Monitoring of the 'Energiewende'

Why Germany is Presently not on Track?

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- 5th Monitoring Report of the Federal Ministry of Economics "Energy of the Future"
- Published in December 2016
- Topics:
  - Targets and indicators
  - Renewables
  - Energy demand and efficiency
  - Buildings
  - Transportation
  - Greenhouse gases and environmental impacts
  - Power plants and supply security
  - Affordable energy and competition
  - Grid infrastructure
  - Integration of the energy system
  - International context

- Assessment of Independent Expert Commission “Energy of the Future” of the 5th Federal Monitoring Report
- Published in December 2016
- Topics:
  - Credibility of the energy transformation
  - Organizing climate protection
  - Improving energy efficiency
  - Broad approach to transportation
  - Strategic REN development
  - Securing electricity infrastructure
  - Affordability of energy
  - Using digitalization

Agenda: Mixed Performance

- **Indicators showing the mixed performance of the 'Energiewende'**
- Renewable Electricity as a success story
- External reasons for the failure
- Internal reasons for the failure
- Conclusions for 2030 and beyond

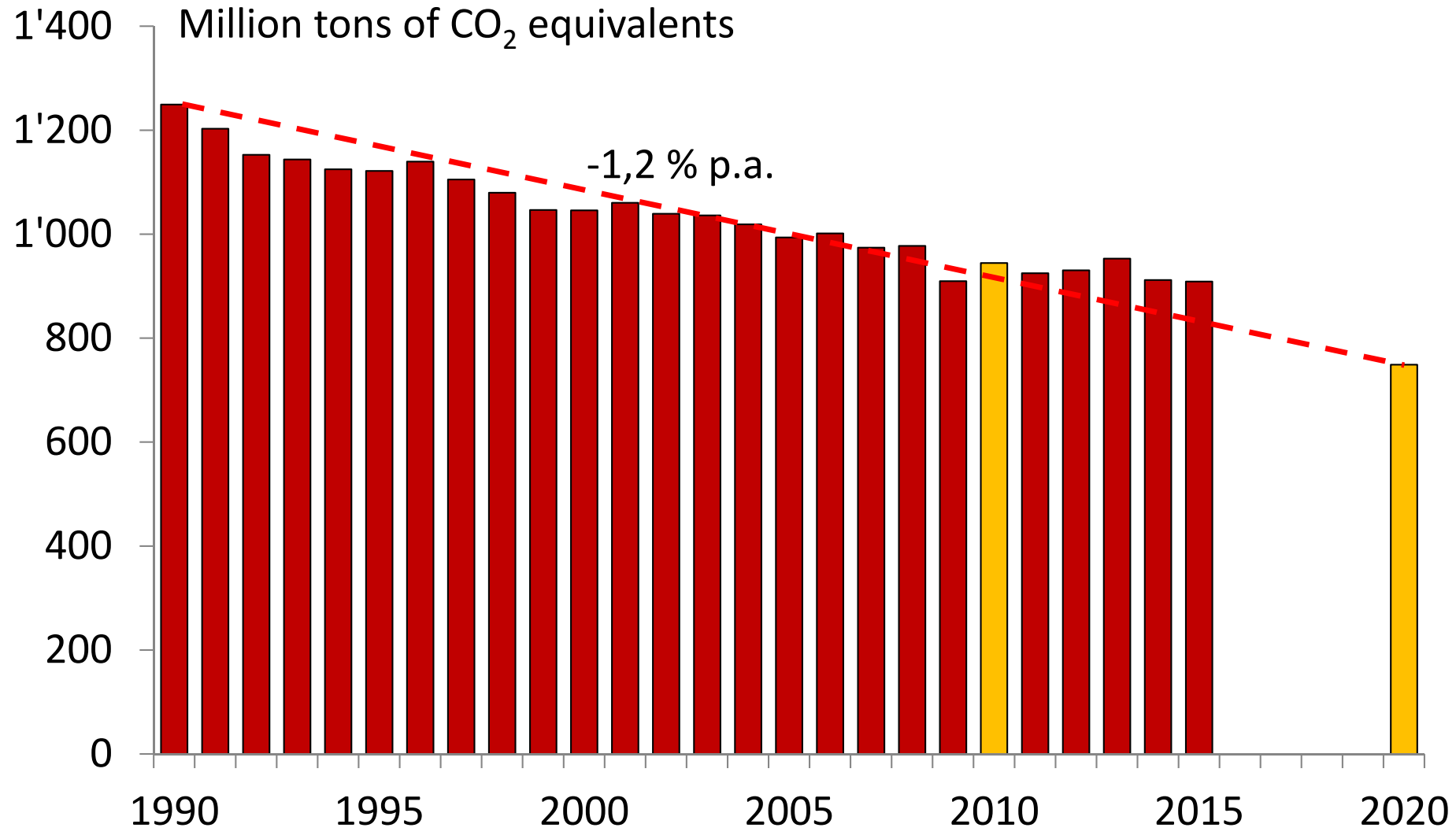
Energy Concept 2050 decided in 2010

[Germany; Source: BMWi & Energiew. Tagesfragen 67(2017)1]

	2016	2020	2050
Greenhouse gas emissions (base year 1990)	-27,3%	- 40%	-80-95%
Primary energy consumption (base 2008)	-6,5%	- 20%	-50%
Gross electricity consumption (base 2008)	-3,2%	-10%	-25%
Heat demand of buildings (base 2008)	-6,3%	-20%	
Final energy in transportation (base 2005)	+1,3%	-10%	-40%
Renewable share final energy	14,6%	18%	60%
Renewable share electricity	31,5%	35%	≥80%
Renewable share heat supply	13,0%	14%	
Renewable share transportation	5,2%	10%	

Greenhouse Gas Emissions in Germany

[BMWi 2017, Arbeitsgemeinschaft Energiebilanzen 2018]



Phase-out of Nuclear Power in Germany

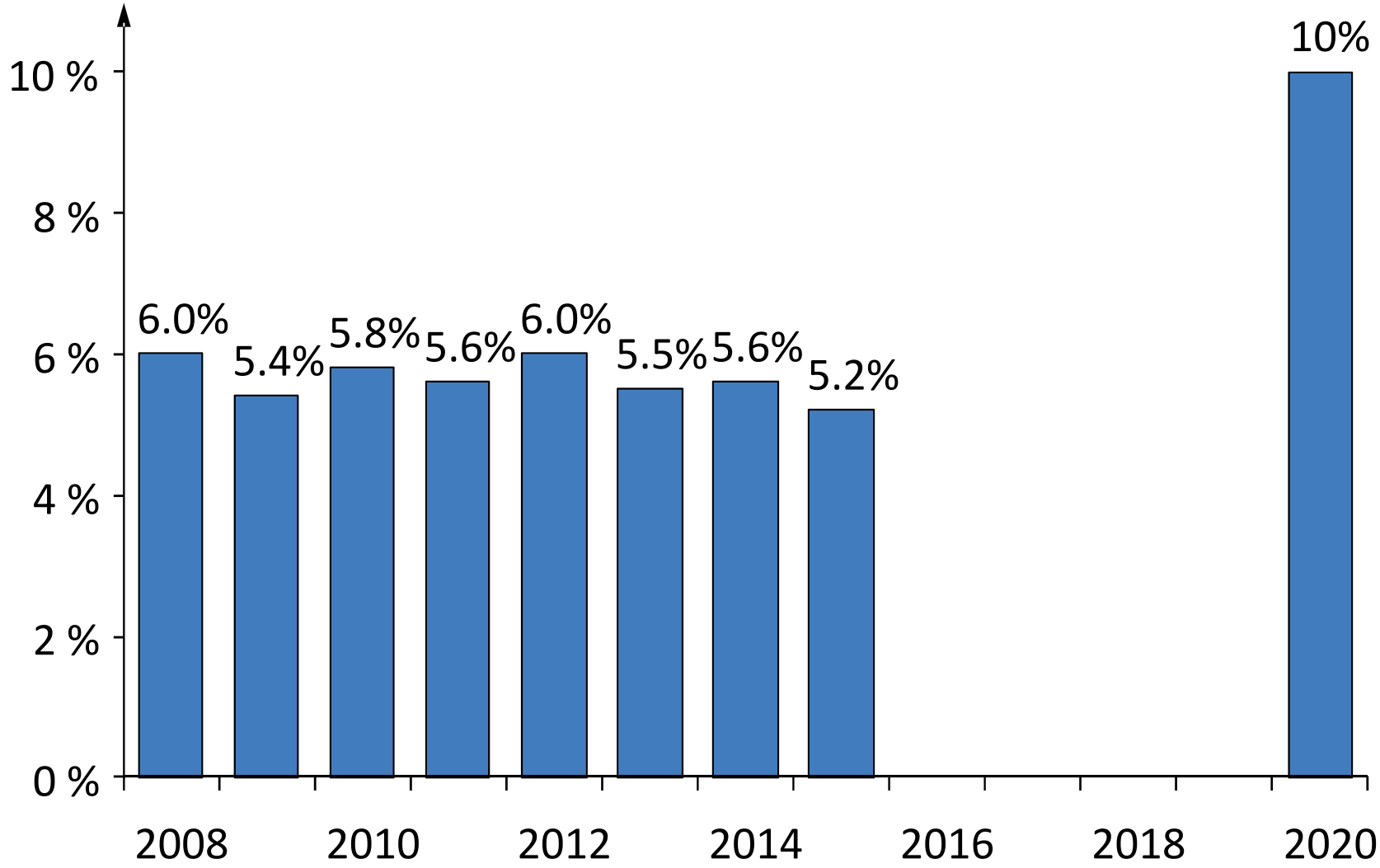
[Source: 5th Monitoring Report 2016]

- March 2011 (Fukushima): Phase-out decision
- In 2018, nearly 50% of the nuclear capacities is still operating:

	Phase-out until end of the year	Gross capacity (MW)
Philippsburg 2	2019	1‘468
Grohnde	2021	1‘430
Gundremmingen C		1‘344
Brokdorf		1‘480
Isar 2	2022	1‘485
Emsland		1‘406
Neckarwestheim 2		1‘400
		10’013

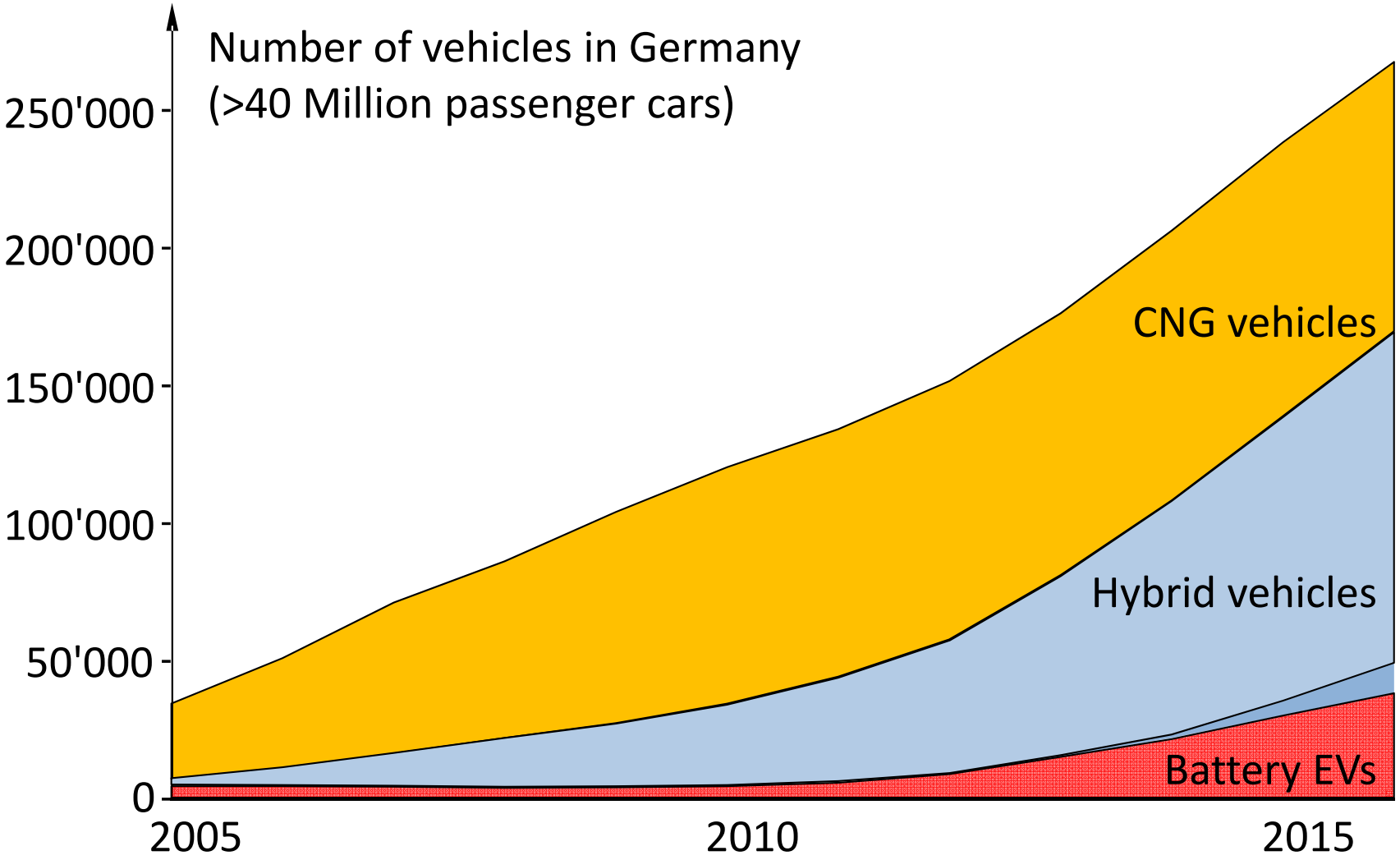
REN Share in Transportation

[Source: 5th Monitoring Report 2016]



Stock of Vehicles with Alternative Fuels

[Source: 5th Monitoring Report 2016]



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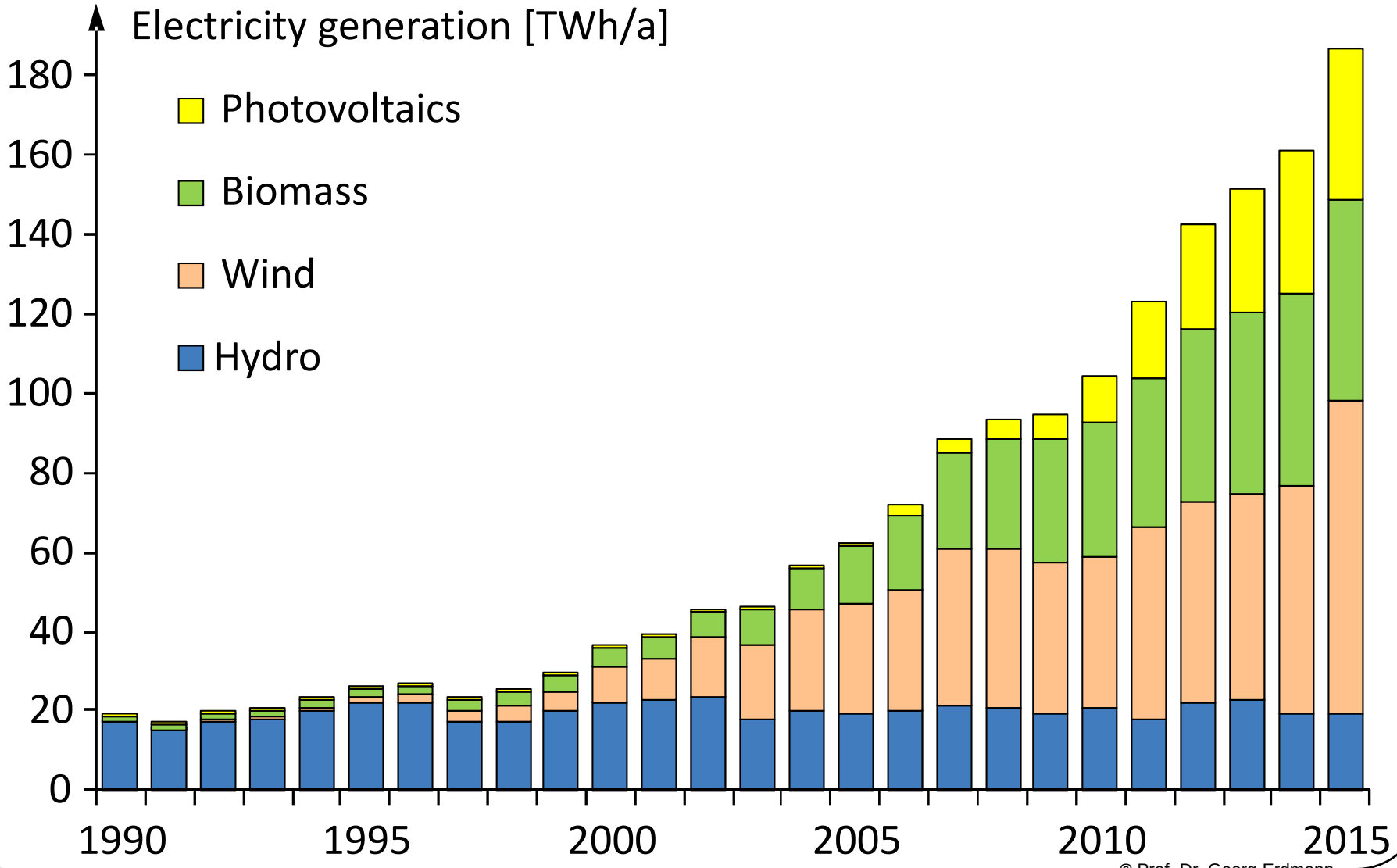
Renewable Electricity in Germany [Source AGEB]

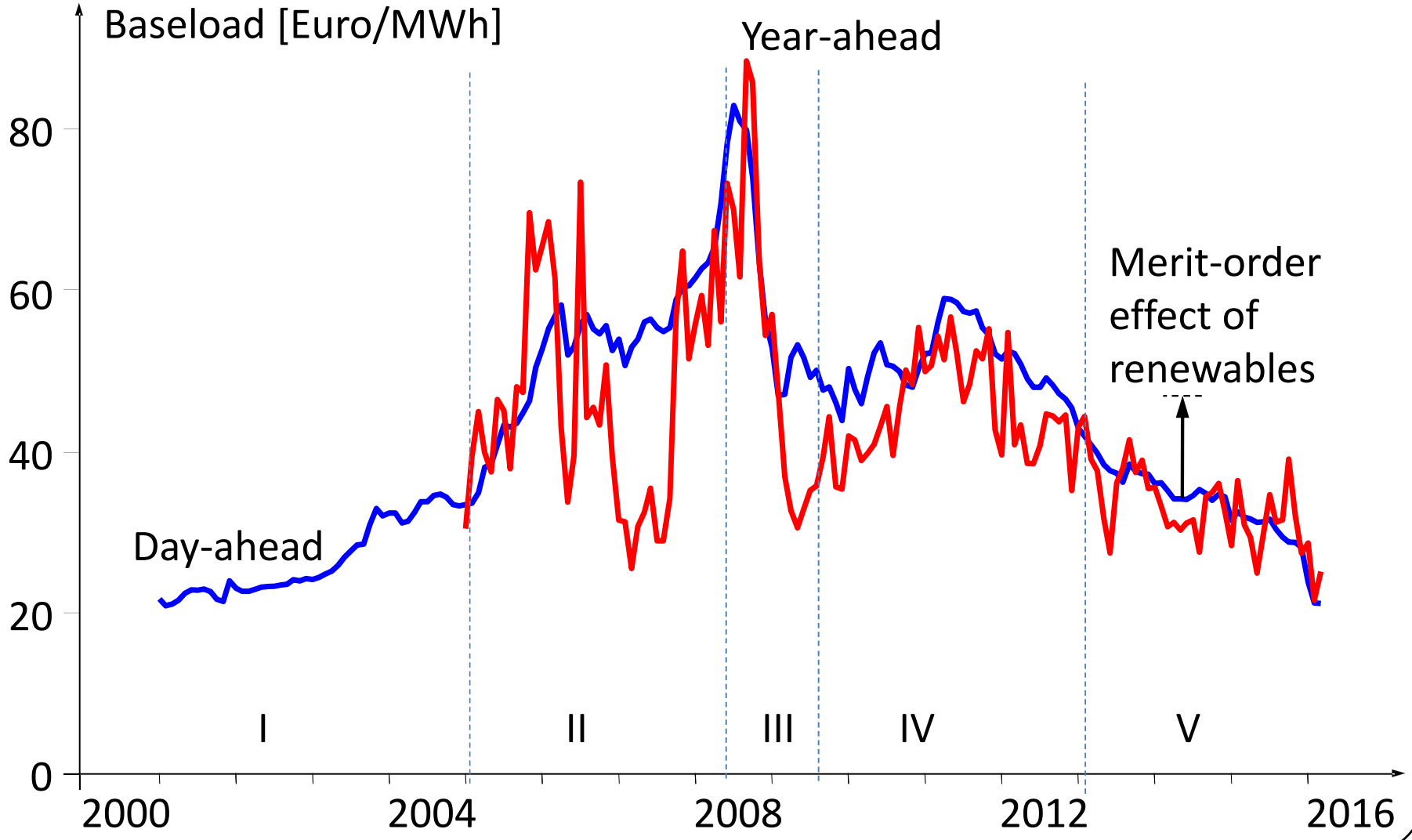


Expenditures for Electricity Consumption

[Assessment Report of the Independent Expert Commission 2016]

Billion Euros	2010	2011	2012	2013	2014	2015
Total annual expenditures	**60.9**	**63.6**	**64.3**	**71.0**	**70.3**	**69.4**
Expenditures induced by governmt	**17.2**	**23.0**	**23.3**	**30.0**	**32.3**	**31.3**
Electricity taxes	6.4	7.2	7.0	7.0	6.6	6.6
Concession fees	2.1	2.2	2.1	2.1	2.0	2.0
Renewable electricity levy	8.3	13.4	14.0	19.8	22.3	22.0
Combined heat and power Levy	0.4	0.2	0.3	0.4	0.5	0.6
Offshore grid levy (§ 17F ENWG)	-	-	-	0.7	0.8	0.0
Expenditures regulated by the government	**16.9**	**17.6**	**19.0**	**21.2**	**21.4**	**21.4**
Fees for the transmission grid	2.2	2.2	2.6	3.0	3.1	3.5
Fees for the distribution grid	14.7	15.4	16.4	18.2	18.3	17.9
Expenditures driven by the market	**26.8**	**23.1**	**22.0**	**19.8**	**16.6**	**16.8**
Market value of REN electricity	3.5	4.4	4.8	4.2	4.1	4.7
Generation, marketing and sales	23.3	18.6	17.2	15.6	12.6	12.0

Wholesale Power Prices [Sources: EEX, EPEX]



Success Factors for Renewable Electricity

- Favorable interest rates & high debt shares
  (typically 80% at the beginning of an REN investment)
- Renewable Electricity Act (EEG) provides state aid without budget constraints (until 2015/2035)
- Money collected directly from electricity customers
- No relevant opposition against REN support
  (special exemptions for energy intensive industries)
- Motivated through the anti-nuclear movement against the “big four”, entrepreneurial startups have proven that new technologies can be alternatives

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„External“ Reasons for the Failure

- Studies who justified the German ambitions 2010/11
  - Prognos/EWI/GWS (August 2010) „Energieszenarien für ein Energiekonzept der Bundesregierung“ für das BMWi
  - Prognos/EWI/GWS (Juli 2011) „Energieszenarien 2011“
- They underestimated population and GDP growth
  - ~300‘000 persons more in 2015
  - probably >1,1 Mio. persons more in 2020
- They oversaw net electricity exports (54 TWh in 2016)
- They used unrealistically high energy and CO_2 prices

International Energy Prices versus Forecast of Prognos/EWI/GWS 2011

		Realized 2008	Forecast for 2015	Realized 2015	**Difference 2015**
Crude oil price	USD/Barrel	94	90	50	**-44.4%**
Crude oil price	Euro/t	484	495	356	**-28.1%**
Natural gas border price	Euro/MWh	27	24	20	**-16.7%**
Hard coal price	Euro/t.c.e.	112	82	68	**-17.1%**
ETS price	Euro/t	17,40	15	7,45	**-50.0%**

Problems with Scenario Studies

- Recent projections and scenarios of Fraunhofer ISI/Öko-Institut for the Federal Ministry of the Environment (BMU) assume for 2030
  - Crude oil price of 114 US$/Barrel (!)
  - ETS price of 35–50 €/t
- If prices would be lower the challenges of meeting ambitious GHG targets are larger
- Why alternative scenarios with low energy and GHG prices are systematically not taken into consideration?

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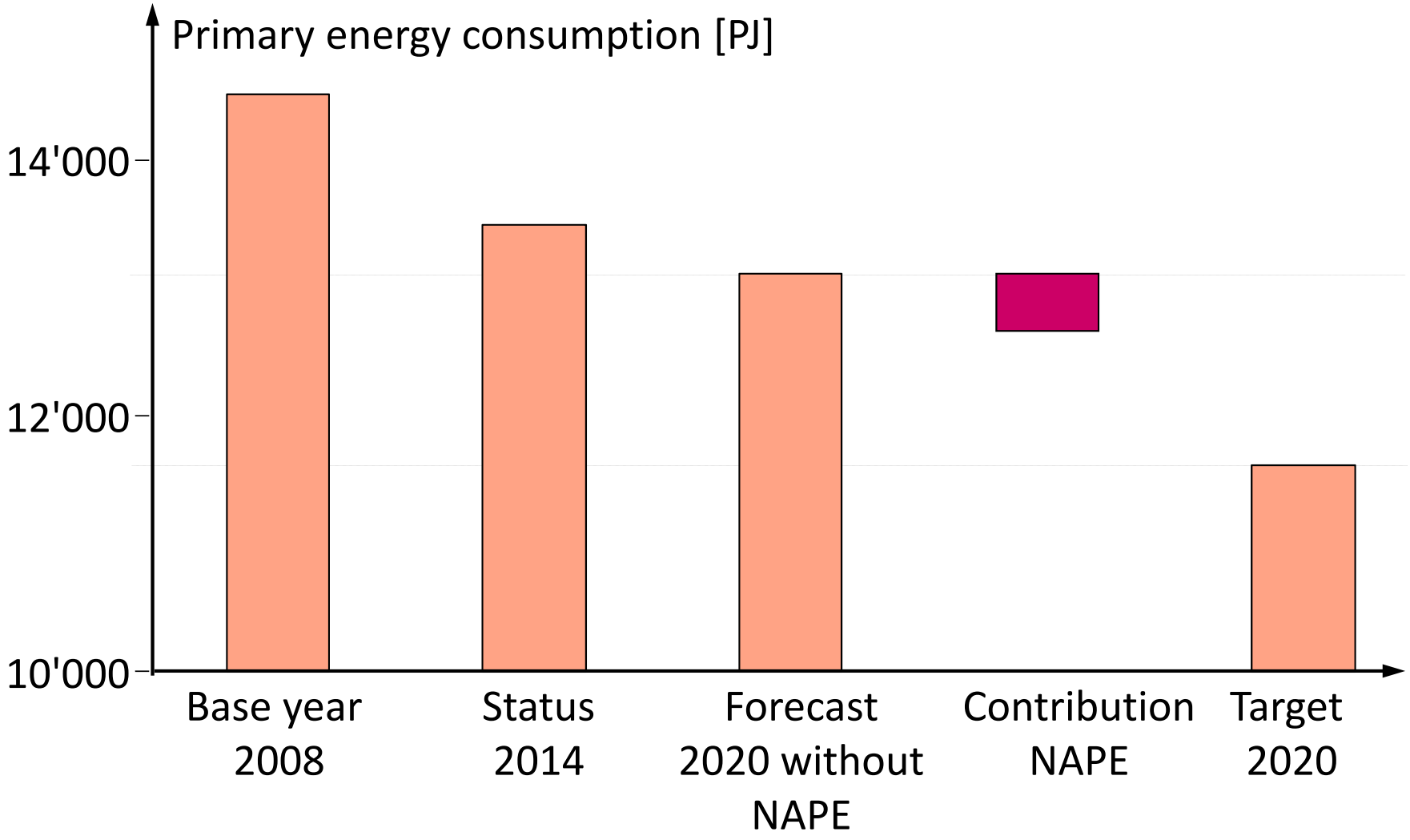
„Internal“ Reasons for the Failure

- Missing compensation for the accelerated nuclear phase out (~50 million tons of CO_2 in 2020)
- Insufficient intensity and performance of instruments (National Action Plan Energy Efficiency NAPE, subsidies in favor of electric vehicles)
- Insufficient ability of the government to overcome the opposition of relevant interest groups against effective measures, in spite of the public support of the ‚Energiewende‘ (phase-out of lignite power generation, opposition causing delays of power grid extension, financial program to support energy efficient buildings …)

National Action Plan Energy Efficiency NAPE

[Impact of 28 individual measures proposed by the government in 2014]



Selection of Important NAPE Measures

[Source: 5th Monitoring Report 2016]

	Short-term measures	Expected energy reduction in 2020 [PJ]
1	Energy consulting	4.0
2	Modernization of buildings	13.0
3	CO_2reductions in buildings	12.5
4	Energy efficiency auctions	26 – 51.5
5	Energy efficiency Contracting	5.5 – 10
6	Energy efficiency in production	29.5
7	Energy efficiency networks	74.5
8	Top-runner program (with EU)	85.0
9	Energy audits	50.5
10	Efficiency label for heating systems	10.0
11	Other short-term measures	~10
	Total	320 - 350
	Efficiency measures in transportation	110 - 162

Asymmetric Emotionalization

- The emotionalizing anti-nuclear debate of the 1980ies has no equivalent in the building and the transportation sectors
- Thought experiment: If the building sector and the transportation sector would each receive state aid of ~20 billion Euros annually, what would be the consequence on GHG emissions?
- While renewable electricity is supported by the popular Renewable Energy Act (EEG), most other instruments are based on debates among experts
- Can the proposed “Climate Protection Act” help?

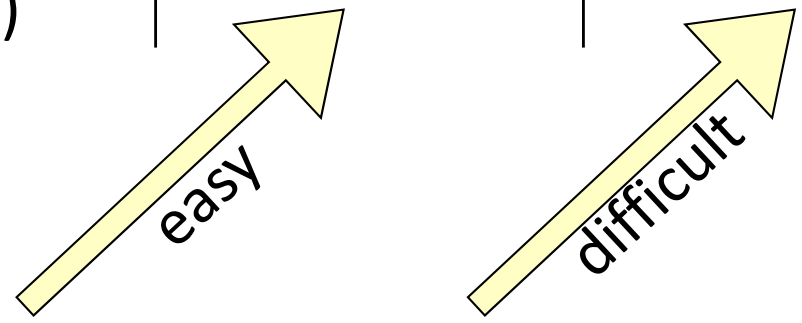
Federal Climate Protection Plan 2050

[Proposal according to a Cabinet Paper of 07.11.2016]

Action field [Mio. t CO_2 equiv.]	1990	2014	2030 (absolute)	2030 (reduction against 1990)
Energy sector	466	358	170 – 180	64 – 61 %
Buildings	209	119	70 – 80	67 – 62 %
Transportation	163	160	95 – 98	42 – 40 %
Industry	283	181	130 – 133	54 – 53 %
Agriculture	88	72	58 – 61	34 – 31 %
Total	1248	902	533 – 562	57 – 55 %

German GHG Perspectives Towards 2030

	GHG emissions (Mio. tons)	Thereof: EU-ETS sectors (Mio. tons)	Non-ETS sectors (Mio. tons)
1990	1248		
2005	992	521	471
2030 EU proposal	589 (-53% against 1990)	297	292



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