The German Energiewende

Uwe Nestle

Agder energi workshop, Kristiansand (Norway)

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EnKliP

Energy and Climate Policy | Consulting

FÖS | GREEN BUDGET GERMANY
FORUM ÖKOLOGISCH-SOZIALE MARKTWIRTSCHAFT

What is EnKliP?

EnKliP stands for Energy and Climate Policy I Consulting

EnKliP is Uwe Nestle as a freelancer

Uwe Nestle is

- **Engineer for Technical Environmental Protection**
- **Expert for Energy Policy**
- **Gained experience in the Federal Ministry for the Environment for about 10 years**

EnKliP is ready to

- **Produce studies and analyses**
- **Give talks**
- **Work national and international**

Content

General Aspects of the Energiewende

Electricity Market Design

Costs of Renewable Energy in the Power Sector

The New Renewable Energy Sorces Act (EEG)

Balancing Wind and Solar Power

Effects of the Energiewende to the Neighbors

Challenges

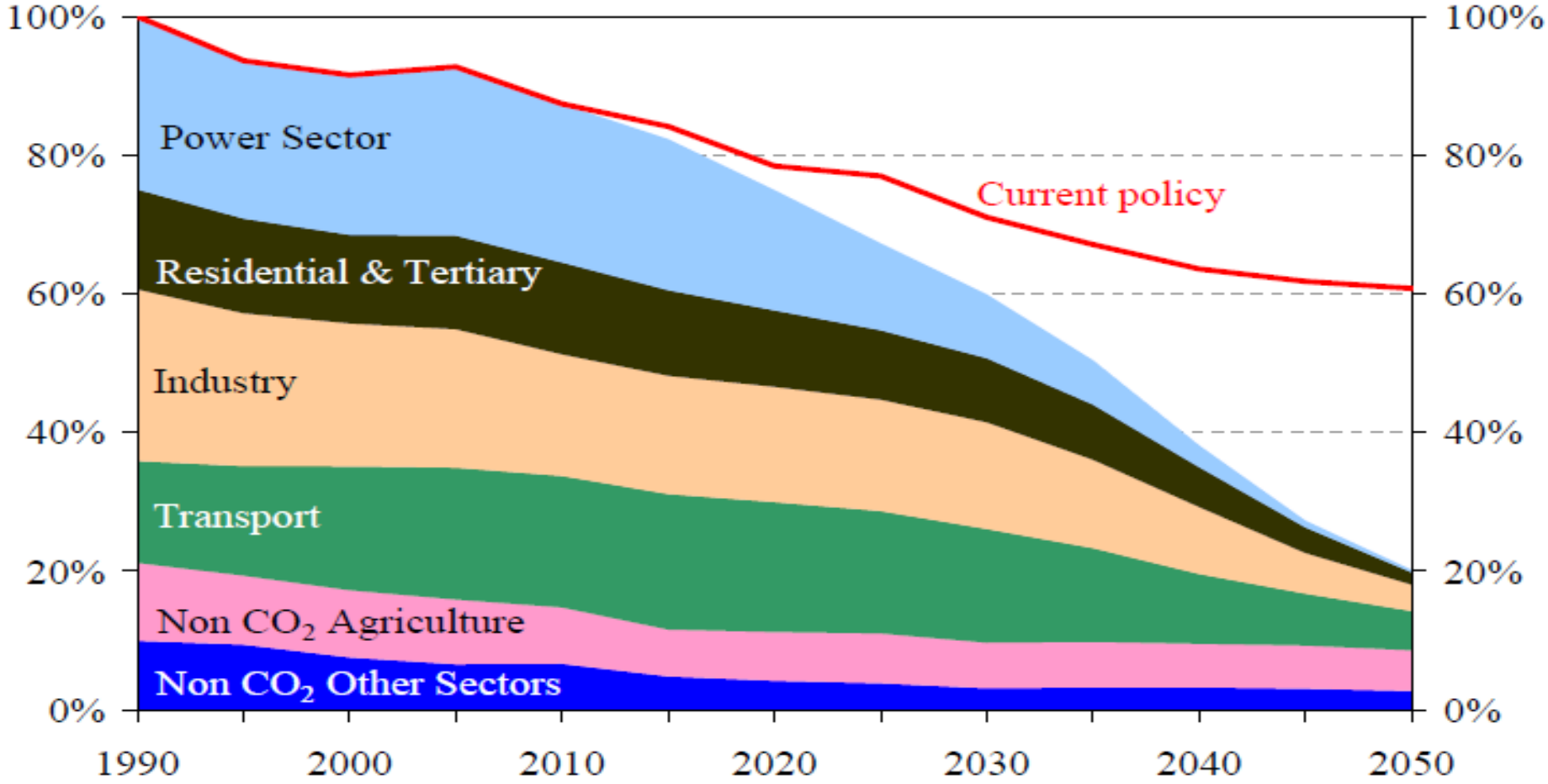
Kofi Annan 2014

Former Secretary General of the United Nations

"The Climate Crisis threatens the well-being of hundreds of million people. It undermines the human right to food, water, health and security.

This is not only a worrying future scenario but is already happening today."

Challenges



Reductions in EU GHG emissions in order to achieve a domestic reduction of 80% by 2050 (100% = 1990)

(EC 2011, Roadmap for moving to a competitive low carbon economy in 2050)

Challenges

In the power sector, affordable and almost zero-emissions technologies exist

Renewables:	Wind power
	Solar power
	Hydro power
	Geothermal power
	Biomass
Carbon Capture, Transport and Storage (CCTS):	Still relevant GHG-emissions Not available before 2020
Nuclear:	No sustainable option

Challenges

German generation system needs modernisation

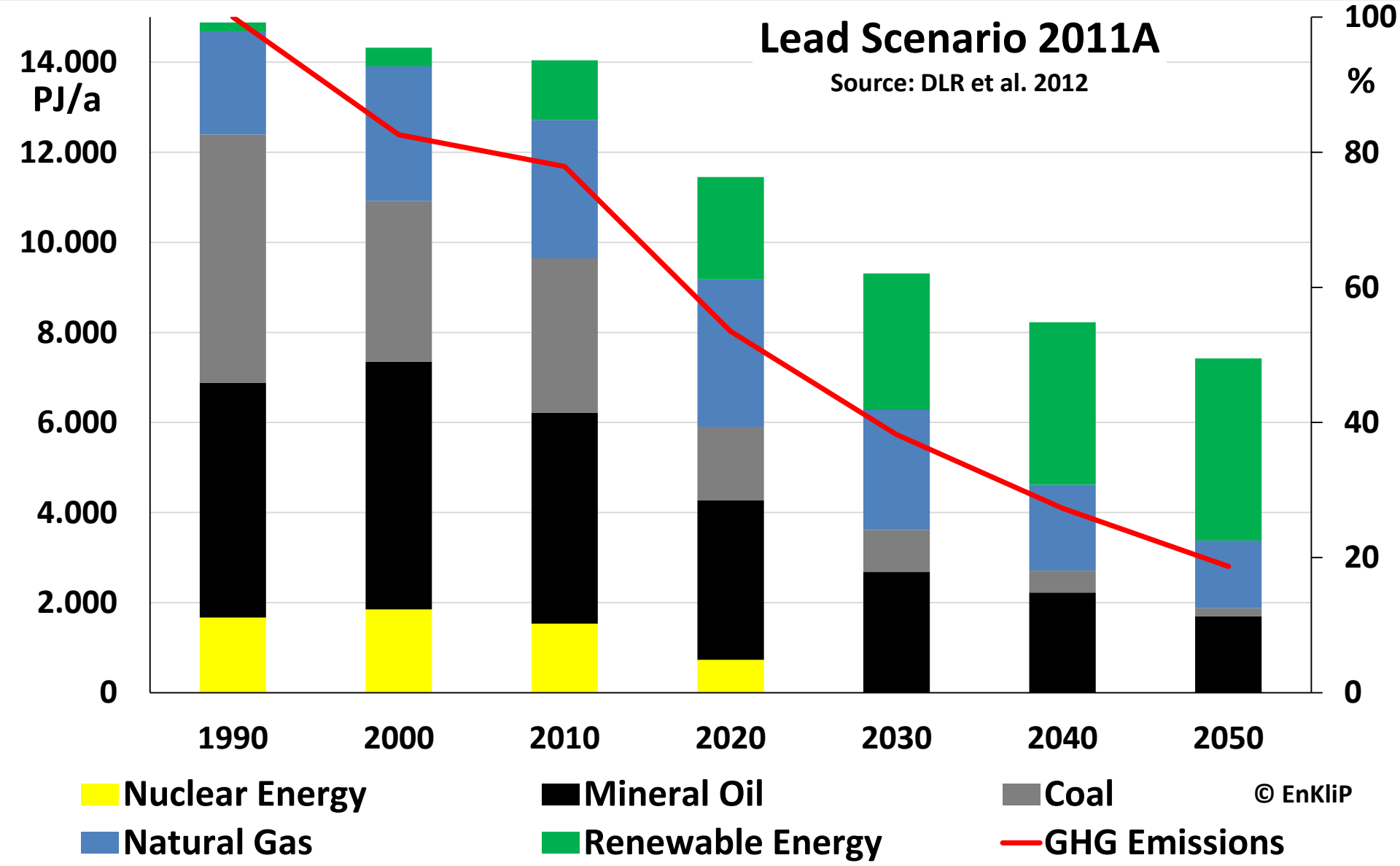
A) For climate protection reasons

B) Many power plants are old

- 50% of installed coal capacity is older than 30 years
- 25% of installed coal capacity is older than 40 years
- 40% of installed natural gas capacity is older than 30 years
  (source: BNetzA)

C) Phase out of nuclear power until 2022

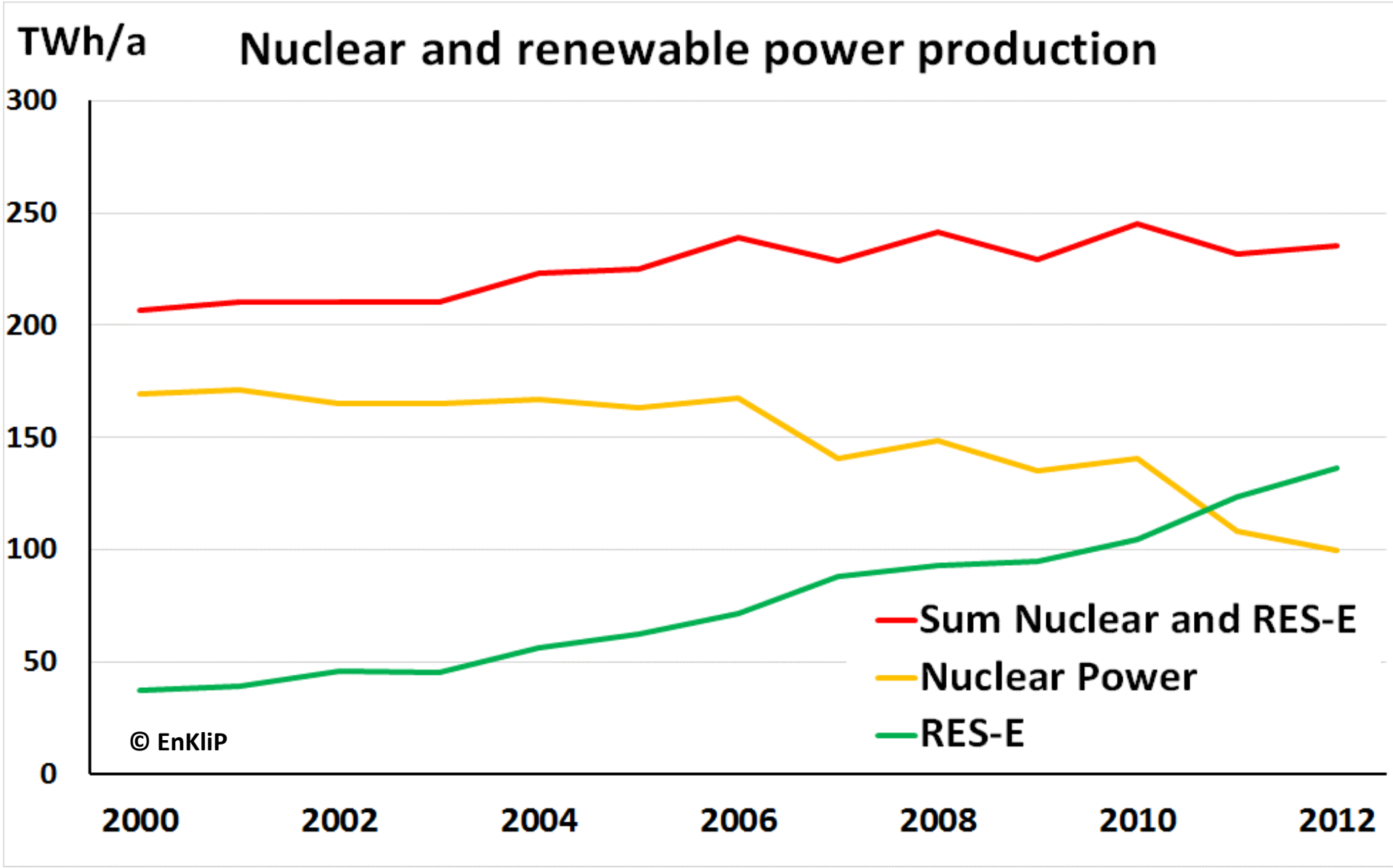
Possible energy future of Germany (Governmernt Study)



The Start of the German Energiewende in 2000

	Major instruments of the Energiewende
1999	Ecological Tax Reform (until 2002)
1999	Strong increase of subsidies for RES-Heating
2000	Renewable Energy Sources Act (EEG)
2002	Act to phase out nuclear power
2003	Ecological Finance Reform
2006	Strong increase of subsidies for efficiency in the heating sector
2010	Prolonged running time of nuclear power plants
2011	2. Act to phase out nuclear energy. New: Deadline 2022

The Energiewende is a success



CO2-emissions in the power sector 1990 to 2014

Source: Agora Energiewende 2015

Reduced CO2-emissions by the power sector:

➔ **Minus 6 % since 2000, minus 16 % since 1990**

Source: www.epexspot.com

The Energiewende is a success

Increase of electricity export since 2002

➔ From balanced to 9 % of total consumption in Germany

Decreasing nuclear power production since 2000, strongly in 2011

➔ Minus 43 % since 2000 (used to be one quarter+ of production)

➔ Increasing natural gas consumption in electricity sector until 2010

➔ Power demand decreasing since 2007

Decreasing hard coal consumption in electricity sector since 1990

➔ Minus 23 % since 2000

Decreasing nuclear power production since 2000, strongly in 2011

➔ Minus 43 % since 2000

Increasing RES-E share since 1990

➔ RES- production increased by for times

Source: www.epexspot.com

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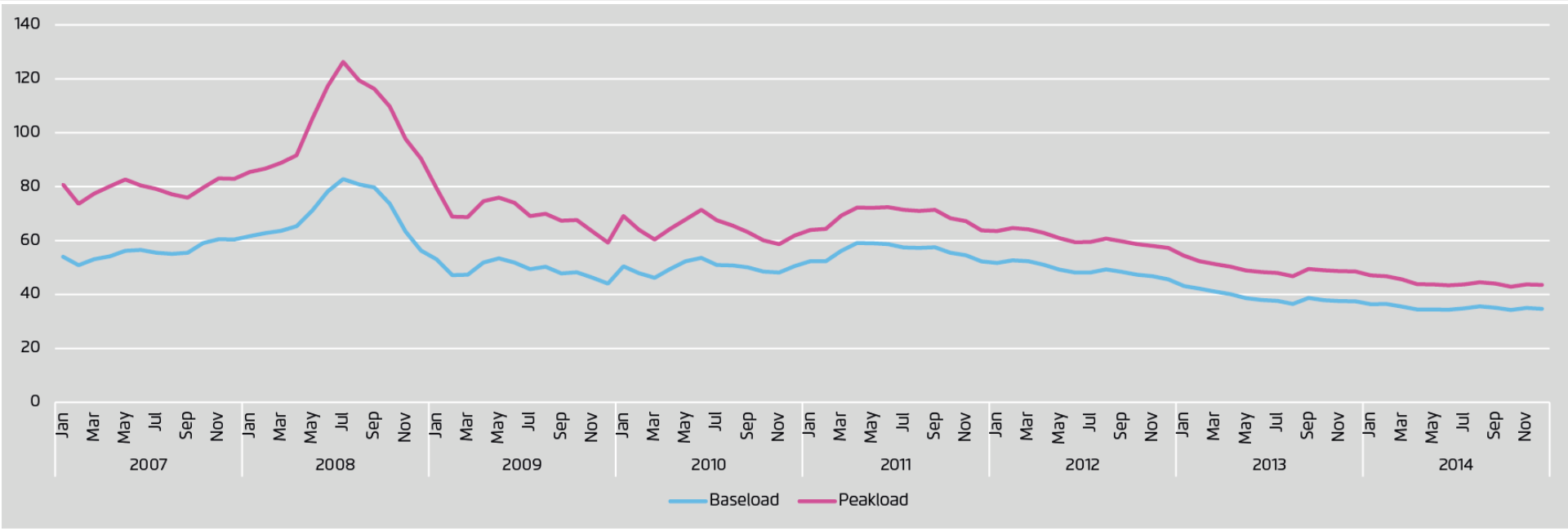
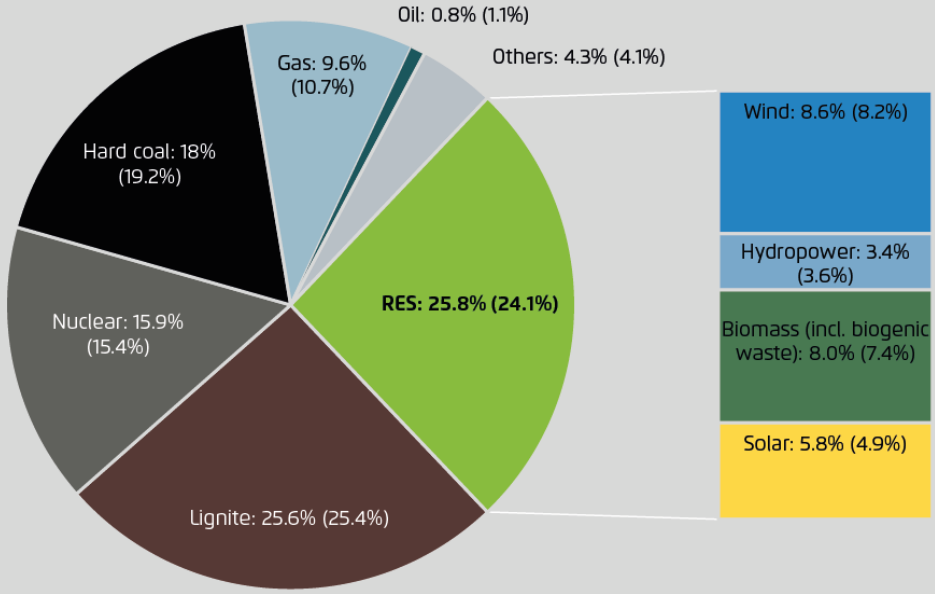
Electricity Prices at the EEX (Annual Futures) form 2007 to 2014



Source: Agora Energiewende 2015

Source: www.epexspot.com

The structure of the power generation system



Source: Agora Energiewende 2015

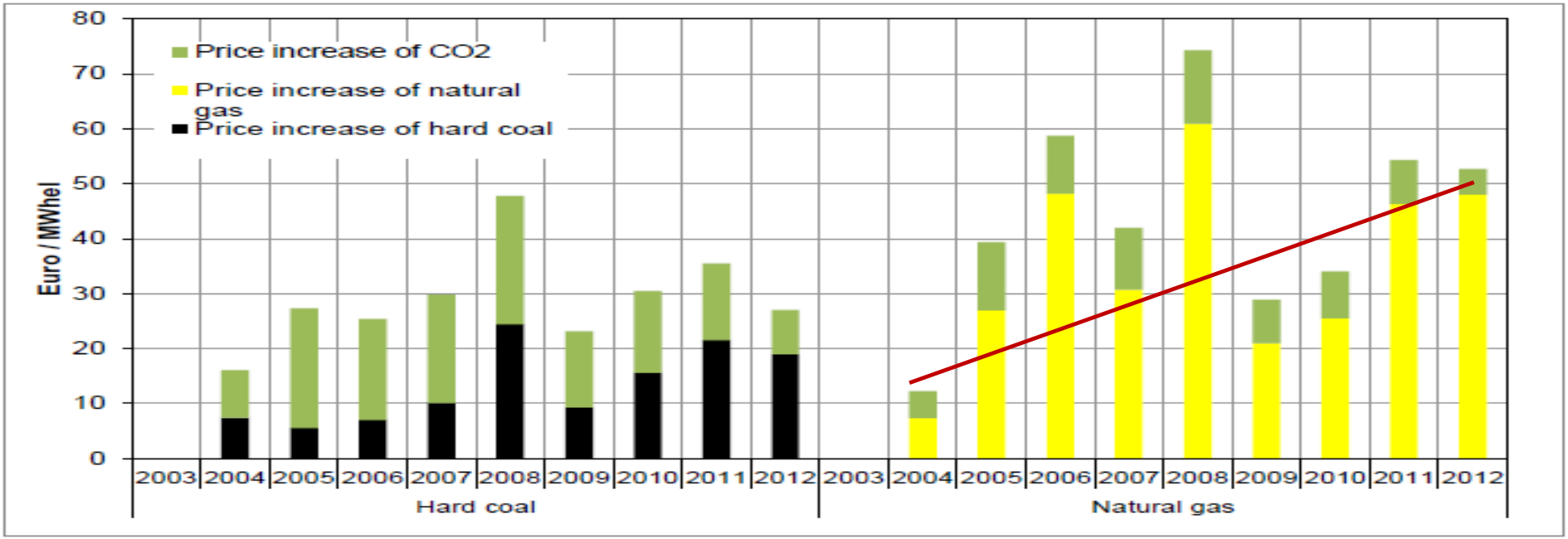
Nuclear phase out by 2022

Many fossil power plants are old and need to be replaced

Climate protection not possible with coal power plants

Costs for older hard coal and natural gas power plants

Figure S1 *Development of short-term marginal costs for older gas- and coal-fired power plants (which set the price on the electricity market) in Germany as a result of fuel and CO_2 price developments on the futures market, 2003 to 2012*



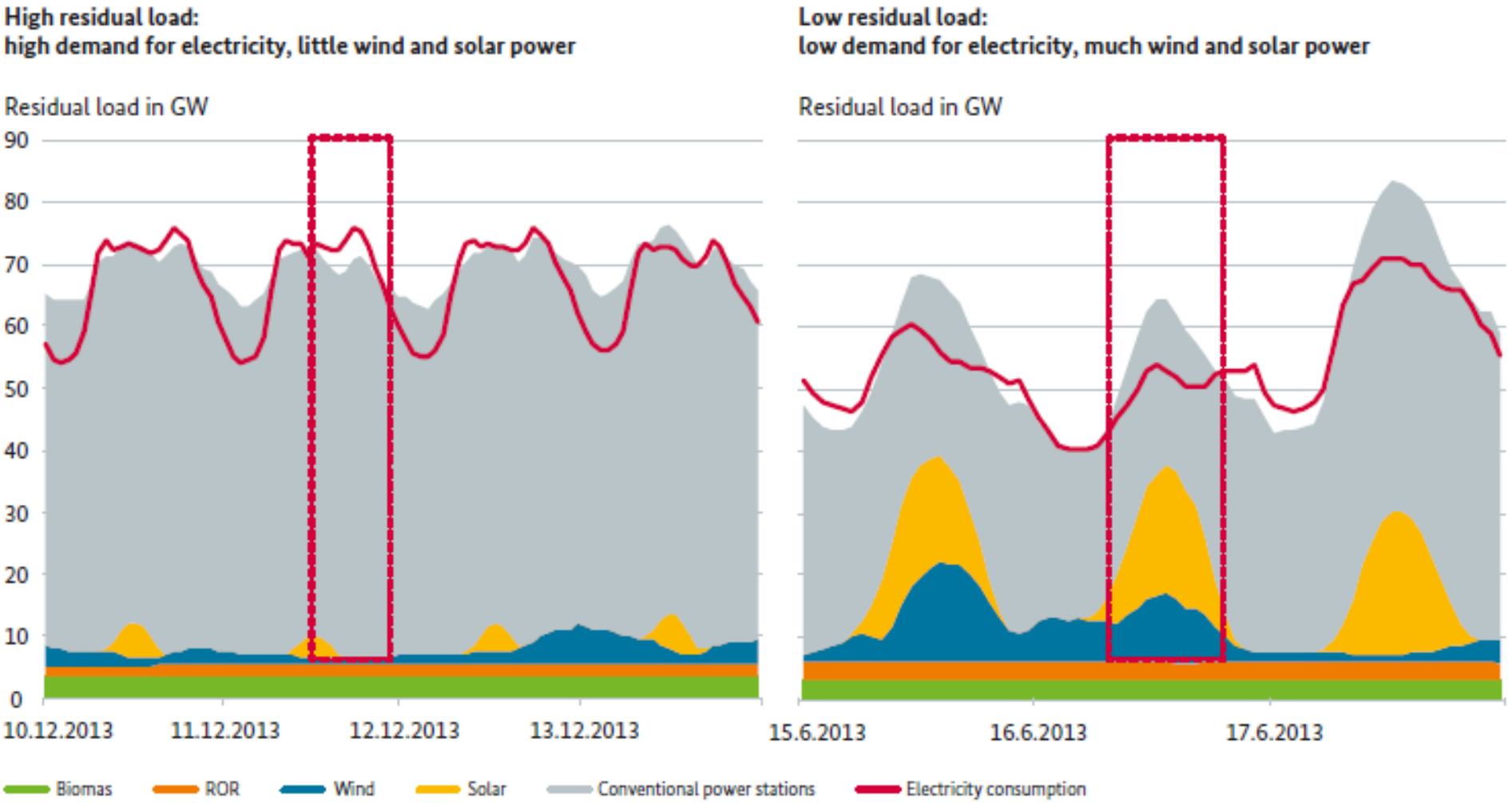
Source: Öko-Institut 2012

➔ **Electricity price at the EPEX: about 40 €/MWh, further dropping**

➔ **Electricity costs of older natural gas power plants are higher than market price!**

➔ **Only few full load hours possible**

RES-E-production, demand and production



Source: BMWi 2014

The challenge

Due to steady low and dropping prices for electricity,

many existing power plants do not make profits any more,

in particular gas power plants might be phased out,

no investments in new power plants – except of RES-E.

➔ This might become a problem for the security of power supply – if renewables can´t do it alone

Decision of principle is required

Optimised electricity market (Electricity Market 2.0)
or
Additional market (Capacity Market)

Proposal: Electricity Market 2.0

<u>No regret measures:</u>

Developing the spot and balancing markets further strengthen incentives to uphold balancing group commitments

Optimising network charges and state-imposed price components

<u>Expanding and otimising power grids</u>

<u>Accept extreme price peaks</u>

<u>Capacity reserve as a safeguard</u>

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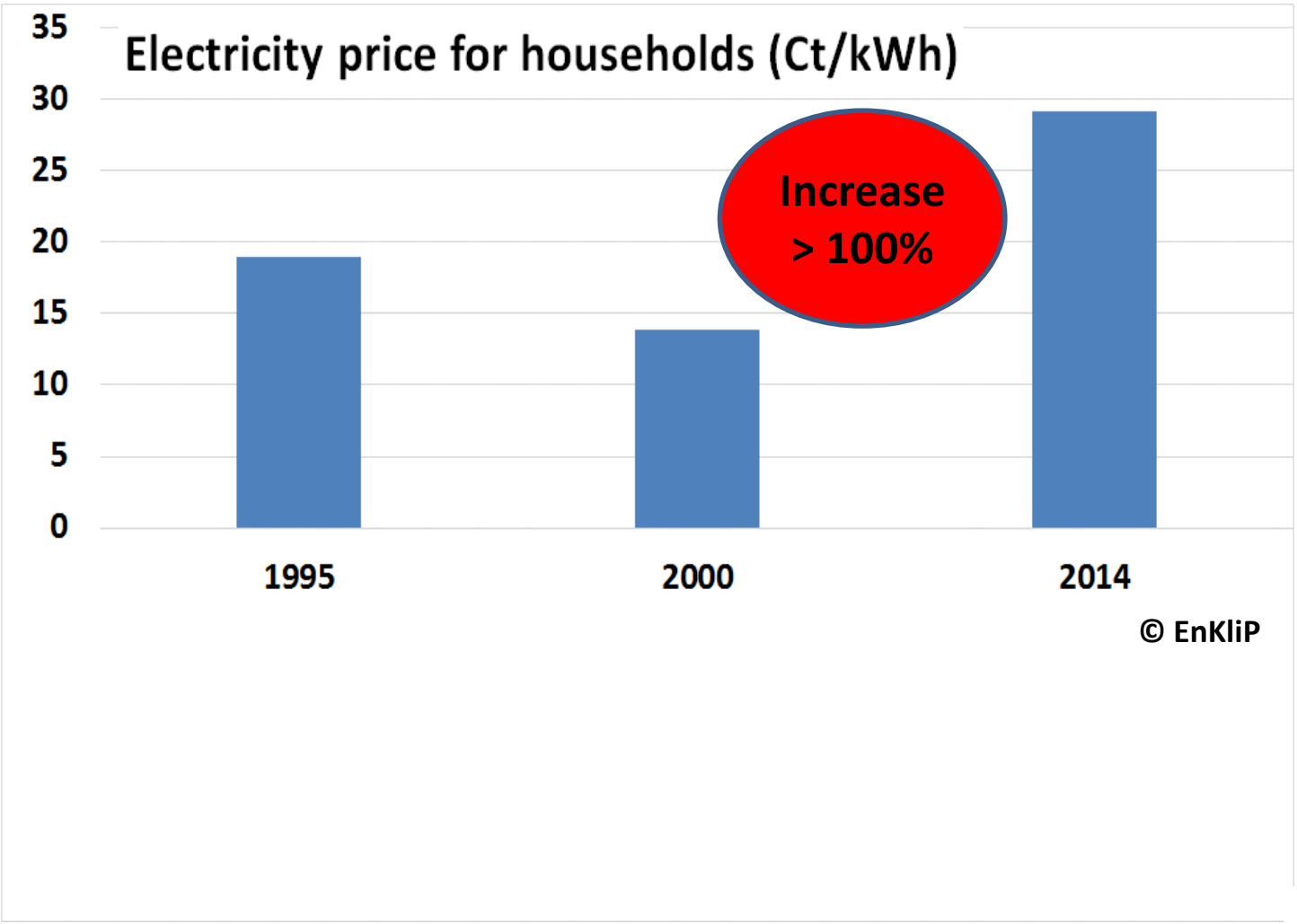
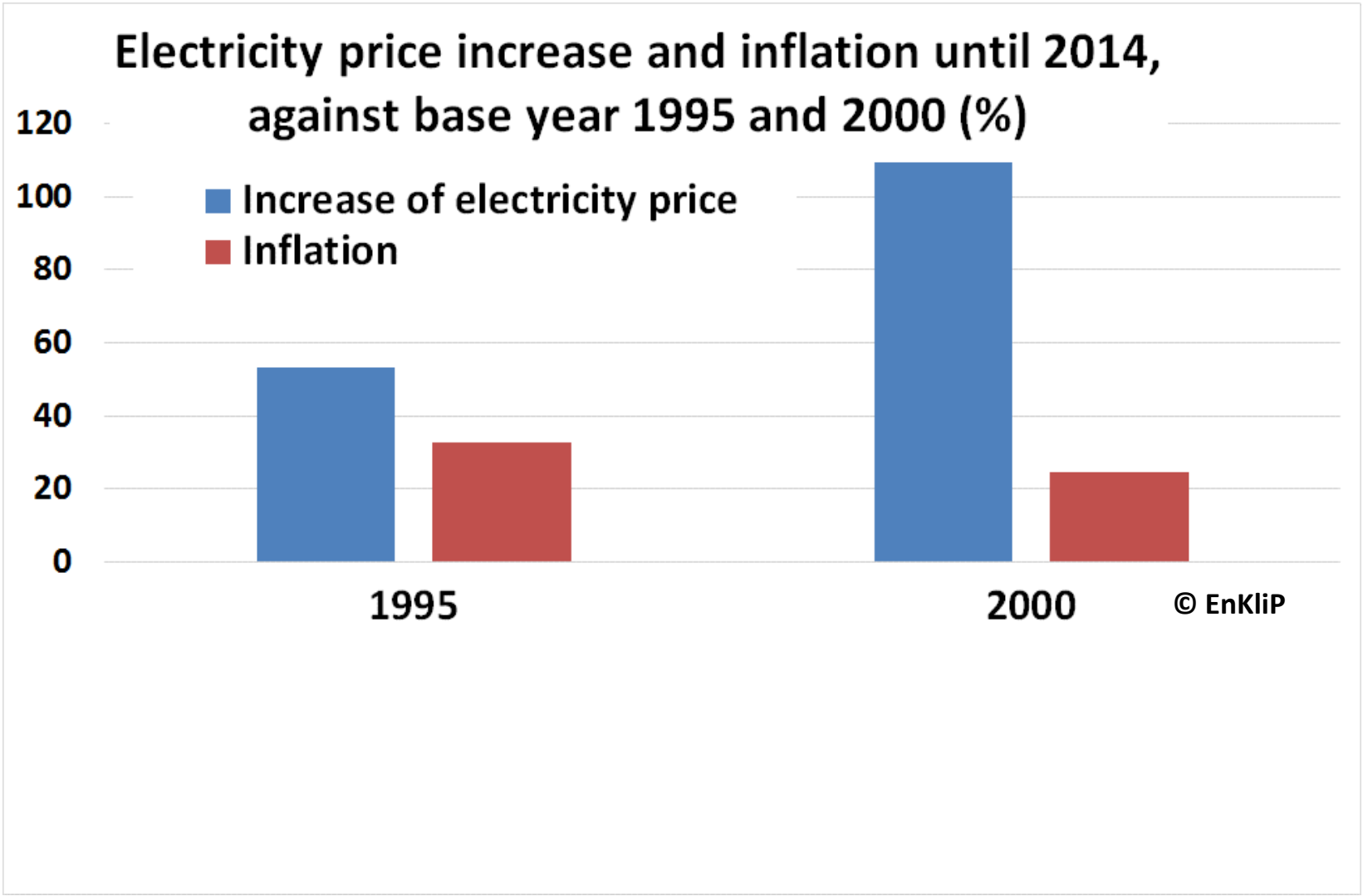
RES-Costs



© EnKliP

RES-Costs


Electricity price increase and inflation until 2014,
against base year 1995 and 2000 (%)
120
100
80
60
40
20
0
Increase of electricity price
Inflation
1995
2000
© EnKliP

RES-Costs

EEG-surcharge 2015: 6,2 Ct/kWh, for 27 % RES-E

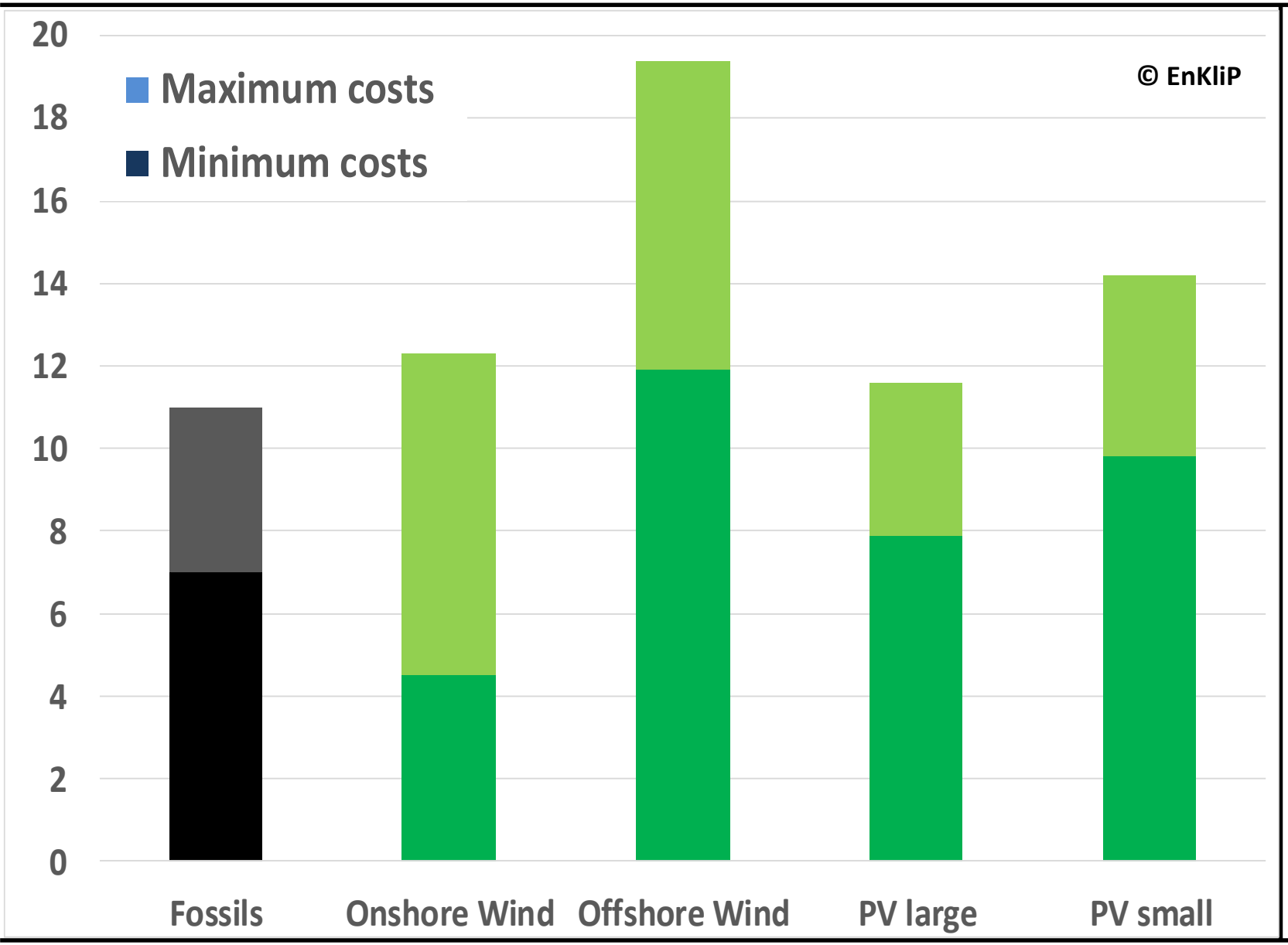
EEG-surcharge ≠ extra costs for RES-E extansion

EEG-surcharge compares

- **full costs of new RE-installations with**
- **operation costs of old, written down and subsidised conventional power plants**

➢ ***A fair calculation would compare the electricity generation costs of <u>new</u> conventional and renewable power plants***

Production costs for power generation with new power plants



Sources:

Prognos 2013

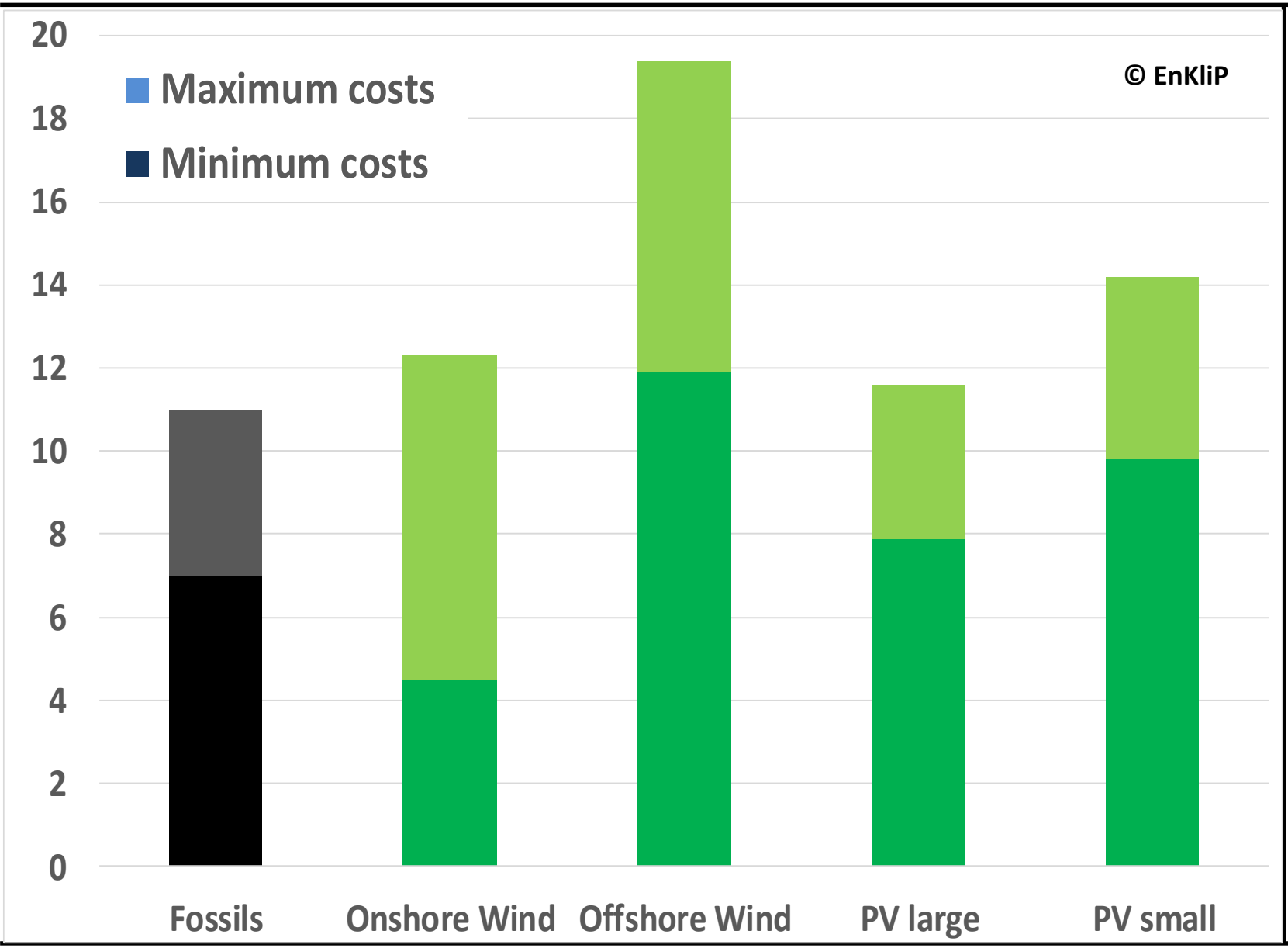
Agora 2013

DECC 2012

Fhg ISE 2013

FÖS 2012

Production costs for power generation with new power plants



External costs:

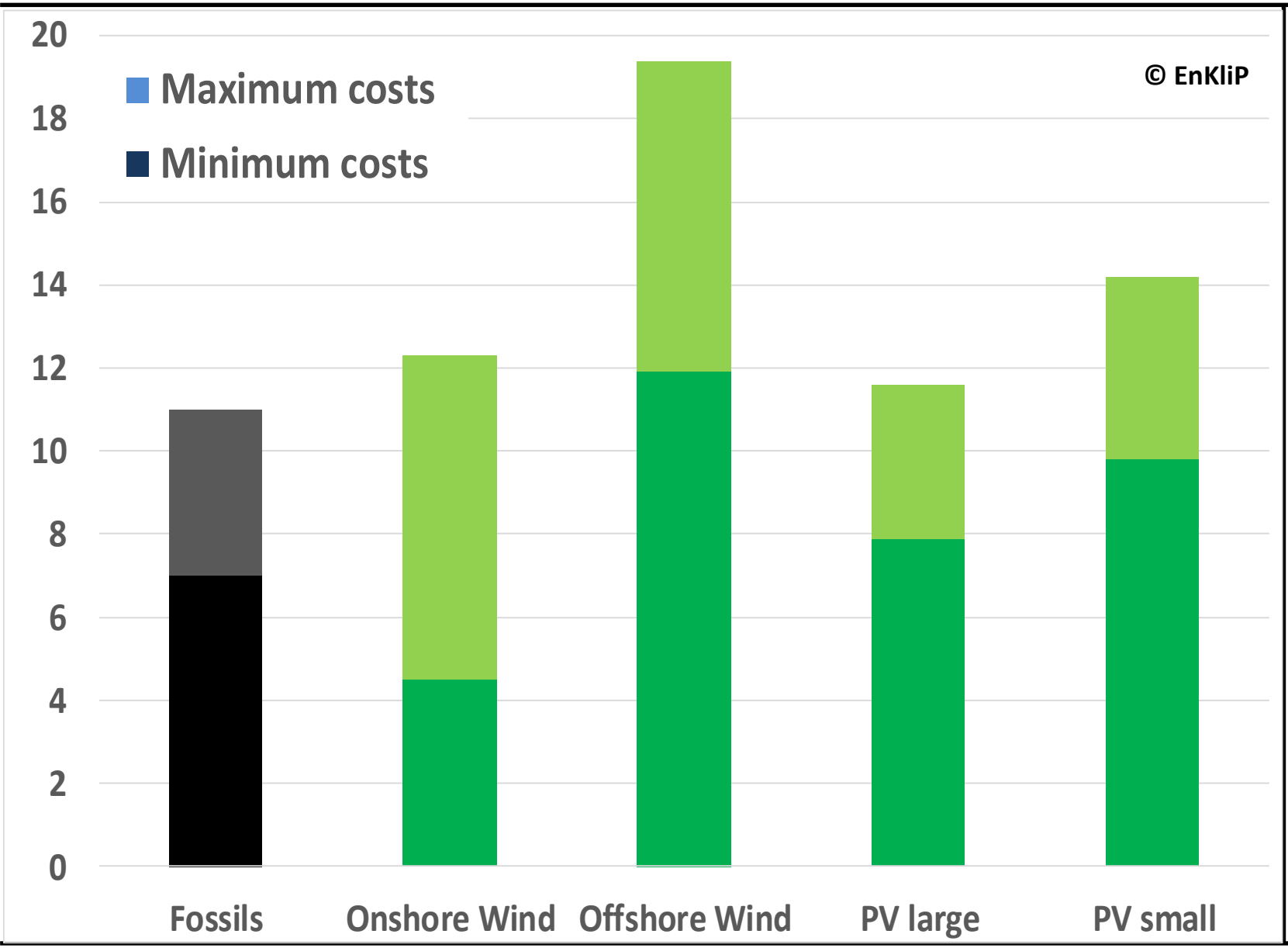
Brown coal:
9,2 Ct/kWh

Hard coal:
7,5 Ct/kWh

Gas:
3,8 Ct/kWh

Nuclear:
9-35 Ct/kWh

Production costs for power generation with new power plants



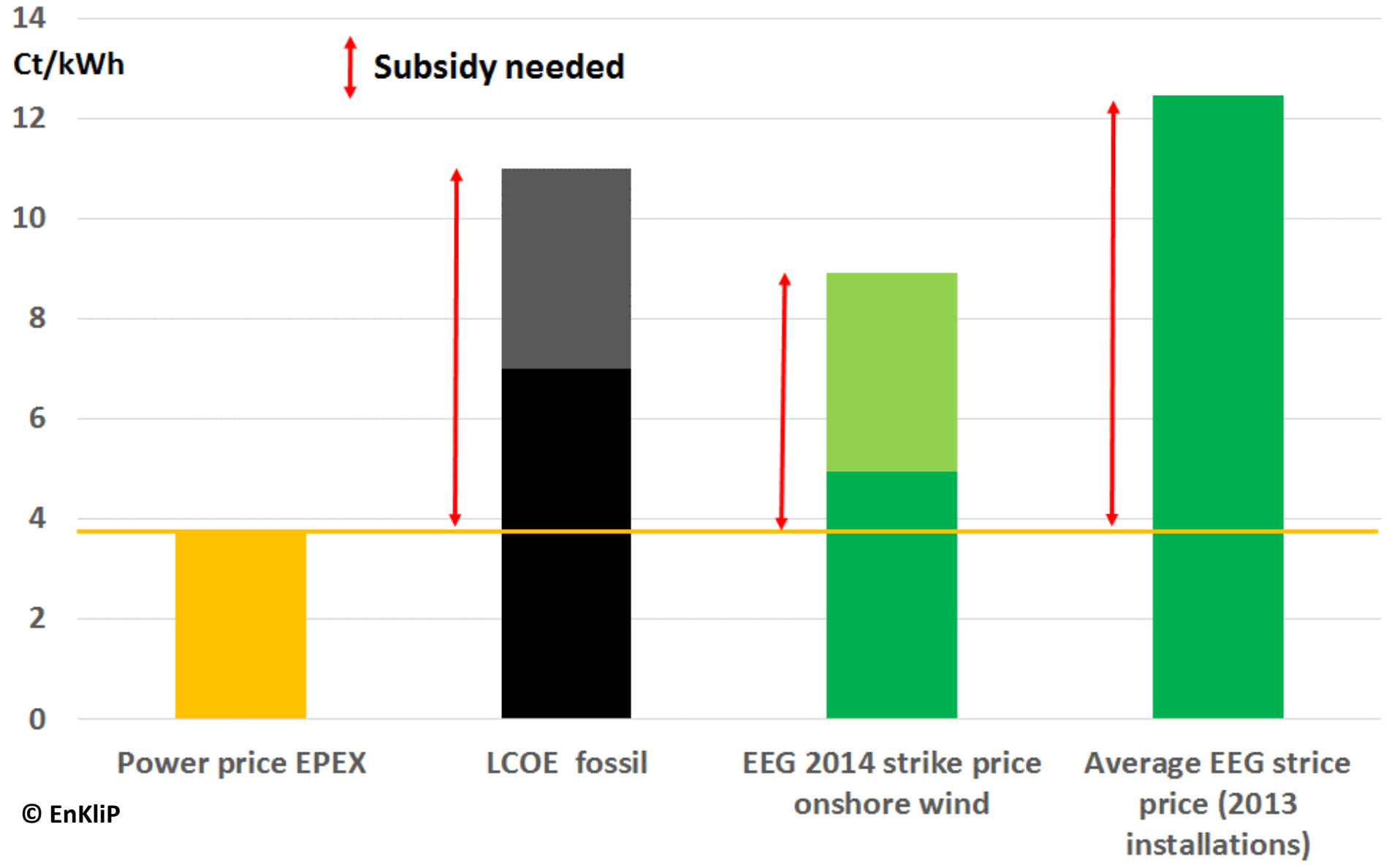
Trend:

RES-E ↘

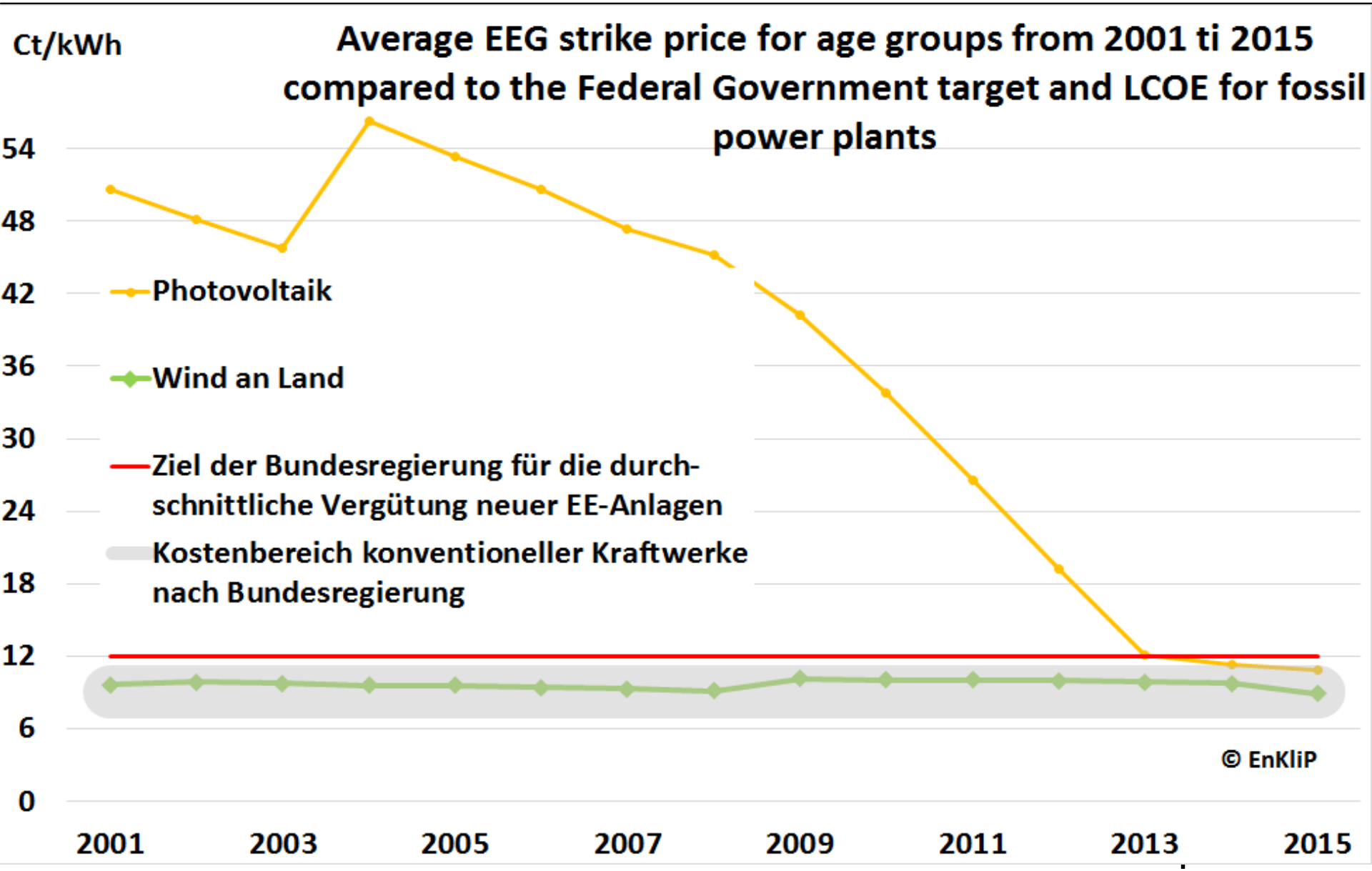
Fossil ↗

Nuclear ↗

EEG surcharge: the wrong indicator



Balancing of fluctuating RES-E



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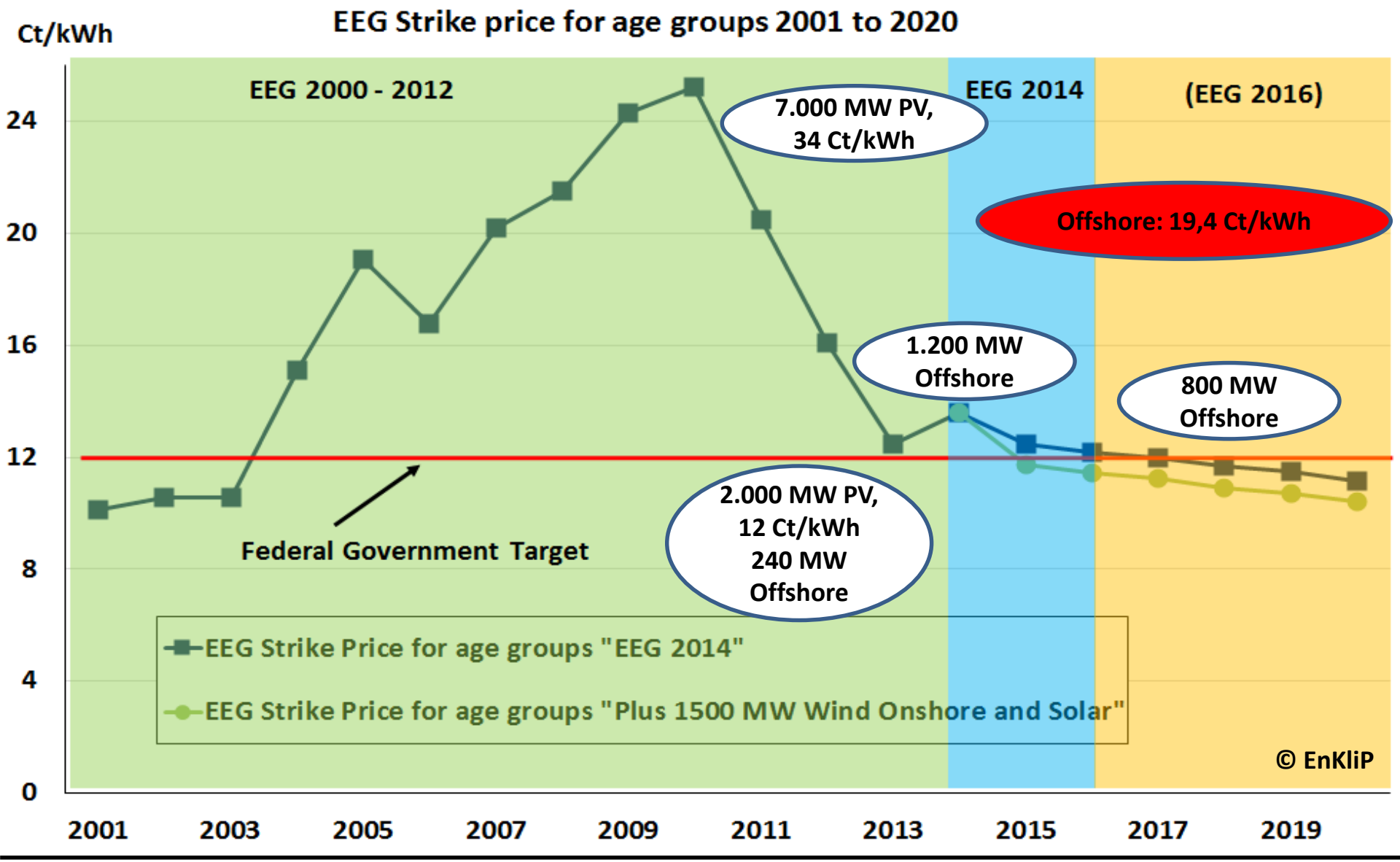
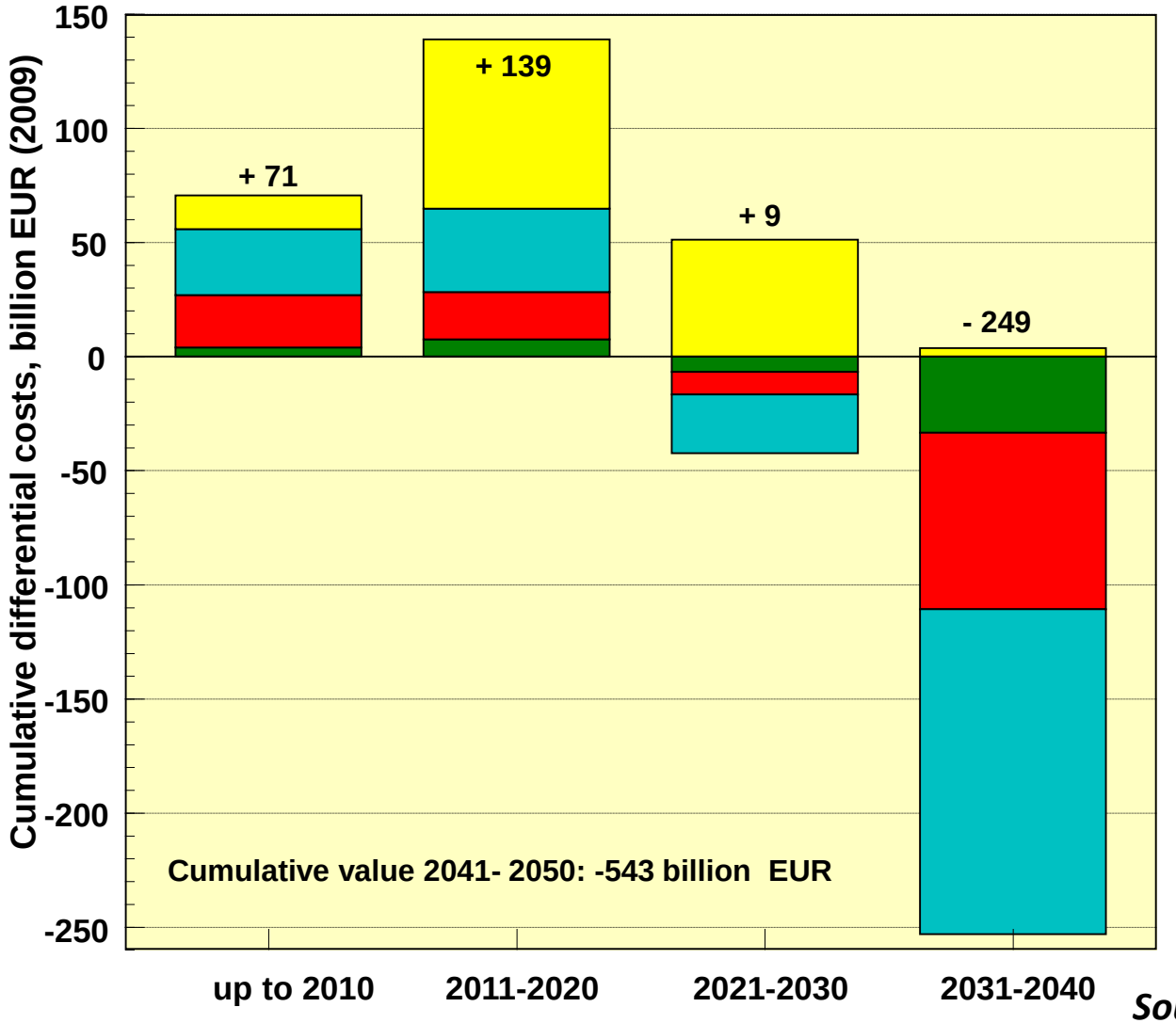
Cost effects of the EEG 2014: Average strike price of age group



German Government study on RES-expansion: Cumulative differential costs

- Scenario 2011 A; all renewables; pricepath A -



Szen11/DIFKUMGES; 12.11.11

RES-share 2040

Total	50%
RES-E	75%
Heating	40%
Fuels	30%

GHG-reduction: 72%

Source: DLR et al. 2012

RES costs

Conclusions on the costs of renewables

- Some RES-E are no more expensive than conventional energies, such as onshore wind and photovoltaics
- If external costs are internalised, most RES-E are cheaper than conventional energies
- RES extension is an investment in the future – also from the economical view

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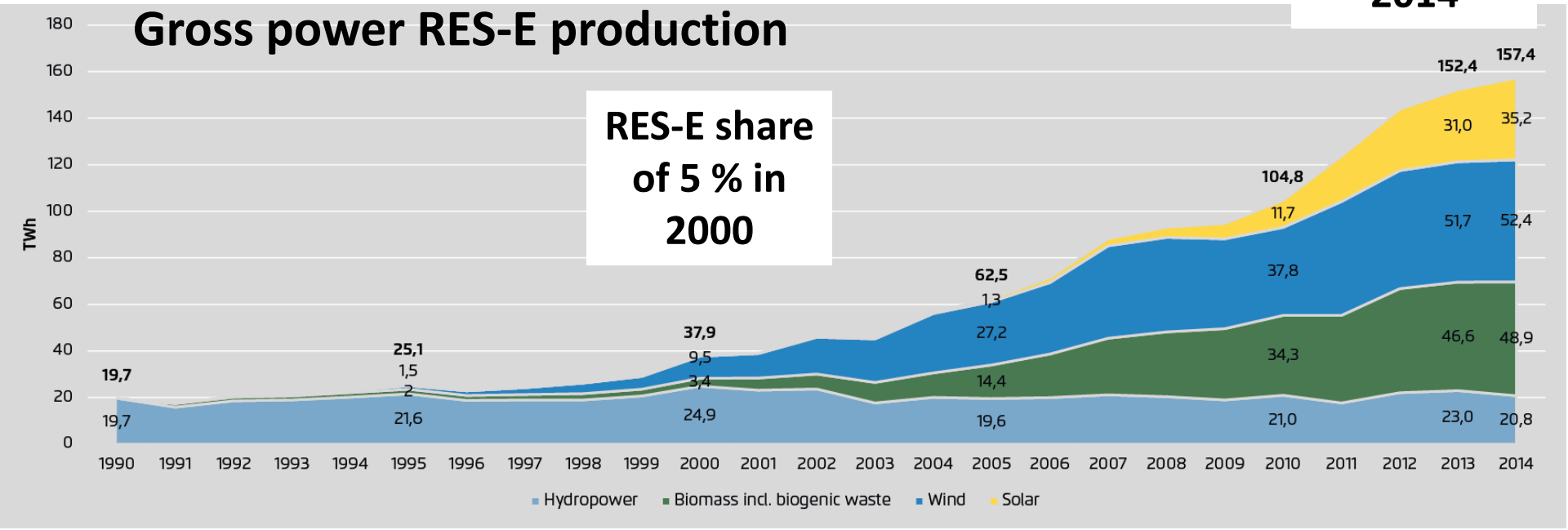
RES-E development 1990 to 2014

RES-E share of 27,2% in 2014



Source: Agora Energiewende 2015

More positive effects of the EEG

- **RES-Costs dropped, with photovoltaik strongly**

➔**Great deal for global development and climate protection**

- **380.000 jobs**
- **90 Mio. t CO2 emissions reduced (10 % of total German emissions)**

The new EEG and new energy policy in Germany

Discussion lead by

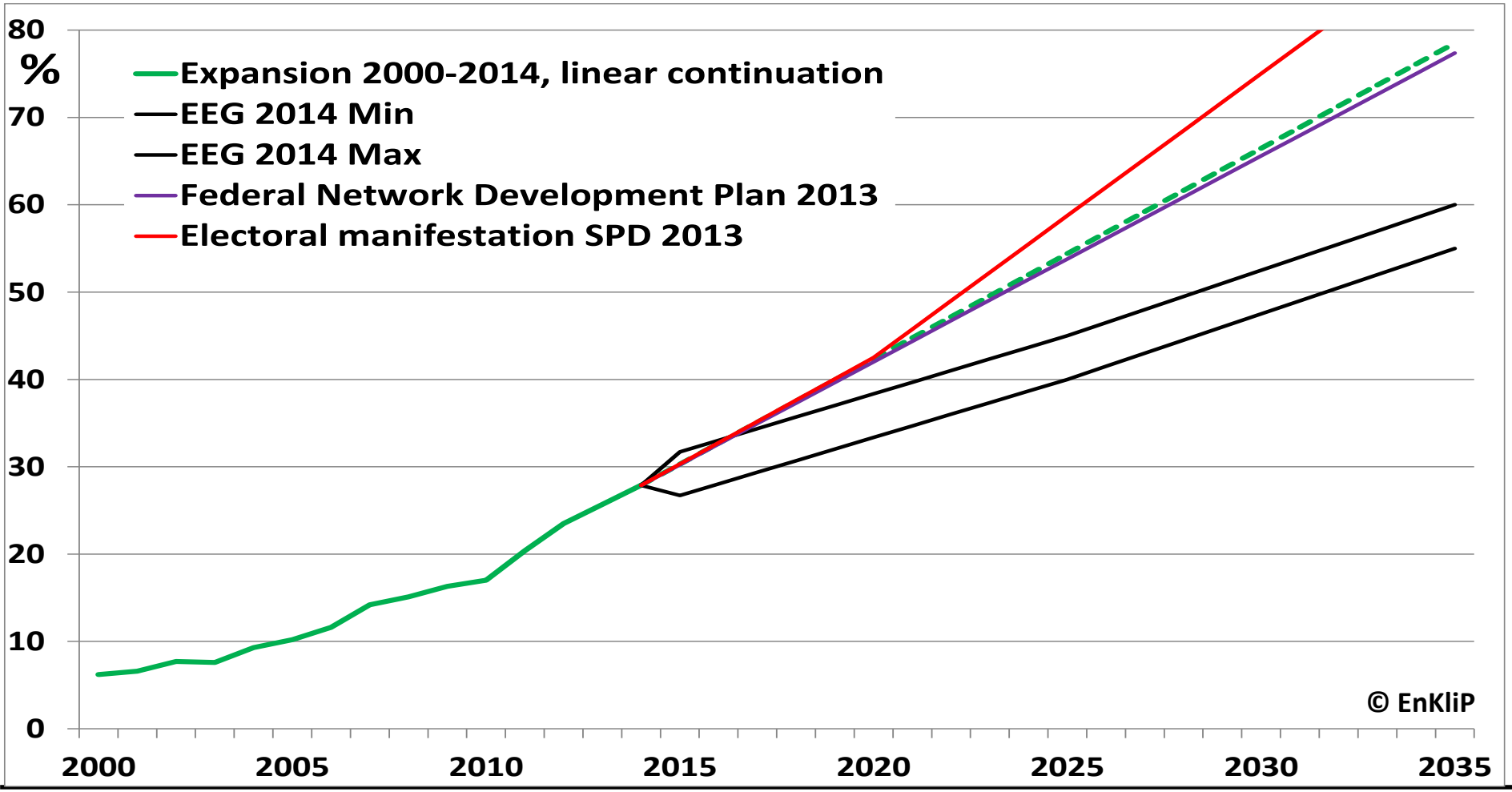
- **Misunderstandings**
- **Market oriented thinking**
- **More negative atmosphere against RES**
- **Unfavorable responsibilities**

Changes in the EEG

- Fixed strike price is abolished
  Obligatory direct marketing (basis premium tariff)
  (EEG 2012: mandatory direct marketing)
  ➔ For variable RES-E not resonable
  ➔ Leads to higher costs (0,4 Ct/kWh)
  ➔ Puts big players in a better position
- „Sun tax“ for own consumption of RES-E
  (mainly photovoltaic, 30 – 40 % of the EEG surcharge is to be payed)
- Reduction of feed-in-tariff for onshore wind

Fundamental changes in the EEG

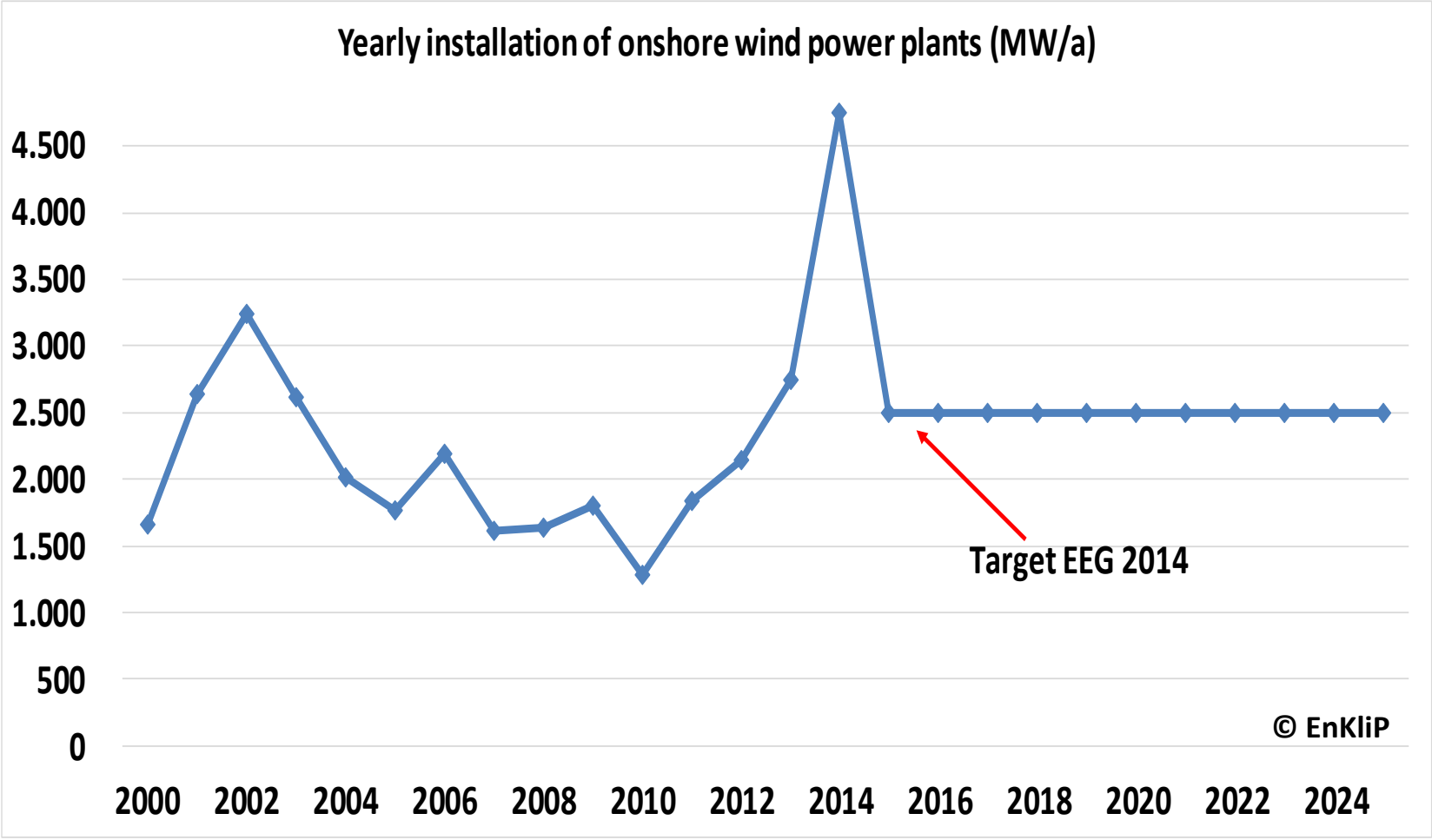
➔ ➔From minimum targets to a corridor for RES-E-



Fundamental changes in the EEG

➔ Corridor for RES-E-Expansion

- 2500 MW/a onshore wind and photovoltaics



Fundamental changes in the EEG

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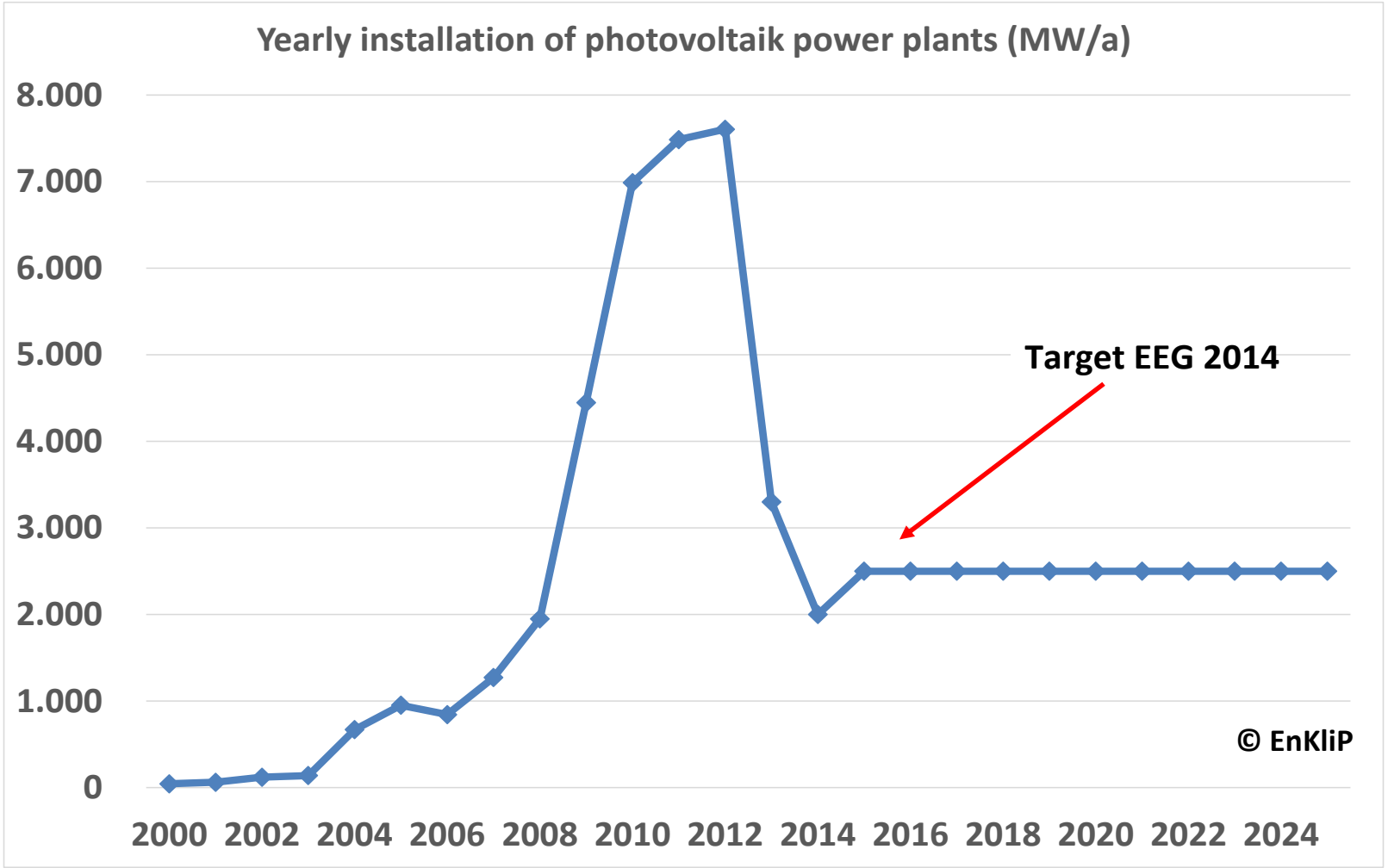
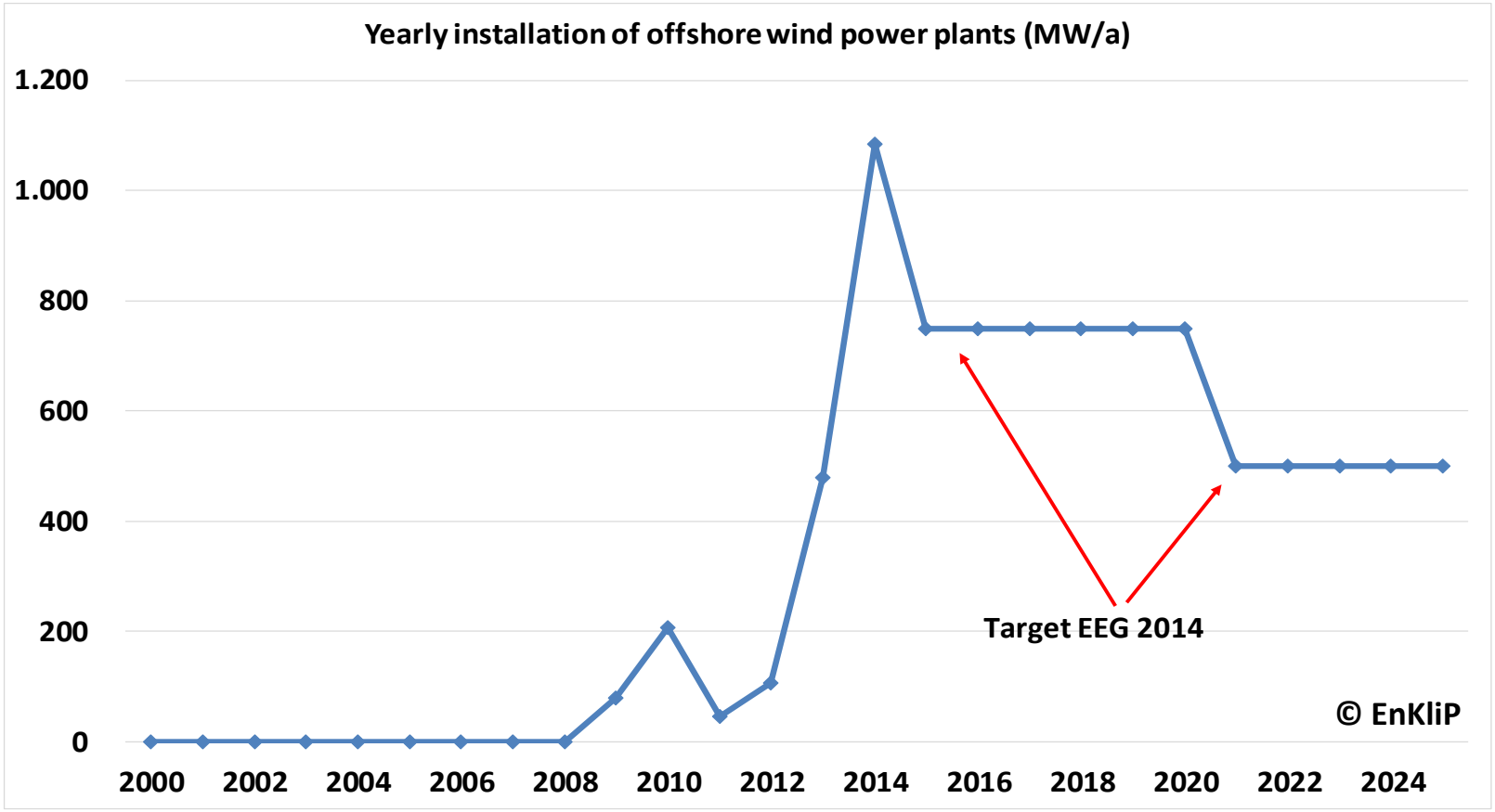


EEG 2014

Fundamental changes in the EEG

➔ Corridor for RES-E-Expansion

- 2500 MW/a onshore wind and photovoltaics
- 750/500 MW/a offshore wind

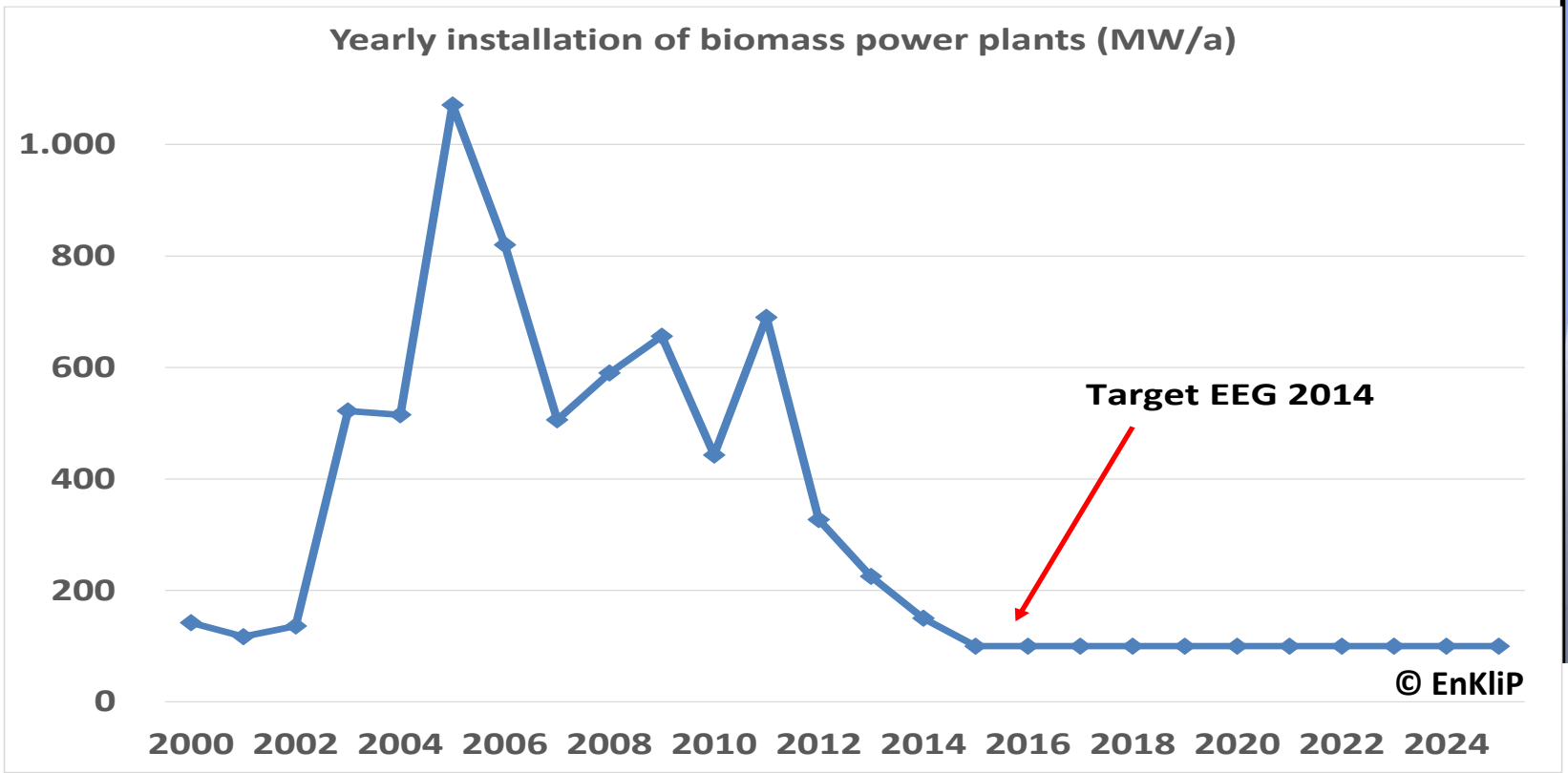


EEG 2014

Fundamental changes in the EEG

➔ Corridor for RES-E-Expansion

- 2500 MW/a onshore wind and photovoltaics
- 750/500 MW/a offshore wind
- 100 MW/a biomass



Fundamental changes in the EEG

➔ Corridor for RES-E-Expansion

- 2500 MW/a onshore wind and photovoltaics
- 750/500 MW/a offshore wind
- 100 MW/a biomass

➢ *Corridor will clearly reduce RES-E expansion*

➢ *Still strong increase, share of 80% in 2050 can be reached*

Change to bidding process

- scheduled for „latest 2017“
- pilot project for open space photovoltaics

➢ *International experience: few evidence for cost savings*

➢ *Disadvantage for small and medium companies*

➢ *Risk for the dynamic expansion*

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Balancing of fluctuating RES-E (1/3)

- **Beside variable RES (wind, solar), back up or „flexibilitiy“ capacity is needed**
- **Flexibilitiy capacity needs to produce electricity when wind and solar does not supply sufficient power**

➢ **The question is: how often do we need these flexibilitiy capacities?**

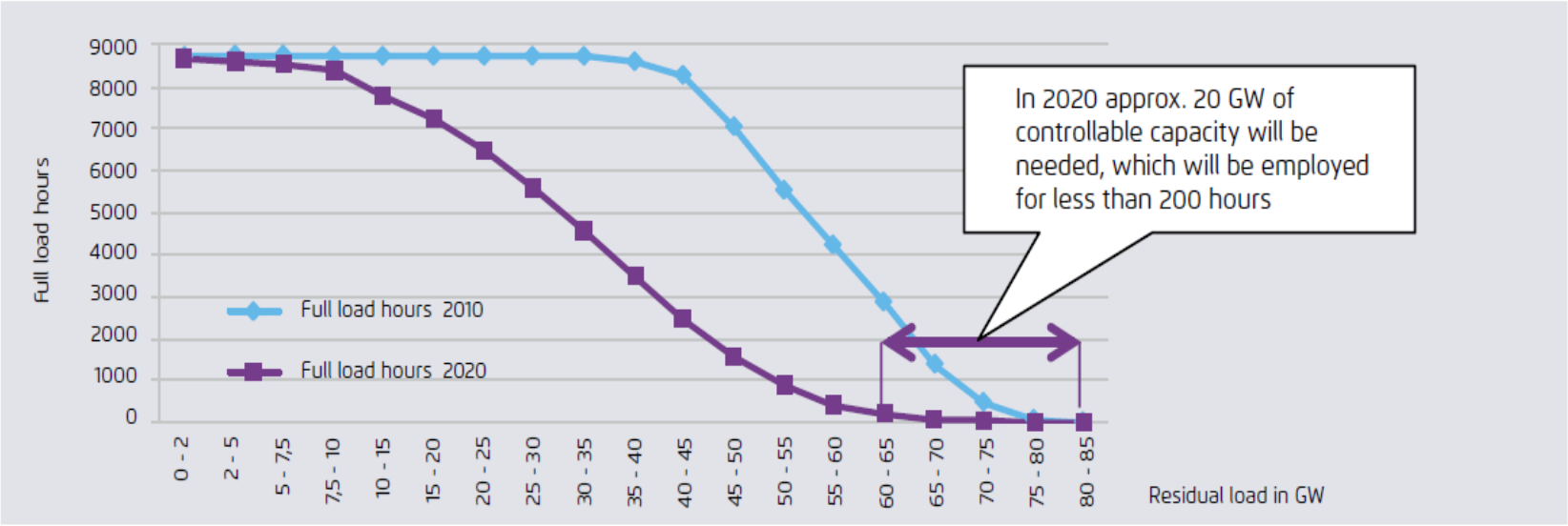

Figure 8: Demand for flexible and controllable back-up capacity to cover maximum peak load (Source: Agora Energiewende 2013).

Balancing of fluctuating RES-E (2/3)

What technologies are available?

- Grid expansion to use geographic compensation
- Grid expanison to use existing storage capacities (Scandinavia, Alpine region)
- Optimization of existing biomass power plants
- Demand side management
- Standby sets
- Storage capacities
- Gas turbines

Costs of gas turbines to cover the 20 GW flexibilitiy capacity needed until 2020:
0,15-0,3 Ct/kWh

Source: Agora Energiewende, EnKliP

Balancing of fluctuating RES-E (3/3)

Additionally, „excess RES-E“ can to be used

- In the heating sector
  - Heating pumps for district heating
  - Heating pumps in well isolated buildings
  - Hydrogen
  - „Wind-gas“
- In the transport sector
  - E-mobility for cars
  - Overhead lines on the Autobahn for trucks
  - Hydrogen for trains, ships, plaines
  - „Wind-gas“
- In the long run: hydrogen or „wind-gas“ to produce electricity if wind and sun is not sufficient

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Energiewende and the neighbor countries

The effect of the German Energiewende to its neighbor countries

- Increased electricity transport form north to south via Poland, The Netherlands, Tzech Republik, etc.
- Reduced profits for power plants
- Reduced gross marked electricity price
- Reduced price of CO2-certificates
- Reduced costs for RES-technologies (makes climate protection cheaper, also for German neighbors)
- Reduced risk of a nuclear accident and its consequences
- Germany gains important experience in dismanteling nuclear power plants – can be hlepful for others
- No negative effects on support security visible

Thank you for your attention

Uwe Nestle

+49-431-53677053
+49-1520-8177456

Uwe.Nestle@EnKliP.de

www.EnKliP.de
www.DasEnergieQuiz.de