Energy in Europe

Dash for Gas versus Widespread Modernisation

Brussels, 24th January 2011
## EURACOAL

European Association for Coal and Lignite

### General Assembly
Coal producers, coal power generators, coal traders, research institutes

### Executive Committee
Discussions, opinion forming, work targets

<table>
<thead>
<tr>
<th>President:</th>
<th>Dr.-Ing. Hartmuth Zeiß</th>
<th>Vice-Presidents:</th>
<th>Phil Garner, Dr. Maksymilian Klank, Prof. Dr. Franz-Josef Wodopia</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Brussels Office:</th>
<th>Committees:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secretary-General:</td>
<td>- Energy Policy Committee:</td>
</tr>
<tr>
<td>Brian Ricketts</td>
<td>Dr.-Ing. George Milojcic – Zygmunt Borkowski</td>
</tr>
<tr>
<td>Team:</td>
<td>- Technical Research Committee:</td>
</tr>
<tr>
<td>Gitta Hulik</td>
<td>Dr.-Ing. Jürgen Czwalinna – Bernd Bogalla</td>
</tr>
<tr>
<td>Marguerite Johnson</td>
<td>- Environment Committee:</td>
</tr>
<tr>
<td></td>
<td>David Brewer – Bernd Bogalla</td>
</tr>
<tr>
<td></td>
<td>- Market Committee:</td>
</tr>
<tr>
<td></td>
<td>Nigel Yaxley – Gitta Hulik</td>
</tr>
</tbody>
</table>

24.01.2011
World coal consumption
+ 40% growth from 2000 to 2010

Mill. tce
0 500 1.000 1.500 2.000 2.500 3.000 3.500 4.000 4.500 5.000

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

China Asia & Australia Africa/Middle East Russia Europe America

Source: BP, Statistical Review of World Energy, June 2010
Schätzung 2010 VdKI
Europe in the past – for example Germany –
7 major utilities

- Electric power supply provided by regional monopolies
- Price controlled by states
- Low level of integration

Source: Uni Hannover, Grundlagen der elektrischen Energieversorgung, Prof. Oswald
Europe today – on the way to a single market

- Unbundling
  - Power generation
  - Transmission
  - Distribution
- Cross border competition
- Increasing integration

A European power market is under development – but still a lot of questions.

Source: www.wikipedia.org
Energy policy objectives in the power sector

Security

Infrastructure
EU power & gas grids
Trans-European Networks (TEN)

Affordable
- Competition
- Market organisation, Unbundling

Energy mix
CCS a CO₂ hedge

Environmentally friendly
- IED – SO₂, NOₓ, dust
- ET – CO₂

Investment is key and shapes the future

Who is responsible for „security“ in the power sector?
Forecast electricity demand
Abbildung 4-1: Stromerzeugung nach Energieträgern in der EU-27 im Referenzszenario

Stromerzeugung (netto) in TWh

Forecast electricity supply
Abbildung 3-6: CO$_2$-Cap für den ETS-Sektor inkl. CDM/JI im 20 %-Szenario, in Mio. t CO$_2$
Electricity demand and share of CO$_2$-free power generation, CO$_2$ cap and specific CO$_2$ emissions in power generation determines the coal-gas mix.
Electricity demand and share of CO\textsubscript{2}-free power generation, CO\textsubscript{2} cap and specific CO\textsubscript{2} emissions in power generation establish coal-gas mix

Example:

**Question:**

Electricity\textsubscript{coal} Electricity\textsubscript{gas} (TWh)

**Known:**

Specific CO\textsubscript{2} emissions: Gas\textsubscript{CO2} = 0.53 kg CO\textsubscript{2}/KWh, Coal\textsubscript{CO2} = 1.00 kg CO\textsubscript{2}/KWh (estimate 2010)

Electricity\textsubscript{fossil}: Estimate 1 500 TWh, CO\textsubscript{2} – without industry/transport 1 250 Mt (estimate 2010)

**Two equations:**

I: Electricity\textsubscript{fossil} = Electricity\textsubscript{coal} + Electricity\textsubscript{gas}

II: CO\textsubscript{2}Electricity = Electricity\textsubscript{coal} x Coal\textsubscript{CO2} + Electricity\textsubscript{gas} x Gas\textsubscript{CO2}
Short-term marginal costs influence prices for CO₂

Required costs for CO₂ in order to compensate cost advantage of coal over gas

If the coal price goes down, CO₂ price has to go up or vice versa.

A CO₂ reduction can be achieved in the short to medium term only by replacing coal with gas. The gas/coal price ratio determines the price of allowance certificates.
EU 27 power plant capacity and balance 2000 - 2009

Changes in 2009 (MW)

- Gas: +81067 (6226)
- Wind: +65102 (10048)
- Hydro: +3122 (226)
- Others: +4177 (1096)
- Photovoltaic: +13027 (4200)
- Nuclear: -7204 (-954)
- Coal: -12010 (-794 *)
- Oil: -12920 (101)

* In 2406 MW – Out 3200 MW

Source: EWEA, Wind in power 2009
Impact of auctioning on generation cost

Case study: 100 % auctioning, CO₂-prices 0 – 30 €/t.

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Generation cost without CO₂</th>
<th>Generation cost including CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old power plants</td>
<td>Low efficiency, 1300 g CO₂/kWh, but no capital cost</td>
<td>Disadvantage up to 39 €/MWh</td>
</tr>
<tr>
<td>New power plants</td>
<td>High efficiency, 950 g CO₂/kWh, but capital cost</td>
<td>Disadvantage up to 28 €/MWh</td>
</tr>
<tr>
<td>CCS-Plants</td>
<td>Ultra-low CO₂ emission, 150 g CO₂/kWh, but high operational and capital cost</td>
<td></td>
</tr>
</tbody>
</table>

Medium-term: Strong negative impact on generation cost and power prices, auctioning works like a CO₂ tax. No incentive to build BAT plants. Long-term: Phase-in of CCS is high risk because only driven by high and uncertain power prices.
Assumptions for energy prices - Germany

III. Quarter 2010 - €/tce
Coal: 88 € cross border
Gas: 245 € power plants

Sources: Statistik der Kohlenwirtschaft, EWI/EEFA, BEE, FFE 2009, WWF 2009 / Prognos
Energy flow is cash flow

€7.0 billion turnover for a 1,000 MW power plant over 20 years operating 7,000 hours/year at a base-load-price of €50/MWh

- Fuel costs: 1/3 share of turnover
- Plant costs: 2/3 share of turnover
- 70 up to 100% domestic added value

- Fuel costs: 75% share of turnover
- Plant costs: 25% share of turnover
- Up to 100% imported

Power generated from coal promotes growth in the EU
Structure of power generation in selected EU countries 2008

Gross power generation
TWh  Share of coal %

EU 27 * 3.367 26
Poland 156 90
Czech Republic 84 58
Greece 64 52
Bulgary 45 52
Germany 633 44
Romania 65 40
UK 389 32
Hungary 40 18
Spain 311 16
Italy 319 14
Belgium 85 7
France 576 4

Share in %

coal  oil  gas  nuclear power  others / hydro

* Peat and oil shale included in Other/Hydro
Data as per: 06/2010
Source: EUROSTAT – Energy / Yearly statistics 2008

Slide 16
# European – national competencies for energy and CO\textsubscript{2} policies

<table>
<thead>
<tr>
<th>Fields of action</th>
<th>Fields of actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>energy *</td>
<td>CO\textsubscript{2} and NO\textsubscript{X}, SO\textsubscript{2}, dust</td>
</tr>
<tr>
<td></td>
<td>Functioning of energy markets</td>
</tr>
<tr>
<td></td>
<td>European network infrastructure power, gas – CO\textsubscript{2}?!</td>
</tr>
<tr>
<td></td>
<td>Energy solidarity, crisis management</td>
</tr>
<tr>
<td>Member States</td>
<td>Non ET sector</td>
</tr>
<tr>
<td></td>
<td>Choice of energy sources</td>
</tr>
<tr>
<td></td>
<td>- Renewables, nuclear!</td>
</tr>
<tr>
<td></td>
<td>- Coal and lignite?</td>
</tr>
<tr>
<td></td>
<td>Utilisation of indigenous energy resources</td>
</tr>
<tr>
<td></td>
<td>- Coal and lignite?</td>
</tr>
<tr>
<td></td>
<td>General structure of energy supply</td>
</tr>
</tbody>
</table>

* § 194 – Treaty of Lisbon
EURACOAL’s interest: modernisation

- Use of indigenous resources like coal to improve security of supply and to maintain important industry clusters
- Coal and gas have to deliver the backup of renewables
- Europe can achieve its CO$_2$ targets by following a path of modernization

- Discussion of the investment framework under ET scheme
EURACOAL’s interest: CCS

- CCS is like a safety valve for the CO₂ market
- CCS gives relief if the prices for CO₂ are so high that they destroy industry and harm consumer interests
- CCS enables the EU to maintain an energy mix in the long term which is essential for security of supply

- Concerted effort on CCS demonstration and preparation for the development of a CCS transport and storage infrastructure are crucial
Different Fuels for Power Generation - different questions, answers and views

<table>
<thead>
<tr>
<th></th>
<th>Coal</th>
<th>Oil</th>
<th>Gas</th>
<th>Nuclear</th>
<th>Renewables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security of supply</td>
<td>+++</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price risk / competitiveness</td>
<td>+++</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport / waste risk</td>
<td>+++</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{CO}_2$ emissions</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer acceptance</td>
<td>++</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Importance for the power sector</td>
<td>+++</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>