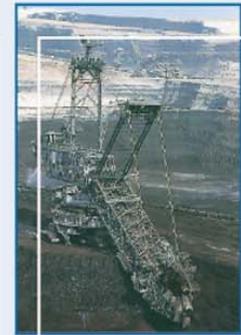




**SDIMI
2007**



**Coal in the EU Energy Power
Current Challenges and Barriers
to Cleaner Coal Power**

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Presentation Overview



- **Introduction**
- **The Role of Coal for Power Generation in the EU and for Affordable Power Supply**
- **Coal in the Future Energy Mix of EU**
- **Challenges to Cleaner Coal Power**
- **Barriers to Cleaner Coal Power**
- **Conclusions**





1. Introduction

The current energy price level suggests future supply bottlenecks

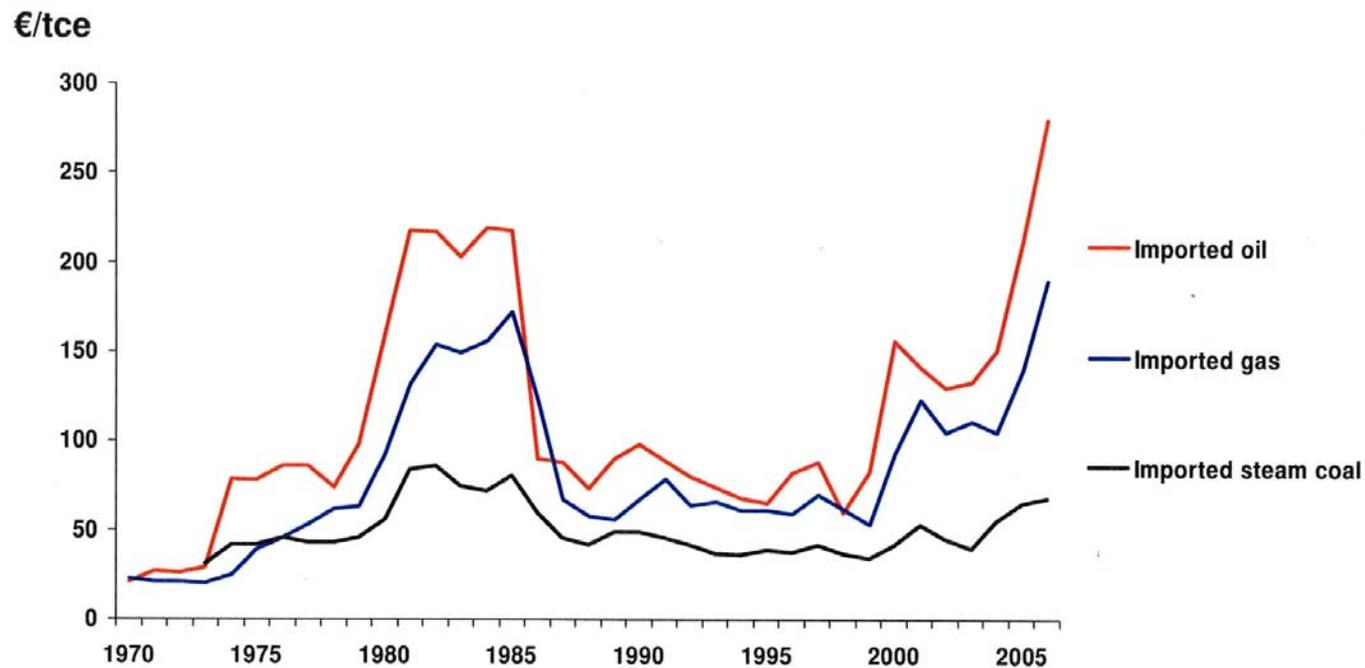


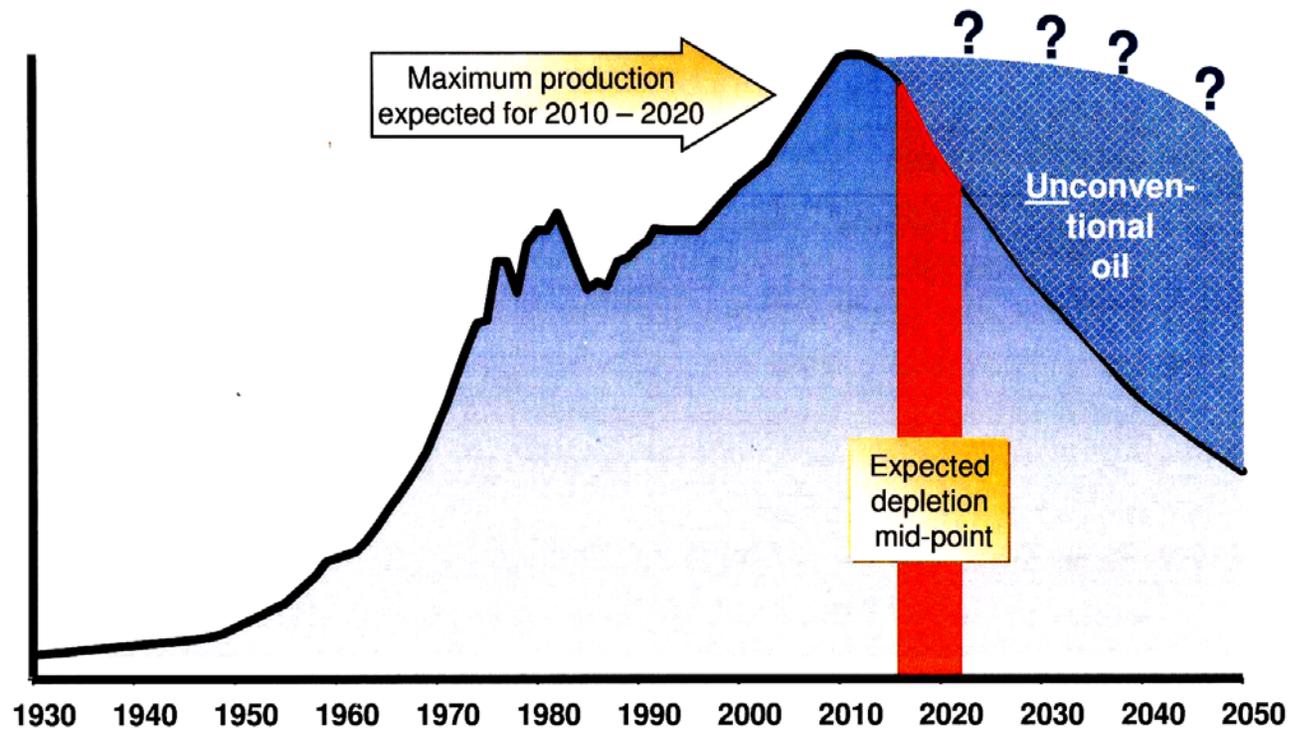
Figure 1: Price developments of imported energies free European border (Germany)





1. Introduction

Crude oil demand exceeds available production capacity



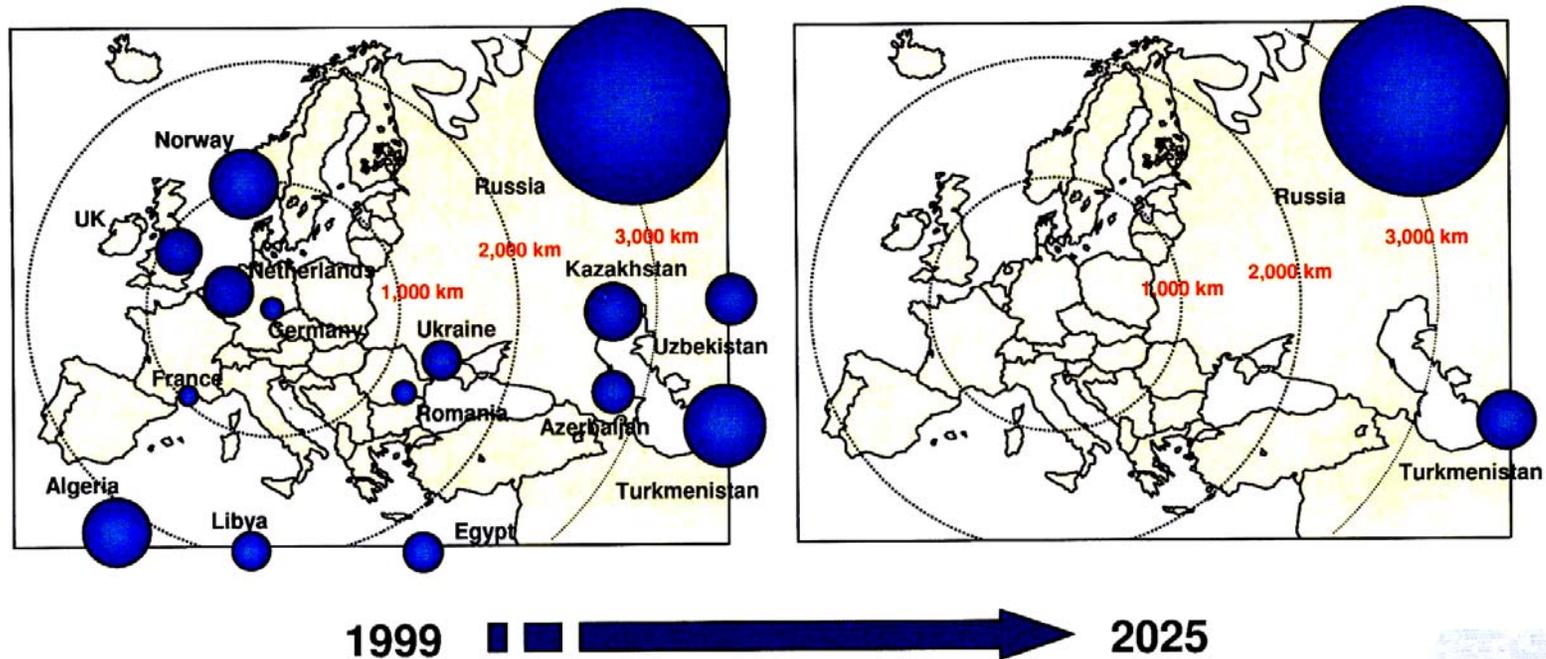
Source: Udall and Andrews, 1999
and Hiller, 1999

Figure 2: Crude oil production capacity till 2050





1. Introduction



► Growing dependence on gas sources in politically unstable regions

Figure 3: Gas reserves in the European area 1999/2025 (Source RWE)





2. The Role of Coal for Power Generation in the EU and for an Affordable Power Supply



2.1 Reserves

- Coal reserves are abundant
- Coal reserves are distributed more favourable than those of gas and oil

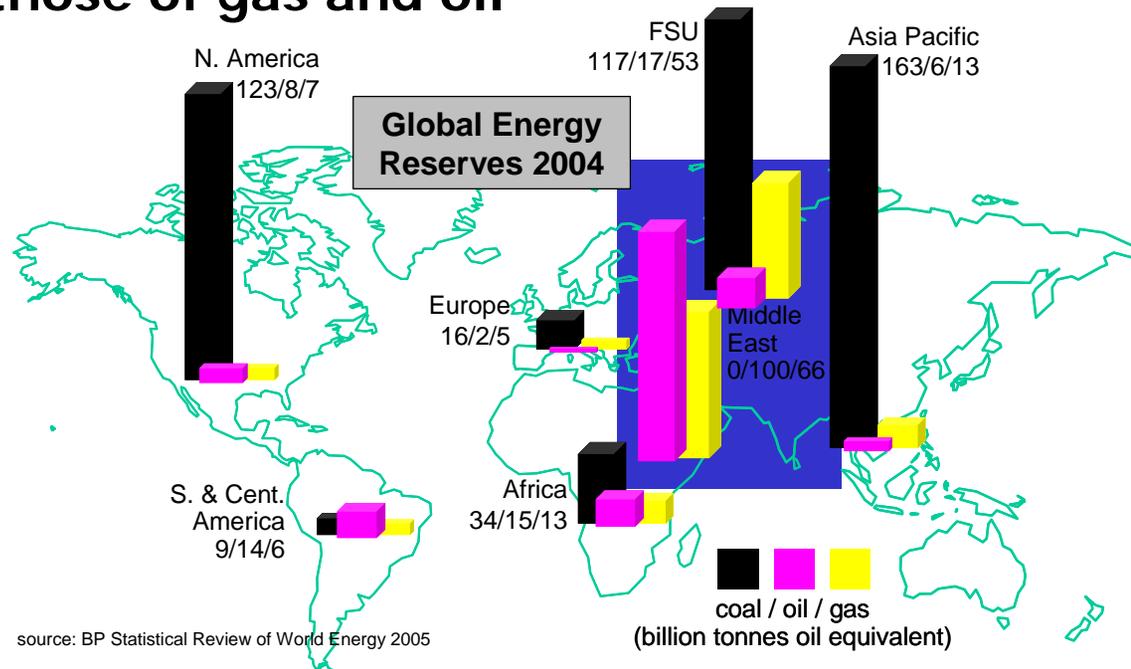


Figure 4: Distribution of fossil fuels reserves around the globe (source: BP Statistical Review of World Energy 2005)





2. The Role of Coal for Power Generation in the EU and for an Affordable Power Supply



2.2 Coal Production and Consumption

- Europe is the third largest coal consumption region in the world behind China and USA

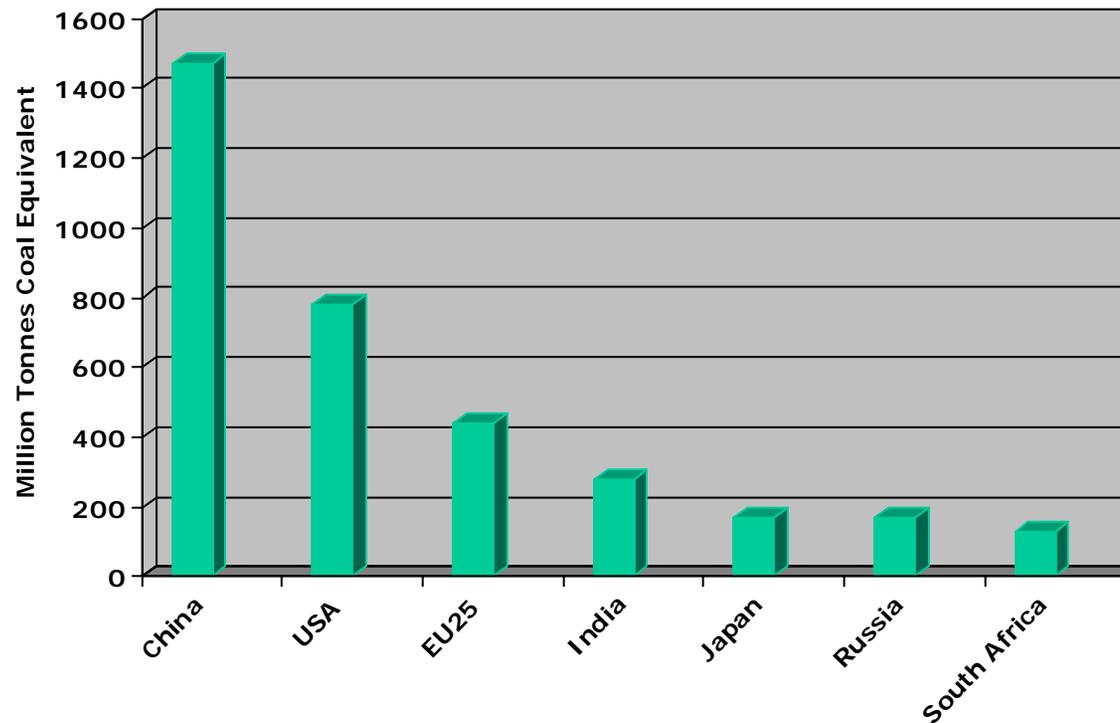


Figure 5: Major world coal consumer countries





2. The Role of Coal for Power Generation in the EU and for an Affordable Power Supply



2.2 Coal Production and Consumption

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

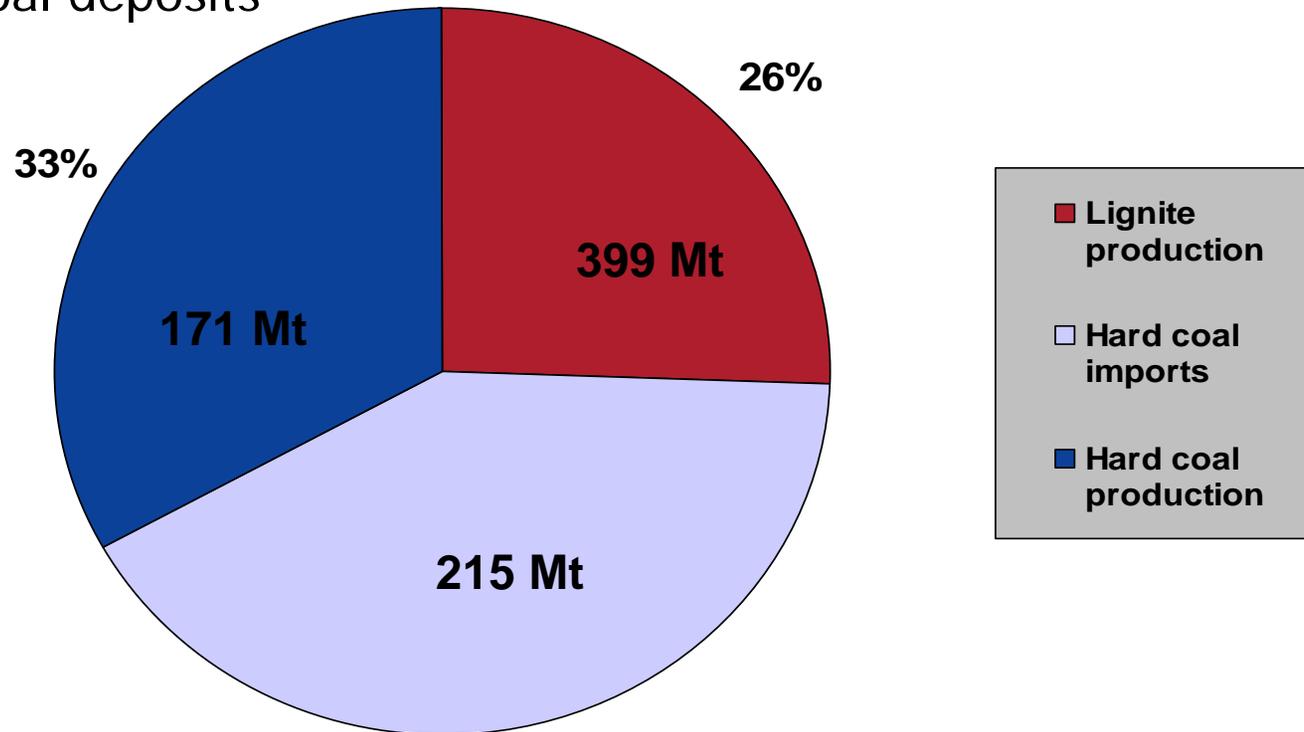


Figure 5a: EU25 Solid Fuel Supply 2005 (adjusted for calorific value)





2. The Role of Coal for Power Generation in the EU and for an Affordable Power Supply



2.3 The role of coal in power generation

- Power generation structures in selected EU-27 states. Coal is important in EU power generation

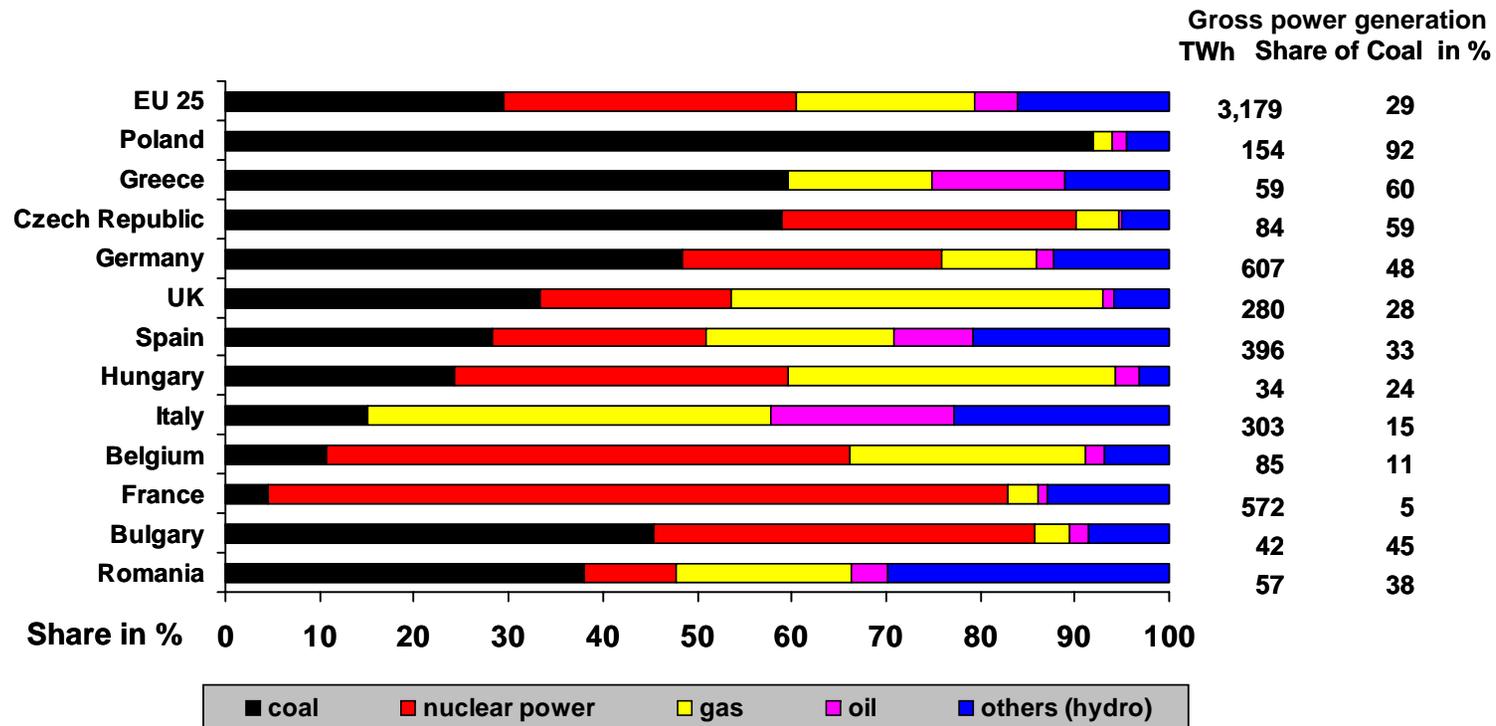


Figure 6: Different power generation composition in EU Member states





2. The Role of Coal for Power Generation in the EU and for an Affordable Power Supply



2.3 The role of coal in power generation

- The diversity of the generation mix across the EU varies from one member state to the other

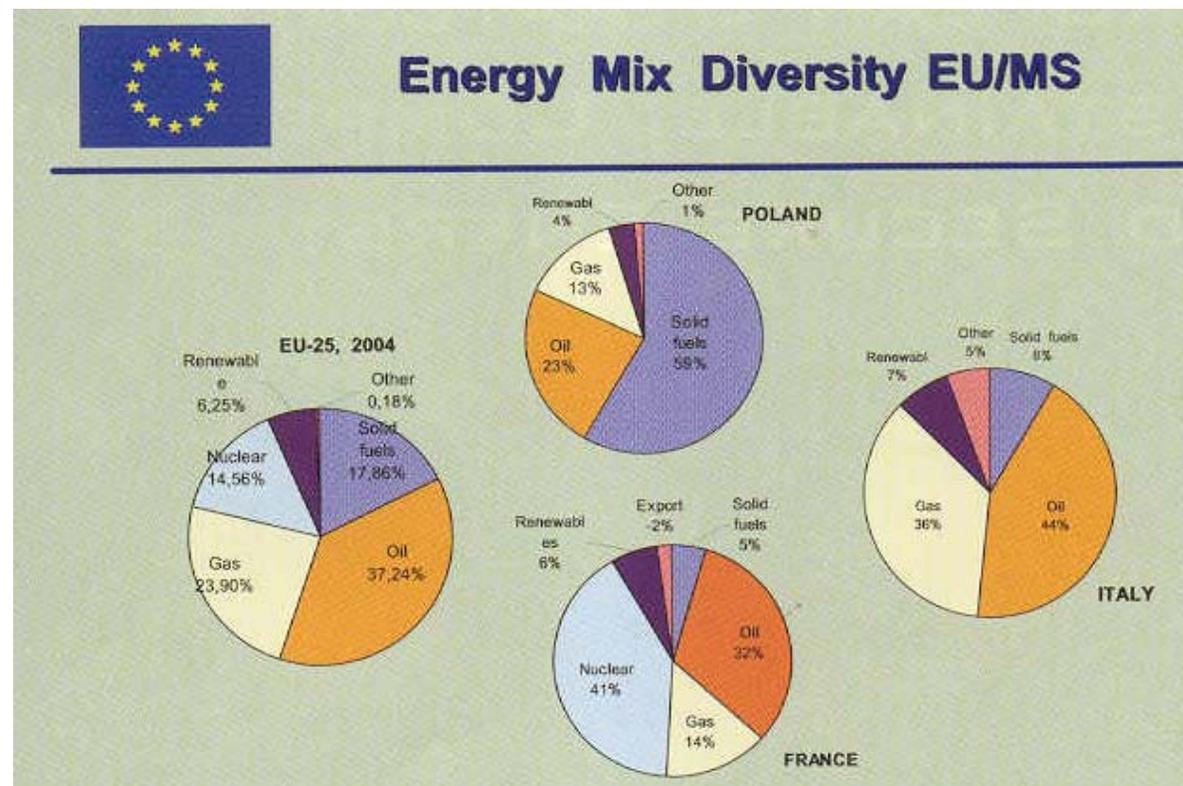


Figure 7: Energy mix diversity of EU Member States

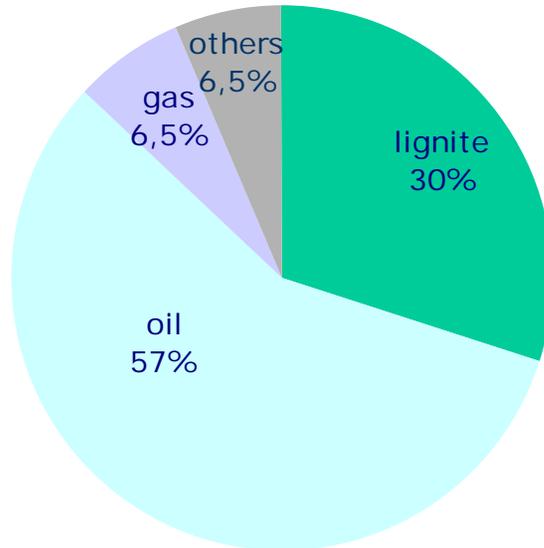




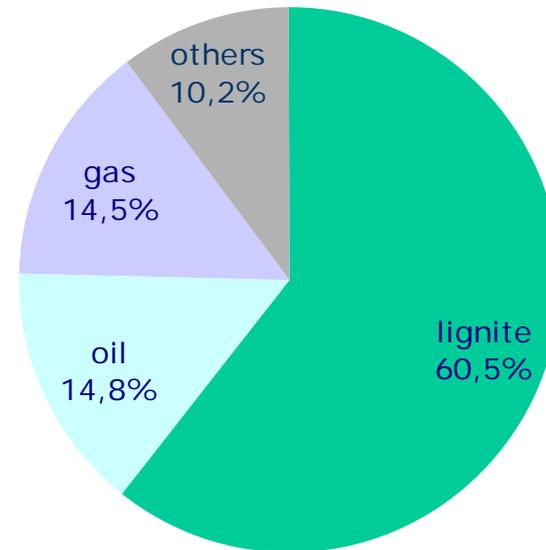
2. The Role of Coal for Power Generation in the EU and for an Affordable Power Supply



2.4 The role of lignite in Greece's power generation



Primary Energy Consumption in 2004



Electricity generation by fuel type in 2005

Figure 8: Greece total primary energy consumption in 2004 and electricity generation by fuel in 2005





2. The Role of Coal for Power Generation in the EU and for an Affordable Power Supply



2.4 The role of lignite in Greece's power generation

- Lignite as the base load fuel gives a competitive strength in its power generation fuel mix

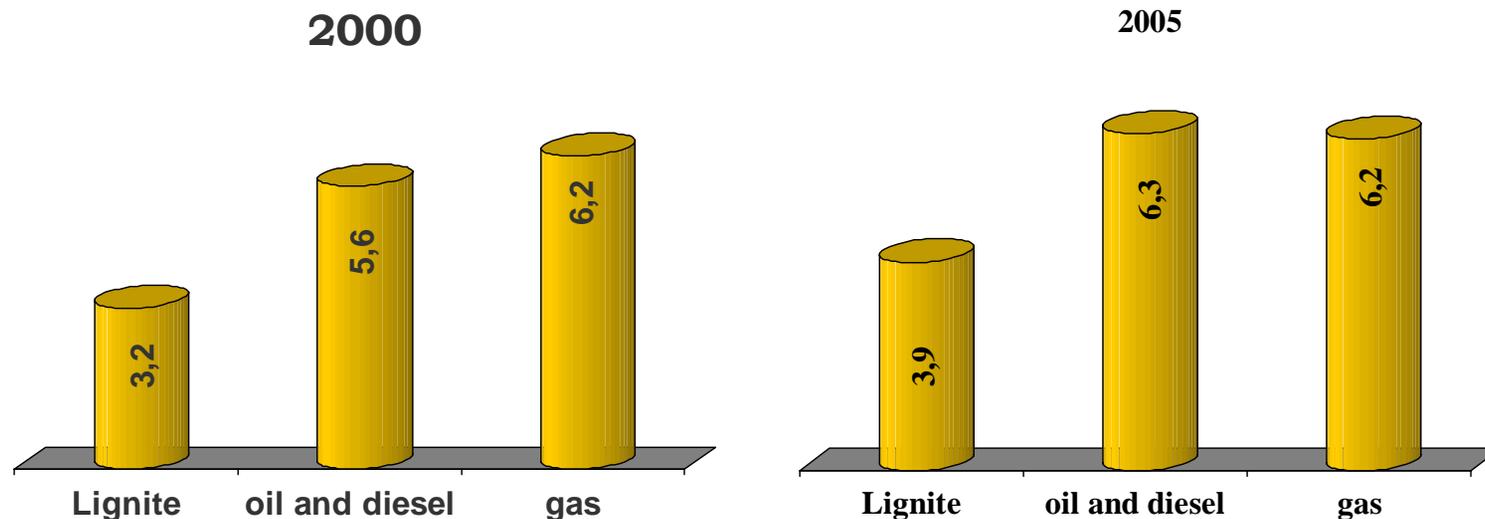


Figure 9: Generation cost per fuel type (€/KWh) in the years 2000 and 2005



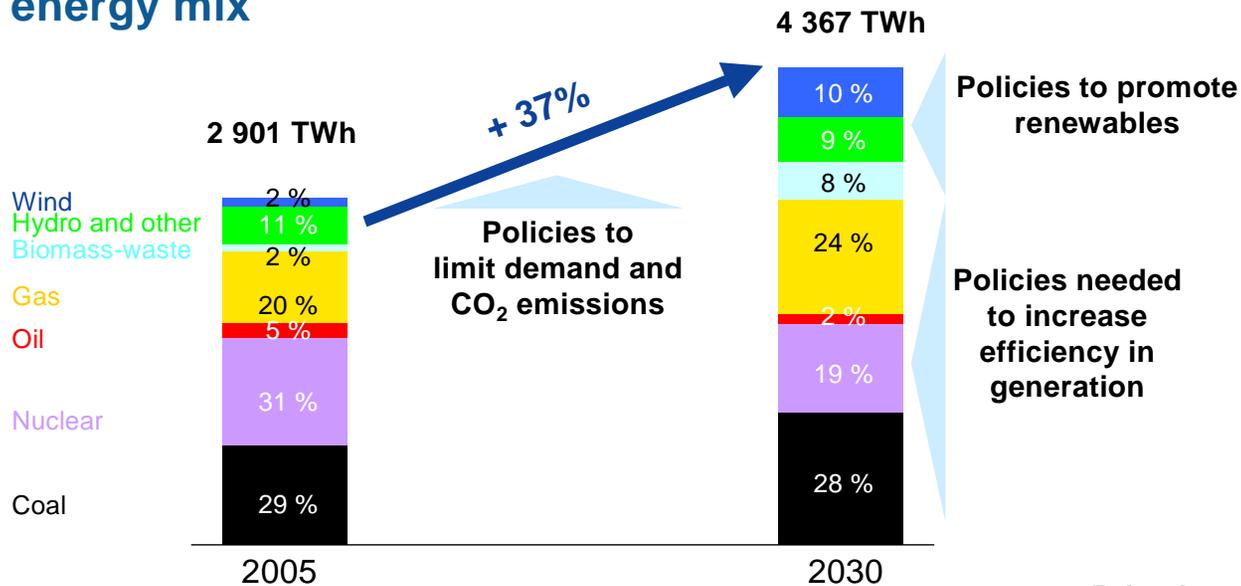


3. Coal in the Future Energy Mix of EU

- The EU Commission's predicted trend to 2030 for power generation

Coal in European Energy Policy

Coal will remain a major component of the European energy mix



Policies are needed to enable all fossil fuels to contribute to the solutions for climate change

Figure 10: Energy mix and increase in energy demand by 2030 – EU Commission's scenario





3. Coal in the Future Energy Mix of EU



- **The major objective of the latest EU Energy Package recently adopted by the Commission**
 - **20% share of renewables, even more in electricity production**
 - **20% energy increase (1990 to 2020)**
 - **13% less energy use from now to 2020**
 - **Greenhouse gas reduction in EU-27 by 20% (2020 compared to 1990). Objective of 30% to be proposed in international negotiation. Aim to 50% reduction by 2050.**

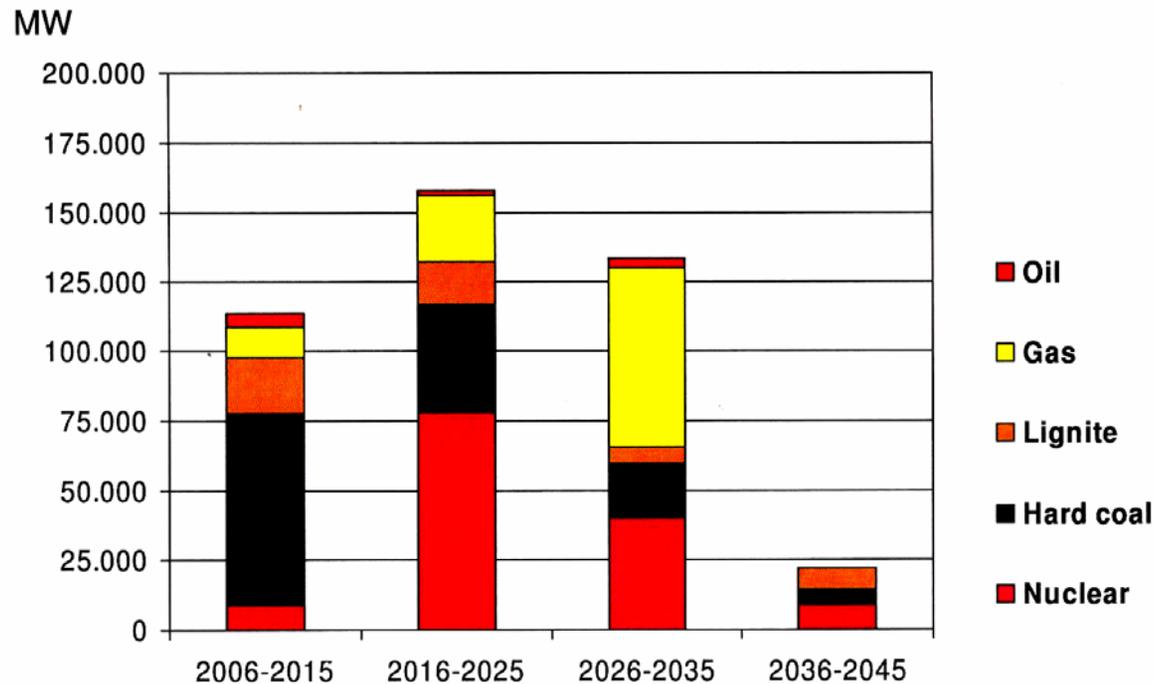




3. Coal in the Future Energy Mix of EU



- Based on a simplified assumption with a lifetime of 40a for coal-based and nuclear power plants and of 30a for oil and gas-based power plants



Source: Prognos

Figure 11: Power generation capacity to be replaced in the EU-25 in the short to medium term





4. Challenges to cleaner coal power



- Lignite mining and lignite-based power generation will continue to meet sustainability criteria

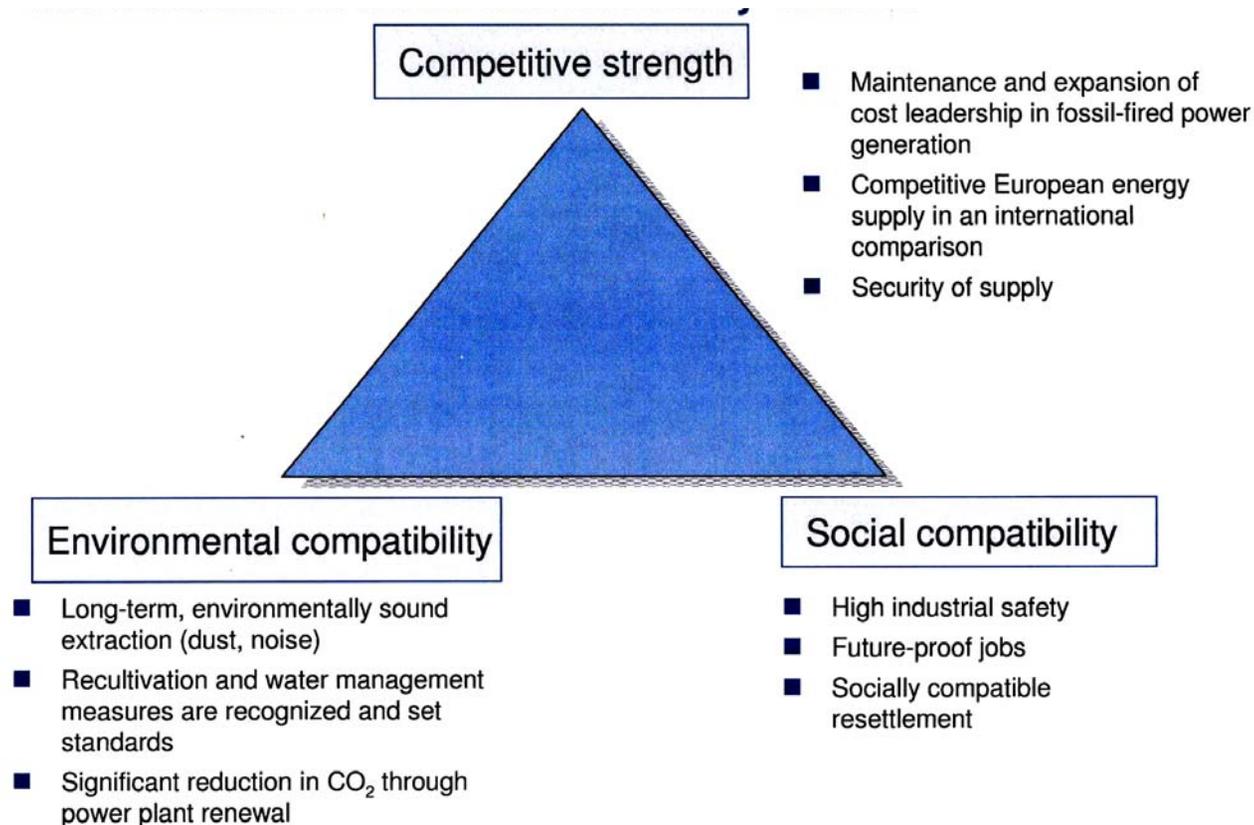


Figure 12: Principles of EU energy policy





4. Challenges to cleaner coal power



- In EU coal sector face great challenges which are as follow:
 - Security of supply must be underpinned in the long term
 - Efficient actions must be taken to prevent climate changes
 - Investment in replacement and new generations plant and grid installation must be made





4. Challenges to cleaner coal power



- **Clean Coal concept**

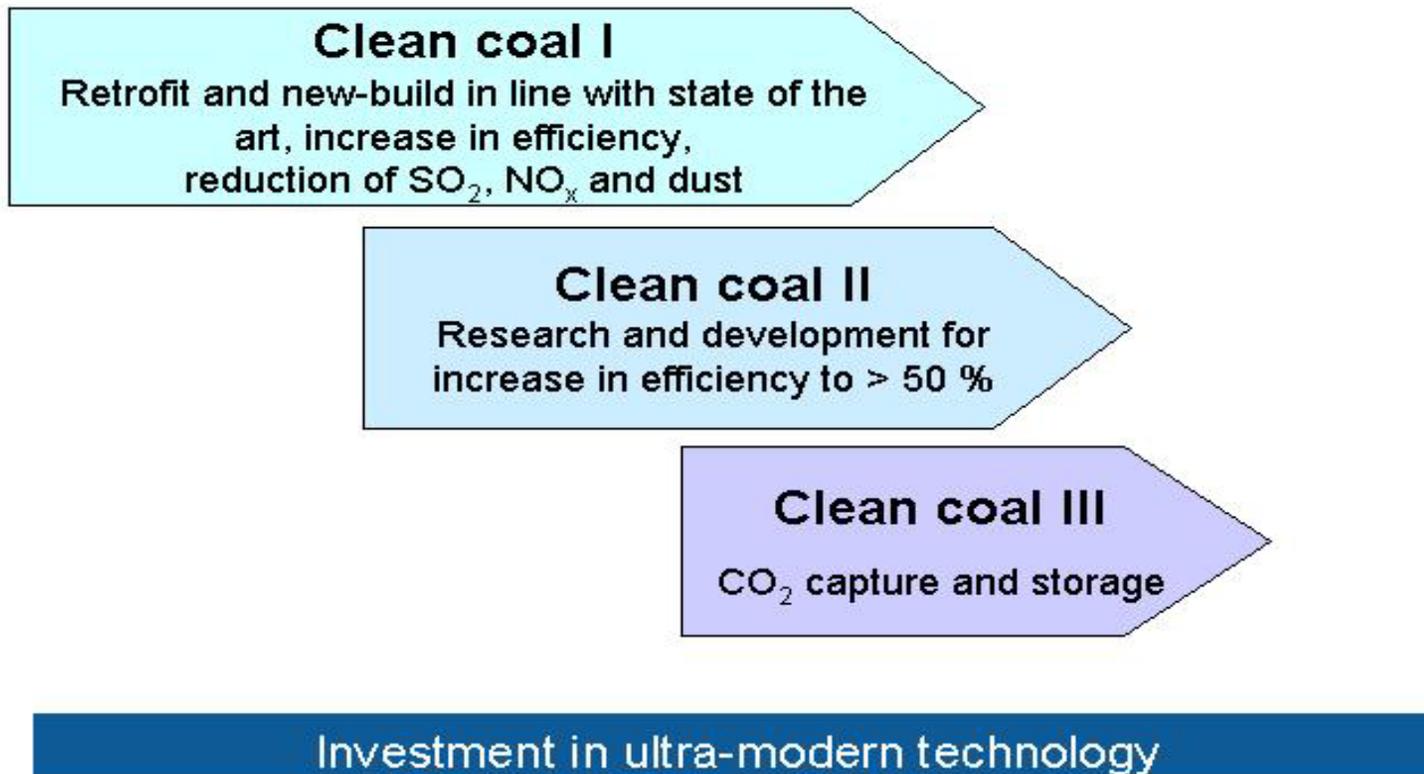
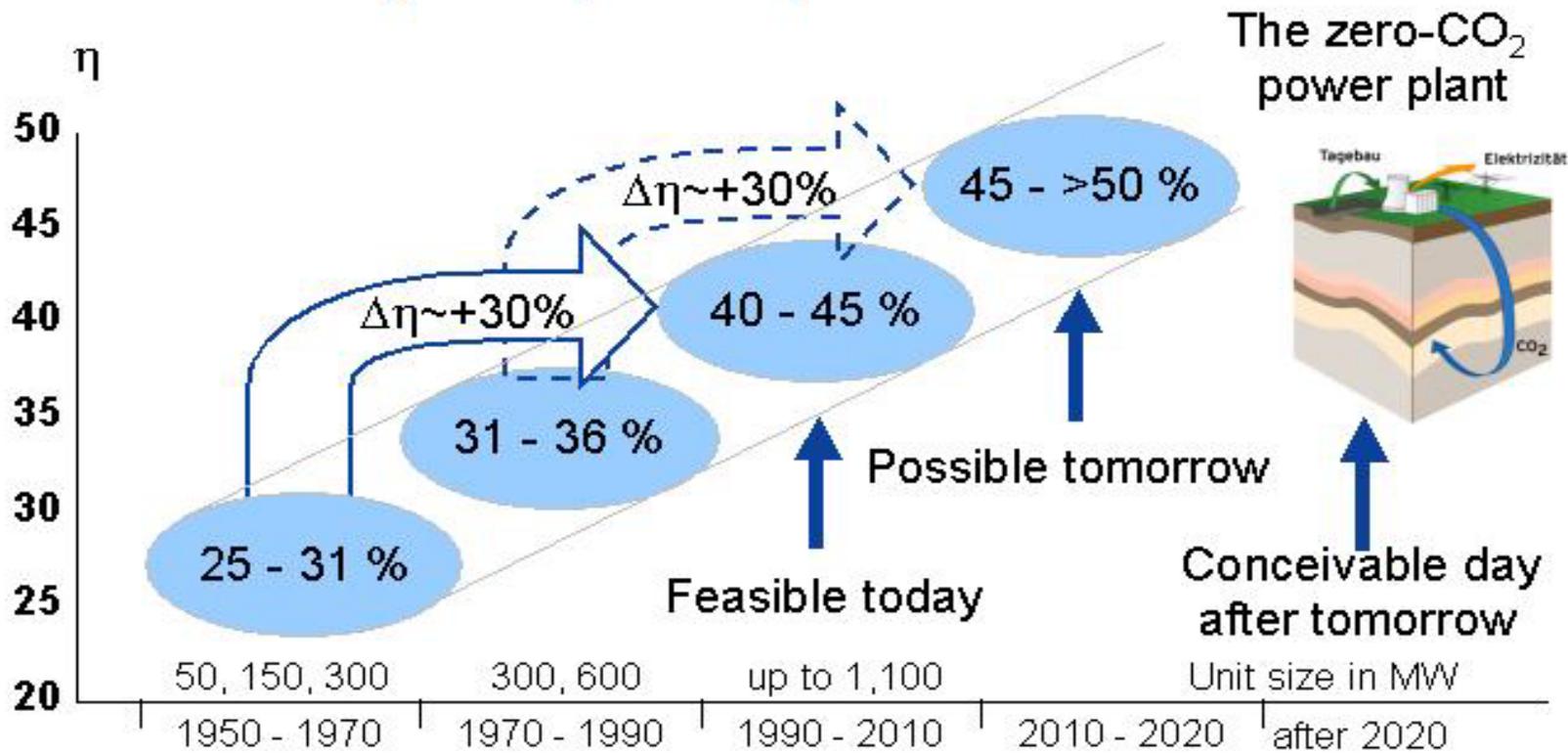


Figure 13: Clean coal comes in three stages





4. Challenges to cleaner coal power



The right approach: continuous power plant modernization/renewal

Figure 14: Evolution of power plants increase in efficiency and future targets





4. Challenges to cleaner coal power



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%**

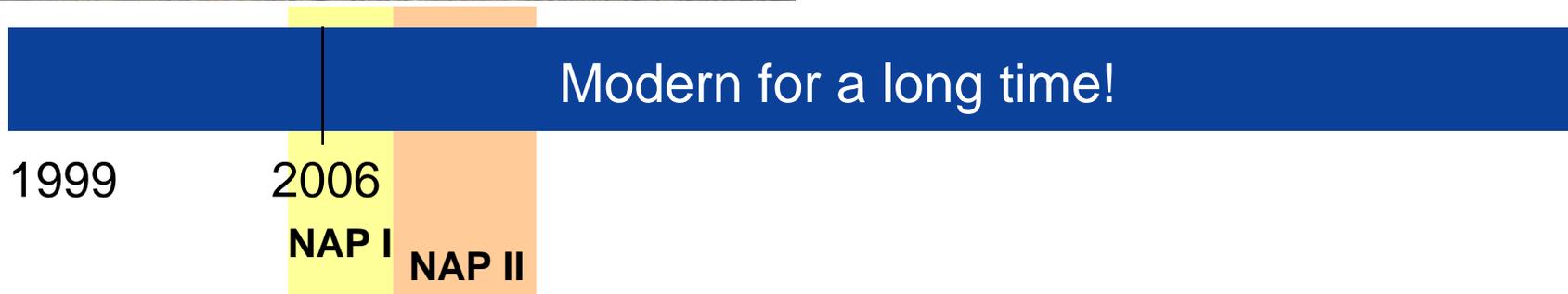


Figure 14a: Lignite-fired power plant "Lippendorf"





5. Barriers to cleaner coal power



5.1 Emission Trading Scheme (ETs)

- EU ETs can only drive investment if there is longer term certainty
- CO₂ reduction through fuel switching has become increasingly expensive and risks jeopardizing European competitiveness
- Significant CO₂ reductions can be achieved in the meantime with more efficient capacity replacing life-expired plants
- The ETs is the main reason for a lack of investment in coal-fired plants in many EU Member States



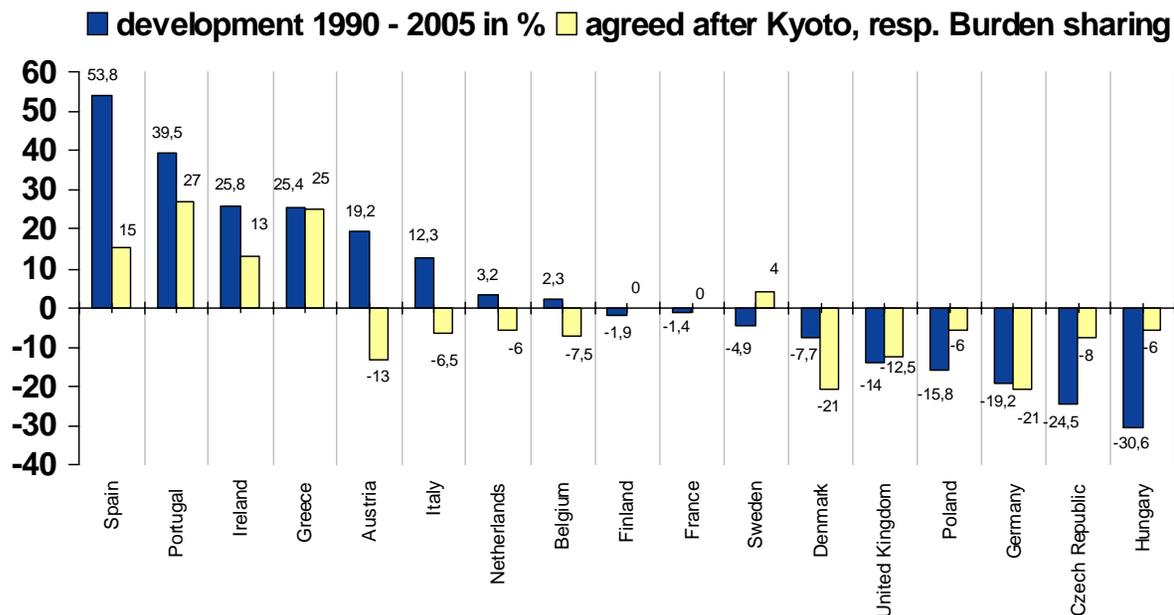


5. Barriers to cleaner coal power

5.1 Emission Trading Scheme (ETs)

Emissions Trading – Burden Sharing

EU-Greenhouse Gas Emissions



Source: UNFCCC 2006, DIW Berlin

Figure 15: Changes in Greenhouse Gas Emissions since 1990 and comparison to the Kyoto commitments-Burden sharing





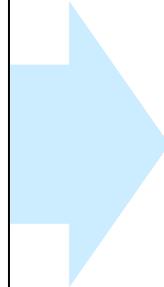
5. Barriers to cleaner coal power



5.2 The Status of CO₂ capture and storage

CO₂ Capture

- Pre-combustion at gasification plants (IGCC)
- By combustion of oxygen (Oxyfuel)
- Post-combustion at conventional power plants



CO₂ Storage

- In depleted oil and gas fields
- In aquifers
- In coal seams
- By mineralisation

Research in both areas with the same effort.

Without possibilities for storage and acceptance, no zero-CO₂ power plant.





5. Barriers to cleaner coal power



5.2 Storage of CO₂

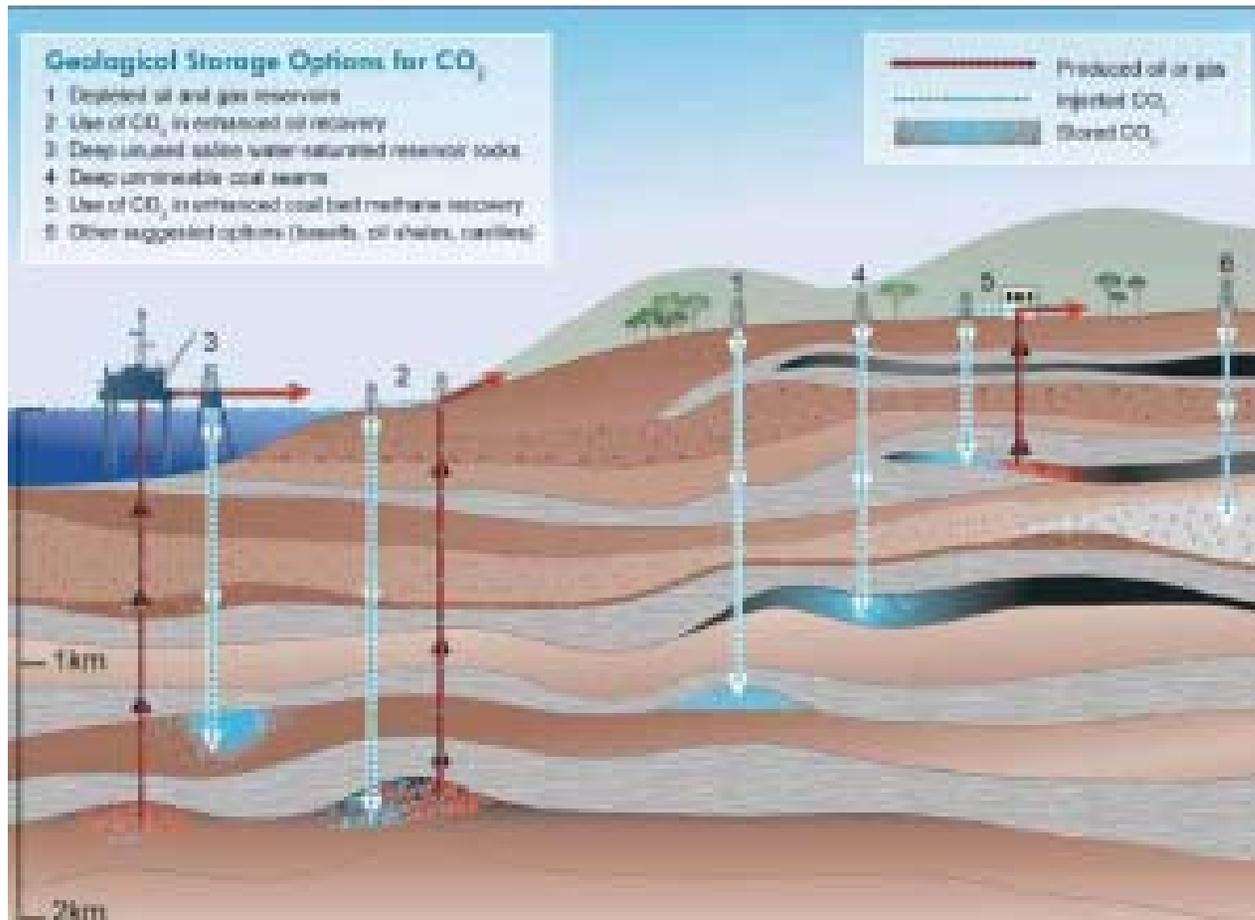


Figure 16: Geological Storage of CO₂

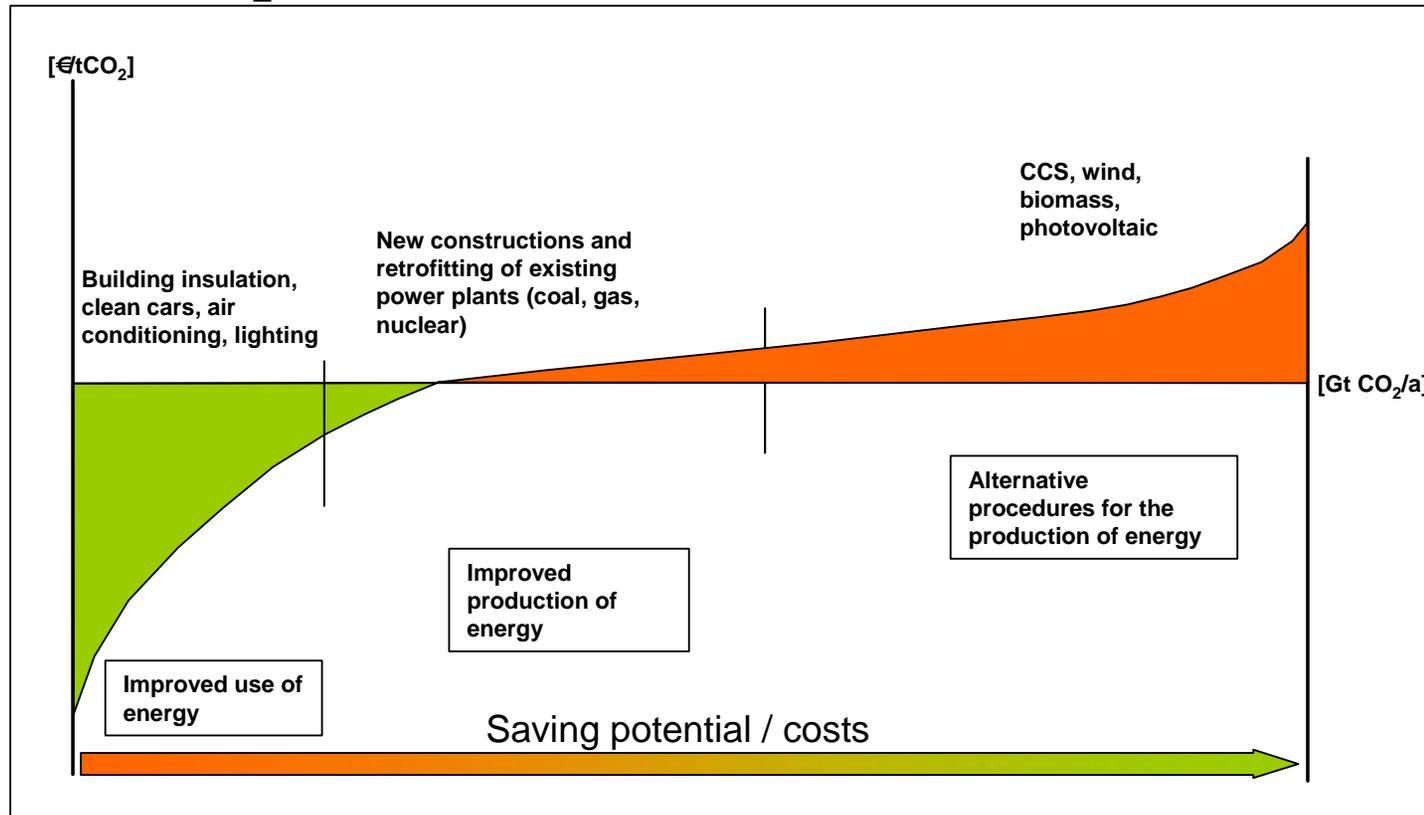




5. Barriers to cleaner coal power



5.2 Cost of CO₂ reduction



Source: simplified description McKinsey Study

Use all potential available. Provide incentives in order to achieve what can already be done





6. Conclusions

- Coal provides a unique contribution to security of supply
- Reasonable and relatively stable prices of coal help competitiveness
- Coal already has a fully functioning market – aiding competitiveness
- Coal also responds well to the Green Paper priorities
 - The Coal Industry backs the ZEP and SMK Technology Platforms





6. Conclusions

- **Coal Industry welcomes planned coal-based pilot and demonstration plants with CO2 Capture and Storage**
- **Continues modernisation and efficiency improvements help to reduce CO2 emissions in the short and medium term**
- **Technological as well as Political action is needed to make CCS and cleaner power from coal a reality**
- **An efficiency of more than 50% in coal fire power plant still needs research and development**





6. Conclusions

- The EU ETs regime must ensure that investment in coal-fired power plants in the medium term as well as in the long term are supported
- CCS is a promising technology route an upgrade to the commercial scale is the challenge but realistic timeframes are required



6. Conclusions

Coal is a sustainable part of EU energy mix

Thank you

