Excess Refining Capacities in Europe: Impact on the United States and Asia

*By Jean-Pierre Favennec**

Oil Products Demand in the World

Demand by Region

Global demand for petroleum products is increasing at some 1 to 2 percent per annum. Excluding the former Soviet Union, where consumption collapsed from 8 million bbls/day in 1987 to less than 4 in 1996, growth is of the order of 3 to 4 percent per annum.

Asia is the area where growth is the highest, over 5 percent per annum. Other areas of significant growth are Latin America, the Middle East and Africa. On the other hand, in the two largest markets, North America and Europe, growth in demand has been relatively slow (See Table 1).

Table 1
Product Consumption
million tonnes

	1988	1996	96/88
Asia	583.3	885.4	+51.8%
Middle East	150.5	190.5	+26.6
Africa	88.1	110.3	+25.2
Latin America	227.1	277.5	+22.2
Europe	700.1	740.1	+5.7
North America	873.5	912.5	+4.5
FSU	414.6	196.5	-52.7
Total	3037.2	3312.8	+9.1

Demand by Product

Three products, motor gasoline, gas oil (automotive and heating) and heavy fuel oil, account for two thirds of total products consumption. If one excepts the IEA classification of gas (i.e. LNG, LPG and ethane, not really a group of petroleum products) consumption of jet kerosene has shown the highest growth, although demand for motor spirit and automotive gas oil has also increased strongly. In contrast, use of heavy fuel oil has fallen over the last 25 years (See Table 2). (Note: gas oil demand data are not generally broken down between automotive and heating use. However, heating gas oil use is largely limited to Europe - some 100 million tons per annum - and United States - about 40 million tons per annum - so world consumption of automotive gas oil is of the order of 650 to 680 million tons per annum.)

Refining Worldwide

Refining Capacities

The refining industry converts crude oil into fuels which provide 40 percent of global energy requirements. The industry developed considerably in the 1960s and 1970s. Refining capacity peaked at 4.1 billion tons in 1980 before dropping to 3.6 tons in 1986 following the two oil crises. It subsequently increased slightly between 1987 and 1996. At the end of 1996, refining (atmospheric distillation) capacity worldwide stood at 3.8 billion tons per year.

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Table 2
Consumption By Product
million tonnes

	1973	1994	94/73
Gas	100.5	180.9	+80%
Aviation Fuels	115.8	174.4	+51
Gas Oil	592.8	819.3	+38
Motor Gasoline	559.0	760.1	+36
Naphtha	100.7	135.1	+35
Other Products	193.4	257.2	+33
Refinery Fuel	146.1	171.9	+18
Kerosine	75.2	80.2	+7
Bunkers	134.9	135.0	0
Residual Fuel	748.5	483.8	-35
Total	2766.9	3197.9	16

Source: IEA

Refining capacity reflects the demand for petroleum products. It was the strong increase in demand that caused the sharp rise in capacity up to 1980; between 1950 and 1980 capacity doubled every ten years. It was the fall in petroleum product consumption following the rise in crude prices in the 1970s that led to refinery shutdowns and to reductions in distillation capacity.

Refining capacity is concentrated in North America (23 percent of world capacity), in Europe (22 percent), in the former Soviet Union (14 percent) and in Asia (21 percent). Capacity is growing rapidly in the latter region; 50 percent of ongoing construction is concentrated there. The strong economic growth of the newly industrialized countries, which are often lacking in energy resources, results in considerable demand for petroleum products. Substantial growth in capacity can also be seen in the OPEC countries, particularly in the Middle East where demand is stimulated by very low product prices.

World Refining Capacities Versus Products Consumption

Only two regions have a deficit in refining capacity: North America and Asia. Because of the collapse of oil products (and overall energy) demand, the FSU has substantial excess capacity. Latin America and the Middle East are the largest product exporters (See Table 3).

Table 3
Product Consumption vs. Refining Capacities
million tonnes - 1996

	Refining Capacity	Product Consumption	Prod. Cons/ Ref. Cap.
Asia	814.3	885.4	109%
North America	864.2	912.5	105
Europe	820.2	740.1	90
Africa	145.3	110.3	76
Latin America	372.6	277.5	74
Middle East	269.8	190.5	71
FSU	517.0	196.5	38
Total	3803.4	3312.8	114.8

Source: *Oil and Gas Journal* and *BP Statistical Review*

In Western Europe refining capacities are 707 Mt/y and products consumption around 670 mt/y. Because of the importance of exchanges with other regions, excess capacities are estimated around 1 Mbd (50 mt/y).

Margins

Excess capacities in Europe (both in Western Europe and in the FSU) have made for low refining margins over recent

years. After having leveled off at about $ 2/bbl in early 1990, a complex European refinery's margins were around $1.5/bbl up to mid-1996 while full costs (catalysts, chemicals, personnel, maintenance, overheads, depreciation and return on investment) are in the range of $ 3/bbl.

Since it is relatively easy to transport products from one region to another one, poor margins have spread out in other areas. In the Gulf of Mexico, for several years now, margins for a complex refinery (of the FCC type) have been fairly low, ranging from $0 to $2/bbl (for West Texas Intermediate, the American benchmark crude). In this region, which is wide open to imports, margins are affected by products arriving from abroad, particularly from Europe. In contrast, margins are higher in the midwest (around $1.7/bbl) and in California (around $3/bbl for several years).

The situation in Asia is better. Refining margins have been around $3-4/bbl on average for the last few years. Margins in this part of the world are currently stronger than elsewhere because of continued growth in demand and because there are some protected markets on which prices bring in a profit. Nevertheless, temporary local factors, particularly the negative supply/demand balance in China, Indonesia, India and Vietnam, strongly affect these margins.

Overcapacity in Europe

A refinery can actually operate much more than 95 percent of the time and the stream factor is at best around 90 percent. So low margins clearly result from low stream factors. and although the latter have improved since the beginning of the eighties they are not yet satisfactory.

However, the scheduled shutdown of atmospheric distillation capacity does not exceed a few thousand barrels per day (or million tonnes per year); there are several obstacles that prevent margins from improving.

The internationalization of trade. Even an effective reduction in European capacity would probably only slightly improve margins because the free circulation of products throughout the world tends to restrict and to balance the prices of different products, and therefore of margins. Moreover, the notion of constraint in relation to margins is clearly illustrated by the use of the term window.

Abundance of light crudes. The difference in price between medium and light crudes is decreasing. A number of accumulations of low density crudes have been discovered during the last ten years and this has increased the proportion of light crude in overall production. This has tended to distort the situation. Refineries, particularly European refineries with conventional conversion facilities, find themselves with a crude supply that is no longer suited to their facilities which are designed to process medium to heavy crudes. Hence, until recently, the price of gasoline was relatively low and that of fuel oil fairly high, with a crack spread that did not help the profitability of cracking units.

Consequently, in view of the abundant supply of light crudes, the situation is currently economically more favorable for small hydroskimming refineries that might otherwise have had to be shut down. Hence the limited number of closures of this type or refinery. However the decision to close a refinery with conversion facilities is more difficult to take because of the size of the investment involved. In addition, since these refineries are more sophisticated they are better equipped to handle a reversal of the situation.

The cost of closing a refinery is very high – around $100 million, or more because of the cost of site rehabilitation. This is a decisive criterion, because even if margins are relatively low it is still often preferable to continue to operate the refinery. What company would be prepared to close a refinery and bear the cost on its own for the sake of the European refining industry when its competitors would gain by an increase in margins ?

Products Imports and Exports

For both strategic and economic reasons refineries have generally been built in consumer regions, within easy reach of markets. However, in the 1970s, the oil producing countries made significant investments in what are known as "source refineries" for export purposes, and so a tendency developed for the large crude oil production areas also to export products. These exports have never accounted for a very large share of the consumption of industrialized countries but they play an important part in the world petroleum balance.

Table 4
Product Imports and Exports
million tonnes - 1996

	Imports	Exports	Net Imports
North America	98.8	59.8	39.0
Latin America	24.1	50.7	-26.6
Europe	83.1	36.2	46.9
FSU	12.6	55.9	-43.3
Middle East	3.7	111.0	-107.3
Africa	15.7	34.4	-18.7
Asia	169.5	63.8	105.7

Source: *BP Statistical Review*

Three regions export significant quantities of products:

- The Middle East and especially the Arabian/Persian Gulf countries (mainly Saudi Arabia and Kuwait) which export large amounts of products to Asia. This is a key element in the oil industry since, as can be seen from Table 4, Asian imports are equivalent to Middle East exports.
- Latin America, and especially Venezuela, which is an important source of gasoline for the United States.
- The FSU which exports fair amounts of naphtha, diesel oil and residual fuel oil to Western Europe.

The situation of Western Europe is unique since, despite overcapacities, this region imports large quantities of products from the FSU, but has to export fair amounts of gasoline.

Analysis of European Product Imports and Exports

Margins are low in Europe, mainly because of overcapacities, but also because of the mismatch between refining structure and product demand. The consumption of diesel oil for transport purposes is very high and exceeds production, while excess gasoline and fuel oil are exported.

Product Flows Between the FSU and Western Europe

Western Europe imports about 10 million tonnes of gas/diesel oil from the FSU every year. Oil products demand collapsed in this region, especially in Russia (from 250 million tonnes in 1990 to 130 million tonnes in 1996), because of the economic crisis. Of course, oil production decreased also, but at a slightly lower pace. Consequently, there are now huge excess capacities.

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Excess Refining Capacities...(continued from page 11)

Exports of crude oil and products have remained one of the main sources of hard currency for the FSU which exports about 1 million barrels per day of crude oil and a slightly lower quantity of products. But since FSU refineries are on average rather old and poorly equipped with conversion (cracking) facilities, they produce mainly straight run products, i.e., naphtha, gas oil and reduced crude for export.

Western Europe is long in gasoline but short in naphtha, and the FSU, together with North Africa, are the main source of this product. All the same, Western Europe imports large quantities of gas oil. Because of its rather high sulfur content, Russian gas oil cannot be used as a motor fuel in Western Europe and is mainly sold as heating oil. Europe also imports atmospheric residue from the FSU, and this is used in vacuum distillation units and catalytic crackers to make light products.

Product Flows Between Europe and the United States

On the other hand, Europe is now a gasoline exporter, a significant change compared to the situation in the 1980s when this region imported gasoline. This can be explained by two factors:

- increased dieselization of the private car population has reduced the demand for gasoline over the last few years, and
- the production of unleaded gasoline has required the construction of new process units (isomerization, alkylation) and has increased gasoline production.

A rather large share of this excess gasoline is exported to the United States. This outlet is of key importance to the European refiners.

The other large supplier of gasoline to North America (United States) is Venezuela, and imports from the Caribbean area have for many years made up the balance. However, over the last 20 years, imports from the Virgin Islands and Trinidad and Tobago, have been drastically reduced and imports from Venezuela have developed.

Venezuela is one of the few OPEC countries (along with Saudi Arabia and Kuwait) to have a strategy for the development of refining both locally and abroad. PDVSA owns large refineries in the United States but has also developed some very large and very sophisticated plants in Venezuela - Amuay, Cardon etc. - which are among the largest refineries in the world.

Gasoline imports are low during winter and usually peak at the beginning of spring. Gasoline prices follow a similar trend. Of course, one reason for the differential between the gasoline (FOB) price in Europe and the gasoline (CIF) price in the United States is the cost of transportation between Europe and New York, and the differential must be high enough to make it worthwhile.

Investments to Meet Environmental Constraints and How to Finance Them

Substantial capital expenditure is required in North America and in Europe in order to meet increasingly strict product standards. But margins are low in many, if not all, areas and make financing questionable.

In Europe, importing products from the FSU is a very convenient and rather cheap alternative to the construction of

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Asia-Pacific Energy Security: Lessons from Asian Electricity Reform

*By Guy F. Caruso and Xavier Chen**

Energy security is widely understood as one of the key issues of the Asia-Pacific region. Indeed, over the past two decades, strong economic growth, growing population and urbanization, increased income levels, implementation of the programs of industrialization and poverty reduction in the developing countries of the Asia-Pacific region have generated strong demand for commercial energy in this region. The total primary energy demand more than tripled between 1973 and 1993 and is expected to more than double between now and 2010. Ensuring the availability of an adequate energy supply at reasonable costs is vital for the region's future growth. It is also a vital issue worldwide as the energy markets, especially the oil market, are globalized.

In this paper, we would like to discuss the issue of energy security for the Asia-Pacific in light of the experiences of Asian electricity reform that we have learned from our recently published *Asia Electricity Study*[1].

Why are the experiences of Asian electricity reform relevant to the energy security of the Asia-Pacific region ?

- First of all, electricity supply security is one of the important aspects of energy security. It is so not only because electricity as a form of energy is being increasingly utilized in modern societies, it is also because as the centerpiece of the energy system, the development of the electricity sector has profound impacts on the whole energy system.
- Secondly, the loss of electricity supply (either blackout or brownout), which is a serious loss of energy security, produced severe adverse impacts on the social and economic life in a large number of Asian developing countries in the 1980s and early 1990s. The ways by which many of these countries have solved or eased the electricity supply shortage problems would provide some useful lessons on how these countries can also solve the problems related to oil shortage, coal insufficiency and lack of gas infrastructures.

Of course, there are important differences between the electricity supply industry and other energy industries. Electricity is derived from other sources of energy and its supply security will ultimately depend on that of other energy sources. There are also important geo-politically related external aspects of oil supply security, which is much less significant in the electricity sector. However, energy security of a country is not just a matter of external supply. Reduced reliance on external supplies is very important, but not the whole answer. Internal factors such as regulatory framework, investment regime, pricing and taxation policy, and demand management are also highly relevant. It is on these internal factors of a country's energy security that some

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[1] See footnote at end of text.