

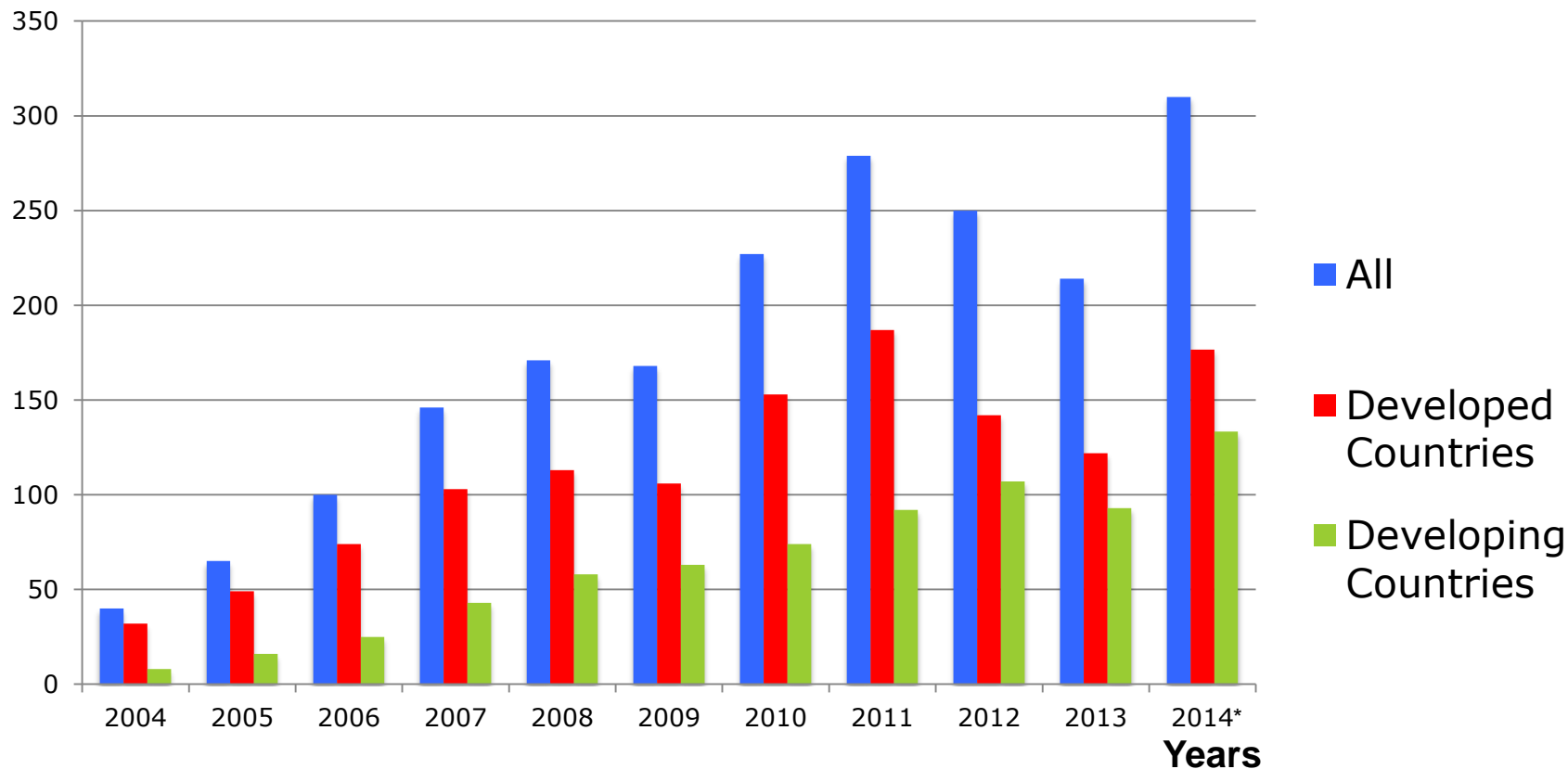
Renewables conquer Energy business

Kiew 4th February 2015

Hans-Josef Fell
President of Energy Watch Group
Member German Parliament
(1998-2013)

Development of Global New Investment in Renewable Energy since 2004

**Billion US
Dollars**



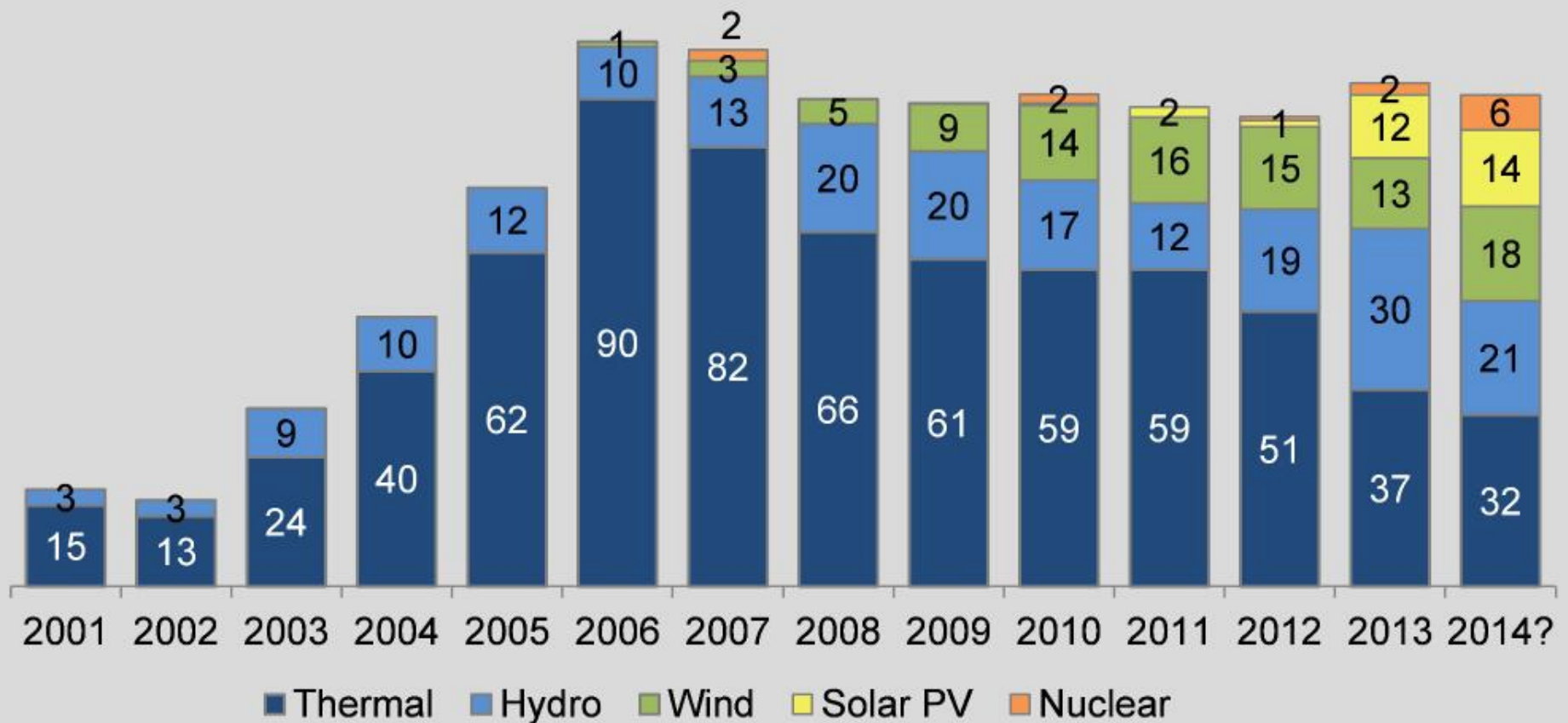
Source: FS-UNEP Collaborating Centre for Climate & Sustainable Energy Finance, 2014

Global Trends in Renewable Energy Investment 2014

* Shares of developed and developing Countries are estimated

Hans-Josef Fell
www.hans-josef-fell.de

China annual power grid capacity additions (GW)



Note: 2014 is CEC projection. Thermal figures are mostly coal but also include a small amount of gas and biomass-fired power plants; Source: China Electricity Council, Global Wind Energy Council

The world trend is clear: Renewable will fast increase; fossil and nuclear will decrease

- Energy consumer countries will go out of fossil fuels because of rising prices and climate protection
- Energy producer countries must now this trend
 - When they are too late to go to renewables they will face great economic disasters in the coming decades

A Path to Sustainable Energy by 2030



'Wind, water and solar technologies can provide 100 percent of the world's energy, eliminating all fossil fuels.'

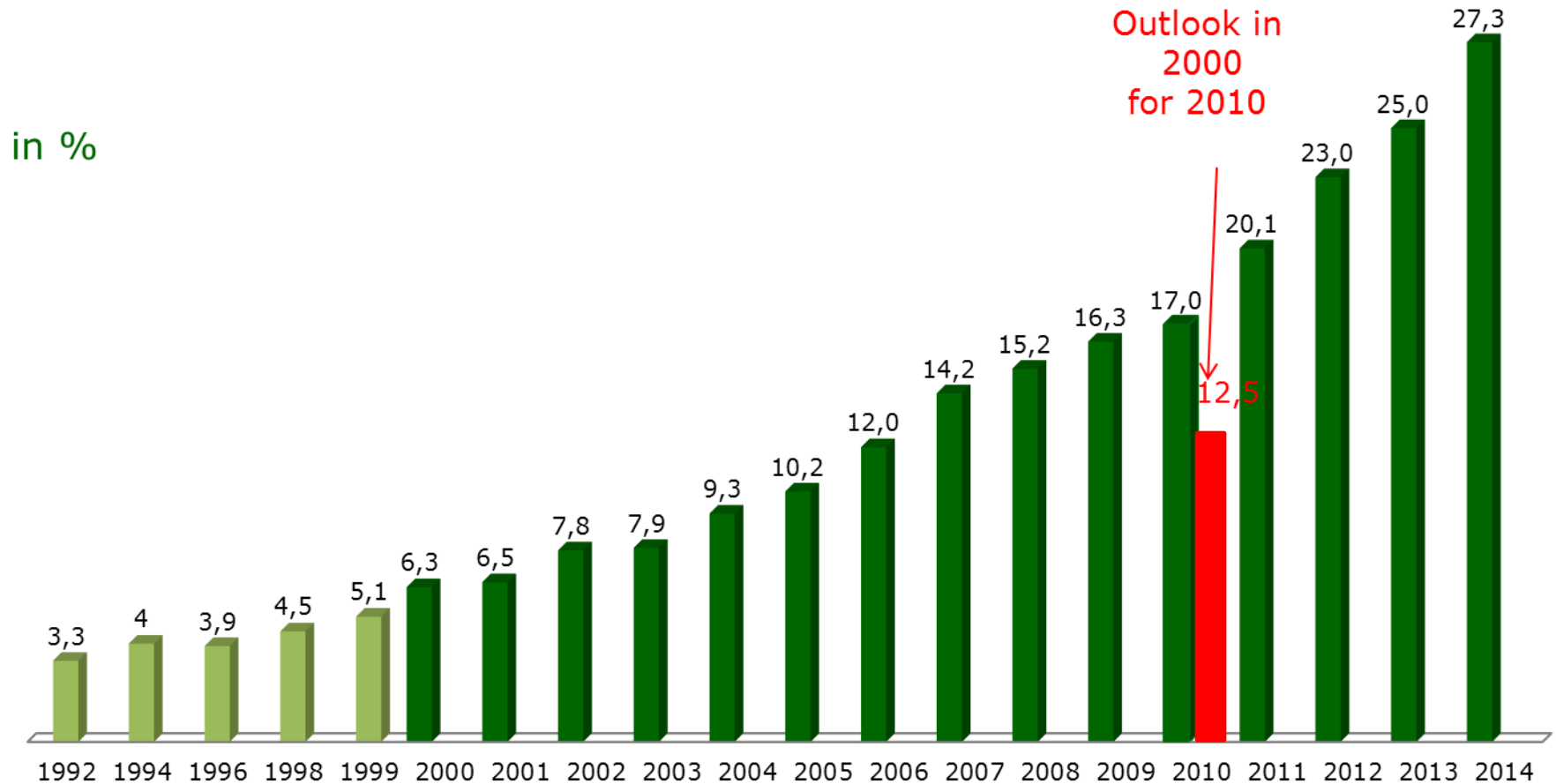
(Mark Z. Jacobson & Mark A. Delucchi)

Costs of renewable energy vs. costs of continued use of fossil fuels

Estimated costs fossil, nuclear energies (US \$)	
Petroleum	3350-4475 Bn.
Natural Gas	550-830 Bn.
Coal	150-300 Bn.
Electricity	1490-2150 Bn.
Sum p.a. (without external costs)	5000-7750 Bn.
Sum 2010-2030 (+ 20% rise)	200 000 Bn.
Sum to replace world's energy with 100 % renewables by 2030	100 000 Bn.

With political support, renewable energy grows very fast

(Share of renewables in the gross electricity consumption in Germany)



Industry electricity prices have been falling in Germany for years

Der VIK-Index gibt im Mai 2014 weiter nach

Aufgrund weiter gefallener Quartals-Großhandelspreise (Q3-14 bis Q2-15) an der EEX um durchschnittlich* 1,11€/MWh (-2,94%) gegenüber dem Vormonat, hat der VIK-Index aktuell nochmals um 2,38 Punkte (-1,80%) nachgegeben. Der VIK-Index beinhaltet keine Steuern, Abgaben oder sonstige Umlagen. Aktuell liegt der VIK-Index bei 130,14 Punkten.

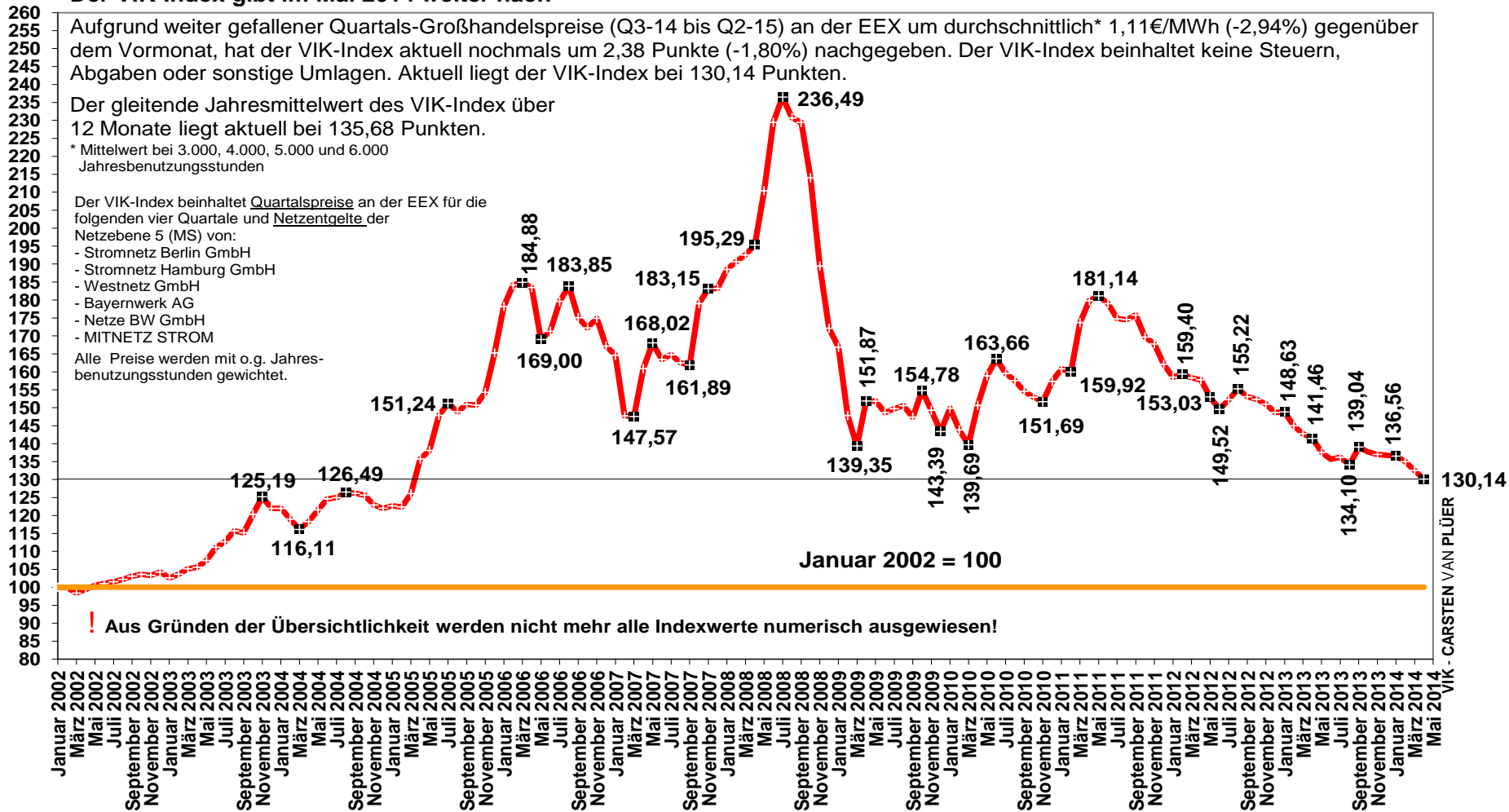
Der gleitende Jahresmittelwert des VIK-Index über 12 Monate liegt aktuell bei 135,68 Punkten.

* Mittelwert bei 3.000, 4.000, 5.000 und 6.000 Jahresbenutzungsstunden

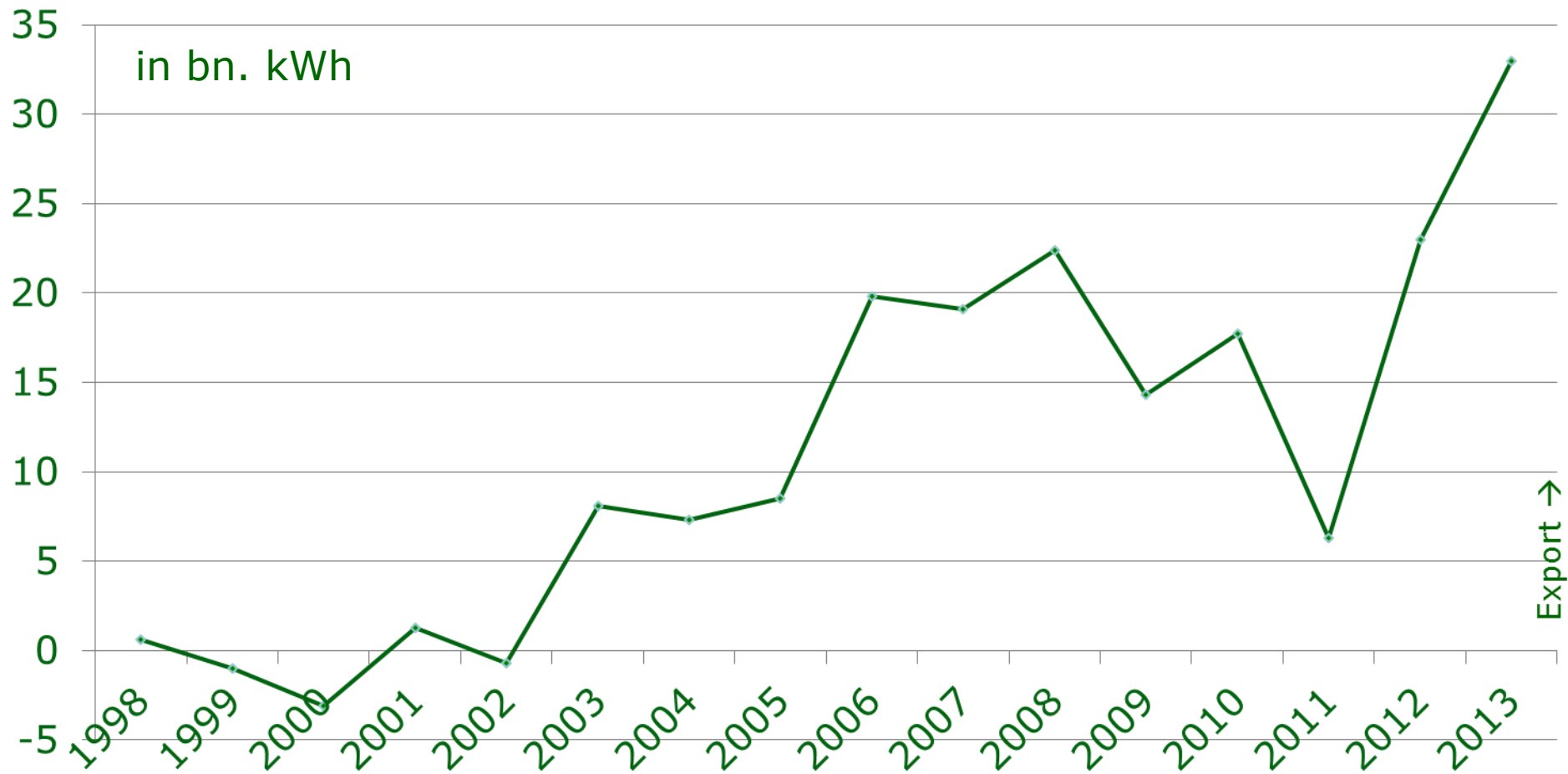
Der VIK-Index beinhaltet Quartalspreise an der EEX für die folgenden vier Quartale und Netzentgelte der Netzebene 5 (MS) von:

- Stromnetz Berlin GmbH
- Stromnetz Hamburg GmbH
- Westnetz GmbH
- Bayernwerk AG
- Netze BW GmbH
- MITNETZ STROM

Alle Preise werden mit o.g. Jahresbenutzungsstunden gewichtet.

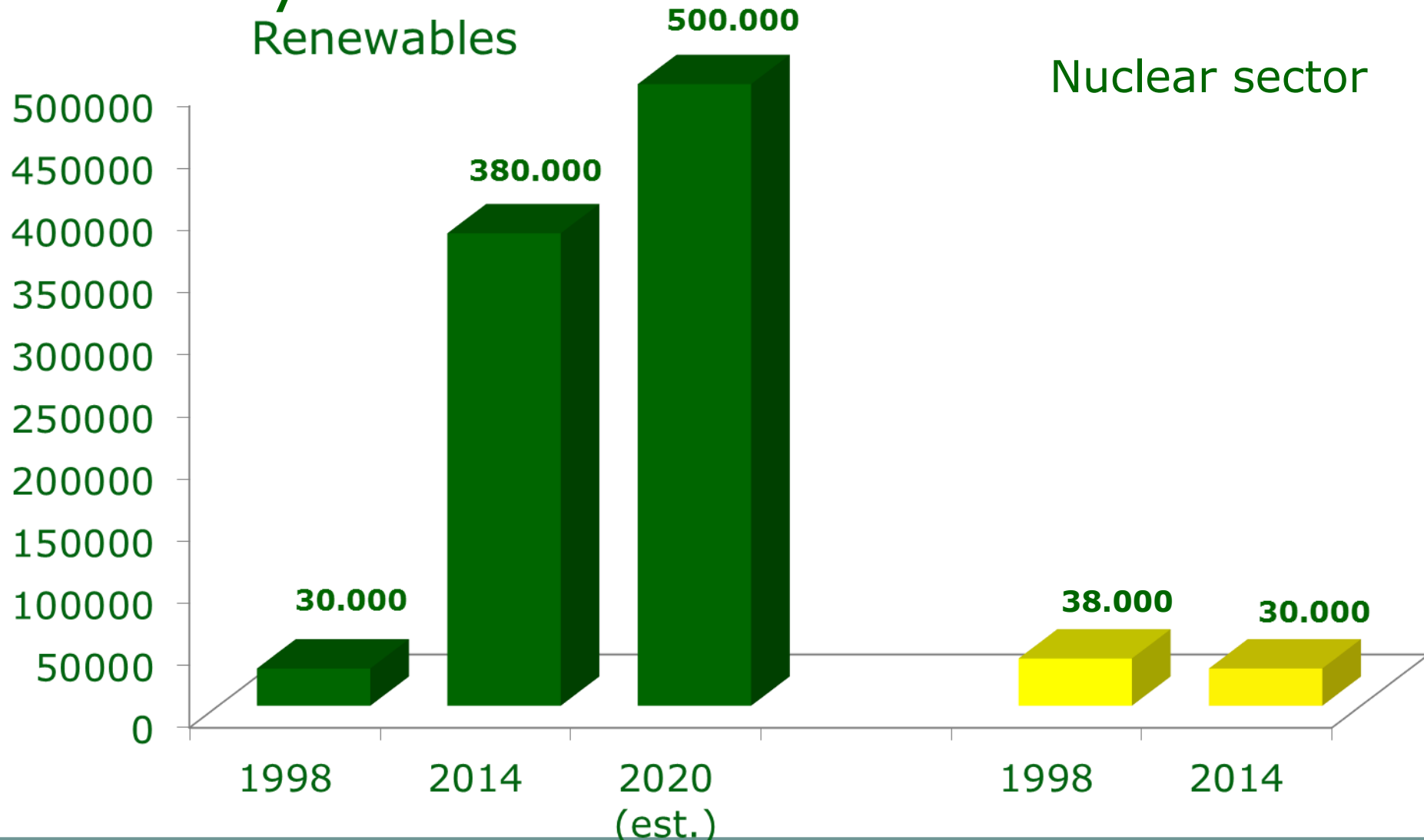


German electricity export: after phasing out 8 nuclear reactors record export in 2013

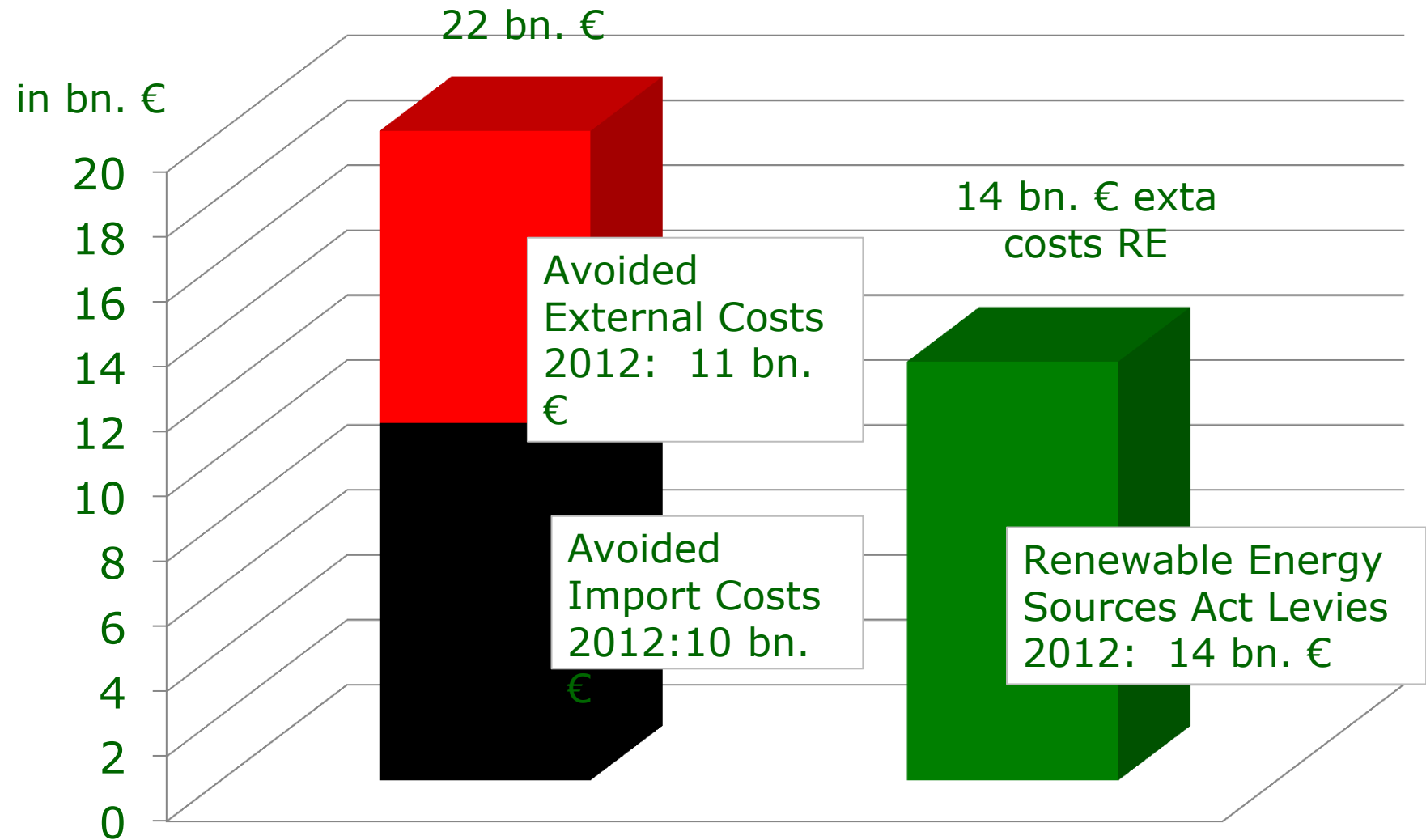


Quelle: statista.de 2012; AGEB, 2013

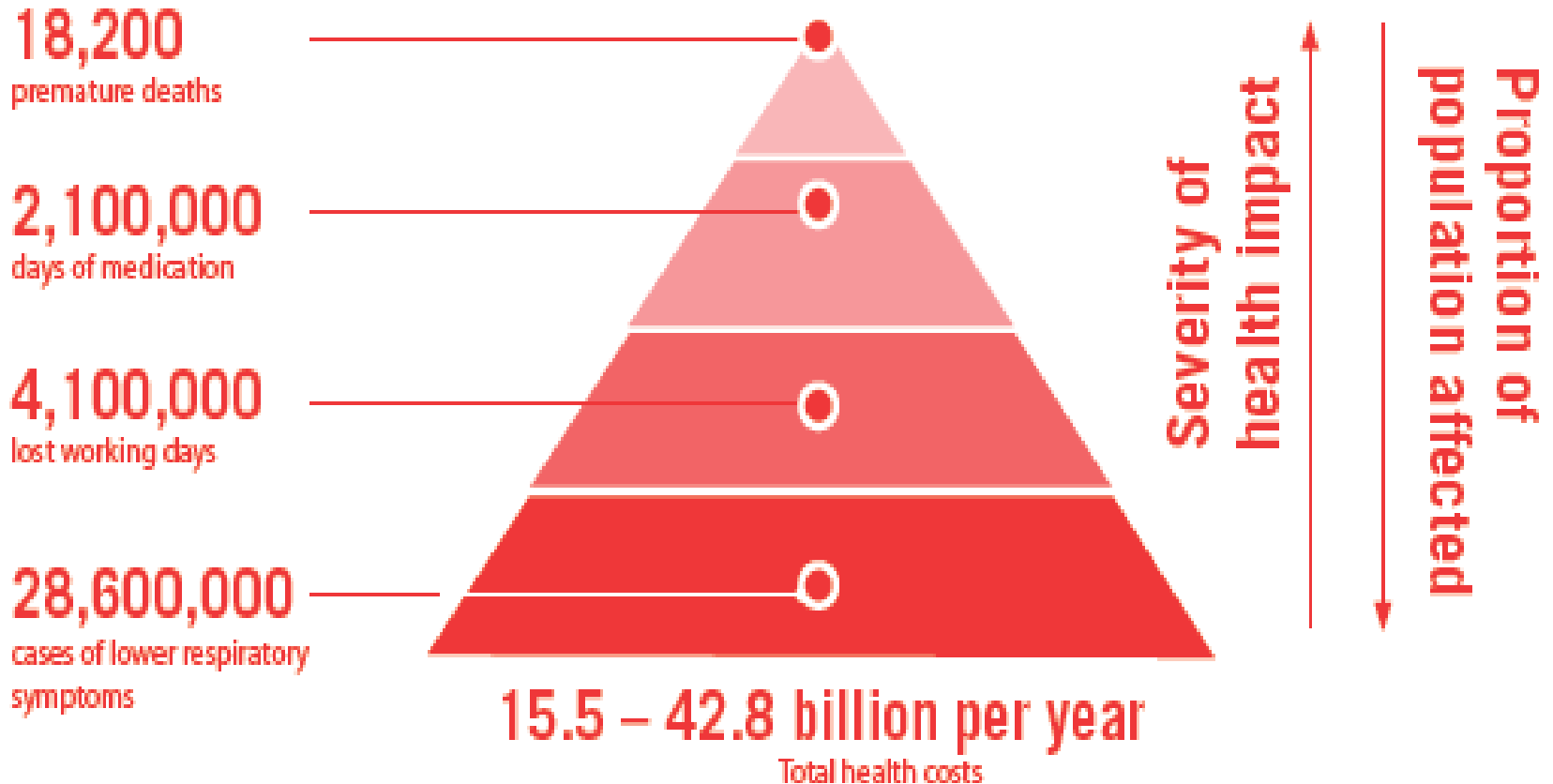
Renewable Energy as a job engine in Germany



Avoided Costs by Renewables in Germany in 2012

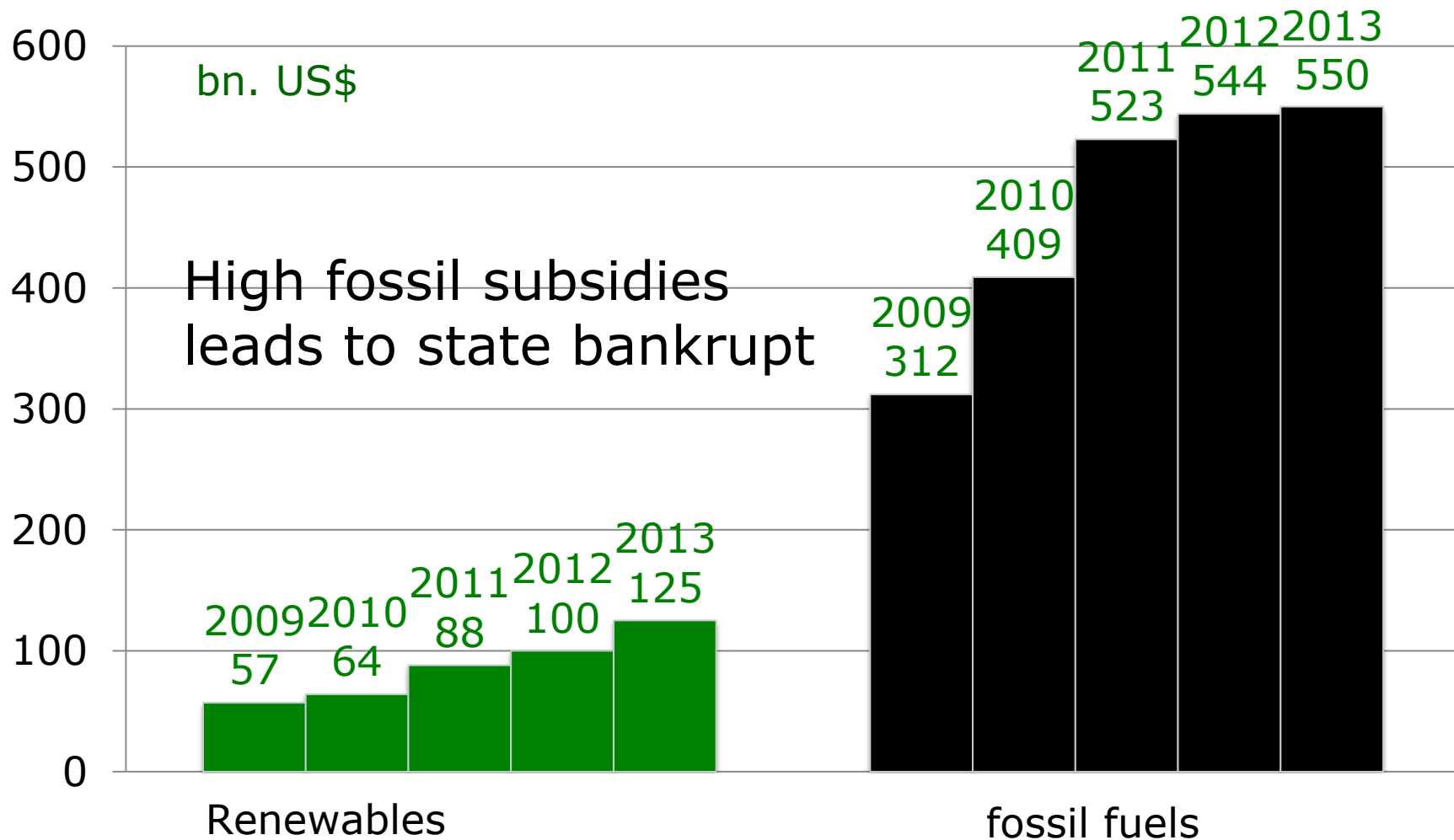


Annual health impacts caused by coal power plants in the EU (27)



Global subsidies: renewables/fossil fuels

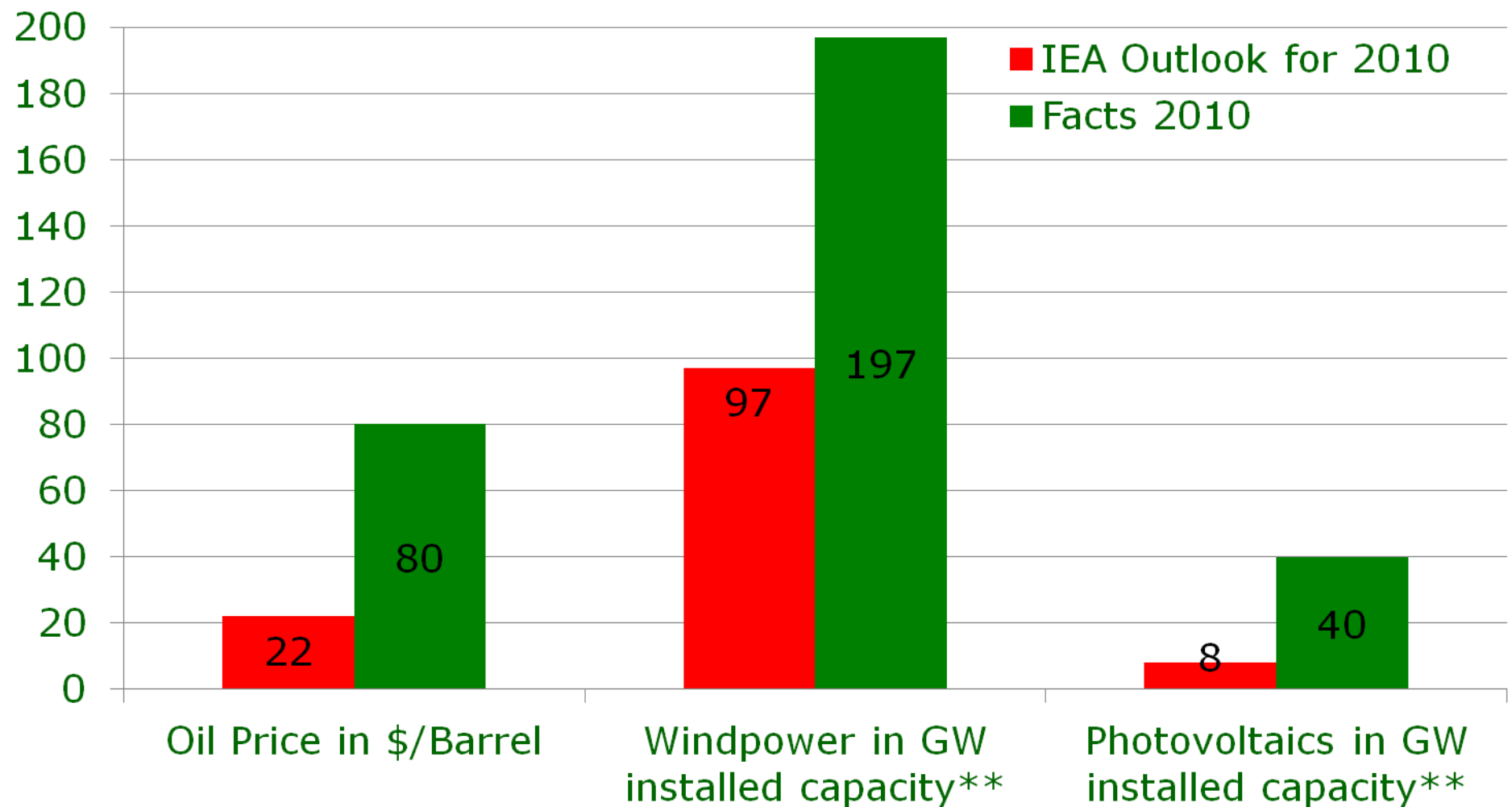
Global warming subsidies: 100 US\$/t CO₂



Obstacles against REN Investment

- Wrong evaluations in fossil/nuclear
- Wrong political frameworks
- Political fight against REN from fossil/nuclear business sector

Forecast Errors of the IEA in 2004



* Forecast of the International Energy Agency in World Energy Outlook 2004 for the year 2010

** global installed capacity in Gigawatts

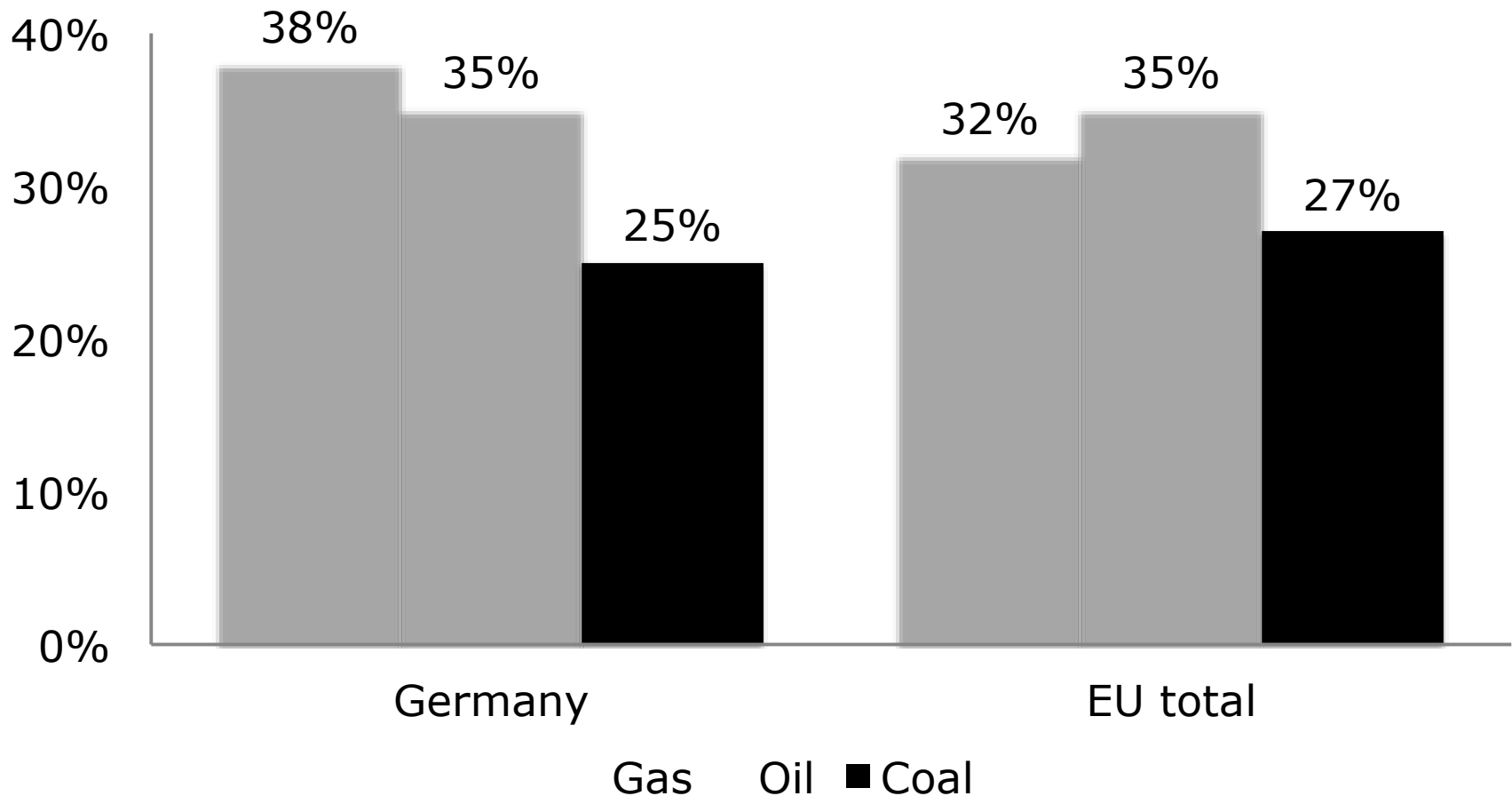
Sources: IEA, MWV, GWEC, EPIA

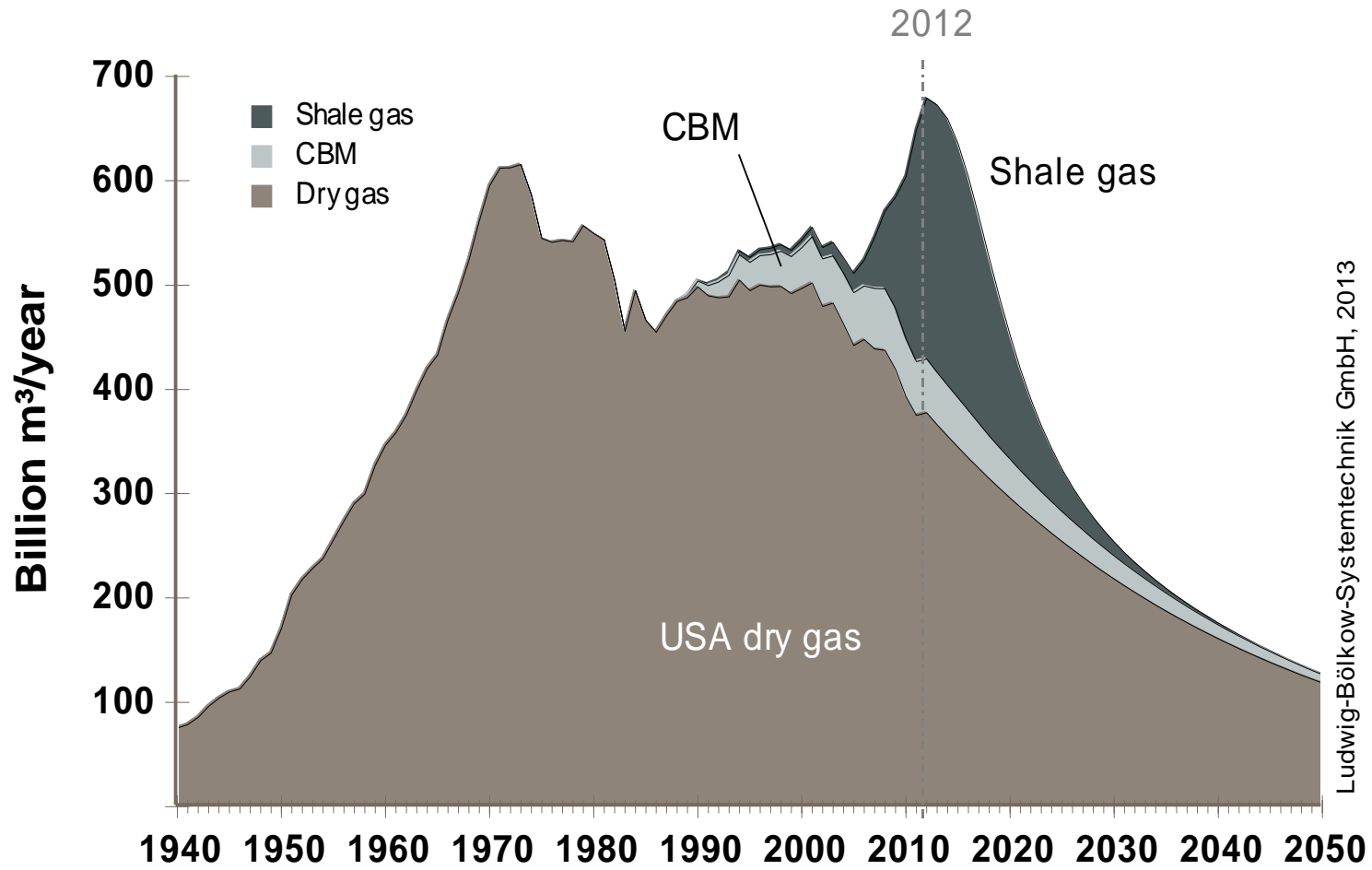
Hans-Josef Fell
www.hans-josef-fell.de

Ukraine-crisis is a gas and oil crisis

- Energy dependency of Ukraine and EU from Russia is self-induced and increased over years.
- Energy dependency is reason for political powerlessness for G7, EU, G.
- It is without any chance to find solutions within the fossil energy sector (diversification)
- Only the switch to renewables can bring political and energy independency.

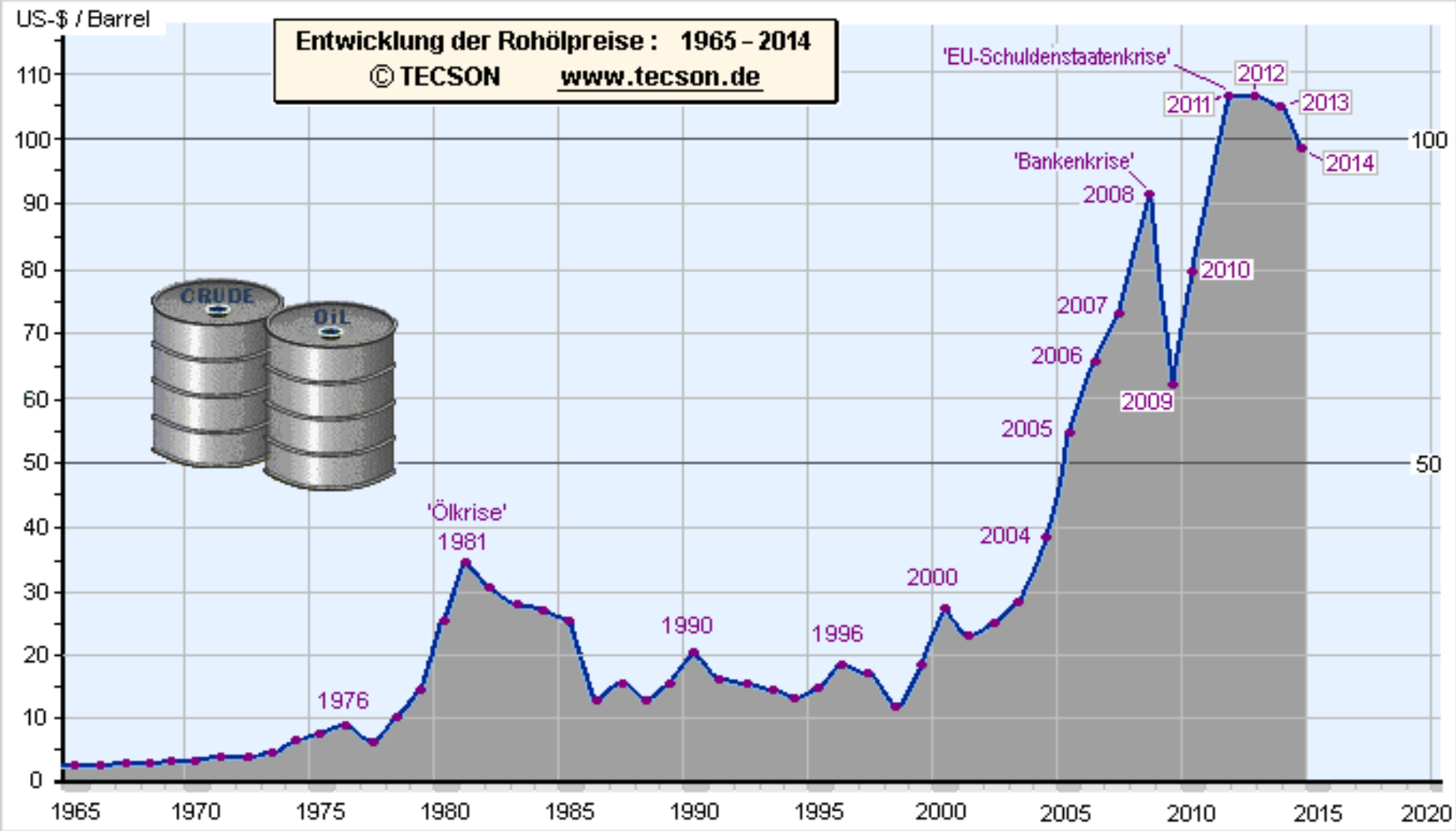
Energy imports of Europe from Russian Federation 2013





Ludwig-Bölkow-Systemtechnik GmbH, 2013

Development Crude Oil Prices 1965-2014



Source: Tecson

US Oil- und gasfracking business is economical collapsing (Januar 2015)

- Schlumberger dismissed 9000 jobs
- US Steel announced to close two tube factories .
- Insolvency WBH Energy, Austin, Texas
- Baker Hughes dismissed 7000 Jobs
- BHP Billiton will close 10 of its 26 US-Fracking facilities until summer 2015

What's the reality today?

- REN investment is cheaper than fossil/nuclear
- Fossil/nuclear becomes more and more stranded investment
- Private fossil/nuclear investment comes only with public subsidies. This leads to public borrowing

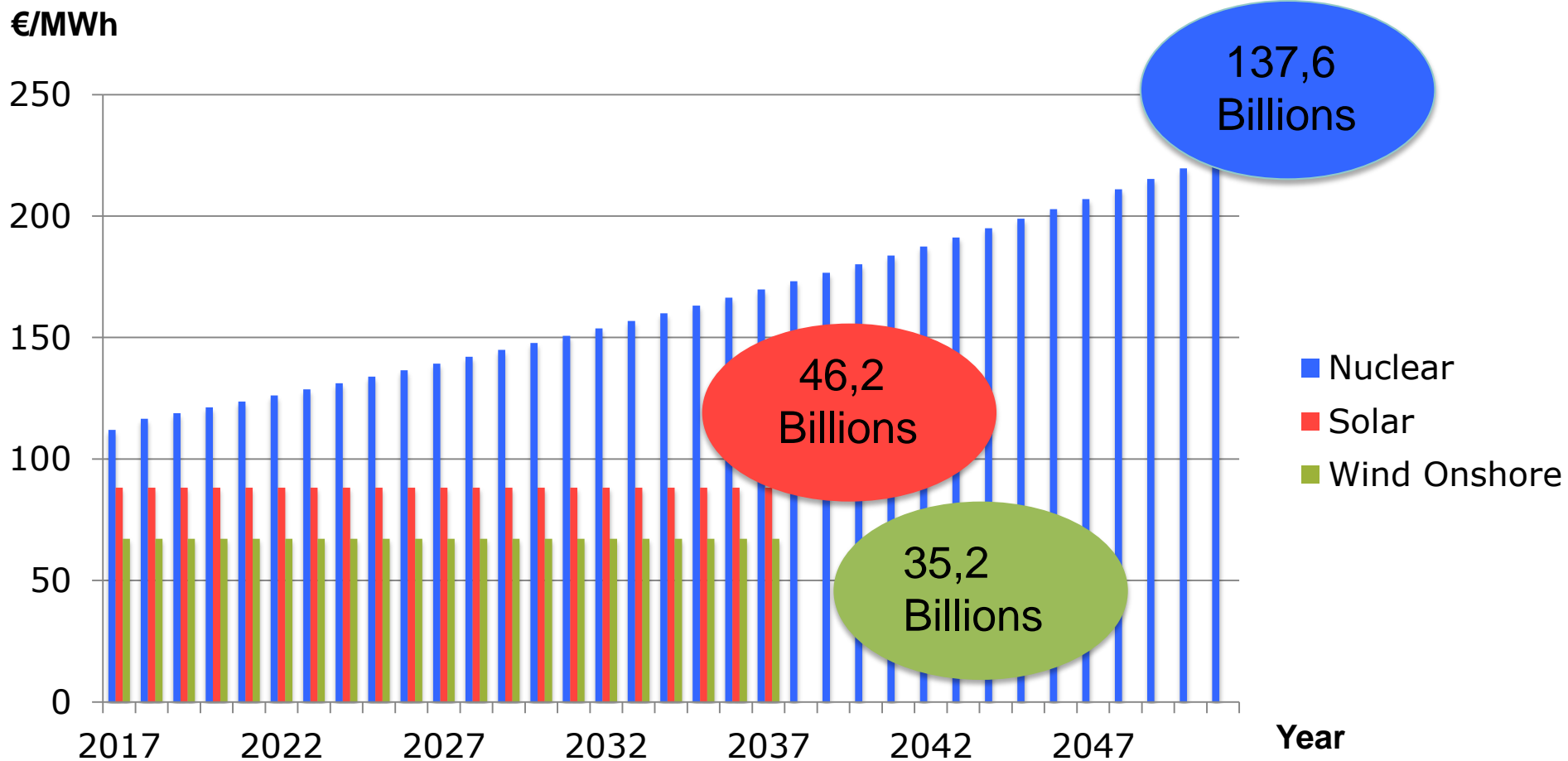
Nuclear Renaissance?

Only very few new started.

All are overbudget and late

- Nuclear power plants in operation are declining:
2005: 441; 2013: 434
- Olkiluoto (Finland):
build start 2005; forecast cost 3 bn. €, 4 years;
2014: >13 years late, >200% overbudget
- Flamanville (France):
start 2007; forecast cost 3.3 bn. €, 5 years;
2014: >2018 ready (11 years), >costs 8.5 bn. €
- The French nuclear contracting company Areva
made therefore in last three years 4 Bill. Euro
deficit and stands before bankrupt

Costs of Feed-in Compensation for New Nuclear Power Plants in Great Britain, PV and Wind Power Plants in Germany



Source: Agora Energiewende und Prognos, 2014

Data in € at future prices

Hans-Josef Fell
www.hans-josef-fell.de

Pripjat Towncenter, April 2006: 20 years after Chernobyl nuclear accident

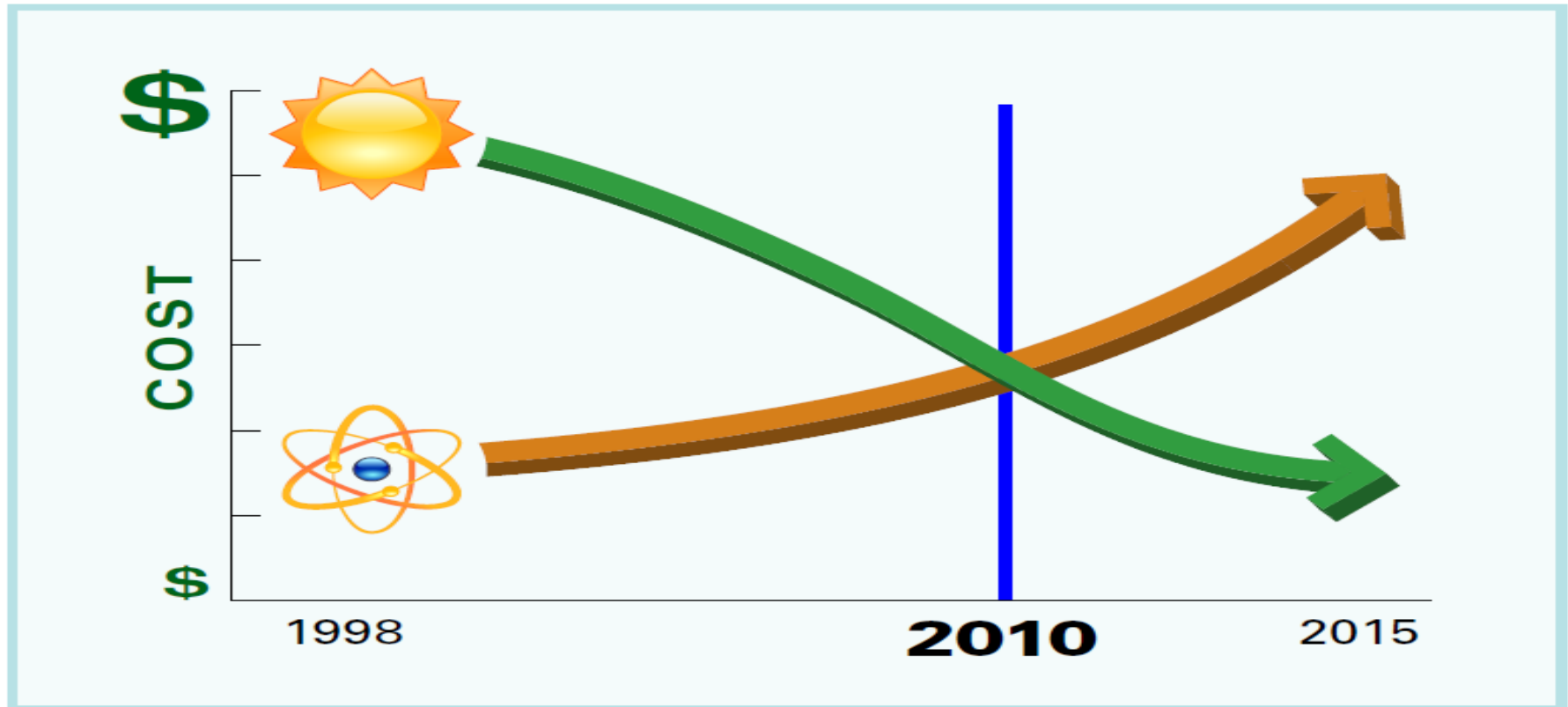


Investment in fossil/nuclear will become stranded investment

- Coal/Gaspower in Germany is already stranded investment:
 - **E.ON now will swap out coal and nuclear business and concentrate new business on Renewables and distribution**
- China begins partly to ban use of coal
- New nuclear power plants in EU are financial flops
- New drilling for deep sea oil in Brasil and shale gas in USA are not economic

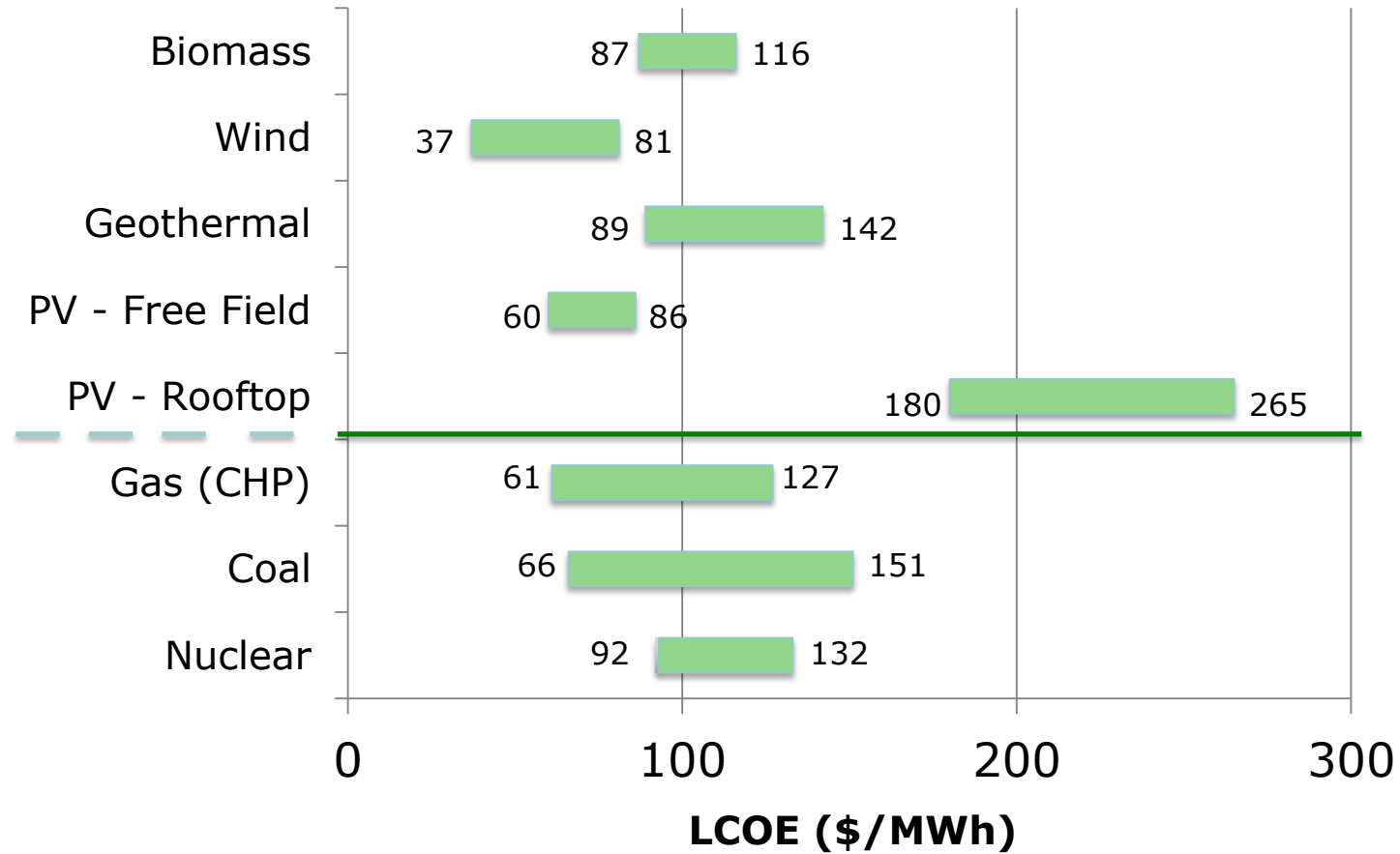
Solar and Nuclear Costs – The Historic Crossover

Solar Energy is Now the Better Buy



Levelized Cost of Energy Comparison

US Minimum and Maximum Price



Climate protection and energy security policies

Promoting Renewable Energy and Chemistry & Organic Farming:

- **laws for feed-in-tariffs** (GET FIT for undeveloped countries)
- **tax relief** for renewables
- **carbon tax**
- **canceling subsidies** for fossil and nuclear energy, fossil chemistry and intensive agriculture,
- **research and education** offensive for renewables and organic farming
- **reducing obstacles** for approval
- dispose big areas for reforestation and greening

not successful:

- quota or certificate systems (unable to promote fast climate protection)
- Emission trading

Key Points of an effective Renewable Energy Act (Feed in Law; EEG)

- privileged grid access
- feed-in tariff have to be sufficient for an economic operation
- funding of the feed-in tariff via electricity rate
- no cap for feed-in of renewable energies
- guaranteed period of remuneration
- no local content rules

- furthermore: no obstructions by a restrictive permission policy

My advice for Ukraine

- Fast development of renewable sector in Ukraine
 - Wind, Solar, Geothermal, Hydro, Waves
 - Bioenergy also for export:
 - Biofuels from sustainable farms (no monocultures)
 - Biocoal from agriculture and municipal waste
- Otherwise Ukraine will lose the business with energy without any compensation and will stay too long in Russian energy dependency

7 Years Energywende in Großbardorf



Power



Heat



475%



90%

Jahresverbrauch Strom 2011

ca. 1.600.000 kWh

Jahreserzeugung in EE-Anlagen:

ca. 7.600.000 kWh

Jahresverbrauch Wärme 2011

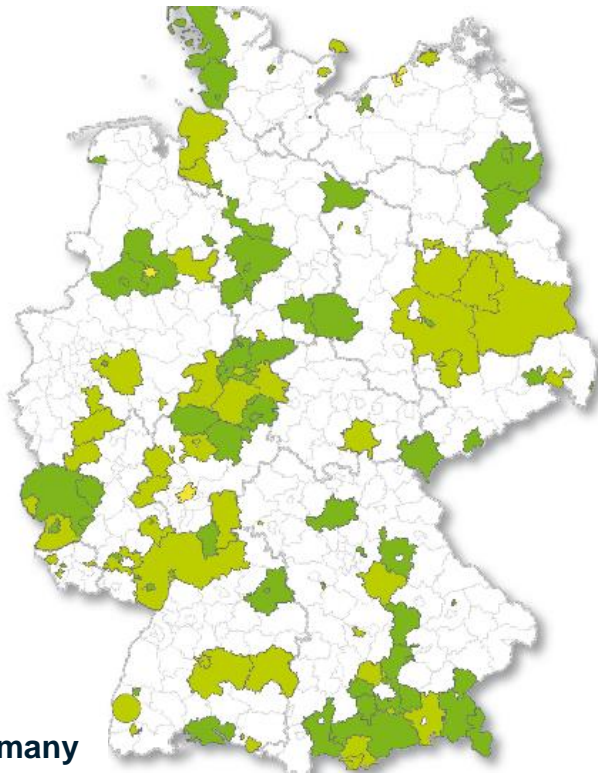
ca. 3.200.000 kWh

Jahreserzeugung in EE-Anlagen:

ca. 2.880.000 kWh

100% RENEWABLES

www.go100re.net



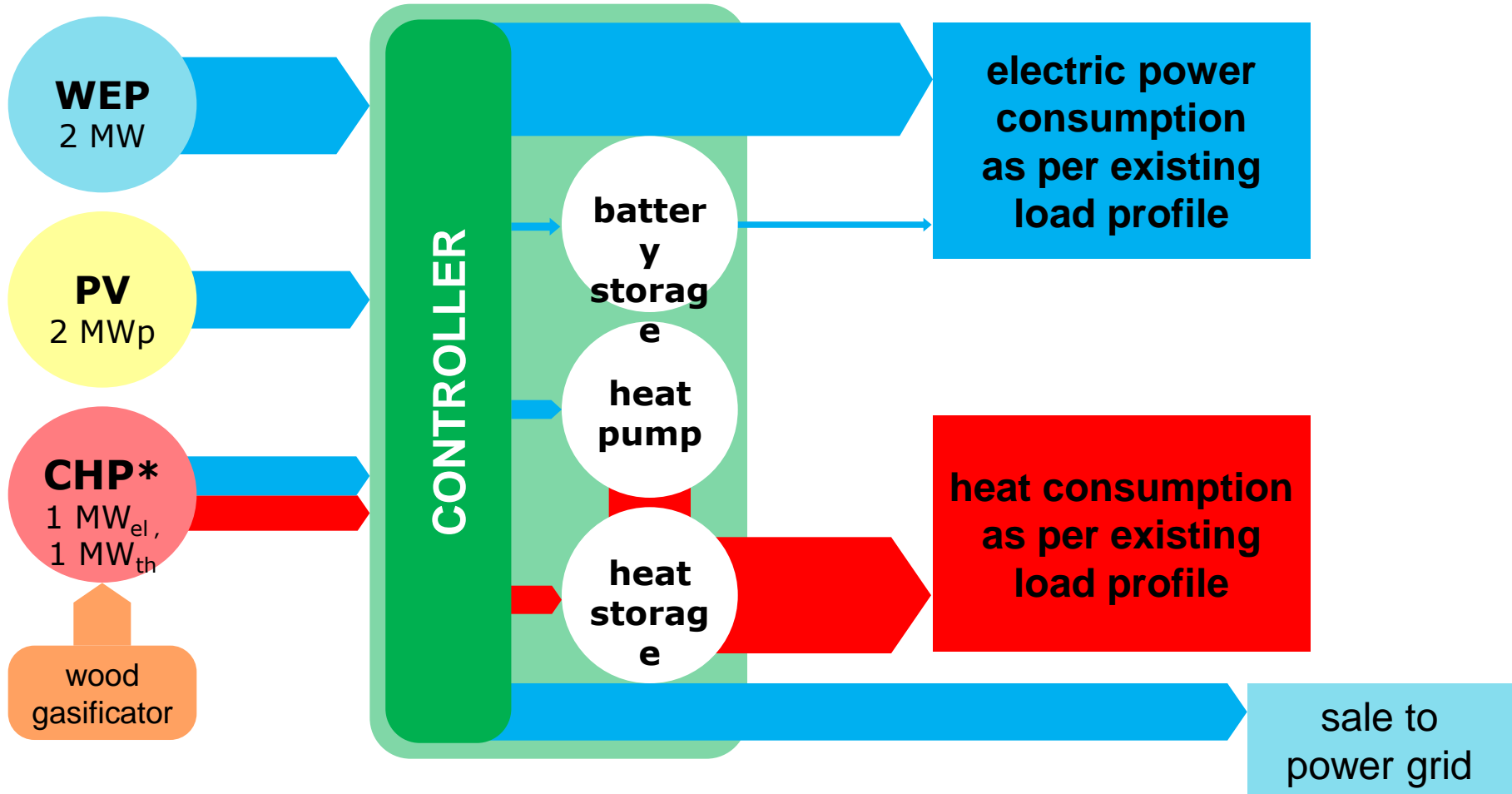
Germany

Countries with a 100% RE target
*Denmark; Sweden; Costa Rica;
Island; Scotland; Upper Austria*

Cities with 100% RE target
*Barcelona, Spain; Masdar City UAE;
Munich, Germany; Msheireb Downtown
Doha, Qatar; San Francisco, USA*

**Small Island States with 100%
RE target**
*Islands of Tuvalu; Maledives; Cook
Islands*

Energy Flow in a Combined Power Plant



*CHP supplies maximum load plus required redundancy, degree of self sufficiency 100%, proportion of own consumption approx. 75%

3 MW Solar power plant Belectric

Produce: Solar electricity, blind current, frequency and voltage stability



Batterie Storage Tinningstedt



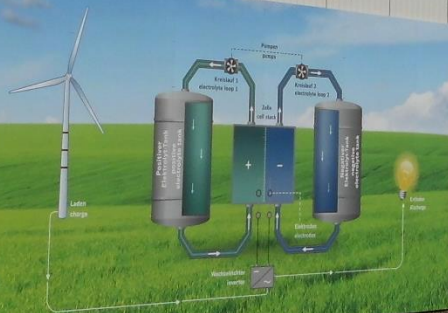
So funktioniert eine Vanadium Redox-Flow Batterie

Operation principle of a vanadium redox flow battery

Strom, z. B. von einem Windrad, wird in die Batterie eingespeist. Die elektrische Energie wird in der Zelle umgewandelt und in den Elektrolyten gespeichert.
Elektrolyte strömen in zwei mit Platinen abgegrenzten Kreisläufen. Beide Elektrolyte enthalten Vanadium-Ionen als Ladungsträger.
Beim Entladen wird die gespeicherte Energie in der Zelle wieder in elektrische Energie umgewandelt. Damit kann ein Verbraucher betrieben werden.

Electrical energy, e.g. from a wind turbine, is stored in the battery. The red stack converts the electrical energy to chemical energy, which is stored in the electrolyte.
The positive and negative electrolytes circulate in closed loops. Both electrolytes contain vanadium ions as charge carriers.

On discharge, the stored energy is converted back to electrical energy in the cell stack. The energy now can drive an external load.



BOSCH

First wind park in Germany with Vanadium Redoxflow storage. Wind power surplus is used in times of lacking wind. Technical Management by Plan 8 GmbH.

www.plan-8.de

Agro-PV in Italy

Twice yield: Solarelectricity and corn

Shadowing farmland to save water



Hydrothermal Carbonisation (HTC)



Process:

Input: Plants, Agriculture and Municipal Waste;

Output: Biocoal;

HTC can decontaminate radioactivity. I seek support for research program.

Target:

decontaminate Tchernobyl region and substitute lignite by biocoal

Usage of biocoal:

- Fuel: 8 €/MWh (Mineral coal 22 €/MWh)
- Chemical base (oil substitute)
- Fertiliser (carbon binding in soil)

Greening the Deserts: 20% greened desert areas with oleiferous plants can substitution the global mineral oil demand



Greened Egypt desert at Luxor with Yatropha brings oil & food

Greening eroded areas with biochar

July 2010

August 2011

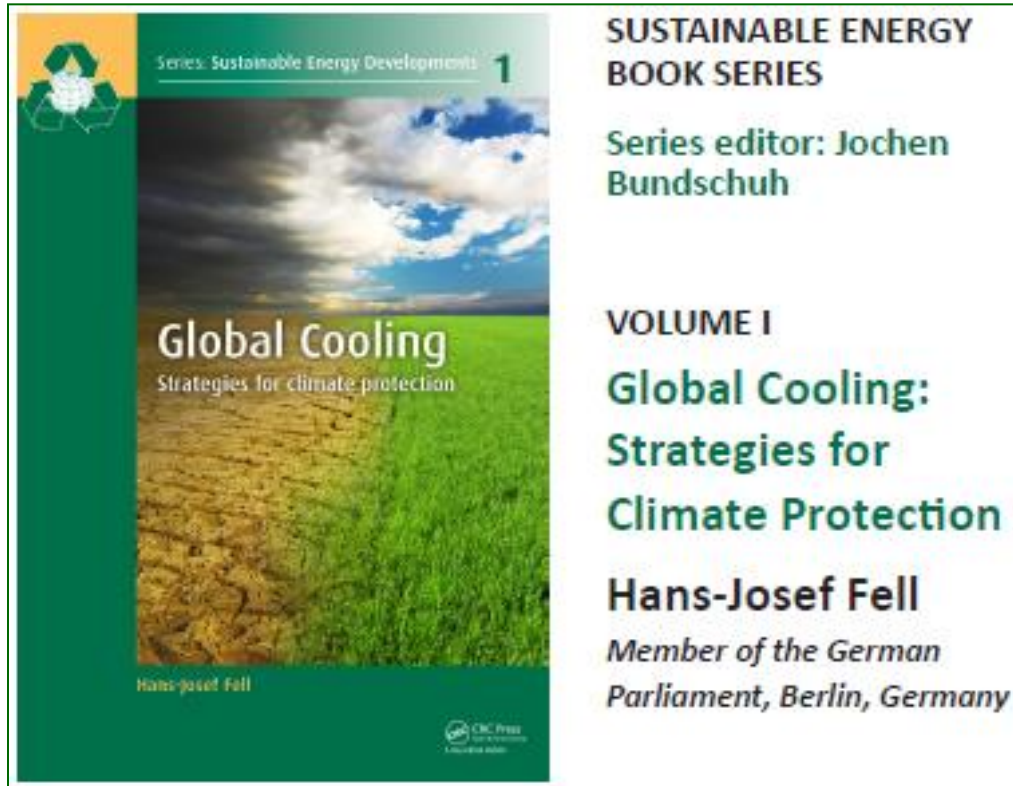


For 60 years it looked
like this

Now it looks like this

Coalmining area in USA

Book about Global Cooling



published in summer
2012.

paperback edition for
19 €.

German version
available

www.globalcooling-climateprotection.net

***Thank You Very
Much for Your
Attention!***

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