

*100% Renewables for Jordan is
necessary, possible and economic.*

Jordan 6th December 2017

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

Political challenges

- Global warming, loss of biodiversity
- Peak oil, energy security
- Nuclear and environmental disasters
- Oil wars, poverty, refugees, economic crises

→ All these challenges are connected with fossil and nuclear energies

Renewables will solve these problems

Fukushima March 2011



Until 2012 the costs of the reactor disaster amounted to €100 bn.

COP 21: Stop Climate warming at 1,5 C

But at today's warming at 1,3° C is already unacceptable:

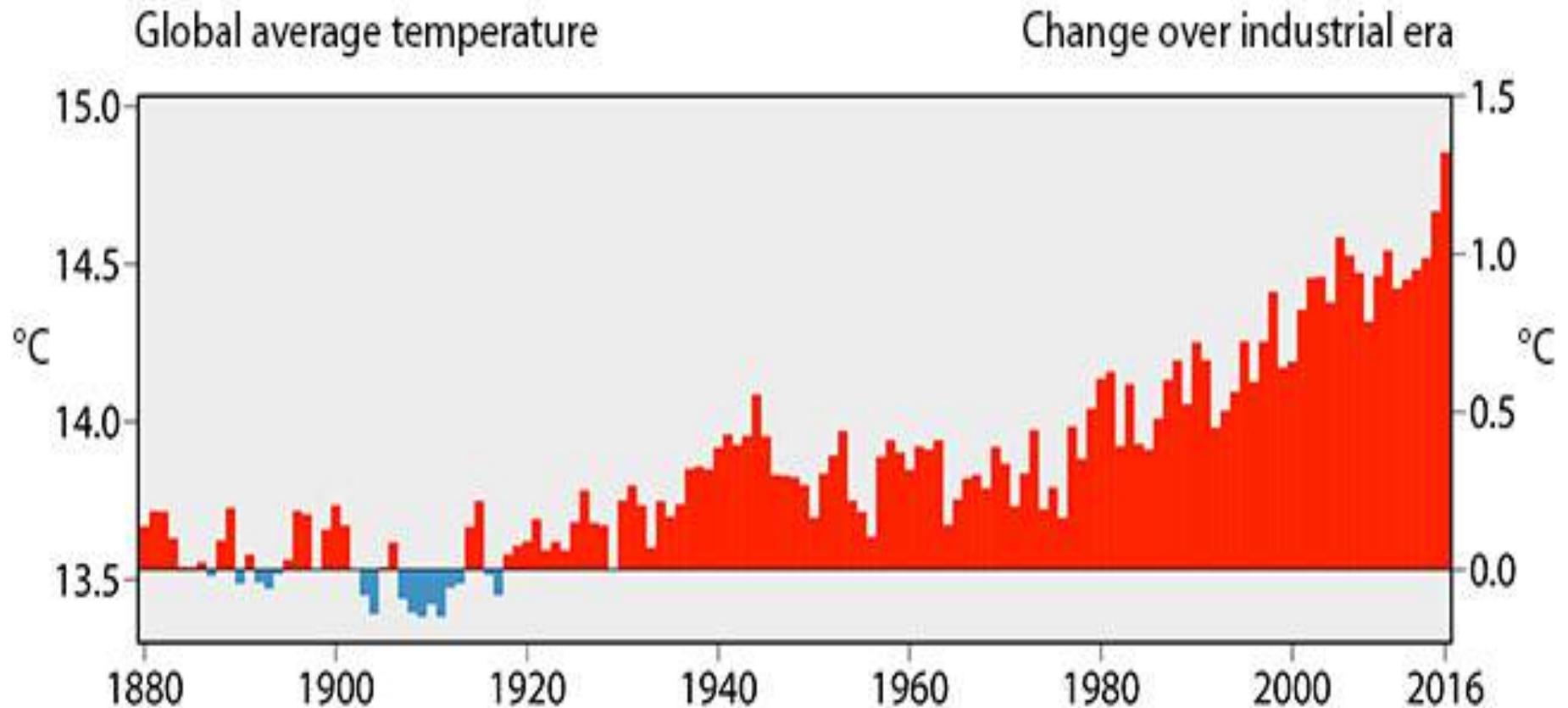
aridity and forest fires, floods and storms, sea level rising



The better choice is:

Global Cooling

ECMWF: Global Warming 2016: 1,3 °C



Paris goal 1,5°C possibly reached at 2020 ?
What to do then? More Emissions?

Crises of climate warming and peak oil can only be solved by two parallel strategies:

1. Stop greenhouse gas emission

(not only a reduction of emissions)

- switch to 100% renewables
- completely stop the use of fossil and nuclear energies in energy, chemistry, transport, agriculture

2. Take out carbon from atmosphere

- convert plants to humus soil (biocoal)
- reforesting big areas, greening the deserts
- Organic agriculture

The Target must be 330 ppm CO₂

This leads to global cooling, instead of global warming

Greening the degraded land:

20% greened degraded land areas with oleiferous plants can substitute for the global mineral oil demand



Around 2000 Gt CO₂ could be taken out of atmosphere in next 30 years

With 100% REN this will lead to **350 ppm** (**Global Cooling**)

Greened Egypt desert at Luxor with Yatropha brings oil & food

India: DaimlerChrysler jatropha project

At the beginning



First plantings



After some years



Driving with biodiesel



Quelle: DaimlerChrysler, Jatropha – Biodiesel from Eroded Soils, A Concept for Sustainable Mobility in Developing Countries, RBP/CF July 17, 2006

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Greening: carbon sinks; new habitat



Water + Electricity from the same windmill



Sea water desalination



Oil plant Yatropha in the desert of Fuerte Ventura

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

Hydrothermal Carbonisation (HTC) to produce biochar (biocoal) from all organic



First HTC
plant in Germany

Process:

Input: plants, agriculture
and municipal waste;

Output: biocoal;

Usage of Biocoal:

- Fuel (e.g. in coal power)
- Chemical base (oil substitute)
- Fertiliser (carbon binding)

Agro PV in China, Yinchuan; Desert Gobi



Source: Gimbel, BayWa Re

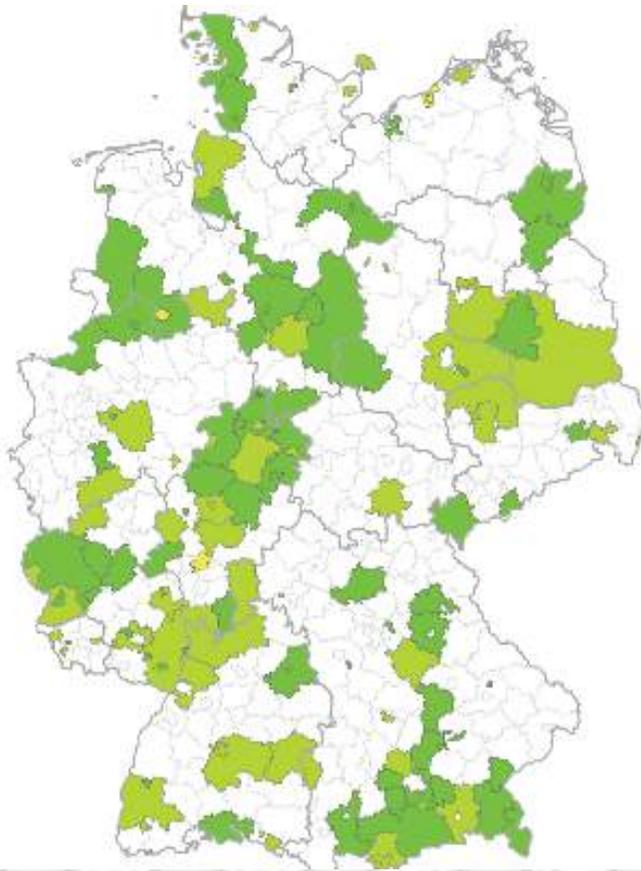
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Shadowing saves water, drip irrigation: Food can grow in former desert



100% **RENEWABLES**

www.go100re.net



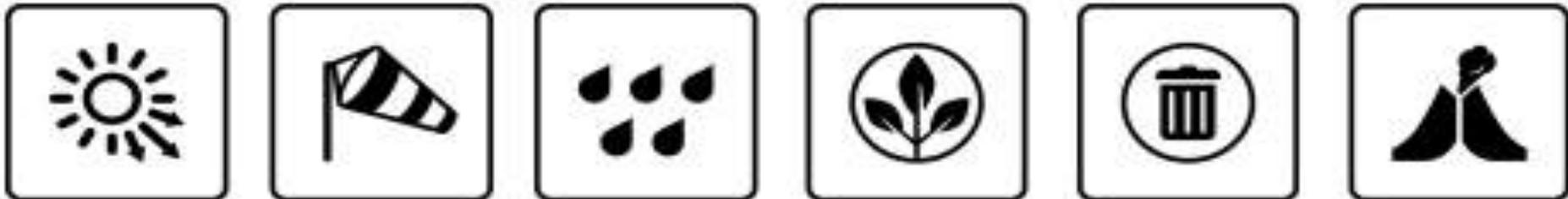
**Nov 2016, COP22, Marrakech:
48 countries (Climate Vulnerable Forum)
decided for 100% RE target**

*More Countries e.g.: Denmark; Sweden;
Costa Rica; Iceland; Cape Verde*

Cities with 100% RE target e.g.:
*Barcelona; Masdar City; Munich;
Masheireb; Downtown Doha; Vancouver;
San Francisco; Copenhagen; Sydney;*

Companies with 100% RE target e.g.:
Google, Coca-Cola, Ikea, Walmart

Global Energy System Based on 100% Renewable Energy - Power Sector



Study funded by the
German Federal Environmental Foundation (DBU) and
Stiftung Mercator GmbH

First Global Modelling of a Global 100% Renewable Energy System - Powersystem

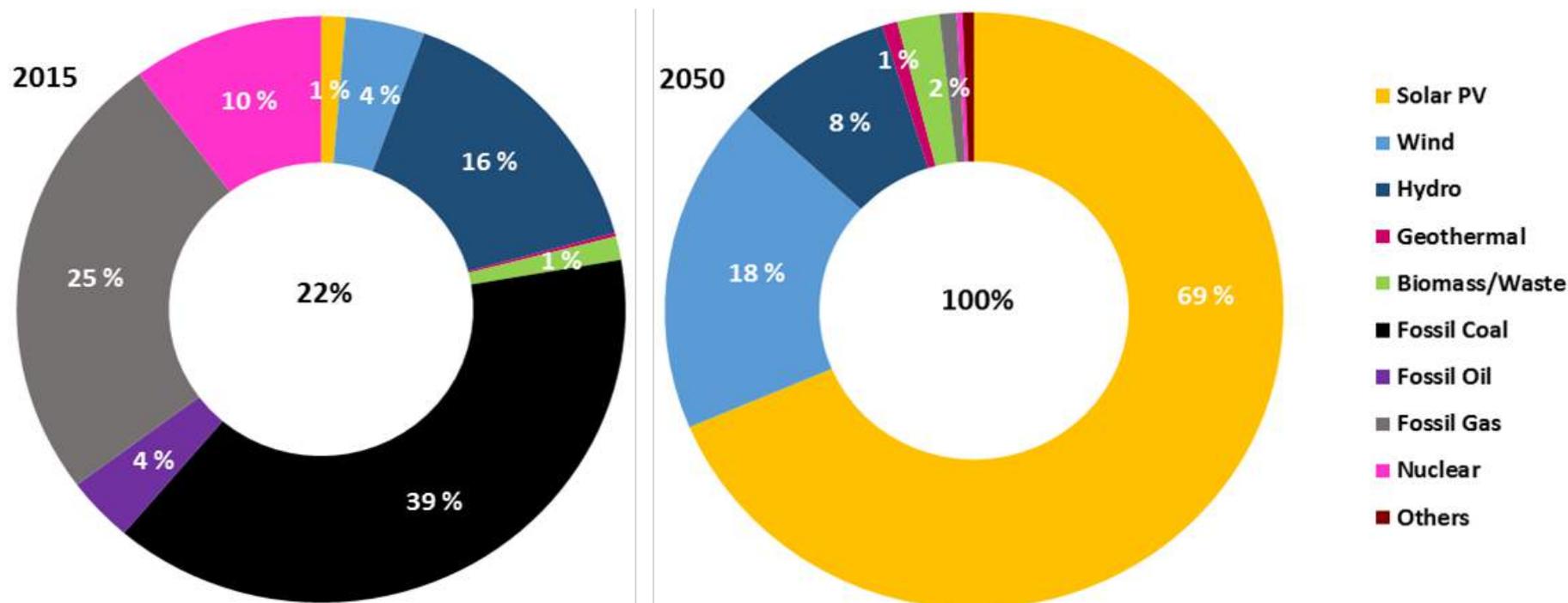


- The modelling by LUT runs at full hourly resolution
- Real weather data for solar, wind and hydro resources
- World population grow to 9.7 billion by 2050.
- Global power sector demand is set to increase from 24 TWh in 2015 to around 49 TWh by 2050.

Source: <http://energywatchgroup.org/studies/>

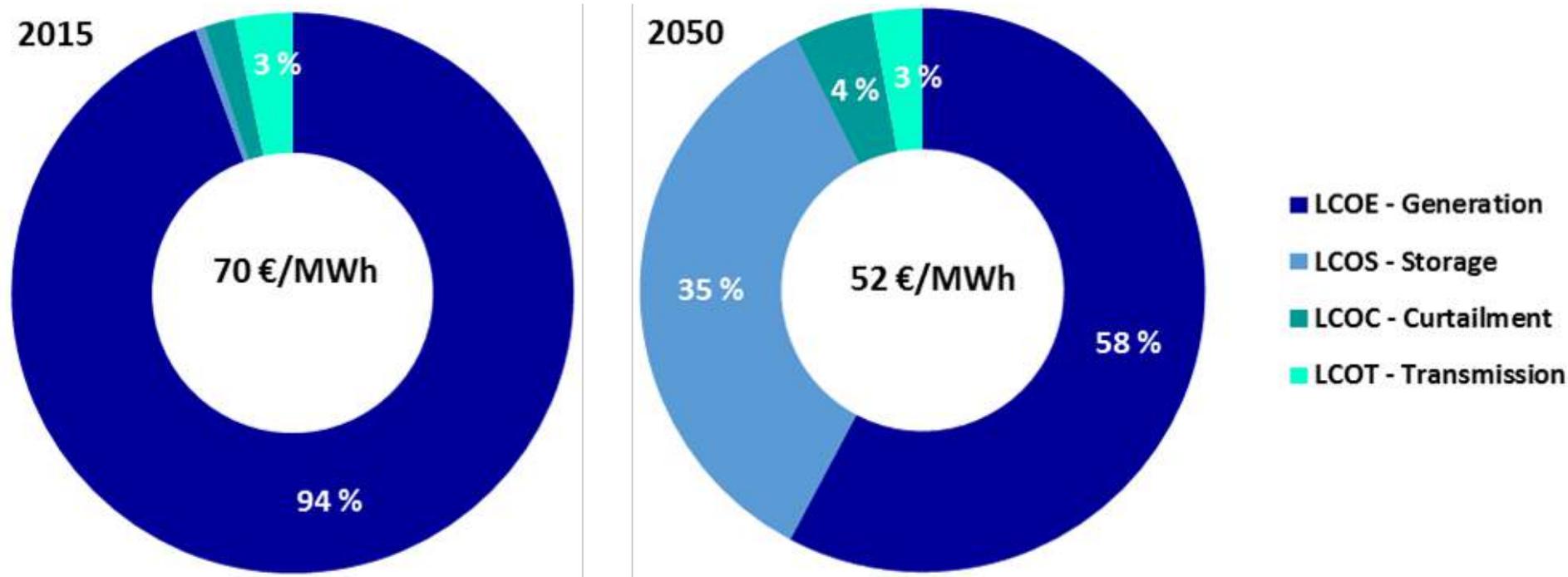
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Electricity Generation 2015 and 2050



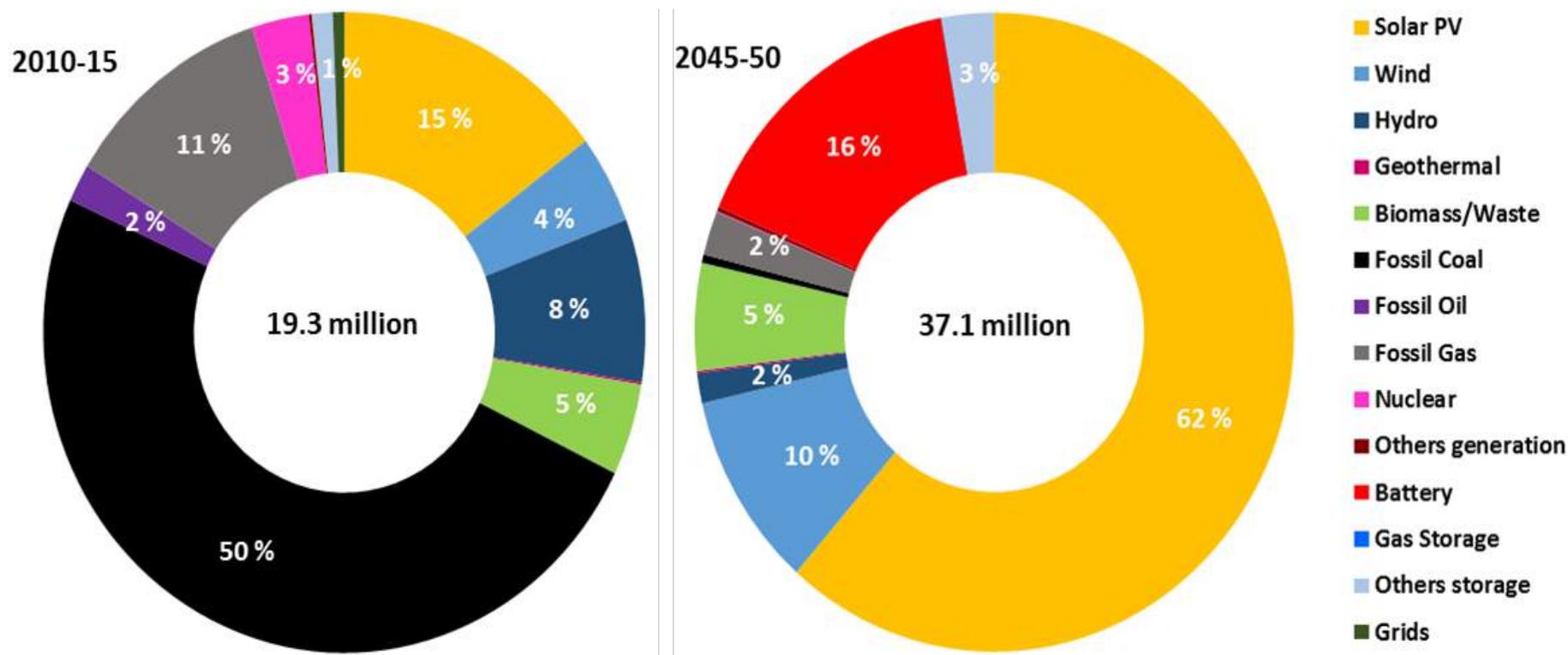
- In 2050, solar PV 69%, wind 18%, hydropower 8%, bioenergy 2% of the total electricity mix globally.
- Gas generation is only from renewable energy based gas
- Nuclear power still accounts for negligible 0.3% of the total electricity generation, due to the end of its assumed technical life, but could be phased out earlier.

Renewable Electricity is Cost-efficient



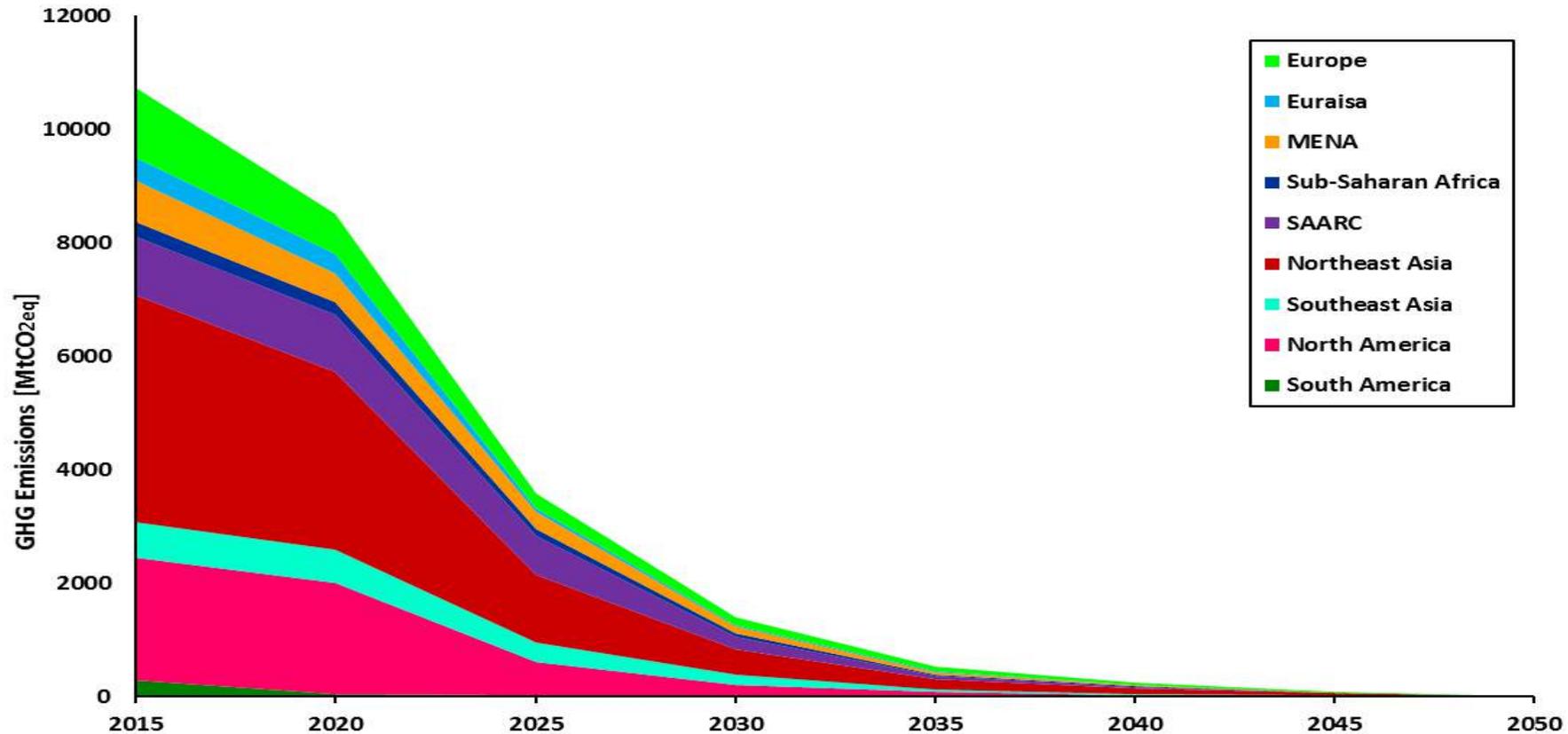
- Total levelised cost of electricity (LCOE) on a global average for 100% renewable electricity in 2050 is €52/MWh (including curtailment, storage and some grid costs), compared to €70/MWh in 2015.

Employment



The global energy transition to a 100% renewable electricity system creates 36 million jobs by 2050 in comparison to 19 million jobs in the 2015 electricity system.

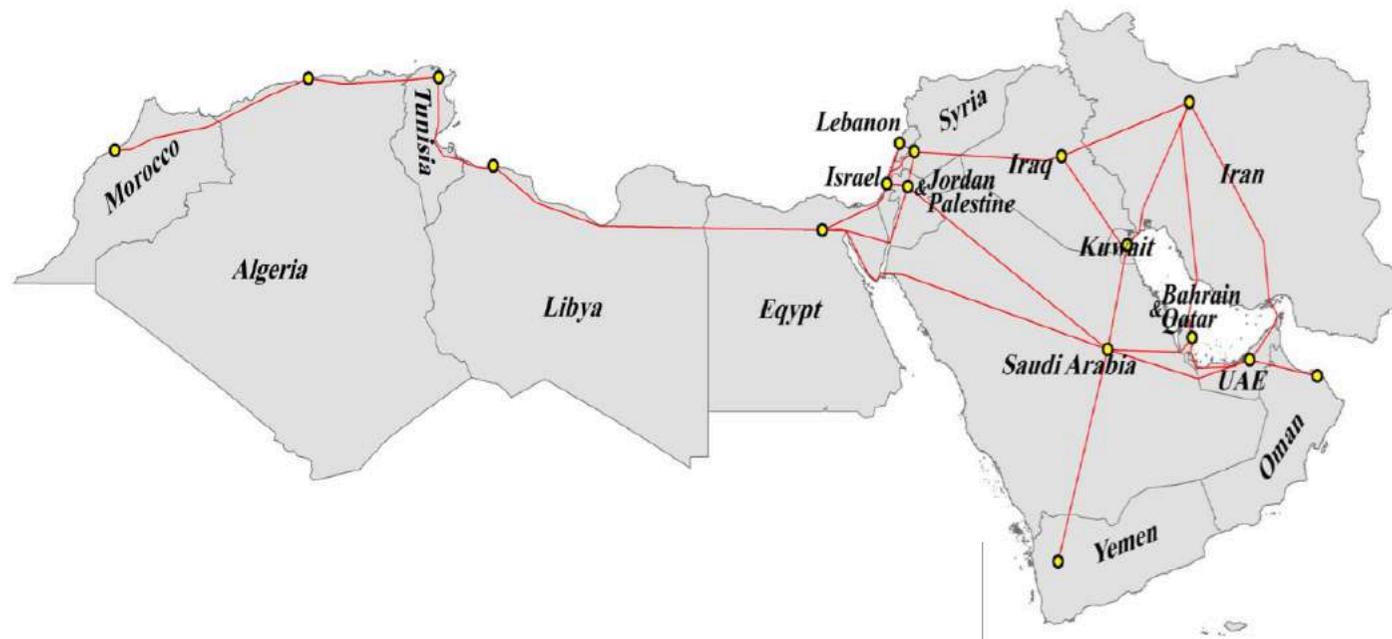
100% RE will reduce GHG to zero



Global greenhouse gas emissions significantly reduce in power sector from about 11 GtCO_{2eq} in 2015 to zero emissions by 2050 or earlier, as the total LCOE of the power system declines.

MENA Region: 100% Renewables

Lappeenranta University Finland

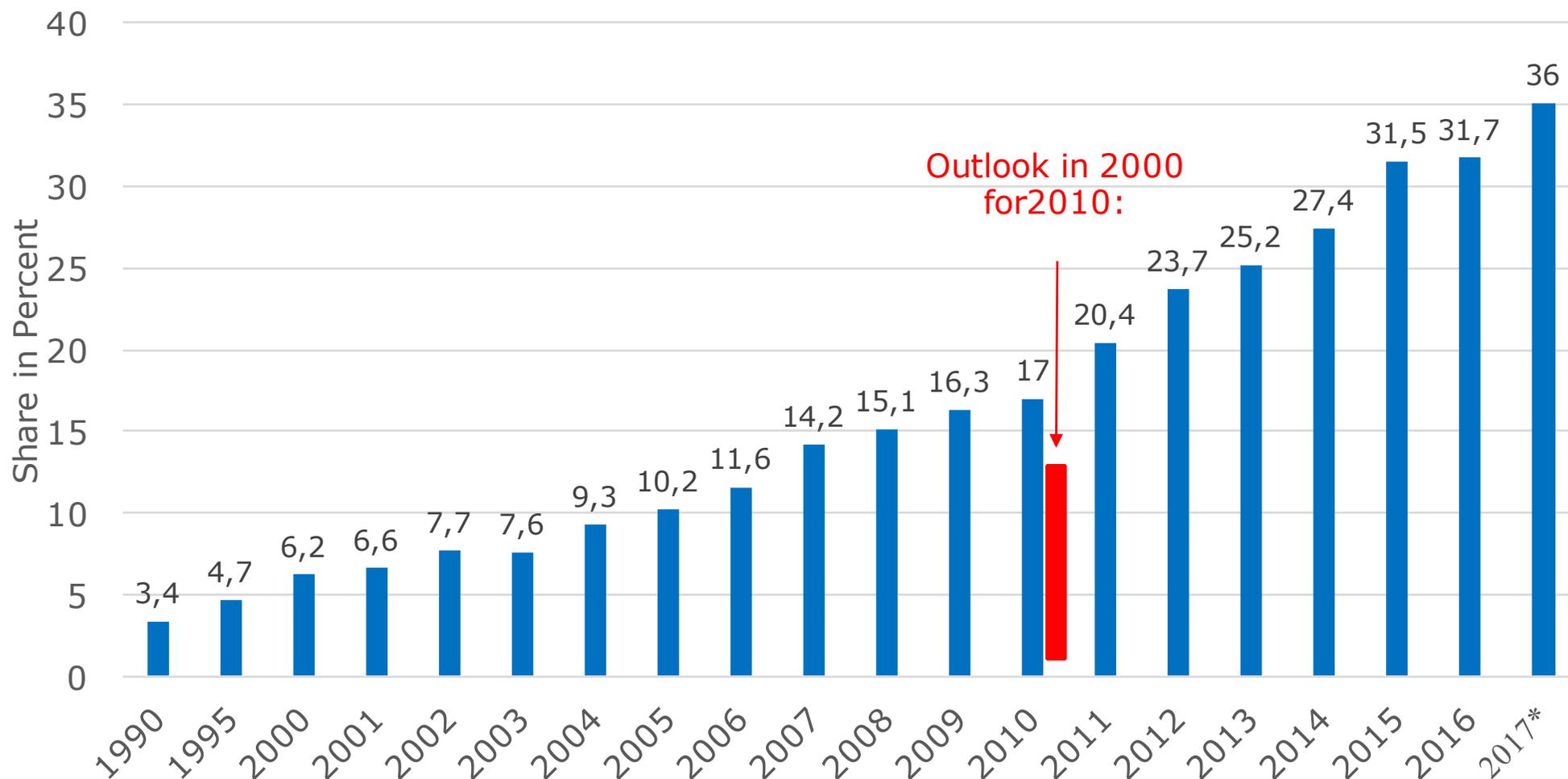


Levelized cost el.
(Generation,
Transport,
Storage):
6,1 Eurocent/kWh

We can simulate also Jordan 100% renewables
Doners are welcome

Political support stimulates renewable growth

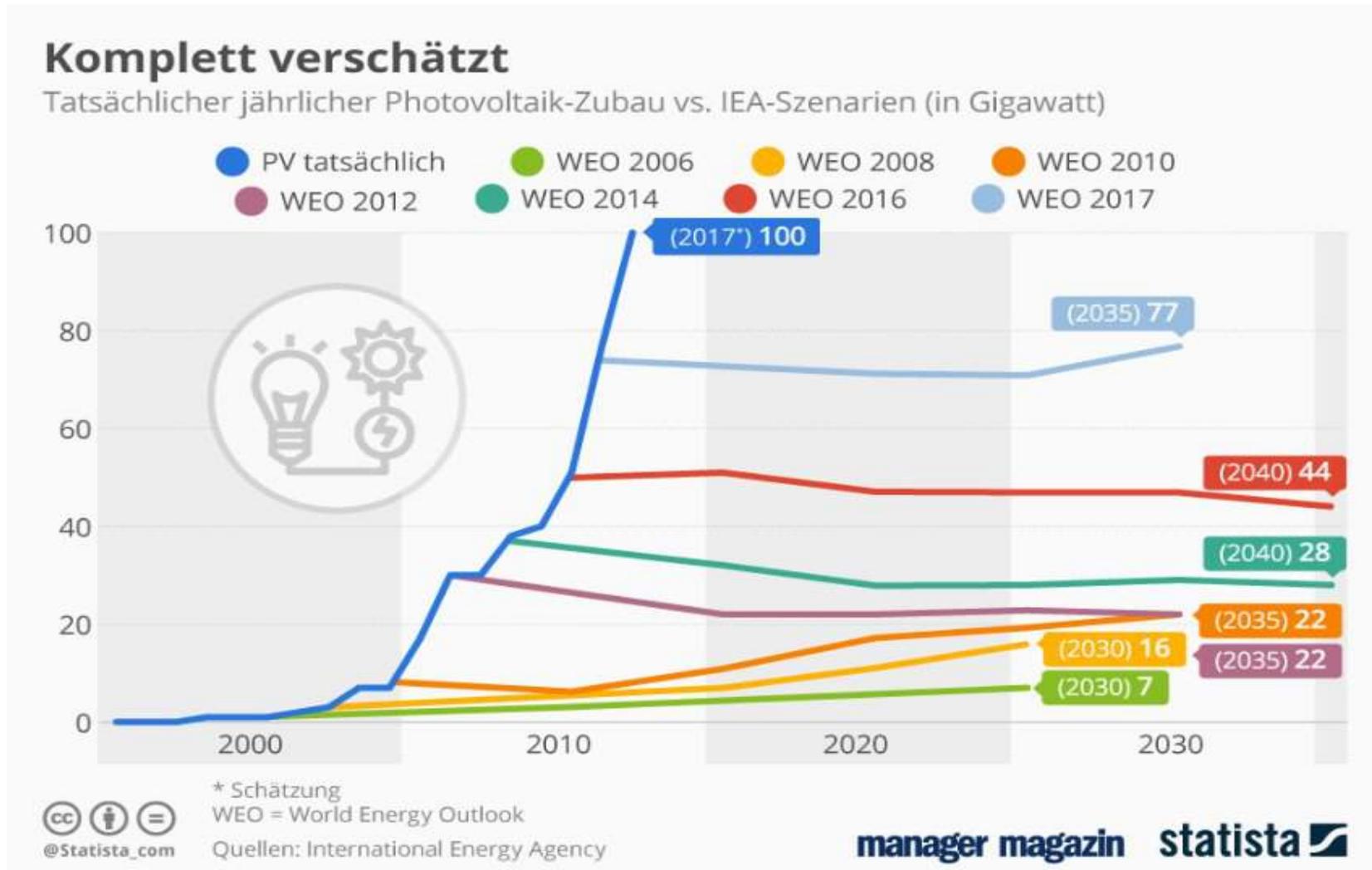
Share of renewable electricity in Germany



Source: BMWi, AGEE-Stat, BEE

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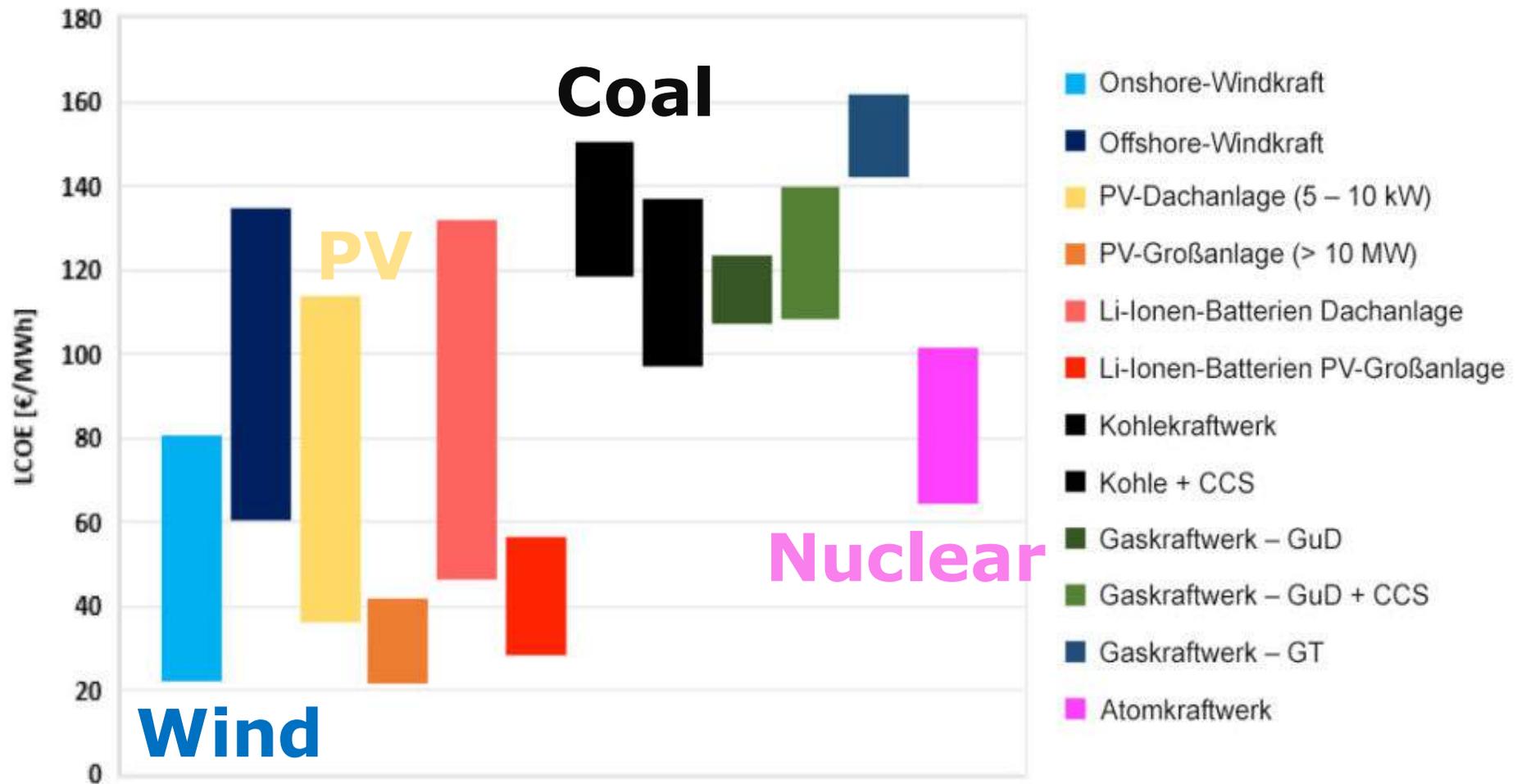
PV Reality and projections of IEA



Source: <http://www.manager-magazin.de/unternehmen/energie/world-energy-outlook-der-iea-ignoriert-solarenergie-seit-jahren-a-1178384.html>

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PV and wind power = cheapest energy in G20 States



Source: <https://www.pv-magazine.de/2017/07/05/studie-photovoltaik-und-windkraft-spaetestens-2030-in-allen-g20-staaten-guenstigste-stromquelle/>

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Nuclear power is too expensive

- New nuclear power plants
 - GB: Hinkley point is double so expensive then solar and wind (Guardian: British government in an unpublished Study)
- Existing nuclear power becomes uncompetitiv with renewables
 - USA: 5 atomic plants closed in 2013/14
 - USA: 9 atomic plants will close next years:
 - Fort Calhoun 2016; Clinton and Fitzpatrick 2017; two in Quad Cities 2018; Pilgrim and Oyster Creek 2019;two in Diablo Canyon 2025.

Policy Recommendations

- Instruments, enabling direct private investments in renewable energy and other zero- emission technologies.
 - The German Renewable Energy Sources Act (EEG) with a fixed feed-in-tariff
 - Hybrid renewable power plant remuneration
 - Tenders only for capacities above 40MW
- Phasing-out all state subsidies to fossil fuel and nuclear energy generation
- Tax exemptions for investments in renewable energy
- Replacement of emission trading system with carbon & radioactivity taxes
- Research and education

Key findings of Energy Watch Group Study Feed in tariff - tendering

- Tenders curbs the expansion rate of RE growth
- Tenders slow cost reduction of RE technologies: according to the learning curve, costs decrease only with further increases in market volume;
- Tenders reduce the diversity of actors; private investors, energy cooperatives, and SMEs
- Tenders help cement the market power of oligopolies by large corporations and encourage corruption
- **More Details:** http://energywatchgroup.org/wp-content/uploads/2017/09/FIT-Tender_Fell_PolicyPaper_EN_final.pdf

Overall concepts for 100% renewables

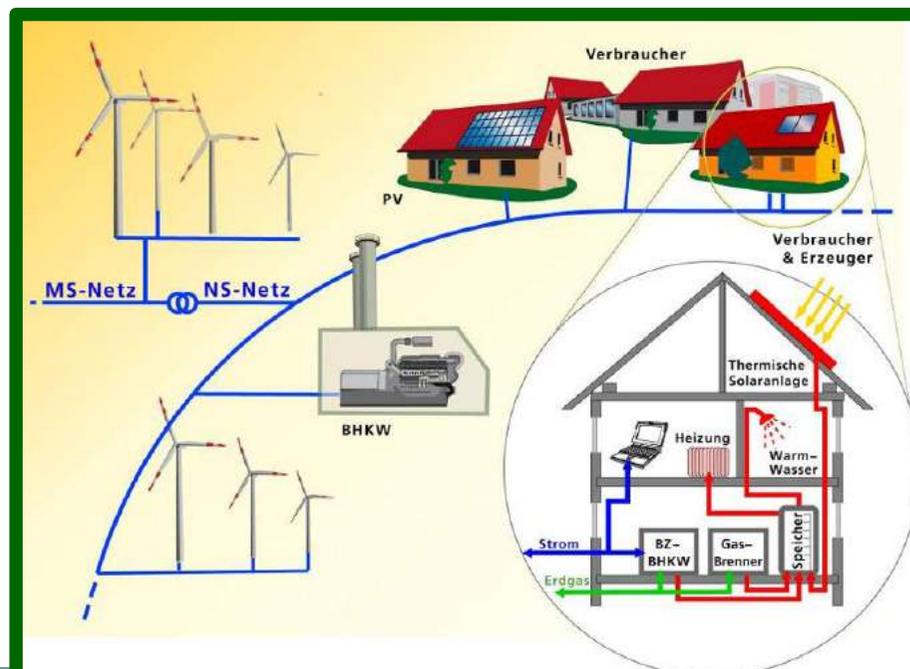
- Renewable energy for: heating, cooling, mobility, electricity, industry

Wind, solar, hydro, waves, bioenergy, geothermal power

- Storage: hydro pump; batteries; power to gas; ice (heat) storage

- Big data; smart homes; smart cities

Hybrid/
electric
vehicles



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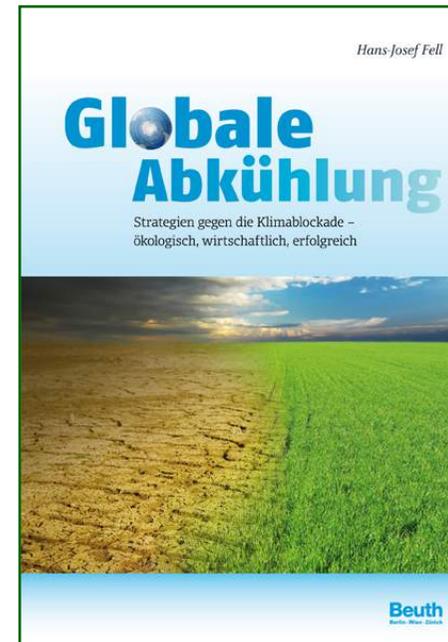
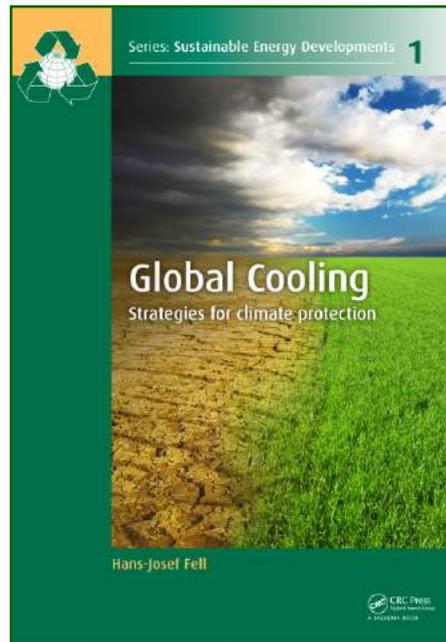
Feed-in tariff for combined renewable power producer

- Tariff is paid for per law if:
 - Power generation meets demand each hour of the year
 - Mix of 100% renewable power generation
 - Frequency and voltage stability, reactive power is guaranteed
- Effects:
 - Grid stability is growing, decentralised bottom-up approach
 - Integration of heating/cooling and electro-mobility
 - Development of storage technology
 - Emergence of smart cities

Leonardo di Caprio 17.4.2017 in Shanghai at Presentation of new BYD E-cars Global Cooling by 1° C



Global Cooling/Globale Abkühlung Strategies for Climate Protection/ Strategien gegen die Klimaschutzblockade



[https://www.crcpress.com/
Global-Cooling-Strategies-for-Climate-
Protection/Fell/p/book/9780415628532](https://www.crcpress.com/Global-Cooling-Strategies-for-Climate-Protection/Fell/p/book/9780415628532)

[http://www.beuth.de/de/arti
kel/globale-abkuehlung](http://www.beuth.de/de/artikel/globale-abkuehlung)

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

www.hans-josef-fell.de

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