The Need for Smart Megawatts

Power Generation in Europe – Facts & Trends

December 2009

RWE

The energy to lead

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Executive Summary

The energy to lead

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[1] is far from being solved

Shutdowns	Existing conventional power plants will go offline in the coming years due to:	> Ageing power plants with low efficiency > Stricter CO_2 allocation (full auctioning) > Flue gas requirements/Large Combustion Plant Directive > Nuclear policy in Germany
New builds	Many new conventional power plants have been announced, but most are unlikely due to:	> Financing difficulties > Lack of sufficient price signals > Supply constraints and high prices of power plant components > Delays due to quality problems > Political risks (e.g. pending: CO_2 allocation in CEE, support of CCS) and local public opposition > Economic availability of long-term and firm gas supply
Demand	Capacity demand in this region[1] will be stable or slightly increase over the next years because:	> Recession reduces capacity demand in the short-term only > In NW Block of UCTE demand structure will be more peak-loaded (e.g. increased use of air-conditioning and electric heating) > In NE and SE Block of UCTE rising standards of living and industrial growth will be accompanied by higher energy demand > Improved energy efficiency will be offset by rising electrification (heat pump, e-mobility, etc.)

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[1] 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

Development of renewables capacity	More than 50% of expected investment in generation until 2020 is in renewable energy	> Huge wind and solar new build anticipated in the EU 27 > Capacity in 2008: 65 GW wind, 9.5 GW photovoltaic and 0.01 GW solar thermal > Forecast for 2015: 140 GW wind[1], 20 GW photovoltaic[2] and 1.2 GW solar thermal[3] > Forecast for 2020: 208 GW wind[1], 52 GW photovoltaic[2] and 2.4 GW solar thermal[3]
The impact on the system	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	> In recent years, unreliable generation from renewables in Germany could be ”transported“ to other countries like the Netherlands, Poland and France > Now, all of (northern) Europe is boosting its wind and solar capacity as a result of more ambitious EU climate targets > This means that, at the same time, those countries are likely to have more feed-in from wind and solar than needed > As a consequence, huge spikes and drops will have to be balanced out more and more in each individual grid/portfolio
Possible solutions	How can markets react to these increasing imbalances?	1. Adding new flexible capacity to the system (new fossil-fired power plants) 2. Retrofitting the existing generation portfolio 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)

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 Europe

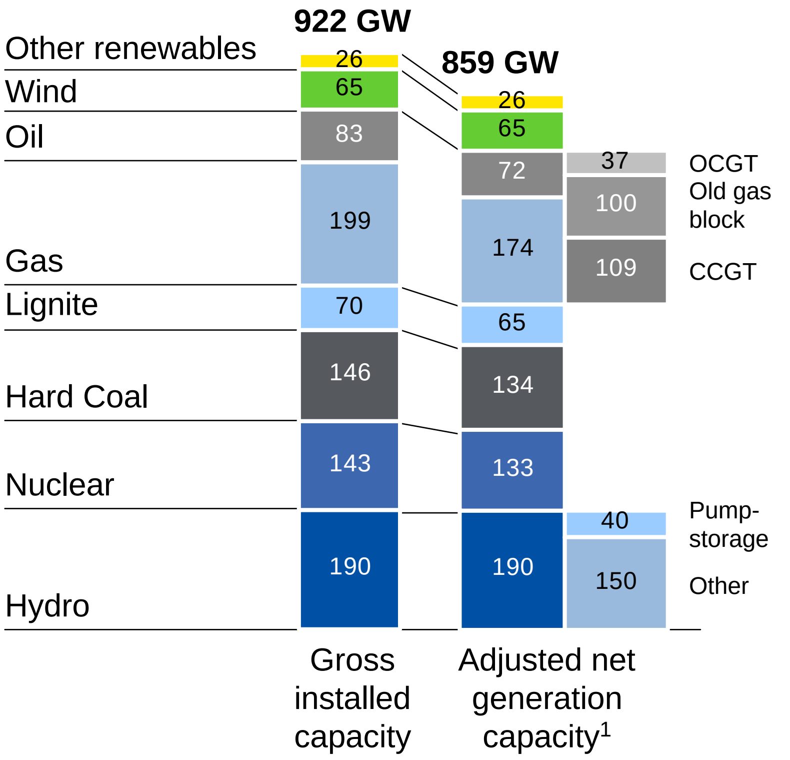
The following chapter provides an overview of the generation mix in Europe and in individual European regions

Europe’s total generation capacity: 922 GW gross, 859 GW adjusted net

Countries

Austria
Balkan (5)
Baltic (3)
Belgium
Bulgaria
Czech Republic
Denmark
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Luxembourg
Netherlands
Norway
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden
Switzerland
UK

Generation structure in 2008

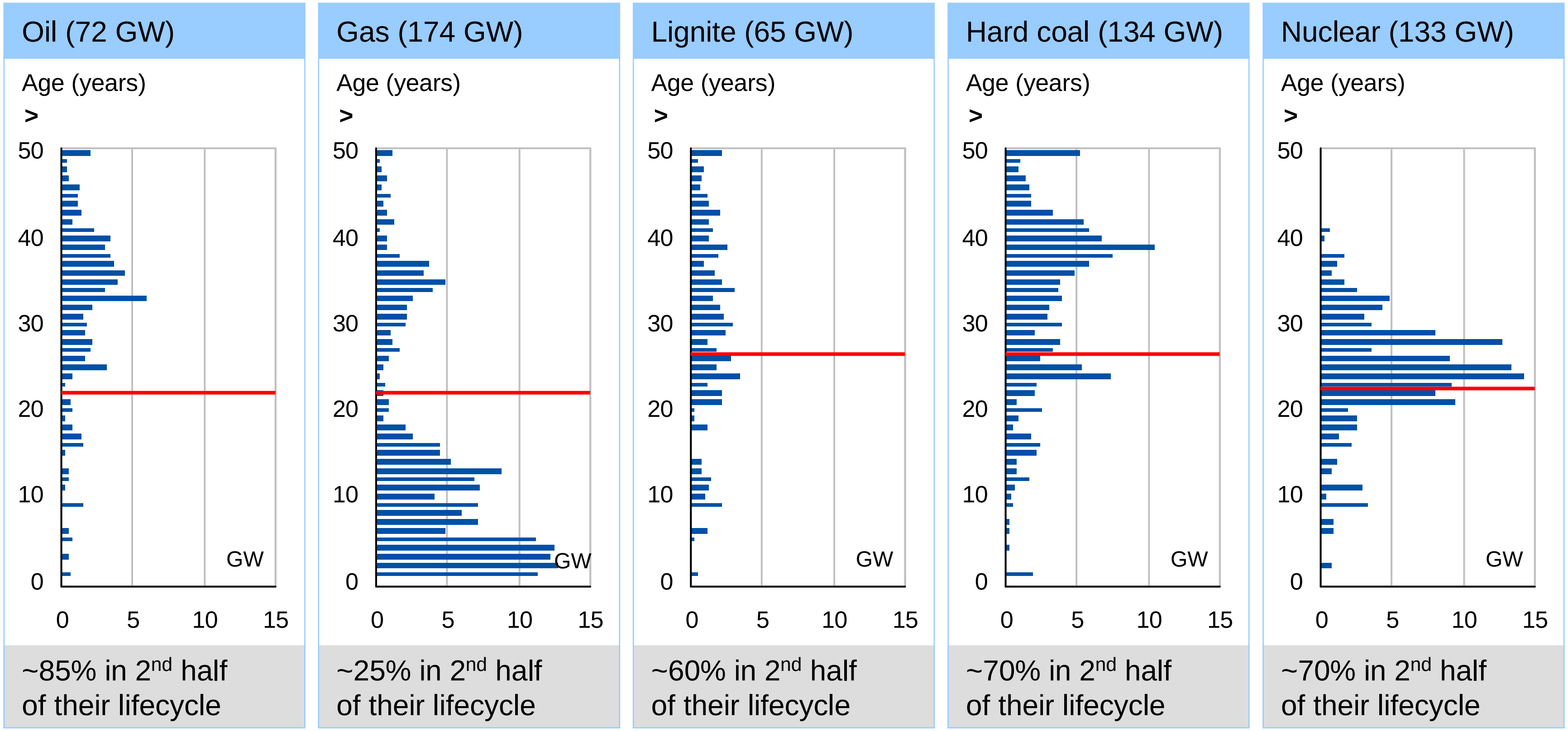


Sources: Platts Database, CERA, RWE.

[1] Assumptions: net capacity is 93% of gross capacity for conventional power plants; recognition of plants > 10 MW for conventional power plants in Eastern Europe, of plants > 20 MW for the rest of Europe.

Overview of generation mix in Europe: Ageing power plants – a key challenge

Age structure of power plants in Europe in 2008 in GW[1]



Oil (72 GW)	Gas (174 GW)	Lignite (65 GW)	Hard coal (134 GW)	Nuclear (133 GW)
~85% in 2nd half of their lifecycle	~25% in 2nd half of their lifecycle	~60% in 2nd half of their lifecycle	~70% in 2nd half of their lifecycle	~70% in 2nd half of their lifecycle

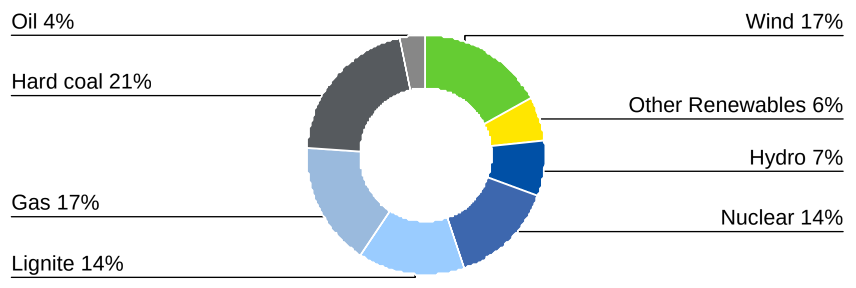
━ Half lifetime (typically)

Sources: Platts Database, RWE.

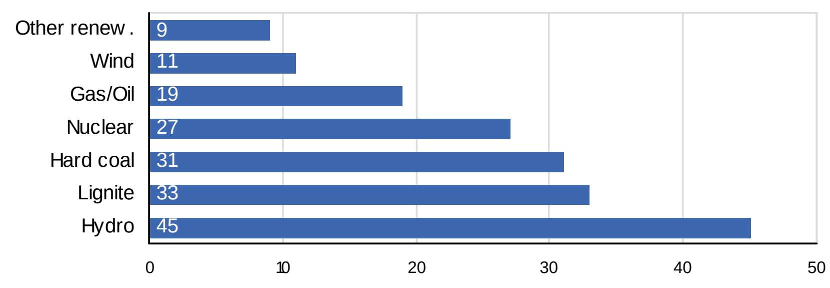
1 Adjusted net generation capacity.

Generation mix in Germany

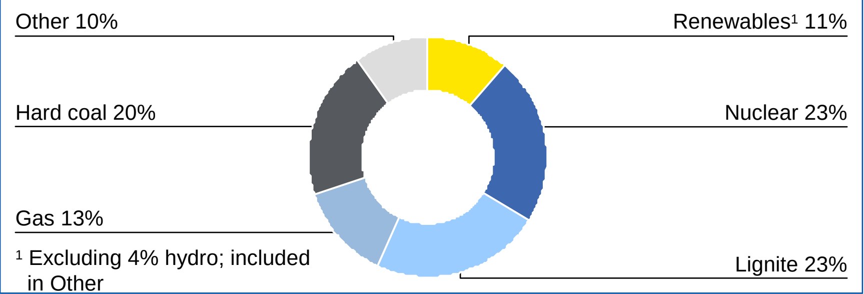
Net capacity: 140 GW (2008)



Average age by fuel (2008) [in years]

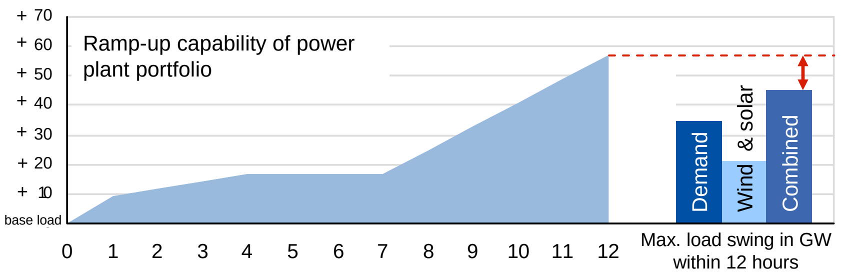


Gross generation: 639 TWh (2008)



[1] Excluding 4% hydro; included in Other

Flexibility in GW per hour (2008)

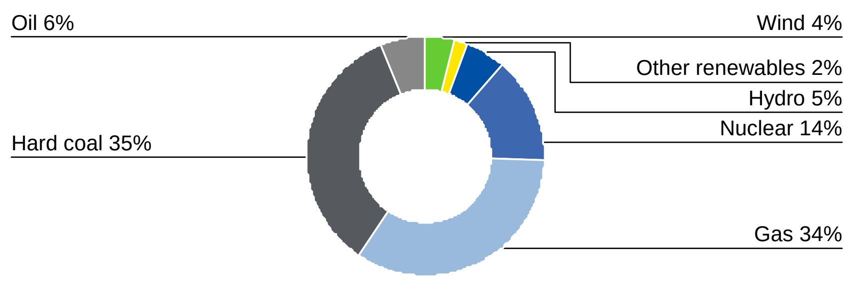


- 66% of German generation is based on nuclear and coal (hard coal and lignite)
- The change in demand and limited wind and solar feed-in are already putting existing flexible capacity under pressure. The remaining margin (red arrow) assumes that all flexible capacity is available

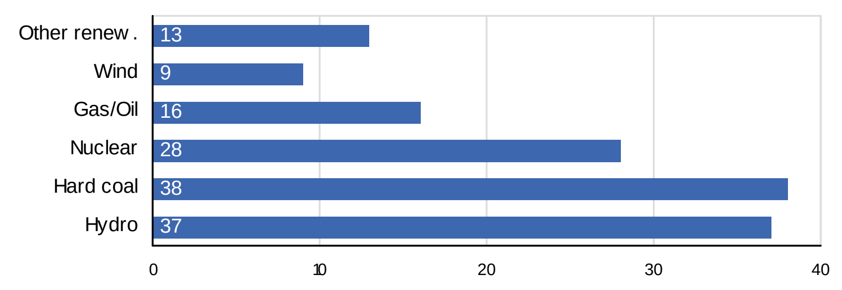
Sources: Platts Database, BDEW, RWE.

Generation mix in UK

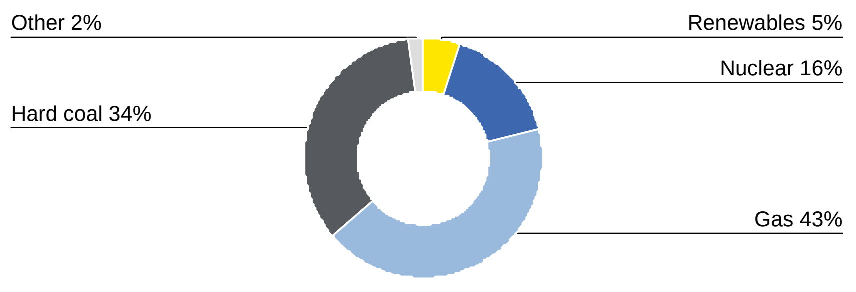
Net capacity: 82 GW (2008)



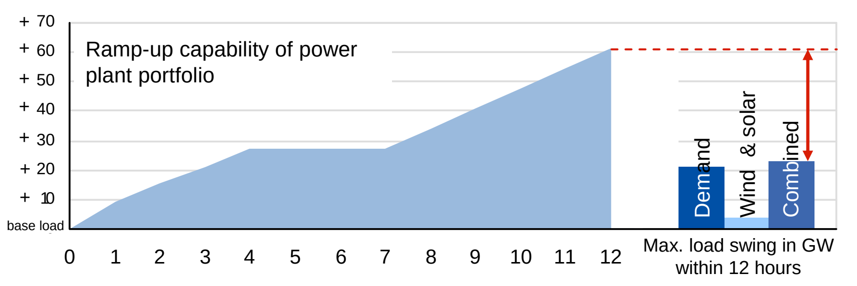
Average age by fuel (2008) [in years]



Gross generation: 388 TWh (2008)



Flexibility in GW per hour (2008)

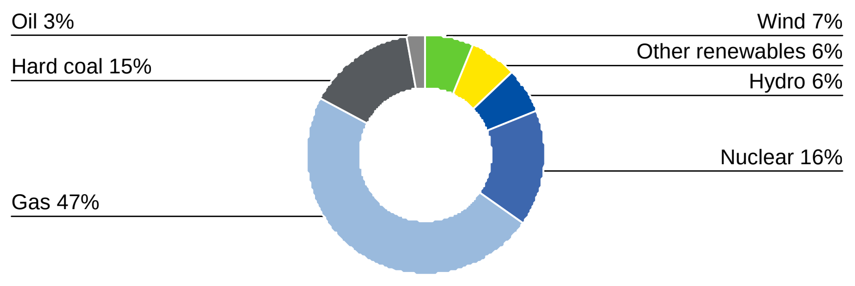


- \> Gas, hard coal and nuclear are the main elements of generation in the UK
- \> Gas is the main price setting plant (due to gas price seasonality)
- \> Renewables share is low, but is set to grow significantly

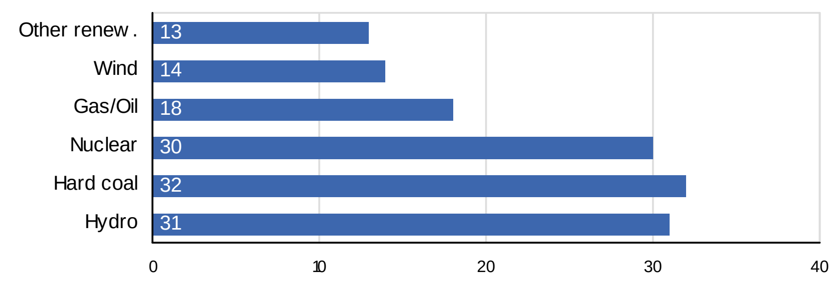
Sources: Platts Database, UCTE, RWE.

Generation mix in the Benelux

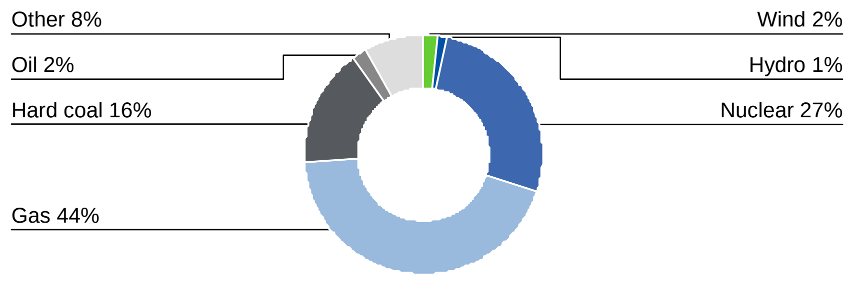
Net capacity: 39 GW (2008)



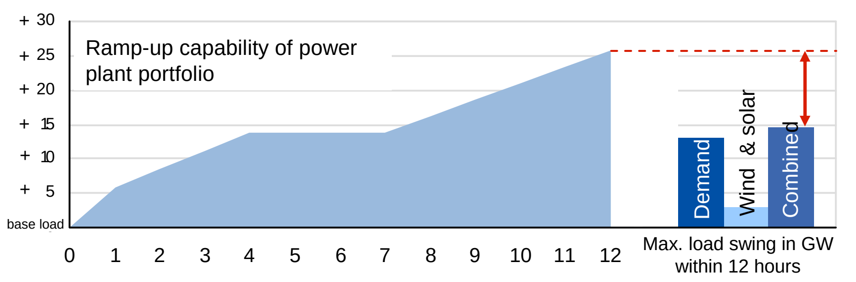
Average age by fuel (2008) [in years]



Gross generation: 196 TWh (2007[1])



Flexibility in GW per hour (2008)



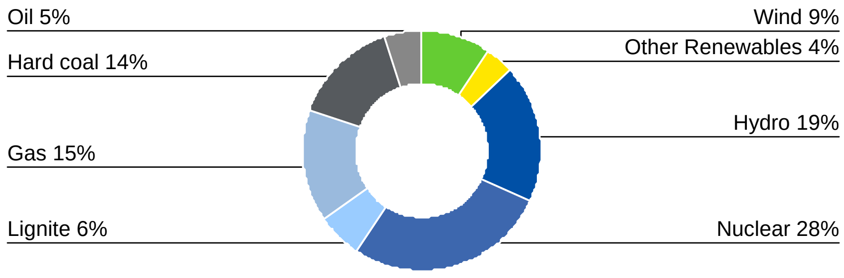
- Benelux capacity is largely based on gas
- Due to the large share of rather flexible capacity, the Benelux will likely become a swing market for north-western Europe

Sources: Platts Database, Eurostat, RWE.

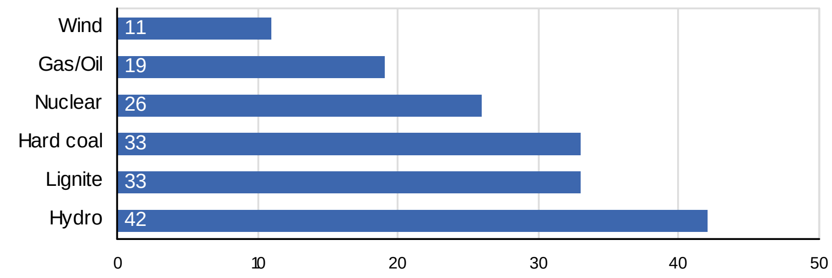
1 No 2008 Eurostat data available.

Generation mix in the North-Western Block[1]

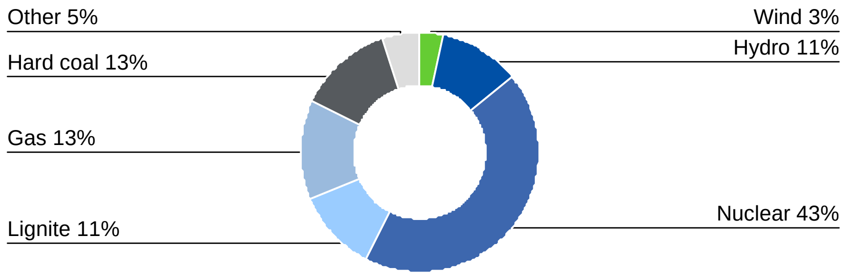
Net capacity: 330 GW (2008)



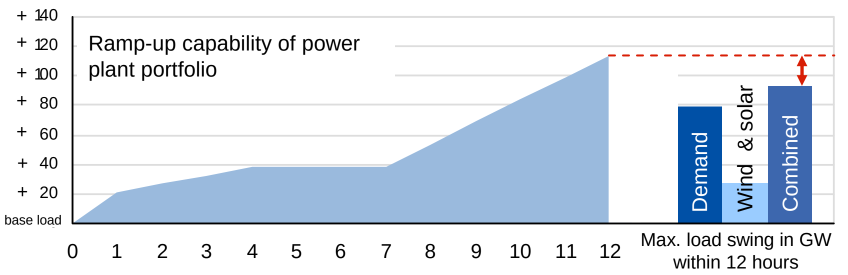
Average age by fuel (2008) [in years]



Gross generation: 1,534 TWh (2007[2])



Flexibility in GW per hour (2008)



- 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.

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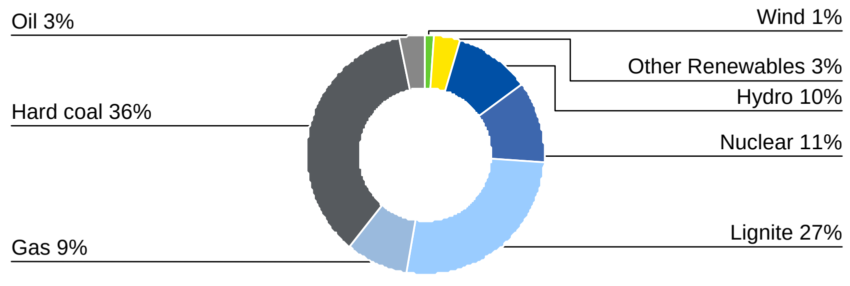
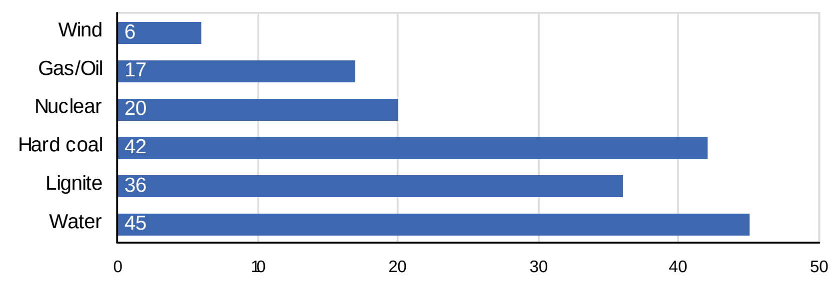
1 North-western block: Austria, Belgium, France, Germany, Luxembourg, Netherlands, Switzerland.
2 No 2008 Eurostat data available.

Generation mix in the North-Eastern Block[1] (CEE)

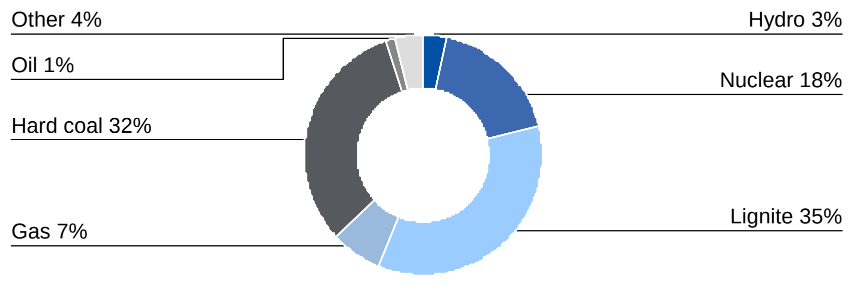
Net capacity: 66 GW (2008)



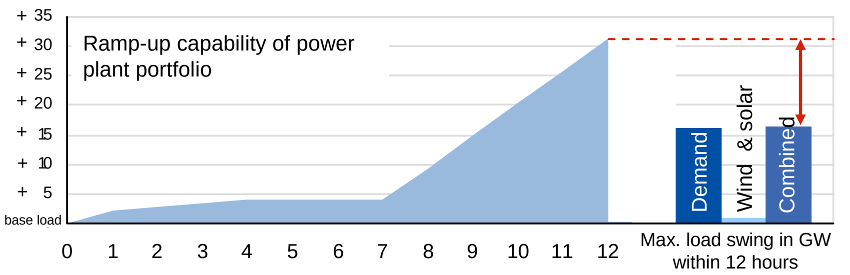
Average age by fuel (2008) [in years]



Gross generation: 316 TWh (2007[2])



Flexibility in GW per hour (2008)



- Lignite and hard coal account for nearly two thirds of capacity
- This region has the oldest hard coal and lignite generation base; it therefore has a strong replacement need. The high portion of flexible capacity, which needs more than 7 hours to come online, underpins this

Sources: Platts Database, Eurostat, RWE.

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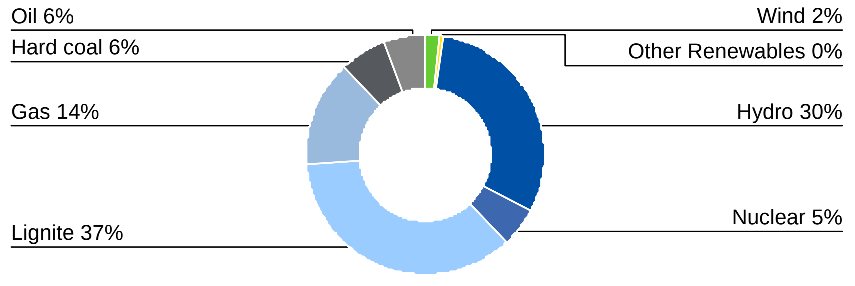
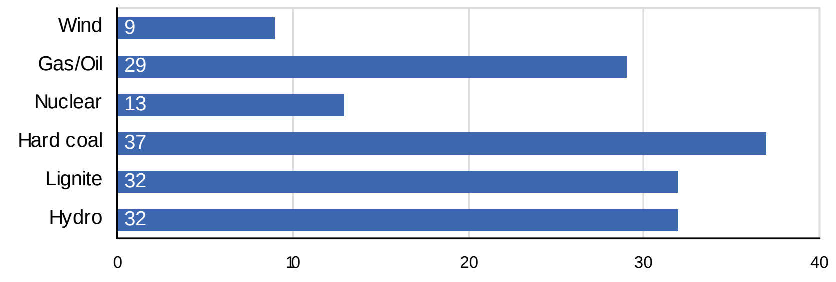
1 North-eastern block: Czech Republic, Hungary, Poland, Slovakia.
2 No 2008 Eurostat data available.

Generation mix in the South-Eastern Block[1] (SEE)

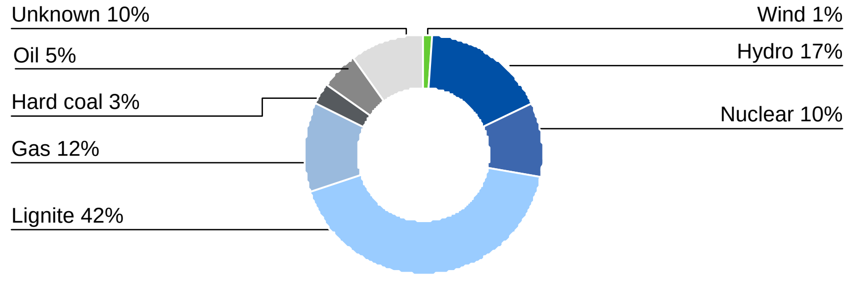
Net capacity: 60 GW (2008)



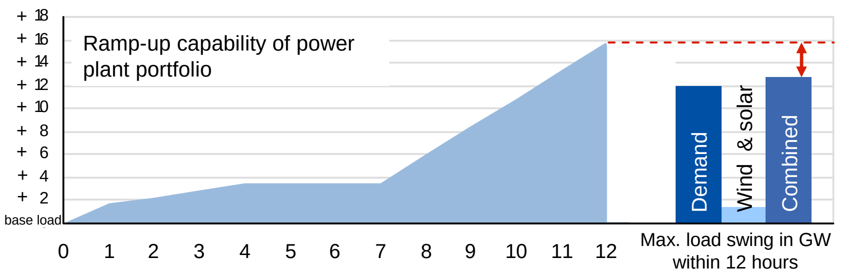
Average age by fuel (2008) [in years]



Gross generation: 230 TWh (2008[2])



Flexibility in GW per hour (2008)



- > Capacity strongly based on lignite, which accounts for 37%
- > Hard coal, lignite, and gas/oil power plants (nearly two thirds of total capacity) urgently need replacement due to their above-average age. The lack of rapidly available flexibility is another indicator of this

Sources: Platts Database, Eurostat, UCTE, RWE.

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1 South-eastern block: Bosnia-Herzegovina, Bulgaria, Greece, Macedonia, Montenegro, Romania, Serbia.
2 No 2008 Eurostat data available. In addition 2008 UCTE net generation data used.

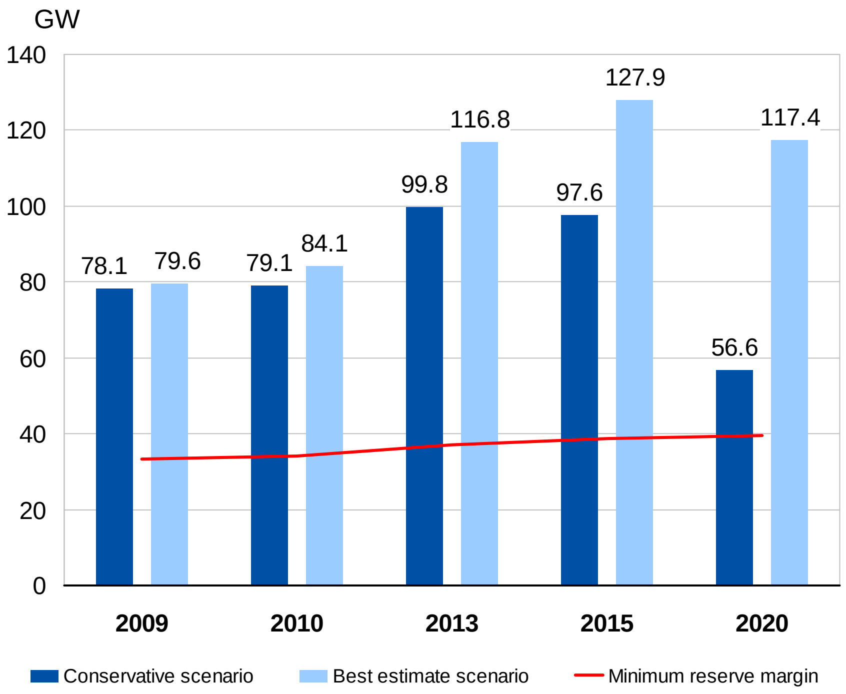
Studies on Generation Capacity

The following chapter provides an overview of major studies on generation in Europe

The UCTE[1] System Adequacy Report for Europe (2009)

Why UCTE expects the European reserve margin to remain adequate …

Reserve capacity and margin[2]



… based on the following assumptions

- Generation adequacy of the UCTE system should not be at risk up to 2020. This is because most of the investments confirmed in December 2008 should be operational by 2015
- This assumption is largely based on the number of investments announced during the second half of 2008, notably gas, hard coal and wind power
- About 20 GW per year of various generating capacity would have to be commissioned before 2020 to maintain the level of adequacy at an appropriate level
- UCTE expects consumption to grow on average by 1.6% p.a. until 2015

[1] UCTE, since July 2009 included in the European Network of Transmission System Operators for Electricity (ENTSO-E).

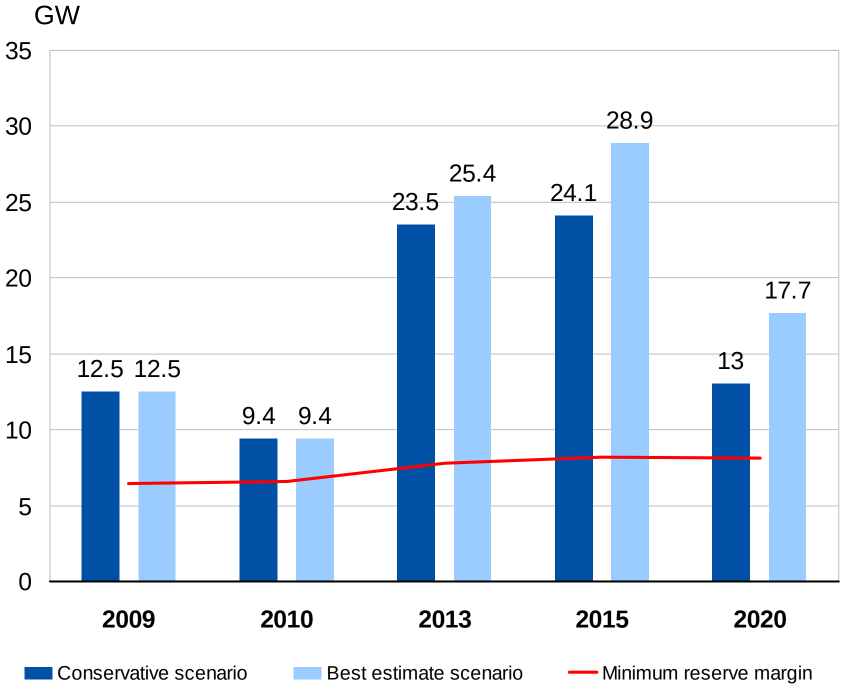
[2] Incl. nuclear phase-out in Germany and for one block in Belgium.

Source: UCTE, January 2009. Basis: 3rd Wednesday, January, 11:00 a.m.

The UCTE[1] System Adequacy Report for Germany (2009)

Why UCTE expects the German reserve margin to remain adequate …

Reserve capacity and margin



… based on the following assumptions

- UCTE assumes a nuclear phase-out
- Analysis based on power plant projects already announced: net addition of 20–22 GW in fossil fuel-fired capacity by 2013
- Estimates addition of 20 GW in wind capacity by 2020
- Remaining capacity is likely to decrease from 2015
- But: there are a lot of uncertainties e.g. public acceptance of wind power capacity development, nuclear phase-out in Germany, progress in the carbon capture and storage technology

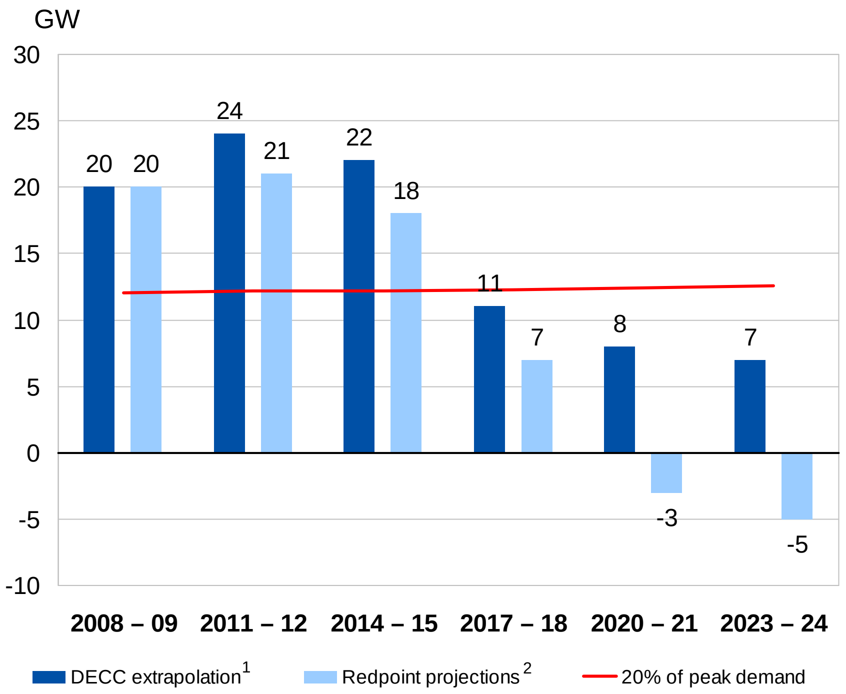
[1] UCTE, since July 2009 included in the European Network of Transmission System Operators for Electricity (ENTSO-E).

Source: UCTE, January 2009. Basis: 3rd Wednesday, January, 11:00 a.m.

DECC/NGC and Redpoint: System adequacy until 2015 in the UK

UK government expects margins will remain adequate in UK until 2015 but then deteriorate

Gross capacity margin without new builds



… based on the following assumptions

- Demand growth of approx. 0.75% per year from 2008/2009 to 2020
- Closure of
  - 11 GW opted out coal and oil stations between 2012–2016
  - around 6 GW of existing nuclear plants
  - possibly additional 10–14 GW of existing fossil stations by 2020 as a result of the current draft of the Industrial Emissions Directive (Redpoint)
- Only new builds actually under construction are included in these calculations
- 20% is considered as adequate gross margin

[1] Department of Energy and Climate Change (DECC) based on National Grid Company (NGC) Seven Year Statement. September 2009 Call for Evidence p.31.

[2] Redpoint report for DBERR, June 2008: Implementation of EU 2020 Renewable Target in the UK. Figure 27. Average of two plant retirement scenarios.

The trend:research study on Germany

In the medium term the threat of a capacity gap will be aggravated …

- Political decisions about the nuclear lifetime extension will be crucial for the demand of power plant capacity
- Assuming the phase-out of nuclear power is maintained, electricity consumption can only be covered with additional investments in renewables and coal and gas-fired power plants
- But: new-build projects have faced a lot of opposition
- The politically supported expansion of renewables has been hit especially by the financial crisis
- Every second component supplier is having to contend with postponed or cancelled projects

… based on the following assumptions

- Period from 2008 to 2030 examined
- 60% of coal and gas power plant projects in Germany are in doubt or will be cancelled completely
- In the past, utilities faced a lot of local opposition and considerably higher construction and raw materials costs
- In 2008, the cost for one kilowatt of capacity of a hard coal plant was at a record level of €1,700
- The financial and economic crisis has put an additional burden on the financing of projects, especially for smaller utilities

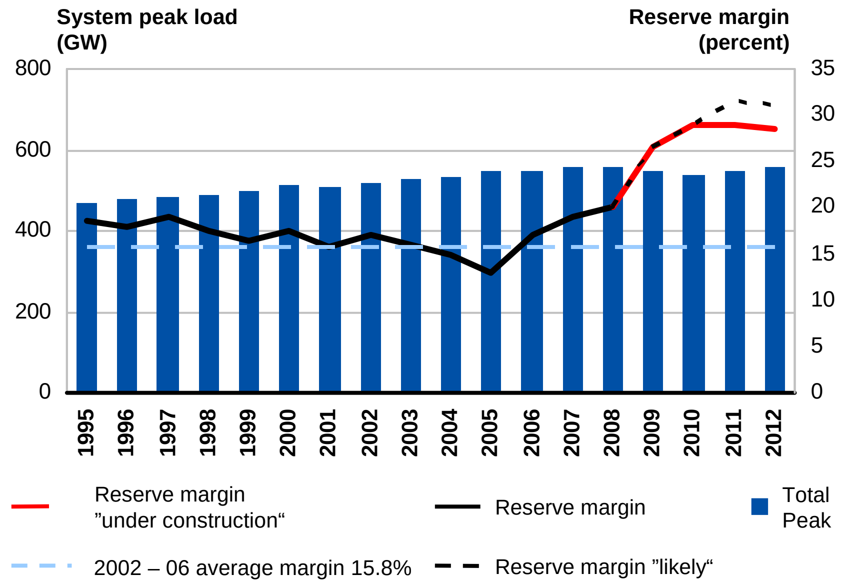
› Study confirms capacity gap, but if nuclear power plants get permission to extend lifetimes by up to 50 years, trend:research expects an electricity surplus between 2020 and 2030

Source: Handelsblatt, trend:research, June 2009 and October 2009.

The CERA study on Europe

CERA expects looming overcapacities in Europe …

CERA EU 21+2 reserve margin and system peak demand



… based on the following assumptions

- Power plants under construction continue to come online and therefore overcapacity will emerge in most Western European countries
- 23 GW will come online in 2009 (of which 17 GW are already under construction, excl. wind power)
- 25 GW will come online in 2010 (of which 18 GW are under construction, excl. wind)
- Most new builds will be gas-fired plants, which account for 61% of total capacity under construction; coal plants represent 23%
- In Central Eastern European countries reserve margins will hover around the current level

Overall, a rise in the European reserve margin to above 25% is expected from 2009 to 2012

Source: CERA: “Economic turmoil puts utilities under pressure”, June 2009.

The dena study on Germany (2009)

dena expects a capacity gap in 2020 …

- Scenario A: a gap of 10.6 GW, 1 GW below the figure published in January 2009, assuming a decreasing electricity consumption
- Scenario B: a gap of 14.2 GW, assuming a flat electricity consumption
- In both scenarios, there will be a need to build new highly efficient coal and gas-fired power plants to secure supply
- New builds are supposed to run as mid and peak-load power plants
- Current new builds (fossil-fuelled and renewables) are not sufficient to close the gap. Therefore old, inefficient power plants with higher CO_2 emissions and higher marginal costs will stay in operation.

… based on the following assumptions

- The study considered a nuclear phase-out
- The capacity gap was confirmed, but to a slightly lower extent. The reasons for this were mainly:
  - dena took into account the remaining capacity of some nuclear power plants (due to outages). Therefore the last nuclear power plant will go offline in 2023 instead of 2020
  - the first time inclusion of the volume transfer from Mülheim-Kärlich
- dena expects to see more cancellations of new builds, therefore the basis for the study is only preliminary

› dena confirms the capacity/efficiency gap resulting in extended lifetime of old power plants with high CO_2 emissions and consequently in higher electricity prices

Source: Handelsblatt, October 2009.

Our view (I): most of the studies are based on optimistic and sometimes unrealistic assumptions

Studies do not take into account the impact of the financial and economic crisis which does not only affect demand but also new-build capacity (page 42 et seqq.)

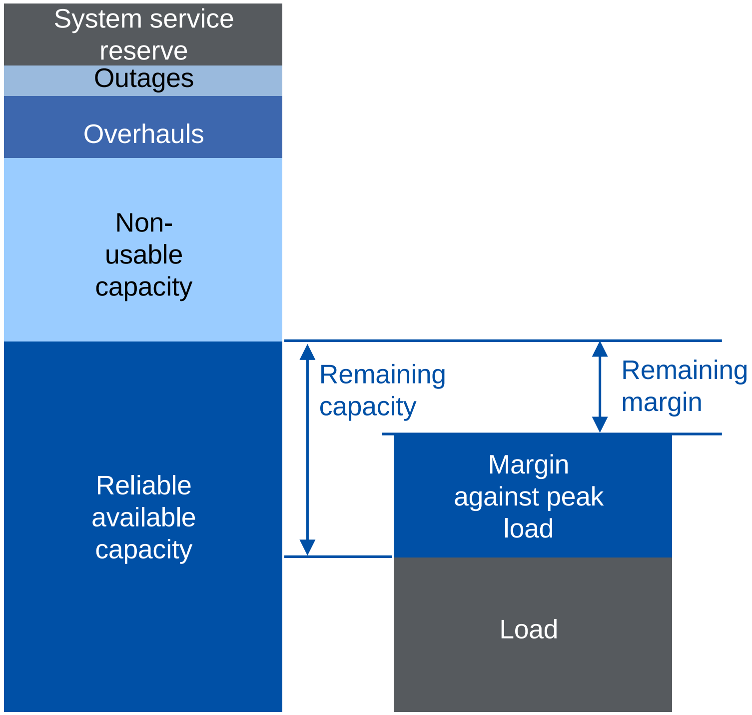
Studies use mainly data from grid operators for announced new-build projects which usually overestimate what actually comes online. This is because grid connection capacity is one of the first applications to be secured in power plant projects. If these projects fail, they are often not corrected in the statistics

A share of renewables capacity which is far too high (> 20%) is often treated as firm (which is rather 5% for onshore and 10% for offshore) by some of the studies

Studies use typical load situations and ignore extreme scenarios, e.g. low wind generation and high demand on very hot or very cold days at the same time (page 58 et seqq.)

Our view (II): most of the studies do not make a good prediction of future spread developments

Generation adequacy analysis (UCTE)



Our view

- > Analyses only consider technical availability and adequacy of the generation system
- > Cost structure of existing power plants does not form part of the study and is not reflected in its outcome
- > Do not allow dynamic review of changing commodity prices and regulatory environment (e.g. change of CO_2 allocation, realization of offshore wind farms) and their impact on the generation portfolio
- > Merit order analysis is a better tool for looking at the dynamics of generation markets

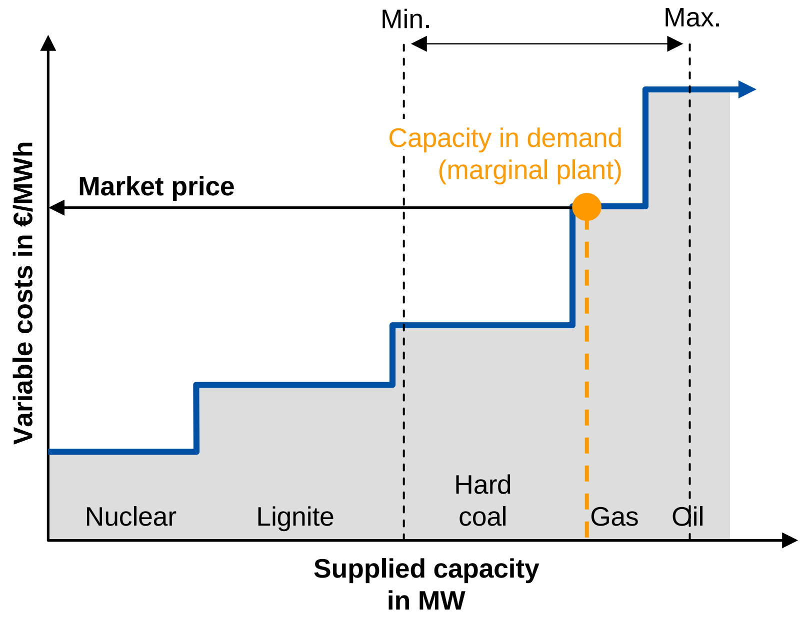
Understanding the Merit Order

The following chapter explains how to read and interpret the structure and dynamics of a merit order in power generation

The energy to lead

The merit order and aspects influencing its structure provide a better tool for looking at the dynamics of power plant portfolios

The German merit order – the marginal power plant principle

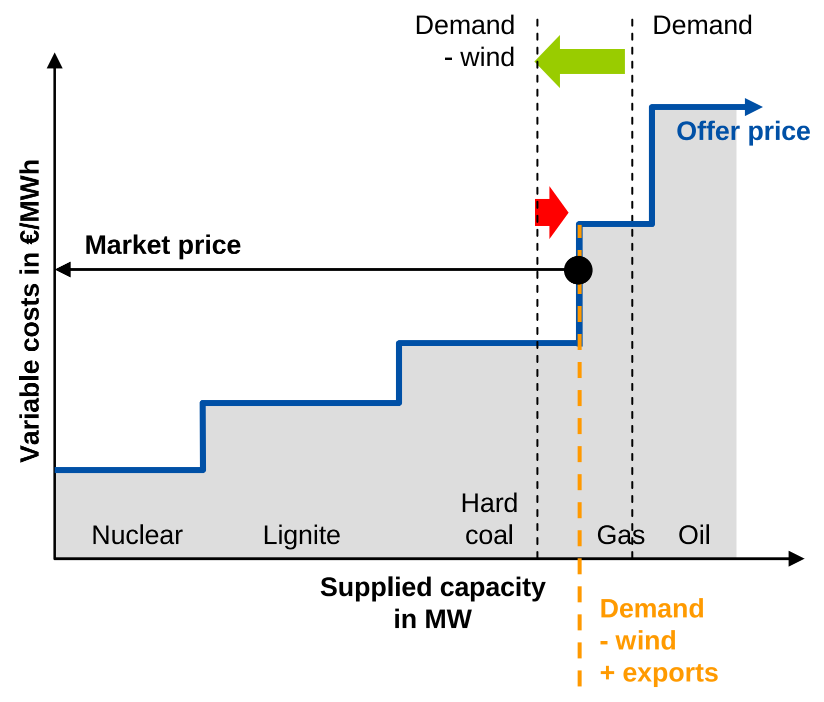


- Due to low price elasticity of demand, prices in electricity markets are driven by the merit order structure
- The operation of power plants follows the sequence of short-run marginal costs: the merit order
- Margins depend primarily on the cost efficiency of the available supply, not on adequacy (marginal plant mechanism)

Due to the significant time requirement for planning, permitting and constructing new generation capacity, as long as there are no systematic shifts in commodity price relations (e.g. hard coal vs. gas), merit order forecasts are valid for several years

Wind generation works more or less like negative demand

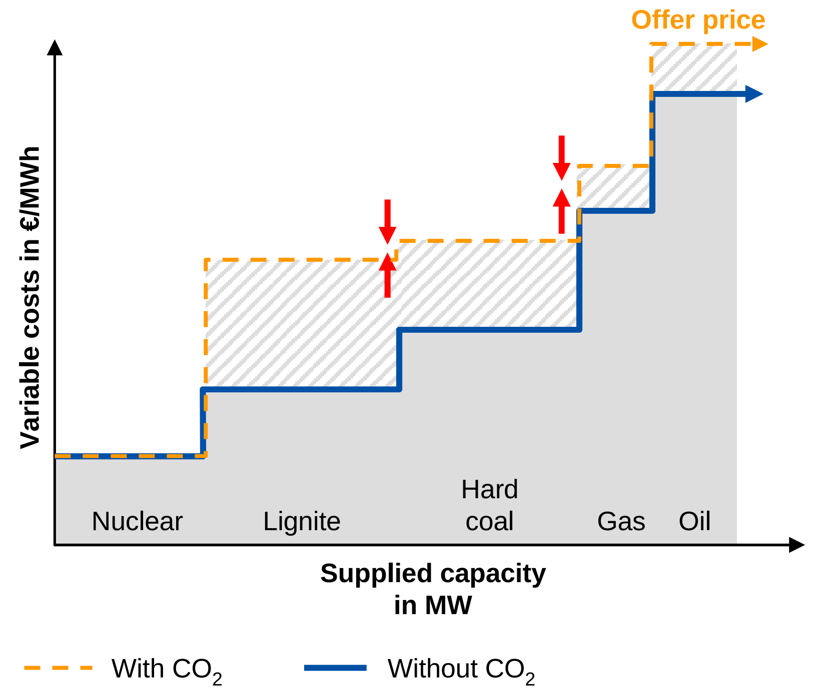
Change in German merit order due to wind generation



- Being treated as “negative demand”, must-run capacity (e.g. power generation from wind) changes the demand which has to be covered by conventional power plants
- This means, although must-run changes the resulting market price indirectly, it does not change the structure of the merit order
- In times of high must-run feed-in and low domestic demand the overall effect is partially compensated by exports

The CO_2 cap-and-trade system has reduced the gap in the merit order between upper base load and lower peak load electricity

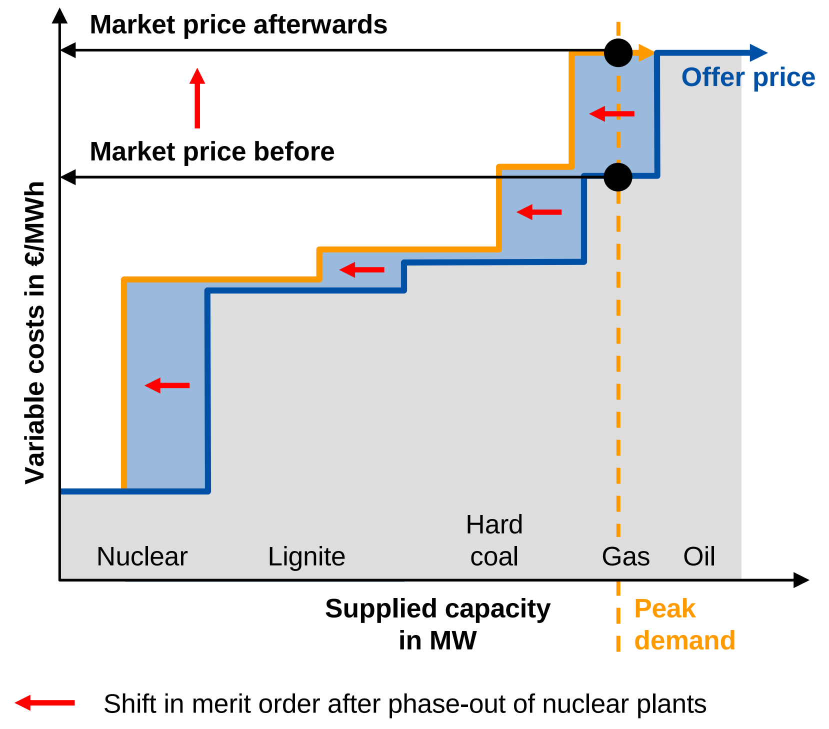
Change in German merit order due to CO_2



- > Marginal costs for old lignite-fired power stations increased more than marginal costs for efficient hard coal plants
- > Marginal costs for old hard coal-fired power stations rose more compared to those of efficient gas-fired power stations
- > As this is a dynamic system with changing fuel price relations (e.g. gas vs. hard coal), it is difficult nevertheless to predict at which CO_2 price level a switch between the fuel types in the merit order would happen

Phasing out nuclear power stations would cause capacity used to cover peak load demand to shift significantly

Shift in merit order after phaseout of nuclear plants

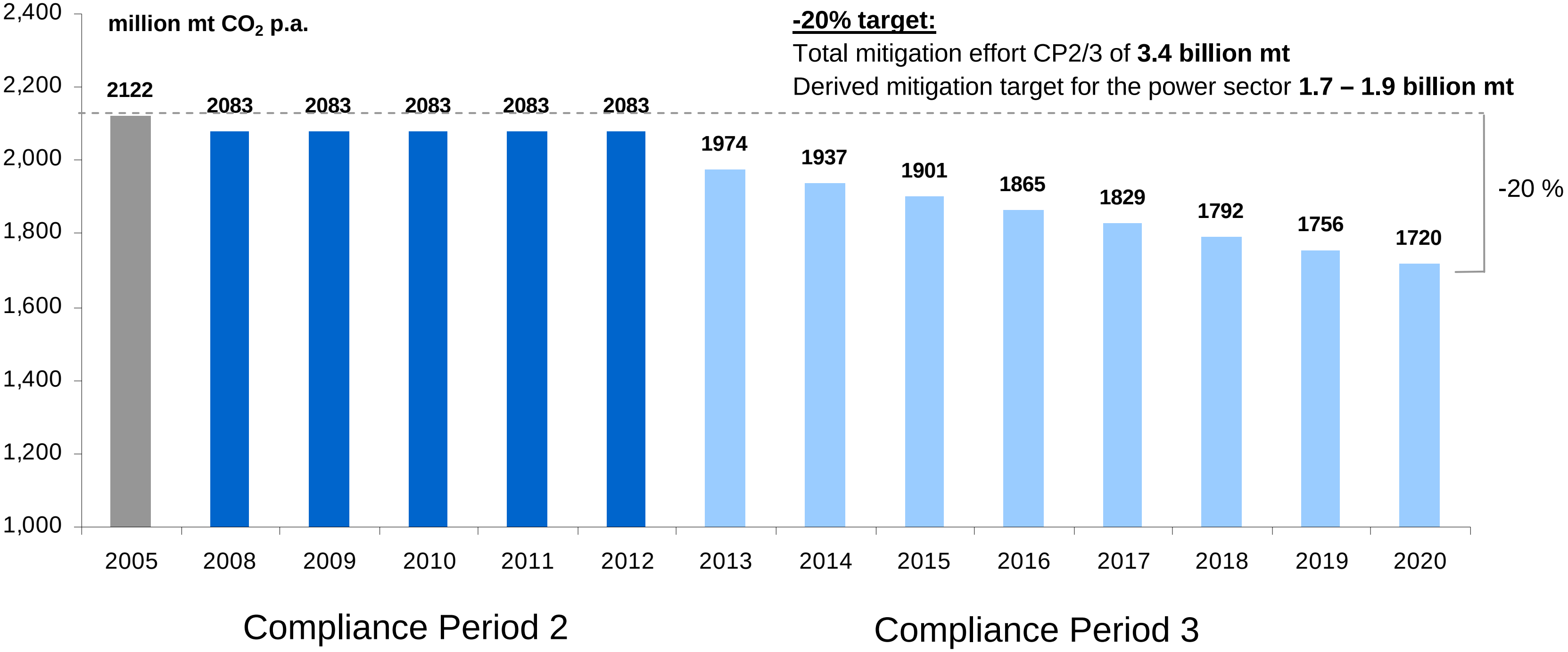


- Power plants with higher marginal costs (like gas turbines and oil peakers) will be needed more frequently and sooner than if nuclear power plants were not phased out
- This would structurally lead to price increases
- In addition, phasing out nuclear power plants would also increase demand and therefore prices for CO_2 certificates which might further push up power prices

Impact on Capacity

The following chapter presents various drivers which will influence the size and the necessary type of installed generation capacity in Europe and sheds some light on the development of the demand side

CO_2 reduction targets will remain an important driver for changes in European power generation



-20% target:
Total mitigation effort CP2/3 of **3.4 billion mt**
Derived mitigation target for the power sector **1.7 – 1.9 billion mt**

Source: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1869&format=HTML&aged=0&language=EN&guiLanguage=en#fn2.

EU membership forces closure of more than 5 GW of nuclear capacity in CEE countries

Bulgaria

Kozloduy
Units 1 and 2 (440 MW each)
as of December 31, 2002[1]
Units 3 and 4 (440 MW each)
as of December 31, 2006

Slovakia

Jaslovske Bohunice V1
Block 1 (440 MW) as of December 31, 2006
Block 2 (440 MW) as of December 31, 2008

Lithuania

Ignalina
Unit 1 (1,360 MW) as of December 31, 2004
Unit 2 (1,360 MW) as of December 31, 2009

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1 Shut down during negotiations between Bulgaria and the EU regarding Bulgaria's EU membership.

The EU Large Combustion Plant Directive (LCPD)

Since 2008, coal and oil-fired power stations have been governed by the Large Combustion Plant Directive (LCPD).This sets new limits on the amounts of sulphur dioxide (SO_2), nitrogen oxides (NO_x) and dust power stations can emit.

Step 1

- Power plants had to choose whether to comply with the LCPD or request a limited life derogation (opt out)
- Power stations which opted out are allowed to run for 20,000 hours, or until the end of 2015, whichever comes sooner

Step 2

Those power stations which comply with the LCPD are governed in one of two ways[1]:

- Emission Limit Value (ELV)
  The power station must adhere to specific limits to the amounts of pollutants produced on a "milligramme per cubic metre of waste gas" basis
- National Emission Reduction Plan (NERP)
  A company is given an overall allowance (amount of a pollutant that can be emitted per year) of emissions it may produce. The emission allowances issued under NERP are tradable within a member state

Step 3

- In addition to the above, existing oil and coal-fired power plants must reduce nitrogen oxide emissions from 500 mg/Nm^3 to 200 mg/Nm^3 by January 1, 2016. This will entail fitting selective catalytic reduction (SCR) equipment

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[1] While most the EU member states, including Germany, chose to implement Emission Limit Values (ELV), a number have opted for National Emission Reduction Plans (NERPs), while in the UK individual power plants could choose between being regulated on the ELV, or under a NERP.

Due to the LCPD a shut-down of 11–12 GW by end of 2015 (or earlier) is expected in the UK

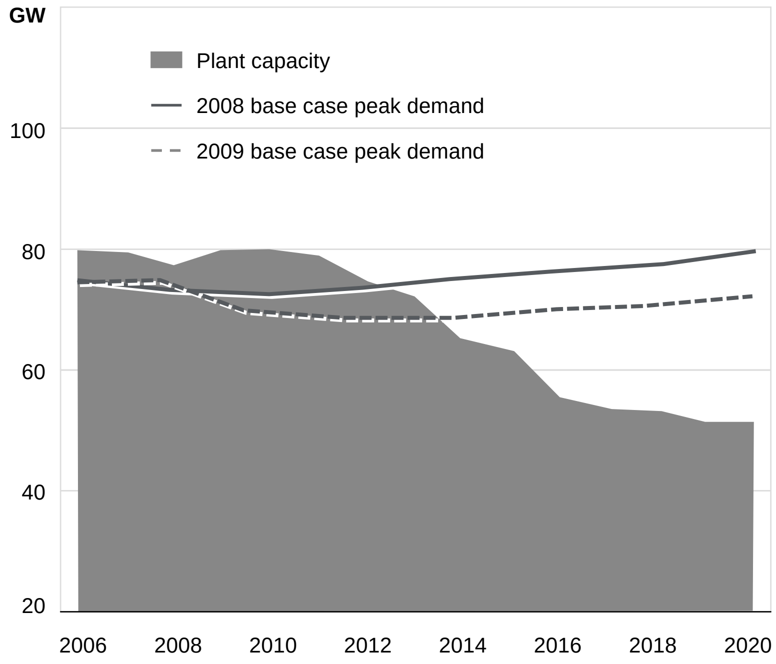
Installation	Operator	Fuel	Installed capacity (MWe)	Number of boilers	Number of plants	Capacity opted in[1] (MW)	Capacity opted out[2] (MW)	FGD[3] status
Kilroot	AES	Coal/Oil	520	2	1	520	0	Under construction
Eggborough	British Energy	Coal	2,000	4	1	2,000	0	2 units fitted
Drax	Drax Power	Coal	3,960	6	1	3,960	0	Fitted
Kingsnorth	E.ON UK	Coal	2,000	4	1	0	2,000	No FGD
Ratcliffe	E.ON UK	Coal	2,000	4	1	2,000	0	Fitted
Ironbridge	E.ON UK	Coal	1,000	2	1	0	1,000	No FGD
Grain	E.ON UK	Oil	1,300	2	1	0	1,300	No FGD
Cottam	EDF Energy	Coal	2,000	4	1	2,000	0	Fitted
West Burton	EDF Energy	Coal	2,000	4	2	2,000	0	Fitted
Rugeley	International Power	Coal	1,000	2	1	1,000	0	Fitted
Didcot A	RWE npower	Coal	2,000	4	1	0	2,000	No FGD
Aberthaw	RWE npower	Coal	1,500	3	1	1,500	0	Fitted
Littlebrook	RWE npower	Oil	1,370	3	1	0	1,370	No FGD
Fawley	RWE npower	Oil	1,000	2	1	0	1,000	No FGD
Tilbury	RWE npower	Coal	1,020	4	2	0	1,020	No FGD
Ferrybridge	Scottish & Southern Energy	Coal	2,000	4	2	1,000	1,000	Fitted
Fiddlers Ferry	Scottish & Southern Energy	Coal	2,000	4	1	2,000	0	Fitted
Peterhead	Scottish & Southern Energy	CCGT	1,320	2	1	1,320	0	N/A
Longannet	Scottish Power	Coal	2,304	4	1	2,304	0	Under construction
Cockenzie	Scottish Power	Coal	1,152	4	2	0	1,152	No FGD
Uskmouth	Uskmouth Power	Coal	393	3	1	393	0	Fitted
Total			**33,839**	**71**	**25**	**21,997**	**11,842**	

1 Compliant with emission limits in LCPD (Drax, Eggborough, Peterhead and Longannet in NERP).
2 Limitation of operating hours to 20,000 between Jan. 1, 2008 and Dec. 31, 2015. No requirement to fit FGD.
3 FGD: flue gas desulphurisation.

Source: company information.

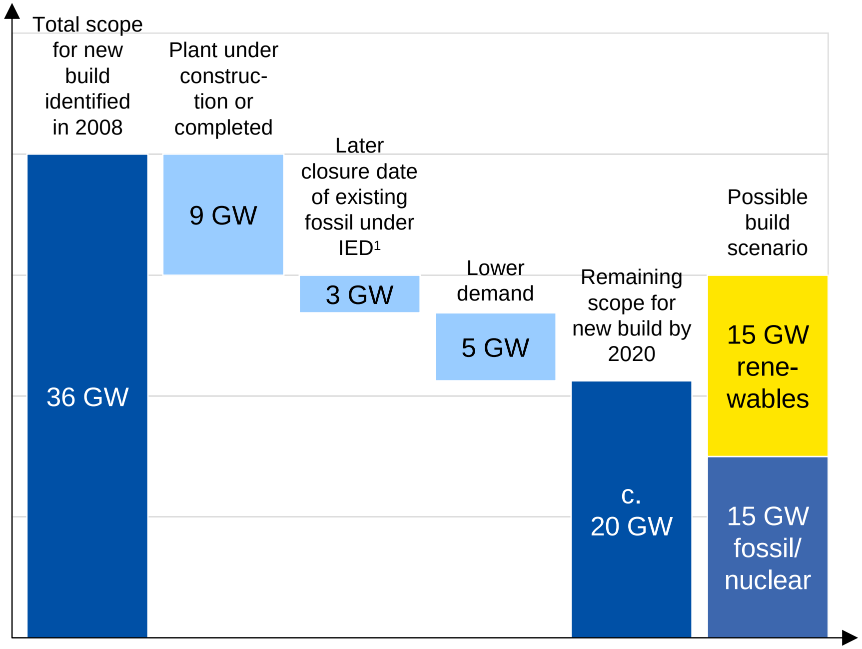
The result is: The UK requires 20–30 GW of further new plant by 2020

UK generation capacity development 2006–20



- > Investors must see attractive returns for new plant to be constructed

Lower estimate than 2008 but opportunity remains



- > Actual build depends on the contribution from renewables, which have a lower capacity credit

---

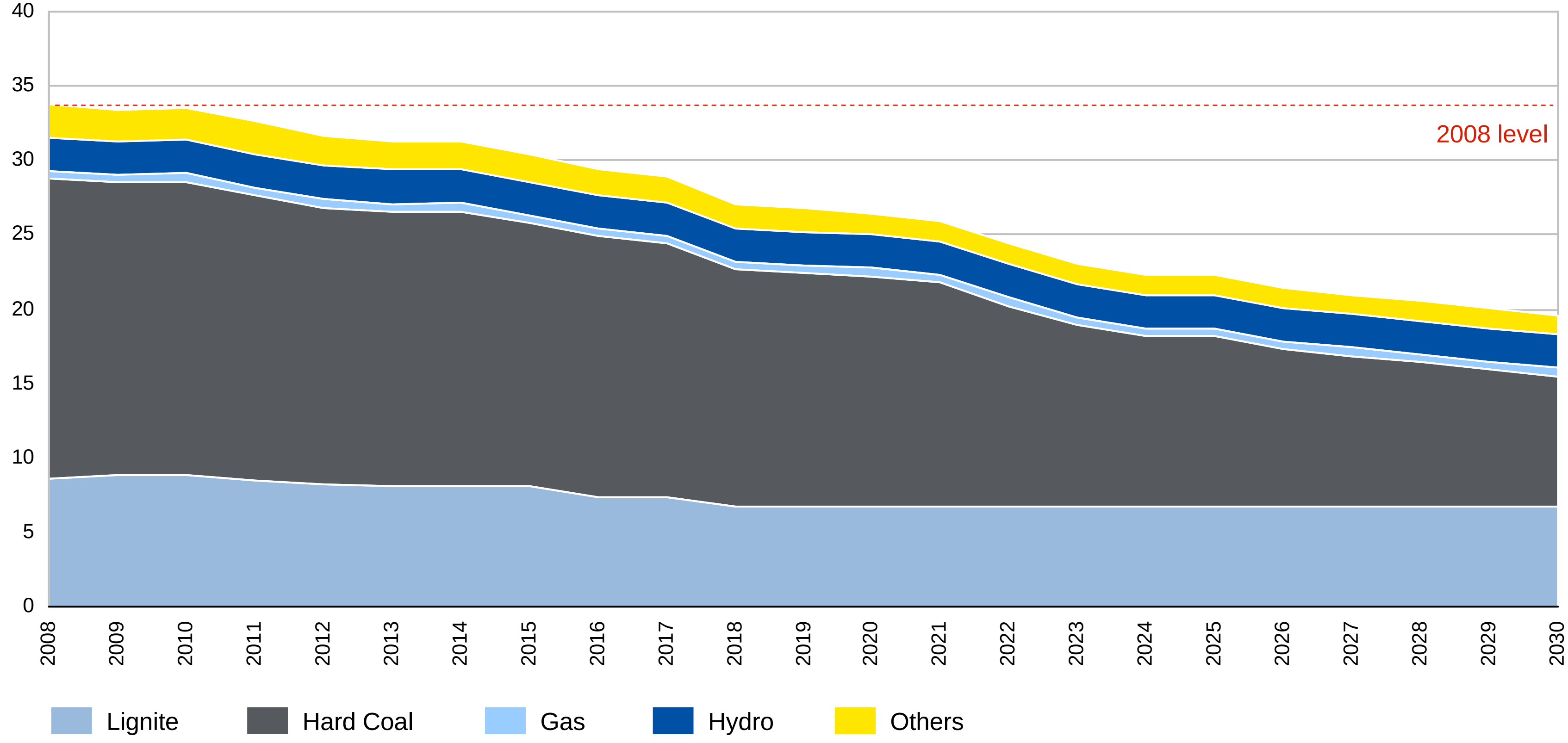
1 Industrial Emissions Directive.

Source: RWE npower analysis.

Source: RWE npower analysis

Poland: a sharp decrease in supply from 2015 onwards due to decommissioning resulting from the EU LCPD[1] is expected

Gross installed capacity (GW) for conventional plants and hydro (w/o renewables)



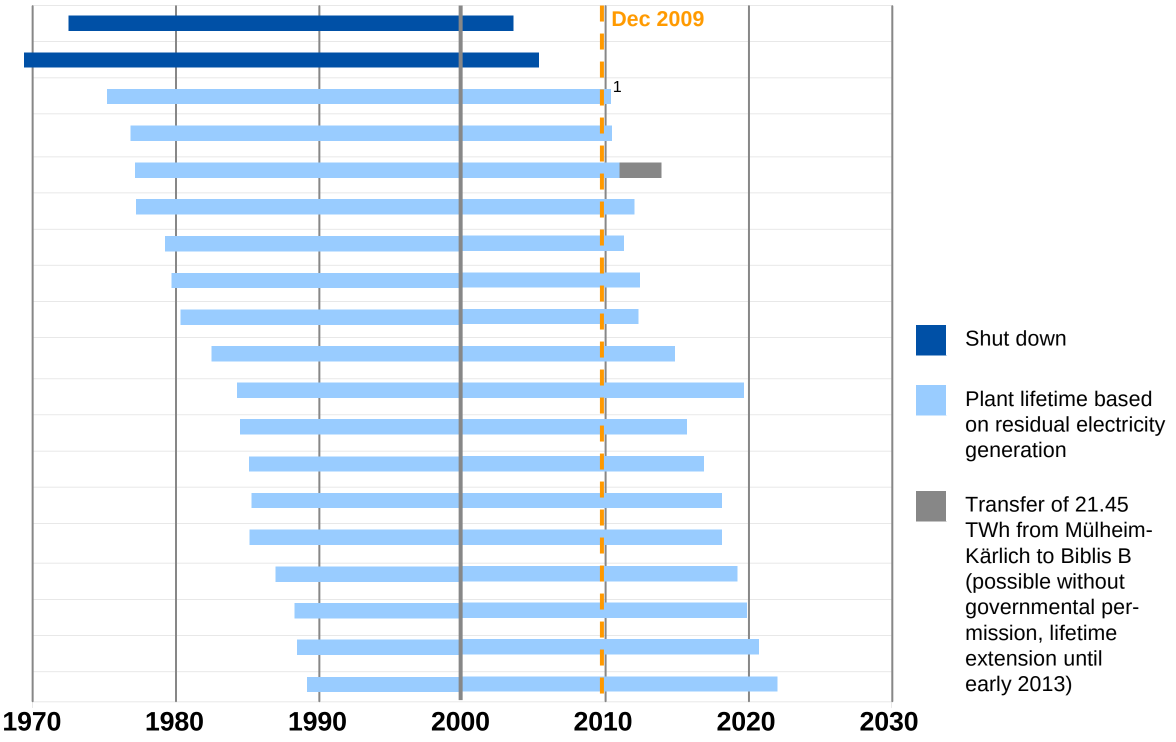
[1] Large Combustion Plant Directive; refers only to existing power plants, except new build in Belchatow (lignite, 885 MW gross).

Source: Ministry of the Economy, Poland, May 2008.

German law still in force: phaseout of nuclear power plants

TWh remaining by 2000 in accordance with Nuclear Energy Act

	Capacity per power plant MW	TWh
Stade	640	23
Obrigheim	340	14
Biblis A	1,167	62
Neckarwestheim 1	785	57
Biblis B	1,227	81
Brunsbüttel	771	48
Isar 1	878	78
Unterweser	1,345	118
Philippsburg 1	890	87
Grafenrheinfeld	1,275	150
Krümmel	1,346	158
Gundremmingen B	1,284	161
Gundremmingen C	1,288	168
Philippsburg 2	1,392	199
Grohnde	1,360	201
Brokdorf	1,410	218
Isar 2	1,400	231
Emsland	1,329	230
Neckarwestheim 2	1,305	236



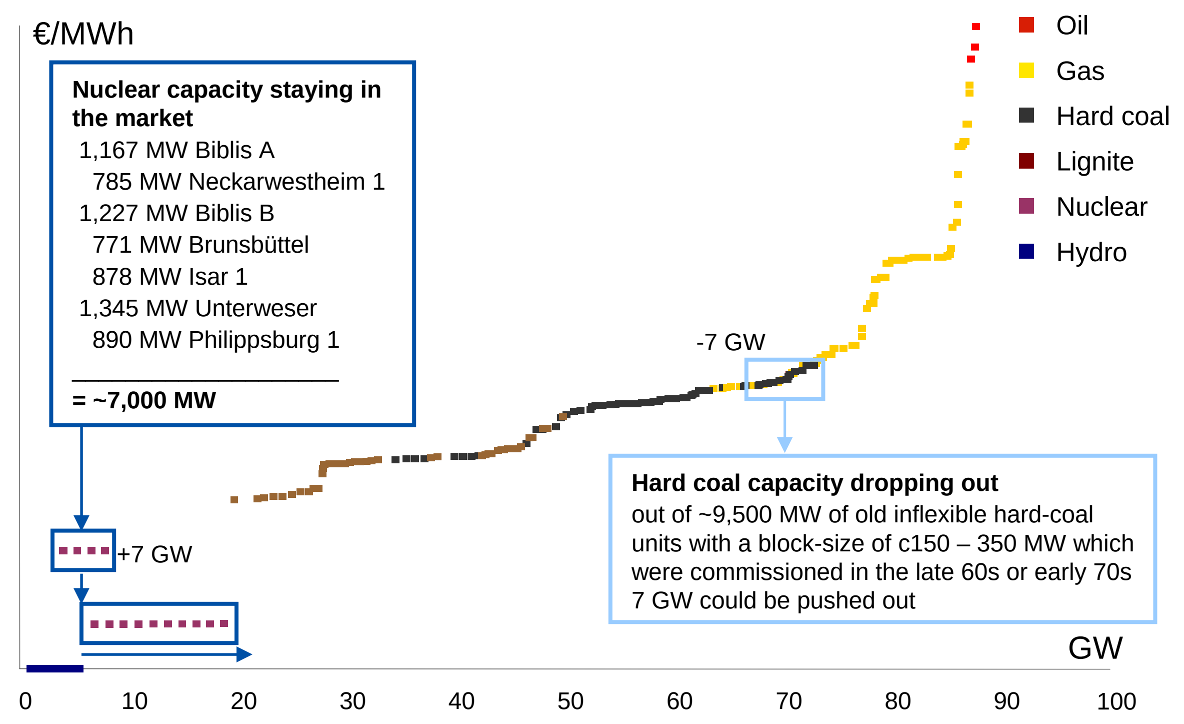
Replacement of more than 20,000 MW in nuclear power capacity required

Note: RWE has a total allotment of 107.25 TWh from Mülheim-Kärlich.

1 Expected remaining lifetime at least until 08/2010.

Nuclear lifetime extension can push some 7 GW of old hard coal plants out of the market within the next 5 years

Merit order of the German wholesale generation portfolio in 2014 **before** nuclear extension[1, 2]



Nuclear capacity staying in the market
1,167 MW Biblis A
785 MW Neckarwestheim 1
1,227 MW Biblis B
771 MW Brunsbüttel
878 MW Isar 1
1,345 MW Unterweser
890 MW Philippsburg 1

= ~7,000 MW

Hard coal capacity dropping out
out of ~9,500 MW of old inflexible hard-coal units with a block-size of c150 – 350 MW which were commissioned in the late 60s or early 70s 7 GW could be pushed out

- Due to nuclear lifetime extension 7 GW would stay in the market
- Plants fired with subsidized hard coal mined in Germany today will then not be redesigned to use imported coal, but decommissioned in the next years. This is due to their insufficient flexibility for peak load operation
- The peak segment of the merit order will almost be unaffected by a nuclear lifetime extension

Assumptions:

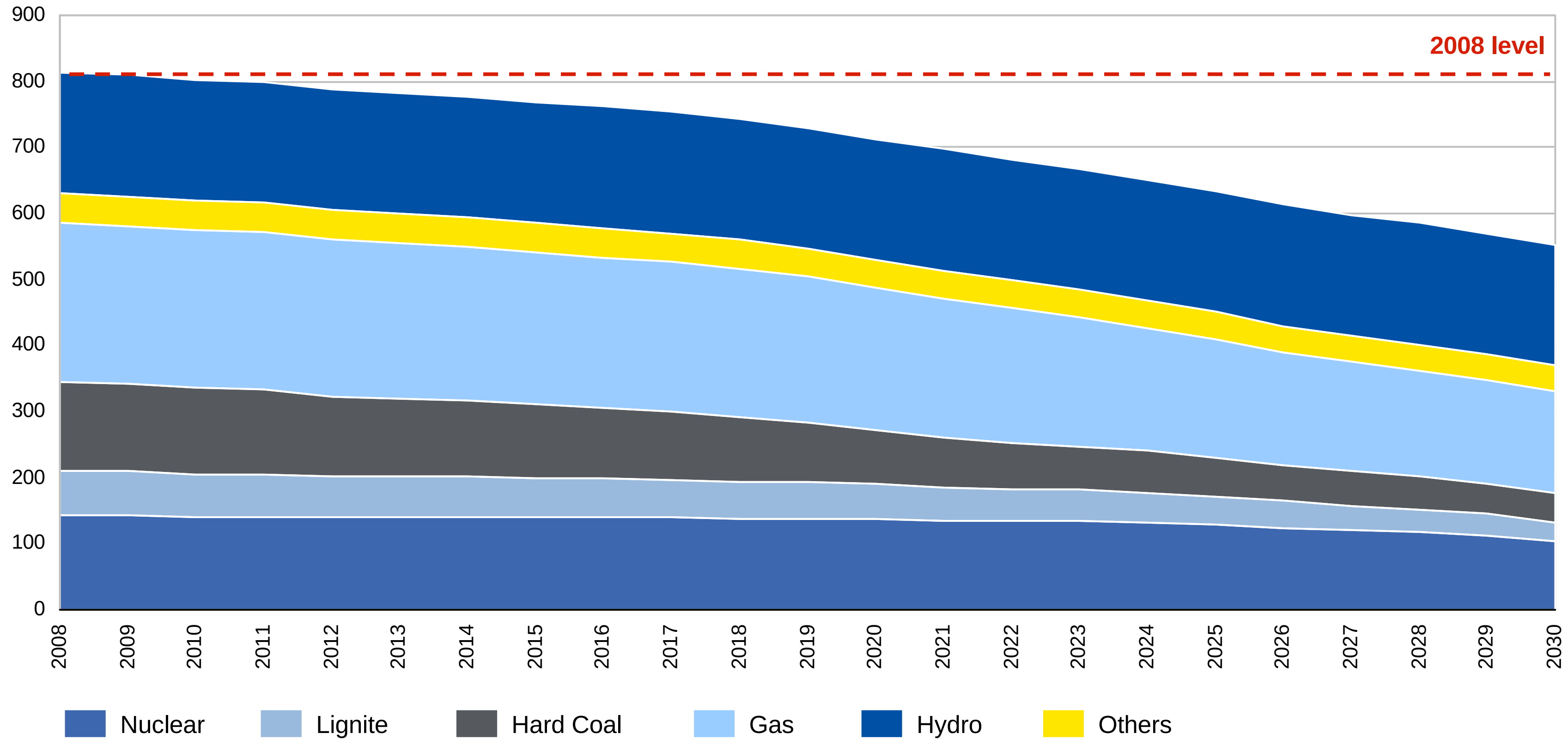
1 New build projects currently under construction and announced decommissioning taken into account; renewables with feed-in tariffs not on the supply-side of the wholesale market. Renewables and cogeneration reduce residual demand, which is partly compensated by increasing demand for exports in Germany.

2 Commodity prices: 10 €/MWh th hard coal, 28 €/MWh th gas, 30 €/t CO_2.

Source: RWE merit order model.

Conclusion: How much conventional capacity will be shut down by when in Europe?

Gross installed capacity (GW) for conventional plants and hydro (w/o renewables)



Source: Platts Database/ RWE, Lifetime assumptions: hydro ~150 years, conventional plants ~50 years.

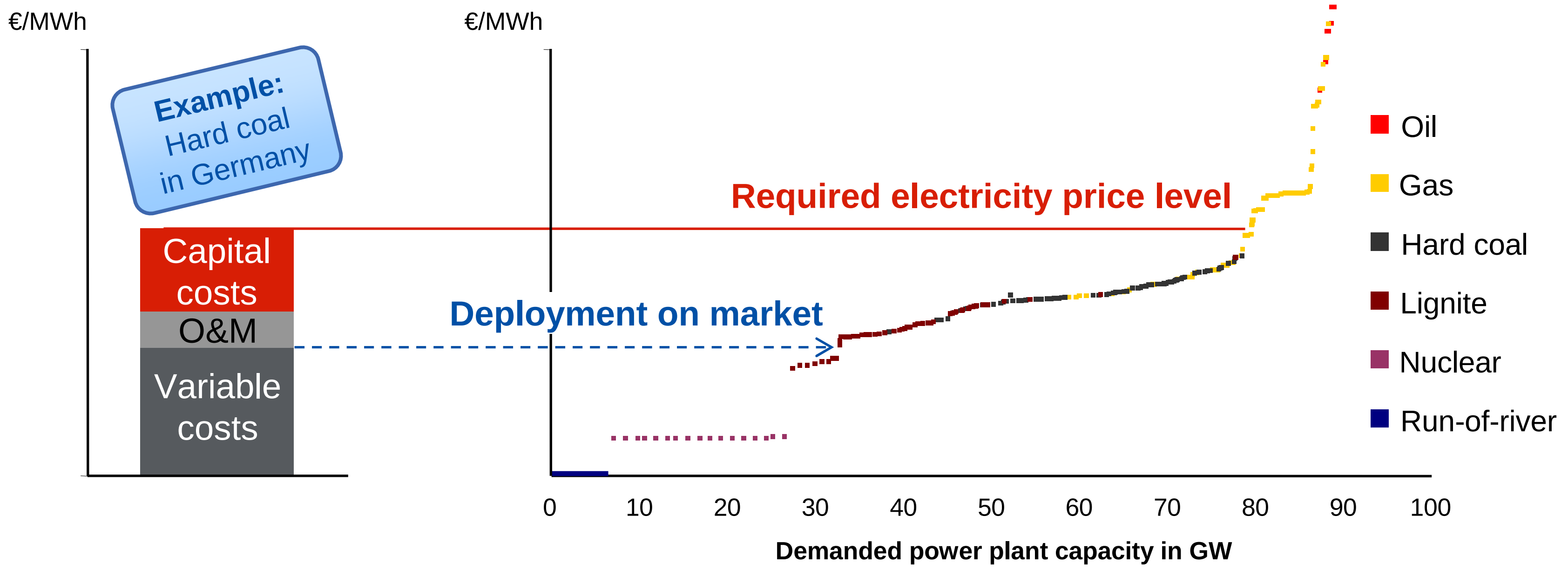
Impact on Capacity

RWE
The energy to lead

Currently obtainable spreads are not adequate for recovering the full costs of new hard coal-based power plants

Full costs of a hard coal-fired power plant[1]

Merit order of German power plant portfolio in 2009
(Order of deployment and electricity price on the basis of variable costs[2])



Price formation:
On the electricity market, the electricity price changes hourly on the exchange according to the variable costs of the last power plant required.

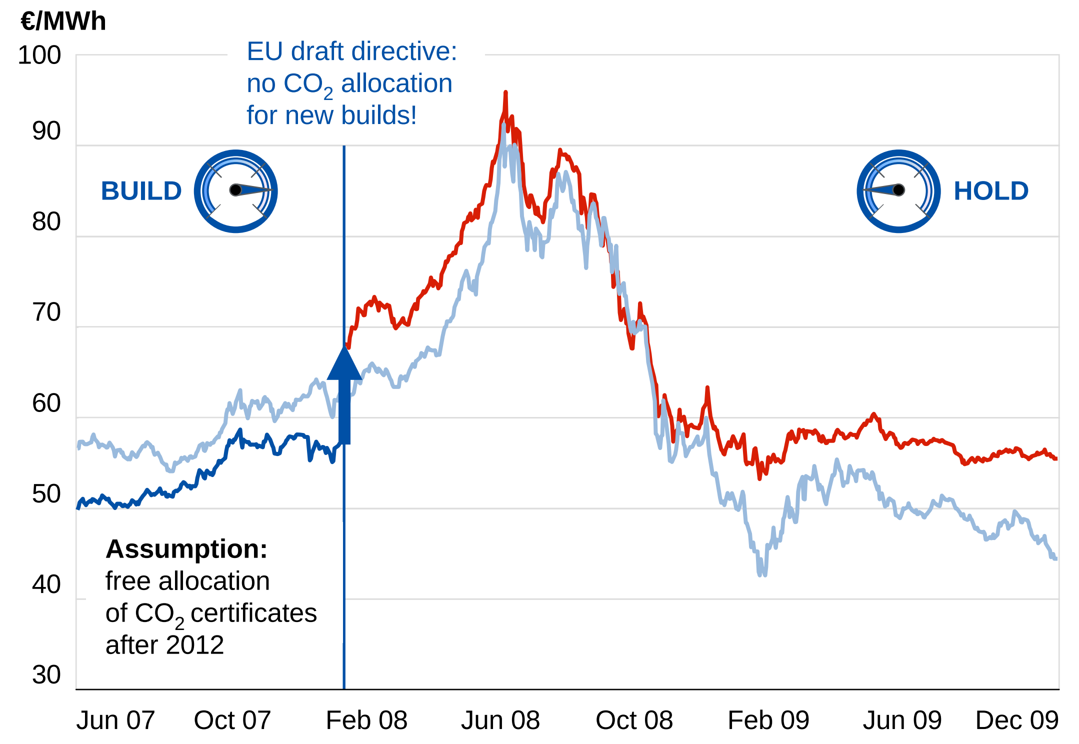
---

1 Discounted average costs. Plant price level: 2009, net efficiency of 46%, plant useful life: 40 years, at 7,000 full load h/a.

2 Forwards front year (2010) at € 15/t CO_2, € 23/MWhth gas, € 8/MWhth hard coal (plus domestic fuel transport to power plant).

New hard coal plants: since decision of no CO_2 allocation post 2012, new build has been to “hold”

Full costs[1] of new hard coal-fired power plants and power forwards in a comparison



> Promised CO_2 cost relief for new highly efficient plants ensured new-build incentives on market until the end of January 2008

> With CO_2 full auctioning, the full costs of new plants are at present still above the price level for electricity

> High CO_2 and fuel prices as in summer 2008 are necessary if the efficiency advantages of new plants are to generate adequate contributions to profit on the market

— Power base forward[1]

— Market entry price hard coal[2] with CO_2 auctioning

— Market entry price hard coal[2] with CO_2 benchmark allocation

---

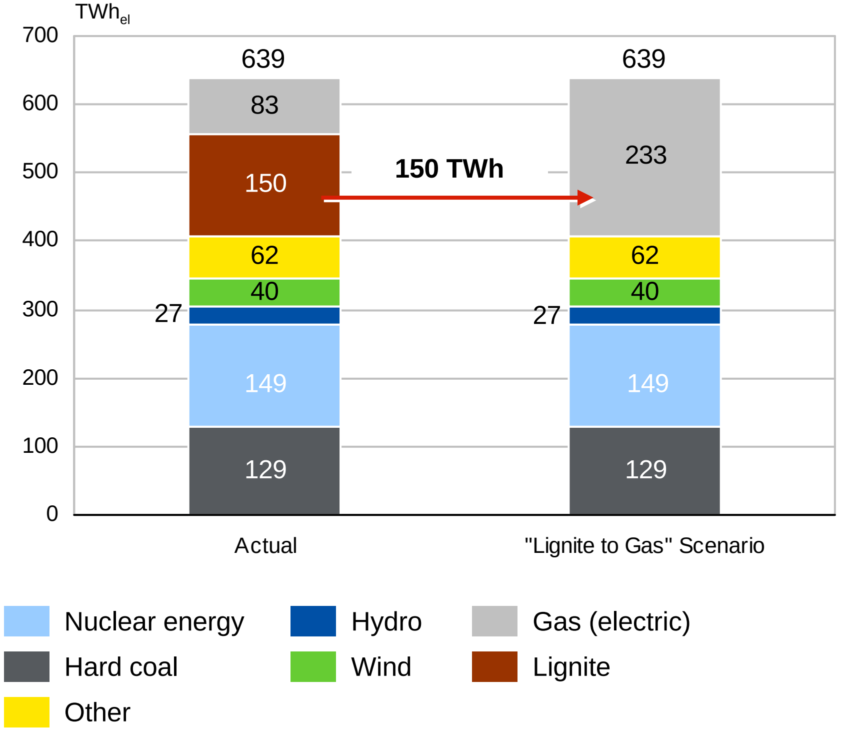
1 Valuation on basis of forward listings, front year for hard coal API#2, CO_2 EUA, electricity EEX base.

2 Efficiency: 46%, capital cost €1,450/kW, O&M at 3% of investment p.a., 7,000 full load h/a, 40 years of useful life.

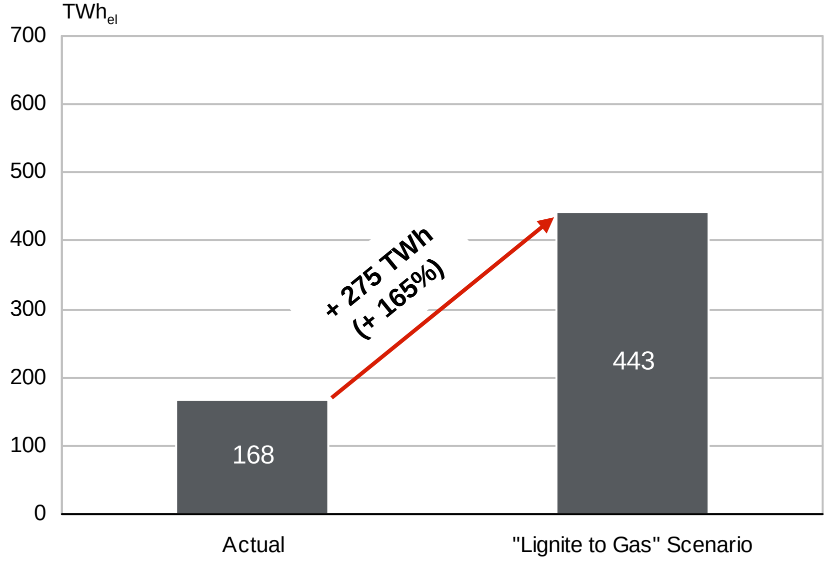
New gas plants: sourcing is a constraint – difficulties in closing long-term firm gas supply contracts underpin this

Hypothetical gas demand assuming an immediate switch from lignite to gas-based power production

Electricity generation (gross) by energy source in Germany in 2008



Gas demand for electricity generation in Germany in 2008

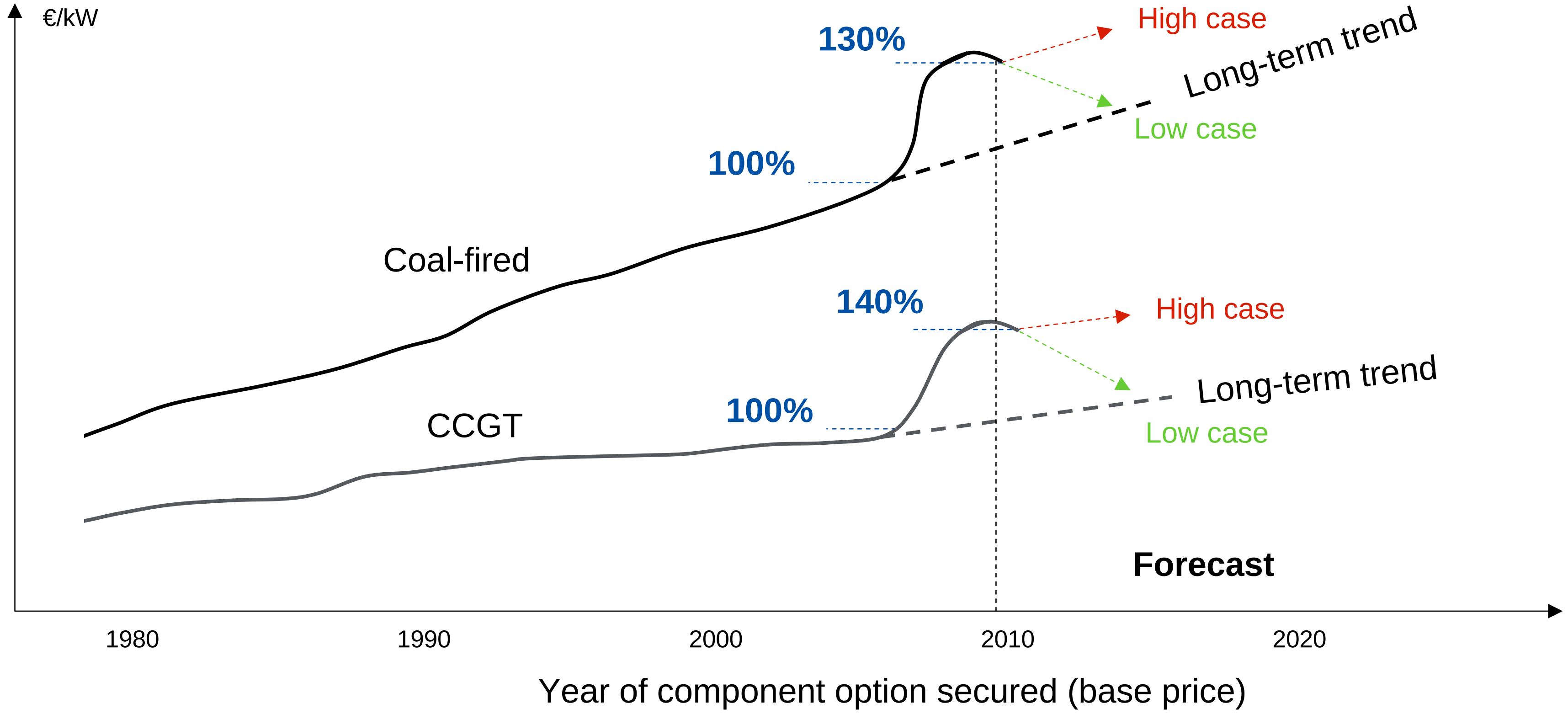


- Additional gas demand of ~275 TWh (~26 bcm)
- ~30% of total current German national gas consumption

Source: RWE estimates.

Scarcity drives costs: New-build power station costs up more than 30% for coal and 40% for CCGT

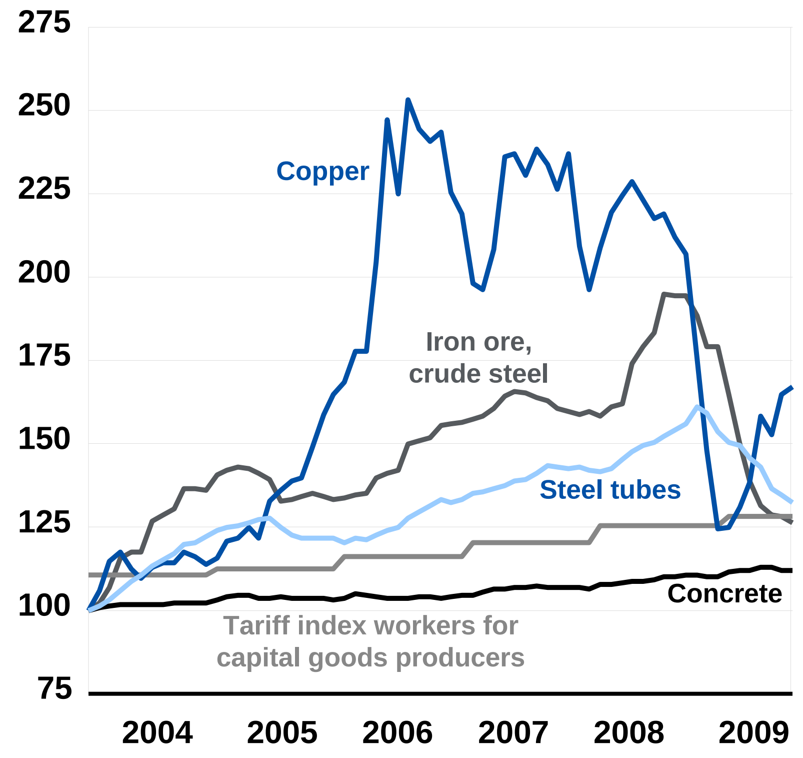
Development in specific plant prices for coal-fired power stations and CCGT plants – by year of component option secured



Source: External market information and in-house market expertise.

The global demand for resources drives prices for power plant components

Cost indices



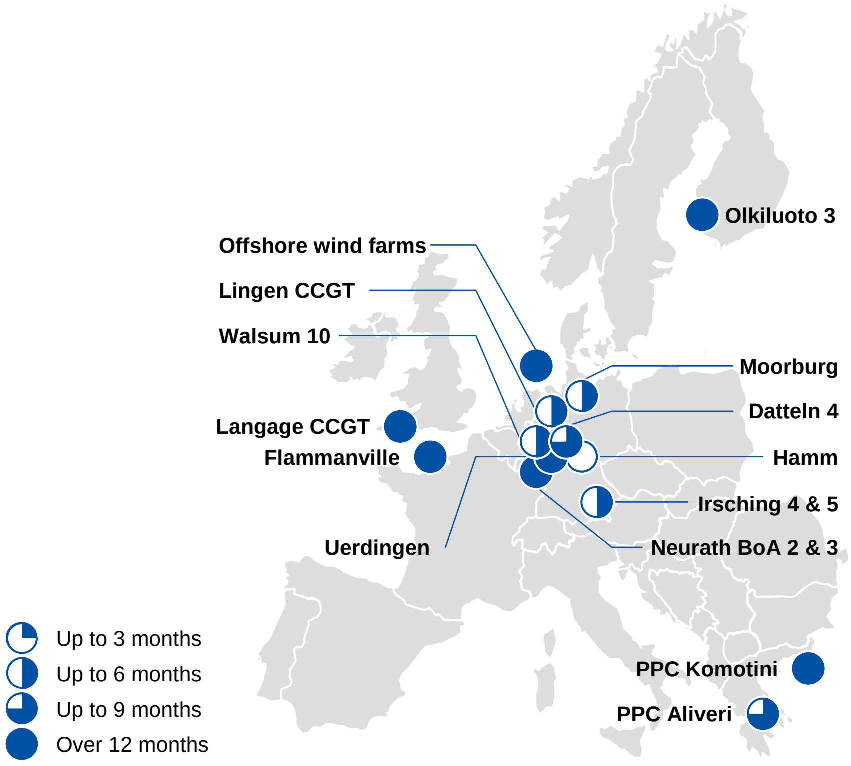
Prices for components (last 4 – 5 years)

Steam generator	+60%	↑
Steam turbine	+35%	↗
Alloyed pipes	+30%	↗
Civil works	+30%	↗

Source: Statistisches Bundesamt, manufacturer price index of commercial products.

Quality problems: delays and cost increases due to problems in meeting quality standards are common

Delays in current new-build projects – Examples in Europe –



Quality problems main reason for current delays

Quality supervision

> Supplier and subcontractor checks are a fundamental function for operators today

Claim management

> Consumes substantial resources on both sides of the contract

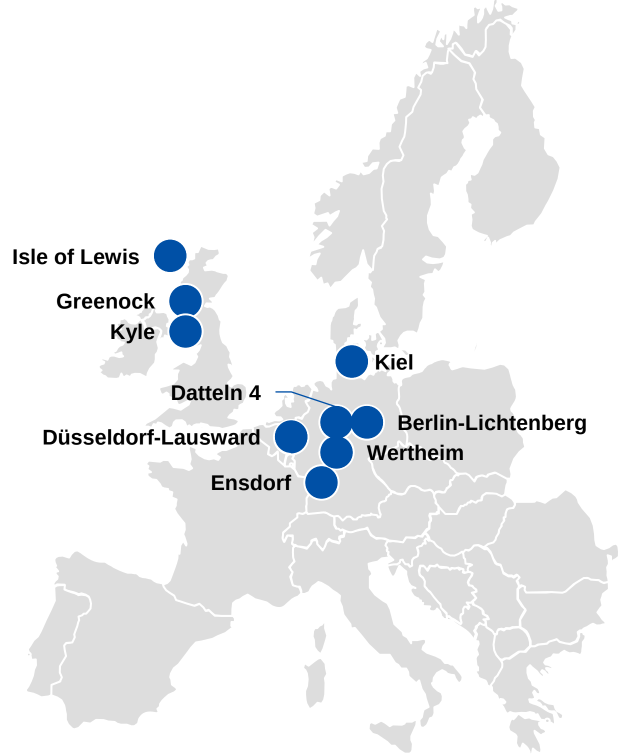
> “Ties up” staff

> Claims threaten schedule and economic efficiency

Source: Press analysis.

Public and/or political opposition: a major reason for the cancellation/delay of new-build projects in Germany and UK

Cancelled / delayed new-build projects – Examples in Europe –



Reasons for public and political opposition

Public opposition

- “Green” organisations support and stir up public opposition especially against hard coal new builds (e.g. in Kiel and Ensdorf)
- Even wind projects were rejected after being approved by local politicians e.g. Isle of Lewis

Political opposition

- “Green washing” of political parties, therefore stronger opposition to hard coal plants
- Consequently stronger demand for gas-fired plants or biomass-fired plants

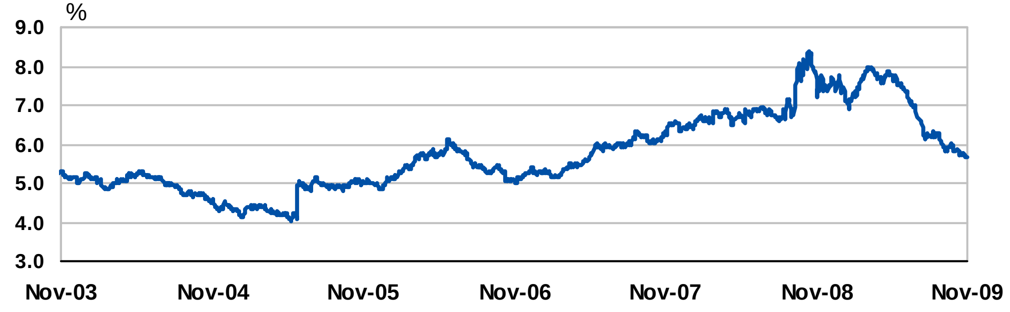
Source: BDEW, October 2009.

Financing costs and higher demand for equity hampers new-build projects

Financing problems in current new-build projects

- Financing of new-build projects is still determined by high interest rates in the past.
- Banks nowadays demand a 50% equity share for conventional new builds. Projects of large municipalities are especially hard hit.
- Financing of wind and solar projects has also become much more difficult due to the demand for a higher equity share.
- Procedure for financing has changed: from syndicated bank credits to “club deals,” in which e.g. 5 banks are involved without having a lead bank. As a result: financing takes longer.

Average benchmark interest rate development, rating category BBB+, for 20 years based on €



Source: Bloomberg

DOWJONES
Energy Daily 24. Juni 2009

Energiebranche beklagt Finanzierungsprobleme beim Kraftwerksbau

BERLIN (Dow Jones)--Die restriktive Vergabe von Krediten droht nach Einschätzung der Energiebranche zu einem Hemmnis für die Erneuerung des deutschen Kraft
rden. Die Kreditinstitu-
twerksbau, die früher
des Bundesverbandes
f Martin Schmitz, am

ke hin zu einer kohlen-
Energieerzeugung",
z. Die technische Lauf-
ne AKW liege bei 60

ere Entwicklung des
forderte der Ver-
nt staatliche Förderin-
strumente. Neue Techniken im Wär-
memarkt könnten sich unter
tigen Rahmenb

wirtschaft die CO2-
Emissionen der Stromerzeugung bis
zum Jahr 2020 um 30% reduzieren.
Das Erreichen dieses Ziels werd
zwangsläufig gravi
gen au

Börsen-Zeitung 24. Juni 2009

Für große Stadtwerke wird Kraftwerksfinanzierung eng

Energieverband fürchtet europaweite Stromlücke

Börsen-Zeitung, 24.6.2009
ge Berlin – Die deutsche Strominde-
dustrie fürchtet im nächsten Jahr-
zehnt hierzulande wie auch euro-
paweit eine nennenswerte Strom-
lücke. Zugleich beklagen in jüngs-
ter Zeit selbst etablierte Stadt-
werke eine drastische Verschär-
fung der Finanzierungsbedingun-
gen, wodurch immer mehr Kraft-
werksprojekte scheiterten. Der-
weil legt der Branchenverband
BDEW Eckpunkte für ein langfristi-
ges Zukunftskonzept vor, das eine
sichere, wirtschaftliche sowie um-
weltverträgliche Energieerzeu-
gung gewährleisten soll – wozu
die Kernkraftwerke länger am
Netz bleiben müssten.

Nachdem Anbieter von erneuerba-
ren Energien schon seit Herbst über
deutlich höhere Eigenkapitalanforde-
rungen klagen, die Banken für die Fi-
nanzierung von Windkraftanlagen
oder Solarparks zur Voraussetzung
machen, berichtet nun auch Rolf

20% Braunkohlewerke seien. Im Ge-
nehmigungsverfahren befänden sich
16 Projekte mit knapp 11000 MW,
davon fast 70% Steinkohlekraft-
werke. Wie bei den im Bau befindli-
chen Werken ist nahezu jedes fünfte
Vorhaben ein Gaskraftwerk und gut
jedes zehnte Projekt erzeugt Strom
aus erneuerbaren Energien. Für die
fernere Z
men vo
auf die
ten Kra
weitere
werden

CO
Zug
mit d
2020"
tische
stabile

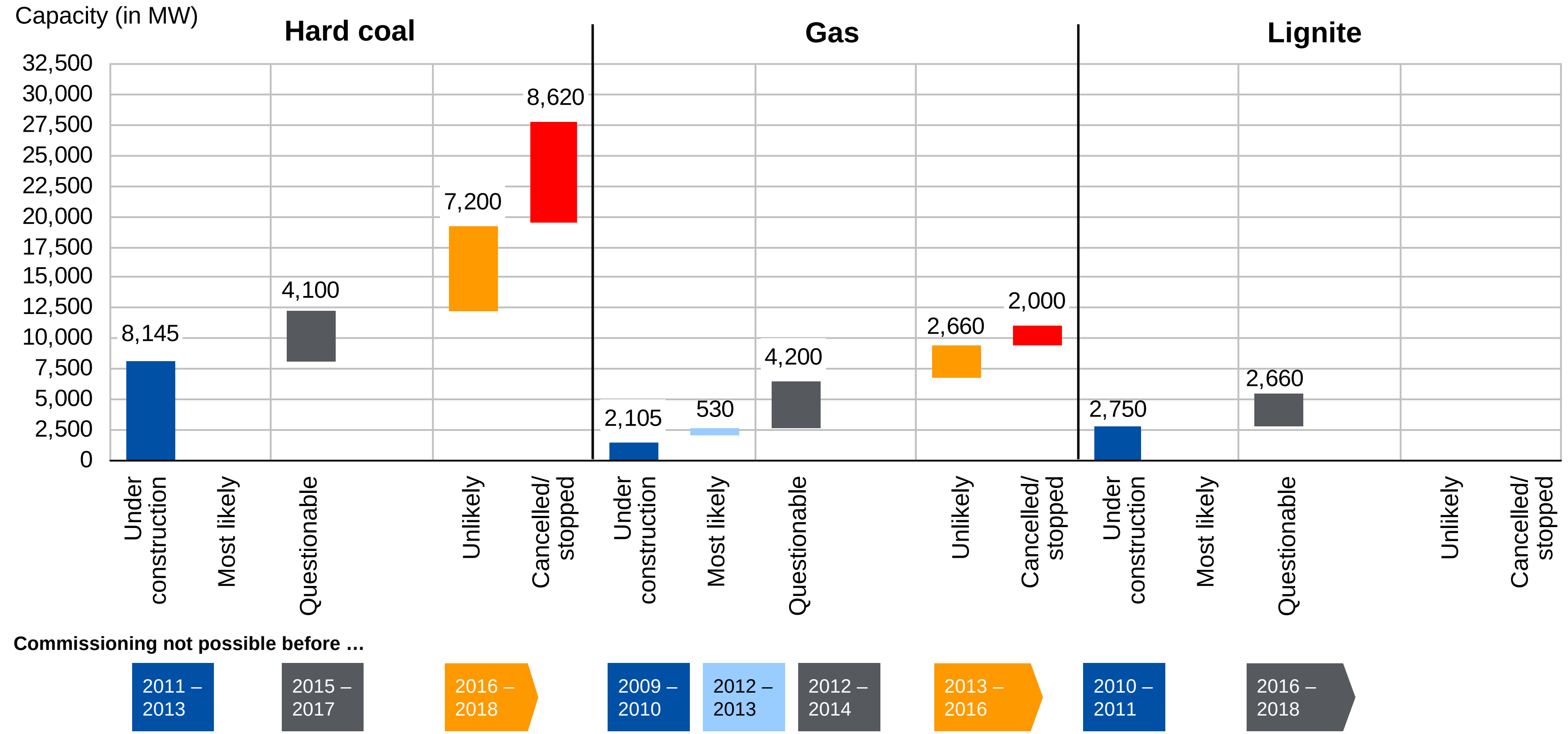
gen gefordert, um eine weitgehend
CO₂-neutrale Elektrizitätserzeugung
bis zum Jahr 2050 darstellen zu kön-
nen. In diesem Zusammenhang ist
für Hildegard Müller, Vorsitzende
der BDEW-Hauptgeschäftsführung,
„enttäuschend", dass dem Gesetz
zur sicheren Lagerung von abge-
schiedenem Kohlendioxid (CO₂) das
Aus zumindest in dieser Legislaturpe-
riode droht. Damit würde auch die
EU-Förderung entfallen, warnt die
Verbandschefin. Da auch Kraftwerks-
bauer betroffen seien, drohe der In-
dustrie ein „Kollateralschaden".
Zusätzlich zum heute schon exis-
tierenden CO₂-Zertifikatesystem will
der Verband weitere Gutschriften

“Energy sector encounters difficulties in financing new-build projects”

“Limited power plant financing available for large municipal utilities”

As a result, nearly 70% of current power plant projects in Germany will probably not be realised

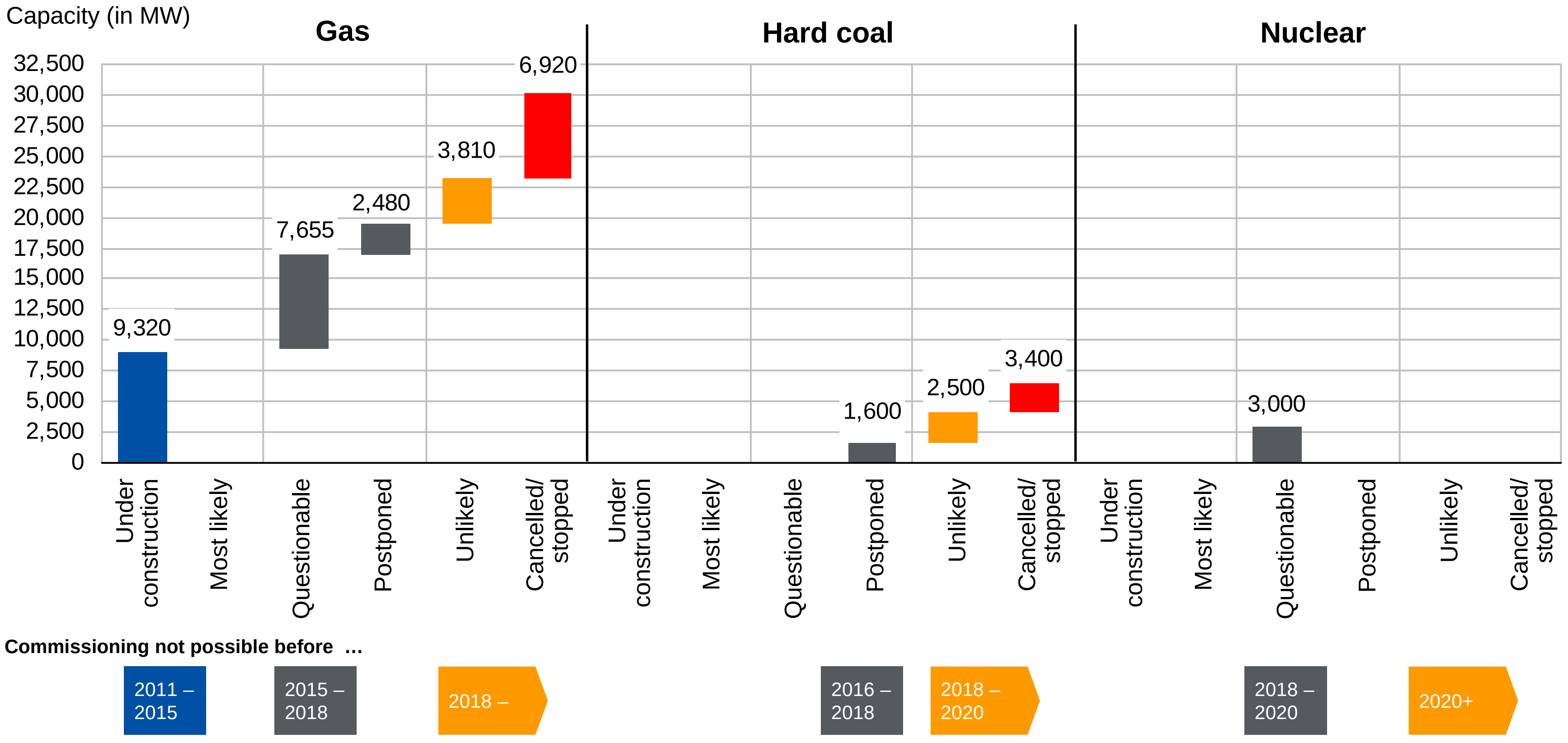
Power plant projects in Germany in MW (total net capacity: 45 GW = 35% of current capacity)



Source: RWE, December 2009.

In the UK more than 70% of all previously identified new-build projects are not expected to be realised

Power plant projects in the UK in MW (total net capacity: 40.7 GW = 49% of current capacity)



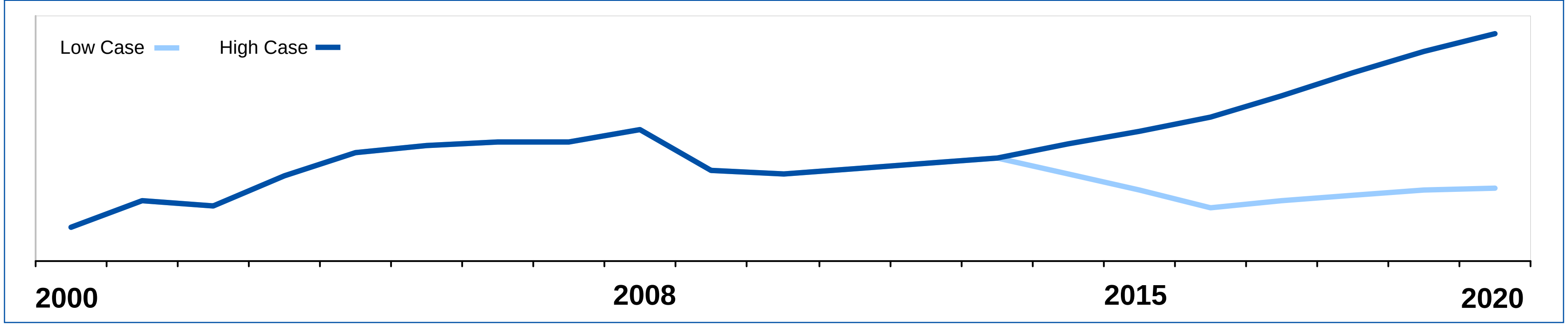
Source: RWE, December 2009.

Impact on Capacity

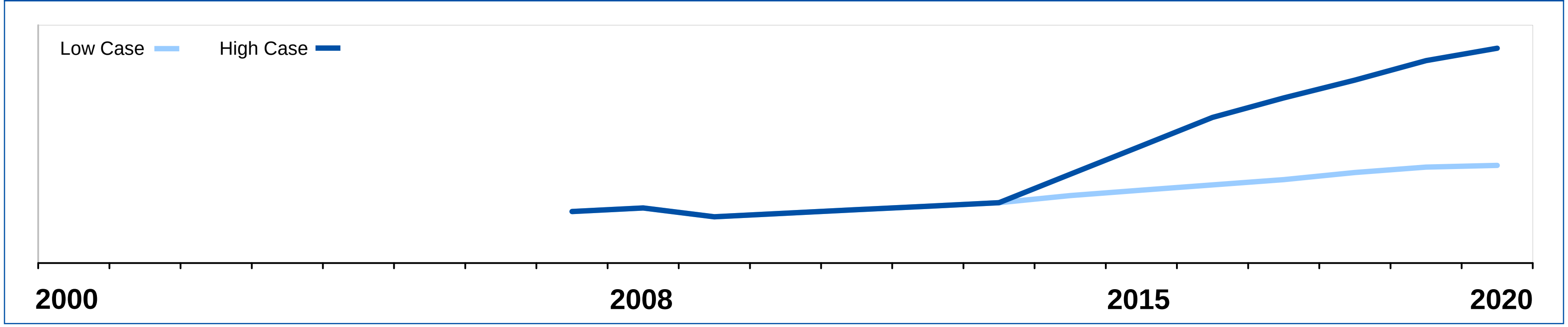
The energy to lead

The demand side – medium and long-term development

North-Western Europe[1] and UK



CEE[2] and SEE[3]



1 UCTE north-western block: Austria, Belgium, France, Germany, Luxembourg, Netherlands, Switzerland.

2 UCTE north-eastern block: Czech Republic, Hungary, Poland, Slovakia.

3 UCTE south-eastern block: Bosnia-Herzegovina, Bulgaria, Greece, Montenegro, Romania, Serbia.

Source: RWE.

The demand side – what is driving the trends in our view

North-Western Europe and UK: “flat”

- Reaching the pre-crisis level of demand will take a few years, especially in industry-dependent countries like Germany
- Rising efficiency and enforced energy policies have a negative impact on demand in industries
- The service sector provides the dominant source of demand growth throughout countries as economies become less industry-based
- Household sector demand will grow in the UK but not in Germany, but will continue to provide stability of demand
- Rising electrification, e.g. heat pumps or air conditioning, and in the transportation sector the use of electric vehicles provides additional sources of consumption growth. Contribution to overall level of consumption is expected to be highest in Germany.

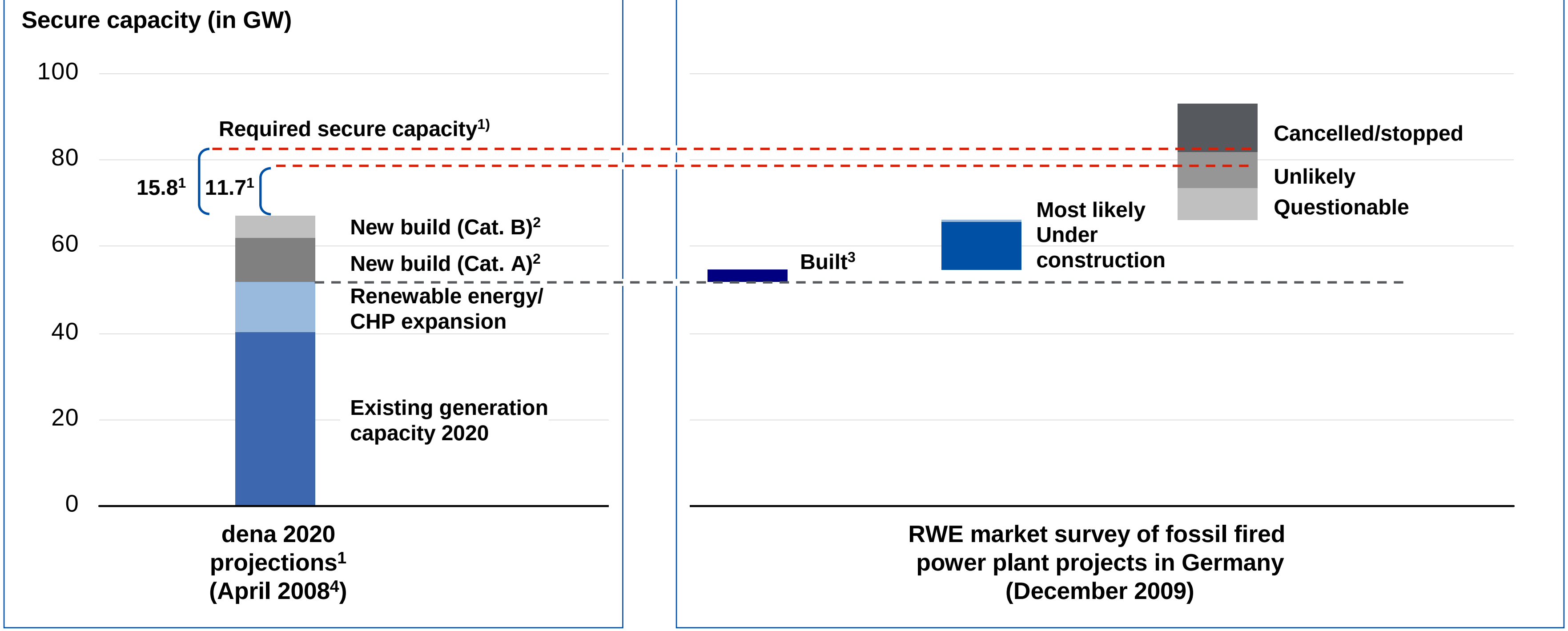
CEE and SEE: “growth”

- We expect longer-run potential growth rates to be unaffected by the crisis such that real convergence forces (that are associated with higher real GDP growth) will begin dominating again after 2012. Trend growth of demand in CEE and SEE will thus be higher in the coming years than in the rest of Europe
- Energy-intensive industry consumption constitutes a low share of overall electricity consumption. Overall demand is thus less affected by the energy intensive industries’ slump. We expect that real convergence will lead to rising demand in energy intensive industries and rising demand in non-energy intensive industries
- Ageing of society also affects CEE countries. It leads to shrinking populations, higher spending on social welfare and slows economic growth. Demand in the household sector will thus exhibit limited growth dynamics in most countries. This is however not the case for countries like Greece and Turkey
- As in western Europe, electricity demand in the services sector will grow throughout all countries

So will current investments fill the capacity/efficiency gap in Germany? We do not think so

Significant reliable new build needed[1] …

… but current projects cannot fill the gap



1 Source: dena, April 2008. Basis: nuclear phase-out, full achievement of government targets in renewable energy and CHP, flat consumption (15.8 GW) or reduction in consumption by 0.5% p.a. (11.7 GW).

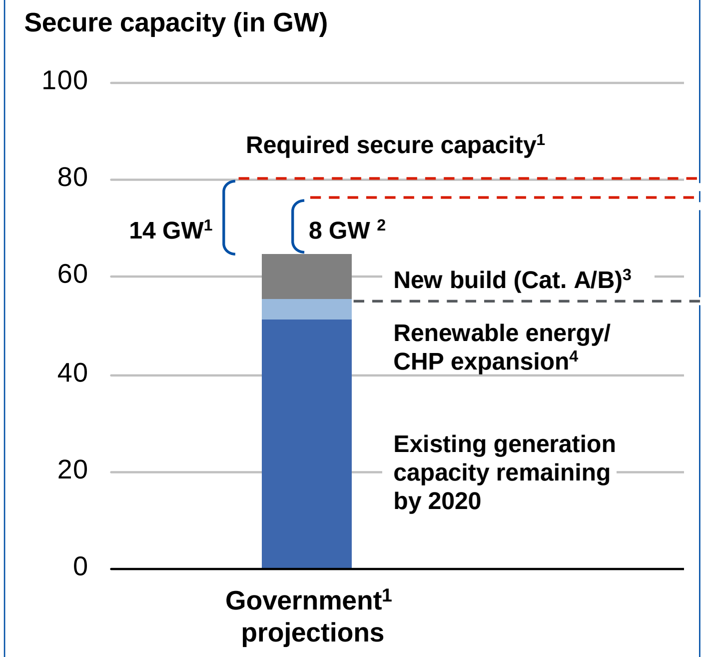
2 Category A: projects under construction or operating after 2005, Category B: projects with high probability of execution.

3 Power plant projects already operating since 2005 included in dena new-build category A plus additional projects completed in the meantime (2.8 GW of secured capacity).

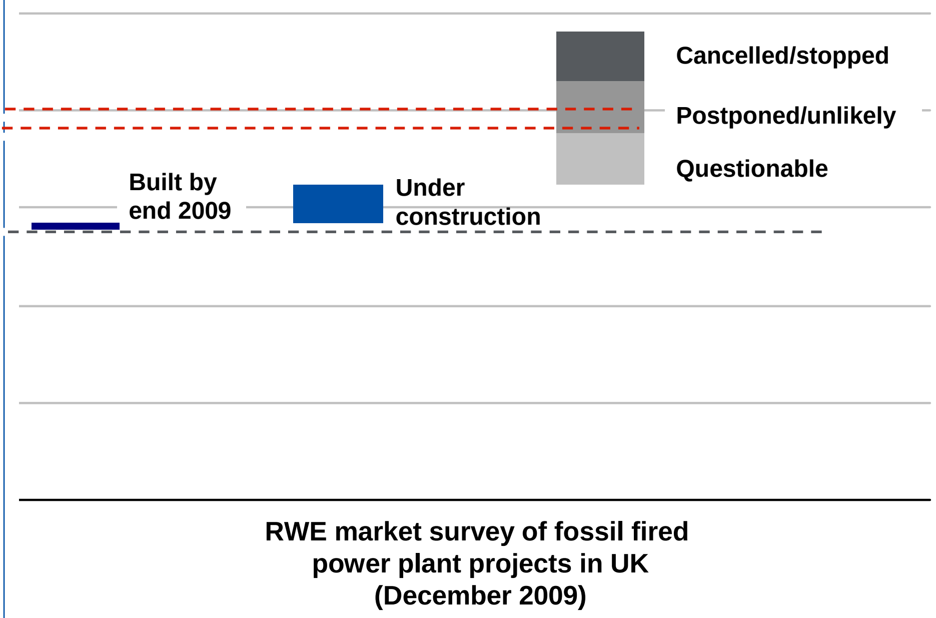
4 General trends confirmed in the dena study of November 2009.

Similarly in the UK, current projects will not be able to fill the capacity/efficiency gap

Significant reliable new build needed[1] …



… but current projects cannot fill the gap



1 Redpoint report for DBERR June 2008: Implementation of EU 2020 Renewable Target in the UK. Figure 27. Average of two plant retirement scenarios.

2 8 GW requirement assumes no demand growth. 14 GW assumes 0.75% p.a. average demand growth up to 2020.

3 Category A/B: projects already built or under construction.

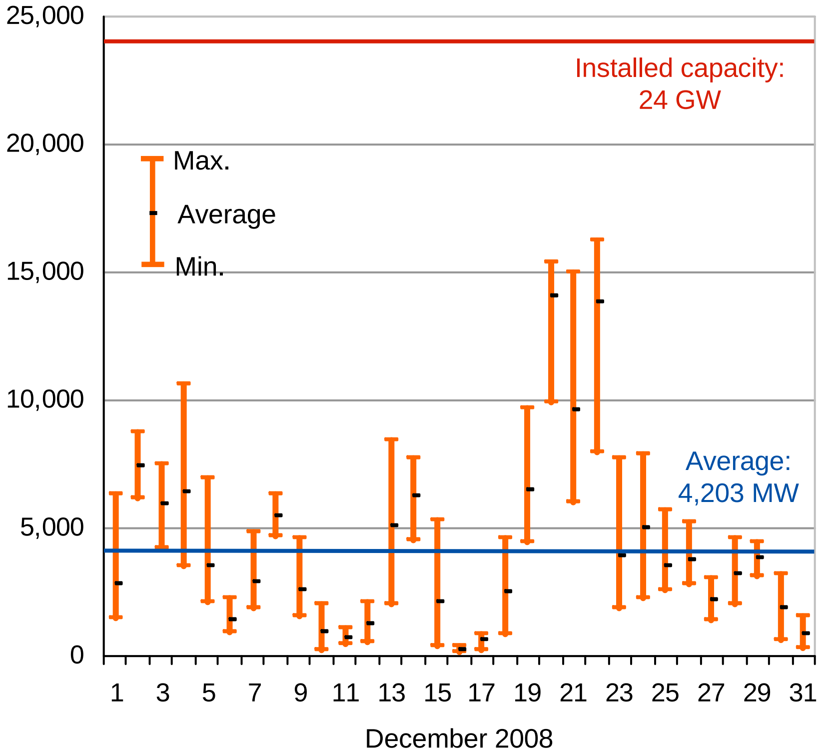
4 Additional build of 16 GW renewables is assumed with equivalent capacity of 25%.

The Big Challenge:
Integrating Renewables

The following chapter explains why more renewables cannot be the only solution for filling the capacity gap and which new challenges arise from more wind and solar

Wind adds megawatts – and volatility

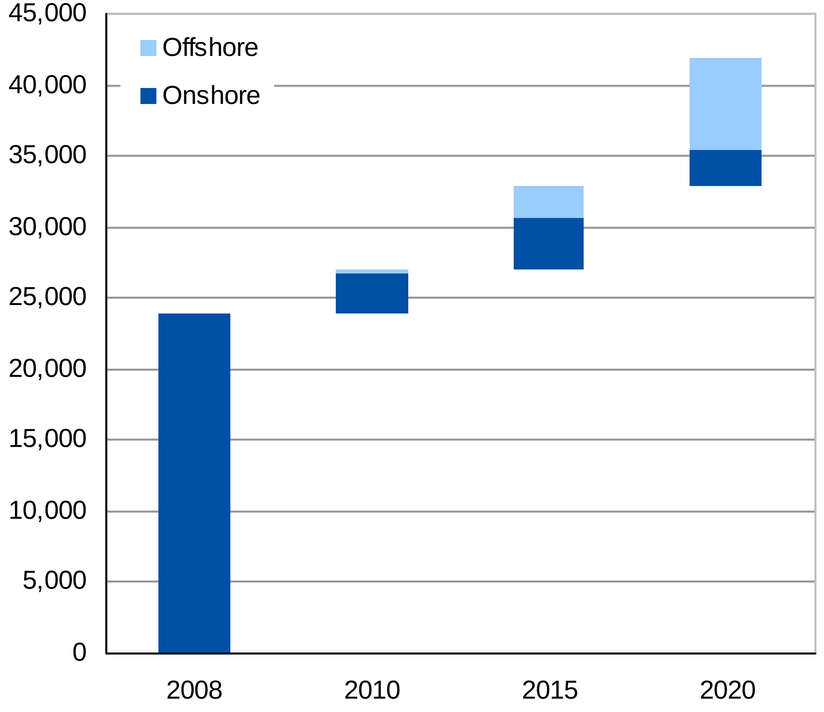
High volatility of load profile of wind capacity in Germany [MW]



Source: BDEW.

Extensive addition to wind capacity by 2020 in Germany will increase volatility [MW]

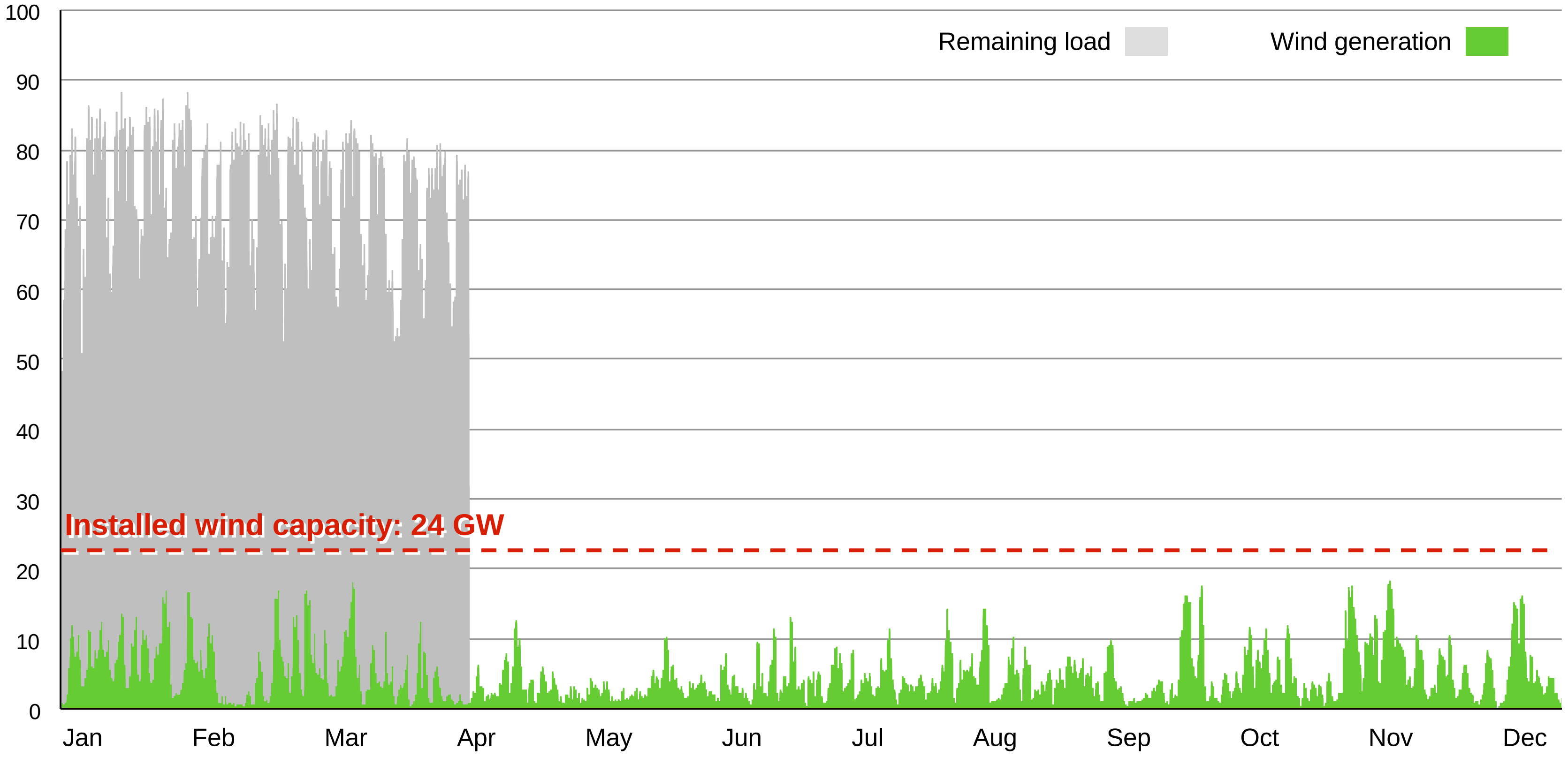
Government scenario 2009 for wind capacity extension



Source: German Federal Environment Ministry, August 2009.

Power generation from wind in 2008 in Germany

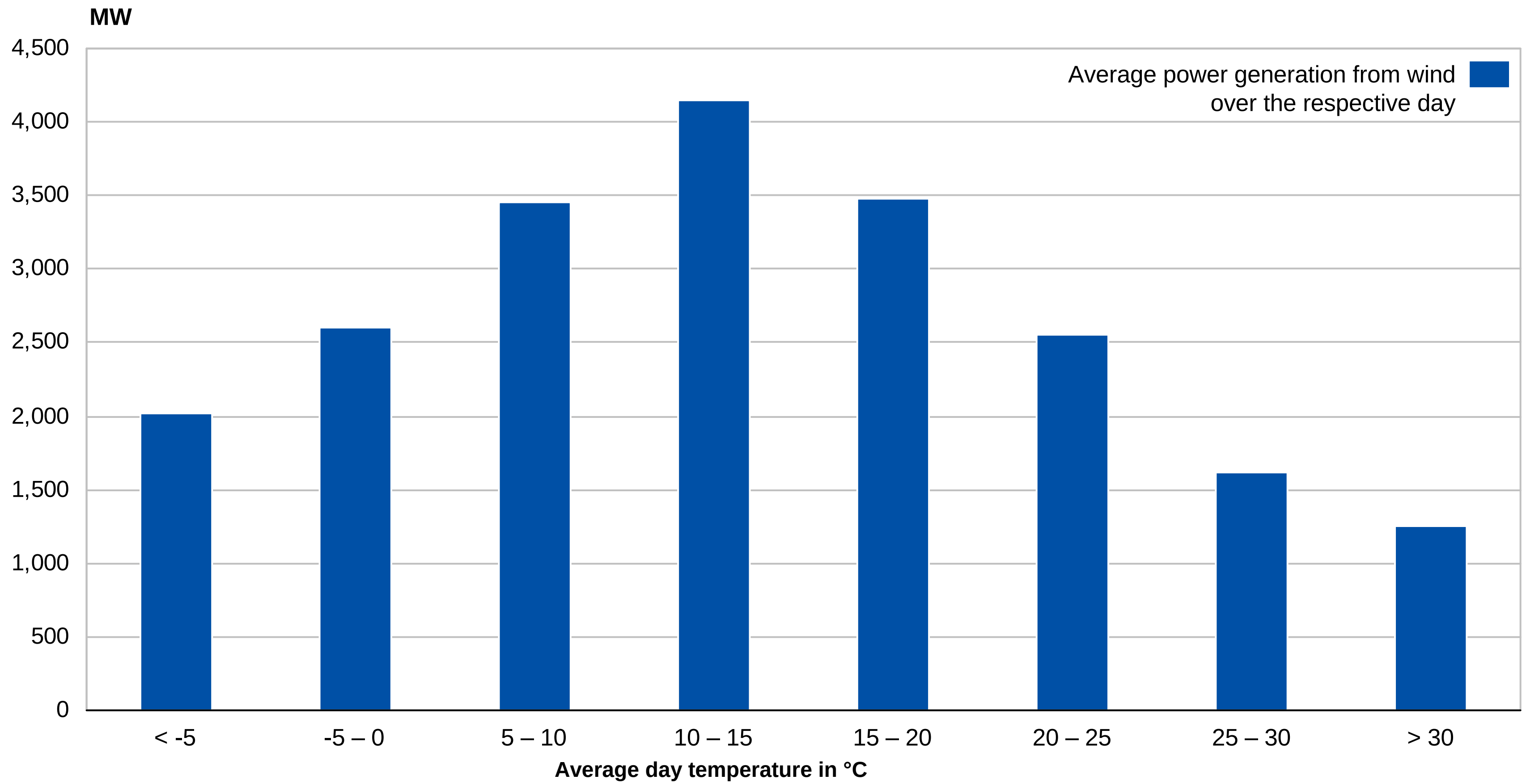
Hourly load curve in GW



Source: RWE.

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

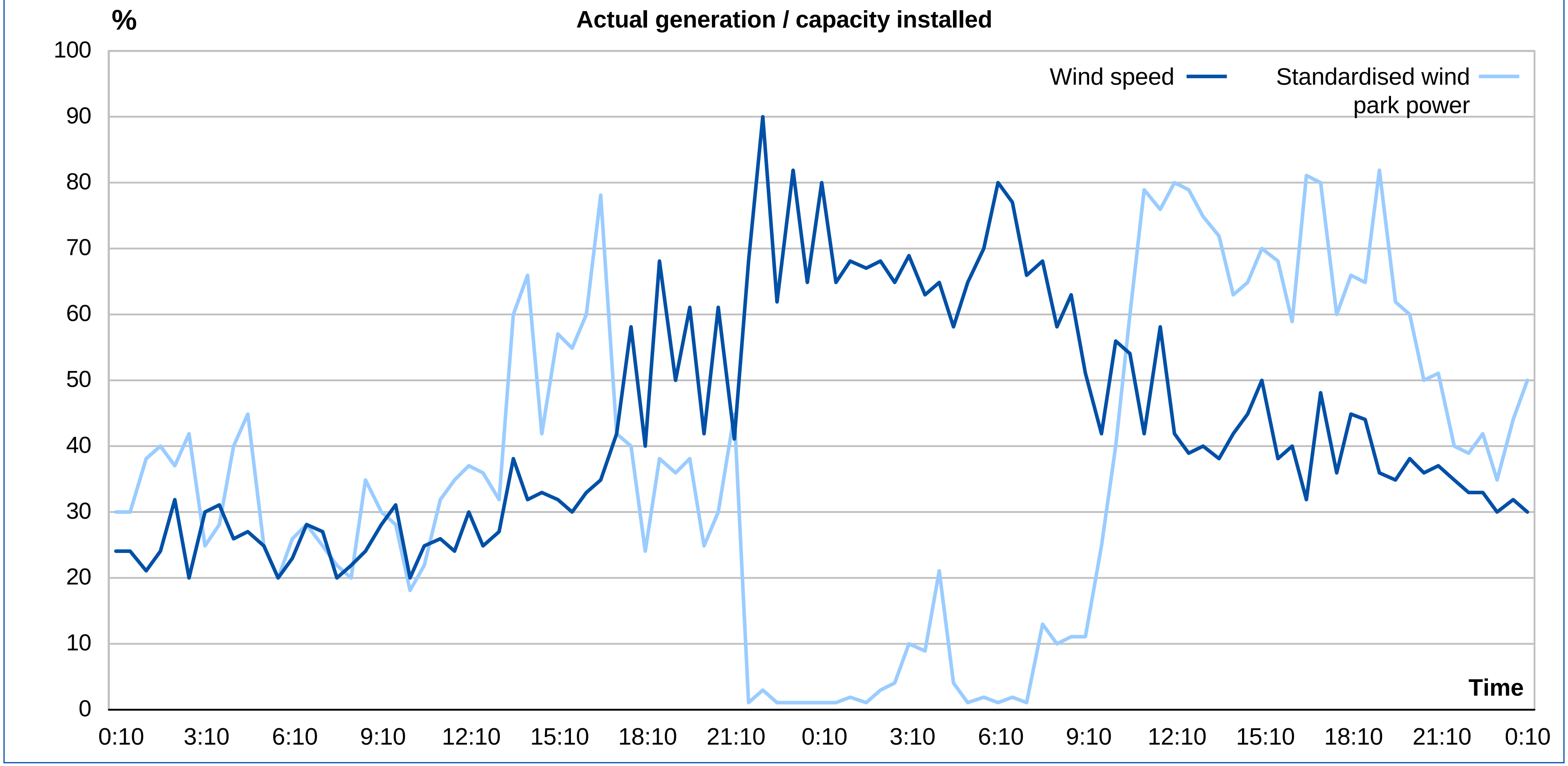


Source: RWE.

… and more wind doesn't always result in more power generation

Illustrative

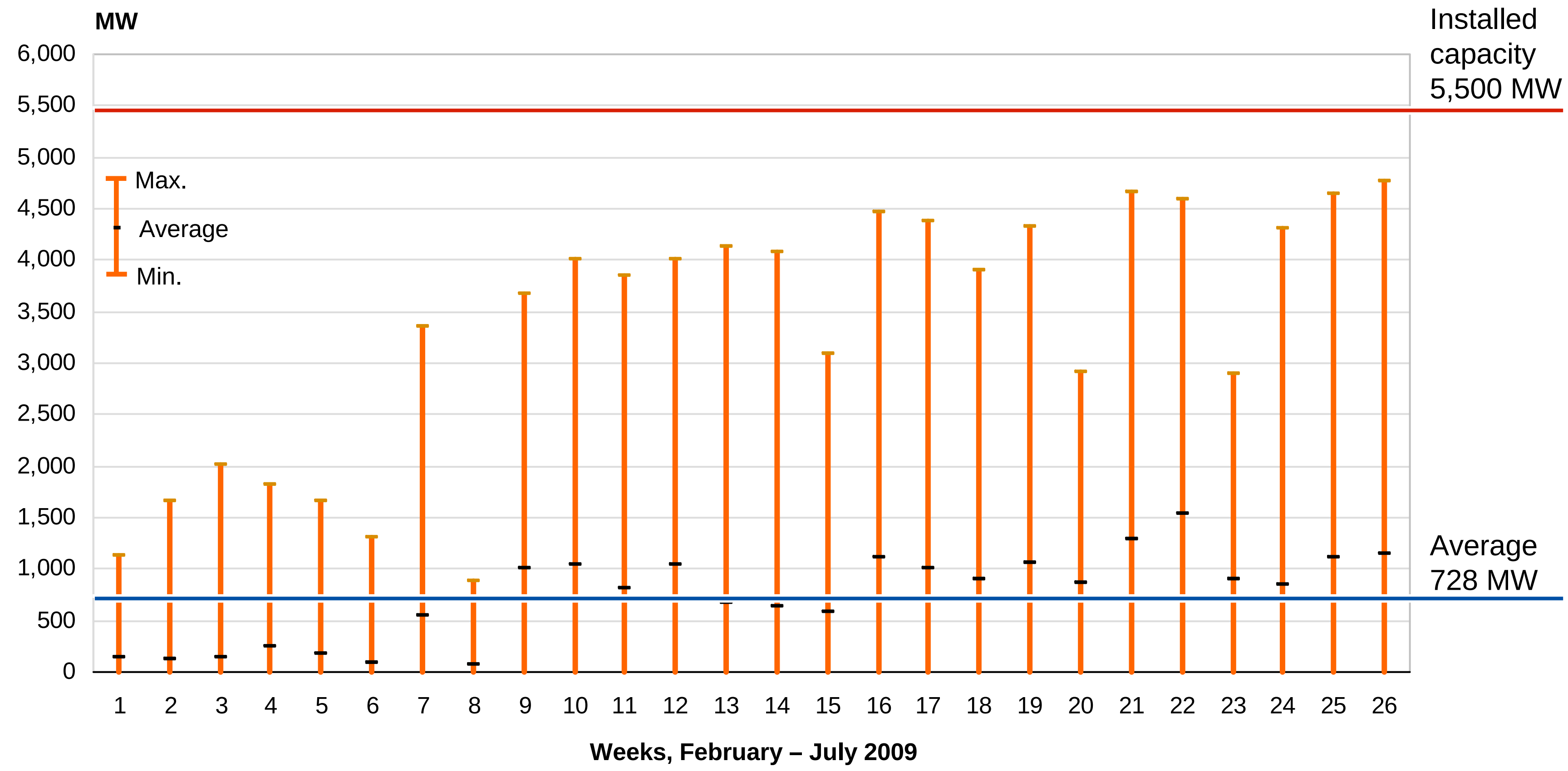
Wind turbines are pitched in case of heavy storms to avoid damages



Source: Institut für Windenergie und Energiesystemtechnik, 2008.

Solar power is easier to forecast – it is definitely not there at night, but it already has an installed base of over 5 GW

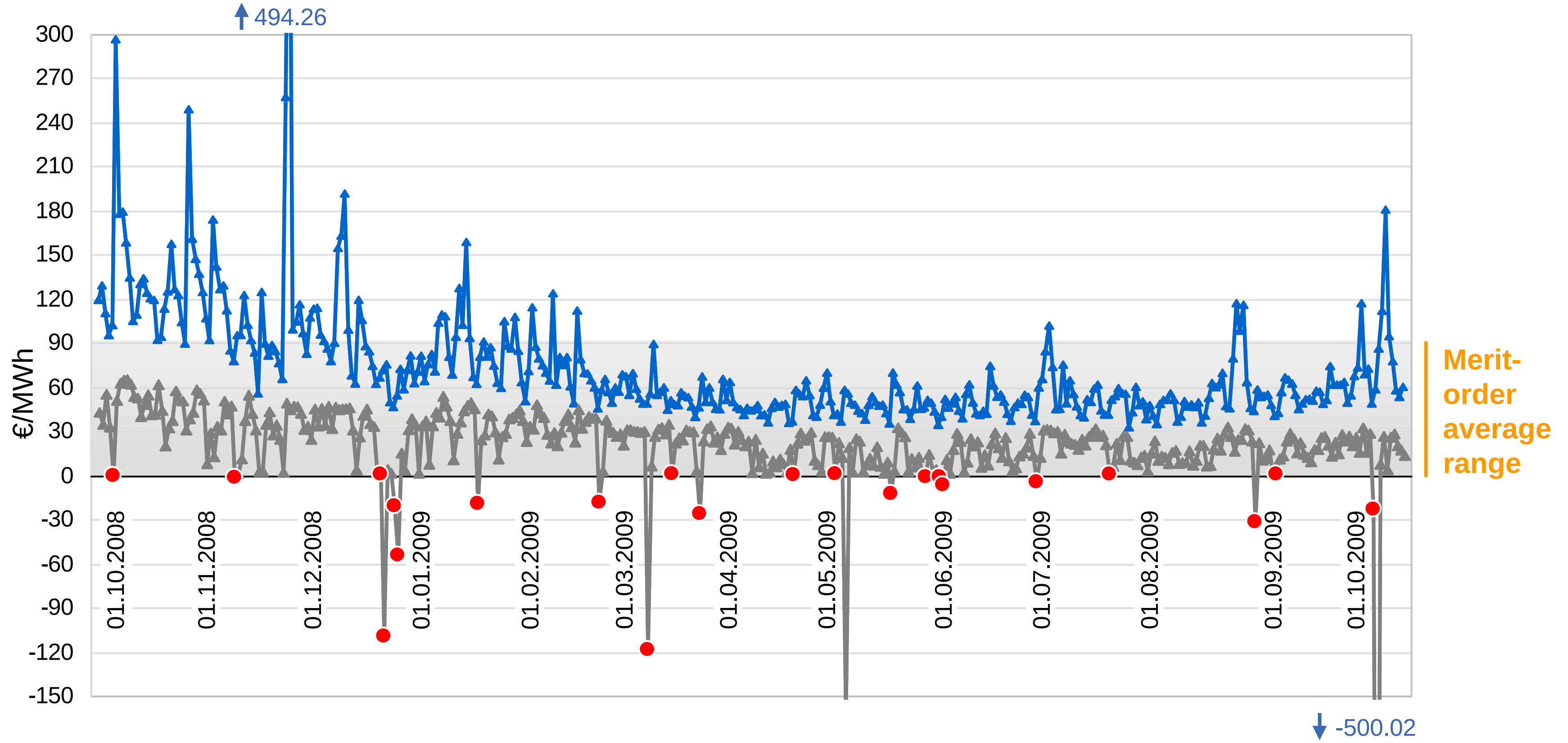
Minimum, average and maximum load of German solar plants (from February to July 2009)



Source: RWE Supply & Trading.

Wind and solar together dramatically change the need for flexibility – in the short term ...

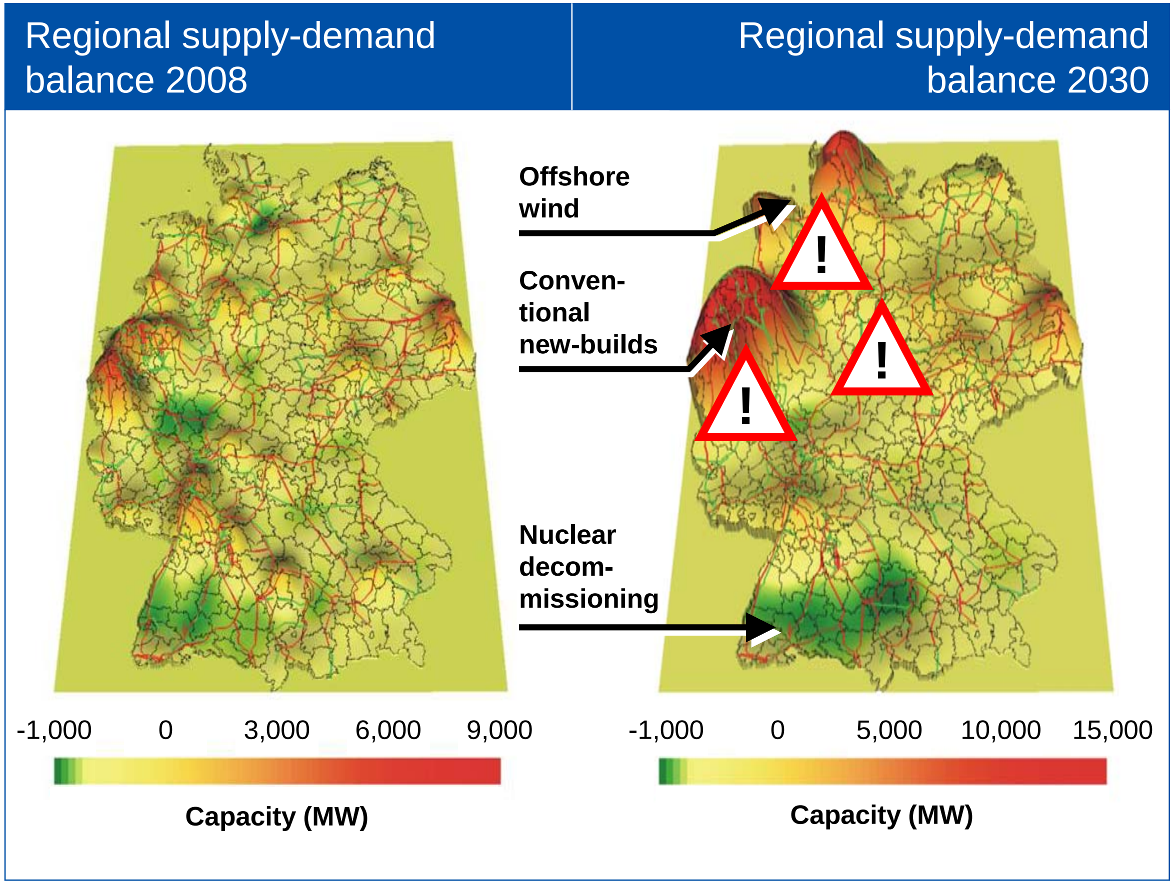
Growing proportion of renewables leads to higher price volatility. October 2008 to October 2009:
60 hours with negative prices; highest price reached: +€500/MWh, lowest -€500/MWh



Daily maximum price   Daily minimum price (indicated in red when negative)

Source: EEX spot prices.

... and due to grid constraints also in the long term



Regional supply-demand balance 2008

Regional supply-demand balance 2030

⚠ Grid bottlenecks

- > Increasing need for new investment in the transmission network is recognised by the German government and all required projects are mentioned in the “EnLAG”[1]
- > But the extension of the electricity transmission network is not progressing as planned
- > To date, 38 out of 159 projects in Germany are behind schedule due to
  - – Time-consuming approval procedures
  - – Increasing public resistance
  - – Legal constraints (e.g. underground cables)

Source: RWE internal estimates.

[1] EnLAG = Energieleitungsausbaugesetz (German Law for the Acceleration of the Construction of Ultra High-Voltage Networks).

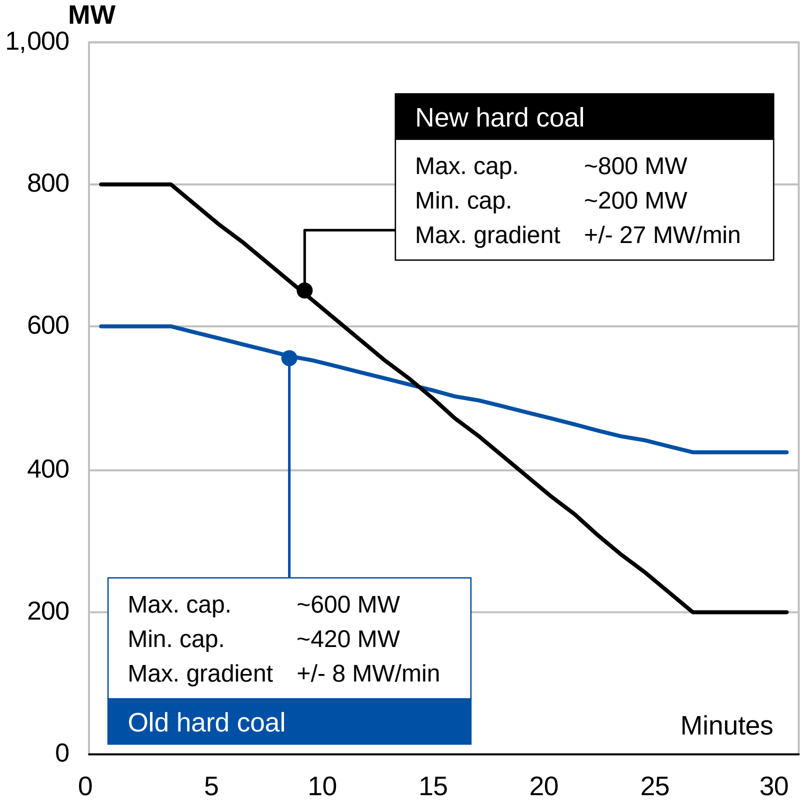
The Value of Flexibility

Integrating renewable energy into generation is one of the crucial challenges for current and future power plant portfolios. Every single megawatt of new wind or solar capacity needs at least 0.9 megawatt of fossil-fired capacity as back-up. The following chapter explains the commercial benefit of flexible generation capacity – in other words, the value of “smart megawatts”

RWE
The energy to lead

Hard coal-fired power generation can be flexible

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



New hard coal

Max. cap.	~800 MW
Min. cap.	~200 MW
Max. gradient	+/- 27 MW/min

Max. cap.	~600 MW
Min. cap.	~420 MW
Max. gradient	+/- 8 MW/min

Old hard coal

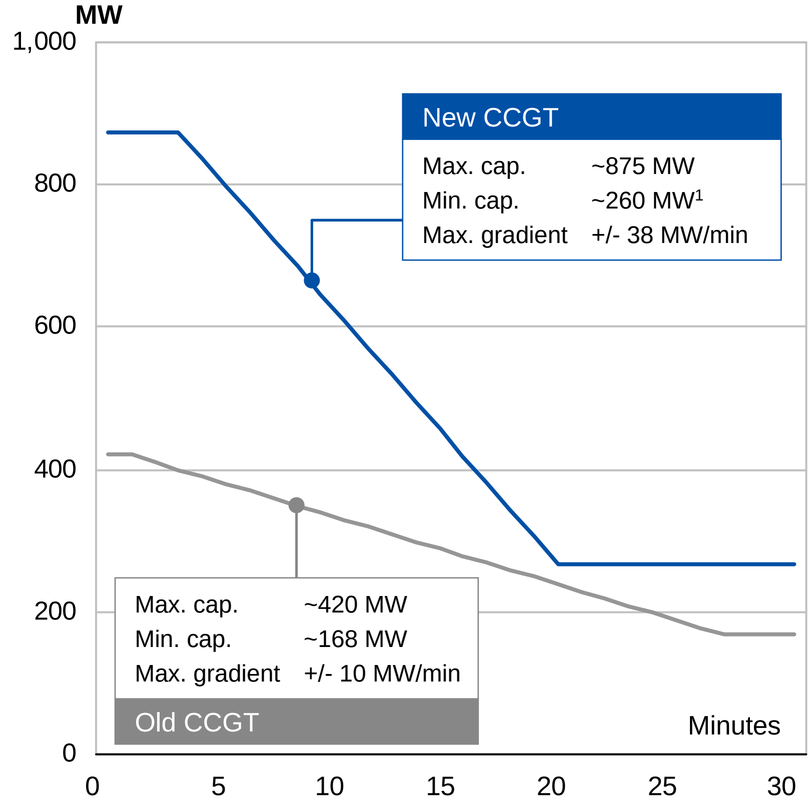
New hard coal-fired 1,600 MW plant – 2 flexible 800 MW units for mid-merit regime

Example: RWE new build in Hamm (Germany)

Source: RWE.

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.

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

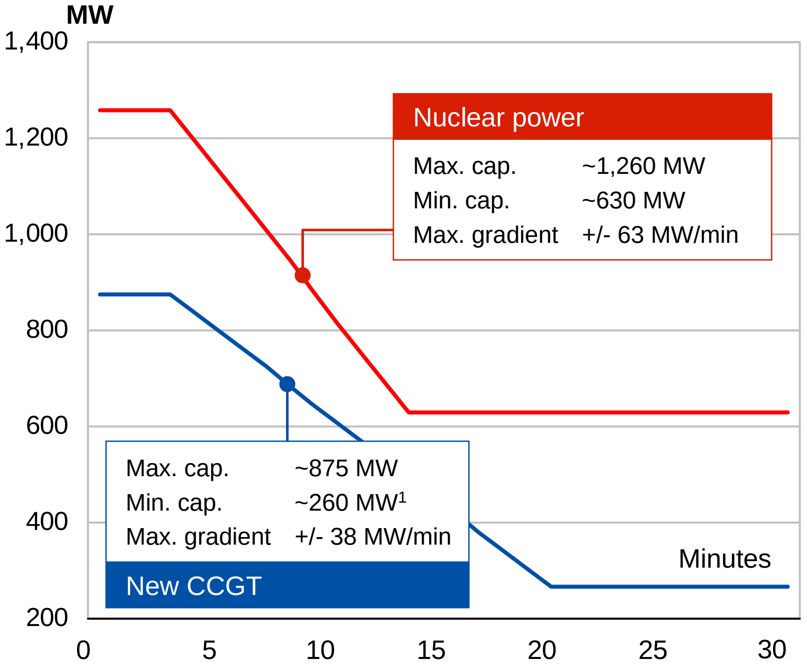
Example: RWE new build in Lingen (Germany)

---

[1] One turbine gets turned off.

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



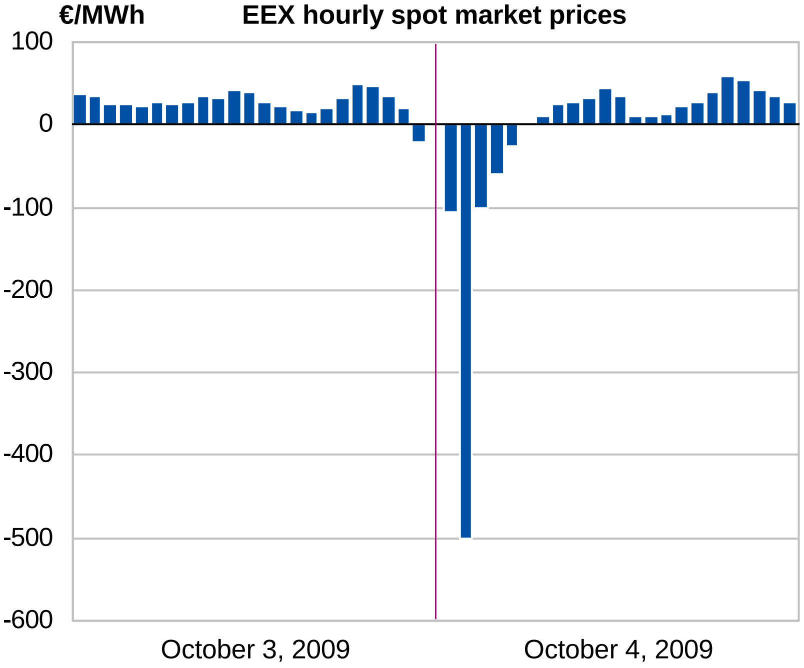
Nuclear power

Max. cap.	~1,260 MW
Min. cap.	~630 MW
Max. gradient	+/- 63 MW/min

New CCGT

Max. cap.	~875 MW
Min. cap.	~260 MW[1]
Max. gradient	+/- 38 MW/min

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



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

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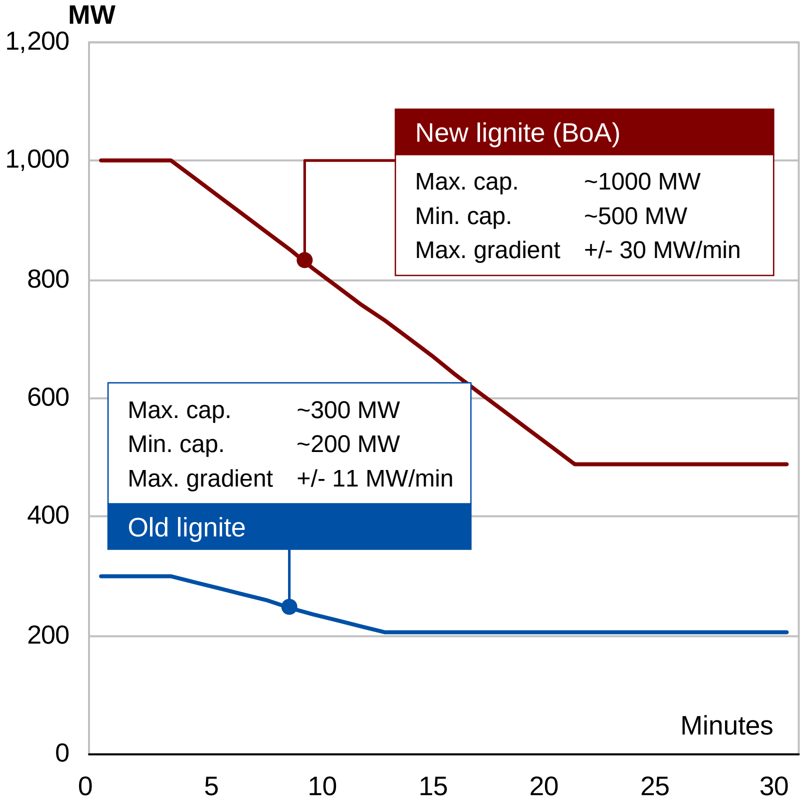
1 One turbine gets turned off.

2 Installed nuclear capacity of RWE in Germany.

Major improvements possible also with new lignite plants

Comparison of ramp capacities between old lignite and new lignite



New lignite (BoA)

Max. cap.	~1000 MW
Min. cap.	~500 MW
Max. gradient	+/- 30 MW/min

Max. cap.	~300 MW
Min. cap.	~200 MW
Max. gradient	+/- 11 MW/min

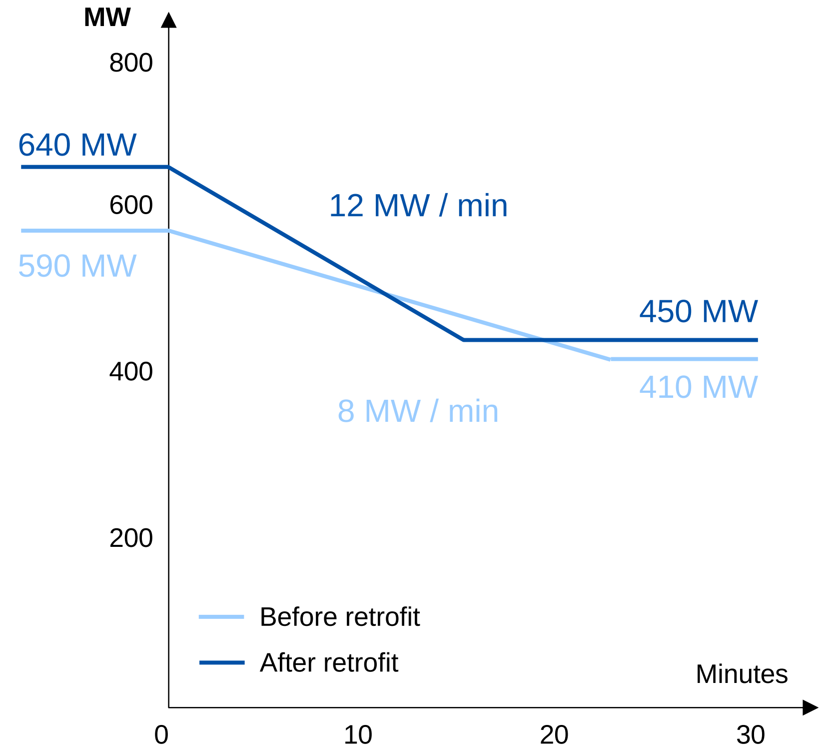
Old lignite

Lignite-fired 2,000 MW plant – two 1,000 MW units for base-load regime

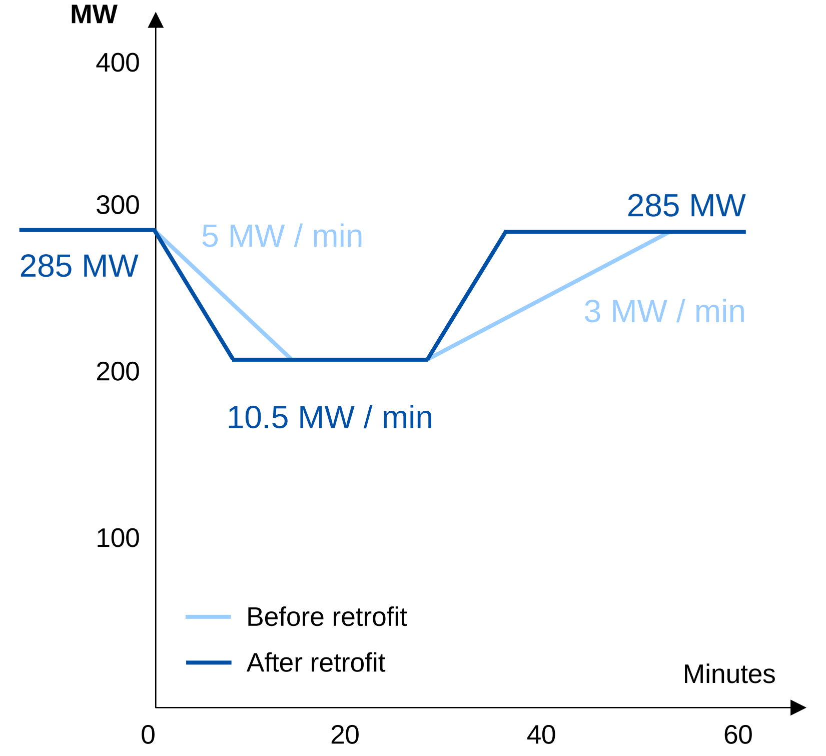
Example: RWE new build in Neurath

And there are also ways to retrofit old lignite plants: steeper load ramps (< 1h) are important for use as balancing power

Retrofit of control system, optimisation of cooling tower and renewal of generator and condenser at RWE Niederaussem units G, H

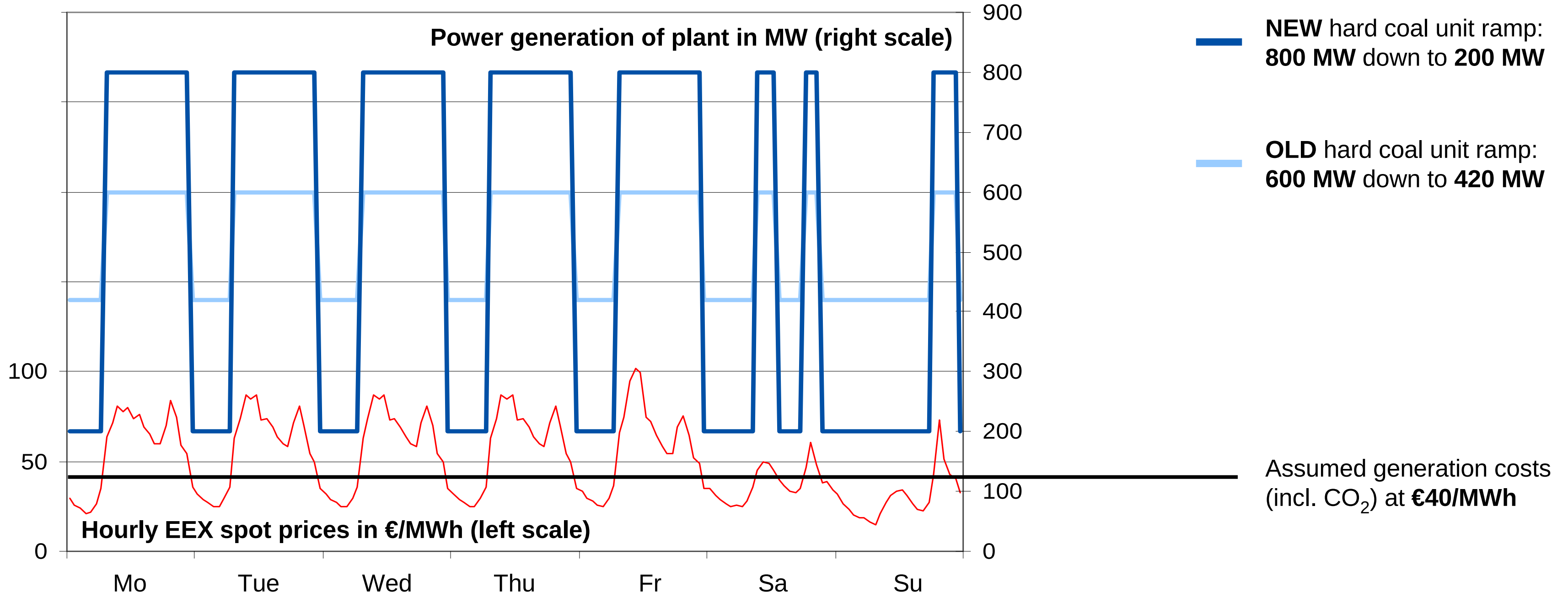


Retrofit of control system at RWE Neurath units A, B, C



New hard coal vs. old hard coal in a standard scenario

NEW flexible hard coal unit vs. OLD less flexible hard coal unit

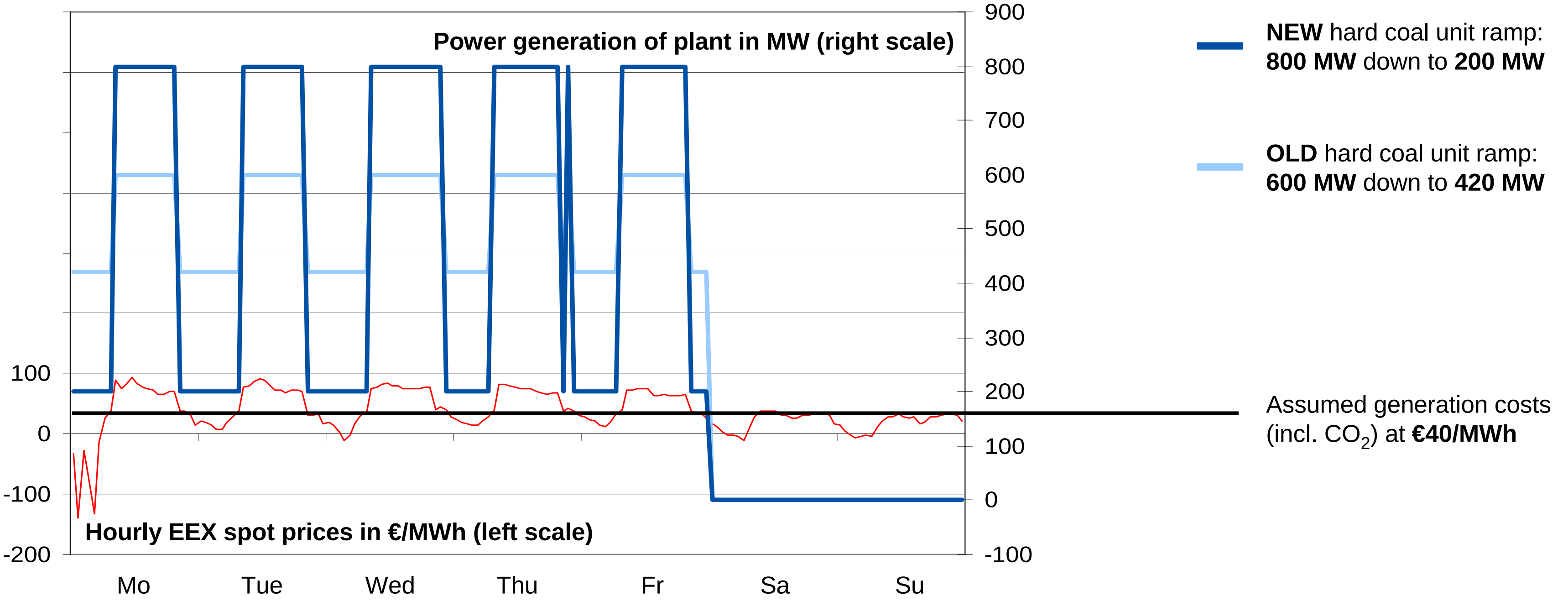


- > **Flexible units are better at “tracking” the spot price structure** and this in turn leads to higher fuel cost savings when spot prices are “too low”.
- > In this example of a typical week (no price spikes) **the higher flexibility** already leads to a higher generation margin of **20% per MW installed.**

Source: RWE.

New hard coal vs. old hard coal in a volatile price scenario

NEW flexible hard coal unit vs. OLD less flexible hard coal unit

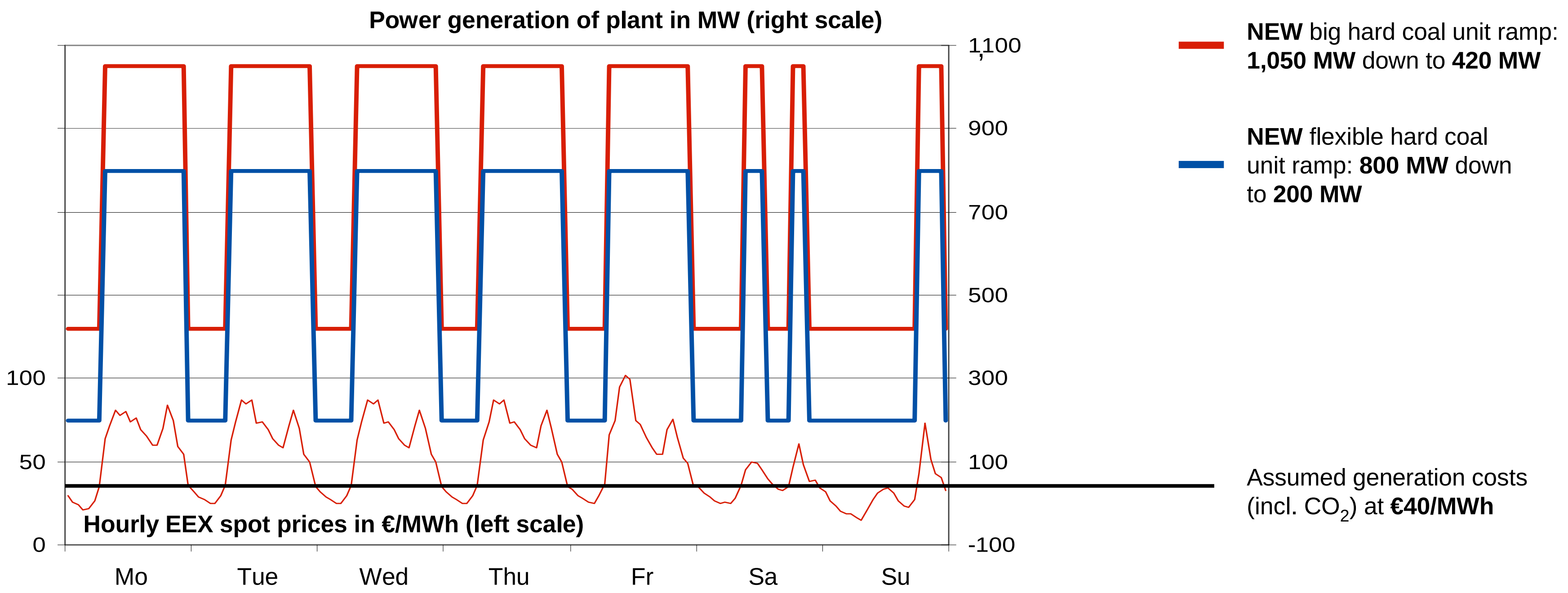


- In a very volatile spot price environment, **e.g. with negative prices, this advantage becomes more striking.**
- Even when assuming that over the low price weekend both units will be “switched off” completely **the advantage can still be more than 60% per MW installed.**

Source: RWE.

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

NEW flexible hard coal unit vs. NEW big less flexible hard coal unit

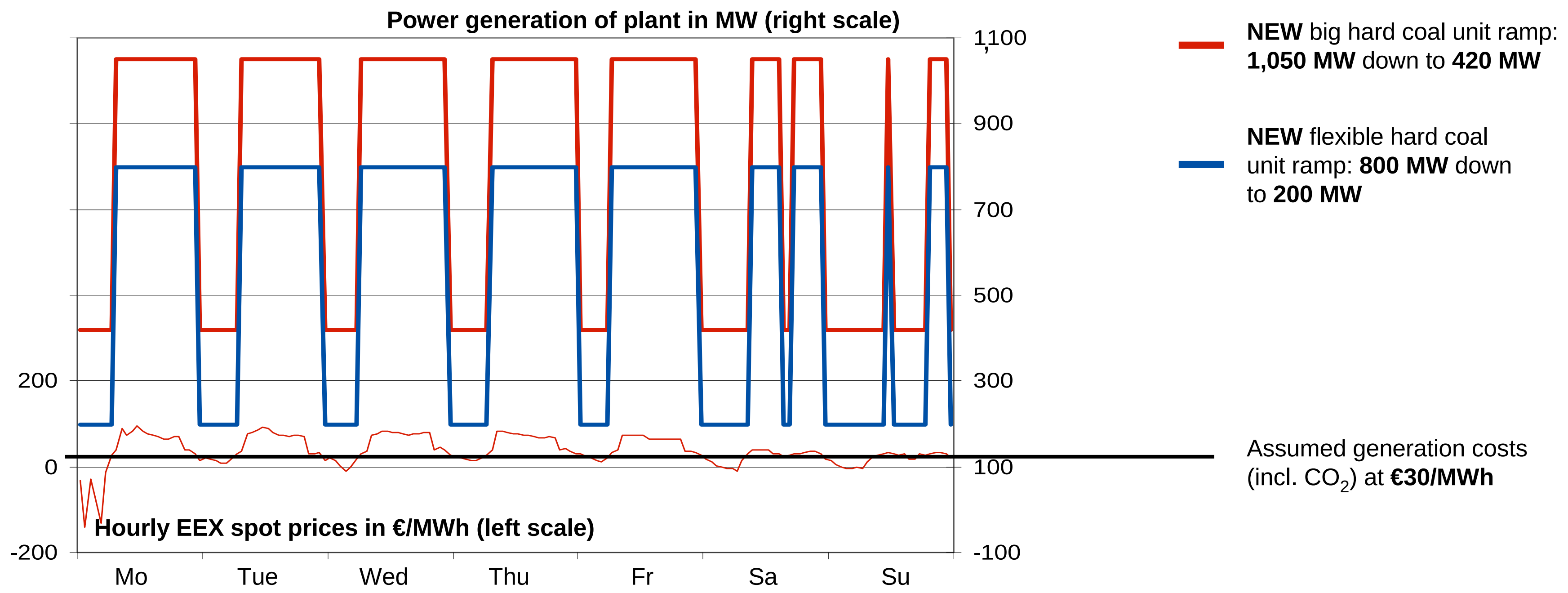


> In a standard spot price environment without negative prices the **flexible unit already obtains about 6% higher returns per MW installed than a new big one.**

Source: RWE.

Flexible hard coal vs. big hard coal in a volatile price scenario

NEW flexible hard coal unit vs. NEW big less flexible hard coal unit



> In a more volatile spot price environment with negative prices and some hours being just slightly “in-the-money” (even with in this case lower assumed generation costs of €30/MWh) the **flexible unit obtains about 10% higher returns per MW installed compared to the bigger, but less flexible unit.**

Source: RWE.

The previous simplified examples explain a lot, but it's not the full story

The more new hard coal blocks will have to run in mid merit or even peak, the more important their start-up specifications become

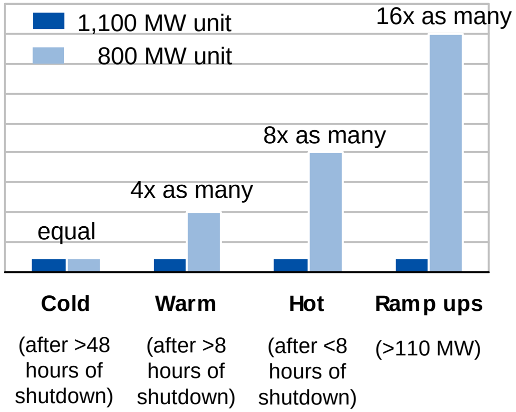
Previous scenarios presented exclude additional effects from

Start-up costs

Instead of just ramping down old and inflexible power plants, one could also decide to shut them down completely, e.g. overnight. However, start-up costs after a complete shutdown are very important and much higher for old hard coal units, as well as new bigger units compared to a new smaller and flexible block

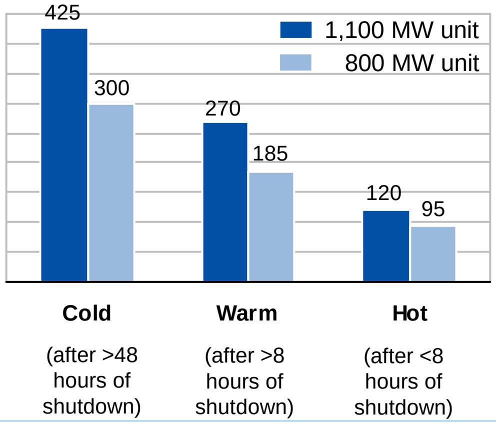
Possible number of start-ups…

…over the lifetime of the plants



Ramp-up time

…in minutes between first ignition and 100% load

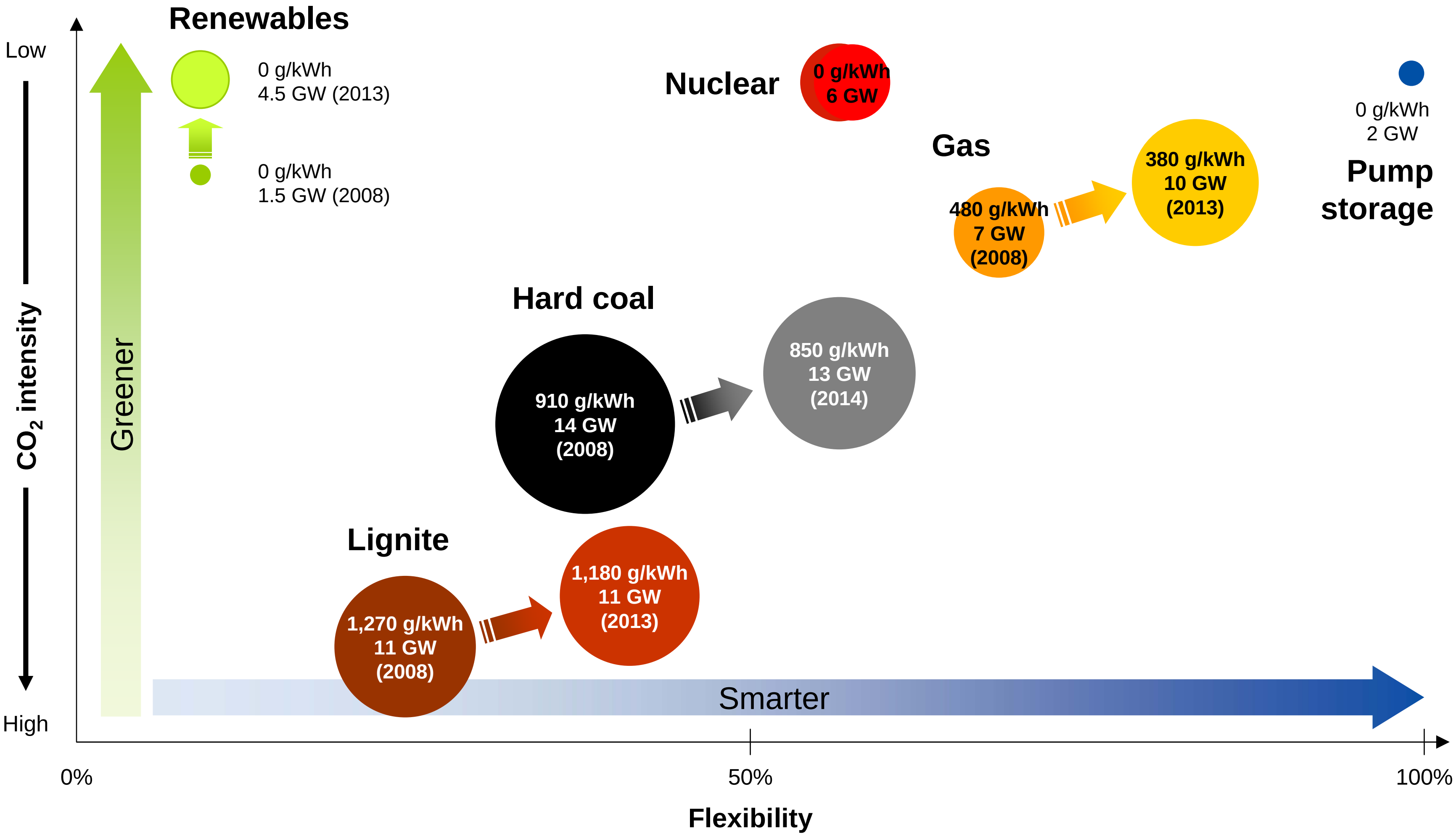


Source: RWE.

Conclusion for RWE

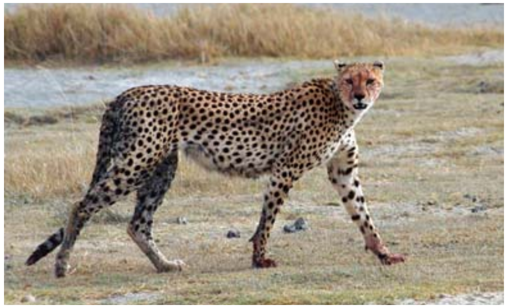
The energy to lead

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

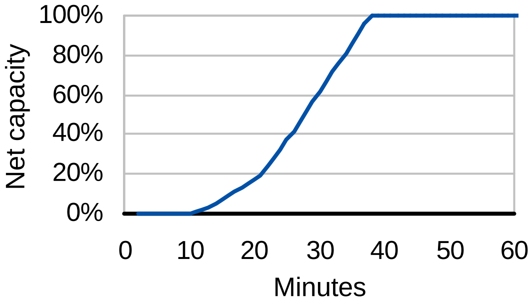


RWE’s strategy to fetch flexibility premia is threefold

Sprinting



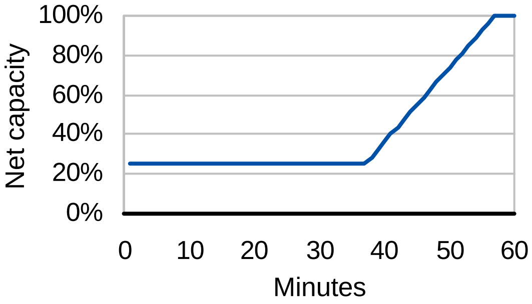
Ramp capacity **CCGT** Lingen[1]



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

Lurking

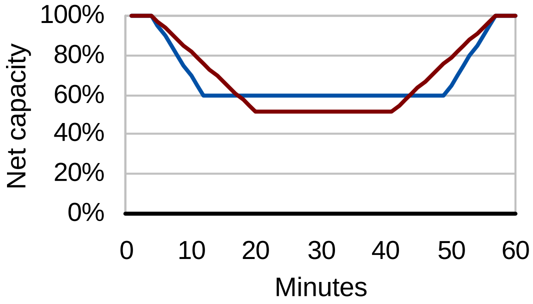
Ramp capacity **hard-coal** plant Hamm



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

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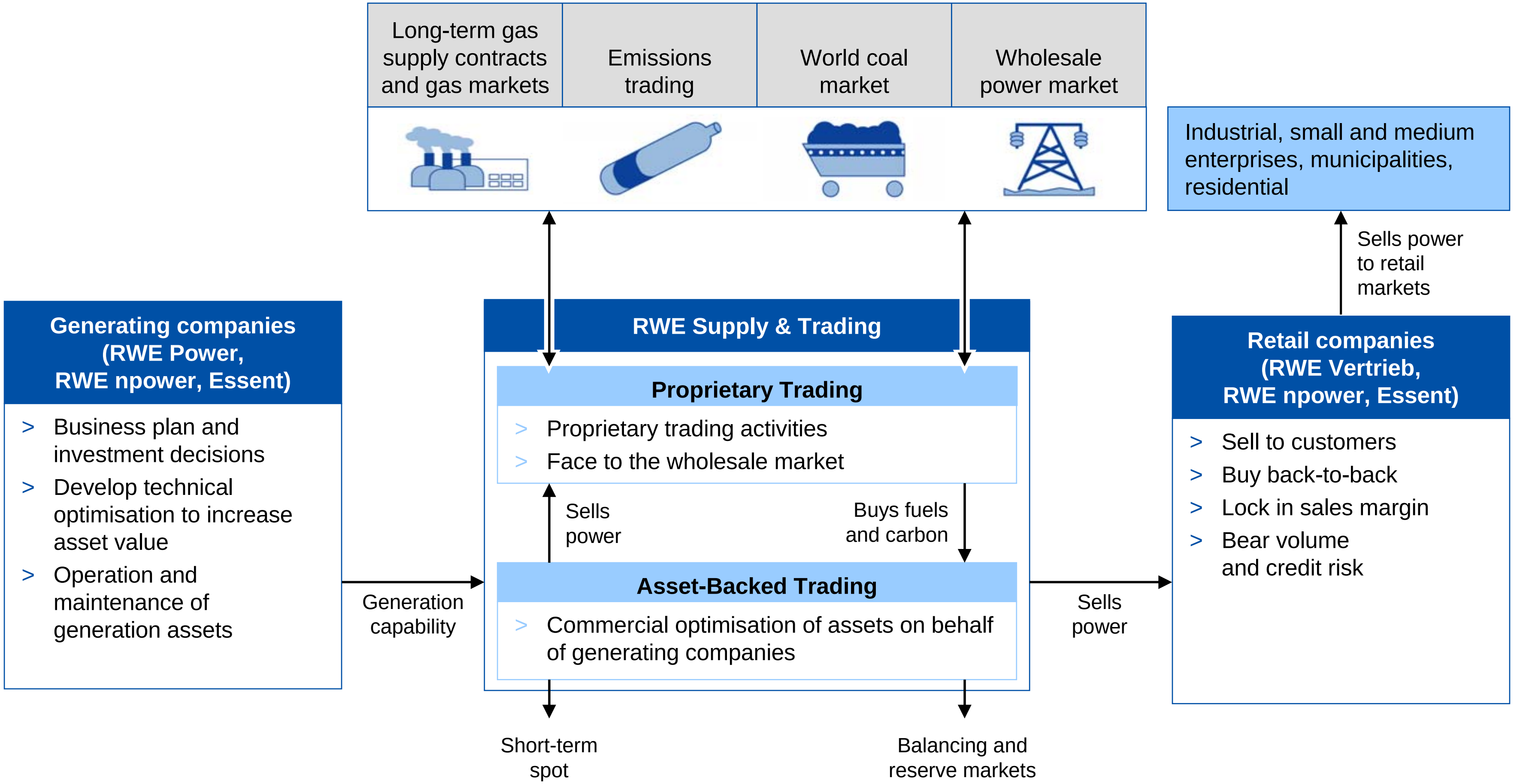
[1] Unrestricted start-up concept until 12 hours after shutdown

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



Long-term gas supply contracts and gas markets	Emissions trading	World coal market	Wholesale power market

Industrial, small and medium enterprises, municipalities, residential

Sells power to retail markets

Generating companies (RWE Power, RWE npower, Essent)

- Business plan and investment decisions
- Develop technical optimisation to increase asset value
- Operation and maintenance of generation assets

Generation capability

RWE Supply & Trading

Proprietary Trading

- Proprietary trading activities
- Face to the wholesale market

Sells power

Buys fuels and carbon

Asset-Backed Trading

- Commercial optimisation of assets on behalf of generating companies

Short-term spot

Balancing and reserve markets

Sells power

Retail companies (RWE Vertrieb, RWE npower, Essent)

- Sell to customers
- Buy back-to-back
- Lock in sales margin
- Bear volume and credit risk

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_2 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_2 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