

Reliability of UK Supplies of Electricity Generated from Coal.

Prepared By

Professor John H Gittus. F R Eng. D Sc. D Tech.
Consultant.

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PROFESSOR JOHN H GITTUS.

John Gittus was elected Regents' Professor at the University of California in Los Angeles in 1990. He is Visiting Professor of Nuclear Engineering at the University of Plymouth, England. He was a Director of the United Kingdom Atomic Energy Authority (later AEA Technology) and is now a Consultant to Governments and private industry on nuclear matters world-wide. His recent clients include BNFL Plc, The UK Government's Department of Trade and Industry, Serco Plc, The Sumitomo Corporation, the French nuclear company COGEMA, Amersham Plc the radio pharmaceutical company, Cox Insurance Plc, the world's largest commercial insurer of nuclear risks, Chaucer Insurance Holdings and ESKOM, the South African utility.

Professor Gittus is a Fellow of the Royal Academy of Engineering (Britain's top 1,000 engineers) and has Doctor of Science degrees from the Universities of London and Stockholm. He has held over 30 patents and published over 100 papers in learned Journals describing his personal research. He invented Nimonic 115, the strongest of the early creep-resistant alloys used for the hottest turbine blades in jet engines and went on to develop a theory of creep that forms the basis of many of his papers to the Royal Society and the Philosophical Magazine. He used this theory to develop one of the world's first computer models of nuclear fuel elements, with which he forecast that some of the fuel element designs then extant would fail as their lives were extended in a quest for cheaper power. He was able to model the failure processes and deduced remedies that have been applied throughout the world. Fuel element failures are now rare, due in part to this early work.

He held a series of senior posts in the UKAEA, where he headed the late Lord Marshall's Task Force at Harwell and produced the UK's first nuclear-reactor Probabilistic Risk Assessment, for Sizewell B. He became Director of the R&D programme that underpinned the design details of Sizewell B, then Director of Safety and Director of Communications. He left the UKAEA to become the first Director General of the British Nuclear Industry Forum, where he helped with the restructuring of the UK nuclear industry, a process that is still going on. When his term of office there was complete he became a consultant, first to his successor and then, quickly, to other nuclear companies at home and overseas. On the death of Lord Marshall of Goring, Professor Gittus was appointed to succeed him at Cox Insurance Holdings Plc, advising on the insurance of the world's nuclear power stations and other nuclear installations. Since January 2003 Professor Gittus and Mr Michael Dawson have led Syndicate 1176, the biggest commercial nuclear insurer in the world and Lloyds of London's most profitable syndicate.

Amongst his published papers are two communicated to the Royal Society by P.A.M. Dirac and describing Professor Gittus's solution of a problem with the structure of matter which Dirac said he himself had been unable to solve.

Entry From Who's Who

Name

GITTUS, John Henry.

Awards

DSc. DTech; FREng 1989.

Positions

Consultant, Amersham Plc, since 1999. Consultant, Cox Power Holdings, since 1997; Consultant, Serco Plc (formerly AEA Technology) since 1993; Senior Partner, NUSYS Consultants, Paris.

**Personal
Details**

Born 25 July 1930; *son* of Henry Gittus and Amy Gittus; *married* 1953, Rosemary Ann Geeves; *one son two daughters*.

Education

BSc 1st Honours Mathematics London 1952; DSc Phys London 1976. DTech Metall Stockholm 1975. CEng, FIMechE, FIS, FIM.FREng

Work

British Cast Iron Res. Assoc., 1947-1955; Mond Nickel Co., R&D Labs, Birmingham, 1955-1960 (develtd Nimonic series high temp. super alloys for aircraft gas turbine engines); United Kingdom Atomic Energy Authority, 1960-1989: Research Manager, Springfields; Head, Water Reactor fuel develtd; Head, Atomic Energy Tech. Br., Harwell; Director: Water Reactor Safety Research; Safety and Reliability Directorate, Culcheth; Communication and Information; Dir Gen., British Nuclear Forum, 1990-1993. Consultant: Argonne Nat. Lab., USA, 1968; Oak Ridge Nat. Lab., 1969. Visiting Professor: Ecole Polytechnique Fédérale, Lausanne, 1976; Univ. de Nancy, 1984; Regents' Prof., UCLA, 1990-1991; Prof. of Risk Mgt, Plymouth Univ., 1997-. Editor-in-Chief, Res Mechanica, 1980-1991.

Publications

Uranium, 1962; Creep, Viscoelasticity and Creep-fracture in Solids, 1979; Irradiation Effects in Crystalline Solids, 1979; (with W. Crosbie) Medical Response to Effects of Ionizing Radiation, 1989; numerous articles in learned jls.

Recreations

Old houses, old motor cars, old friends.

Address

(office) 22 Buckingham Gate, SW1E 6LB. *Telephone:* +44 7775 898 449.

Clubs

Royal Society of Medicine, Institute of Directors.

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Summary

In this Report I examine statistics on UK coal production, stocks, consumption and on the political risks presented by coal-supplier countries. From this information I deduce the future reliability of UK coal supplies.

Currently, Britain's coal stocks will last three months if supplies are interrupted. Although UK domestic coal production is falling, this is because imports are cheaper. The UK could, given time, be once again self-sufficient in coal.

Eight foreign countries each *export* more coal than the UK *imports*. Indices of Political Risk and Political Risk Insurance Premiums show that four of these exporters offer a low Political Risk of renegeing on contracts.

Significantly, neither the Political Risk Indices nor the Political Risk Insurance Premiums contain data on the risks presented to domestic supplies by domestic *strikes* and the UK, which scores well for Political Risk, had major coal strikes in 1972, 1974 and 1984.

The low Political Risk presented by the UK and by four or more other countries, each of which is separately capable of supplying all the UK's coal imports, together with the UK's stocks and production potential, led us originally to conclude that there is about a chance in a million of the UK's coal supplies drying up.

A reanalysis that takes a more pessimistic view of the impact of strike-action leads us now to conclude that future UK coal imports will be interrupted for a period of 6 months with a frequency of up to *0.000018/year*.

Introduction.

In this Report I examine statistics on UK coal production, stocks, consumption and on the political risks presented by coal-supplier countries. From this information I deduce the future reliability of UK coal supplies.

Britain's Coal Production, Imports and Consumption.

Currently, Britain's coal stocks will last three months if supplies are interrupted, as illustrated in the following figures: ¹

Figure 1: UK Coal Production and Imports.

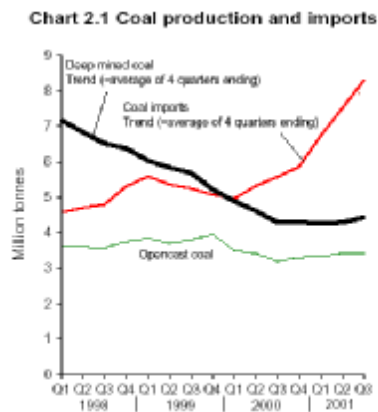
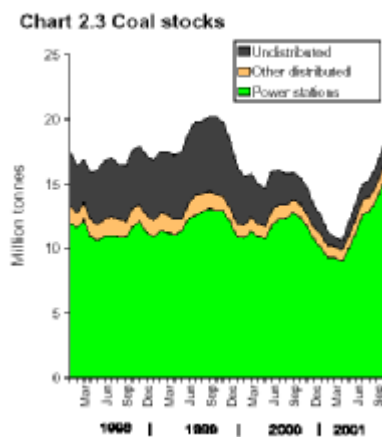
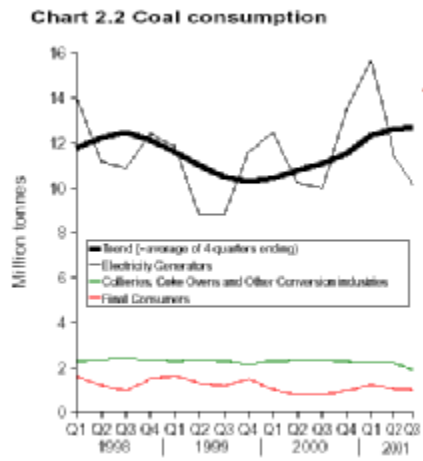


Figure 2: UK Coal Stocks.



¹ Energy Trends, DTI 2002. Sets of tables can be found at www.dti.gov.uk/energy/energystats/energystats.htm.

Figure 3: UK Coal Consumption.

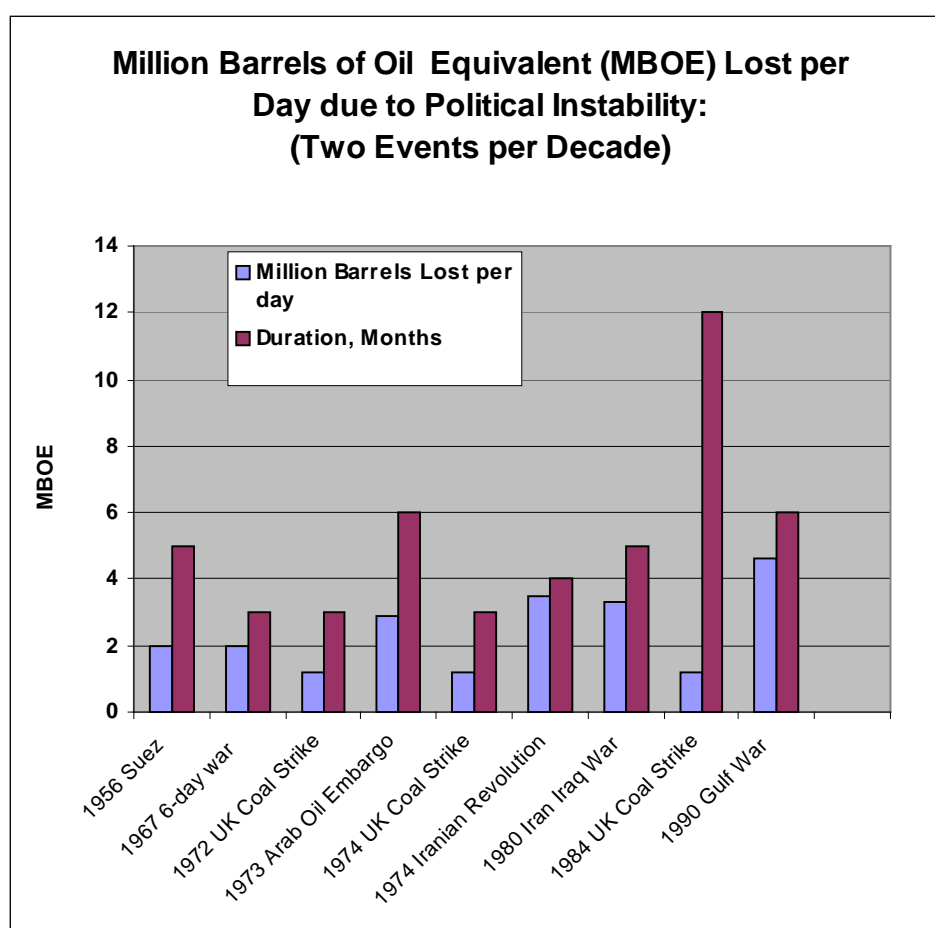
Although UK domestic coal production is falling, this is because imports are cheaper.

The UK could, given time, be once again self-sufficient in coal.

Political Disruptions of Britain's Coal Supplies.

Disruption of oil and coal supplies due to political activities has occurred twice per decade in the last 50 years. The following graph illustrates this. (Britain used more than a million barrels of oil equivalent per day throughout the period of this graph).

Figure 4: Politically-Motivated Interruptions to UK Fossil Fuel Supplies, 1956-2002.

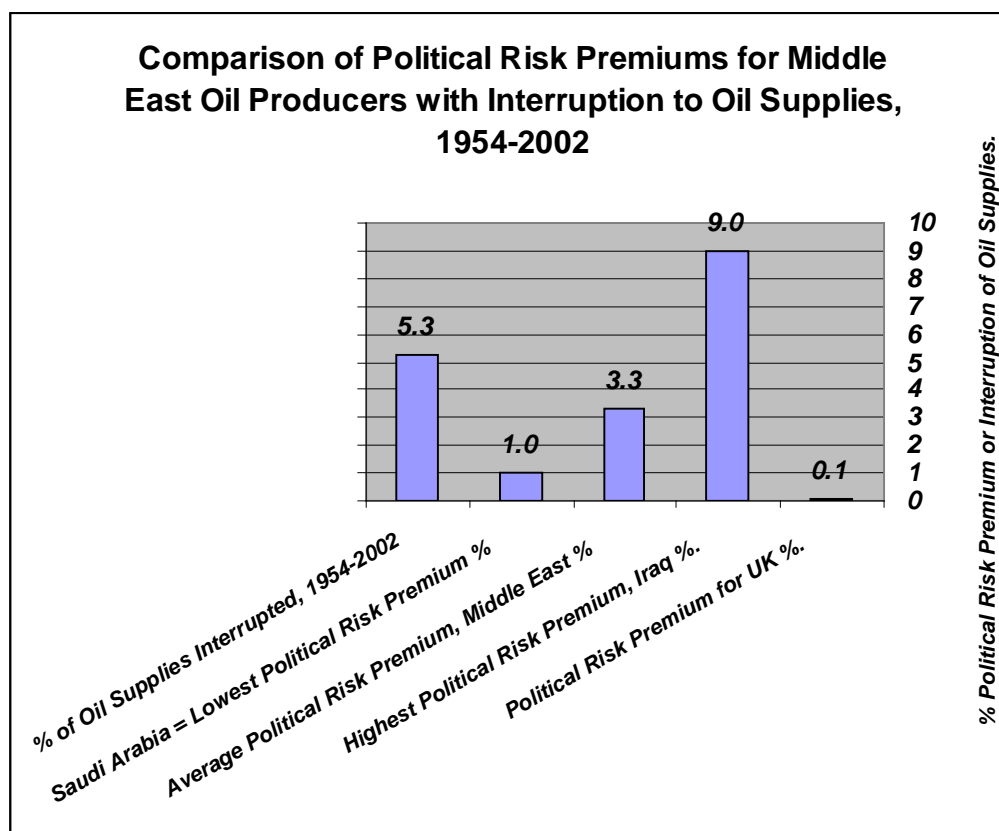


In the 1972, 1974 and 1984 Britain had major coal strikes. Each was a politically-motivated interruption of all domestic coal supplies that lasted, in the case of the 1984 strike, for more than 12 months.

Now, in the case of *oil* supplies, which have been interrupted about 5% of the time, we have (in the next Figure) correlated the frequency and magnitude of the

interruptions with Indices of Political Instability. For the countries of the Middle East that have the greatest oil reserves, the average Political Risk Insurance Premium in 2002 is 3.3% and the range is from 1% to 9%.

Figure 5: Political Risk Premiums for Main Middle East Oil Producers Compared to the Interruption of Oil Supplies, 1954-2002.



The interruptions to oil imports were of similar *daily magnitude* to the UK's *daily consumption* of oil and occurred at a frequency of 6 in 46 years or one in eight years and this is the kind of pattern that we can expect for any politically-engineered interruption of fossil fuel supplies- the three UK coal strikes each lasted a significant part of a year- a whole year in the case of the last one.

We are bound to conclude that, despite the low values of the Political Risk Indices for the UK during the last half-century, the risk of politically-inspired interruptions to domestically-mined coal, of mean duration 6 months, has been $3/46 = 6.52\%$, whilst coal supplies have been interrupted for $6.52 \times 0.5\text{year} = 3.26\%$ of the 46 year period.

Significantly, neither the Political Risk Indices nor the Political Risk Insurance Premiums contain data on the risks presented to domestic supplies by domestic *strikes*.

The following figures show that eight foreign countries each *export* more coal than the UK *imports*. Four of these exporters offer a low Political Risk of renegeing on contracts.

Figure 6: Exports of Coal, Trillion BthU.

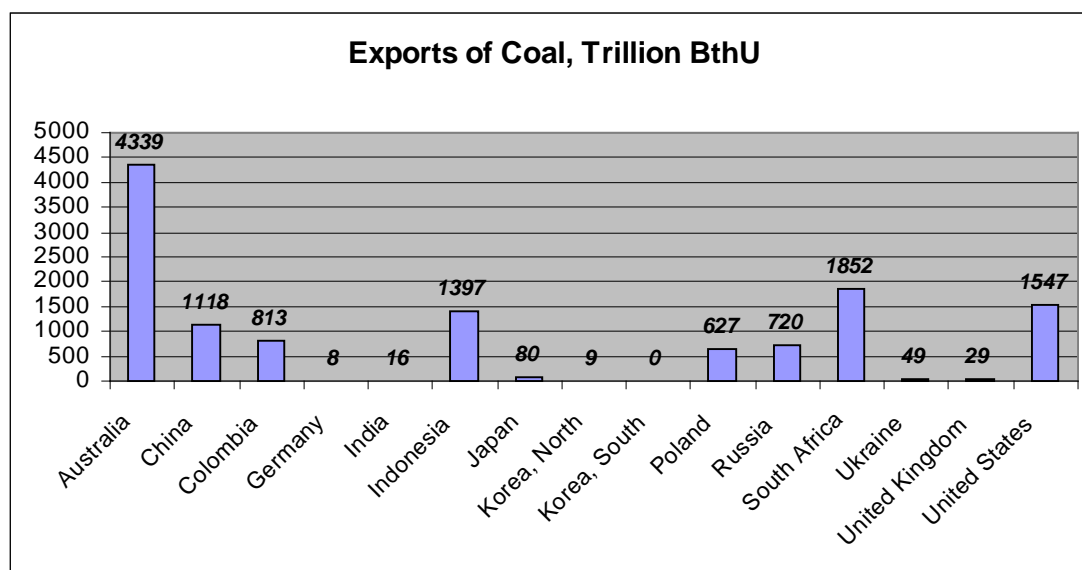


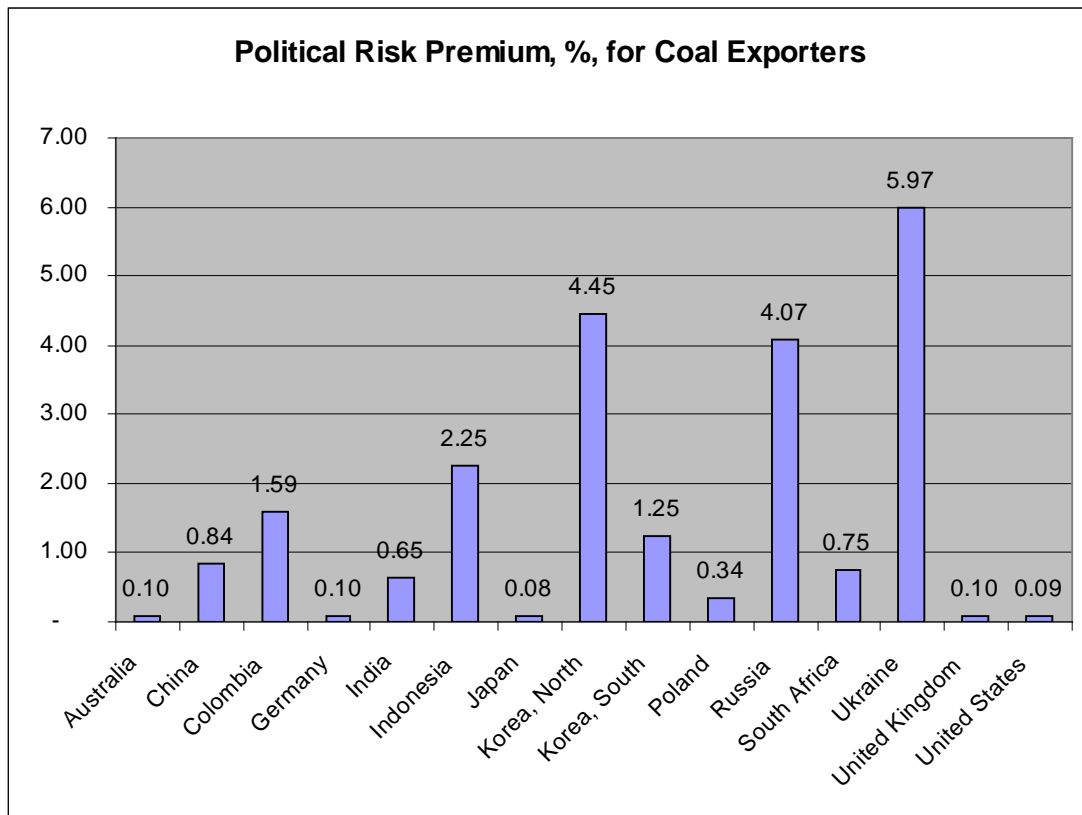
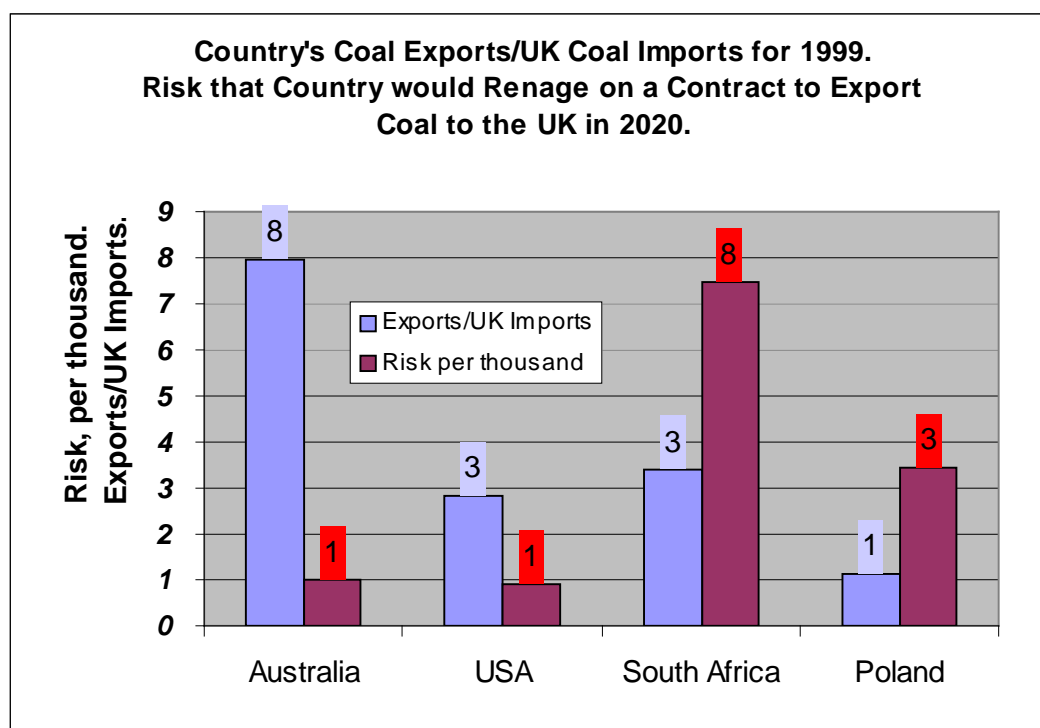
Figure 7: Political Risk Premium, %, for Coal Exporting Countries and the UK.

Figure 8: Country's Coal Exports/UK Coal Imports for 1999. Also the Risk that a Country would Reneg on a Contract to Export Coal to the UK in 2020 for Political Reasons, other than Strikes.



Impact of Strikes.

Neither in Australia, nor in the USA, South Africa or Poland have there been such frequent or prolonged coal-strikes as in the UK. Nevertheless, for the present purposes, we shall take the pessimistic view that in future, coal strikes will have the same pattern in these four countries as they have had in the UK over the last 46 years.

We conclude, therefore, that UK coal imports will be interrupted for 6 months with a frequency of 0.00018/year.

Conclusion Concerning the Reliability of UK Coal Supplies.

The low Political Risk presented by the UK and by four or more other countries, each of which is separately capable of supplying all the UK's coal imports, together with the UK's stocks and production potential, led us originally to conclude that there is about a chance in a million of the UK's coal supplies drying up.

A reanalysis that takes a more pessimistic view of the impact of strike-action leads us now to conclude that future UK coal imports will be interrupted for a period of 6 months with a frequency of *0.00018/year*.