PIU Energy Project

COAL – INITIAL SCOPING NOTE

Reference: Coal 1 v1.0
Date: August 2001

1. PURPOSE OF THIS NOTE AND WAY FORWARD

1.1 The note seeks to briefly summarise relevant recent history and to identify key areas for subsequent investigation.

1.2 This is one of a series of initial scoping notes that have been prepared by the PIU Energy Review Team on a series of topics. The team will not be producing scoping notes on every aspect of the Review. Some areas relevant to the Review have already been explored in depth by the PIU Resource Productivity and Renewables Review Team which has been working since January 2001 and which has been merged into the Energy Review Team.

Readers should not assume that the PIU has in any respect closed its mind. Propositions are made, and questions are put, in order to draw responses.

1.3 We will be taking forward discussion of the questions and propositions raised in this note over the next two months.

1.4 This will be done via a series of bi-lateral meetings with key stakeholders. We are also likely to arrange a workshop involving all key stakeholders where views on the key issues can be exchanged and debated, probably during October.

1.5 The PIU has already invited all interested parties to put submissions to it by 10th September on all aspects of the PIU Energy Review. Interested parties are invited to respond in their submissions to the questions and propositions raised in this scoping note.

1.6 We would also be grateful if interested parties could let us know as soon as possible if they consider this note overlooks key questions, if any of the questions posed, or propositions put, are fundamentally mis-conceived, or if the note contains any factual errors.

2. HISTORY AND BACKGROUND

2.1 Coal is used both as a primary fuel for electricity generation and as an input into industrial process, notably steel-making. Coal's contribution to UK energy needs has been in decline for many years. Coal accounted for 74% of UK primary energy requirements in 1960, falling to 36% by 1980 and 17% by 2000.

2.2 There have been two major reasons for the long term decline of coal:

- New competitors. Since the 1960s, nuclear power has been an alternative means of electricity generation and increased availability of natural gas has enabled gas to be substituted for coal in all its uses, including power generation.
- Environmental. Increasing regulation of emissions from coal combustion (smoke, particulates, acid gases) has increased the cost of using coal in many uses and encouraged consumers to move to cleaner fuels.

Production and Use

2.3 UK coal production has fallen from 198 million tonnes (mt) in 1960 to 130 mt in 1980 and 32 mt in 2000. Up to the mid 1980s, UK imports and exports of coal were small in relation to total production and use. From the mid 1980s, the UK has increasingly become a net importer of coal, particularly the coking coals required by the iron and steel industry, although small quantities of coal are still exported.

2.4 In 2000, the UK used 59 mt of coal of which 78% was used for electricity generation, 15% in coke ovens with the remaining 7% spread over industry, commerce and domestic use. The electricity sector is thus the key source of demand for coal.

2.5 The UK's coal requirements in 2000 were met by 32 mt of local production (of which 18 mt was from deep mines and the rest opencast), 23 mt of imports and a stock draw of about 5 mt. Less than 1 mt was exported[1].

Coal Imports

2.6 Coal imports in 2000 included 8.5 mt of coking coal, over half of it from Australia and most of the rest from Canada and the USA. The main sources of imports of steam coal, mostly for use in power generation and industry, were Columbia (39%) and South Africa (32%) with smaller volumes from Australia, Poland, the USA and elsewhere.

2.7 During the 1990s, prices for imported steam coal varied considerably, but the trend was mainly downwards. Prices reached a low of below 70 pence per gigajoule (p/GJ) in mid 1999, but have since recovered to around 115 - 120 p/GJ[2]. Most imported coal has a sulphur content of around 1% although coals with a range of sulphur content are available at differing prices. By comparison, most UK coal has a sulphur content of between 1% and 2%

Coal in Electricity Generation

2.8 In 1990, coal accounted for two thirds of the fuel used for electricity generation in the UK. By 2000, this had fallen to about one-third. The reasons for this decline have been:

- Environmental. Generators have had to meet increasingly strict controls on emissions of sulphur dioxide and nitrogen oxides. To some extent these controls have been met by installing abatement equipment such as flue gas desulphurisation (FGD), but generators have also chosen to reduce coal use in favour of gas

[1] Mostly to Ireland, Norway and elsewhere in Europe.
[2] These are prices delivered to UK ports. Onward delivery to inland power stations could add a further 30 pence/GJ. There are about 25 GJ per tonne.

generation that produces much lower levels of these emissions and to use more low sulphur imported coal instead of UK product.
- Cheap Gas. Natural gas prices have been low throughout most of the 1990s and the costs of new gas fired power stations have also been falling. For generators wishing to build new capacity, gas-fired capacity has been clearly cheaper than coal. No new coal-fired plants have come into operation since the mid 1980s.
- Market Distortions: The DTI's 1998 White Paper concluded that investment in new gas-fired generation had been excessive because of distortions in the wholesale electricity market, mainly excessive concentration in plant ownership and flaws in the structure of the wholesale market, the Pool.

2.9 Generators have generally chosen to run new gas fired stations in preference to coal stations where possible, reflecting both the low price of gas and their need to comply with emission limits. However, during the past year increases in the price of gas have led generators to use coal stations rather more than before.

2.10 At present, there is some 30,000 MW of electricity generating plant capable of burning coal in the UK, most of it built in the 1960s and early 1970s. This accounts for some 40% of total generating capacity. Plant capable of burning gas accounts for about 30% of total generating capacity. At present, 6,000 MW of coal plant is fitted with FGD and work is proceeding to install FGD at a further 2,000 MW. Some generators are considering whether to install further FGD.

Government Policy

2.11 There have been two full-scale reviews of the role of coal in the UK energy balance in the last decade—in 1993 and 1998.

2.12 The main conclusions of the 1993 Review[3] were:
- The then Government's energy policy centred on the creation of competitive markets within which the coal industry must take its place;
- Subsidies would be available for sales of deep mined UK coal to the electricity industry in excess of the volumes covered by five year contracts agreed between the main generators and British Coal[4];
- British Coal should be privatised.

2.13 Privatisation of British Coal took place at the end of 1994 with the bulk of the mines being sold to RJB Mining (now UK Coal) which continues to account for the vast majority of UK deep mine production and a significant part of open-cast production.

2.14 The main conclusions of the 1998 Review[5] were:
- Distortions in the electricity market were encouraging excessive investment in new gas-fired generation, displacing coal, and threatening to undermine the longer term diversity and security of energy sources for power generation;
- A reform programme was set out to address the distortions;

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[3] Set out in a DTI White Paper of March 1993 (Cm 2235).
[4] The amounts of coal subsequently subsidised under this scheme were small.
[5] Set out in a DTI White Paper of October 1998 (Cm 4071)

- Whilst the reform programme was being implemented, a stricter regime for new power station consents would operate in which new gas fired generation would generally not be permitted unless in the context of good quality combined heat and power.

2.15 The main elements and outcomes of the reform programme were:

- Seek practical opportunities for divestment of coal plant by the major generators. During the next eighteen months, Powergen and National Power each disposed of 4,000 MW of coal capacity.
- Reform of the wholesale electricity market. New Electricity Trading Arrangements (NETA) were designed and replaced the Pool at the end of March 2001.
- Taking account of plant divestments and the expectation that NETA would be implemented soon, the stricter consents policy was ended in November 2000, since when new gas fired stations have been able to obtain consent.

2.16 In April 2000 the DTI announced a temporary subsidy scheme for UK coal producers to enable them to withstand the uncertainties associated with the lifting of the stricter consents policy, the introduction of NETA and unusually low prices for imported coal. The scheme was designed to enable the UK coal industry to establish a viable future within a competitive energy market. The scheme has been approved by the European Commission and will run until July 2002 when the existing European Coal and Steel Community Treaty, which governs state aid to coal producers, comes to an end.

3. PROSPECTS

International Coal Prices

3.1 Future levels of international coal prices will affect the commercial viability of coal production in the UK. International coal prices, relative to gas prices, will also affect generators' choices regarding the relative use of existing gas and coal fired plant and their decisions about when to invest in new plant and of what type.

3.2 About 10% of world electricity is still generated from oil and oil is also still extensively used for industrial heat raising. This means that increases in the price of oil create substitution possibilities for coal and hence a linkage between oil and coal prices. It is also possible that in the longer term, oil use will be increasingly confined to transport markets and that the linkage between oil prices and those of other fossil fuels will become weaker.

3.3 DTI projections[6] assume that oil prices will lie between \$10 and \$20/bbl up to 2020 whilst coal prices at UK ports will be between \$26.5 and \$42.4/tonne (about 75 – 120 p/GJ). Some observers have criticised these assumptions on the grounds that the oil price, and hence gas price, assumptions are unrealistically low and are likely to understate the potential role for coal.

[6] Energy Paper 68, published in November 2000.

***Questions**:*

Are coal prices delivered to the UK over the next 10-20 years likely to fall or rise compared to the current level of around 115 - 120 p/GJ?

Will international coal prices move in line with oil prices?

Coal fired Electricity Generation

3.4 DTI projections suggest that over half the existing coal fired capacity will close in the next decade and that by 2010, coal fired generation will be between 35% and 80% of current levels.

3.5 Given the expected content of new European Directives for acid gas abatement, it is unlikely that existing power stations without FGD would be able to continue operation at any significant level beyond about 2015. It is possible that even these stations would have to close sooner, or install further equipment for nitrogen oxide abatement.

3.6 Although most existing coal stations are 30 years old or more, the costs of keeping them running are generally quite low except when major refurbishment or fitting acid gas abatement equipment becomes necessary. The extent to which coal plant is chosen to operate in preference to gas plant will depend on the relative prices of gas and coal and on environmental restrictions.

3.7 The willingness of generators to fit further acid gas abatement equipment, or to build new coal plant, will depend on their expectations regarding the future competitive position of coal plant. This is turn will depend on future coal and gas prices and will also be influenced by expectations of the value of reducing carbon emissions.

***Questions**:*

What is the range of possibilities for UK coal-fired generation over the periods to 2010 and 2020, based on existing UK policies and expectations for future EU Directives?

For how long can the lifetime of existing sets with FGD be extended?

How much additional FGD equipment is likely to be fitted to existing stations?

Under current policies and expected prices are generators likely to choose to build new coal plant?

UK coal production

3.8 The prospects for UK coal producers were assessed in a report by the consultants IMC for the 1998 Review of Fuel Sources for Power Generation. The report concluded that:

- The costs of existing mines were all very similar;
- There was limited scope for significant cost reduction in future;
- Existing deep mines could sustain output in excess of 20 mt/year up to around 2010, subsequently falling to around 10 mt/year by 2020, at costs below 120 p/GJ;
- Production costs from new mines would be higher than those from existing mines whilst costs of opencast production are lower.

> ***Questions**:*
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> *What are the current estimates of future production levels and pit-head production costs from existing deep mines?*
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> *What level of pit-head prices would producers require to open new deep mines in the UK.*
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> *How long would it take for new deep mines to come into production?*
>
> *What contribution can opencast coal be expected to make given local environmental concerns?*

3.9 The costs of UK production and the level of international coal prices are likely to be the main factors affecting the ability of UK producers to compete against imported coal.

> ***Questions**:*
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> *Are there other factors likely to affect the competitiveness of UK coal?*
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> *If so, what would the impact be?*

4. COAL AND SECURITY OF SUPPLY

Coal stocks

4.1 Of all sources of energy, coal is the cheapest to store safely in large quantities. Energy systems using coal are therefore less vulnerable to interruptions in the delivery or production chain.

4.2 Coal fired power stations also offer a high degree of reliability as well as a good deal of flexibility that is needed in order to balance supply and demand on the electricity grid continuously.

***Questions**:*

Does ease of storage justify retaining some role for coal in the energy mix?

Should there be some minimum share for coal in the electricity market?

Is it worth retaining coal-burning equipment, including power stations, for back-up, even if regular use would conflict with environmental objectives?

Sources of Coal

4.3 World coal reserves are more evenly distributed than those of oil or gas. About 25% of reserves are in the USA, 15% in Russia, 10% in each of China, Australia, Europe and India and 5% in South Africa.

4.4 Coal is more costly to transport than oil and about 85% of coal is consumed in the country of origin. The main exporters of coal are currently Australia, USA, South Africa, Indonesia, China, Indonesia, Canada and Poland. This is a diverse group of countries in both geographical and political terms. As prices and consumption patterns change in future some of these may reduce exports and others may increase exports.

***Question**:*

What is the risk of a cartel of coal exporting countries, similar to OPEC, emerging?

4.5 Coal production in several of the major exporting countries is dominated by 4 large companies, Billiton/BHP, Rio Tinto, Anglo-American and Glencore. It has been estimated that some 50% of internationally traded coal is currently produced by these companies and some observers have expressed concern that this concentration could lead to cartelisation and higher prices.

***Question**:*

What is the risk of future coal prices being sustained significantly above competitive levels by the action of a small group of international corporations?

4.6 The UK has substantial port capacity able to handle coal and the capability of transporting substantial coal volumes from ports to power stations by rail. Nevertheless, a further significant rise in coal imports would require additional investment in port and rail facilities.

***Question**:*

Is there a significant risk that port and rail constraints will limit the UK's ability to import the coal it may require in the medium to longer term?

4.7 UK coal can also offer significant advantages in terms of proximity and reduction of transport disruption risks, combustion qualities that are well understood by UK customers and the ability to respond rapidly to customer needs.

> ***Question**:*
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> *Does UK coal offer security benefits which are not recognised in the prices it is able to command in the market?*

5. COAL AND THE ENVIRONMENT

Existing Coal Using facilities

5.1 In broad terms, the combustion of coal produces higher levels of pollution than for other fossil fuels[7]. Coal has inherently higher carbon content than other fossil fuels. In 1998, coal accounted for 23% of UK carbon dioxide emissions, 71% of sulphur emissions (mostly from stations without FGD) and 18% of nitrogen oxide emissions[8].

5.2 Emission limits for gases other than carbon dioxide and methane are largely determined by EU Directives and the way those Directives are implemented in the UK by the Environment Agency[9].

5.3 Based on existing power stations, a unit of coal-fired electricity generation causes the emission of about twice as much carbon dioxide as a unit of gas fired generation. This differential explains why the switch from coal to gas fired generation during the 1990s helped reduce UK emissions.

Cleaner Coal

5.4 A detailed review of cleaner coal technology is being undertaken by the DTI which will feed into the PIU Energy Review. The Consultation Paper issued by DTI[10] poses a series of questions which that review will address. For that reason, this note asks no separate questions about clean coal technologies.

5.5 Cleaner coal technology has generally been taken to refer to processes that achieve higher efficiencies combined with abatement equipment for acid gases[11]. These processes are generally technically proven but not yet deployed commercially to any great extent. Improved efficiency would reduce greenhouse gas emissions from coal fired electricity generation, perhaps by around 20%[12]. This would still leave coal generation producing significantly more greenhouse gases than gas generation.

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[7] For a detailed tabulation see DTI Digest of UK Energy Statistics Table B.1.
[8] Sulphur dioxide and nitrogen oxides are the main gases contributing to acid rain.
[9] SEPA in Scotland.
[10] Dated 30th July 2001.
[11] Cleaner coal also encompasses coal extraction, preparation and use other than in power stations.
[12] Or more in the case of old coal stations in some non-OECD countries.

5.6 About 40% of world electricity generation uses coal, much of it in old and inefficient power stations. Replacing these stations with modern ones could make a significant contribution to reducing world emissions of greenhouse and other gases.

5.7 Carbon sequestration: At present there are no systems commercially available to capture carbon dioxide emissions and store them to prevent them reaching the atmosphere and contributing to global warming[13]. One possibility is for the captured carbon dioxide to be pumped into depleted oil or gas reservoirs, a process which could also aid further oil or gas extraction from those reservoirs. Carbon sequestration would be of greatest value to coal producers, but the technique could also be used for emissions from oil and gas.

Coal Mine methane

5.8 Methane (natural gas) collects in coal deposits and coal mines and may be released to the atmosphere when coal is produced and from abandoned coal workings[14]. Unburned methane is a much more potent global warming gas than carbon dioxide.

> ***Questions****:*
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> *Are there sufficient incentives to collect methane from coal workings and use it to produce energy?*
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> *What is the appropriate balance between collecting and using the methane, and preventing its release in the first place?*

6. COAL AND SOCIAL ISSUES

6.1 Total employment in the UK coal industry is currently about 13,000[15], down from 88,000 just 10 years ago. Although the remaining level of employment is very small as a percentage of the workforce, some coal producers are operating in areas of relatively high unemployment, caused to a considerable degree by previous closures of coal mines.

6.2 Employment in the coal industry has long been a matter of social concern in a number of European countries including the UK. Germany in particular has paid large subsidies to its high cost coal industry in recent years, although the balance of social and energy security considerations driving this policy is not entirely clear.

> ***Question****:*
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> *As in other areas, the PIU is considering how far, and in what way, industrial and employment objectives should form a central part of energy policy: views are invited in relation to coal?*

[13] Although various elements of the system are in commercial use.
[14] Methane in unworked coal deposits is known as coal bed methane and its environmental consequences are similar to other extraction of natural gas.
[15] Includes deep mines and opencast