GLOBAL ENERGY SECURITY –

FOSSIL FUELS

AT THE HEART OF A BURNING ISSUE

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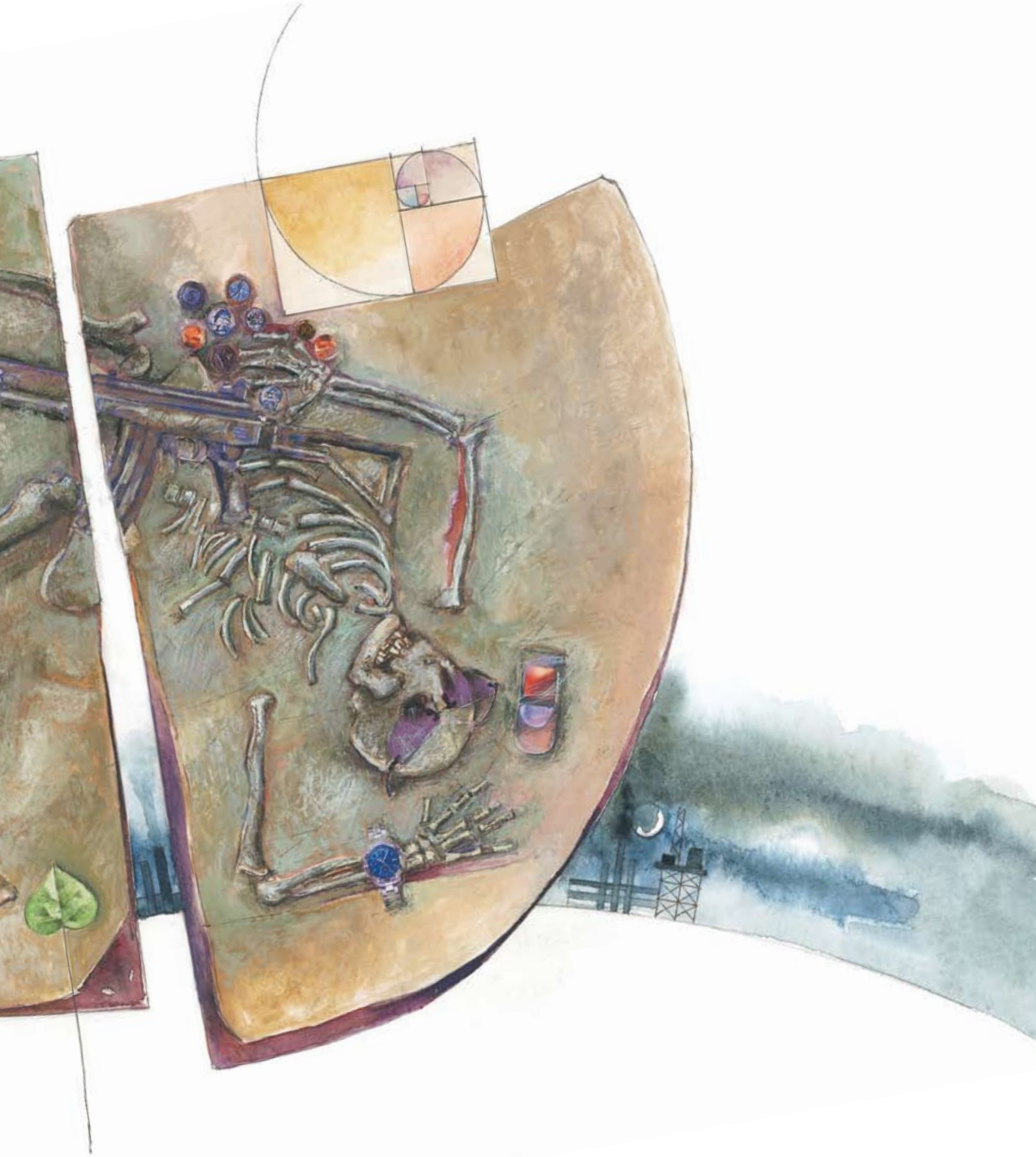

WORRIES ABOUT GLOBAL ENERGY security have intensified over the last year. If current economic and political trends continue, this may be just the start of a decades-long period of heightened tensions, and even conflict, over the issue. Far-sighted, collaborative approaches are now needed on the part of both governments and companies.

Until recently, the issue of energy security was rarely debated with much excitement except perhaps in obscure governmental working groups or university seminars on 1970s geopolitics. Suddenly, however, it has become a hot topic again. Together with climate change, an issue these days increasingly mentioned in the same breath, energy security has become a major theme of political and media debate, particularly since the start of 2006.

In his State of the Union address in January 2006, for example, President George W Bush surprised the world (particularly given that he is a former oilman) by proclaiming that "America is addicted to oil" and setting out the "great goal" of significantly reducing America's dependence on supplies from the Middle East. In January the same year, politicians across Europe began an intense debate about the risks of dependence on imported Russian gas, after Russia had temporarily halted gas supplies to the Ukraine. These sort of anxieties were heightened further later in the year by soaring oil and gas prices. Meanwhile, the debate about climate change was also becoming increasingly noisy in many countries. In Britain, for example, the publication in late 2006 of a government-commissioned economic study, *The Economics of Climate Change: The Stern Review:* which argued that the impacts of climate change could cost as much as 20% of global GDP, was described by Prime Minister Tony Blair as a "wake-up call to every country in the world".

To top it all, in November 2006, the International Energy Agency (IEA) published its annual *World Energy Outlook*, a generally sober publication whose warnings this time of potential global energy crises made headline news in many regions. The IEA's executive director warned of the potential for "skyrocketing prices or more frequent blackouts... more supply disruptions, more meteorological catastrophes – or all these at the same time." Such worrying scenarios helped ensure energy security remained a significant theme of global political debate in early 2007 too, including most recently at the G8 summit in June.

What has driven energy security up the political agenda in this way? What are the prospects for averting the worst outcomes going forward? And what are the likely effects of increased insecurity on the world's energy mix? The focus of this article is on energy security (and particularly of primary energy supplies). However, none of these questions – and certainly not the last – can be answered without factoring in concerns about climate change too.

There is also a common theme in the answers to all of the questions: the importance of collaborative and long-term solutions. One of the underlying causes of today's energy-security problems, for example, is that both governments and companies in the past have often focused on securing short-term outcomes or adopted approaches which appeared sensible on an individual basis, but which perversely sowed the seeds for longer-term or collective challenges. In the same way, one of the key factors that will now determine whether current energy-security concerns (and indeed climate change) get worse or better is whether governments and companies now avoid repeating such short-term, and narrowly focused, patterns of behaviour.

To understand first of all the recent re-emergence of energy security as a high-profile political issue, it helps to start with economic and geological factors – albeit these provide only a partial explanation of the trend.

Fuelling concerns

Over the last year or so, concerns have grown about the potential for long-term mismatches in demand and supply for two of the most significant fuels in the world's current energy mix: oil and gas. Whereas demand for both fuels is predicted to rise significantly in the next few decades, supplies are expected to be increasingly derived from a small group of countries which happen to be geologically blessed with large, and cheap-to-exploit, reserves. Growing realisation of this potential long-term trend partly underlay the spikes in prices in 2006, and the first half of 2007.

On the demand side, the world's overall energy needs are expected to be around 50% higher in 2030 compared with today, according to IEA predictions, with the increase driven by both economic and population growth. For all the current attention focused on renewable energy, 80% of this increase is predicted to be met by fossil fuels – that is, oil, gas and coal. Industrialisation in Asia, and particularly in China, has recently driven energy demand faster than many analysts had anticipated. Between 2000 and 2004, for example, both GDP and oil demand in China grew by more than 8% annually. The process of industrialisation is often naturally energy-intensive. Also OECD countries have increasingly outsourced their heavy industry to Asia, adding to that region's fast-growing appetite for energy, as Enno Harks[1], an energy expert in the German government, pointed out in a recent article.

On the supply side, it has become increasingly apparent that efforts by OECD countries to find and produce oil from fields outside the Middle East are starting to bump up against some natural limits.

Demonstrators in the Ukrainian capital, Kiev, protest Russian moves early in 2006 to significantly increase gas prices to Ukraine

Ivan Chernichkin/Reuters/The Bigger Picture

Certainly western nations had some initial successes in this respect in the decades following the oil shocks of the 1970s. However, many of the domestic oil and gas fields which were opened up in this period – for example in the North Sea and Alaska – are now approaching the end of their lives.

In this way, the imbalanced geological distribution of oil and gas reserves is now expected to re-assert itself over the next few decades. With the Middle East holding two-thirds of the world's remaining oil reserves, for example, exports from the region are expected to be increasingly critical to meeting the expected increases in global oil demand (though boosting Middle East oil production sufficiently to meet these needs will require major increases in capital investment).

In terms of gas, meanwhile, three countries – Russia, Iran and Qatar – sit on 60% of the world's reserves.

Correspondingly these countries are predicted to be increasingly important exporters of gas going forward – certainly if the expected growth in world demand is to be met. (Coal, the third major fossil fuel, by contrast, is distributed much more evenly across the globe, and also in larger quantities – a point which will be returned to at the end of the article.)

All of this might matter less, of course, if it were just market economics and geology dictating energy trends. Any excess of demand over supply for oil or gas would cause prices to rise, but this in turn would induce more supply and also curb countries' appetite for energy. Actual disruptions

Paul Navarrete/AFP/Getty Images

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to energy supplies should be avoidable. Yet that ignores the array of political pressures and other real-world motivations and constraints faced by both exporters and importers of energy. It is these short-term dynamics which lie at the heart of the security concerns.

Political sparks

Focusing first on the exporters, many of the countries with the largest reserves suffer obvious political instability. Iran, Iraq, and Saudi Arabia, together sitting on a fifth of the world's proven reserves, for example, are all run by governments facing significant internal threats or external pressures or both. Nigeria, another major exporter, struggles to control violence in its oil-producing region, the Niger Delta (its oil exports in 2006 were significantly reduced as a result).

Political pressures also help explain another common phenomenon in many non-OECD energy-rich states: a lack of investment in expanding production capacity. The state-owned firms which are in control of energy production in many such countries, for example, are often treated as cash cows by governments. The revenues they generate are frequently used to fund welfare or public programmes viewed as important by politicians or rulers, but this is sometimes at the expense of re-investment necessary to maintain or expand oil or gas output (and energy production is still often considered too 'strategic' a sector to allow in foreign investors, particularly in the Middle East). The IEA has highlighted the current relatively low rates of energy investment in both the Middle East and Russia as key factors which may prevent world production capacity responding to the expected growth in demand.

Then there are explicit attempts by governments to restrain energy supplies. Most famously, OPEC, the Middle East-dominated oil producers' organisation, has long sought to limit oil supply so as to keep prices relatively high. A study for NATO also recently warned of the potential future emergence of an 'OPEC for gas', an equivalent body dominated by Russia (though Russia has strongly denied seeking this).

Whether or not such a gas cartel emerges, the use of energy as a tool for securing political outcomes has certainly been on the rise in a number of major energy exporters. In some countries, this has been driven by a general growth in anti-western sentiment and resource nationalism, and in other countries by the activities of particular disaffected or radical groups. When energy prices are high, as they have been recently, restricting – or even just threatening to restrict supplies – can send shock waves through international energy markets, and thus present an attractive political weapon to rebels of different sorts.

Venezuela's left-wing and anti-American president, Hugo Chávez, for example, at one point recently threatened to stop exporting his country's oil to America, a country he views as imperialist. (Mr Chávez has also recently nationalised investments by foreign oil companies in Venezuela.)

In Russia, where anti-western sentiment is more moderate, the state has nonetheless also been exerting increasing control over the energy industry – for example, Gazprom, the state gas monopoly, has gained control over the giant Sakhalin project which was once majority owned by Shell, and similar moves now appear possible against a major BP investment. Meanwhile, Russia's move to raise gas prices to Ukraine in early 2006 was seen by many – though this was denied by the government – as a way of exerting political influence over its smaller neighbour. Reported Russian plans to route or re-route export pipelines away from disfavoured neighbours have been interpreted in a similar light.

In Nigeria, meanwhile, the rebel groups in the Niger Delta have attacked local energy infrastructure partly to gain attention for their political cause: they argue that poverty-stricken local communities have received too few of the economic benefits from oil revenues. In Saudi Arabia, rebels of a different sort have been at work: in 2006, al-Qaeda tried to blow up a major oil facility in the desert kingdom. Though it failed this time, the terrorist network knows that disrupting energy supplies on a sufficient scale could significantly damage western economies. The IEA, meanwhile, recently warned that maritime export routes for Middle East oil are vulnerable to "piracy, terrorist attacks, or accidents".

Importing insecurity

If short-term political dynamics and competition between different interests within the exporting countries are helping drive energy insecurity,

Opposite far left: May Day surprise: on 1 May this year, populist president Hugo Chávez announced that Venezuela's state oil company is to take at least 60% of four heavy-oil upgrading projects in the Orinoco Belt which had been controlled by BP, ExxonMobil, Total, Chevron and ConocoPhillips

Opposite left: Looking east? Russia's President Vladimir Putin reviews Vietnamese troops in Hanoi. Russia appears to hold all the aces in deciding on export routes for Siberian oil and gas to Asia, while the country's state-controlled natural-gas monopoly, Gazprom, jealously guards its control of gas-export pipelines

however, a broadly similar statement can be made about many importing countries too. In particular, many large energy importers, rather than collaborating to secure sufficient supplies of energy for long-term economic growth globally, appear to be engaging increasingly in head-to-head, and potentially damaging, competition in this area.

Admittedly, the importing countries are undertaking a variety of uncontroversial and sensible policies to reduce insecurity – for example, encouraging energy efficiency within their own economies, working through organisations such as the IEA, and promoting additional domestic energy production.

The potential for a future supply crunch, however, has meant that the major importers also now appear to be focusing hard on securing access to particular overseas oil and gas provinces so as to protect their immediate national interests. This approach may cause other countries to fear being excluded from deals and thereby raise the level of energy insecurity overall. The fact that many of the most abundant remaining oil and gas fields are in Middle East countries still opposed to significant foreign involvement has made this short-term competition all the more intense in other energy regions (such as Central Asia and the Caspian region, Russia, and West Africa).

In Africa, for example, Chinese, Indian, American and other western companies and governments have all been working hard to persuade energy-rich nations to grant them licences to develop oil and gas fields, often with increasing fervour (some analysts have compared this rush to the imperial powers' 'scramble for Africa' in the 19th century). Certainly the growing desire to secure access to energy has meant broader concerns sometimes appear to have been pushed aside. Western activists have complained that China has turned a blind eye to local human-rights abuses in the Sudan, for example, where it now has substantial oil investments. The Chinese have denied these accusations. Western investors themselves, of course, have often preferred not to raise human rights and ethical concerns too directly in their dealings with non-democratic, but energy-rich, states such as Kazakhstan.

The route of export pipelines from the energy-rich Caspian, meanwhile, has been the subject of intense diplomatic competition over the last decade – with the US, for example, pushing for routes that avoid both Russia and Iran. Further east, China and Japan have been engaged in a diplomatic tussle of their own over export routes from Russia's Siberian oil and gas fields, with each country, predictably, wanting the energy to flow its way.

As well as these external factors, various domestic issues in importing countries have added to energy-security concerns too. For example, in the same way that many exporting countries have been investing too little in their energy industries, so there has been a lack of investment in many importing countries' 'downstream' energy-supply systems – such as in oil

Gallo Images

US President George W Bush and G8 summit host German Chancellor Angela Merkel in discussion on the first day of the summit in June this year. The Heiligendamm summit is likely to be clearly remembered for the apparent US turnaround on climate change. Having signalled profound disagreement with the ambitious goals suggested by Merkel, the US president agreed to seriously consider the target of a 50% reduction in global carbon emissions by 2050

refineries, or gas and electricity infrastructure. In many cases, such facilities need to be expanded or upgraded to ensure uninterrupted supplies to consumers. In many developing countries indeed, millions of people have no access to modern forms of energy, such as electricity, in the first place. Part of the problem in many wealthy countries, meanwhile, has been protests from local communities, or 'nimby' ('not in my backyard') opposition, over the construction of major new industrial installations.

A final addition to this mix of worries, of course, is climate change. Extreme weather events, such as storms and hurricanes, for example, can easily knock out major pieces of energy infrastructure. In 2005, for example, Hurricane Katrina (though not necessarily itself related to global warning) caused a shutdown of much of the US Gulf Coast's production and refinery facilities. Such events clearly have the potential to impact both importing and exporting nations in the future.

Breaking the pattern

So what are the prospects for averting the worst outcomes from this overall state of heightened energy insecurity? And what is the likely effect on the overall mix of fuels used to generate the world's energy? The

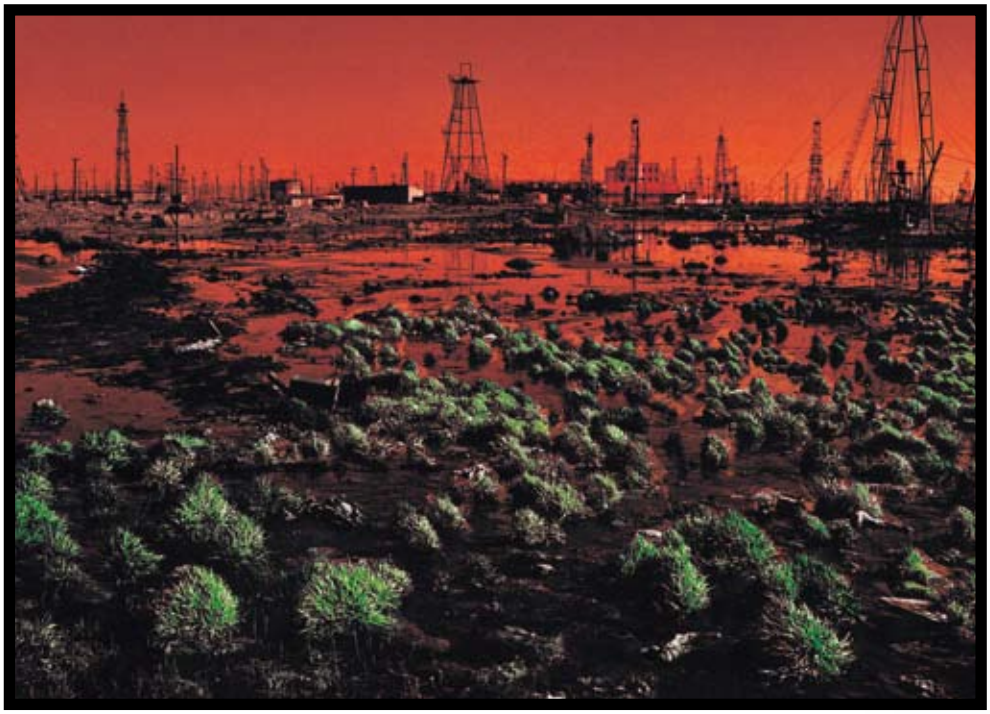
Below: Resource curse? In Nigeria, poor governance has led to the skewed distribution of huge oil revenues, with few economic benefits to impoverished communities. Here, a man rinses soot from his face at the scene of an oil pipeline explosion near Nigeria's commercial capital, Lagos. Hundreds of people were burned alive when fuel from a vandalised pipeline exploded in Nigeria's largest city in December 2006

Akintunde Akinleye/Reuters/The Bigger Picture

answer to the first question clearly hinges on the extent to which governments, companies and other actors are able to avoid the patterns of the past, and develop longer-term, more collaborative approaches.

A variety of unpredictable factors, it should be emphasised, may help defuse the situation in the meantime. A major economic slowdown in China, for example, would significantly dampen the growth of energy demand. On the supply side, potential output constraints could be lifted by, say, the discovery of major new oil and gas deposits in OECD regions, or even a decision by Middle East countries to welcome foreign firms and invest more in production capacity. None of these developments seems very likely for the time being, however.

Over the last 70 years or so, for example, the major western energy importers such as America and Britain sought to secure their energy supplies by supporting friendly, but undemocratic, regimes in energy-rich countries, and sometimes by interfering directly in these countries' political systems so as to ensure the oil kept flowing. This helped perpetuate poor governance in many countries, as well as general resentment of foreign interference. In this way, it helps explain some of the current instability in Iran, Saudi Arabia, Iraq and other major exporters. It also helps explain why resource nationalism remains a significant



Farid Khayrulin/Still Pictures

The unacceptable face of resource nationalism? Myriad oil-rig platforms bring heavy pollution to Azerbaijan's Caspian Sea territory

The importance of breaking the patterns of the past can be seen in the fact that many of the current challenges over energy security have their roots or at least parallels in earlier approaches. Over the decades, as mentioned previously, a common pattern has been for governments and companies to seek to fix problems or achieve outcomes in the short term, but thereby sow the seeds for broader or longer-term difficulties.

political theme in all energy-rich developing countries today.

From the perspective of the exporting countries, meanwhile, past attempts on their part to restrain energy supplies, while achieving political or economic outcomes in the short term, often damaged their interests in the long term. A good example of this is OPEC's squeeze on supplies in the 1970s. This led to a huge increase in oil prices, and certainly raised the international political profile of the Middle East exporters. But it has also triggered an intensified search by western nations for energy reserves outside OPEC's control, thereby weakening the cartel's share of the global oil market for several decades. Similarly today, energy exporters that threaten to withhold supplies of oil or gas may succeed in making a political point on the international stage – but they risk heightening energy insecurity among importing nations and thereby accelerating their search for alternative supplies and suppliers.

In this way, if all players today were focused on potential long-term, as well as short-term, outcomes, different approaches would likely be adopted. Importing nations might devote more attention to ensuring good governance, and

When the oil runs out... City-state-sized Middle East emirates like Dubai (below) are rapidly transforming themselves, relying on major new sources of revenue such as free-trade zones, financial services and tourism

Devadasan/Reuters/The Bigger Picture

promoting local democracy and social stability in energy-rich countries and a little less attention to securing immediate exploration or export deals. Exporting countries would recognise their interest in investing in production capacity and boosting output so as to keep customers tied to them for the long term. All this would require greater collaboration (for example, between the importers, who would need to agree not to compete on the basis simply of short-term favours offered to exporters) and also more far-sighted leadership (for example, on the part of energy exporters who might need to divert money from popular social projects to long-term re-investment in energy).

For this reason, it may not be wise to bet on such an outcome. True, there are some promising signs: for example, the Extractive Industries Transparency Initiative, a collaborative project aimed at improving governance through the transparent reporting of revenues from energy and mineral production, has gained the support of a number of importers and exporters. Even so, political reality and old habits are likely to die hard.

Want more gas? Look northward, angel

Thomas Wolfe: *Look Homeward, Angel*

Natural gas offtake is growing steadily. Current US consumption is forecast to rise from 65 to 85 billion cubic feet per day (bcfd) a decade hence, with the amount having to be imported rising from 10 to 25 bcfd. Similar import forecasts have been made for other developed economies owning natural-gas reserves.

Those imports will come from the Middle and Far East and Africa, together accounting for about half of known reserves, or from Russia and Central and South America, containing most of the remaining reserves. But while natural gas can be transported thousands of kilometres across land by pipeline, it is not feasible to do so by submarine pipelines. The gas must be liquefied by lowering its temperature to –163°C, thereby enormously reducing its volume for marine and road transportation. Despite the high cost of doing that, liquefied natural gas (LNG) consumption is forecast to treble over the first 20 years of this century.

That still, however, leaves LNG importers dependent on countries or regions not famous for their political stability. Hence the welcome from Western Europe and the US to the Norwegian project to harvest gas from beneath the Barents Sea, then liquefy and export it. The Norwegian krone 58 billion (approx. $10 billion) project, known as *Snohvit* (Snow White) because it lies deep inside the Arctic Circle, comes on stream this year and is expected to earn more than three times its investment by 2030.

There are many remarkable aspects to the project. It is the first time Barents gas resources are being exploited. The platforms for doing so do not float on the sea's surface but lie on its bed, feeding gas through a 160-kilometre pipeline to an on-shore liquefying plant. Gas extraction and pipeline transportation are remotely controlled by operators located 140 kilometres away in Melkøya.

Importantly, carbon capture and storage (CCS) technology will also be tested as part of this project. ◆

Statoil

In the Barents Sea, workers on Melkøya, an island just off the port of Hammerfest, are putting the finishing touches to a terminal to receive gas from the Snohvit field 140 kilometres offshore. By the end of 2007, the plant will be receiving a steady flow of gas to be frozen and liquefied for export to Europe and the US

In fact, if the potential mismatch between global energy demand and supply materialises as predicted over the next few decades, it may be that all the political dynamics underlying the current levels of insecurity only become worse. Higher oil and gas prices will make it easier and more tempting for exporters, or rebel groups within them, to use energy as a political weapon. Similarly, the scramble by importers to secure remaining reserves may intensify, with the potential even for violent conflict for control over energy-rich regions if any of the major importers feels excluded or economically endangered by lack of supplies.

All mixed up

Finally, examining the potential impact of such insecurity and other factors on the world's energy mix, and particularly on coal, provides another example of the importance of collaboration. An obvious potential implication of growing insecurity is to tilt the balance in favour of fuels less vulnerable to disruption. True, production of all major existing fuels, including oil, gas and coal, will likely need to rise significantly over the next few decades if the expected growth in global energy demand is to be met. However, the effect of energy insecurity – at least isolated from other factors – should be to support the fastest growth of energy sources considered relatively secure. This would include renewable energies, such as solar and wind power, nuclear power (assuming, that is, current public opposition to this technology in many countries can be overcome) – and also coal.

Coal deposits, as mentioned previously, are not only reassuringly widely distributed across the globe (for example, America, Australia, China and India all have major domestic reserves), they are also further from exhaustion than the other fossil fuels. At current rates of production, proven global coal reserves will last for over 150 years, compared with around 40 years for oil and 64 years for gas. All this, together with the favourable economics of coal as a fuel for electricity generation, help explain the fast growth in global coal consumption currently. China and India are driving much of this increase. China, for example, is reported to be opening a new power station fired by coal every few days.

If climate-change concerns are fed into the equation, however, the world's long-term energy mix becomes more difficult to predict. As noted earlier, debates about energy security and climate change are becoming increasingly intertwined, with concerns about security making it politically easier for governments to start to push ahead with reforms to tackle climate change, and vice versa. Yet unlike nuclear and renewable energy, which score well on both security and climate concerns (and also unlike gas which is relatively environmentally friendly), coal is currently seen to be a big part of the problem in terms of climate change.

Coal, as it is now used, accounts for some 38% of the world's carbon dioxide (CO_2) emissions from fossil fuels , thus making it currently a controversial choice for nations seeking energy sustainability as well as security. Importantly, however, various collaborative projects between major companies and governments are now under way to develop 'clean coal' technology (one possibility, for example, is to capture and store underground the CO_2 from coal-fired power stations, potentially making coal as benign in this respect as renewables). The trouble is that, for the time being, such technologies are often uneconomic, and remain at the research stage. Almost all coal is still currently burned in a climate-unfriendly way.

Assuming governments begin sooner or later to act on their stated desire to make deeps cuts in global carbon emissions, the success or otherwise of such 'clean coal' technology collaborations could therefore become critically important for the coal industry. If such collaborations make only incremental progress in the future, then the current rise in coal demand – whatever its security benefits – could tail off and go into reverse over the long term. If, on the other hand, energy companies and governments devote greater efforts to working together in this area, and thereby succeed in proving the effectiveness and economics of clean coal, then the sector could guarantee its growth for the very long term. As with energy security itself, the extent of collaboration and far-sighted leadership among key actors holds the key to creating positive outcomes from a potential crisis. ◆

1 "International interests and tensions", published in *World Energy 2006* (World Energy Council 2006)

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