Prime Minister
To note Mr
Ridley's interest
in these issues.
N.L.W.
15.11

SECRETARY OF STATE
FOR THE ENVIRONMENT

Prime Minister

THE COST OF COAL

I have seen a copy of a letter from Cecil Parkinson's Private Secretary to yours covering a paper on the cost of coal.

I am sure it is helpful that we have this sort of information so that we can work towards an accurate comparative pricing of the fuels used in electricity generation. I know my officials have already commented on the paper you have seen, and I understand that a revised version will be coming forward which reflects our views. In particular, I think we need to get some of the scientific assertions just right; and we also need to include the costs which fall within my responsibilities - for example, the restoration of derelict land. I have also asked my officials to see if they can produce some suggestions towards improving the methodology in what I know is a difficult area.

I look forward to seeing a further revise of the paper in due course.

N R

14 November 1988

cc Secretary of State for Energy
Richard Wilson, Cabinet Office

cc PM

cc P.W.

cc BI

SECRETARY OF STATE FOR ENERGY
THAMES HOUSE SOUTH
MILLBANK LONDON SW1P 4QJ
01 211 6402

We need a summary of the figures for our briefing folder

N L Wicks Esq CBE
10 Downing Street
LONDON
SW1A 2AA

Prime Minister 4

See especially §17 of report and §§ 28 – 30 of annex.

A fascinating read. N.L.W. 7.12

6 December 1988

Dear Nigel,

THE COST OF COAL

In my letter of 28 October enclosing a paper on the true cost of coal I undertook to provide some additional figures on deaths and accidents in the coal industry and information from the CEGB on the cost of removing grit and dust from power station flue gases and disposing of fly ash.

A revised version of the paper is now attached. This includes the further information we have obtained. The paper also takes account of comments by DOE officials referred to in Mr Nicholas Ridley's minute of 14 November to the Prime Minister and includes as he suggested a passage dealing with the cost of restoring derelict colliery land.

I am sending a copy of this to Roger Bright in Nicholas Ridley's office and to Richard Wilson in the Cabinet Office.

Yours ever,

Stephen

S HADDRILL
Principal Private Secretary

THE COST OF COAL

Summary

The production and consumption of coal both generate costs additional to the costs of labour, capital and materials. Some of these additional costs can be quantified and are met by the industries concerned. Some cannot, and fall on others. Paragraphs 2-16 below discuss these "additional costs" in summary terms; a fuller discussion is contained in the Annex.

A: PRODUCTION COSTS

2. The main "additional costs" resulting from the production of coal are:

- Costs of subsidence damage resulting from deep-mining;
- Costs of restoring opencast sites;
- Disposal of colliery spoil;
- Costs of industrial deaths, injuries, and diseases.

Subsidence

3. Over the past five years the British Coal Corporation (BCC) have provided in their accounts an average of about £90m a year in respect of subsidence damage. This is equivalent to about £1.16 per tonne of deep-mined coal. It does not include the cost of the inevitable stress and strain suffered by those whose property is damaged by subsidence.

4. The future trend of subsidence costs is likely to be downward because of better methods of predicting and controlling subsidence damage.

Opencast Site Restoration

5. Over the last 3 years restoring land affected by opencast operations has cost the BCC an average of £11m a year, equivalent to about £0.75 per tonne of opencast output. This does not include the cost of the loss of amenity or the additional noise, dust and traffic which are inevitable while opencast sites are being worked.

6. If the BCC is successful in its aim of increasing opencast production total costs (although not necessarily average costs) are likely to rise.

Restoration of Derelict Land

7. The effect on the landscape of British Coal's deep mining activities also require restoration usually when mining ceases.

Costs in the form of derelict land grant have averaged £17 million pa over the past five years.

Disposal of Colliery Spoil

8. Underground mining operations currently produce 60m tonnes of spoil every year - about 0.75 tonnes of spoil for each tonne of coal. The cost to the BCC of disposing of this spoil is currently in the region of £150m a year, equivalent to £1.80 a tonne of deep-mined coal.

9. The BCC has a programme designed to reduce the production of spoil. If this is successful, the costs of spoil disposal should fall.

Deaths, Injuries and Diseases

10. Health and safety in coal mines have improved enormously in recent years. Even so, deaths over the past 5 years excluding 1984/85 have averaged 24 a year or 0.06 per 100,000 man shifts. The comparable figures for serious injuries are 16,070 and 41.5 respectively.

11. Pneumoconiosis is no longer a serious problem in the industry. But noise-induced hearing loss is a developing problem.

12. Costs to BCC of industrial deaths, injuries and diseases and to the tax payer in social security benefits have proved impossible to quantify. But no figure could adequately take into account the suffering of the men and their families.

B: CONSUMPTION COSTS

13. The main "additional costs" resulting from the consumption of coal are:

- Costs of controlling emission of smoke and dust;
- Costs of controlling emission of gases contributing to production of acid rain;
- Costs related to emission of carbon dioxide, widely regarded as the main cause of the "greenhouse effect" (about one third of UK CO_2 emissions came from power stations).

Smoke and Dust

14. Clean air legislation and the development of technology have significantly reduced emission of smoke and dust due to coal combustion. But the electricity supply industry has to remove smoke and dust from power station flue gases and dispose of fly ash at a net annual cost of some £6 million.

Acid Rain

15. Measures so far agreed in order to reduce emissions of oxides of sulphur and nitrogen in flue gases from coal-fired power stations will cost at least £840m over the next 10 years; additional measures recently agreed by EEC Environment Ministers will cost at least an additional £660m over the period to the year 2003.

16. The contribution of the emissions of SO_2 and NO_x from power stations to the formation of acid rain is now generally accepted. But the damage attributed to, and the costs generated by that problem, are matters of continuing controversy.

Greenhouse Effect

17. With present and forseeable technology it is not feasible to remove carbon dioxide from the flue gases of coal-fired boilers. Each tonne of coal burned produces over 2 tonnes of carbon dioxide, so that total production of the gas from the use of solid fuel in the UK in 1985 was 235 million tonnes, out of a world total of emissions of carbon dioxide of some 18 billion tonnes. It is not yet possible to quantify, or even identify, the resulting costs.

MB220OC

ANNEX

THE COST OF COAL

Introduction

This paper examines human and environmental costs involved in the production and consumption of coal. Such costs which fall to the coal producer or consumer are not always separately identified in the accounts of the industries concerned. Some of these costs fall on others outside the coal producing and consuming industries and can often be quantified only inadequately if at all. These human and environmental costs are discussed and where possible quantified in terms of coal production and consumption.

I. COSTS OF COAL PRODUCTION

2. All the costs set out in this section of the paper are incurred in the production of coal. Some are individually specified in the accounts of the British Coal Corporation (BCC). Others not so separately specified are identified.

Subsidence costs

3. These are the costs to the BCC of compensating those whose property or land is damaged by subsidence. This is the inevitable consequence of extracting coal underground and allowing the overlying strata to collapse into the resulting space.

4. Subsidence is difficult to cost on an annual basis, as the process whereby claims are made and settled can be lengthy. In 1987-88 the BCC received just over 16,000 new claims, resolved nearly 17,000 but still had over 30,000 claims outstanding. The BCC make annual provision in their accounts for this liability. In 1987-88 the accumulated provision totalled nearly £300 million. On average, over the past five years, nearly £90 million has been provided annually. Averaging this total provision over the total tonnage of deep mined coal produced over the same period gives a subsidence compensation cost of £1.16 per tonne of coal.

5. Such quantified costs are not the only ones incurred as a result of subsidence. Damage can be severe and the time taken to repair it lengthy. On occasion family life can be disrupted by the need to move to alternative accommodation while repairs are carried out. Although some of these inconveniences can be compensated in cash terms there is no compensation for the considerable stress and strain that may be suffered.

6. The future trend in subsidence costs is likely to be downward reflecting the considerable advances made by the mining industry in its ability successfully to predict and so better to control subsidence.

Opencast site restoration

7. Over the past 3 years restoring land affected by opencast operations has cost the BCC on average £11 million p.a. or some £0.75 per tonne of saleable opencast coal. The BCC aim to increase production from opencast sites, so that site restoration costs overall (though not necessarily per tonne of coal) can also be expected to increase.

8. Opencast operations can have considerable impact on the environment particularly as they are now being increasingly located in greenfield sites rather than areas already affected by deep mining. Though they are subject to strict planning conditions, they have an unavoidable visual impact on the countryside and generate noise and dust and additional traffic through the surrounding area.

Restoration of Derelict Land

9. As in the case of a number of our older industries the closure of plants - in this case collieries - requires action being taken to remove surface plant, infill and make safe the mine shaft and generally restore the site to a state in which it is suitable for alternative use or development. The British Coal Corporation is assisted in this by grants made from the Derelict Land Grants Programme administered by the Department of the Environment. Over the past five years grants from this programme to the coal industry have averaged some £17 million a year.

Disposal of colliery spoil

10. Underground mining operations currently produce about 60 million tonnes p.a. of minestone dirt and spoil or 0.75 tonnes of spoil for each ton of coal mined. Of this 32 million tonnes come from face operations. The BCC are currently carrying out a five year programme aimed at reducing face dirt by 25%. But even if this is successful the amount of dirt and spoil to be disposed of annually would still be some 50 million tonnes for the industry at its current size.

11. Spoil is mostly disposed of by tipping. The cost of disposal varies according to the distance between the colliery and the tip with the range lying between £2 and £7 per tonne of spoil. The annual cost of spoil disposal to the BCC is currently in the region of £150 million or some £1.80 per tonne of deep mined coal produced.

The human costs

(i) Fatalities and injuries

12. Although coal mines are much safer places than they used to be there is still an unfortunate continuing cost in fatal accidents and injuries. The figures over the past nine years are shown in

table 1 attached. They show a steady decline in deaths and injuries in both absolute terms and in relation to the number of man-shifts worked; but deaths and injuries (some of them serious) continue. No precise costs can be ascribed to such accidents although they do impact on the industry's resources in terms of man-days lost. For example in 1987/88 nearly 220,000 man-days were lost through accidents.

(ii) Mining and health

13. Historically, one of the main health hazards in coal mining was pneumoconiosis, which results from long exposure to high concentrations of coal and mineral dust and progressively damages the lung tissues. Increasing efficiency of dust suppression techniques and careful X-ray monitoring of the workforce have considerably reduced the incidence of the disease. In 1987-88 the incidence of pneumoconiosis was down to 0.7% of the workforce at collieries compared with 8.5% in 1965.

14. Very few new cases are now occurring and these are mainly amongst older miners with many years service underground. This downward trend is likely to continue in future with the combination of improved dust supression methods and the much reduced average age of the underground workforce, which is now under 34 years.

15. Pneumoconiosis compensation is paid by the BCC under a 1974 agreement between the NCB and the mining unions. Payments according to the severity of the disease are in the form of lump sums (for over 10% lung impairment) and weekly payments up to the age of 65 for the more severely disabled. The cost of these payments over the past nine years totalled some £17 million [about 2p per tonne of deep mined coal produced over the period].

16. [CONFIDENTIAL: A more recently established mining health hazard is damage to hearing. Claims for noise-induced hearing loss have only relatively recently been made but have been increasing at a considerable rate (from 2580 in 1986-87 to 12,268 in 1987-88). Some 18,000 claims have been received so far of which about 8,500 are outstanding. Costs of individual claims settled to date average just over £2,000, i.e. some £20 million in total.

17. The BCC has provided £40 million in their 1987-88 accounts for this latent liability. Their auditors have questioned the adequacy of this provision in view of the steep increase in the rate of new claims; they consider the provision should be about £80 million. None of these cost figures have been released and the provision for noise induced hearing loss is not identified in the Corporation's accounts. Liability to the extent of agreeing a formal compensation scheme has not been admitted as in the case of pneumoconiosis. Litigation on test cases is also being threatened and in view of this and the greater potential liability should a test case succeed, none of the figures in paragraphs 15 and 16 should be publicised].

16-17?

18. A major cause of illness in the mining industry is various forms of back pain. These are associated with certain underground tasks particularly those requiring miners to work in cramped conditions. The BCC is carrying out research into such musculo-skeletal problems seeking in particular to establish their relationship to particular work tasks. Unfortunately there are no readily available statistics on which to base an estimate of the cost of this problem to the industry.

II COSTS OF COAL CONSUMPTION

19. This section of the paper examines the contributions from coal consumption attributed to three environmental problems; emissions of smoke and dust, acid rain and the greenhouse effect. Where possible the costs of combatting these contributions are estimated.

Smoke and dust

20. These emissions have for centuries been associated with the burning of coal. They have largely been eliminated in the UK by clean air legislation and the trend in the industrial and domestic markets away from coal to other fuels. But the electricity supply industry as a major coal burner still has to remove smoke and dust from power station flue gases. Some 99.3% is removed by electrostatic precipitators.

21. Grit and dust so removed yields some 8.25 million tonnes of fly ash annually. Removal costs £3.8 million a year and fly ash disposal £11.25 million. But a proportion of fly ash is sold for conversion eg into light weight building blocks yielding revenue of £9 million a year. This reduces net cost of grit and dust removal to some £6 million annually.

Acid rain

22. Acid rain is responsible for acidification of lakes and rivers, and has been blamed for widespread tree damage in parts of Europe. Although in the case of tree damage some of the causal links are more difficult to establish it is generally believed that emissions of sulphur dioxide and oxides of nitrogen are causal agents. Accordingly controls for removing them from power station flue gases have been accepted as necessary.

23. The removal of 90% of sulphur dioxide from power station flue gases can be accomplished by the installation of a variety of scrubbing processes known as Flue Gas Desulphurisation (FGD). Some generate an effluent problem in the need to dispose of the products of the process. Costs depending on the power station and the nature of the FGD process used range from £5 to £12 per tonne of coal burned. They tend to be lowest for new power stations and increase for older stations with lower load factors and shorter working lives.

24. The removal of 30% to 40% of nitrogen oxides from power station flue gases can be achieved by the installation of specially designed burners to reduce the formation of these gases in the combustion process. As burners must anyway be periodically replaced the cost is not so great as for FGD. Costs average some £0.4 per tonne of coal burned in a range from £0.30 to £0.75 per tonne again increasing from the lower end of the range for a new station to the upper end for an older station with low load factor and limited useful life.

25. The agreed application of these control measures in the UK to date covers:

(i) fitting of FGD and low NOx burners to all new power stations;

(ii) the retrofitting by CEGB (with Government agreement) of FGD to 6000 MW of coal fired plant (Drax and Fiddlers Ferry) in the period to 1997 at an estimated cost of £660 million (April 1988 prices); and

(iii) a ten year programme by CEGB (to 1996) to fit low NOx burners to 12 of its large coal fired power stations (23,000 MW) costing some £180 million (April 1988 prices).

26. The recent agreement by EC Environment Ministers to reduce sulphur dioxide emissions by 60% (from 1980 levels) by the year 2003 would require fitting FGD to a further 6000 MW of existing plant. Assuming a further 3 x 2000 MW were so fitted this is estimated to cost a further £660m.

27. The cost of the measures to control emissions of sulphur and nitrogen oxides so far undertaken is some £840 million. This could rise to £1500 million to achieve the EC 60% reduction target for SO_2 by 2003.

The Greenhouse Effect

28. This effect arises from certain gases emitted into the atmosphere absorbing and reflecting back to earth some of the heat radiated by the sun. As the concentrations of these gases in the atmosphere increase there will be a warming effect on the earth which if significant will result in climatic changes and a rise in sea levels. This hypothesis is complex and not yet fully understood or fully accepted. But a key component of the greenhouse gases is carbon dioxide which is emitted from the combustion of fossil fuels. Each ton of coal burned yields over 2 tonnes of carbon dioxide. The concentration of the gas in the atmosphere has increased by 25% since 1860.

29. Scrubbing carbon dioxide from power station flue gases is technically feasible but is not regarded as a practical option. Aside from creating a massive effluent problem in disposing of the products the cost would be prohibitive. It is estimated the cost

both in operating the plant and in the consequent reduction in power station efficiency would increase electricity costs by between 50% and 100%. A solution if one has to be found would more likely lie in a combination of measures including increased energy efficiency, reduced power generation from combustion of fossil fuels and reafforestation.

30. It is too early to attempt to cost means of combatting the greenhouse effect. All that can be done is to suggest the measure of the UK contribution that would have to be tackled if reduction in carbon dioxide emissions were established as the key controlling factor. Global emissions of carbon dioxide from fossil fuels total some 19 billion tonnes pa of which about half is thought to be absorbed by plant life, the oceans etc. giving a net annual addition to the atmosphere of about 10 billion tonnes, [this together with emissions from other sources is consistent with the 3 billion figure in the Prime Minister's recent speech to the Royal Society which was given in tonnes carbon]. The UK contribution to this global total of carbon dioxide emissions (for 1985; the latest figures available) was:

from fossil fuels	-	565 m tonnes (3%)
" coal fired power stations	-	158 m tonnes (0.9%)
" other solid fuel use	-	77 m tonnes (0.4%)

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TABLE 1

COAL MINES

YEAR	FATALITIES ACTUAL	FATALITIES RATE (/100000 Manshift)	ALL ACCIDENTS (INCL. NON MAJOR) ACTUAL	ALL ACCIDENTS (INCL. NON MAJOR) RATE (/100000 Manshift)
1979	46	0.09	40.848	81.04
1980	42	0.08	36.775	72.66
1981	35	0.07	31.115	64.26
1982	38	0.08	25.015	34.39
1983	30	0.07	19.446	45.34
1984/85	22	N/A	N/A	N/A
1985/86	28	0.08	12.480	44.19
1986/87	15	0.05	112.480	45.22
1987/88	9	0.04	86.89	38.62

N/A - Due to miners strike

Source - HSE

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10 DOWNING STREET

CF.

M. Beaverbrook. Could I please have a copy of the summary paper

PL. see PM's comment. pas 12/12

Could you pl ask D/Ech to prepare a summary of the figures which can be used for the question's forlder. done pas 12/12

N. C. W.

12-12

10 DOWNING STREET

From the Principal Private Secretary

31 October 1988

THE COST OF COAL

The Prime Minister was grateful for the paper on "The Cost of Coal" attached to your letter of 28 October. She found it very interesting.

I am sending a copy of this letter to Roger Bright (Department of the Environment) and Richard Wilson (Cabinet Office).

N. L. WICKS

Stephen Haddrill, Esq.,
Department of Energy.

SECRETARY OF STATE FOR ENERGY
THAMES HOUSE SOUTH
MILLBANK LONDON SW1P 4QJ

01 211 6402

Nigel Wicks Esq CB
Private Secretary to
The Prime Minister
10 Downing Street
LONDON
SW1A 2AA

28th October 1988

Dear Nigel,

THE COST OF COAL

Following my Secretary of State's recent meeting with the Prime Minister on the coal industry you asked for a paper on the true costs of coal, including the costs of such problems as subsidence and spoil disposal. I enclose a note prepared by our officials. This is comprehensive and we have put figures to most of the problems associated with coal. I am sure you will appreciate, however, that it is difficult to be precise about some of the costs. We are now preparing some additional figures on deaths and accidents in the coal industry and we are obtaining information from the CEGB on the costs of the removal of grit and dust from power station flue gases and the disposal of fly ash from power stations. I will let you have those figures shortly.

I am sending a copy of this to Roger Bright in Nicholas Ridley's office and to Richard Wilson in the Cabinet Office.

Yours ever,

S Haddrill.

S HADDRILL
Private Secretary

N.B. one page of attachment is CONFIDENTIAL.

THE COST OF COAL

SUMMARY

The production and consumption of coal both generate costs additional to the costs of labour, capital and materials. Some of these additional costs can be quantified and are met by the industries concerned. Some cannot, and fall on others. Paragraphs 2-16 below discuss these "additional costs" in summary terms; a fuller discussion is contained in the Annex.

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- Costs of subsidence damage resulting from deep-mining;
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- Costs of industrial deaths, injuries, and diseases.

SUBSIDENCE

3. Over the past five years the British Coal Corporation (BCC) have provided in their accounts an average of about 90m a year in respect of subsidence damage. This is equivalent to about 1.16 per tonne of deep-mined coal. It does not include the cost of the inevitable stress and strain suffered by those whose property is damaged by subsidence.

4. The future trend of subsidence costs is likely to be downward because of better methods of predicting and controlling subsidence damage.

OPENCAST SITE RESTORATION

5. Over the last 3 years restoring land affected by opencast operations has cost the BCC an average of 11m a year, equivalent to about 0.75 per tonne of opencast output. This does not include the cost of the loss of amenity or the additional noise,

dust and traffic which are inevitable while opencast sites are being worked.

6. If the BCC is successful in its aim of increasing opencast production total costs (although not necessarily average costs) are likely to rise.

DISPOSAL OF COLLIERY SPOIL

7. Underground mining operations currently produce 60m tonnes of spoil every year - about 0.75 tonnes of spoil for each tonne of coal. The cost to the BCC of disposing of this spoil is currently in the region of 100m a year, equivalent to 1.20 a tonne of deep-mined coal.

8. The BCC has a programme designed to reduce the production of spoil. If this is successful, the costs of spoil disposal should fall.

DEATHS, INJURIES AND DISEASES

9. Health and safety in coal mines have improved enormously in recent years. Even so, deaths over the past 5 years excluding 1984/85 have averaged 24 a year or 0.06 per 100,000 man shifts. The comparable figures for serious injuries are 16,070 and 41.5 respectively.

10. Pneumoconiosis is no longer a serious problem in the industry. But noise-induced hearing loss is a developing problem.

11. Costs to BCC of industrial deaths, injuries and diseases and to the tax payer in social security benefits are proving difficult to quantify but this is being pursued further. Such figures will not of course, take into account the suffering of the men and their families.

B: CONSUMPTION COSTS

12. The main "additional costs" resulting from the consumption of coal are:

- Costs of controlling emission of smoke and dust;

- Costs of controlling emission of gases regarded as contributing to production of acid rain;

- Costs related to emission of carbon dioxide, widely regarded as the main cause of the "greenhouse effect".

SMOKE AND DUST

13. Clean air legislation and the development of technology have reduced emission of smoke and dust due to coal combustion to negligible levels. But the electricity supply industry has to remove smoke and dust from power station flue gases and dispose of fly ash.

ACID RAIN

14. Measures so far agreed in order to reduce emissions of oxides of sulphur and nitrogen in flue gases from coal-fired power stations will cost 840m over the next 10 years; additional measures recently agreed by EEC Environment Ministers could cost an additional 660m over the period to the year 2003.

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16. With present and forseeable technology it is not feasible to remove carbon dioxide from the flue gases of coal-fired boilers. Each tonne of coal burned produces over 2 tonnes of carbon dioxide, so that total production of the gas from the use of solid fuel in the UK in 1985 was 235 million tonnes, out of a world total of emissions of carbon dioxide of some 18 billion tonnes. It is not yet possible to quantify, or even identify, the resulting costs.

THE COST OF COAL

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repair it lengthy. On occasion family life can be disrupted by the need to move to alternative accommodation while repairs are carried out. Although some of these inconveniences can be compensated in cash terms there is no compensation for the considerable stress and strain that may be suffered.

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THE HUMAN COSTS

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remove smoke and dust from power station flue gases. Some 99.3% is removed by electrostatic precipitators. Annual costs are being sought from the industry for the capital and running costs of this plant and disposal of fly ash.

ACID RAIN

20. Acid rain has been blamed for acidification of lakes and rivers, and for widespread tree damage in parts of Europe. Although some of the causal links are more difficult to establish it is generally believed that emissions of sulphur dioxide and oxides of nitrogen may contribute. Accordingly controls for removing them from power station flue gases have been accepted as necessary.

21. The removal of 90% of sulphur dioxide from power station flue gases can be accomplished by the installation of a variety of scrubbing processes known as Flue Gas Desulphurisation (FGD). Some generate an effluent problem in the need to dispose of the products of the process. Costs depending on the power station and the nature of the FGD process used range from 5 to 12 per tonne of coal burned. They tend to be lowest for new power stations and increase for older stations with lower load factors and shorter working lives.

22. The removal of 30% to 40% of nitrogen oxides from power station flue gases can be achieved by the installation of specially designed burners to reduce the formation of these gases in the combustion process. As burners must anyway be periodically replaced the cost is not so great as for FGD. Costs average some 0.4 per tonne of coal burned in a range from 0.30 to 0.75 per tonne again increasing from the lower end of the range for a new station to the upper end for an older station with low load factor and limited useful life.

23. The agreed application of these control measures in the UK to date covers:

(i) fitting of FGD and low NOx burners to all new power stations;

(ii) the retrofitting by CEGB (with Government agreement) of FGD to 6000 MW of coal fired plant (Drax and Fiddlers Ferry) in the period to 1997 at an estimated cost of 660 million (April 1988 prices); and

(iii) a ten year programme by CEGB (to 1996) to fit low NOx burners to 12 of its large coal fired power stations (23,000 MW) costing some 180 million (April 1988 prices).

24. The recent agreement by EC Environment Ministers to reduce sulphur dioxide emissions by 60% (from 1980 levels) by the year 2003 would require fitting FGD to a further 6000 MW of existing plant. Assuming a further 3 x 2000 MW were so fitted this is estimated to cost a further 660m.

25. The cost of the measures to control emissions of sulphur and nitrogen oxides so far undertaken is some 840 million. This could rise to 1500 million to achieve the EC 60% reduction target for SO_2 by 2003.

THE GREENHOUSE EFFECT

26. This effect arises from certain gases emitted into the atmosphere absorbing and reflecting back to earth some of the heat radiated by the sun. As the concentrations of these gases in the atmosphere increase a warming effect on the earth may result in climatic changes with the possibility that sea levels could rise. This hypothesis is complex and not yet fully understood or accepted. But a key component of the greenhouse gases is carbon dioxide which is emitted from the combustion of fossil fuels. Each ton of coal burned yields over 2 tonnes of carbon dioxide. The concentration of the gas in the atmosphere has increased by 25% since 1860.

27. Scrubbing carbon dioxide from power station flue gases is technically feasible but is not regarded as a practical option. Aside from creating a massive effluent problem in disposing of the products the cost would be prohibitive. It is estimated the cost both in operating the plant and in the consequent reduction in power station efficiency would increase electricity costs by between 50% and 100%. A solution if one has to be found would

more likely lie in a combination of measures including increased energy efficiency, reduced power generation from combustion of fossil fuels and reafforestation.

28. It is too early to attempt to cost means of combatting the greenhouse effect. All that can be done is to suggest the measure of the UK contribution that would have to be tackled if reduction in carbon dioxide emissions were established as the key controlling factor. Global emissions of carbon dioxide from fossil fuels total some 19 billion tonnes pa of which about half is absorbed by plant life etc. giving a net annual addition to the atmosphere of about 10 billion tonnes, [this together with emissions from other sources is consistent with the 3 billion figure in the Prime Minister's recent speech to the Royal Society which was given in tonnes carbon]. The UK contribution to this global total of carbon dioxide emissions (for 1985; the latest figures available) was:

from	fossil fuels	-	565 m tonnes (3%)
"	coal fired power stations	-	158 m tonnes (0.9%)
"	other solid fuel use	-	77 m tonnes (0.4%)

TABLE 1

COAL MINES

YEAR	FATALITIES ACTUAL	FATALITIES RATE (/100000 Manshift)	ALL ACCIDENTS (INCL. NON MAJOR) ACTUAL	ALL ACCIDENTS (INCL. NON MAJOR) RATE (/100000 Manshift)
1979	46	0.09	40.848	81.04
1980	42	0.08	36.775	72.66
1981	35	0.07	31.115	64.26
1982	38	0.08	25.015	34.39
1983	30	0.07	19.446	45.34
1984/85	22	N/A	N/A	N/A
1985/86	28	0.08	12.480	44.19
1986/87	15	0.05	112.480	45.22
1987/88	9	0.04	86.89	38.62

N/A - Due to miners strike

Source - HSE

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