LIGNITE INDUSTRY IN GERMANY AND ITS LONG-TERM CONTRIBUTION TO A TRANSFORMATION OF THE ELECTRICITY SYSTEM

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Domestic lignite: large resources, modern opencast mines and power plants in 2016

- **Rhenish mining area**: 7,477 MW, 2.9 Mrd. t
- **Helmstedt mining area**: 11,502 MW, 0.4 Mrd. t
- **Central German mining area**: 3,344 MW, 1.5 Mrd. t
- **Lusatian mining area**: 62.3 TWh, 55.0 MW, 1.5 Mrd. t

**Lignite output**, in mill. t
- **Electricity generation**, in TWh
- **Power plant capacity**
- **Deposits – approved and developed opencast mines**

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1) Amount of usable storage according to approved plans of brown coal = 0.25 billion t
2) Power plant: Standby since 01 Oct 2016
Status: 02/2017 – data preliminary, partly estimated
### Power generation Mix in Germany, 2002 and 2016

<table>
<thead>
<tr>
<th>Source: Arbeitsgemeinschaft Energiebilanzen</th>
<th>Data: 15. August 2017</th>
</tr>
</thead>
</table>

#### Total Power Generation

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Power Generation Mrd. kWh</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>586,7</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>648,3</td>
<td>+ 10,5%</td>
</tr>
</tbody>
</table>

#### Generation Mix

<table>
<thead>
<tr>
<th>Source</th>
<th>Year</th>
<th>Mrd. kWh</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear</td>
<td>2002</td>
<td>164,8</td>
<td>28,1%</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>167,5</td>
<td>25,8%</td>
</tr>
<tr>
<td>Coal</td>
<td>2002</td>
<td>292,6</td>
<td>49,9%</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>261,5</td>
<td>40,3%</td>
</tr>
<tr>
<td>Oil/Gas</td>
<td>2002</td>
<td>84,6</td>
<td>13,1%</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>86,4</td>
<td>13,3%</td>
</tr>
<tr>
<td>Hydro</td>
<td>2002</td>
<td>65,0</td>
<td>10,0%</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>23,7</td>
<td>3,2%</td>
</tr>
<tr>
<td>Wind/Solar/Biomass/Waste</td>
<td>2002</td>
<td>27,8</td>
<td>4,7%</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>20,5</td>
<td>3,2%</td>
</tr>
</tbody>
</table>

#### Notes
- Coal + Gas/Oil: 261,5 + 86,4 = 347,9 Mrd. kWh, which is 53,7% of total power generation.
## Energy policy targets of Germany

Issued 28. September 2010; addition June 2011, status August 2017

<table>
<thead>
<tr>
<th></th>
<th>2016 1)</th>
<th>2020</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary energy</td>
<td>- 6,5 %</td>
<td>- 20 %</td>
<td>- 50 %</td>
<td></td>
</tr>
<tr>
<td>consumption (2008)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of renewables</td>
<td>15 %</td>
<td>18 %</td>
<td>30 %</td>
<td>60 %</td>
</tr>
<tr>
<td>in gross final</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>energy consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>- 3,8 %</td>
<td>- 10 %</td>
<td>- 25 %</td>
<td></td>
</tr>
<tr>
<td>(2008)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of renewables</td>
<td>31,7 %</td>
<td>35 %</td>
<td>50 %</td>
<td>80 %</td>
</tr>
<tr>
<td>in electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greenhouse gas</td>
<td>- 27,6 %</td>
<td>- 40 %</td>
<td>- 55 %</td>
<td>- 80 – 95 %</td>
</tr>
<tr>
<td>emissions (1990)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear phase-out *</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EEG levy *</td>
<td>6.354 ct/kWh</td>
<td>≤ 3.5 ct/kWh</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Addition from June 2011; 1) estimated, preliminary

Status: 15. August 2017
Energy debate focussed on CO\textsubscript{2} and national targets

- **Action Programme Climate Protection 2020**
  - Ambition: THG emissions - 40 % 2020, Actual 2016 ≈ - 26 %

- **Climate Protection Plan 2050**
  - Ambition: THG emissions - 80/95 %
  - Interim stage 2030 - 55 % THG
  - Only achievable by massive interventions and if all sectors were included - energy, transport, industry, agriculture, buildings.

Comprehensive "anti-coal campaign" of NGO's, Greens and Gas Industries. But no majority against coal at CDU, SPD, FDP, who accept the coal in transition period.
EU-ETS: The key instrument designed for the long term

- Early action 1990 – 2005
- CO₂ reduction of the sectors covered by ETS today
- EU - 11.1 % essentially new members
- Germany 19.7 % essentially former DDR

Decision 2009
2266
- 1.74 %/a
- 21 % Base 2005

Decision 2014/15
1789
- 2.2 %/a
- 43 % Base 2005

1306
Economic Goals of Germany’s Federal Government for the Electricity Industry

The Federal Government’s Objectives under the Coalition Agreement:
Proportion of Renewables: In 2020: min. 35 %, in 2025: 40 % - 45 %; in 2035: 55 % - 60 %
Gross Electricity Consumption: Stable at 600 TWh

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April 15, 2015
One of the biggest challenges facing the energy sector became apparent in January 2017. There was a windless period with hardly any sun. The high installed capacity of wind onshore (approx. 46 GW), wind offshore (approx. 4 GW) and solar (approx. 42 GW) is not very useful without sufficient supply from renewable sources. Even if three times as much wind capacity had been installed, the plants would have produced almost no electricity in these weather conditions. Existing RES technologies can not guarantee a reliable, uninterrupted supply. As long as no solution to this problem is found, coal and gas power plants are still needed.
Reliable and available capacity power is becoming short

Authorization scenario for network development plans 2017-2030 *

Simultaneous feed-in Wind and PV 2015 minimum value 0,35 GW maximum value 42,50 GW

Rising load

* Authorization scenario for network development plans 2017-2030, lignite DEBRIV; 2030 without security (2,7 GW) top value, without Weisweiler (1,8 GW) and Jänschwalde (1,9 GW) lower value; 2035 if necessary new building Jänschwalde if necessary in addition 1 GW - CCS

13. January 2017
Economic Targets of Germany’s Federal Government for the Electricity Sector

The Federal Government’s objectives under the coalition agreement:

- Share of renewables: In 2020: min. 35 %, in 2025: 40 % - 45 %, in 2035: 55 % - 60 %
- Gross electricity consumption: Stable at 600 TWh

1) Security from 1. October 2016 – 1.5 GW Rhineland, 1.0 GW Lusatia, 0.4 GW Helmstedt
2) Phase-out locations Weisweiler/Inden (approx. 1.8 GW), Jänschwalde (approx. 1.9 GW); Jänschwalde if necessary new building 1 GW with CCS

13. January 2017
Security of supply is the most important question during transformation of the German power system. The decision to face out nuclear and to base the future generation system mostly on wind and photovoltaic leads toward the question how to maintain security of supply.

1. Wind and photovoltaic generation can stay over some month at very low levels and sometimes power input is close to zero. Security of supply can only be maintained in the next decades by two systems for one task. One side renewable capacity, the other side power plants which are available all year using gas, hard coal or lignite. This is the reasonable and economic pathway to maintain security of supply.

2. German lignite is the only energy carrier, which is long term available and competitive. This is essential for the whole industry. Lignite mining and power generation is very important for mining regions.

3. Power generation in Germany based on coal will decrease in a way that is fully compatible to the ambitious CO₂ targets in Germany and Europe. CO₂ emissions in Europe are regulated under the EU ETS. Interventions on national level have no influence on the CO₂ emissions in the Union and are of big disadvantage for Germanys competitive position.
International conference:
Coal in the period of energy transformation
August 29, 2017; Katowice

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