THE CLOSURE OF BRITISH ENERGY'S NUCLEAR POWER STATIONS

A report to Greenpeace

November 2002

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Preface

The Government's central justification for the controversial £650 million loan to British Energy is that the company's nuclear reactors are needed to maintain the security of the UK electricity supply. Greenpeace commissioned this report from ILEX to test that assumption.

Whilst no single piece of analysis can deal with all the issues raised by the closure of a major incumbent of the UK energy system, this report comes to a clear and unequivocal conclusion on this central assumption. It shows that within 2-3 years all of British Energy's nuclear power stations could be closed whilst maintaining a 20% margin of security for the electricity system. In other words, British Energy reactors are <u>not</u> essential to maintain security of supply.

Greenpeace believes that the benefits to the UK environment and taxpayers of early closure of British Energy's stations would be great. We offer this report not as a definitive view of how to do that, but as evidence that it can be done.

- In Greenpeace's view, the single biggest reason for the current crisis in the UK power generation sector is Government intervention in the market to stop the weakest player, nuclear power, being pushed out. Despite chronic over-capacity on the system, the Government does not appear willing to allow British nuclear reactors to close even when they are losing money. This policy is distorting prices and making it impossible for the market to respond to underlying signals.
- The extraordinary decision to put over half a billion pounds of public money into British Energy to stop it going into administration has profound implications for its competitors and for energy policy as a whole. In market terms, it is clearly discriminatory and anti-competitive. It is having a damaging affect on combined heat and power and renewable energy companies – the very businesses we need to meet our energy demands. It is also likely to distort the Government's energy policy and could result in its Energy White Paper being skewed by its desire to secure a market for British Energy's power.
- The central objective of the Government in making the 'loan' is in its words to*' ensure the safety of BE's nuclear plant and security of electricity supplies'*. The first objective carries little weight since nuclear plant regularly close safely and quickly, but the second has been become absorbed by many as a basic truth. The assumption is that a generator making up 13% of the UK's power capacity could not possibly be closed quickly without the lights going out.

- This report shows that this is not the case. ILEX uses dispassionate analysis to show that all of British Energy's reactors could be closed in the next 2 to 3 years whilst maintaining a large margin of security for power supply. Indeed the UK's entire fleet of ageing nuclear reactors could be closed within 3-4 years whilst maintaining a level of system security considered acceptable by the National Grid Company. The reasons are two fold: There is existing over-capacity in the system, and the owners of power stations which are currently in service (or which have been temporarily withdrawn) would keep them open if they have the confidence that wholesale power prices will rise. There is also a large pool of gas power plant which developers would be able to build quickly if they can have the same confidence in prices rising.
- The quickest way to do this is for the Government to close Britain's nuclear reactors. As ILEX point out, short-term wholesale electricity prices leapt to 2.3p/kWh when it was first thought that British Energy's stations could close. That long term prices remained lower was inevitable once it was clear that the Government was going to step in to bail British Energy out. The price rises that ILEX estimate are needed to ensure new gas plant construction would only bring wholesale prices back to the level that was last seen in 1999. Since recent price drops have not been reflected in domestic bills it should not be assumed that any consequent rise in wholesale prices would be fully transferred through to domestic electricity bills.
- The worst thing that could happen is for the current uncertainty about British Energy's future to continue. In ILEX's words in a British Energy closure scenario *'any doubt about whether the withdrawals will actually be carried through is likely to lead to weaker prices'*. The same could be said for any decision to keep British Energy's reactors limping along from week to week. Signals have to be firm and clear on a long term basis for generators to take the risk of building new gas power stations, to retain plant in service and to return plant to service which has been temporarily withdrawn.
- In Greenpeace's view the benefits of an early closure to British Energy reactors go beyond a healthy re-balancing of the market. There would also be big gains for the environment and for the taxpayer. Every year British Energy's reactors generate 460 tonnes of highly radioactive spent fuel which contributes to the mountain of high level waste in the UK for which there is no safe disposal option. Early closure of its reactors would avoid a further 20 years of nuclear waste generation. Greenpeace is currently running a process with industry and policy experts to agree a menu of carbon saving options available to Government to make up for the additional carbon emissions generated by new gas power stations. There are a number of significant measures, missed by the Governments climate change programme, which would exceed this carbon gap.

- British Energy's escalating operating and capital costs would also be brought under control. The decommissioning costs of early closure are not as high as commonly thought, because the most costly parts of the process occur between 30 and 130 years after closure. This means that a relatively small increase in the current British Energy decommissioning fund can cover long term costs through the effects of interest rate gains on the fund.
- The British Energy debacle is the latest in a long line of evidence that demonstrates that nuclear generators cannot compete in an open market under the same rules as conventional power plant. The Government will therefore be failing the market, as well as taxpayers and the environment if it continues to bend the rules to secure a place for nuclear power.

This ILEX report shows one route available to the Government that avoids such blatant favouritism. It reinforces Greenpeace's view that the UK energy system will be stronger and more sustainable if the Government uses the current BE crisis to secure a rapid closure of the UK's nuclear reactors.

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1. INTRODUCTION AND SUMMARY

1.1 Greenpeace has asked ILEX[1] to consider a future in which British Energy's nuclear power stations are withdrawn from service, progressively, over the next two or three years[2]. Specifically, we have been asked to:

- consider whether, under such an eventuality, it would be feasible in practice to maintain the security of electricity supply at an acceptable level;
- estimate the extent to which such a British Energy closure programme (and the announcement of that programme) would raise electricity prices; and
- comment on whether this price increase is likely to be sufficient, in itself, to guarantee acceptable security of supply (if that can be achieved), or whether additional measures might be necessary - and, if so, what those measures might be.

1.2 The closure of the British Energy nuclear power stations over the next two or three years would raise a number of other issues, such as:

- the economic impact of the increase in electricity prices;
- the availability of resources, including human resources, to effect the closures;
- the economic impact of the costs of nuclear plant decommissioning being incurred earlier than would otherwise have been the case;
- the net environmental impact of the reduction in nuclear generation coupled with the increase in gas and/or coal-generated electricity which would replace it; and
- the consequent reduction in the diversity (as opposed to security) of electricity supply, which might make electricity supplies more vulnerable to interruptions to the chains of supply for gas and/or coal.

We have not been asked to address these issues, and we make no further comment on them here.

1.3 We have analysed published (and well-supported and well-respected) data and projections on electricity demand, and on existing and prospective power stations, from the owners of the electricity grids in England & Wales (NGC - the National Grid Company) and Scotland (the two Scottish companies - ScottishPower and

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1 A brief description of ILEX is attached at Annex A.

2 We have also considered a sensitivity in which BNFL-Magnox's nuclear plant are also withdrawn from service over the next two-three years.

Scottish & Southern Energy). From these we have developed projections for the balance between generating capacity and peak demand in Great Britain (GB) as a whole. Taking our lead from NGC, we have assumed that acceptable security of supply is delivered when total generating capacity exceeds a 'base case' for peak demand (in an average winter cold spell) by 20%.

1.4 We conclude from our analysis that:

- All of British Energy's nuclear power stations could be withdrawn from service by the winter of 2004/5, and an acceptable level of security of supply maintained, providing that:
  - none of the other power stations currently in service are withdrawn, except for the announced planned closures of Magnox nuclear power stations by BNFL-Magnox;
  - prospective new capacity which has full planning consent is commissioned according to NGC's projected timetable, except that:
  - three fully-consented gas-fired prospects are commissioned, in 2004, earlier than in the above timetable - but no earlier than was the original intention as communicated to NGC; and
  - two existing generating sets which have been withdrawn within the last four years, but which have not been permanently closed, are returned to service.
- All of British Energy's nuclear power stations could be withdrawn from service by the winter of 2005/6, and an acceptable level of security of supply maintained, providing only that:
  - none of the other power stations currently in service are withdrawn, except for the announced planned closures of Magnox nuclear power stations by BNFL-Magnox; and
  - prospective new capacity, whether or not fully-consented, is commissioned according to a feasible timetable as envisaged by NGC.
- All of British Energy's and BNFL-Magnox's nuclear power stations could be withdrawn from service by the winter of 2005/6, and an acceptable level of security of supply maintained, providing that:
  - none of the other power stations currently in service are withdrawn;
  - prospective new capacity which has full planning consent is commissioned according to NGC's projected timetable, except that:

  - three fully-consented gas-fired prospects are commissioned, in 2004, earlier than in the above timetable - but no earlier than was the original intention as communicated to NGC;

  - two existing generating sets which have been withdrawn within the last four years, but which have not been permanently closed, are returned to service.

- All of British Energy's and BNFL-Magnox's nuclear power stations could be withdrawn from service by the winter of 2006/7, and an acceptable level of security of supply maintained, providing only that:

  - none of the other power stations currently in service are withdrawn; and

  - prospective new capacity, whether or not fully-consented, is commissioned according to a feasible timetable as envisaged by NGC.

1.5 ILEX considers that Transco will have sufficient capacity to connect the three new gas-fired power stations to the National Transmission System (NTS) with firm gas supplies by 2004/05 rather than their currently proposed connection date.

1.6 Our central view of wholesale electricity prices in about 2004/5 is that they would need to rise from about 1.6 to 1.7p/kWh (which they would be in the absence of the withdrawal of significant generating capacity) to 2.4 to 2.6p/kWh - in order to incentivise the timely provision of alternative capacity to replace the British Energy nuclear withdrawals.

1.7 For all of British Energy's nuclear capacity to be withdrawn (without prejudicing security of supply) by winter 2004/5, in particular, a speedy decision needs to be made - and that decision needs to be firm in order to maximise the probability that prices in the market will rise as high as 2.4 to 2.6 p/kWh.

1.8 Nevertheless, some doubt remains as to the ability of the electricity market, as currently constituted, to deliver such prices in a timely and sustained manner. We accordingly suggest that there may a case for adjusting the present trading arrangements for electricity, by introducing an explicit recognition for generators of the value of providing available capacity at times of high electricity demand.

1.9 We consider that there is little prospect of further significant capacity being provided by renewable generation technologies and by CHP (cogeneration) over the next two or three years, over and above the growth in those technologies which is already incorporated in the projections which we have used from NGC and the two Scottish companies.

1.10 Notwithstanding this, there are two measures which could incentivise acceleration in the growth of renewable generation, generally:

- a commitment from government, as firm as it can be, to targets for renewables beyond the end-date of 2010 in the present Renewables Obligation; and

- an increase in the buy-out price for Renewable Obligation Certificates (ROCs) above the present p/kWh.

1.11 Growth in CHP could be greatly assisted if the government were to decide to provide an incentive similar to the Renewables Obligation scheme. The justification for doing so would turn on CHP's environmental benefits, which arise from the fuel saving resulting from the simultaneous production of its two outputs - electricity and heat (often in the form of steam).

2. PLANT MARGIN ANALYSIS

2.1 This analysis is for the Great Britain system as a whole and is primarily based on the following publicly available information:

- National Grid Company (NGC) 2002 Seven Year Transmission Statement for the transmission system in England and Wales;
- ScottishPower 2001 Seven Year Transmission Statement for the portion of the transmission system in Scotland that is owned and operated by ScottishPower; and
- Scottish and Southern Energy 2001 Seven Year Transmission Statement for the portion of the transmission system in Scotland that is owned and operated by Scottish and Southern Energy.

2.2 In this Section we present analysis of the system margin in Great Britain over the next six years under differing scenarios of British Energy (BE) retirals and other system capacity.

Demand Assumptions

2.3 We have considered the peak winter demand (based on an average cold spell[3]) in order to determine if a safe system margin can be maintained.

2.4 The peak demand projections have been taken from the three Seven Year Transmission Statements and combined to give a peak demand projection for Great Britain, as shown in Table 1.

[3] The NGC defines average cold spell, or ACS, as the combination of weather elements which gives rise to a level of peak demand within a financial year which has 50% chance of being exceeded as a result of weather variations alone.

Table 1 - Peak demand projections (GW)

	NGC	ScottishPower	Scottish and Southern	Total
2002/3	55.3	4.15	1.66	61.1
2003/4	56.4	4.10	1.67	62.2
2004/5	57.3	4.10	1.68	63.1
2005/6	58.1	4.04	1.68	63.8
2006/7	59	4.04	1.69	64.8
2007/8	59.7	4.02	1.70	65.4

Source: NGC, ScottishPower, and Scottish and Southern Energy

2.5 These projections are for demand on the transmission system and as such exclude demand met by capacity embedded in the distribution systems. Therefore projections of embedded generation (both CHP and renewables) have been netted off[4]. When developing their projections the system operators take into account the government objectives on CHP and renewables which are:

- a target of 10GW of installed CHP capacity in the Untied Kingdom by 2010[5]; and
- a target that 10% of electricity supplied by 2010 should be sourced from renewable fuels (including all hydro output);

2.6 However, the rules of the present electricity market have disadvantaged CHP generators because inflexible generators, such as CHP, are exposed to volatile imbalance prices[6], which may not cover their costs when these plant spill power to the system. As a consequence potential CHP developers have been discouraged and the NGC projects a reduction in the commissioning of new CHP plants over the next few years as compared to historical levels.

4 In Scotland some renewable generation is connected to the transmission system and hence is included in our capacity projections presented later in this section.

5 At the end of 2001 the installed CHP capacity in the UK was 4.6GW of which 3.6GW was embedded in the distribution systems (source NGC).

6 Under these rules generators who generate more or less than their notified position (notified at gate closure – one hour before real time) must either sell the additional power at the system sell price (SSP) or buy additional power at the system buy price (SBP). These prices are not necessarily the same in each half-hour and are designed to penalise imbalance, and as a result SSP can be very low while SBP can be very high.

2.7 The transmission companies assume that to meet the GB renewables targets there is likely to be a higher percentage of generation met by renewable energy in Scotland than in England and Wales. This is the reason for the lower, and in ScottishPower's case negative, peak demand growth projections for Scotland – as much of this additional renewable generation is assumed to be embedded in the distribution systems.

Capacity Assumptions

2.8 The capacity assumptions have also been taken from the seven-year statements.

Existing capacity

2.9 We have assumed that all existing capacity, except the Magnoxes, will remain open on the system. The Magnoxes are retired in accordance with NGC and BNFL for those located in England and Wales and according to BNFL for Chapel Cross located in Scotland.

Table 2 – Magnox retiral assumptions

Plant	Retiral date
Calder Hall	End of 2002/3
Chapel Cross	End of 2004/5
Dungeness	End of 2005/6
Oldbury	End of 2007/8
Sizewell A	End of 2005/6
Wylfa	End of 2007/8

Source NGC and BNFL

2.10 As a sensitivity to these assumptions on the Magnox plant closures we also investigate the options on closing the Magnox plant early.

2.11 The British Energy plant (a total of 9.8GW) is assumed to retire in two batches – 2.5GW retires immediately and the remaining before the winter of 2004/5.

New capacity

2.12 We have assumed that a further 220MW of renewable capacity is commissioned by 2004/5 in Scotland and is connected to the transmission system[7].

[7] Source ScottishPower Seven Year statement.

2.13 In England and Wales we base our new capacity projections on the two NGC scenarios of new capacity:

- NGC Consented – that capacity that has Section 36 and Section 14 consents (refer Table 3); and
- NGC SYS – that capacity which has been classified as transmission contracted by the NGC, although it may not be fully consented[8]. (The Consented scenario is a subset of this scenario, refer Table 3 and Table 4).

Table 3 - New capacity assumptions under the NGC consented scenario

Plant	Registered Capacity (MW)	NGC Assumed commissioning date
Fleetwood	774	2006
Immingham CHP 1	260	2003
Langage 1	1010	2005
Norwegian Interconnector	1320	2004
Partington	420	2004
Scunthorpe	294	2005
Spalding	840	2004
Staythorpe C1	415	2003
Staythorpe C2	415	2003
Staythorpe C3	415	2004
Staythorpe C4	415	2004
Wallend	1320	2007

Source: NGC Seven Year Statement

[8] It is unlikely all of this plant will proceed according to the NGC assumptions. In particular the Enron (Seal Sands) and British Energy plant (Sleaford) may be doubtful but this does not impact upon our conclusions.

Table 4 - new capacity assumptions under the NGC SYS scenario (over and above NGC Consented Scenario)

Plant	Registered Capacity (MW)	NGC Assumed commissioning date
Barking OCGT	155	2005
Barking OCGT	165	2005
Immingham CHP2	560	2006
Keadby 2	750	2005
Killingholme PG2	800	2006
Langage 2	310	2007
Purfleet	270	2005
Rassau	1320	2005
Rhosgoch 1	575	2005
Rhosgoch 2	270	2005
Seal Sands	770	2005
Severnside	1320	2007
Sleaford	850	2007

Source: NGC seven-year statement

2.14 The assumed commissioning dates of the new capacity are as in the NGC assumptions. The NGC states that they do not strictly adhere to the formal transmission contracted date, but make pragmatic assumptions to determine the likely commissioning date.

2.15 However as part of our analysis we consider the impact of commissioning three plants (Langage, Scunthorpe and Wallend) earlier than assumed in 2004/5[9]. For this early commissioning to occur these projects would need to be incentivised to proceed very quickly. Given that Langage is a NRG project and Wallend an Enron project it may be necessary for these projects to be sold to other developers if this

[9] We have included only those plant with Section 36 and Section 14 consents, and with an NGC assumed commissioning date later than originally proposed. We have also assumed that plant could not be commissioned any earlier than 2004/5, other than those already firmly planned to commission by this time.

scenario was to eventuate. In Annex 2 we discuss the implications on gas supply if we were to commission these three projects early.

Decommissioned capacity

2.16 The NGC has stated that a total of 4.13GW of plant has been decommissioned (as opposed to disconnected which is defined as the irreversible closure of a power plant). The NGC states that some or all of this decommissioned plant could be returned to service at some future date. In our analysis we examine the possibility of two sets at each of Grain and Tilbury both of which decommissioned relatively recently in 1998 returning to service by 2004/5; they have a total capacity of 1.02 GW.

Total capacity

2.17 The total capacity assumptions under the two NGC scenarios are shown in Table 5. Note that we have adjusted the NGC projections to include Scottish capacity, and we have assumed that no plant closures other than the Magnox nuclear plant. We present capacity projections with and without the early BE retirals.

Table 5 – Total capacity projections (GW)

	NGC Consented	NGC SYS	NGC Consented (with BE retirals)	NGC SYS (with BE retirals)
2002/3	76.6	76.6	74.0	74.0
2003/4	78.1	78.2	75.4	75.4
2004/5	81.6	81.6	71.6	71.6
2005/6	83.0	86.7	73.1	76.7
2006/7	83.0	89.3	73.1	79.3
2007/8	84.3	92.6	74.3	82.6

Source: NGC, ScottishPower, Scottish and Southern, and ILEX analysis

2.18 In Table 6 we show the projected capacity if we were to bring the commissioning of three CCGTs forward as discussed in paragraph 2.14. In Table 7 we show the projected capacity if we were also to recommission plant as outlined in paragraph 2.16.

Table 6 – Total capacity projections with ILEX assumptions on advancing some new capacity commissioning (GW)

	NGC Consented	NGC SYS
2002/3	74.0	74.0
2003/4	75.4	75.4
2004/5	74.3	74.3
2005/6	74.4	78.0
2006/7	74.4	80.6
2007/8	74.3	82.6

Source: NGC, ScottishPower, Scottish and Southern, and ILEX analysis

Table 7 – Total capacity projections with ILEX assumptions on advancing some new capacity commissioning and recommissioning of old plant (GW)

	NGC Consented	NGC SYS
2002/3	74.0	74.0
2003/4	75.4	75.4
2004/5	75.3	75.3
2005/6	75.4	79.0
2006/7	75.4	81.6
2007/8	75.3	83.6

Source: NGC, ScottishPower, Scottish and Southern, and ILEX analysis

Conclusions

2.19 The NGC has stated that a plant margin of 20% could be considered the notional planning margin for England and Wales, given international experience. We have assumed that this is equally applicable to Great Britain as a whole.

2.20 We have presented the plant margin under both the NGC Consented scenario and SYS scenario – but assuming no retirals other than the BE and Magnox plant. The

only difference between the two scenarios is that under the SYS scenario further new build capacity is assumed from 2005/6.

2.21 We have also defined two variations on these capacity scenarios:

- 1.3GW of plant is commissioned in 2004/5 rather than 2005/6 and 1.3GW is commissioned in 2004/5 rather than 2007/8 (see paragraph 2.15); and
- the above scenario with an additional 1.02GW of decommissioned plant recommissioned by 2004/5 (see paragraph 2.16).

2.22 The plant margin projections are shown in Figure 1 and Figure 2. As can be seen, an acceptable plant margin could be maintained in 2004/5 if 2.6GW of new CCGT capacity were bought forward to this time coupled with recommissioning 1.02GW of plant. If this were not to happen then the capacity margin would drop to unacceptable levels. Beyond 2004/5 we would need further, currently un-consented, capacity to be commissioned – as in the SYS scenario. In the consented scenario charts we have also shown the system margin under a scenario where the BE nuclear plant are retired according to the current BE plans for comparison.

2.23 In all cases in which BE plant is retired earlier than planned, the plant with section 36 and section 14 consents must commission as planned (other than those plant we assume commission early). If commissioning dates were not met then the system margin would be below an acceptable level in the period 2003-2005.

Figure 1 – plant margin under the Consented scenario

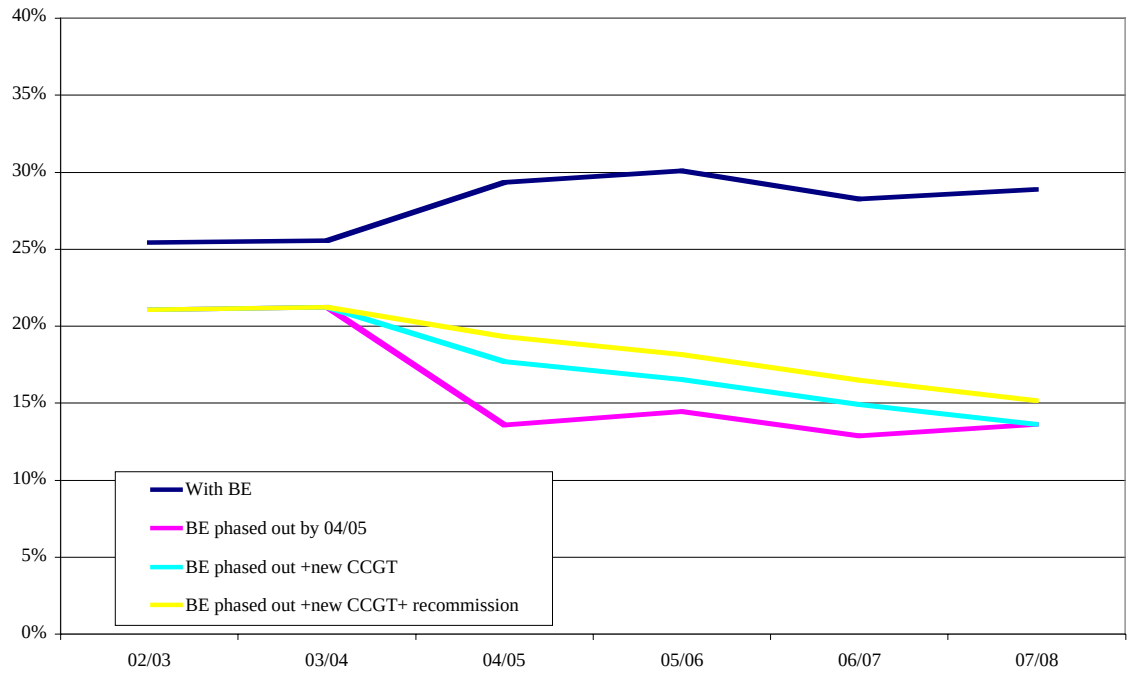
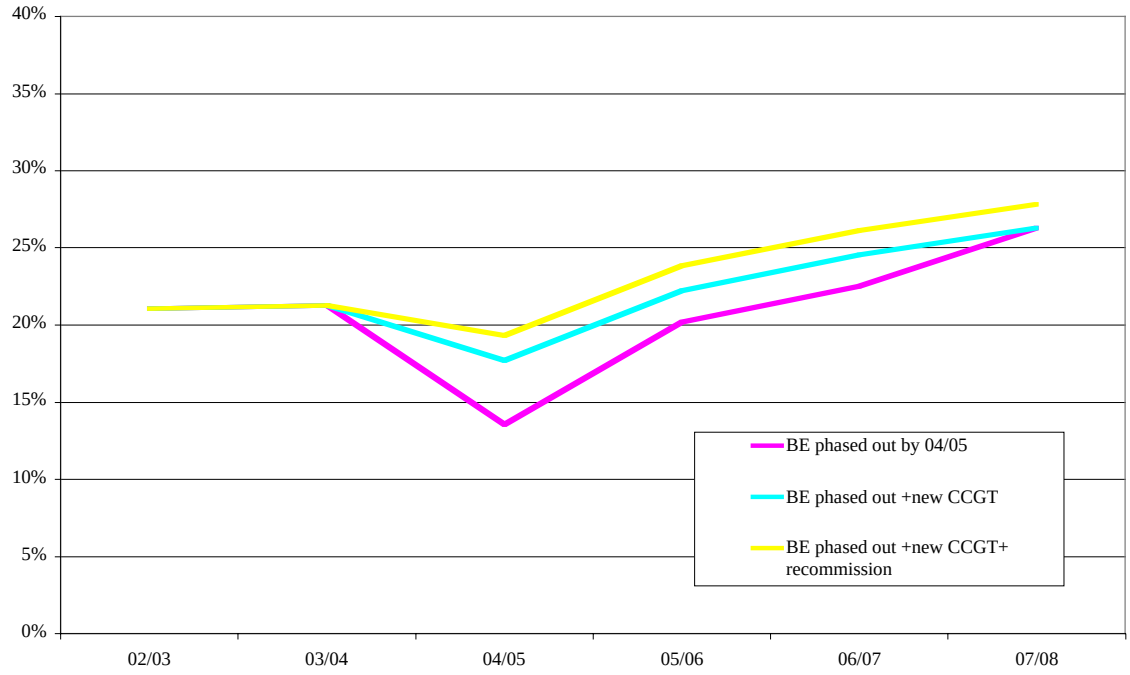
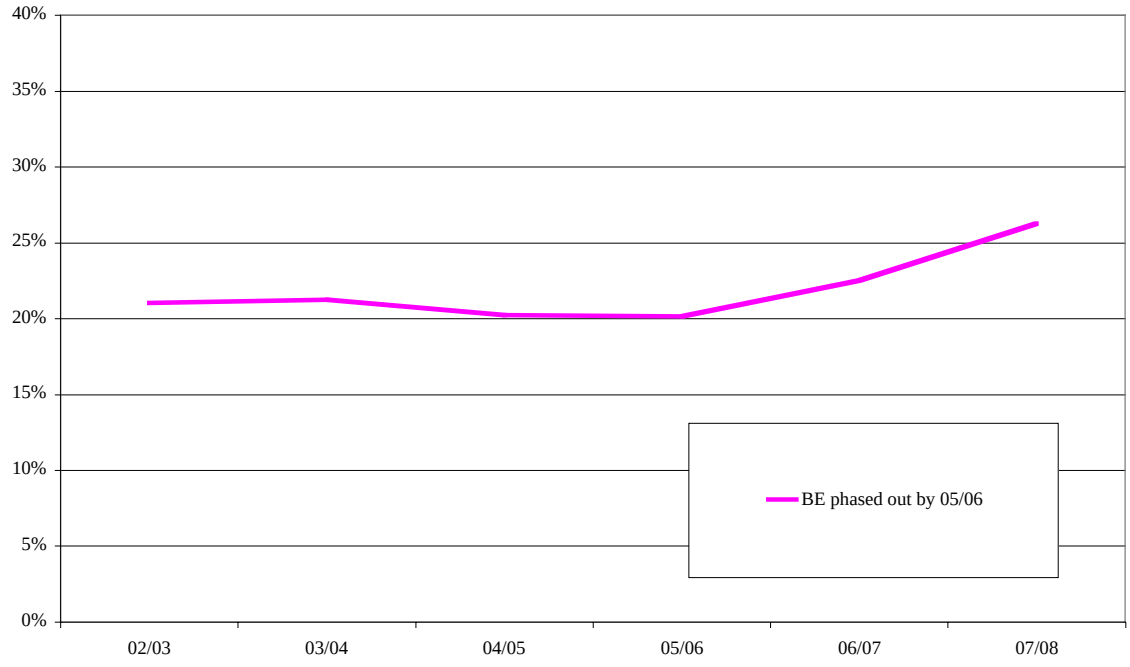


Figure 2 – plant margin under the SYS scenario



2.24 As a further sensitivity, we show in Figure 3 that under the SYS scenario if the full decommissioning of the BE plant was delayed by a year, an acceptable plant margin would be maintained without requiring new build to be bought forward or the recommissioning of plant.

Figure 3 - Plant margin under the SYS scenario with BE retirals by 2005/6



Sensitivity on Magnox retirals

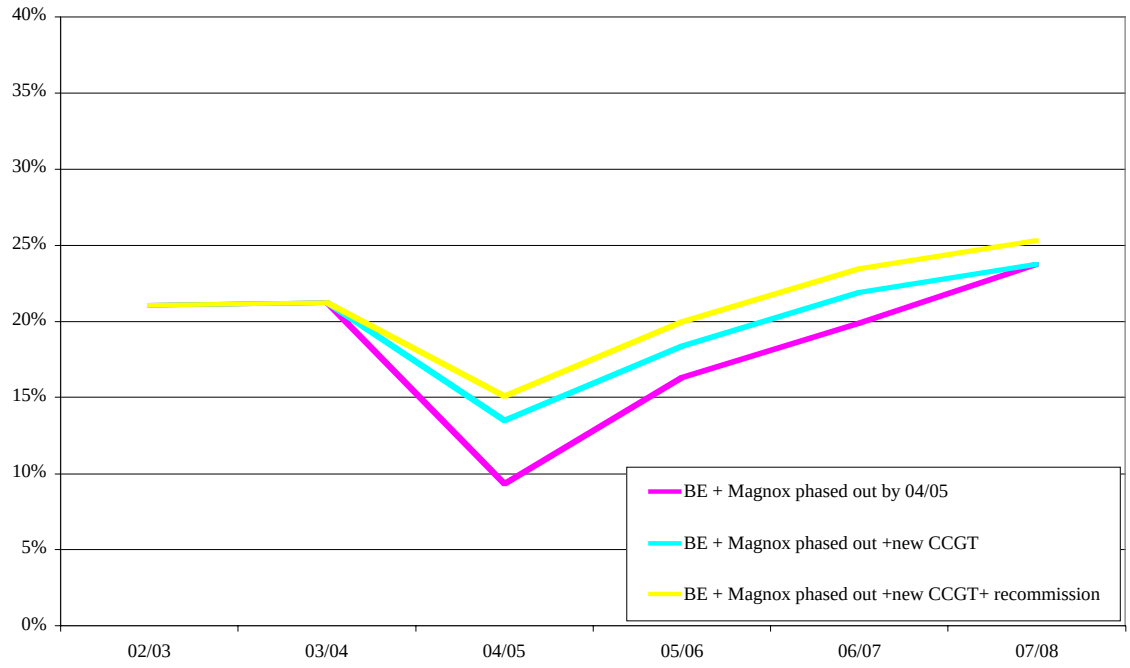
2.25 The analysis presented above assumed that the Magnox plant will be retired in accordance with the published BNFL-Magnox plans. However, should this nuclear plant be closed earlier than anticipated this could invalidate our conclusions regarding maintaining an acceptable plant margin.

2.26 Below we discuss what measures would need to be taken in order to maintain an acceptable plant margin under a number of scenarios for retiral of all the nuclear plant, both owned by British energy and owned by BNFL-Magnox.

All nuclear plant retired by 2004/5

2.27 In Figure 4 we present the plant margin under the SYS scenario with all nuclear plant retired before 2004/5. As can be seen, it would be impossible to maintain an acceptable plant margin in 2004/5 even if new CCGT developments were bought forward coupled with the recommissioning of capacity. Beyond 2004/5, an acceptable plant margin could be maintained from 2005/6 if new plant were then to be developed in line with the NGC SYS assumptions.

Figure 4 - Plant margin under the SYS scenario with BE & Magnox retirals by 2004/5



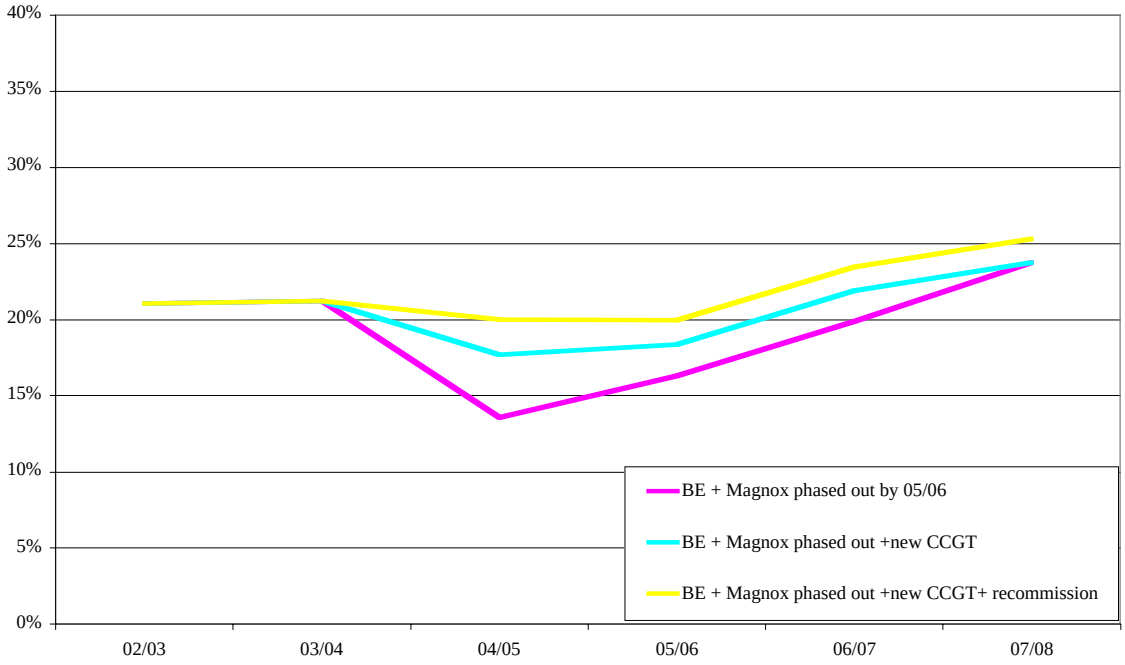
All nuclear plant retired by 2005/6

2.28 In Figure 5 we present the plant margin under the SYS scenario with all nuclear plant retired before 2005/6. As can be seen, it would be possible to maintain an acceptable plant margin in 2004/5 if new CCGT developments were bought forward and plant was recommissioned. Beyond 2004/5, an acceptable plant

margin could be maintained if further new plant were then developed in line with the NGC SYS assumptions.

2.29 In this sensitivity we have assumed that 3.1GW of nuclear capacity remains on the system in 2004/5, down from 9.94GW in 2003/4. The higher the available nuclear capacity in 2004/5 then the less new plant (or recommissioned plant) would be required.

Figure 5 - Plant margin under the SYS scenario with BE & Magnox retirals by 2005/6

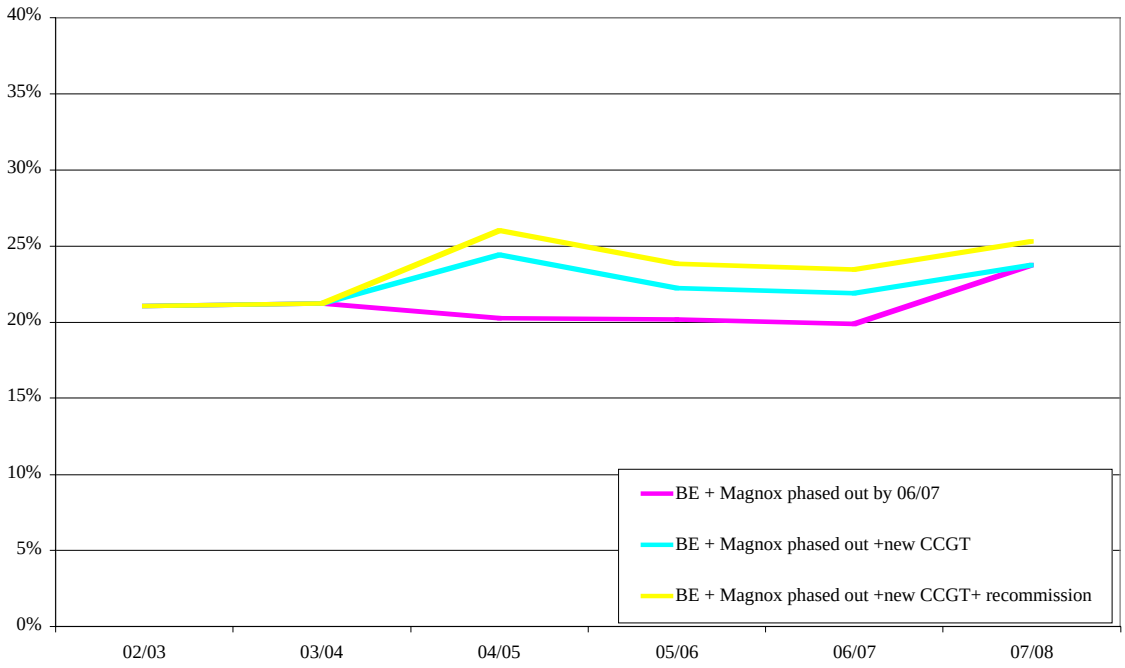


All nuclear plant retired by 2006/7

2.30 In Figure 6 we present the plant margin under the SYS scenario with all nuclear plant retired before 2006/7. As can be seen, it would be possible to maintain an acceptable plant margin under the SYS scenario without the need to bring forward new capacity or recommission some decommissioned plant.

2.31 In this sensitivity we have assumed that 2.47GW of nuclear capacity remains on the system in 2005/6 and 6.88GW in 2004/5, down from 9.94GW in 2003/4.

Figure 6 - Plant margin under the SYS scenario with BE & Magnox retirals by 2006/7



3. THE DELIVERY OF SECURITY OF SUPPLY

Electricity price impacts

3.1 Our central view of wholesale electricity prices in 2004/5 is that, in the absence of the withdrawal of significant generating capacity, they are likely to average about 1.6 to 1.7 p/kWh over that year[10]. This is also consistent with the traders' present Forward Curve for 'base-load' products.

3.2 In the eventuality of substantial withdrawals of capacity, as is envisaged above for British Energy's nuclear plants, our central view is that this price would need to rise to:

- about 2p/kWh in order to prevent the withdrawal of further plants from the system, in addition to the British Energy nuclear stations;
- in the region of 2.4 to 2.6p/kWh in order to incentivise the development of new gas-fired power stations.

This latter price should also be more than sufficient to incentivise the return to service of the two decommissioned sets discussed in Section 2.

3.3 If prices in the region of 2.4 to 2.6p/kWh could be guaranteed, then it is likely that our two scenarios for the replacement of the British Energy nuclear capacity could be achieved. The most problematic element in those scenarios would be the bringing forward of the three new gas stations, in the scenario in which the British Energy nuclear plants are all withdrawn by the winter of 2004/5. These three stations are all fully-consented, and they were all originally intended to commission before winter 2004/5. Arrangements for their connection to the gas National Transmission System are well-advanced (see Annex 2). If the price signals were there, then it can be assumed that construction would be commenced reasonably rapidly. For these types of station, a two-year period between commencement of construction and commissioning is reasonable. They could therefore be up and running by winter 2004/5.

3.4 It will, however, be clear from this discussion that to meet the winter 2004/5 deadline any decision on British Energy plant withdrawals will need to be made speedily. It will need also to be a firm decision - i.e. as far as possible not revocable - in order to minimise uncertainty in the market and maximise the probability that prices will rise to the 2.4 to 2.6p/kWh level. Any doubt about whether the withdrawals will actually be carried through is likely to lead to weaker prices.

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[10] All prices quoted in this report are expressed in October 2001 money-values.

3.5 As our analysis in Section 2 demonstrates, in our 2005/6 scenario the need for a speedy decision is not quite so pressing.

Prices and the market

3.6 While we can be reasonably confident that prices which are at an appropriate level (and on a sustained basis) will deliver acceptable security of supply, it is less clear that the electricity market, as currently constituted, can be depended upon to deliver such prices. There are two causes for concern, which we discuss in the two paragraphs below.

3.7 When traders recently believed that there was a high probability that British Energy's power stations would close, the short-term (day-ahead) price rose - on occasions to about 2.3p/kWh. However, prices further out responded only weakly. For example, for the coming winter season prices only firmed from about 1.73 to 1.85p/kWh. For new power stations to be constructed there must be a high degree of confidence (on the part of the developer, the lending banks and/or a power purchaser) that the necessary prices will be sustained over a number of years.

3.8 Of the required rise in electricity prices, from 1.6 or 1.7p/kWh to 2.4 or 2.6p/kWh, only a very small amount (0.06p/kWh) would be due to an increase in the cost of fuel consumed in electricity generation. The great majority would reflect the market's response to the risk of a shortage of capacity at times of high electricity demand. But using a plant margin of 20%, as we have, does not mean that that risk will be significant in every winter. Indeed, the very point of such a security standard is that a real risk of shortage should occur only rarely. As an example, since at least the winter of 1990/1, actual peak demand has never exceeded its ACS (average cold spell) equivalent [11] - i.e. there have been none of the cold snaps which are allowed for in the risk analysis which underlies the formulation of the 20% plant margin. This means that it may only be in the occasional winter that capacity becomes short, and prices in consequence become extremely high; for many years the average of short-term prices could be below the 2.4 to 2.6 p/kWh which is required. Such behaviour in short-term prices is not an encouraging background for the development of new power stations.

3.9 For these reasons we suggest that there may be a case for adjusting the present trading arrangements for electricity, to introduce an explicit recognition for generators of the value of providing available capacity at times of high demand. The present market arrangements have demonstrated their ability to, by and large, cover generators' fuel and other variable costs - but not, as is explained in paragraph 3.7 above, to deliver the high prices which are required to cover their costs for providing available capacity. Of course, with the present over-capacity on the system, the market has not been fully tested in this respect. However, the evidence of the weak price reaction to possible British Energy closures and the

[11] NGC Seven Year Statement, 2002, Figure 2.1.

argument in paragraph 3.8 suggest that there is a finite probability that the present market will not deliver, if left to its own devices.

3.10 Here is not the place to explore the nature of a mechanism for recognising available capacity, but several options have been employed:

- the electricity market in England & Wales used to contain an explicit half-hourly payment for available capacity, calculated from the day-ahead risk that demand would exceed the total capacity likely to be available;
- some electricity markets (such as in Spain) incorporate an administered value for capacity, which is applied on an hourly basis by reference to the level of demand; and
- a requirement for future capacity can be exogenously set, to meet a given level of security, with prospective providers of capacity bidding in a competitive auction; this arrangement is in use in the PJM (Pennsylvania – New Jersey – Maryland) market in the US.

Renewables and CHP

3.11 In Section 2 we have used projections for the growth of renewables and CHP (cogeneration) which have been developed by NGC and the two Scottish companies. It is possible that growth in renewables and CHP could be accelerated beyond those projections.

3.12 For renewables the primary prospect for accelerated growth is in offshore wind projects. At present some 18 prospective projects are in the process of seeking all necessary planning consents, but none is as yet fully consented. For that reason it is unlikely that all will be up and running before winter 2004/5, for example.

3.13 At current levels of proposed development wind power's contribution to security of supply is small. The total capacity of the 18 prospective projects would perhaps be about 1.8GW, allowing for intermittency this might give an effective contribution of 0.9GW to the plant margin.

3.14 Because only part of this 0.9GW could feasibly be in place by winter 2004/5, the resulting additional contribution to plant margin would be rather small - and so we have ignored it in our analysis.

3.15 Notwithstanding this, there are two measures which could incentivise acceleration in the growth of renewable generation:

- a commitment from government, as firm as it can be, to targets for renewables beyond the end-date of 2010 in the present renewables obligation. A target for 2015, or even 2020, would assist the financing of such projects; and
- an increase in the buy-out price for Renewable Obligation Certificates (ROCs) above the present 3p/kWh. This price sets a guaranteed floor to the extra

revenue that renewables obtain, over and above the general market price for electricity[12]. Again, this measure would assist the financing of schemes.

3.16 As regards CHP, in Section 2 we have explained the problems which this technology currently faces. Growth in CHP could be greatly assisted if the government were to provide an incentive similar to the Renewables Obligation scheme. The justification for doing so would turn on CHP's environmental benefits, which arise from the fuel saving resulting from the simultaneous production of its two outputs - electricity and heat (often in the form of steam).

3.17 Even if the government were to introduce a CHP Obligation scheme immediately, the practicalities of developing schemes are such that little additional capacity could be up and running within two or three years. In this context, we anticipate that the average size of future CHP schemes will only be about 0.05GW. For these reasons in Section 2 we have made no allowance for additional CHP capacity, over and above that already incorporated in the NGC and Scottish companies' projections.

[12] The buy-back price is the penalty price imposed on electricity Suppliers who fail to meet their Renewable Obligation targets. It is therefore a marker for the value of ROCs, which Suppliers must obtain (by generating renewable electricity themselves or purchasing it from others) in order to demonstrate that they have met their targets. In fact the effective value of ROCs can be higher than this, because the revenue from the penalties on those Suppliers who have not met their targets is re-cycled to those who have. This extra value is, however, volatile and uncertain - and not considered bankable by lenders to prospective renewable projects.

ANNEX A - DESCRIPTION OF ILEX

A.1 ILEX Energy Consulting Ltd. specialises in the **competitive electricity and gas markets** and in the emerging **carbon markets.** We provide expert commercial advice to a wide range of clients including: utilities, electricity generating companies, financial institutions, energy suppliers, distributors, governments, regulators, the European Commission, trade associations and larger energy users.

A.2 Many of our clients are in the private sector, where we help with detailed business strategy development and risk assessments based on our analytical and modelling skills. This commercial experience gives us a distinctive edge when providing energy policy advice.

A.3 Our extensive modelling capability allows us, amongst other things, to:

- make detailed price projections for gas and wholesale electricity in the UK, Ireland, Italy, Spain, the Netherlands and Germany and we are in the process of expanding geographically. We produce regular and tailored reports on each country;
- evaluate businesses for the purposes of mergers and acquisitions;
- project green electricity and cogeneration prices in the UK and Europe;
- evaluate investments in the widest range of new electricity generation projects (conventional and renewable) and gas infrastructure; and
- aid clients in developing longer-term energy policies aimed at minimising business risk and costs.

A.4 We use our extensive knowledge of markets to:

- prepare detailed country reports;
- assist with market design, rule formulation and regulatory analysis;
- assess the policies now being applied to reducing CO_2 emissions – emissions trading, renewables promotion policies, energy efficiency obligations, and so on; and
- provide in-house training for companies in the energy markets.

ANNEX B - GAS SUPPLY ISSUES

B.1 Given their locations, ILEX considers that Transco will have sufficient capacity to connect the three power stations to the National Transmission System (NTS) with firm gas supplies by 2004/05. This is earlier than their planned commissioning dates. Both Langage and Scunthorpe are sufficiently well advanced that Transco has included them in its capacity expansion plans for 2002/03 and 2003/04[13]. In addition, Scunthorpe is in relatively close proximity to the entry terminals of Easington and Theddlethorpe and so should not encounter capacity constraints. The Welland site in Kent is also close to the NTS, and may initially be interruptible, or part interruptible, but the possible development of a LNG import terminal at Isle of Grain by 2005 or 2006 and the fact that neighbouring Medway Power Station is interruptible would reduce this possibility.

B.2 One factor that will need to be taken into consideration is that of interruption of other, older power stations during periods of peak demand. ILEX is aware of nine power stations, set up in the early 1990's on British Gas's Long Term Interruptible (LTI) contracts, which have interruptible connection agreements with Transco – Roosecote, Brigg, Peterborough, Sellafield, Keadby 1, Barking, Little Barford, Derwent and Medway. This represents 4.47 GW of capacity. On a peak day Transco is very likely to interrupt these power stations to maintain supplies to its firm supplies. Most of this capacity is dual fuelled with gas oil, although many of the sites do not normally keep sufficient stocks of gas oil to carry on through a continued interruption, which may cause problems in a prolonged cold spell. In addition, there are a number of sites such as PowerGen's Killingholme, Connahs Quay and Teesside that have interruptible connections to the NTS, but also have direct connections to beach terminals and so have alternative sources of gas in the event of interruption.

B.3 Transco is currently in the process of reviewing its exit regime, which may include the conversion of all sites to be firm, and thus reduce the importance of this issue. Transco would then pay sites to interrupt, making it a commercial decision. There may then be interruption by the gas supplier. Many power stations may therefore wish to continue generating if the electricity prices are high enough. The gas prices are likely to be very high on these days, to justify the use of peak storage to supply strong demand. This will therefore have a knock-on effect to the electricity prices.

[13] Announced at Transco Winter Operations Review, May 2002.

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