

# Efficiency and flexibility of coal-fired power plants

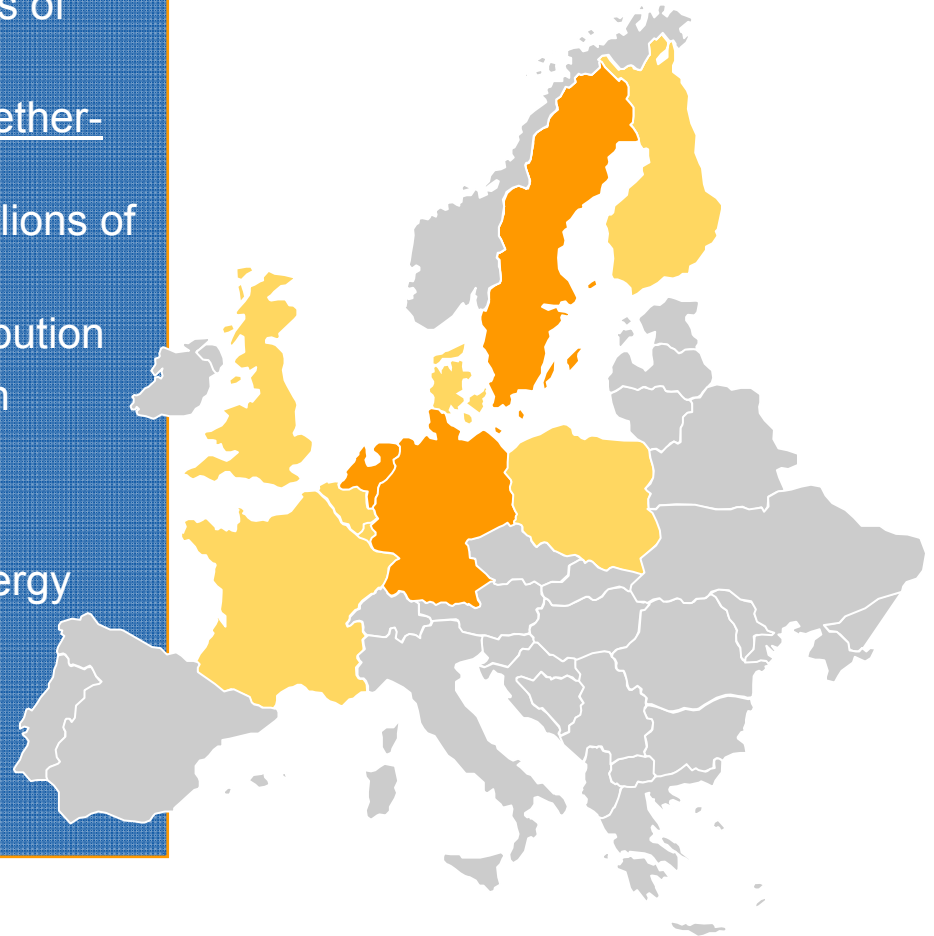
European Coal Round Table

21<sup>st</sup> March 2012, Brussels

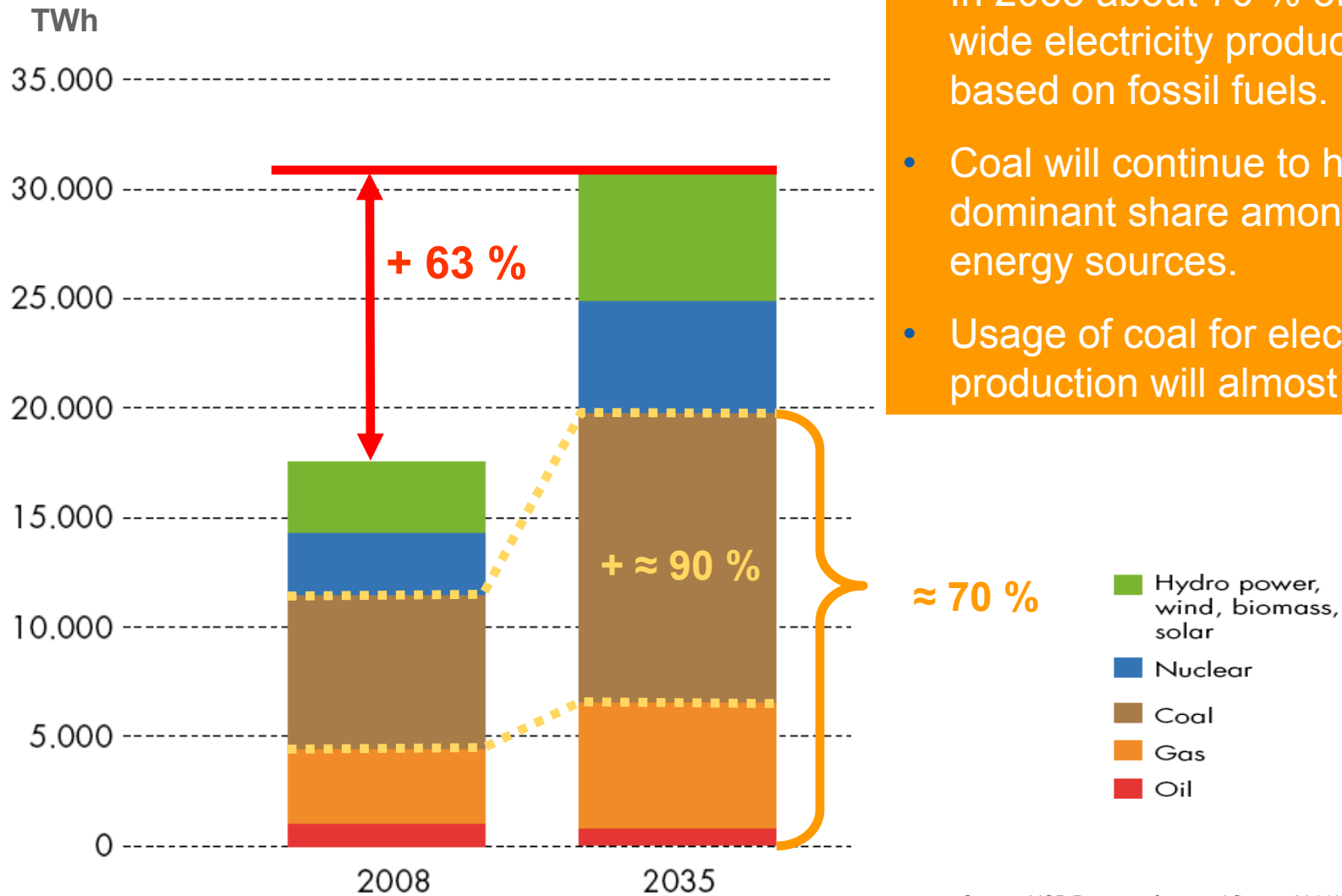
Wolfgang Dirschauer  
Head of climate policy  
Vattenfall Europe AG

# Vattenfall: a European energy company

- Vattenfall is one of Europe's largest generators of electricity and largest producer of heat
- Operations were conducted in Sweden, the Netherlands, Germany, Finland, Denmark, Poland, Belgium, France and the UK with up to 7.8 millions of electricity costumers
- Electricity: generation, transmission and distribution
- Heat: production, transmission and distribution
- Gas: transmission und distribution
- Energy trading and lignite mining
- Consulting and contracting activities in the energy sectors
- approximately 38,000 employees
- The parent company, Vattenfall AB, is 100 % owned by the Swedish state



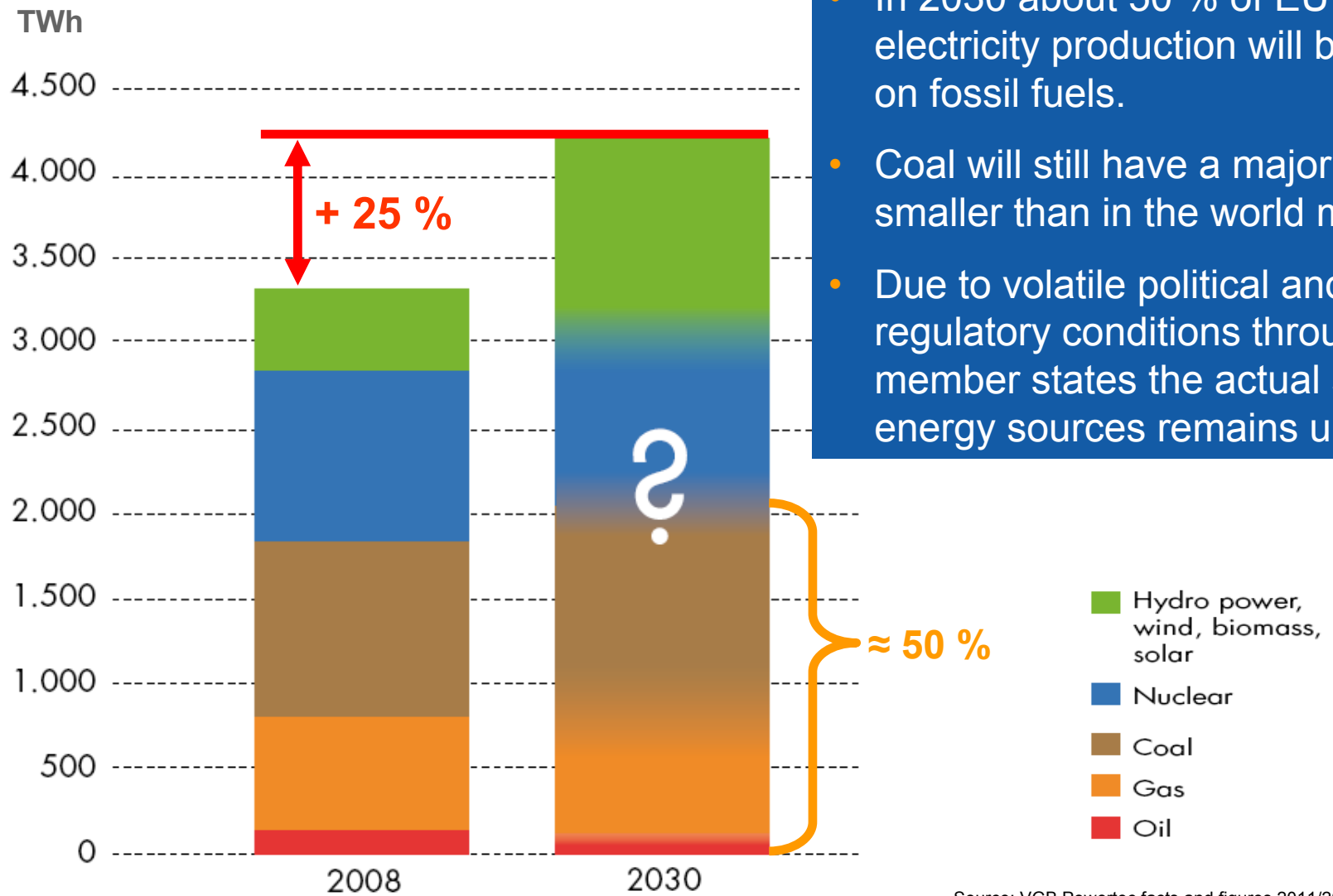
# Expected growth in electricity generation (world wide)



- In 2035 about 70 % of the world wide electricity production will be based on fossil fuels.
- Coal will continue to have a dominant share amongst the fossil energy sources.
- Usage of coal for electricity production will almost double.

Source: VGB Powertec facts and figures 2011/2012; IEA; Eurostat

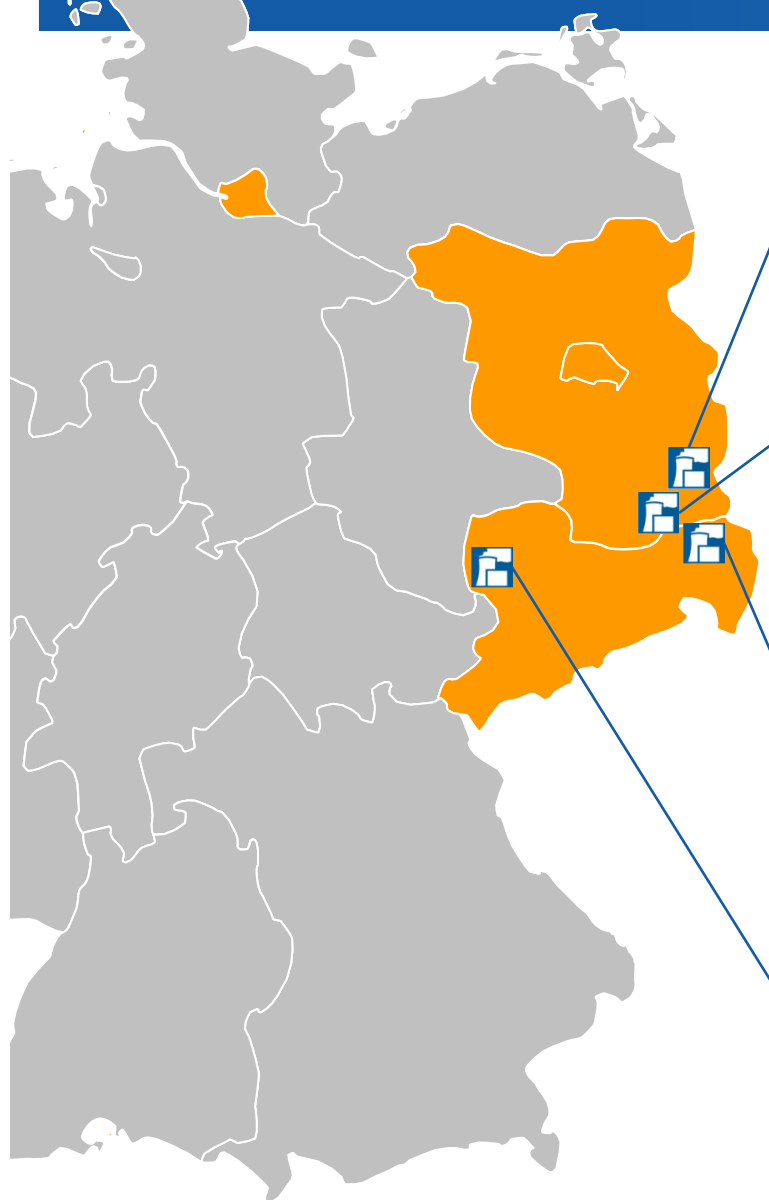
# Expected growth in electricity generation (EU)



- In 2030 about 50 % of EU's electricity production will be based on fossil fuels.
- Coal will still have a major share, but smaller than in the world market.
- Due to volatile political and regulatory conditions throughout EU member states the actual share of energy sources remains unclear.

Source: VGB Powertec facts and figures 2011/2012, IEA, Eurostat

# Locations of Vattenfall's lignite power plants



Power plant	Capacity
<b>Jänschwalde</b>	<b>3.000 MW</b>
6 blocks a 500 MW	
<b>Schwarze Pumpe</b>	<b>1.600 MW</b>
2 blocks a 800 MW	
<b>Boxberg</b>	<b>1.900 MW</b>
2 blocks a 500 MW	
1 block 900 MW	
1 block 675 MW (in commissioning)	
<b>Lippendorf</b>	<b>920 MW</b>
2 blocks a 920 MW (50% Vattenfall / 50% EnBW)	
<b>Total</b>	<b>7.420 MW</b>

# Example: power plant Jänschwalde



Commissioning	1980 - 1988
Fuel	lignite
Efficiency	35.5 % <sub>net</sub> (after several retrofits)
Blocks	6 x 500 MW <sub>gross</sub>
Total capacity	3.000 MW <sub>gross</sub>
Site minimum (includes restrictions due to heat deliveries etc., minimal technical load is lower)	≈ 750 MW <sub>gross</sub>
Load range	≈ 2.250 MW <sub>gross</sub>
Load change velocity	2 % P <sub>N</sub>

# Example: power plant Schwarze Pumpe

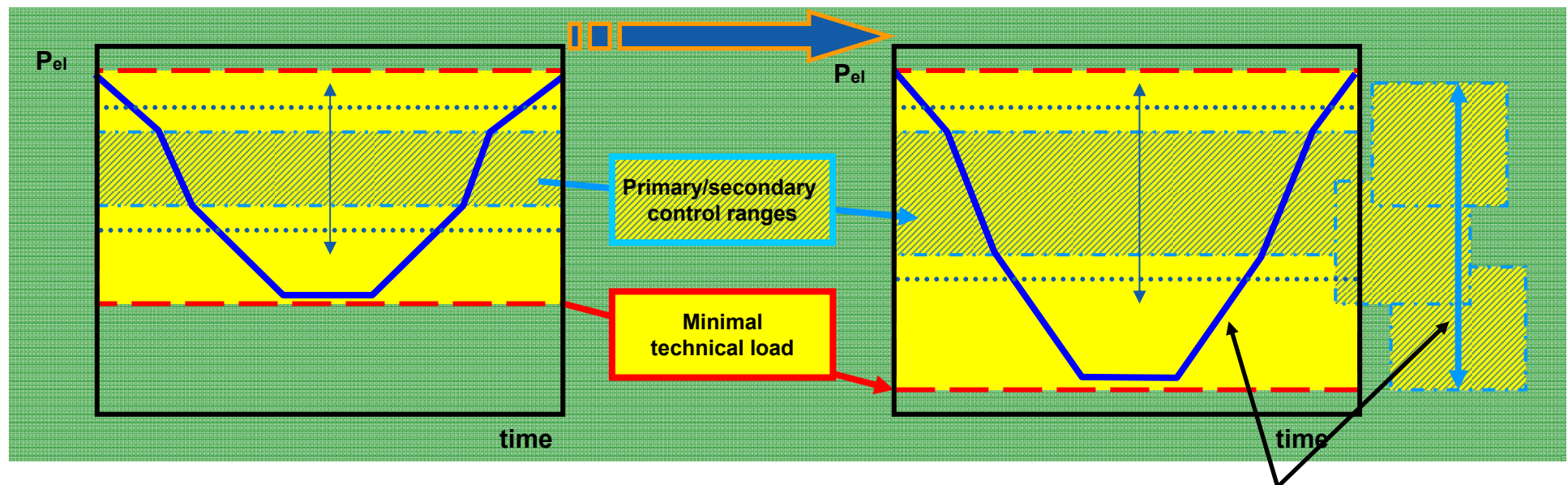


Commissioning	1997/1998
Fuel	lignite
Efficiency	41 % <sub>net</sub>
Blocks	2 x 800 MW <sub>gross</sub>
Total capacity	1.600 MW <sub>gross</sub>
Site minimum (includes restrictions due to heat deliveries etc., minimal technical load is lower)	≈ 650 MW <sub>gross</sub>
Load range	≈ 950 MW <sub>gross</sub>
Load change velocity	3 % P <sub>N</sub>

# Increase of load flexibility and load change velocity

## Targets:

- Increase of load control range by reducing the minimal technical load
- Therefore increase of primary and secondary control range
- Increase of load change velocity
- Optimization of start-up and shutdown processes



Adaptation of the gradients to move primary/secondary control ranges over the whole load range.

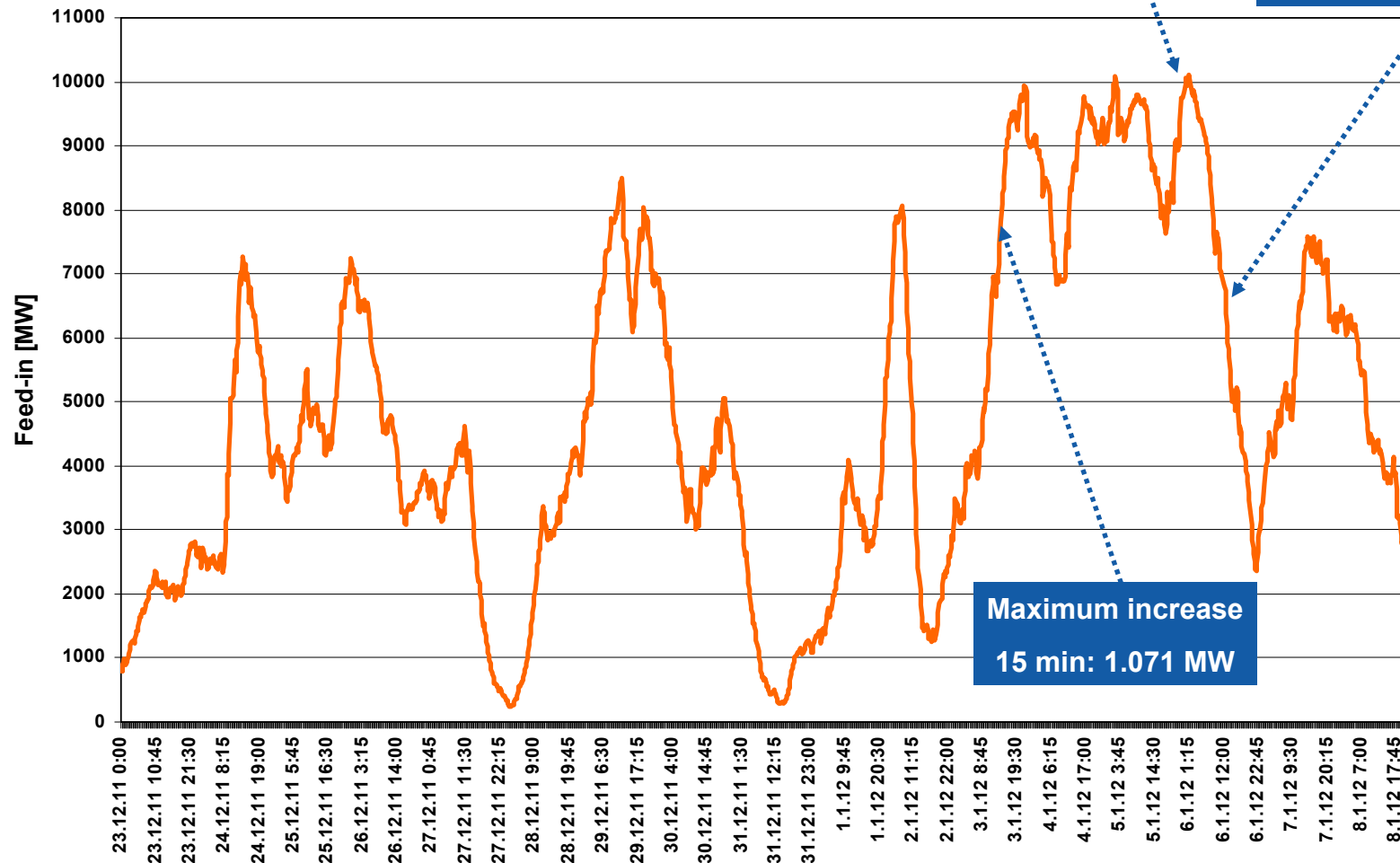


# Wind feed-in within eastern German transmission grid

- Period 23.12.2011 – 08.01.2012
- Total installed wind capacity in 50Hertz transmission grid  $\approx$  11.500 MW

Maximum wind feed-in 10.106 MW  
on 05.01.2012 at 21:15 o'clock

Maximum reduction  
1 h: -1.388 MW



Source: 50Hertz

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Confidentiality - None (C1)

# Target: Flexible Generation Management

- Coal
- Nuclear (2022)
- Gas



- Wind
- Hydro
- Biomass
- PV



smart  
generation and  
distribution  
management

- (Smart-Grid)
- DSO
- TSO



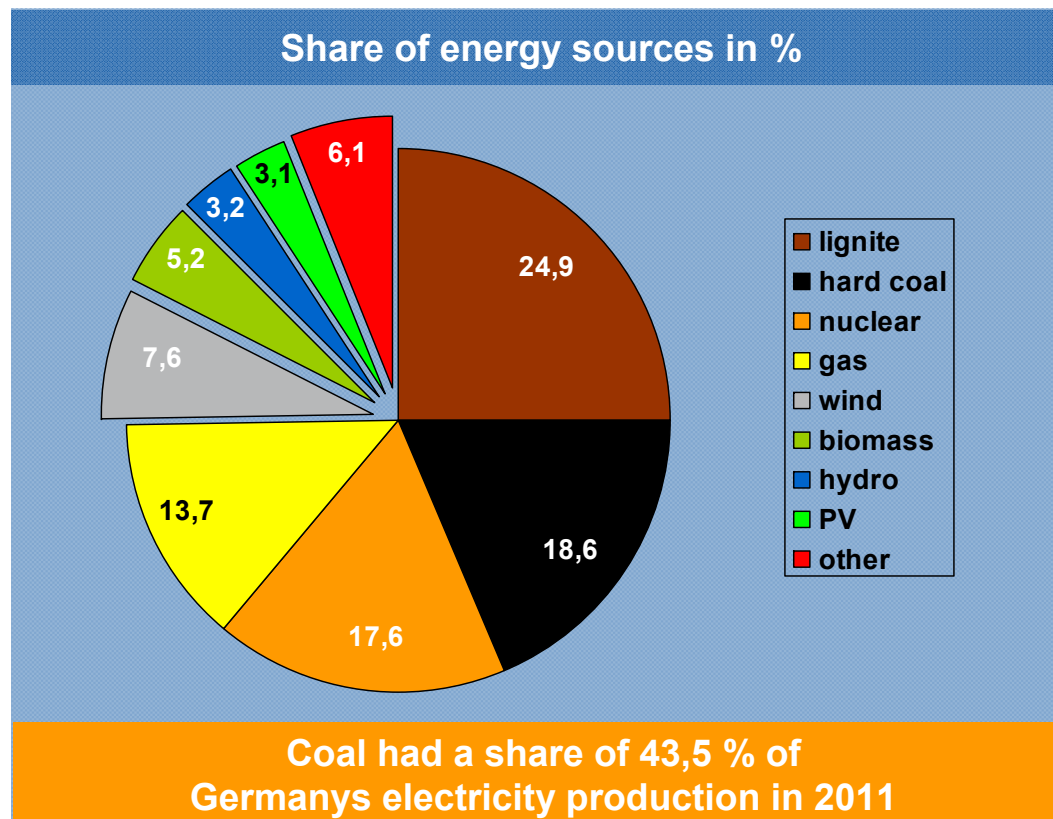
- Pump storage
- New storages



# Electricity generation in Germany 2011

Overall electricity production (gross): 614,5 TWh

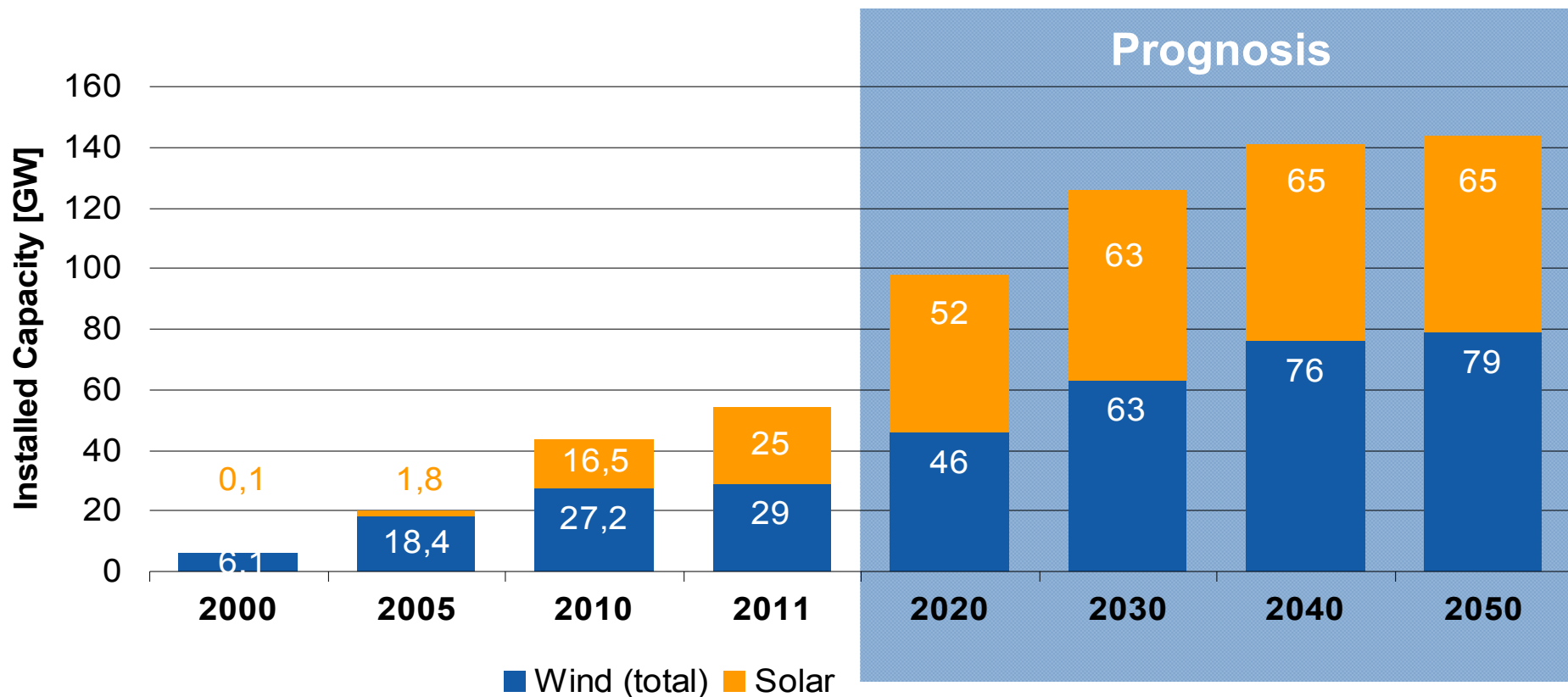
Overall installed capacity: 167.820 MW



Source: BDEW 03/2012

# Growth of wind and solar capacity in Germany

The increasing share of intermittent electricity from renewable plants with feed-in priority requires a significantly higher controllability of conventional power plants.



Source: Prognos, base scenario 2010A, September 2011

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Thank you for your interest and  
**„Glück auf!“**

