

# Energy Security

## Insights



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### Energy choices: India and beyond

Concerns about energy security are both overtly as well as in subtle ways influencing energy decisions for the future. Combined with the recent experience of increased oil prices in the global market and the war in Iraq, most countries that are importing sizeable quantities of oil, and particularly those that have a growing dependence on imports, are now looking at means to bring about a shift in energy production and consumption patterns. To these realities has been added the recent assessment of the IPCC (Intergovernmental Panel on Climate Change), which clearly indicates that not only is climate change a concern for the future, but several of its impacts are also already being observed in various parts of the world. Among some aspects of this assessment is the finding that during the 20th century the average surface temperature increase globally was 0.74 °C as compared to 0.6 °C in the earlier assessment report. Projections for the future highlight the best estimate at the lower range for the 21st century of a temperature increase of 1.8 °C and at the upper end a best estimate of 4.0 °C. The most recent of the three Working Group reports focuses on mitigation measures by which emissions of GHGs (greenhouse gases) can be reduced at minimal cost. There are, as assessed, a number of energy efficiency measures that can bring about sizeable reduction in emissions in the short and medium term, but a range of policies would be required to ensure that new technologies are developed and disseminated on a large scale. For the first time, IPCC has also assessed the option of nuclear energy for supply of electricity.

One of the major messages of the Working Group III Report as part of the Fourth Assessment Report of the IPCC is the reality of major co-benefits associated with reducing GHG emissions, in which energy security features as an important component. There are, in addition, benefits in terms of reduced local pollution and in the case of transportation, where a shift to public transport would have great relevance, much lower levels of congestion on our roads and highways and the lower cost of highway and road construction and maintenance as a result. All of this suggests that for countries and those involved in arriving at agreements at the international level, it would be useful to deal with the issue of climate change in conjunction with considerations of energy security. This at least could be a major innovation in decision-making at the national level, particularly in oil-importing countries, of which China and India are certainly an important part. Such an approach could lead to a combined strategy that addresses the twin objectives of mitigation of GHG emissions and ensuring a higher level of energy security. It is expected that this debate will enter into the negotiations for the next commitment period of the Kyoto Protocol, which would intensify in the coming Conference of the Parties to be held in Bali, Indonesia during December 2007.



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# India's energy security: foreign, trade, and security policy contexts<sup>1</sup>

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India today faces an enormous energy challenge. With ambitious targets of growth rates of 8% over the next two decades, the country's energy consumption is expected to more than double by 2020 to meet development aspirations. It is becoming clear that an increasingly large fraction of India's energy will come from imports of different fuels. The country's fuel mix consists of oil (36.39%), coal (51%), gas (8.87%), nuclear (1.53%), and hydro (2%). As far as oil is concerned, India is the fifth-largest consumer in the world and is likely to take the third place in the next four to five years. More than 70% of the country's crude oil requirement is imported. This is projected to increase to as high as 90% in the next couple of decades. Apart from increasing its dependency on imported oil, the economy is expected to rapidly become dependent on external sources of both gas as well as coal. The demand-supply gap for gas has been estimated to be about 83 MSCMD (million standard cubic metres per day) in 2006/07.<sup>2</sup> To bridge this gap, the government and private sector companies are pursuing various gas import options including imports of LNG (liquefied natural gas) and import of gas through trans-national gas pipelines. In the case of coal, which was once considered to be abundantly available, the domestic supply shortfall is expected to be 55 MT (million tonnes) by 2006/07 and 105 MT by 2011/12 (Planning Commission 2002).

This trend of increasing import dependency raises concerns not only with regard to the magnitude of imports but also with regard to monetary outflows. In 2004/05, the net petroleum import bill for the country was about Rs 1033.7 billion. Further, a major concern in the energy imports scene, apart from the increasing

dependency on imports, is that a large chunk of imports to India (mainly oil and gas) are from politically sensitive regions. Therefore, while there is a need to search for alternative sources of oil to ensure diversity of supply, there is also a need to engage with these regions more broadly in order to ensure stability of investments and supply. Finally, the emergence of India as a major consumer and importer of energy products has meant that the country's energy security is today intimately linked with geopolitical developments in different parts of the world. In turn, India's demand growth will play a large role in shaping the nature of trade flows, energy markets, and prices globally.

It is in this context that TERI (The Energy and Resources Institute) in collaboration with KAF (Konrad Adenauer Foundation) organized a one and a half day conference on 'India's energy security: foreign, trade, and security policy contexts' on 29 and 30 September 2006. The conference brought together a diverse cross-section of stakeholders and experts from India, Germany, China, and Japan. This included past and present members of the foreign services, armed forces and navy, the media, and the planning commission. The German delegation included leading energy experts and members of the German Bundestag. Also well represented were energy experts and economists from India, China, and Japan, including a group from TERI as well. The conference brought out an interesting range of perspectives on the problem of energy security, going beyond the problem of how to access energy to include questions regarding definitions of energy security, wider implications of energy access strategies, and critiques of current state policy.

A few key topics were planned for this conference and their discussion helped in

<sup>1</sup> Summary of the TERI-Konrad Adenauer Foundation Conference

<sup>2</sup> Estimate by Market and Development Research Associates done for GAIL in 2003/04. GAIL Infraline Report 2005.

underlining the importance of energy to foreign and trade policy. These focus areas were as follows.

- The room to manoeuvre that India currently has in its energy securing strategies.
- The importance of understanding the foreign, trade, and security implications of strategies being followed or planned or that need to be in place.
- Learning from experiences in the West and East in dealing with energy security policy issues. Are governments shifting from markets to more strategic approaches? What energy security policy options are being pursued?
- Emerging global and regional trends: are new institutions needed to foster energy security? What opportunities can be created for cooperation between consumers and producers? What role for Asian/South Asian energy cooperation?

This article seeks to take a retrospective look at the conference discussions and papers as a whole, and identify some overarching themes that formed the topics of discussion. These themes were found to be central to the analysis and debate throughout the conference and are becoming increasingly important to the framing of energy policy today—not just in India, but also across the world. In what follows, therefore, we shall introduce and briefly discuss these ideas. A more detailed insight may be obtained by referring to the conference proceedings. Many of these themes also find a place in the country papers published in this issue of *Energy Security Insights*.

### Contextualizing energy security

Energy security is one of those oft-used terms that unfortunately mean very different things to different people. Unsurprisingly therefore, there was some discussion in a few of the papers on how energy security should be understood; how its meaning might change depending on whose perspective is used; and the different opportunities and constraints that lie before India today. One issue that came up quite clearly was the divergence between the concept of energy security and its implications for

the more affluent (and largely urban) middle classes and its meaning for the vast majority of Indians who are still poor and live in rural areas.

A key challenge faced by India, it was pointed out, is solving the rural energy problem and dealing with issues of energy and poverty linkages.<sup>3</sup> Cooking comprises 75% of the household energy demand, of which, 70% still comes from biomass. Additionally, over 50% of the population lives in households without electricity and about 80% on an income of below \$2. Achieving 8% growth, meeting the MDGs (Millennium Development Goals), and eradicating poverty within the next two or three decades will therefore require solving some basic energy needs as well. Apart from obtaining adequate energy supplies at prices that are affordable, climate change concerns have created a second threat that India faces in meeting energy needs. The continued focus by the developed world on arguing that India's contribution to incremental greenhouse gas emissions is unsustainable while ignoring the fact that their own emissions are rising in order to maintain an unsustainable lifestyle is unfortunate. It was pointed out by this presenter, that India's energy consumption in 2031/32 will only equal that of China today and still be below 15% of the 2003 US per capita consumption. Thus, if the global community wishes to make a commitment to eradication of poverty and delivering the MDGs then it needs to ensure that India is allowed to get the modest levels of commercial growth she needs.

An aspect of the energy security debate was the need to keep in mind two basic truths.<sup>4</sup> The first of these is that India's problems, lifestyles, geography, strengths, weaknesses, and so on are all very different from those of a country such as the US. It is crucial to remember this when talking about energy priorities for this country, or what energy security might mean to India, because otherwise, there is a danger of focusing on issues that may capture government and public interest abroad but in India are marginally relevant and affect only a small group of people. The second proposition was that underlying any kind of security – energy or otherwise – must be a sound economic

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<sup>3</sup>Surya Sethi, Adviser (Energy), Planning Commission

<sup>4</sup>Subroto Roy, Consulting Editor, *The Statesman*

substructure. Debates regarding energy strategies such as equity oil investments are meaningless without this. Many 'strategic' energy policy decisions (equity investments, naval defence upgradation, undersea pipelines, and so on) are characterized by extremely high costs. It is debatable whether these expenses are justified in the context of India and whether our economy can bear government expenditures of this kind. Nor is it possible to obtain efficient choices that reflect majority interests unless decisions are made in a proper economic framework. Thus, addressing the concerns of India's economy and governance would go a long way towards providing security.

In another paper presentation, the point was made that to understand why energy security was important and how to deal with it, it was first necessary to examine a set of underlying drivers of this concern.<sup>5</sup> These include both internal and external forces. This sentiment was echoed in discussions during the conference on several occasions, and brief debates on agriculture, demographic trends, and recent geopolitical history in West Asia only served to highlight the variety of factors influencing energy policy and energy security perceptions. The paper also presented an approach to analysing the constraints to change faced by India through a path dependency argument, illustrated with a couple of case studies. These helped to make the point that institutional history, economics, technology, and information gaps, all play a crucial role in creating both real and perceived energy-linked threats. Acting together, these factors can make it extremely difficult to move away from status quo situations and can thus be a huge obstacle to achieving greater energy security.

### **The need for an integrated approach to achieving energy security**

Over the last decade, it has become increasingly clear that traditional objectives of energy security cannot be achieved in isolation from other concerns such as environmental sustainability or equity. This integrated approach towards energy

security, moving away from a more traditional-supply-centric approach to the issue, was evident throughout the conference. Papers discussing energy policy in different parts of the world – India, China, Japan, and Germany – all served to reiterate this point. While supply issues did make up a large part of the discussion (focusing on issues such as price rise, geopolitics, maritime security, and the need for import diversification), there was a great deal of time given over to discussing demand side management, equity concerns, and environmental issues. For example, the debate on hydroelectric power and nuclear power tended to look at environmental threats as being very much a part of energy security concerns. This issue of the newsletter includes three country papers (China, Japan, and Germany) and all of these reflect the multiple concerns alluded to above. It was particularly interesting to see unanimity of themes such as the need to control demand for energy in different papers and during the discussions. In particular, questions relating to India's energy efficiency and the success of various policy tools used in Japan (such as the top-runner programme to increase appliance efficiencies) came in for discussion. The multiplicity of issues discussed highlight the fact that today, questions relating to sustainable consumption are seen as being crucial to ensuring energy security and sustainability.<sup>6</sup> In many parts of the world, energy security is therefore being looked at as a multi-faceted challenge where success will not only require such reliable and affordable supplies, but also smart and more enlightened consumption patterns.

### **Energy security imperatives and implications to India's foreign policy**

One of the central objectives of the conference was to understand the links between India's energy security imperatives and its foreign policy. It has been the case for a number of years now that countries such as the US have made energy (particularly oil) a part of their foreign policy thinking. Similarly, many of the links between energy and international relations and

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<sup>5</sup>Ligia Noronha, Centre for Research on Energy Security, TERI

<sup>6</sup>In large part this has occurred because of the recent sharp focus on global environmental concerns, and the need to control GHG emissions through a reduction of fossil fuel use.



foreign policy, have been evident for a while to large oil producers such as Saudi Arabia. Some of these aspects were explored during the conference for the West Asian region, where the author looked at the geopolitics of oil and gas in the region and specifically the American role in how trade flows have developed.<sup>7</sup>

In recent years however, 'energy diplomacy' and 'energy-aware foreign policy' have come to mean a great deal in more countries of the world than ever before. It has been argued that Russia today looks upon energy as a key tool in regaining some of her previous influence on the world stage (Smith 2006). Developing countries and large consumers such as India and China have also begun to feel the need to view foreign policy decision-making through the lens of their large energy needs. One way in which this has manifested itself is through equity investments made by both states (particularly for oil). Many of these investments are in problem states with dictatorial regimes (such as India's investments in Sudanese oilfields). Similarly, India's relationship with the US and voting decisions in different fora (such as the IAEA [International Atomic Energy Agency]) have an effect on the country's energy trade prospects with Iran.<sup>8</sup>

India's energy concerns will have, and are having some major implications on her foreign policy imperatives.<sup>9</sup> This includes the need that will be felt to protect investments made in unstable nations, and the diplomatic instruments required for this purpose. These tools may include influencing the stability of particular regimes, interfering in the political process, non-transparent spending of funds in a foreign country, and so on. None of these are foreign policy instruments that India has traditionally been comfortable using.

Similarly, India's attempt to engage in civil nuclear trade and be accepted as one of the 'rightful' nuclear weapon states has meant confronting the implications of closer relationships

with the US (an important ally, whether for nuclear trade or otherwise) on our relationship with West Asia and specifically countries such as Iran. Balancing a US-friendly policy with one that recognizes the importance of West Asia and Iran as a trading partner and particularly an energy partner, is an important challenge for India today. Meeting this challenge will require a far more pragmatic foreign policy than before. This pragmatism must extend to our relationships with all the major powers, including China, Russia, and the US. In turn, it may well be necessary to join issue-based, ad-hoc coalitions.<sup>10</sup>

Other areas where India's foreign policy is likely to face new challenges, the author argued, include the need to be concerned about the interests of private players investing in foreign markets, the need to rethink our relationships with our neighbourhood in light of our energy (particularly gas) needs, and the need to establish ourselves as a stakeholder in the international community and take on many more responsibilities than we have so far done. The last is inevitable as a consequence of the country's growing economic profile and status as a major player on the energy market.

#### *'Natural' energy cooperation with 'traditional' conflict partners*

A repeatedly made point during the conference, both by Indian delegates and those from China, Japan, and Germany, was the importance of cooperation between major consumers and between buyer and sellers of energy. Today, there is a whole range of 'natural' cooperation opportunities between countries such as China and India or China and Japan. Ironically, these countries could be viewed as traditional conflict partners as well, with relationships being at best somewhat cool and, at worst, actively hostile.

Between India and China, for example, there are clear synergies that could be exploited. Both countries are heavy energy consumers and

<sup>7</sup>Talmiz Ahmad, Director-General, Indian Council of World Affairs

<sup>8</sup>For example, the recent civil nuclear agreement has been thought to have had a direct link with Iran's hard line on the pricing of natural gas through the proposed Iran-Pakistan-India pipeline.

<sup>9</sup>C Rajamohan, Strategic Affairs Editor, *The Indian Express*

<sup>10</sup>India is a signatory to the Kyoto Protocol. Even so, the country has also become a member of the Asia-Pacific Partnership on Clean Development and Climate, widely seen as a counter coalition on global warming spearheaded by the United States (which of course has not ratified the Kyoto Protocol).

importers, with rising energy demands. The dependence of both nations on the Persian Gulf, vulnerability to price rise, and security concerns centering around the Straits of Hormuz, are common areas of concern. The two countries signed a series of MoU (memorandum of understanding) in January 2006 to enhance energy cooperation with statements of intent covering the entire petroleum chain from exploration to refining. Five commercial agreements have been signed between Indian and Chinese companies and there have been instances of cooperation between ONGC (Oil and Natural Gas Corporation) Videsh Ltd and China's CNPC (China National Petroleum Corporation) in equity oil investments.<sup>11</sup> Cooperation in acquiring equity oil and gas is a win-win for both countries because competition has only served to drive prices up (as occurred in the case of the bidding war for PetroKazakhstan).

Some areas of potential cooperation between India and China<sup>12</sup> include joint management of stockpiles, lobbying to scrap the 'Asia Premium', lobbying for an Asian marker crude, clean coal technology cooperation, cross investments in refineries and pipelines in Central Asia and Africa, and cooperating in the trade of hydroelectricity—from across the Chinese border to India and even potentially from Central Asia.

These opportunities exist hand in hand with conflict situations, both due to the traditional wariness that the two countries have for each other, as well as newer sources of tension. These include competition for equity oil, Chinese interests in gas in Myanmar (in the same oil fields India has been actively pursuing)<sup>13</sup>, the 'string-of-pearls' strategy of the Chinese navy in the Indian Ocean, and so on. Similarly, while there exist many opportunities for tripartite cooperation between India, China, and Japan (in areas such as technology transfer and development of clean coal combustion technologies, lobbying to remove the Asia Premium, joint stockpile management, and so on)

there are strong tensions between China and Japan over disputed areas in the South China Sea. Even in these regions however, joint surveys are a way of at least assessing the energy resources that may be available.

More generally, going beyond Asia, the theme of cooperation was stressed repeatedly. The European Union's potential as a partner for India in many areas, including energy-linked research and development is one example. It was also pointed out that there are many gains that could be had from giving very large energy consumers such as India and China some sort of a role in the IEA (which already has South Korea and Japan as full member countries). This is especially the case because of the pressing need to spread best practices and technologies to tackle climate change concerns. In that regard, expanding the countries involved in the Energy Charter treaty and post-Kyoto climate change agreements, would help tie together producer and consumer nations on the twin fronts of energy and climate concerns. These two multilateral initiatives, therefore, could be our best hope of building more widespread and lasting frameworks for international energy cooperation.

### **The importance of energy markets in ensuring energy security**

One of the key themes running through the conference was the importance of well-functioning markets and their potential in reducing conflict and increasing energy security for all countries. Markets that are transparent and allowed to operate with a minimal amount of distortion from geopolitical and state forces, hold the potential to mitigate risk and ensure a sense of security both for buyers of energy, as well as selling countries.

A paper on energy markets in India pointed out that there are distortions both in international trade of commodities such as oil, as well as in every energy market in the domestic sector.<sup>14</sup> Government control over the pricing of almost all domestic coal production for example, has led to

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<sup>11</sup> China's CNGC and India's ONGC have, for example, acquired 37% of a PetroCanada Syrian Oil Field.

<sup>12</sup> These options were discussed by Sudha Mahalingam, Nehru Memorial Centre

<sup>13</sup> The Myanmar Energy Ministry signed an MoU with PetroChina for the sale of gas from its Block A-1 reserve in December 2005. India has also expressed a strong interest in building a pipeline to import gas from the A-1 block to India.

<sup>14</sup> Joseph Massey, Deputy Managing Director, Multi Commodity Exchange

serious problems of inefficiency, corruption, and a black market. Similarly, because of the lack of market mechanisms to allow free movement of electricity at the appropriate price, there is a curious situation wherein endemic power shortages exist and yet grid electricity is unavailable at any price. A similar problem exists in the case of natural gas. The government's desire to import gas at prices low enough to allow supply at administered prices in India has resulted in blocking off supplies from the international market (where low-priced gas is not easily available), even though there exist domestic consumers willing to buy gas at a higher price. Once again a well-functioning market would have allowed this gap to be filled.

Apart from ensuring availability at differential prices, the other key role for markets is in mitigation of risk. A major issue with bilateral trades is risk from a variety of factors, many of which may have nothing to do with the trade agreement per se but may involve other issues between the two partners. There is, therefore, an advantage to trading in commodity exchanges located in neutral venues. The multilateral nature of trades, transparency, and the guarantee of functioning market mechanisms result in reduced transaction costs and far greater security. The leading exchanges in the world are the NYMEX ([New York Mercantile Exchange] New York), ICE ([Inter Continental Exchange] London), and TOCOM ([Tokyo Commodity Exchange] Tokyo) but in the past, downstream, consumers in India have been unable to use these markets due to RBI (Reserve Bank of India) regulations. However, with the expansion of these exchanges to other parts of the world and the establishment of the MCX (Multi-Commodity Exchange) in India, things are changing.

Trading on an exchange provides not just price transparency and lower transaction cost, but also helps insure against risk and allows oil from

different parts of the world to be bought or sold easily. In doing so, a major contribution is made towards ensuring energy security. A case has been made that commodity exchanges increase the possibilities of speculation, price volatility, and price rises. This is probably not an entirely fair assessment. There are two clear advantages with an exchange that bilateral trades do not have. The first is that transaction costs are lower (of the order of 0.5%) while they are much higher in a bilateral trade where they may be as high as 1%–2%. The second is the role of speculators in providing insurance against risk. The part played by the financial investor on the exchange is allowing a trade to take place and taking on the risk burden for the lowest possible price. Without speculators or financial investors, in many cases the trade may not even have occurred.

While it was clear following the conference discussions that there was potentially a very positive role for markets to play, it was also pointed out that the underlying security in all kinds of trade is far greater when it takes place between democratic nations. Thus, the three aspects of widespread cooperation, democratization, and increasing faith in markets, together provide a pathway towards global energy security that is likely to be far more successful than the alternative (which in many ways is gaining ground today), of resource nationalism, bilateral trade arrangements, and competitive geopolitical strategizing.

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# International energy security and Japan's strategy\*

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## Introduction

Energy is a vital commodity, required for economic activity and public welfare. Ensuring a stable supply, in terms of availability and price, is therefore, one of the most important challenges facing Japan. Japan, being poor in terms of the availability of domestic energy resources, depends on imports from the international energy market for most of its supply. For Japan, therefore, the establishment of an energy security system, based on a global perspective is the most important task in light of national interests.

However, some aspects of Japan's overall approach to the energy problem still lag behind the changes taking place in the world. In particular, we need to be mindful of the fact that the paradigm shift that emphasizes the strategic importance of energy has far greater significance than is appreciated in Japan. This paper first analyses major risks and threats to the international energy market today. It then discusses the problems with the current approach taken by Japan and identifies the measures that Japan should take in the future. Finally, it discusses the specific goals addressed by Japan's new national energy strategy.

Since the first oil crisis, Japan has strived to achieve the best energy mix, through such measures as the diversification of supply sources, while making efforts to utilize energy more efficiently (energy conservation). As a result, its dependency on oil was reduced to about 50% and the importance of oil, to the national economy as a whole, decreased significantly. (The ratio of the financial value of oil imports to GDP [gross domestic product] decreased from 4.2% as of fiscal

year 1974, to 2.1% as of fiscal year 2005.) Japan currently has oil stockpiles that can last for about 170 days, including state-owned and private ones. Furthermore, the country is implementing various measures under the provisions of the newly established Basic Energy Policy Law, which sets the basic orientation of future policies around the three pillars of energy security, environmental protection, and economic growth (the pursuit of economic efficiency).

However, Japan is faced with its own reality characterized by the emergence of such issues as the growing dependency on oil imported from the Middle East; the stagnation of nuclear power projects; the discontinuation of the Japan National Oil Corporation and the re-examination of oil development policies; and difficulty in meeting the emission reduction goals set forth by the Kyoto Protocol. Japan should strengthen its efforts in the following areas, in view of the aforementioned paradigm shift concerning the approach to energy issues.

### *Establishing a comprehensive national energy strategy*

Japan's energy policies should be made more effective on issues that are inseparably entangled with matters such as diplomacy, defense, economic and trade policies, environment, and education. In addition, there are issues, such as the threat of terrorism, against which we must strengthen safeguards because these issues have not been emphasized in the past development of Japan's energy policies, constituting gaps in policies. In the context of cultivating a shared perception among the public, education is also an important issue.

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\* This paper is based on the report of the 27th Policy Recommendations, The Establishment of an International Energy Security System, published by the JFIR (Japan Forum on International Relations), Inc. in May 2006 and is an abridged version of the paper presented at the TERI-KAF conference, 29-30 September 2006.



Today, Japan needs to establish a comprehensive energy strategy for the nation, based on current and future global trends. To this end, a comprehensive approach that takes account of a range of matters such as diplomacy, defense, economic and trade policies, environment, and education is essential and it is imperative that issues are clearly prioritized.

In terms of creating an action plan, we need to create short-, medium-, and long-term action plans that delineate the roles and responsibilities of the nation, local governments, and the private sector. Such planning has to reflect our perception of international relations. The national government has to assume responsibility for developing national strategies that protect national interests, strengthen its own capacity in this respect, and play a corresponding role. To this end, namely strengthening the capacity for energy strategy development, national efforts should be made to reinforce inter-ministerial and inter-agency cooperation under the leadership of the prime minister. On these points, France would be a good example for Japan. More specifically, it is noteworthy that France traditionally adheres to the doctrine of protecting its vital interests on its own in terms of general security and energy security policies and consistently observes this doctrine as it formulates national strategies, develops its players in the market, and establishes market rules, while giving consideration to national interests.

We should also note that China, which has intensified national efforts to strengthen energy security, established an 'Energy Leading Group' headed by Prime Minister Wen Jiabao. The members of the group are ministerial-level representatives of energy-related government organizations and the establishment of such a group is significant because it shows China's commitment to reinforcing the comprehensive efforts of the nation.

Japan's energy risk management system also requires reinforcement. With regard to risk management, comprehensive and systematic preparation is required in the form of short-term measures concerning supply and price, and mid- to long-term measures concerning sustainability. On the subject of oil stockpiles, for example, even though we already have sufficient stockpiles, we

still need to conduct further discussions and preparations in order to ensure an effective disposal of reserves. Another important issue requiring discussion is the safety of the public (humans), protection of life, and the security of lifelines to that end, through such actions as disaster prevention at nuclear power plants and LNG (liquefied natural gas) terminals, measures against terrorism, and vigilance against a major blackout.

#### *Striving further to achieve the best energy mix*

Japan needs to strengthen its efforts to achieve the best energy mix by further diversifying its sources of supply and developing alternative sources of energy. It is very important that Japan makes good use of the unique features and advantages of each energy source and of its technology, human resources, and experience, as we promote the development of nuclear power, natural gas, and coal, as well as new and renewable forms of energy.

Even though nuclear power generation is discussed in detail in a separate paragraph, it is worth mentioning here that Japan is the only country in the world that does not have nuclear weapons but has complete facilities for nuclear fuel cycle, a fact that has a very significant meaning in the context of international politics. In view of this fact, and of such facts that nuclear power is a semi-domestic source of energy and is an indispensable choice for achieving reduction of CO<sub>2</sub> emissions, there is a need to strengthen efforts to promote nuclear power development.

The demand for natural gas, as a cleaner fuel, is growing and natural gas is expected to play a more important role as a primary energy source in the future. We need to establish a more economic and flexible supply system in order to meet market needs. In view of the fact that demand for natural gas has increased rapidly in recent years in countries such as China and the US, it is also important that a future-oriented strategy is established to ensure the security of Japan's supplies of natural gas.

Coal has the major advantages of stability and low cost of supply because of its abundance. While coal is expected to play an important role in the future, as it does now, environmental issues such as CO<sub>2</sub> emissions from its use will have to be dealt

with. Therefore, efforts to make use of coal should be integrated with the development of clean coal technologies.

Renewable energy sources are promising as future sources of energy because they are basically domestic sources and can play an important role in the efforts to curb global warming. Renewable energy sources including hydropower, presently, have only a very limited share of 5% in the total primary energy supply. To ensure that they achieve major penetration in the market in the future, it is important that the supply cost is reduced through further technical development.

#### ***Strengthening the development of energy technologies***

Technology plays a critical role in terms of simultaneously dealing with major long-term challenges concerning energy security, the environment, and economic growth (economic efficiency). Technological development is crucial to certain aspects of the above-mentioned pursuit of the best energy mix, in terms of developing and increasing the shares of different sources of energy. It is also important to the progress of energy conservation. Moreover, establishing and developing technological areas where Japan enjoys superiority provides one important pillar for Japan's international energy strategies. More specifically, those technologies must be further developed in which we already enjoy international superiority, such as energy conservation and environmental protection measures, as well as the technology and know how developed through Japan's experience as an advanced nation in terms of nuclear power generation.

Concerning the future development of energy technologies, it is important that technological strategies are prepared under a comprehensive set of energy strategies in consideration of how given technologies will be accepted in the global community and with an emphasis on feasibility. The choice of technologies for carbon capture and storage, for example, has to be made after sufficient examination from these perspectives.

When planning the development and practical utilization of technologies, strategies need to be developed according to a grand design and with a long timeframe in mind, understanding that a long

lead time will be required. For example, since renewable energy, as well as hydrogen energy is very important in the future energy mix, it is extremely important that we pursue the development of corresponding technologies as a long-term challenge. It should, however, be noted that such forms of energy probably could make only a small contribution as a primary energy supply in the time span of 10 to 20 years. It is also important that we choose energy options, and develop strategies to make the choice possible, from a long-term perspective of the energy supply-demand balance, the trend in energy prices, and the limited availability of fossil fuel resources from a very long-term perspective.

#### ***Developing internationally competitive players capable of carrying out the strategy***

Even though the national government is responsible for the development of a comprehensive energy strategy, it is not an actual player in the market. Therefore, based upon appropriate role sharing between the government and private sectors, the capacities of energy companies need to be established to compete in the international market as Japan's players.

Particularly in the area of oil and gas development, it is expected to see the emergence of national-flag companies that are powerful enough, in terms of technology, capital, and management, to be able to compete effectively with national oil companies and the oil majors in the international market. As long as Japan is dependent on energy supplies procured from the international market, Japan's oil industry requires players of such integrity that they are stronger in procuring supplies and have stronger bargaining power in their relations with suppliers.

For the future of nuclear power generation, it is also important that the emergence of major players is encouraged in such areas as nuclear equipment manufacturing and in the electric power industry, so that they can ensure succession and retention of technologies and human resources in the long term. It is also important to review the structure of the energy industry, with such ideas as re-organizing the industry on vertical or horizontal integration, in view of the above-mentioned points

and with an intention to support the emergence of strong players.

***Supporting progress of the international energy strategy and regional cooperation in Asia***

The mechanisms of international cooperation need to be reinforced to strengthen energy security for Japan. Currently, there are various frameworks for international cooperation such as partnerships between advanced energy-consuming countries through the IEA (International Energy Agency); producer-consumer dialogues through the IEF (International Energy Forum); regional cooperation among APEC (Asia-Pacific Economic Cooperation) nations and among ASEAN (Association of South East Asian Nations) +3 nations; and bilateral cooperation between major countries. For Japan, it is important to build multiple layers of international cooperation mechanisms that serve different purposes.

Most importantly, Asian countries that share the same interests as energy-consuming countries, should work together to create a cooperative and joint approach within the region, taking advantage of such frameworks as the East Asia Summit. Important programmes that can be pursued in this manner include a thorough implementation of energy conservation measures in Asia where energy utilization efficiency is still low, by means of establishing appropriate benchmarks, for example. It is also required that the energy-consuming countries of Asia join hands to restrain the suppliers' market power and eliminate restrictions to more flexible energy trading (for example, restriction on destinations).

Japan should use its accumulated experience, knowledge, and technological capabilities in formulating an energy security policy, as it promotes regional cooperation in Asia. As agreed at the ASEAN+3 Energy Ministerial Meeting in 2004, Japan should take a leading role in cooperative activities for preparing oil stockpiles, developing the oil market, promoting the utilization of natural gas and renewable energy, and so on, while at the same time transferring

energy conservation technologies and helping to implement clean coal technologies.

In connection with energy-related cooperation in Asia, the relationship with China is very significant. To prevent China from becoming a destabilizing factor in the international energy market, Japan should strive to share a common perception with China on the importance of regional cooperation, with the purpose of inviting China to join the framework of cooperation. Concerning sovereignty issues such as the EEZ (exclusive economic zone) in the East China Sea, however, Japan should of course insist on its national interests being upheld with arguments that are internationally persuasive. Even though we cannot be optimistic about the future of energy-related cooperation with China, as demonstrated by this example, we must note that the escalation of tension and competition between the two major energy consumers in Asia will harm both parties and profit only the energy-exporting countries. As the importance of Japan's energy strategies in relation to China and Asia grows in the future, an approach to manage energy-related interactions between Japan and China in reliance on the Japan-US alliance is also important, in view of the increasing military and political powers of China. India is in the unique position of being capable of serving as a bridge between the oil-consuming nations of East Asia and the oil-producing nations of the Middle East, and is expected to increase its impact on the international market as its energy consumption increases. In this respect, Japan should attach importance to partnering with India in the area of energy cooperation.

***Establishing a strategic approach to oil producing nations to ensure a stable supply of oil***

We should note that oil is expected to be the foundation of Japan's energy supply for a considerable time to come, even with progress in the development of alternative energy sources. Since oil excels in economics and convenience, it is difficult to find an alternative energy source, particularly as a fuel used in the transport sector. It is extremely important, therefore, that we try to use oil in an efficient way and at the same time establish a strategic approach to oil-producing

nations for purposes of ensuring a stable supply of oil.

Since the oil-producing nations of the Middle East will assume increasing importance as sources of oil, Japan, to start with, should strengthen interdependent relationships with these countries. To this end, Japan needs to strengthen the support systems for the private sector seeking to do business with the oil-producing nations of the Middle East through such measures as working to improve the investment climates in those countries and enhancing financial vehicles and insurance for trade and investment. Political and social stability in the Middle East is a major prerequisite and to realize this, we need to make the maximum use of soft power through technical cooperation in the areas of IT, medical care, the environment, and so on. Political stability in the Middle East requires not only economic development but also human resource development. In this respect, we should help develop, through education of the increasing youth population, a milieu in which fanaticism and extreme ideologies are unlikely to grow and as a means to achieve this end, it will be worthwhile if we consider improving our system of accepting students from abroad. For the stability of the entire Middle East region, efforts toward Middle East peace-making have great significance. Japan needs to reinforce, more than ever, its policy measures and international cooperation with the goal of supporting progress in Middle East peace making.

Besides strengthening interdependent relationships with the oil producing nations of the Middle East, another important challenge facing Japan is to develop and secure new sources of energy supply as a means of strengthening the bargaining power it has as a major energy consumer and importer, while at the same time achieving a diversification in supply sources. To this end, it is extremely important that Japan should be able to effectively utilize oil and natural gas resources in Russia, in view of the great supply potential that they offer, given the geographical proximity to Japan and the importance of Russia as a supplier of energy to north-east Asia. Japan, therefore, needs to establish a strategic approach towards Russia, based on a long-term vision. We also need to observe trends in the oil-producing nations of Africa and Central Asia, with

particular attention being paid to the potential for resource development and the possibility of production capacities being increased.

#### *Improving the energy infrastructure and market according to a grand design*

The improvement of infrastructure, such as pipelines to Japan, for transportation of energy from those countries that possess resources, will help strengthen energy security and improve the domestic energy market through diversification of supply sources. In addition, such infrastructure improvement is important in terms of promoting links with Asian countries and integration of the Asian market. However, with uncertainty about and competition in the energy market, a major investment to infrastructure is unlikely to happen if it is left entirely to decision-making by individual companies.

In this sense, it is important that the energy infrastructure be improved according to a comprehensive national strategy developed with a long-term vision and perspective into the future. Particularly on the subject of energy resource development in East Siberia and Sakhalin of Russia, we should examine a pipeline construction plan for the entire north-east Asia, including a plan for the transportation infrastructure to Japan, from a strategic point of view, identifying drawbacks and constraints to its realization and then take appropriate measures. Because Japan depends on imports for most of its energy supply, ensuring the safety of energy transportation routes is another important challenge.

Concerning the optimum distribution of resources, an effective use of the market mechanism is the most efficient approach, in principle. Therefore, it is important that we enhance the market function, which calls for not only the improvement of hard infrastructure such as that mentioned above, but also the preparation of soft infrastructure by making the market more transparent, improving the climate for competition, promoting free and flexible energy trading, and so on. Speaking about international rules, important rules that should be made include such rules that may make the market more transparent and enable the sharing of information in a timely manner and international rules concerning direct overseas



investments to promote resource development. When establishing such rules, we must pay due attention to the protection of energy security as a national interest.

#### *Meeting challenges of maintaining and expanding the role of nuclear energy*

Since nuclear energy, as a non-fossil (carbon-free) energy, is an inevitable choice in view of the need to stabilize the world's energy supply and the restrictions imposed by the global warming issue, its use needs to be maintained and expanded. Japan, therefore, should re-affirm the importance of nuclear energy, in the context of dealing with energy security and the global warming issue and make efforts to maintain and expand its role. In order to maintain and expand the role of nuclear energy, Japan must meet the following five challenges.

- Ensuring continued investment in nuclear power generation in the liberalized market
- Strengthening the backend measures (measures concerning spent fuels and the processing and disposal of the final wastes)
- Developing innovative technologies for higher safety and economic efficiency of nuclear power plants
- Restoring the public's confidence and improving the decision-making processes in the arena of nuclear power plants
- Strengthening the system for nuclear non-proliferation

#### **Accelerating the introduction of renewable energy**

Along with nuclear power generation, we need to expand the use of renewable non-fossil energy. Presently, with few exceptions (for example, wind power and geothermal generation), renewable energy options tend to be less competitive than others. Renewable energy options, however, need to be positioned as important energy options in the long term because they provide domestic sources of energy and are effective as measures for countering global warming. Most promising among them are the three options of wind power generation, solar photovoltaics, and biomass.

For us to ensure further expansion in the

utilization of renewable energy, we first need to do the following.

- Re-evaluate, from time to time, appropriate measures for promoting the penetration of renewable energy into the competitive market, such as the RPS (Renewable Portfolio Standard) legislation, and reinforce such measures as identified of being effective and efficient.
- It is desirable that the government's strategy for the development of technologies for renewable energy is redesigned and a system for technological development led by the private sector is established, based on a policy to pursue innovative and diverse options in the mid to long term and pursue cost reduction and practical application in the short term. In parallel to this, studies on comprehensive evaluation of the relationship between technology and society should be promoted.
- It is also important that policies for expanding and supporting the new-energy industry, with a view to the global market, are implemented. More specifically, we expect the implementation of industrial policies, designed from a wider perspective such as the strengthening of support for developing nations that will have great demand for renewable energy, and also of support in the context of global warming prevention on the basis of the CDM (clean development mechanism).
- It is essential that renewable energy, as a form of local-based energy, is supported by the involvement and leadership of local government. Since even the implementation of wind power generation may be complicated by a siting problem, we need to clearly establish the details of the siting and environmental assessment processes.

#### *Designing a future framework for effective global warming prevention measures*

Global warming prevention also requires planning of long-term measures as part of a comprehensive energy strategy. Being aware that decisions in the post-Kyoto international rule-making process will have a crucial bearing on countries' economic growth and industrial competitiveness and also that rule-making will reflect the bare reality of

international politics, Japan should be a key insider to this rule-making and take the lead in framing concepts for moves to create fair and effective rules. With the Kyoto Protocol having taken effect, formally obliging Japan to control the emissions of greenhouse gases, it goes without saying that we should strive to achieve these goals with a strict implementation of global warming prevention measures toward the First Commitment Period (from 2008 to 2012).

At the G8 Summit held in Gleneagles, Great Britain, in July 2005, the leaders of advanced nations, including the US, shared an awareness of the critical nature of climate change issues and the need for long-term measures. They clearly identified the need for internationally coordinated action with such mechanisms as the UNFCCC (UN Framework Convention on Climate Change) and the IPCC (Intergovernmental Panel on Climate Change). However, the Kyoto Protocol is currently handicapped by the breakaway of the US and Australia, and by exemption from the obligation to reduce emissions for developing nations including China and India. Therefore, it is essential that Japan establish a framework that is inclusive of these countries. In this respect, it is important that, in addition to the top-down approach used to date, we should bring in a bottom-up approach that allows countries to select measures matching their specific circumstances, as a framework of international rules. With such arrangements in place, we need to build a scheme to ensure support for the development and dissemination of technologies through international cooperation.

Particularly, when we pay attention to developing nations, having a vision that is not limited to the solving of global warming issues, but inclusive of ideas on the solving of energy security

and local environmental issues, will help strengthen our relationships with developing nations and facilitate framework planning.

Moves in this direction have already become manifest with the establishment of the APP (Asia-Pacific Partnership) on Clean Development and Climate in July 2005 by six countries. Japan, the US, Australia, China, India, and South Korea. It is also beneficial if Japan can commit itself eagerly to the activities included in the action plan agreed upon at the G8 Summit, such as the IEA's project for the collection of an efficiency index and other data from different countries, including developing nations and the work concerning the UNFCCC's technology-transfer clearing house. With a view to Japan's hosting of the G8 Summit in 2008, we should establish a strategy that takes a truly integrated approach to energy and environmental issues.

Japan should pursue international negotiations with the aim of taking initiatives in the building of a framework that serves not only Japan's national interests but also global interests, in terms of contributing to the prevention of global warming, by making use of the country's technological and other resources. Since the global warming issue requires long-term efforts, the aim should be to transform the entire country into a low-carbon society while maintaining competitiveness in the international market. As a country that is heavily dependent on imported energy, Japan should promote the development of technologies, such as energy conservation technologies, renewable energy technologies, nuclear power technologies, and carbon capture and storage technologies, and strive to establish an energy supply-demand system capable of ensuring energy security, while at the same time contributing to the prevention of global warming.

# China's energy security: issues and solutions\*

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The past few years have seen a growing shortage of international energy supply and rising oil prices, posing grave challenges to China's energy security. Faced with such a situation, China has paid greater attention to its energy security and formulated a development strategy to build a stable, economical, and clean energy supply system by giving priority to conservation, relying on domestic resources while diversifying sources of supply, protecting the environment, and strengthening international cooperation. That China's energy strategy stresses on diversification shows that China intends to ensure its energy security by overcoming various difficulties to achieve a sustainable, stable, healthy, and fast economic growth.

## China's energy production and consumption

China is not only a major energy consumer, but also a major producer with a high degree of self-sufficiency. In 2005, China's energy production reached 2.06 billion tonnes of standard coal and the consumption was 2.22 billion tonnes, ranking the second both in terms of production and consumption with a self-sufficiency of 93%. Coal is the primary source of energy for China and oil comes the second. In 2005, China produced 2.19 billion tonnes of coal. While meeting the domestic demand, China exports 60–80 MT (million tonnes) of coal every year and is a main exporter of coal and charcoal in the world. China's power generation capacity in 2005 amounted to 500 million kW (kilowatts) and was the second largest only after the US (United States). China produced over 181 MT of petroleum and 50 BCM (billion cubic metres) of natural gas.

New and renewable energy in China developed fast, and substitute energy also began to develop. Wind-power-generating capacity of China in 2005 amounted to 1.26 million kW. Solar-power-generating capacity reached 70 000 kW with solar

radiation system covering over 8000 square metres—the largest in the world. Production capacity of methyl alcohol and ethyl alcohol and other biological and coal-related fuels stood at 6 MT per annum. Experimental projects of coal liquefaction have made steady progress. The ratio of coal, petroleum, natural gas, hydropower, and nuclear power today occupies 68%, more than 22%, less than 3%, and less than 9%, respectively, in China's energy consumption. Thanks to the growing need of energy and unbalanced consumption structure, China's environment is faced with severe challenges.

As the primary energy source in the world, petroleum approximately makes up 40% of the global energy use. Although petroleum only occupies a share of over 22% in China's energy consumption, its importance is far greater than its ratio for China's energy security. China's demand for petroleum is growing rapidly, and it has registered an annual growth rate of more than 10% since 2000. The development of natural gas lags behind that of petroleum in China. It was not until the 1990s that production of natural gas began to accelerate, and has maintained a steady growth of over 10% since 2000. But the demand of natural gas has outpaced its production. Therefore, in the foreseeable future, China is likely to depend upon international sources to meet its growing demand of oil and gas. It is predicted that China would have to import over 55%–60% of oil and 25%–45% of gas needed by 2020.

## Problems for China's energy security

To ensure its energy security, China has to deal with following issues.

- First, China does not have an adequate supply of oil and gas at home, and the expanding gap of demand and supply has made it increasingly dependent on foreign sources. Over 40% of its

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oil used in 2005 came from foreign resources and the ratio will grow in the future. For China, energy security is the question of inadequate domestic supply. With fast economic growth in China, this will become a factor that has direct bearings on the country's sustainable development, social stability, and national security.

- Second, China's consumption of oil and gas grows too fast and the energy-use efficiency is too low. The ratio of energy consumption and growth in China is larger than that in Japan, the US, and other developed countries. For instance, the ratio of energy consumed to per \$10 000 GDP (gross domestic product) in Japan is 0.5 t, 1 t in the US, 1.8 t in South Korea, 2 t in India, and 1.9 t in China. China's energy-use efficiency today is equivalent to that of the US in the 1980s. To achieve its sustainable economic growth, China has to redouble its efforts to save oil resources, particularly for automobiles and industrial uses by taking initiatives in areas of technology innovation, management, and policy-making.
- Third, China is faced with more difficulties than before in exploring and developing petroleum. Only 44% of China's explorable oil reserves have been proven and there is a great potential for further exploration. But further exploration and development of oil reserves is very difficult. They are either very deep or very tough in terms of geological conditions such as terrain, desert, and offshore, which call for more investment and cutting-edge technologies. Natural gas resources in China are quite rich, but again with difficulties like low density and other challenging geological conditions.
- Fourth, there are many difficulties for China importing oil. For Chinese companies, how to handle the question of exploring and importing foreign oil and gas resources under such a complex situation with both favourable and unfavourable conditions is a long-term task ahead.

Following are the problems. The first problem facing Chinese companies in exploring foreign oil and gas resources is that most of the countries have nationalized their resources. As for those that have

not, they are either under exploration of other foreign companies or the conditions for exploration, both physical and political, are very tough. Risks are very high for Chinese oil companies.

- Chinese companies have to deal with a highly competitive environment for their overseas operations. Given their disadvantages in terms of capital, technology, equipment, talents, experiences, marketing, and image, Chinese companies are faced with an uphill task of beating their foreign counterparts.
- In cooperation with foreign countries, Chinese companies have to overcome problems like difficulties in exploring, developing, and investment.
- With constraints of laws and contracts of the target countries, which are meant to limit the possibility of foreign companies to make a windfall, Chinese companies find it extremely difficult to make profits though they can presumably get returns for their investments.
- The Chinese companies have to take various risks in areas of politics, investment environment, markets, and assessment vis-à-vis reality of cooperative projects. Unstable situation in the Middle East, Africa, and other oil-rich regions and danger posed by pirates in the Maraca Straits have all implications for China's importing of oil from abroad. Proper measures need to be taken to deal with these issues.
- Dramatic fluctuation and rising oil prices have brought about difficulties for China's energy importing. Oil prices had skyrocketed to over \$80 before they started to fall in August 2006. Oil prices on 15 September (2006) fell to \$58.44. There are four factors for the falling of oil prices though the primary cause was the reduced concern on short supply and decrease of demand. The first factor is political. People are now less worried about escalation of Iran's nuclear problem. The second factor is natural calamity. It is very unlikely that we will have a serious natural disaster in the near future. The third factor is the increase of supply. Global oil storage, particularly the commercial oil storage, has been on the rise. The fourth factor is market demands. Fuel demands are not very high at



the moment because it is now autumn, and summer has just been over, and winter has not come yet. Therefore, there might not be fast-rising oil prices, but days when there was low-priced oil are gone. Oil prices are not going to come back to \$10, \$20, or \$30 per barrel. Prices of oil will continue to rise and are widely regarded as increase of production costs and burden on the economy and the general public, which is detrimental to the development of national economy and social stability.

### **Possible solutions for China's energy security**

There are two approaches to meet China's energy needs, one is through domestic sources and the other is through international ones. China has adopted an energy development strategy that it will mainly focus on establishing a stable, reliable, and secure domestic energy supply system to solve the problem of inadequate supply, particularly in terms of oil and gas supply.

#### *China's national strategy of energy development*

- China is the second-largest and fast-growing oil consumer in the world. It would be extremely undesirable for China to depend on international sources to meet its growing energy appetite, as there is simply no single country or countries that can help China in this area.
- If China shifts the pressure of energy needs to the international community, it will aggregate the short supply of global energy, resulting in skyrocketing prices of oil and impeding global economic growth, and consequently China's economic growth.
- If China turned to the world community for its energy needs, it would have to pay a huge amount of money for its energy bill, which would increase the burden of the budget and hinder its own economic development.
- The potential for development and production of new and renewable energy in China. China is able to meet its energy needs is huge by itself. What it needs to do is to import some oil and gas from the international sources to complement its domestic sources.

Obviously, the thinking underlining China's energy security strategy is diversification of energy sources, that is, to diversify the energy products

and sources of supply with a comprehensive approach. By diversifying energy products, China is meant to increase its investment in exploration, development, and refinery of petroleum and natural gas, and development of new and renewable energy such as solar and wind power . China will also adopt a comprehensive approach to its energy demand, which includes measures as follows.

- To establish a stable and safe domestic oil and gas supply system by increasing investment in exploration, development, and refinery in petroleum and natural gas
- To use energy efficiently
- To vigorously develop new and renewable energy including wind power, solar power, small hydropower facilities, and nuclear power and optimize the energy consumption structure by reducing ratio of coal and petroleum use.
- To step up its efforts for clean use of coal with a view to protecting the environment and improving energy-use efficiency.
- To set up its strategic reserve system so as to reduce the risk of short supply.

Over the past few years, the Chinese government has taken various measures to alleviate its energy shortage. In 2004, China adopted a mid-term and long-term plan for energy and decided to take a comprehensive approach, which advocates that China will pay equal attention to development and conservation with conservation as the top priority for the purpose of sustained development. China's State Planning Commission published a special long-term plan of energy conservation and enacted a law for use of recycled energy in 2005, providing legal support to the development and use of new and renewable energy. At present, China is working hard to strengthen the research on new and renewable energy by taking various measures like legislation, taxation, and other necessary supports. China hopes that new and renewable energy would take up 50% in its overall energy consumption by 2050 so as to fundamentally change China's energy consumption structure, substantially reduce its over-dependence coal and petroleum, and protect ecological environment.

While stressing on legislation for development and use of new and renewable energy, the country

has also redoubled its efforts to invest in oil and gas exploration, development, and refinery and launched a nationwide campaign to increase awareness on energy conservation and encourage development and use of new and renewable energy. All these efforts have started to pay off. In 2005, China's oil and gas exploration made new progress. Petroleum output reached to 181 MT, 6 million more than that in 2004. Conservation and use of new and renewable energy also helps reduce the oil demand in China. In 2005, China's oil demand stood at 311 MT, rising by 6% over the corresponding period compared to a 19% increase of 2004. Thanks to the reduced demand of oil in 2005, China imported 130-MT less oil than 2004. That was only an increase of 3.3% over the corresponding period. The oil imported in 2004 reached 122.72 MT, an increase of 34.8% over the previous year. Increase percentage of oil imports in 2005 decreased by 31% compared to that in 2004. All these achievements were made in the context where China's economy grew by 9.9% in 2005.

In taking the above-mentioned measures to mitigate its energy shortage, the Chinese government has emphasized on improving the efficiency of energy use by setting up a target of reducing the ratio of GDP vis-à-vis energy use by 20% within of period of 'the Eleventh Five-year Plan' (2006–10). This target will call for a fundamental shift of China's development mode as conservation and efficient use of energy will not only help alleviate the country's shortage of energy, but more importantly, also enhance the quality of China's economic growth and give an impetus for technological innovation and development. China has made conservation of energy as its state policy to support building an economic structure of resources saving.

China's road to a resource-saving society, however, is long and bumpy. Reducing 20% of the ratio of GDP to energy use within five years means that China will have to cut the ratio by 4% each year. Performance of the first six months of 2006, the first year of 'the Eleventh Five-year Plan', was not satisfactory. Instead of reduction, the ratio rose by 0.8% compared to the corresponding period of 2005. The oil imports in the first half of 2006 also increased by a large amount compared to that of 2005. All these developments say that the

development mode has not changed in a substantial way and there are turns and twists ahead for China.

#### *China's international strategy of energy development*

Given the fact that China is not able to meet its demand of energy, China has to import energy, particularly petroleum. Oil that China imports can be divided as oil of share and oil of trade. China's goal is to set up a stable and reliable international energy supply system to complement its domestic supply structure. For China, its energy security can be ensured by four approaches: first and foremost is a stable and sufficient energy supply; second is safety of energy transporting; third is a reasonable pricing regime; and last is protection of environment. To ensure a lasting energy security, China needs an international energy strategy. Given its thinking of diversification of energy supply sources, China's international strategy for energy development includes the following.

- Diversification of oil-supply sources  
In other words, China has to import both equity oil and traded oil, and China will import oil not only from the Middle East, but also from Russia, the Central Asia, Africa, and other regions.
- Diversification of energy products  
China will have to import oil, but it should also import natural gas, liquefied gas, and oil sand.
- Diversification of means of energy transport  
Within first few years since China became a net import country of oil in 1993, it focused on sea transporting because the oil was mainly imported from the Middle East. With rising importance accorded by China to oil and gas supply from Russia and Central Asia, the country has increasingly paid attention to building oil and gas pipelines. It is considering building oil and gas pipelines connecting China to various regions—for example, the proposed gas pipelines to Turkmenistan, Iran, and Myanmar, and oil pipelines connecting China–Russia–India.

- Diversification of energy cooperation  
China wants to diversify its cooperation with countries around the world. China is ready to cooperate not only with oil-producing countries, but also with oil-consuming countries. China wants to extend cooperation on oil exploration, development, processing, and transporting. It is also ready for cooperation on energy conservation, efficient use and development of new and renewable energy as well as development of nuclear and clean coal energy. China's energy cooperation with other countries of the world is profound and extensive. For example, it is cooperating with the US on developing use of gas in coal mines and with Europe on wind power, solar power, and biology-related technology of energy. Between China and Russia, the two countries are working on implementing cooperation on exploration, development, and transportation of oil and gas in east and west Siberia.

China's international strategy of energy development is to be formulated in the context where global demand of energy is growing but supply is decreasing, oil prices rising, and great power competition for oil and gas resources is intensifying. The implementation of China's international energy strategy needs two wheels. One is diversification, and the other is international cooperation. Both are indispensable for China's energy security. To promote international energy cooperation, there has to be a change in mindsets and a new energy security concept has to be built.

- Energy security is not a matter of one country, but a question shared by all the countries. Only when international energy security is ensured can one country have its own security. Therefore, while every country will have to attach importance to its own energy security, it has to take into account other's needs.
- Energy security can only be ensured through international cooperation. China shall advocate cooperation and avoid vicious competition not only between oil-exporting countries, but also between oil-consuming countries.
- The goals for international cooperation are aimed at mutual benefit and at creating a win-win situation. Therefore, one should not only

consider their own interests but also other's interests.

- To conduct a multi-faceted, all-round, all-dimensional cooperation in all the possible regions, including technology, capitalization, talents, production, transportation, and sales. Regions of cooperation should include all the possible regions in the world including the disputed areas by following the principles of 'putting aside differences for common development' so that resources in those disputed areas could be fully used. The joint survey by China, the Philippines, and Vietnam recently in the South China Sea was a good example.
- Flexible and multi-dimensional cooperation, which can take the form of bilateral cooperation or multilateral cooperation or between states or companies or between state-owned companies or private sectors. It can also take the form of buying a whole oil field or company or part of its shares. It can bid by one company or through joint bidding of two or more than two companies. Terms of cooperation can also vary from a long-term one to a specific project. Energy cooperation and dialogue should be initiated between international and regional organizations like OPEC (Organization of Petroleum Exporting Countries) and EIA (Energy Information Administration). Efforts should also be made to promote establishment of regional energy cooperation regime to jointly safeguard security of oil supply and stable pricing of oil.

Energy cooperation has now become the general trend of the world and is in conformity with the interests and aspirations of all the countries. It is heartening that China and India, the two large oil producers and consumers, have decided to forge a strategic partnership for energy cooperation and the results so far have been fruitful. Although the cooperation is at its early stage, it has maintained a good momentum. Energy cooperation between China and India conforms to the fundamental interests of the two countries, and some agreements have been reached upon for all-round cooperation. It is my strong belief that the potential of this cooperation is huge and the prospects are bright.

# Geopolitics of energy: a German and European view\*

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Against the background of increasing perceived shortages throughout the world, energy security has become a key issue when it comes to national interests and agendas. Many states have ever less confidence in market mechanisms and are increasingly opting for state intervention, both domestically and externally. Their main motive is the booming demand particularly in Asia's dynamic economies – above all India and China – and the resulting continued high prices for oil and gas. This has raised growing doubts as to whether it is possible to have energy security at affordable prices. What is more, energy is increasingly used by key states as a bargaining chip. It cannot be ruled out that this could lead to conflicts in future.

On coming to power in November 2005, the new German government called for an energy security strategy in its coalition agreement. This strategy is to be integrated into an EU (European Union) framework which is still to be discussed. The key to achieving our trio of goals, namely security of supply, efficiency, and environmental compatibility, is to significantly reduce the need for energy imports-by making greater use of renewable energies, increasing energy efficiency as well as saving energy.

However, within the scope of our foreign and security policy we have to shape the dependence of Germany and Europe on imports of fossil energies, which will nevertheless continue to grow for the time being, in such a way that our energy security is guaranteed. This can only be done through the development of cooperative international structures. We will strive to achieve this goal through a comprehensive dialogue among energy producers, consumers, transit countries, and the private sector in order to reduce the potential for conflict in the energy sphere. In keeping with our

economic policy, our goal is to ensure fair competition and efficient pricing on a long-term basis by setting reliable international parameters.

## Energy security in Germany and Europe

Imports of fossil sources of energy are expected to rise to 85% of overall energy requirements by 2030. The same applies to Europe as a whole, the US, and the major consumers in Asia, including India. As the world's largest oil reserves are in the Middle East, dependence on this politically unstable region will increase worldwide, as will competition for access to these resources. The gas situation is not so critical as the world's reserves are spread wider and will last longer at the current annual rate of production. In Norway we have a reliable major producer within Europe, which currently covers 15% of the EU's import requirements. Nevertheless, as they only have pipeline links with two other supplier countries (40% of the gas supplied to Europe comes from Russia, 25% from Algeria), countries in Eastern and Central Europe in particular are largely dependent on Russia. EU gas imports from Russia could rise to more than 60% of requirements by 2030.

The problem is not the lack of availability or depleted reserves in the medium term. The risks of the coming decades lie, above all, in geopolitical factors, in climate change, and in other ecological problems. In this connection, the IEA (International Energy Agency) has pointed out the following growing risks to energy security.

- Increasing dependence for oil supplies on a decreasing number of producer countries
- Ever-greater risk of disruptions to supply due to the growing international trade with oil and gas
- Danger of political instability in producer and transit countries

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\* Abridged version of the paper presented at the TERI-KAF conference, 29–30 September 2006.



## Energy security and changes to the geopolitical landscape

The end of the Cold War and the rise of new political and economic powers have radically changed the geopolitical and economic landscape. These changes have had an impact on energy markets and on security of supply. Two trends are emerging in global energy security. One is towards economic efficiency based on the market economy. With some exceptions, the countries following this trend include the member states of the EU, Japan, and the US. The other trend is the direct implementation of national interests. The latter group undoubtedly includes China, Russia, some states in the Middle East, and to some extent India. They are united, among other things, by their mistrust in US dominance and American demands for economic liberalization and political democratization.

For some time now, there have been clear signs that globalization of the energy markets has passed its zenith and that we will have to deal with a growing re-politicization of energy flows between exporting and importing nations. Some recent indications of this include the following.

- The re-nationalization of the Russian energy industry, which has impacted on the CIS region (most recently the Russian-Ukrainian gas dispute)
- China's neo-mercantilist energy policy and, to a lesser degree, that of India (development of privileged relations in the energy sphere with certain energy exporters)
- The Polish proposal for a European Energy Security Treaty
- The US President's State of the Union address of January (lessening dependence on Gulf oil)
- The reactions of the Spanish government to the attempt by the German company E.ON to take over ENDESA and that of the French government to the campaign led by the Italian company ENEL to take over the French company Suez

## Energy security through diversification

Diversification is key to energy security. This applies firstly to the energy mix but, above all, with a view to the supply areas and the transit countries, it requires prioritization for

- safe producer and transit countries,
  - those with manageable security, and
  - critical producer and transit countries.
- The basic conditions for energy security through diversification are favourable for Europe.
- Today Europe has a balanced energy mix from largely secure sources. However, the share of imports of oil/gas from unstable regions is set to rise considerably as North Sea reserves are almost exhausted.
  - In contrast to North America and East Asia, Europe has a favourable location for expanding its supply of gas: 80% of the world's reserves lie within a 4000-km European radius, which makes possible a pipeline-based supply. Iran and Qatar together have greater gas reserves than Russia. There are also considerable reserves in the Caspian region. The South Caspian region is not further away than Western Siberia and, what is more, it can produce gas at a lower price. However, there is no transport link at present.
  - Although the construction of the Nabucco pipeline has been discussed for some time now, a final decision has not yet been taken. It is in Europe's interests to create the infrastructure for gas imports from the Caspi and Gulf regions as additional sources of energy.
  - Another additional option lies in diversification in the direction of LNG (liquefied natural gas), possibly from Qatar from 2014 onwards.

## Cooperative energy security throughout Europe

The Russian-Ukrainian gas dispute has increased fears, particularly in Eastern Europe, that Russia will use energy as a means of exerting political pressure. The proposal circulated by Poland in early 2006 for an EEST (European Energy Security Treaty) with a mutual assistance commitment (energy NATO [North Atlantic Treaty Organization] pact) – which would include not just the EU but also NATO states – cannot, however, create energy security in Europe as it is directed against Russia, the main producer, and excludes transit countries such as Ukraine. The current situation – Europe needs Russian gas (and oil), Russia needs Europe's markets, capital, and above all energy know-how – suggests, indeed makes imperative, a cooperative approach in future.

At all events, a cooperative energy security strategy would have to include the following two elements.

- *Enhanced Energy Charter process (basis: Energy Charter Treaty of 1994)* The Energy Charter brings together the EU member states, other western European states, as well as the states of the Eurasian region. The aim of the Treaty is to establish a legal framework to promote long-term cooperation in the energy field. The most important Treaty provisions deal with investment protection, the trade in primary sources of energy and energy products, transit, and dispute settlement. Although it has not been ratified by Russia to date, the EU and its member states can use this political instrument to try and influence Russia. In the run-up to the G8 summit in St Petersburg, various EU member states and the EU Commission have – unsuccessfully – called upon Russia to ratify the Energy Charter.
- *Development and political reinforcement of the EU's energy dialogue with Russia* On the EU side, the dialogue includes member states, as well as the European energy industry and international financial institutions. Four working groups comprising 100 European and Russian experts are discussing issues relating to infrastructure, trade, investments as well as energy efficiency and are drawing up proposals for the energy dialogue.

#### **Developing the energy dialogue with producer countries**

An enhanced dialogue between consumers and producers would require an intelligent mix of bilateral, European, and multilateral instruments, as well as the close involvement of our energy industry. According to the Commission's Green Paper, there is a trend towards making greater use of the EU's market and negotiating power. At the international level, it is crucial that we strengthen the International Energy Forum, which is still a relatively informal body, for the dialogue between producers and consumers.

- The EU's dialogue on energy with Russia is especially important. The new member states in particular are pressing for the EU–Russian dialogue on energy to be used to a greater extent to push through the EU's goals.

The success of an EU energy partnership with Russia will ultimately stand and fall with the option of mutual access to markets in the energy sector (EU investments upstream in Russia, Russian investments downstream in the EU).

- Together with Norway, the EU wants to give a new focus to its diversification strategy, particularly in the gas sphere. Basically, this is about opening up new fields in the far north and in the Barents Sea and two possible pipeline feeds from there to Germany, among other countries. Trilateral cooperation in the far north including Russia is also being considered. Norway is an integral part of the EU's internal energy market due to the EEA (European Economic Area) Agreement.
- As EU energy imports from politically unstable regions of the world are expected to rise despite successful diversification, Europe will have to bolster its political strategy vis-à-vis unstable export and transit countries. It must foster good governance and rule-of-law structures in these countries, improve investment conditions for German companies, help resolve regional conflicts, and build up regional security structures (inter alia, Iraq, Iran, Central Asia, Southern Caucasus, and North and West Africa), for example through EU cooperation with the states of the GCC (Gulf Cooperation Council). Due to its impact on the entire Arab region, this also includes the Middle East conflict.

#### **Developing the dialogue on energy with non-European consumers**

A consumer–consumer dialogue on energy security between the western energy importers is currently taking place within the IEA. This group should be extended to include all large-scale consumers, for instance India. Accepting that our interests (energy security, energy efficiency, and so on) are at least partially identical, there is a broad basis for these dialogues, not only with India, but also with China and the US.

- *India* India, too, is ever more dependent on imports of fossil raw materials. While domestic oil production is falling, economic growth during the last few years has resulted in a large increase in oil imports. It is expected that India's

dependency on oil imports will rise from the current 40% to more than 90% in 2030. Energy security is now one of the key features of India's foreign policy. Since 2001, Indian companies have been investing in oil and gas projects abroad, including problem states such as Sudan and Iran. Within the framework of the EU-India Joint Action Plan of September 2005, the EU also initiated a dialogue on energy with New Delhi. The EU-India Energy Panel launched in the summer of 2005 last met in New Delhi on 6 and 7 April 2006. (An Indo-German Energy Forum was also founded on 26 April 2006 during the visit to Germany by Prime Minister Singh.) At present another session of the Energy Panel (or a separate energy conference) during the German EU Presidency in the first half of 2007 is being planned. With the conclusion of the US-Indian nuclear agreement, which is currently being debated in the US Senate and in which the conflict between NPT (non-proliferation treaty) principles and energy security has become apparent, the EU is also now forced to rethink its cooperation with India on the civilian use of nuclear energy.

- *China* The EU is cooperating successfully with China in the field of energy efficiency and environmental technology. However, there is a danger that a dispute will develop with China over its aims. In its hunger for resources, the country is pursuing a neo-mercantilist approach (among other things, it is buying up oil and gas fields) in its efforts to export the Chinese development model. This will have far-reaching consequences for our foreign and security policy. In particular, China's relations with numerous pariah states, including Sudan, Zimbabwe, and Iran, in connection with its energy policy runs counter to everything the international community is doing to promote respect for human rights and good governance, as well as the fight against corruption, and so on. The EU's aim is to conduct an intensive bilateral strategic dialogue with China to encourage Beijing to assume more responsibility on the international stage (Kreft 2006).

Furthermore, we should consider whether to gradually integrate India and China into the G8 and to strengthen cooperation with the IEA.

- *United States* Both sides would like to extend the underdeveloped EU-US dialogue on energy, as was decided at the recent American-European summit in Vienna. At that meeting, a proposal put forward last year by Commission President Barroso to begin a strategic dialogue between the EU and the US on energy security was taken up. Just like our own, US energy security policy is principally aimed at ensuring a functioning world market. The US is potentially both a partner, for example, in issues relating to China's actions in Africa and Latin America, and a rival, for example, with regard to the Norwegian reserves in the Barents Sea. A change on a global scale in the energy sector is inconceivable without the world's biggest consumer of energy (25% of oil and gas consumption) and CO<sub>2</sub> (carbon dioxide) emitter (rejection of the Kyoto Protocol). On the other hand, the US as a global power is of central importance, especially for securing sealanes, as well as for the stability of many oil-producing countries.

#### Energy infrastructure security

The existing global energy infrastructure is very vulnerable from the source to the consumer as it was created when terrorism was not yet a global threat. Nuclear power stations, refineries, and choke points in the maritime transport network are especially critical. Roughly 80% of the oil from the Gulf states passes through the Straits of Hormuz. Some 75% or 80% of Chinese and Japanese oil imports cross the Straits of Malacca. A terrorist attack on the world's largest oil refinery in Saudi Arabia was only just prevented earlier this year.

In future, the EU will be forced to address many more critical issues concerning the physical and political security of energy infrastructure (in particular of the pipelines), as well as necessary redundancies should there be a stoppage. Energy infrastructure and transport security issues are being discussed in NATO too. Close cooperation among producers, consumers, and transit countries at the international level is of key importance here.

#### Energy security and non-proliferation

In working out an energy security concept, the link to proliferation-related issues should not be underestimated. A number of emerging economies

with growing energy requirements are now considering making greater civilian use of nuclear energy (among others, Ukraine, Malaysia, Myanmar, Thailand, and Indonesia). Thus, countries in other parts of the world could arouse the same fear as Iran (where an unpredictable regime could succeed in producing the fissile material needed for nuclear weapons by mastering the fuel cycle and using it for another purpose).

In order to prevent the further dissemination of technologies that could be used for proliferation (in particular for uranium enrichment and the reprocessing of spent nuclear fuel), the head of the IAEA (International Atomic Energy Agency), El Baradei, favours multilateral approaches for these elements of the fuel cycle as they involve multilateral 'co-ownership' (if possible without technology transfer), which could also prevent critical states from acquiring sensitive technologies. This debate has gained a new level of topicality as a result of the Russian proposals on establishing regional centres for fuel services and the US Global Nuclear Energy Partnership.

#### **Energy security and development policy**

High energy prices hit developing countries particularly hard, drive them out of the market, and widen the North-South gap. For example, the soaring price of oil from \$30 to \$50 per barrel has burdened Kenya with an annual rise in foreign exchange expenditure of \$400 million, the equivalent of the country's entire development aid in 2004. Development cooperation should focus to a much greater extent than hitherto on renewable energies, energy conservation, increased energy efficiency, as well as technology transfer.

In those developing countries with abundant sources of energy, the high energy prices have led to additional revenue which fuels systematic corruption and opaque systems of patronage and, in some cases, hinders development ('resources curse'). With a view to stabilizing many key producer countries, the EU supports, among other things, the enhanced British EITI (Extractive Industries Transparency Initiative) that aims to make revenue from energy more transparent in budgets.

#### **Energy security and climate protection**

Energy security and climate protection are inextricably linked. To the extent that the consumption of fossil energies is rising worldwide, efforts to reduce in particular CO<sub>2</sub> emissions are necessary in order to avoid further increasing the already considerable burden on the environment. The question as to what will happen in 2012 after the first commitment period of the Kyoto Protocol has ended is of global importance. It will be virtually impossible to prevent the impending climatic disaster without the cooperation of the US, Russia, and the major emerging economies, especially India and China.

#### **Energy security policy is peace policy**

Energy security policy, which goes beyond energy security, similar to the extended security concept, is a stability and conflict prevention policy and thus, a peace policy. In addition to the energy security of all concerned, conflict prevention is to the fore.

- Enhanced energy efficiency, the further development of renewable energies, and the export of such innovative concepts and technologies reduce undesired dependence in foreign and security policy throughout the world and, at the same time, potential tensions (for example, relating to the use of energy as a political weapon).
- A sustainable energy and environmental policy reduces the burden on the climate and the sources of life on our planet and thus, the danger of conflicts about natural resources, such as water, wood, arable, and pasture land.
- Cooperative energy policy on a regional and global scale aimed at reconciling interests creates win-win situations, has a preventative effect against unregulated conflicts over the distribution of resources, and increases long-term security of supply for all concerned as well as their ability to make long-term calculations.

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# Geopolitical oil vulnerability of oil-importing countries<sup>1</sup>

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This paper assesses the relative geopolitical oil supply vulnerability of 26 net oil-importing countries for the year 2004 using a modified version of the geopolitical risk measure constructed by Blyth and Lefevre (2004). The countries studied have been selected from three major oil-consuming regions – Europe, North America, and Asia-Pacific – that together account for about 80% of the total world consumption. Generally, the exposure of an economy towards external supply disruptions is measured by net energy import dependence. From the security point of view, dependence on domestic fuel supply is preferred over imported fuel, as it avoids risks from geopolitical insecurities and exchange rate uncertainties. The greater the level of imports the greater the possibility and cost of disruption, if it occurs. However, import dependence cannot be considered as the only factor of importance as security of supply involves a large number of aspects, such as the concentration of suppliers and political risk in the supplying countries. The higher the geographical diversification of the supply sources, the lower is the risk associated with the loss of any particular supply source. In addition, diversification in favour of economies that are politically more stable can further shield importing countries from geo-strategic risks.

Blyth and Lefevre (2004) have proposed a geopolitical oil risk measure using a modified version of the HHI (Herfindahl–Hirschman Index).<sup>3</sup> In addition to the import dependence, concentration of supply sources, and political risk in supplying countries, they have included one additional

component in the measure – market liquidity or the size of demand relative to the size of the market – which determines the ability of a given consuming country to shift between various suppliers. We have used their measures to arrive at the relative vulnerability of the 26 oil-importing nations.

First, for each consuming country, market shares for each of the countries from which it imports its oil are calculated as a proportion of its total oil demand. If a consuming country also produces oil domestically, then it is considered as one of the supplier with its share of the market determined by its production.<sup>4</sup>

Second, for each consuming country, the degree of supply concentration is measured using a modified version of HHI, which is defined as the sum of squares of the adjusted market shares of different oil-exporting countries. The market shares are adjusted by a political risk factor that is derived by using country risk ratings published by ICRG (International Country Risk Guide). It is important to note that at the time of summing up of the adjusted market shares, the value of domestic production is given a value zero as domestic production is assumed to not contribute towards geopolitical risks.

Third, the above measure of oil supply concentration is multiplied by an adjusting factor relating to the market liquidity of a given consuming country. Unlike Blyth and Lefevre (2004), who have measured market liquidity as the ratio of world oil supply to the oil demand of a consuming country, we have measured market liquidity as the ratio of world

<sup>1</sup> This paper is based on an ongoing study on 'Assessing the relative geopolitical risk of oil importing countries' developed as a part of the research under the project titled 'Building an energy secure future for India through a multi-stakeholder dialogue process', supported by the Nand and Jeet Khemka Foundation.

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<sup>3</sup> The index places additional weight on the contribution of players with higher shares and thus, decreases with increasing number of suppliers and/or a more equal distribution of their relative shares.

<sup>4</sup> Here, our approach differs from Blyth and Lefevre (2004). In their measure they have considered all the countries that can physically supply a given consuming country, while (like Neff 1997) we have considered only those countries that are net exporters to a given consuming country in the year 2004.

oil imports to the net oil imports of a given country (as the amount which an exporting countries consumes domestically is not available for trade).

Finally, the above oil market concentration risk measure for a given oil importing country is multiplied by its oil share to obtain the contribution of oil in the overall geopolitical energy risk of an economy. The higher the share of oil in TPES (total primary energy supply), the greater is the direct exposure of an economy towards the above measured oil market concentration risk.

In our approach, we have assumed that OPEC (Organization of Petroleum Exporting Countries) member countries<sup>5</sup> act as a single supplier. The crucial design of supply diversification entails independence of the sources. The current structure of the oil market where production quotas for all member countries are currently defined by OPEC, oil prices are very sensitive to changes in OPEC production policies.

## Results

The final values of GORM (geopolitical oil risk measure) of the selected oil-importing countries (that combines five risk indicators) with corresponding ranks across the selected countries are given in Table 1. The higher the GORM, the higher is the vulnerability of a given economy to geopolitical uncertainties (which is denoted by the higher ranking).

The average geopolitical oil risk for the selected 26 countries is estimated to be about 0.26. If we cluster countries above and below all-country average then it is seen that the Japan, Switzerland, Greece, the Philippines, and Korea are the five most vulnerable countries with the GORM significantly larger than the all-country average. By contrast, China, Australia, Sweden, New Zealand, the US, India, and Germany are the six most oil-secure countries with their GORM much below the all-country average (Table 1 and Figure 1).

The average GORM of all the selected European countries at 0.26 is equal to the all-country average risk. The average GORM for the five European countries, namely, Switzerland, Greece, Ireland, Portugal, and Finland at 0.42 is more than double the average risk of the rest of the European countries (0.20 for other 13 countries).

The average GORM of all the seven Asian economies at 0.28 is found to be slightly above the European and the all – country average. However, for the three Asian economies – Japan, the Philippines, and Korea – the average risk of 0.57 is significantly higher than the all-country and the Asian average. The relatively lower overall Asian average risk (all seven countries) is explained by very low risk measures of China and Australia. New Zealand and India, on the other hand, are found to have moderate risk.

## Discussions

On the whole, we see that there are enormous differences in individual performances among the countries (both within the regions and between regions) in terms of their final geopolitical risk (Table 1 and Figure 1).

As explained earlier, the five factors – net oil import dependence, concentration of oil supply sources, political risk in the oil supplying countries, the size of oil demand relative to the total world oil supply, and share of oil in the TPES – govern the differences in the GORM among various consuming countries. As the GORM implies, the more vulnerable countries consistently represent higher values for most of the individual indicators.

Within Asia-Pacific, Japan, Korea, and the Philippines are found to be vulnerable for almost all indicators; their energy mix is highly biased in favour of oil; their high import dependence is very poorly diversified with a very high dependence on politically unstable OPEC member countries (mainly on OPEC-Middle East); and their market liquidity is also comparatively low (except in the case of the Philippines). India, on the other hand, has relatively lower oil share in its energy mix (which significantly improves its relative position in the final measure), but except that, it is vulnerable as assessed by all indicators. New Zealand is extremely vulnerable in terms of two indicators: high oil import dependence and the share of oil in TPES. Notable exceptions to this Asian trend include China and Australia. Australia (with somewhat higher oil share) and China (having relatively lower market liquidity) are found to do well with respect to most of the indicators.

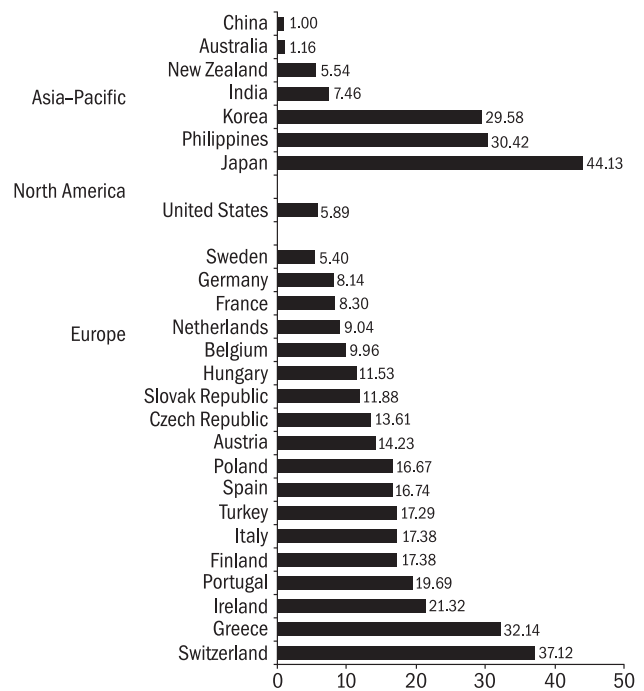
<sup>5</sup>For the current paper, we have assumed that OPEC (Organization of Petroleum Exporting Countries) includes 11 countries: Saudi Arabia, Iran, Iraq, Kuwait, Venezuela, UAE, Algeria, Nigeria, Qatar, Libya, and Indonesia. Angola, which has joined OPEC in 2007, has been excluded.

**Table 1** Geopolitical oil risk measure (2004)

Countries	Final geopolitical oil risk measure	Final geopolitical oil risk measure rank
<b>Asia-Pacific</b>		
Australia	0.019	25
New Zealand	0.091	23
Japan	0.724	1
Korea	0.486	5
India	0.122	21
China	0.016	26
Philippines	0.499	4
Average A (All 7c)	0.280	
Average A (3 c) (Japan; Korea; Philippines)	0.570	
<b>North America</b>		
United States	0.097	22
<b>Europe</b>		
Austria	0.234	13
Belgium	0.163	17
Czech Republic	0.223	14
Finland	0.2854	8
France	0.1362	19
Italy	0.2853	9
Spain	0.275	11
Hungary	0.189	16
Ireland	0.350	6
Netherlands	0.148	18
Poland	0.274	12
Turkey	0.284	10
Slovak Republic	0.195	15
Sweden	0.089	24
Switzerland	0.609	2
Portugal	0.323	7
Greece	0.528	3
Germany	0.134	20
Average-E (18c)	0.262	
Average-E (5c)	0.419	
Average-total (26 c)	0.261	

Notes c denotes countries; E denotes Europe; A denotes Asia-Pacific

Likewise, within Europe there are enormous differences between countries. The five European countries, namely, Switzerland, Greece, Ireland, Portugal, and Finland (with risk measures significantly above the European average) display almost similar trends with respect to the individual indicators. Most of the European economies have very high oil import dependence and comparatively lower market liquidity. But, the import dependence of these five economies is very poorly diversified in terms of supply sources, which results in relatively much higher overall risk as compared to other European countries (especially Sweden, France, Germany, Italy, Belgium, and the Netherlands) which have well-diversified sources. At the same time, these five economies are among the most vulnerable countries with respect to the share of oil in TPES.



**Figure 1** Final geopolitical risks relative to China (2004)

The US is observed to be vulnerable mostly with respect to market liquidity and (to a lesser extent also) its import dependence. The 64% import dependence of the US is well diversified both by countries and regions (with relatively lower dependence on OPEC), which significantly reduces its risk compared to other countries.

Further, it is observed that despite differences in individual indicators some countries have almost identical geopolitical risk measures. The examples of India and the three European countries, namely, France, the Netherlands, and Germany are quite interesting. All the four countries have nearly equal overall geopolitical risk but unlike India the other three countries are almost entirely dependent on imports for meeting their oil requirements. However, their well-diversified imports and much lower market liquidity (except Germany) result in nearly the same overall risk. In fact, on the similar basis, Sweden and the US have much lower levels of risk as compared to India and other Asian countries such as Japan, Korea, and the Philippines (Table 1 and Figure 1).

On the whole, we observe that the supply sources of the Asian countries are poorly diversified with very high dependence on OPEC-Middle East. On the other hand, the European countries and the US due to their geographical advantage are able to import more competitively (as compared to most Asian oil

importing countries) from countries other than OPEC members such as Canada, UK, Norway, and FSU.

## Conclusion

By evaluating the basis of the variation in the overall geopolitical oil vulnerability measure of the various economies, policy-makers can identify and thus, address the problems that can protect nations from the threat of sudden oil supply interruptions. Policies such as increasing domestic production, restraining oil demand can significantly reduce the vulnerability of the economies by reducing oil import demand but impose high economic costs in the short run. Thus, in the short-to medium-term, it may be pragmatic for the consuming countries (particularly for the Asian economies) to reduce their dependence on politically difficult OPEC countries and to diversify their sources of supply in favour of relatively more secure regions such as FSU and the Caspian Sea or work at seeking improvements in geopolitical relationships through consumer–consumer or consumer–producer dialogues and investments in upstream sector in oil-producing countries. In the longer term, world oil production will be increasingly concentrated in OPEC countries, especially in the Middle East, where most oil reserves are concentrated. Thus, in the long run the best policy measures should induce reduction in overall oil dependence through measures such as increasing oil efficiency and making oil demand more responsive to prices.

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# The Indian hydrocarbon scenario in the Kirit Parikh Report: a comment

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The *Hydrocarbon Vision 2025*, published by the Government of India in February 2000 (Planning Commission 2000), set out in stark terms, India's energy security predicament: its crude oil self-sufficiency declined from 63% in 1989/90 to 30% in 2000/01. In 2024/25, crude oil self-sufficiency was expected to be a mere 15%. The situation relating to gas was equally grim. From 49 BCM (billion cubic metres) in 2006/07, India's demand for gas is expected to rise to 125 BCM in 2024/25. As against this, production from existing fields and discoveries was 52 BCM, leaving a gap of 75 BCM to be filled through new domestic discoveries and from imports. The electric power sector was projected to account for 71% of the total incremental growth in India's natural gas demand from 2000 to 2025. India's installed power capacity at present is based on coal (59%), hydropower (26%), gas (10%), and nuclear (2%). In the period up to 2025, the share of gas in the energy mix would be 20%.

The IEP (Integrated Energy Policy) document prepared by the Planning Commission, in August 2006, under the Chairmanship of Mr Kirit Parikh, takes a holistic view of India's energy requirements up to 2031/32. The report postulates that, in order to reach growth rates of 8% per annum up to 2031/32, the country needs to do the following.

- Increase primary energy supply by three to four times
- Expand electricity generation capacity by five to six times from the 2003/04 levels, that is, power generation capacity must increase from the current 160 000 MW (megawatt) to nearly 800 000 MW by 2031/32 (Planning Commission 2006, p. 13).

Taking into account power and other commercial requirements, the report suggests that India's primary commercial energy requirement (in million tonnes) would be as given in Table 1 (Planning Commission 2006, p. 28).

Table 2 gives the gas requirement in the average fuel mix adopted as a standard by the Committee for

**Table 1** India's primary commercial energy requirement (million tonnes)

Year	Coal	Oil	Gas	Nuclear
2011/12	257	166	44	17
2021/22	464	278	97	45
2031/32	835	486	197	98

Source Planning Commission (2006, p. 28)

**Table 2** Gas requirement in the average fuel mix (billion cubic metres)

Year	8% GDP growth rate	9% GDP growth rate
2006/07	12	14
2021/22	52	59
2031/32	119	134

Source Planning Commission (2006, p.22)

growth rates of 8% and 9% (Planning Commission 2006, p. 22).

The place of gas in the energy mix between 2003/04 and 2031/32 is projected as follows (Table 3).

To reach its growth targets, India would need to pursue all available fuel options and energy sources, conventional and non-conventional. However, the factual position with respect to specific energy resources has to be noted. Today, India's energy mix is: coal 51%; oil and gas 45%; hydropower 2%, and nuclear 1.5%. In 2022, fossil fuels will continue to dominate India's energy mix to the extent of 75%, with hydropower providing 14%,

**Table 3** Place of gas in the energy mix (between 2003/04 and 2031/32)

Energy source	2003/04 (%)	2031/32 (%)
Coal	51	50.5
Oil	36	30
Gas	9	12
Nuclear	1.5	6
Hydro	2.14	2.12

Source Planning Commission (2006, p.29)

and nuclear power 6.5%. Even robust votaries of nuclear power have noted that, most optimistically, nuclear energy will provide only 8.8% in India's energy mix in 2032, as against 76% for fossil fuels, and 12% for hydropower. In 2052, when nuclear energy is likely to be 16.4% of our energy mix, coal is expected to be 40%; hydrocarbons 35%; and hydropower 5.1% (Srinivasan, Grover, and Bhardwaj 2005).

The Kirit Parikh report has looked at different international price scenarios pertaining to coal and gas. Its conclusion is unambiguous.

Any supply strategy over the coming decades will have to emphasize India's major resource, that is, coal. Coal is the most abundant domestically available primary energy resource other than thorium and solar insolation. In the 'coal-based development' scenario, the total demand for coal increases from 172 MTOE (million tonnes of oil equivalent) in 2004/05 to 1022 MTOE in 2031/32. Measured in MT of Indian coal with 4000 kcal/kg (kilocalories per kilogram), the requirement of coal will thus increase from 406 MT in 2004/05 to 2555 MT in 2031/32 (Planning Commission 2006, p. 46).

The report has looked at 11 different energy supply scenarios to obtain an 8% GDP (gross domestic product) growth rate per annual up to 2032. These different scenarios are based on varying assumptions relating to: maximum coal-based development; maximum civilian nuclear energy; maximum hydropower generation; utilizing natural gas to provide 16% of electricity generated; obtaining higher efficiencies in coal-based power plants; up-gradation of infrastructure; and obtaining 50% improvement in fuel efficiency (Planning Commission 2006, p. 41).

Based on various scenarios provided in the report, the total commercial energy required in India in 2031/32 varies from a low of 1351 MTOE (million tonnes of oil equivalent) to 1702 MTOE (Planning Commission 2006, p. 45). The report also notes that coal would be the principal source of energy for India, accounting for 41%–54% under the various energy mix scenarios set out in the report. It goes on to state the following.

Even at the 41% level, India will need 1.6 billion tonnes (about four times the current production). At the higher share, requirement could rise to 2.5 billion tonnes (over six times the current production) of coal requirement from

domestic sources. The additional coal requirement from domestic sources will be even higher if the past trend of falling domestic coal quality is not arrested (Planning Commission 2006, p. 71).

The report has played down the role of gas in the energy-mix projections under the different scenarios. Generally, the share of gas is placed at below 11%; if gas is used to the maximum extent to generate power, even then it will only provide 16% of the power generated (Planning Commission 2006, p. 48).

It appears that while the India Hydrocarbon Vision 2025 document had given considerable importance to the role of gas in the energy mix to realize the projected national growth rates, the Kirit Parikh report has instead stressed the importance of coal. However, the report has hedged its conclusions with a number of assumptions and caveats, which raise doubts about the place assigned to coal in the national energy mix. In this context, the report

- states that domestically produced coal has high ash content and low calorific value: the coal utilized in the country has 4000 kcal/kg as against 6000 kcal/kg available in imported coal. In fact, the coal used in the Indian power plants has a calorific of value 3500 kcal/kg (Planning Commission 2006, p. 11).
- points out that the quality of domestic coal is itself deteriorating and that a 5% deterioration in Indian coal quality would significantly increase the demand for coal in 2032 (Planning Commission 2006, p. 46).
- notes that objectives of the nationalization of the domestic coal industry have not been realized completely. There is acute shortage in respect of both coking and non-coking coal; with the increasing share of open-cast mines in providing coal, the quality of coal available from domestic sources is increasingly of poorer quality (Planning Commission 2006, p. 12).
- further states that large estimates of total coal reserves 'give a false sense of security because current and foreseeable technologies will convert only a small fraction of the total reserves into a mineable category' (Planning Commission 2006, p. 12).
- calls for massive inputs of technology in the areas of clean coal and in-situ coal gasification but notes that this is in its infancy at present (Planning Commission 2006, p. 12).

- notes that the development of new coal mines has a gestation period of about eight years (Planning Commission 2006, p. 47). While decrying the poor performance of the public sector units in the coal industry, the principal recommendation made in the report is to substantively expand private mining (Planning Commission 2006, p. 47). The report does not explain how this would reduce the period of development of new mines; nor is there any suggestion in the report that private companies should bring in new technologies that are somehow beyond the reach of public sector companies.
- projects additional requirements of coal at between 1.6 and 2.5 billion tonnes, a large proportion of which would have to be imported (Planning Commission 2006, p. 47).

The Kirit Parikh Report also looks at energy scenarios in 2032 that include full utilization of India's hydropower potential, a 40-fold increase in the use of renewables, and 20-fold increase in nuclear power capacity. In respect of nuclear power, the report recognizes that this extraordinary expansion would still contribute only 4%–6% to the national energy mix. It does not look at the 'economics' of utilizing nuclear power, including the cost of new technologies for power generation, safety of the facilities, and safe waste disposal. The conclusion is unavoidable that projections of these energy sources are unrealistic.

Taking the above factors into account, while India's energy security would remain anchored in coal, domestic coal would not be sufficient to meet its requirements and India would have to depend on imported coal. The comparative economics of importing coal and obtaining gas through transnational pipelines and as LNG (liquefied

natural gas) has not been examined in the report. However, taking into account the fact that imported coal prices would move in tandem with those of imported gas, the conclusion is unavoidable that imported gas, particularly by transnational pipeline, will have a much larger share in the country's energy mix than has been projected in the report.

Given the abundance of natural gas reserves in India's neighbourhood as also the domestic potential that is being explored and developed today, India could utilize far more gas for its power requirements than the Parikh report suggests. The fact that import of natural gas is price-sensitive is self-evident and is, indeed, applicable to all commercial transactions. However, if India is to meet the targeted growth rates, we have to keep an open mind with regard to the utilization of different energy sources, and accept that different aspects of the national energy economy such as coal, gas, and nuclear power, are a part of a globalized economy and cannot be immune from price trends in the international markets.

*(The views expressed in the article are of the author.)*

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CeRES (Centre for Research on Energy Security) was set up on 31 May 2005. The objective of the Centre is to conduct research and provide analysis, information, and direction on issues related to energy security in India. It aims to track global energy demands, supply, prices, and technological research/breakthroughs - both in the present and for the future - and analyse their implications for global as well as India's energy security, and in relation to the energy needs of the poor. Its mission is also to engage in international, regional, and national dialogues on energy security issues, form strategic partnerships with various countries, and take initiatives that would be in India's and the region's long-term energy interest. Energy Security Insights is a quarterly bulletin of CeRES that seeks to establish a multi-stakeholder dialogue on these issues.

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