# Cooperative Solar Power in Germany and Mauritius
# Port Louis, 15. Nov 2013

Dipl.-Ing., Dipl.-Volksw. Dieter Seifried,
Büro Ö-quadrat

# Overview

- Development of renewable electricity sector in Germany
- What have been the driving forces and the political framework?
- Impact on PV-market worldwide
- Cost-Benefit of PV-Systems
- External costs
- Cooperative use of solar energy in Germany and Mauritius

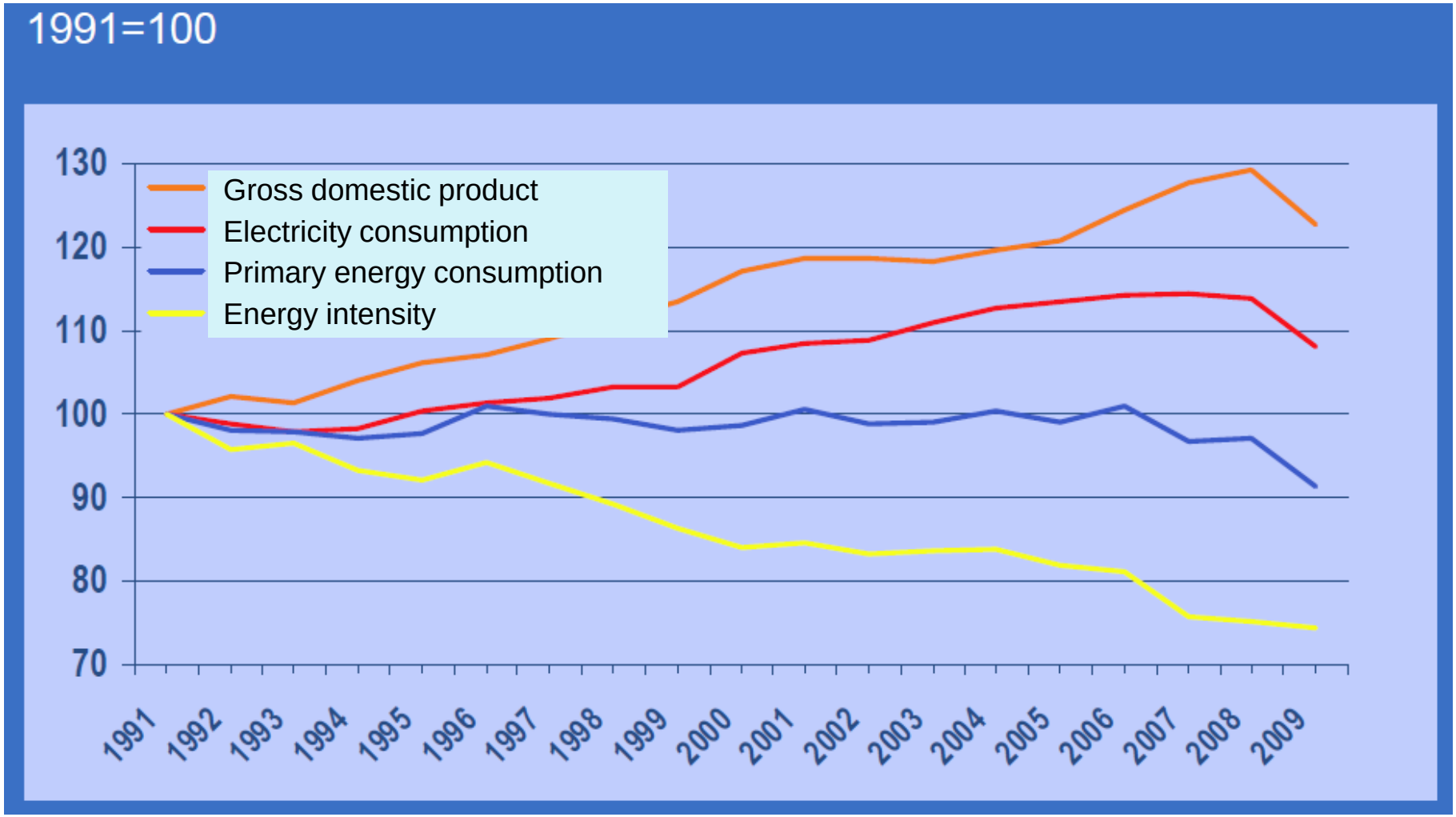
# German's Electricity sector

## *Basic data*

| |  |  |
|---|---|---|
| Total electricity production | 650´000 GWh | 2´500 GWh |
| Installed capacity | ca. 90 GW | 0,6 GW |
| Electricity con-sumption per person | 8,000 kWh/a | 2,000 kWh/a |

# German's Energy sector

## *Basic data*




Source: Institut der deutschen Wirtschaft Köln, 2010

# German's Electricity sector

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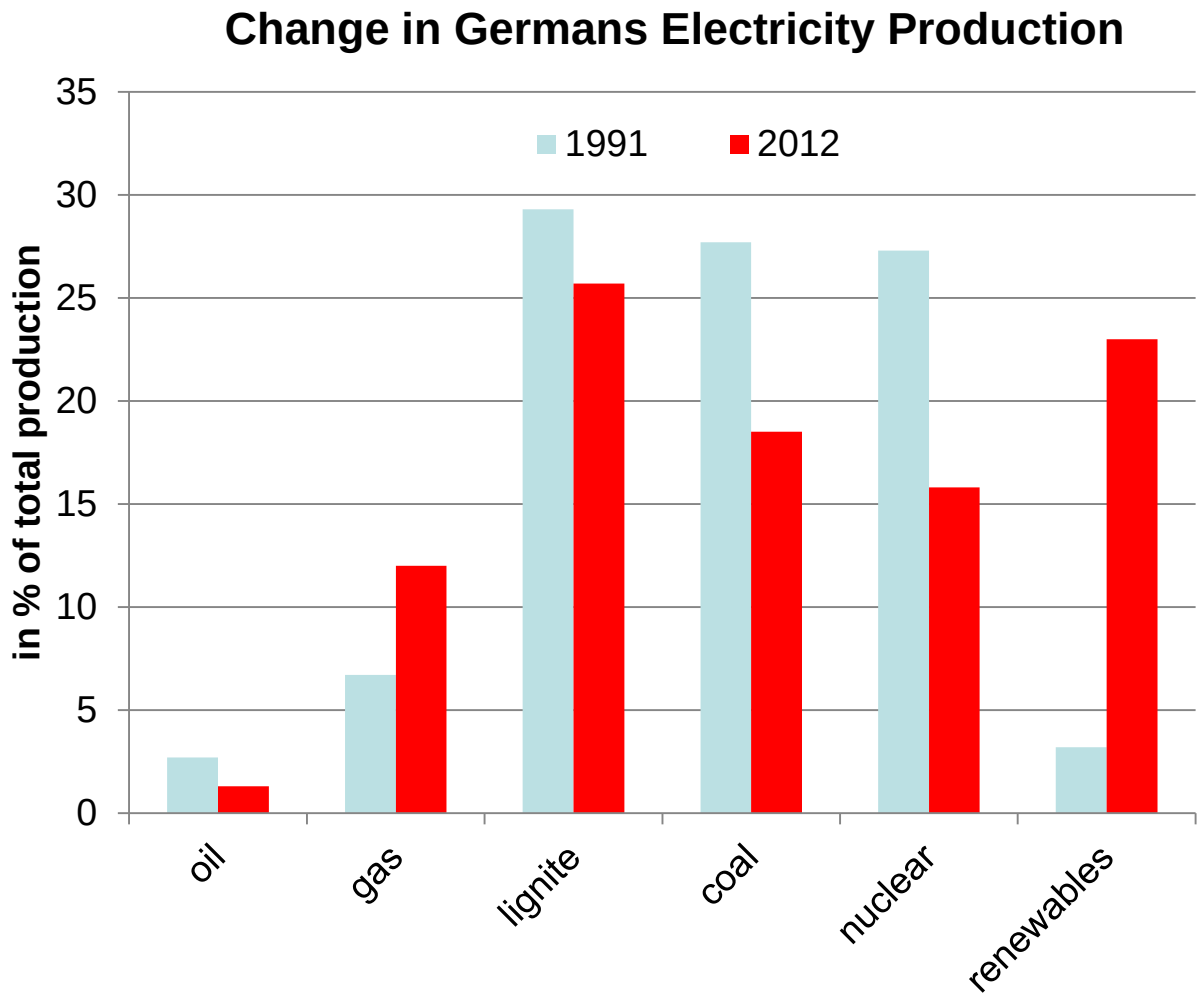



Source: Institut der deutschen Wirtschaft Köln, AG Energiebilanzen

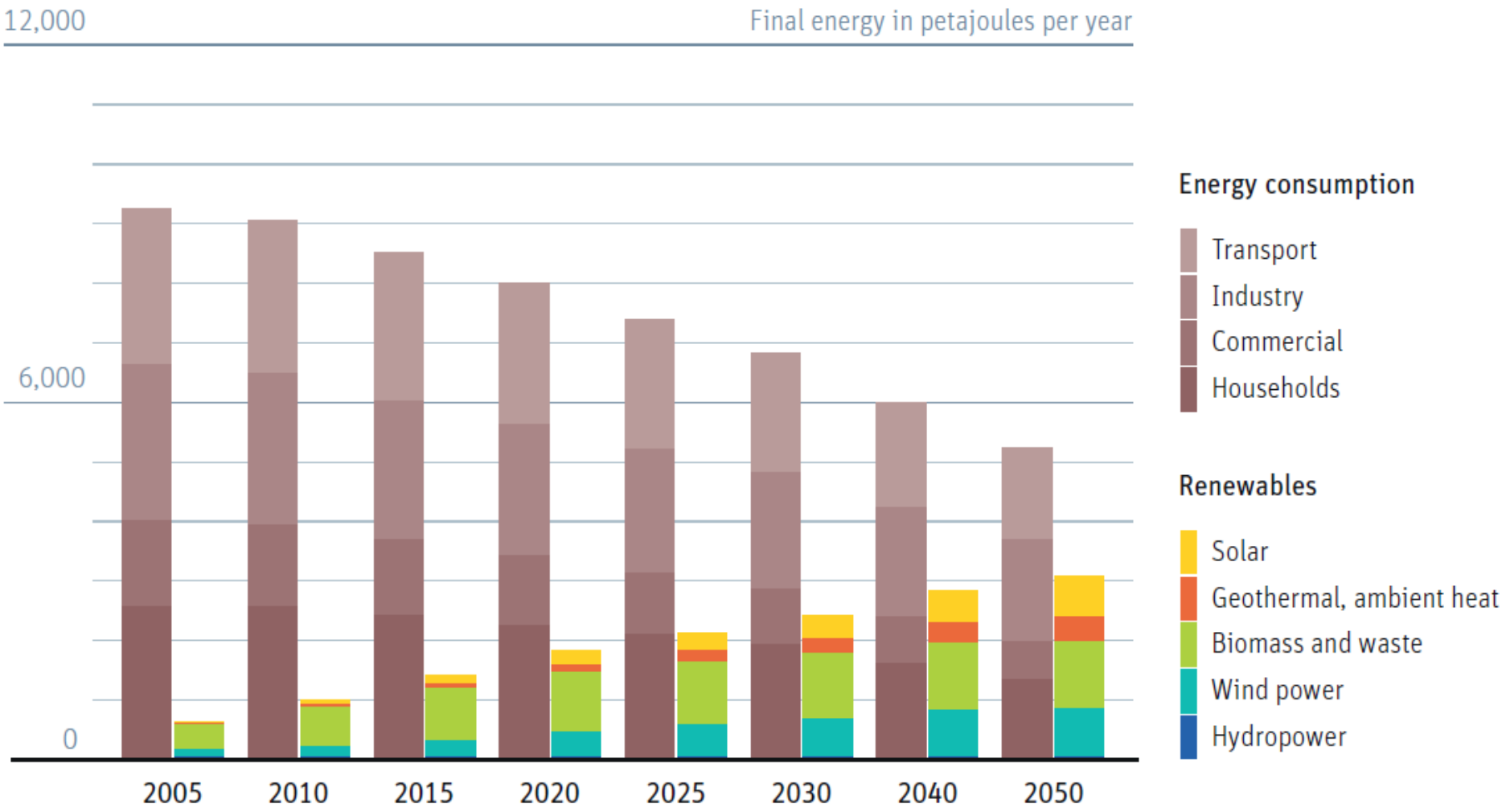
# The German government‘s energy and climate goals (6.6.2011)

- To reduce greenhouse gas emissions by 40 % of the 1990 values by 2020 (80-95% until 2050)
- To double energy productivity until 2020
- To increase the share of renewable sources in electricity generation to 35 % by the year 2020 (fact: first half of 2012: 25%)
- Reduce the electricity consumption by 10 percent until 2020 (compared to 2010)
- Phase out of nuclear power

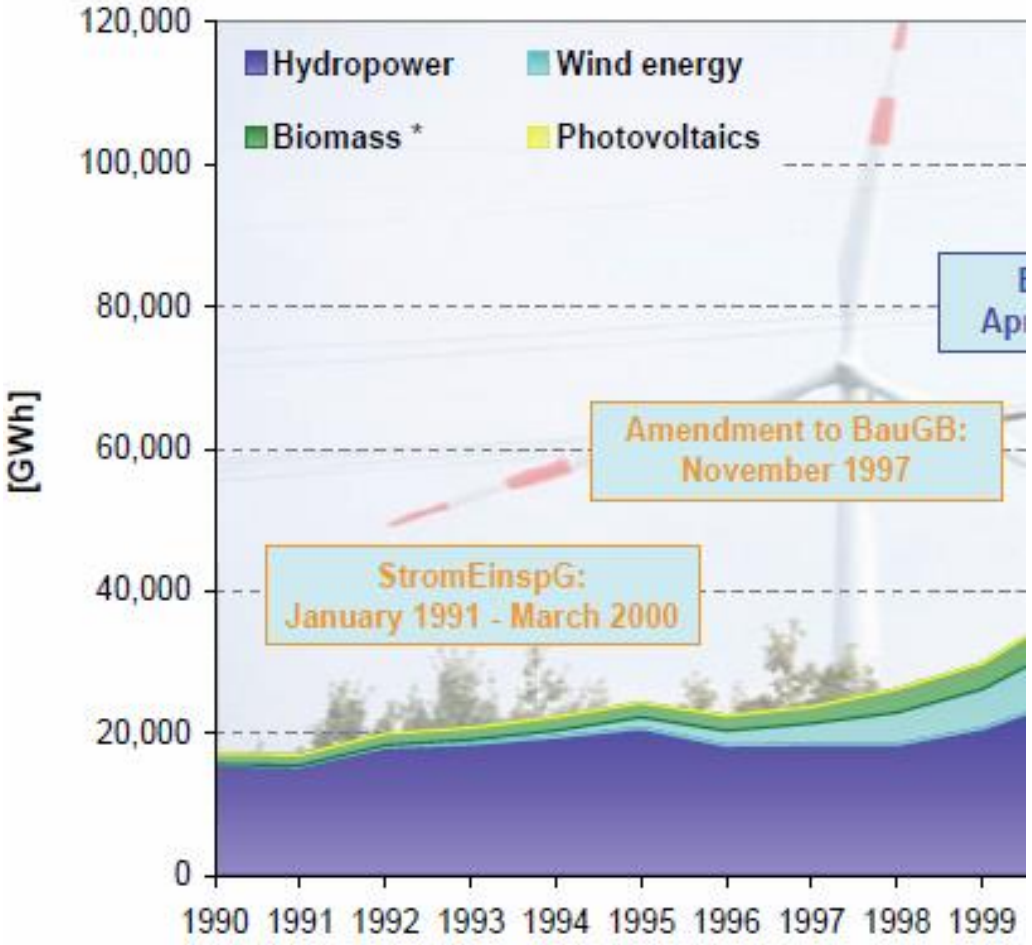
# Germany's plan: ramp up renewables, drive down energy consumption

Final energy supply and demand in Germany 2005–2050, scenario

*Source: DLR Lead Study, scenario A*



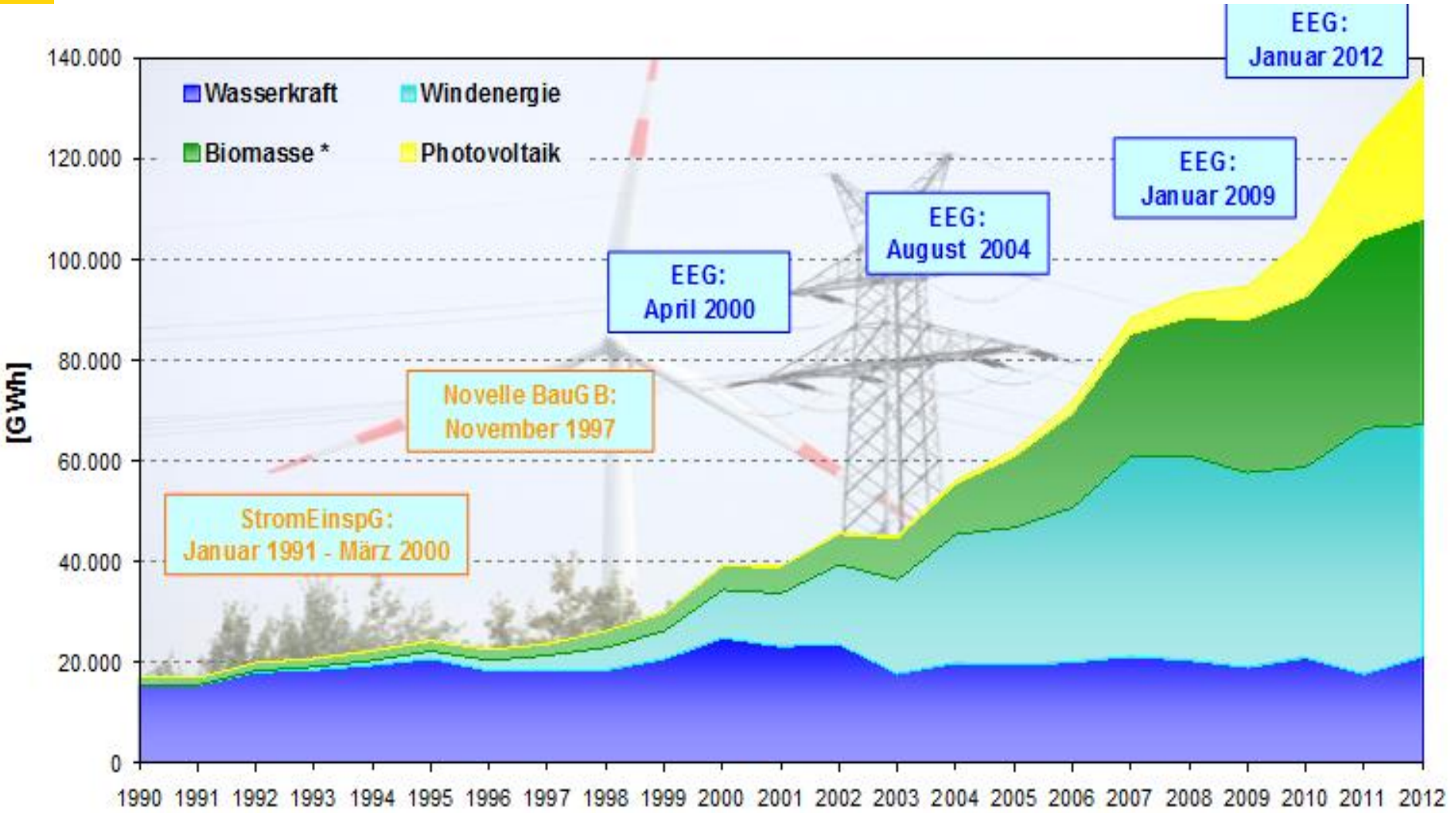
# Renewable Energy Sources in Germany (Electricity Sector) *Year 1990-1999*




- Share of renewables in electricity production only 4%
- Only little development or electricity generation from renewables
- Mostly wind power

# Renewable Energy Sources in Germany

*Year 1990-2012*



# Renewable Energy Sources Act (REA)

## *The Corner Stones*

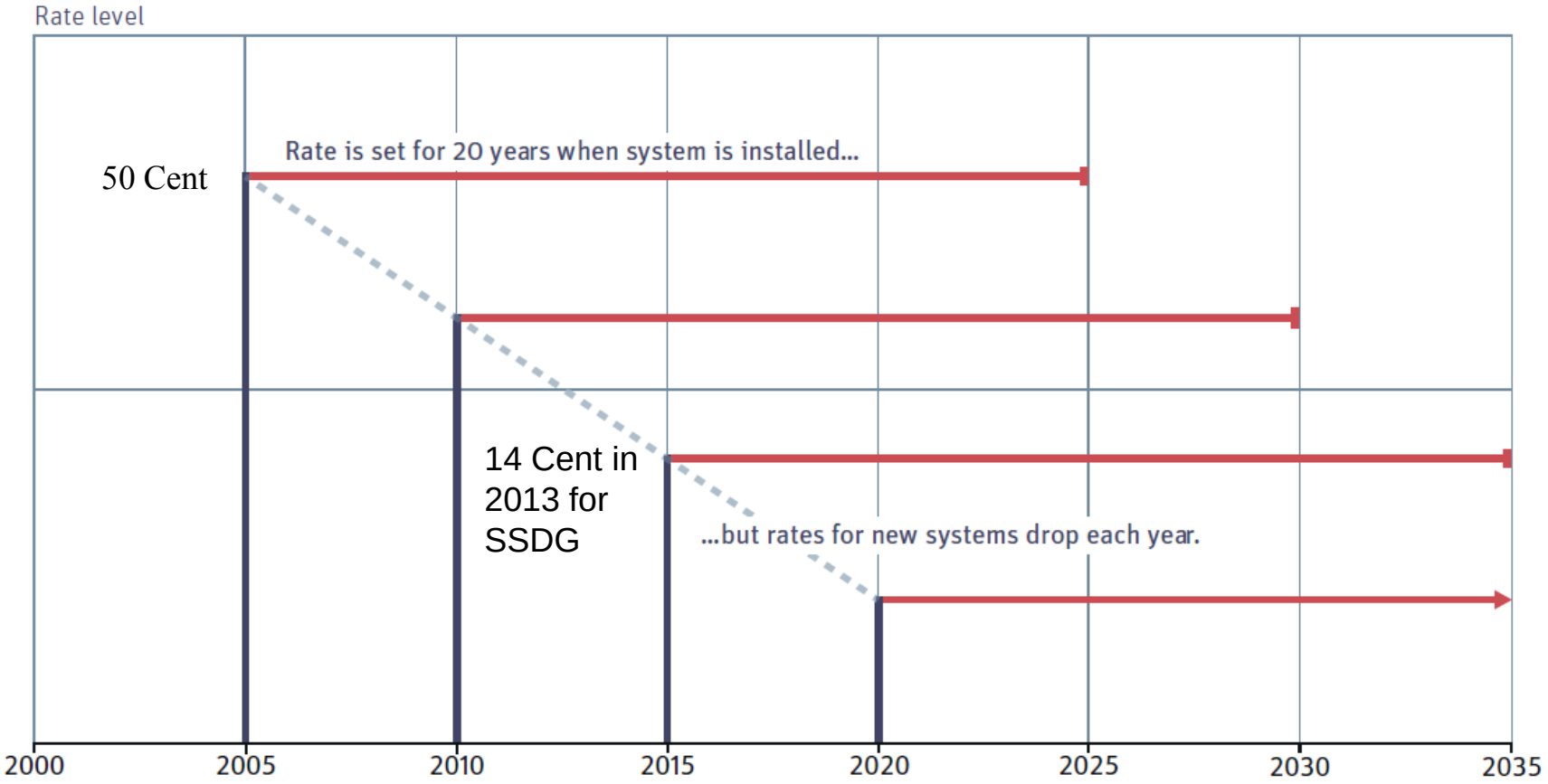
- Priority grid access and priority transmission for renewables
- Grid access costs are borne by grid owner
- Legal guarantee of a minimum fixed tariff for 20 years
- The tariffs are differentiated according to the technology and the size of the power plants
- Tariff is determined in a way that the investor can recover his costs for the investment (and interest of capital) over a timeframe of 20 years
- To give an incentive to reduce the costs of renewable installations, the feed-in price for new installations is lowered every year (degression rate)
- The cost of the subsidies are paid by all electricity customers through a surcharge on the electricity price (exemption: big industry customers)

# Feed-in tariff

## Feed-in tariffs provide investment certainly and drive costs down

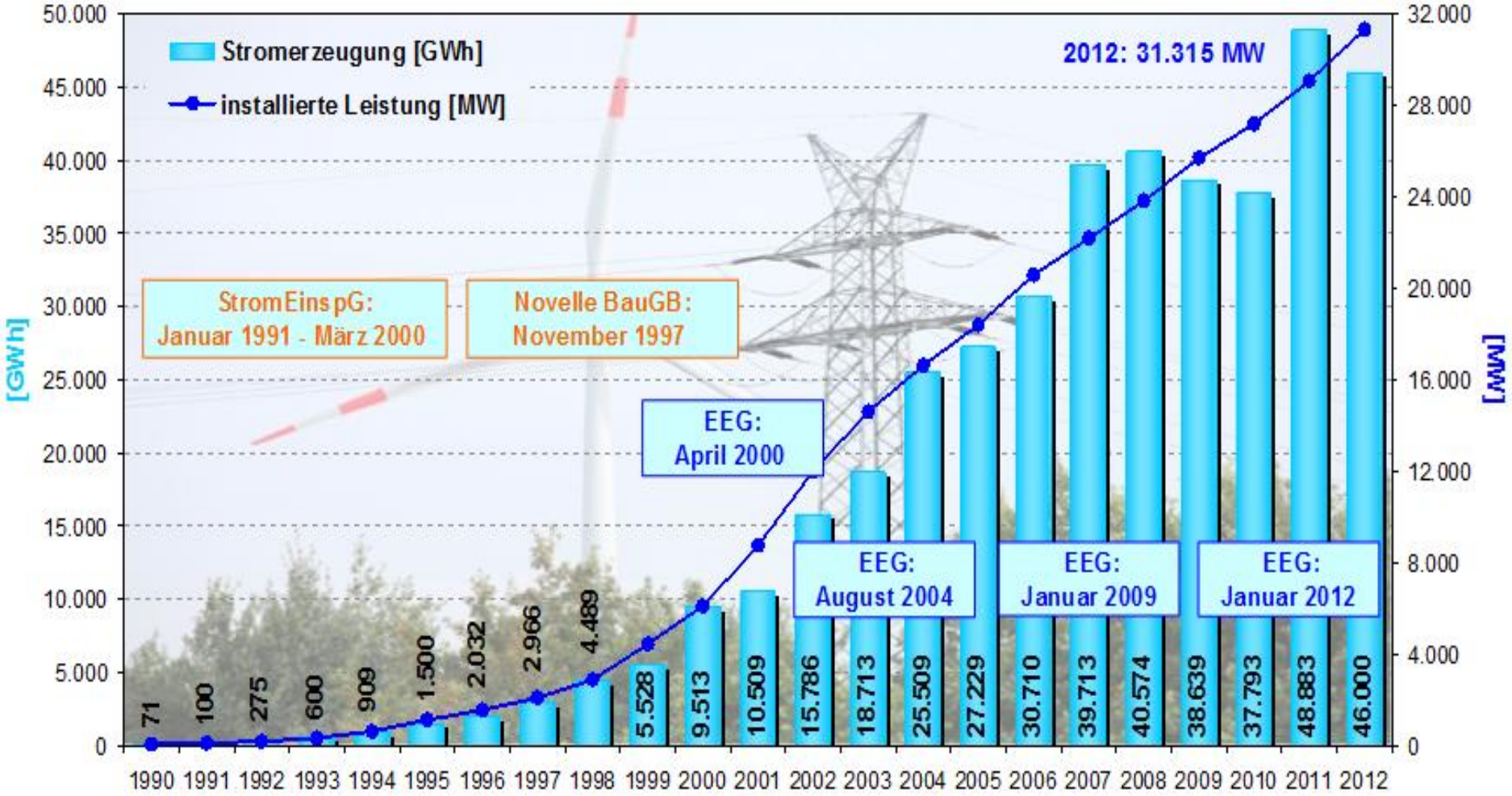
Simplified generalization of feed-in tariff with 20 year duration

*Source: Own estimates based on WFC*



# Rising the Wind Power under REA

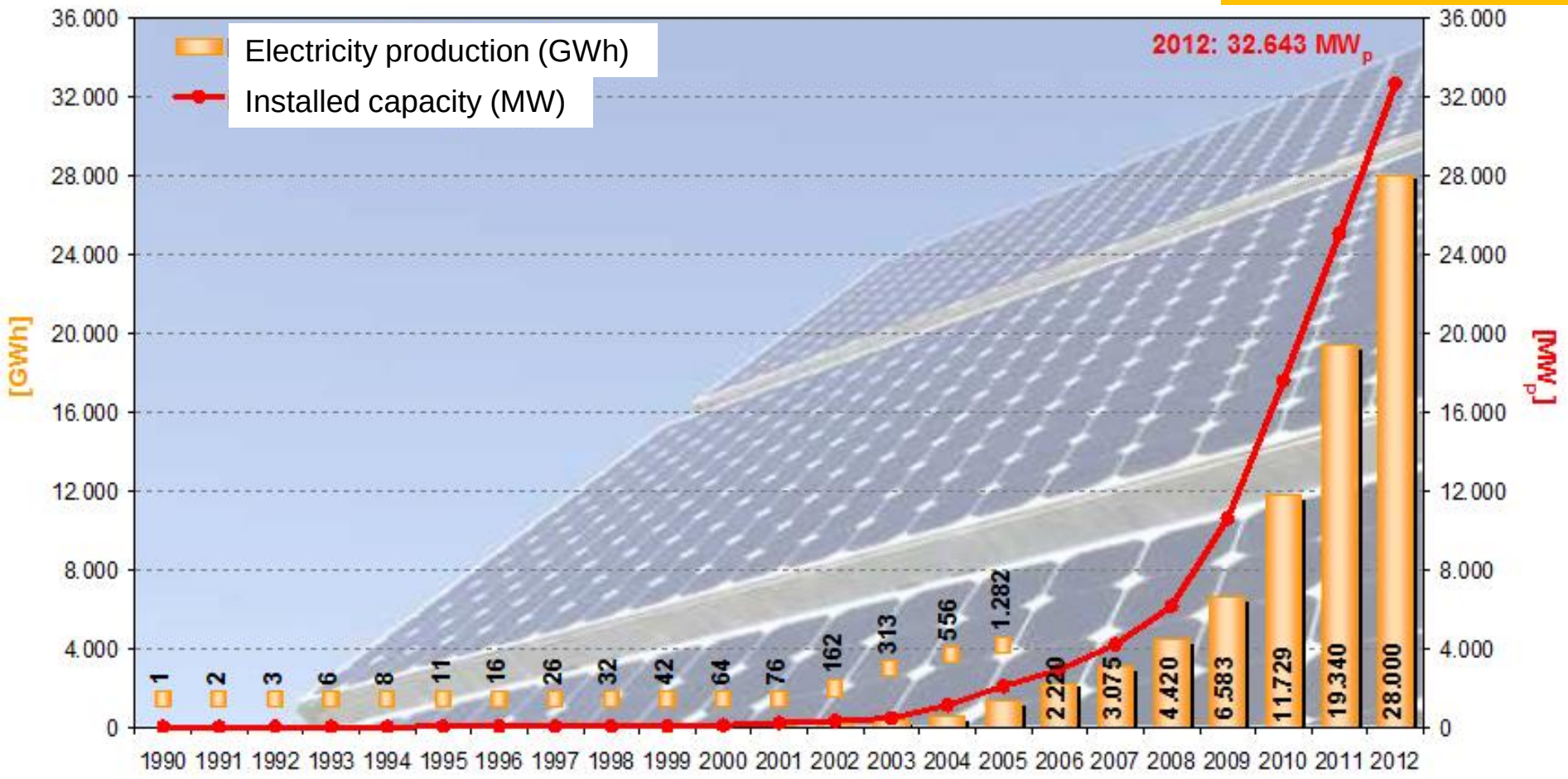
*Windpower Installations in Germany*



# Rising the Solar Power under REA

## *Photovoltaic Installations in Germany*

**2013: 36,000 MW**



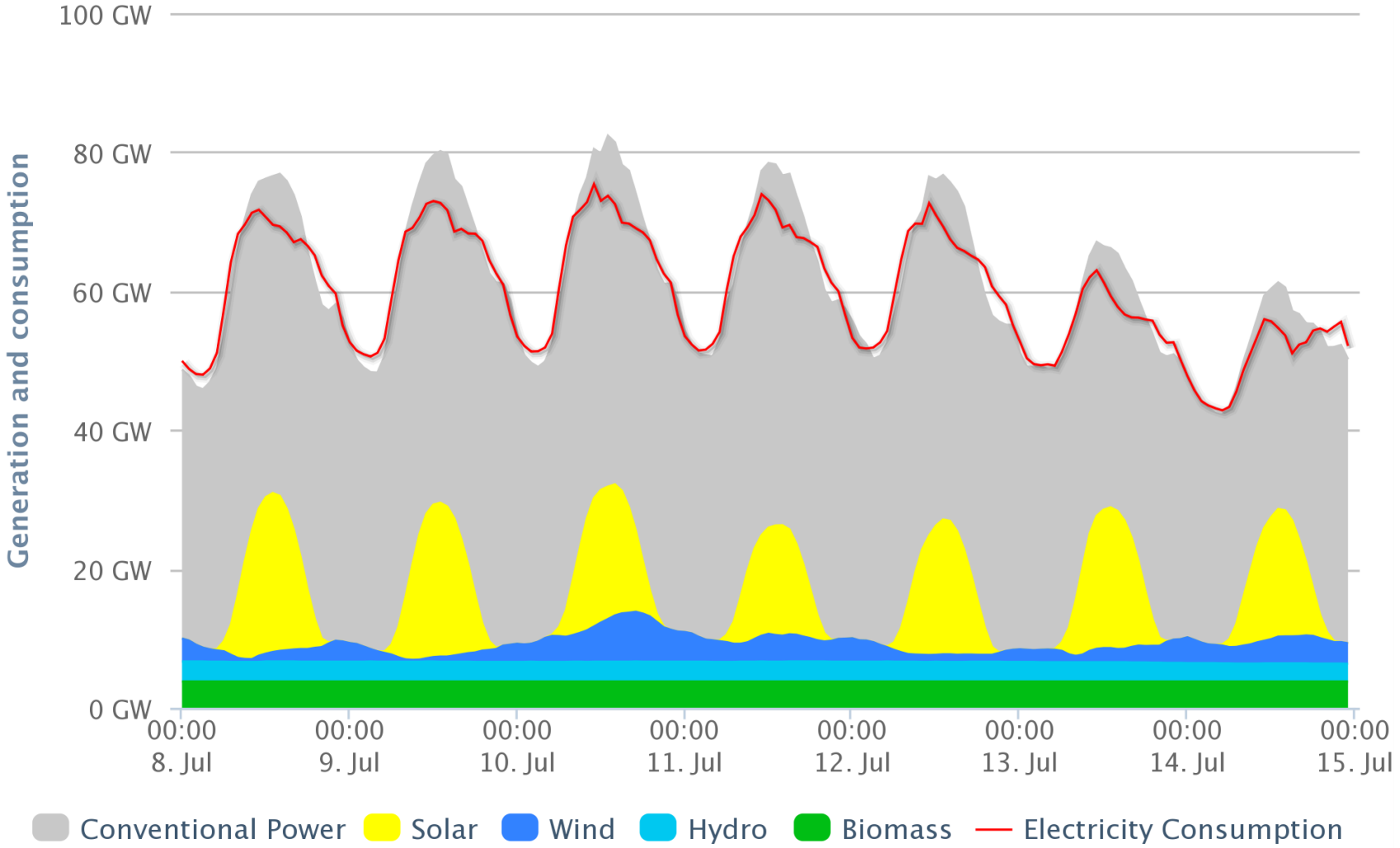
# Renewables have been underestimated systematicly

- **Association of German Electricity Producers (VDEW) 1993:**
  „Renewable energies like sun, water, wind and others will never cover more than **4%** of Germany‘s electricity consumption even in the long run.”

- **Angela Merkel 2005**: „It is not realistic to think that the share of renewable energy will ever reach 20% of total electricity consumption in Germany.”
  **Today in Germany: 25%**

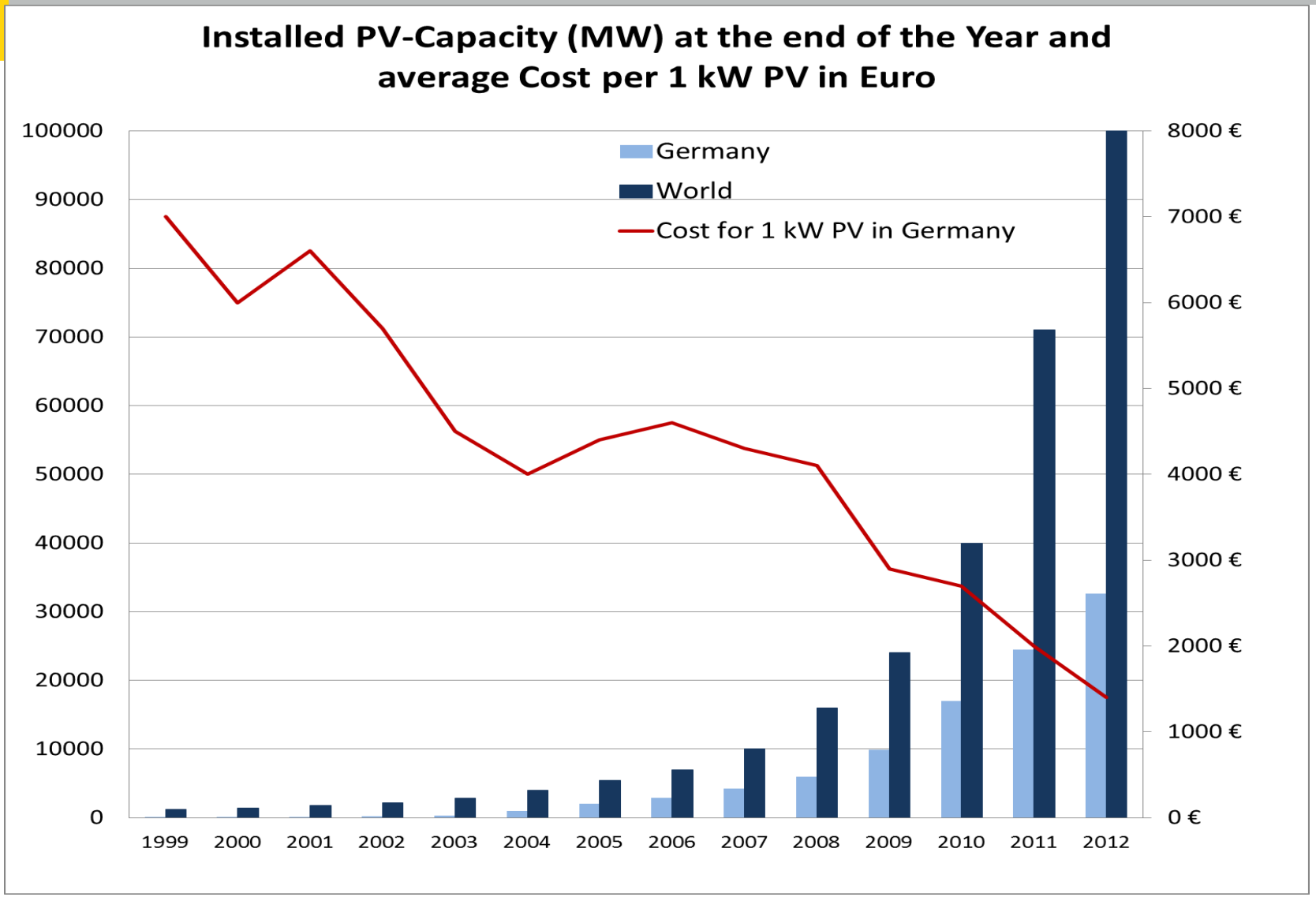
- **International Energy Agency (IEA) 2002**:
  Forecast of the PV capacity **worldwide** in the year 2020: 4.000 MW.
  Today installed in **Germany** ca. **36.000 MW**

# Situation in Germany (July 2013)




Last Update: 09.11.2013, 10:30

# Enormous Growth of PV-Installations worldwide

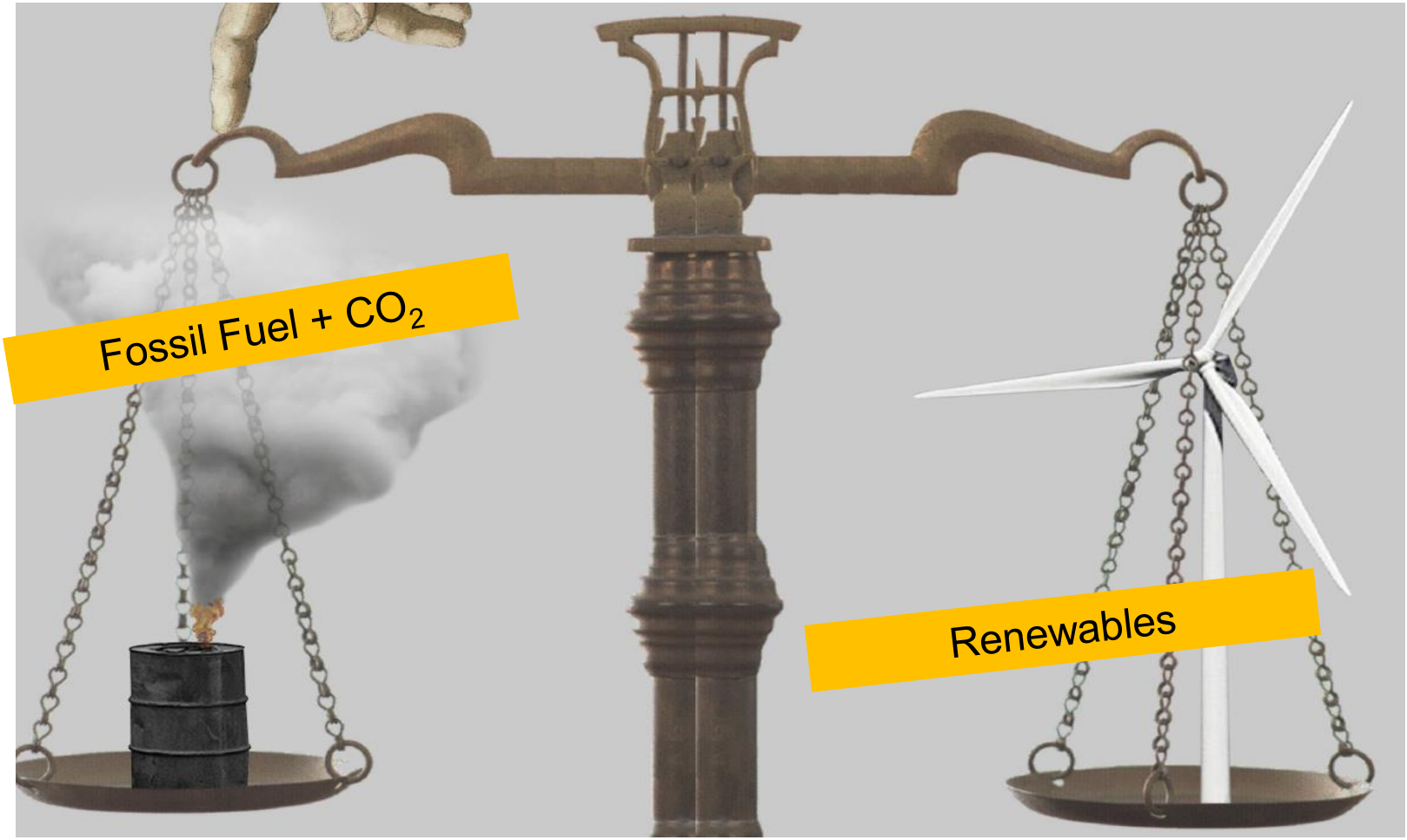


# Renewable Energy Sources Act (REA)

## *The Consequences*

- Mass production leaded to tremendous reduction in costs for PV systems
- Big technological progress with wind-energy
- Today, solar energy from PV-Systems is cheaper than electricity from Diesel plants
- Decentralized power offers chances to rebuilt and democratize the energy system
- Including external costs of the energy system PV is less costly than any other fossil fuels

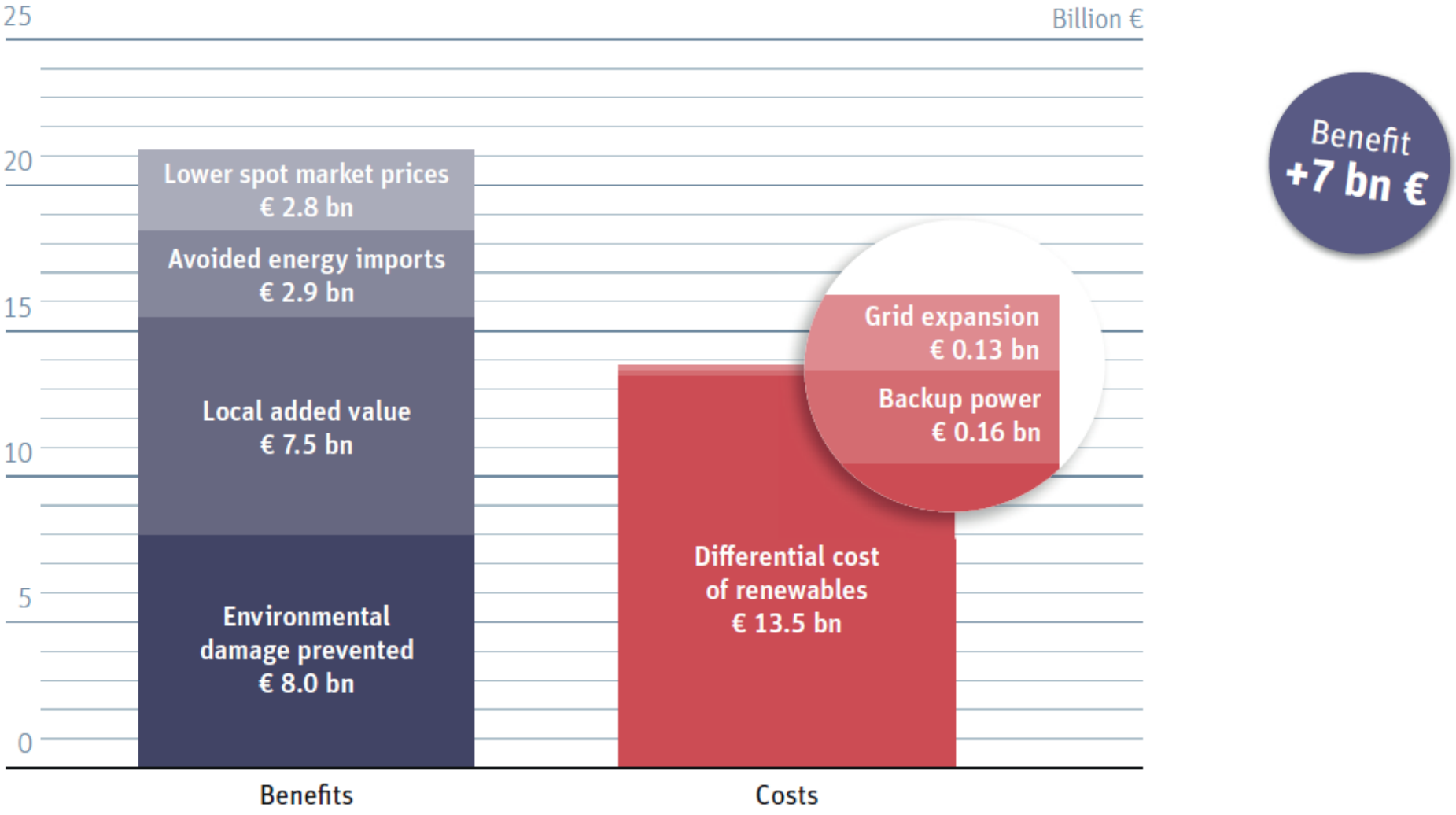
# The Need to overcome Market Distortions



# Renewables save Germany more than 7 billion euros per year

Costs and benefits of renewables in energy use, Germany, 2011

*Source: AEE*



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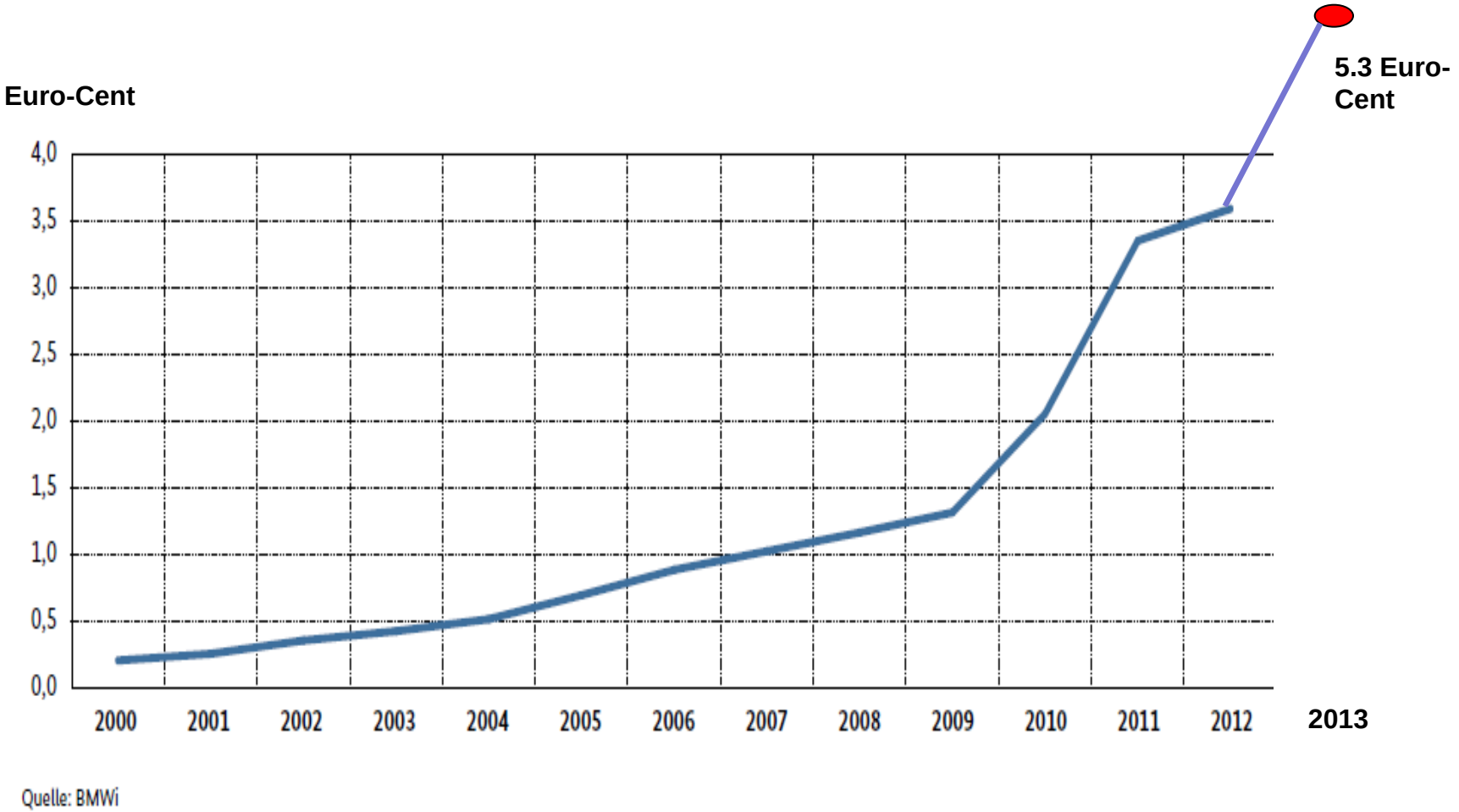
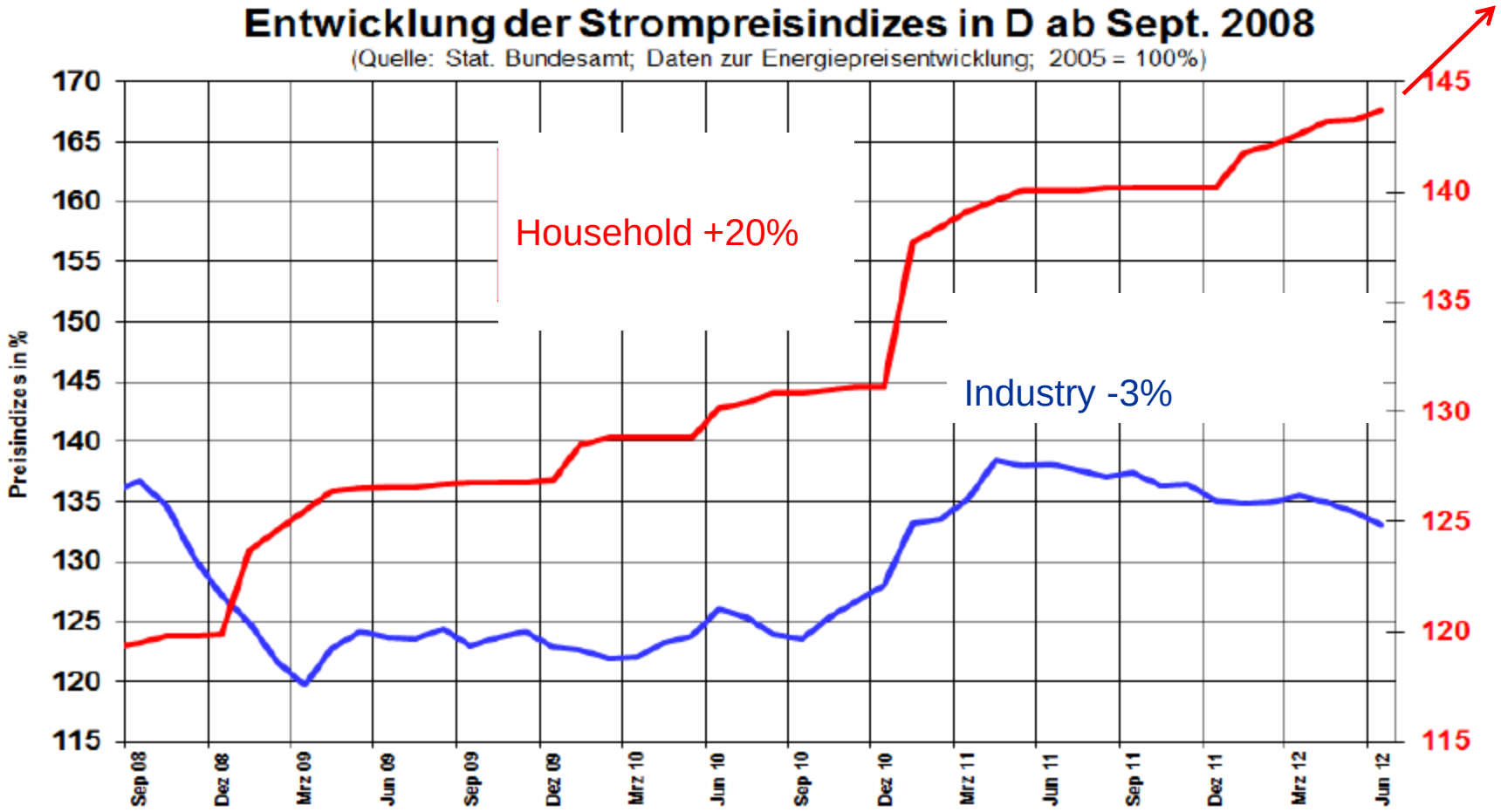
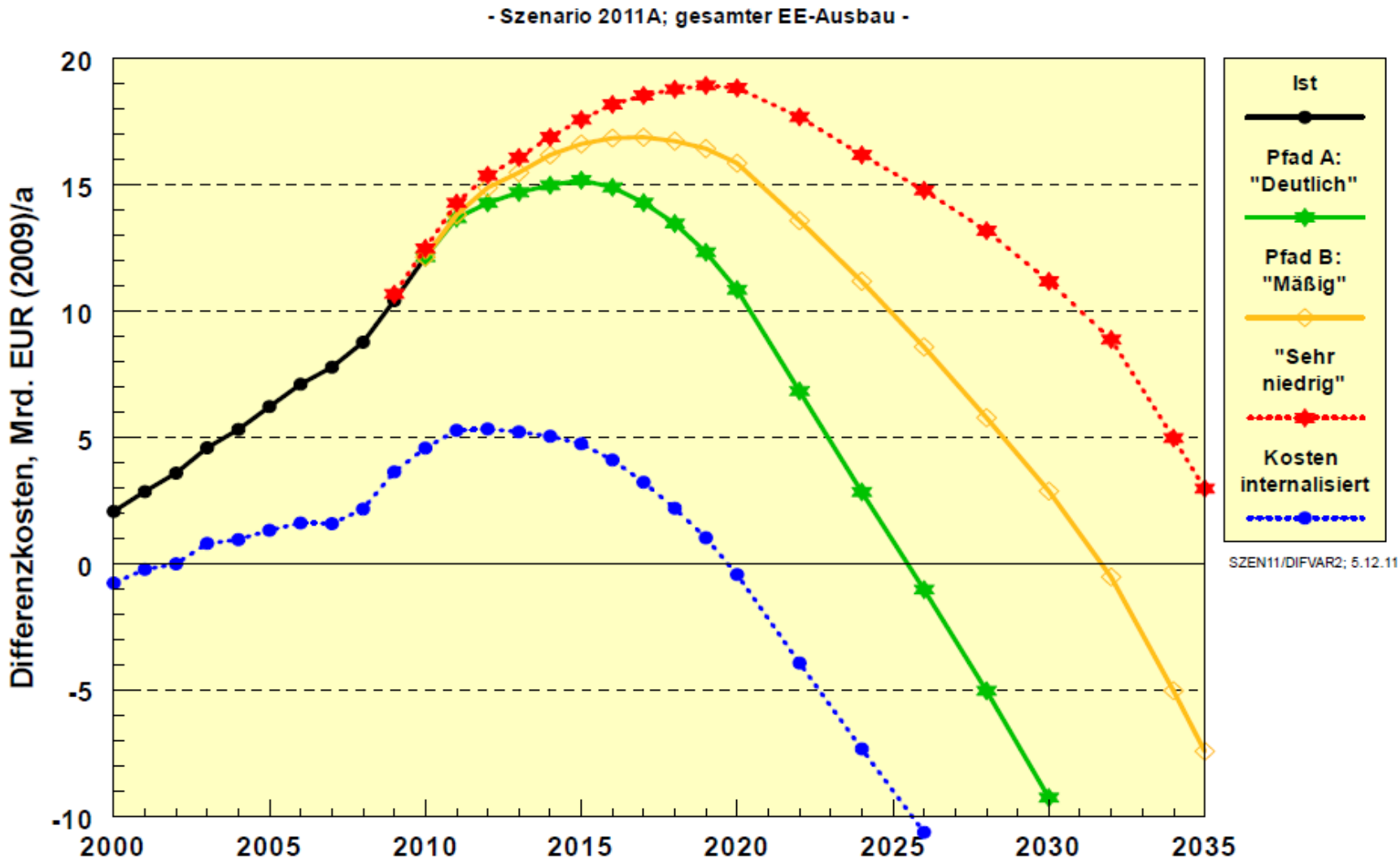



Quelle: BMWi

# Different Situation for household and industry



# The costs of changing the fossil electricity system into a renewable system




Quelle: Nitsch, Langfristszenario 2011

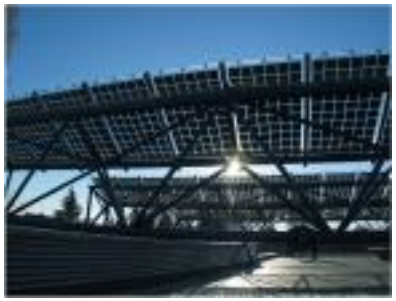
# Renewable Energy Sources Act (REA)

## *The Consequences*

- More than 1 Mio. Households produce their own solar electricity
- All are connected to the grid
- Surplus is feed in the grid

# The first performance contracting project with citizen participation: Eco-Watt Project at Staudinger School

# The solar&save projects: Willibrord-Gymansium in Emmerich



# Cooperative Project: School in Engelskirchen

Aggertal-Gymnasium before renovation

# Cooperative Project: PV-System along the road in Freiburg

- Built in 2006
- 360 kW
- Invest 1,9 Mio. Euro
- 80 people involved

# Cooperative Project: PV-System in Football Stadion in Freiburg

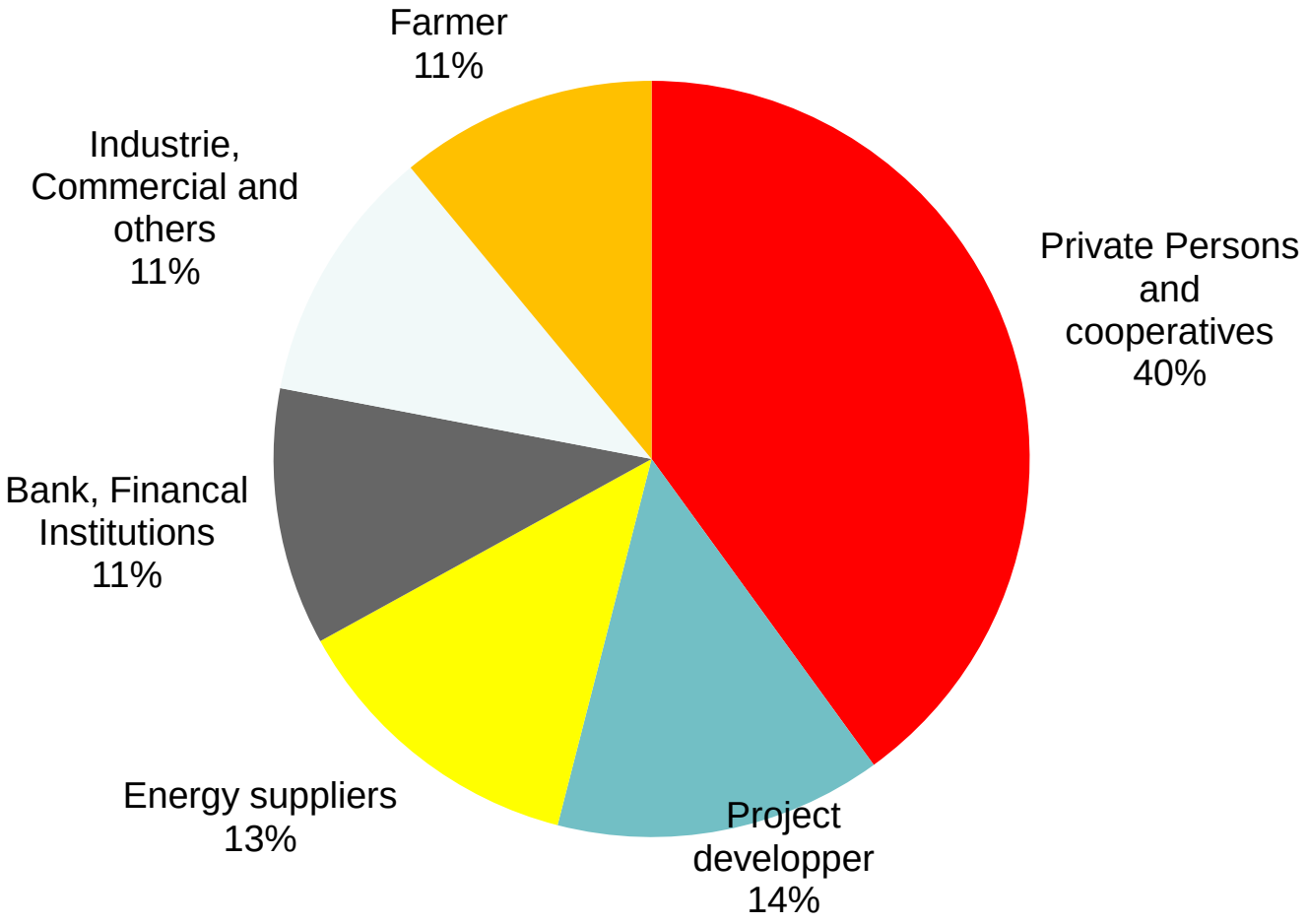
- Started in 1995
- In 2004: 1000 kW
- 400 people involved

# Why do people invest in Renewable Energy Projects?

- They got their money back with an interest-rate
- Low risk
- People want to know what is done with their money
- People are convinced, that renewables are the solution for our environmental and climate problems
- What does your money do in a biological farm project or in a PV-systems?
  It make sense!

# Ownership of renewable energy plants in Germany

**Germany: Renewable energy plants mostly in the hand of citizens and farmers**
(Total of **53 000 MW** in 2010)

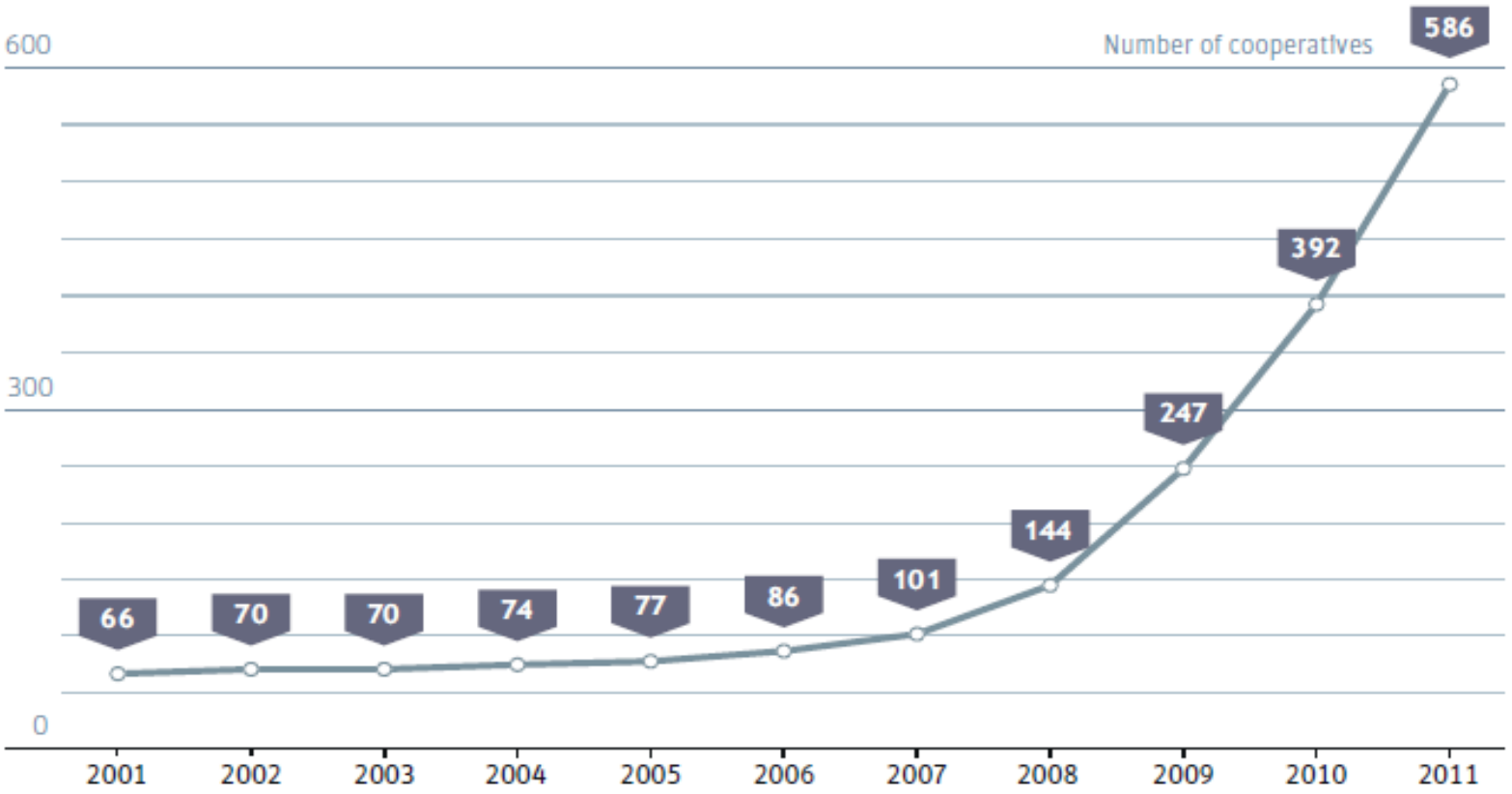


# Cooperatives are investing in renewables

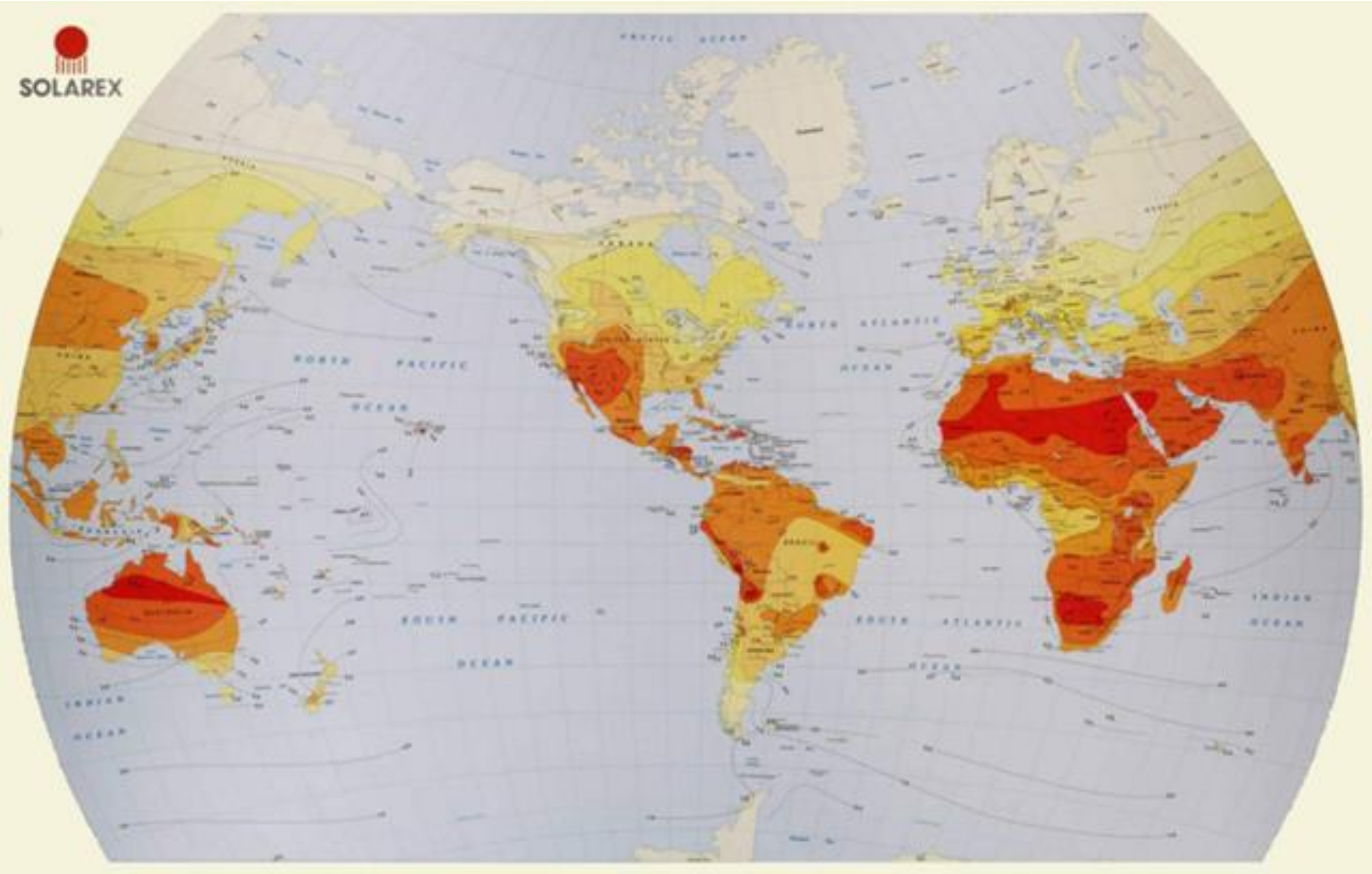
## Citizens form cooperatives to drive the energy transition

Number of energy cooperatives in Germany, 2001–2011

*Source: AEE*



# Solar Radiation in Mauritius: more than 50% higher than in Germany



# Cooperative PV-project in Mauritius

Members of trade /credit unions

Invest

return

Energy-cooperative

Contract with Project Company (key turn)

Monitoring and Management

Contract with landowner

Education and Information

Cooperative Project

Insurance

Delivers electricity

CEB

CEB Feed-in tariff

# Cooperative Project: Abondoned Sugar Cane Field

- Abandoned Sugar Cane Fields (North-West)
- Capacity 500 kWp
- Electricity production 750´000 kWh/year
- Investment: ca. 24 Mio. MRU
- 300 to 600 people from cooperatives
- 15-20 years

# Example Germany: Sheeps control the plants

# Cooperative Project: PV-System on houses of pig-breeders

- Capacity 10*4 kWp
- Electricity production 60,000 kWh/year
- Investment: ca. 2.5 Mio MRU
- 100 to 200 people
- 15-20 years
- Feasibility depends on feed-in tariff


VIVRE LE RESPECT
POUR TRANSFORMER NOTRE ECOLE

# Cooperative Project: PV-System and energy saving in schools

- Capacity ca. 100 kWp
- Electricity production 150 000 kWh/year
- Investment: ca. 7 Mio MRU
- 100 to 300 people from Cooperatives
- Demonstration project and education
- 15-20 years

# Cooperative PV-project in Mauritius

Union/Cooperative pays part of the wage to energy cooperative

Invest

Energy-cooperative

Retirement pension for union workers

Cooperative Project

Delivers electricity

CEB

CEB Feed-in tariff

# Renewables are seen as a menace by the existing energy system

- Every kWh produced from renewables cannot be produced by fossil fuels
- Every kWh produced from renewables will result in a reduced contribution profit margin for coal fire plants
- In Germany renewables are mostly small plants and owned by private persons
- It´s a change from centralized decisions to private and cooperative action
- It´s a change from imported energy carriers to “free” energy
- It´s a change to climate-friendly and sustainable energy consumption

The change from the existing energy system to a renewable system produce conflicts, fights and political influence.

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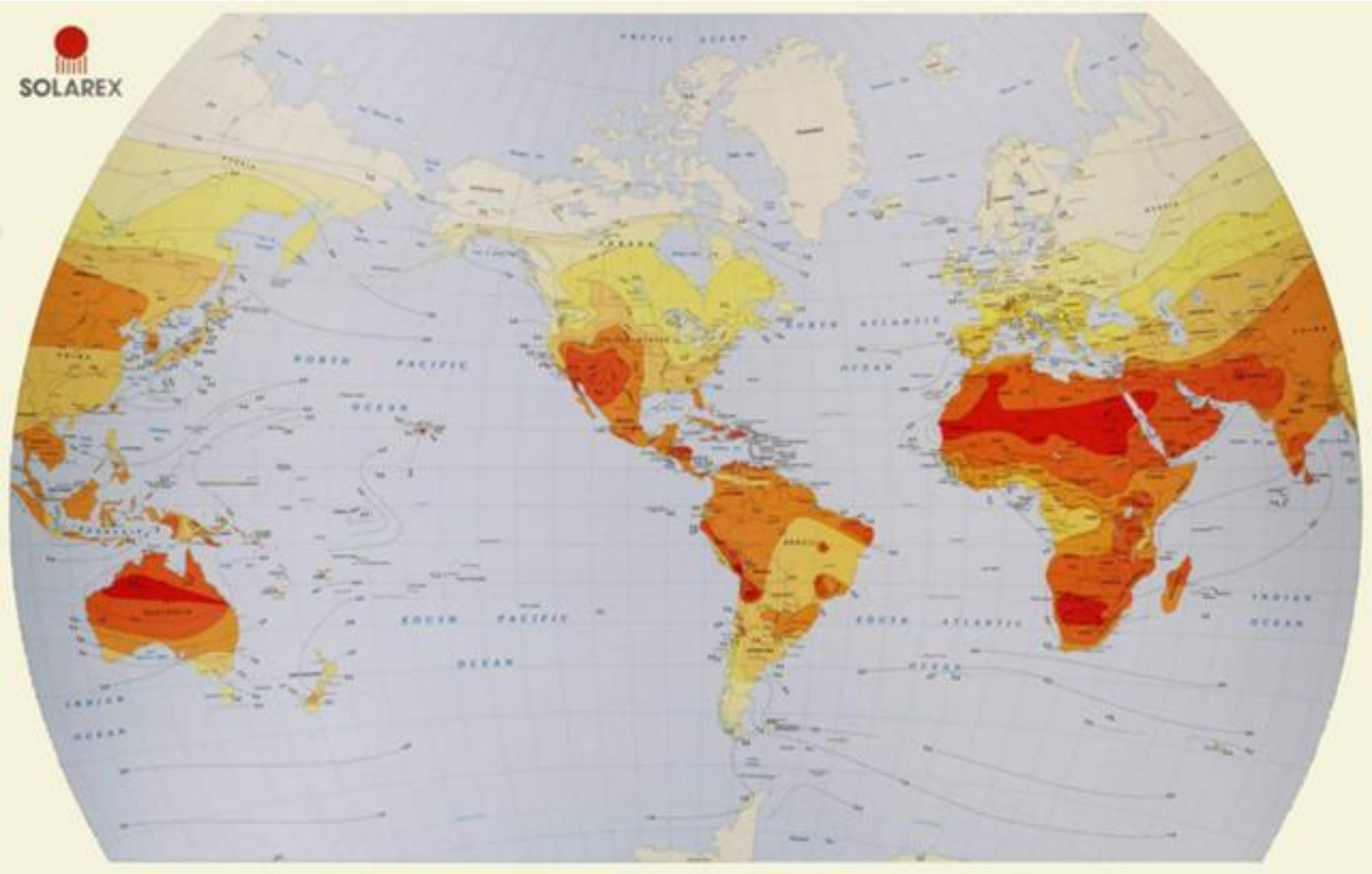


**Thank you!**

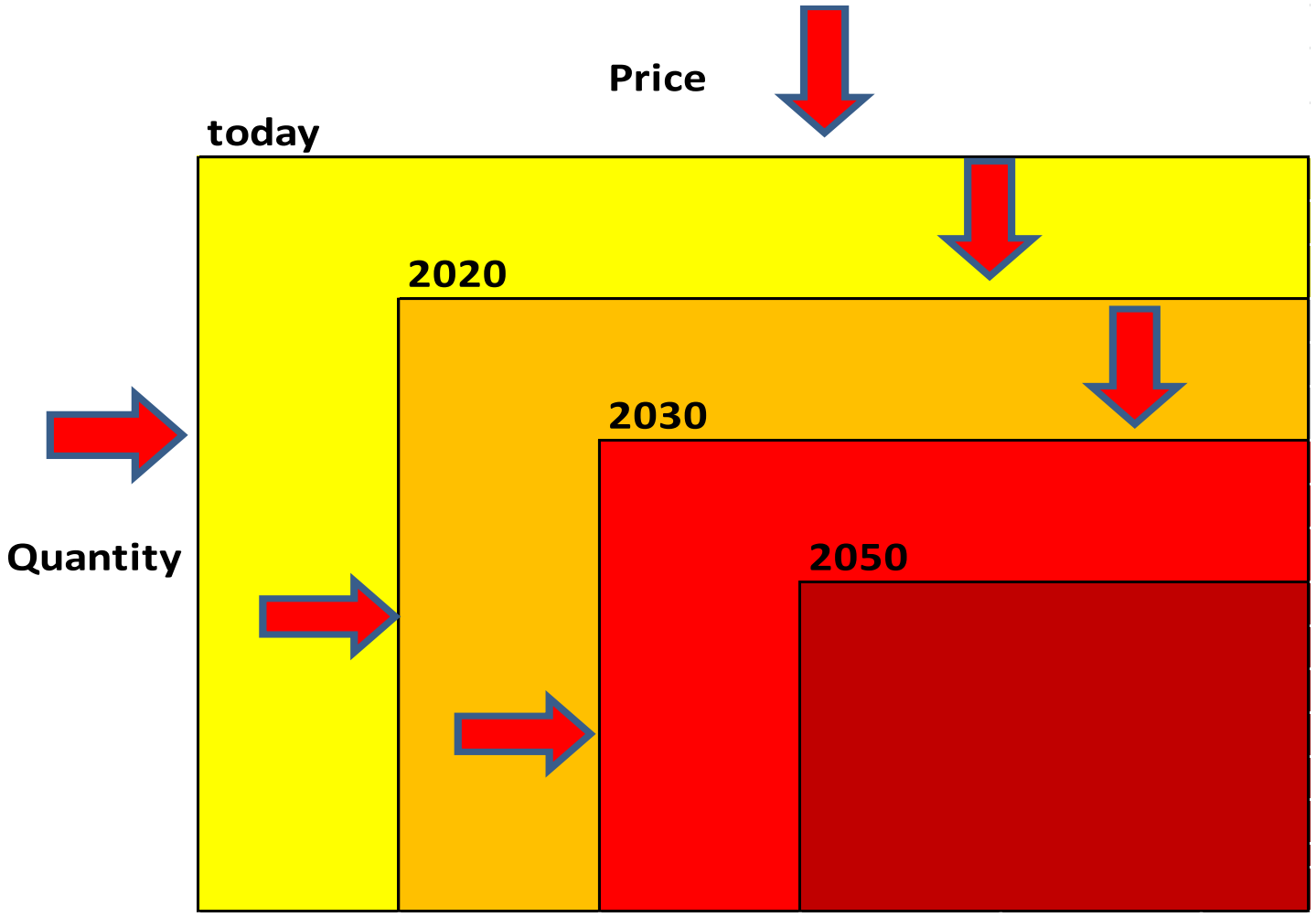
**More information:**

**seifried@oe2.de**

**www.oe2.de**

Danke!

# Companies with fossil fuel power are under pressure



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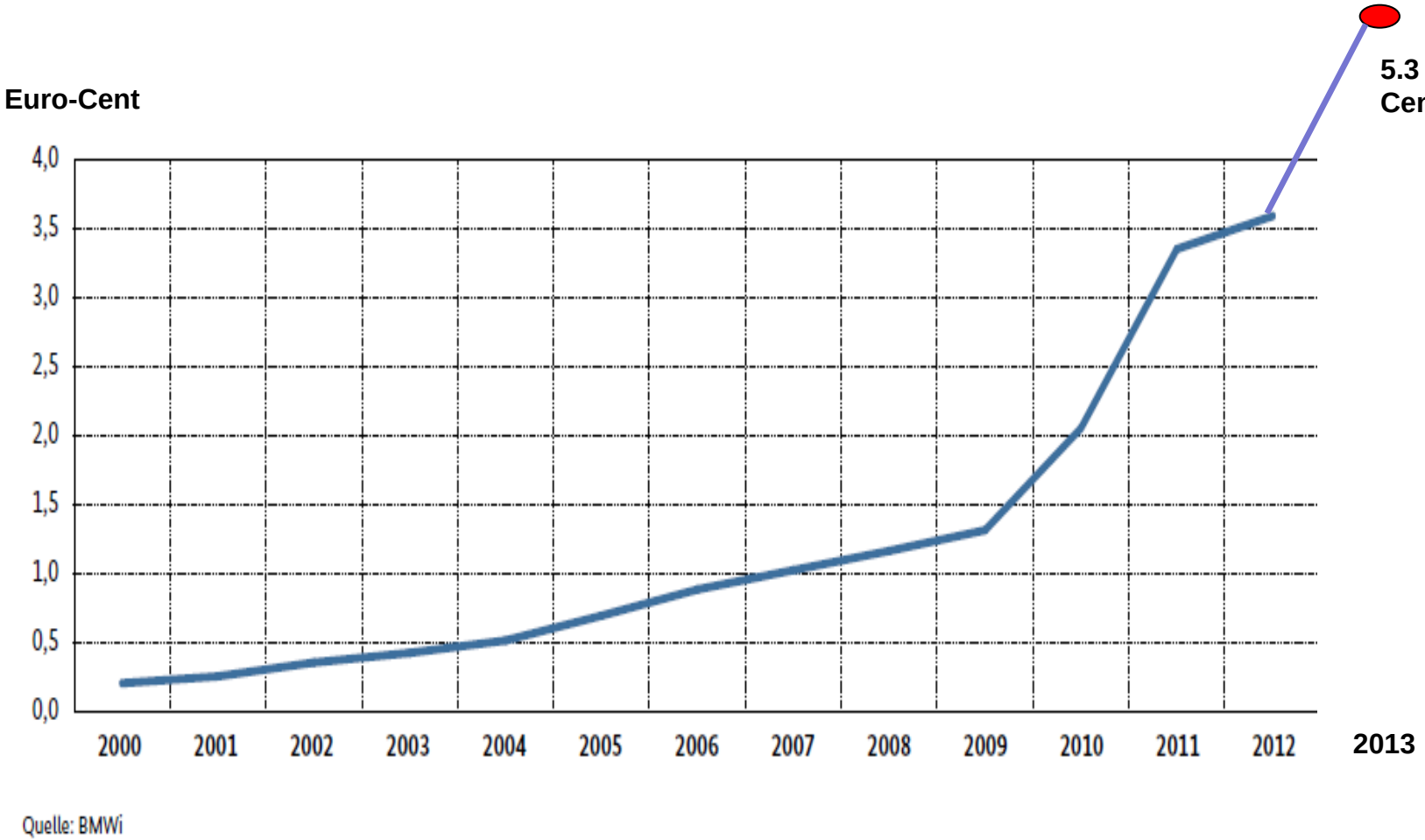


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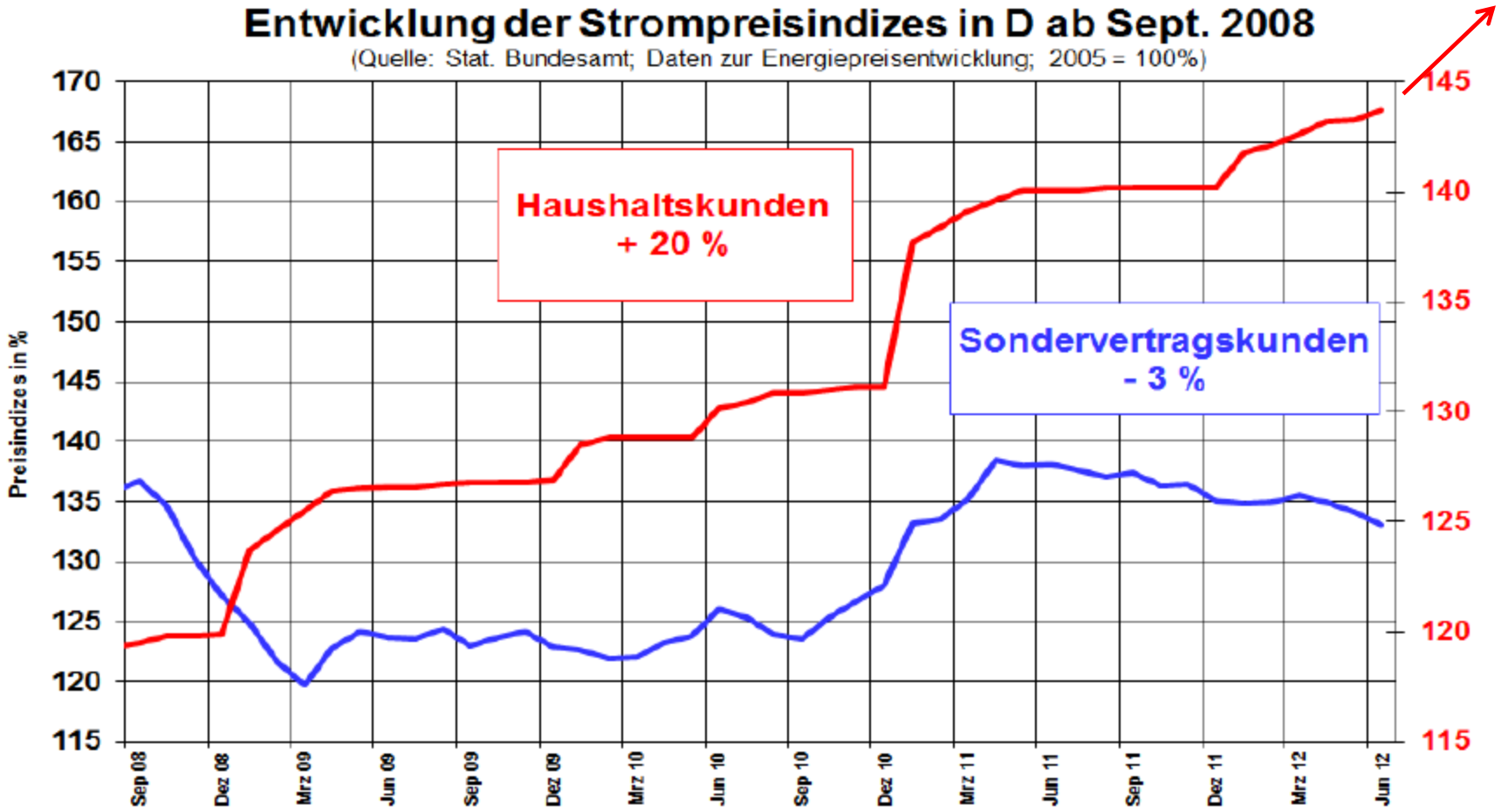

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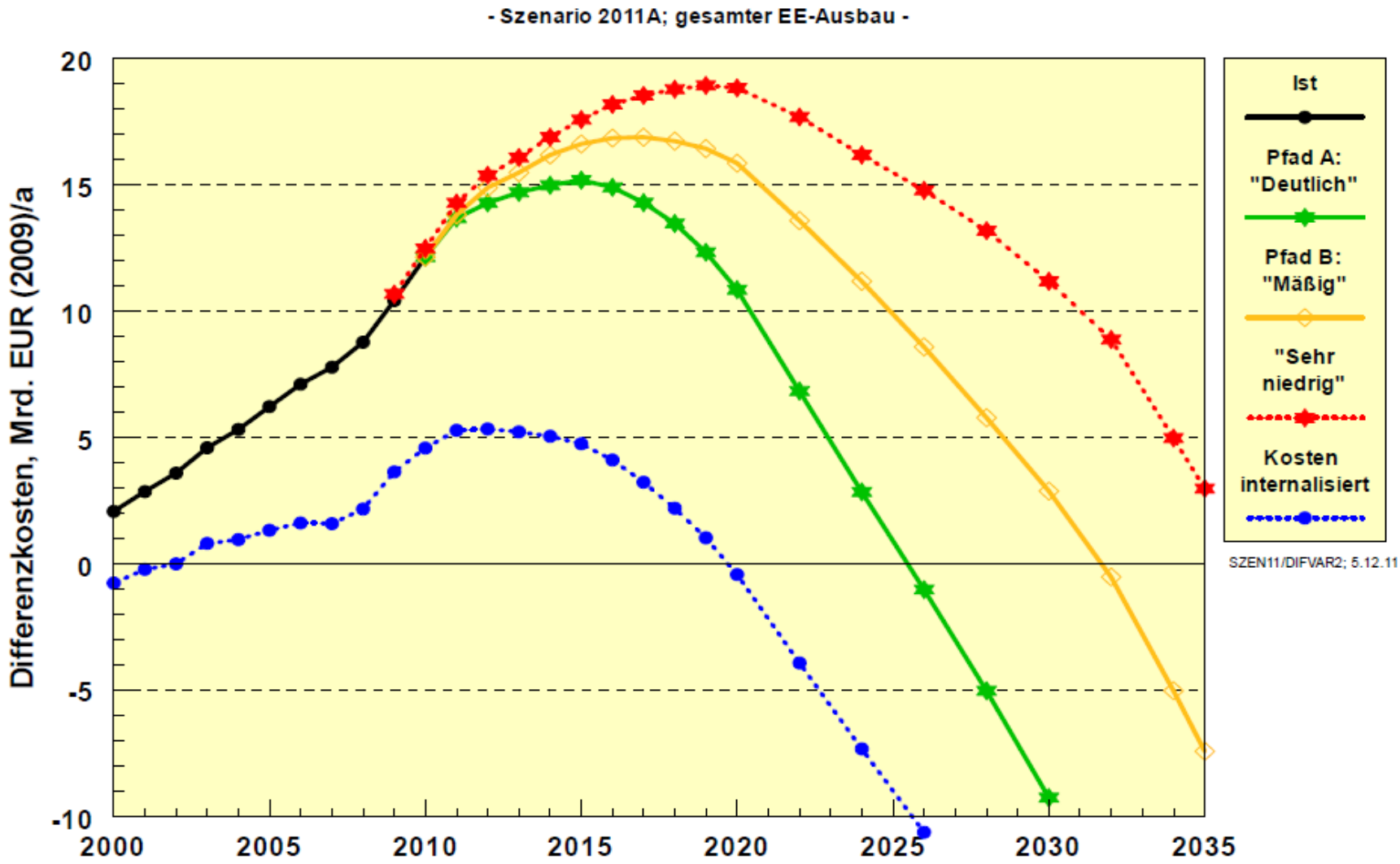


Quelle: Nitsch, Langfristszenario 2011

# REA 2007

## *Examples for feed-in tariffs (Euro-Cent/kWh)*

| | up to 150 kW | up to 500 kW | up to 5 MW | >5 MW |
|---|---|---|---|---|
| **Hydropower**[1] | 9.38 | 9.38 | 6.45 | special rule |
| **Waste and mine gas**[2] | 7.33 | 7.33 | 6.36 | special rule |
| **Biomass**[2] | 10.99 | 9.46 | 8.51 | 8.03 |
| | up to 5 MW | up to 10 MW | up to 20 MW | >20 MW |
| **Geothermal**[3] | 15.00 | 14.0 | 8.95 | 7.16 |
| | up to 30 kW | up to 100 kW | >100 kW | |
| **Photovoltaics** | | | | |
| on roofs and noise barriers[4] | 49.21 | 46.81 | 46.30 | |
| as solar façades[4] | 54.21 | 51.81 | 51.30 | |
| ground-mounted[5] | 37.95 | 37.95 | 37.95 | special rule |

# Feed-in tariff

| | | PV capacity | Feed-in tariff | Degression (per month) | reimbursement |
|---|---|---|---|---|---|
| Feed-in tariff June 2013 | Roof mounted | < 10 | 15,35 | 1,8% | 100% |
| | | 10 - 40 | 14,56 | | 90% ← |
| | | 40 - 1.000 | 12,99 | | |
| | | 1-10 MW | 10,63 | | 100% |
| | Ground- mounted | < 10 MW | 10,63 | | 100% |
| Feed-in tariff July 2013 | Roof mounted | < 10 | 15,07 | 1,8% | 100% |
| | | 10 - 40 | 14,30 | | 90% ← |
| | | 40 - 1.000 | 12,75 | | |
| | | 1-10 MW | 10,44 | | 100% |
| | Ground- mounted | < 10 MW | 10,44 | | 100% |
| | | > 10 MW | 0,0 | | |