

# Investor and Analyst Conference Call

Essen, December 9, 2009

## The Need for Smart Megawatts

Power Generation in Europe – Facts & Trends

Thomas Birr, Vice President Strategy

Dr. Thomas Glimpel, Head of Portfolio Management

Ingo Alphéus, Vice President Investor Relations



Until recently, expectations about the future of the European generation market were mainly driven by concerns about tight capacity

Are these concerns still **justified**?

---

What has **changed** since then?

---

Are there **new challenges**?

---

# The future capacity situation in the converging markets in Europe<sup>1</sup> is far from being solved

<b>Shutdowns</b>	Existing conventional power plants will go offline in the coming years due to:	<ul style="list-style-type: none"><li>&gt; Ageing power plants with low efficiency</li><li>&gt; Stricter CO<sub>2</sub> allocation (full auctioning)</li><li>&gt; Flue gas requirements/Large Combustion Plant Directive</li><li>&gt; Nuclear policy in Germany</li></ul>
<b>New builds</b>	Many new conventional power plants have been announced, but most are unlikely due to:	<ul style="list-style-type: none"><li>&gt; Financing difficulties</li><li>&gt; Lack of sufficient price signals</li><li>&gt; Supply constraints and high prices of power plant components</li><li>&gt; Delays due to quality problems</li><li>&gt; Political risks (e.g. pending: CO<sub>2</sub> allocation in CEE, support of CCS) and local public opposition</li><li>&gt; Economic availability of long-term and firm gas supply</li></ul>
<b>Demand</b>	Capacity demand in this region <sup>1</sup> will be stable or slightly increase over the next years because:	<ul style="list-style-type: none"><li>&gt; Recession reduces capacity demand in the short-term only</li><li>&gt; In NW Block of UCTE demand structure will be more peak-loaded (e.g. increased use of air-conditioning and electric heating)</li><li>&gt; In NE and SE Block of UCTE rising standards of living and industrial growth will be accompanied by higher energy demand</li><li>&gt; Improved energy efficiency will be offset by rising electrification (heat pump, e-mobility, etc.)</li></ul>

<sup>1</sup> UCTE NW Block (AT, BE, F, GER, LUX, NL, CH), NE Block (CZ, HUN, PL, SK), SE Block (BA, BG, GR, MNE, ROM, SRB), Scandinavia and the UK.

# The issue of tight capacity has only been delayed, not solved

## New-build power plant capacity

Of the 300 GW of new-build power plant capacity in Europe already announced, just 55 GW are likely to come online by 2015 and an additional 15 GW by 2020

## Shutdowns

Some 40 GW of old generation capacity, or 5% of overall capacity, will go offline by 2015 due to regulatory reasons, despite being profitable

## Capacity demand

The crisis will dampen demand for some time, but there is no sign of systematic and long-term lower capacity demand in Europe

By 2015 at the latest, this situation alone will lead to rising power prices and more volatility in the European market

# But this is not the full story: the main challenge in Europe will be the integration of increasing renewables capacity

<b>Development of renewables capacity</b>	More than 50% of expected investment in generation until 2020 is in renewable energy	<ul style="list-style-type: none"><li>&gt; Huge wind and solar new build anticipated in the EU 27</li><li>&gt; Capacity in 2008: 65 GW wind, 9.5 GW photovoltaic and 0.01 GW solar thermal</li><li>&gt; Forecast for 2015: 140 GW wind<sup>1</sup>, 20 GW photovoltaic<sup>2</sup> and 1.2 GW solar thermal<sup>3</sup></li><li>&gt; Forecast for 2020: 208 GW wind<sup>1</sup>, 52 GW photovoltaic<sup>2</sup> and 2.4 GW solar thermal<sup>3</sup></li></ul>
---	--	--

<b>The impact on the system</b>	Already today, the availability of renewables can change from one hour to the next in the magnitude of 30,000 MW; in 2015 possibly 60,000 MW	<ul style="list-style-type: none"><li>&gt; In recent years, unreliable generation from renewables in Germany could be "transported" to other countries like the Netherlands, Poland and France</li><li>&gt; Now, all of (northern) Europe is boosting its wind and solar capacity as a result of more ambitious EU climate targets</li><li>&gt; This means that, at the same time, those countries are likely to have more feed-in from wind and solar than needed</li><li>&gt; As a consequence, huge spikes and drops will have to be balanced out more and more in each individual grid/portfolio</li></ul>
---------------------------------	--	--

<b>Possible solutions</b>	How can markets react to these increasing imbalances?	<ol style="list-style-type: none"><li>1. Adding new flexible capacity to the system (new fossil-fired power plants)</li><li>2. Retrofitting the existing generation portfolio</li><li>3. Other measures (e.g. flexible use of nuclear capacity, pump-storages, load management on the demand side, smart grids in combination with e-mobility)</li></ol>
---------------------------	---	--

1 European Wind Energy Association, Emerging Energy Research Q3 2009.

2 European Renewable Energy Council.

3 European Solar Thermal Power Industry Association (ESTIA).

# Therefore, there is not just a need for capacity, but for flexible capacity

## Existing power plants

- > The value of existing power plants will rise as long as new-build projects are cancelled or delayed
- > Existing power plants can be retrofitted with limited capex to make them more flexible

## New power plants

- > Flexible new power plants, which actually come online, will be superior to inflexible power plants in the merit order

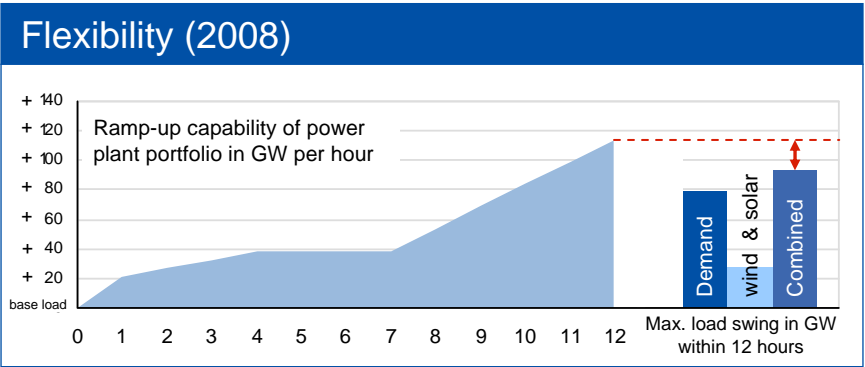
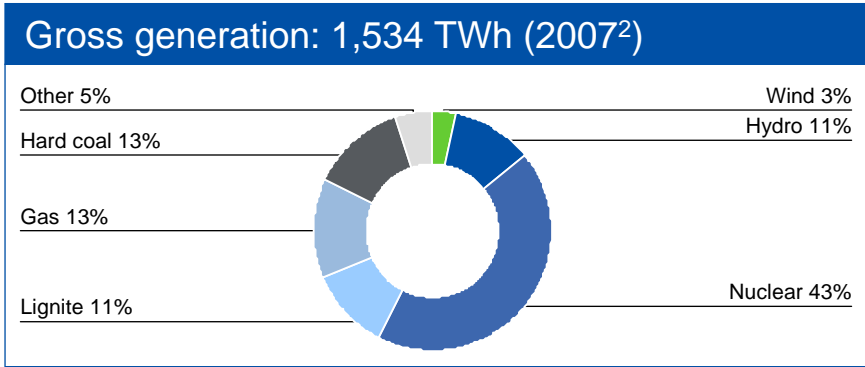
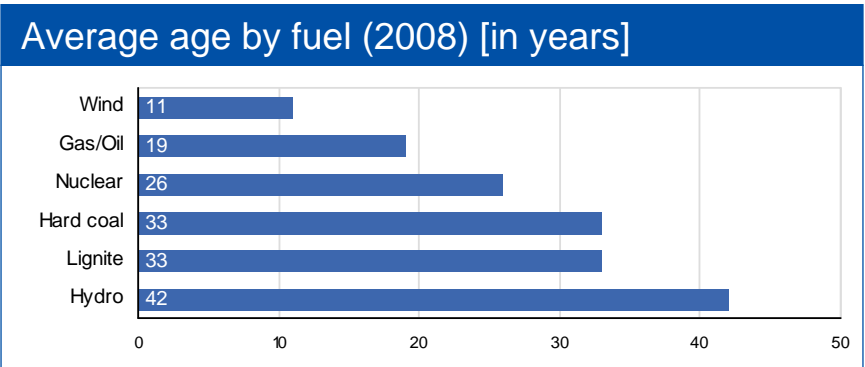
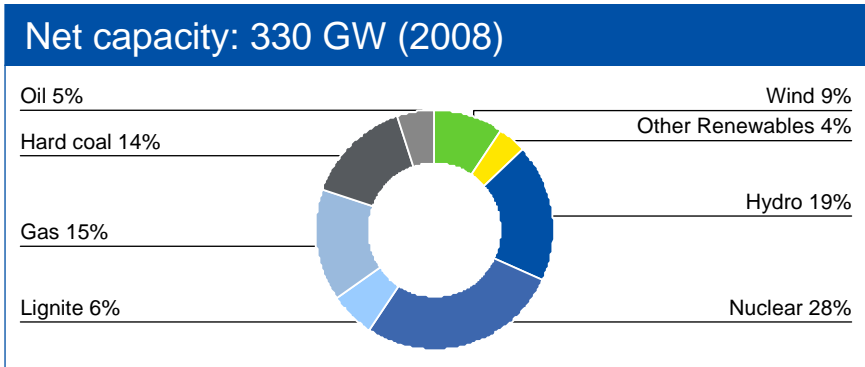
## Diversified portfolio

- > A big, diversified portfolio can react better in volatile load and price scenarios than individual or groups of a few generation units



Flexible “smart megawatts” can earn a premium in a more and more volatile market

# Generation mix in the North-Western Block<sup>1</sup>



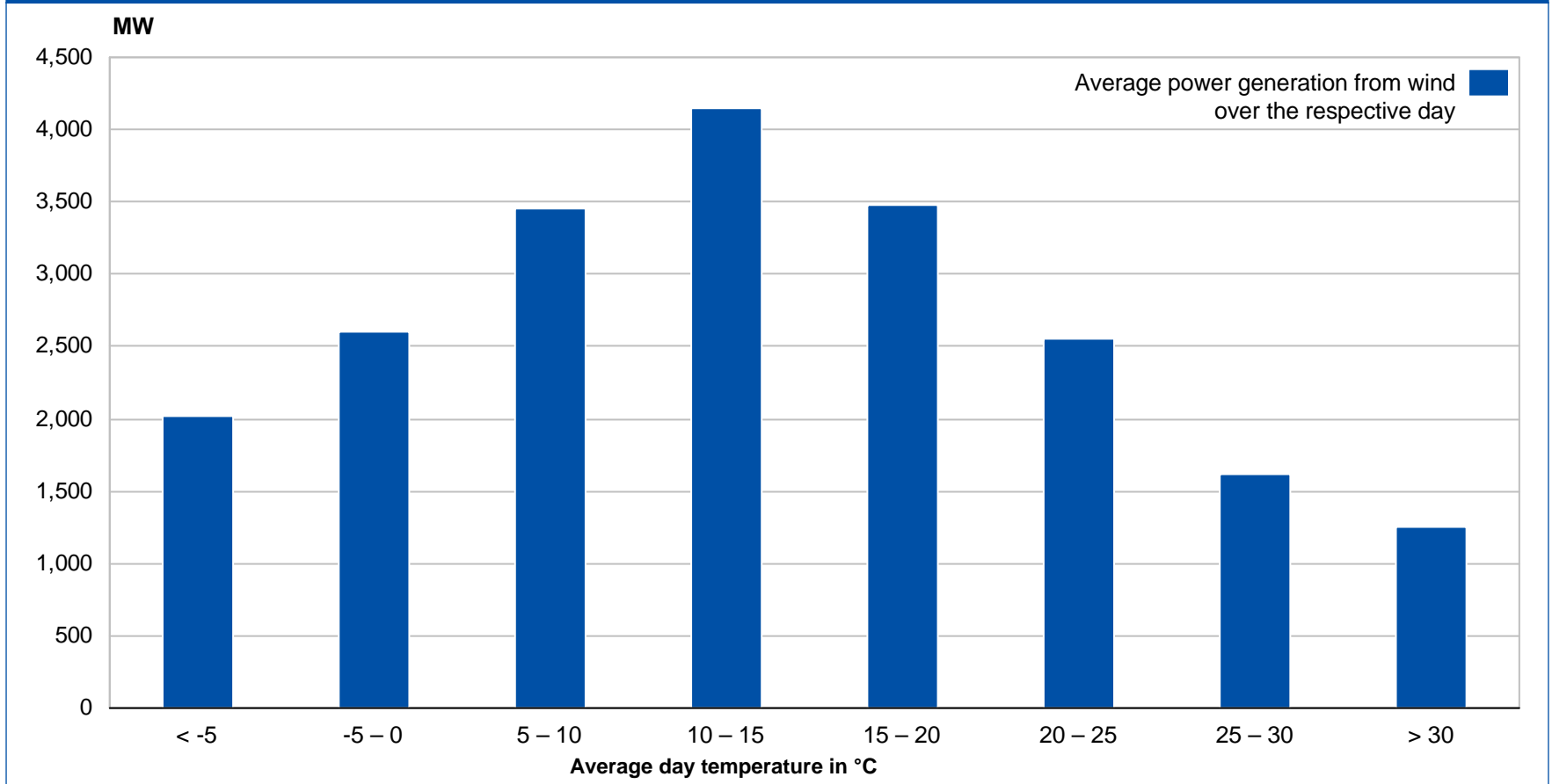
- > High proportion of nuclear capacity (28%)
- > Nuclear is also the most important fuel in power generation, mainly due to the high contribution from France
- > The existing load swing already leads to a tight remaining flexibility margin in this market area

Sources: Platts Database, Eurostat, RWE.

1 North-western block: Austria, Belgium, France, Germany, Luxembourg, Netherlands, Switzerland.  
 2 No 2008 Eurostat data available.

# Not only is wind volatile, but most of the time it is not there when it is urgently needed ...

Correlation of average power generation from wind and average day temperature in °C

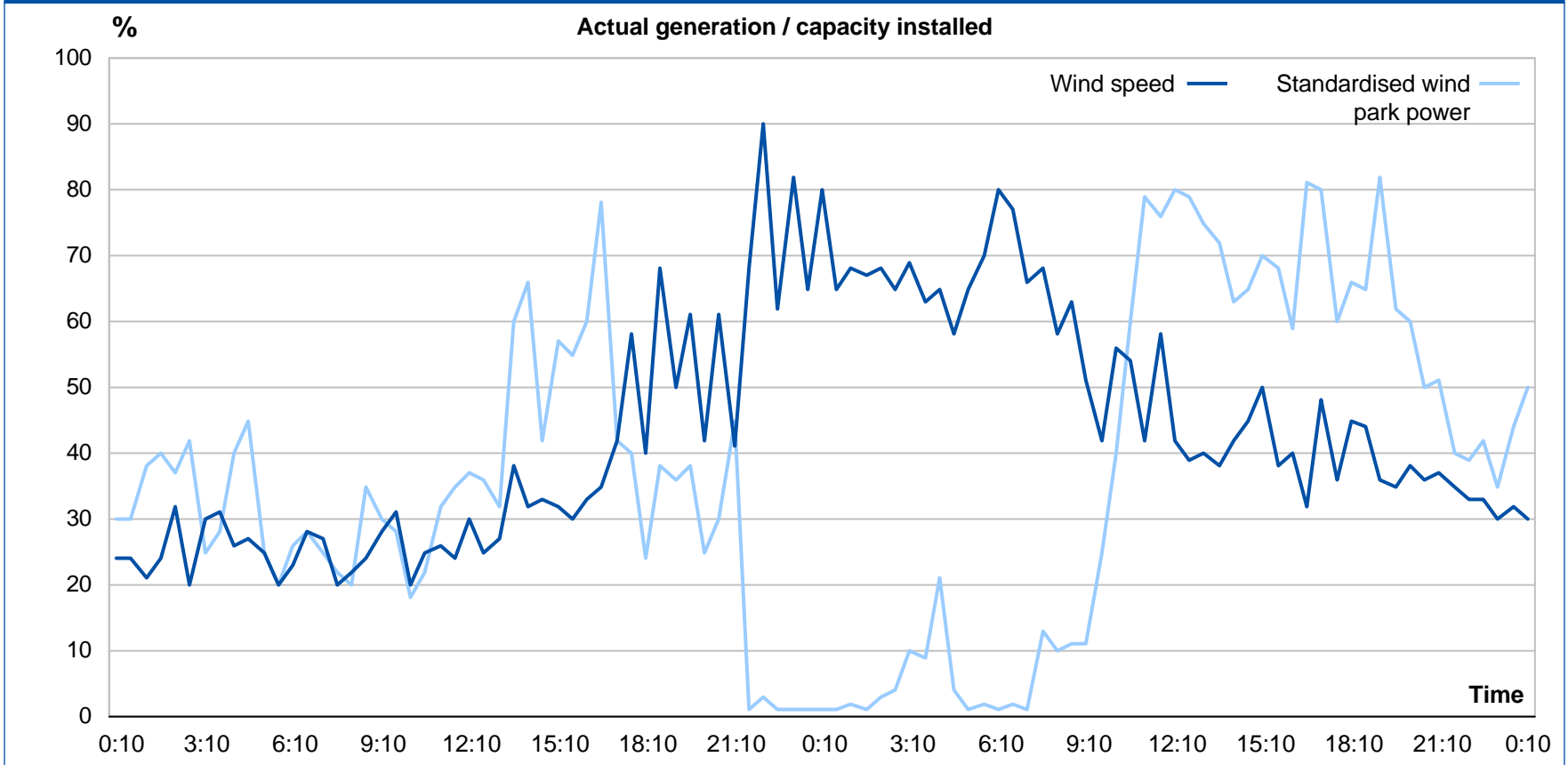


Source: RWE.

# ... and more wind doesn't always result in more power generation

Illustrative

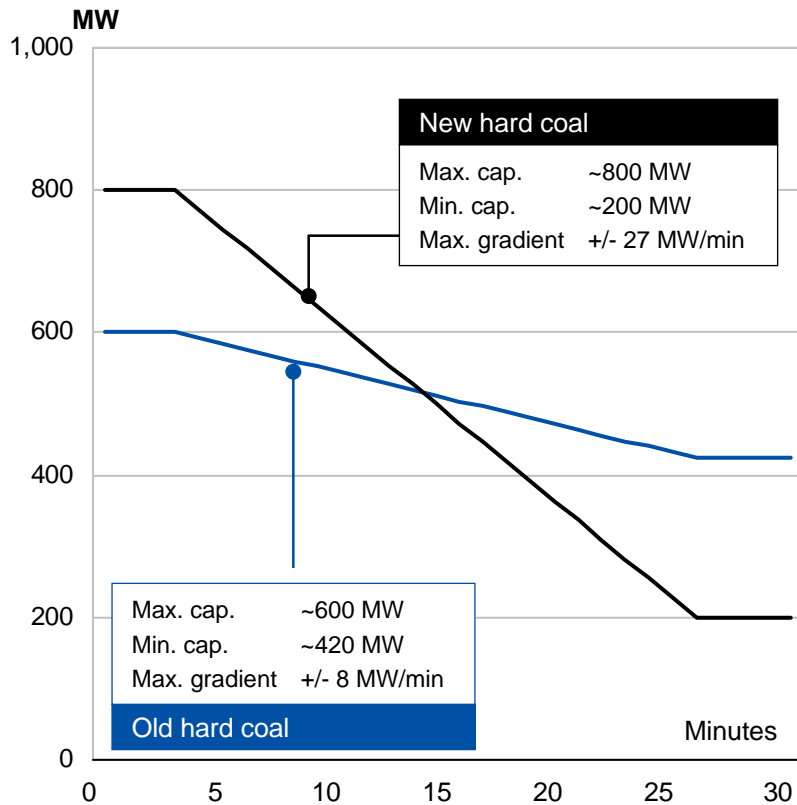
Wind turbines are pitched in case of heavy storms to avoid damages



Source: Institut für Windenergie und Energiesystemtechnik, 2008.

# Hard coal-fired power generation can be flexible

## Comparison of ramp capacities between old hard coal and new hard coal



Source: RWE.

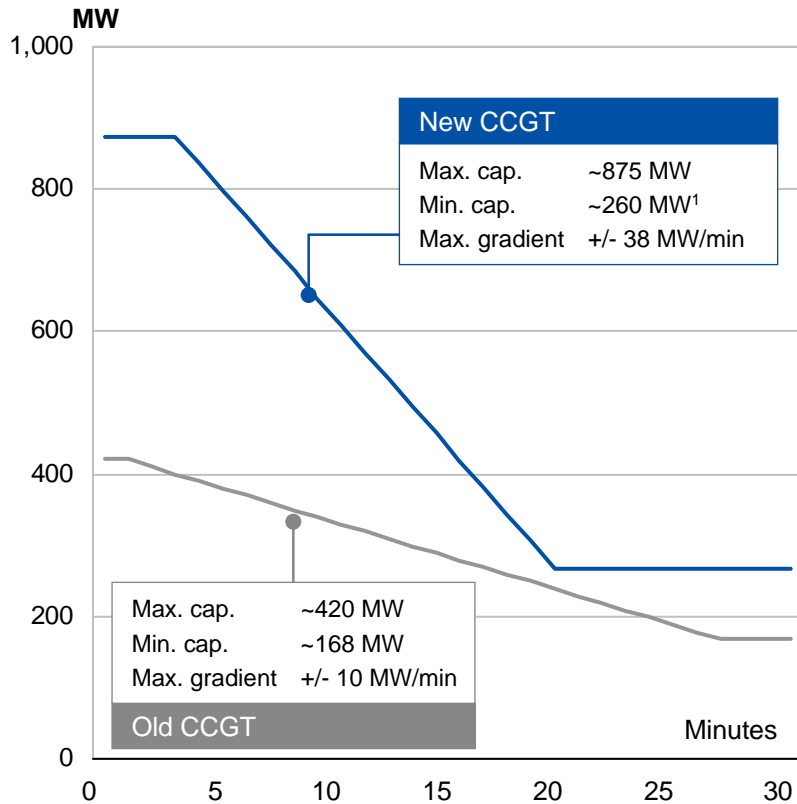
## New hard coal-fired 1,600 MW plant – 2 flexible 800 MW units for mid-merit regime



Example: RWE new build in Hamm (Germany)

# Combined-cycle gas turbines offer steep ramp capacities to cope with volatile wind generation

## Comparison of ramp capacities (old CCGT vs. new CCGT)



Source: RWE.

1 One turbine gets turned off.

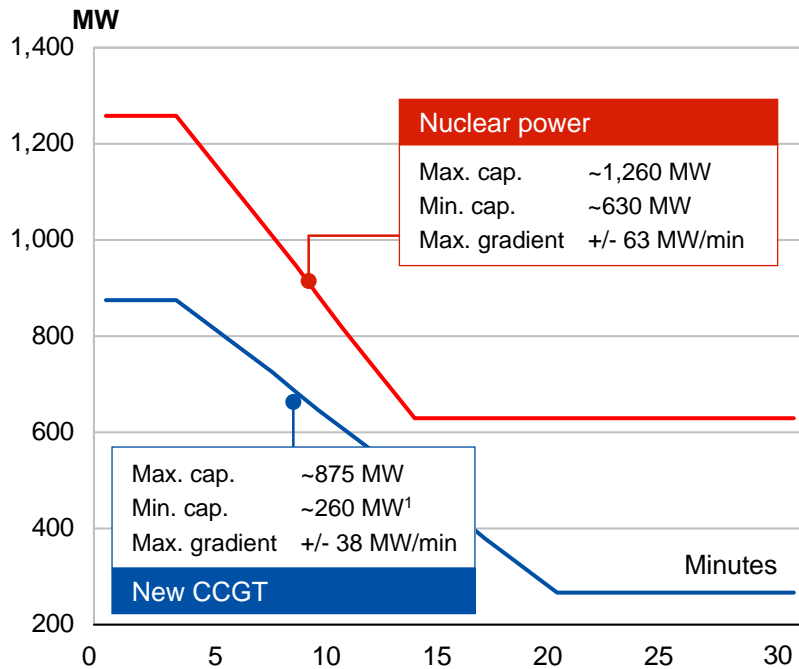
## New gas-fired 875 MW plant, > 58% efficiency for peak times



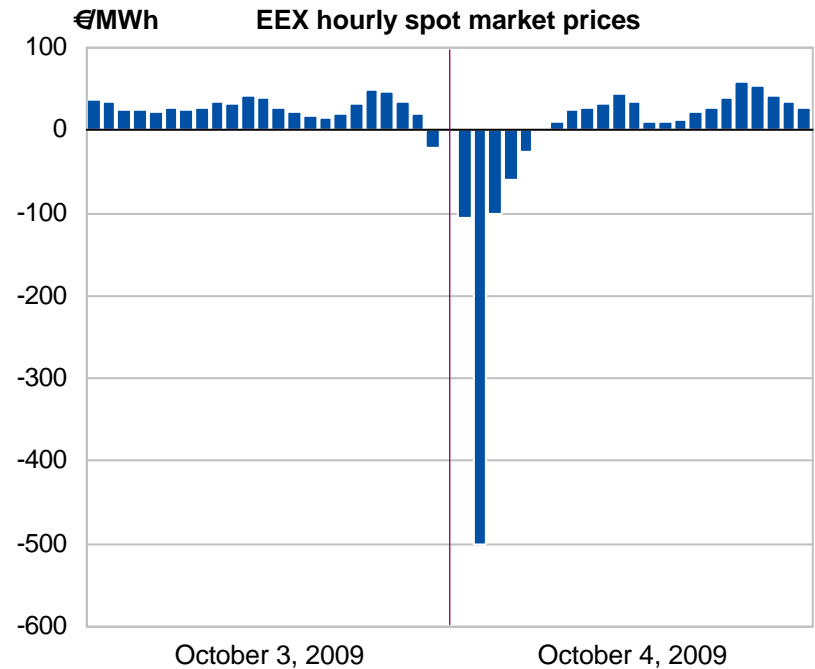
Example: RWE new build in Lingen (Germany)

# Nuclear is not only able to provide base load at rather negligible variable costs, but also high tech in flexibility

Steep ramp rates of nuclear, already used e.g. in France to ensure system stability, steeper than CCGT



Negative hourly power prices are even too low for almost zero variable costs

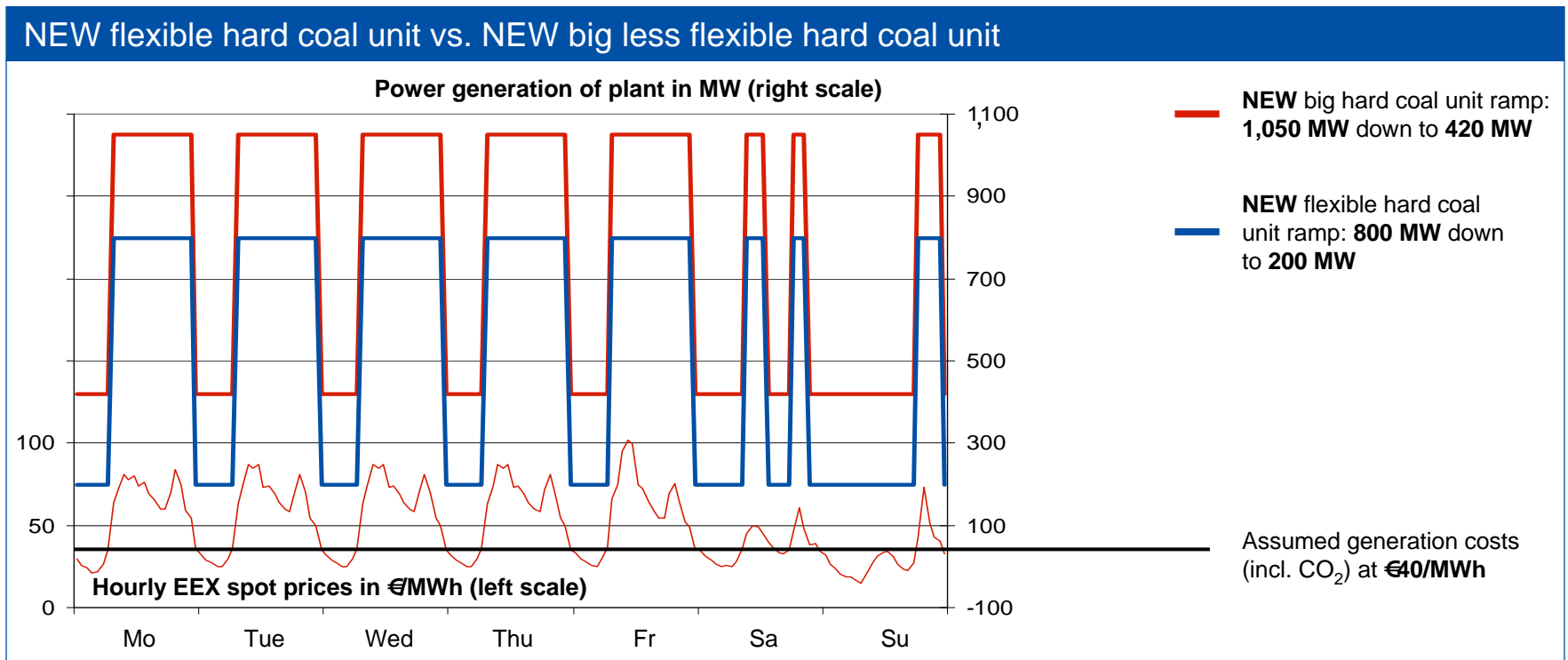


➤ A flexible use of 6 GW<sup>2</sup> of nuclear capacity could avoid waste of resources and costs in a magnitude of €3 million on just one weekend like the one above

<sup>1</sup> One turbine gets turned off.

<sup>2</sup> Installed nuclear capacity of RWE in Germany.

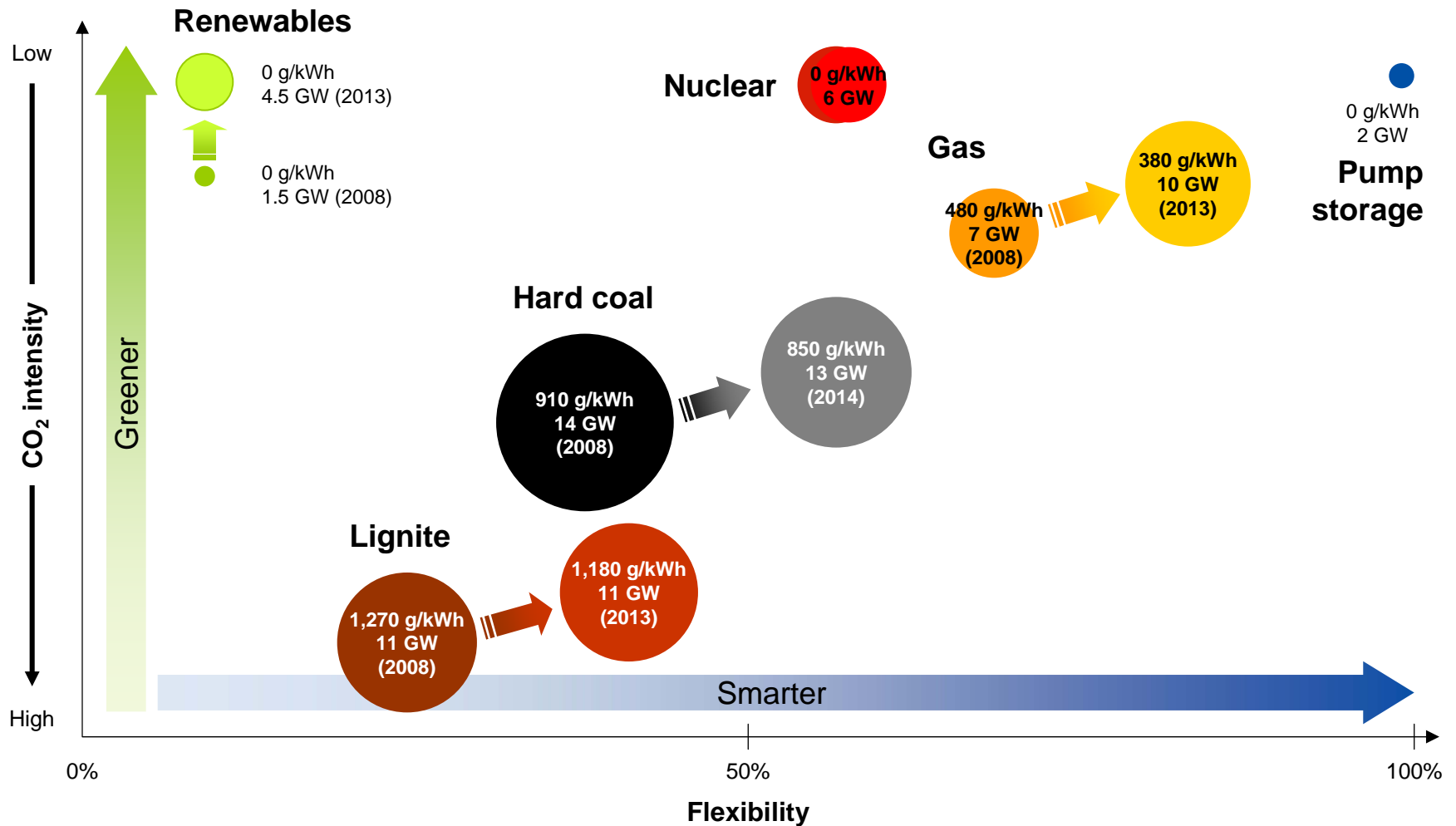
# Flexible hard coal vs. big hard coal in a standard scenario



- > In a standard spot price environment without negative prices the **flexible unit already obtains about 6% higher returns per MW installed than a new big one.**

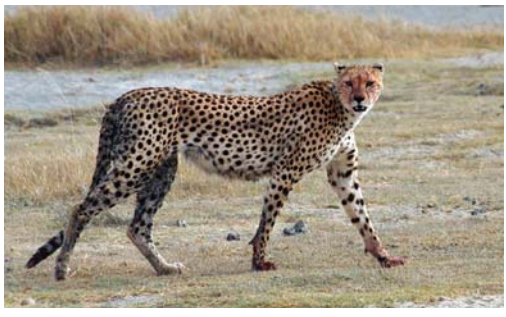
Source: RWE.

# RWE power plant portfolio – 2008 vs. 2013/14: Strong investments in “smarter” and “greener” megawatts

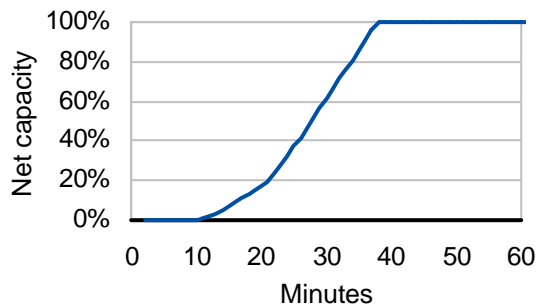


# RWE's strategy to fetch flexibility premia is threefold

## Sprinting



Ramp capacity **CCGT**  
Lingen<sup>1</sup>

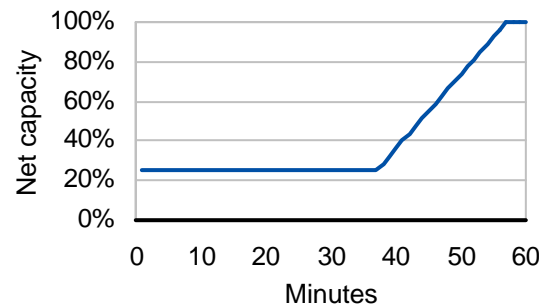


Gas capacities offer quick start-up capabilities. Partial load is expensive. Gas remains ideal to cover peaks, even in volatile markets.

## Lurking



Ramp capacity **hard-coal**  
plant Hamm

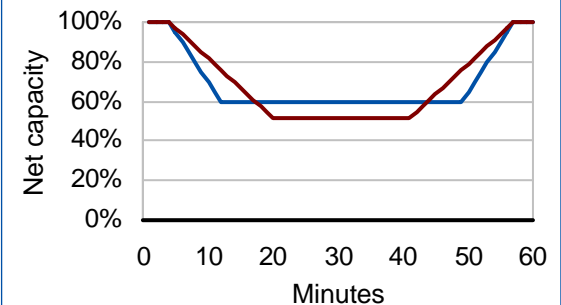


New coal capacities can be dispatched with 25% of rated output. The plants can profitably wait for high prices over a period of temporarily low demand.

## Gliding, diving and rising



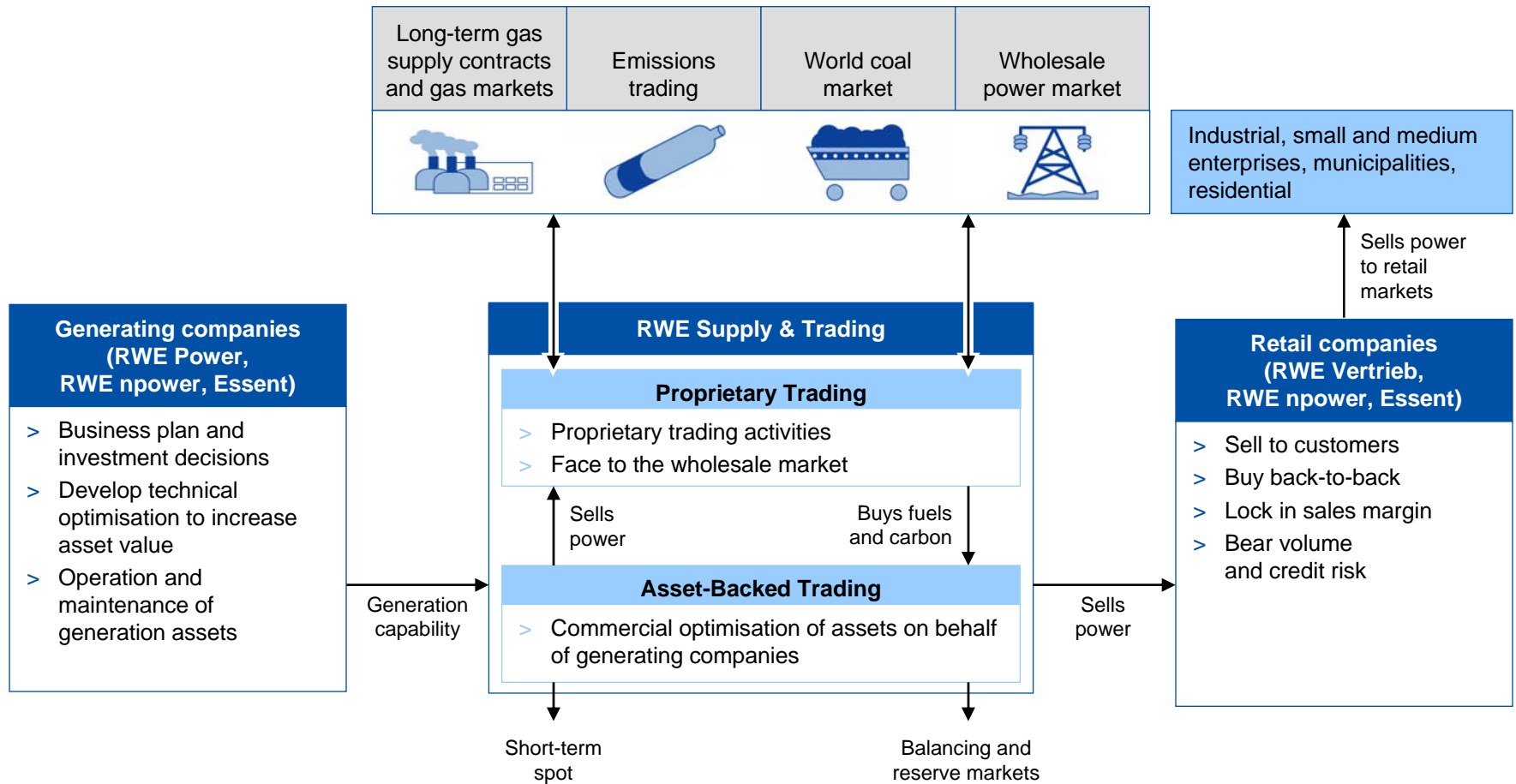
Ramp capacity **nuclear**, e.g. Biblis,  
or **new lignite**, e.g. Neurath



Although designed for the base-load regime, nuclear plants and new lignite plants can be dispatched flexibly, and they can be operated to provide partial load.

<sup>1</sup> Unrestricted start-up concept until 12 hours after shutdown

# Centralised pan-European asset management: moving assets closer to the market to generate additional margin



# Conclusion (I)

**Power demand will go different ways in Europe.** While in Germany demand is expected to reach pre-crisis levels only in a few years, forecasts for CEE/SEE show earlier and stronger consumption growth

With demand back to “normal”, EU reserve margins in Central Europe will tighten. The lights will not go out as old, inefficient capacity will be operating longer. But **a new gap will arise: the “efficiency gap.”** This is because inefficient power stations with high consumption of fuel and CO<sub>2</sub> will be price setters. As a consequence, price signals for the new build of more efficient power plants are expected

On top of this comes another effect. Due to the increasing share of volatile electricity generation from renewables, there is a **higher demand for flexibility in power generation.** Because of the lack of flexibility of the current European power plant portfolios, more volatile market reactions, e.g. price spikes and negative prices, can be seen

Renewables and new conventional power plants in mature markets like Germany, the UK and the Netherlands will **push mainly old hard coal capacity out of the market** which is not efficient and flexible enough to cope with the new market environment

Only flexible coal and gas power plants (new and retrofitted old) are capable of coping with the new market environment. They are **“smart megawatts.”** They are best suited to obtaining high “clean spreads” in times of volatile spot prices for electricity on the one hand and to avoiding temporarily uncovered costs of operation on the other hand

## Conclusion (II)

RWE currently has some **9,000 MW of additional “smart megawatts“ under construction** to cope with volatile demand. They can earn a flexibility premium compared to conventional technology

In emerging regions (like CEE and SEE) **the main driver is to build the most efficient technology** to operate under an attractive „price umbrella“ of existing less efficient plants, save CO<sub>2</sub> costs and cover growing demand

The new market situation will favour **sophisticated asset optimisation** (short-term and long-term position management across NW Europe) to leverage portfolio advantages: It is not enough for “smart megawatts“ to just be there – they also need to be managed and marketed