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Market-based Options for Security of Energy Supply

Insuring against Disruptions of Energy Supply

Transport Energy Security

The Unseen Risk?

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Abstract

The decline in significance given to energy security in recent years can be associated with increasing trust in the self-balancing security of a global-trading economy. After the events of the first years of the 21st century, that framework now looks more problematic, at least for oil supplies. The underlying level of risk that characterised the oil market of the late 20th century has changed, exacerbated by the increasing inelasticity of demand for oil-based products in the transport sector of the world's economies, which in its turn reflects the strategic dominance of transport within economies.

The prudent course for the international community is to reduce the underlying causes of possible geopolitical constraints by making them more manageable through normal channels. One such constraint that is within every nation's capability (and self-interest) to reduce is the upward drift in the price inelasticity of domestic oil consumption. This could involve increasing the ability to divert oil used within the domestic economy to transport. Yet for many industrial economies, this option has largely been exhausted and a more radical approach of opening up new energy vectors to supply the transport sector may be needed. Taking preventative action after a security event is generally more straightforward than taking precautionary action to ensure that it never happens. The latter course may only be successful through a coincidence with other interests. The current environment agenda is such a coincident interest with transport fuel security.

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[1] This equates to 690.10^9 tonnes in the Middle East, compared with 95.10^9 tonnes in South America, 64.10^9 tonnes in North America and 65.10^9 tonnes in the former Soviet Union.

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1 No end to history

As the liberal market model of the global economy gained ground towards the very end of the 20th century, energy security began to decrease as a component within OECD members' energy policy. This was an entirely consistent development. In integrated, liberalised markets, fossil-fuel suppliers would rely as much on the basic products supplied to them by their customers, as their customers relied on fossil fuels. The liberalisation of energy markets required no further adjustment to earlier policies. As indigenous sources of energy, retained for national security (such as deep-mined coal or nuclear energy) were stripped of their subsidies and exposed to liberal market disciplines, they withered. Nevertheless, the first year of the 21st century demonstrated, with a jolt, that the shared values that are needed to underpin a global, liberalised market were not even remotely established. Further, this demonstration came from the very area of the world vital to energy supply, the Middle East.

2 Middle East transition and the price of oil

Under the scenario of liberalised markets, the present authoritarian regimes in the Middle East would gradually transform to liberal market democracies. On reflection, commentators may have been too sanguine about the prospects of realising this scenario. Unfortunately, at the beginning of the 21st century, 65% of the world's oil-proven reserves are located in this region.[1] While it is true that the underlying political uncertainty will increase risks, this does not necessarily imply an immediate risk to the security of supply. The system run under the International Energy Agency (IEA) has been tested several times and it has so far been able to help avert crises. Nevertheless, it may be wise in the long term to seek to reduce the price inelasticity of oil. Reducing price-inelasticity is not necessarily the same as reducing total demand, but it would be a reversal of the current underlying trend. The case for treating decreasing price-inelasticity as the immediate target of energy security is reinforced by two factors that have grown covertly in the 1990's. These are the development of conditions for a chaotic market price and the growth of severe inelastic demand for transport fuels.

2.1 Supply-side price instability

The world's exploitation of oil has never followed the classical economic model of exhausting the cheapest reserves first. Considerations of national security have led most countries to consume a mix of fuels within their market place, most of which have been subsidised to some degree relative to Middle East oil. The consequence is that the 1990's continued to exhaust the global oil reserves in the $15 to $25 per barrel price range. The future energy market then draws from a tranche of resources with long-term marginal costs (which includes the front-end investment costs of bringing new investment on line) at $25 a barrel or more, and a core resource at around $10 billion in the Middle East, with little left in between. This 'coring out' of the cost of reserves in the $15 to $25 price band is the 20th

century's legacy to the 21st century. Some of these high-cost options have short-term costs (i.e. a low cost of extra production once on-stream) comparable with Middle East oil production. If these were to be brought on line then Middle East producers risk being forced back to their short-term costs. This cost structure sets the scene for a price that fluctuates chaotically between 'floors' and 'ceilings'. A price spike brings on expensive investment that, during a drop in demand, offers a price that falls right back to low values. Figures for c/kWh quoted for new nuclear capacity are typically twice those for operating costs of an existing nuclear plant. For renewable energy sources, like wind or tidal power, the difference is even larger. OPEC, while venturing to high prices in periods of high demand, is unwise to hold that position too long unless the high-cost alternatives come on-stream. A market that is unstable between a floor and ceiling price leads to only mild discomfort, unless the demand side is price-inelastic. This is exactly what happened to refined oil products in the 1990's. In such circumstances it usually proves politically impossible to simply use market-clearing prices as the management tool for sudden scarcity. The problem is particularly acute for transport, where the price elasticity for gasoline is very low and the transport service is critical the economy.

2.2 Sclerosis, not inelasticity

The oil crises of the 1970's are not good models for an oil crisis in the 21st century. The point on which to focus is the use of transport fuel in the economy. The consumption of oil in transport has risen faster than any other energy component of the developed economy. This does not reflect a substitution for other kinds of access technology. The internal combustion engine has created new and expanded journey patterns, gradually back-filled by extended physical relocation and the separate centralisation of housing, workplace, leisure and services. Travel surveys show consumers spend about as much time travelling now as they did 20 years ago in almost every developed country. But since the car now dominates as the transport mode, they are travelling around twice the distance, in more complex, individualised journey patterns.[2] This is perfectly consistent with a market model, where the search for optimality drives down resilience.

The implication, however, is that oil for transport has become a much more ingrained basic product of the economy. There has been no significant diversification in transport fuel mix beyond refinement of the oil feedstock. So the 1970's model of creating price elasticity in a price-unstable market by forms of rationing and allocation has become totally undermined. Allocating priority access to fuel supplies in times of shortage to key workers, such as doctors, fails if the plant operator cannot get to the hospital to manage the air conditioning. There is no point to 'working from home' with IT if engineers cannot service the server farms. Old presumptions, such as withdrawal of transportation for leisure use, fails when leisure is not for picnics but access to centralised service industries that are such a key part of the economic product.

The problem is that transport is totally price-inelastic in the (very) short term and totally price-elastic in the (very) long term (through a readjustment of the relative location). A long period of relatively low prices causes long-term relaxations in the economy that cannot be quickly reversed. While energy source diversity characterises the electricity and low-grade heating sectors of the economy, surface transport and aviation remain doggedly committed to

[2] For example, in the UK there has been a 40% increase in the distance travelled per capita (all powered by gasoline) since the last oil crisis.

only one fuel technology. An oil shortage would not now be an inconvenience. Because transport has become a basic commodity, it would be nearly catastrophic.

3 Increasing the price elasticity

There is more to energy policy than energy security. Perversely, a poor policy that encourages inefficient use of energy provides some fat in energy consumption in times of shortage. Very efficient use of energy is good for the economy, but may actually increase the need to pay greater attention to energy security issues because of a lack of slack. Designer inefficiency must be the most inefficient way to create energy security, but it also creates a sense of complacency. Low thermodynamic energy requirements like space heating are typically much easier to substitute than high-grade mechanical energy (including motive power) in times of shortage.[3] This contrasts with the transport sector where lowering speed limits (and thus increasing journey times) or rationing (withdrawing some journeys altogether) results in real economic impact. The best that can be done is to select the most efficient vehicle where choice from a fleet is available. Otherwise, in the short run, provision of access is stuck with patterns determined by previous land-use developments. A more proactive policy on transport price elasticity has three parallel tracks. The first is to have the capability of bringing increased supplies of non-Middle East oil on stream. The second is to be able to free oil from other uses by fuel substitution. The third and bolder track is to open up a new transport-fuel supply grid, using sources such as biofuels, hydrogen or electricity. Detailed options will vary with national circumstances. Few are cheap compared with $15 a barrel, though comparable or less to the military expenditure or economic disruption of not delivering the policy.

3.1 Options

Simply exhausting non-Middle East oil does nothing to improve the situation whilst the basic parameters of the security problem persist. But the capacity to bring *extra* oil on stream is an important element for softening the price elasticity of the product. Similarly, oil is used to raise steam in boilers or provide low-grade heating. Technologies are available off-the-shelf to enable dual firing with non-fossil oils, coal or gas. On the electricity grid, a non-oil fired plant can similarly displace oil by changing the merit order of the plant or making savings in low-grade demand such as building services. Finally, there is the option of introducing renewable energy where it could displace oil in current use. All these approaches effectively free available oil feedstock for refining and to transport quality refinery products. Biodiesel may be an especially important issue in developing countries where oil imports are first going directly to strategic uses such as water extraction and pumping. In regions with availability to gas, the oil substitution scenario is already exhausted.

3.2 Opening up a second grid

One of the reasons that the non-transport sectors are relatively resilient is that they are serviced by a portfolio of energy-sector supply grids. By contrast, transport has only one oil-based energy vector. Electric power to rail and trams is relatively small. Natural gas is an

[3] For instance, a temperature change of 1°C in a thermostat, along with an appropriate choice of clothing can save around 10% of consumption in a building with no loss in performance. Within high-grade energy uses, provision of local task lighting can make twice this savings.

important option here, for countries with indigenous or secure gas supplies,[4] as is liquefied natural gas. But in both cases the fiscal structure for motoring costs would seem to be needed to support the diversification. More ambitious is electrochemical technologies, either conventional batteries charged when oil is not on the supply grid or fuel cells supplied with hydrogen from a non-oil source. In both cases an intermediate energy vector is added alongside oil to gain access to the diversity of the national fuel mix. These may not be immediately accessible technologies but they are increasingly important as oil reserves concentrate in the Middle East through exhaustion elsewhere. Someday in the future, of course, technologies like these will be the successors to oil for transport. What they all have in common is that they provide a reduced environmental impact for transport.

4 A policy of looking for allies

The more adventurous the security programme is for reducing price inelasticity, the more it will need allies if it is not to have to wait until the first oil shortages to prove its rationale. Traditionally, the domestic industries that benefit from a policy of fuel diversity such as nuclear and deep-mined coal have proven to be powerful lobbyists for fuel security. They have been considerably weakened under liberalised energy markets. They have also suffered a heavy handicap as a result of environmental protection policy. This handicap points to a problem if any proactive security policy were to lead to a reduction in environmental aspirations. Environmentalist energy policy had focussed largely on renewable energy sources, particularly with reference to reduced air emissions. In the transport sector, environmental interest had focussed more on efficiency than alternative fuels. An interesting exception has been initiatives such as the London Congestion Charge, where ‘green vehicles’ are exempt for a fee. Environmentalists, however, may not be a block. They could be the strongest ally.

4.1 Why environmentalists also have a problem

Environmental policy was the major determinant of much of the developed world’s energy policy in the early 1990’s. Its assaults on the traditional, subsidised energy industries did much to pave the way for the form of energy sector that survived the liberalisation of markets. After all, the subsidised industries received their subsidies both in cash and in weak environmental standards. The environmental energy policy at the beginning of the 21st century seems largely shaped by combating global warming. In one sense the issue becomes easier year by year. Since the effect is accumulative, its sceptics have an increasingly difficult task year on year to explain away rising global temperatures. But the policy faces a real difficulty as the balance between the mitigation and the abatement effort is struck. Unusually for an environment issue, abatement is not as effective as the mitigation of immediate harm.[5] So environmentalists face a difficult and split constituency. They are already adding fuel security to the reasons for promoting greater use of renewable energy. But this is in an undeveloped form and in most cases is only weakly linked to the mainstream fuel-security agenda. The worst case scenario for environmentalists would be an energy emergency that reinstated coal and nuclear energy as the basic fuels of a developed economy. As the example

[4] Around 75% of gas reserves are held about equally between the former Soviet Union and the Middle East, at a global-reserves-to-production ratio of 60 years.

[5] Even in the 2002 sustainable development policy scenario published by the United Nations Environment Programme in *Global Environment Outlook 3, Past, Present and Future* (London: Earthscan), the policy still delivers no impact on global temperatures until around 2025.

of the London Congestion Charge exemptions show, green environmental policies can in fact be used to increase the diversity of the fuel mix in the transport sector.

5 Conclusion

There is a tough logic to energy security in the first few decades of the 21st century:

- Even if globalisation is to be the long-term security framework, there could be a very difficult transition period ahead in the next two decades.
- Recent events in the Middle East have highlighted premature expectations of globalisation.
- The Middle East will become the predominant supplier to the world oil market in the next few decades.
- There is currently little to stabilise the traded oil price between a floor price created by low, Middle East short-term costs and a ceiling created by the large, long-term costs of alternative energy supplies.
- The major oil importers have economies that have allowed transport fuel to gain an unparalleled strategic significance.
- Policies exist that would weaken the price-inelasticity of oil demand without appearing to jeopardise the economic stability of the Middle East.
- These policies predominantly relate to diversifying the transport fuel mix.
- The best hope of a precautionary application of these policies is an alliance with environmental interests, since diversified fuels tend to have lower environmental impacts.
- Environmentalists would have much to lose if they did not join the alliance and much to gain if they did.
- Private sector and regional governments are important players in the transport fuel diversification game.

The first steps are a serious scenario analysis of the implications of oil disruption that use data reflecting recent changes in the structure of the transport market. It would inevitably lead to power markets that have the flexibility to substitute-out oil, to refining capacity able to handle a rebalance of demand, to greater use of indigenous renewable resources and the development, over time, of parallel supply grids to oil for key elements of the transport sector.

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About INDES

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The INDES project focuses on market-compatible, cost-effective security of supply responses by the European Union. Security of supply is understood as insurance against risks, in which responsibility is shared between the EU, member states, energy companies and customers. Thus security of supply is seen as an economic risk-management strategy. Critical to such an approach is first the minimisation of the insurance 'premium' to achieve the degree of security that is politically called for. Second, there is a need to identify the best systemic actor able to 'hedge' the risk. This can be governments, companies, consumers or in some cases, the market itself subsequent to careful design. Based on these premises, INDES research has emphasised two areas: i) costs of energy supply disruptions and ii) costs of potential policy responses. Towards this end, robust methodologies to assess costs and a sound empirical basis for cost data were used as the precondition for informed policy choices reflecting both effectiveness and cost-efficiency. Following this work, INDES research sought to identify the appropriate market-compatible instrument and the associated actors that would convey the process, be they governments, companies or consumers.

INDES has operated around three axes. The first was academic workshops that developed and refined the methodological framework and empirical base. The second was stakeholder workshops that presented and discussed findings with policy-makers and other stakeholders. The third axis has been the promotion of publications – both academic and policy-relevant – that aim at participating in the existing academic debate and influencing policy-makers. For more information on the project and the series of working papers, visit the INDES website at http://www.energymarkets.info/indes/index.html.

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