

ELECTRICITY SUPPLY & DEMAND



Electricity demand

- Prerequisite for Economic Development
 - Population growth = Electricity demand
 - 1.3 Billion new customers in last 25 years
- Development of cooling as well as heating demand
- Competitive advantages versus other fuels



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Electricity consumption

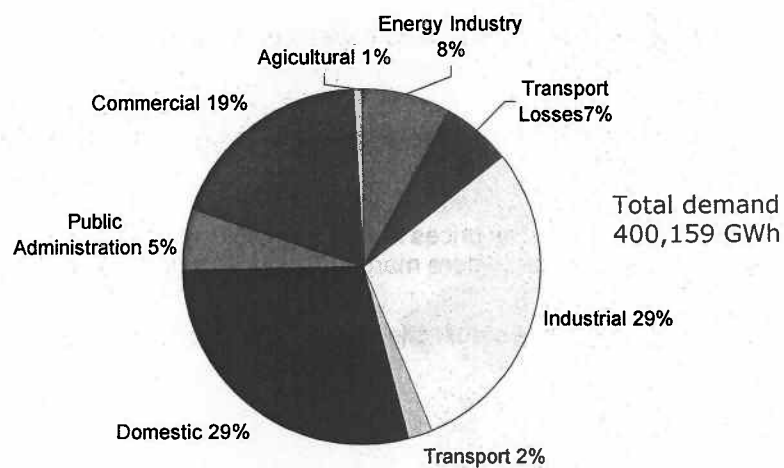
- Domestic
 - Electrical appliances
 - Some central heating, hot water, cooking
- Industrial and commercial
 - Energy intensive industry
 - Commercial power, IT
- Transport
 - Railways



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UK electricity demand



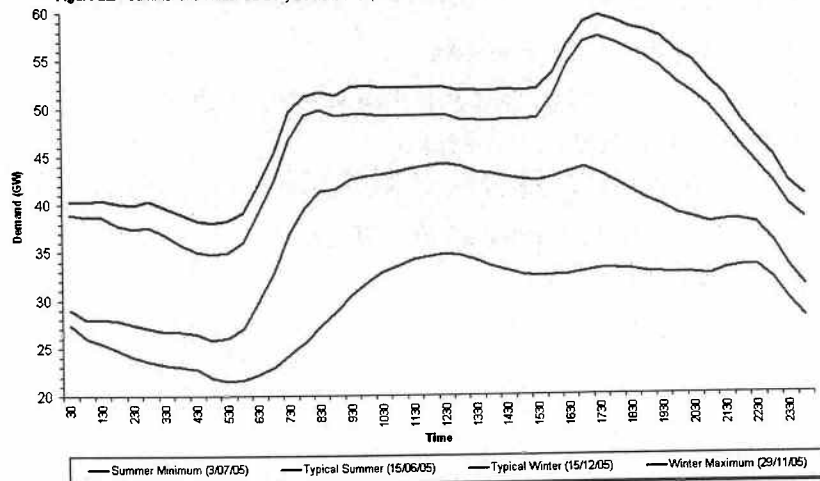
DUKES: DTI Digest of UK Energy Statistics

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Daily electricity demand profiles

Figure 2.2 - Summer and Winter GB Daily Demand Profiles in 2005/06



Source: National Grid

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Electricity markets

- Consistent Annual Demand increases but no correlation between Oil & Electricity demand
- Increased demand for power mainly non-Oil generated except in Far East
- Very volatile electricity prices in free markets on a short term basis: may be some impact where marginal generators are oil based
- In longer term share of fuel oils as a power source likely to decline



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Electricity price determinants - competitive market

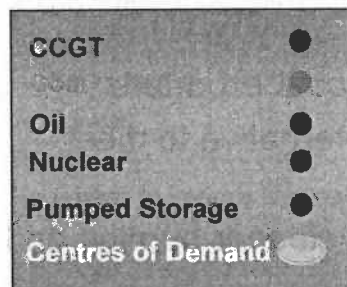
- Supply
- Demand
- Weather
- Power station availability
- Transmission constraints
- Cost of marginal plant
- Exchange rates
- Market infrastructure
- Politics
- Fuel prices



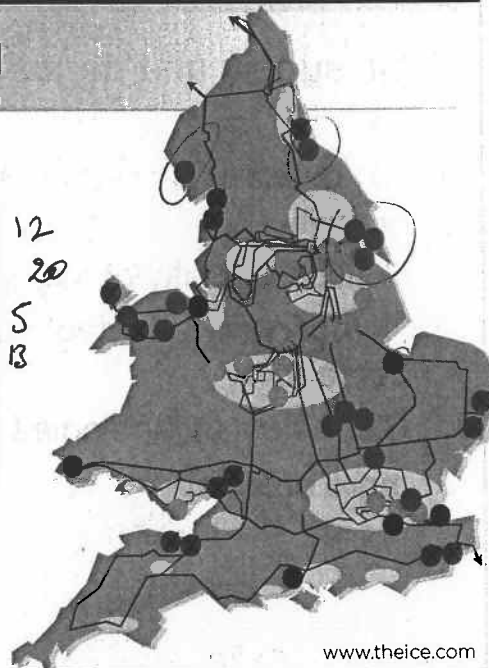
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The UK National Grid



12
20
5
13



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Spot market: balancing mechanism
transparency → reflect real value.
long term deals based on spot market.

Of 5-10% max of market.

COAL SUPPLY & DEMAND



Coal, supply and demand

- Big reserves, 200-250 years, evenly distributed globally
- Political stability of major coal exporters
- No economically viable alternative to meet demand
- Clean coal technologies - cleaner burning and more efficient



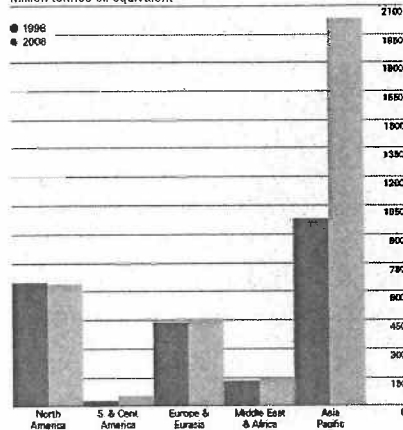
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Coal production – Coal consumption

Production

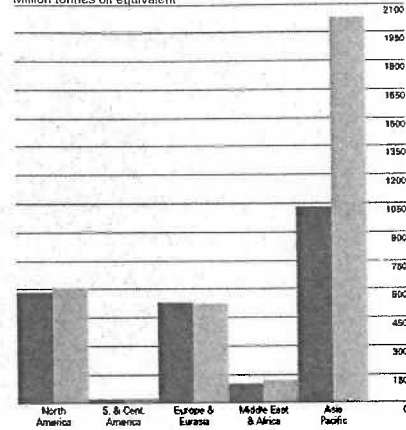
Million tonnes oil equivalent

● 1996
■ 2006



Consumption

Million tonnes oil equivalent



Source: BP Statistical review

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Importers and exporters

Importers

- Asia
 - Japan
 - South Korea
 - Taiwan
- Europe
- Big growth in imports to Asia

Exporters

- Australia
- Columbia
- Indonesia
- Russia
- South Africa

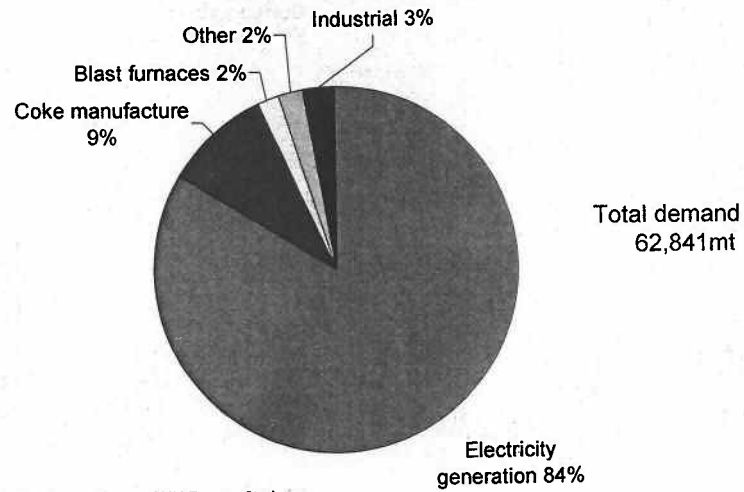
• Canada?
• China?
• Poland



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UK coal demand



DUKES: DTI Digest of UK Energy Statistics

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MARKET EVOLUTION



Evolution of a market

Undeveloped

- Mostly term contracts
- Prices fixed or long term escalators

Examples: 1970s oil, European natural gas

Immature

- Development of a short-term or spot market for physical balancing
- Market acquires some transparency as prices are reported
- Some OTC swaps trade: launch of futures contracts

Examples: UK Gas; UK Electricity; US Electricity



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Evolution of the market

Active/Maturing

Spot prices accepted as benchmarks

- Resulting volatility generates opportunity/need to manage price risk and trade
- Full range of markets both exchange and OTC based: futures, options, swaps
- Examples
 - International Oil
 - US Gas
 - Scandinavia Electricity

Forward market ≠ future market.



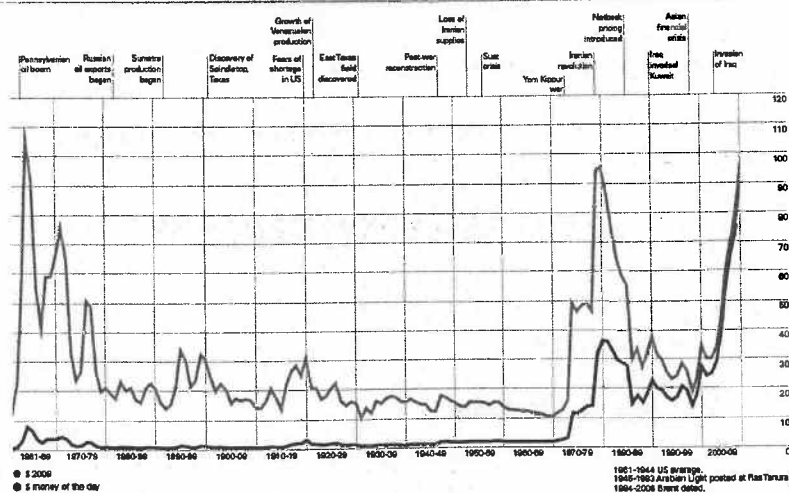
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OIL MARKET EVOLUTION

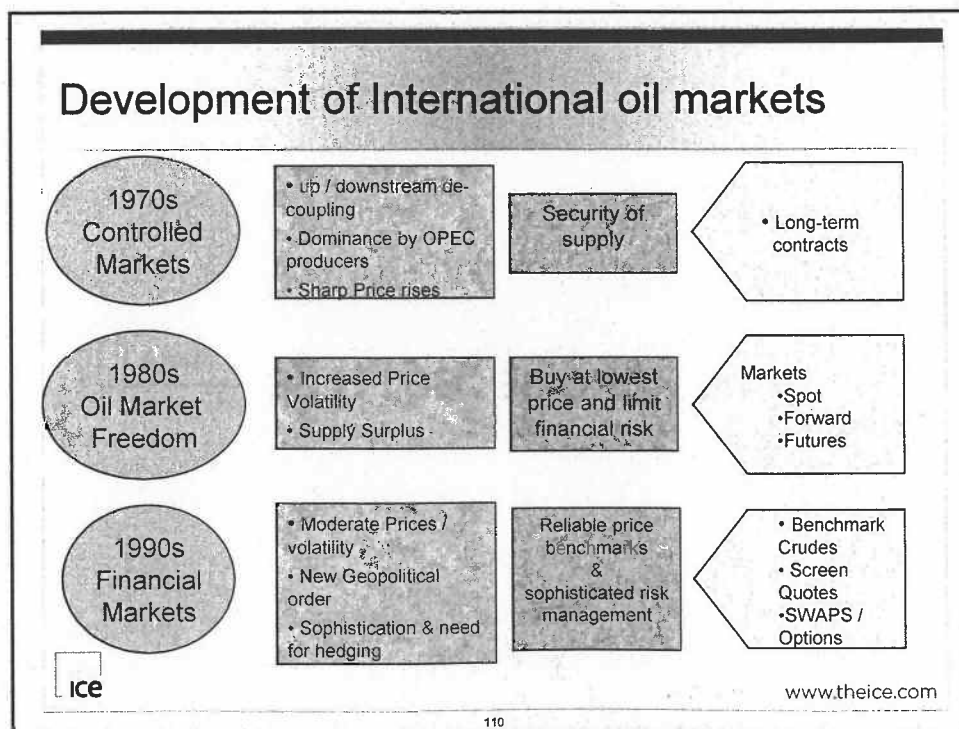
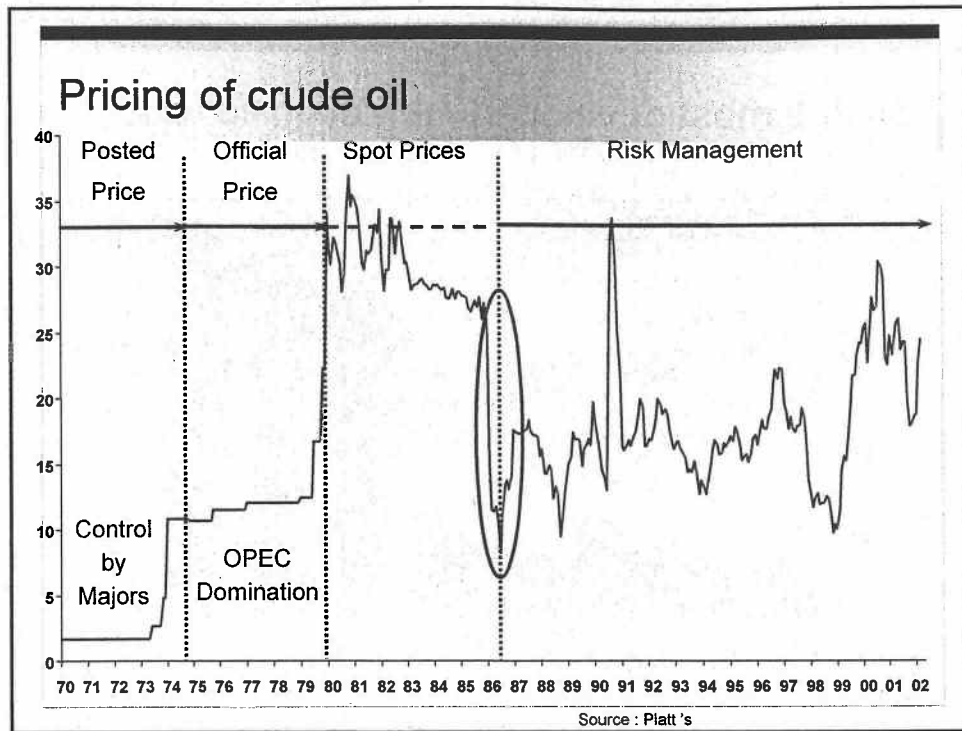
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Crude oil prices since 1861

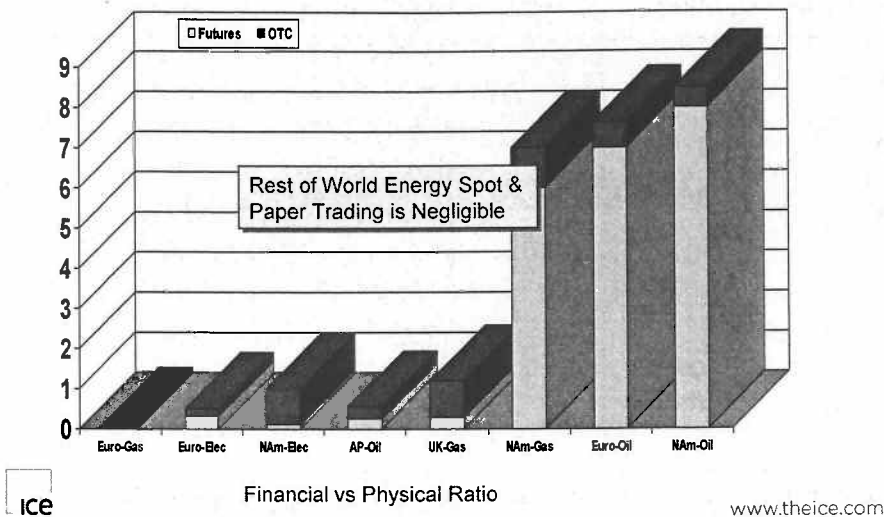


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Source: BP Statistical review www.theice.com



Oil: the most developed market



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EXERCISE: BOTTLES

types of derivatives

- Physical (OTC)

- Swap (OTC)

- Futures: standardized specs, delivery months, price
 - 99% do not go to physical delivery (single day)
 - hedging vehicle.

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- convergence price with physical at expiry

not always physical delivery but cash settlement

- cleared (insured)

→ clearing house
 counter party to all the deals
 default fund

pay margin (10% of contract value: imm)

OTC less regulation, less transparency.

Swaps : months in the future (avg. 6 months)
price is the avg of a month
bilateral netting (no clearing house)
index
tenor (up to 5 years [rare than futures])

Forward OTC, bilateral
for very large units -- no speculation.
600K b
offsetting with 2 counterparties.
Standard contract
2 day BFOE contract

But
Futures
only
in the future

Fixed only
(No physical delivery)

Physical oil markets

- Physical oil markets exist for the purpose of delivering and receiving physical oil
- Contracts are normally non-standard; title and risk in the oil is transferred from one party to the other at a specific time and location

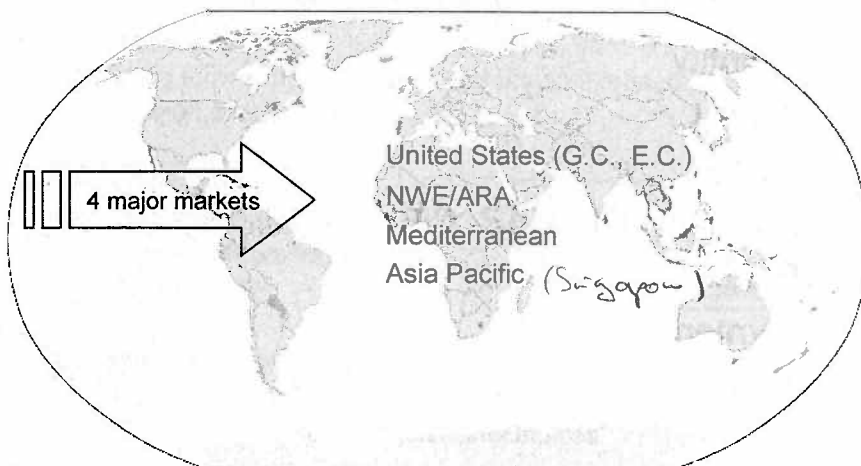
Physical delivery



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Oil products markets



Gulf Coast; East Coast
North West Europe



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Barge market more active than cargo → dominant benchmark

Barge

Cargo

- Gasohol
- Gas oil
- Diesel
- 3rd/4th

- Naphtha
- Ethanol
- 1st/2nd

Physical crude oil contracts

- One-off unique bilateral transactions
- Spot contract: Cargo of gas oil loading Kuwait March 1-3
- Term Contract: 50,000 barrels per day Kuwait Crude over year 2008
- Result in physical delivery of oil
- Rare for seller not to have physical availability at time of sale



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Elements of a physical oil deal

- Quantity
- Quality
- Period
- Delivery (FOB, CFR, CIF)
- Price
- Payment
- Other



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PRICING & BENCHMARKS



Pricing methods, oil market

- Types of contract
 - Long term supply contracts that are spot related
 - One off spot trades
- Linked to an index
 - Oil price publications
 - Futures or forward market
 - Triggers/EFP
- Outright or average over period
 - Formula price
 - Government Selling Prices/Panel Indices

Units in \$US
per metric tonne
per barrel
per US gallon



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Benchmarks

There are many qualities of oil

- Benchmarks provide a **standard industry reference point** that is fair, market related, transparent and understood by all participants
- Benchmarks facilitate business by providing a focal point for **differential pricing** of related commodities

Benchmarks enable :

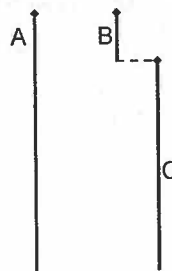
- Hedging (take an opposing paper position to protect against a price change in the physical)
- Price transparency (discovery & dissemination of prices)

A - Forcados

(Dated Brent plus \$2.65)

B - Dated/Forcados diff \$2.65

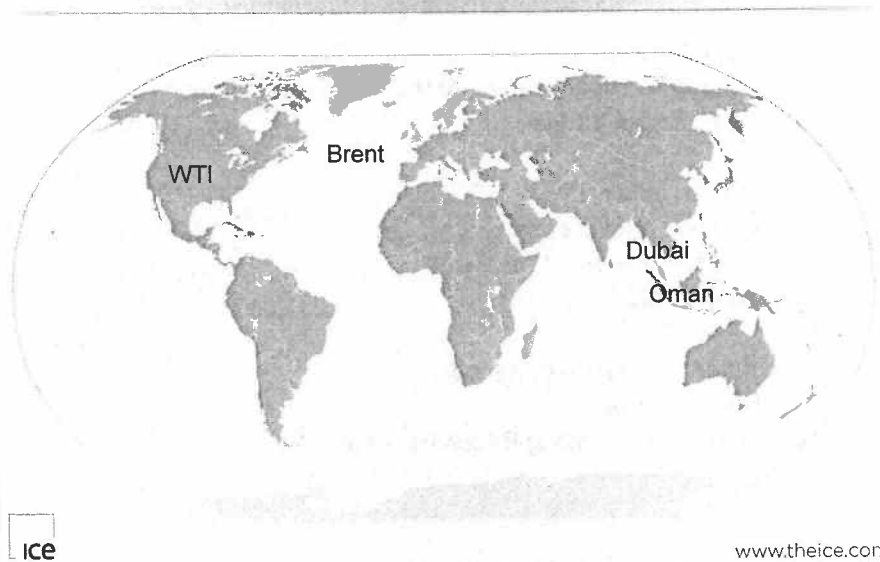
C - Dated Brent \$64.54



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Global crude benchmarks



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Relative prices – Atlantic basin

- Brent / WTI are used as the reference price
- All other crudes are bought or sold as a differential to Brent and WTI
- Differentials in
 - Location
 - quality
 - supply & demand for the grade (arbitrage opportunities)
 - seasonality
 - refiner value



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OPEC

- Formed at the Baghdad Conference, 1960
- The Organisation of the Petroleum Exporting Countries
- Original members: Iran, Iraq, Kuwait, Saudi Arabia and Venezuela
- Present members - Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, UAE and Venezuela
- Indonesia has left the organisation
- Supply 40% of the worlds oil production
- Own 78% of proven crude reserves

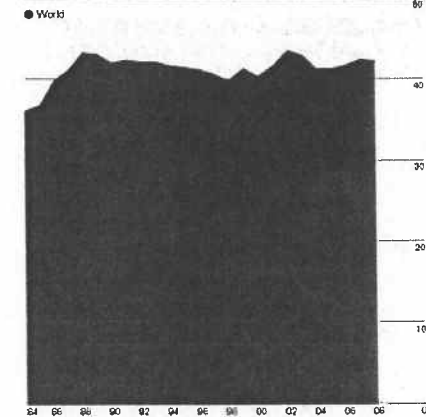


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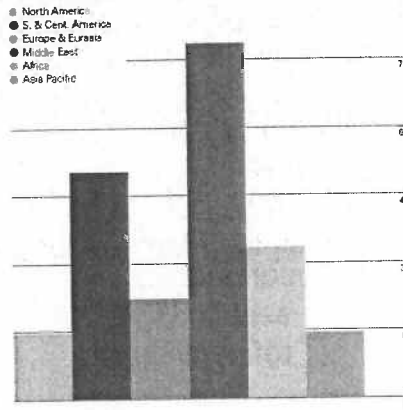
122

Oil reserves-to-production (R/P) ratios

Reserves-to-production (R/P) ratio
Years



2008 by region



Global proved oil reserves in 2008 fell by 3 billion barrels to 1,258 billion barrels, with an R/P ratio of 42 years. Declines in Russia, Norway, China and other countries offset increases in Vietnam, India and Egypt. The 2007 figure has been revised higher by 23.1 billion barrels, with the largest upward revisions in Venezuela and Angola.

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Source: BP Statistical review

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Issues from an OPEC perspective

- Target price band for crude oil
- Judgement of market
- Reliability and timeliness of stock data
- Compliance with quotas
- Long term maintenance of Oil as a major energy source
- Avoidance of
 - major financial crises
 - search for and switch to alternative fuels
- Tax levels in consumer countries

OPEC's objective is to co-ordinate and unify petroleum policies among Member Countries, in order to secure fair and stable prices for petroleum producers; an efficient, economic and regular supply of petroleum to consuming nations; a fair return on capital to those investing in the industry

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Taxation and tariffs

- Producing countries tax crude oil production to varying degrees
- Most economically wealthy countries tax petroleum products: in the U.K. about 80% of the price of a gallon of petrol is tax
- Taxation affects behaviour
 - US gasoline consumption
 - France diesel
 - creation of the Brent forward market due in part to tax optimisation
- No taxes exist in the international market between crude oil export and ex-refinery gate but taxation can affect the short term market



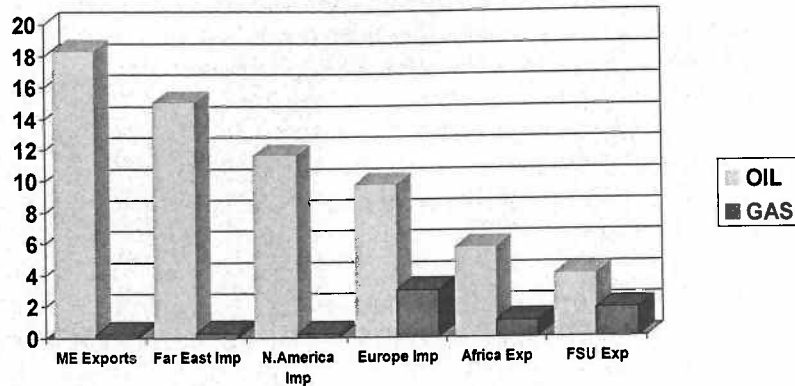
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NATURAL GAS MARKET EVOLUTION



Oil and gas trade: a comparison



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Natural gas markets

- Most of the World's Gas is produced & consumed in the local Country or Region
- Most international contracts are on a long term partnership basis (exceptions Canada/USA) with
 - Long term take or pay contracts
 - Some operational flexibility
 - Prices linked to oil
- Spot markets are active in North America & UK, growing in Northern Europe, but rare elsewhere

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Long term contracts

Producers require long-term take-or-pay contracts before investing

In regulated markets distributors had captive markets:
Interstate Pipelines in US, BG in UK

But

Storage & Transmission infrastructure limited

Seasonal and within-day demand can vary significantly

Volume balancing is vital



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Gas contract terms

Gas Quality - almost always standard (legal) specification

HCV - High Calorific
LCV - Low Calorific

Point of Delivery - metering

Volume

- | | |
|--------------------------------|------------------------------|
| • Maximum rates (daily/hourly) | Buyer's Right (swing) |
| • Minimum off take (annual) | Buyer's obligation |

Interruptions to Supply

- Contract Rights (interruptible contracts)
- Force Majeure - equipment breakdown, markets, compensation for default



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Gas pricing

Historically the price was determined by alternative Oil fuels

The actual price will be influenced by:

- Volume required
- Off-take pattern
- Flexibility versus Commitment

Once established need to carry into the long term

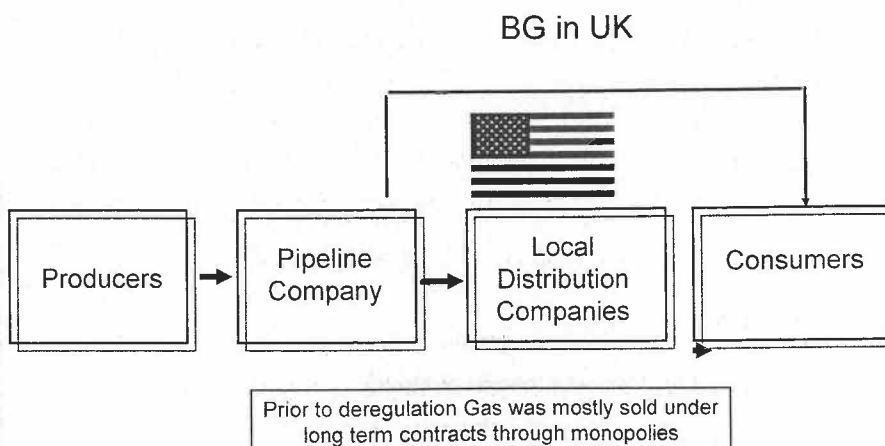
- Indexation
- In traded markets GAS benchmarks are replacing Oil priced contracts



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Common historical domestic structure



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Gas trading

Typical development of trading

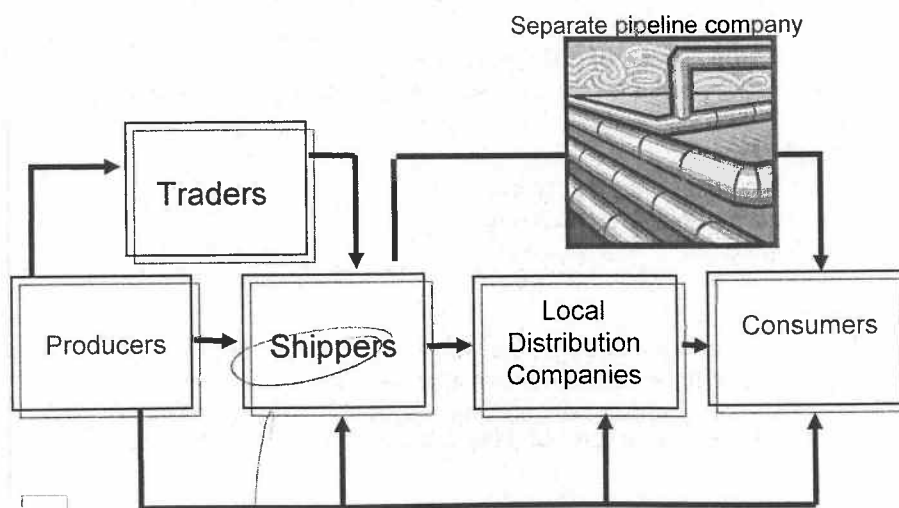
- Long-term contracts & monopolies
- Deregulation in US then UK
 - Government competition philosophy
 - Consumer pressure
- Emergence of spot trading markets, North America, UK, EU
 - Many buyers and sellers
 - Standard or semi-standard contracts
 - Price transparency and benchmarks
 - Sufficient liquidity
 - Variety of products - financial as well as physical
 - Spot markets are growing in continental Europe



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Deregulated gas structure



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Right to move the gas in the pipeline

U.S. natural gas spot market

- Development of spot trading
 - 1984-3 to 5% of total gas consumption
 - 1988 – 75%
 - 1993 onwards – 40% (stable)
 - US, 2002 – 80% consumption met by domestic production, 16% imported from Canada
- Reasons for the development of spot trading in the USA
 - Existence of gas surplus
 - Introduction of TPA and unbundling of pipeline services
 - Abrogation and re-negotiation of long term contracts
 - Decline in creditworthiness forced many companies into short term trading



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North America - market structure

- Trading occurs at 30 hubs
- Henry Hub - focus of price formation
 - Delivery point for the Nymex natural gas futures contract
- Spot deals
 - Firm (monthly)
 - Interruptible (monthly)
 - Swing (daily)
- Long term deals
 - Long-term index contracts with monthly price resets
 - Price indices based on spot market deals
 - Most natural gas transactions now priced through formulae that establish some form of differential to the Nymex contract



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US Natural Gas trading

- Focus of price formation for North American gas industry
- Natural Gas trades
 - as a future trading on CME/NYMEX
 - as OTC products, bilateral or on the ICE platform

Market structure:

- 10,000 producers
- 300 shippers
- 1600 Local Dist. Co's
- 44 pipeline companies



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UK spot market - driving forces

- Introduction of competition into supply
 - Industrial, Commercial & Domestic
 - Full competition for all consumers since 1998
 - Vibrant market - 40+ shippers, 70 producers
- Introduction of TPA and unbundling of pipeline services
 - Network Code introduced March 1996
 - Daily balancing at the National Balancing Point (NBP)
 - Transco remain sole transmission/distribution agent
- Gas surplus (import requirement 2005 onward)
- Renegotiation of long-term Take or Pay contracts



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TPA in Britain

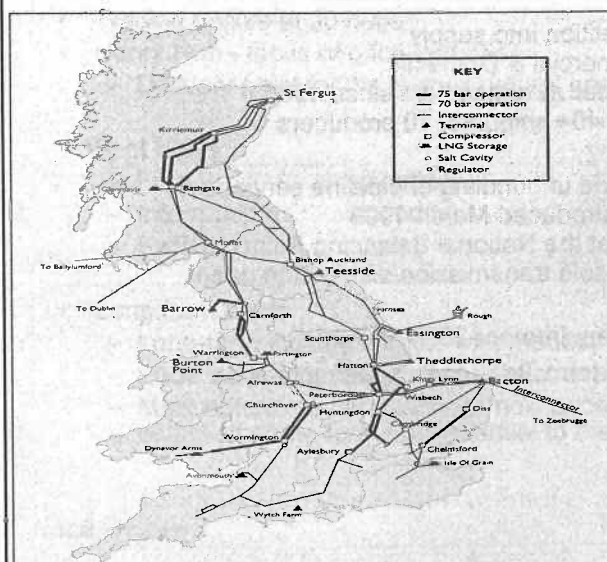
- One dominant transport operator (Transco)
- Regulated access
 - Tariffs based on allowed rate of return on assets
 - Set by Ofgem
- Network Code covers all conditions and tariffs for access
 - Entry-exit transportation system
 - Commodity charges on throughput
 - Imbalance charges



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National transmission system



- Six input terminals
- Nineteen million output points
- Seven major storage points
- Maximum daily throughput 357.4 mm cubic metres
- 267,300 kilometres of pipe
- Gas flows from North to South

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UK trading

- NBP
 - Designed as the balancing mechanism
 - Gas traded on-system
 - Transco matches trades and transfers ownership rights
 - Gas is entry paid
 - Each delivered parcel at NBP has been traded many times
- Beach
 - Entry points to transmission system
 - Where Transco takes title until re-delivered



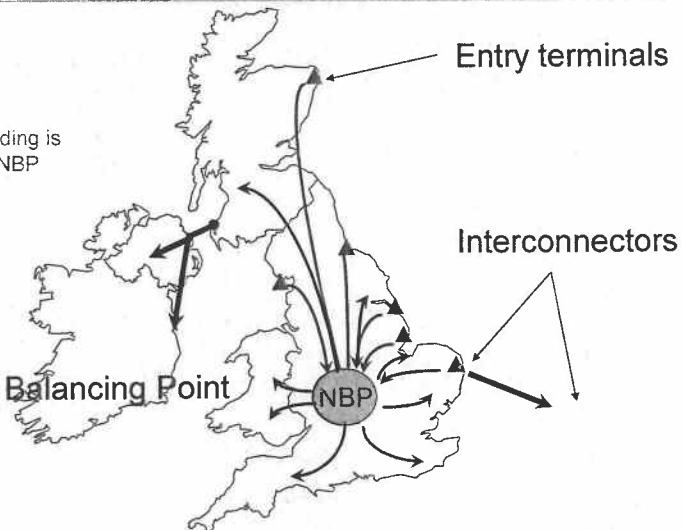
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Trading opportunities

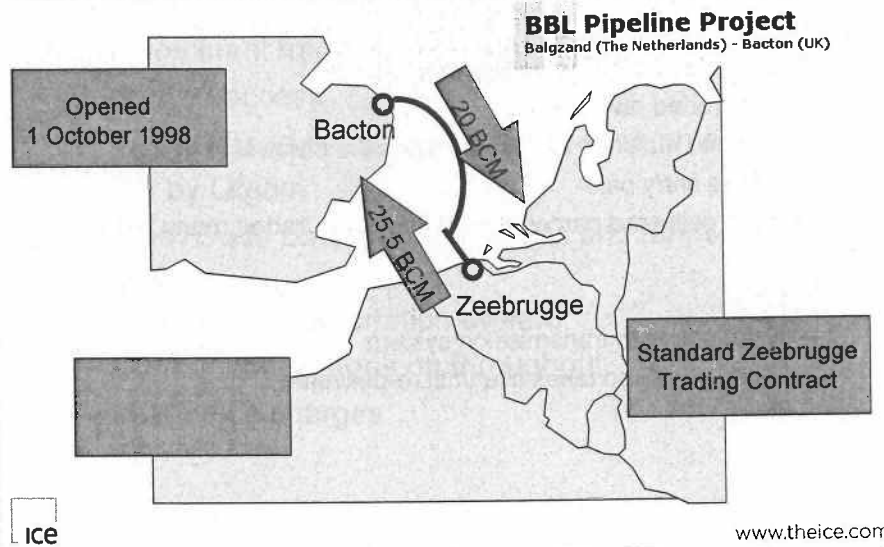
Est. 90% of trading is based around NBP

National Balancing Point (NBP)



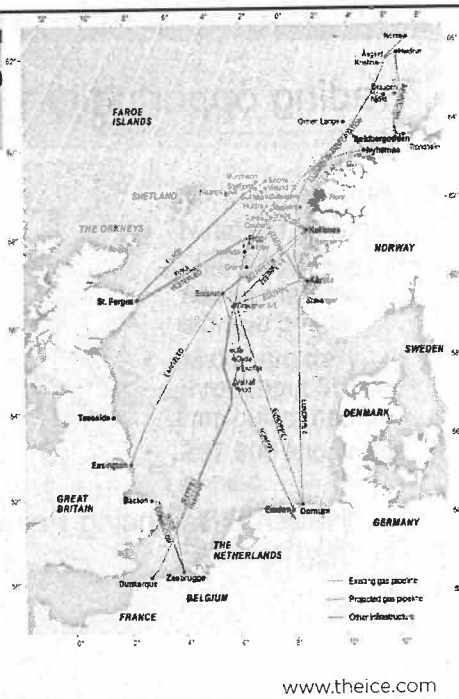
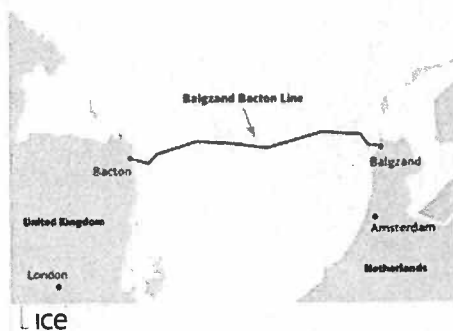
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Britain – Europe Interconnector



Other pipeline imports to UK

- Balgzand / Bacton pipeline
8 bcm/yr from 2007, Dutch Gastransport Services, Centrica commitment
- Norwegian Langeled pipeline direct export to UK



On-the-day commodity market (OCM)

- OCM replaced Transco bid flexibility mechanism October 1999
- Designed as a market based medium to aid Shippers and Transco to fulfil their balancing requirements
- Used by Transco, Shippers and Traders
- Screen based, operated by EnMo, independent Market Operator
 - Anonymous
 - Fully cleared
 - Screen based market



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ICE Futures Europe, Natural Gas future

- NBP natural gas futures, start date January 1997
 - 1000 therms a day for a month (minimum 5 contract lots)
 - Price transparency
 - Futures centrally cleared through ICE Clear Europe
 - Electronic trading platform
- ICE futures volume up to 10-15,000 contracts per day
- Months, seasons and quarters are traded
- Volume varies seasonally; new pipeline connections to UK offer new trading opportunities, financial participants have entered the market



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Growth in futures volumes

Participants

- 60+ participants
- Producers
- Retail customers
- Trade houses
-
- Hedge funds
- Utility companies (EU)
- Banks

Events

- Weather - forecast and actual
- Storage data and news
- Production streams
- Demand data
- Inter-connector flows
-
- New infrastructure – Langede & BBL pipeline
- LNG



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OTC and brokered trading

- Voice and internet brokers
- Brokers
 - Spectron, ICAP, Tullett/Prebon
-
- Intercontinental Exchange – many to many marketplace

Footnote

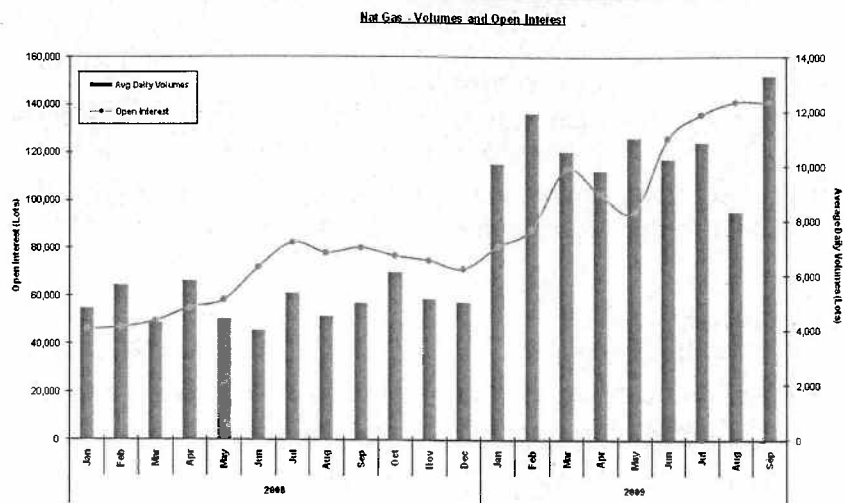
- One counterparty markets – problems?
 - EnronOnline & DynegyDirect



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ICE Natural Gas Futures, volume & open interest



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Development of the UK gas market

In a few years the gas market has seen:

- Published commodity price at various entry points
Development of competitive market
- Paper trading several times physical trade
ICE futures contract
- Long term contracts linked to NBP spot prices
New entrants
Volatile prices

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European supply competition

- UK supply competition developed from 1990
 - Full domestic gas supply competition from 1998. Consumers no longer need to buy gas from a single supplier

Rest of EU supply competition determined by EU Gas Directive 1998

- Barcelona Summit anticipated full I&C market opening by 2004

EU Directives

Electricity (Feb 97)

- At least 25.3% of market by Feb 99
- 28.3% in 2000
- 32.5% in 2003

Gas (Aug 98)

- 20% to open initially by 2000
- 28% by 2003
- 33% by 2008
- Power generators included

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European gas

UK market

- Spot market 25%
- Transco/TPA
- Regulator established 1986
- first real competition in 1989/1990
- Many gas producers/shippers
- ICE Futures and OTC market

Mainland Europe

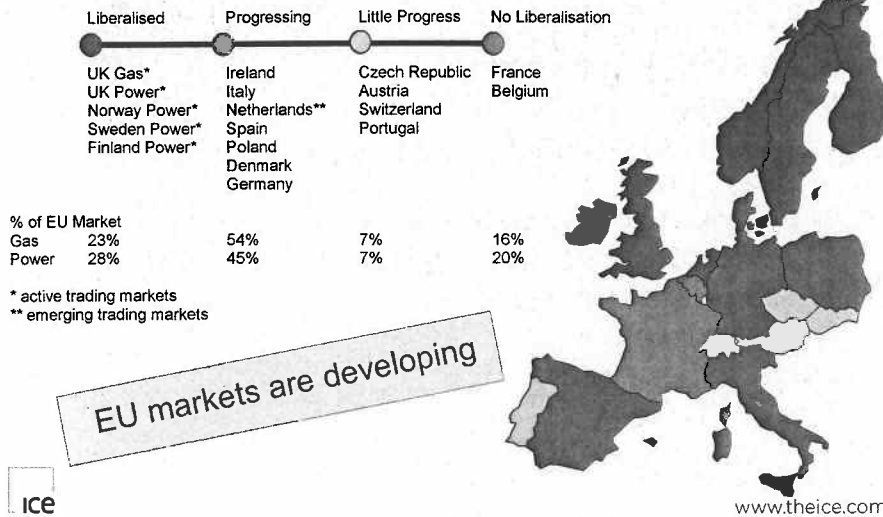
- Small spot market
- No readily available TPA
- Few regulators on UK model
- Fewer producers, very few with direct access to the market
- But ... major merchants theoretically free to re-sell gas to whoever they choose
- Enron fall-out

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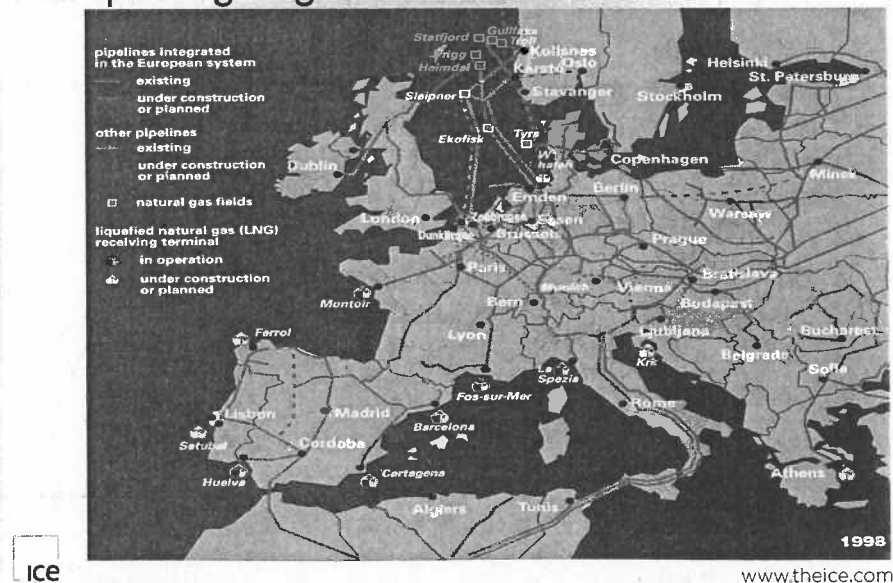
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Sp of London through UK

Liberalisation across Europe



European gas grid



Long-term contracts in Europe

- Three major suppliers
 - Gazprom, Gasunie, Sonatrach
- Negotiated agreements
 - Long-term 15-25 years
 - Take-or-pay
 - Swing and load factor variable
 - Infrastructure included in supply contract
 - Limited spare capacity
 - Oil price indexation
- Interconnector contracts

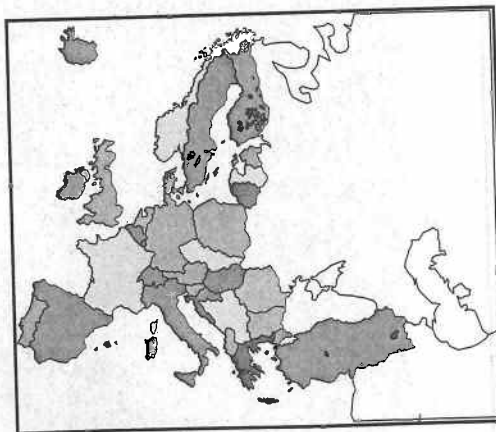


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A European natural gas market

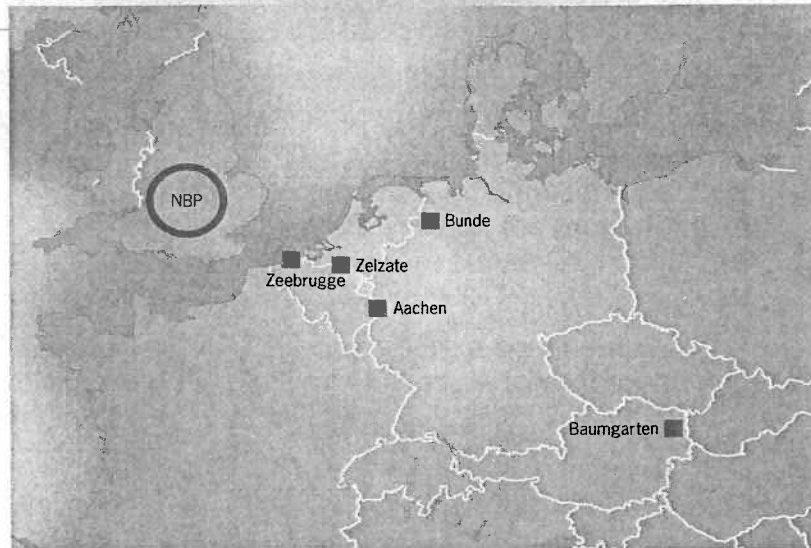
- Resistance of incumbents
- Social costs
- Weak TPA directive
- Regulated TPA
 - No publication of tariffs
 - Derogations
 - Few qualifying customers
- Supply Side Participation?
- Long term contract culture
- Spot markets are growing



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Gas trading in continental Europe



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European trading hubs (1)

- Baumgarten
 - Entry point for Russian imports
 - Gazprom
- Bunde-Oude
 - Norwegian, Dutch and Russian pipeline hub, storage capacity
 - Participants – Statoil, Gasunie, Ruhrgas, BEB, Wingas
 - 2 competing hubs split liquidity – EuroHub and Hubco
 - Hubco dominated by German integrated companies (need for regulation?)

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Europe Gas Markets

- NBP
- TTF
- Zeebrugge
- PEG
- EGT
- BEB
- PSV
- CEGH
- GTF
- AOC
- Russia



159

NBP, UK

- Most mature of the European Gas markets
- Price rose until July 08 on the back of immensely strong oil prices, financial institutions and hedge funds, record high Summer prices
- Reduction in activity following bank failures in September 2008, liquidation of positions as non gas market participants returned to their core markets
- Credit issues reduced trading volumes, sentiment changed from extremely bullish to extremely bearish
- High price volatility reduced levels of speculation
- Supply problems from Norway gave some support
- Link to oil prices through European long-term contracts kept prices strong in Summer 2008

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TTF, Netherlands

- Easiest of the continental markets to trade, tight bid offer spreads for prompt contracts, 2 front months and 2 front seasons
- Exchange trading, merger finalised between operators APX and Endex; APX more liquid in the prompt market and Endex more liquid down the curve
- 59 active members
- Close links to NBP although TTF, a continental exchange has more direct exposure to oil through long term supply contracts



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Zeebrugge, Belgium

- Belgium market linked to UK via Interconnector pipeline
 - Connected to UK interconnector and developed early
 - > 50 participants, majority trading daily
 - Seen as extension to UK market via interconnector
 - Storage capacity and LNG receiving terminal
 - UK (Interconnector) Oct 1998
 - Norway (Zeepipe)
 - Algeria and others (Distrigas LNG terminal)
 - Belgium (Distrigas grid - connections to France, Germany, Netherlands, Luxembourg)
- Interconnector shippers and other traders
 - Zeebrugge standard trading contract
 - Development of spot market
 - Basis trades with UK, Zelzate, Aachen, Bunde



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PEGs, France

- GRT gaz, operator of 4 balancing zones, merged Zones West, North and East from Jan 2009 to form a large consumption area
- Consolidation into
- Volumes increased following more opportunities to trade the spread between other hubs, especially Germany due to EGT zone merger
- Volumes grew in 2008 across all zones including PEG S West and South, the most illiquid regions. Day-ahead and within day contracts
- 47 companies signed up by Sep08
- North zone is the main focus for balancing, East is second most active due to location next to Germany
- Within day and day-ahead trading takes place on GRTgaz's trading platform operated by Powernext
- Powernext launching a futures platform by end 2009
- No market limits growth of trading volumes
- Good storage in Northern France



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163

EGT, Germany

- Trading volumes have grown since EON merged its market areas, EGT Nord, Mid and Sud, October 2007
- Day ahead, weekend and front month are the most active contracts
- Limited trading on the forward curve, trades done are often a diff to TTF or NBP
- 105 companies registered and 85 are active, Austrian and Italian companies increasing their activity
- Some financial players moved into the market
- EEX exchange started July 2007, spot and futures volumes have grown steadily
- Reasonable liquidity out to 2 years
- 4 market makers in the spot market and 5 in the futures market
- Consolidation across Germany's zones met some delays but is planned to continue



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164

Growth of LNG

- UK first ever importer
- Japan dominates international market – 80% of World re-gasification units split between Korea and Japan
- Japan has no natural hydrocarbon reserves
- Expensive
 - Liquefaction through refrigeration and Pressurisation
 - Vacuum Shipped & Stored
- Growing trade,
 - environmental benefit
 - increasingly competitive market – Trinidad, Middle East, Indonesia, Algeria
 - advances in technology
 - alternative source of supply to local pipeline delivery



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165

LNG – Liquefied Natural Gas

- Market projected 60% increase in production capacity in 5 years to 2010
- World capacity 214 MM mt year 2007 compared with 135 MM mt end 2002
- Major projects in Qatar (Ras Laffan – 2 trains), Egypt (Union Fenosa)
- UK construction and upgrading - Isle of Grain, Herbranston
- First shipments received from Algeria July 2005
- Over 20 proposed new LNG import terminals in US
- Sempra received FERC approval for first US LNG terminal build in 20 years, Cameron LNG terminal in Hackberry, Louisiana
- Specific production, transport and storage facilities required
- Vessel construction requirements, larger vessels give economies of scale



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Natural gas prices

- Prices are transparent in US/UK; transparency is growing in Europe

UK - pence per therm

USA - dollars per Million btu

Europe - Euro's per kwh

Various - calorific value / cubic metres in local currencies



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167

ELECTRICITY MARKET EVOLUTION



UK Electricity Infrastructure

- Prior to 1990 nationalised industry - CEGB controlled all aspects of the electricity market:
 - Generation -production
 - Transmission -bulk transportation at high voltage
 - Supply -wholesale purchasing and retailing
 - Distribution -transport and delivery to customers
- Registered capacity of the UK market is approximately 66 GW
- Total consumption approximately 350 TWh



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169

Electricity in England and Wales

Prior 1990

CEGB

&

12 area distribution boards

Post 1990

National Power
PowerGen
Nuclear Electric

National Grid

12 Area distribution boards



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170

England & Wales Electricity (1)

- Generation
- Transmission
- NGC
- Supply - 12
RECs
- Distribution

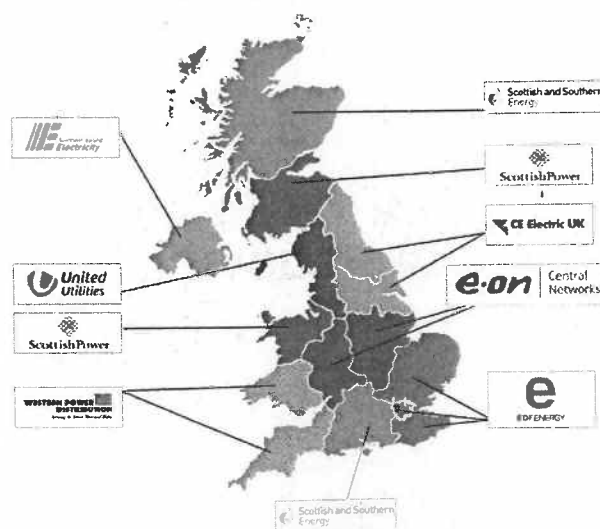


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171

Distribution areas



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172

England & Wales Electricity (2)

Prior to 1990

- Monopolistic
- Cost-plus tariffs
- Engineering led
- Centrally planned
- Closed to new entrants

After 1990

- Competitive
- Downward pressure on prices
- Market led
- Encourages diversity
- Open to new entrants



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173

The electricity pool 1990-2001

- A centralised market mechanism (est. 1990)
 - All electricity sold into the Pool
 - All electricity bought from the Pool
 - Enabled NGC (Independent System Operator) to retain responsibility for matching supply and demand in a competitive market
- How did it work?
 - D-1 generators submitted offers for each genset for each 30minute settlement period
 - NGC stacked offers in merit (price) order
 - NGC scheduled plant to meet forecast demand (including reserve)
 - NGC called plant in or closed plant to maintain real-time balance



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Demand forecast

- Forecast demand for England & Wales for the following day:-
 - Historic information
 - Demand from large customers
 - Weather forecast
 - Interconnector demand
- Produce demand profile for each half hour



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175

Pricing in the pool

- System marginal price (SMP)
 - Price bid by marginal generator
 - Ignores transmission constraints
 - Received by all those in unconstrained schedule
- Generators also receive capacity payments
- $\text{SMP} + \text{Capacity payments} = \text{Pool Purchase Price (PPP)}$
- Uplift *to pay on line*
 - Cost incurred in maintaining stability on National Grid
 - Difference between forecast and actual costs
 - Ancillary services
 - Reserve
 - Paid for by demand side
- $\text{PPP} + \text{Uplift} = \text{Pool Selling price (PSP)}$



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Pricing in the pool

Implications

- Generators were paid the price of the most expensive genset whatever their own generation offer was
- Generators could zero-bid to ensure they were always running but rely on receiving higher prices almost all the time
- Physical trading in the pool
 - All physical electricity priced through the pool
 - This limited trading market development
 - Pool price risk could be hedged with EFA's and CFD's



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177

Problems with the pool

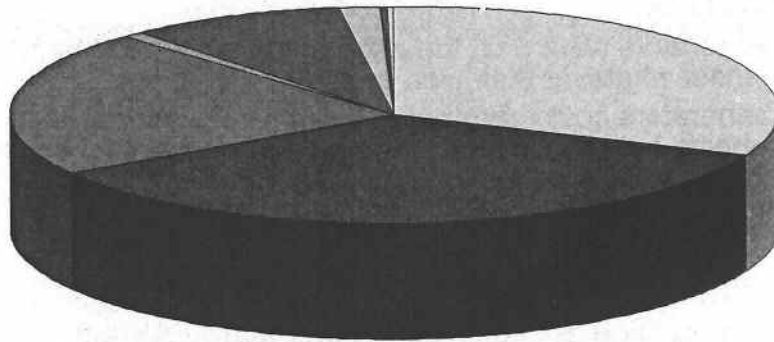
- Lack of competition in price setting, despite new entrants
 - Nuclear/CCGTs mostly zero-bidding
 - Coal used for marginal generation
- Abuse of market power
 - Prices rising despite supply competition and falling generation costs
- Complex and lacking transparency
- Bias towards new entrants (and against old coal)
- Slow pace of reform
 - Generators club- regulator kept at safe distance



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178

SMP (System Marginal Price) Price Setting



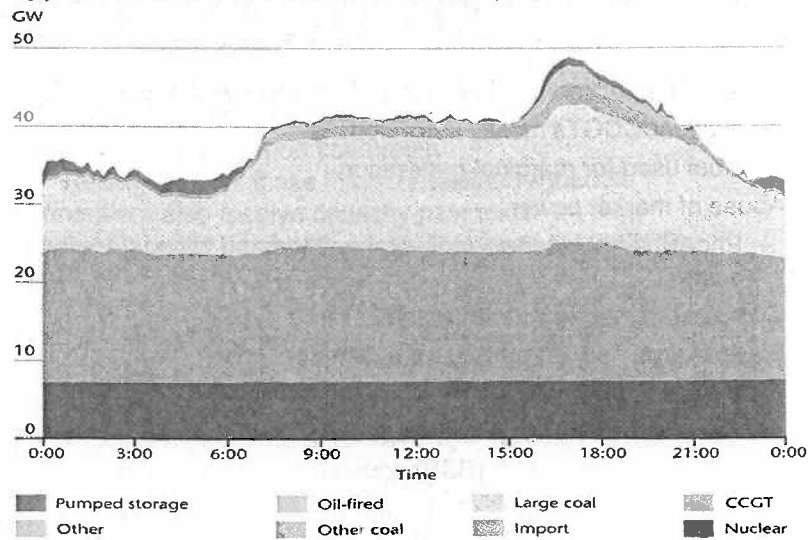
■ National Power	■ Powergen	■ Energy Group	■ Scottish Power
■ British Energy	■ Magnox	■ First Hydro	■ EdF
■ Others	■ Scottish Hydro		

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179

Typical Winter Demand in 1999/00 (23/11/99)



Source: National Grid Energy Settlements and Information Services Ltd

The New Electricity Trading Arrangements (NETA)

- Pool Review in 1997
 - Radical changes proposed
- Review of Electricity Trading Arrangements (RETA) 1998
- NETA
 - First deadline October 2000
 - Implemented 27 March 2001



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Aims of NETA

- Promote competition between generators
- Efficient balancing
 - Market-based system
 - Cost-reflective pricing
- Free trade, not a single Pool price
- Transparency
- No overt capacity payments
- Participants to face financial consequences of their actions
- Demand-side participation



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182

Forecasting a major factor

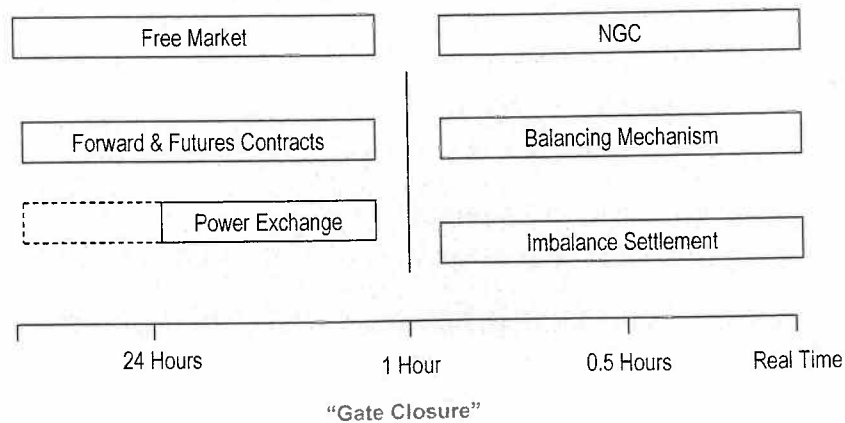
- Generators and suppliers need accurate price and demand forecasting to participate effectively under the new markets arrangements
- Accurate forecasting may limit exposure to unpredictable market prices



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NETA – the new market structure



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Balancing mechanism

- Start trading at gate closure (1hr ahead)
- NGC responsible for correcting imbalances
 - Sole counterparty to all trades
- Offers -
 - Generators to increase output
 - Suppliers to decrease consumption
- Bids -
 - Generators to decrease output
 - Suppliers to increase consumption



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Settlement process

- Financial penalties for those out of balance
 - Buyers pay volume-weighted average of accepted offers
 - Sellers receive volume-weighted average of accepted bids
 - Combines energy and flexibility values



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186

Today

- Fully liberalised Electricity market in Great Britain
Network operated by National Grid Transco
- 14 Distribution Companies based on original area boards
- 7 Major vertically integrated Supply and Trading Companies:
 - EON
 - RWE
 - Scottish Power
 - Scottish & Southern Energy
 - Centrica
 - British Energy
 - EDF Energy
- All have generation, trading and supply



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187

NETA impact

- Most electricity, >95%, is traded outside of the NETA Balancing Mechanism through bilateral trades
Both generation and demand side participation takes place, removing the possibility for price fixing
- Harder for smaller independent producers to operate
Prices initially dropped due to over capacity
Low electricity prices led to plant closures and mothballing
- Problems for renewable energy and embedded generators
 - Embedded generation working group
 - Renewables Obligation
- NETA has been replaced by BETTA (British Electricity Trading & Transmission arrangements)



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188