CANADIAN FORCES COLLEGE/COLLÈGE DES FORCES CANADIENNES

JCSP 35/ PCEMI N° 35

MDS RESEARCH PROJECT/PROJET DE RECHERCHE MED

GLOBAL ENERGY SECURITY AND THE IMPLICATIONS FOR THE EXERCISE OF POWER AND THE UTILITY OF MILITARY FORCE FOR THE UNITED KINGDOM

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ABSTRACT

This paper argues that the UK faces an energy security challenge – due to depletion of its own resources and a worsening global energy situation – that necessitates a new focus for UK national power on maintaining access to imported energy. This paper argues that energy is a plausible *casus belli* in the twenty-first century and reviews the position of the UK within the global energy market, identifying 37 countries of energy interest, which the UK has limited scope to influence. Moreover, British energy policies are constrained by the depletion of UK energy reserves, unrealistic expectations of imported Norwegian energy and unwise dependence on Russian energy. The corollary is that the utility of the military instrument for the UK is in supporting the other instruments of national power, in order to secure access to scarce energy, and that the UK must be robustly realist in its approach to international relations.

CHAPTER 1 – INTRODUCTION

This paper argues that the United Kingdom (UK) faces an energy security challenge – due to the combined effects of the depletion of its own energy resources and a worsening global energy security environment – that means that the focus for the exercise of national power for the UK should be to maintain access to imported primary energy. In this context, the utility of military force for the UK will be founded on the ability of the military instrument to support the other instruments of national power in maintaining access to the imported energy that is essential to the security and prosperity of the UK.

This paper will examine the fundamentals of UK energy security and their implications for the exercise of power and the utility of force for the UK. For the purpose of this examination, *energy security* is defined as a state's ability to secure access to sufficient, stable and affordable supplies of the primary energy that is necessary for the prosperity and stability of the state and the welfare and prosperity of its citizens.

In 2008, the United States National Intelligence Council reported with "relative certainty" that global economic and population growth will put pressure on energy, food and water resources by 2025:

> Resource issues will gain prominence on the international agenda. Unprecedented global economic growth … will continue to put pressure on a number of highly strategic resources, including energy, food, and water, and demand is projected to outstrip easily available supplies over the next decade or so. … Oil and gas production of many traditional energy producers already is declining. … Countries capable of significantly expanding production will dwindle; oil and gas production will be concentrated in unstable areas. As a result of this and other factors, the world will be in the midst of a fundamental energy transition away from oil toward natural gas, coal and other alternatives. … Perceptions of energy scarcity will drive countries to take actions to assure their future access to energy supplies. In the worst case, this could result in interstate conflicts if government leaders deem assured

> access to energy resources, for example, to be essential for maintaining domestic stability and the survival of their regimes.[1]

The possibility of Malthusian[2] energy shortages and resulting conflict is central to this bleak assessment.

This paper will argue that energy is a scarce resource, and energy scarcity and conflict are linked, and therefore energy is a plausible *casus belli* in the twenty-first century. Although energy crises have historically been temporary phenomena of geography, politics or market imperfections rather than genuine scarcity, and the shared interests of parties involved in the energy market have acted to promote continuity of energy supply, Malthusian energy shortages (real or perceived) are increasingly likely to be drivers of conflict. Remaining oil reserves are now largely "tough oil" and unconventional oil (with low net energy yield) and there is similar looming scarcity of natural gas and uranium. Moreover, the geopolitics of energy are increasingly complicated, especially in terms of the role of energy transit states, the mutual dependence of importing and exporting states, and the interplay of commercial, diplomatic, military, security and regional factors in competition for energy.

This paper will discuss the links between energy, security and national power, to show that energy is a grand strategic concern for states, rather than merely a military strategic, operational or tactical factor in conflict. Although energy is essential to military capability and manoeuvre, the relatively-small scale of today's military forces as energy

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[1]United States National Intelligence Council, NIC 2008-003 *Global Trends 2025: A Transformed World* (Washington DC: Superintendent of Documents, US Government Printing Office, 2008), iv-ix; http://www.dni.gov/nic/PDF_2025/2025_Global_Trends_Final_Report.pdf ; Internet; accessed 23 March 2009.

[2] Malthusian: relating to the population theory of Thomas Malthus, who postulated that human population tends to grow in geometric progression whilst resources only grow in arithmetic progression, leading eventually to resource shortages, in the absence of some check on population.

consumers in the context of advanced, energy-hungry economies, means that the supply of energy for military operations is not the main factor likely to drive states to conflict over energy. Instead, access to primary energy supports the diplomatic, military and – most significantly – economic elements of national power that are fundamental to a state's potential to act to secure its goals. Access to primary energy has been the object of the application of the diplomatic, military and economic elements of national power in many instances since the early twentieth century. In an era of energy scarcity, however, primary energy has increasing importance as both an instrument and an objective of national power, is increasingly vulnerable to interruptions of supply, and is increasingly important in the internal stability of economies and societies.

In this context of energy scarcity and increasingly complex energy geopolitics, it is necessary to evaluate the position of the UK in the global energy market – in terms of its growing dependence on energy imports and transit relationships – to identify the countries of energy interest to the UK. This paper will argue that the stated countries of energy interest to the UK represent a broad constituency of large primary energy importers (competing for access to scarce energy), major primary energy suppliers to the UK, globally-dominant energy suppliers (with the power to influence prices and supply), major producers of natural gas (the most important form of primary energy for the UK), the main energy transit countries, and the littoral states of maritime choke points. The UK has limited scope to influence this broad constituency.

In light of these threats to UK energy security, it is necessary to evaluate the nature of contemporary British[3] power and the efficacy of UK government policy on

[3] "UK" and "Britain"/"British" are used interchangeably in this paper.

energy security. This paper will argue that British national power is constrained by the rapid depletion of UK oil and natural gas reserves, unrealistic expectations of increasing access to energy imported from Norway, unwise dependence on energy imported from Russia, and a lack of strategic energy storage or long-term supply contracts. It will be shown that, although UK energy policy is increasingly focused on energy security, there are inconsistencies and weaknesses, leading to a parts-of-government rather than whole-of-government approach.

This analysis will culminate in an assessment of the role that the military instrument should play in UK energy security. It will be argued that the utility of military force for the UK, in an era of energy security, will be founded on the ability of the military instrument to support the other instruments of national power to maintain access to the imported primary energy that is essential to the UK.

This paper will be focused at the levels of policy and strategy, and will consider the adequacy of UK national strategies and policies, and how these should be reflected in British defence policy.[4] This paper will consider issues across the domains of national security, foreign affairs and defence, as they apply to energy security.

This paper will adopt a realist approach to international relations, under which states are assumed to act rationally, in self-interest, to maximize their security and probability of survival. This approach has been chosen because it is based on the compelling idea that foreign policy is fuelled by the desire for power and because it

[4] National strategies direct the coordinated application of the instruments of national power. National policies are the aspirations set principally by the Prime Minister and Cabinet. Defence policy shapes the structures and capabilities of the armed forces. For the British taxonomy of policy and strategy, see: Ministry of Defence, Joint Doctrine Publication 0-01 *British Defence Doctrine*, 3rd Ed. (Swindon: The Development, Doctrine and Concepts Centre, 2008): paragraphs 111 to 116; http://www.mod.uk/NR/rdonlyres/9E4BA75A-8E9F-4A52-983B-44A0226C4906/0/20080924_jdp0_01_3rdEd_U_DCDCIMAPPS.pdf ; Internet; accessed 19 March 09.

reflects long-established British political and diplomatic culture, and focuses on the complexity of the world.[5] Moreover, a realist approach avoids the dangers of moralism in security and foreign policy,[6] which would detract from the analysis.

This paper will deal with energy security only in terms of its relationship to securing and furthering British interests, and will not discuss the associated topic of climate change or wider, values-based security concepts such as human security and "Responsibility to Protect."[7] This is not an autarkic approach: this paper deals with the dependence of the UK on its international relationships to secure energy, in a context where the UK cannot be self-sufficient.

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[5] For power, see: Sean Molloy, "Truth, Power, Theory: Hans Morgenthau's Formulation of Realism," *Diplomacy & Statecraft* 15(1) (2004): 1-34; http://search.ebscohost.com/login.aspx?direct=true&db=ahl&AN=A000564352.01&site=ehost-live ; Internet; accessed 10 April 2009.

For British political and diplomatic culture, see: Samuel Azubuike, "Still Buying Insurance? The Realism behind Tony Blair's Post-September 11 Evangelization," *Review of International Affairs* 3, Issue 1 (Autumn 2003): 64-80; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=13672693&site=ehost-live ; Internet; accessed 10 April 2009.

For a discussion of the merits of focus on world complexities, see: Alan Wolfe, "Back to Crackpot Moralism," *World Policy Journal* 25, Issue 3 (Fall 2008): 218-220; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=35025186&site=ehost-live ; Internet; accessed 10 April 2009.

[6] Adrian Hyde-Price, "A 'tragic actor'? A realist perspective on 'ethical power Europe'," *International Affairs* 84, Issue 1 (January 2008): 29-44; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=28745176&site=ehost-live ; Internet; accessed 10 April 2009. See also C. A. J. Coady, "The Moral Reality in Realism," *Journal of Applied Philosophy* 22, Issue 2 (August 2005): 121-136; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=17696936&site=ehost-live ; Internet; accessed 10 April 2009. Coady suggests the dangers of moralism are: moralism of scope (erroneously categorizing as 'moral' issues that are not); imposition (inappropriate resort to a moral position, insisting that others conform); abstraction (to principles too universal for the actual situation); absolutism; and deluded power (distorted, self-righteousness belief).

[7] International Commission on Intervention and State Sovereignty, *The Responsibility to Protect – Report of the International Commission on Intervention and State Sovereignty* (December 2001); available from http://www.iciss.ca/report2-en.asp#synopsis ; Internet; accessed 6 November 2008.

CHAPTER 2 –ENERGY SCARCITY

The first step in characterizing the energy security challenge facing Britain is to evaluate the extent to which primary energy[8] is scarce and to establish a conceptual link between resource scarcity and conflict, to demonstrate that energy is a plausible *casus belli* in the twenty-first century.

Scarcity is central to the nexus between energy and security. It is the actual or perceived excess of demand over supply for primary energy that determines the nature of energy relationships between nations and the importance of energy in national strategies. However, the question of energy scarcity is complicated by the fact that there is no definitive answer on how long fossil fuels will last or on the likely impact of their demise. Opinion on the longevity of fossil fuels is dominated by debate over the future of oil, encompassing a spectrum of views from "Hubbertian" to "cornucopian."[9] The Hubbertian school arises from the peak oil theories of M. King Hubbert and is predicated on oil (and natural gas) being finite, with production following a bell-shaped curve, peaking when 50 % of reserves have been extracted. Implicit is the idea that *reserves*[10] are not significantly smaller than *resources*,[11] since exploitation technology is continually

[8] The focus of this paper is primary energy, as the form in which energy is extracted from the environment and traded across borders. The term *primary energy* refers to hydrocarbon fossil fuels, nuclear fuel, renewable energy and biomass that have been extracted from the earth or the ambient environment, for the energy that they embody, and that have not been subject to energy conversion after extraction, other than refining (where applicable). Primary energy is energy in its basic form, which states must either extract within their own borders or trade in order for their economies and societies to function. It is the form of energy that is relevant to international relations and security.

[9] Terms coined by Kenneth Deffeyes. See: Kenneth S. Deffeyes, *Beyond Oil – The View From Hubbert's Peak* (New York: Hill and Wang, 2005), 10.

[10] *Reserves* are the quantity of a particular fossil fuel that it is feasible and cost-effective to extract.

[11] *Resources* are the estimated total natural occurrence of a particular fossil fuel.

improving throughout the life-span of the fossil fuel and so will not extend significantly the post-peak tail of production.[12]

The cornucopian school is typified by views of optimistic commentators like Peter Odell and Øysten Noreng. Odell posits that plentiful flows of coal, oil and natural gas, plus limitations on energy demand, mean there will be little pressure on energy markets throughout the twenty-first century.[13] Noreng suggests the world is not about to run out of oil, more oil is being found, oil supply costs are falling and improvements in technology and organization are more than offsetting resource depletion.[14]

Similarly, there is little consensus on the link between fossil fuel stocks and modern conflicts. The debate can be characterized as a spectrum of views from the resource conflict school of thought to market-based optimism. The resource conflict school is typified by writers like Michael Klare and Thomas Homer-Dixon. Klare presents a pessimistic view of:

> A world of rising powers and shrinking resources [that] is destined to produce intense competition among an expanding group of energy-consuming nations for control over the planet's remaining reserves of hydrocarbons and other key industrial materials.[15]

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[12] Note that, for a particular fossil fuel, the distinction between *resources* (the larger figure) and *reserves* (the smaller figure) is subtle: *resources* only grow when genuine new finds are made of the fossil fuel in question, whereas the *reserves* figure can vary with the market price of the fossil fuel: an increase in market price makes it viable to extract the tougher, costlier-to-produce portions of the total *resource*. So, when the oil price rises, so do oil *reserves*, since it becomes viable to drill and operate the more expensive wells and extraction processes, even though no new oil *resource* has actually been discovered. Hubbertians simply point out that this ability of a rising price to elicit ever-growing quantities of new (or newly-viable) fossil fuel is limited by the finite nature of the total oil *resource*.

[13] Peter R. Odell, *Why Carbon Fuels will Dominate the 21st Century's Global Energy Economy* (Brentwood: Multi-Science Publishing, 2004), xi-xxii.

[14] Øysten Noreng, *Crude Power: Politics and the Oil Market* (New York: I.B. Tauris, 2002).

[15] Michael T. Klare, *Rising Powers, Shrinking Planet – The New Geopolitics of Energy* (New York: Metropolitan Books, 2008), 8.

Homer-Dixon draws links between scarce resources (including energy) and conflict.[16] Allied with these views is the link inferred by various writers between energy scarcity and a "New Great Game" in Central Asia.[17] The market-based optimism view is typified by the Energy and Environment Programme of the Royal Institute for International Affairs, which concluded (albeit in 1996) that the worldwide energy market was characterized by a "new geopolitics" of market-oriented development.[18]

More difficult to place on the spectrum of views on energy and conflict is the utopian school of thought, typified by Ernst Frankel. In his book *A World Beyond Petroleum*, Frankel outlines a potential future in which traditional fossil fuels are sidelined in favour of abundant non-conventional fossil fuels[19] and renewable energy, circumventing the geopolitical challenges and security risks associated with traditional fossil fuels.[20]

With such a broad range of views, it is necessary to examine these schools of thought, distil the compelling arguments and synthesize a reasonable view on energy scarcity and conflict.

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[16] Thomas Homer-Dixon, *Environment, Scarcity and Violence* (Princeton: Princeton University Press, 1999).

[17] Lutz Kleveman, *The New Great Game – Blood and Oil in Central Asia* (New York: Atlantic Monthly Press, 2003).

[18] John Mitchell, Peter Beck, and Michael Grubb, *The New Geopolitics of Energy* (London: Royal Institute of International Affairs, 1996), xv-xvii.

[19] Bitumen, tar sands and oil shales.

[20] Ernst G. Frankel, *Oil and Security – A World Beyond Petroleum* (Dordrecht: Springer Verlag, 2007).

HUBBERTIANS AND CORNUCOPIANS

The Hubbertian School – M. King Hubbert and Kenneth S. Deffeyes

Kenneth Deffeyes[21] has coined the terms "cornucopians" (for those who posit that human ingenuity and the market will delay the oil peak for twenty years or so) and "Hubbertians" (for those in his own school of thought, who support the ideas of M. King Hubbert).[22]

Central to the Hubbertian school is Hubbert's "Techniques of Prediction as Applied to the Production of Oil and Gas", commonly known as peak oil theory.[23] Hubbert's derivation is mathematically complex but it generates a symmetrical "logistic curve" plot of the predicted oil production rate in a particular oil field, against time.[24] The area under the curve represents total production for the oil field. The symmetrical curve gives rise to the common re-statement of Hubbert's peak oil theory as the idea that oil production will start to decline when 50% of the ultimate total production has been produced. In fact, this symmetrical "logistic curve" is not unique to Hubbert and oil: it is commonly used to model growth functions in nature. Hubbert simply justified the

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[21] A former colleague of M. King Hubbert and fellow petroleum geologist.

[22] Deffeyes, *Beyond Oil* …, 10.

[23] M. King Hubbert, "Techniques of Prediction as Applied to the Production of Oil and Gas," in *Oil and Gas Supply Modelling*, Special Publication 63, edited by S. I. Gass, 16-141 (Washington, D. C.: National Bureau of Standards, 1982); cited in Deffeyes, *Beyond Oil* …, 35-51.

[24] Deffeyes provides a simplified re-working of Hubbert's method, by plotting the ratio P/Q (where P is the oil production in any given region in any given year and Q is the cumulative oil production for the region), for each year for which data are available, against the value Q (the cumulative production up to and including that year), as an x-y plot on linear axes. A straight line is then fitted through the plotted data to estimate the total quantity of oil, Q_t, that will be produced in the life of the region being studied. With Q_t thus estimated, the equation of the fitted line (in the form $P = f(Q, Q_t)$) is transformed into an equation of the form $Q = f(\text{time})$, which gives a symmetrical bell curve of annual production (Q) on the y-axis, against time on the x-axis, on linear axes. This bell curve is of the common form known as a "logistic curve" and exhibits a peak at 50% total production. See Deffeyes, *Beyond Oil* …, 35-51.

application of this curve to the growth and decline of oil production in a given region, and fitted it to historical data for United States (US) oil production. [25]

Although Hubbert's theory is controversial, some of the criticism is based on inadequate understanding. For example, Homer-Dixon suggests that Hubbert's model requires the input of an initial estimate of the future rate of production and the final total production.[26] This is incorrect: Hubbert's method itself produces these estimates. It is more valid to criticize Hubbert's theory on the basis that it relies on fitting a straight line to limited early production data,[27] despite the fact that the fitted line must ignore many early data points to get a usable result. Indeed, the crux of peak oil theory is that it simply relies on fitting a commonly-used logistic curve to historical data, to extrapolate future production. The method relies on correlation between time and historical production data, rather than demonstrating a causal link, and has been supported retrospectively on the basis of a reasonable fit between Hubbert's predictions and subsequent data for the US oil industry.

Indeed, even Deffeyes is weak in his causal justification for peak oil theory, resorting to the lazy analogy that the ease of catching fish depends on how many fish remain in the pond.[28]

Notwithstanding the controversy over peak oil theory, the method leads to specific estimates of world oil reserves. Hubbert estimated in 1969 that the world's total oil

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[25] Deffeyes, *Beyond Oil* …, 35-42.

[26] Homer-Dixon, *The Upside of Down* …, 85-89.

[27] A P/Q-against-Q scatter plot.

[28] Deffeyes, *Beyond Oil* …, 35-42.

resources were 2.1 trillion barrels and that oil production would peak in the year 2000. Deffeyes' own estimate is that world oil resources are 2.013 trillion barrels, with production peaking in 2005. Deffeyes claims that "half a dozen [other] petroleum geologists" have reached similar conclusions.[29]

Deffeyes cites a range of other evidence in support of peak oil theory. Firstly, Hubbert's analysis appears to have predicted the real peak in US oil production.[30] Secondly, the 2003 peak in Saudi oil production was consistent with Deffeyes' view that, by that time, there was no significant under-utilized oil production capacity anywhere in the world.[31] Thirdly, Deffeyes states that, despite increases in oil prices, and a lack of spare refinery and tanker capacity, there has been a recent lack of investment by oil companies, indicating that oil companies see no value in increasing capacity now that world oil production is peaking.[32] In response to the "cornucopian" argument that "Hubbertians" ignore the role of technology in improving oil extraction (and thereby delaying or avoiding an end to oil), Deffeyes counters that the effects of technology and incentives to maximize production were present in Hubbert's original data and are accounted for in the peak oil model.[33]

The Association for the Study of Peak Oil and Gas (ASPO) is also prominent in the Hubbertian school. ASPO is a network of scientists who share the view that oil and natural gas are finite resources subject to depletion, that the peak of oil discovery was

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[29] *Ibid.*, xiii, 3-4.

[30] *Ibid.*, 11.

[31] *Ibid.*, 44.

[32] *Ibid.*, xv-xvi.

[33] *Ibid.*, 39.

passed in the 1960s, and the world started consuming more than was being found in 1981, since when the gap between discovery and production has widened. According to ASPO:

> Despite the uncertainties of detail, it is now evident that the world faces the dawn of the Second Half of the Age of Oil, when this critical commodity, which plays such a fundamental part in the modern economy, heads into decline due to natural depletion. A debate rages over the precise date of peak, but rather misses the point, when what matters — and matters greatly — is the vision of the long remorseless decline that comes into sight on the other side of it. The transition to decline threatens to be a time of great international tension. Petroleum Man will be virtually extinct this century, and *homo sapiens* faces a major challenge in adapting to his loss.[34]

Amongst the many analysts who have contributed papers to ASPO, Shafiee and Topal have computed depletion times for oil, coal and natural gas of approximately 35, 107 and 37 years, respectively; suggesting that coal will be the only fossil fuel remaining after 2042.[35] James Leigh has concluded that there are ominous signs of oil depletion, which validate peak oil theory.[36] Meng and Bentley have found the arguments against peak oil theory are either incorrect or should be set in broader context. They assess that conventional oil production will peak in the near term and, despite the contribution of non-conventional oil[37] and oil substitutes, the conventional oil peak will impact the total

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[34] Association for the Study of Peak Oil and Gas, "Welcome to ASPO International," http://www.peakoil.net/ ; Internet; accessed 9 March 09.

[35] S.Shafiee and E. Topal, "When will fossil fuel reserves be diminished?" *Energy Policy* 37, Issue 1 (January 2009): 181-189. Headline figures taken from abstract published at http://www.peakoil.net/publications/when-will-fossil-fuel-reserves-be-diminished ; Internet, accessed 9 March 09.

[36] James Leigh, "Beyond Peak Oil in Post Globalization Civilization Clash," *The Open Geography Journal* 1, no. 10: 15-24. Key conclusions taken from abstract at http://www.peakoil.net/publications/beyond-peak-oil-in-post-globalization-civilization-clash ; Internet, accessed 9 March 09.

[37] Non-conventional oil is oil recovered from deposits other than reservoirs in which oil occurs as pump-able liquid; for example, oil recovered from oil shales and tar sands. Non-conventional natural gas is natural gas that is recovered from sources such as gas-saturated rock layers, fractured shales and gas hydrates.

availability of oil.[38] Mohr and Evans have indentified a range of existing estimates for the peak oil year, from 2004 to 2047, and developed their own model, which compares well with Hubbert's and predicts a peak in conventional oil production between 2010 and 2025.[39] Greene *et al* have concluded that there is a high probability that production of conventional oil outside the Middle East will peak before 2025.[40]

Unsurprisingly, the Organization of Petroleum-Exporting Countries (OPEC) refutes peak oil theory. According to OPEC, the idea of peak oil discourages investment and fosters security concerns. In 2006, OPEC claimed "wide recognition that there are clearly sufficient resources to satisfy future energy needs," calling for increased investment in oil production but failing to support with evidence their denial of peak oil theory.[41]

In December 2005, the US House of Representatives' Committee on Energy and Commerce examined the question of peak oil. The Committee took evidence from a number of experts, including the President of ASPO, who was certain that oil production

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[38] Q. Y. Meng & R. Bentley, "Global oil peaking: Responding to the case for 'abundant supplies of oil,'" *Energy* 33, Issue 8 (August 2008): 1179-1184. Key conclusions taken from abstract at http://www.peakoil.net/publications/global-oil-peaking-responding-to-the-case-for-abundant-supplies-of-oil ; Internet, accessed 9 March 09.

[39] S.H. Mohr and G.M. Evans, "Peak Oil: Testing Hubbert's Curve via Theoretical Modelling," *Natural Resources Research* 17, no. 1 (March 2008): 1-11; http://www.springerlink.com/content/d131872k5637wx26/fulltext.pdf ; Internet, accessed 9 March 09.

[40] David L. Greene, Janet L. Hopson and Jia Li, "Have we run out of oil yet? Oil peaking analysis from an optimist's perspective," *Energy Policy* 34, Issue 5 (March 2006): 515-531. Key conclusions taken from abstract at http://www.peakoil.net/publications/have-we-run-out-of-oil-yet-oil-peaking-analysis-from-an-optimists-perspective ; Internet, accessed 9 March 09.

[41] Organization of Petroleum-Exporting Countries, "Oil Outlook to 2025," OPEC Review: Energy Economics & Related Issues 30, Issue 4 (December 2006): 203-234; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=23785076&site=ehost-live ; Internet; accessed 20 January 2009.

would peak before 2020.[42] In contrast, Robert Esser, of Cambridge Energy Research Associates (CERA) told the Committee that peak oil was not a helpful concept and that CERA predicted an "undulating plateau" for oil production, in 20 to 40 years, rather than an imminent peak. CERA's findings were: the world was not running out of oil in the near- or medium-term; an increasing share of production was from "non-traditional" sources but the novelty of "non-traditional" sources was temporary; and declared reserves were constrained by outmoded disclosure rules. CERA saw the major risk to oil production arising not from lack of reserves but from above-ground political, contractual and economic factors, and lack of qualified people and oil infrastructure.[43] However, Robert Hirsch, of consultants SAIC, advised the Committee that peak oil was a real issue, and that most regional peaks so far had been sharp, followed by rapid decline. There were a number of oilfields that were not subject to above-ground constraints on production but which had already passed their production peak, including Texas and the North Sea. The economists' theory of higher prices leading to ever-increasing reserves ignored the geological fact of finite oil resources. In Hirsch's view, however, peak oil represented a looming crisis for liquid fuels rather than for primary energy in general, due to the alternatives available for electricity generation.[44]

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[42] Kjell Aleklett, "Peak Oil Theory," (Evidence to the House of Representatives Committee on Energy and Commerce) *FDCH Congressional Testimony* 7 December 2005: http://search.ebscohost.com/login.aspx?direct=true&db=mth&AN=32Y3188731449&site=ehost-live ; Internet; accessed 20 January 2009.

[43] Robert Esser, "Peak Oil Theory," (Evidence to the House of Representatives Committee on Energy and Commerce) *FDCH Congressional Testimony* 7 December 2005: http://search.ebscohost.com/login.aspx?direct=true&db=mth&AN=32Y3835493131&site=ehost-live ; Internet; accessed 20 January 2009.

[44] Robert L. Hirsch, "Peak Oil Theory," (Evidence to the House of Representatives Committee on Energy and Commerce) *FDCH Congressional Testimony* 7 December 2005: http://search.ebscohost.com/login.aspx?direct=true&db=mth&AN=32Y3278193085&site=ehost-live ; Internet; accessed 20 January 2009.

Clearly, the views of the Hubbertian peak oil school are hotly contested and it is necessary to consider the opposing, cornucopian view.

The Cornucopian School

The cornucopian school is typified by optimistic views on the abundance of conventional oil and natural gas, and the ability of non-conventional oil and natural gas to make up any shortfalls as supplies of conventional fossil fuels taper off. Some cornucopians see non-conventional fossil fuels providing extended relief over the transition period to renewable energy; others favour theories that fossil fuels are effectively infinite.

In his book *Crude Power: Politics and the Oil Market*, Øysten Noreng concludes that the world is not about to run out of oil, more oil is being found and oil supply costs are falling; improvements in technology and organization are more than offsetting resource depletion. Noreng's view is that oil supplies appear practically inexhaustible due to new discoveries and technological progress. So far, oil crises have been caused by politics rather than scarcity and the end of oil has not materialized. Current proven oil reserves are greater than at any time in the past, in absolute terms and in relation to annual consumption, and non-OPEC oil discoveries have been consistently under-estimated, whilst ultimate OPEC oil reserves are unknown because of limited exploration since the 1970s. Noreng concludes that the geographic distribution of oil is a more important factor than oil being finite or otherwise.[45]

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[45] Noreng, *Crude Power* …, 1-21, 42, 103-116, 152-158.

Peter Odell, in his book *Why Carbon Fuels will Dominate the 21st Century's Global Energy Economy*, argues that, for the majority of the twenty-first century, energy demand will be so constrained that there will be little or no pressure on relatively plentiful flows of coal, oil and natural gas, and that the shared interests of parties in the energy market will ensure continuity of supply, albeit with temporary disturbances due to occasional economic and political difficulties (as in the twentieth century). Odell considers that recurring fears over scarcity of non-renewable energy have all proved groundless and are misplaced, mainly due to recent trends in energy use: since 1973, the rate of increase in global energy consumption has fallen back to below the 1860-1945 long-term trend of 2.2% per year, with no likelihood of a return to a higher rate.[46]

Odell believes that conventional oil reserves will continue to appreciate in volume, due to reappraisals, exploration and improving recovery rates. In only one year (1997) since 1979, have exploration and development activities not led to full replenishment of the stock of reserves.[47] Moreover, from 2000 to 2003, 76 billion barrels of oil were produced but proven reserves increased by a *net* 60 billion barrels.[48]

Odell categorizes as "flat earthers" those who deny the continuing appreciation of reserves due to technological development and exploration.[49] He contradicts Deffeyes' views on the coincidence of high prices, lack of spare refinery and tanker capacity, and lack of investment by the oil companies.[50] Odell also contradicts Deffeyes on the effects

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[46] Odell, *Why Carbon Fuels will Dominate* …, i-xxii, 1-9.

[47] *I.e.* increasing declared reserves by an amount sufficient to offset extraction.

[48] *Ibid*., 35-49, 124-125.

[49] *Ibid*., 35-49.

[50] Deffeyes, *Beyond Oil* …, xv-xvi.

of technology and market incentives to maximize oil production, which Deffeyes maintains were present in Hubbert's original data and peak oil model.[51]

Odell sees non-conventional oil as a major constituent of ultimate oil reserves. But, in Odell's view, natural gas will be the prime energy source for the twenty-first century, due to: geopolitical factors (the distribution of deposits outside the Middle East); environmental reasons (natural gas releases less carbon dioxide per unit of energy than coal or oil); and rapid growth in proven reserves (which tripled from 1975 to 2000). However, he acknowledges that increasing availability of hydrocarbons to the end of the twenty-first century will depend on the exploitation of non-conventional natural gas.[52]

Odell's overall prognosis is that the amount of energy that will have to be provided from non-carbon sources in the twenty-first century will be insignificant.[53] There will be little or no pressure on supply for at least the next 20 years and no reason for oil, natural gas or coal prices to rise in real terms until the mid-twenty-first century. Post-2060, however, energy prices will increase significantly to maintain production (mainly of natural gas) as technology reaches its limit.[54] In forecasting this, Odell at least accepts some limits to improvements in energy extraction technology.

Odell's parting shot is to support disputed theories on oil and natural gas as renewable resources, based on the abiogenic theory of inorganic origins of hydrocarbons, and repleting oil and natural gas fields.[55] Again, this is in conflict with Deffeyes (the

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[51] *Ibid*., 39.

[52] Odell, *Why Carbon Fuels will Dominate* …, 23-27, 50-51, 71-89, 124-125.

[53] *Ibid*., 71-79.

[54] *Ibid*., 104.

geologist), who sees no evidence to support such theories.[56] In 2006, Glasby reviewed the two theories of abiogenic formation of hydrocarbons[57] and concluded that neither was valid and both had been overtaken by improved understanding of the formation of hydrocarbons.[58]

ENERGY SCARCITY AND CONFLICT

In parallel with controversy of energy scarcity, there is debate over the propensity of energy scarcity to lead to conflict. This debate is polarized between those who see scarcity as a catalyst for conflict and those who see the market operating to ration energy and avoid conflict. And there are utopians who foresee a world in which hydrocarbon fuels are no longer significant.

The Resource Conflict School

In his book *Environment, Scarcity and Violence*, Thomas Homer-Dixon analyses environmental scarcity and the unequal distribution of resources.[59] Homer-Dixon reviews the basic Malthusian idea that scarcity tends to grow with population, due to diminishing returns to labour. For a more modern context, neo-Malthusians hypothesize that population growth diverts capital from savings and investment to current

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[55] *Ibid*., 113-122.

[56] Deffeyes, *Beyond Oil* …, 62-63.

[57] The Russian-Ukrainian theory and Thomas Gold's theory.

[58] Geoffrey P. Glasby, "Abiogenic Origin of Hydrocarbons: An Historical Overview," *Resource Geology* 56, no. 1 (2006): 85-98.

[59] Homer-Dixon, *Environment, Scarcity and Violence* …, 8-15.

consumption (impacting productivity) or causes social change that may reduce efficiency of production. However, these theories have not been validated by experience, due to improvements in technology, which have overcome apparent resource barriers. In Homer-Dixon's view, the over-reaction to apparent energy crises in the 1970s and 1980s, and the lack of long-term repercussions, shows the weakness of Malthusian theory. Instead, institutions, policies and technologies have a positive effect on resource availability and a limiting effect on demand, thereby limiting or avoiding scarcity. Optimists argue that material scarcities reduce ultimately to energy scarcities, since – given sufficient energy – all basic resources can be extracted from the earth. Indeed, optimists argue that human ingenuity may one day develop a limitless source of energy, finally confounding Malthusian theorists. Homer-Dixon's view is that finite resource limits and other social and environmental factors may constrain the availability of resources and so Malthusian scarcity may occur if ingenuity or adaptation is lacking, especially in the case of the energy scarcity.[60]

Homer-Dixon proposes three types of violent conflict that may arise from scarcity: simple-scarcity conflicts, group-identity conflicts and insurgencies. Simple-scarcity conflicts are "the interstate resource wars [that] we intuitively expect when states rationally calculate their interests in a situation where there is a fixed or shrinking pie of natural resources". Scarcity wars fit into the rationalist school of international relations.[61]

What Homer-Dixon brings to this discussion is a model for the link between scarcity and conflict. He gives us a basic model of scarcity – arising either from the finite

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[60] *Ibid*., 29-38, 114-124.

[61] *Ibid*., 136-141.

nature of a non-renewable resource, or the Malthusian effect of diminishing returns to labour or capital expended in extracting that resource, or the neo-Malthusian effect of failure of ingenuity or adaptation in securing or using a resource – and the potential for resulting conflict.

Thomas Homer-Dixon is Hubbertian in his views on oil, which he thinks is in transition from abundance to scarcity. In his book *The Upside of Down – Catastrophe, Creativity and the Renewal of Civilization*, he links the progress of civilizations to the concept of Energy Return on Investment (EROI). The net energy return from extracting primary energy is the gross energy obtained minus the energy expended to do so, hence an EROI ratio arises. Homer-Dixon hypothesizes that societies are forced, over time, to accept decreasing EROI.[62] He links this with the rise and fall of civilizations:

> All our [Western] societies require enormous flows of high-quality energy just to sustain, let alone raise, their complexity and order … Without constant inputs of high-quality energy, complex societies aren't resilient to external shock. In fact, they almost certainly can't endure. These ever-present dangers drive societies to relentlessly search for energy sources with the highest possible return on investment (EROI). They also drive societies to aggressively control and organize the territories that supply their energy and to extend their interests, engagements, and often their political and economic domination far beyond their current borders – as we see today with American involvement in Iraq and the Persian Gulf. After a certain point in time, … a society's return on its investments to produce energy – its EROI – starts to decline. … Today humankind is facing the same trend with many of its vital energy sources, like conventional oil, natural gas, and hydropower. … Now, as we're drilling deeper and going farther abroad for our oil and gas, and as we're turning to alternatives like tar sands and nuclear power, we're finding that we are steadily spending increasing amounts of energy to get energy. … If we can't sustain these flows [of high-quality energy], our societies … will unravel.[63]

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[62] Homer-Dixon, *The Upside of Down* …, 51-53.

[63] *Ibid*., 54-55.

Homer-Dixon identifies energy as our "master resource," which sustains the order and complexity of modern society, and warns of the "foreshocks of the inevitable transition from oil abundance to oil scarcity."[64]

Homer-Dixon suggests that those who proclaim that oil and mineral resources are effectively inexhaustible base their arguments on the experiences of the 1973-75 and 1979-81 oil shocks, which appeared falsely to signal the end of oil but which were followed by recoveries in production and easing of prices. But these commentators misunderstood the earlier crises, which were geopolitically-generated, rather than being caused by genuine scarcity. Although geopolitics will continue to play a role, future oil shocks will arise from genuine scarcity. Homer-Dixon assesses that oil discovery peaked in the 1960s and – on the balance of evidence – the world is nearing its peak output of conventional oil. What remains to be extracted is tough oil and unconventional oil, with low EROI. This trend is worldwide: Homer-Dixon believes the largest conventional oil deposits have already been found, even in Central Asia and the Arctic. He cautions that this global uncertainty cannot fully be overcome by enhanced oil recovery techniques or non-conventional oil because of their low EROI. In particular, extraction of oil from tar sands is vulnerable to the price and availability of natural gas, which is necessary for the extraction process but is intrinsically scarce and valuable as primary energy in its own right.[65]

Homer-Dixon sees no strong prospect for alternative forms of primary energy to relieve the problems of scarce and uncertain oil: natural gas is seriously depleted in its

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[64] *Ibid*., 80-83.

[65] Homer-Dixon, *The Upside of Down* …, 81-94.

conventional form, expensive to extract (low EROI) from unconventional sources, and expensive and hazardous to store and transport; and coal is abundant but damaging to extract and polluting in use. In Homer-Dixon's view, the development of ethanol bio-fuel is futile due to an EROI less than one[66] and the scarcity of agricultural land. Solar power offers insufficient power density[67] to supply cities and industries, nuclear power involves problems of waste and security, and hydrogen-based energy is a false hope.[68] Homer-Dixon's prognosis is that the world's appetite for energy is enormous and growing, we are highly dependent on oil, and oil will become scarcer and more expensive. This will escalate international tensions as actors vie for control of oil supplies and rising energy costs impact economies. The world faces the challenge of a critical transition in energy (from abundance to scarcity, low EROI to high EROI) whilst facing a continuing imperative for economic growth.[69]

Homer-Dixon warns that the shift from high-EROI to low-EROI energy threatens America's dominance and will encourage the US to use all means (including force) to secure access to energy, bringing the US into confrontation with India and China, which similarly have insufficient domestic primary energy. According to Homer-Dixon, the likely result is widespread conflict over energy resources.[70]

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[66] *I.e.* it is a net energy-consuming process.

[67] In this context, *power density* is the electrical power generated per unit area of solar generating plant: the energy incident upon one square metre of the Earth's surface is about 250 watts; solar generation will convert some small percentage of this into electrical energy but the electrical consumption of an urban or industrial area is considerably higher than 250 watts per square metre.

[68] Hydrogen is *secondary* energy: it requires an energy input to extract hydrogen from water (at EROI<1); hydrogen cannot be extracted directly from the earth or atmosphere as primary energy.

[69] Homer-Dixon, *The Upside of Down* …, 94-100, 198-203, 214-215, 251.

[70] *Ibid*., 263-264.

Michael Klare is similarly pessimistic. In his book *Rising Powers, Shrinking Planet – The New Geopolitics of Energy*,[71] Klare perceives the emergence of a "new international energy order", in which Russia acts as the "imperious power broker of Eurasian energy supplies", the US is "distressingly dependent" on foreign oil, and China and India, as the world's fastest-growing economies, challenge older powers in the global hunt for energy. Klare's prognosis is bleak:

> The prospects are worrying. A world of rising powers and shrinking resources is destined to produce intense competition among an expanding group of energy-consuming nations for control over the planet's remaining reserves of hydrocarbons and other key industrial materials. To enhance their competitive stances vis-à-vis one another, energy-deficient countries may forge strategic partnerships with friendly energy-rich states, often cementing these arrangements with massive arms transfers, new or revived military alliances, and troop deployments to unstable energy-producing regions. Such moves, which are already visible on the political landscape, are a recipe for all sorts of conflicts, any of which might someday spin out of control.[72]

Klare sees a world in which "easy oil" runs out – giving way to "tough oil" – and coal, natural gas and uranium are also becoming scarce. International rank will depend on whether a nation is in energy surplus or deficit, and "petro-superpowers" will wield disproportionate power as a result of their energy reserves, overshadowing military power. Klare predicts that the international balance of power will be affected by: the efforts of Japan and China to secure energy for their economies; the increased leverage of energy-rich states like Kazakhstan, Nigeria and Venezuela; energy states' use of energy power to gain concessions and patronage, and to avoid censure; resource nationalism; energy hysteria; American unease over access to the oil required for its military; and

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[71] Klare, *Rising Powers, Shrinking Planet …*,

[72] *Ibid*., 8.

unrealistic hopes for achieving energy independence by disengaging from the world economy.[73]

Klare's views are rooted in the belief that remaining oil reserves are largely "tough oil" and that there are similar looming problems for natural gas and uranium. Klare argues that oil production will have to rise by 42%, natural gas by 65% and coal by 74% to satisfy world energy requirements in 2030, despite likely (small) increases in renewable energy. This presents a problem because nearly 50% of the world's current oil comes from finds over 25 years old, undue reliance is placed on Saudi Arabian reserves, oil exploration is getting more expensive and yielding less, and the net energy yield is low from non-conventional oil sources (tar sands and oil shales). Klare predicts severe oil shortages from 2012, unless a global economic depression lowers demand.[74]

Klare acknowledges the attractions of natural gas as an alternative to oil but highlights various difficulties. Gas is harder to transport than oil, requiring either pipelines or Liquefied Natural Gas infrastructure. New gas discoveries peaked in the early 1980s, peak extraction has been predicted for 2019, and it has been estimated that current gas reserves represent only 40-64 years of supply (at current and projected consumption rates). Moreover, the world's major remaining gas reserves[75] are vulnerable to political upheaval, supplier restraints and inadequate connectivity.[76]

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[73] *Ibid.*, 9-31.

[74] *Ibid.*, 32-43.

[75] In Iran, Qatar, Russia, Algeria, Kazakhstan, Nigeria, Saudi Arabia, Turkmenistan, UAE, US and Venezuela.

[76] *Ibid.*, 44-49.

Klare sees no brighter prospect for coal, with world coal production expected to plateau around 2025-2030. Nor does he see a long term future for nuclear power, with uranium reserves likely to be exhausted in 40 years.[77]

On the demand side, Klare sees China, India, Brazil, Indonesia, Malaysia, South Korea and Turkey vying for control of key resources, and picks out three regions where the risk of energy confrontation is acute: the Caspian basin and Central Asia, Africa, and the Persian Gulf.[78]

The "New Great Game" in the Relationship between Energy Scarcity and Conflict

Complementing Klare's theme of confrontation in the Caspian basin and Central Asia, the "New Great Game" is a term frequently used in recent writing about Central Asia, referring to the modern geopolitics of the region and drawing parallels with the Great Game of the late nineteenth and early twentieth century, when Russia and the British Empire vied for dominance in Central Asia. The New Great Game is supposedly one of rivalry for power and profit in Central Asia and the Caucasus, driven by oil and natural gas. This is a conception of the relationship between energy scarcity and conflict that is subtly different from the resource conflict school in that it is regionally-focused and involves commercial as much as political rivalry.

In his book, *The New Great Game – Blood and Oil in Central Asia*, Kleveman identifies the importance to the US of the Caspian basin as a source of oil outside the Middle East. But the geopolitics of the region are complicated by: the role of Russia in

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[77] *Ibid*., 49-55.

[78] *Ibid*., 56-87, 115-145.

the former-Soviet states; the unresolved division of the Caspian seabed between the five littoral states;[79] Azerbaijan's role in Turkey's access to the Caspian Sea and Central Asia; the various oil and natural gas pipelines that criss-cross the region; border disputes and ethic conflicts in Nagorno-Karabakh, Chechnya and Georgia's Pankisi Gorge; and the overlapping energy interests of the US, UK, Iran, China, France and Pakistan.[80]

Kleveman asserts that all Russian interventions in the Caucasus are about oil: Russia attacked Chechnya in 1994 partly to protect the flow of Azeri oil through the Baku-Supsa pipeline, which runs from the Caspian to the Black Sea, crossing Chechnya and the rest of the Caucasus.[81] Moreover, energy dominates the geopolitics of the other regional states. Georgia's only source of power is its position as an energy transit state, crossed by pipelines to the Black Sea and the Mediterranean (via Turkey). Kazakhstan needs access to a deep-water port for the 10 million barrels of crude per day that it could be producing by 2020. Turkmenistan also needs access to export. Iran would like to cooperate with Kazakhstan and Turkmenistan to avoid having to pipe oil from its southern oilfields to users in the north of Iran.[82]

The concept of the New Great Game brings the following to the debate on energy security: the strategic energy importance of the Caucasus, Caspian Sea and Central Asia; the importance of energy transit states; the mutual dependence of importing, exporting

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[79] Russia, Kazakhstan, Turkmenistan, Azerbaijan and Iran.

[80] Kleveman, *The New Great Game – Blood and Oil in Central Asia* …, 5-6, 24-28, 50, 90, 146-148, 101-113, 136, 242-243.

[81] *Ibid*., 50-54.

[82] *Ibid*., 31-37, 74-76, 119-123, 135, 137-140, 166-167.

and transit states; and the interplay of commercial, diplomatic, military, security, ethnic and regional factors in competition for energy and the risk of conflict.

Market-based Optimism

To balance this debate, however, it is necessary to acknowledge that some commentators see no issue with the finite nature (or otherwise) of fossil fuels, or a strong link between energy and conflict. Although it is not a view found in many recent references, some commentators believe that energy security can be assured by the market. The Energy and Environment Programme of the Royal Institute for International Affairs (RIIA) concluded in 1996 that governments had stepped back to allow markets to manage energy investment and trade. This market-based approach was characterized by a "new geopolitics" of creative, market-oriented development, promoting stable cross-border investment, cooperative arrangements to guarantee supplies, stable Russian energy exports to Europe, development of Caspian Sea energy, expansion of natural gas supplies to Asia, development of nuclear power, and international arrangements to tackle climate change.[83] This optimism for market-based solutions is indicative of an era when the RIIA felt able to state that, with the exception of the Middle East, the world had entered a period of wider but less acute geopolitical issues of energy, leading governments to withdraw from the management of energy supply and investment.[84] Although this view may seem outmoded in 2009, it is included here for completeness and to illustrate the rapidity with which perceptions of energy issues have changed in recent years.

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[83] Mitchell, Beck and Grubb, *The New Geopolitics of Energy* …, vx-xvii.

[84] *Ibid*., 177-191.

The Utopian School

The utopian school is founded on the idea that alternative energy can end dependence on fossil fuels. In his book *A World Beyond Petroleum*, Ernst Frankel describes a future less reliant on fossil fuels and therefore less susceptible to the capriciousness of Middle Eastern oil producers, due the combined effects of efficiency measures and alternative energy. In Frankel's opinion, global oil consumption will soon peak but he suggests that oil prices will be restrained by the effects of this peak, a plateau in OPEC's market share, the heavy debts of most OPEC countries and the emergence of new oil suppliers. In Frankel's view, concerns over climate change are constraining demand for fossil fuels, which are being eclipsed by nuclear energy and renewables, and producers may have difficulty selling oil by 2023. He sees the influence of the Middle East declining significantly as cheaper, more accessible oil is found elsewhere, and the US, China and Russia out-produce Saudi Arabia in terms of total primary energy, of which oil is a declining subset.[85]

Frankel's analysis, however, is inconsistent. His argument relies on a tenuous hypothesis: climate change and security concerns driving wholesale movement away from fossil fuels to alternatives, resulting in a fall in oil prices. However, he also sees development of abundant oil reserves outside the Middle East but offers no motivation for the necessary exploration, given that he predicts falling oil prices. Frankel's argument confuses cause and effect in predicting the decline of fossil fuels. Moreover, his assertion on the plentiful nature of oil is poorly supported. Indeed, Frankel's intention only becomes clear in the preamble and finale of his book, in which he offers alternative

[85] Frankel, *Oil and Security – A World Beyond Petroleum* …, xxvi-xxvii.

futures for – respectively – a Saudi Arabia sidelined in 2050 after the world decided to wean itself off Middle Eastern oil after the events of 11 September 2001,[86] and a US enfeebled by energy addiction, partial desertification and religious confrontation.[87]

Utopian views, like Frankel's, are not energy security theses but instead manifestos for alternative energy. They perpetuate wishful myths and lack the analysis of works such as David MacKay's *Sustainable Energy – Without the Hot Air*, which uses engineering science to assess thoroughly the difficulties and limitations of renewable energy.[88] Mackay's study of the limited prospects for British renewable energy highlights the economic, social and environmental constraints that make the utopian school an inadequate hypothesis for the trajectory of global energy security.

A REASONABLE VIEW ON ENERGY SCARCITY AND CONFLICT

There is no definitive answer on how long fossil fuels will last and little common ground between the Hubbertian and cornucopian schools. The Hubbertian school is populated by geologists and founded on intuitive appeal and a commonly-used logistic curve, fitted to historical data and selectively validated. The cornucopian school is populated by economists who either deny Malthusian theory or cite market imperfections as the only possible causes of energy price shocks or scarcity, or rely on non-conventional oil and natural gas, or resort to disputed theories of inorganic origins of hydrocarbons. The utopian school is based on wishful thinking in lieu of engineering science.

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[86] *Ibid*., xv-xvi.

[87] *Ibid*., 153-154.

[88] David J. C. MacKay, *Sustainable Energy – Without the Hot Air* (Cambridge: UIT Cambridge Ltd., 2009); available for download free of charge at www.withouthotair.com ; Internet; accessed 16 April 2009.

Analysts such as Jim DiPeso have evaluated the Hubbertian and cornucopian arguments and only been able to conclude that the world faces daunting energy choices, with implications for energy security, climate change and global development.[89] Even Dr Mark Jaccard – a Canadian energy and environment economist of world standing – does not provide a satisfactory answer. Jaccard seems to overlook that extraction of non-conventional fossil fuels is energy intensive (low EROI, in Homer-Dixon's terms) when he claims that the world has the "technical capacity to produce gaseous and liquid fuels … from any fossil fuel source including unconventional oil and gas, oil sands, orimulsion and coal."[90] Dr Jaccard's recent book – *Sustainable Fossil Fuels* – is cornucopian in assuming limitless gains to resource discoveries and technical adaptation, and its advocacy of non-conventional fossil fuels as a sustainable future.[91] Although he acknowledges that the potential for continual expansion in fossil fuel supply is central to disputes between geologists and economists (*i.e.* Hubbertians and cornucopians), Dr Jaccard plumps for the cornucopian view.[92] It is difficult to dissociate this view from Canadian resource nationalism founded on a world-leading abundance of non-

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[89] Jim DiPeso, "Peak Oil?" *Environmental Quality Management* 15, Issue 1 (Autumn 2005): 111-118; http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=18339052&site=ehost-live ; Internet; accessed 20 January 2009.

[90] Mark Jaccard, "Hybrid Energy-economy Models and Endogenous Technological Change," in *Energy and Environment*, ed. Richard Loulou, Jean-Phillippe, and Georges Zaccour, 81-110 (Boston: Kluwer Academic, 2005), 82; http://www.emrg.sfu.ca/EMRGweb/pubarticles/2005/JaccardinLoulouBook051.pdf ; Internet; accessed 10 April 09.

[91] Jaccard, *Sustainable Fossil Fuels* …

[92] *Ibid*., 154-161.

conventional oil, which is the basis of the Canadian government claim that Canada is an "emerging energy superpower".[93]

However, there are some compelling themes and common ground discernible in the views surveyed in this chapter and it is possible to synthesize a reasonable view on energy scarcity. Firstly, it is clear that, so far, energy crises have been caused by the geographic distribution of oil, political factors and market imperfections rather than scarcity. Secondly, the shared interests of parties involved in the energy market act to promote continuity of supply, albeit with occasional economic and political disturbances. However, imperfect competition, rigidities and inertia hamper the market, resulting in persistently unstable energy prices. Moreover, remaining oil reserves are largely "tough oil" and unconventional oil (low EROI). Although natural gas will be the main energy source for the twenty-first century, natural gas is also likely to become scarce this century. There is also the possibility of a looming scarcity of uranium. Post-2060, therefore, energy prices are likely to increase significantly. This situation will be exacerbated by the geographic distribution of primary energy, with the Caucasus, Caspian Sea and Central Asia having increasing importance. Other increasingly-important geopolitical factors are the role of the energy transit states; the mutual dependence of importing, exporting and transit states; and the interplay of commercial, diplomatic, security and regional factors in competition for energy and risk of conflict. In the extreme, neo-Malthusian energy shortages may occur if adaptation to energy scarcity is

[93] Department of Finance Canada, *Advantage Canada: Building a Strong Economy for Canadians – Summary* (Ottawa: Department of Finance Canada, 2006), n.p.; http://www.fin.gc.ca/ec2006/pdf/ecpame.pdf ; Internet; accessed 24 March 2009.

lacking, which may be due to political factors, market failure, social friction, shortage of capital or constraints on science.

Therefore, it is reasonable to state that energy scarcity – real or perceived, permanent or temporary, global or regional or national, accidental or deliberate – is sufficiently imminent and potentially influential to provoke resource conflict. Energy scarcity is therefore a plausible *casus belli* in the twenty-first century.

CHAPTER 3 – ENERGY, WAR AND POWER

Having established that energy scarcity is a plausible *casus belli*, the next step in analysing the energy security challenge facing the UK is to evaluate the links between energy, war and power. Ostensibly, the links are obvious and long-standing: at the end of First World War, Senator Bérenger, of France's Comité Général du Pétrole, stated that oil was "the blood of [Allied] victory."[94] In the 1920s, US President Calvin Coolidge declared that: "The supremacy of nations may be determined by the possession of available petroleum and its products."[95] However, the links bear closer scrutiny in order to understand the modern nature of energy security.

The links between energy, war and power take many forms: energy in the service of military capability and manoeuvre; energy in support of the elements of national power; energy as an instrument of national power; energy in internal stability; and energy as an object of power in an era of scarcity. This chapter will review these links and identify the dominant features of the modern nexus of energy, war and power.

HISTORICAL LINKS BETWEEN ENERGY, WAR AND POWER

Energy in the Service of Military Capability and Manoeuvre

It was the advent of industrial age warfare from the 1850s onwards that made energy-intensive technologies and modern forms of energy essential to military capabilities and manoeuvre, and therefore also targets for denial. An early example of energy in the service of military capability was the Royal Navy's conversion from coal to

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[94] Daniel Yergin, *The Prize: The Epic Quest for Oil, Money and Power* (New York: Free Press, 1990), 183.

[95] Yergin, *The Prize* …, 218-223.

oil power in the early twentieth century, to attain higher speeds, greater range and simpler operations.[96] A good second example of energy in the service of military capability is the different aviation gasoline available to the Allies and Nazi Germany in World War Two. With Germany reliant on synthetic fuel production, only 87 octane aviation gasoline was available to the Luftwaffe, whereas the UK had access to 100 octane fuel, which conferred tactical advantages in the Battle of Britain.[97]

The importance of modern primary energy for manoeuvre also came to the fore in the First World War and was underlined during World War Two. The First World War was the first major conflict in which mechanical road transport played a notable role in the manoeuvre of military forces: for example, improvised use of motor taxis to deploy reinforcements allowed the French to halt the German advance on Paris in September 1914.[98] In World War Two, Rommel's mobile campaign in North Africa was heavily dependent on fuel, which forced an operational pause in June 1941. After re-supply, Rommel launched an offensive against the British but, in doing so, overextended his supply lines, giving Montgomery (with his own fuel supplies secure) the opportunity to exploit Rommel's poor logistic situation and defeat Axis forces in North Africa by May 1943.[99] This second example illustrates that, whilst access to primary energy is an enabler to military capability and manoeuvre, it is also a source of weakness and a potential target. In fact, the denial of access to energy has an equally long history in warfare, from UK-led denial operations in Romanian oilfields in 1916 to the strategic

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[96] Yergin, *The Prize* …, 151-155.

[97] *Ibid*., 383.

[98] *Ibid*., 168-170.

[99] *Ibid*., 339-343.

targeting of the German synthetic oil industry as part of the Combined Bomber Offensive in World War Two.[100]

Ostensibly, from these examples, the strongest link between energy and war is energy's role in military capability and manoeuvre, and its consequent importance as a target for denial. It would be easy to conclude that the most important implication of energy security for the utility of military force is therefore the need to secure access to sufficient fuel to conduct military operations. However, the relatively small size of modern armed forces and the limited nature of modern conflict mean that this is not necessarily so: modern armed forces are not major users of energy in the context of national economies. By rough estimate, for the UK to deploy and sustain indefinitely a medium- to large-scale war-fighting force would require less than 5% of UK oil refinery output.[101] Thus, although energy is a key factor in military technologies and the capabilities thus generated, and a critical requirement and/or weakness at the tactical, operational and even military-strategic levels of war, the small scale of today's military forces in the context of large, energy-hungry economies like the UK, means that the supply of energy for the conduct of military operations is not a significant grand-strategic issue. There are other aspects of the relationship between energy and war that are of greater significance.

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[100] *Ibid*., 180, 344-350.

[101] See Appendix 1 for justification.

Energy in Support of the Elements of National Power

National power is the ability to influence other state and non-state actors, in line with national strategy, in order to achieve national objectives.[102] Commonly, national power is considered to be founded on diplomatic, military and economic factors, which provide a nation with the potential to act. Energy has a role in support of these elements of national power.

In the diplomatic sphere, in the later part of the "Great Game" of British-Russian rivalry, in the early 1900s, Russia attempted to use energy as a means to extend its strategic influence through Persia and the Gulf to the Indian Ocean, by seeking to build a pipeline from the Baku oilfields to the Persian Gulf, to export kerosene to India.[103] British opposition prevented the construction of the pipeline but this was a clear attempt to use energy to enhance diplomatic influence.

British-Russian rivalry was also a factor in the development of British oil interests in Persia from 1903 onwards. Although access to oil was necessary for the Royal Navy's transition to oil, the decision to develop oil interests specifically in Persia was driven by diplomacy. The British Foreign Office were concerned about Russian expansionism and the security of India, and British policy was that the establishment of naval bases in the Persian Gulf, by any other power, would be regarded as a grave threat to British interests. A strategic decision was therefore made to boost the British presence in the Gulf via a

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[102] John Spanier and Robert L. Wendzel, *Games Nations Play*, 9th ed. (Washington: CQ Press, 1996), 128; quoted in David Jablonsky, "National Power," *Parameters*, 27, no. 1 (Spring 1997): 34-54; http://www.carlisle.army.mil/usawc/parameters/97spring/jablonsk.htm ; Internet; accessed 15 March 09.

[103] Yergin, *The Prize* …, 137. Kerosene was used for lighting at the time.

commercial oil venture in Persia.[104] Energy supported the diplomatic element of national power.

The role of energy in supporting the military element of national power has already been introduced in the context of energy in the service of military capability. Churchill made a statement to Parliament in 1913, on the national interest in oil following the Royal Navy's conversion to oil:

> If we cannot get oil, we cannot get corn, we cannot get cotton and we cannot get a thousand and one commodities necessary for the preservation of the economic energies of Great Britain. … On no one quality, on no one process, on no one country, on no one route and on no one field must we be dependent. Safety and certainty in oil lie in variety and variety alone.[105]

This statement also underlines the role of energy in support of the economic element of national power. To use Homer-Dixon's term, energy is the "master resource" for economies.[106] The recent history of the Soviet Union and the new Russia provide good examples of energy's role in the economic element of national power. Deffeyes draws a link between oil, the Soviet economy and the collapse of the Soviet Union. Up to 1985, the Soviet Union was producing three times more oil than Saudi Arabia and exporting oil to gain hard currency to pay for imports. This ended when Saudi Arabia flooded the market with oil, bringing the price below the level of Soviet production and transportation costs, denying the Soviets market share. This caused a loss of hard currency for the Soviets, who suffered consumer shortages, which – Deffeyes hypothesizes – hastened the

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[104] *Ibid*., 140-141.

[105] Yergin, *The Prize* …, 160.

[106] Homer-Dixon, *The Upside of Down* ..., 80.

collapse of the Soviet Union.[107] In the post-Soviet era, Sergey Sevastyanov has linked Russia's interest in multinational cooperation in the energy sector to the need to develop the economies of the Russian Far East and eastern Siberia.[108]

Overall, therefore, it is indisputable that energy plays a role in supporting the elements of national power: the abundance of energy or easy access to energy supports the diplomatic, military and economic elements of national power (*i.e.* the national *means*) that are fundamental to a nation's potential to act to secure its goals.

Energy as an Instrument of National Power

The tools that a nation may use to achieve its goals are the *instruments* of national power; they are the *ways* by which national power is brought to bear. In many cases, energy is an instrument of national power. In the words of Daniel Yergin:

> "The equation – oil equals power – has already been proven on the battlefields of World War I, and from that conflict emerged a new era in relations between oil companies and nation-states. These relations were, of course, fuelled by the volatile dynamics of supply and demand: who had the oil, who wanted it, and how much it was worth. Yet now more than the economics of the marketplace had to be factored into the equation. If oil was power, it was also a symbol of sovereignty. That inevitably meant a collision between the objectives of oil companies and the interests of nation-states, a clash that was to become a lasting characteristic of international politics."[109]

There are several good examples of the use of primary energy as a coercive instrument of national power. After the Anglo-French invasion of Suez in 1956,

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[107] Deffeyes, *Beyond Oil* …, 11-12.

[108] Sergey Sevastyanov, "The More Assertive and Pragmatic New Energy Policy in Putin's Russia: Security Implications for Northeast Asia," *East Asia: An International Quarterly* 25, Issue 1 (April 2008): 35-55; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=32459483&site=ehost-live ; Internet; accessed 20 January 2009.

[109] Yergin, *The Prize* …, 229.

President Eisenhower considered the use of oil sanctions to punish and pressure the UK and France.[110] Over a decade later, the day after Israel initiated the Six-Day War, Arab oil producers banned oil shipments to the US and UK, and limited shipments to West Germany, precipitating an oil crisis worse than that caused by Suez. Although the ploy ultimately failed,[111] this first use of the Arab oil weapon was a clear example of energy as a coercive instrument.[112]

The Arab oil weapon was deployed more successfully in 1973, when Saudi Arabia led an oil embargo on the US, in retaliation for American support to Israel during the Yom Kippur War. In this case, the embargo was more effective, due to unified action by OPEC and a lack of spare oil production capacity in the US, leading to what was later called the "First Oil Shock."[113]

The utility of energy as a disruptive instrument is exemplified by the fact that, in the Cold War years (especially the late 50s, early 60s), Soviet oil was aggressively marketed in the West, as both a commercial and a political move, to foster western European dependence on Soviet energy, weaken the unity of the North Atlantic Treaty Organization (NATO) and subvert the Western oil position in the Middle East.[114]

More recently, in December 2005, Russia interrupted natural gas shipments to Ukraine as a coercive tactic to force a resolution of a price dispute between the two

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[110] *Ibid*., 479-492.

[111] Due to a combination of diverting non-embargoed oil shipments, the availability of super-tankers to do so, and the availability of US oil production capacity in reserve.

[112] Yergin, *The Prize* …, 554-558.

[113] *Ibid*., 600-632.

[114] *Ibid*., 519.

countries.[115] Margarita Balmaceda has identified Armenia, Ukraine and Hungary as similarly vulnerable to energy coercion by Russia. Lacking connections to European energy networks, these three countries have been Moscow's best coercive levers for limiting the impact of European Union (EU) efforts to bring Caspian and Central Asian oil and natural gas directly into the EU. According to Balmaceda, in 2006 Gazprom[116] used natural gas prices to coerce Armenia to cede control over the construction of a natural gas pipeline from Iran.[117] Russia appears to be using energy coercion at the sub-regional level to maintain its wider, regional potential for energy-based coercion of the EU.

Primary energy is also a powerful mercantile instrument: in Yergin's words, "petroleum remains the motivating force of industrial society and the lifeblood of the civilization that it helped create." But this power has limits. Oil and natural gas exports were the main cash crop of the Soviet Union but the industry was hamstrung by inefficiency, poor organization, poor technology and neglect. The fall of the Shah of Iran, who personified oil power in the 1970s, demonstrated that oil power is more complicated than simply oil revenue. In the 1980s, Germany and the Pacific Rim countries were economically successful despite their lack of oil power. In the 1990s, the Iraqi invasion of Kuwait showed the limits of commercial oil power in the face of an aggressive, militarily powerful neighbour. Instead, the strongest example of the utility of energy as a mercantile instrument of national power is the modern trend for state-owned companies

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[115] David C. Wagman, "Energy-Stick Politics," *Power Engineering* July 2006: 5.

[116] The Russian state-owned natural gas monopoly.

[117] Margarita M. Balmaceda, "Corruption, Intermediary Companies, and Energy Security – Lithuania's Lessons for Central and Eastern Europe," *Problems of Post-Communism* 55, no. 4 (July/August 2008): 16–28.

of the energy exporters to wield power in the market and – to varying degrees – to act as proxies for their governments. State-owned energy companies such as Saudi Aramco, Petroleos de Venezuela, Pomex (Mexico), the Kuwait Petroleum Company, Pertamina (Indonesia) and Statoil (Norway) have considerable market power.[118] Gregory Gleason has characterized Russia's use of state-owned or state-sponsored energy companies as a "neo-mercantilist development strategy," under which Russia uses state-led organizations, state finances and state political leverage to seek regional commercial benefits, which are used to further foreign policy goals. Russia's post-2001 resurgence has been fuelled by rising oil prices and supported by the foreign policy power that Russia derives from European dependence on Russian natural gas.[119]

An extreme use of energy as a political instrument is the overt "petro-politics" played by President Chevez of Venezuela. Although Chavez's threats to cut oil exports to the US have proved empty, they have had an effect by temporarily raising oil prices in reaction.[120]

Energy and Internal Stability and Security

If energy - the "master resource" – is fundamental to a nation's potential to act, it is also important in the stability and viability of the polity. Energy plays a role in

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[118] Yergin, *The Prize* …, 779-780.

[119] Gregory Gleason, "Russia in Central Asia," *Paper presented at the annual meeting of the International Studies Association's 50th Annual Convention "Exploring the Past, Anticipating the Future"*, New York, 15 February 2009; http://www.allacademic.com/meta/p312548_index.html ; Internet; accessed 7 March 09.

[120] Moira Herbst, "Oil Prices: It's Not About the Oil," *Business Week Online* 22 February 2008: 6; http://search.ebscohost.com/login.aspx?direct=true&db=mth&AN=30060982&site=ehost-live ; Internet; accessed 20 January 2009.

nationalism, internal security and the stability of economies and societies but this is a two-way relationship: the impacts of nationalism, internal strife, intra- and inter-state conflict, terrorism and organized crime, and natural disasters all have a bearing on the supply of energy and consequences for the internal stability of the nations involved.

Oil provided a unifying cause for Arab nationalism in the 1950s and 60s, acting as a bargaining chip in achieving Arab sovereignty and giving Arab nations the facility to wage economic warfare against Israel and its supporters.[121] Similarly, when Iranian Prime Minister Mossadegh nationalised the Anglo-Iranian Oil Company in 1951, he was fulfilling an Iranian nationalist mandate.[122]

The world's first example of disruption of energy supplies as a result of internal strife occurred in Baku during the 1905 Russian revolution: oil workers went on strike and there was open rebellion, destruction, looting and ethnic conflict, interrupting the output of oil.[123] In the 1920s, Mexican oil production was repeatedly disrupted by ongoing outbreaks of rebellion, poor governance, excessive regulation and tax hikes, to the extent that – with Mexican oil satisfying 20% of US demand – there was strong sentiment in Washington for military intervention to protect American oil interests in Mexico.[124] More recently, fighting between the Nigerian military and rebel militia, in the

[121] Yergin, *The Prize* …, 509.

[122] *Ibid*., 450-478.

[123] *Ibid*., 130-131.

[124] *Ibid*., 231-232.

oil region of the Niger Delta, helped raise oil prices over $50 per barrel in September 2004.[125]

An example of the effect of strife in the consumer country is provided by the European fuel protests in September 2000. In France, truckers and farmers blockaded oil refineries and storage areas, in protest against diesel prices. Ambulance, bus and taxi drivers joined the protests. Protesters blocked railway tracks, caused regional food and fuel shortages, and inspired similar protests in Belgium and Spain.[126] In the UK, road hauliers and farmers staged "go-slow" protests on arterial roads and blockaded oil refineries. The British protests spread rapidly and initially gained some public support but a lack of fuel prevented deliveries to supermarkets, hospitals and service stations, and there were instances of fuel and food rationing. The British government used emergency powers to get fuel tankers moving and end the protests.[127]

Energy supplies have also been disrupted by inter-state conflict. In 1980s, the Iran-Iraq war spilled over into the Persian Gulf when Iran attacked tankers carrying Iraqi oil from Kuwait, in retaliation for an Iraqi attack on the Kharg Island oil terminal. This "Tanker War" escalated to the extent that, in November 1986, Kuwait sought US

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[125] Stanley Reed and Chris Power, "Why Nigeria Will Rock Oil Markets Again," *Business Week* Issue 3903 (11 October 2004): 71; http://search.ebscohost.com/login.aspx?direct=true&db=mth&AN=14588162&site=ehost-live ; Internet; accessed 20 January 2009.

[126] Barry James, "Fuel Protests Appear Set to Spill Over From France," *International Herald Tribune* 6 September 2000 [on-line]; available from http://www.iht.com/articles/2000/09/06/france.2.t_1.php ; Internet; accessed 17 March 2009.

[127] BBC, "2000: French fuel protests spread to UK," *On This Day – 8 September 2000* ; available from http://news.bbc.co.uk/onthisday/hi/dates/stories/september/8/newsid_2503000/2503119.stm ; Internet; accessed 17 March 2009.

protection for its shipping.[128] The UK initiated its Armilla Patrol to protect British shipping and interests in the Persian Gulf.

In 1990, the Iraqi invasion of Kuwait led to an embargo on Iraq and disruption that removed 4 million barrels per day from the world oil market (cuts on the same scale as 1973 and 1979 "oil shocks"). By November 1990, the US decided to use its Strategic Petroleum Reserve (SPR) to regulate prices (rather than just to avoid shortages) in the event of conflict. When the air campaign against Iraq commenced in January 1991, the oil price increased from $30 to $40 per barrel but rapidly fell back to $20 (the pre-invasion level) due to confidence in the SPR and the post-winter drop in demand.[129]

The potential for disruption of energy supplies as a result of terrorism or organized crime is also clear and has an elevated profile since 11 September 2001. According to Gal Luft, of the Institute for the Analysis of Global Security:

> Since September 11 it has become increasingly apparent that terrorist groups have identified the world energy system as the Achilles heel of the West. Throughout the world jihadist terrorists attack oil and gas installations almost on a daily basis with significant impact on the oil market. [130]

Luft points out that, until recently, the oil market had sufficient flexibility to deal with supply disruptions, which could be offset by spare production capacity within OPEC (mainly Saudi Arabia). However, due to growing Asian demand, this spare capacity has eroded from 7 million barrels per day (mbd) in 2002 (9% of the market) to about 1.5 mbd

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[128] Yergin, *The Prize* …, 765.

[129] *Ibid*., 769-779.

[130] Gal Luft, "Terrorist Threats to Energy Security," (Evidence to the House of Representatives Committee on International Relations Subcommittee on International Terrorism and Non-proliferation) *FDCH Congressional Testimony* 27 July 2005: http://search.ebscohost.com/login.aspx?direct=true&db=mth&AN=32Y1426426203&site=ehost-live ; Internet; accessed 20 January 2009.

today (less than 2% of the market). As a result, the oil market is very sensitive to disruption. Luft warns that targeting pipelines, tankers, refineries and oil fields is easy and effective, and suggests that such attacks have already added a "fear premium" of $10-$15 per barrel on the price of oil.[131]

Chow and Elkind have analysed the disruptive effect of natural disasters on US energy supplies. More than 100 oil and natural gas platforms were destroyed by Hurricanes Katrina and Rita in 2005 and America's only deep-water oil import facility[132] ceased operation for several days. Refineries producing nearly 20% of America's throughput shut down and remained unavailable until mid-October 2005. Flows in feeder and trunk pipelines were also interrupted. American retail gasoline prices rose by 30% in one week and there were gasoline shortages. US Federal officials urged Americans not to engage in panic buying and President Bush asked Americans to reduce their driving.[133]

Energy as an Object of Power in an Era of Scarcity

Having discussed energy in the service of military capability, in support of the elements of national power, as an instrument of national power and in the realm of internal security, it is necessary to complete the survey of energy, war and power by analysing the position of energy as an object of the application of national power in a context of energy scarcity.

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[131] Luft, "Terrorist Threats to Energy Security."

[132] The Louisiana Off-shore Oil Port.

[133] Edward Chow and Jonathan Elkind, "Hurricane Katrina and US Energy Security," *Survival* 47 no. 4 (Winter 2005–06): 145–160.

The diplomatic instrument has been used to secure primary energy since the 1928 Achnacarry conference, when American and British governments encouraged their nations' oilmen to collaborate to conserve profits and control costs in the oil industry.[134] More recent diplomatic efforts to secure oil include the adoption by the Japanese government, in 1973, of resource diplomacy as a formal element of foreign policy, with the aim of guaranteeing access to oil.[135] Similarly, China's need for energy has driven it to seek access to Latin American resources, using a carefully-pitched diplomacy of non-interference in other states' internal affairs, to make Chinese energy firms attractive partners for Latin American states.[136]

The use of the military instrument of power to secure access to energy is exemplified by the strategy of Japan in the 1930s and 1940s. In the 1930s, Japan produced only 7% of its own oil requirements, and imported 80% of its oil from the US and 10% from Dutch East Indies. Despite the fact that oil only accounted for around 7% of Japan's energy consumption at the time, it was strategically important to Japan for military uses and shipping. The Japanese strategy of *Hokushu Nanshin,*[137] which led to war in the Pacific, was an attempt to use the military instrument of national power to secure access to natural resources, especially oil.[138]

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[134] Yergin, *The Prize* …, 261-263.

[135] *Ibid*., 598-599.

[136] Maite Iturre and Carmen Mendes, "Regional Implications of China's New Foreign Policy in Latin America: The Energetic Factor," *Paper presented at the annual meeting of the International Studies Association's 50th Annual Convention "Exploring the Past, Anticipating the Future"*, New York, 15 February 2009; http://www.allacademic.com/meta/p311881_index.html ; Internet; accessed 7 March 09.

[137] Defend in the north, advance to the south.

[138] Yergin, *The Prize* …, 307-327.

In the European theatre in World War Two, the defence of Romanian oil fields and the capture of Caucasian oil fields were driving factors in Hitler's Eastern Front campaign.[139] Hitler's willingness to over-extend his forces on the Eastern Front was partly motivated by the need for oil but led to military defeat, opening the way for Hitler's eventual strategic defeat, which was – in turn – hastened by lack of fuel.

The use of the military instrument in the Suez crisis of 1956 was motivated, to a great extent, by British fears over access to oil, which appeared to be threatened by Egyptian President Nasser's brand of Egyptian nationalism and pan-Arabism. British Prime Minister Eden feared the establishment of a pan-Arab bloc that would deny UK access to Middle Eastern oil but the key issue was the importance of the Suez Canal to British access to oil. Eden warned Khrushchev and Soviet Prime Minister Bulganin, in April 1956: "I must be absolutely blunt about the oil because we would fight for it. … We could not live without oil … we [have] no intention of being strangled to death."[140] The Anglo-French action in Suez in 1956 was therefore an attempt to use the military instrument of national power to secure access to energy.

Subsequently, the 1960s were an era of Anglo-American retreat from the Middle East. The UK's position in the region was weak (due to Suez, its economic decline and withdrawal from empire) and the US was politically-weak due to Vietnam. In January 1968, British Prime Minister Wilson announced the final British withdrawal from defence commitments east of Suez, to be complete by 1971. According to Daniel Yergin, the withdrawal from east of Suez was not driven by the cost of garrisoning these territories

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[139] *Ibid*., 329-339.

[140] *Ibid*., 479-492.

but rather by the growth of Arab nationalism, which made it unwise to maintain a military presence in the Middle East. The UK withdrew from the Persian Gulf in 1971, leaving what Yergin describes as "a power vacuum in the region that supplied 32% of free world's petroleum and held 58% of proven oil reserves," which led the US to turn to the Shah of Iran as their instrument for security in the region.[141] This example serves to illustrate that the military instrument can be blunted by economic, diplomatic and domestic factors, and may necessitate use of alternative means to secure access to oil. These alternative means may be distasteful and ultimately unsuccessful (as in the American use of the doomed Shah of Iran as a proxy in the Gulf region).

The role of economic power in pursuit of scarce energy is exemplified by US policy in the Persian Gulf in the 1930s, where the US government used tax credits and subsidies to secure strategic access to oil by successfully encouraging and supporting US companies to invest in Persian Gulf oil ventures.[142]

DEDUCTIONS ON THE LINKS BETWEEN ENERGY, WAR AND POWER

This chapter has examined the links between energy, war and power, using historical examples. It has been shown that energy is a critical requirement and/or weakness at the tactical, operational and even military-strategic levels of war but the small size of today's armed forces, in the context of large and energy-hungry economies such as the UK, means that the supply of energy specifically for military operations is not

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[141] *Ibid*., 565-566.

[142] Henry Lee and Dan A. Shalmon, "Searching for Oil China's Initiatives in the Middle East," *Environment* 49, Issue 5 (June 2007): 8-21; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=25289568&site=ehost-live; Internet; accessed 21 January 2009.

a grand-strategic issue. Access to primary energy, however, supports the diplomatic, military and economic *elements* of national power that are fundamental to a nation's potential to secure its goals. In an era of energy scarcity, primary energy has increasing utility as an *instrument* of national power and importance as an *object* of the application of the diplomatic, military and economic elements of national power.

To understand the modalities of how access to primary energy may be both an instrument and an object of UK national power – in a general context of energy scarcity and increasingly complex geopolitics of energy – it is necessary next to evaluate the position of the UK in the global energy market, its dependence on energy imports and its key energy import and transit relationships.

CHAPTER 4 – THE UK IN THE GLOBAL PRIMARY ENERGY MARKET

Having concluded that energy is a plausible *casus belli* in the twenty-first century, and reviewed the nexus of energy, war and power, it is necessary to turn to the position of the UK in the global energy market and identify the key energy exporting, importing and transit countries of interest. This chapter will show that the countries of energy interest to the UK are a broad constituency of large primary energy importers (competing for access to scarce energy), major energy suppliers to the UK, globally-dominant energy suppliers (with power to influence prices and supply), major producers of natural gas (the most important form of energy for the UK), the main energy transit countries, and the littoral states of maritime choke points. The UK has limited scope to influence this broad constituency.

THE GLOBAL PRIMARY ENERGY MARKET

Global Total Primary Energy Supply (TPES) was 11 740 million tonnes of oil equivalent (Mtoe) in 2006, of which the main internationally-traded forms were oil, coal and natural gas; see Table 4.1.[143] TPES growth averaged 2.9% per annum over the last 25 years with growth slowest for oil and fastest for natural gas and nuclear energy; see Table 4.2. Organization for Economic Cooperation and Development (OECD) countries still produce 47.1% of world primary energy but the Middle East, China, Asia, Latin America and Africa have increased in energy importance over the last quarter of a century, whilst the former Soviet countries and the non-OECD countries of Europe have declined in importance; see Table 4.3.

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[143] International Energy Agency, *Key World Energy Statistics 2008* (Paris: International Energy Agency, 2008), 6; available from http://www.iea.org/textbase/nppdf/free/2008/key_stats_2008.pdf; Internet; accessed 3 March 2009.

Table 4.1 – Composition of World Total Primary Energy Supply, 2006

Energy Source	Proportion of World Total Primary Energy Supply, 2006
Oil	34.4%
Coal and Peat	26.0%
Natural Gas	20.5%
Combustible Renewables and Waste	10.1%
Nuclear	6.2%
Hydroelectricity	2.2%
Other: geothermal, solar, wind, tide/wave/ocean energy	0.6%

Source: International Energy Agency (IEA), *Key World Energy Statistics 2008*

Table 4.2 – Growth of World Total Primary Energy Supply, 1973 to 2006

Energy Source	Share of World Energy Supply (Mtoe)		Average annual growth, 1973 to 2006	Trends
	1973	2006		
TPES	6115	11 741	2.9%	
Oil	2819	4039	1.6%	Small increases in production share for China and Africa Small decline for the Middle East Middle East remains the dominant oil-producing region (30.6% of world oil in 2007) Former Soviet countries produced 15.8% of world oil in 2007
Coal & Peat	1498	3053	3.1%	Weight of hard coal production shifting from OECD countries and former Soviet Union to China China now produces nearly half of the world's hard coal
Natural Gas	978	2407	4.0%	Middle East, former Soviet countries, Latin America and Africa responsible for most of the increase in production
Nuclear	55	728	11.9%	

Source: calculations based on IEA, *Key World Energy Statistics 2008*[144]

[144] International Energy Agency, *Key World Energy Statistics 2008* …

Table 4.3 – Largest Exporters and Importers of Crude Oil, Natural Gas and Coal, 2006/07

Exporters						Importers					
Largest Exporters of Crude Oil (2006)		**Largest Exporters of Natural Gas (2007)**		**Largest Exporters of Coal (2007)**		**Largest Importers of Crude Oil (2006)**		**Largest Importers of Natural Gas (2007)**		**Largest Importers of Coal (2007)**	
Country	**Million tonnes**	**Country**	**Million cubic metres**	**Country**	**Million tonnes**	**Country**	**Million tonnes**	**Country**	**Million cubic metres**	**Country**	**Million tonnes**
Saudi Arabia	358	Russia	191 892	Australia	244	United States	358	United States	130 300	Japan	182
Russia	248	Canada	106 988	Indonesia	202	Japan	203	Japan	95 627	South Korea	88
Iran	130	Norway	86 136	Russia	100	China	145	Germany	88 355	Taiwan	69
Nigeria	119	Algeria	62 676	Colombia	67	South Korea	120	Italy	73 950	India	54
Norway	109	Netherlands	55 666	South Africa	67	India	111	Ukraine	50 087	UK	50
UAE	106	Turkmenistan	51 064	China	54	Germany	110	France	42 902	China	48
Mexico	99	Qatar	38 329	United States	53	Italy	94	Turkey	35 832	Germany	46
Canada	93	Indonesia	33 554	Canada	30	France	82	Spain	34 474	United States	33
Venezuela	89	Malaysia	32 039	Vietnam	30	Spain	61	South Korea	33 385	Italy	25
Kuwait	88	United States	22 905	Kazakhstan	23	UK	59	UK	30 837	Spain	24

Source: International Energy Agency, *Key World Energy Statistics 2008*[145]

[145] International Energy Agency, *Key World Energy Statistics 2008* …

Using the data from Table 4.3, it is helpful to group the major exporters and importers of crude oil, natural gas and coal into broad categories of dominant, very large and large producers and importers; see Table 4.4. At this stage, it is clear that the UK is a very large importer of primary energy (in the world top ten for oil, natural gas and coal), in a world market that is dominated by Russia and Saudi Arabia (as exporters) and the US and Japan (as importers).

Table 4.4 – Ranking of Major Primary Energy Exporting and Importing Countries

	Exporters	**Importers**
Dominant	1. Russia 2. Saudi Arabia	1. United States 2. Japan
Very Large	1. Canada 2. Norway 3. Australia 4. Indonesia 5. Iran 6. Nigeria 7. UAE 8. Mexico 9. Venezuela 10. Kuwait	1. Germany 2. South Korea 3. China 4. Italy 5. India 6. France 7. UK 8. Spain
Large	1. United States 2. Algeria 3. Netherlands 4. Colombia 5. South Africa 6. Turkmenistan 7. China 8. Qatar 9. Malaysia 10. Vietnam 11. Kazakhstan	1. Taiwan 2. Ukraine 3. Turkey

Source: International Energy Agency, *Key World Energy Statistics 2008*[146]

[146] International Energy Agency, *Key World Energy Statistics 2008* …

THE UK POSITION IN THE WORLD ENERGY MARKET

The UK became a net importer of energy in 2005.[147] Although the UK still exports some oil (see Figure 4.1), these exports are declining and the UK is a substantial oil importer (Figure 4.2), being the ninth largest oil importer in the world in 2006 (importing around 56-59 million tons, or 2.6% of world imports/exports).[148] The UK continues to export substantial amounts of natural gas (Figure 4.3) but imports three times as much as it exports (Figure 4.4). In 2007, the UK was the eighth largest natural gas producer in the world but the tenth largest natural gas importer (at 30 837 million cubic metres, 3.4% of world imports/ exports).[149] The UK now exports a negligible amount of coal, importing fifty times as much as it exports (Figures 4.5 and 4.6), and was the fifth largest coal importer in the world in 2007 (50 million tonnes, 5.5% of world imports/exports).[150] Although data for the global uranium trade are not readily available, the UK nuclear industry operates 2.7% of the world's installed nuclear capacity and is reliant on imported uranium.[151]

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[147] Central Intelligence Agency, "United Kingdom," in *The 2008 World Factbook* (Washington D.C.: Central Intelligence Agency, 2008); available from https://www.cia.gov/library/publications/the-world-factbook/print/uk.html ; Internet; accessed 4 April 2009.

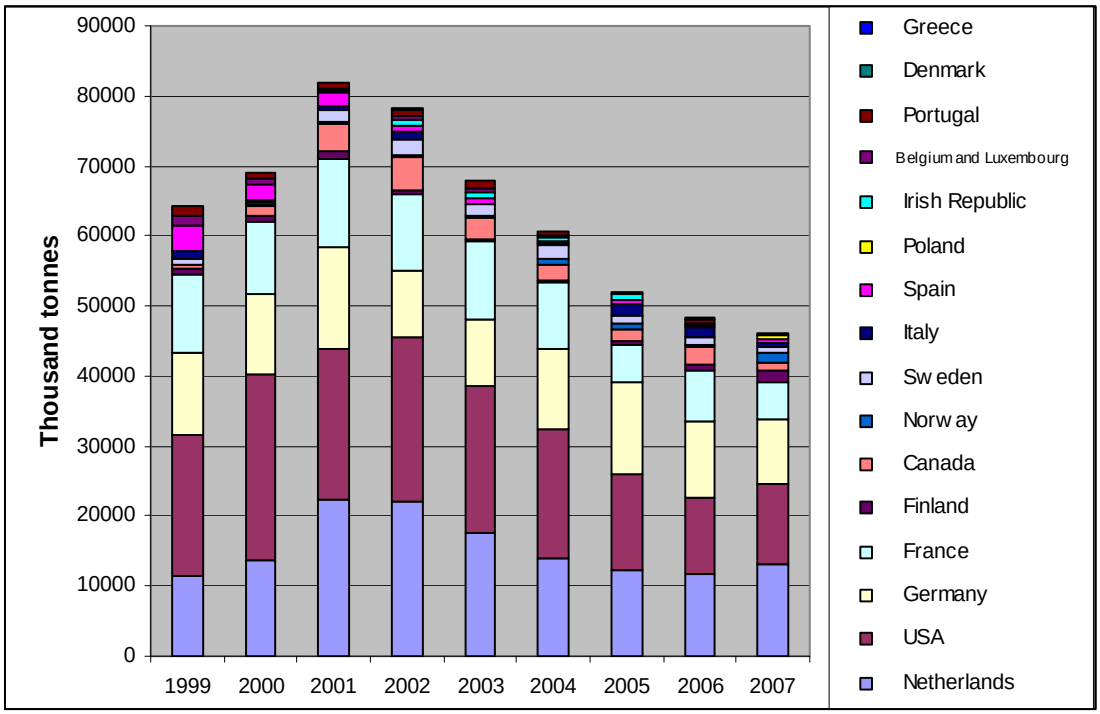
[148] International Energy Agency, *Key World Energy Statistics 2008* …, 21.

[149] *Ibid*., 13.

[150] *Ibid*., 15.

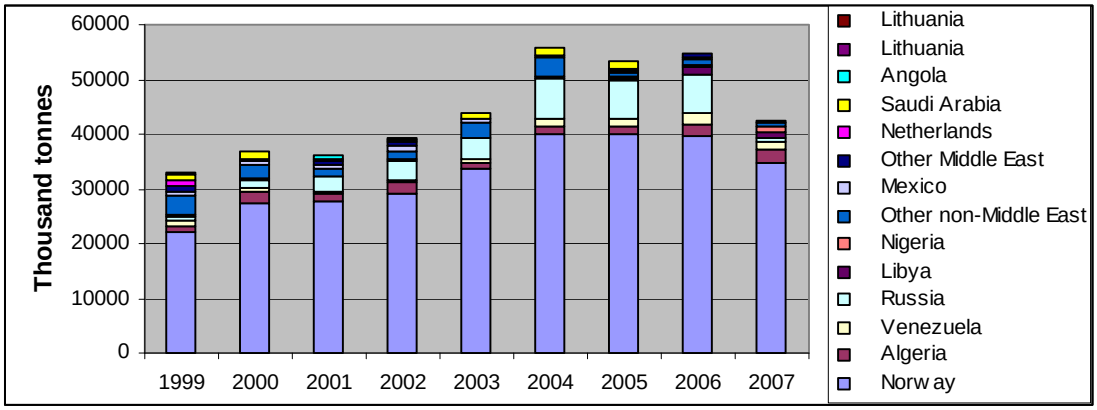
[151] *Ibid*., 17.

Figure 4.1 – Exports of Crude Oil from the UK, by Country, 1999-2007



Source: UK Department for Business Enterprise and Regulatory Reform (BERR), Energy Statistics: *Foreign Trade, Annual Figures: Digest of UK Energy Statistics*

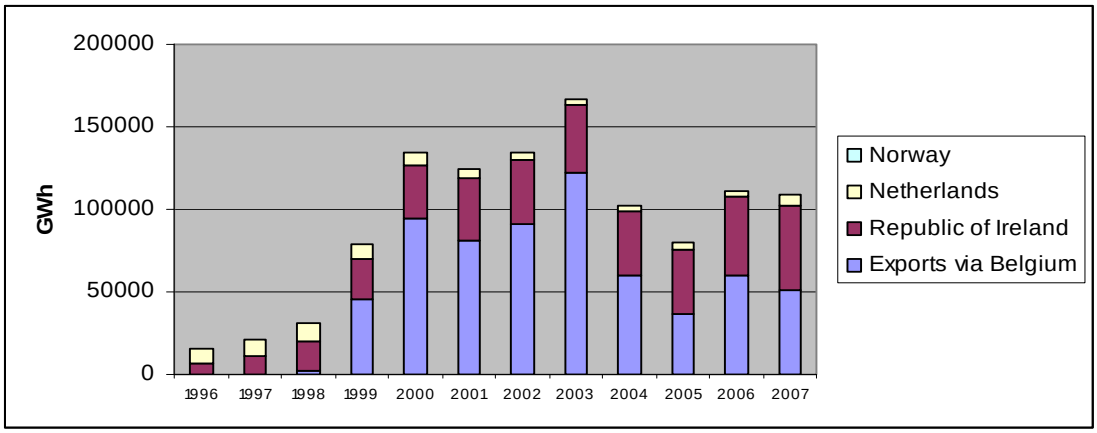
Figure 4.2 – Imports of Crude Oil to the UK, by Country, 1999-2007



Source: UK BERR, Energy Statistics: *Foreign Trade, Annual Figures: Digest of UK Energy Statistics*[152]

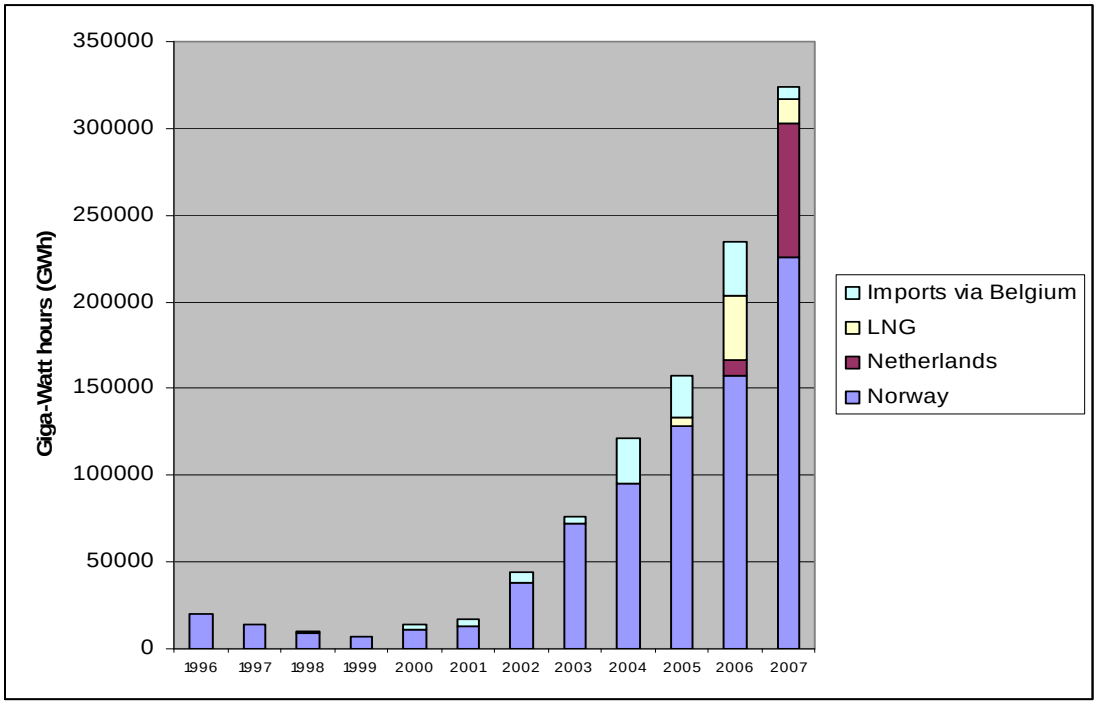
[152] UK Department for Business Enterprise and Regulatory Reform, "Imports and Exports of Crude Oil by Country (DUKES G.4)," in *Annual Figures: Digest of UK Energy Statistics (DUKES)* (London: Department for Business Enterprise and Regulatory Reform, 2008); http://www.berr.gov.uk/energy/statistics/source/trade/page18526.html ; Internet; accessed 4 April 09.

Figure 4.3 – Exports of Natural Gas from the UK, 1999-2007



Source: UK BERR, Energy Statistics: *Foreign Trade, Annual Figures: Digest of UK Energy Statistics*

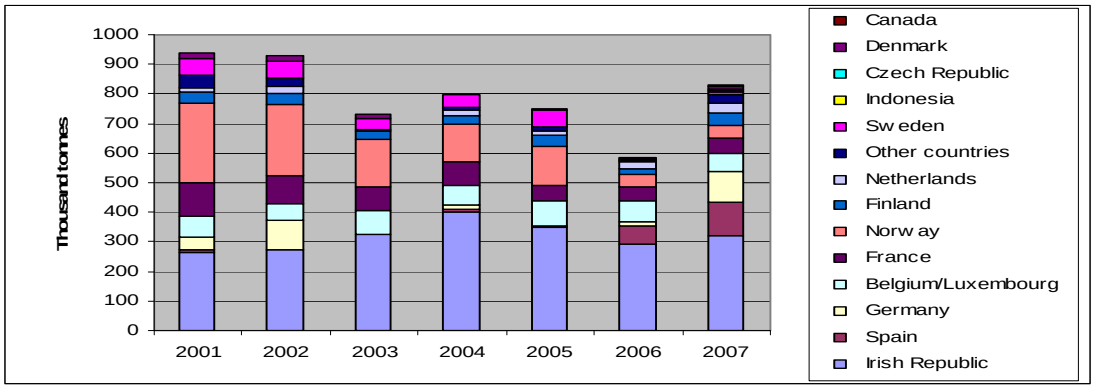
Figure 4.4 – Imports of Natural Gas to the UK, 1999-2007



Source: UK BERR, Energy Statistics: *Foreign Trade, Annual Figures: Digest of UK Energy Statistics*[153]

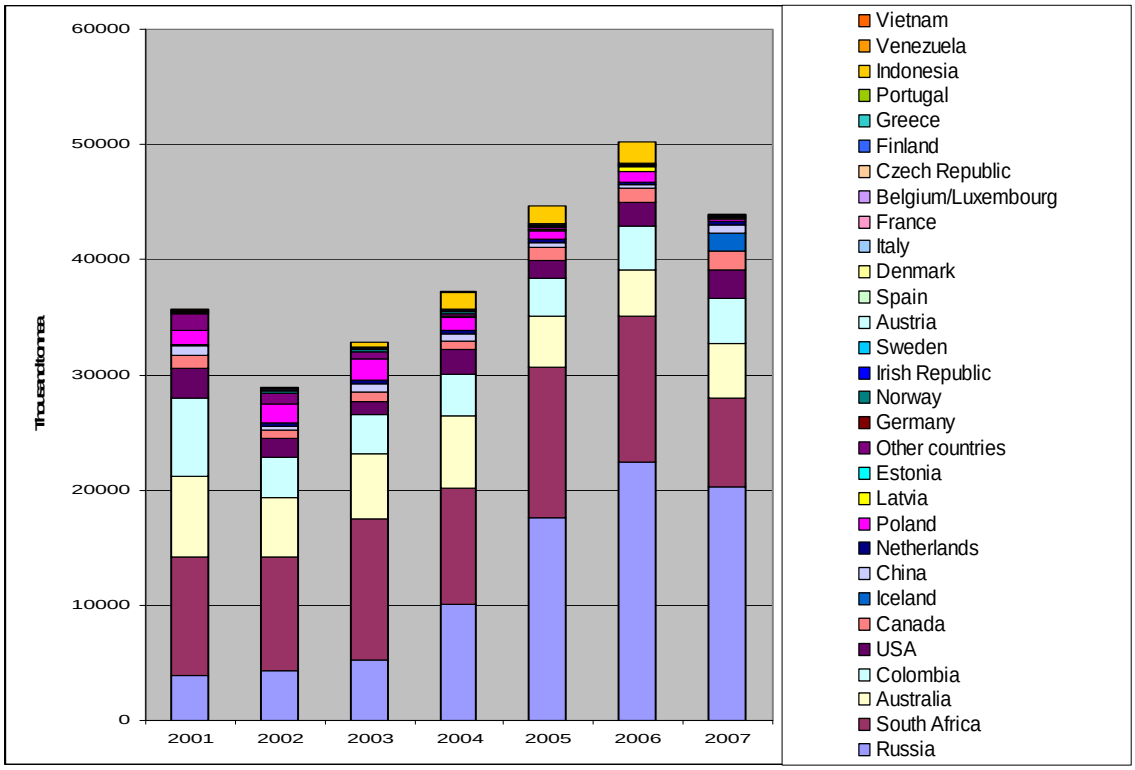
[153] UK Department for Business Enterprise and Regulatory Reform, "Physical imports and Exports of [Natural] Gas, 1997 to 2007 (DUKES G.6)," in *Annual Figures: Digest of UK Energy Statistics (DUKES)* (London: Department for Business Enterprise and Regulatory Reform, 2008); http://www.berr.gov.uk/energy/statistics/source/trade/page18526.html ; Internet; accessed 4 April 09.

Figure 4.5 – Exports of Coal from the UK, by Country, 2001-2007



Source: UK BERR, Energy Statistics: *Foreign Trade, Annual Figures: Digest of UK Energy Statistics*

Figure 4.6 – Imports of Coal to the UK, by Country, 2001-2007



Source: UK BERR, Energy Statistics: *Foreign Trade, Annual Figures: Digest of UK Energy Statistics*[154]

[154] UK Department for Business Enterprise and Regulatory Reform, "Imports and Exports of Solid Fuel (DUKES G.5)," in *Annual Figures: Digest of UK Energy Statistics (DUKES)* (London: Department for Business Enterprise and Regulatory Reform, 2008); http://www.berr.gov.uk/energy/statistics/source/trade/page18526.html ; Internet; accessed 4 April 09.

Key Energy Suppliers, Competitors and Market Giants

To analyse the position of the UK in the global energy market, it is useful to use the above import/export data to identify the energy importing and exporting countries that have significant influence on UK energy security. From Figures 4.1, 4.3 and 4.5, it is clear that the declining magnitude of UK energy exports means that the main customer countries for UK energy do not *per se* merit analysis, other than where a country's importing of UK energy is indicative of an energy thirst that may lead to that country and the UK competing as potential customers for scarce energy. From the data in Table 4.4, it is evident that the US, Japan, Germany, South Korea, China, Italy, India, France, Spain, Taiwan, Ukraine and Turkey are the world's largest energy importers, with the potential to come into competition with the UK to secure access to scarce energy.

From the data in Figures 4.2, 4.4 and 4.6, it is apparent that a number of countries are relevant to UK energy security because of their prominence in supplying primary energy to the UK in recent years. These countries are Norway, Russia, Algeria, South Africa, Australia, Colombia, USA, Australia and Canada.

This leaves three further categories to consider: the energy-producing countries with sufficient market share to influence energy supplies or prices, to the detriment of the UK; the countries that will rise in importance as the UK energy mix changes over time; and the countries through which energy is transported (the transit countries). The countries in the first of these categories (the dominant suppliers) can be drawn from Table 4.4: Russia, Saudi Arabia, Canada, Norway, Australia, Indonesia, Iran, Nigeria, UAE, Mexico, Venezuela and Kuwait.

The Changing UK Energy Mix: The Growing Importance of Natural Gas

The next step identifying countries of energy relevance to the UK is to cross-check the list with emerging trends in the UK energy mix. Figure 4.7 (overleaf) illustrates the changing UK primary energy mix from 1970 to 2020. The UK has become much more reliant on natural gas in recent years and this increased requirement has been met – at a time of decreasing UK natural gas output – by increasing imports from Norway, Belgium and the Netherlands, and by Liquefied Natural Gas (LNG) imports; see Figure 4.4 (above). These trends are apparent in the date summarized at Table 4.5.

Table 4.5 – UK Natural Gas Market – 2005, 2015 and 2020

UK Natural Gas Market	2005		2015		2020	
	Billion cubic metres	Proportion of Total	Billion cubic metres	Proportion of Total	Billion cubic metres	Proportion of Total
UK production	96	94%	32	22%	-	11%
Imports from Norway	10	10%	33	23%	-	18%
Imports from Russia	4	4%	44	31%		
Other imports (Countries not specified)					-	36%
LNG imports	0	0	34	24%	-	29%
Piped to/from continental Europe (negative for exports)	-8	-8%	0	0%	-	7%

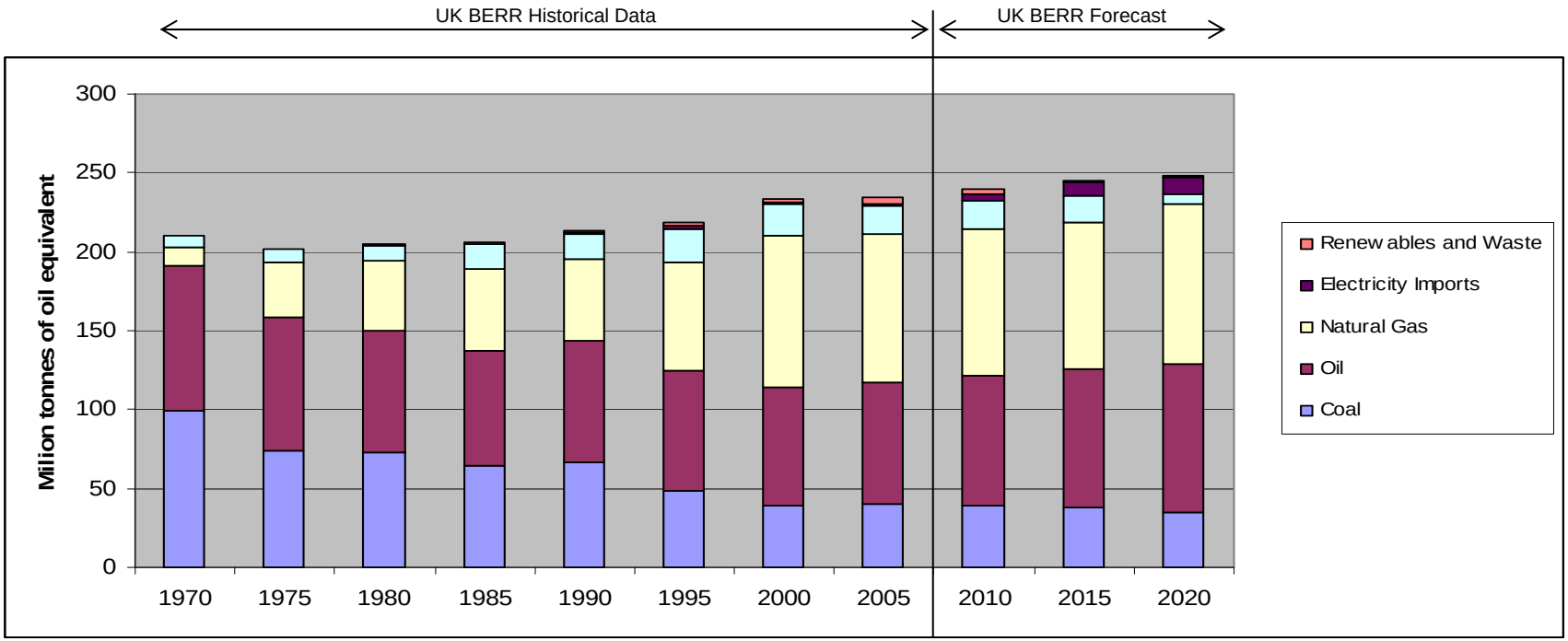
Sources:

Jon Bradley, "Market Behaviour – Which Way Will the [Natural] Gas Flow?"[155]
UK Department of Trade and Industry (DTI): *2006 Energy White Paper*.[156]

[155] Jon Bradley, "Market Behaviour – Which Way Will the [Natural] Gas Flow?" (presentation to the *Transporting Britain's Energy* Seminar, 7 July 2005); http://www.nationalgrid.com/NR/rdonlyres/77321F64-7611-4AB9-9B20-82A3C723D3C2/4197/CentricaJohnBradleyTBE7July2005.pdf ; Internet; accessed 4 April 2009.

[156] Department for Business Enterprise and Regulatory Reform, Cm 6887 *Energy Review Report 2006 – The Energy Challenge* (Norwich: TSO, 2006), 87. http://www.berr.gov.uk/files/file31890.pdf ; Internet; accessed 9 March 2009.

Figure 4.7 – Changing UK Primary Energy Mix – 1970 to 2020



Sources:

UK BERR, Energy Statistics: *Annual Figures: Digest of UK Energy Statistics Long Term Trends*[157]

UK BERR, *Updated Energy and Carbon Emissions Projections – February 2008* [158]

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[157] UK Department for Business Enterprise and Regulatory Reform, "Inland [UK] Consumption of Primary Fuels and Equivalents for Energy Use, 1970 to 2007 (DUKES 1.1.1)," in *Annual Figures: Digest of UK Energy Statistics (DUKES) Long Term Trends Tables* (London: Department for Business Enterprise and Regulatory Reform, 2008); http://stats.berr.gov.uk/energystats/dukes1_1_1.xls ; Internet; accessed 5 April 09.

[158] UK Department for Business Enterprise and Regulatory Reform, URN 07/947X *Updated Energy and Carbon Emissions Projections – February 2008* (London: Department for Business Enterprise and Regulatory Reform: 2008), 22. http://www.berr.gov.uk/files/file39580.pdf ; Internet; accessed 5 April 2009.

However, National Grid[159] have cautioned that there is considerable uncertainty over future flows to the UK of natural gas piped from continental Europe, due to the emergence of alternative markets, improved pipelines and storage in continental Europe. Moreover, LNG imports to the UK are uncertain, due to: the novelty of LNG; the existence of alternative, potentially more lucrative markets elsewhere; an excess of re-gasification[160] capacity over production capacity (providing a wide range of potential market destinations); contractual uncertainties; and uncertainties over the completion of new LNG import facilities in the UK.[161]

In light of these risks, National Grid have assessed the potential impact to the UK of a loss of either LNG or piped natural gas imports from continental Europe. Until approximately 2010, a relatively small increase in natural gas imports from Norway would avoid shortages. However, by 2013/14, the increasing importance to the UK of LNG and the UK's unrealistic reliance on natural gas piped from Norway mean that a loss of either LNG or Norwegian supplies would result in the need to source substantially increased volumes of natural gas piped from continental Europe. After 2015, the increasing dependency of the UK on imported natural gas means that loss of one type of

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[159] National Grid plc is the descendant of the UK state-owned Central Electricity Generating Board, privatised in the 1990s, and now operates electricity and natural gas distribution networks in England, Wales and the northeastern US.

[160] Re-gasification is necessary at or close to the point of entry of imported LNG, arriving by ship, in order to convert the LNG to gaseous form to be piped to consumers.

[161] National Grid plc, "Transporting Britain's Energy 2008: Development of NTS [National Transportation System] Investment Scenarios," (paper prepared by National Grid plc for its 8th annual industry seminar *Transporting Britain's Energy 2008: 2020 Energy Targets and Challenges*, held on 10 July 2008 at One Great George Street London as part of the Transporting Britain's Energy consultation process), 18-20; http://www.nationalgrid.com/NR/rdonlyres/2450AADD-FBA3-49C1-8D63-7160A081C1F2/27054/DevelopmentofInvestmentScenarios2008.pdf ; Internet accessed 4 April 2009.

supply would result in the need for significant imports from other sources.[162] The deduction is that all of the major natural gas producing countries must be added to the list of countries of energy relevance to the UK. These countries are: Russia, Canada, Norway, Algeria, Netherlands, Turkmenistan, Qatar, Indonesia, Malaysia and the US.[163]

The Transit Countries: The Importance of Pipelines

The list of countries of energy interest to the UK is not complete without the transit countries through which primary energy passes by pipeline or ship. Pipelines are becoming increasingly significant due to three factors: the growing importance of natural gas, which can only be moved by pipeline or as LNG; the increasingly diverse geographic distribution of active oil fields; and the Central Asia energy states' need for access to export markets.

The major natural gas pipelines running towards the borders of the European Union (EU) cross a number of non-EU, non-NATO transit countries: Kazakhstan, Uzbekistan, Turkmenistan, Russia, Belarus, Ukraine, Moldova, Tunisia, Algeria and Morocco.[164] Major oil pipelines running towards the EU cross Azerbaijan, Russia, Georgia, Belarus, Ukraine and Kazakhstan.[165] Each of these countries is therefore of energy interest to the UK. Moreover, Turkey should be added to the list because, notwithstanding its NATO membership and aspirations to join the EU, it represents an

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[162] National Grid plc, "Transporting Britain's Energy 2008 …," 28-30.

[163] International Energy Agency, *Key World Energy Statistics 2008* …

[164] Gaz de France, "Major European Natural Gas Pipelines" (Paris: Gaz de France, 2005); http://www.gazdefrance.com/upload/documents/public/carte_des_reseau_de_trans_1115914032.pdf ; Internet; accessed 9 April 2009.

[165] Kleveman, *The New Great Game – Blood and Oil in Central Asia* …, inside cover.

important, non-Russian transit route for energy from the Caspian basin and Central Asia to the Mediterranean and Europe.

The Transit Countries: The Importance of Maritime Choke Points

The worldwide movement of primary energy by ship is subject to a number of well-known maritime choke points. Although British oil comes mainly from Norway, Russia and Algeria, the supply and price of oil for Britain are set on a worldwide market that is susceptible to interruptions of worldwide oil shipping because half of the world's oil production is moved by tankers on fixed maritime routes, hence the importance of oil transit choke points (which are also choke points for LNG and coal shipments). The US Energy Information Administration identifies six maritime chokepoints: the Strait of Hormuz (the exit of the Persian Gulf), the Strait of Malacca (linking Indian and Pacific Oceans), Bab el-Mandab (linking the Red Sea to the Gulf of Aden), the Panama Canal, the Suez Canal and the Bosporus strait.[166] The littoral states for these choke points need to be added to the list of countries of relevance to UK energy security: Oman, Iran, Indonesia, Malaysia, Singapore, Yemen, Djibouti, Eritrea, Panama, Egypt and Turkey. To this list should be added Morocco, due to the substantial amount of energy shipped through the Straits of Gibraltar.

[166] Energy Information Administration, "World Oil Transit Chokepoints," in *Country Analysis Briefs* (Washington: US Government Energy Information Administration, 2008); http://www.eia.doe.gov/emeu/cabs/World_Oil_Transit_Chokepoints/Background.html ; Internet; accessed 6 April 2009.

The Countries and Territories of Energy Interest for the UK

The consolidated list of countries of energy interest to the UK comprises 37 states, each falling into one or more of six categories of interest (large primary energy importers, major primary energy suppliers to the UK, globally-dominant energy suppliers, major natural gas producers, transit countries and the maritime choke point littoral states); see Table 4.7 overleaf. In addition, there are nine states that are allied to the UK, via NATO and/or the EU or long-standing alliance, but also of energy importance to the UK; see Table 4.6. In addition, there are three territories of potential energy security importance to the UK: Gibraltar, Cyprus and the Falkland Islands.

Table 4.6 – Allied Countries of Energy Importance to the UK

Country of Energy Interest to the UK	Class of Interest				NATO	EU
	Large primary energy importer	Major primary energy supplier to UK	Globally-dominant energy supplier	Major natural gas producer		
USA	Yes	Yes		Yes	NATO	
Canada		Yes	Yes	Yes	NATO	
Australia[167]		Yes	Yes			
France	Yes				NATO	EU
Germany	Yes				NATO	EU
Italy	Yes				NATO	EU
Netherlands				Yes	NATO	EU
Spain	Yes				NATO	EU
Norway		Yes	Yes	Yes	NATO	

[167] Australia has been included because of the close historical, cultural, political and military ties with the UK, its role within the semi-formal *Australia-Britain-Canada-America* group for military cooperation, and its recent extensive involvement in coalition military operations alongside the UK.

Table 4.7 – Countries of Energy Interest to the UK

Country of Energy Interest to the UK	Class of Interest					
	Large primary energy importer	**Major primary energy supplier to UK**	**Globally-dominant energy supplier**	**Major natural gas producer**	**Transit country**	**Choke point littoral state**
Russia		Yes	Yes	Yes	Yes	
Algeria		Yes		Yes	Yes	
Indonesia			Yes	Yes		Yes
Turkey	Yes				Yes	Yes
Iran			Yes			Yes
Malaysia				Yes		Yes
Morocco					Yes	Yes
Turkmenistan				Yes	Yes	
Ukraine	Yes				Yes	
China	Yes					
India	Yes					
Japan	Yes					
South Korea	Yes					
Taiwan	Yes					
Colombia		Yes				
South Africa		Yes				
Kuwait			Yes			
Mexico			Yes			
Nigeria			Yes			
Saudi Arabia			Yes			
UAE			Yes			
Venezuela			Yes			
Qatar				Yes		
Azerbaijan					Yes	
Belarus					Yes	
Tunisia					Yes	
Uzbekistan					Yes	
Georgia					Yes	
Kazakhstan					Yes	
Moldova					Yes	
Djibouti						Yes
Egypt						Yes
Eritrea						Yes
Oman						Yes
Panama						Yes
Singapore						Yes
Yemen						Yes

UK INFLUENCE IN THE WORLD ENERGY MARKET

Influencing the 37 Countries of Energy Interest to the UK

Space precludes a study of each of the 37 countries of interest. However, a review of the most important countries in the group and some general deductions will support the argument that the UK has limited scope to influence this broad constituency.

Firstly, Russia is the dominant energy supplier in the group. In Michael Klare's words, Russia is an "energy juggernaut," with its energy behaviour shaped by Vladimir Putin[168] and Gazprom (the state-owned natural gas monopoly), Rosneft (the leading state-owned oil firm) and Lukoil (the largest privately-owned oil company).[169] Nygren says that energy is the essential instrument in a strategy of reintegrating former-Soviet states into a new Russian economic empire by creating and exploiting monopoly and monopsony power for energy.[170] According to Sergey Sevastyanov, the New Energy Policy introduced during the Putin presidency offered security of supply to foreign partners in return for security of demand for Russian energy exports. Russia has chosen Germany and Italy as its preferred energy partners in Europe and is using the threat of shifting energy exports to Asia to increase its influence with Europe. Sevastyanov suggests, however, that this threat is not credible, due to the location of the majority of Russian energy reserves in the west of the country.[171]

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[168] Putin's doctoral thesis was on the subject of *Mineral Raw Materials in the Strategy for the Development of the Russian Economy*.

[169] Michael T. Klare, *Rising Powers, Shrinking* ..., 88-114.

[170] Bertil Nygren, "Putin's Use of Natural Gas to Reintegrate the [Commonwealth of Independent States] CIS Region," *Problems of Post-Communism* 55, Issue 4 (July/August 2008): 3-15; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=33376206&site=ehost-live ; Internet; accessed 20 January 2009.

[171] Sergey Sevastyanov, "The More Assertive and Pragmatic New Energy Policy in Putin's Russia …," 35-55.

Opinion is not unanimously negative on Russian energy policy: Bahgat has argued that Russia's rising energy production is likely to enhance global energy security.[172] *The Economist's* view is that oil revenue supported the bellicose style of the Putin administration but, with oil prices falling, Russian growth will become increasingly dependent on foreign investment, which could temper the tone of the Medvedev presidency.[173] However, on 5 January 2009, Russia chose to interrupt natural gas supplies to the EU via Ukraine. Ukraine was paying below market rates, had reneged on a transit deal and was diverting natural gas earmarked for the EU.[174] Russia was keen to expose Ukraine as an unreliable transit country and to separate European natural gas contracts from its contracts with Ukraine. The EU was almost unanimous in its frustration with Russian behaviour but Germany and Italy played down the incident.[175]

Notwithstanding debates over Russia's motives, Russian dominance of European energy is real (see Dettmer[176]) and significant for Britain. For the UK, the most important issues are the extent to which Russia's use of the energy weapon is constrained or motivated by its need to secure export revenues, and the extent to which the EU can

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[172] Gawdat Bahgat, "Russia's Oil Potential: Prospects and Implications," *OPEC Review: Energy Economics & Related Issues* 28, Issue 2 (June 2004): 133-147; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=13506427&site=ehost-live ; Internet; accessed 20 January 2009.

[173] Arkady Ostrovsky, "Swaggering On," *The Economist – The World in 2009* (London: The Economist Newspaper Ltd., 2008), 92.

[174] *The Economist*, "Energy in the European Union – Gas Wars," 10 January 2009.

[175] *The Economist*, "Russia, Ukraine and Gas – War-War, not Jaw-Jaw" and "Charlemagne Column – Energetic Squabbles," 17 January 2009.

[176] Jamie Dettmer, "European Dependence on Russia's Gazprom," *Insight in the News* 29, Issue 29 (6 August 2001): 13; http://search.ebscohost.com/login.aspx?direct=true&db=bwh&AN=4903002&site=ehost-live ; Internet; accessed 20 January 2009.

temper Russian energy power. EU unity is important here but Germany and Italy have already wavered. The UK's ability to influence Russia will therefore depend on Russia's need for energy customers and inward investment, unanimity in the EU (to leverage potential monopsony power) and the congruence of EU objectives with those of the UK.

China is one of the large primary energy importers with which the UK may have to compete to secure access to scarce energy. As the most populous county in the world and the world's second-largest economy (since 2003), China needs energy for growth: it became a net oil importer in 1993 and replaced Japan as the world's second-largest oil importer in 2003. China has pursued a variety of strategies to diversify its energy mix and its sources of imported energy, seeking to increase imports from Russia, Central Asia and the Caspian Sea basin, and the Gulf.[177]

China's closed political system, size and energy thirst make it inevitable that its activities are viewed with unease. However, Chinese academics Lei and Xuejun have argued that the negative perception of Chinese energy strategy is an "illusory and exaggerated thesis." They argue that the growth in Chinese demand for imported oil was actually slower than growth in US oil imports in the period 1995 to 2005, and that China's overseas energy investments have little effect on availability of oil and natural gas. Chinese national oil companies have, however, invested in over 30 countries and 130 energy deals, predominantly in Sudan, Kazakhstan and Indonesia, which account for 79% of Chinese overseas oil production, and oil is also shipped to China from Chinese interests in Oman and Peru.

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[177] Gawdat Bahgat, "Energy Partnership: China and the Gulf States," *OPEC Review: Energy Economics & Related Issues* 29, Issue 2 (June 2005): 115-131; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=17304076&site=ehost-live ; Internet; accessed 20 January 2009.

Lei and Xuejun suggest:

> It is perfectly natural and normal that China and the West conceive different outlooks on the global energy market and, therefore, each side's energy concept and policy are different. Washington thinks that China's energy security policies are rooted in the mercantilist policy of the Chinese leadership just as mercantilism seems to serve as the theoretical foundation for China's energy security politics. The formulation of China's energy security policies follows a 'strategic' or 'realistic' paradigm, while America's is oriented toward 'market-driving' or 'liberalism'.[178]

Michael Glosny has summarized China's foreign policy goals:

> … [to] maintain a stable peripheral environment for regime security and economic modernization; [to] improve China's image to reduce fears of an aggressive, threatening China; [to] maintain territorial sovereignty and prevent the *de jure* independence of Taiwan; and [to] increase power and influence to become a regional or global great power. [179]

Glosny argues that these goals rely on maintaining friendly relations within Southeast Asia and therefore China may be a force for regional peace, stability, and prosperity.[180]

Ian Taylor argues that China's extensive oil diplomacy in Africa has two main goals: to secure oil supplies in the short-term, to feed growing demand in China; and to position China as a major player in the international oil market. In Taylor's view, China's access to Africa is supported by a policy of non-interference in domestic affairs,

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[178] Wu Lei and Liu Xuejun, "China or the United States: Which Threatens Energy Security?" *OPEC Review: Energy Economics & Related Issues* 31, Issue 3 (September 2007): 215-234; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=26596539&site=ehost-live ; Internet; accessed 20 Januray 2009. See also: Xu Yi-chong, "China's Energy Security," *Australian Journal of International Affairs* 60, Issue 2 (June 2006): 265-286; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=20855499&site=ehost-live ; Internet; accessed 20 January 2009.

[179] Michael Glosny, "Heading toward a Win-Win Future? Recent Developments in China's Policy toward Southeast Asia," *Asian Security* 2, Issue 1 (February 2006): 24-75; http://search.ebscohost.com/login.aspx?direct=true&db=tsh&AN=24925460&site=ehost-live ; Internet; accessed 6 March 2009.

[180] Glosny, "Heading toward a Win-Win Future …," 24-75.

disinterest in human rights, and turning a blind eye to autocracy and corruption, giving it access where more discerning international partners are not welcome.[181]

Like China, India is a large and rapidly-growing economy (expected to grow at over 5 percent per annum for the next 25 years), with a big energy thirst. By 2006, India was the world's fifth largest energy consumer and was expected to overtake Japan and Russia to become the third largest by 2030. India will remain a net importer of oil, will run out of coal in forty years, and has limited natural gas reserves. According to the Brookings Institution, India's energy-related global activity reflects its foreign policy of "enlightened self-interest." India has a preference for cooperation, country-by-country energy diplomacy and buying overseas energy assets, and may be willing to use its military power to secure energy by taking on a greater share of the international security burden of protecting oil and natural gas supply lines.[182]

The UK's ability to secure access to primary energy, in the face of buyer competition from countries such as China and India (and Japan, South Korea and Taiwan) and to moderate the strategic behaviour of these giant buyers will depend on the UK's ability to do two things. Firstly, the UK must make itself the most attractive customer for energy producers, by price, contractual arrangements, ease and security of shipping, and reciprocal trade. The UK must exploit the interdependence of energy producers and consumers by ensuring that is it easier, more lucrative and less risky to sell energy to the UK than elsewhere. As India has identified, there may be a military role in support of

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[181] Ian Taylor, "China's Oil diplomacy in Africa," *International Affairs* 82, Issue 5 (October 2006): 937-959; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=22554643&site=ehost-live ; Internet; accessed 20 January 2009.

[182] Tanvi Madan, "India" in *The Brookings Foreign Policy Studies Energy Security Series* (Washington, DC: The Brookings Institution, 2006): 1-2; http://www.brookings.edu/fp/research/energy/2006india.pdf ; Internet; accessed 7 March 2009.

this. Secondly, the UK must exploit the dependence of the giant energy buyers, as the world's workshop countries, on markets for their manufactured products. The UK must exploit the interdependence of manufacturing and service-based consumer economies by pressing the point that a UK (or the West in general) starved of energy will not be in a position to buy Chinese goods.

Amongst the 37 countries of energy interest to the UK, there are a number in the Caspian basin and Central Asia. Subhod Atala has argued that the US, Russia, China, Iran, India, Turkey, Pakistan and Saudi Arabia are all vying for influence in the region, for access to energy and geopolitical influence, but the regional situation is complex.[183] The implication for the UK is that the Caspian basin and Central Asia have a geopolitical significance much wider than energy, and that any application of power in the region is likely to be very tricky. Even the power of the US cannot always be brought to bear in Central Asia: in February 2009, Kyrgyzstan opted to close the US base at Manas leaving

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[183] Subhod Atala, "Central Asian |Geopolitics and US Policy in the Region: the post-11 September [2001] Era," *Mediterranean Quarterly* 14, Issue 2 (Spring 2003): 95-109; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=26967482&site=ehost-live ; Internet; accessed 20 January 2009.

For a survey of the roles played by Azerbaijan, Kazakhstan and Turkmenistan in the new 'great game' over energy and strategic control of Central Asia, see: Tammy Farrenkopf, "Playing the Energy Game: Pipeline Politics in Russia 's Backyard," *RUSI Newsbrief* 12 July 2006: n.p.; http://www.rusi.org/go.php?structureID=articles_newsbrief&ref=A44B51FDF5E0F8 ; Internet; accessed 12 April 2009.

For a survey of the challenges to the development of Caspian Sea energy, see: Gawdat Bahgat, "Pipeline Diplomacy: The Geopolitics of the Caspian Sea Region," *International Studies Perspectives* 3, Issue 3 (August 2002): 310-327; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=7143917&site=ehost-live ; Internet; accessed 20 January 2009.

For a downbeat assessment of the plays down the significance of the Caspian basin, see Mamdouh G. Salameh, "Caspian Oil is no Middle East," *Minerals and Energy - Raw Materials Report* 17, Issue 2 (1 September 2002): 33-41; http://search.ebscohost.com/login.aspx?direct=true&db=eoah&AN=3895832&site=ehost-live ; Internet; accessed 20 January 2009.

See also: Gareth Winrow, "Geopolitics and Energy Security in the Wider Black Sea Region," *Journal of Southeast European & Black Sea Studies* 7, Issue 2 (June 2007): 217-235; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=25508214&site=ehost-live ; Internet; accessed 20 January 2009

the US with no bases in Central Asia.[184] Turkey may be a better target for influence. President Obama's visit to Turkey in April 2009 was indicative of Turkey's strategic importance (including its potential as a non-Russian energy transit corridor from the Caspian basin to Europe) and the significance of its aspiration to join the EU.[185]

Having considered the giant energy suppliers and consumers and potentially the most problematic region amongst the 37 countries of energy interest to the UK, it is useful to finish by making some general observations on the remaining countries. Amongst the 37, Venezuela postures as the archetypical rogue energy state. Venezuela has been described as the most important oil and natural gas country in the western hemisphere, although there have been setbacks to production, due to political instability and industrial mismanagement. President Chavez has repeatedly threatened to suspend oil exports to the US and divert them to China but these threats are largely empty due to the dependence of Venezuela's oil producers on a US refinery infrastructure that is superior to that available in China.[186] Moreover, oil provided 92% of Venezuela's export

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[184] BBC, "Kyrgyz closure of US base 'final,'" 6 February 2009; http://news.bbc.co.uk/2/hi/asia-pacific/7873866.stm ; Internet; accessed 6 February 2009

[185] *The Economist*, "America, Turkey and Europe – Talking Turkey," 11 April 2009. See also articles by Cutler, Bacik, and Tekin and Walterova:
Robert M. Cutler, "Turkey and the Geopolitics of Turkmenistan's Natural Gas," *Review of International Affairs* 1, Issue 2 (Winter 2001): 20-33; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=6875138&site=ehost-live ; Internet; accessed 20 January 2009.
Gökhan Bacik, "Turkey and Pipeline Politics," *Turkish Studies* 7, Issue 2 (Summer 2006): 293-306; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=23219395&site=ehost-live ; Internet; accessed 20 January 2009.
Ali Tekin and Iva Walterova, "Turkey's Geopolitical Role: The Energy Angle," *Middle East Policy* 14, Issue 1 (Spring 2007): 84-94; http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=24361542&site=ehost-live ; Internet; accessed 20 January 2009.

[186] Luis E. Giusti, "Energy Security in Latin America," (Evidence to the Senate Foreign Relations Committee) *FDCH Congressional Testimony* 22 June 2006;

revenues in the first nine months of 2008.[187] The power of Venezuela's oil weapon is limited: energy power is only genuine when the exporter has access to diverse markets.

Turning to the general characteristics of many of the remaining countries on the list of 37, the energy supplier countries in the group share some typical characteristics: monolithic, energy export-dependent, un-diversified, poorly-developed economies, in unstable areas with ongoing border disputes; internal tensions or ongoing ethno-religio-cultural tensions with the west. For a review of energy in the Iranian economy, for example, see Schott.[188] Chapman and Neha Khanna discuss the role of the Gulf States in global energy security.[189] David Sands has written on the African oil industry, including Nigeria.[190]

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http://search.ebscohost.com/login.aspx?direct=true&db=mth&AN=32Y0980559450&site=ehost-live ; Internet; accessed 20 January 2009.

[187] *The Economist*, "Venezuela – Socialism with Cheap Oil," 3 January 2009.

[188] Jeffrey J. Schott, "Energy and the Iranian Economy," (Evidence to the House of Representatives Joint Economic Committee) *FDCH Congressional Testimony* 25 July 2006: http://search.ebscohost.com/login.aspx?direct=true&db=mth&AN=32Y1510946818&site=ehost-live ; Internet; accessed 20 January 2009.

[189] Duane Chapman and Neha Khanna, "The Persian Gulf, Global Resources and International Security," *Contemporary Economic Policy* 24, Issue 4 (October 2006): 507-519; http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=22942094&site=ehost-live ; Internet; accessed 20 January 2009.

[190] David R. Sands, "Africa Struggles to Convert Oil Wealth into Tool for Prosperity," *The Washington [DC] Times*, 6 September 2004, n.p.; http://search.ebscohost.com/login.aspx?direct=true&db=bwh&AN=4KB20040906113740&site=ehost-live ; Internet; accessed 20 January 2009.

Working with the Allies of Energy Importance to the UK

The allies of energy importance to the UK have been listed in Table 4.6 for completeness but it is assumed that the ties of the EU and/or NATO (and the relationship between the UK and Australia) mean that energy relations between these countries are regulated by markets and law, and need not be analysed in the context of energy security for the UK.

Protecting the Territories of Potential Energy Importance to the UK

Gibraltar is a British Overseas Territory[191] and a Permanent Joint Operating Base (PJOB) for British forces. Its importance for UK energy security is its location on a maritime choke point, dominating sea lines of communication between the Mediterranean (and therefore from the Black Sea and Suez Canal) and the Atlantic. It is important for the UK to retain military use of Gibraltar harbour and airfield, as a contingency against any future need to secure freedom of movement through the Strait of Gibraltar.

On Cyprus, the UK retains Sovereign Base Areas (SBAs)[192] at Akrotiri airfield, Episkopi and Dhekalia.[193] These SBAs form the Cyprus PJOB and are important for UK energy security as potential bases for operations to secure freedom of maritime movement through the Suez Canal and the Bosporus, and from the littoral states of the eastern Mediterranean.

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[191] UK Foreign and Commonwealth Office, "Country Profile – Gibraltar (British Overseas Territory)," http://www.fco.gov.uk/en/about-the-fco/country-profiles/europe/gibraltar ; Internet; accessed 16 April 2009.

[192] Note that Sovereign Base Areas are military bases, rather than colonial territories.

[193] UK Ministry of Defence, "Permanent Joint Operating Base (PJOB) – Cyprus," http://www.mod.uk/DefenceInternet/AboutDefence/WhatWeDo/DoctrineOperationsandDiplomacy/PJHQ/PjobCyprus.htm ; Internet; accessed 16 April 2009.

The Falkland Islands are a British Overseas Territory[194] (by the choice of the inhabitants) and the site of a PJOB, to protect the Territory and its inhabitants. The UK government is supporting the Falkland Islands government in its development of offshore hydrocarbon resources but little has been done to develop these resources, other than some exploratory drilling in 1998, since when the price of oil has not been high enough for long enough to encourage further exploration.[195] Although the UK and Argentina have signed a Joint Declaration on cooperation and exploitation of possible offshore oil and natural gas deposits, Argentina has been inconsistent in its approach to collaborative exploration.[196] The implication for energy security of the UK is that the Falkland Islands presents a potential new British hydrocarbon field that may need to be secured and defended in the future.

DEDUCTIONS – THE UK IN A GLOBAL NETWORK FOR ENERGY

This chapter has argued that the countries of energy interest to the UK are a broad constituency of large primary energy importers (competing for access to scarce energy), major energy suppliers to the UK, globally-dominant energy suppliers (with power to influence prices and supply), major producers of natural gas (the most important form of energy for the UK), the main energy transit countries, and the littoral states of maritime

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[194] UK Foreign and Commonwealth Office, "Country Profile – Falkland Islands (British Overseas Territory)," http://www.fco.gov.uk/en/about-the-fco/country-profiles/south-america/falkland-islands ; Internet; accessed 16 April 2009.

[195] Falkland Islands Government Department of Mineral Resources, "Petroleum Summary," http://www.bgs.ac.uk/falklands-oil/Introduction.htm ; Internet; accessed 17 January 2009.

[196] Falkands.info, "Joint Declaration of 27 September 1995: Cooperation over Offshore Activities in the South West Atlantic," http://www.falklands.info/history/95comm.html ; Internet; accessed 17 January 2009.

choke points. This constituency comprises 37 countries, including dominant energy exporters like Russia, giant and competing energy consumers like China and India, complex and unstable regions (the Caspian Sea basin and Central Asia) and a gaggle of other nations in varying states of under-development and instability. Ostensibly, there is limited scope for the UK – as a major energy importer – to influence this broad constituency in order to maintain energy security. This leads to the question of the nature of the UK's power, in this context, and the adequacy of UK energy policies; these are the subjects of the next chapter.

CHAPTER 5 –ENERGY IN UK NATIONAL POWER AND POLICY

Having analysed energy scarcity, the nexus between energy and war, and the UK's position in the global energy domain, the next step is to assess the role of energy in UK national power and policies. This chapter will briefly survey concepts of national power before examining UK national power and UK energy policies and examining whether they are adequate to deliver energy security.

CONCEPTS OF NATIONAL POWER

The concept of national power was touched upon in Chapter 3, which introduced the idea of elements and instruments of national power. David Jablonsky defines power as that which provides the "ability to influence the behaviour of other actors in accordance with one's own objectives."[197] Joseph Nye encapsulates power as the "ability to achieve one's purposes … to do things and to control others … the ability to get others to do what they would otherwise not do."[198] Spanier and Wendzel provide perhaps the clearest definition of national power: "the ability to influence other state and non-state actors, in line with national strategy, in order to achieve national objectives."[199]

Sources, Determinants and Elements of National Power

The sources, determinants or elements of national power are those factors that give a state the potential to act. Michael Mann defines five sources of geopolitical power:

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[197] Jablonsky, "National Power…," 34-54;

[198] Joseph S. Nye Jr., *Power in the Global Information Age – From Realism to Globalization* (New York: Routledge, 2004), 53.

[199] John Spanier and Robert L. Wendzel, *Games Nations Play*, 9th ed. (Washington: CQ Press, 1996), 128; quoted in Jablonsky, "National Power…," 34-54.

economic power; ideological power; military power; leadership; and political power (to convert economy, ideology, wealth and morale into military power and diplomacy).[200] J K Galbraith takes a different approach, defining three sources of power for the modern state: political personality; property, in the form of the resources it commands and dispenses; and organization.[201] David Jablonsky suggests that the elements of national power constitute the resources for the attainment of national objectives and goals, and are the product of natural determinants and social determinants.[202]

Types and Instruments of National Power

The types and instruments of national power are the means by which national power is brought to bear. Michael Mann defines six types of social power: distributive, collective, extensive, intensive, authoritative and diffused.[203] In J K Galbraith's taxonomy, there are three instruments for the exercise of power: condign, compensatory and conditioned power.[204] Joseph Nye identifies just two types of power: command

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[200] Michael Mann, *The Sources of Social Power, Volume II – The Rise of Classes and Nation-states, 1760-1914* (Cambridge: Cambridge University Press, 1993), 258-260.

[201] John Kenneth Galbraith, *The Anatomy of Power* (Boston: Houghton Mifflin Co., 1983), 145.

[202] Jablonsky, "National Power…," 34-54. Natural determinants are concerned with the number of people in a nation and with their physical environment: geography, resources, and population. Social determinants concern the ways in which the people of a nation organize themselves and the manner in which they alter their environment: economic, political, military, psychological and informational factors.

[203] Mann, *The Sources of Social Power* …, 2-6. Distributive power is the power of actor A over actor B, in a zero-sum game. Collective power is the joint power of actors A and B, cooperating to exploit nature or another actor, C. Extensive power is the power to organize large numbers of people over far-flung territories. Intensive power is the power to mobilize a high level of commitment from the participants in a state. Authoritative power is the power to elicit conscious obedience to deliberate commands. Diffused power is the power to elicit spontaneous, unconscious and decentralized obedience, other than by direct command.

[204] Galbraith, *The Anatomy of Power* …, 4-6. Condign power wins submission by the ability to impose an alternative that is unpleasant or painful. Compensatory power wins submission by the offer of a

power, based on inducement and threats; and co-optive power, based on the attraction of ideas, agenda-setting and shaping of preferences.[205]

British Defence Doctrine recognizes three instruments of national power: diplomatic, economic and military. The diplomatic instrument is an instrument of persuasion, reinforced by the possibility of coercion, and enhanced by communication, reputation, integrity and the military and economic instruments. The economic instrument involves the use of overseas investment, international flows of capital and trade, development assistance, incentives, boycotts, tariffs and sanctions. The military instrument is the ultimate expression of national power, and ranges from deterrence and coercion to deliberate application of force to neutralize a specific threat.[206]

Assessment of National Power

Although some writers have attempted to make semi-quantitative assessments of national power – notably Cline's *World Power Assessment*[207] – the variety of taxonomies for elements and instruments of power, the difficulty of assigning numerical assessments to intangibles, and the dangers of endowing indicative figures with unwarranted precision make such assessments questionable. Moreover, as David Baldwin points out, Cline's

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reward. Conditioned power is exercised by changing belief, by persuasion, education or social commitment.

[205] Nye, *Power in the Global Information Age* …, 56.

[206] Ministry of Defence, Joint Doctrine Publication 0-01 *British Defence Doctrine*…, paragraphs 117 to 132

[207] Pp = (C + E + M) x (S + W). Where: Pp = perceived power; C = critical mass = population + territory; E = economic capacity; M = military capacity; S = strategic purpose; and W = will to pursue national strategy. Ray S. Cline, *World Power Assessment 1977: A Calculus of Strategic Drift* (Boulder, CO: Westview Press, 1977), quoted in David A. Baldwin, *Paradoxes of Power* (New York: Basil Blackwell Inc., 1989), 142-143.

numerical abstraction of power would only be useful if power were monolithic, homogeneous, uni-dimensional and substitutable (*i.e*. fungible, like money).[208] Therefore, to examine British power a limited qualitative assessment will be carried out here, using the broad categories of economic, diplomatic and military power.

Current Foundations of UK National Power

The UK is a major economy, trading power and financial centre. It has the sixth largest Gross Domestic Product (GDP) in the world and a population of 61 million, and enjoys a location close to North Atlantic sea lanes and continental Europe. The post-industrial UK economy is service-based.[209] However, the UK is a net energy importer and there is limited scope for the UK to reduce dependence on energy imports by large-scale adoption of renewable energy.[210] Moreover, The British economy, although strong in recent years, has been in recession since late 2008.

The UK has influence as a permanent member of the United Nations Security Council, a founding member of NATO and a member of the EU, and the UK's most important ally is the US. The UK has a global approach to foreign policy and enjoys the cultural influence and business access resulting from widespread use of the English language. However, in some regions, the UK remains constrained by its colonial history. Moreover, the UK must balance post-War declinist inclinations, an Atlanticist perspective and a developing relationship with the EU.[211]

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[208] David A. Baldwin, *Paradoxes of Power* (New York: Basil Blackwell Inc., 1989), 143.

[209] The service sector accounts for 74.5% of GDP and 77% of employment in the UK.

[210] MacKay, *Sustainable Energy* …

[211] The EU now accounts for over half of the UK's export/import trade.

The UK has the second highest defence spending in the world. The British military, although only twenty-eighth largest in the world, is well trained and equipped and has recent and broad operational experience. However, British forces are committed to operations in Afghanistan and are in the process of withdrawing from Iraq.[212]

Influencing the 37 Countries of Energy Interest to the UK

The relevance to energy security of national power is how it translates into the ability to influence the 37 countries of energy interest to the UK (identified in Chapter 4), to secure stable, affordable primary energy. British economic influence amongst the constituency is weak. The UK is a significant export customer for only seven of the 37 countries, with the maximum UK share being 8.1% of Turkey's visible exports. Only eight of the 37 countries buy a significant proportion of their goods from the UK, with the maximum being Azerbaijan buying 7.2% of its visible imports from the UK. Therefore, the scope to influence the 37 countries via trade is small. In terms of diplomatic influence, the UK is a member of several international organizations, of which fourteen have some potential bearing on energy security.[213] However, membership of these organizations is patchy amongst the 37countries of interest; see Table 5.1.

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[212] Summary of British National Power synthesized from various sources: The Economist, *Pocket World in Figures*, 2008 ed. (London: Profile Books, in association with The Economist, 2007), 232-233; The International Institute for Strategic Studies, *The Military Balance 2009* (London: Routledge, for The International Institute for Strategic Studies, 2009), 447-452; Stuart Croft, Andrew Dorman, Wyn Rees and Matthew Uttley, *Britain and Defence 1945-2000 – A Policy Re-evaluation* (Harlow: Pearson Education Limited, 2001), 1; Central Intelligence Agency, "United Kingdom," in *The 2008 World Factbook*…, n.p..

[213] World Trade Organization (WTO), African Development Bank Group (AfDB), Euro-Atlantic Partnership Council (EAPC), Group of 20 (G-20), International Chamber of Commerce (ICC), International Criminal Court (ICCt), International Development Association (IDA), International Energy Agency (IEA), Nuclear Energy Agency (NEA), Nuclear Suppliers Group (NSG), Organization for Economic Cooperation and Development (OECD), Organization for Security and Cooperation in Europe (OSCE), Permanent Court of Arbitration (PCA) and Western European Union (WEU). See Appendix 2 for a summary of the aims of these organizations.

Table 5.1 – Participation in International Organizations and Trade with the UK amongst the Countries of Energy Interest to the UK

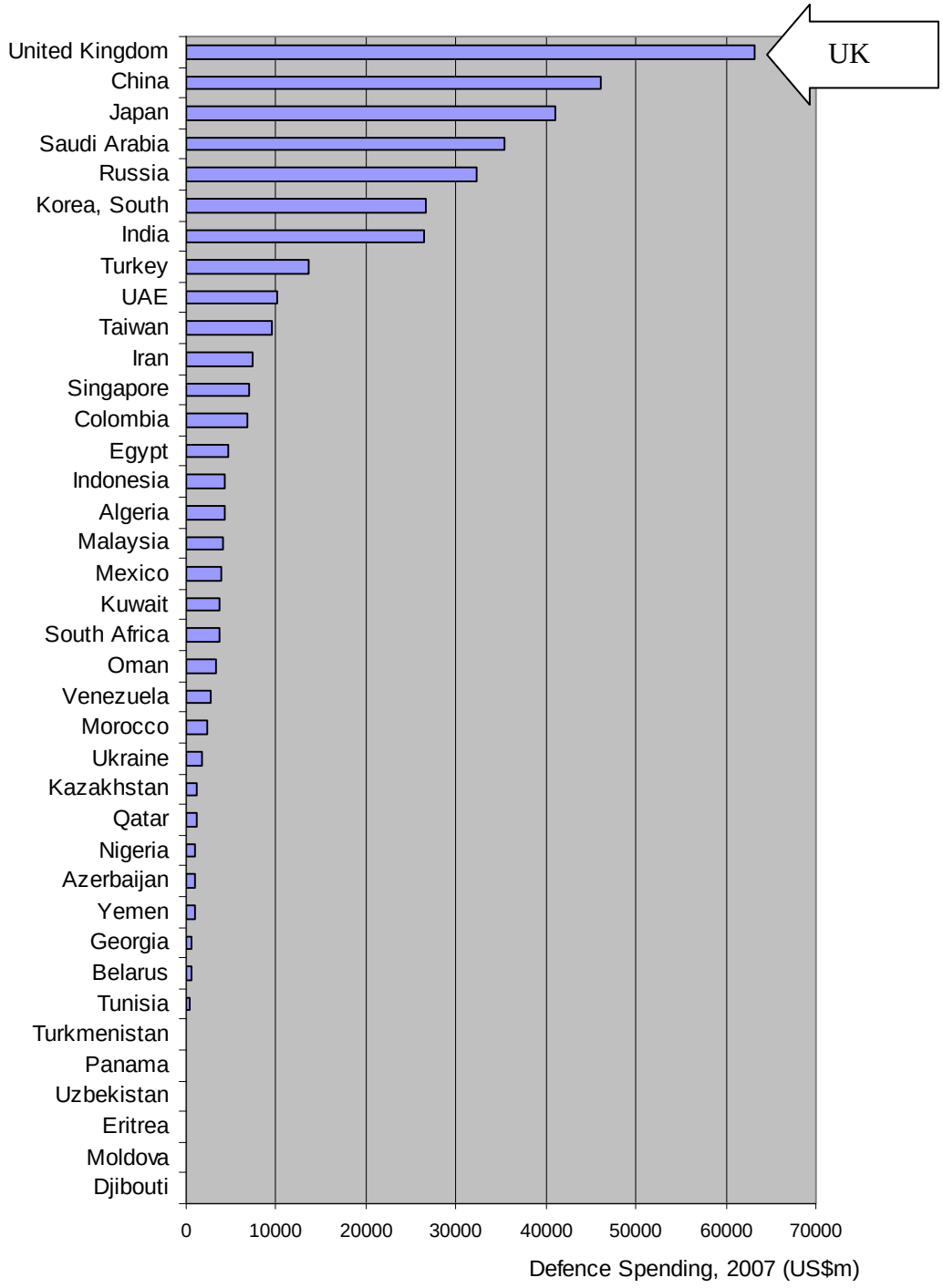
Country	WTO	AfDB	EAPC	G-20	ICC	ICCt	IDA	IEA	NEA	NSG	OECD	OSCE	PCA	WEU	Proportion of country's international trade	
															Exports to UK	Imports from UK
Russia			Y	Y	Y	Y	Y			Y	Y	Y	Y			
Algeria	Y	Y			Y	Y	Y					Y				
Indonesia	Y			Y	Y		Y									
Iran					Y	Y	Y						Y			
Malaysia	Y				Y		Y						Y			
Morocco	Y	Y			Y	Y	Y					Y	Y			4.60%
Turkey	Y		Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	8.10%	
Turkmenistan			Y				Y					Y				
Ukraine	Y		Y		Y	Y	Y			Y		Y	Y			
China	Y	Y		Y	Y		Y			Y			Y			
India	Y	Y		Y	Y		Y						Y		4.40%	
Japan	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
South Korea	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
Taiwan	Y				Y											
Colombia	Y				Y	Y	Y						Y			
South Africa	Y	Y		Y	Y	Y	Y			Y			Y		7.70%	4.50%
Kuwait	Y	Y			Y	Y	Y						Y			4.60%
Mexico	Y			Y	Y	Y	Y		Y		Y		Y			
Nigeria	Y	Y			Y	Y	Y						Y			5.70%
Saudi Arabia	Y	Y		Y	Y	Y	Y						Y			4.50%
UAE	Y				Y		Y									5.30%
Venezuela	Y				Y	Y	Y						Y			
Qatar	Y				Y		Y						Y			5.70%
Azerbaijan			Y		Y		Y					Y				7.20%
Belarus			Y				Y			Y		Y	Y		6.30%	
Tunisia	Y	Y					Y					Y				
Uzbekistan			Y			Y	Y					Y				
Georgia	Y		Y		Y	Y	Y					Y			5.40%	
Kazakhstan			Y				Y			Y		Y				
Moldova	Y		Y			Y	Y					Y				
Djibouti	Y	Y				Y	Y									
Egypt	Y	Y			Y	Y	Y					Y	Y		4.20%	
Eritrea		Y				Y	Y						Y			
Oman	Y					Y	Y									
Panama	Y				Y	Y	Y						Y		5.40%	
Singapore	Y				Y		Y						Y			
Yemen						Y	Y									

"Y" denotes member of the specified international organization
See Appendix 2 for a summary of the aims of these international organizations.
Source: *CIA World Factbook*

Ostensibly, the UK is a strong military power, with higher defence spending than any of the 37 countries of interest (Figure 5.1) and the sixteenth largest regular military, amongst the 37 plus the UK (Figure 5.2). However, neither defence spending nor the size of the armed forces is a perfect metric for military power. The spending metric cannot discriminate differences in national cost structures. The personnel figure is even less useful, since functions performed by civilians or contractors in one country may fall within the uniformed cadre in another, and the metric provides no information on quality of troops or their level of equipment. Superficially, the UK armed forces should be sufficiently large and well-funded that they could militarily impose the UK's will on many of the countries of energy interest. However, it would be unthinkable for Britain to do so unilaterally. Firstly, there are the constraints of domestic consent, legality, morality, distance, equipment, cost-effectiveness, long-term repercussions and diplomatic opprobrium. Secondly, such a move would ignore the history of failure of energy adventurism: Imperial Japan, Nazi Germany and Ba'athist Iraq all failed to secure access to energy by invasion; and the UK has its own experience of failure in Suez. Thirdly, despite being the sixteenth largest regular military amongst the 37 plus the UK, the British military (like many others) is no longer of sufficient size to invade another sizeable country. Very crudely, if one divides the size of British forces by a factor of three for the numerical superiority required by the attacker, and a further three to account for force readiness,[214] one gets the "UK (adjusted)" bar on Figure 5.2. This shows that – by crude numerical estimate – the UK could not expect to launch a successful, unilateral intervention into any but the smallest of the 37 countries of energy interest.

[214] To sustain expeditionary operations requires approximately one third of personnel strength preparing for operations, one third on operations and one third recovering from operations, whilst the defending nation could be 100% mobilized on its own territory.

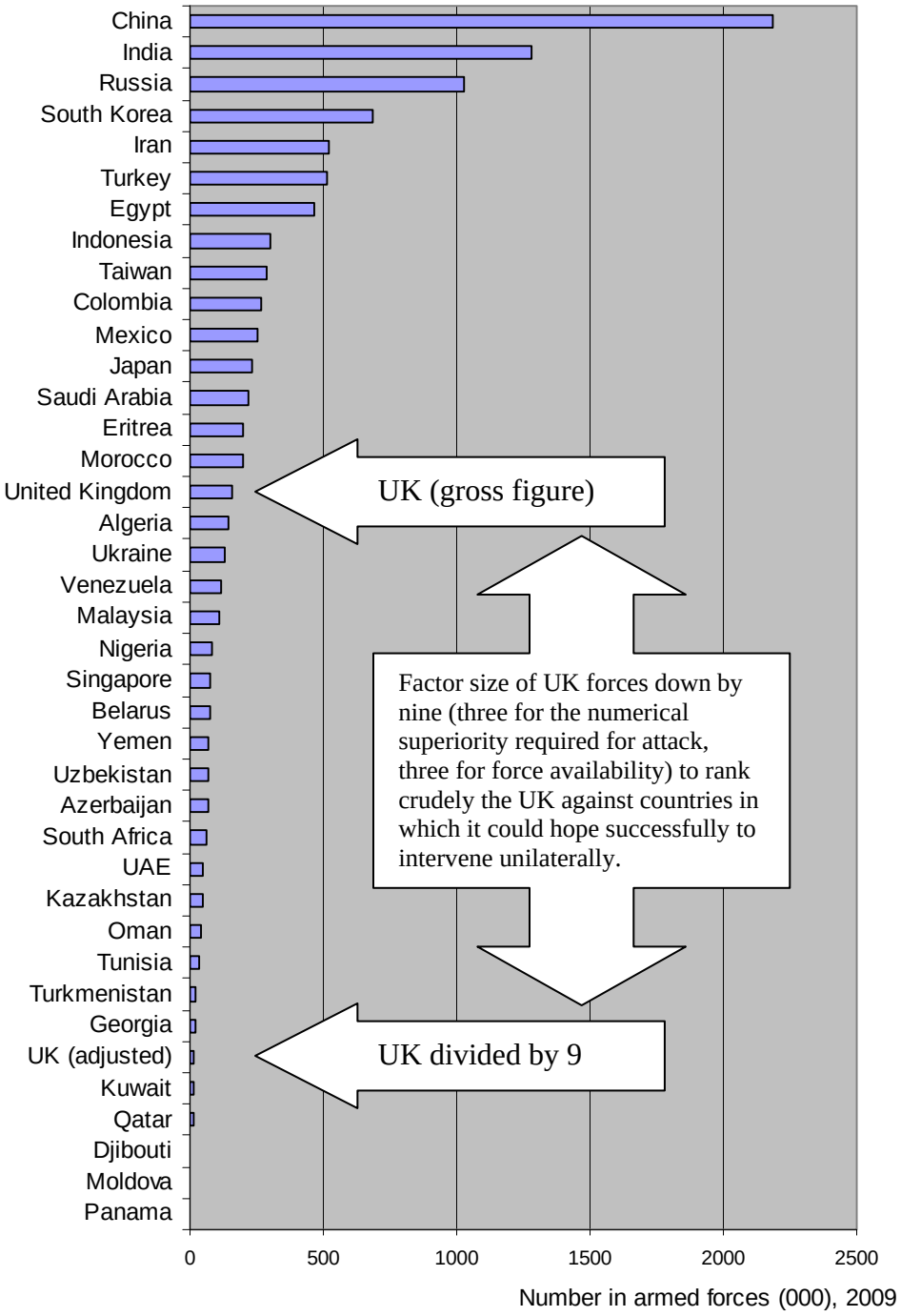
Figure 5.1 – Defence Spending: UK and the 37 Countries of Interest



Source: plotted from data tabulated in The International Institute for Strategic Studies (IISS), *The Military Balance 2009*[215]

[215] The International Institute for Strategic Studies, *The Military Balance 2009* (London: The International Institute for Strategic Studies, 2009), 447-452.

Figure 5.2 – Size of the Armed Forces: UK and the 37 Countries of Interest



Source: plotted from data tabulated in IISS, *The Military Balance 2009*[216]

[216] The International Institute for Strategic Studies, *The Military Balance 2009…*, 447-452.

This crude but frank appraisal of British power illustrates that, although the UK may be militarily potent, the real world utility of British military power in securing UK energy security is in support of wider UK energy policy, which is reviewed below.

UK ENERGY POLICIES

Background to UK Energy Policy

The UK used to enjoy abundant oil and natural gas from the North Sea. But, as Dieter Helm points out, the UK failed to use this time of plenty to invest in energy storage, strategic energy contracts, energy distribution systems or developing energy relationships in Europe.[217] Thus, the UK was ill-prepared to deal with shifts in its energy status and world energy markets after 2000, despite the fact that the British economy became increasingly service-based and decreasingly energy-intensive through the 1980s and 1990s (decoupling growth in GDP from energy demand). According to Helm, British energy policy remained rooted in the 1980s and 1990s.[218] In Helm's view, this left the UK with a number of energy security disadvantages, especially for natural gas: the UK's relations with Russia are poor, it has no relationship with Gazprom (unlike Germany, Austria, Italy and France), it is located at the extremity of pipelines that run through the Ukraine, and it is reliant on "interconnector" pipelines from continental Europe. The UK lacks natural gas storage and long-term supply contracts, exposing the UK to price volatility and interruptions in supply, and is particularly reliant on Norwegian natural gas

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[217] Dieter Helm, *Credible Energy Policy – Meeting the Challenges of Security of Supply and Climate Change* (London: Policy Exchange, 2008), 21; http://www.dieterhelm.co.uk/publications/Credible_energy_policy_Dec08.pdf ; Internet; accessed 13 April 2009.

[218] Dieter Helm, *British Energy Policy* (Paper published in the Yearbook of International Relations, 2007), 3, 6, 9-10; http://www.dieterhelm.co.uk/publications/British_EP_150808.pdf ; Internet; accessed 13 April 2009.

(which may not flow at the rate the UK requires) and LNG (which is inherently more costly than piped natural gas).[219]

Caroline Kuzemko has reviewed the role of the state in UK energy from the 1950s to the present and, in particular, UK energy policies from 1998 to 2008. She comments that the UK has moved from an era of state ownership of energy companies (1950s to 1970s), to the privatization of energy in the 1980s and 1990s, to the market-oriented energy policies of the New Labour government (since 1997), which are beginning to show weaknesses.[220]

In tracing the evolution of UK energy policy, Kuzemko identifies the emergence, during the Thatcher premiership (1979-1990), of the idea of energy as just another tradable commodity. When New Labour came to power in 1997, their energy policy aped Conservative ideas of private ownership and competitive markets but added low prices, reduced carbon emissions and the international promotion of liberal energy markets. Kuzuemko characterizes this as "a market-oriented energy paradigm" and the "depoliticisation of energy." But, in Kuzemko's view, contradictions have emerged in the "re-conceptualization of energy as an issue of national concern," since 2005 (with the drop-off in North Sea production), leading to a new focus on re-establishing self-sufficiency, investment in renewables, increased use of coal and willingness to continue investment in the North Sea.[221]

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[219] Helm, *Credible Energy Policy* …, 46.

[220] Caroline Kuzemko, *Energy, Ideas and Institutions: a Contextual Analysis of UK Energy Policy 1998-2008*, Paper presented at the Annual Meeting of the International Studies Association's 50th Annual Convention "Exploring the Past, Anticipating the Future," at the New York Marriott Marquis, New York, 15 February 2009; http://www.allacademic.com/meta/p310812_index.html ; Internet; accessed 7 March 2009.

[221] Kuzemko, *Energy, Ideas and Institutions.…*

Kuzemko found very little research on UK energy policy from the perspective of international relations.[222] Kuzemko's findings echo those of a study conducted by Philip Andrews-Speed and Peter Cameron for the UK Economic and Social Research Council in 2006. They identified several areas for further study on the vulnerability of the UK to disruptions in oil and natural gas imports. They found a lack of international relations expertise in British research institutions for oil and gas, and a lack of oil and gas expertise in British international relations research cells.[223]

Although Kuzemko, Andrews-Speed and Cameron may be correct in detecting a lack of consistent philosophy and academic rigour to support UK energy policy in recent years, there appears to be a reassuring level of pragmatism in the approach of the current British government to energy security. Rather than following an outmoded paradigm for energy or allowing policy to be paralysed by intellectual debate, there are encouraging signs of genuine progress in UK energy policy, especially with respect to energy security. This is clear from the flurry of energy policy papers produced since 2003.

UK Department of Trade and Industry Energy White Paper 2003 – *Our Energy Future – Creating a Low Carbon Economy*

The 2003 Energy White Paper was based on four pillars (the environment, energy reliability, affordable energy and competitive markets). It acknowledged *inter alia* the

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[222] *Ibid*.

[223] Philip Andrews-Speed and Peter Cameron, *Security of International Oil and Gas – Challenges and Research Priorities* (Project for the Economic and Social Research Council, University of Dundee Centre for Energy, Petroleum and Mineral Law and Policy, August 2006); http://www.dundee.ac.uk/cepmlp/research/ESRC%20CEPMLP%20FinalReport.pdf ; Internet; accessed 4 April 2009.

criticality of affordable energy for the UK and the increasing dependence on imported oil and natural gas but placed most emphasis on competitive markets and cutting carbon dioxide emissions. The best way to maintain energy reliability was considered to be energy diversity and an effective market but action was also required on infrastructure, regulation, European energy markets, and international relationships to promote regional stability, economic reform and foreign investment in energy-producing regions. Energy relationships were seen as mutual dependencies between the UK and Norway, Russia, the Middle East, North Africa and Latin America.[224]

The word "security" was used interchangeably with "reliability" in the 2003 White Paper. Energy reliability was sought through energy diversity and greater use of renewable and distributed energy sources. The 2003 White Paper committed the Department of Trade and Industry (DTI)[225] and the Foreign and Commonwealth Office (FCO) jointly to monitor trends in international oil markets and to prepare for risks and uncertainties in oil security and for the UK to support the work of the International Energy Agency (IEA) in encouraging oil security arrangements. The 2003 White Paper committed the Government to continue to monitor energy security through the Joint Energy Security of Supply (JESS) Working Group. However, the Ministry of Defence (MOD) was not a member of the JESS Group and the only mention of the MOD in the

[224] Department of Trade and Industry, Cm 5761 *Energy White Paper: Our energy future – creating a low carbon economy* (Norwich: TSO, 2003), 3-9. http://www.berr.gov.uk/files/file10719.pdf ; Internet; accessed 9 March 2009.

[225] The UK Government department responsible for energy policy at the time.

document was a commitment to work with industry and the MOD to ensure that windfarm developments did not impair military activities.[226]

The 2003 approach to UK energy security can therefore be categorized as some-of-government, rather than whole-of-government.

UK DTI Energy Review Report 2006 – *The Energy Challenge*

The 2006 Energy Review Report described progress in the four pillars set out in the 2003 White Paper and reinforced the Government's commitment to a market-based approach to energy security. The emphasis of the 2006 Review was on the need for the UK to become significantly less carbon-intensive, improve energy efficiency, use cleaner energy and ensure good access to fuel supplies, transport infrastructure and effective markets. Two main security challenges were cited: the UK's increasing dependence on imported oil and natural gas; and the need to ensure the market delivered necessary investment in electricity infrastructure. The risks arising from greater dependence on imported oil and natural gas were: increasing reliance on Russia, Central Asia, the Middle East and Africa; increasing global competition for energy supplies; the risk that supplier countries may not invest to increase output; an increasingly tight oil market, under increased OPEC influence; the lack of a global trading market for natural gas; and upward pressure on prices and increased risk of political intervention in international energy transactions. The proposed response to these risks was the promotion of open and

[226] Department of Trade and Industry, Cm 5761 *Energy White Paper* …, 9, 11, 14-16, 53, 86-88, 76-94.

competitive international markets and a UK market that encouraged investment, diversity of supply and growth in domestic energy supply.[227]

The Report devoted a lengthy passage to international energy security and drew a link between increasing demand for energy imports, energy security and the reliability of suppliers and markets. It was acknowledged that the UK needed confidence in international energy markets, a diverse mix of fuels, a variety of supply routes, storage facilities and a robust energy transport infrastructure.[228]

The Report acknowledged the importance to the UK of: coal from South Africa, Russia, Australia and Columbia; oil from Russia, Central Asia, the Middle East and North Africa; and natural gas from Norway and increasingly Algeria, Qatar, Russia, the Caspian region and Nigeria. Although export revenues would encourage these energy-exporting countries to form relationships with importers such as the UK, the UK was exposed to increasing risks arising from: constraints on energy investment; market opacity; slow progress to market liberalization; the potential for unrest and supply disruption at source; and accidents and natural phenomena. These risks were exacerbated by strong global growth in energy demand, particularly from India and China.[229]

The UK's planned response to these risks was: to encourage open international energy markets, transparency, good governance and stability in source and transit regions; to support the IEA in encouraging contingency arrangements for supply shocks; to make

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[227] Department of Trade and Industry, Cm 6887 *Energy Review Report 2006 …*, 12-24.

[228] *Ibid*., 77-91.

[229] *Ibid*., 77-91.

the most of UK domestic energy resources; to encourage flexibility in UK energy and to evaluate the need for UK strategic gas storage.[230]

The 2006 Energy Review Report was a frank admittance of the energy security risk to the UK. However, it also led to the cessation of the activities of the JESS Working Group (by calling for new arrangements for energy market information and analysis of security of supply), despite the 2003 White Paper commitment to continue to monitor energy security through the Group.

Joint Energy Security of Supply Working Group

The JESS Working Group had been set up in July 2001, to bring together the DTI and the Office of the Gas and Electricity Markets (the market regulator) to assess risks to the UK's gas and electricity supplies.[231] The JESS Working Group published its final report (*Long-Term Security of Energy Supply*) on 13 December 2006, since when the Government has been reviewing the role of the Group. The report was frank in its assessments, highlighting – *inter alia* – serious malfunctions in EU energy markets, the importance of the UK's election to the Board of the International Energy Forum Secretariat, the long-term availability of uranium, the lack of uranium recycling capability in the UK, and new indicators for security of supply. Overall, however, the Report's focus was on infrastructure and markets, rather than import-dependency. [232]

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[230] *Ibid*., 77-91.

[231] Department of Trade and Industry, Cm 5761 *Energy White Paper* …, 132.

[232] Department of Trade and Industry, JESS Working Group December 2006 Report - *Long-Term Security of Energy Supply*. http://www.berr.gov.uk/files/file35989.pdf ; Internet; accessed 9 March 2009.

Despite the implication that JESS reporting would continue and widen in scope, the December 2006 report was the final one from JESS, which has now been replaced by the Energy Markets Outlook (EMO) project.[233] However, the tenor of the new EMO is market-based, emphasizing the Government's role in providing a regulatory framework, incentivising deployment of renewable technologies and removing market barriers. The UK's high and growing energy import dependency is acknowledged in the new document but dealt with as just one of a number of risks.

JESS was a partial effort to address the security of energy supply. The MOD played no role in JESS.[234] Moreover, JESS was developing in scope when it was abandoned in favour of the EMO, which seems to have a stronger market emphasis, at the expense of wider energy security. This appears inconsistent with the frank treatment of energy security increasingly present in UK Energy White papers.

UK DTI Energy White Paper 2007 – *Meeting the Energy Challenge*

The 2007 White Paper was unequivocal in its approach to energy security:

> The United Kingdom has a challenge in common with every other nation of the world. Energy is essential for economic growth, and although the link between growth and energy use has become weaker the world's demand for energy is increasing rapidly, leading to greater competition for finite natural resources. … On current trends, world demand for energy is set to increase by 53% between 2004 and 2030. Even if action is taken to save energy, reflecting the need to reduce emissions, a significant increase in demand is still likely, requiring a substantial response in energy supplies. … The IEA [International Energy Agency] reports that global oil

[233] Department for Business, Enterprise and Regulatory Reform, "Joint Energy Security of Supply Working Group (JESS);" http://www.berr.gov.uk/energy/reliability/security-supply/jess/index.html ; Internet; accessed 13 April 2009.

[234] *House of Commons Hansard Written Answers for 17 Sep 2007*, Col. 2173W; http://www.publications.parliament.uk/pa/cm200607/cmhansrd/cm070917/text/70917w0002.htm ; Internet; accessed 13 April 2009.

> and [natural] gas reserves are sufficient to sustain economic growth for the foreseeable future. But they are concentrated in relatively few locations around the world. Our [UK] security of supply challenge, therefore, lies in recovering and bringing energy resources to market.[235]

The Paper indentified two long term energy challenges for the UK: to tackle climate change and to ensure access to secure, clean and affordable energy as the UK became increasingly dependent on imported fuel. The risks to the reliability of future UK energy supplies were listed as: the concentration of oil and natural gas supplies in regions that include less stable parts of the world; the rise of resource nationalism and state intervention in access to resources; the potentially inefficient and politicized role of national champions and nationalized industries; the concentration of significant market power over reserves and transit routes; poor market information, destabilizing prices and inhibiting investment; regulatory uncertainty; and the threat of terrorism, accident and natural disaster. The impact of these risks on a UK that was increasingly dependent on imported fuels (increasing to 80% reliance on imports by 2020) was that the UK would face more volatile consumer energy prices, more complex international relations with consumer and producer nations, and increased vulnerability to overseas disruptions of energy supplies.[236]

The key aims of the UK's strategy to deliver energy security and a low-carbon economy were to: save energy; encourage investment in renewables and decentralized energy; encourage diversity of energy supplies; maximize economic production of domestic energy; encourage development of more effective and transparent international

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[235] Department of Trade and Industry, Cm 7124 *A White Paper on Energy – Meeting the Energy Challenge – May 2007* (Norwich: TSO, 2007), 28-32. http://www.berr.gov.uk/files/file39387.pdf ; Internet; accessed 16 March 2009.

[236] Department of Trade and Industry, Cm 7124 *A White Paper on Energy* …, 6-8, 32-33.

energy markets; and improve the UK energy investment framework. Gas security of supply would be improved through development of offshore natural gas facilities, LNG infrastructure and natural gas storage.[237]

With the 2007 Energy White Paper, the Government strengthened its language on energy security and made delivering energy security a firm commitment. However, there was no overt definition of a role for the MOD in energy security. The 2007 White Paper acknowledged the multi-faceted character of the energy security problem but failed to signal a whole-of-government approach to tackling it.

UK Department for Business, Enterprise and Regulatory Reform[238] White Paper on Nuclear Power 2008

The 2008 White Paper on nuclear power presented the Government's conclusion that excluding nuclear power from the UK's energy mix would increase the costs (and risk of failure) of tackling climate change and ensuring security of energy supplies.[239] Although this renewed commitment to nuclear power was justified as a low-carbon, affordable, dependable and safe course of action, the fact that a New Labour government, in the twilight of its popularity and almost certainly going against the instincts of its core supporters, made such a strong, long-term commitment to nuclear energy probably shows that Government thinking was strongly influenced by energy security.

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[237] *Ibid*., 19-22

[238] The Department for Business, Enterprise and Regulatory Reform (BERR) replaced the Department of Trade and Industry (DTI) in June 2007 and inherited responsibility for UK energy policy until the creation of the Department of Energy and Climate Change in October 2008.

[239] Department for Business, Enterprise and Regulatory Reform, CM 7296 *Meeting the Energy Challenge – A White Paper on Nuclear Power – January 2008* (Norwich: TSO, 2008), 5-6; http://www.berr.gov.uk/files/file43006.pdf ; Internet; accessed 13 April 2009.

The Creation of the UK Department of Energy and Climate Change

The UK Department of Energy and Climate Change (DECC) was created in October 2008, bringing together energy policy (from the Department for Business, Enterprise and Regulatory Reform) and climate change mitigation policy (previously the remit of the Department for Environment, Food and Rural Affairs). The creation of DECC was presented as the embodiment of the UK view that climate change and energy policies are inextricably linked. At its formation, three objectives were set for DECC: to ensure UK energy is secure, affordable and efficient; to deliver a low-carbon Britain; and to achieve an international agreement on climate change in December 2009.[240] DECC acknowledges that one of Government's key responsibilities is to ensure that the UK enjoys secure and affordable energy, whilst accelerating the transition to a diverse, competitive, low-carbon energy mix.[241] DECC's concept of a diverse energy mix is: oil and natural gas; coal; nuclear; renewable energy (in particular, offshore wind energy); carbon capture and storage; distributed energy and heat (combined heat and power, and micro-generation); and emerging low-carbon technologies.[242]

For energy security, two factors are significant in the formation of DECC. Firstly, energy security has been elevated to the top of the list of objectives for the new

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[240] Department of Energy and Climate Change, "About Us," http://www.decc.gov.uk/en/content/cms/about/about.aspx ; Internet; accessed 9 March 2009.

[241] Department of Energy and Climate Change, "UK Energy Supply," http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/uk_supply.aspx ; Internet; accessed 9 March 2009.

[242] Department of Energy and Climate Change, "The Energy Mix," http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/energy_mix.aspx ; Internet; accessed 9 March 2009.

department. Secondly, the creation of DECC increases the prominence of the energy brief in the UK Cabinet.

Evaluation of UK Energy Policies

The 2003 White Paper, 2006 Energy Review and 2007 White Paper exhibit increasing frankness and pragmatism on energy security for the UK. However, Dieter Helm suggests that they are notable for what they do not contain: security of supply aspects have been largely neglected; nuclear investments have been left "for the market to decide;" infrastructure investment continues to be regulated independently of government; and no incentives have been offered for investment in energy system spare capacity.[243] Helm characterizes current UK energy policy as "the dash-for-wind before 2020 … and the dash-for-nuclear after 2020", which he derides as creating the conditions for a domestic security of supply problem (due to the inability to deal with peaks in demand).[244]

In Helm's view, the question of the UK's dependence on imported natural gas has not been adequately addressed. Helm points out that the Russian interruption of natural gas supplies to Ukraine in winter 2005-06 had a direct effect on the price and availability of natural gas in the UK; it "exposed all the main weaknesses of the British energy sector: inadequate infrastructure, inadequate storage, a gas dependency in the electricity sector, and a lack of long-term contracts."[245]

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[243] Helm, *British Energy Policy* …, 8.

[244] Helm, *Credible Energy Policy* …, 24-26.

[245] *Ibid*., 22.

The origins of this problem lay in the fact that the UK rapidly depleted its energy reserves in the North Sea, using the tax revenues to fund government expenditure. In contrast, the Netherlands instigated a depletion policy in 1961, to husband natural gas reserves, and Norway has used North Sea oil and natural gas revenue to build a sovereign wealth fund that is now one of the largest in the world.[246] In this context of state-managed output by the UK's major natural gas suppliers, the idea of diversity of natural gas supply is illusory. Norway's natural gas output is tied to its depletion policy and the needs of its small population and their sovereign wealth find, so there is no guarantee that Norwegian natural gas will be available in sufficient quantities to satisfy the UK. And the Caspian states are tending to route their natural gas exports via Russia due to the political risks of the alternative routes via Georgia and Turkey. Russia is therefore much more powerful in the European gas market than its overt market share suggests. This situation is exacerbated by the efforts of the "gas-poor" nations, such as Germany, Austria and Italy to develop preferential supply agreements with Russia.[247]

In Helm's view, the British insistence on addressing these problems through markets and competition is at odds with German and French experience and practice: enhancing pan-European competition can actually conflict with national competition.[248] As *The Economist* has reported, although competition was intended to improve European energy markets, it has actually fostered a wave of mergers and acquisitions leading to the

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[246] *Ibid*., 20-21.

[247] *Ibid*., 23.

[248] Helm, *British Energy Policy* …, 8-9.

formation of large, multi-national energy companies in an unintended oligopoly market for electricity and natural gas.[249]

Moreover, European rhetoric of diversifying energy supplies ignores the fact that most eastern European states are reliant on Russian natural gas.[250] And the European reaction to the 2008 "August war" in Chechnya was characterized by the appeasing behaviour of "gas-swilling Russophiles (such as Italy and Germany)," damaging the idea of a common European foreign and security policy. In *The Economist's* opinion, the occurrence of such "Eurowobbles" could be reduced by liberalizing European Union energy markets and building an effective interconnected European natural gas pipe network.[251]

None of these issues appears to be forcefully addressed in UK energy policy. Nor is there overtly a whole-of-government approach to the challenge of energy security for the UK. Although the FCO is accorded an increasing role, the MOD seems to be excluded from UK energy policy, at least in public.

DEDUCTIONS ON ENERGY IN UK NATIONAL POWER AND POLICY

The UK is ostensibly strong economically, diplomatically and militarily but faces a significant energy security challenge, due to its dependence on imported energy and the wide range of countries that have an impact on UK energy security but which are not necessarily open to British economic or diplomatic influence. It is inconceivable that the UK would use the military instrument alone to intervene in one of these countries to

[249] *The Economist*, "European Energy – Power Games," 28 February 2009.

[250] *The Economist*, "Energy in Eastern Europe – Gasping for Gas," 17 January 2009.

[251] *The Economist*, "Leader – Europe Stands up to Russia," 6 September 2008.

secure access to energy. The real world utility of British military power in energy security is in support of wider UK energy policy. However, British energy policy is constrained by the rapid depletion of UK oil and natural gas reserves, unrealistic expectations of increasing access to energy imported from Norway, unwise dependence on energy imported from Russia, lack of strategic energy storage or long-term supply contracts, and a narrow skills and intellectual base in the British energy industry. Although UK government policy on energy is increasingly focused on energy security, there are inconsistencies and weaknesses in the approach, leading to a parts-of-government rather than whole-of-government approach to the problem.

The next chapter will argue that, in this tricky energy context, the utility of military force for the UK will be founded on the ability of the military instrument to support the other instruments of national power in maintaining access to the imported energy that is essential to the security and prosperity of the UK.

CHAPTER 6 – IMPLICATIONS OF ENERGY SECURITY FOR THE UTILITY OF MILITARY FORCE FOR THE UK

It has been argued so far that: energy is sufficiently scarce to be a plausible *casus belli* for the twenty-first century; the nexus between energy and war is multi-faceted and pertinent today; the UK is dependent on energy imports but has limited scope to influence the countries that impact UK energy security; and, although the UK is ostensibly powerful, British power is constrained by the UK's dependence on imported energy, which the military instrument alone is unlikely to be able to secure.

The culmination of this paper is to consider the difficulty of military futurism, the changing utility of military force and potential military roles in energy security before making deductions on the implications of energy security for the utility of military force for the UK.

The Difficulty of Military Futurism

Colin Gray encapsulates the difficulty of predicting the nature of future conflict in order to make defence policy:

> Argument over alternative visions of future war has profound implications for defence planning … [but] identifying a nation's future strategic priorities has proved to be a very imprecise art, and as a result peacetime force structures have seldom proved relevant when put to the test of war.[252]

It is perhaps unsurprising, therefore, that Gray makes no defence policy or capability recommendations in the 399 pages of his book *Another Bloody Century – Future*

[252] Colin S. Gray, *Another Bloody Century – Future Warfare* (London: Weidenfeld & Nicolson, 2005), 171-172.

Warfare.[253] But the culmination of this paper is to attempt what Gray calls "the mission impossible of finding reliable knowledge about future warfare."[254]

In the words of General Sir Rupert Smith, "Without an enemy it is not possible to formulate a strategy, and without a strategy it is not possible to make anything but the broadest decisions on weapons and equipment."[255] This paper has defined the broad energy security challenge facing the UK plus a constituency of countries of energy interest to the UK, if not an actual enemy. The final step is to attempt military futurism and analyse what the British military need to be able to deliver to the nation in support of energy security.

The Changing Utility of Military Force

In many respects, argument over the utility of force (and thus future capabilities) centres on the debate over the nature of future conflict. According to some commentators, inter-state war is redundant. Colin Gray identifies a number of arguments against a return to regular inter-state warfare: is it unattractive because it would be unprofitable; fewer and fewer societies will tolerate it; it has been rendered inutile by the danger of escalation to a nuclear exchange; it has been made impractical by American military dominance; and there is now a social and cultural aversion to war in some societies and regions, such as Europe.[256]

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[253] Gray, *Another Bloody Century* …, 1-399.

[254] *Ibid*., 371.

[255] General Sir Rupert Smith, *The Utility of Force – The Art of War in the Modern World* (London: Allen Lane, 2005), 268-269.

[256] Gray, *Another Bloody Century* …, 172-177.

For Sir Rupert Smith, war is now:

> … war amongst the people: …the ends for which we fight are changing; we fight amongst the people; our conflicts tends to be timeless; we fight so as not to lose the force; on each occasion new uses are found for old weapons; [and] the sides are mostly non-state.[257]

But Paul Hirst offers a different and evolving view of war in the twenty-first century:

> A world living on the legacy in the international system of the embedded liberalism created after 1945 and still dominated by the Great Powers, led by the United States, acting in concert with and through the international institutions that they fund, is still the most likely outcome for the international system in the early part of this [twenty-first] century. Thereafter, the problems of environmental crisis, population growth and world poverty will make this system increasingly hard to sustain. In the medium term these problems will not create forces capable of shaking Western hegemony, but they will be capable of making its rule ever more difficult and less legitimate. It is almost impossible to see the present world order as sustainable in the long run, it is so unfair and environmentally destructive. The populations of the advanced countries, especially the USA, will not be willing to reduce energy and oil consumption until faced with probably irreversible effects. They are equally unlikely to accept more generous resource transfers to the poorest or support for migrants and refugees.[258]

Hirst's view strikes a chord with many of the themes of energy scarcity, power, war and energy security presented in this paper and leads to the deduction that, although Smith's "war among the people" is a compelling narrative for war today, there is a significant risk of a return to state-on-state regular warfare in a twenty-first century characterized by resource scarcity. As Colin Gray expresses it, "the belief that major war has had its day may be true ... [but] it may not be true enough."[259] Thus, though we may hope and even assess that major war is unlikely, the military has a duty to prepare for the arguably low probability but high impact of future large scale conflict. For the UK, the dependence on

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[257] Smith, *The Utility of Force* …, 17, 269-305.

[258] Paul Hirst, *War and Power in the 21st Century* (Cambridge: Polity Press, 2001), 147-148.

[259] Gray, *Another Bloody Century* …, 170.

imported energy is so great that the impact of losing access to imported energy would be severe and so the British armed forces must be prepared to do whatever is necessary to secure legitimate UK access to energy, across the spectrum of conflict.

Potential Military Roles in Energy Security

As alluded to in Chapter 5, the UK is unlikely to take aggressive unilateral action to impose its will directly on another nation in the cause of energy security. Putting aside the legal, ethical and democratic hurdles, such action is unlikely to be feasible with the current size of Britain's armed forces. The example of Suez serves to support this view. At the time of the Suez Crisis, in 1956, the British armed forces had recently been awarded a rearmament package, the UK was spending 10% of Gross National Product in defence, 7% of the British working population were either in the armed forces or working in support of them, and one eighth of the UK output of metal manufactured goods was devoted to defence. Yet the mobilization for Suez took three months to organize, reservists had to be re-called and units has to be redeployed from other theatres to form the intervention force.[260]

Instead, in supporting UK energy security, the British armed forces are more likely to be called upon to support the other instruments of national power. Smith's conception of modern conflict is useful here:

> We seek to create a conceptual space for diplomacy, economic incentives, political pressure and other measures to create a desired political outcome of stability, and if possible democracy.[261]

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[260] Stuart Croft, Andrew Dorman, Wyn Rees and Matthew Uttley, *Britain and Defence 1945-2000 – A Policy Re-evaluation* (Harlow: Pearson Education Limited, 2001), 12.

[261] Smith, *The Utility of Force* …, 271.

Although it is risky to predict what this might mean in terms of military capabilities and missions, Alistair Kerr, writing in 2004, outlined potential military roles in energy security. He identified physical security of energy installations and tankers as the most important defence-related challenge posed by the UK's new dependence on imported energy and recommended protection of pipelines, port facilities, associated infrastructure, oil tankers and energy personnel (domestic and expatriate). Kerr saw NATO having an energy security role in engagement with Turkey, Russia and the former-Soviet states on energy security issues, and defusing tensions between such nations (via the Partnership for Peace and security sector reform). Kerr saw a military role in anti-piracy, security advice to British companies operating overseas, pooling energy security information with strategic allies, protective security and counter-terrorist capacity building, and protection for installations and tankers in high-threat environments. Kerr also pointed out the value of the UK's involvement in the Five Power Defence Arrangement (with Australia, New Zealand, Malaysia and Singapore) and its potential utility in protecting, securing or consequence management in the Straits of Malacca.[262]

In February 2008, RUSI took the view that "while NATO will most likely maintain a low-profile role in the area of energy security, there are a few specific potential areas where NATO may add value." These areas were: intelligence-sharing and surveillance on infrastructure; human intelligence; intelligence dissemination;

[262] Alistair Kerr, "Energy Security: The Risks and Realities," *RUSI Journal* 149, no. 6 (December 2004),: 16-19; http://www.rusi.org/publication/journal/journal/ref:P41B986EDB2209/credited:true ; Internet; accessed 12 April 2009.

deployment of forces to conduct military operations; consequence management for natural disasters; assistance to allies and partners to produce best practice guidelines.[263]

In December 2008, NATO Secretary General Jaap de Hoop Scheffer laid out three roles for NATO in Energy Security: to police and to protect on the high seas; to foster partnerships (especially with Russia and in the Caucasus, Central Asia, North Africa and the Gulf); and to support member countries, by consultation, common strategic analysis and Alliance preparation. The Secretary General outlined his philosophy on NATO's role in energy security:

> In short, I submit that NATO can, and should, act as a catalyst in persuading our member countries to take a more strategic look at energy security and to develop a more collective approach. It is obvious that energy suppliers need energy buyers as much as the other way round. But it is also just as obvious that the energy buyers will not get the best commercial deals, nor maximise their negotiating leverage, nor guarantee their individual energy supplies in the long run, if they do not take a unified approach *vis-à-vis* the major suppliers. A frank and open dialogue within the Alliance can help to foster this sense of common strategic interest.[264]

The Implications of Energy Security for the Utility of Military Force for the UK

The implications of energy security for the utility of military force for the UK cannot be neatly distilled in terms of predictions on the nature of future conflict or the specific capabilities that the British armed forces must generate. Indeed, the uncertainties and risks brought about by the UK's new dependency on imported energy validate the

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[263] Royal United Services Institute, *RUSI Policy Paper – Energy Security and NATO Policy* (London: RUSI, 2008); http://www.rusi.org/downloads/assets/Energy_Security_PP_13_Feb_2008.pdf ; Internet; accessed 12 April 2009.

[264] Jaap de Hoop Scheffer, "NATO and the Challenge of Energy Security," *RUSI Journal* 153, no. 6 (December 2008): 56-59; http://www.rusi.org/go.php?structureID=articles_journal&ref=A494A8226CFD14 ; Internet; accessed 12 April 2009.

wisdom of threat-based, rather than capability-based, defence planning. Instead, the implications of energy security are that the motives for military action become more realist and the consequences of failure more severe.

Access to imported energy is now essential to the British way of life. The UK can neither be self-sufficient in energy nor could it realistically use military force unilaterally to secure access to energy. Instead, the utility of the military instrument for the UK is in supporting the other instruments of national power in order to secure access to scarce energy: carrying a notable share of the military burden on coalition and alliance operations, in order to maintain the UK's strategic alliances; contributing to collective energy security measures through NATO and the EU; making the UK a safe, secure, preferred customer for energy-exporting states; supporting the rule of law and building security capacity in the energy-exporting and transit states; protecting the global trade that fosters the pacifying effect of global economic interdependence; maintaining maritime freedom of movement; protecting energy infrastructure; providing intelligence support and assisting in post-attack/disaster consequence management for the rapid recovery of energy infrastructure.

As such, the roles of the British armed forces in the new era of energy scarcity may not be markedly different from those carried out in support of human security, stabilization operations or global counter-terrorism. What is fundamentally different, however, is that operations in support of energy security must take first priority for the UK. Wars of necessity must supplant wars of choice; the UK must be robustly realist in its approach to international relations, and accept that the UK must prioritize the economic and the mercantile before the humanitarian. This is not an autarkic approach, however: the new dependence of the UK on imported energy does not allow an

isolationist view. Indeed, as so often before in history and as Croft *et al* point out, for Britain, the maintenance of world order and the protection of its interests amount to the same thing.[265]

Lastly, the effort to achieve energy security for the UK must be a whole-of-government effort. US President Carter's 1977 "moral equivalent of war" speech has been frequently misquoted in energy security literature and dates from a period of illusory energy scarcity (rather than the real scarcity that faces the UK today) but Carter's wider message is applicable today. He was advocating a whole-of-government mobilization of all of the instruments of national power to overcome an energy crisis when he said:

> Two days from now, I will present my energy proposals to the Congress. Its members will be my partners and they have already given me a great deal of valuable advice. Many of these proposals will be unpopular. Some will cause you to put up with inconveniences and to make sacrifices. The most important thing about these proposals is that the alternative may be a national catastrophe. Further delay can affect our strength and our power as a nation. Our decision about energy will test the character of the American people and the ability of the President and the Congress to govern. This difficult effort will be the "moral equivalent of war" - except that we will be uniting our efforts to build and not destroy.[266]

The UK must adopt a whole-of-government approach to energy security. In the context of the energy security challenge facing the UK, the utility of military force for the UK will be founded on the ability of the military instrument to support the other instruments of national power in maintaining access to the imported energy that is essential to the security and prosperity of the UK.

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[265] Croft et al, *Britain and Defence 1945-2000* …, 31.

[266] Jimmy Carter, *The President's Proposed Energy Policy*, televised speech made by the President of the United States on 18 April 1977; http://www.pbs.org/wgbh/amex/carter/filmmore/ps_energy.html ; Internet, accessed 31 March 2009.

CHAPTER 7 – CONCLUSIONS

This paper has argued that the UK faces an energy security challenge – due to the combined effects of depletion of its own resources and a worsening global energy security environment – that means that the focus for the exercise of national power for the UK should be to maintain access to imported primary energy.

To support this hypothesis, it has been shown that energy is a scarce resource and Malthusian energy shortages (real or perceived) are increasingly likely to be drivers of conflict. Energy scarcity and conflict are linked, and energy is a plausible *casus belli* in the twenty-first century. However, although energy is a tactical and operational factor in conflict, the small scale of today's armed forces as energy consumers in the context of advanced economies, means that access to primary energy is primarily a grand-strategic matter.

The UK is a major energy importer within a global market, in which the countries of energy interest to the UK are a broad constituency of 37 states: large primary energy importers, major energy suppliers to the UK, globally-dominant energy suppliers, major producers of natural gas, the main energy transit countries, and the littoral states of maritime choke points. This constituency includes Russia, China, India, complex and unstable regions like the Caspian Sea basin and Central Asia, and a variety of other countries in varying states of under-development and instability. The UK's ability to influence Russia's energy behaviour depends on: Russia's need for customers for its energy; Russia's need for inward investment; unanimity in the EU; and the congruence of EU objectives with those of the UK. The UK's ability to secure access to primary energy in competition with giant energy importers such as China and India depends on the UK's ability to make itself the most attractive customer for energy exporters and to exploit the

dependence of the giant energy buyers, as the world's workshop countries, on markets for their manufactured products.

Although the UK is economically, diplomatically and militarily powerful, the UK is dependent on imported energy and there is limited scope for the UK to influence the broad constituency of 37 countries of energy interest. British energy policy is constrained by the rapid depletion of UK oil and natural gas reserves, unrealistic expectations of increasing access to energy imported from Norway, unwise dependence on energy imported from Russia, and a lack of strategic energy storage or long-term supply contracts. Although UK energy policy is increasingly focused on energy security, there are inconsistencies and weaknesses, and a parts-of-government rather than whole-of-government approach.

Access to imported energy is now essential to the British way of life. The UK can neither be self-sufficient in energy nor could it realistically use force unilaterally to secure access to energy. Instead, the utility of the military instrument for the UK is in supporting the other instruments of national power to secure access to scarce energy. The roles of the British armed forces in the new era of energy scarcity may not be markedly different from those carried out in support of human security, stabilization operations or global counter-terrorism. What is fundamentally different is that operations in support of energy security must take first priority for the UK. Wars of necessity must supplant wars of choice: the UK must be robustly realist in its approach to international relations and prioritize the economic and the mercantile before the humanitarian. This is not an autarkic approach: the new dependence of the UK on imported energy does not allow an isolationist view.

APPENDIX 1 – MODERN ARMED FORCES AS ENERGY USERS IN THE CONTEXT OF NATIONAL ECONOMIES

A rough calculation, based on open-source documents, will serve to demonstrate that modern armed forces are not major users of energy in the context of national economies. The UK Ministry of Defence (UK MOD) total fuel bill was £416M in Financial Year (FY) 2006-07 and £537M in FY 2007-08.[267] Even if we assumed that this entire bill was for the cheapest type of fuel (AVTUR jet fuel) and zero-rated for tax and duty), and that the purchase prices paid were half the typical low-volume retail prices (less tax) for AVTUR bought in non-bulk quantities at UK airports,[268] a conservative (over-) estimate of the total mass of fuel[269] purchased by the UK MOD would be 1 to 1.2 million tonnes per year. The UK's total of nine oil refineries produce 82 million tonnes of oil products per year.[270] Routine military fuel consumption therefore accounts for no more than 1.5% of UK refinery output.

Looked at another way, Royal Air Force (RAF) tanker aircraft currently dispense between 80 and 200 tonnes of fuel per week during air refuelling in support of coalition operations over Iraq and Afghanistan.[271] Even if the higher of these two figures were

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[267] Ministry of Defence, HC850-I *Ministry of Defence Annual Report and Accounts 2007-2008 Volume 1: Annual Performance Report* (Norwich: TSO, 2008); 237; http://www.mod.uk/NR/rdonlyres/31D096E9-3F41-4633-BEA2-AE62CF97C3AE/0/annrptvol1_200708.pdf ; Internet, accessed 19 March 2009

[268] Approximately £0.57 per litre in FY2006-07 (based on "Average Fuel Prices," *Flight Training News* 228 (June 2007); 19; http://ftnonline.co.uk/clients/ftnonline/dataandstatisticsFTN228.pdf ; Internet; accessed 19 March 2008) and approximately £0.80 per litre in FY2007-08 (based on a straw pole of UK airport internet sites).

[269] At a specific gravity for AVTUR of 0.80 kg/m^3.

[270] Department of Trade and Industry, Cm 7124 *A White Paper on Energy – Meeting the Energy Challenge – May 2007* (Norwich: TSO, 2007), 114. http://www.berr.gov.uk/files/file39387.pdf ; Internet; accessed 16 March 2009.

scaled up by the total RAF tanker aircraft fleet size, doubled to take account of refuelling on the ground, doubled again for an increased sortie rate for higher intensity operations and multiplied by a further factor of three (to simulate a larger air deployment for a war-fighting operation), the total aviation fuel consumption for such a hypothetical air component could be conservatively (over-) estimated at approximately 2 million tonnes of fuel per year. One could add to this a maritime component of – perhaps – 25 surface ships, each consuming approximately 28 tonnes of fuel per day,[272] to give an estimated total maritime fuel requirement of 1 million tonnes per year. For the land component, based on fielding 35 000 troops, at a reported modern fuel consumption rate of 16 gallons (US) per soldier per day,[273] the estimated total land component fuel requirement would be 0.6 million tonnes. Therefore – by rough estimate using open sources – it appears that, for the UK to deploy and sustain a medium- to large-scale force (in UK terms) for war-fighting would require no more than approximately 4 million tonnes of fuel per year, equating to less than 5% of UK refinery output.

David MacKay has approached this issue from another direction and assessed that the routine activities of the British armed forces amount to an energy bill of 4 kilowatt-hours per day for each person in the UK, within an overall energy requirement of 195 kilowatt-hours per day per Briton (for all the activities necessary for everyday British life, including daily car journeys, annual holiday flights, heating and cooling, light, electrical

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[271] Royal Air Force, *RAF Operational Update*, various dates; http://www.raf.mod.uk/rafoperationalupdate/opsupdate/; Internet; accessed 19 March 2009.

[272] Based on typical fuel consumption figures for a Type 42 destroyer, from: http://www.baesystems.com/BAEProd/groups/public/documents/bae_publication/bae_pdf_ccomms_hms_daring_info.pdf ; Internet; accessed 19 March 2009.

[273] Klare, *Rising Powers, Shrinking Planet* …, 9-31.

gadgets, food, manufactured goods, transport of goods and national defence).[274] This means that energy for defence equates to about 2% of the energy bill for the UK as a whole, for current levels of training and operational activity. Factoring for the increased activity of more intense and/or larger scale war-fighting operations would bring the figure close to the 5% estimated above.

Therefore, energy for defence and war-fighting only represents a maximum of approximately 5% of the energy required for the British economy and way of life as a whole.

[274] MacKay, *Sustainable Energy* …, 100.

APPENDIX 2 – INTERNATIONAL ORGANIZATIONS OF POTENTIAL UTILITY TO THE UK FOR ENERGY SECURITY

Organization		Aim
WTO	World Trade Organization	To provide a forum to resolve trade conflicts between members and to carry on negotiations with the goal of further lowering and/or eliminating tariffs and other trade barriers
AfDB	African Development Bank Group	To promote economic development and social progress
EAPC	Euro-Atlantic Partnership Council	To discuss cooperation on mutual political and security issues
G-20	Group of 20	To promote open and constructive discussion between industrial and emerging-market countries on any issues related to global economic stability; helps to support growth and development across the globe
ICC	International Chamber of Commerce	To promote free trade and private enterprise and to represent business interests at national and international levels
ICCt	International Criminal Court	To hold all individuals and countries accountable to international laws of conduct; to specify international standards of conduct; to provide an important mechanism for implementing these standards; to ensure that perpetrators are brought to justice
IDA	International Development Association	To provide economic loans for low-income countries
IEA	International Energy Agency	To promote cooperation on energy matters, especially emergency oil sharing and relations between oil consumers and oil producers
NEA	Nuclear Energy Agency	To promote the peaceful uses of nuclear energy
NSG	Nuclear Suppliers Group	To establish guidelines for exports of nuclear materials, processing equipment for uranium enrichment, and technical information to countries of proliferation concern and regions of conflict and instability
OECD	Organization for Economic Cooperation and Development	To promote economic cooperation and development
OSCE	Organization for Security and Cooperation in Europe	To foster the implementation of human rights, fundamental freedoms, democracy, and the rule of law; to act as an instrument of early warning, conflict prevention, and crisis management; and to serve as a framework for conventional arms control and confidence building measures
PCA	Permanent Court of Arbitration	To facilitate the settlement of international disputes
WEU	Western European Union	To provide mutual defence and to move toward political unification

Source: Central Intelligence Agency, "Appendix B - International Organizations and Groups," in *The 2008 World Factbook*…, n.p; https://www.cia.gov/library/publications/the-world-factbook/appendix/appendix-b.html ; Internet; accessed 14 April 2009.

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