Asian Oil Demand: A Long-Term Analysis

*By Fatih Birol**

The economic performance of many Asian economies during the past three decades has been impressive.[1] China, East Asia and South Asia - the dynamic Asian regions (DARs) - have a remarkable record of high economic growth; stronger, indeed, than any other region of the world during the last decade with an average annual 8 percent rate, compared with 2 percent elsewhere. The three major developing countries with the largest populations - China, India and Indonesia - are in the process of implementing structural reforms aimed at linking them more closely to the global economy. To a greater or lesser extent most of the East Asian countries have taken steps to liberalize their economies, including measures to open foreign trade and investment regimes, reduce subsidies and fiscal deficits, privatize state enterprises and control inflation. While some countries commenced such a process more than a decade ago, others have undertaken policy reforms only recently. The result in many of the economies in the region has been increased competition and efficiency.

The importance of the DARs in the global economy is also growing rapidly: 25 percent of world GDP in 1996, approximately twice as high as in 1973. The Chinese economy, measured in terms of purchasing power parities, is already the second-largest in the world. And since the 1970s, the DARs' share in world population has been more than 50 percent, with around 3 billion people, China alone accounting for 1.2 billion.

Accompanying the substantial growth in economic activity has been a rapid increase in energy consumption, which, coupled with rich coal, oil and gas reserves with which some of these countries - not least China, India, Indonesia and Malaysia - are endowed, make them one of the most important regions in international markets. The DARs currently account for about 18 percent of total primary energy demand, implying a substantial gain of almost 10 percentage points in the last two decades (Table 1), mainly because of their rapid economic development. Total primary energy demand in China increased threefold in the last two decades, and that of East Asia fourfold. The DARs have the lion's share of world demand for solid fuels, not least because China and India consume high amounts of coal. It increased to more than 30 percent in 1993, up from 18 percent in 1973. The DARs as a total have also experienced very high growth in oil and gas consumption, the demand for each growing three and nine times respectively between 1973 and 1993. Total electricity generation has increased more than five times in the same period. The DARs now account for more than a fifth of world carbon emissions, compared with a tenth in the 1970s.

Since their strong economic growth can be expected to continue, the long-term implications for trends in energy consumption are likely to be substantial, as is the impact on a series of related issues, such as environmental problems, investments in energy infrastructure, security of supply and trade. Developments in these energy markets, moreover, are expected to have a growing impact on international energy.

Table 1
Shares of the Dynamic Asian Regions in the World
Percent

	1973	1993	2010
GDP in PPP terms	13.2	23.0	35.9
Population	51.9	53.4	53.1
Primary Energy Demand	8.4	17.8	26.2
Solids	17.5	34.3	46.8
Oil	5.9	15.1	23.2
Gas	1.1	5.4	11.5
Nuclear	1.3	4.6	10.8
Hydro/Others	0.9	2.6	6.7
Electricity Output	5.7	14.6	23.3
CO_2 Emissions	10.0	21.9	31.0
Net Oil Import Dependence	NA	36.8	64.9

Outlook

As with any projection, a number of assumptions have to be made, in this instance combining those on baseline GDP and population growth with rising world energy/oil prices and historical trends in energy efficiency.[2] One of the major results of projections made by the IEA in the *World Energy Outlook*-1996 Edition is the strong increase of energy demand in the DARs, with energy demand up by 5 percent a year to 2010 - a substantial market gain in total world demand, and 45 percent of the increase between now and then. The share of DARs could thus exceed a quarter of world energy demand by 2010.[3] In absolute terms total primary energy demand in China is expected to double over the projection period, and the increases in East and South Asia to increase by more than that. This area's current level of primary demand of over 1400 Mtoe is expected to exceed 3000 Mtoe in 2010.

The projections presented in this paper refer only to the commercial energy sector and exclude the consumption of traditional fuels or biomass, such as fuel wood, animal and vegetal wastes, and bagasse. Indeed, one of the striking features of the energy markets of the DARs is the continuing extensive consumption of traditional fuels. Although estimates vary widely, it is known that biomass continues to meet a substantial proportion of the region's energy demand, particularly in the household sector - especially in rural areas, where a large part of energy demand is met by traditional fuels, although it is true also of a large number of the urban poor.

In spite of the strong increase in primary energy demand, one of the notable - and enduring - aspects of the DARs' energy profile in aggregate terms is the very low energy consumption per capita. The expected average energy consumption per person in 2010 in China and East and South Asia will be 1.1, 1.2 and 0.4 tonnes of oil equivalent (toe) respectively - substantially lower than that of OECD countries in the 1970s (about 4 toe per person) or the current OECD figure of 4.6 toe (even allowing for traditional fuels).

Coal and oil will continue to dominate markets for

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[1] See footnotes at end of text.

primary fuels, with more than 80 percent of primary energy demand in 2010. On a global scale, it is projected that the current share of the DARs in world demand for solid fuels will increase from a third to about a half by 2010. China plays a special role in both DAR and world demand for solid fuel, particularly since the current quarter-share of China in world coal consumption is expected to reach nearly a third by 2010. Similarly, India, also a major producer of coal (third after the United States and China), is projected to contribute to some 17 percent of the region's solid demand in 2010. Most coal use in the region is expected to be in industry, in particular for iron and steel production, as well as in power generation - with severe environmental implications, both regionally and globally.

Another important outcome of the projections is the long-term oil outlook of the region. The oil demand of the DARs is expected to increase substantially up to 2010, with an average annual growth rate around 5 percent. In absolute terms, DARs total oil demand in 2010 is projected to be close to 22 mbd. The DARs will then account for 42 percent of the increase in world demand for oil between now and 2010. Since their oil production is expected to be sluggish, their dependency on imported supplies is likely to increase substantially. The DARs currently import around 40 percent of their oil consumption, a figure expected to grow to 65 percent in 2010. While non-OPEC supply is projected to absorb a significant proportion of the increase in world oil demand in the medium term, in the longer term, the largest potential remains in six OPEC countries: Saudi Arabia, Kuwait, Iran, Iraq, United Arab Emirates and Venezuela. These countries are endowed with resource bases that can be exploited at relatively low cost.[4] This long term picture of world oil supply suggests that the current reliance of DARs on oil supplies from the Middle East will increase significantly. It is also important to note that as a result of sectoral developments discussed below, the petroleum product mix in the DARs is expected to register a continuous trend towards a lighter product mix.

East Asia currently consumes the most oil of all developing regions, with demand expected to rise rapidly by around 4 percent as an annual average, resulting in a demand of over 10 million barrels per day (mbd) in 2010, by when the current regional dependency on oil imports of 50 percent is expected to rise to over 75 percent. South Korea is the largest oil consumer in East Asia, but since it has no reserves of its own it depends entirely on imported oil. Korea is one of the major oil importers in the world, with an import volume of crude of around to 1.6 mbd in 1994 and a dependency that year on imports from the Middle East of 77 percent. Korea's dependence on Middle Eastern oil is likewise expected to increase substantially.

Indonesia and Malaysia are the two largest oil-exporting countries in the region. Indonesia is a mature oil-producing country, with only a limited potential of increasing its current capacity of around 1.5 mbd. Crude oil production in Indonesia will gradually decrease, and its impact on the oil market will decline. This is despite the concerted effort to substitute gas and coal for current oil use in Indonesia's energy sector. Malaysia, which produced 0.8 mbd in 1995, is facing fast-growing domestic demand, threatening its status as an exporter.

Oil demand will increase more strongly in South Asia than among all other developing regions, more than 6 percent a year on average up to 2010. The current dependency of South Asia on imports - 61 percent of total demand - is therefore projected to increase to almost 90 percent. India, as an important oil producer and the largest consumer in the region, is expected to become increasingly dependent on imports, its current 55 percent dependency projected to grow considerably, imposing a serious foreign exchange burden on the economy. Currently, imported oil accounts for about one-third of India's total import bill and that makes the economy vulnerable to world oil price changes. For example, the unexpected increase in world crude oil prices in 1996 cost India more than an additional 2 billion dollars.

Oil demand in China is also expected to grow strongly, at 5 percent per annum, reaching a level of around 7 mbd by 2010. Prospects for China's production are highly uncertain, resting as they do on assumptions about the potential and the pace of development for the Tarim and other basins in the northwest part of the country. While holding great potential, China's oil output is assumed to increase modestly over the outlook period. This, combined with the projections for oil demand, suggests that the country may have to import close to 3 mbd of oil in 2010. The shift in the sources of Chinese crude imports is therefore important. Before 1992 China's imports primarily came from Asia, but since 1993 the volume of crude imports from the Middle East has exceeded that from Asia. China thus becomes a more important player in the world oil trade.

The main factors behind the strong growth in oil demand are, clearly, strong economic growth, urbanization and the growing desire for mobility. In contrast with the OECD countries, oil will continue to be an important fuel in all end-use sectors, mainly in the household and transportation sectors.

High growth in oil demand in the household sector is mainly driven by rising income levels. It is empirically evident that there is a strong relationship between household sector energy/oil demand per capita and GDP per capita. However, it is also interesting to note that at higher income levels - around $1000 per annum - a trend towards saturation is observed.[5] There are also demographic determinants of oil demand in the household sector of the DARs, such as population growth, household formation and the degree and rate of urbanization. The continuing transition from traditional noncommercial fuels (wood, animal and vegetal waste, and so on) to modern commercial fuels (oil, electricity) also helps to explain the high demand growth in the household sector. Noncommercial energy in these regions is mostly used in the household sector for cooking and heating. In this context, a typical shift from noncommercial traditional energy to petroleum products is the case of switching from using fuelwood to LPG for cooking purposes. This is, of course, not a straightforward trend and there exists other substitution processes, such as the substitution of electricity for kerosene in uses such as lighting.

As with the household sector, the impetus to high oil demand growth in the transportation sector of DARs will come from increasing economic activity, rising per capita income levels and the continuing process of urbanization. The expansion in the vehicle fleet is expected to remain strong.

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Passenger vehicle ownership rates in the countries of DARs are substantially below those of industrialized countries. Even allowing for possible impediments to expansion such as congestion or government regulation, there remains much room for growth in vehicle numbers. Urbanization in DARs will require more transport for people (commuting to work), food and manufactured goods (distribution to new and more distant destinations) as well as increased investment in infrastructure.

In general, oil demand in the power generation sectors of DARs is expected to grow at lower rates than that of electricity demand. This is in line with the trend of (at least) the last decade. Coal and gas fired capacity is expected to increase significantly. In DARs, similar to other developing regions, the choice of fuel for power generation is usually determined by the fuel that is locally available.

There are other reasons that explain the rapid growth of oil demand in DARs. The lack of gas infrastructure in most of the countries limits interfuel substitution, namely substitution of gas for oil and other fuels. Moreover, existing energy pricing polices for domestic petroleum products can also play a significant role in encouraging high oil demand growth. The retail prices of many petroleum product types are relatively low when compared with that of international markets (Table 2). Domestic energy pricing in most of the countries in the region has been influenced by sociopolitical motives, such as equity for low income groups. In this context, large subsidies were introduced in the past and, in a number of countries, remain today in one form or another. This is especially true for the pricing of domestic petroleum products, albeit in varying degrees for different fuel types. In general, the retail price of kerosene (to protect the poor segments of population) and fuel oil (to promote the industrialization process) are kept lower than their economic costs, while gasoline prices are usually set (relatively) higher. Broadly viewed, the prices of petroleum products in a number of countries in the region are mostly below their economic costs. This leads to "wasteful" consumption. However, it is also to be noted that many of the countries of DAR are in the process of revising their existing pricing policies and reducing regulations on their energy sectors.

Table 2
Selected Petroleum Product Prices 1995/96
Prices in USc/l

	Gasoline	Diesel
India	59.0	22.3
Indonesia	32.4	17.6
Malaysia	44.1	25.1
Thailand	34.1	26.4
Korea	77.0	27.4
Phillippines	37.6	27.3
Spot Prices (Singapore)	14.8	17.1
Japan	114.8	71.6
OECD Total	107	5.9

Sources: *Key Indicators of Developing Asian and Pacific Countries*, Asian Development Bank (1996), *Energy Prices and Taxes*, IEA/OECD (1997).

Environmental Implications

A major aspect of the high growth in energy and oil demand is its impact on the environment. The long-term trends in CO_2 emissions of the DARs are of central importance not only for the region itself but also for the world as a whole. By 2010 the total CO_2 emissions from the developing regions of the world are likely to overtake those from the OECD area. The DARs are major contributors to world carbon emissions, and their share is likely to increase substantially over the next 15 years to around 50 percent of the annual increase in world emissions of CO_2.

Among all developing countries, China will remain the largest single source of CO_2 emissions and is projected to more than double its emissions (by around 2.7 billion tonnes) by 2010. China's projected increase in emissions is, therefore, only slightly lower than the projected increase for the whole of the OECD.

The rapid increase in emissions from the DARs is a result not only of high growth in energy demand but also of the structure of the fuel mix. As discussed above, the energy markets of DARs rely heavily on coal, the most carbon-intensive of all the fossil fuels. The poor quality of coal and standards of low energy-efficiency exacerbate already high carbon emissions.

Uncertainties

Projecting long term global energy and oil involves considerable uncertainties. These include policy changes, the geological potential of unexplored regions, technological developments, the use of noncommercial energy in developing countries and the future preferences of energy users. The links between energy supply and demand, energy prices and economic activity are also imperfectly understood.

Furthermore, several assumptions must be made in order to derive the projections presented in this paper. These include two key assumptions, namely, the development of economic activity and energy/oil prices. In this context, the question of "*the sustainability of high economic growth rates of DARs for the future*" is an important one. Assumptions based on the extrapolation of past economic growth trends into the future could provide misleading results. For example, in the context of East Asian economies, due to high income elasticities, a one percentage point difference in GDP assumptions (in 2010) would result in an under- or over-estimation of oil demand of about 2 mbd. Therefore, the figures presented in this paper should be seen as a likely outcome only if the assumptions upon which the projections are based actually come to pass and assuming economic agents continue to behave as they have in the past.

Noncommercial fuels play a significant role in the energy markets of DARs, although these are not included in the figures presented in this paper. The use of these traditional fuels in developing countries as a total is estimated to account for about one third of total energy consumption today, or some 11 to 14 percent of world total energy consumption. The omission of noncommercial energy use in developing countries is an important component of the uncertainties involved in the projections provided by this paper. In fact, the dynamics of interfuel substitution between commercial and noncommercial energy in developing countries is an important factor which shapes the evolution of the level and the

structure of energy demand in developing energy markets. Without taking noncommercial energy use into consideration, estimating the income and price elasticities of energy demand for developing countries is likely not to reflect the real responses of consumers.

The issue of technological development is another factor underlining the uncertainty of the energy and oil demand projections. Growing importance of developing countries for world energy and environmental trends underlines the significance of the technology related uncertainties surrounding these regions. One of the key uncertainties is whether future development in these regions will follow a path similar to that which OECD regions have followed. There is some evidence to suggest that the development of developing countries may not necessarily follow the same pattern as the OECD. The significant effects of having access to a supply of external capital, technological leapfrogging and a more globalized economy (relocation of heavy industries) could mean that development in developing countries could proceed in a different manner. This would result in a different pattern of energy demand in developing regions, such as DARs.

Conclusion

The outlook for oil in the DARs to 2010 highlights their growing importance in world energy and oil markets. Oil demand in the region is expected to grow at 5 percent per annum on average. Transportation and household sectors will be the engine of growth in oil demand. In aggregate terms, crude oil production in DARs is projected to remain sluggish. As a result, the dependency of the region on imported oil is expected to rise significantly. Some countries in DARs will become major net oil importers. Moreover, as a result of projected trends in world oil supply, it is expected that the DARs' reliance on Middle East oil will grow significantly. This could expose the DARs to volatility and instability of world oil prices.

Current levels of petroleum products prices in many countries of DARs are significantly lower compared with those on international markets. Furthermore, the price ratios among different petroleum products are not determined on economic grounds. The removal of price distortions for some petroleum products, in levelling of the playing field, would significantly affect energy market developments in many countries. The lifting of energy price regulations and allowing market forces to set the prices of petroleum products, could dampen the rapid increase in DAR oil demand and hence reduce oil intensity.

The projected high growth trends in oil and electricity demand will put pressure on the supply side of energy markets of DARs. The need for additional capacity in the refinery industry and electricity sector is an important implication of the long term outlook of this region. Since many countries in the DARs may find it difficult to generate sufficient funds from domestic savings to carry out the investments necessary to expand power generation systems, they will have to attract foreign funds. This in turn may require restructuring and deregulation of the power generation sector in many of the countries in DARs.

Footnotes

[1] This paper is mainly based on the *World Energy Outlook*,

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The Jane Carter Prize

The British Institute of Energy Economics, the International Association of Energy Economics and the Association for the Conservation of Energy invite the submission of essays for the 1996-97 award of the *Jane Carter Essay Prize*. This is offered annually in memory of Jane Carter, former Chairman and Vice President of the BIEE, President of the IAEE and Head of the Energy Conservation Division of the U.K. Department of Energy. The prize for 1996-97 will be a cash award of US$800 together with a plaque.

Essays can be on any aspect of energy efficiency and conservation. The aim, however, is to encourage new thinking on energy conservation policy. The emphasis of the essay should, therefore, be on the policy rather than the scientific or technical aspect of the subject.

The competition is open to anyone under the age of thirty-five. Essays should not be more than 8,000 words long. The winning essay will be considered for publication in a range of energy journals and a summary will be published in the *IAEE Newsletter*.

Essays should be submitted in English, in triplicate and in typed form, by 30 September, 1997 to:

Mary Scanlan, Administration Secretary
British Institute of Energy Economics
37 Woodville Gardens
Ealing, London W5 2LL
United Kingdom

Essays should include a 150 word summary. The name, address and age of the author should be on a separate sheet which can be detached from the essay which will be judged anonymously. Manuscripts will not be returned.

Conference Proceedings
18th IAEE International Conference
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