Perspectives on International Coal Markets and Prices

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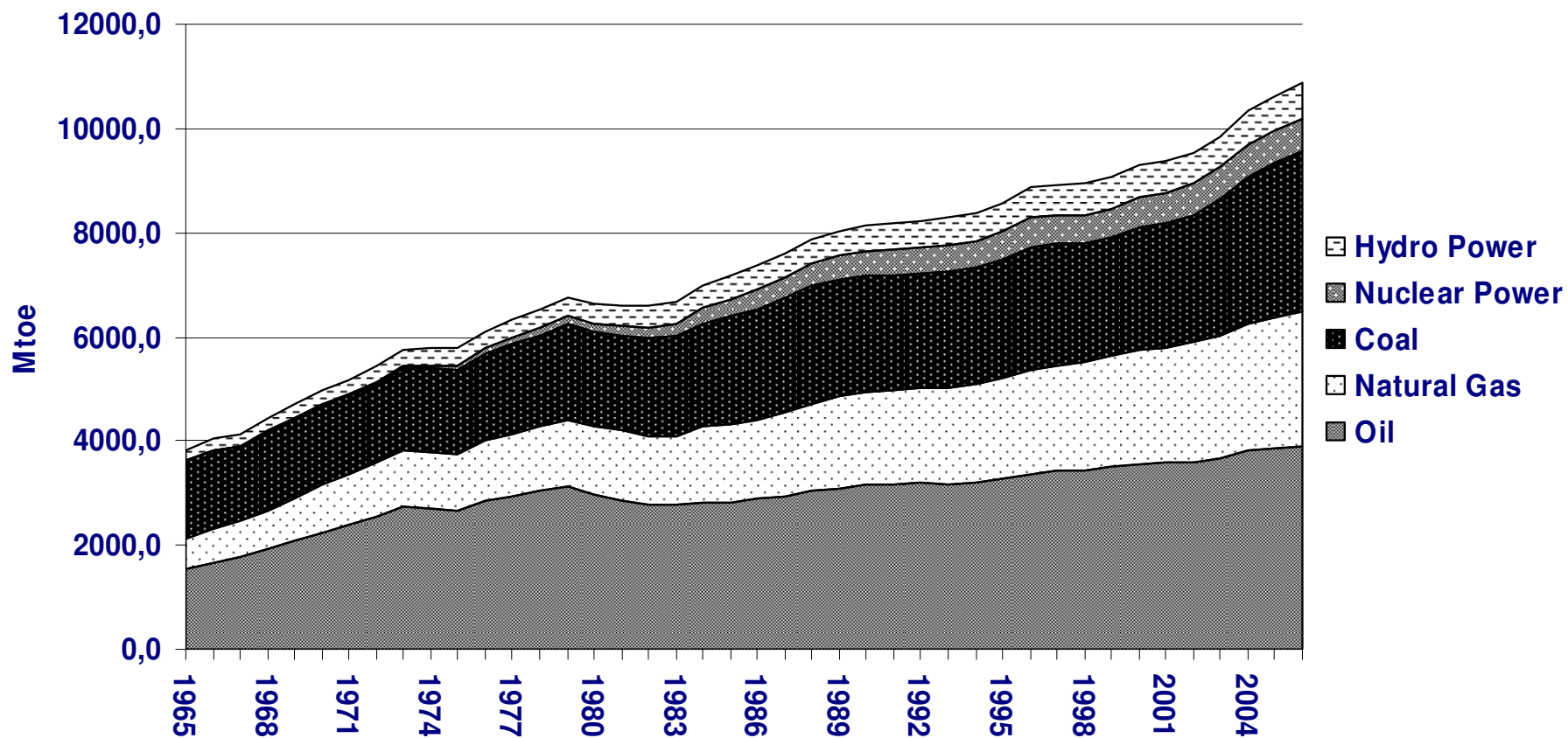**Luleå University of Technology**
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Agenda

1. Introduction: Historical Development

– Before the 1960s hardly any trade – substantial decreases in tranportation costs opened up a market.

– Today an international market (Note: most coal consumption is still produced in the same country).

– Steam coal emerged as a viable option for electricity use even for countries with little/expensive production.

– In 2001 91% of produced coal was used in electric power generation.

– World hard coal consumption has increased by more than a third since 2000.

1. Introduction: Coal in Energy

Energy Consumption by Fuel
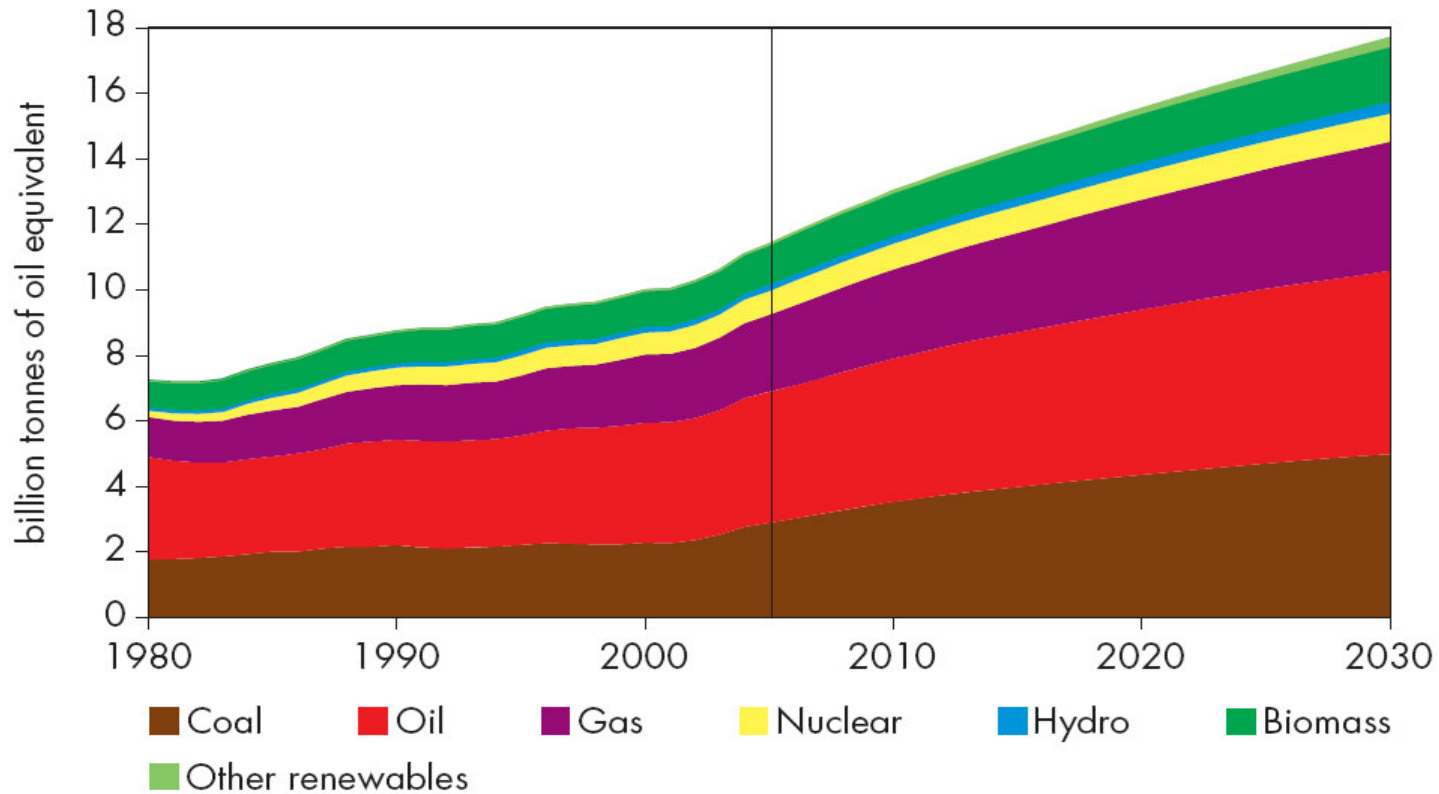

Legend:
- Hydro Power
- Nuclear Power
- Coal
- Natural Gas
- Oil

Y-axis: Mtoe (0,0 to 12000,0)

X-axis years: 1965, 1968, 1971, 1974, 1977, 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001, 2004

Source: BP Statistical Review, 2007

1. Introduction: Future

Figure 1.1: **World Primary Energy Demand in the Reference Scenario**

1. Introduction: Future

- **Alternative Policy Scenario:**
  - Assumes that energy-security and climate-change concerns have been adopted.
  - Energy demand in 2030 is 11% less than in the Reference Scenario (RS).
  - CO_2 emissions are 19% lower in 2030 than in RS, but are 25% higher than in 2005.
  - Lower fossil-energy consumption – due to more effcient technologies.
  - Demand for coal falls more than the demand for other fuels.

Source: World Energy Outlook, 2007
*** CCS is not deployed**

1. Introduction: Conclusions

- Coal's share in energy has been stable, and rising, during the last decades.

- Security of supply not an issue regarding coal – reserves are abundant globally.

- Q: Why has coal's share been rising despite many negative aspects?

- A: Prices and international trade. Reminder of presentation devoted to these issues.

2. Price Development

Coal Prices in US $ per tonnes
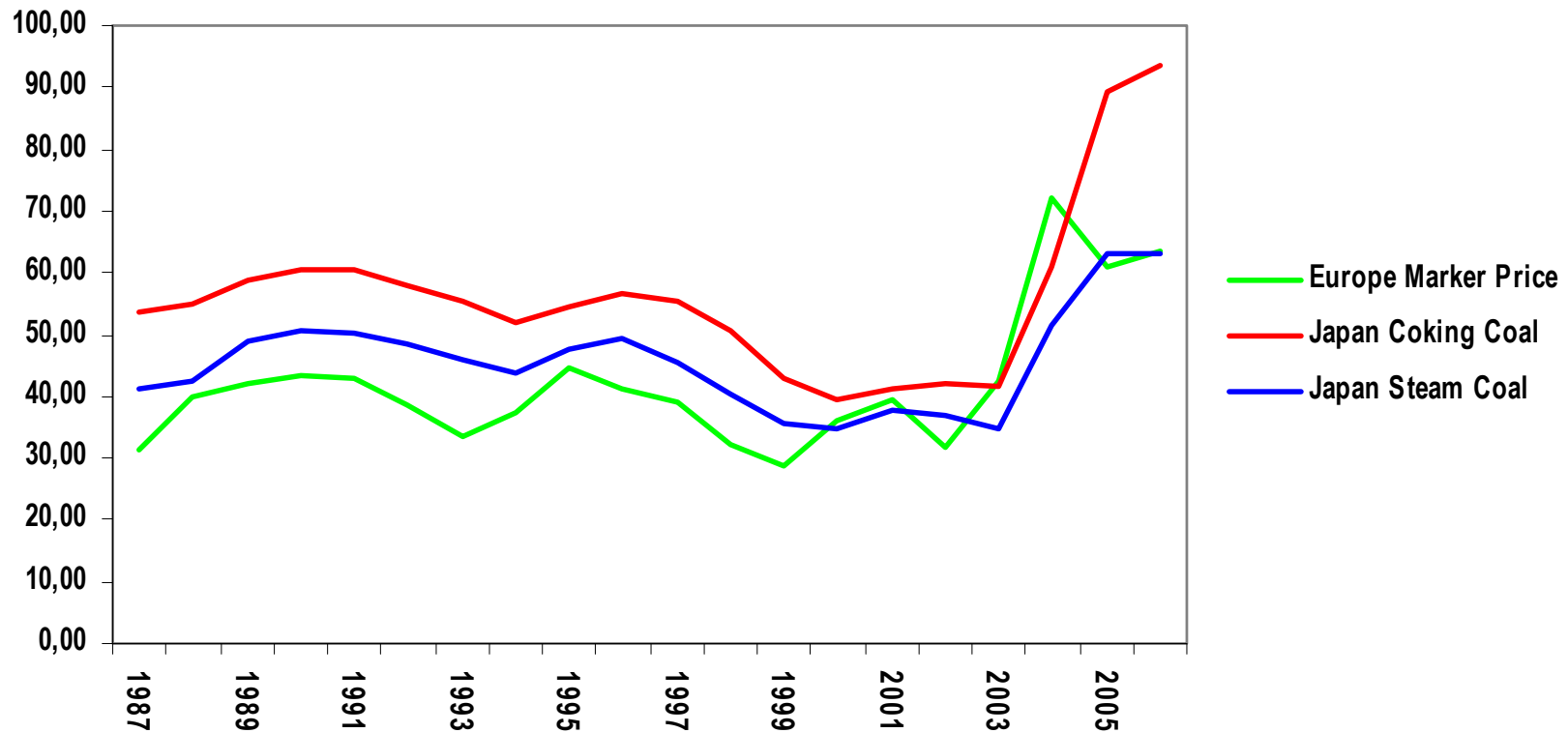
Source: BP Statistics, 2007

2. Price Development: Analysis

- **Why higher prices since 2002?**
  - Substantial increase of energy demand in China and India.
  - A period of lower market prices between 1991-2002 $\rightarrow$ low investments in exporting countries.
  - Althogh these investments are now being made, the rapid increase in coal demand is higher – upward pressure on prices.
  - Transportation costs has increased due to the general higher demand for transported bulk goods.

2. Price Development: Future

- Volatile prices reflect supply and demand uncertainties.

- High prices will continue if the strong demand continues (dependent on China & India).

- However, price of coal has increased less than prices of oil and natural gas.

- Coal is still expected to be the cheapest option – but dependent on future energy policy developments.

2. Price Development: Future

Figure 2: Assumed Ratio of Natural Gas and Implied Relation of Coal Prices to Oil Prices in the Reference Scenario

— European gas imports — Japanese LNG imports — US gas imports — OECD steam coal imports
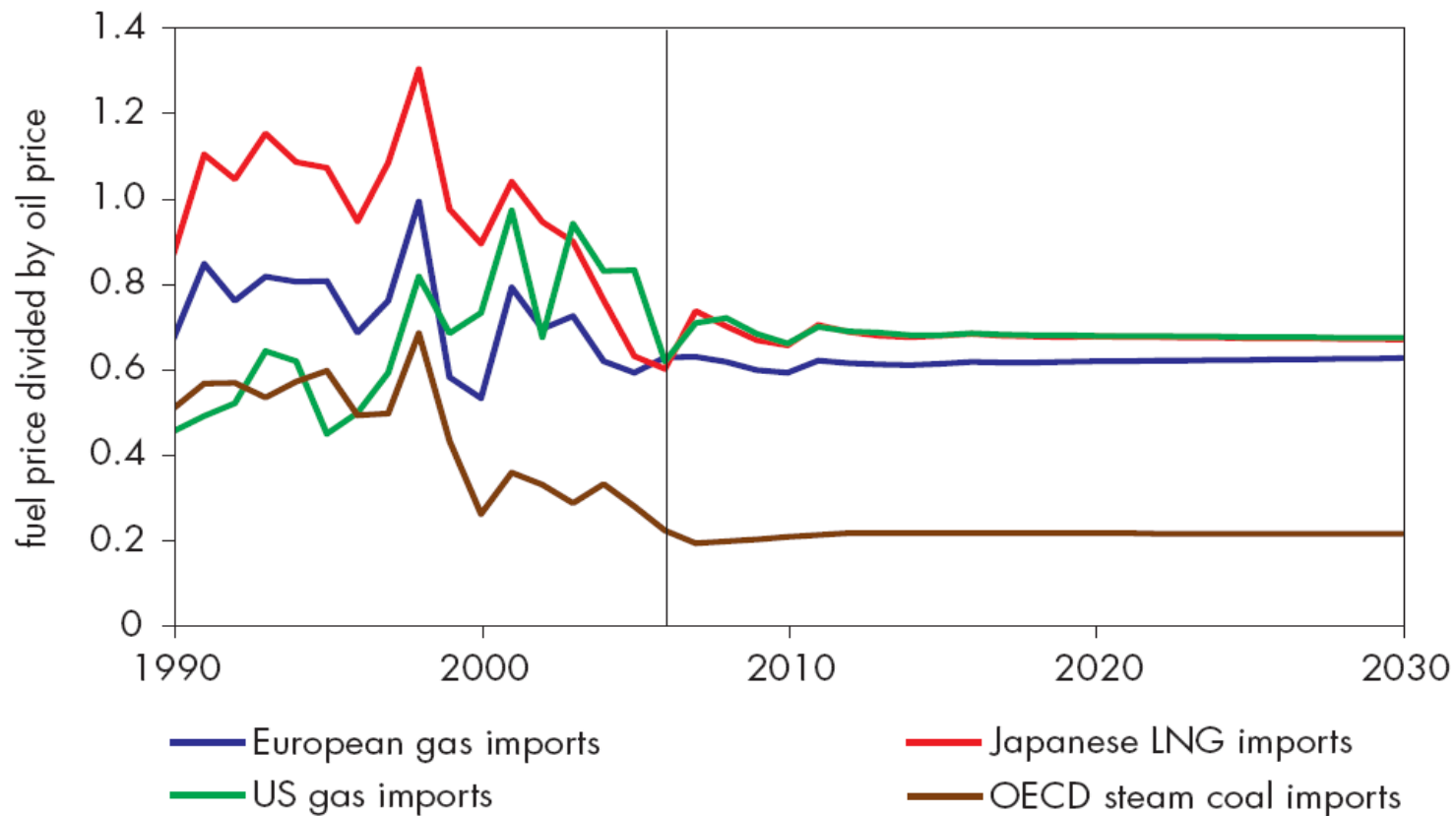
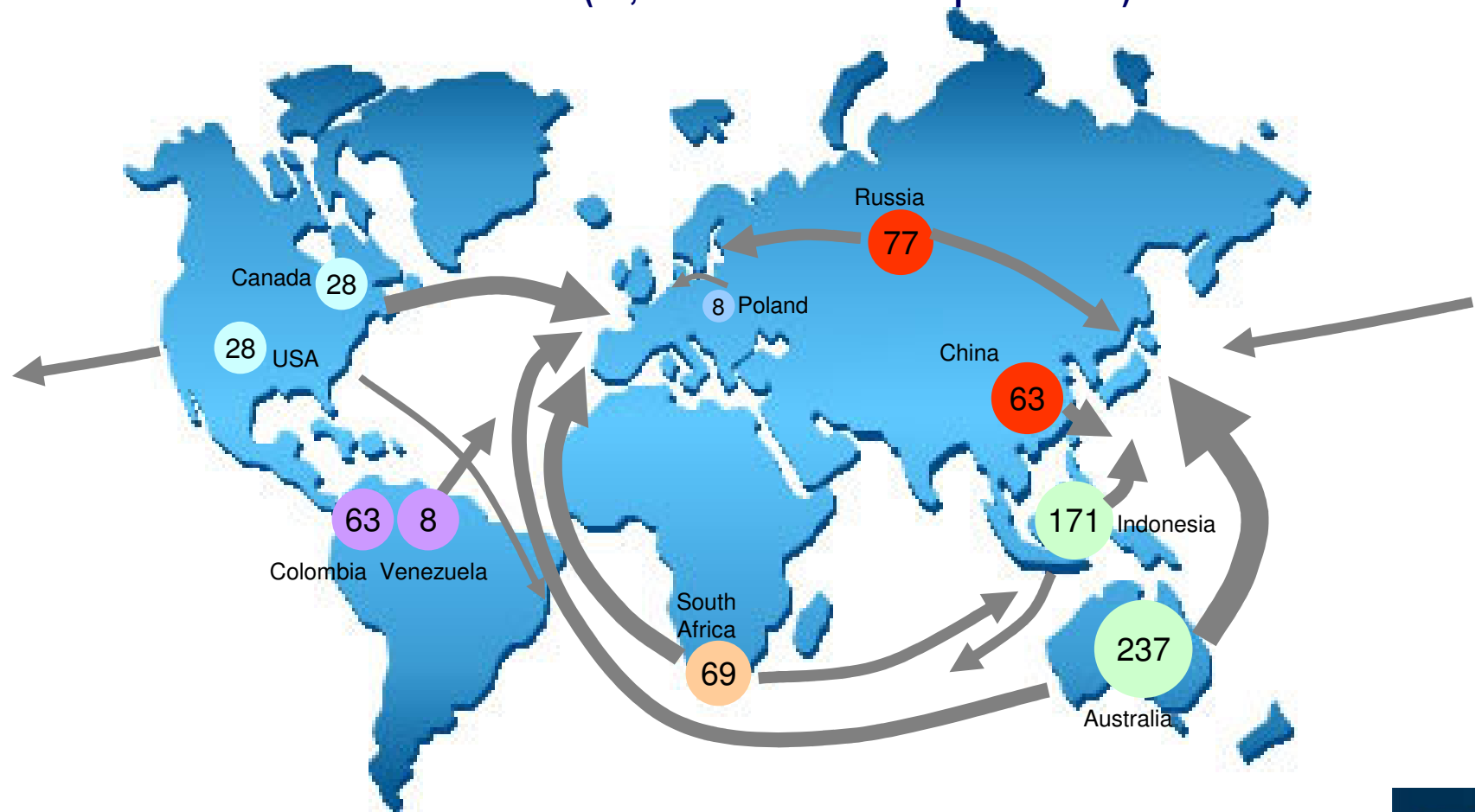**Source: World Energy Outlook, 2007**

3. Trade and Market Integration

- **Development of Trade:**
  - Coal is today considered an international market – supplies are shipped all over the world.
  - During last 20 years seaborne trade of steam coal has increased 8% per year (coking coal 2 %).
  - Transportation costs account for a large share of the delivered price – the steam coal market is divided in Atlantic and Pacific market's.
  - Market's overlap when coal prices are high and supplies large. South Africa point of convergence.

3. Hard Coal Seaborne Trade

Seaborne traded coal 2005: 782 Mt (14,6% of 5351 Mt world production)

Russia 77

Canada 28

8 Poland

28 USA

China 63

63 Colombia   8 Venezuela

171 Indonesia

South Africa 69

237 Australia

3. Trade and Market Integration

Market integration in the international coal industry:

A cointegration approach

The Energy Jornal, Vol. 27, No. 1 (2006)

- Background:
  - Development towards a unified international coal market.
  - Parallelled with an increasing number of M&A's.

3. Trade and Market Integration

Purpose:

- To test the hypothesis of a world market for coal – and to investigate market integration over time.

- Main focus is international trade and price relationships in spatially separated coal markets.

- The concept of 'law of one price' is thus used for defining the presence of a single market.

3. Trade and Market Integration

Method and Data:

- The method applied for defining the relevant market is cointegration and error-correction models.

- Price series that are cointegrated cannot drift apart without limit. The error-correction model further analyses short-run responses to price shocks.

- Data: European and Japanese quarterly import prices (CIF) for coking and steam coal from 1980 and 2000.

3. Trade and Market Integration

- Non-stationarity among price series is a necessary condition for cointegration $\Rightarrow$ test for unit root. Thereafter, test for cointegration $\Rightarrow$ A linear transformation of two non-stationary series that results in a series that is stationary: $p_{j,t} - \alpha - \beta p_{i,t} = \varepsilon_t$

- The difference between the time series is varying at random around a fixed level.

- The long-run relationship captures the cointegrating relation, and the short-run relationship describes deviations from the long-run trend.

3. Trade and Market Integration

- When non-stationary variables in a model are verified as cointegrated, the following ECM model can be derived:

$$\Delta p_{j,t} = \alpha + \beta_j \Delta p_{j,t-k} + \beta_i \Delta p_{i,t-k} + \delta EC_{t-1} + \varepsilon_t$$

  ,where k represents the lag length and the error correction term is represented by EC_{t-1}, which adopts the following form:

$$EC_{t-1} = p_{j,t-1} - \alpha - \beta p_{i,t-1}$$

- This term captures the deviation from long-run equilibrium, and the coefficient measures the speed of adjustment, which indicates how long it takes for the time series to move back to the equilibrium level in case of e.g. a price shock in one region.

3. Trade and Market Integration

Results:

$$P_E = 0.30 + 0.91P_J \qquad P_J = 0.21 + 0.95P_E$$
$$(2.00)\,(23.39) \qquad\qquad (1.35)\,(23.39)$$

- Both the coking and steam coal market indicate the existence of a world market – long-run cointegrating relationships.

- Tendencies towards greater integration for coking coal due to faster short-run adjustments.

- Short-run adjustments indicate that prices in Europe influence prices in Japan for steam coal (and v.v.). Explained by the timing of price negotiations.

3. Trade and Market Integration

Market Integration over time:

- To investigate whether the price series have become more integrated over time, the price series data is separated in two time periods (1980s + 1990s).

- The results regarding steam coal show that cointegration cannot be confirmed in the 1990s. This result is reproduced using spot prices as well.

- It thus seems as steam coal has become less integrated over time. Surprising?

3. Trade and Market Integration

Possible explanations:

- Trade of steam coal has a stronger regional tendency – indicated by trade routes.

- Prices of coking coal is higher than for steam coal.

- Demand for steam coal more price sensitive:
  - Has more substitutes in production

- During the 1980s more coal in energy than in the 1990s.
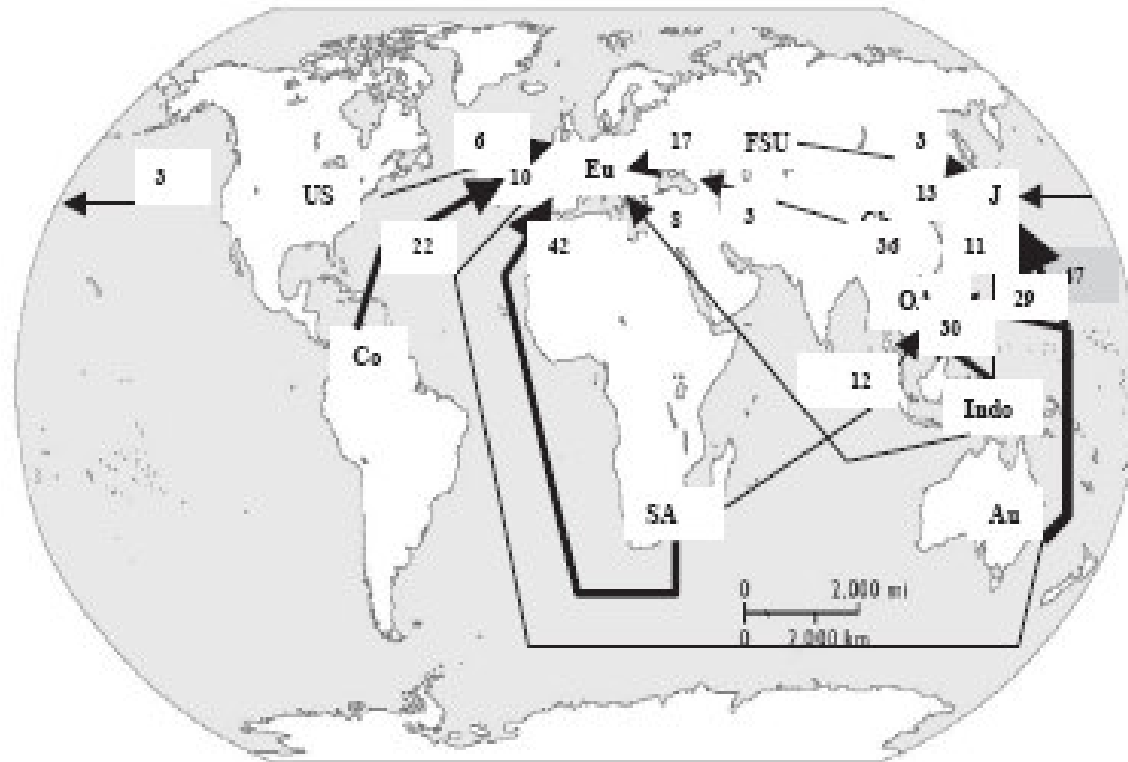
3. Steam Coal Trade Routes 2000

Fig. 3. World steam coal trade routes 2000 (Mt). *Source*: Own construction based on IEA (2001).
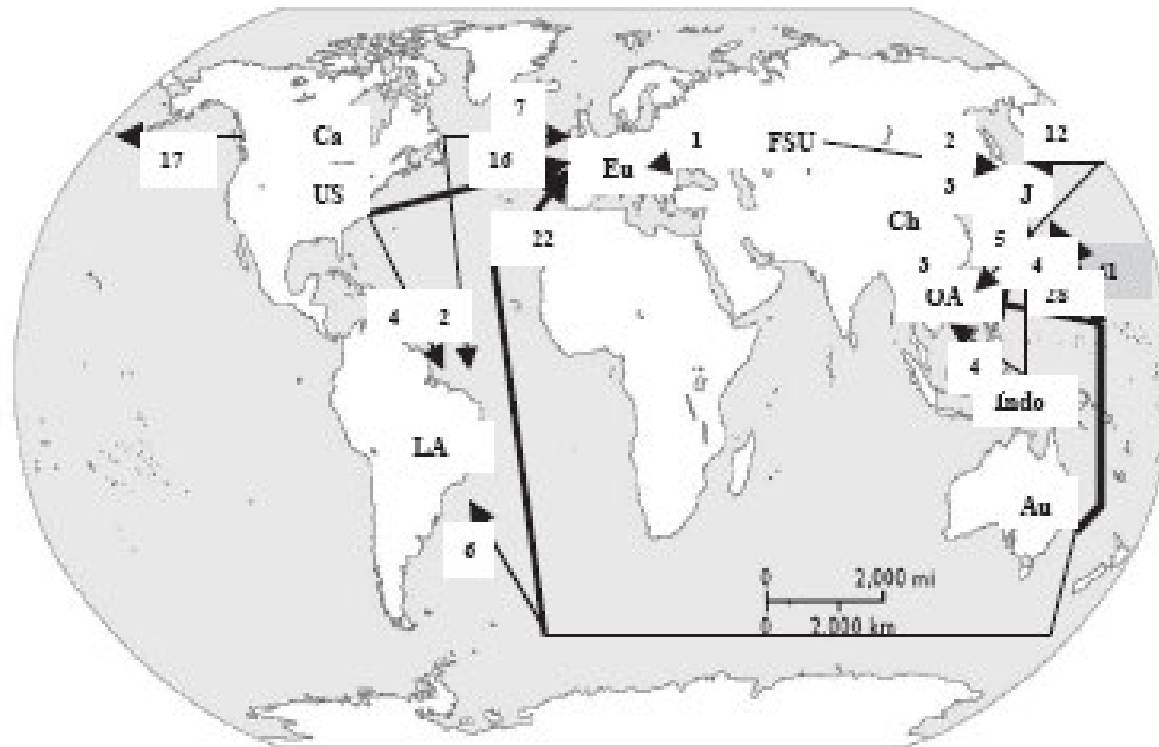
3. Coking Coal Trade Routes 2000

Fig. 1. World coking coal trade routes 2000 (Mt). *Source:* Own construction based on IEA (2001).

3. Trade and Market Integration

Conclusions:

- Both steam coal and coking coal prices are cointegrated in the long-run.

- Coal is an abundant product – large reserves – and supplies are spread out worldwide.

- Coal can be considered as diverse both in production and consumption.

$\rightarrow$ **Coal can be a reliable part of the future energy mix.**

4. Conclusions

- **Prices and Market Integration**
  - High coal prices likely to prevail during periods of high demand.

  - Compared to other fuels – coal is still a cheap option.

  - Coal reliable source of energy as long as the reserves are large and abundant.

4. Conclusions

- **Coal's Role in Energy Supply**
  - Positive – an abundant source of energy in a world of high and increasing energy use – and need for 'security of supply'.

  - Negative – future of coal depends on weather clean-coal possibilities continue to develop into cost efficient alternatives