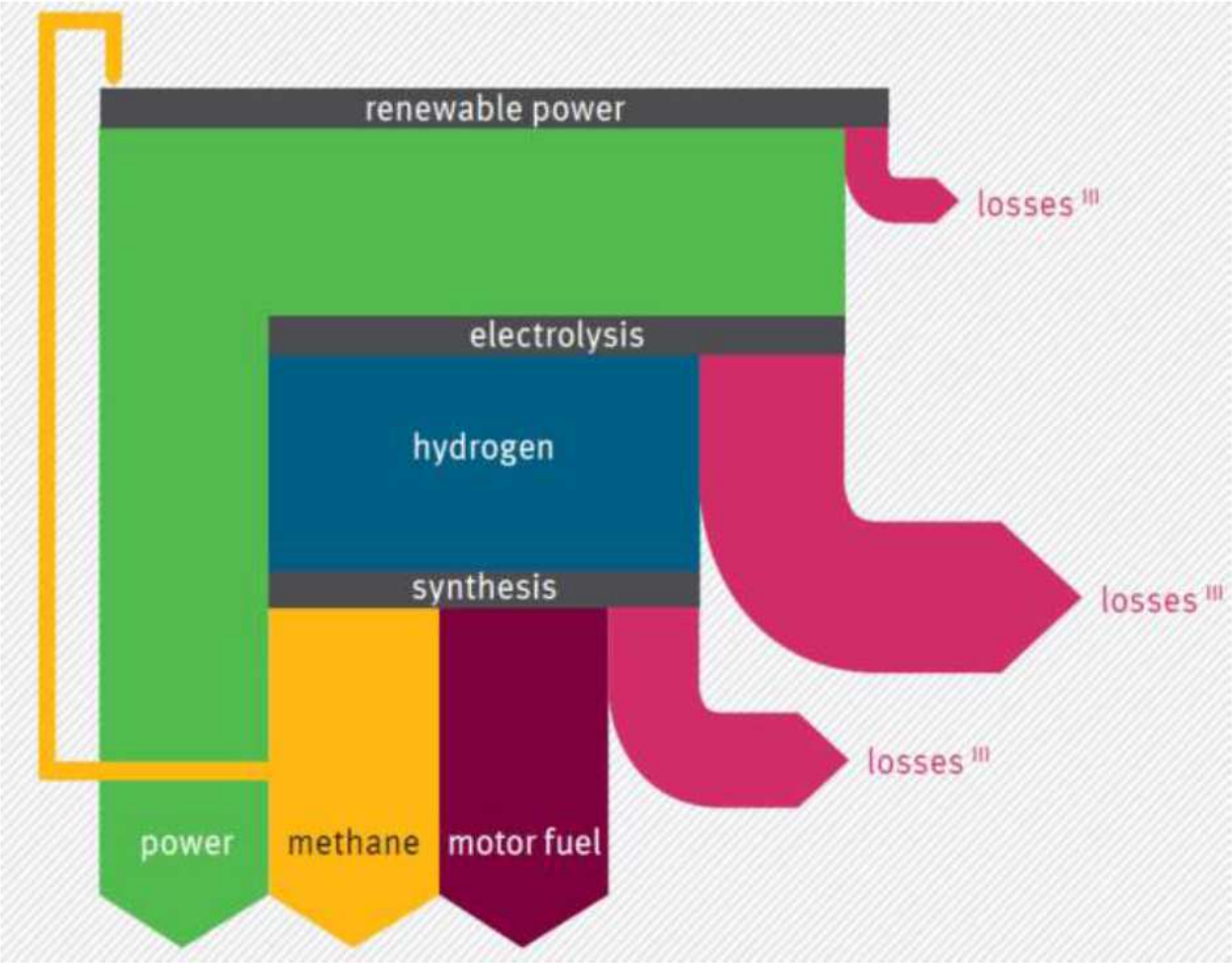
Therefore we need **to foster public acceptance** and a well-coordinated collaboration with EU member states!

UBA study: “Germany 2050: A greenhouse gas-neutral country”





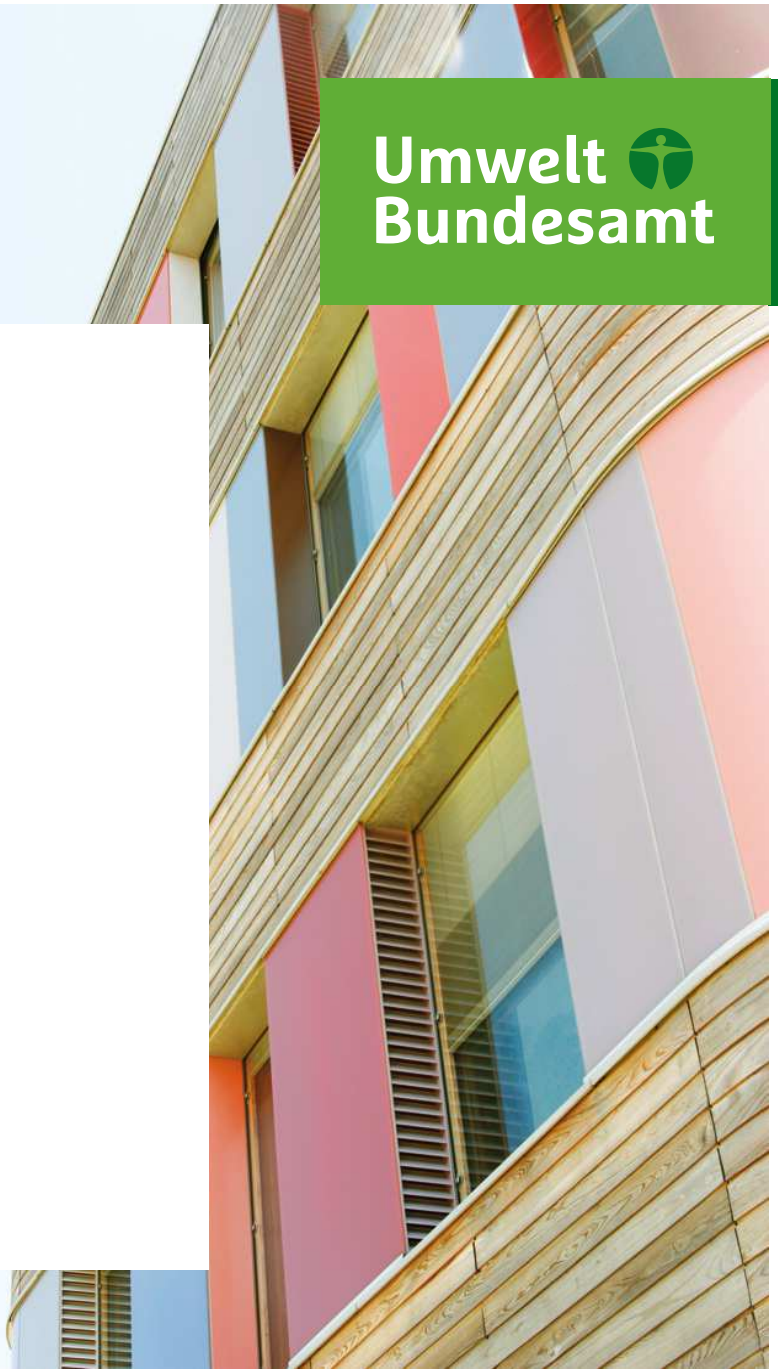
A possibility for a future energy flow according to an UBA scenario



In an energy system based on renewable energy, electricity could become the primary energy carrier. It can be used to produce gaseous and liquid energy carriers.

Conclusions – Greenhouse Gas Neutral Germany 2050

- The GHG-neutral energy supply is **technically feasible**.
- Final **energy consumption can be halved**, if saving potentials are consistently exploited and efficiency is increased across sectors.
- Conversion of renewable electricity into chemical energy sources: **Power to gas or liquid** – PTG & PTL will be important to supply industry with fuels and chemicals and also the transport sector with fuel.
- In an electricity-based GHG-neutral energy supply system, energy losses will be higher
- Because its production is more energy-efficient and no carbon source is needed, **hydrogen** should be used as a final energy source.



THANK YOU !

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