Coal and environment – a case study

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Structure

• Coal’s relevance today and tomorrow
• Challenge for the future of coal
• Coal usage at German Vattenfall
• Using coal, but avoiding carbon dioxide
• Activities to gain acceptance for CCS
• Requirements for a legal framework
Coal’s relevance today and tomorrow

Lignite in Germany

Nearly a quarter of the power demand in Germany is covered by lignite. Lignite is mined without subsidies in opencast mines and converted with high security and high environmental standards to power and heat in nearby power plants.

Gross Energy Generation 2009 in Germany

- Lignite: 24%
- Nuclear energy: 23%
- Hard coal: 18%
- Renewables: 16%
- Natural gas: 13%
- Other: 6%

Source: BDEW, 01/2010
Coal’s relevance today and tomorrow

Outlook: development of global energy mix

![Graph showing the development of global energy mix from 1980 to 2030. The graph includes the following energy sources: Other renewables, Biomass and waste, Hydropower, Nuclear power, Gas, Oil, and Coal. The chart indicates a significant growth in coal's relevance, with a +62% increase from 1980 to 2005 and a +73% increase from 2005 to 2030. The chart also shows a +51% growth in the sum of coal, oil, and gas from 1980 to 2005 and a +57% increase from 2005 to 2030.]

Role of coal in the future

- Coal is needed to meet the global energy demand. And the use of coal for example in India and China will even increase.
- Also Germany cannot refrain from lignite as the only domestic fossil energy source that can be extracted in large amounts without subsidies.

It is not in question, ”if“ coal will be used in the future, but ”how“ we are going to use it.
CO₂ emissions: Targets for reduction are set

**European Union (EU):**
- Kyoto target for EU-15 (1997): reduction of 8 per cent until 2012*
- Target for EU-27 (2007): decrease of CO₂ emissions by 20 per cent until 2020*
- If other big countries join emission trading, goal rises to 30 per cent*

**Germany:**
- Kyoto target of 21 per cent reached* (burden sharing within EU-15).
- Meseberg 2007: decrease of CO₂ emissions by 30 per cent until 2020*
- Meseberg target rises to 40 per cent, if EU sets goal of 30 per cent*

*) reduction compared to 1990
### Lignite Reserves and 2nd Lusatian Seam

#### Approved mining fields
<table>
<thead>
<tr>
<th>Field</th>
<th>Reserves (mill. t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jänschwalde</td>
<td>135.5</td>
</tr>
<tr>
<td>Cottbus-Nord</td>
<td>32.2</td>
</tr>
<tr>
<td>Welzow-Süd</td>
<td>387.7</td>
</tr>
<tr>
<td>Nochten</td>
<td>365.2</td>
</tr>
<tr>
<td>Reichwalde</td>
<td>366.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,286.8</strong></td>
</tr>
</tbody>
</table>

#### Continuation
<table>
<thead>
<tr>
<th>Field</th>
<th>Reserves (mill. t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welzow-Süd, sub-field part II</td>
<td>210</td>
</tr>
<tr>
<td>Nochten, priority area</td>
<td>300</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>510</strong></td>
</tr>
</tbody>
</table>

#### Future coal field
<table>
<thead>
<tr>
<th>Field</th>
<th>Reserves (mill. t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jänschwalde-Nord</td>
<td>250</td>
</tr>
</tbody>
</table>

#### Reserves 2nd Lusatian seam
- **ca. 12.1** bill. t
- Of it commercially exploitable: **3.6** bill. t

- Spreading of 2nd Lusatian seam
- Depleted seam areas

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### Coal usage at German Vattenfall

#### At a Glance

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lignite mining</strong></td>
<td>55.7 mill. t</td>
</tr>
<tr>
<td>Jänschwalde opencast mine</td>
<td>11.9 mill. t</td>
</tr>
<tr>
<td>Cottbus-Nord opencast mine</td>
<td>6.4 mill. t</td>
</tr>
<tr>
<td>Welzow-Süd opencast mine</td>
<td>21.1 mill. t</td>
</tr>
<tr>
<td>Nocthen opencast mine</td>
<td>16.3 mill. t</td>
</tr>
<tr>
<td><strong>Lignite-fired power plants</strong></td>
<td>7,420 MW</td>
</tr>
<tr>
<td>Jänschwalde</td>
<td>3,000 MW</td>
</tr>
<tr>
<td>Boxberg</td>
<td>1,900 MW</td>
</tr>
<tr>
<td>Schwarze Pumpe</td>
<td>1,600 MW</td>
</tr>
<tr>
<td>Lippendorf (50% Shares)</td>
<td>920 MW</td>
</tr>
<tr>
<td><strong>Power generation (gross)</strong></td>
<td>50 TWh</td>
</tr>
</tbody>
</table>

State: 12/2009
Using coal, but avoiding carbon dioxide

Developing CCS

Capture
CO₂ Sequestration

Transport
CO₂ Pipeline

Storage
Geological Storage

Target: Parallel development of technology for carbon dioxide capture and storage.
Using coal, but avoiding carbon dioxide

Development of CO$_2$ sequestration

Picture: Vattenfall’s Pilot Plant, Schwarze Pumpe

- **CEBra (CB)**
  - 0.5 MW$_{th}$
  - 2006

- **ADECOS (DD)**
  - 0.05 MW$_{th}$
  - 2005

- **Pilot Plant (Schwarze Pumpe)**
  - 30 MW$_{th}$
  - mid 2008

- **Demo Plant**
  - ca. 300 MW
  - ca. 2015

- **Commercial Plant**
  - after 2020
Using coal, but avoiding carbon dioxide

Possible storage sites for demo phase

Birkholz and Neutrebbin:
- Identified as two promising structures for a CO₂ storage demonstration project by Vattenfall in 2007.

Distance to demo plant:
- 50/100 km pipeline transportation from the Oxyfuel & Post-combustion capture demo at the Jänschwalde power plant.

Storage horizon:
- Sandstones of the Middle Buntsandstein formation at approx. 1,300 m depth
- Cap-rock: Several hundred meters of mudstone.

Storage volume:
- Total volume to be injected 50 Mton of CO₂ (base-case).
Using coal, but avoiding carbon dioxide

Next step: exploring the geological formation

Vattenfall needs to explore the potential storage sites

- to be able to evaluate the suitability of the geological formations;
- to be able to answer open questions on a valid basis;
- as an essential step towards a permit procedure for later CO$_2$ storage.
Using coal, but avoiding carbon dioxide

But the region is concerned

The planned exploration is discussed highly emotional:

- Concerned people in the region reject all activities connected with potential CO$_2$ storage;
- To fight exploration appears to them as the first step to prevent later CO$_2$ storage.

Gaining acceptance in the region is the key for success of the whole demo project.
Activities to gain acceptance for CCS

Vattenfall’s activities in the region I

Dialogue with the region:
- Local information campaign (mailing, advertising, roadshow);
- Increased regional presence (information centre Beeskow);
- Telephone hotline.

Dialogue with important stakeholders:
- E-mail newsletter with general information on CCS and on the project;
- continuous contact program;
- Ca. 700 national and international guests in information centre Beeskow.
Activities to gain acceptance for CCS

Vattenfall’s activities in the region II

Giving detailed information:
- Series of lectures by neutral experts in the information centre Beeskow;
- Internet platform (www.vattenfall.com/ccs);
- Different brochures for different stakeholders.

Enabling employees to argue for CCS:
- Comprehensive information via intranet, employees magazine or specific CCS seminar.
Activities to gain acceptance for CCS

Example: Regional Advisory Board

Regional Advisory Board to accompany the geological exploration in eastern Brandenburg:
– Initiated by the federal government of Brandenburg;
– Board comes together every four weeks;
– Since July until now four sessions held;
– The board is professionally moderated.

Function of the Board:
– Accompanying the exploration;
– Supervising the results of the exploration to care for maximal transparency.

17 decision-making members:
– Representatives of both exploration regions (Beeskow, Neutrebbin), f. e. major, district administrator;
– Representatives of the citizens‘ initiative against CCS;
– Governmental supervising authority;
– Vattenfall.
Requirements for a legal framework

CCS requires a legal framework

- 5th June 2009 an EU directive on CCS had been published;
- The EU directive should lead to comparable laws for the implementation of CCS in all EU member states;
- In Germany the implementation of a national law on CCS is discussed since last summer;
- German legislation has not enacted a law on CCS by now.

Germany needs a law on CCS soon, to benefit from CCS in the mix with other instruments to avoid CO₂.

The law must ensure the security of storage site AND must enable private investment in the new technique.
Conclusions

• Germany and the world need coal and other fossil fuels to meet the energy demand – today and tomorrow. Parallel we need to reduce CO$_2$ emissions in all sectors.

• CCS enables us and large scale industries to use fossil fuels and to reduce CO$_2$ emissions at the same time. Therefore Germany should develop and use CCS in mix with other instruments.

• Both: Acceptance for CCS by the public and a suitable legal framework are necessary for successful implementation of the new technology.
Thank you for your attention!