arrhenius INSTITUT FÜR ENERGIE- UND KLIMAPOLITIK
INSTITUTE FOR ENERGY AND CLIMATE POLICY

Changing electricity markets

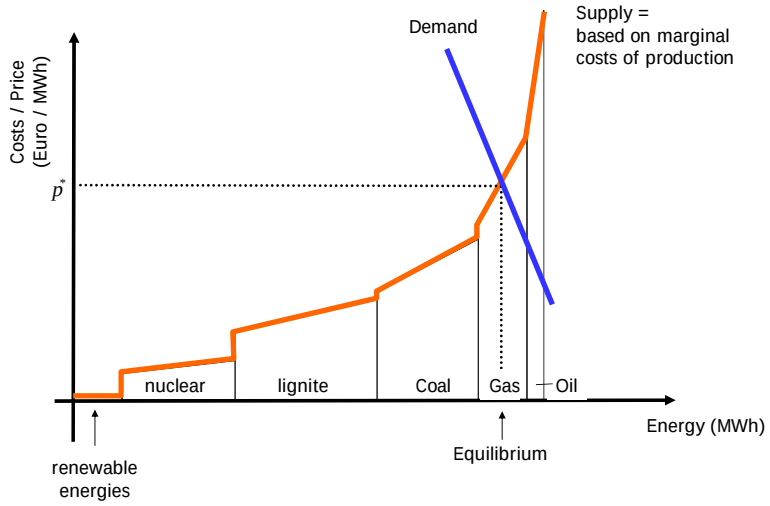
PHOTON's 4th Solar Electric Utility Conference
Stuttgart, 28 April 2010

Dr. Sven Bode
sven.bode@arrhenius.de

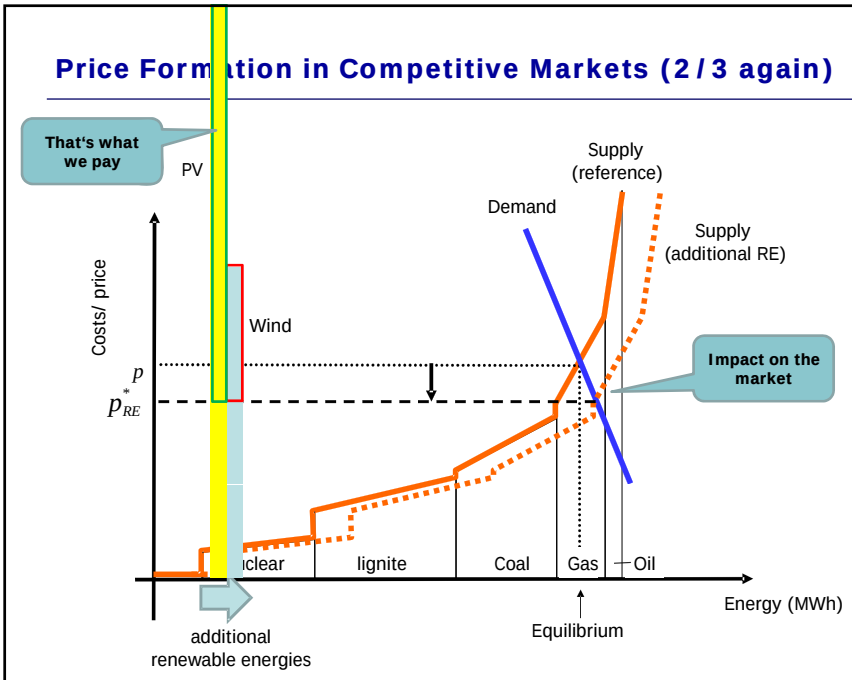
Overview

- Effect of PV on liberalised power markets (in general)
- PV in Germany
  - Current support scheme
  - Effect on the German power market (incumbents and new entrants)
- Options

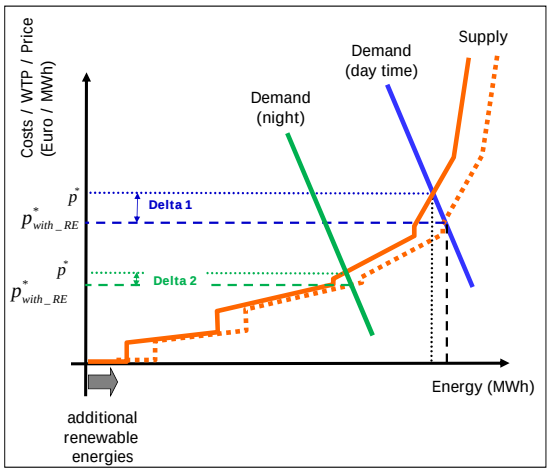
Price Formation in Competitive Markets (1 / 3)



Price Formation in Competitive Markets (2 / 3 again)



Price Formation in Competitive Markets (1 / 3)

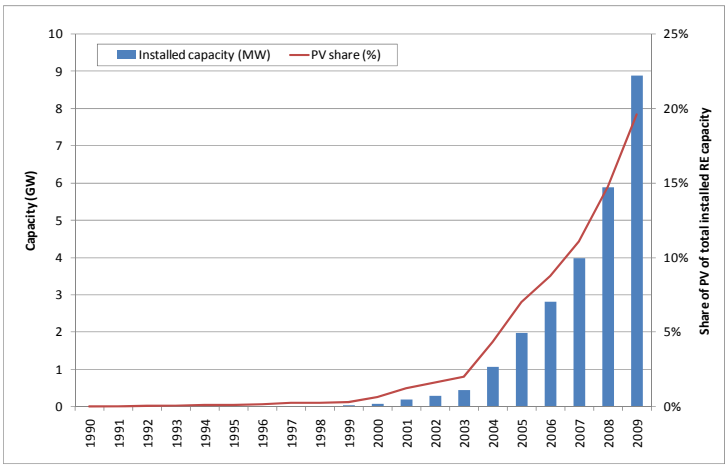


- Slope of supply curve generally increasing
- PV: power production at high load / prices
- Price reducing effect of PV on average higher than for other RE (relevant for higher PV capacity)

First presented, 2nd Solar Electric Utility Conference, Munich, March 2009

→ We do face high PV capacities today

Past development of PV in Germany



Source: BMU 2010

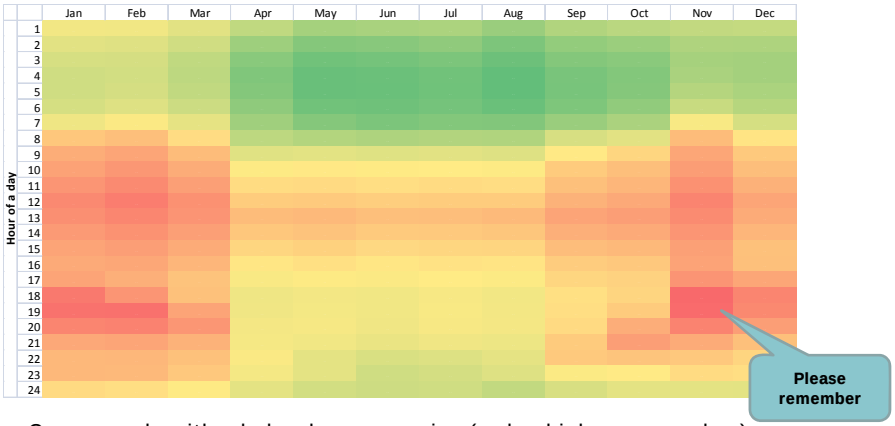
PV Share: ~ 20 % of total RE capacity in Germany in 2009

PV feed-in tariff scheme (EEG) in Germany: April 2010

- Additional, one-time cuts
- Target corridor between 2.5 and 3.5 GW per year;
  expected capacity: 2020: 42 GW, 2030 74 GW (65 GW s.t. FiT)
- Additional, capacity dependent cuts for 2011 and 2012
  - 2 (3) percentage points on 2011 (2012) per 1,000 MW above upper threshold
- Exceeding of corridor most likely:
  - Additional cuts realised with time lag
  - No additional cuts above 6.5 GW
  - Module prices continue to decrease (drastically)

Load in Germany

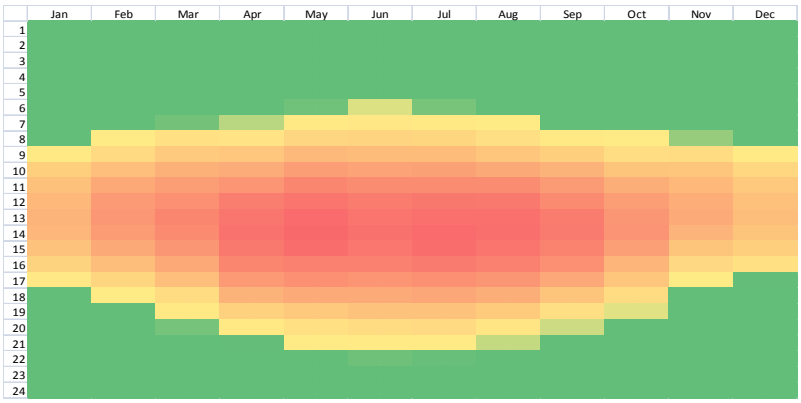
„Load mountains“: average demand in different hours of the year (red = high; green = low)



Corresponds with wholesale power price (red = high; green = low)

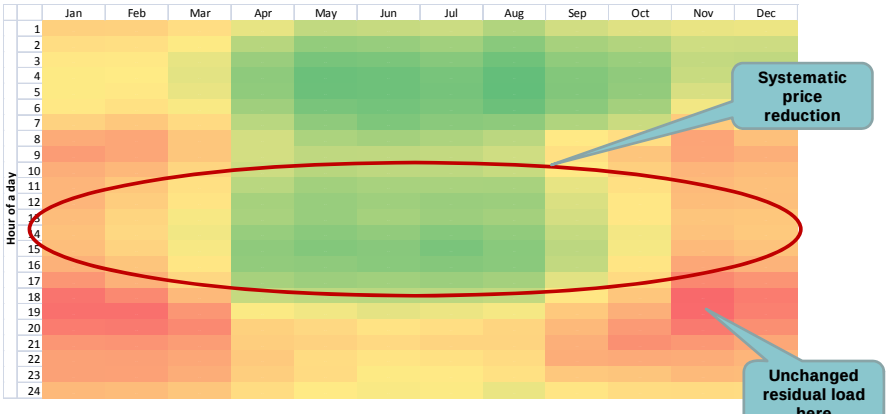
Power generation from PV in Germany

„PV production mountains“: average power production in different hours of the year (red = high; green = low)



Residual Load in Germany

„Risidual load mountains“: average residual load in different hours of the year (red = high; green = low)



Corresponds with wholesale power price (red = high; green = low)

Impact of PV on the power market

- Quantitative analyse with power market model
  - 8,760 hrs;
  - all major plants in Germany;
  - Wind, PV: scale-up of historical data
- Results:
- Power price decrease...
  - Impact on utilities/ operators of conventional plants?

Impact of PV on the power market

- Market Volume (revenue of all conventional plants)
- Specific plants
  - Existing plant (coal-fired)
  - New (gas-fired)

Blank

For details see:

Bode & Groscurth: The Impact of PV on the German Power Market, April 2010

http://www.arrhenius.de/38.0.html

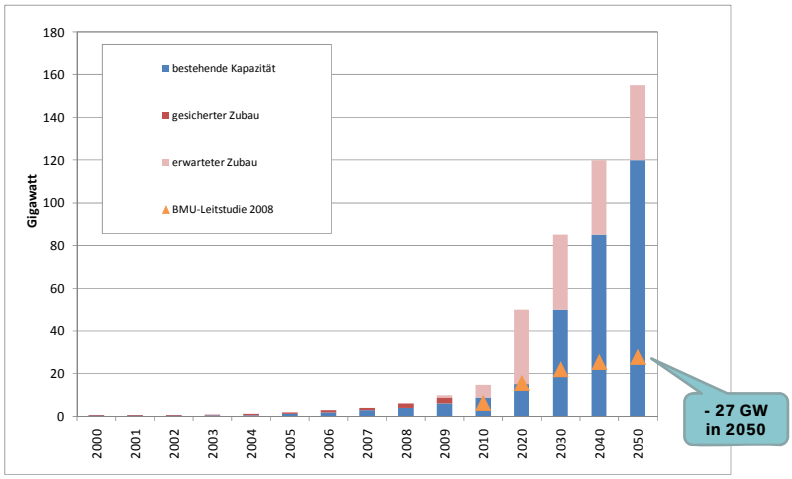
Impact of PV on the power market

- Whole sale price decreases (when prices are relatively high)
- Existing plants
  - Contribution margin reduced considerably
  - Adjustments of the plants' value? Stranded investments?
- New plants
  - Incentive to invest reduced considerably
  - Are needed as back-up (see "November evening on earlier slides)
  - Doubling of capacities likely (PV for summer, something else for winter) → high costs to the consumer
  - Note: Storage: Business case for daily cycles first (for seasonal storage open)

Options

- No policy concept for long-term Germany power market
- 100 % renewables desirable target but,
  - What technologies? (Different combinations have different impacts)
  - What path?
  - What's our willingness to pay?
- Massive impact of unconstrained PV build-up on power market, still neglected until now.
- If slow down of PV built-up is desired to weaken effects (and to buy some time):
  - Absolute caps need to be defined (development of module costs unknown in advance)
  - Possible caps for Germany: 500 MW to 3,000 MW per year

Options



BMU Lead Study renewable energy 2008 (earlier versions similar):
"This Lead Study 2008 presents the "Lead Scenario 2008", a scenario showing how greenhouse gas emissions in Germany can be cut to about 20% of the 1990 baseline by the year 2050."