

# *Pathways to 100% Renewable Energy*

**Abu Dhabi 2nd November 2017**

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

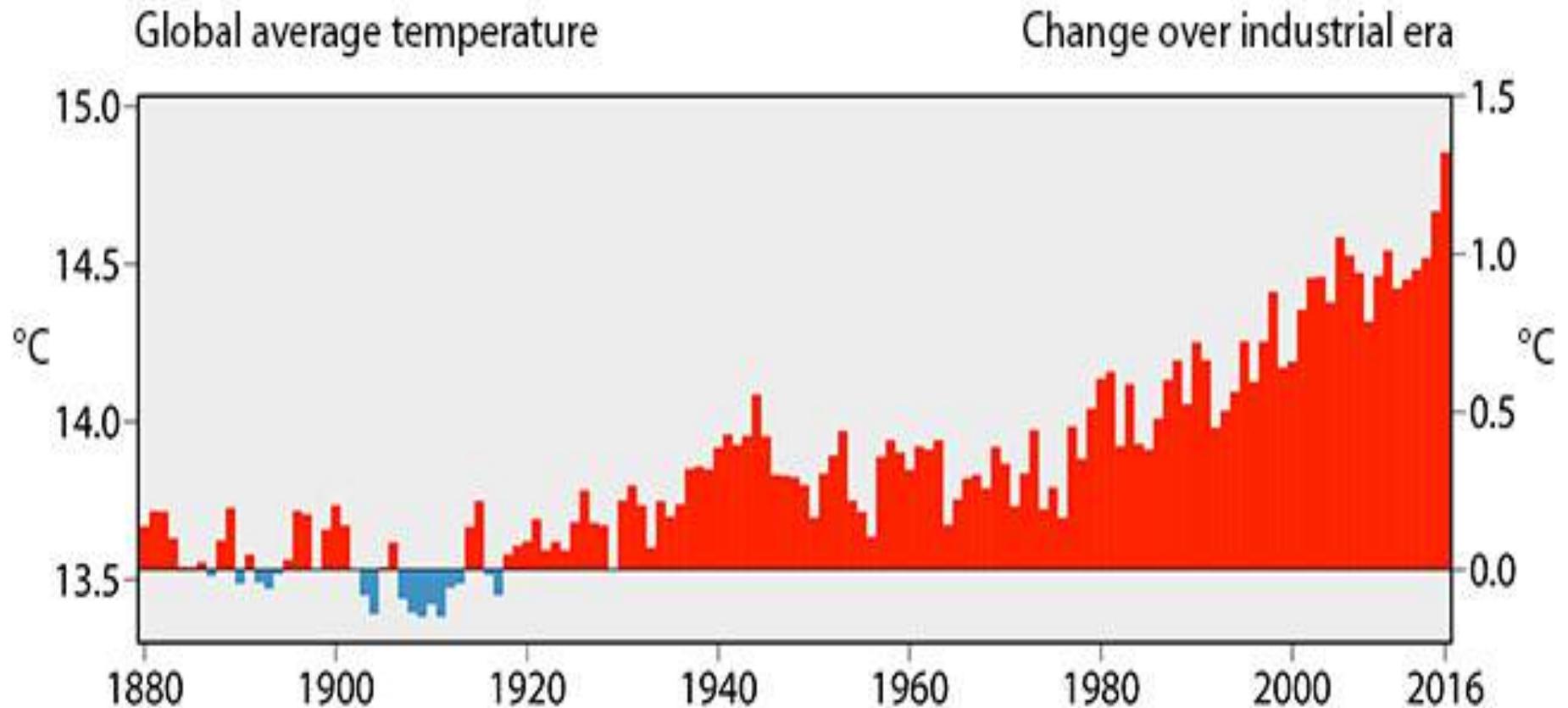
# Political challenges

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

All these challenges are connected with fossil and nuclear energies

→ **Renewables will solve these problems**

# 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 CO<sub>2</sub>**

**This leads to global cooling, instead of global warming**

# Agro PV in China, Yinchuan; Desert Gobi



Source: Gimbel, BayWa Re

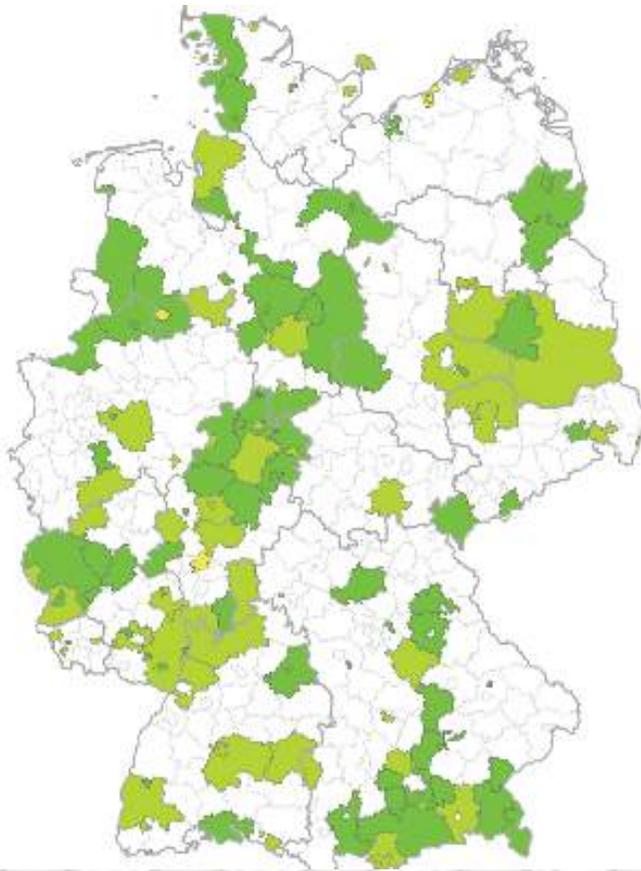
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# Shadowing saves water, drip irrigation: Food can grow in former desert



# **100%** **RENEWABLES**

[www.go100re.net](http://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*

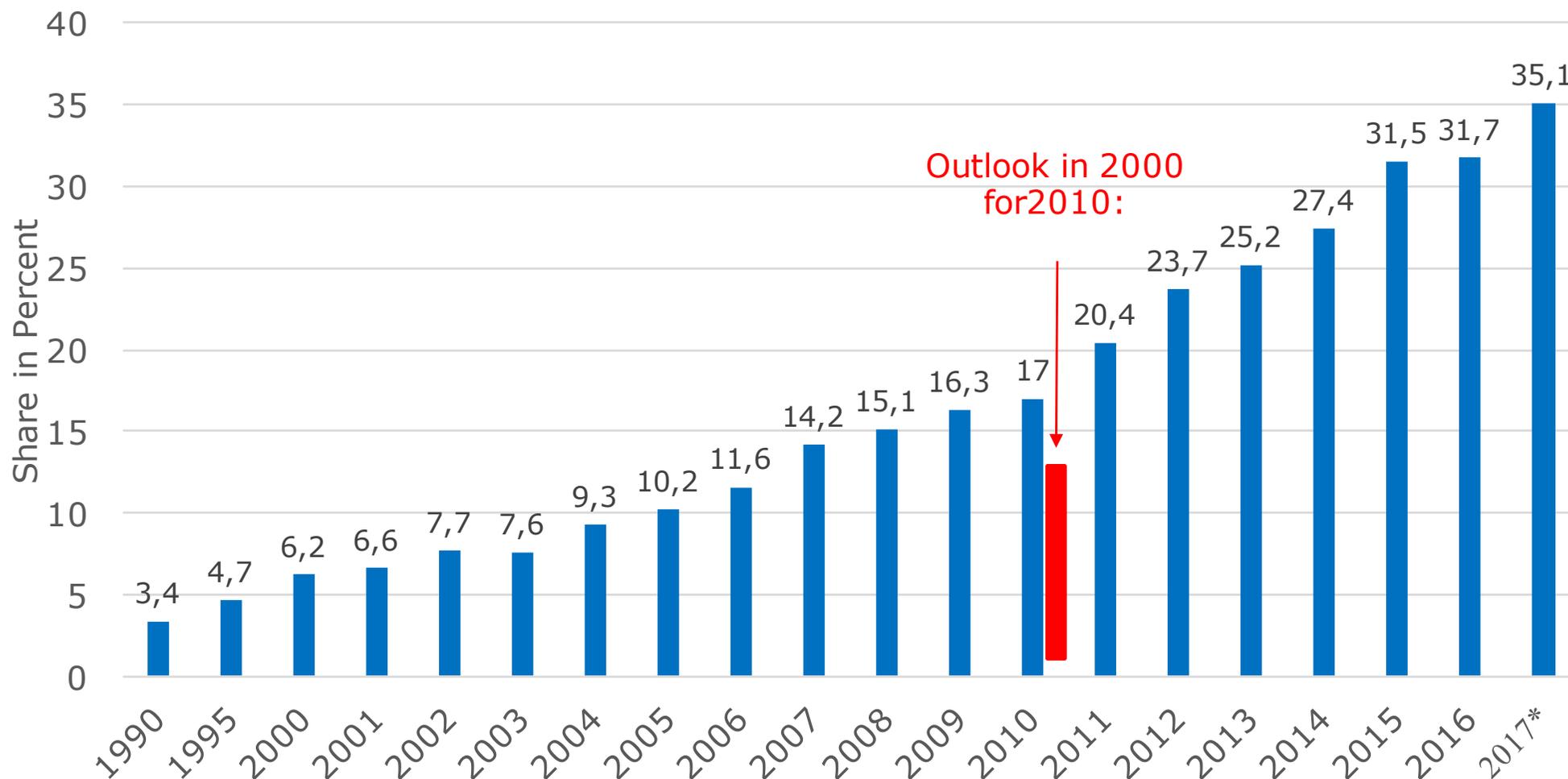
# Global Energy system based on 100% Renewable Energy – Power sector

- Global simulation by Lappeenranta University Finland, will be published by Energy Watch Group on 8. Nov. 2017 at COP 23 in Bonn
- Keyfindings:
  - feasible at every hour throughout the year
  - more cost effective than existing system



# Political support stimulates renewable growth

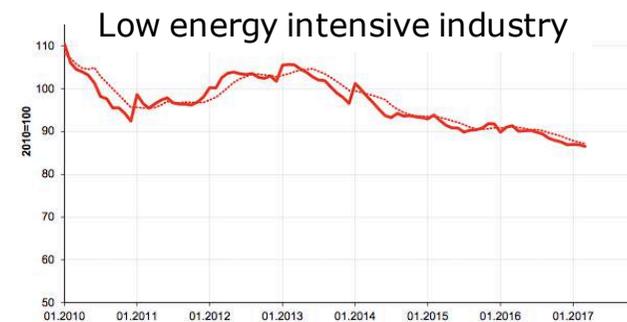
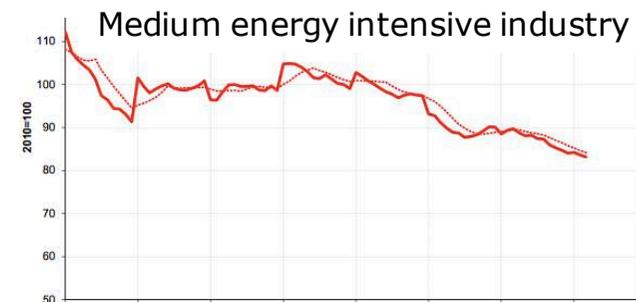
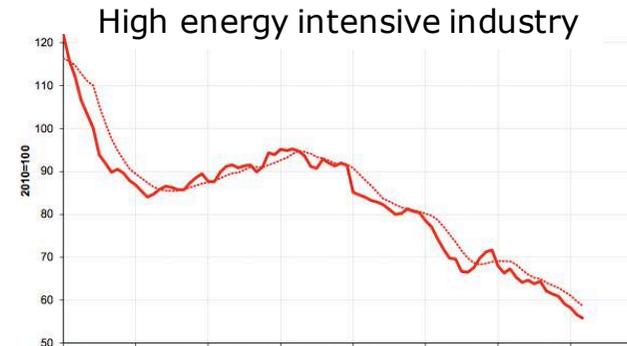
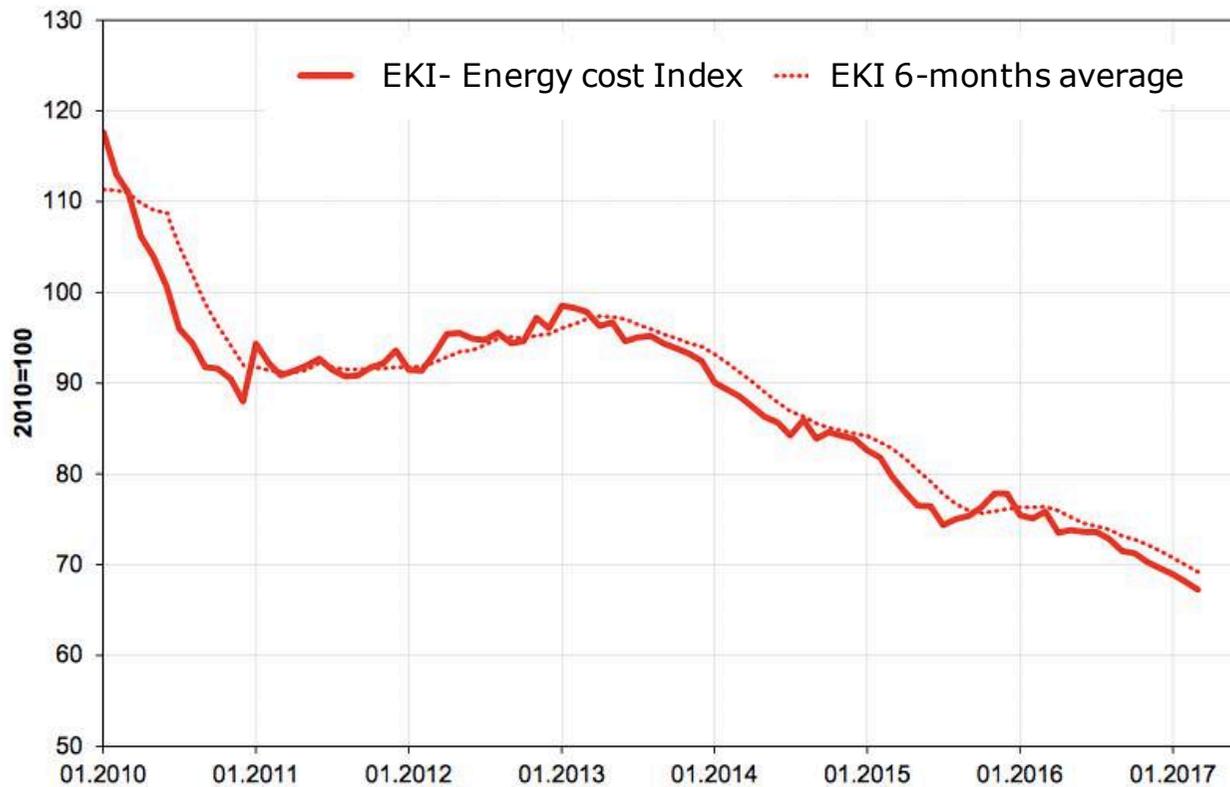
## Share of renewable electricity in Germany



Source: BMWi, AGEE-Stat, BEE

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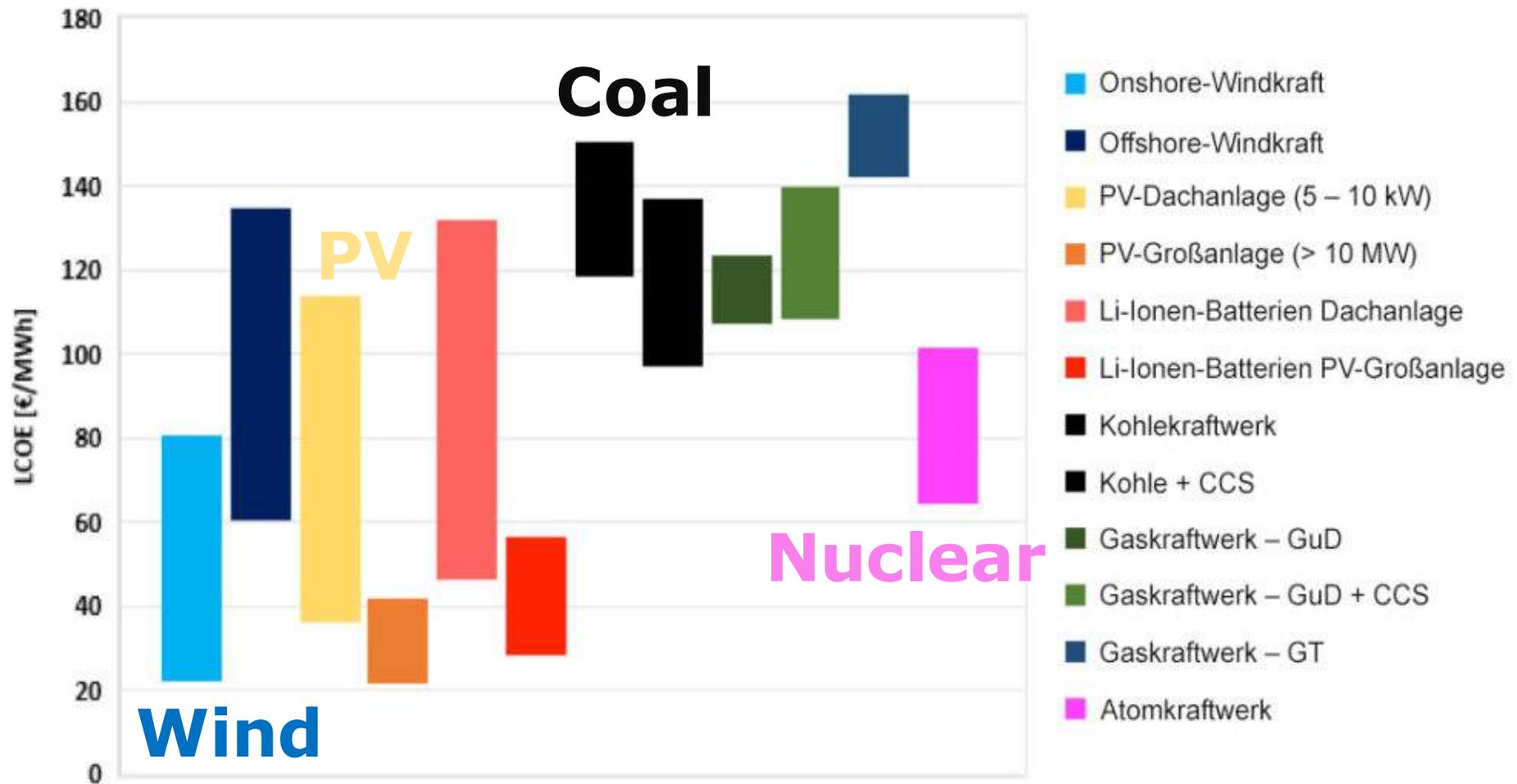
# While renewables expanded, the energy costs of the German industry have been declining since 2010



Source: Öko-Institut e.V.

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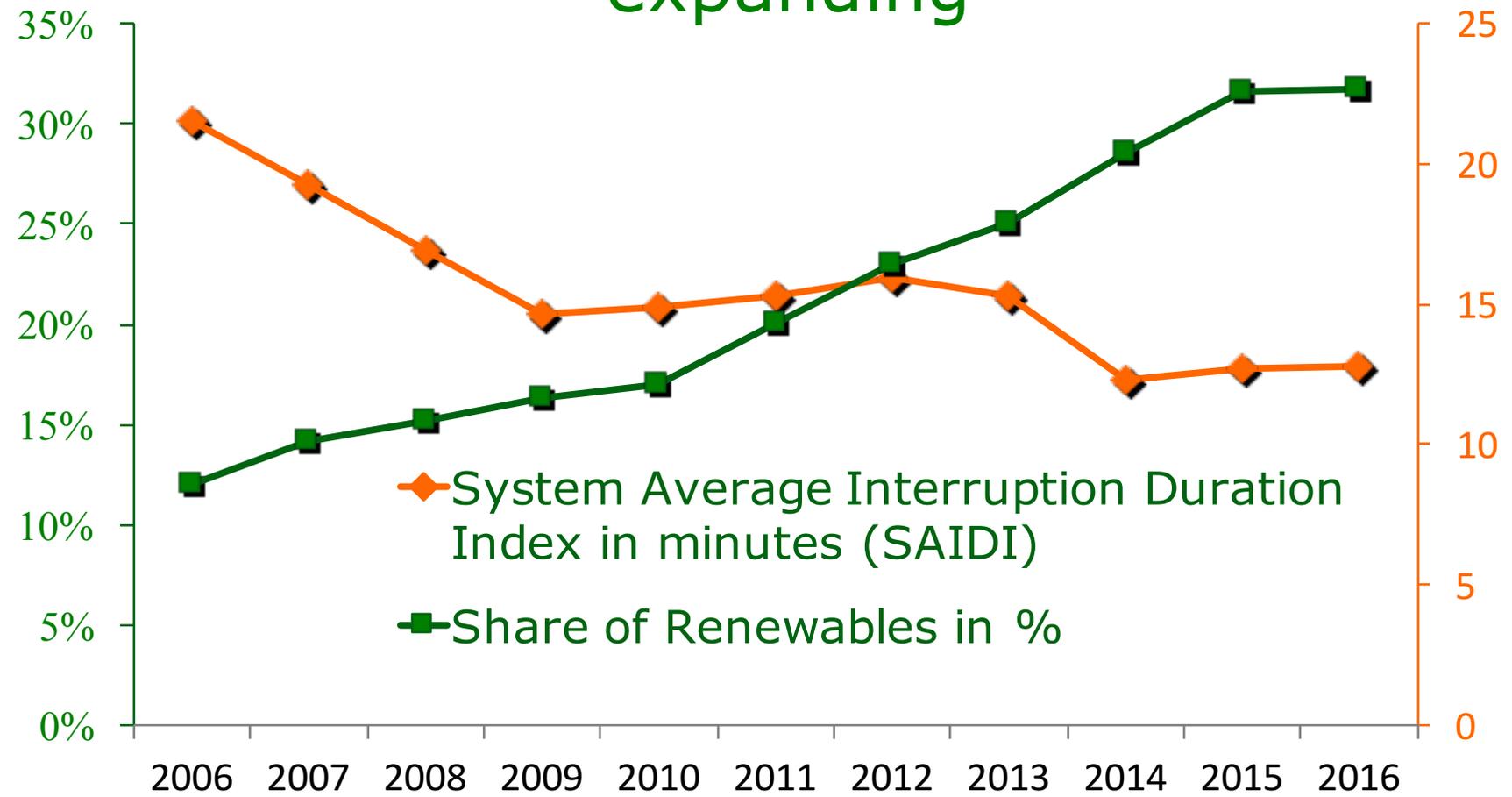
# PV and wind power = cheapest energy in G20 States



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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# Reality in Germany: Increasing grid stability while renewables are expanding



Source: Bundesnetzagentur (2015);  
[http://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen\\_Institutionen/Versorgungssicherheit/Stromnetze/Versorgungsqualitaet/Versorgungsqualitaet-node.html](http://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen_Institutionen/Versorgungssicherheit/Stromnetze/Versorgungsqualitaet/Versorgungsqualitaet-node.html) ; BMU, BEE, bdew

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# Policies for Renewable Growth

- **Laws to stimulate investment**
  - **Feed-in-tariffs (FIT)** (GET FIT for developing countries)
  - Tendering, auctioning
  - Others: premium options, net metering and many more
- **Canceling subsidies** for fossil and nuclear energy, fossil chemistry and intensive agriculture
- **Tax relief** for renewables
- **Carbon tax**
- **Research and education** for renewables and organic farming
- **Reducing obstacles** for approval
- Dispose big areas for reforestation and greening

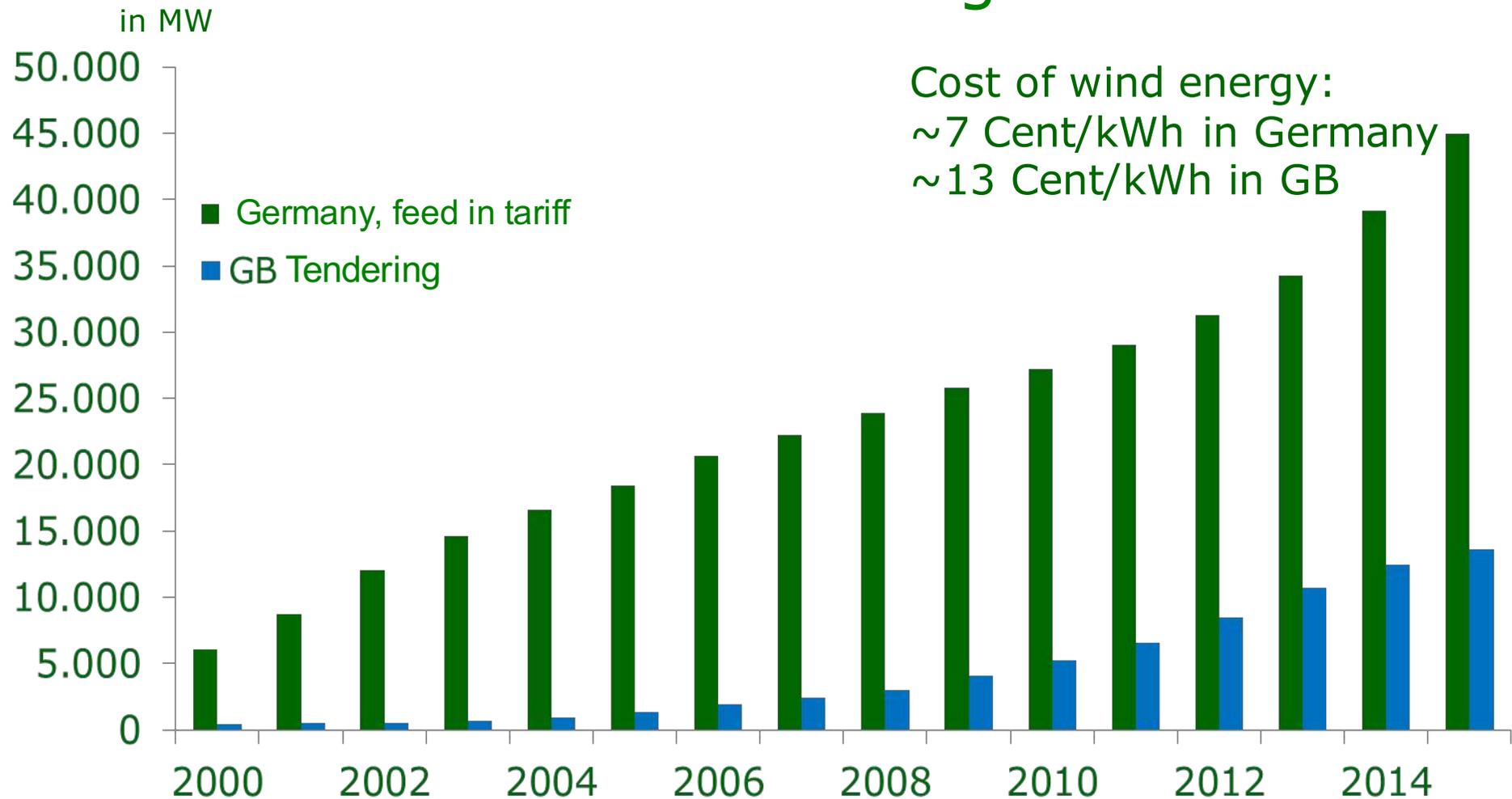
## Not successful:

- Tendering or certificate systems
- Emission trading

# 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](http://energywatchgroup.org/wp-content/uploads/2017/09/FIT-Tender_Fell_PolicyPaper_EN_final.pdf)

# Installed Wind Capacity in G and GB shows: Feed in Tariff is more successful and cheaper than Tendering

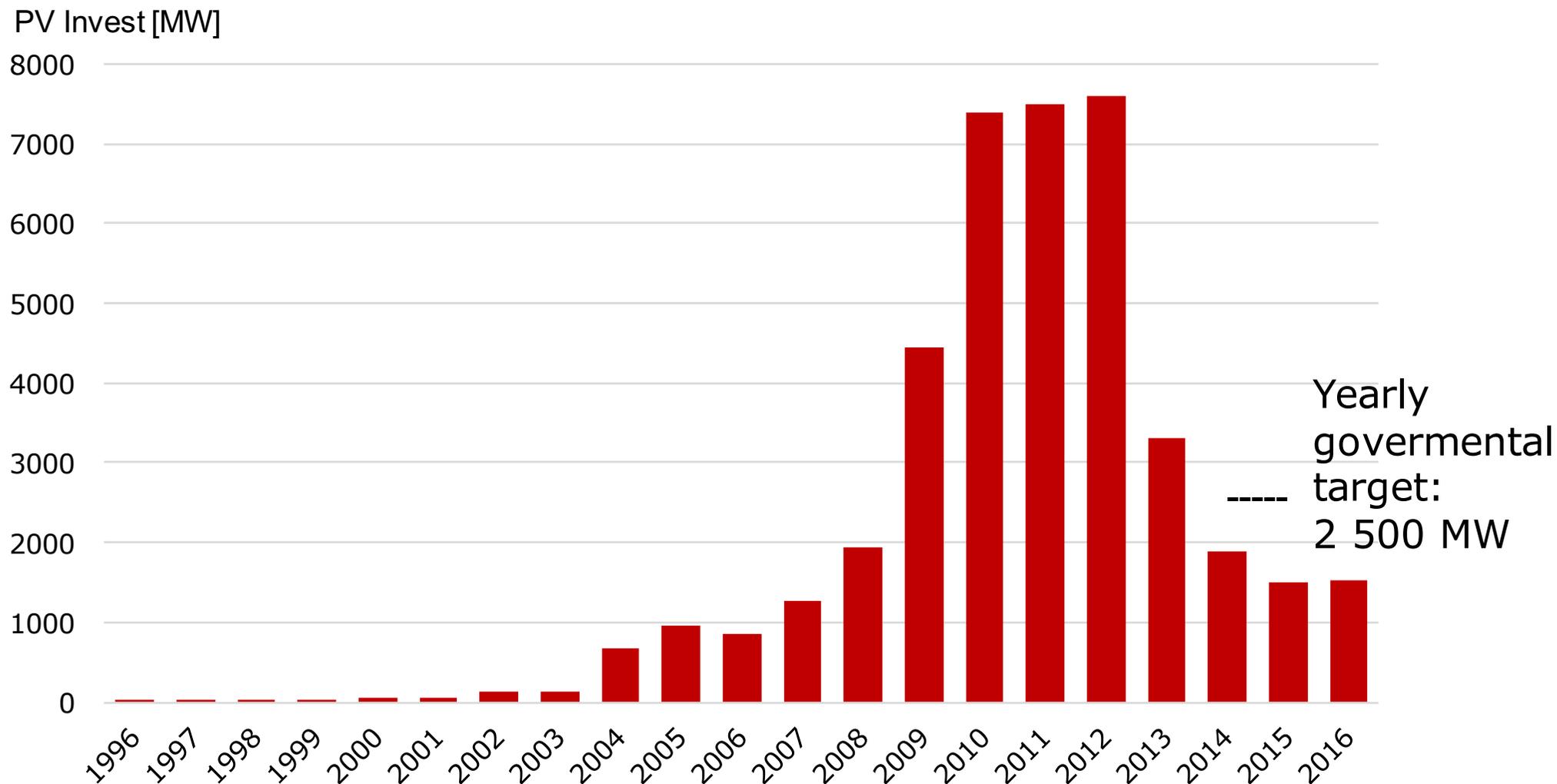


Source: Volker Quaschnig, 2016:  
[http://www.volker-  
quaschnig.de/datserv/windinst/index.php](http://www.volker-quaschnig.de/datserv/windinst/index.php)

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# Yearly PV investment in Germany

## the switch to tendering and other impairments of EEG leads to drastic market decline

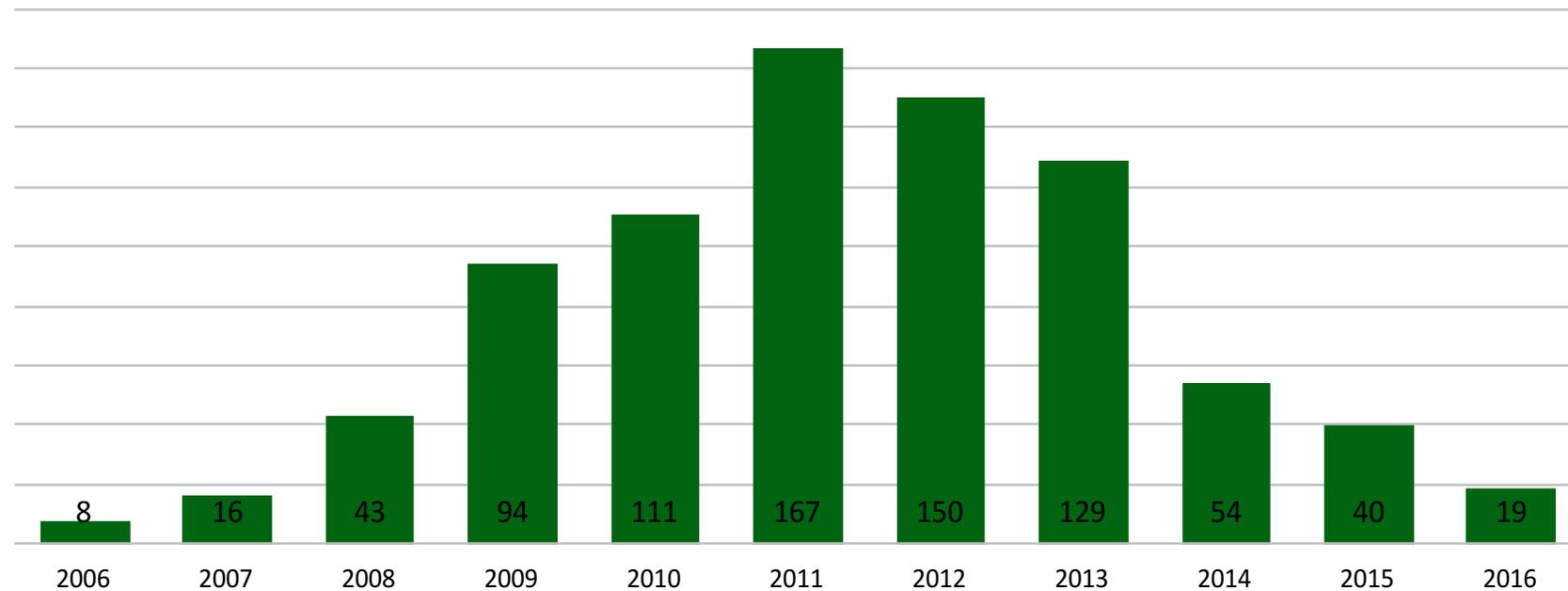


Quelle: Volker Quaschnig, 2017

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# Strong decline in new establishments of energy cooperatives in Germany since 2014



**Reasons: More bureaucracy and other impairments of EEG**  
**Mainly: switch from FIT to Tendering**

Quelle: „Zum Stand von Energiegenossenschaften in Deutschland“,  
Leuphana Universität Lüneburg 2015  
<http://www.tagesspiegel.de/wirtschaft/genossenschaften-buergerenergie-bekommt-schuetzenhilfe-aus-bruessel/19393904.html>

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# Key points for an effective Renewable Energy Act (Feed-in Law; EEG)

- Privileged grid access/priority dispatch
- Feed-in tariff has to be appropriate for economic operation, with variations depending on technology and size
- Funding of feed-in tariff via electricity rate
- No cap for feed-in of renewable energies
- Guaranteed period of remuneration
- Tenders below 40 MW do not make for a successful policy as they strongly restrict the plurality of actors\*
- Also: No obstructions by a restrictive permission policy

\* [http://energywatchgroup.org/wp-content/uploads/2017/09/FIT-Tender\\_Fell\\_PolicyPaper\\_EN\\_final.pdf](http://energywatchgroup.org/wp-content/uploads/2017/09/FIT-Tender_Fell_PolicyPaper_EN_final.pdf)

# 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

# Overall concepts for 100% renewables

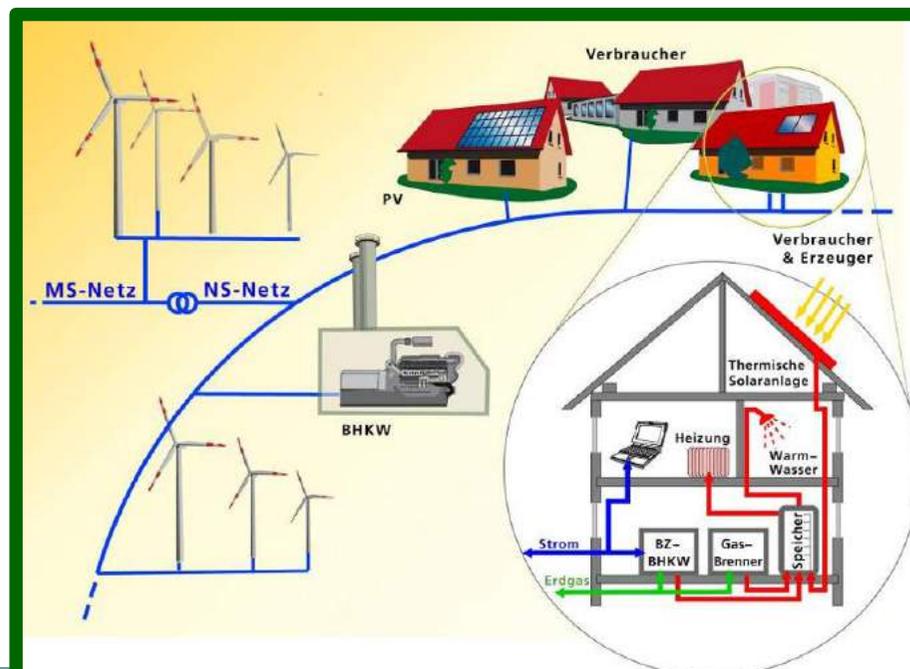
- Renewable energy for: heating, cooling, mobility, electricity, industry

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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# **Solar hot water** for heating the houses in the district in Hohenlohe Germany

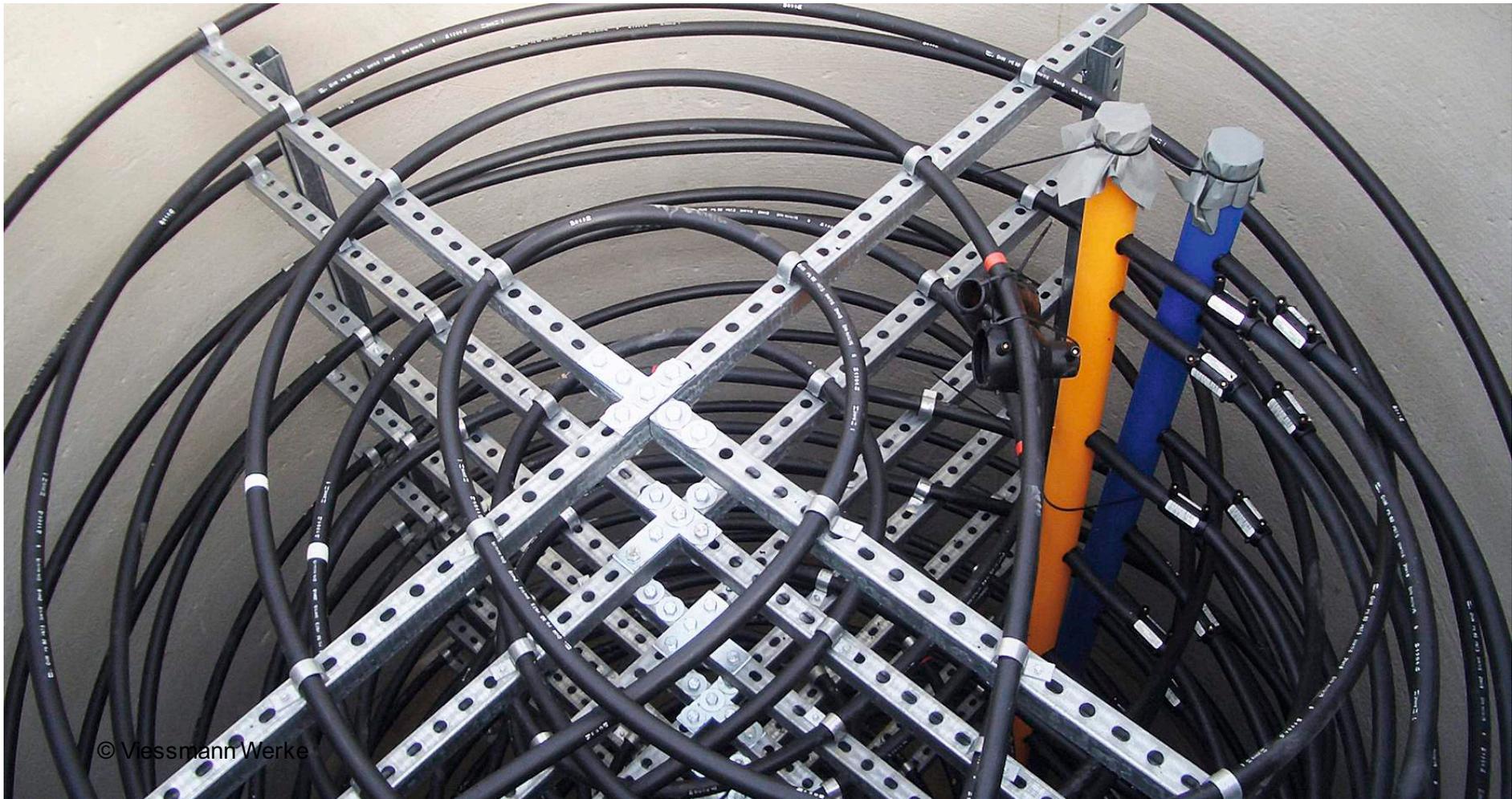


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# Ice storage:

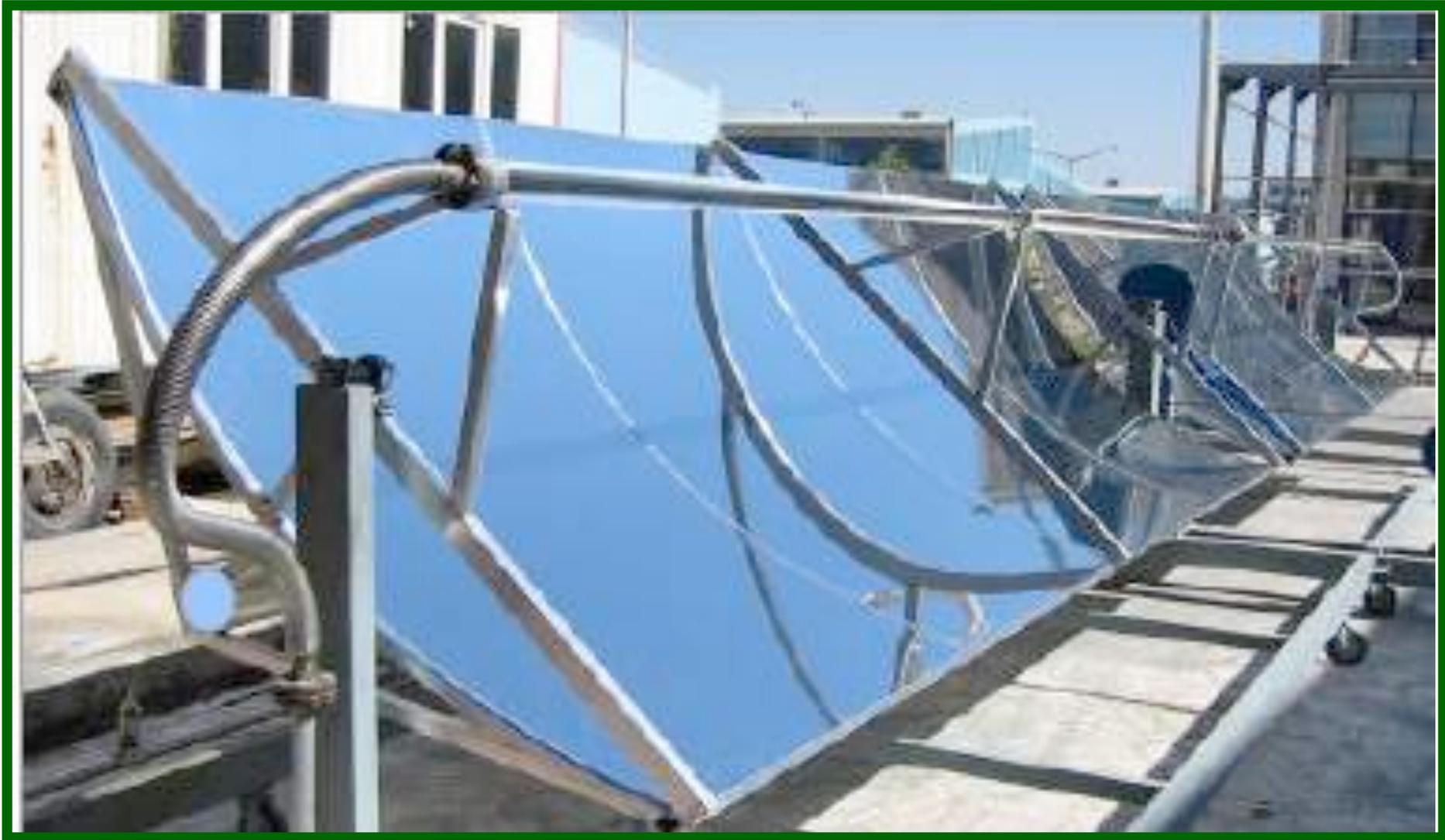
## Efficient and large volume seasonal storage for heat



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# Solar Cooling with Parabolic Channel Collectors on a Big Turkish Hotel



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# Solarthermal Powersystems also for water desalination



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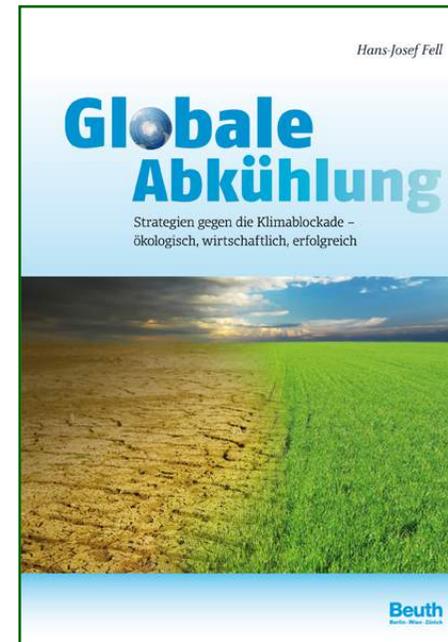
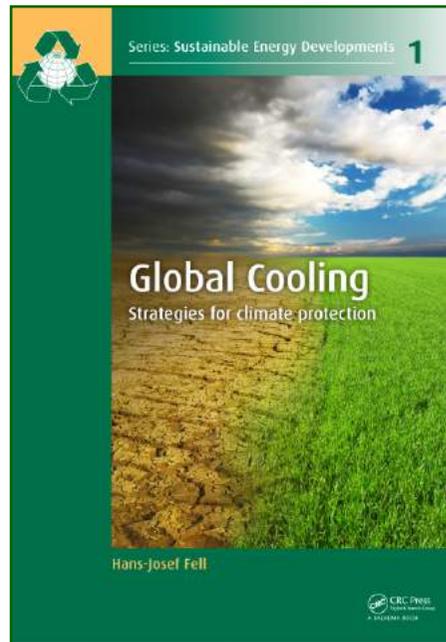
# Double pitfall for fossil/nuclear business

- Rising oil/gas/coal/uranium prices
  - Energy consumers switch to renewables
- Declining oil/gas/coal/uranium prices
  - Financers stop investing
  - State budget on the way to bankruptcy
- Both leads to economic pressure for fossil/nuclear companies
- \$3.4 trillion fossil fuel assets are flagged for divestment by more than 500 institutions and 2,040 individuals from 43 countries

# 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!***

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[www.energywatchgroup.org](http://www.energywatchgroup.org)