About the benefits of a CO$_2$ transport and storage infrastructure in Europe

A coal industry perspective
EU Council and Parliament resolutions on mitigation of climate change

By 2020:

- 20% renewables, 20% energy savings, 20% GHG reduction

By 2050:

- Limiting global temperature rise ≤ 2°C; Target value ≤ 450 ppm CO₂ in atmosphere
- Reduction of worldwide anthropogenic GHGs to 50% of 1990 level
- Fair burden-sharing, i.e. industrialized states minimize disproportionately high, i.e. 80 – 95% relative to 1990
- Fairness at ≈ 2 t GHGs per capita and year
Mitigation of climate change in the EU

two stages – two speeds

For the EU, this means reducing GHGs from 5.8 bn t/a in 1990 to some 4.6 bn t in 2020 and some 1 bn t/a in 2050.
**CO₂ reduction in period from 2020 to 2050**

Annual reduction rate in GHGs on a scale of ≈ 120 m t/a can no longer be reached by

- increasing efficiency, falling conversion losses, switching fuels

**Instead, completely new approaches are needed**

- Expansion of wind and photovoltaics must be shaped and designed together with the electricity-storage issue and a robust back-up generation system

- Zero-CO₂ final energy – electricity – for heating market

- new technologies must be launched, e.g.
  - e-mobility, hydrogen?
  - CO₂ capture
  - solar-thermal power plants

Beyond 2020, innovation leaps are required, since the GHG reduction targets can no longer be achieved using today’s technology. CO₂ sinks needed.
CO$_2$ infrastructure as location factor

- The utilization of oil, gas and coal, increasingly after 2020 and – as things stand today – only possible at all in 2050, with carbon capture.

- Security of supply in the electricity sector and industrial production are linked with CCS technology in the medium term already.

- A CO$_2$ transport and storage infrastructure will be needed after 2015/2020.
Obstacles and possible approaches for a demonstration of CCS

- acceptance – necessity is not recognizable
  - Decision on national and regional level, CCS one element of solution portfolio from 2020 onwards

- complexity of process chain capture-transport-storage
  - Separation of tasks where it makes sense, dialogue with industry & power generators

- First Mover – cannot capitalize on development expenses – free-riders profit
  - Public support for demonstration

- Financing the demonstration of capture and elements of a CO$_2$-infrastructure
  - transparent process of granting funds for certain methods, e.g. Oxyfuel, IGCC und post-combustion in power generation, projects in chemical industry/refineries, setup of infrastructure
CCS important contribution to CO$_2$-mitigation

Contribution to 50% emissions reduction by 2050 (BLUE Map Scenario)

Source: IEA Energy Technologies Perspectives 2008
Projects in Jänschwalde and Hürth to demonstrate the functioning of the CCS chain: power-plant – transport – storage

In the demonstration projects, regional solutions are possible, but limits are discernible.
## Major CO₂ sources in Central Europe

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of operations &gt; 10 m t/a</th>
<th>Number of operations 10 – 3 m t/a</th>
<th>Number of operations 3 – 0.35 m t/a</th>
<th>Total CO₂ emissions of selected operations, in m t/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>0</td>
<td>10</td>
<td>33</td>
<td>86</td>
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<td>Belgium</td>
<td>0</td>
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<td>Germany</td>
<td>9</td>
<td>23</td>
<td>153</td>
<td>434</td>
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<tr>
<td>Poland</td>
<td>2</td>
<td>10</td>
<td>56</td>
<td>162</td>
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<tr>
<td>Czech Rep.</td>
<td>0</td>
<td>8</td>
<td>33</td>
<td>74</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11</strong></td>
<td><strong>56</strong></td>
<td><strong>308</strong></td>
<td><strong>807</strong></td>
</tr>
</tbody>
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Reducing complexity

- CCS-Demonstration as integrated technological process proves to be difficult; lack of concepts for industrial application

- Separation of tasks in industrial-scale application reasonable:
  - Capture conducted by operator of facility:
    - Technology exists, industrial application needs incentives: three processes available in power generation
  - Setup and operation of CO₂ transport- and storage-infrastructure by specialized companies:
    - CO₂-transport tested, acceptance and regulation needed
    - CO₂-storage needs balance of interests between regions and utilization competition

Government action guarantees non-discriminatory access to a CO₂ - infrastructure and ensures sufficiently large capacities in the future
**CO₂-infrastructure provides planning reliability as CO₂-prices become calculable** (qualitative illustration)

Decision-makers know their costs of capture and are able to estimate the operating expense for transport and storage, if a CO₂-transport-storage-infrastructure is available. With the exhaustion of the cheapest mitigation potentials CO₂-prices rise slowly over time.
Why does the demonstration of CCS need public financial support?

- CCS is an innovative technology in competition with established technologies whose development is publicly supported, e.g. large utilities invest in wind power generation.

- As electricity is a basic commodity energy companies have little incentive to use unproven and very costly technology such as CCS.

- Engineering in energy generation is particularly vulnerable to free-riding as lessons learnt can be used by all firms.

Due to these market failures investor activity is currently focused on projects which are rather small.

They will help development of CCS but not at the pace necessary for commercial deployment in 2020.

A large number of demonstration projects is needed (EU/ G8 aims) but their development is not market driven.

Source: UK DECC, 2009
Build up of a CO₂-infrastructure

Potential CO₂-storage areas, exemplary base structure of a CO₂-transport pipeline system and the gas pipeline infrastructure in Germany (schematic overview)

Source: ET (8) 2009, Dr. Matthes
Benefits of CCS-technology

Security of supply and balanced energy mix:
- with CCS coal remains reliable, affordable and domestic contribution to a stable energy supply
- even larger dependence on imported, expensive natural gas can be avoided with use of coal; in the long run gas power stations need CCS as well
- inexpensive back-up system for Renewables

Path towards a decarbonized industry:
- in the near future CCS indispensable for important industries (cement, steel, petroleum processing, chemical industry)

Export potential:
- Leadership in CCS-technology can be used to realize export potential (e.g. in China, India)