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RENEWING ENERGY SECURITY

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Overview and summary

Energy security has risen on the policy agendas of many countries as a result of:

- reaction to the oil price surge of 2000;
- commitments to restrict greenhouse gas emissions following the Marrakesh Agreement;
- uncertainty about stability of supplies to final consumers following the California shortages and European fuel price protests of 2000;
- the 'war against terrorism' following 11 September, and the growing Israeli–Palestinian conflict.

This paper reviews the broad policy context within which energy security is placed, the outlook for energy supply and its key uncertainties, the security risks involved at the national and consumer level, and the scope for 'dialogues' between producers and consumers. The broad conclusions of the paper are that:

- international trade and investment provides the best route to national energy security for most countries;
- the benefits of international energy trade and investment can be compatible with policies to protect the environment and reduce greenhouse gas emissions, although such policies do not necessarily reinforce energy security;
- within countries the security of distribution of energy to final consumers requires policy support, whether or not the primary sources of energy are imported or domestic;
- the international framework for energy trade and investment will work best if the interests of countries dependent on energy exports are taken into account.

These conclusions are set in a 'mosaic vision' of a global energy system in which each of many different market fragments attracts competition from a diversity of sources, fuels and technologies. The whole is connected by flows of trade and investment, but there is no 'winner takes all' source of supply or policy.

1 Energy among other policies

Energy policy proposals typically reflect three perspectives: security, environment and economics: 'reliable, affordable, and environmentally sound' in the US Energy Plan of May 2001. The European Parliament talks of 'security of supply, competitiveness and protection of the Environment' (Report of EP Committee A5-0363.2001, October 2001). The UK Cabinet Office Performance and Innovation Unit (PIU) Energy Review (February 2002) talked of '... securing cheap, reliable and sustainable sources of energy supply'. In Japan the slogan is '3Es: Energy security, Environmental protection and Economic efficiency' (Advisory Committee for Natural Resources and Energy, July 2001).

There is no universal policy solution. The 'three Es' do not cover every energy security issue. Policies for the environment, security or economics go far beyond energy. There are contradictions to be resolved and balances to be struck. Energy realities affect the costs and risks of following the broader policies.

Security policies

Security policies deal with matters far wider than energy. They are concerned with protecting persons and property, within a structure of legal process. In the UK fuel protests of 2000 the police were concerned with protecting the rights and persons of protestors as well as of tanker drivers and their employers. Military capacity for defence of 'homelands' is required to defend more than the stability of power supplies or the price of gasoline at the pumps.

For most countries, access to competitive energy depends on access to the energy available in the world trading system, and it is protection of that system in general, rather than specifically the energy component, that is critical to security. That protection depends in turn on international cooperation, alliances, the support of the UN, and in the last resort the military participation of the US. Because the US is the last resort for global security generally, its interest in energy security is slightly different from that of other countries. US defence capability and the economic resources to sustain it depend on the ability to secure, in all circumstances, supplies of energy in terms as good as, or better than, those available to geopolitical rivals or challengers.

However, the US cannot sustain its levels of energy consumption per head, or per dollar of output, without increasing energy imports, like most of its potential rivals, so it is inevitably committed to continued protection of international energy trade. In the last resort, at the cost of breaking up the international market, the US could secure only its own supplies from a dependent group of exporters. In an extreme situation US voters might also accept more severe policies to restrict demand – for example by imposing higher fuel efficiency standards on vehicles, buildings and industry – and expanding nuclear energy on the French model. But splitting the world market for physical trade in this way would leave the US with high-cost energy supplies and its economic competitors in Asia with lower-cost supplies.

While the US needs energy security more than its rivals because of its world-leading role, some other countries need it because they fear rejection by the world – or by the US – and sanctions on energy supplies: South Africa under apartheid, North Korea and Cuba are examples. For these countries, and for the US, energy security has a special role in protecting national independence. For the rest, the US dependence on international supplies is a guarantee of their security.

Economics in developed countries

For the main economies, which are also international industrial and trading economies, *relative* costs and risks are critical. The movement towards liberalization of power and gas markets in many countries reflects a choice of competition as the best means of procuring and delivering final energy – like other goods and services – at the lowest possible cost. The transition to liberalized and competitive markets for gas and electricity has in many countries involved cost-saving reductions in spare network and generating capacity. In the oil products market, competition, 'just-in-time' deliveries, and network rationalization has reduced spare capacity and with it the flexibility of distribution to final consumers. For all forms of energy, therefore, competition and liberalization have tended to reduce costs but also increased the risks of local shortages to consumers. These risks may be limited by policies which impose reserve capacity in network systems, and require stock to be held near the point of consumption. Such precautions do not necessarily affect the attractiveness of international supplies. Nor do they justify (either economically or politically) barriers to imports. Policies to protect the distribution of energy to final consumers within a country should not depend on whether the primary energy is supplied from domestic or imported sources. In the long run the expanding compass of the EU and World Trade Organization will not admit exceptions for energy.

Economics in developing countries

For most developing countries, security of supply means security of *expanding* supply in line with their economic growth. Liberalization to achieve lower costs may compound the difficulties which under-funded state monopolies (or private utilities squeezed by price controls) face when investing to expand. Inviting international investors and companies to take part in that expansion is part of the broader, slow and difficult modernization of their economies. For some major countries, such as China and India, this is accompanied by a demand for increasing energy imports, investment in import infrastructure, and integration into international markets for trade and investment. As in the developed countries, imports and inward investment are part (though not all) of the solution to securing the expansion of energy supplies.

For developing countries dependent on energy *exports* there are additional challenges. Their economic growth will not be sustainable unless the revenues gained from exports are sufficiently combined with the human, social and economic capital of their countries to diversify future economic growth. Energy exports themselves may create barriers to that development and diversification. Export rents flowing into a narrow structure of elites may increase social divisions, perpetuate authoritarian regimes, and fund civil or regional military conflicts. The export sector may bring technology, training and markets but may also divert resources from other sectors. Energy exports therefore create risks for the exporting country and investors in it as well as its trading partners. To mitigate these effects some non-governmental organizations (NGOs) advocate restrictions on foreign investment or sanctions on exports from projects in countries where negative impacts appear to outweigh the positive.

International agencies such as the World Bank, the International Finance Corporation (IFC) and the regional development banks are taking account of these non-economic factors before agreeing to support energy export projects. Some governments (such as the government of Chad) have found it necessary to make commitments about the future disposal of their export revenue. In other countries, governments may hold off foreign investment and trade because exposure to them would open their domestic policies to scrutiny – especially as the scrutiny now tends to go beyond simply economic factors to cover issues such as human rights, revenue distribution and environmental impacts.

Climate change policy

Borrowing security arguments to support climate policies, or vice versa, may spoil both cases. Policies and commitments by governments to reduce emissions per unit of economic activity affect energy demand and fuel choice by a mix of economic incentives (taxes, subsidies) regulations, and 'cap and trade' hybrids, to achieve:

- greater efficiency in the use of all forms of energy by consumers, through better management of the equipment and buildings which exist today;
- switching to low-carbon fuels such as natural gas and nuclear in loading power generation plants in networks;
- new investment in plants for low-carbon generation in the future;
- investment – often public investment – in new technology and infrastructure which can transform the underlying demand for services such as transport, power, shelter and comfort into less intensive demands for energy.

The cost of reducing emission trends varies – high for transport, low for power generation where there are many alternatives. Many demand policies have long lead times, either because of the need for new investment by consumers or because of the inertia of habits and institutions. They are unlikely to affect energy security in the short to medium term. The components of climate change policy, taken together, will slowly add to the historical trend towards lower energy intensity which is already driven by the shift of activity to services and 'light' industrial activity in most developed economies. For a period this change may appear sufficient to disengage greenhouse gas emissions from economic growth as conventionally measured. To stabilize emissions at any particular rate (or reduce them), the annual change in the demand/emission relations needs *forever* to equal (or exceed) the rate of economic growth, adjusted for changes in the balance of economic sectors.

Whether these policies eventually affect energy *security* depends on specific details. In the OECD as a whole less than 5% of oil consumption is used in electricity generation. Reducing the use of electricity in most OECD countries will have little or no effect on the consumption or import of oil and therefore on the risks of price fluctuations and interruptions of oil supply. Reducing the use of oil in transport may reduce oil imports (though not necessarily from the Middle East, the lowest-cost source) but will have little effect on the security of electricity supply. In some developing countries oil is a major source of power and the situation is different.

The three perspectives of national security, economics, and climate change mean that energy security cannot be one-dimensional. Each perspective needs to be faced with policies that work in that dimension and reflect its constraints. Clear thinking requires thinking about complex situations.

2 Uncertainties in the energy outlook

Defining security problems requires some understanding of the underlying energy statistics. The two main publicly available long-term energy outlooks are those published by the International Energy Agency (IEA) and the US Energy Information Agency (EIA).[1] There are differences, owing partly to different assumptions about economic growth in individual regions, and partly to different assumptions about fuel substitution in sectors. The studies are a rich source of data for analysis of the factors generating the reference case, and of alternative cases, mainly focused on the possible effect of climate change policies in demand and the potential for the development of low-carbon 'alternative' energy sources. The IEA and EIA studies are nevertheless sufficiently similar for the broad outlines of the reference cases to present a common picture of the energy outlook to 2010 and 2020 before taking into account the effect of climate change policies which have not yet been formulated or adopted. Variants which illustrate strong climate protection policies (to reduce the demand for energy and shift the balance of demand to low- or zero-carbon fuels) show that these are likely to be effective in the long term rather than in the short term on which security considerations focus.

The overriding conclusion for energy security is that in the future the world's energy markets, and energy security, will be shaped less and less by the policies of the developed countries. It is the growth of energy demand and supply outside the industrial countries that will determine the future in which the industrial countries trade and invest in energy.

Energy demand

Uncertainty about the rate and composition of developing countries' growth is a source of uncertainty in global predictions. Annual global primary energy use is projected to increase by about 60% by 2020, doubling in developing countries and increasing by about a third in OECD countries. In the latter countries, 2% annual growth of final energy use will follow 3% annual economic growth; in developing countries annual growth just above 3% in final energy use will follow GDP growth just above 4%, with both rates higher in Asia than elsewhere. By 2020 energy use in developing countries will roughly equal that in developed countries.

The share of transport in global energy use will grow to around 20% (nearly 60% of oil use). Rates of growth will be more than twice as fast in developing countries as in the developed countries (which will account for just over half of transport demand for energy in 2020). The share of power generation in energy use will also grow, to around 40%. Two-thirds of the absolute growth will occur in developing countries, whose use of electricity will be around 85% of that of the industrialized countries. However, fossil fuel use in power generation in developing countries will reach 130% of OECD levels (compared with 65% now). The non-fossil (mainly nuclear) share of electricity generation will fall by around 10% in developed countries (compared with around 5% – mainly hydro – in developing countries).

[1] *World Energy Outlook* (2000 and 2001), and *International Energy Outlook* (2002), respectively.

Price

The reference projections reflect conventional wisdom that the trend price of international (Brent or IPE) crude oil prices in 2020 will be around $25/bbl (2002 $)(EIA 2002) to $28/bbl (IEA 2000), corresponding roughly to the lower half of the OPEC target range for the basket of OPEC crudes; $25/bbl also happens to be the average of international prices since 1986, since when the oil share of the global energy market has been more or less stable.

National and regional markets for gas are not fluid and integrated, unlike oil markets. The IEA explicitly, and the EIA implicitly, projects the present gas price structure forward in line with oil prices. Projections for gas prices themselves are less clear: market prices have a large element of transportation costs. These price projections set a difficult hurdle for the expansion of nuclear energy, and of renewables unless carbon penalties are recognized in the market. However, international coal prices are also projected as constant or falling slightly in real terms. Technologies for the clean combustion of coal (through conversion to methane or hydrogen, with sequestration of carbon) may benefit from a favourable price context as well as a reduction in conversion costs as the technologies are tested and developed.

Supply

At these kinds of prices, the conventional wisdom is that global energy supplies can be made available to meet the demand projected. Potential supplies are extensively reviewed in IEA 2001. EIA 2002 differs in some respects (greater price elasticity for oil supply). There are important uncertainties about matching particular fuel availability to demand in individual places.

Gas

Gas consumption is projected to expand absolutely and as a share of energy consumption in all regions, mainly through its increasing use in power generation in industrial countries and to replace polluting fuels in many developing-country megacities. For Europe (and the UK in particular), Northeast Asia and the US, virtually all the expansion will be from imports. Globally about two-thirds of incremental gas production will cross borders, bringing the share of trade in gas production globally to around 45% (compared with around 52% for oil). This more than doubles the present share of the international gas supply trade. The increase in both consumption and trade maintains existing trends. These projections, if realized, will transform the global gas situation in four major ways:

- To produce the gas, new investment will be necessary by the major exporting countries: Russia, Iran, Indonesia, Bolivia, Algeria, Nigeria, Qatar and a variety of smaller developing-country suppliers. All of these are in some degree open for direct or indirect foreign investment in the gas sector. It is possible that some of these governments will seek to establish a common approach to trade on the OPEC model. The already meet in a Gas Exporters' Forum.
- To transport the gas, investment will be necessary in very large infrastructure projects for new or greatly expanded trade routes: liquefied natural gas (LNG) to the US, southern Europe, South Asia, and China; pipelines within Southeast Asia and from the Caspian and Central Asia to Asian and south European markets.
- Pricing and types of contract structures are likely to converge, as a result of liberalization in major importing gas and electricity markets and as a result of the greater international flexibility.

- The relationship between gas and oil prices will become more ambiguous, with each limiting the other. Between 40% and 50% of global oil supply is used outside the transport markets, in power generation in developing countries, in industrial and commercial markets and in petrochemicals. All are open to substitution by gas, and there may be some niche incursions into the transport market from gas converted to liquids. Gas supplies are expanding, gas transportation is being opened to competing suppliers, and final consumers have been getting the benefits of competition in 'liberalized' markets. Competition is likely to limit gas prices in a 'virtuous' (for the consumer) circle in which lower prices expand markets at the expense of oil.

Nuclear ambiguity

In liberalized markets, the economics of new power plant construction are affected by comparison with current electricity prices (based on depreciated plants) and with other fuel supplies where 'externalities' such as waste disposal and decommissioning costs are not incorporated in prices as they are for the nuclear industry. The IEA reference case projects an absolute as well as a relative decline in the worldwide use of nuclear power. EIA 2002 projects a small absolute increase in capacity, but with the nuclear share of world electricity generation falling from 16% to 12% by 2020.

Both projections show striking differences among countries on present policies. In the EIA projection the US and Western Europe (except France) and Russia show a net reduction of nuclear capacity of around 40 GW by 2020, while the developing countries, Japan, Canada and France show a net increase of 50 GW. The nuclear industry continues to offer new reactor designs, to reduce size (and improve economics) by pebble-bed reactors, and to increase safety by 'passive-safe' reactors. However, in the US and Europe (outside France and Finland), the lack of interest in new building limits the development of trained personnel in numbers sufficient to maintain an option for future nuclear expansion.

In both projections the share of fossil fuels in the world energy mix rises as a result of the decline in nuclear energy – mainly in Europe. IEA 2000 shows that maintaining current nuclear capacity and improving its load factor could reduce power sector emissions of CO_2 (mainly in Europe) in 2020 by 7% (and total emissions by 2.5%).

Oil

The two projections for oil demand are similar: 115 mmbd (IEA 2000) and 118mmbd (EIA 2002). Neither agency expects world oil production to peak before 2020: as in earlier projections, the peak is swept beyond the planning horizon. Key points are:

- On these projections, all regions, *including the Middle East*, will be producing at close to their limit by around 2020 on the basis of the reserves figures of the US Geological Survey (2000).
- More and more of the production growth is sustained by discoveries in deep offshore waters, increasing productivity from discovered fields, by the development of known but undeveloped reserves in Russia and Iraq, and by the continuing expansion of production from the very large heavy oil reserves in Canada and Venezuela.
- The agencies differ in their projections of where the oil may come from. EIA 2002 projects OECD production in 2020 to be at a similar level to today, while IEA 2000 assumes a decline of around 20%. The EIA projects higher growth in production from Russia. The result of these differences on the supply side is a significant difference in projected growth in the Middle East's share of world oil production from 28% now to to 33% by 2020 in the EIA case, and to about 40% (16% of world energy) in the IEA case. This compares with a Middle East share in 1973 of 36% and 18% respectively. *This implies doubling oil production capacity in the Middle East.*

Further shifts in concentration towards the Middle East are unlikely: beyond 2020 incremental supplies of oil will come mainly from 'non-conventional' and very deep water sources.

- In both projections output from non-OPEC developing countries rises; maintaining their share of world output at around 17–18%. Much of this increase would come from countries in which the new export developments may raise questions about human rights, revenue distribution or environmental impact. These may create difficulties in the countries concerned and for international companies based in North America and Europe which may be involved.

Renewable and 'clean' energy

Renewable energy is expected to supply a smaller share of world energy in 2020 than now, mainly owing to the relatively slow (less than 2%) growth of hydropower, which is currently responsible for over 90% of renewable energy in power generation. Non-hydro renewables are projected to grow more rapidly but will reach less than 3% of global primary energy use (and global electricity generation). The incentives proposed under the Bush climate plan and the EC directive on renewables may increase that proportion. In the longer term a wide variety of candidates could compete for parts of the fossil fuel market if their generic costs reduce, local conditions are favourable, and oil and gas prices are at or above the projected levels. Examples for the power market – subject to management of fluctuations of supply – are wind, solar, biomass for power and biofuels (ethanol) for transportation. Supply of the targeted quantities (20% in the EU) of supply from renewable, and therefore fluctuating and decentralized sources may also require policies to impose reserves of capacity of conventional power stations to ensure stability of supply for final consumers.

Changing dynamics

Trade

The outlook is for an increasing domination of world energy markets by trade, bringing the classic advantages of lower costs for consumers and higher incomes for producers than would otherwise be available. Around 40% or world oil production moves in international trade, which accounts for over 80% of the exporters' production. By 2020 the proportion is likely to increase to over 50%, accounting for nearly 90% of the exporters' production. Most of the oil trade will be directed at Asia.

By 2020 around 45% of gas markets will be supplied by inter-regional trade, compared with just over 20% today. Europe will remain the gas exporters' main market.

Investment

Since 1990 there has been some reopening of oil- and gas-producing areas (including some OPEC countries) to private-sector international investment: directly in the case of West Africa, Brazil and the independent states of the Caspian region. In the Russian oil sector Russian companies themselves are leading an expansion of capacity and of export pipelines to China and the Baltic. There has been a mixture of opportunities for foreign direct investment through production-sharing contracts (PSAs) (which, outside Sakhalin, have moved slowly) and indirect investment through shareholding in Russian companies. The PSA approach has moved slowly – agreements require individual ratification by the Duma – and there are proposals to streamline the process. The Energy Charter Treaty (not yet ratified by Russia) outlines a set of conditions designed to encourage and protect direct foreign investment in foreign energy supply and infrastructure. Conventional wisdom calls for increases of around 6mmbd capacity in developing countries outside OPEC (half of them in Africa) and 7 mmbd in the former Soviet Union. Except perhaps for Russia, these investments require foreign participation. Many projects may involve controversy over the access to land, allocation of state revenues within the countries concerned, and the effect of oil development revenues on the political

structure. International companies and financial institutions are growing more concerned to demonstrate social responsibilities in these difficult situations, but it is difficult for foreign investors alone to overcome the real problems of the local context.

Oil government intervention

Oil revenues are critical for the sustainability of the OPEC countries' economies and important for non-OPEC exporters such as Russia, Mexico and Norway. Between 1980 and 2000 there was a very large structural surplus of oil production capacity, triggered by the second oil price shock of 1979–80. This gave the exporting countries the task of managing capacity utilization. Periods of competition (with changes in market share) alternated with periods of cooperation within OPEC. Experience since that price collapse of 1998 has shown that mutually supportive action by governments of OPEC and principal non-OPEC oil exporters can protect prices from prolonged collapse. By the summer of 2000, however, the structural surplus had reduced to the point where a cyclical surge of around 2 mmbd of demand eliminated spare capacity, and prices surged. Subsequent slowing of demand and expansion of non-OPEC capacity has weakened prices. The balance of future supply and demand mainly depends on macro-economic fluctuations in demand and the leads and lags of supply investment. The governments of oil-exporting countries have no experience of cooperating to allocate the expansion of capacity. They have different potentials for expansion, and conflicting interests in increasing revenues from higher volumes or higher prices when market conditions permit. Leads and lags in investment are likely to continue to generate medium-term cycles in oil prices which will affect the competitiveness of other fuels. Liberalization of final consumer markets for gas and electricity and competition in power generation are changing the traditional basis of financing capacity expansion, especially for long-distance gas infrastructure. Reserve capacity in electricity generation and in electricity and gas transmission has in many countries been reduced as a result of competition in liberalized markets. In some other countries (mainly developing countries or emerging market economies), price controls continue to prevent the generation of revenues to support investment by either state or private enterprise. In the case of the Russian gas industry this may impede the development of Russian resources potential for both domestic and export markets.

Technology

Actual and planned climate change policies, and liberalization of gas and power markets, facilitate the introduction of new technologies which will reduce the use of energy in final consumption (for example in vehicles and in power generation). Liberalization, with open access to transmission systems, opens markets to new supply sources (new-generation nuclear, deep water engineering, gas-to-liquids, 'clean coal' and various renewable sources). Markets – or fragments of them – are also opening to contest from new entrants with new technologies for using different forms of energy. Markets may be deliberately fragmented by regulation to encourage new entrants with promising technologies, e.g. fleets for low-emission vehicles. Giant energy, auto and power plant manufacturing companies spend defensively on R&D and market development. It is difficult at this stage to predict which niche applications will develop. A 'mix and match' of specialized user demands and supply technologies seems more likely than the rise of any single new source with the overriding advantages which oil enjoyed over coal before 1973, or gas now enjoys over oil (and coal) in power generation. Open markets and free competitions may paradoxically lead to a global final energy market which will resemble a mosaic of connected markets defined by particular combinations of environmentally acceptable use, supply and geography. The key to security (and commercial) policy will be how this mosaic connects to the international commodity markets of oil, gas and coal.

3 Security risks and policies

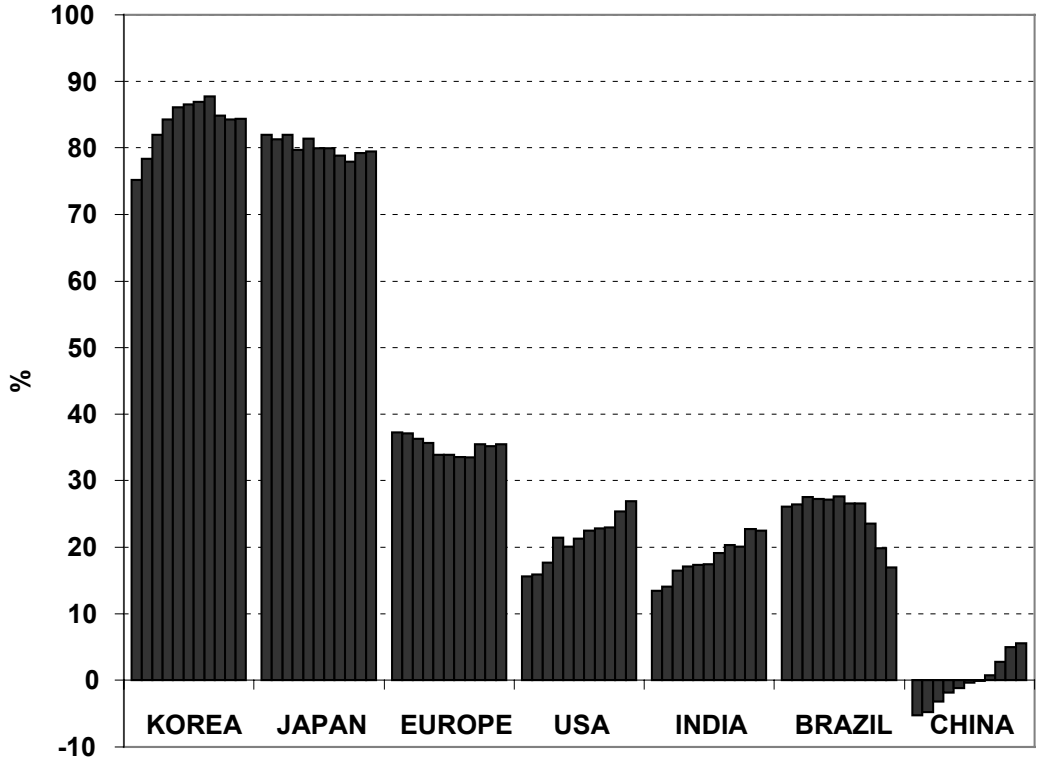
To reduce imports does not necessarily increase security in the same way that reducing greenhouse gas emissions inevitably protects the climate. Domestic energy supplies may be insecure, as the UK found during the miners' strike of 1974 and the fuel price protests of 2000, and Brazil found during the water shortages of 2000. To define energy security *policy* is elusive, given the dependence of the energy economy on trade and the withdrawal of governments from responsibility for planning and delivering energy supplies.

The emerging energy security policies in the US, EU, Japan, the UK and other countries show similarities as well as differences with regard to the main issues.

Inevitability of imports

The classic advantages of trade apply to fuels produced from natural resources: the resources are where they are, and cannot be reproduced by the application of labour and capital anywhere else. Most major consuming countries and regions benefit from high proportions of imports in their energy supply (and are similarly exposed to the risks) (see Figure 1).

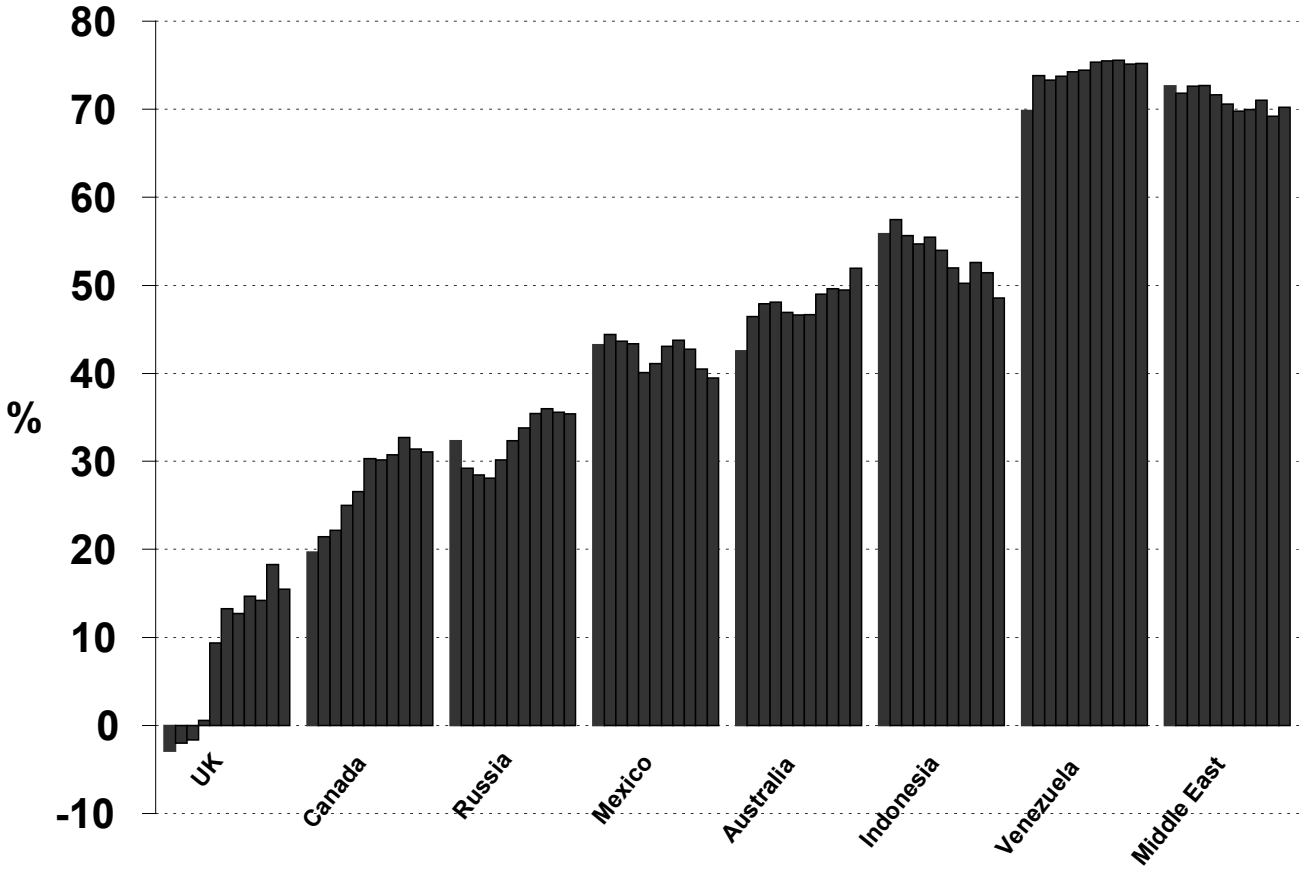
Figure 1: Energy imports as % of consumption 1990–2000



Source: *BP Statistical Review*. Primary energy data on input basis.

For the export-dependent energy producers, likewise, the economic benefits of the world market are enormous. Without growing energy exports their economies could not afford the imports, and their governments could not afford the social and military spending to which they appear committed. This is especially true in the case of oil, where prices in the international market significantly exceed the average costs of production in the main exporting countries. Figure 2 shows their dependence on exports for their energy markets. As much as 70% of the world's oil exports originate in countries each of which depends on the international market to sell more than 70% of its production.

Figure 2: Energy exports as % of production, 1990–2000



***Source*: *BP Statistical Review*.** Primary energy data on input basis.

China, Australia, the UK (currently, but not permanently a net energy exporter) and the Netherlands are exceptional in their low net energy trade.

World energy trade would continue even if countries such as the UK and China were to introduce policies to maintain a rough balance between physical imports and exports of energy fuels, or reduce imports to zero. World prices for traded sources of energy such as oil, gas and coal would affect the 'self-sufficient' countries. Isolation from such prices could not be achieved without constructing trade barriers which would be incompatible with UK or Dutch membership of the EU and the WTO and China's forthcoming membership of the WTO. Unlike some energy policy proposals in previous decades, the policies emerging now accept the inevitability of continuing international trade in energy. The US National Energy Plan, while proposing measures to slow the growth of imports, does

not envisage eliminating them: some 30 of its specific recommendations for action are aimed at improving conditions for international investment in diverse energy sources and trade and for international collaboration on energy issues. The EU Green Paper states:

> Security of supply does not seek to maximise energy self-sufficiency or to minimise dependence, but aims to reduce the risks linked to such dependence. (Executive Summary, p. 3).

In Japan, the government and private sector have shown increasing interest in energy developments through the region, recognizing that Japan's importers are losing their dominant share of the region's energy trade.

Demand restraint

Despite the acceptance of continuing international trade, almost all energy policy statements have a stated aim to 'increase efficiency' or reduce the growth of demand. The US has centred on technology leadership. Many OECD leaders could mimic George W. Bush's applauded words on launching the National Energy Report at St Paul, Minnesota, on 17 May 2001: 'Wise regulation and American innovation will make this country the world's leader in energy efficiency and conservation in the 21st century.' In the US case the policies appear mainly in the Climate Change Policy of February 2002, rather than in the Energy Plan (although the energy bills contain some efficiency proposals, their focus is on increasing supplies).

The EU Green Paper of February 2001 explicitly makes energy 'saving' in buildings and transport the key to its intervention, rather than increasing supplies. Petroleum industry critics believe the Green Paper underestimates the potential for future domestic energy supplies. The Green Paper was followed by a Directive on Energy Performance for Buildings (Do. 501PC0226, Jan. 02) and a White Paper on Transport Policy, COM (2001) 370, Dec. 01. The Japanese government has announced a range of objectives and measures (but not including an energy tax) for households and vehicles. In Britain the PIU Energy Review estimated that 'savings' or increases in efficiency of the order of 30% were, as usual, technically and economically possible in the UK. The PIU explores possible economic mechanisms for overcoming the barriers to achieving these efficiencies. As in other countries, there is a programme of incentives for improving energy efficiency in buildings and vehicles, regulation and efficiency standards, voluntary agreements with industry, and controversially, a complex energy tax which in practice falls mainly on the industrial and commercial sectors.

Policies which aim at increasing energy efficiency and reducing the energy intensity of an economy are not controversial in general though it is often difficult to find and agree on cheap details. Such policies are expected to contribute to general economic competitiveness, and are indispensable for climate change policy. However, their effects on the major 'energy security' risks are less clear:

- 'Efficiency' policies are long-term. They do not provide mechanisms to deal with the problems of disruptions of supply or price swings. It could even be argued that an economy which had squeezed out all redundant energy use might have less flexibility to cope with price shock, disruptions of supply or political leverage on energy than one which still had slack in the system.
- Policies to reduce demand in the long term are also ambiguous in their effect on the risks involved in procuring energy. The 'old risks' affecting supply and markets will mainly still apply at lower levels of demand: some could even be worse. In a low oil demand scenario, with correspondingly low prices to the oil producers, a higher proportion of supply will come from the low-cost Middle

East and a smaller proportion from high-cost OECD or Russian sources. Similar considerations apply to gas, where a large gas market may be diversified through access to LNG supplies, and a 'small' market may be tied to a pipeline supplier. In both cases, the exporters' interest may lead them to closer relationships with the unrestricted – mainly developing-country – markets. This would contradict the intentions stated in the US, EU, and Japanese policies to work for closer relations with exporters,

- Reducing the demand for electricity in the OECD is an important part of climate strategy. Inputs for electricity generation are equivalent to about 70% of all other energy consumption in the OECD. But saving electricity would have little effect on oil imports (because oil supplies only 2% of fuel for OECD electricity generation). While economics (and environmental regulation) continue to favour gas turbine generation, saving electricity might lead to a lower usage of domestic coal, with a greater proportion of electricity supplies dependent on imported gas.

Short term (12–18 months): disruptions of international supplies

Strategic stocks

IEA sharing mechanisms, including the release of government-controlled compulsory stocks, should make it possible to mitigate the effects of very large disruptions of the global oil supply. The probability of such disruptions is low but not zero. Oil supplies from a major exporter to the international market have been seriously cut back or stopped for a period of 3–18 months at times during the past 50 years because of political disruptions (Iraq and Kuwait 1990–91, Iran 1979–80 and 1951, Arab oil embargo 1973, Suez canal crisis 1956). There have been no similar interruptions of international gas or coal supplies.

The level of IEA and national compulsory oil stocks may be less important than the rules about when and how they should be used. In the IEA, the Coordinated Emergency Response Mechanism (CERM) provides a means for coordinating discretionary responses to particular crises – such as that of the onset of the Gulf land war in 1990. (IEA mechanisms are *automatically* triggered only when supply shortfalls exceed 7%, either for the whole IEA group or for an individual country.) This means in practice that the compulsory stocks can be used only in an international emergency and under conditions and in quantities determined by agreement between governments acting through the IEA. They do not provide insurance against smaller disruptions which may nevertheless have significant effects on spot oil prices and all that depends on them.

The US Energy Plan endorses the IEA system, opens the question of whether the Strategic Petroleum (oil) Reserve (SPR) should be enlarged at some future time, and recommends persuading non-IEA members (especially in Asia) to consider strategic stocks as an option for addressing supply disruptions. It also opens the possibility of leasing storage facilities for that purpose. It reaffirms that the SPR should be used for disruptions of oil supplies and not for managing prices.

The EU Green Paper also endorses the role of stocks, and raises three new proposals:

- enlargement of the EU stockholding obligation (90 days of consumption);
- transfer to national public authorities or agencies of the 'compulsory' stocks in countries where they are at present held by industry (at present, about two-thirds of the obligation in the EU as a whole is met by industry);
- the possibility of using or establishing an EU strategic stock reserve (additional to the current strategic reserve) to be managed at community level for 'anti-speculative' price intervention.

The feasibility of the last idea is controversial. Proponents (in the European Commission) argue from the example of central banks that, because central banks can sometimes limit speculative attacks on currencies, so strategic stockholders could sometimes limit speculation on oil prices. Opponents argue that:

- currency management, when successful, has required secret, quick action coordinated between all the world's leading central banks, not just deficit countries;
- currency is a commodity which, unlike oil, can be created or destroyed by the stroke of a pen;
- there is a poor history of unsuccessful commodity stabilization schemes using stocks (such as the International Tin Authority, which went bankrupt);
- the size of stock that might be required would be large – the surge in demand in 2000 amounted to 2 mmbd over a six-month period, equal to about a third of the current level of government-controlled stocks in the OECD;
- producers' quotas could be adjusted to offset the effects of importers' putting stocks on the market;
- Even if intervention were coordinated across the IEA, governments might find it politically risky to accept responsibility for managing the price of an international commodity, nearly 40% of which is imported by non-IEA countries which do not hold strategic stocks.

Local disruptions

There is a high probability that energy supplies to consumers can be disrupted by local and temporary supply problems (as in 2000 with Northeast US heating oil, US west-coast gasoline, power in California, hydro shortages in Brazil and road fuel tax protests in Europe). These may be entirely local in origin (as in strikes by UK miners in 1974 and Petroleos de Venezuela workers in 2002). Price spikes can also be caused by extreme weather conditions affecting demand or distribution, or disasters (such as a nuclear accident) affecting other energy supplies. Financial pressures have tended to minimize commercial stocks of fuel (both in the distribution chain and at the point of use) and reserve capacity in power stations and transmissions systems. When local and temporary shortages occur there is intense bidding for marginal supplies and these prices are rapidly transmitted to the market. Resort to oil as the most flexible fuel for all markets and sectors means that local problems may be transmitted to international oil prices and through that to gas prices in other markets.

All the emerging energy policies recognize this cluster of problems and offer remedies in turn designed to improve the liquidity of markets, ensure connectivity between regions and improve the infrastructure for energy imports. In practice the US government has occasionally intervened to release stocks to ease local physical shortages. Only the EU Green paper suggests the possibility of government responsibility for price levels in such situations.

Terrorist threats

The attacks on 11 September signalled the possibility of future terrorist attacks on a scale far beyond those which have occurred on pipelines in areas of civil conflict such as Algeria and Colombia. Through the International Atomic Energy Authority (IAEA), procedures are being set up to reinforce existing security practices affecting nuclear installations. The petroleum industry is similarly involved in reviewing and upgrading security procedures to protect critical sites. This is a particular challenge in countries where there has not been a terrorist threat in the past, such as the US, which has a diversity of small sites, or in developing countries where the cost of protection seems high in relation to the local economy.

Embargoes of supply

Embargoes of particular importers by oil-exporting countries (as in 1973) would bring about reallocation of supplies in the international market. If widely targeted and widely observed, embargoes become a global political problem. The US would be an indispensable element in any military-backed political action to deal with a major political disruption of international energy supplies (as in the Gulf War). The US may have a different position from that of all other countries. It has exceptional general capability to project military power beyond its borders including, if necessary, to secure a measure of imported energy supplies. It needs this degree of last-resort short-term energy security more than other importing countries, in order to maintain its military capability and the economy which supports it. This capability is desired for general policy reasons – as an extension of homeland defence and the independence of foreign and domestic policy. Other countries may 'free-ride' on this capability – but on US terms. Distortion of international trade could occur through a UN or US embargo against supplies from selected exporting countries or against foreign investment of funds or technology in their oil industries (UN sanctions on Iraq, US sanctions on Iran, Sudan, Burma, Libya). On the basis of historical record, the *probability* of UN or US embargoes against exporters is higher than of exporters' embargoes against importers, which last occurred in 1973. Other countries would be involved in the international political situation created by such embargoes even if they were not importers from the embargoed country.

These general geopolitical considerations are not addressed explicitly in most energy policy documents.

Medium term (3–5 years): export cartel issues

The international trading and investment system will not guarantee stable prices over the medium term for any commodity: investment cycles are inevitable. Oil is no exception. The special perceived risk for oil is that export prices could be distorted by collusion among major exporters. The more likely risk is that investment in expansion will be delayed by 'wait-and-see' policies in major exporting governments. US sanctions on major potential competitors such as Iraq and Iran make delay a relatively safe option for other exporters. For the future, the possibilities of international competition from other oil and energy suppliers and the effect on demand in liberalized domestic energy markets limit the scope for exporters to hold prices by collusion above a long-term competitive level. The history of prices since 1973 supports this assertion.

Some degree of collusion by oil exporters can be expected to protect a floor price (as occurred in 1999–2000). For a cartel to work it needs rules for sharing markets. In crises of over-supply and very low prices (1985–6, 1998–9) OPEC members have eventually cut production more or less in line with pre-crisis production.

There is a more specific reason why aggressive collusion is unlikely to endure. Oil and gas resources are distributed unevenly among exporters. The ratio of current production to reserves is different in different countries. They have different capabilities for, and interests in, expanding supply. Countries with less volume potential (such as Iran) are more interested in slower demand growth and higher prices than those (such as Iraq and Saudi Arabia) that can increase revenues more by expanding volumes at current prices than by restraint.

Moreover, in a growing export market it will be difficult to find a formula for quotas to restrain competition between major oil exporters. OPEC members have no precedent for allocating the expansion of production currently predicted for the period 2005 onwards. Competition is inevitable.

Regional and national rivalries will also support such competition. Different countries have different potential for expansion, and their oil reserves are not distributed according to their populations and needs for revenue. Here again, there is a low probability that major oil exporters could hold prices up for long by sustained collusion.

Diversification

Importers can limit the risk of aggressive cartels by promoting a diversity of energy supplies – international as well as national. This includes, in the US Plan, the promotion of the Baku–Ceyhan pipeline and a variety of gas transport projects that have nothing to do with direct supplies to the US. Japanese companies have similarly been involved in studies for projects to import gas from Russia to China. In Japan the Japan National Oil Company (JNOC) is to be restructured, perhaps privatized or dissolved into the private sector. There is a challenge to create a strong Japanese international petroleum company, perhaps incorporating some JNOC and existing private-sector assets and management. China has already started down this route. As international trade grows and becomes more diversified, the question of cooperation between major gas exporters has been raised, particularly in relation to exports to Europe from Russia, Norway, Algeria and Nigeria. Russia is likely to become a major exporter to Asia in the future, competing by pipeline exports with LNG exporters such as Indonesia, Qatar, the UAE and Iran. In both the European and Asian markets, the range of possible exporters and the volume of undeveloped gas reserves suggest that competition will drive exporters to expand capacity, as in oil, and that any trends towards exporter supply management will probably be defensive, rather than aggressive.

Renewable and 'new' energy forms

The US Climate Change Policy and the EU Green Paper (and the EC proposal for a Directive on Renewables (Document 500PC0884, September 01), as well as the UK PIU Report, propose a variety of incentives for promoting diversity of supply. They would create protected markets, and offer tax incentives or subsidies for renewable energies. 'Targets' of up to 20% of electricity supply, with varying degrees of incentive or compulsion, are mentioned. The recent Japanese policy review proposes to increase the share of new and renewable energy forms (including hydro) from around 5% to around 7% by 2010.

These interventions are necessary because in many places most of these new supplies would not be commercially attractive on a large scale in many places during the next ten years at the static or slowly rising fossil fuel prices expected in the 'conventional wisdom' projections. The subsequent economics might be improved as costs are reduced through experience, larger-scale production and more aggressive identification of specialized or local markets where the new fuels can be justified even today (revealing a 'mosaic' of opportunities).

Private-sector investment in renewables and new energy forms will be supported in most countries, mainly by grants and subsidies for research and development and by non-budget measures such as compulsory quotas to ensure that private-sector power distributors purchase renewable energies. The economic penalties of this intervention are softened by a facility to purchase 'green certificates' in lieu of actual green power.

Investment in new forms of energy supply remains risky. Hopes for reduction of technical costs may not be realized; markets are dependent on government policies, which may change. Non-budgetary measures which secure markets do not necessarily reduce the risks of the inevitable fluctuation in the price of oil and gas that will affect the price with which the new forms have to compete. How far equity investors will go in absorbing these price risks remains to be seen.

The effect of these policies on international energy trade (and therefore the medium-term risks) during the next ten years is likely to be small. Within the EU, and in the long run within the WTO, the diversity of these incentives may raise questions of state aid and trade distortion. The current energy exporters will have reason to raise such questions.

Coal

There are government support programmes for research and development of 'clean coal' technologies and (under climate programmes) carbon sequestration. If these are economically successful they could in the long term lead to a larger role for coal in the energy mix in the US and Europe – and develop technologies which could be transferred to assist the sustainability of coal use in China and India. The coal industry already contains large private-sector companies with equity capable of taking the risk of development of new technologies and an interest in their development.

Nuclear power

The US Energy Plan calls for an expansion in the use of nuclear power, with the 'Nuclear Power 2020 Initiative' to extend the trend to relicensing and extension of existing nuclear plants in the US. Congress is still debating proposals to improve permitting and the issue of national storage for nuclear waste. The Japanese Energy Review still calls for an expansion of nuclear generation, but the proposed expansion has been almost halved compared with previous plans. The EU Green Paper categorizes and describes the current contradictory policies of different EU governments regarding the future of current and potential new nuclear plants and nuclear waste. The UK PIU report emphasizes the need for new nuclear decisions to be taken in accordance with commercial criteria.

Medium term: political issues

In mid-2002 it is not clear whether the recent escalation of violence in the Middle East is 'just one more' episode in the tragic saga of Israeli–Palestinian conflict or whether it will lead to serious negotiations leading to a stable political outcome. In the former case it seems inevitable that, at the very least, governments of some oil-exporting countries will find it more difficult to hold to strong alliances with the US in the face of 'Arab street' revulsion against the treatment of the Palestinians. It would be too simple to conclude the result would be an increased risk of instability among key oil-exporting countries. A less melodramatic result would be a weakening of ties and a reluctance to stand so ready to assist the US and its allies across a range of issues including the management of oil crises and the expansion of supplies.

Low investment in expansion of Middle East oil production capacity, and a willingness to allow temporary disruptions to generate high prices, would change the medium- and long-term energy outlook in much the same way as did developments in the 1970s. Alternatives would be developed faster and at higher costs than would be the case under the present 'conventional outlook'. Once built, they would remain and would continue to produce when prices subside. Oil importers would enjoy a diversity of supplies and the possibilities of renewed competition among Middle East exporters.

A completely different political scenario could have a somewhat similar effect on oil supply. If the Palestinian conflict were resolved, the US would remain committed to a change of regime in Iraq, using force if necessary. If force were used, the same problems would arise for Arab governments supporting the US, compounding this uncertainty, and the same reactions (also not necessarily melodramatic) would threaten. The emergence of a regime in Iraq acceptable to the US would also change the regional balance of power. A 'legitimate' Iraq would compete – albeit peacefully – for

investment, markets and influence with its neighbours. The US would be committed to support the new regime.

Iraq in normal relations with the rest of the region and the world would face an immense task of reconstruction – and possibly reparation to victims of its past policies. To finance this without injection of massive outside aid would require the rapid expansion of its oil industry – probably with private-sector capital investment – in order to secure foreign exchange and government revenue from oil exports. The increase in Iraq's share of the oil market would need to be accommodated by slower expansion elsewhere, or by a price war, or some 'unstable' combination of the two. A scenario which offered other oil exporters a combination of depressed prices and static volumes would carry its own political risks for those countries.

Long term (10–15 years): resource shock

The risk is 'short-termism'. Oil and gas production capacity might reach a plateau before sufficient investment has been made in long-term projects for heavy oil, gas infrastructure, alternative energies, or less intensive energy demand. There would then be a prolonged period of high energy prices, which would cause avoidable economic damage before creating a surplus of new capacity – a prolonged and exaggerated version of a commodity investment cycle.

The policy debate is about the cost of anticipating a problem which might not occur versus the cost of catching up if everybody waits for trouble to happen. If oil prices were to remain significantly above their 1986–2001 average of about $25 in today's money, there would be many economic options for alternative forms of energy supply and more energy efficient demand technology to 'catch up' in many parts of today's open and competitive markets – the 'mosaic'.

Under the 'catch-up' option the main importing economies could stand periods of higher prices during the lead-time of new investments to correct the imbalance when it occurred, because of the small role of oil in their economies. The present modest policies already being developed for renewables, new-generation nuclear and coal technologies, and more efficient transportation would meanwhile improve costs and define market opportunities for future development.

The alternative to 'catch-up' would be large subsidies for these alternatives now in anticipation of a future 'resource shock'. The current expenditure, either by government or by consumers under regulatory duress, would be very difficult to justify. The resource shock – a permanent rise in the price of oil – might never happen. The policy might be self-defeating. The more subsidized alternatives came on the market, the lower would be demand for oil and the price of oil. The oil price would be the benchmark against which the cost of the subsidies or interventions would be measured, so that the more successful they were the more expensive they would appear by comparison with the depressed oil price.

Medium to long term: 'real climate policy' shock

In this scenario the threatening damaging effects of climate change would become politically convincing in many countries and there would be a rush to impose climate protection policies to make up for lost time. Demand restriction policies would thus be severe, and based on 'command and control' (rather than economic instruments) to achieve early, certain results. It can be argued that this shock may in fact be a possibility in the short term, precisely because the necessary policies need to

be started early in order to achieve stabilization of greenhouse gas concentrations at a level which would avoid major climate change threats.

Oil, gas and coal prices would probably fall (from what they otherwise would be) in response to severe demand measures to reduce fossil fuel demand. This in turn would create a need for even stronger intervention to frustrate the effect of lower prices on demand (the 'bounceback') and to support the economics of alternatives. If the policies took the form of taxes there would be political challenges in allocating the extra government revenue: hypothecation of money towards investment in demand reduction and alternate energies would be likely. If the policies took the form of regulation (efficiency standards for automobiles, for example) the costs would fall on consumers. Without coordination, at least across the EU, the interventions might distort trade, and broader trade and investment flows. The openness of the single market within the EU might be compromised.

The probability of this scenario is increasing because of the difficulties of developing real global climate protection policies. A 'real climate policy' shock could present a political and institutional threat to the multilateral and European open economic systems. It could impose economic waste through the 'stranding' of old energy consuming technology and infrastructure, and reduce consumer welfare by diverting resources from consumption to new investment.

The policy challenge from this scenario to would-be investors in energy supply or conversion is like that of the 'resource shock': anticipation versus 'wait and see'.

4 Dialogue

The US Energy Review recommended several initiatives for cooperation and dialogue with individual exporting countries (Russia, India, Venezuela, Brazil), and regions (the Caspian, Africa, the Americas, Asia-Pacific Economic Cooperation (APEC)). It endorsed the opening of certain exporting countries to foreign investment and further dialogues between producer and consumer countries. The EU Green Paper focused on an 'energy partnership' with Russia (the 'Prodi initiative'). There are proposals for specific initiatives with countries involved in the development of trade and transportation routes to Europe, and a general dialogue with producer countries which might include discussion of pricing, long-term agreement, reserve stocks, flexibility in environmental mechanisms and technology transfer. The Japanese Energy Review has, as always, general language about international cooperation and relationships with producer countries. The UK PIU report (like the US) recommends closer integration of energy and foreign policies. However, it focuses mainly on the need to develop a liberalized gas market in Europe to protect the flexibility of imports to Europe.

Energy-importing countries interested in 'dialogue' with exporters face three major difficulties:

- Their interest in dialogue does not fit with using security arguments 'to reduce import dependence' for policies to reduce energy demand, increase the use of renewables or increase energy efficiency. If such measures were justified wholly on environmental or social grounds they could generally be framed so as to be neutral towards imports while meeting their environmental and economic objectives. However, the language of policy debates often emphasizes a bias against energy imports. In any case, as argued above, such measures are ambiguous about the main security issues.
- Their interest in expanding and strengthening the international energy supply system is often associated with the search for new investment opportunities for OECD-based private-sector companies. The Energy Charter Treaty could be seen in this light. For importers, the key point is access to increasing and diverse supplies. Some of these could originate from state-owned enterprises in the exporting countries.
- Countries whose economies and government revenues depend on the export of energy – oil, gas or coal – have little recognition in the current consensus about how the world trade and investment system should develop. For international markets and price stabilization there are possible precedents for considering schemes to stabilize exporters' revenues (and international prices) in the (little used) Commodity Agreement Provision (Article XX) of the GATT. These, or something similar, do not feature in the consuming-country initiatives towards dialogue. There is recognition of a need for mitigation of the effects of climate change policies on developing countries in Article 3.14(h) of the Kyoto Protocol, and the effects of climate change policies on fossil fuel-importing countries may be discussed under that heading.

There are problems in the other direction, of course. Some countries have export and production policies which limit the benefits of trade by practices such as resale restrictions and secrecy. Where foreign private-sector companies are involved the conditions are not always ideal for them to discharge both the developmental expectations of the host government and the ethical and environmental expectations of their home government, investors, and public opinion.

At the moment the 'dialogue' represented by the International Energy Forum is at the stage of cautious approaches to non-contentious issues – e.g. statistics and processes – such as the biennial meetings and a Secretariat to support them. This agenda does not include issues of accountability,

transparency and scrutiny of the local impact of energy project and revenues, which are receiving increasing attention from international lenders and investors.

5 Conclusions

The realities of the policy and international context of energy security, the energy outlook, its risks and the practical options for change are as follows:

- For importing countries, energy security will come mainly from increasing the diversity and flexibility of energy supplies, mainly by international trade and the investment necessary to support it.
- This trend is compatible with the increasing efficiency of energy use, the reduction of greenhouse gas emissions, and the development of renewable energies for environmental reasons. These 'sustainable' policies need not necessarily oppose international energy trade and investment. Such opposition – even if only rhetorical – makes the development of international trade and investment and the management of its risks more difficult,
- The development of international energy trade and investment requires the cooperation of the countries that are dependent on energy export. For them, the energy exports can never be 'just commodities'.
- Political developments in the Middle East (specifically the Israeli–Palestinian conflict and Iraq) will not eliminate Middle East oil exports but may slow the rate of expansion and increase the burden of political and economic change in the governments in the area.

Realities will push policies in these directions. The first priority for 'renewing energy security' is to clarify understanding and remove unnecessary policy obstacles to these trends. This is more a matter of ideas than of new agreements, processes or institutions. How far a 'dialogue' could usefully add to these would depend on how far the principal parties were prepared to recognize, and incorporate into working, understanding and agreements:

- commitment by both sides to support international trade and investment;
- the right of importing countries to reduce energy demand, promote energy efficiency, and support 'renewables' or emission reductions *justified solely for environmental and economic reasons,* with no discrimination against imports,
- The role of governments of energy-export-dependent countries in shaping foreign trade and investment to protect the long-term sustainability of their economies and societies while depleting their energy resources.