THIRD
COAL DIALOGUE

18TH OCTOBER 2006
IN BRUSSELS
INTRODUCTION

Nearly 100 participants from a large number of EU Member States, the European Commission, the European Parliament and from the European coal industry joined the Commission and EURACOAL for their 3rd Coal Dialogue on 18th October 2006. Under the chairmanship of Mr. Heinz Hilbrecht, Director for Conventional Sources of Energy within DG Energy and Transport the participants discussed the role of coal in the future energy mix as well as the strategies to develop low CO₂ coal-fired power plants and CO₂ capture.

As introduction Jean-Arnold Vinois, Head of Unit, Energy Policy and Security of supply within DG Energy and Transport, gave an overview of the current energy policy debate at European level. He highlighted the challenges facing the European Union in matters of security of energy supply, competitiveness and climate protection. His presentation focused on the objectives and priorities mentioned in the Commission’s Green Paper “A European Strategy for Sustainable, Competitive and Secure Energy” of 8th March 2006. After the Council supported its proposal to publish a regular Strategic European Energy Review, the Commission will put forward in December 2006 / January 2007 a proposal for the review as well as for a number of papers related to sustainability, energy mix, Internal Market and external relations. A Communication on Sustainable Coal has also been planned.

Also on behalf of the European Commission, Ioannis Galanis reported on the Impact Assessment that DG Energy and Transport recently carried out concerning the Communication on Sustainable Coal. DG Energy and Transport assumes that coal will continue to play an important role in the European energy mix in the decades to come. Looking at the environmental challenges posed by coal use, integrated technological solutions with further efficiency improvements as well as Carbon Capture and Storage will be necessary. The initiatives and achievements of the Zero Emission Fossil Fuel Power Plant Technology Platform are acknowledged. A suitable regulatory framework recognizing the beneficial aspects of Carbon Capture and Storage practices is regarded as a first but insufficient pre-condition. Further policy initiatives will be needed to facilitate demonstration at commercial scale and subsequent penetration of new technologies enabling low emission power generation from coal under competitive conditions.

The challenges and barriers to cleaner coal power were discussed from the coal industry’s view by the President of the European Association for Coal and Lignite, Nigel Yaxley. He emphasized that coal can respond to all the priorities mentioned in the 2006 Green Paper and asked for a clear statement on this in the EU Strategic Energy Review.

Yaxley reminded participants that indigenous hard coal and lignite production as well as hard coal imports are stable both in terms of supply and price. Modern coal technologies have recently resulted in a decrease of CO₂ emissions from coal-fired power stations in the EU. New large coal-fired power plants emit much less CO₂ than similar old plants. EURACOAL’s President stressed
that the lack of long-term certainty surrounding the trade of CO₂ emission certificates was a barrier to the construction of modern power plants in many Member States. Fuel switching to gas could exacerbate security of supply concerns, increase prices and is not a long term solution to carbon emissions. The EU Emissions Trading Scheme should be shaped so that it does not threaten the modernization of the European power plant portfolio or the development of innovative technologies with coal.

EURACOAL welcomed the proposal of the ZEP Technology Platform to build about 10 CO₂ Capture and Storage power plants by 2015. Reasonable expectations exist to make CO₂-free power plants available on the world market by 2020; however, further improvement of the efficiency of power plants would be necessary beforehand, and this should also be acknowledged as an achievement of the industry by the authorities and by the public.

Dr. Wolfgang Ritschel, Director of the Verein der deutschen Kohlenimporteure and Chairman of EURACOAL's Market Committee, reported on current projects in the major coal exporting countries such as Australia, Columbia, Indonesia, Russia and South Africa. He stated that a stable and also continuously increasing world steam coal market would satisfy European coal demand at competitive prices.

After reports on the coal industry and reliable domestic production in Poland and in the Czech Republic at the 2nd Coal Dialogue, EURACOAL's Vice President Professor Constantinos Kavouridis reported on lignite mining and use in Greece. With 70 Mt of lignite mined annually, and a share of approximately 60% of total Greek electricity production, lignite -in compliance with EU environmental legislation- is expected to remain a secure and economic energy source for the country.

The Panel Discussion is summarized at the end of this booklet.
European Commission: Green Paper on a European Strategy for Sustainable, Competitive and Secure Energy

J.-A. VINOIS
European Commission
DG TREN, Head of Unit C1
Energy Policy and Security of Energy Supply
**EUROPEAN COMMISSION:**

**GREEN PAPER ON A EUROPEAN STRATEGY FOR SUSTAINABLE, COMPETITIVE & SECURE ENERGY**

**SECURITY OF SUPPLY: EU 25**

**FINAL PRIMARY ENERGY DEMAND**

**EUROPEAN COMMISSION: GREEN PAPER ON A EUROPEAN STRATEGY FOR SUSTAINABLE, COMPETITIVE AND SECURE ENERGY**

**EU 25: THE ORIGIN OF IMPORTS**

**EU CO2 emissions by sector**
2005: EU Political consensus on energy policy framework

- To equip EU to play full role in global markets
- To improve sustainability within EU and globally
- To improve internal market functioning
- To stimulate necessary investments
- To improve stability in EU and neighbouring markets
- To reflect the strategic role of energy in achieving other political objectives

COMMON ENERGY POLICY GOALS

- Competitiveness: internal market, competition, interconnections (TEN-T), European electricity grid, research & innovation (clean coal, carbon sequestration, alternative fuels, energy efficiency, nuclear)
- Environment: renewable energy, energy efficiency, nuclear, innovation & research, emission trading
- Security of Supply: international dialogue, European hub development, new capacity and storage of energy, diversification
**Green Paper 8/3/06: 6 priority areas for common actions**

1. Internal market → completing the internal EU electricity and gas market
2. Internal market and Security of Supply → solidarity between Member States
3. A more diverse, efficient & sustainable energy mix
4. Environment → integrated approach to climate change
5. Innovation → a strategic European Energy Technology Plan
6. Towards a coherent external energy policy

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**1. Completing the internal EU electricity and gas market**

- Full implementation of internal gas & electricity markets
- Priority Interconnection Plan
- 2006 Progress report on the functioning of the internal market and Competition report
- Initiative to promote the development of the regional markets in EU
- Guidelines to facilitate cross border transmissions
- Common regulatory framework and structures for the EU’s internal gas & electricity markets
- Examine options of the creation of a formal grouping of Transmission System Operators

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**2. Solidarity between Member States**

- Re-examine how to deal with potential disruptions in the framework of existing electricity and gas security of supply directive
- European Energy Supply Observatory
- Review of existing Community approach to oil and gas stocks
- Improved network security
- Common security standards to protect essential energy infrastructure

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**3. A more diverse, efficient & sustainable energy mix**

- Each Member State or company can chose its own energy mix
- A Strategic European Energy Review (SEER) will be prepared regularly (see below)
- It might be appropriate to aim for EU minimum energy mix from secure and low carbon energy sources
- New Illustrative Nuclear Programme (PINC)

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**4. An integrated approach to climate change**

- Action Plan on Energy Efficiency, including possible international agreement on energy efficiency
- Renewable Energy Road Map, including possible longer term targets
- Implementation of Biomass Action Plan and Strategy for Biofuels
- Proposal for a directive on heating and cooling
- EU Emission Trading Scheme and Kyoto II Actions (by DG ENV)

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**5. A strategic European Energy Technology Strategy**

- Strategic Energy Technology Plan (for 2007)
- Commission Communication on the promotion of sustainable coal technologies
- Emphasis on sustainable energy and nuclear waste questions in 7th RTD Framework Programme
6. Towards a coherent external energy policy: Speaking with one voice

- Limiting the EU's growing dependence on imported fuels
- New framework for dialogue with Russia
- Dialogue with main consumers (USA, China, India)
- International agreement on energy efficiency
- Pan-European Energy Community
- Rapid ratification of the EU Energy Charter Treaty & conclusion of Transit Protocol
- EU Energy Community in South East Europe
- EU Energy Initiative for Developing Countries (DG DEV)

**TOWARDS AN ENERGY POLICY FOR EUROPE**

**STRAIGHT ENERGETIC REVIEW 2007**

**ACTION PLAN 2007-2009**

**Towards an energy policy for Europe**

**Sustainable Development**

- Energy Policy
- Energy Sources
- Energy Efficiency
- Promoting Renewable Energies
- Nuclear Technologies
- Priority Interconnection Plan

**Strategic European Energy Review**

- For Commission adoption in December 2006
- And Council discussion at March 2007
- Spring Summit (German Presidency)
- Endorsed ideas for an external energy policy.
- Endorsed proposal for regular Strategic EU Energy Review.
- Asked Commission to develop concrete proposals.

European Council conclusions of 24 March and 16 June 2006

- Endorsed Green paper and its key priorities.
- Endorsed proposal for regular Strategic EU Energy Review.
- Asked Commission to develop concrete proposals.

**Next steps**

- Public consultations completed on 24 September 2006
- Council debate (Energy, Environment, ECOFIN, Competitiveness, General Affairs, etc)
- European Parliament hearing and report end of November 2006

Further Information

Communication on Sustainable Coal: Impact Assessment and Communication Outline

Ioannis GALANIS
European Commission
dg TREN, Deputy Head of Unit C.3
Impact Assessment - Methodology

- What is the Problem?
- What are the Solutions?
- What are the EU Objectives? (general, specific, operational)
- What are the Policy Options?
- What are the Impacts of each policy option? (economic, social, political and environmental)
- How do the options compare?

What Technological Solutions?

- Focus on improved energy efficiency.
- Focus on carbon capture and storage.
- The integrated technological solution, with focus on both improved energy efficiency and carbon capture and storage (Sustainable Coal technologies).

The integrated solution proved as the only capable of delivering competitive coal-fired generation with "near zero" CO2 emissions.

What Policy Options?

- Option 0: No policy change.
  Existing regulatory framework in not adapted for CCS. No strategic support to demonstration of integrated solution.
- Option 1: Removal of the barriers to Sustainable Coal:
  - Improvement of existing regulatory framework (ETS, Environmental Directives, Conventions of the Sea)
  - Improvement of existing financial instruments (FP7, other)
  - Stable political context regarding future emissions reductions.
- Option 2: More pro-active measures for Sustainable Coal, for:
  - Structure for effective demonstration (i.e. JTI, JU ?) and incentives for wide penetration (i.e. CO2 infrastructure, privileged grid access, timed phase-out).

What are EU Objectives?

- Security of supply: Continued presence of coal in the future energy/electricity mix.
- Operational objectives:
  - Until 2020: new plants with BAT + capture-ready.
  - After 2020: ZEPP is the technology of choice.

Impact Assessment : Problem Definition

- Coal is widely used, mainly for electricity generation.
- Coal will be needed in the future, for the energy security of supply, in the EU and in the World.
  But:
  - Environmental impact of coal combustion (970 Mt CO2 from coal generation in EU in 2005).
  - Sustainable coal technologies are not available.
  - There are barriers to implementation:
    - Cost of the new technologies
    - Lack of demonstration
    - Not adapted regulatory framework
    - Public acceptance of coal and CCS.

What are the Problems?

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  - There are barriers to implementation:
    - Cost of the new technologies
    - Lack of demonstration
    - Not adapted regulatory framework
    - Public acceptance of coal and CCS.
Assessment of Option 0 – No Policy Change

**MAIN ASSUMPTIONS:**

- Some RTD on conversion efficiency and CCS continues.
- No clear commitment to demonstrate integrated technological solutions at commercial size.
- No clear perspective that coal could be used in a sustainable way.

**MAIN EFFECTS:**

- Coal generation capacity is not maintained.
- Share of coal in electricity mix is decreasing: from 29% in 2005 to 17% in 2030 and 15% in 2050.
- Some efficiency improvements: underlying trend.
- Specific CO2 emissions from coal generation are reduced: by -16% in 2030 and by -23% in 2050.

Assessment of Option 1 – Removing Barriers

**MAIN ASSUMPTIONS:**

- Sustained RTD and Demonstration to improve efficiency, reduce CCS costs and demonstrate integrated solutions.
- Sustained investment in coal generation after 2015: upgrading, replacing, adding new capacity.
- Amending the Regulatory Framework removing obstacles to CCS.
- Informing the public on safety, integrity and monitoring of storage.

**MAIN EFFECTS:**

- Coal generation capacity reduced till 2015, than rebuild.
- Share of coal in electricity mix: from 29% in 2005 to 27.5% in 2030 and 27.5 - 30% in 2050.
- Good efficiency improvements: increase till 2015, flat after.
- CCS is fully demonstrated and commercial by 2020.
- Partial penetration after 2020: 25% of capacity in 2030; 75% in 2050; partial use.
- Specific CO2 emissions: - 30% in 2030 and - 55% in 2050.

Assessment of Option 2 – “More Pro-Active”

**MAIN ASSUMPTIONS:**

- Sustained RTD and Demonstration: as in Option 1.
- Effective mobilisation for demonstration of integrated solutions.
- Removing regulatory obstacles to CCS deployment: as in Option 1.
- Additional incentives for wide penetration of CCS.
- Information to the public leading to wide acceptance of CCS.

**MAIN EFFECTS:**

- Sustained investment and increasing coal generation capacity.
- Stable or even increasing share of coal in electricity mix:
  - 29% in 2015 and 2030; 39 – 35% in 2050.
- Good efficiency improvements: as in Option 1.
- CCS is fully demonstrated + commercial in 2020.
- Rapid penetration of CCS, after 2020: systematically used in new plants and retrofits; 30% of capacity in 2030; 100% in 2050; fully used.
- Specific CO2 emissions: - 40% in 2030 and - 90% in 2050.

Impact Assessment – Preliminary Conclusions

- Pursuing high conversion efficiency and development of CCS is the best way to maintain technological leadership and to prevent emissions from growing.
- Despite a reduction in CO2 emissions, Option 0 cannot meet the main objectives.
- Option 1 could give good results up to 2030, through security of supply, reduced emissions and technological leadership. However, it cannot achieve zero emissions.
- Option 2 can meet all the main objectives in the long term (in 2030 and in 2050).

Communication – Outline 1

A Strategy for Sustainable Coal:

- Stressing the global nature of the problem: increase of world coal consumption and of coal-related CO2 emissions. Sustainable solutions by all coal users.
- Removing obstacles to sustainable coal solutions: amend regulatory framework at EU and international levels, improve the technology, reduce costs and implement demonstration. (We are in this option now.)
- Be ready to adopt more pro active measures: to achieve timely demonstration and wide penetration.
Communication – Outline 2

6 lines for actions, envisaged at this stage:

1. Open perspective for **new coal-fired plants**: to be capture-ready till 2020 and with CCS after.
2. Increase **RTD funding** for Sustainable Coal (in FP7).
3. Establish closer collaboration with **third countries** on sustainable coal technologies (as with China).
4. Amend **EU regulatory framework**: the revision of ETS is planned for 2007.
5. Take initiatives for a **stable political context**: for future emission reductions; for the Conventions of the Sea.
6. Examine how best coordinate and support the **10 anticipated demonstration plants**: this evaluation is planned for 2007.

**Description of Option 2 – More Pro-Active**

- **Mobilising Capital and Resources for Demonstration:**
  - Zero Emission Technology Platform: enhanced role.
  - Joint Technology Initiative (JTI): to strongly coordinate projects / common RTD.
  - Joint Undertaking (JU): a company established by the Commission with industrial partners.
  - Specific Financing Instrument: to raise more private/public capital.

- **Additional Incentives for Wide Penetration:**
  - More favourable context for long term investment
  - EU identifies main CO2 infrastructure: pipelines and storage sites.
  - Privileged access of zero emission electricity to the grids.
  - Timed phase-out of non-zero emission power plants (by 2050).
  - State Aid for innovation or environment.
Current Challenges and Barriers to Cleaner Coal Power

Nigel Yaxley
President EURACOAL
Current Challenges and Barriers to Cleaner Coal Power

- Europe in a world context
- Coal and the Energy Green Paper
- Emissions trading as a barrier to investment
- Clean coal – a three stage concept
- Policy requirements to make CCS a reality

World coal consumption is increasing

<table>
<thead>
<tr>
<th>Region</th>
<th>2004</th>
<th>2005</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS America</td>
<td>22.3</td>
<td>21.7</td>
<td>-0.6%</td>
</tr>
<tr>
<td>Europe</td>
<td>17.9</td>
<td>14.5</td>
<td>-3.4%</td>
</tr>
<tr>
<td>Russia</td>
<td>7.3</td>
<td>3.6</td>
<td>-3.7%</td>
</tr>
<tr>
<td>MENA</td>
<td>4.5</td>
<td>2.3</td>
<td>-2.2%</td>
</tr>
<tr>
<td>Asia &amp; Australia</td>
<td>10.6</td>
<td>9.4</td>
<td>-1.2%</td>
</tr>
<tr>
<td>China</td>
<td>34.0</td>
<td>36.0</td>
<td>+6.0%</td>
</tr>
</tbody>
</table>


Europe is the world’s third largest consumer of coal behind China and the US...

... with indigenous coal supply making a major contribution

EU25 Solid Fuel Supply 2005 (adjusted for calorific value)

- Lignite production: 399 Mt (33%)
- Hard coal production: 171 Mt (26%)
- Hard coal imports: 215 Mt (41%)

The Green Paper was largely preoccupied with non-coal issues...

“Coal and lignite, for example, presently account for around one third of the EU’s electricity production: climate change means that this is only sustainable if accompanied by commercialised carbon sequestration and clean coal technologies on an EU level.”
...but coal responds well to the Green Paper priorities (1)

- Energy for growth and jobs in Europe: completing the internal European electricity and gas markets
  - Coal already has a fully functioning market – aiding competitiveness
- An internal market that guarantees security of supply: solidarity between member states
  - Coal can be safely transported and stored and is not subject to the major foreign policy concerns of oil and gas
- Tackling security and competitiveness of energy supply: towards a more sustainable, efficient and diverse energy mix
  - Coal provides a unique contribution to security of supply
  - Reasonable and relatively stable prices of coal help competitiveness

Coal responds well to the Green Paper priorities (2)

- An integrated approach to tackling Climate Change
  - Continuous modernisation and major efficiency improvements help reduce emissions significantly in the short and medium term
  - Carbon Capture and Storage in coal-fired power plants and geological storage to be developed for 2020 and beyond
- Encouraging innovation: a strategic European energy technology plan
  - The coal industry backs the ZEP and SMR Technology Platforms
  - EURACOAL welcomes planned coal-based pilot and demonstration plants with CO2 Capture and Storage
- Towards a coherent external energy policy
  - Indigenous coal reduces import dependency
  - Imports are from diverse sources

Indigenous resources provide security for Europe

Europe is poor on oil and gas resources but has considerable coal deposits

Coal prices are reasonable and relatively stable

Trends in German energy prices 1973 to 2006

Coal is important in EU power generation ...

Power-generation structures in selected EU-25 states

Data as per: 08/2006
Source: EUROSTAT – Energy / Yearly Statistics 2004

... but significant capacity needs to be replaced in the EU-25 in the short to medium term

Lifetime Assumptions:

- OIL: 30 years
- GAS: 35 years
- LIGNITE: 40 years
- COAL: 40 years
- NUCLEAR: 40 years

Source: Prognos

Lifetime Assumptions:

- OIL: 30 years
- GAS: 35 years
- LIGNITE: 40 years
- COAL: 40 years
- NUCLEAR: 40 years
Uncertainty over the future of the EUETS is a barrier to investment in cleaner plant

Lignite-fired power plant “Lippendorf”
- Installed: 1999/2000
- Capacity: 1,874 MW
- Net efficiency: approx. 43%
- Investment: some €2 billion
- CO₂ reduction: ~6 mill. t/a
- ~30%

Modern for a long time!

EU emissions trading regulators did not foresee the major divergence of coal and gas prices

Source: Statistik der Kohlenwirtschaft e.V.

EUETS can only drive investment if there is longer term certainty

- CO₂ reduction through fuel switching has become increasingly expensive and risks jeopardising European competitiveness
- Technologies for CO₂ capture in fossil-fuel power plants and CO₂ sequestration could be exploited in the longer term
- Significant CO₂ reductions can be achieved in the meantime with more efficient capacity replacing life-expired plants
- The Emissions Trading Scheme is the main reason for a lack of investment in coal-fired power plants in many EU Member states

Fuel specific benchmarks are needed together with longer term certainty as in the German model

Emission trading regime in Germany gives longer term certainty

Trading period 2005/07
- Trading period 2008/12

New installations
- Full allocation
- Installation-related benchmarks*

Section 10 NAP-G
- National Allocation Plan Act
- 14 years
- Compliance factor 1

14 years
- Kyoto
- Post-Kyoto

Continuous modernization and increased efficiency is a pre-requisite to CCS...

The right approach: continuous power plant modernization/renewal

Clean coal comes in three stages

Clean coal I
- Retrofit and new-build in line with state of the art, increase in efficiency, reduction of SO₂, NOₓ and dust

Clean coal II
- Research and development for increase in efficiency to >50%

Clean coal III
- CO₂ capture and storage

Investment in ultra-modern technology

The zero-CO₂ power plant

Continuous CO₂ reductions from today to the future

Continuous modernization and efficiency improvements
ZEP Technology Platform proposes 10-12 large scale CCS projects

- Several coal projects are already planned
  - RWE (UK and Germany) – E.ON (UK) – GE (Poland)
  - Vattenfall (Germany) – Powerfuel (UK) – etc
- Necessary to kick-start the CO2 value chain with urgent short and long term commercial incentives for these to go ahead
  - Inclusion in EUETS
  - Clarification of state aid issues
  - Early mover funding mechanisms for pilot projects
  - Long term sustainable mechanisms for full deployment
- Establish robust R&D funding under FP7 and National programmes

Political as well as technological action is needed to make CCS a reality

- EU - Elements of a Directive on CCS
  - Management of the environmental risks associated with CCS
  - Effective and reliable permitting of storage sites
  - Liability for CCS activities
- International maritime and national legal frameworks
- Public Acceptance
  - Less than 10% heard of CCS – Before explanation only 13% were positive, after explanation 55% agreed
  - An early information campaign is necessary to get public support for the large scale implementation of CCS

Coal Industry’s Policy Requirements

- Acknowledge the unique role of coal to security of supply and its contribution to competitiveness
- Further commitment to the vision of CCS including financial support of pilot and demonstration plants
- Support adoption of a legal framework for CO2 storage
- Recognise that increased plant efficiency and continuous modernisation have the potential to preserve resources and reduce CO2 in the short and medium terms
- Acknowledge efficiency increase as a pre-requisite of CCS

Thank you
Coal Mining and Transport Infrastructure - Projects Worldwide

Dr.-Ing. Wolfgang RITSCHEL
Chairman Market Committee
EURACOAL
Coal Mining and Transport Infrastructure
-Projects Worldwide

3rd Coal Dialogue 19th October 2006 Brussels
Dr.-Ing. Wolfgang Ritschel, Euracoal

Development World Production of Hard Coal

International Hard Coal Trade

World Coal Trade: 2005 - 2015

Production / Export / Infrastructure
Situation of the Bulk Market 2006

- Major Bulks: 64%
- 2,645 Mio t = 100%
- 995 Mio t = 38%
- 280 Mio t = 11%
- 720 Mio t = 26%
- 710 Mio t = 27%

Source: Clarkson

Development of Major Bulk Volumes

- 2002 – 2006: + 27%
- 2002-2008/2009: + 41%

Source: Clarkson

Production / Export / Infrastructure

- Colombia
- Indonesia
- Russia / Steam Coal
- South Africa

EURACOAL
Conclusions - World steam coal demand - supplied via seaborne trade - will increase by 135 million t in the period 2005 to 2015 and grow to 670 million t.

- Five big suppliers have potential to increase their production:
  - Australia (+40 – 50 million t)
  - Colombia (+50 – 60 million t)
  - Indonesia (+20 – 30 million t)
  - Russia (+30 – 40 million t)
  - South Africa (+15 – 25 million t)

- Infrastructure is growing corresponding to supply.
  - In all major countries, railways and port capacities are expanding.

- Bulk carrier fleet is growing with demand.

- A mature coal world market will satisfy the European coal demand at competitive prices.
Prof. Dr. Konstantinos Kavouridis
Vice President EURACOAL

Lignite Mining and Use in Greece
Greece, mining 70 Mt annually, is the second lignite producer in the EU, fifth largest in the world.

Lignite in Greece is the main significant domestic energy resource and accounts for approximately 60% of total electricity produced in the Greek power generation system.

Public Power Corporation (PPC) is the dominant lignite producer. Approximately 97% of the lignite used to supply the lignite fired power plants is mined by PPC.

PPC has extracting rights for approximately 60% of the total exploitable reserves of Greece.

PPC is a vertically integrated electricity utility, the largest industrial company in Greece in terms of assets and the third by revenues.

PPC was established in 1950 and was incorporated as a Société Anonyme on 1st January 2001. Until 2000 the company was functioning as a wholly state owned utility. Now Hellenic Republic holds 51.12% of company’s share capital.

In 2001 PPC, as part of its transformation into a commercial entity capable of competing, in a liberalized market adopted an organization structure which more closely reflects its core business operations which include:
- Lignite Mining
- Electrical Generation

PPC is the leader in the Greek energy market producing approximately 90% of the total electricity demand in Greece. Ownership of the national grid (“Transmission System” and “Distribution System”) remains exclusively with PPC.

PPC has more than 50 years in house experience in exploration and open-cast mining.

Mining
- Lignite stays as the major and main pillar of the electricity generation for PPC.
- 97% of the lignite currently used in its lignite-fired power plants is mined from PPC own mines (70Mt per year).
- PPC has more than 50 years in house experience in exploration and open-cast mining.

Generation
- Total generation capacity of 12695MW of which 5288 MW is lignite power capacity. PPC generation capacity accounts 92% of the total generation capacity in Greece.
- Total generation in 2005 of 52,9TWh out of which 60,5% was lignite based.
- Based on Law a generation authorization capacity of 1600 MW is granted to PPC for the renewal and replacement of older units capacity. Out of this capacity, 400 MW will be lignite based and will be located in the Ptolemais-Florina region (North Greece).
Based on Law and with the aim to promote competition in generation, the HTSO is entitled to carry out tendering procedures for new power capacity of 900 MW to be constructed until the end of 2010, in which PPC is not allowed to participate. These plants will be partly financed by providing them long-term contracts (12 year with constant price) with guaranteed electricity sales. The first tender for 300 MW was launched on May 2006.

The following map shows the location of PPC power plants:

- Transmission
  - PPC owns almost 11'400 KM of high voltage transmission lines in the interconnected mainland system.
  - Four (4) active interconnections with neighboring countries (Bulgaria, Albania, FYROM, and Italy) are currently in operation. An interconnection with Turkey is under construction.

- Distribution
  - Sole distributor in Greece with over 7,1 million total customers.
  - A extensive distribution network 287'300 Km distribution lines which provides coverage to the entire population.
  - The operation of the distribution system will be separated from PPC’s business and will be joined with the HTSO until 2007, when all electricity consumers will be eligible customers.

PPC’s Business plants have four main objectives:
- Maintain market leadership
- Achieve efficiency improvements.
- Rationalize investments
- Explore further growth initiatives

The base load fuel is the lignite which gives a competitive strength in PPC fuel mix. Consumer prices in Greece are significantly below those in other comparable markets.

<table>
<thead>
<tr>
<th>EU Country</th>
<th>Industrial customers</th>
<th>Residential customers</th>
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</thead>
<tbody>
<tr>
<td>Austria</td>
<td>10,00 €/kWh</td>
<td>12,00 €/kWh</td>
</tr>
<tr>
<td>France</td>
<td>10,50 €/kWh</td>
<td>12,50 €/kWh</td>
</tr>
<tr>
<td>Germany</td>
<td>11,00 €/kWh</td>
<td>13,00 €/kWh</td>
</tr>
<tr>
<td>Italy</td>
<td>12,00 €/kWh</td>
<td>14,00 €/kWh</td>
</tr>
<tr>
<td>Portugal</td>
<td>8,00 €/kWh</td>
<td>10,00 €/kWh</td>
</tr>
<tr>
<td>Spain</td>
<td>9,50 €/kWh</td>
<td>11,50 €/kWh</td>
</tr>
<tr>
<td>Greece</td>
<td>6,70 €/kWh</td>
<td>8,70 €/kWh</td>
</tr>
</tbody>
</table>

The base load fuel is the lignite which gives a competitive strength in PPC fuel mix. Consumer prices in Greece are significantly below those in other comparable markets.

Source: Eurostat (2005)
The total proven lignite reserves in Greece amounts to approximately 5.8 billion metric tons located widely across Greece today. 3.1 billion tons of them are exploitable reserves suitable for electricity generation.

The following map shows the location of the main exploitable lignite reserves in Greece.

PPC has been granted by Ministerial Decree, the right to exploit approximately 40.5% of the exploitable lignite reserves in Greece located in Ptolemais, Amynteon, Florina and Megalopolis regions. For the remaining exploitable deposits an open tender procedure will be followed in order to grant exploitation licenses.

The quality of Greek lignite varies highly both within and across mines. The heating value ranges from 9610 to 7525 MJ/ton in Florina deposits, from 5850 to 5430 MJ/ton in Ptolemais deposits, from 5430 to 4390 MJ/ton in Amynteon deposits and from 4600 to 4390 MJ/ton in Megalopolis deposits.

Homogenization methods are applied to blend lignite of different quality characteristics to ensure consistent operating efficiency at the lignite-fired power stations, which are designed to burn the lignite produced in the neighboring mines.

The low sulphur content of lignite mined in Ptolemais deposits (0.3-0.6%) (Northern Greece) combined with its high level of calcium oxides (desulphurising agent) makes the combustion less environmentally harmful.

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The four mines (Main field, South field, Kardia field and Amynteon- Florina field) constitute the Lignite Center of Western Macedonia with an annual production of 1.8 Mt.

At present PPC operates five open-cast lignite mines in Western Macedonia region, Northern Greece and in Peloponese region (Megalopolis) located in Southern Greece together producing approximately 70 Mt of lignite per year. Besides PPC’s mines, another Company operates a small lignite mine in Florina’s basin with an annual production of 1.8 Mt.

The four minor mines (Main field, South field, Kardia field and Amynteon-Florina field) constitute the Lignite Center of Western Macedonia with an annual production of 55-57 Mt, while the mining complex in Peloponese region under the name of Lignite Center of Megalopolis produces approximately 14 Mt per year.
Lignite Industry in Greece

Exploitation Technology

- Lignite is mainly extracted by continuous operation of Bucket-wheel excavators, belt conveyors and spreaders. A special mining method “Selective Mining” has been developed in Ptolemais mines to solve the problems of lignite seam morphology (many lignite layers of varying thickness alternated by intermediate waste layers). Using this method the co-extraction and dilution of lignite with waste material is minimized.

The main mine equipment currently used in PPC mines are shown in the following table.

<table>
<thead>
<tr>
<th>EXCAVATORS</th>
<th>Theoretical Output in m³/h</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,000 - 11,100</td>
<td>4</td>
<td>11,000</td>
</tr>
<tr>
<td>5,750 - 5,100</td>
<td>11</td>
<td>5,750</td>
</tr>
<tr>
<td>3,600</td>
<td>8</td>
<td>3,600</td>
</tr>
<tr>
<td>2,200 - 2,200</td>
<td>13</td>
<td>2,200</td>
</tr>
<tr>
<td>1,800 - 2,000</td>
<td>7</td>
<td>1,800</td>
</tr>
<tr>
<td>TOTAL</td>
<td>43</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPREADERS</th>
<th>Theoretical Output in m³/h</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,500</td>
<td>6</td>
<td>1,500</td>
</tr>
<tr>
<td>1,000 - 1,000</td>
<td>6</td>
<td>1,000</td>
</tr>
<tr>
<td>600</td>
<td>2</td>
<td>600</td>
</tr>
<tr>
<td>400</td>
<td>6</td>
<td>400</td>
</tr>
<tr>
<td>200 - 400</td>
<td>2</td>
<td>200</td>
</tr>
<tr>
<td>TOTAL</td>
<td>22</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BELT CONVEYORS</th>
<th>Width (cm)</th>
<th>Km</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,000/3,000</td>
<td>44,8</td>
<td>2,000</td>
</tr>
<tr>
<td>1,600/2,200</td>
<td>39,0</td>
<td>1,600</td>
</tr>
<tr>
<td>1,200/1,800</td>
<td>37,6</td>
<td>1,200</td>
</tr>
<tr>
<td>800/1,200</td>
<td>38,0</td>
<td>800</td>
</tr>
<tr>
<td>600/900</td>
<td>5,0</td>
<td>600</td>
</tr>
<tr>
<td>TOTAL</td>
<td>121,3</td>
<td></td>
</tr>
</tbody>
</table>

- Lignite production has steadily been increasing over the past 3 past decades and particularly after the two oil crises. For PPC it was the predominant source of electricity production. For the period 1970-2005 the lignite production increased with CAGR approximately 7%.

- Figures 7 and 8 illustrate the annual lignite production and the total excavations since 1958 when the PPC mines commenced their operations. The upturn achieved in total excavation over the past two years is unusual for a complex technical operation such as mining.
Efficiency improvements in labour productivity
PPC’s mines made significant improvements over the past 5 years in increasing labour productivities:

- M³ excavated per 8 hours and employee
- Tones mined per employee.
- There is small productivity gap between PPC’s mines and peer group
- It is need to continue improving the productivity to remain competitive
- Productivity improvement is a never ending process

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Figure 8: Total masses excavated in PPC mines (m³ x 10⁶) 1958 - 2005

Mining Business Unit in line with other Business Units of PPC implemented over the last 5 years a realistic cost reduction plan which was putting emphasis on the reduction of personnel expenses by reducing stuffing levels and improving labour utilization.

Figure 10: Illustrates the evolution of number of employees of PPC’s mine for the period 2000-2005.

Lignite is a very cheap and stable source of energy that is readily available in large quantities.

The following diagrams show that the generation costs based on lignite were about 40% below oil and gas costs in PPC power plants.

Figure 11: Generation cost per fuel type (€ C/kWh) in the years 2000 and 2005.
Before coming to environmental issues it is needed to point-out the following:

- Lignite is a key strategic fuel for PPC and Greece due to:
  - Security of supply
  - Low extraction cost due to open cast mining and overall mining conditions.
  - Stable cost compared to the purchase cost of other fuel sources, particularly oil and natural gas.
  - Low sulphur content which makes it less environmentally harmful in and around the mining areas.

Lignite industry (mines and power plants) provides some 15000 jobs considering also other sectors benefit from lignite mining and utilization. Lignite mining and utilization guarantee over a long period of time large amounts of jobs in Greece.

Mining Business Unit is implementing a cost reduction plan which focus on the following objects:

- Reduce staffing levels through natural attrition and contained hiring.
- Improve equipment utilization and O&M practices through:
  - Reviewed maintenance programs
  - Reduction of downtime
  - Improvement of load factor
- Optimize fuel and electricity consumption
- Material purchasing and inventory management:
  - Volume pooling
  - Sourcing and contract management
- Redesign of purchasing processes and organization
- Consolidate inventories and install on-line tracking

Environmental protection is one of the major parameters defining PPC’s overall strategy and its daily operational mining activities.

To handle the technical, financial and social effects of the mining activities, projects have been worked out for environmental reclamation, for the reformation of the landscape and for the best use of the land. As it is shown in the next table 25% of the total land acquired through expropriation procedure for lignite exploitation has already been restored.

<table>
<thead>
<tr>
<th>AREAS</th>
<th>PTOLEMAIS</th>
<th>AMYNTAEON</th>
<th>FLORINA</th>
<th>MEGALOPOLIS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation</td>
<td>23,0</td>
<td>10,0</td>
<td>0,2</td>
<td>19,0</td>
<td>52,2</td>
</tr>
<tr>
<td>Dumping</td>
<td>25,0</td>
<td>14,0</td>
<td>0,1</td>
<td>7,0</td>
<td>46,1</td>
</tr>
<tr>
<td>Restored</td>
<td>31,3</td>
<td>8,7</td>
<td>0,0</td>
<td>7,1</td>
<td>47,1</td>
</tr>
<tr>
<td>Buildings, Warehouses, Yards, land not yet used</td>
<td>30,1</td>
<td>12,7</td>
<td>1,2</td>
<td>8,6</td>
<td>52,6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>109,4</td>
<td>45,4</td>
<td>1,5</td>
<td>41,7</td>
<td>198,0</td>
</tr>
</tbody>
</table>

Table: Use of land in PPC’s mines (Km²) 31.12.2005

Figure 12: Significant progress has been made over the years in reducing emissions from large combustion plants mainly lignite firing.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Dust Emission Factor from Large Combustion Plants</td>
<td>9.23</td>
<td>8.29</td>
<td>5.63</td>
<td>0.70</td>
</tr>
<tr>
<td>Specific SO₂ Emission Factor from Large Combustion Plants</td>
<td>16.77</td>
<td>16.09</td>
<td>9.53</td>
<td>7.02</td>
</tr>
</tbody>
</table>

Figure 12a: Significant progress has been made over the years in reducing emissions from large combustion plants mainly lignite firing.
Kyoto protocol’s application creates a new framework for the energy markets. The introduction of emission allowances will alter operating cost in the power generation sector. Lignite produced electricity affected much than gas produced electricity, because of the higher CO2 emission per unit of output.

For existing PPC’s power plants the average specific emission factor (ton CO2/MWh) related with fuel heating value and power plant efficiency is given in the next table.

In 2005 PPC paid 12.6 m € for the acquisition of CO2 allowances due to an almost 3% more CO2 emissions compared to its NAL’s allowances.

### Table: Specific CO2 emission factor of PPC’s power plants

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Specific Heating Value (ton CO2/MWh)</th>
<th>Heating Value (MJ/ton)</th>
<th>Unit Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lignite Megalopolis</td>
<td>1.49</td>
<td>4.350</td>
<td>32</td>
</tr>
<tr>
<td>Lignite Ptolemais- Amynteon</td>
<td>1.31</td>
<td>5.650</td>
<td>32</td>
</tr>
<tr>
<td>Lignite Florina</td>
<td>0.94</td>
<td>8.180</td>
<td>40</td>
</tr>
<tr>
<td>Oil</td>
<td>0.75</td>
<td>43.500</td>
<td>34</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>0.44</td>
<td>38.000</td>
<td>50</td>
</tr>
</tbody>
</table>

If CO2 emission allowances is lower than 48,4 €/tCO2 the long run marginal cost of electricity production of new lignite-fired units of high efficiency (+40%), which are supplied from deposits to those of Ptolemais, remains competitive compared to gas units with fuel price of 18.5 €/GJ and efficiency of 55%.

The enhancement of lignite competitiveness requires:
- Development and application of new exploitation criteria putting emphasis on particular lignite qualitative factors.
- Efficiency improvement of existing power plants to reduce CO2 emissions and invest in new installations with improved efficiency in the name of the clean coal technology.

In the existing Mining area the exploitable reserves which PPC has been granted the right to exploit them are sufficient to supply the installed lignite power plants for competing 45-50 lifetime since the commence of their operation. In these area the lignite reserves do not sustain a new lignite fired unit.

Figure 14 illustrate the lignite production and the total excavations from the existing PPC’s mines until they are exhausted. The lignite production drops gradually after the year 2015 and the reduction is drastic after the year 2020.
Today and in the future, lignite is and will be a robust element in Greece’s energy portfolio. In fact, viewed against the background of strong rises in oil and gas prices, its importance as a competitive domestic energy source has even tended to grow.

Lignite Industry’s task is and remains to provide answers to questions in connection with mining activities in the area of environmental protection and ecology, in the area of public acceptance, but also in the technical and economic fields. Public acceptance but also economic efficiency in lignite mining are joint goals.

The right approach to tackling climate change is the continuous modernization and major efficiency improvements of lignite power generation plants, which will help reduce emissions significantly in the short and medium term. Continuous modernization and increased efficiency is a pre-requisite to Carbon Capture and Storage. Efficiency and environmental compatibility can be increased in equal measure at low cost.

The fact that the stripping ratios are getting worse in the forthcoming years impose the necessity to apply integrated restructuring programs in the overall value chain of mining activities in order to minimize the operational costs.

Lignite in compliance with EU environmental legislation will continue to be a secure and an economic supply and the predominant source of energy in the power generation system of Greece.

Thank you for your attention.
PANEL DISCUSSION

In the Panel Discussion, participants focused on the following issues:

Mr. Hilbrecht summarized the presentations and suggested removing barriers to low or zero emission power generation from coal in future. Three major action areas have been identified: The regulatory framework; here, existing barriers, resulting from international agreements as well as EU legislation adopted without taking CCS into account, must be lifted. In particular, the Emissions Trading Scheme must be adapted to CCS. Lifting technological and cost barriers should be addressed by the ten demonstration projects announced and be promoted with funds from the FP7 (the Seventh Framework Program for Research in the EU). As far as costs are concerned, the objective must remain to build and operate Capture and Storage installations at €20/t CO₂. Public acceptance issues must be solved; this remains to be done.

Mr. Yaxley again stressed that climate protection issues can only be solved on a world-wide basis. Europe can move forward to a certain extent, but must however obtain that other large emitters make an appropriate contribution.

The Shadow Rapporteur of the European Parliament on the Green Paper, Mr. Reul, MEP, said that the European Parliament, with its Position on the Green Paper, had the opportunity for the first time in a long while to express its opinion on a future European energy policy in general. Coal as an affordable and securely available source of energy would certain play a role in the future energy mix. Mr. Reul referred to a recent Study of the German Bundesanstalt für Geowissenschaften- und Rohstoffe (BGR) according to which coal will be the most important source of energy world-wide in 25 years. Coal must however tackle its environmental challenges. Mr. Reul referred to the success in his country, Nordrhein-Westfalen, where the continuous construction of new power plants has achieved significantly improved efficiency and CO₂ reductions compared with old power plants. In his opinion, the second step -Carbon Capture and Storage- has good perspectives. He explicitly backed the request to not only support renewables in FP7, but also Clean Coal Technologies.

The Rapporteur on the Green Paper within the European Parliament, Mrs. Morgan, MEP, stressed the relatively high CO₂ emissions from coal-fired power plants in her Report. Ambitious objectives for all fields of energy use including renewables were necessary in order to rapidly develop power production capacities with less CO₂ emissions in the EU. Carbon Capture and Storage should be implemented as soon as possible; as objective she mentioned ten functioning power plants with CCS on a commercial basis already by 2015. The ETS should be further developed simultaneously, to promote the polluter pays principle; emissions certificates in particular should be completely auctioned.
Among others, Mrs. Morgan and Messrs. Milojcic, Wodopia, Hilbrecht, Reul, Heinrich, Harris, Bogalla and Yaxley took part in the discussion. During Questions and Answers, participants mainly addressed the following aspects:

CO₂ Capture and Storage is at the moment mainly discussed with regard to coal use; however it is also a question of the use of other fossil fuels in power plants. The coal industry, the authorities and the public must go forward with full commitment to develop all possible technological pathways to achieve CO₂ Capture and Storage. However, at the moment, one cannot say how much time is really necessary and which technological pathway will be the best. This also means that the term “capture ready” remains unclear at the moment. The aspect of coal to liquids should be examined further. Any global targets for greenhouse gas emissions after 2012 should be agreed on very quickly. Policies must set ambitious but still realistic objectives for the industry. Off-beat objectives due to ideological reasons would harm policy making.

EURACOAL’s President Nigel Yaxley thanked the Commission for the joint organization of the 3rd Coal Dialogue. He reaffirmed that the coal sector wants to contribute to the solution of the energy challenges the EU is facing. In particular, the sector is ready to invest in coal projects with Clean Coal Technologies including Carbon Capture and Storage if the political framework is appropriate.

Mr. Hilbrecht and Mr. Yaxley thanked the speakers for their valuable contributions. They particularly thanked Mrs. Morgan and Mr. Reul for their participation and also for the open and frank discussion that would certainly be pursued during 2007.