

Political Developments in the German Lignite Industry and Technology Responses –

From Power Plant Flexibility to Alternative Uses of Lignite

ENERGY24 Congress / Katowice – 11th/12th December 2018

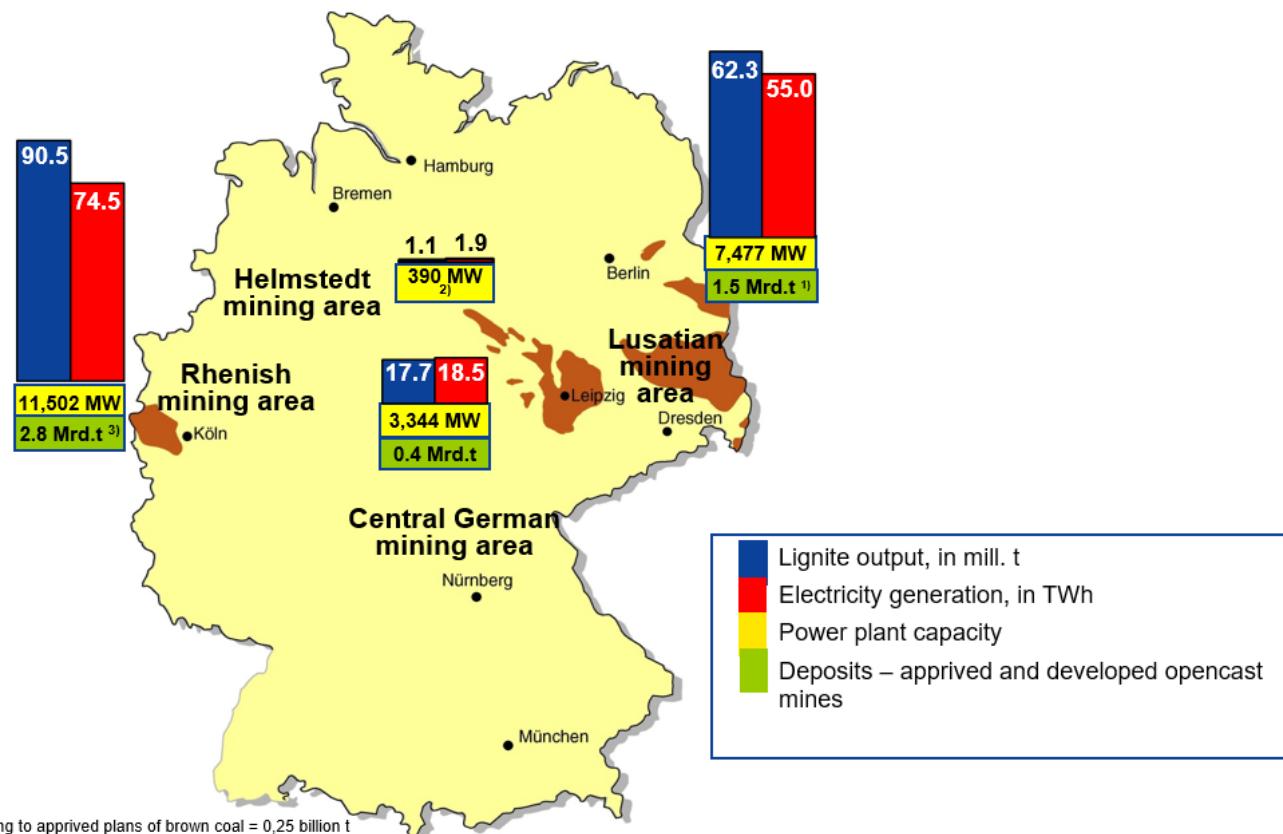
Presentation by Dr. Thorsten Diercks,

General Director / German Lignite Industry Association (DEBRIV)

Lignite mining and lignite use in Germany

Large lignite resources, modern opencast mines and power plants ensure security of supply

2016

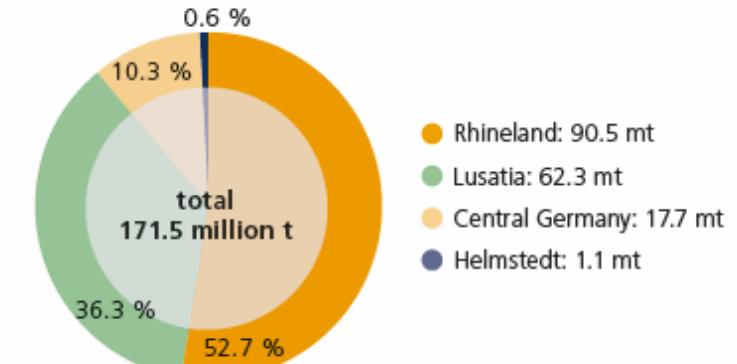


¹⁾ Amount of usable storage according to apprived plans of brown coal = 0,25 billion t

²⁾ Standby since 01.10.2016

³⁾ Based on a decision of the federal state North Rhine-Westphalia made in 2016 the approved reserves will be diminished by 0.4 bn t

Lignite production according to mining areas



Utilisation of lignite 2016

Mining areas	use ¹⁾		
	Generation of electricity and heat	Refining	Others ²⁾
in million t			
Rhineland	80.4	9.8	0.2
Lusatia	58.6	3.7	0.0
Central Germany	16.4	0.7	0.6
Helmstedt	1.6	-	-
Germany	156.9	14.2	0.8

¹⁾ Deviations between production and utilisation caused by change in stocking and deliveries between the mining areas

²⁾ without deliveries to other lignite companies

Lignite contributes to German and European energy transition

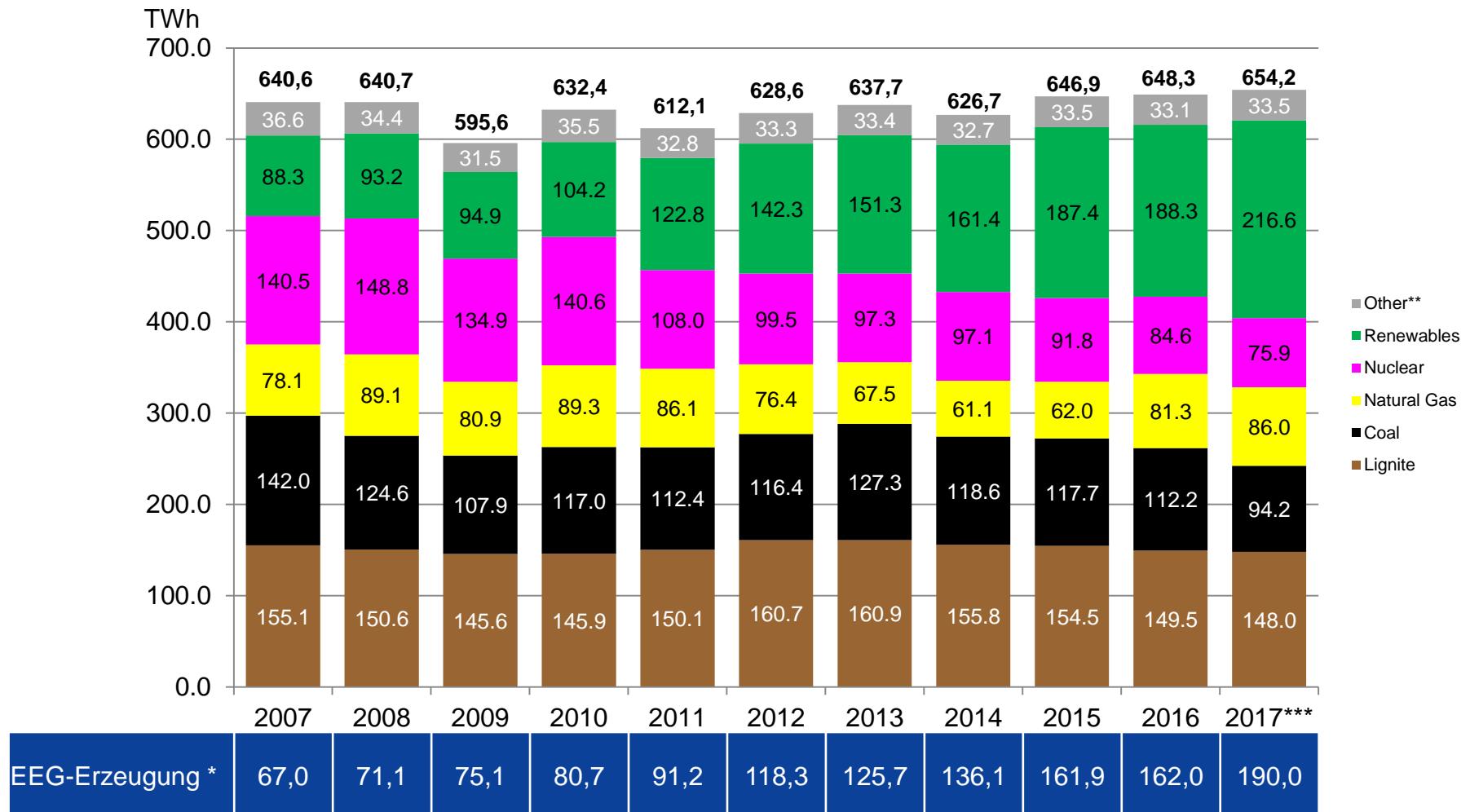
The energy transition requires:

- Maintaining **security of supply** in the framework of the internal market despite volatile renewables and lack of electricity/energy storage.
- **Flexible adaption** to the fluctuating production of renewables and thus stabilizing the electricity grid.
- **CO₂ reduction** in line with European and national targets.



➤ Lignite provides a significant contribution to a safe, cost effective, flexible power supply and contributes above average to the CO₂ reduction.

In 2017, lignite contributed 23 % to German gross electricity generation



* amount of electricity required by EEG (Renewable Energy Law)

** including oil

*** provisional, estimated

Source: AG Energiebilanzen e. V., BDEW, www.eeg-kwl.net

December 21, 2017

Commission on „Growth, Structural Change and Employment“



Work Programme – most important items

- Energy policy: Respect the triangle (secure supply, competitiveness and sustainability/ climate protection)
- Create new and future-oriented employment in the regions concerned
- Measures to definitely achieve the 1990/2030 climate target of -55%; this means -61/-62% for the electricity sector
- Develop a plan to cease electricity production from coal – including a final point in time

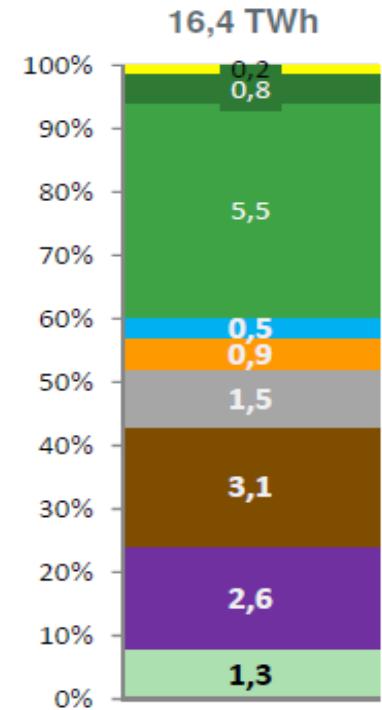
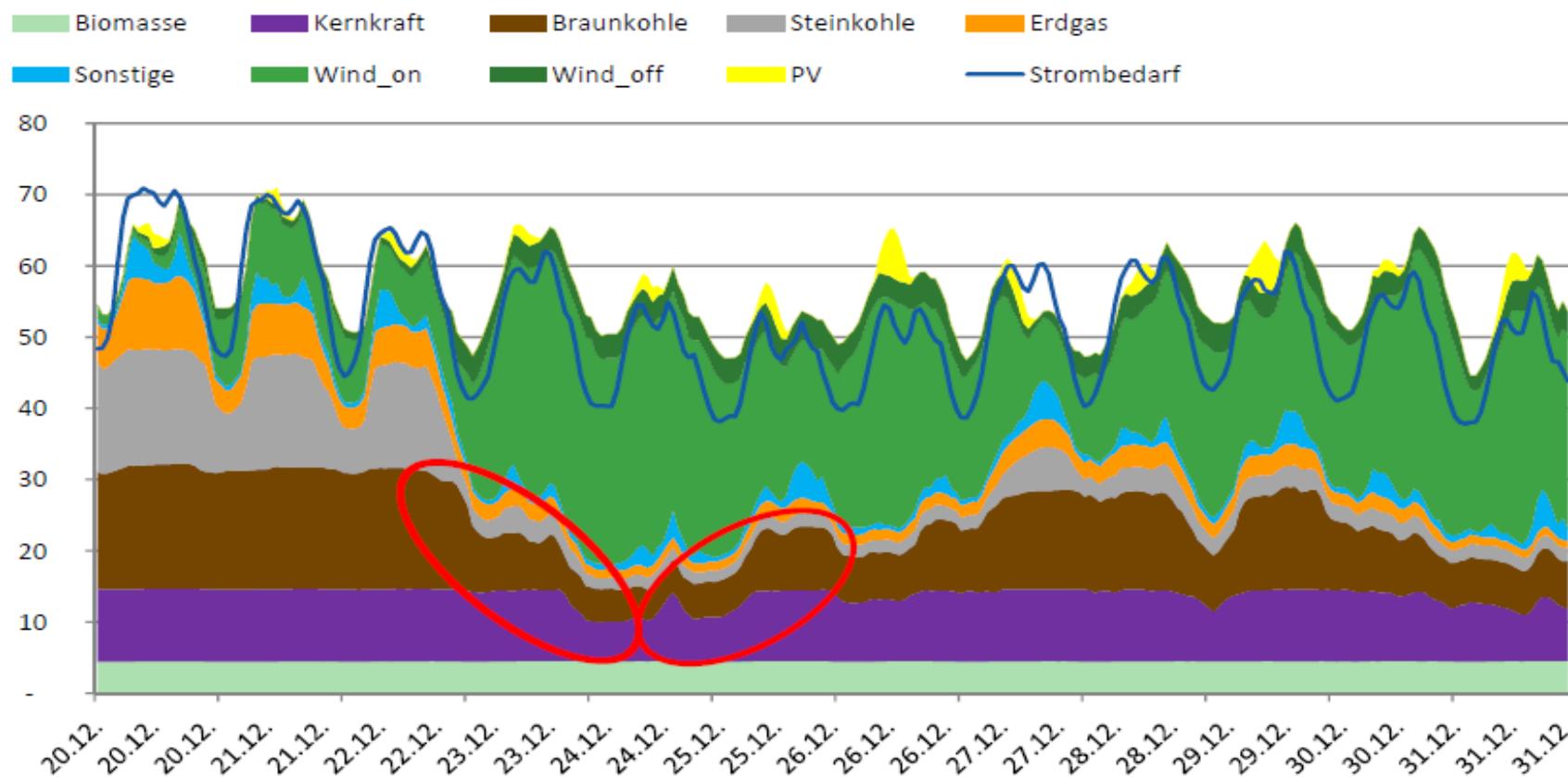
Commission on „Growth, Structural Change and Employment“

Political situation on December 11, 2018

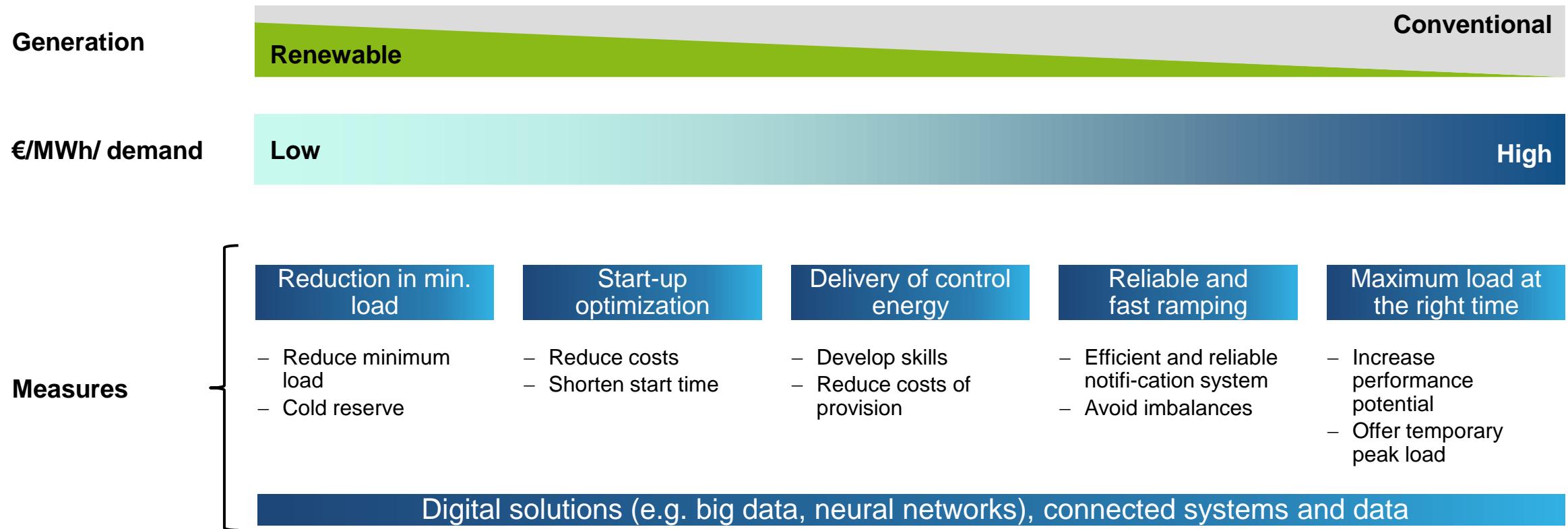
- Länder's Prime Ministers' letter to Mrs Merkel led to a delay: Call to respect the regional, social and industry issues; **do not just focus on GW to be decommissioned**
- Final „Commission“ Plenary Meeting on **February 1, 2019**. Recommendation to the Federal Government by 2/3 of the members – or „no recommendation“
- New WG within the „Commission“ will **clearly define structural measures in the regions**
- Energy intensive industry calls to limit the electricity price increase, if necessary via **State Aid**
- DEBRIV still wants a **fair burden sharing** with regard to climate measures and proposes to start the structural change quickly while **respecting the lignite mining plans accepted by the regions** and by the Länder

Lignite will continue to be indispensable over the long term to provide secured capacity

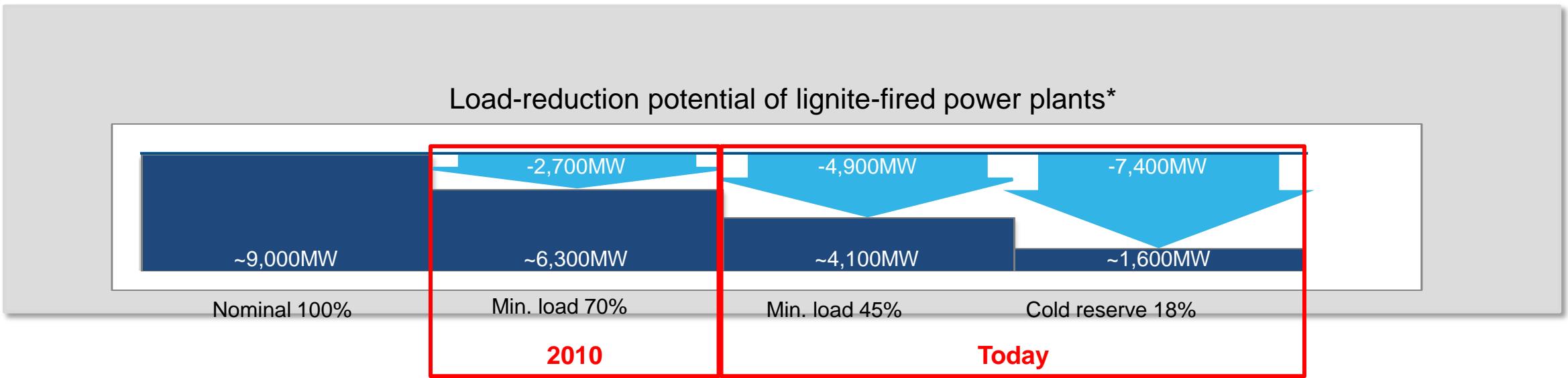
Electricity generation mix 20th – 31st December 2017: Lignite delivers reliable and flexible



Flexible power plants remain vital part of the foreseeable energy transition



Demand-driven use of various options for load reduction



Nearly doubling the load-reduction-potential to minimum load (70 → 45%):

- Load change of ± 4,900MW within < 60 min. using standard gradients**

Further load reduction by using the full cold reserve potential to ~19% of nominal capacity

- Reduction in generation by a further 2,500MW by maximum shutdown of units
(only must-run remaining)

Ongoing efforts to further optimize the potential for load reduction

Load-reducing potential increased significantly.
The fluctuating feed-in of renewable energies can be compensated in a wide range.

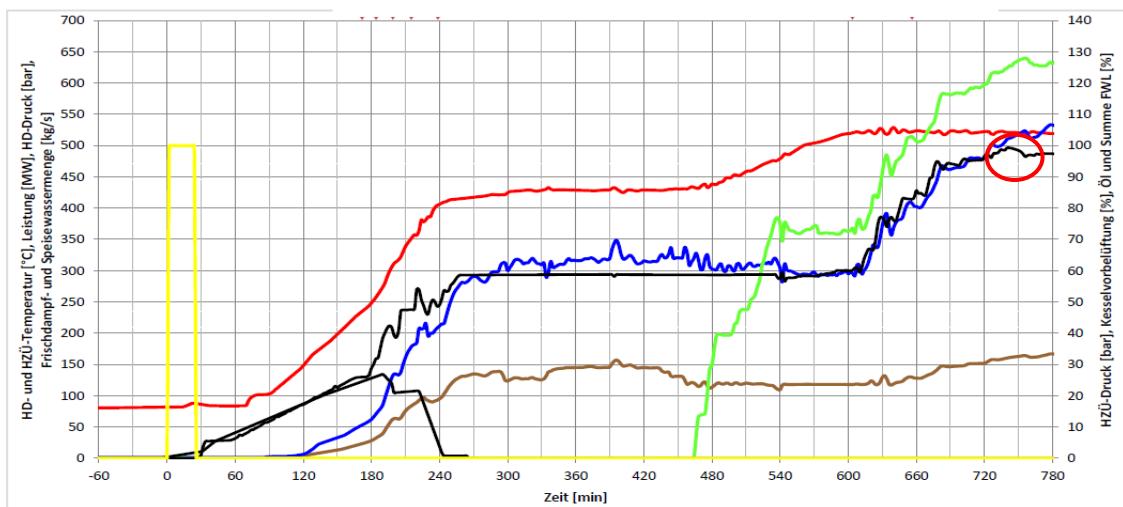
Start-up optimization

Goals:

- Minimizing the costs and duration of start-up
- Increasing reliability for dispatch

Cold start 2010:

- Max. load after > 10h
- High consumption of ignition-oil

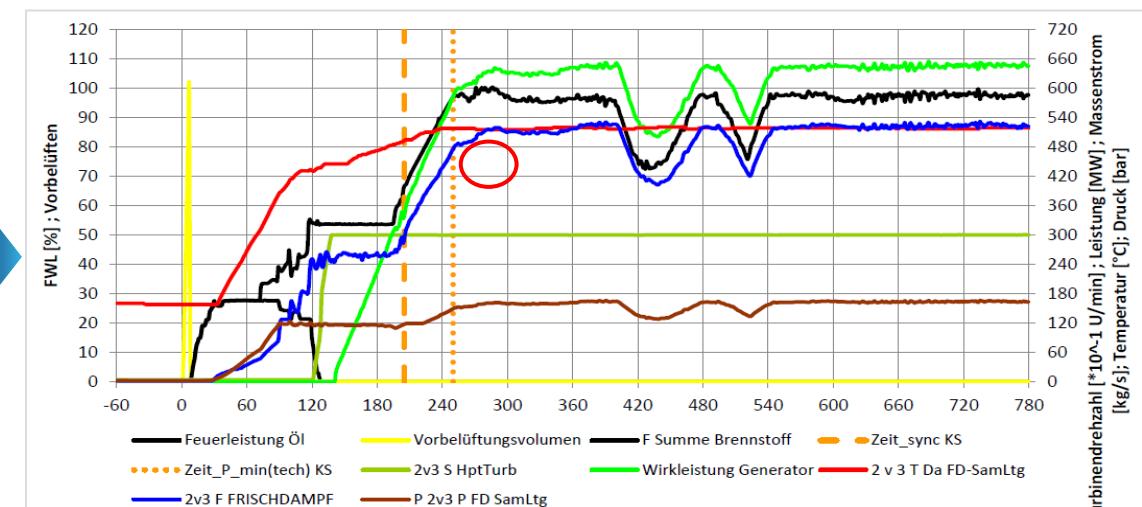


Approach:

- Detailed, systematic process analyses
- Identification of action priorities
- Ensuring sustainability

Cold start 2017:

- Max. load after < 5h
- Ignition oil ~ 50%

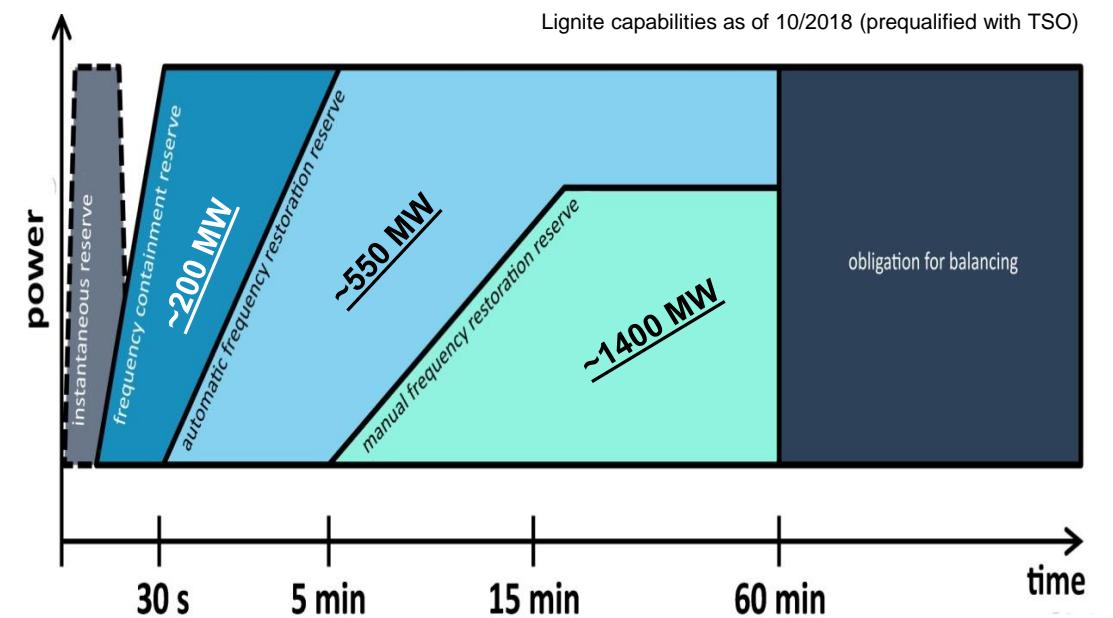


Time and ignition fuels for start-up reduced by 50%.

Delivering control energy and therefore system services

In Germany, delivering control energy in the case of high renewable generation is an important feature of lignite and may offer a "second pillar" in the market.

- Skills for the provision of control energy have been significantly expanded.
- Expansion of capabilities achieved particularly through Instrumentation & Control modernization.
- Costs of control-energy provision are continuously reduced.



Technical measures taken

Reduction in minimum load

- Modernization of control technology and control structures to ensure stable and controllable operation
- Trial runs on each unit to test the minimum possible load point (stable fire)
- Thermal engineering studies to confirm the new minimum load points (proof of economiser- and evaporator-stability = secured flow through water-tubes)

Start-up optimization

- Detailed optimization of the I&C sequences, e.g parallel processing of process steps (instead of sequential) and increase of the degree of automation
- Questioning of procedural boundary conditions and restrictions, e.g. increase of permissible warm-up rates, secured by life-cycle calculations
- Improved and preventive maintenance, especially of the ignition burner systems, to increase reliability

Conclusions

The German lignite industry combines industrial value creation and security of supply with climate protection.

- Lignite is a base-load power producer and guarantor of electricity supply for industry and citizens at competitive prices.
- Lignite-based electricity generation complies with the EU's climate protection targets, particularly the ambitious EU ETS cap. Additional measures such as EPS, CO₂ taxes or any exclusion from possible capacity markets are neither necessary nor useful.
- Already, our power plants are flexible partners of the renewable energy sources. The energy transition and lignite are not at odds with each other.
- With our projects we are preparing for a long-term future. We invest in R&D to contribute to the EU's security of supply and climate protection targets also in the future; we create new lignite application options.

Backup

How lignite contributes to society ...

... and what we would see without it:

Important contribution to **security of electricity supply - "24/7"**

Less supply security due to elimination of ¼ of secure supply

Limits electricity prices significantly and contributes to **securing industrial value chains** in Germany

Increase in industrial electricity prices. Power-intensive industries - with more than 1 million workers in Germany – are losing competitiveness.

Limits Germany's dependence on gas supplies from only a few states

If gas capacities are added, **increased gas imports are necessary**

Has **provided reductions of CO₂ emissions** like barely any other industry; this will also be done in the future according to the EU ETS

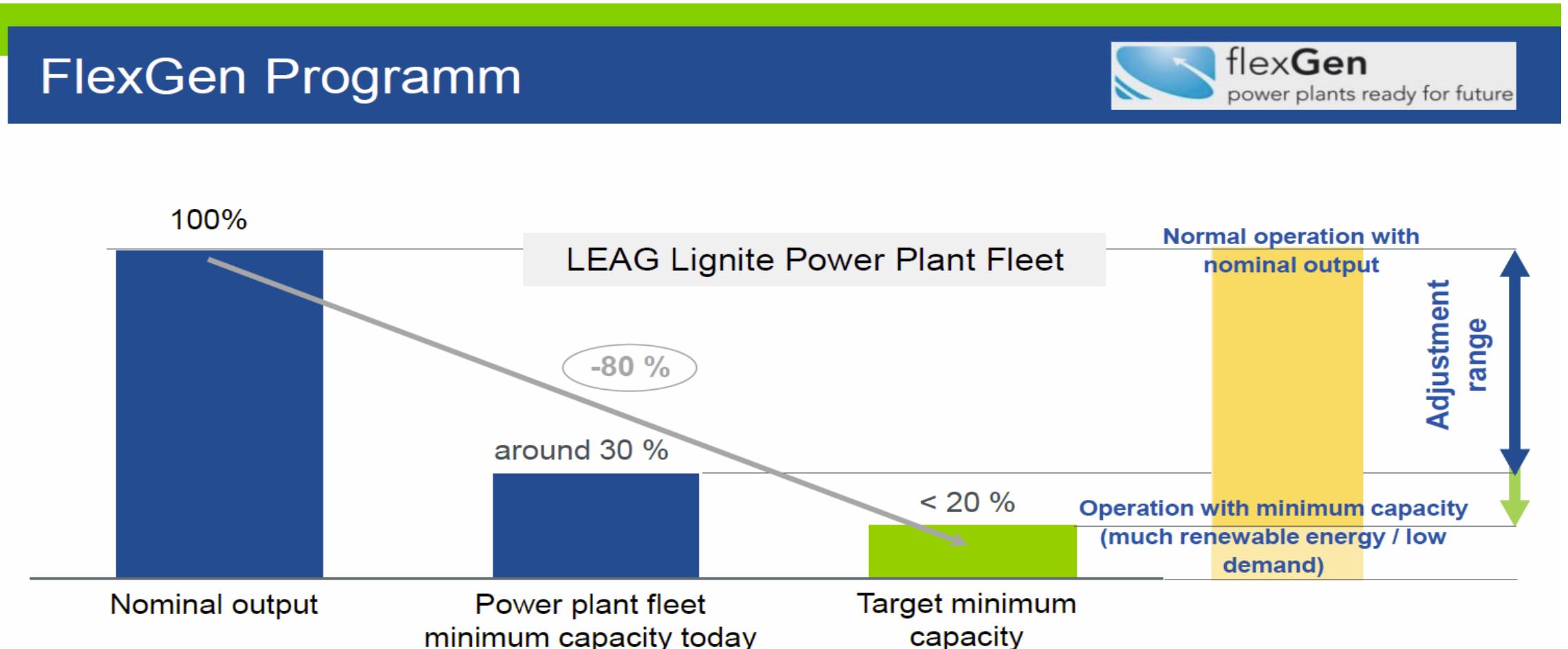
Which CO₂ emissions are produced throughout the entire production chain **of substitutive production?**

Creates work in the – economically weak - **regions** and advances these regions

Brown coal regions change negatively; State subsidies for the regions will not be able to quickly replace the added-value effects of mining, energy producers, energy-intensive industries and their suppliers. **Structural change requires long periods!**

How to ensure power plant flexibility

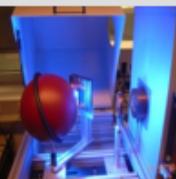
Example LEAG:



Research and Development focusses on current challenges

Example RWE:

1. Stabilize the current business – high performing partner
2. Ensure licence to operate – most trusted partner
3. React to shrinking electricity business – create value-adding products

Power Plant Technology
<ul style="list-style-type: none">• Flexibility enhancement• Performance improvement• Plant concepts• System assessments• Combustion• Co-combustion• Coal quality• Ash landfills• Damage analyses 

Flue Gas Treatment
<ul style="list-style-type: none">• REA+ pilot plant• Dedusting• Desulfurization• NOx –removal• Hg –removal• PCC pilot plants• CO₂ filling station• CCS-strategy, transport & storage 

Fuels
<ul style="list-style-type: none">• Coal preparation and drying• Coal demineralization• Biomass treatment• Coal-water-slurry• Coal-to-Gas• Coal-to-Liquids (CtL/CtG) 



Research and development secure the future viability of our present core business and create new application options

Control energy = System service to the network operator.

In the event of an imbalance between supply and load in the electricity grid, the grid operator calls up control power (to ensure constant frequency 50 Hz).

"instantaneous reserve" = inertia of the rotating masses (generator and turbine counteract the frequency drop. No "real" control power/system services

FCR = frequency containment reserve = primary control power:
approx. 200 MW available in RWE lignite fleet (1/3 of German demand)
Full amount to be provided no later than 30sec after frequency drop

aFRR = automatic frequency restoration reserve = secondary control power
approx. 550 MW available in RWE lignite fleet (1/3 of German demand)
To be provided in full no later than 5 minutes after request by network operator

mFRR = manual frequency restoration reserve = minute reserve or tertiary control power
approx. 1400 MW available in RWE lignite fleet (approx. 100% of German demand)
To be provided in full no later than 15 minutes after request by network operator

Expansion of capabilities achieved in particular through I&C modernization.

"unique feature in case of high renewable generation" means that with a high feed-in of renewable energies only lignite-fired power plants (and nuclear power plants) are connected to the grid and can provide control power.