Improving the efficiency of coal-fired power generation plants

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Content will address ...

- Potential for efficiency improvement
- Barriers to achieving improvement
- High Efficiency, Low Emissions Coal Technology Roadmap
- Wrap up
A wide range of technologies will be necessary to reduce energy-related CO₂ emissions substantially.
Global average efficiencies for coal-fired power plant

Values are far from Best Available Technologies:
- Nordjyllandsvaerket 3 (hard coal, Denmark) reports 47% net on a LHV basis.
- Niederaussem K (lignite, Germany) reports 43% net on a LHV basis

Average plant efficiency does not appear to be improving.
Some reasons to explain it

- Technology is improving, best practices have been disseminated, SC/USC have been built;
  
  BUT

- Subcritical plants continue to be built;

- SC/USC is not cost-effective for smaller unit sizes;

- Coal quality is becoming poorer;

- Existing stock is getting older;

- Cleaning systems consume energy.

Generation efficiencies are not contributing sufficiently to the ambition to achieve 450ppm.
Impact of efficiency on CO$_2$ emissions

A 1 percentage-point rise in efficiency can reduce emissions of CO$_2$ from the average plant by 3%.

Example for illustration only. Approximations by the author based on emissions of 1 ton CO2 per MWh for 0.33 efficiency.
... and on coal resources

Efficiency increases lead to substantial savings in fuel costs.
It is not a trivial matter

- Reporting efficiency is difficult, with no globally-agreed procedure or standard:
  - LHV/HHV
  - Gross/net
  - Different plant boundaries or time limits

- Efficiency is influenced by conditions at each plant:
  - Coal quality
  - Cooling water temperature
  - Operating conditions
  - Maintenance capacity
... and high barriers hamper the aim

- Financial challenges:
  - Lack of financial resources may be an issue
  - Regulated tariffs may hinder a fair return on investments

- Coal quality issues:
  - Is the coal washed? And at what price?
  - Can I recover my investment?
  - Is the purchaser ready to burn clean coal? Plant compatibility.

- Local/regional configuration:
  - District heating
  - Heat and power plants

- Free externalities:
  - No emission limit/charge
World primary coal demand by scenario

Coal consumption is strongly affected by policies.
HELE Coal Roadmap – content

- To identify milestones for the development of coal technologies for power generation to 2050;
- To cover technical, financial, policy and other matters important to realise more efficient generation of electricity from coal;
- To address regional implications of this development pathway, particularly for major coal-using countries.
**HELE Coal Roadmap – provisional timetable**

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<tr>
<th>Date Range</th>
<th>Event Description</th>
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<tr>
<td>Jun 2011</td>
<td>Workshop on the long-term vision for the deployment of clean coal</td>
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<tr>
<td>May – Sep 2011</td>
<td>Review of coal-fired power generation: technologies, policies, regulation, ...</td>
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<td>Jun – Dec 2011</td>
<td>Regional workshops in US, China, India and Eastern Europe</td>
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<td>Jan – Feb 2012</td>
<td>Drafting of roadmap</td>
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<td>Mar 2012</td>
<td>Workshop to review conclusions</td>
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<td>Apr – June 2012</td>
<td>Final drafting, review, editing and design</td>
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<td>Jul 2012</td>
<td>Publication of roadmap</td>
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Wrap up

- Improving efficiency is essential to our aims for environmental sustainability, energy security and long term economic development;

- There remains much scope for improving technology. Research and development in this field must continue;

- Technologies exist to improve efficiency. Unfortunately, there are also barriers hampering the realisation of the huge potential to deploy them.

- Removing these barriers is important and urgent.
Thank you for your attention