



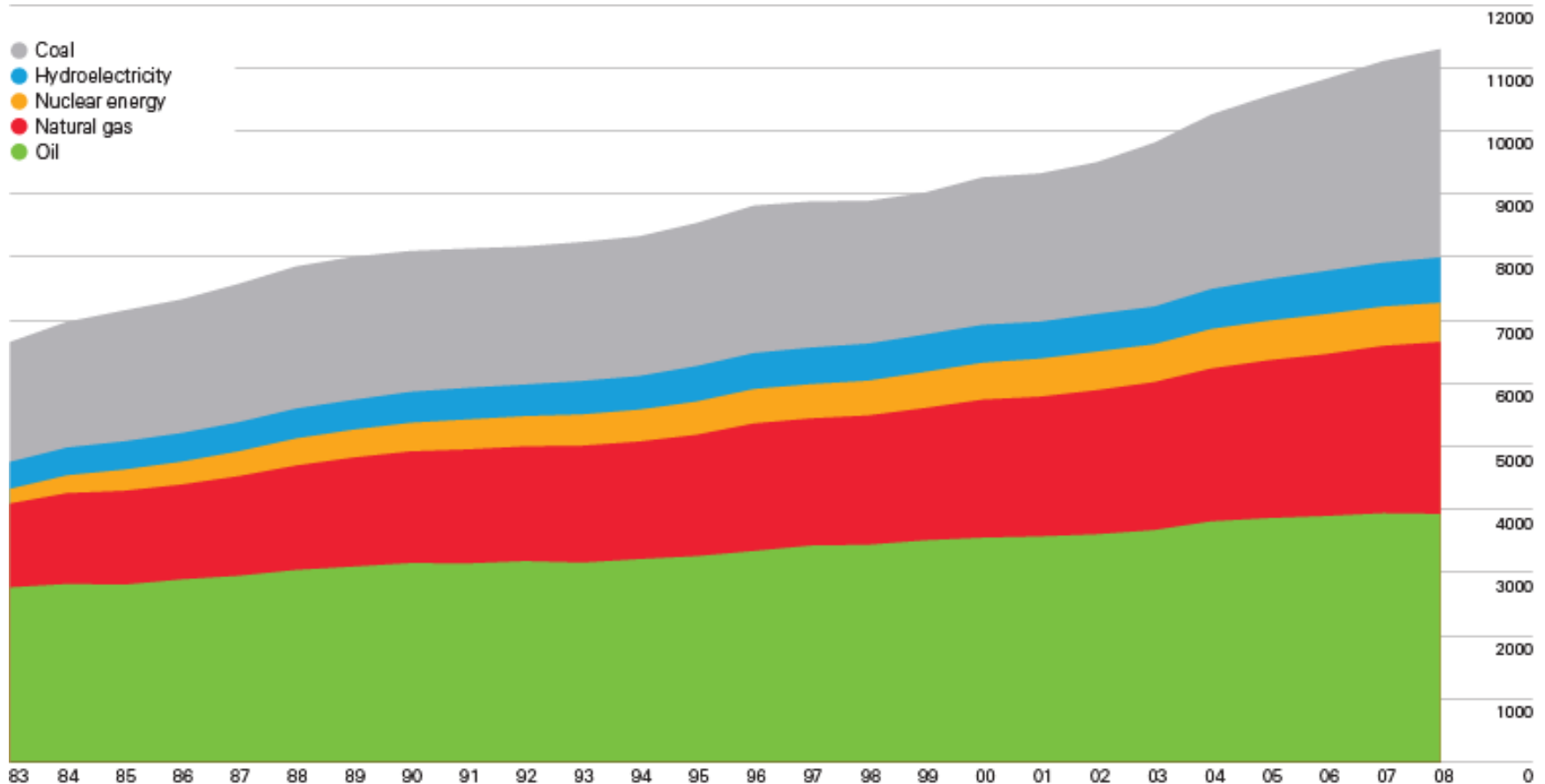
It's a gas, gas, gas...

SPM 9541, November 2010

Aad Correljé

TU Delft Economics of Infrastructures / CIEP

World primary energy consumption



World primary energy consumption grew by 1.4% in 2008, below the 10-year average. It was the weakest year since 2001. Oil remains the world's dominant fuel, though it has steadily lost market share to coal and natural gas in recent years. Oil's share of the world total has fallen from 38.7% to 34.8% over the past decade. Oil consumption and nuclear power generation declined last year, while natural gas and coal consumption, as well as hydroelectric generation, increased.

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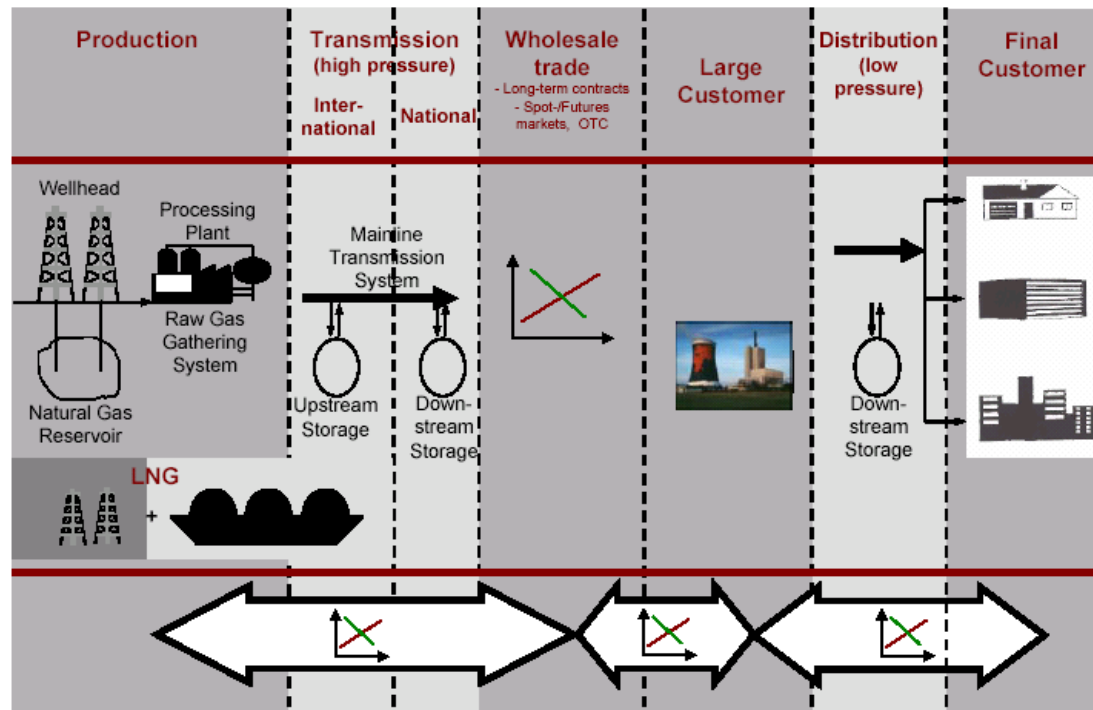
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Gas Markets: From Wholesale to Retail...

1. Introduction
2. The value chain
3. Changes in the world energy and gas markets
4. Two economic perspectives: SCP
5. Two economic perspectives: SCP
6. Gas markets as a globalizing system

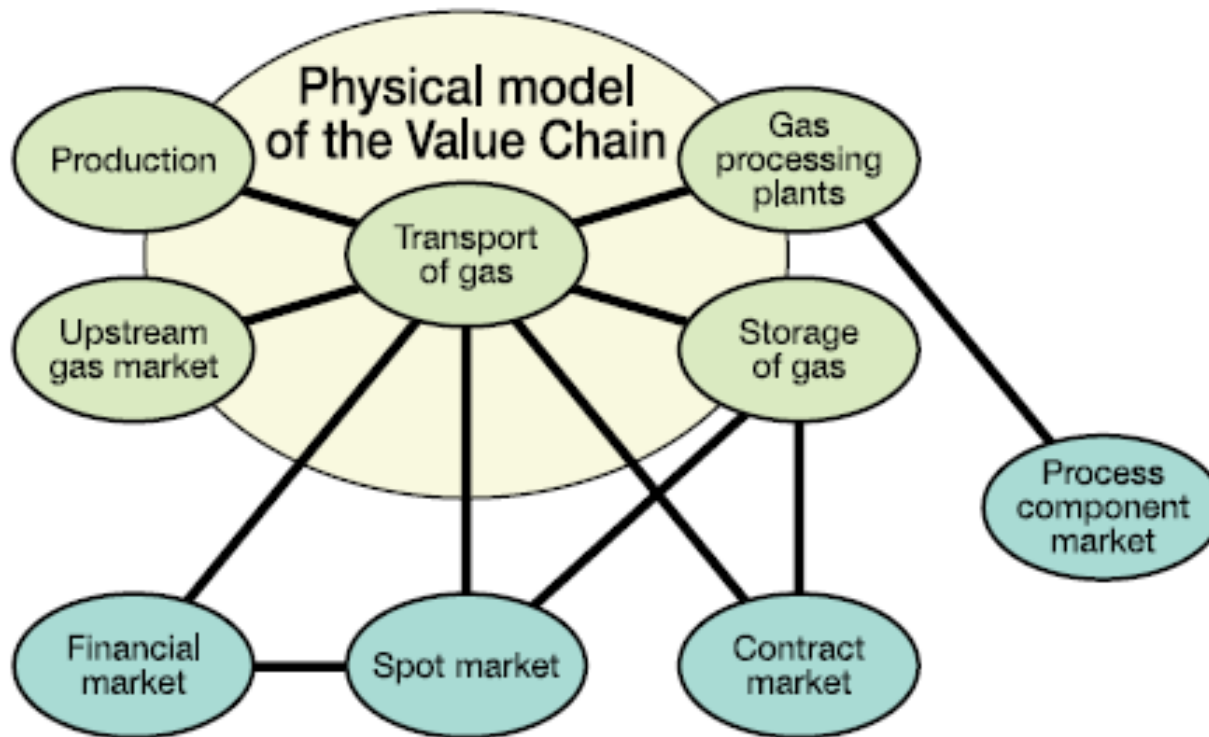
2) The value chain

The Value-Added Chain in the Gas Sector: Areas of Potential Competition

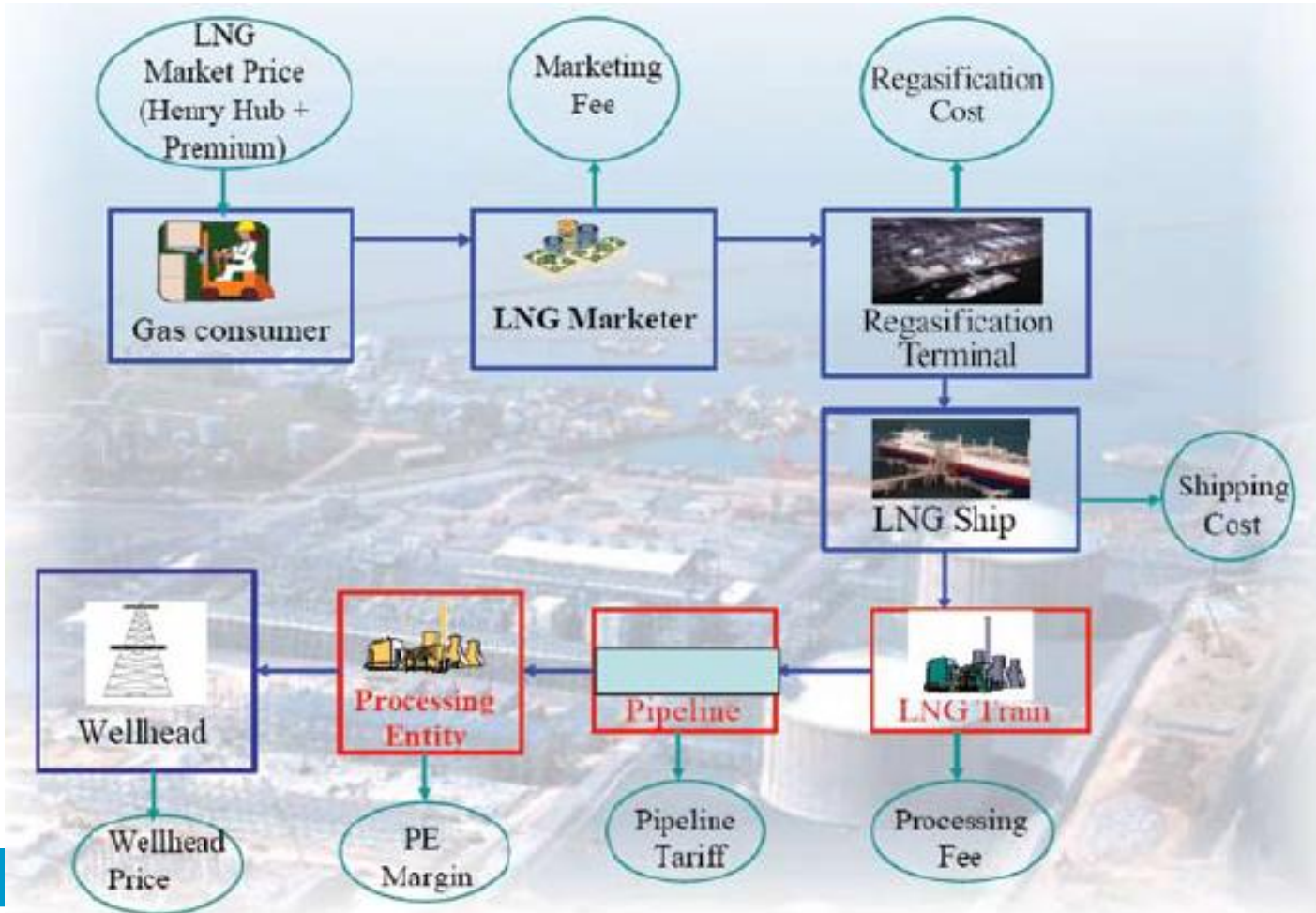


Folie 2

Another value chain...

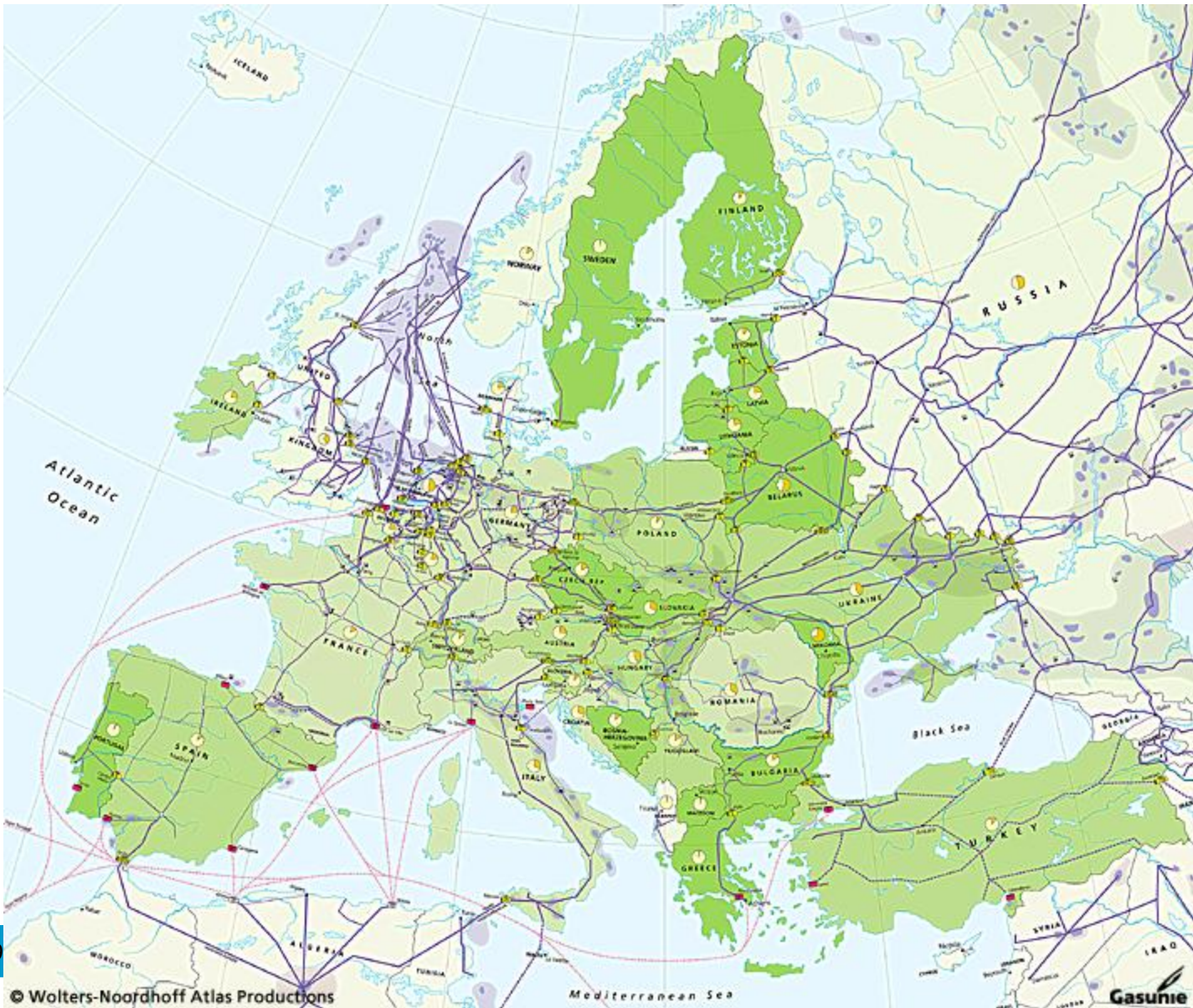


And another value chain...



Characteristics of the gas value chain.....

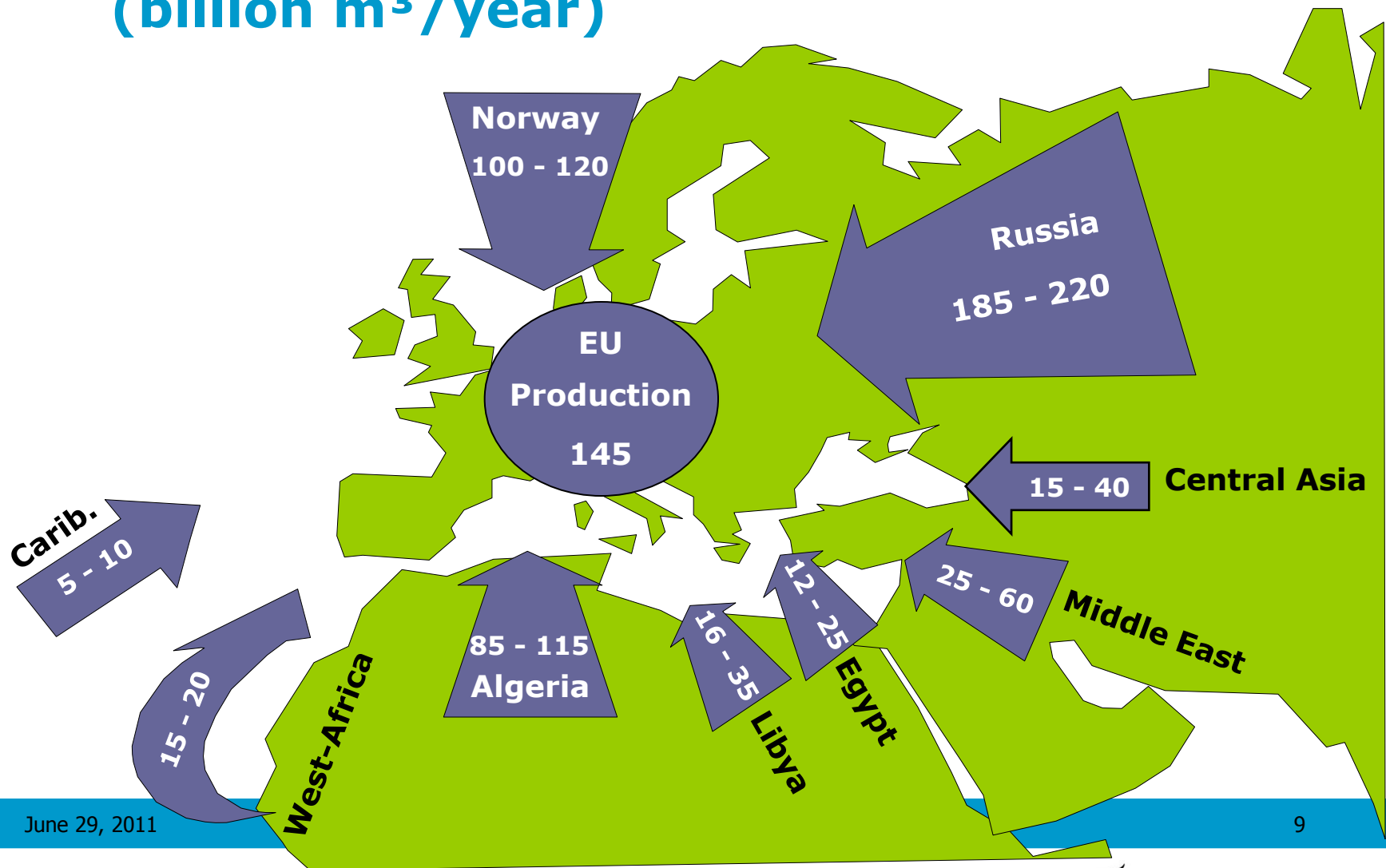
- Long distance
- Seasonal and daily patterns
- Specific Lumpy Investment, Long lead times, high up-front cost
- Fixed v. variable cost
- Scale Economies
- Capacity utilization
- Volume Risk
- Price Risk
- Essential facilities



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Supply Capacities for Western Europe 2010-2020 (billion m³/year)



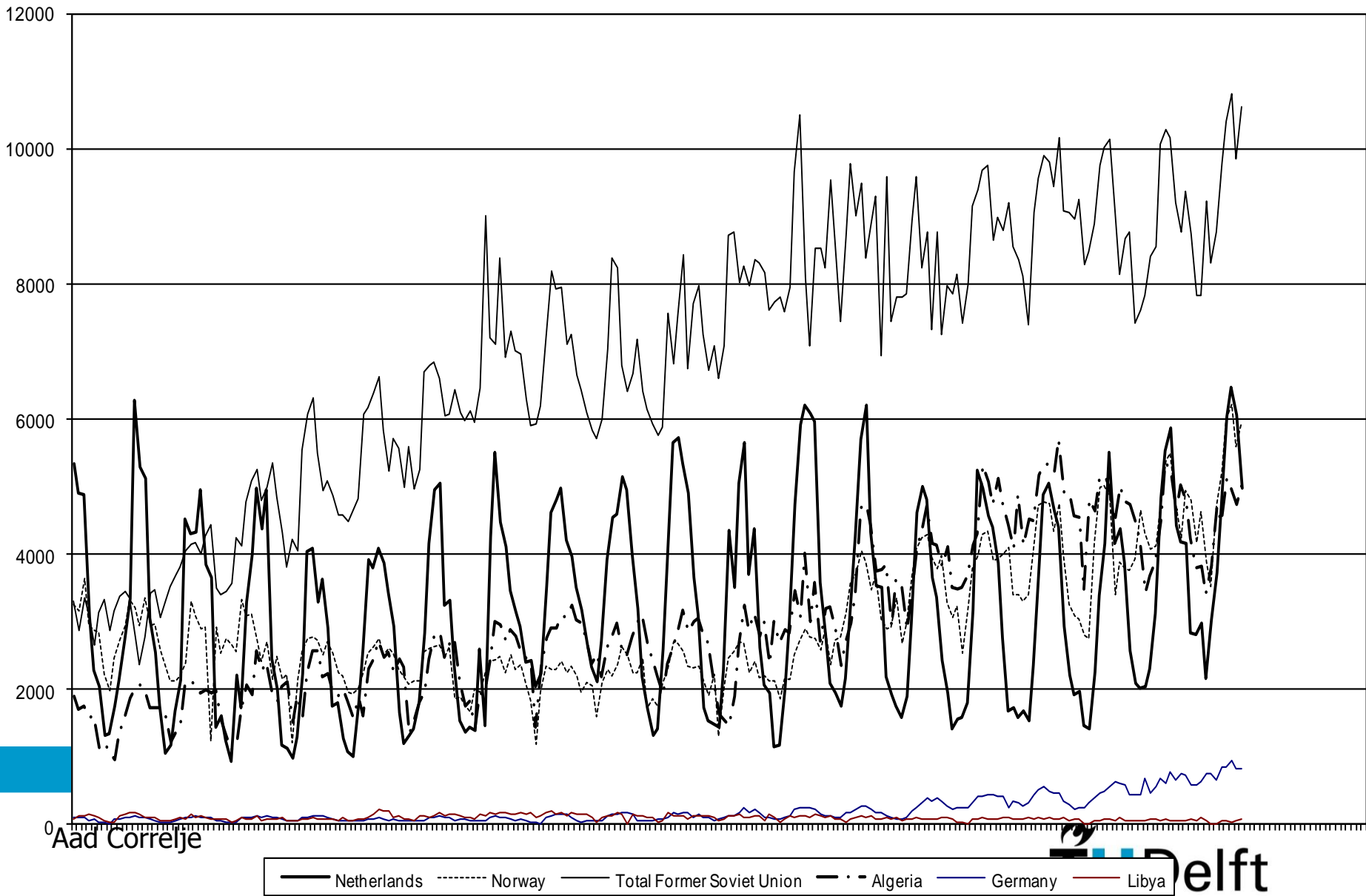
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Characteristics of the gas value chain.....

- Long distance
- **Seasonal and daily patterns**
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Seasonal Variation



Aad Correije

Characteristics of the gas value chain.....

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Capital cost

Transport capacity 30 bcm / year.

US \$ bln

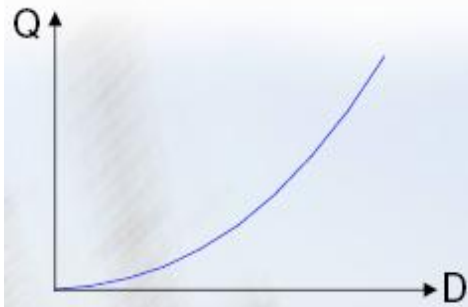
Yamal to Germany	4000 km	14
Iran to India	3600 km	11
Iran to Austria	4600 km	15
Nigeria to Spain	4500 km	18

approx. \$ 3 to 4 mln per km (**Steel quality X 70**
(**Pipeline diameter 56"**
(**Max pressure 100 bar**
(**Incl compressor stations**

Characteristics of the gas value chain.....

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Economics of scale



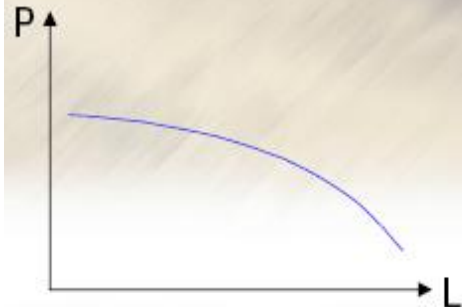
A 48 inch line has (approx.) six times the capacity of a 24 inch line

... but only (approx.) two times the cost



The longer the pipe the lower the capacity,

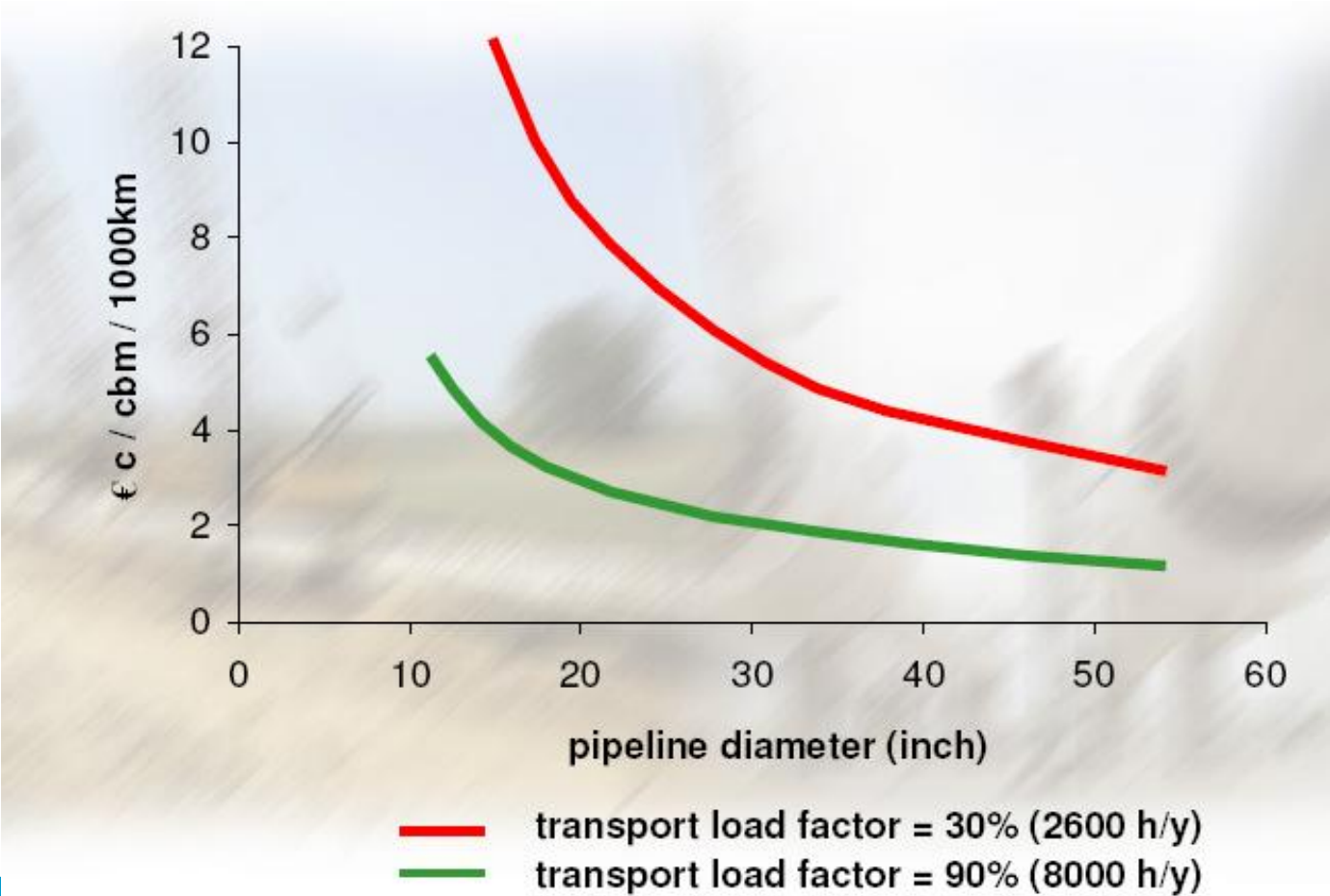
... but the extra length has a marginally reducing effect



The pressure drop per unit of length increases with distance

... hence beyond a certain distance compression becomes necessary and economic

Economies of Scale



Characteristics of the gas value chain.....

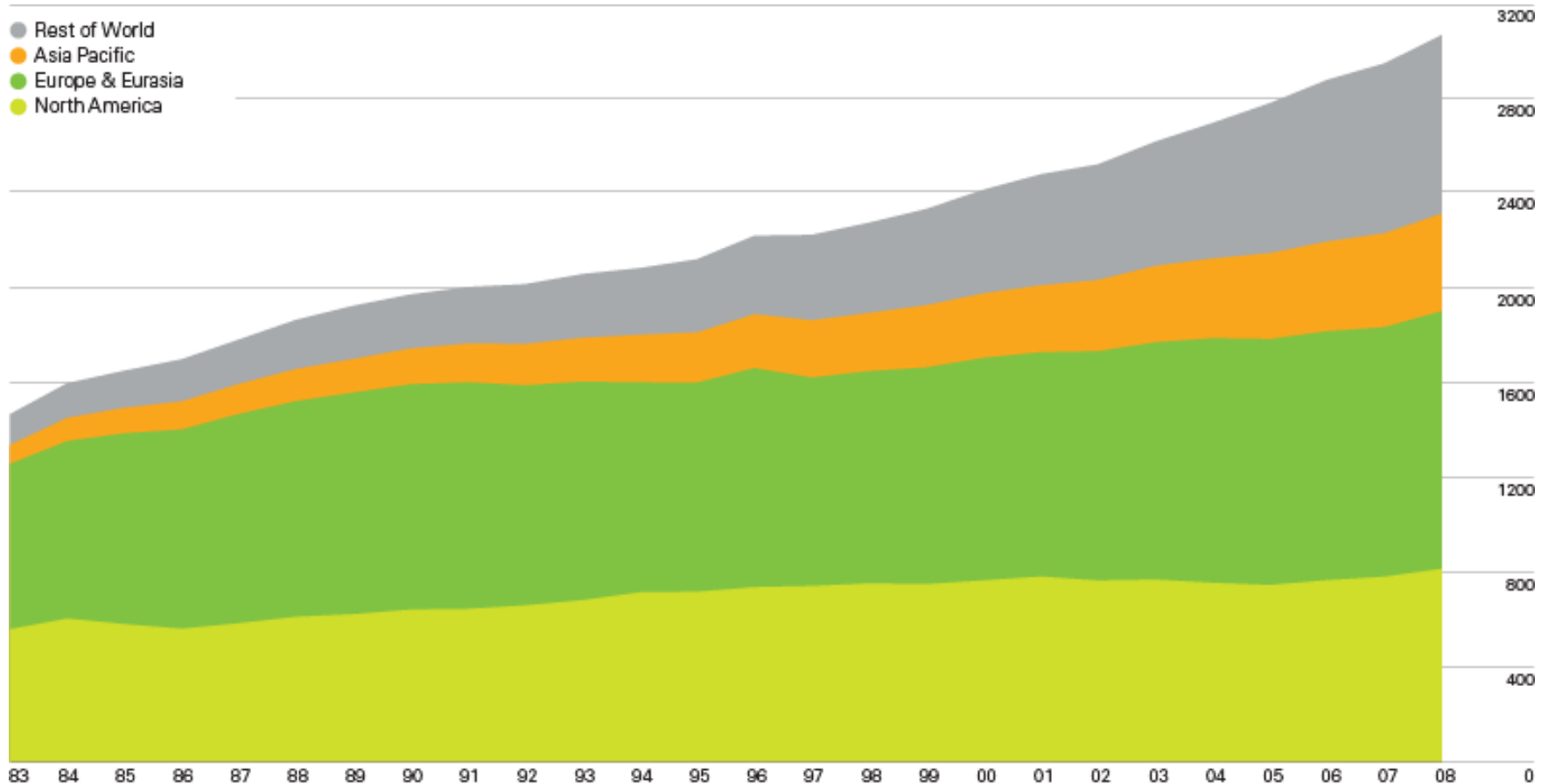
- Long distance
- Seasonal and daily patterns
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Integration and coordination of the value chain in the past

- Production: Oil Companies' Long term Take or Pay/Destination Clause Net Back contracts
- Transmission and LNG: National Joint Ventures Operators' Cost plus
- Storage: National Joint Ventures' Cost plus
- Distribution: Public Local Municipal Firms' Cost plus
- Retail trade: Oil parity pricing, market segmentation

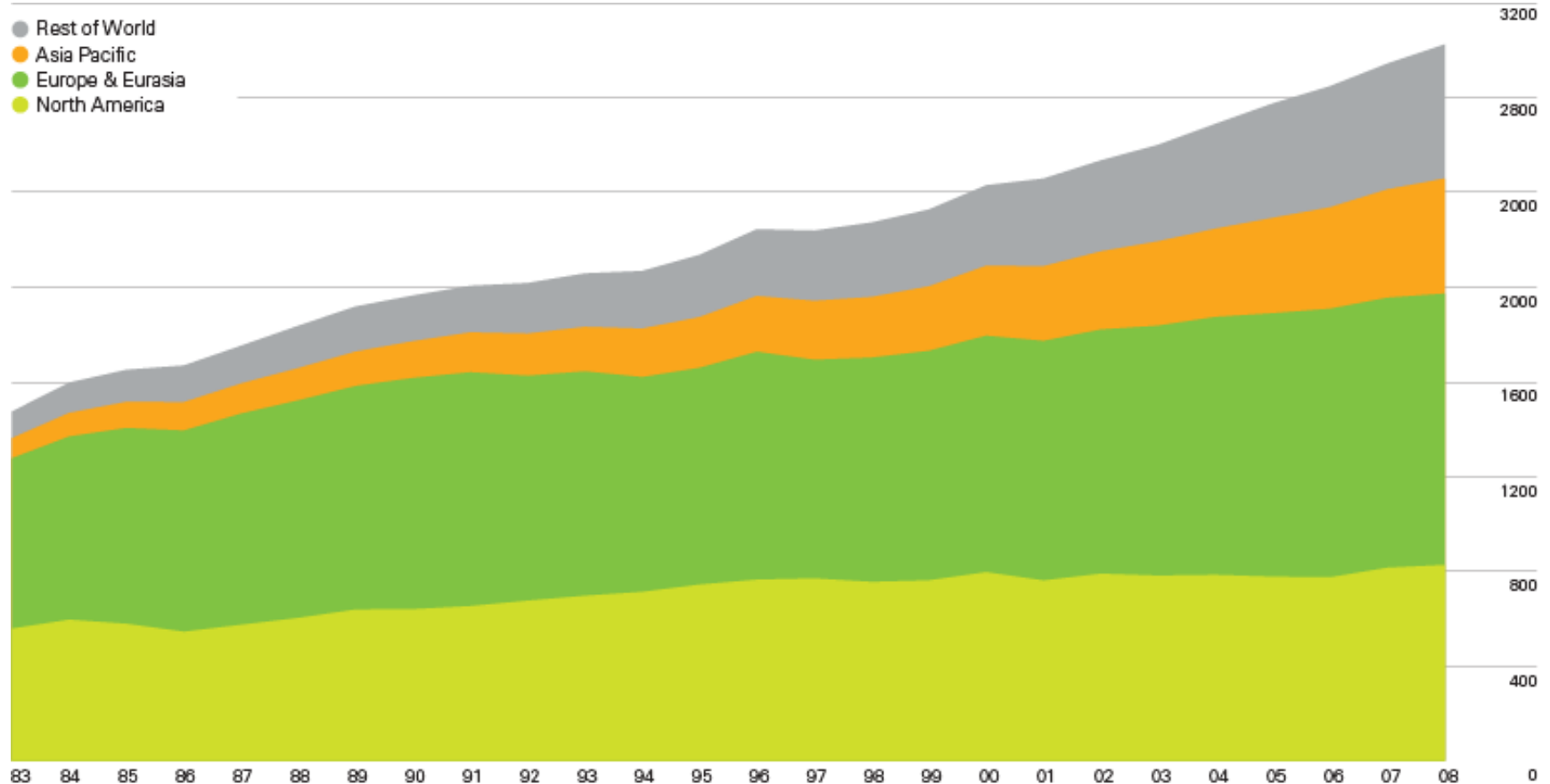
Long term planning and supply/demand coordination

Natural gas production by area



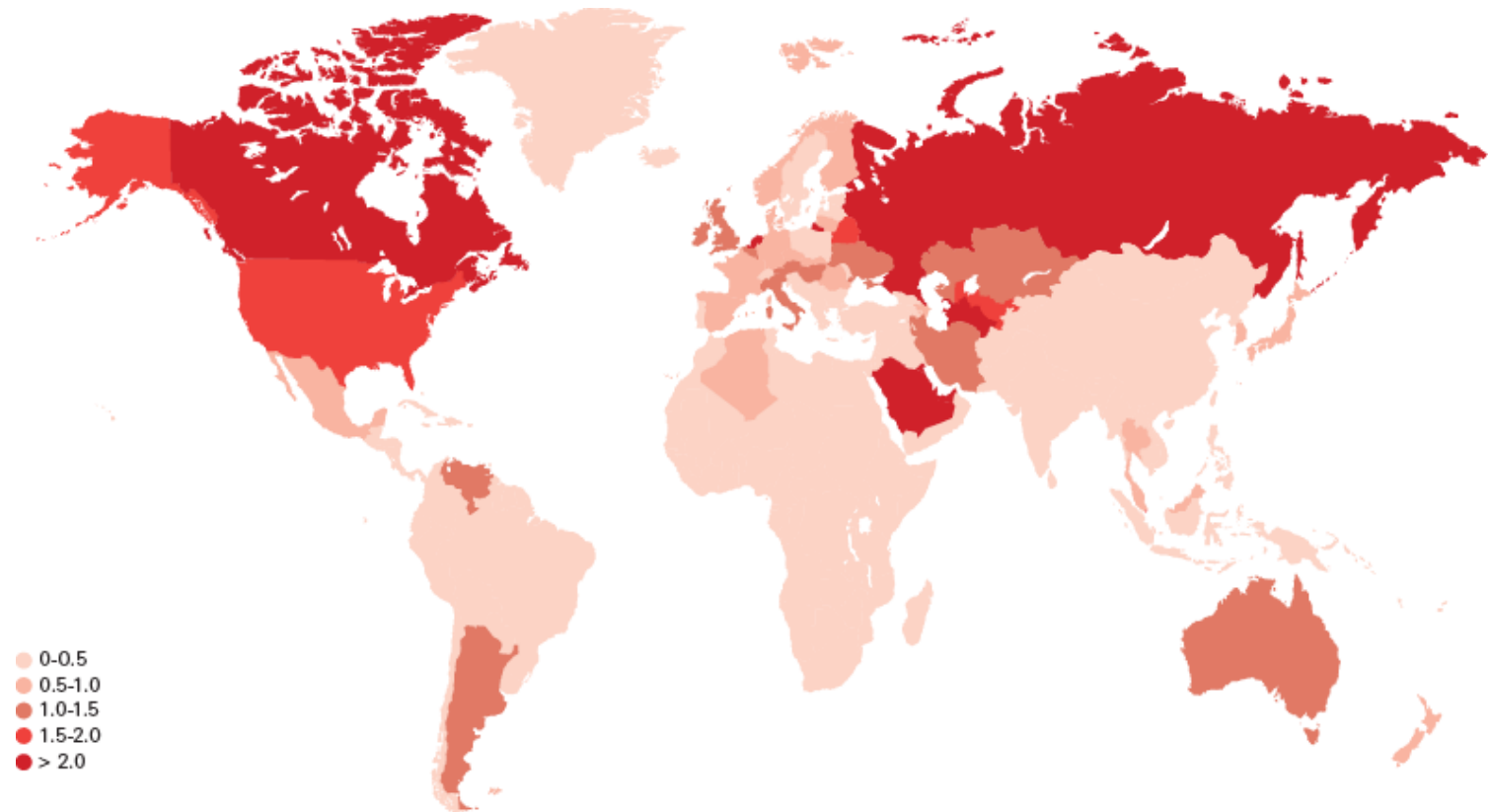
World natural gas production grew by a robust 3.8% in 2008, the strongest volumetric growth since 1984. For the second consecutive year, the US recorded the largest increase, with growth of 41.7bcm. Growth was below the 10-year average for all regions except North America and Europe and Eurasia. Canada recorded the world's largest decline.

Natural gas consumption by area



World natural gas consumption grew by 2.5% in 2008, below the historical average. Growth was broadly distributed, although only North America and the Middle East saw above average growth in aggregate. China accounted for the largest increment to gas consumption, while Russia recorded the largest decline.

Natural gas consumption per capita



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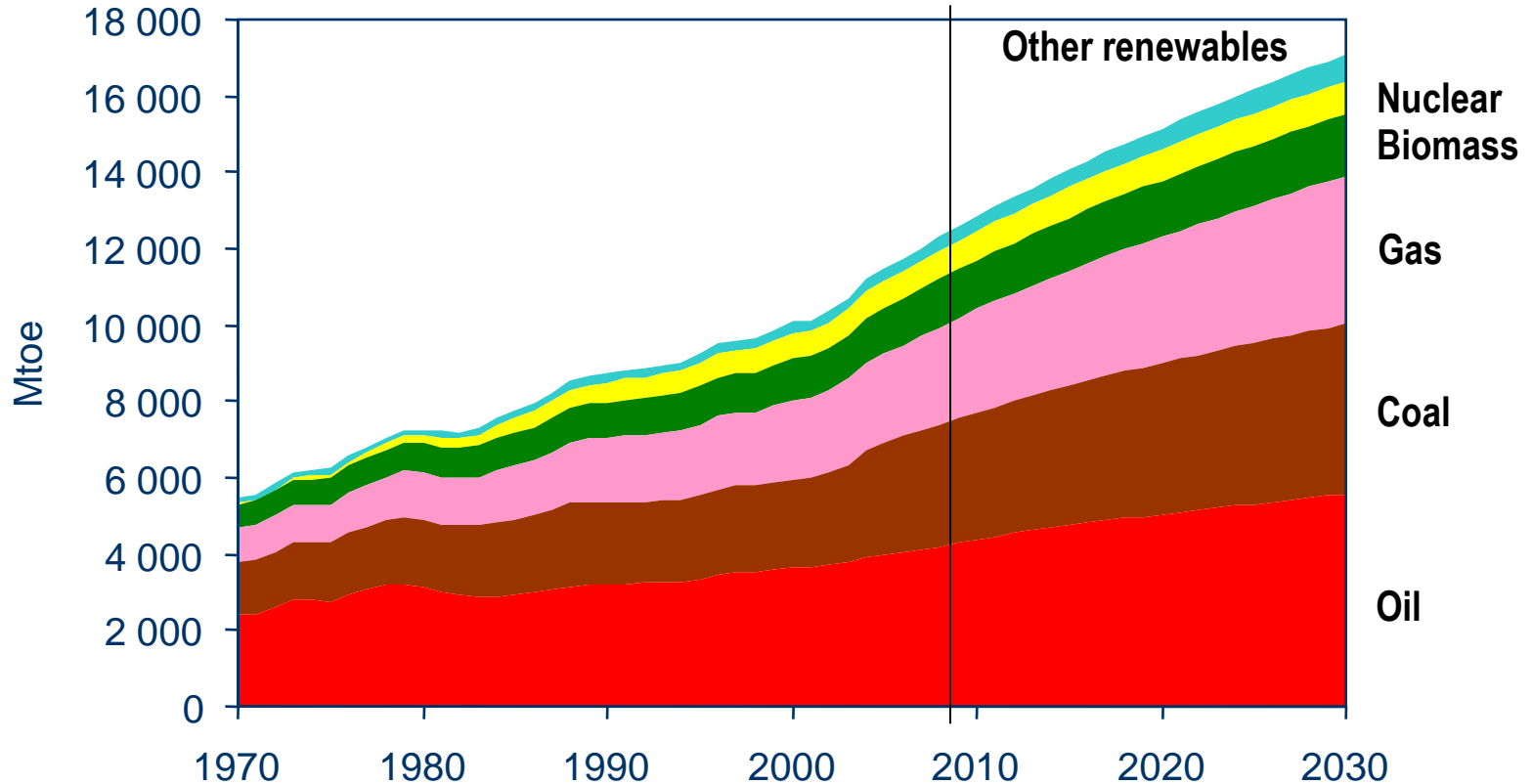
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BP, 2010 Statistical review of world energy

3) Changes in the world energy and gas markets: **Uncertainties**

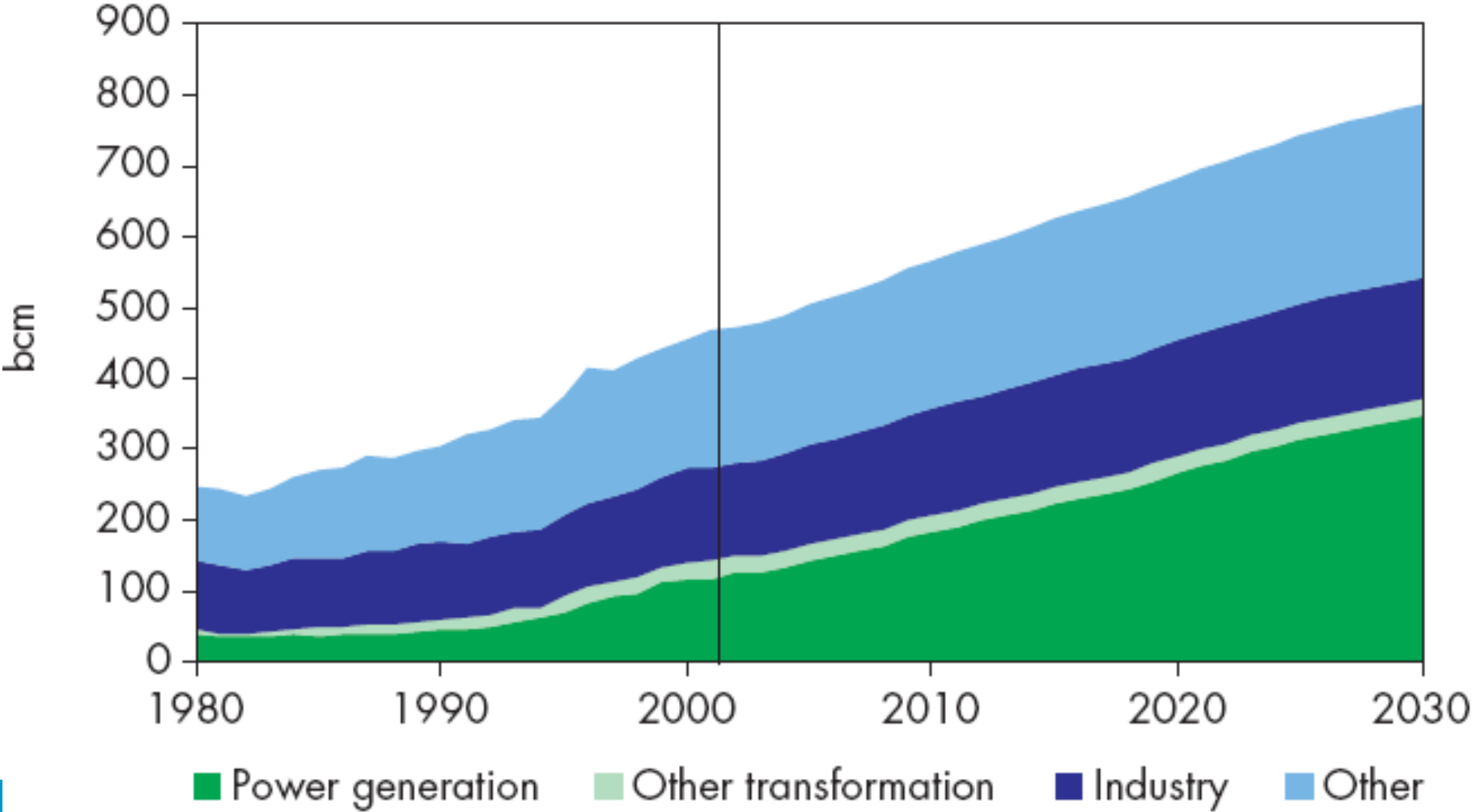
- Changes in the Oil Market
- CO2 Emission Reduction
- Changes in the Gas industry
 - Growth in Consumption?
 - The Power Sector?
 - LNG Trade?
 - External Dependence of Main Markets
 - Liberalization of Markets
 - Integration of Regional Markets

Reference Scenario: World Primary Energy Demand



Global demand grows by more than half over the next quarter of a century, with coal use rising most in absolute terms

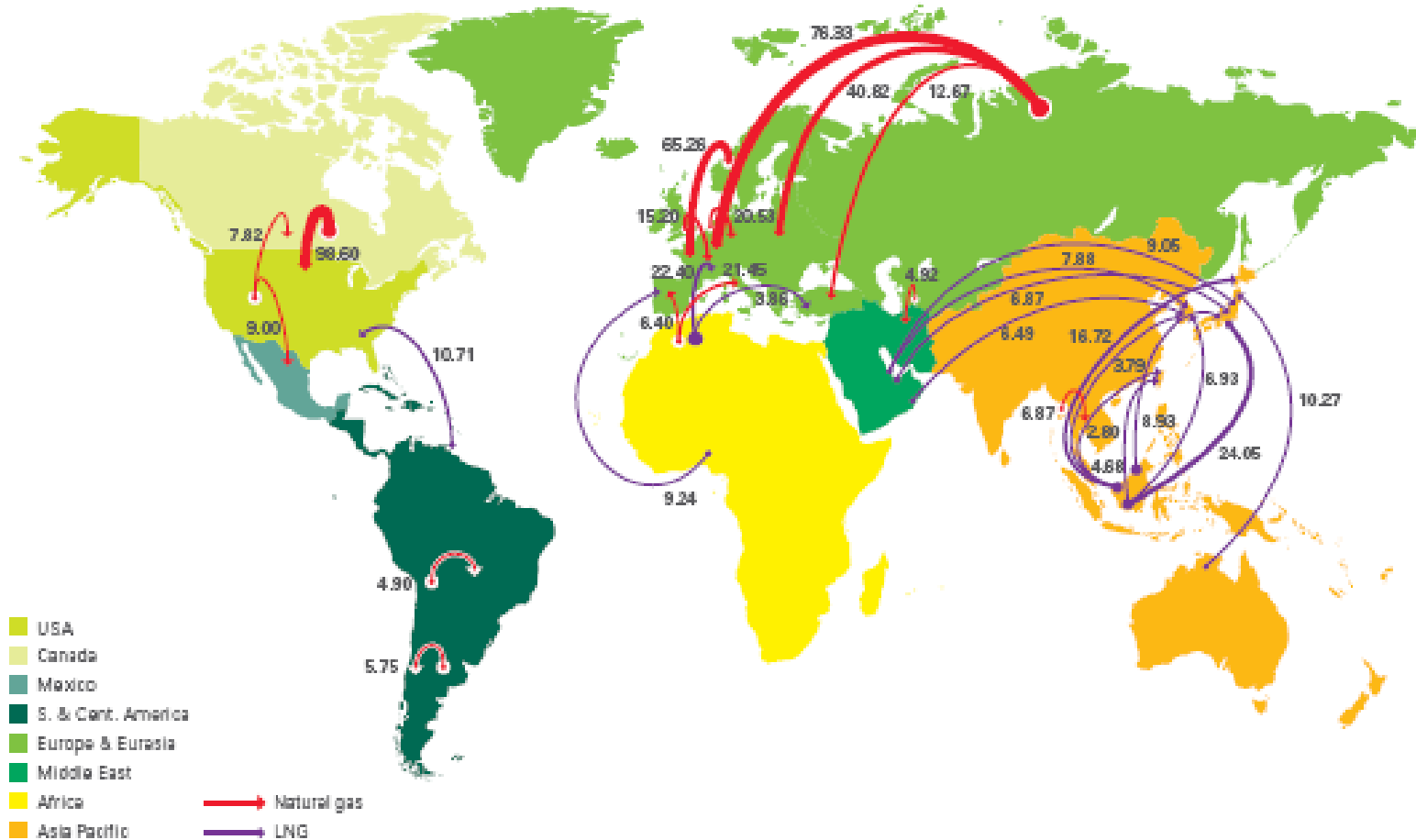
EU Gas demand forecast



Major gas trade movements 2004

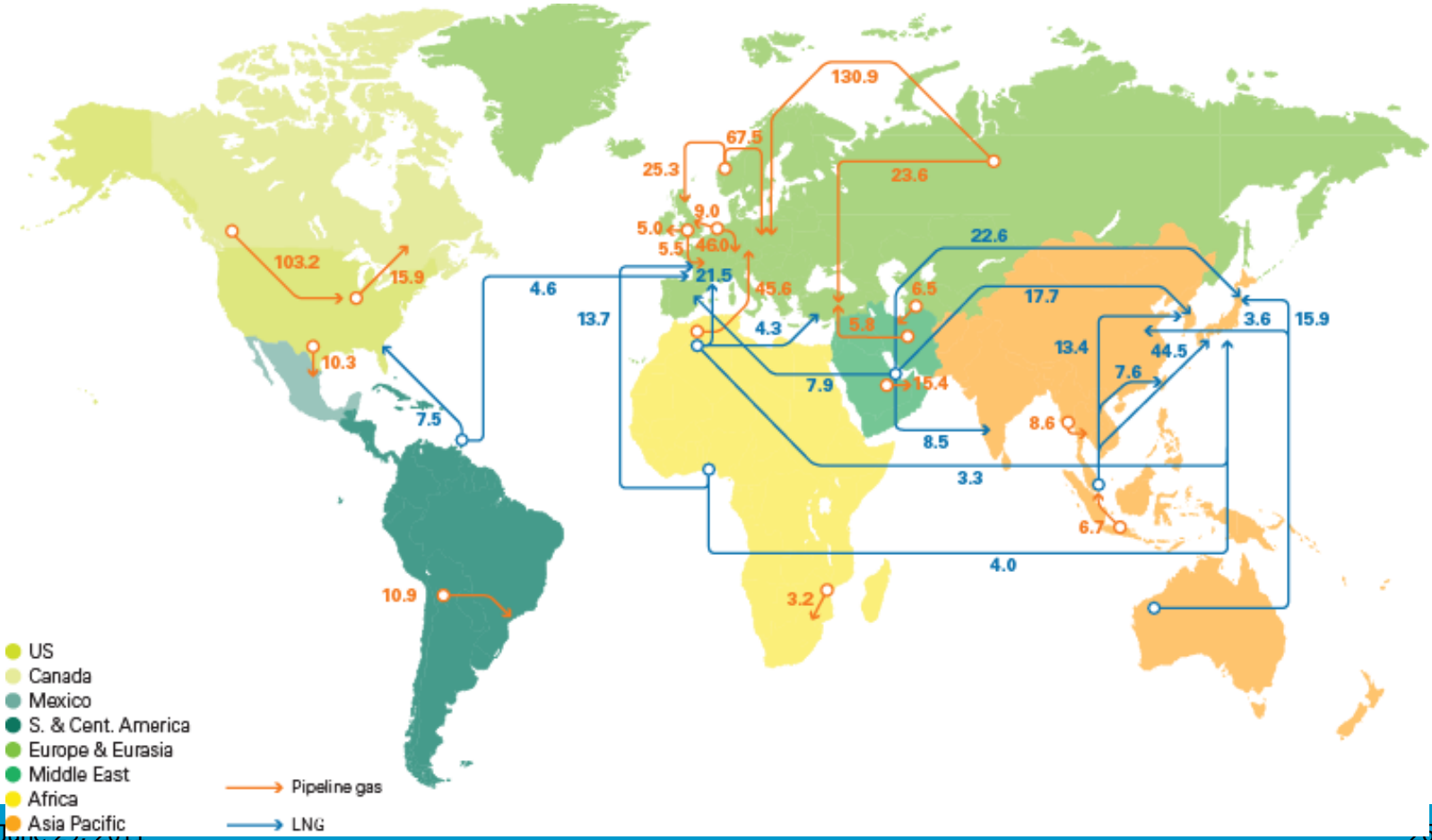
Major trade movements

Trade flows worldwide (billion cubic metres)



BP, 2005 Statistical review of world energy

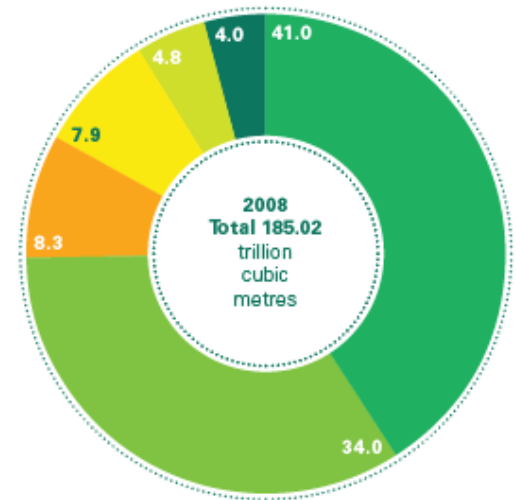
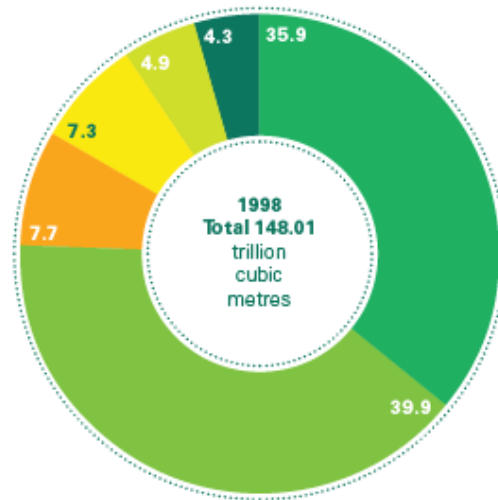
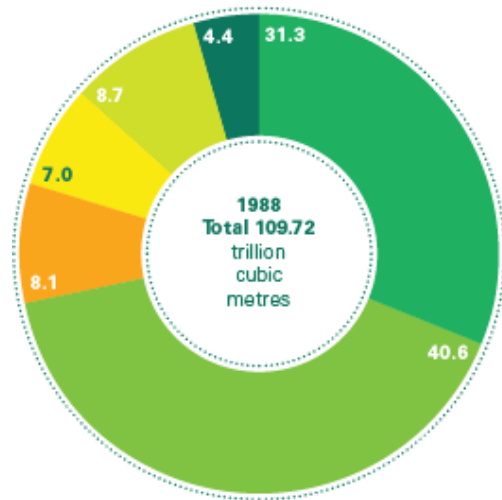
Major gas trade movements 2008



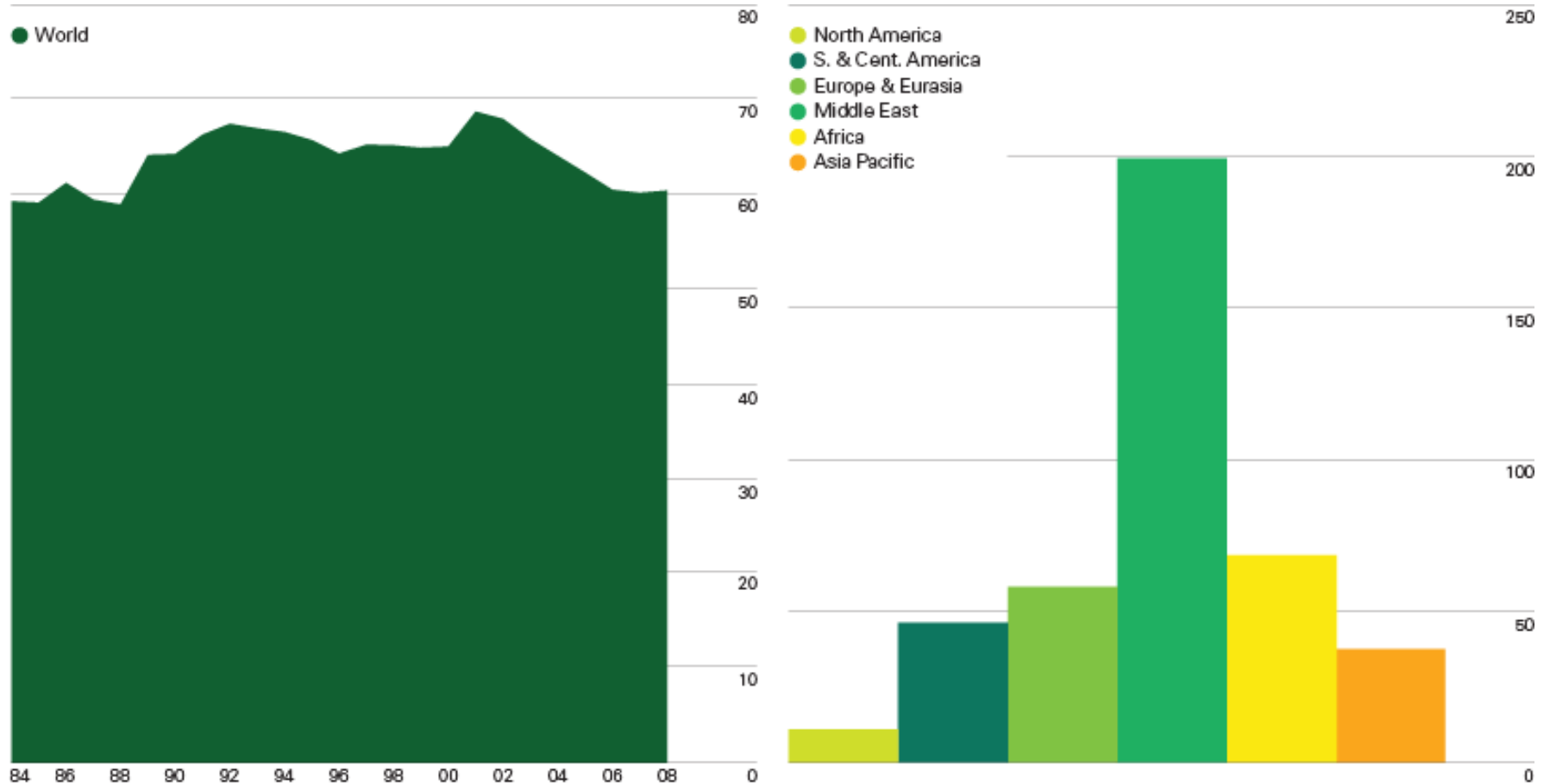
BP, 2009 Statical review of world energy

Proved natural gas reserves and dependence

- Middle East
- Europe & Eurasia
- Asia Pacific
- Africa
- North America
- S. & Cent. America



Reserves-to-production (R/P) ratios

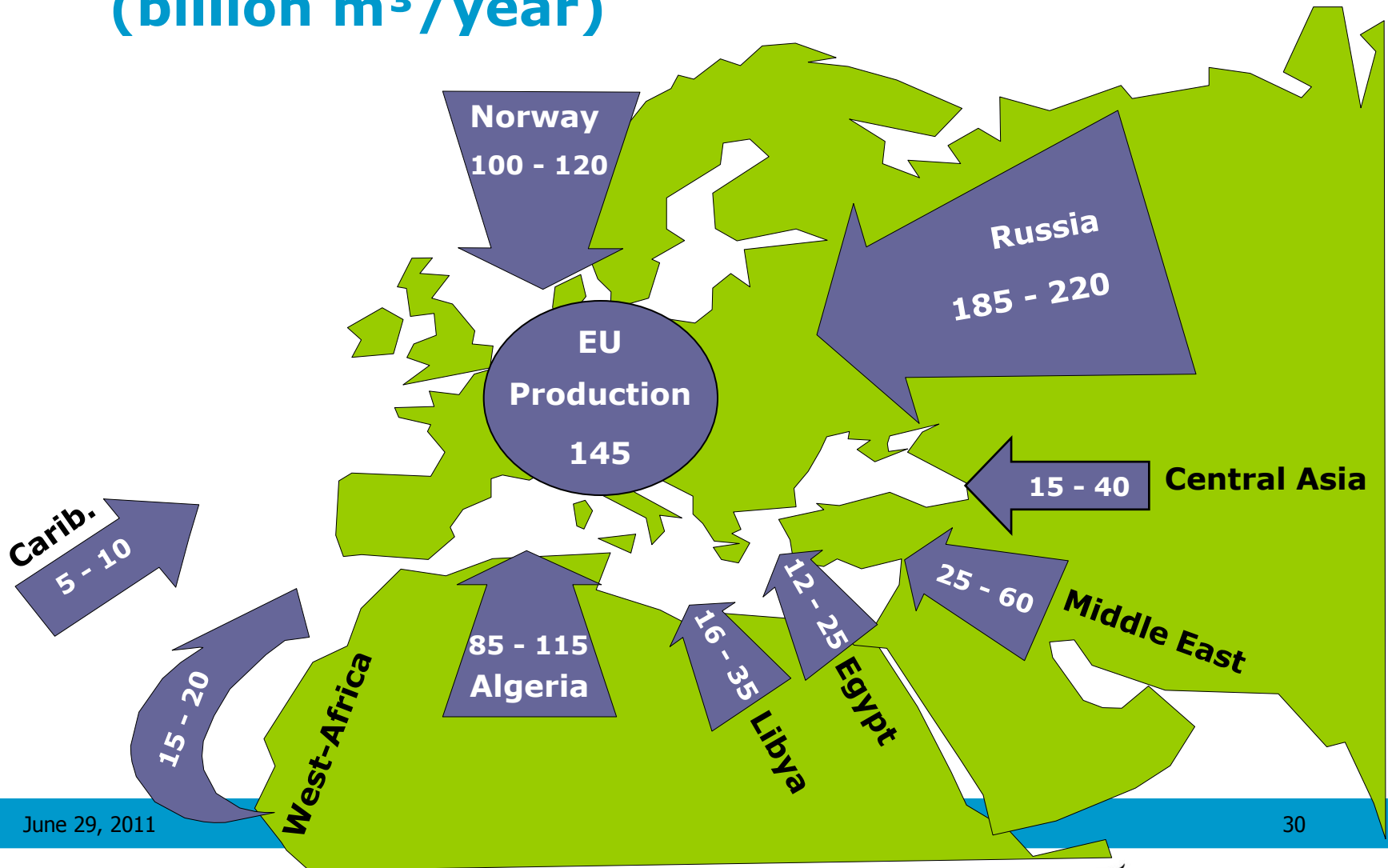


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BP, 2010 Statistical review of world energy

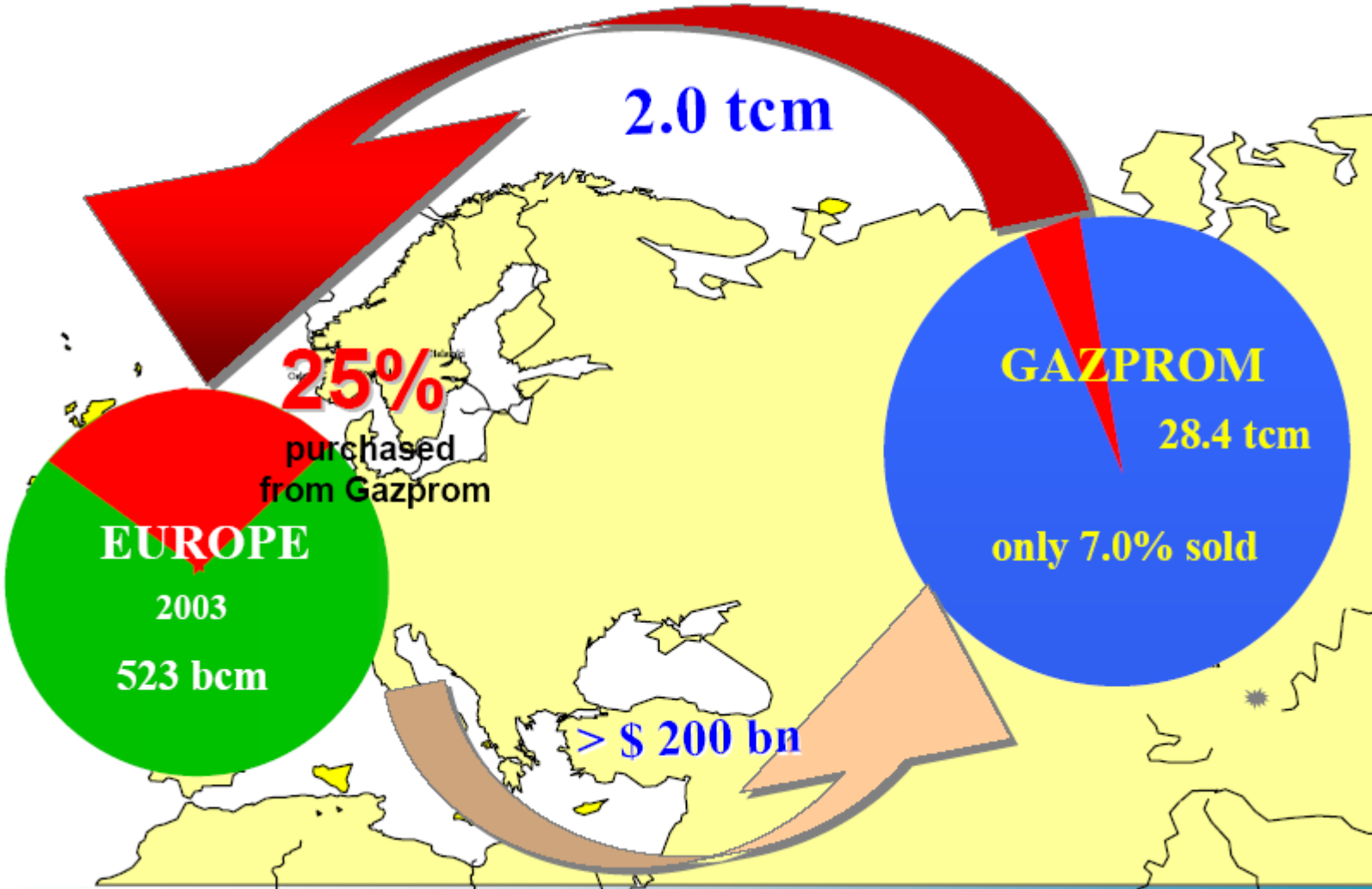
Supply Capacities for Western Europe 2010-2020 (billion m³/year)



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EU and Russia



New Gas supplies: Investments & Timing??

- What will bring the new supplies to market and when
 - Security of supply for EU
 - Security of demand for suppliers
 - Available capital
 - Pace and mode of liberalisation
 - Geopolitical and other risks