

Straits, Passages and Chokepoints: A Maritime Geostrategy of Petroleum Distribution

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Abstract

The transportation of petroleum represents one of the most strategically important circulations of resources in the global economy. Its role cannot be overstated. Yet, petroleum has become a “strategically invisible” commodity as its flow was continuous with limited, but eye opening, disruptions such as the First Oil Shock of 1973. The supply of petroleum is virtually taken for granted. Since about two third of the global petroleum production is carried by maritime transportation, distribution constraints are unavoidable and involve the usage of a set of straits and passages; chokepoints of maritime circulation. This paper provides an overview of the geography of oil supply and demand as well as the strategic issues linked with its maritime circulation. Chokepoints are perceived as resources which values vary according to levels of use. As the era of petroleum dominance is coming to an end, the importance and vulnerability of strategic passages will increase. Their capacity to handle additional traffic appears to be limited, implying that future oil shocks or disruptions are likely to be more related to the challenges of its distribution.

Keywords: Petroleum Distribution, Maritime Transport, Strategic Passages, Hormuz, Suez, Malacca, Bab el Mandeb, Bosphorus, Panama.

Résumé

Le transport du pétrole représente une des plus importantes circulations de ressources au sein de l'économie mondiale. Son rôle ne peut être exagéré. Cependant, le pétrole est devenu une commodité stratégiquement invisible puisque sa circulation a toujours été continue avec des disruptions limitées, mais tragiques, telles que le premier choc pétrolier de 1973. L'offre de pétrole est pratiquement prise pour compte. Du fait que les deux tiers de la production pétrolière mondiale est acheminée par transport maritime, les contraintes de sa distribution sont inévitables et impliquent l'utilisation d'un ensemble limité de détroits et passages : les goulots de la circulation maritime. Cet article se penche sur la géographie de l'offre et de la demande de pétrole de même que sur les problèmes stratégiques liés à sa circulation maritime. Les goulots sont perçus en tant que ressources dont la valeur varie en fonction de leur niveau d'utilisation. Alors que la dominance du pétrole tire à sa fin, l'importance et la vulnérabilité des passages stratégiques risque conséquemment de s'accroître. Leur capacité à accommoder des trafics supplémentaires est limitée, impliquant que les futurs chocs ou disruptions pétrolières seront vraisemblablement liées à la problématique de sa circulation.

Mots clef : Distribution du pétrole, transport maritime, passages stratégiques, Hormuz, Suez, Malacca, Bab el Mandeb, Bosphore, Panama.

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1. Introduction: The Geostrategy of Petroleum

“The Spice must flow”, Spicing Guild, Dune, (Frank Herbert).

This simple sentence taken from a well known science fiction saga is an analogy of one of the core foundations of the global economy to which there is currently no reasonable palliative or any alternative available on the short run. As Spice was to the fantasy future Empire, very few commodities are as vital as petroleum to the tangible functioning of the real world. The flexibility of use of oil has made it a remarkable commodity; it can be used as a source of energy, a lubricant as well as a raw material in the manufacturing of plastics and fertilizers. It has even been argued that petroleum is too valuable a commodity to be used as fuel. As a commodity of strategic importance, petroleum has been for the last century the object of geopolitical confrontations for its access, control and distribution. Even if the energy intensity² of the global economy has declined, growing oil consumption underlines a growing global dependence. The distribution of petroleum from the oil fields, to the refineries and, finally, to the consumers cannot be interrupted in a significant manner under any circumstances. Otherwise serious economic and political consequences may result and a vulnerable and petroleum dependent global economy could come to a grinding halt.

1.1 Oil Supply Strategies

To insure a constant and uninterrupted oil supply, the strategies of industrialized countries have been articulated by the use of military force (mostly by the United States), economic incentives and uneasy alliances with oil producers, namely in the Persian Gulf. Access to this strategic location, especially Saudi Arabia, is likely to be the most important factor of contemporary energy geopolitics (Klare, 2001). The growing dependency on external sources of oil by developed countries, when not entirely dependent on them, only reinforces these conventional strategic considerations where a few key maritime passages – chokepoints of the global economy – are considered as valuable resources with a rather fixed supply (Nincic, 2002). In addition, increased Asian oil demands, especially from China, caused a new shift in petroleum circulation and increased competition over existing known oil resources, including the chokepoints themselves. The new geography of petroleum circulation is thus challenging conventional distribution networks, their security and their reliability.

The control on the supply of oil is becoming increasingly tight with limited alternatives other than to pursue policies and strategies set decades ago. In such a context, the Carter Doctrine drafted to address the security of the Persian Gulf has grown in relevance after more than 50 years of American military presence in the region.

“An attempt by an outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America, and such an assault will be repelled by any means necessary, including military force.” President Jimmy Carter, State of the Union Address, January 23, 1980.

² The amount of energy used per unit of output.

Initially this doctrine aimed at deterring the Soviet Union after its invasion of Afghanistan in 1979, but its application has been the result of very different events and contexts. The old Cold War nemesis gone, the threatening force turned out to be internal to the Gulf region; Iraq. The Carter Doctrine has been applied twice; in 1990 during the First Gulf War and in 2003 for the Second Gulf War. In the first case it was to quell the intentions of Iraq to gain control of a large portion of the regional oil fields with the potentially damaging economic and political consequences. In the second, a hidden goal was to insure the future stability of the Persian Gulf region and thus its oil supplies. However, the policy came at a high economic and political price, which can be seen as a subsidy for the stability in oil supplies paid by the final consumer. The cost of securing access to Middle Eastern oil, ranging from the deployment of forces in the Persian Gulf, the patrol of its water and the supply of military assistance to the countries of the region is estimated to be in the range of \$50 billion per year (IAGS, 2003). The First Gulf War cost more than \$80 billion, while the final costs of the Second Gulf War are not yet fully assessed and could range anywhere between \$125 billion and \$1 trillion, including security and reconstruction costs. Securing oil resources has thus become a complex and expensive undertaking.

1.2 Oil Circulation and Chokepoints

The whole issue of oil dependency for countries that are politically unstable or potentially unreliable involves occasional disruptions, price changes and a transfer of wealth. According to the US Department of Energy, this accounted for over \$3.4 trillion over the last 30 years, with the transfer of wealth to oil exporters accounting for \$1.16 trillion for the same period. The post September 11 era is one of realization of the geopolitical consequences this transfer has caused for the stability of the Middle East and that petroleum must continue to flow regardless. The price fluctuations of the commodity itself have been extensive and often linked with periods of growth and recession of the global economy (Hamilton, 1985). In spite of all the concerns and call to action, alternative sources of energy still have a limited capability at substitution (Rifkin, 2002). Under such circumstances, the global economy will remain dependant and vulnerable to the circulation of oil and especially over its chokepoint for at least the first two decades of the 21st century.

Chokepoints are a common concept in transport geography as they refer to locations that limit the capacity of circulation and cannot be easily bypassed, if at all. This implies that any alternative to the chokepoint involves a level of detour or the use of an alternative that amounts to substantial financial costs and time delays. They can also be perceived as a resource which usefulness varies with the ebb and flows of the geography of circulation. Considering the characteristics of maritime transportation, maritime chokepoints are particularly prevalent. Many of them are the result of the constraints of physical geography while others, namely Suez and Panama, are artificial creations. Three core concepts thus define a chokepoint as a resource:

- **Physical characteristics.** At start, a chokepoint is a location forcing the convergence of traffic and limiting its capacity through its physical characteristics, whether by depth, width or overall navigability. It thus has a limited physical capacity to accommodate maritime circulation.

- **Usage.** The value of a chokepoint is proportional to its usage level and the availability of alternatives. The fact that a chokepoint provides a limit to circulation imposes a threshold to its usage. The closer the traffic is to this threshold, the more the resource is considered to be exhausted.
- **Access.** As a valuable resource a level of control must be established to insure access to the chokepoint. This involves agreements regulating its usage and even conflicts if its access becomes contested. Tolls can also be levied if the chokepoint falls within a well defined jurisdiction managing access infrastructures such as locks.

Although the physical characteristics of most chokepoints are very stable, implying a fixed capacity, their use and value is subject to significant variations. With the growth of maritime circulation and world trade, many have become extremely valuable resources accounting for the most important strategic locations in the world. However, like all fixed supply resources, there is a limit to which they can be used. The closer they are to being “exhausted”, the more unstable their usage is and the more efforts to be spend on securing their access.

This paper reviews contemporary evidence related to oil supply, demand and distribution. Although strategic and economic issues related to petroleum are well understood and have been substantially discussed (Yergin, 1991; Venn, 1986), the unique geography of global petroleum distribution, including its maritime chokepoints certainly deserves a review. The main argument is that distribution issues are as important as those related to production and pricing since distribution is a fundamental factor in ensuring that supply meets demand requirements. First, the complex relationships between petroleum and the global economy are discussed, namely in terms of supply, demand, reserves and distribution. Second, in view of the importance of this distribution, an analysis of the major chokepoints to the maritime circulation of petroleum is undertaken. Even as the era of petroleum dominance draws to an end, the significance of these chokepoints are likely to increase with tighter supplies and growing demands, namely from Pacific Asia.

2. Petroleum and the Global Economy

2.1 Petroleum Production and Consumption

The oil industry is oligopolistic both in its supply, demand, control and in its functional and geographical concentration (Clo, 2000). The demand is controlled by a few very large multinational conglomerates, each having production and distribution systems composed of refineries, storage facilities, distribution centers and, at the end of the supply chain, gas stations. The supply is controlled by a few countries where the oil industry is often nationalized or under the common price-fixing policies of OPEC³, which regulates about 37% of the global oil production. The geography of production and consumption is characterized by a strong spatial differentiation of supply and demand. Because of geographical and geological factors, oil is mainly produced far from where oil is consumed,

³ Organization of Petroleum Exporting Countries.

resulting in acute imbalances which are growing rapidly (Figure 1). Several developed countries, such as the United States, have extracted most of their oil reserves and are gradually shifting to foreign sources⁴. This trend can only be overcome by massive oil transportation infrastructures, including pipelines, terminal, tankers and storage facilities.

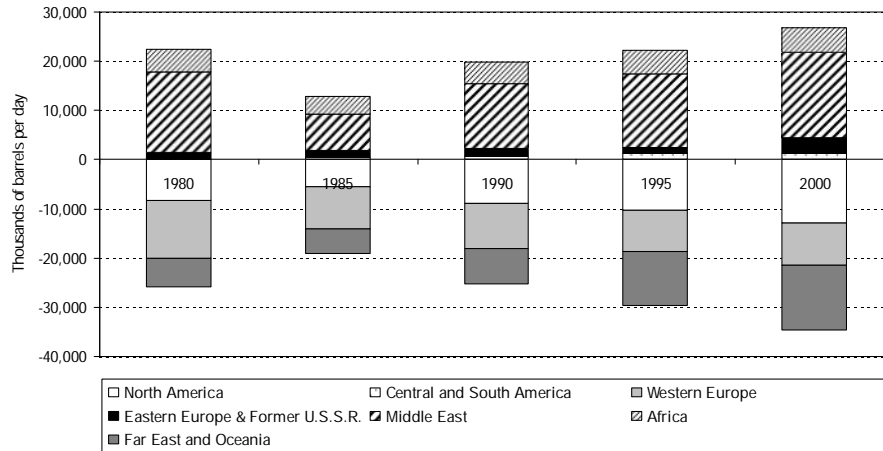


Figure 1 World Oil Balance, 1980-2000

Source: US Energy Information Agency, International Energy Annual Report.

Figure 1 shows a global geography of oil characterized by surpluses and deficits. While the Middle East has the largest surplus (17.3 Mb/d⁵ for 2000), Pacific Asia, North America and Western Europe, all have significant deficits (13.2, 12.9 and 8.5 Mb/d respectively).

Global oil reserves are highly concentrated, with 64% of proven reserves located in the Middle East. The question remains about how much oil reserves are economically available and how much time they would last. Figures about the earth's oil reserves are thought to have been between 2,100 and 2,800 billion barrels before oil began to be exploited in the 19th century. As of 2001, an estimated 1,020 billion barrels of proven oil reserves were available and 900 billion barrels have been extracted, which represents about a third of all available oil reserves⁶. To this figure, can be added between 200 to 900 billion barrels of oil that potentially remain to be found (Campbell and Laherrere, 1998). Considering these figures, the global oil production should peak around 2005-2010 and then start to decline. On a long-term perspective, the control of OPEC will be strengthened since the bulk of remaining oil reserves is located within its jurisdiction. Saudi Arabia alone has about 25% of all the world's oil reserves, putting upward pressures on energy prices.

⁴ As of 2003, the United States was extracting about 8.8 Mb/d and had oil reserves of about 72,677 million barrels.

⁵ Millions of barrels per day (Mb/d). A barrel is the equivalent of 42 US gallons or 159 liters.

⁶ There have been serious issues concerning the real availability of oil reserves, as some figures have been inflated to uphold the confidence of markets and investors. For instance the oil giant Royal Dutch / Shell admitted in 2004 overestimating its oil and gas reserves by 22% (about 4.5 billion barrels).

Oil production has steadily increased in the second half of the 20th century to satisfy a growing demand. On average 68 million barrels of crude oil are produced each day (2000 figures), 32% of it in the Middle East, the single most important oil producing region in the world. About 60% of all the oil being produced is already committed and 40% is sold on open markets. More significantly, excess oil production is limited both in capacity and in its geographical origin. 90% of this excess oil production is located in the Persian Gulf with Saudi Arabia, along with accounting for the world's largest oil reserves, having the additional advantage of being the only major supplier able to provide instant additional capacity if required. Excess production capacity is critical if a major disruption in supply occurred, because the additional capacity can immediately be brought up to maintain current oil supply levels. Recent events, such as the conflict in Iraq and civil unrest in Venezuela and Nigeria, have stretched the world's extra capacity thin to about 1 million barrels per day in 2003. Additional sources of oil are thus scarce and if some are found, the capacity to exploit them and transfer them to markets would take several years.

The global economy has become dependant on cheap oil prices, with the United States being the most eloquent example (Greene *et al.*, 2002). Since 52% of all oil is consumed by transportation activities, motorization is one of the driving forces behind the consumption of petroleum. An average of 77.5 Mb/d were consumed in 2002, 57% of it in developed countries. While the United States ranks as the leading global consumer of oil (20.1 Mb/d), the rapid growth of the Chinese economy in the last decade has propelled China to the second rank of oil consumers (5.5 Mb/d), surpassing Japan (5.3 Mb/d). China accounted for around 40% of the global growth in oil demand in the recent years. About 55% of all the oil consumed in the United States was imported in 2002. This figure is expected to rise to 65% by 2010. Demand is also characterized by a level of seasonality, with heating oil demands in the winter and more gasoline demands in the summer. Depending on the economic sector, price elasticity ranges from small to significant. While a growth in oil prices may adversely impact air transport, car-dependent commuters are much more likely to bear the increase. Other industrial sectors are also significantly affected by oil prices, notably plastics and fertilizers. Growing energy prices are likely to further induce relocation to lower cost locations as manufacturers try to reduce costs they can control, such as labor, real estate and taxes.

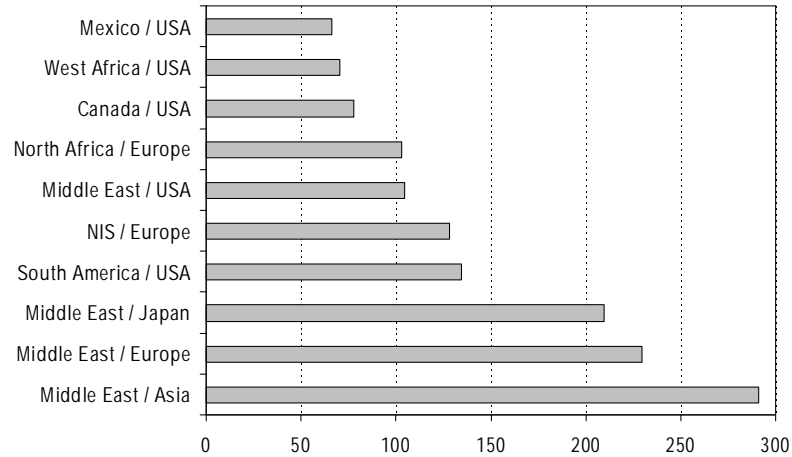


Figure 2 Inter-Regional Petroleum Movements, 1998 (in million tons)
Source: OECD.

International oil trade is correlated with oil prices and transport costs, and oil flows are often linked with the proximity of suppliers and consumers (Figure 2). Since the 1970s there has been a shift in the global flows of petroleum, which were dominated by flows from the Middle East to Western Europe and North America. There has been an accelerated trend that began with the re-industrialization of Japan after World War II. The development of the “Tigers” – South Korea, Taiwan, Hong Kong and Singapore – has also resulted in growing oil demands in Pacific Asia and the corresponding oil flows dominantly serviced by the Middle East. However, the growth of China is the single most important factor in the growth of the global oil demand, and of raw materials in general, as it tightens supplies and drives prices upwards.

2.2 Petroleum Transportation

Petroleum transportation is one of the best examples of a derived transport demand as its circulation is a direct consequence of its consumption. This tightly integrated distribution system involves a continuous flow from the oil fields to the final consumption with rather limited storage outside strategic reserves⁷. The volume of international oil trade increased as a result of world economic growth and additional demands in energy. The largest oil consumers are the most highly developed countries such as the United States Western Europe and Japan accounting for about 75% of global crude oil imports. The international oil trade is necessary to compensate the spatial imbalances between supply and demand (Figure 1). Unlike most other countries, which either consume almost their entire production (United States) or have privileged partners (Russia and Western Europe), a major portion of OPEC’s oil is traded on international markets.

Since the first oil tanker began shipping oil in 1878 in the Caspian Sea, the capacity of the world’s maritime tanker fleet has grown substantially to become a specialized segment of

⁷ As of 2002, American strategic reserves were just under 600 million barrels, which would be enough to supply the American economy for about a month.

the maritime industry (Ratcliffe, 1985). Each year, about 1.9 billion tons of petroleum are shipped by maritime transportation, which is roughly 62% of all the petroleum produced and 37% of all the tons and 44% of all the tons-km shipped by maritime transportation. The remaining 38% uses pipelines, trains or trucks over shorter distances. Most of the petroleum follows a set of maritime routes producing and consuming (Figure 3). More than 100 million tons of oil is shipped each day by tankers, about half of which is loaded in the Middle East and then shipped to Japan, the United States and Europe. Tankers bound for Japan use the Strait of Malacca while tankers bound for Europe and the United States use either the Suez Canal or the Cape of Good Hope, pending the tanker's size and the destination.

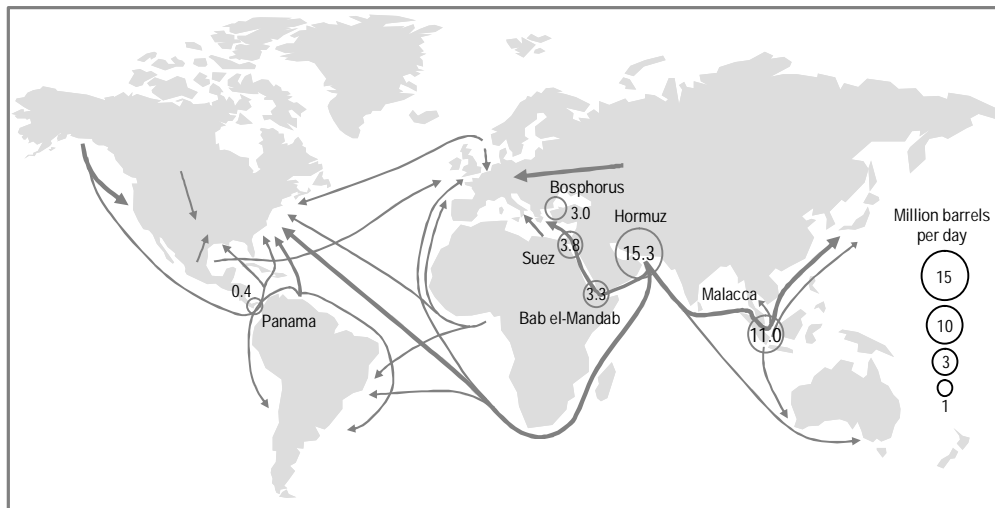


Figure 3 Oil Flows and Major Chokepoints, 2003

The world tanker fleet capacity (excluding tankers owned or chartered on a long-term basis for military use) was about 280 million deadweight tons in 2002. There are roughly 3,500 tankers available on the international oil transportation market. The cost of hiring a tanker is known as the charter rate. It varies according to the size and characteristics of the tanker, its origin, destination and the availability of ships, although larger ships are preferred due to the economies of scale they confer. About 435 VLCCs⁸ account for a third of the oil being carried. Tanker ships can also be used as semi-permanent storage tanks. In 1990, about 5% of the world's tanker capacity was being used for such a purpose.

Different tanker sizes are used for different routes, namely because of distance and port access constraints. There is thus a specialization of maritime oil transportation in terms of ship size according to the markets being serviced. VLCCs are mainly used from the Middle East over long distances (Western Europe, United States and Pacific Asia). "Suezmax"⁹ tankers are mainly used for long to medium hauls between West Africa and Western Europe

⁸ Very Large Crude Carriers, which can carry up to 300,000 deadweight tons of crude oil, about 2 million barrels.

⁹ Tankers between 120,000 to 200,000 deadweight tons.

and the United States, while “Aframax”¹⁰ tankers are used for short to medium hauls such as between Latin America and the United States. Transport costs have a significant impact on market selection. For instance, three quarters of American oil imports are coming from the Atlantic Basin (including Western Africa) with journeys of less than 20 days. Venezuelan oil takes about 8 days to reach the United States while Saudi oil takes 6 weeks. The great majority of Asian oil imports are coming from the Middle East, a 3 weeks journey. In addition, due to environmental and security considerations, single-hulled tankers are gradually phased out to be replaced by double-hulled tankers (Timmons, 2004).

Transportation costs account for a small percentage of the total cost of gasoline at the pump, about 5 to 10% of the added value of oil. As the dependency of the United States on oil imports increases and as new consumers create additional demands, the more a pressure will be felt on the chokepoints of oil circulation.

3. Strategic Passages: Chokepoints of the Global Economy

Maritime transportation, as the dominant purveyor of international freight distribution, operates over a global maritime space. This space has its own constraints such as the profile of continental masses. International maritime routes are forced to pass through specific locations such as passages, capes and straits. There are about 200 of such locations, but only a handful are of strategic importance. By definition chokepoints tend to be shallow and narrow, impairing navigation and their capacity is being challenged by growing maritime circulation but also by the growing size of ships (Feller, 2004). Many chokepoints are next to politically unstable countries, increasing the risk of navigation and compromising their access and use. In recent years, the threat of terrorism has raised additional concerns over maritime circulation (Richardson, 2004). Strategic passages can be mined, blocked by sinking ships, or interdicted by naval forces, artillery or missile systems. Chokepoints truly are the geographical Achilles heels of the global economy.

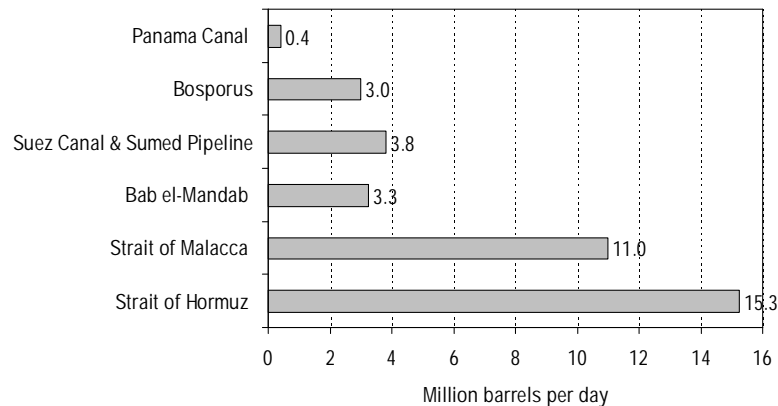


Figure 4 Oil Transited at Major Strategic Locations, 2003

Source: Energy Information Administration (2003)

¹⁰ Tankers between 80,000 and 120,000 deadweight tons.

The geostrategy of maritime petroleum circulation involves six major chokepoints (Figure 4), which handle more than 35 Mb/d. Their use is shared with regular flows of commercial maritime shipping, including containers and other cargoes. Two are of extremely high importance; Hormuz and Malacca since they account for more than 60% of oil transits. Hormuz represents the most important strategic passage in the world, solely because of its access to the oil fields of the Middle East, while Malacca is an active commercial point of transit between the Indian and Pacific oceans. From the Persian Gulf, two major axes of oil circulation serve Western Europe and the United States (westbound) and Pacific Asia (eastbound). As eastbound and westbound oil shipments increase, so does the need to maintain the integrity of the strategic passages supporting its trade. This is particularly the case for China, as its oil imports stretch from the Strait of Hormuz, Malacca and the South China Sea, most of which are patrolled by the United States.

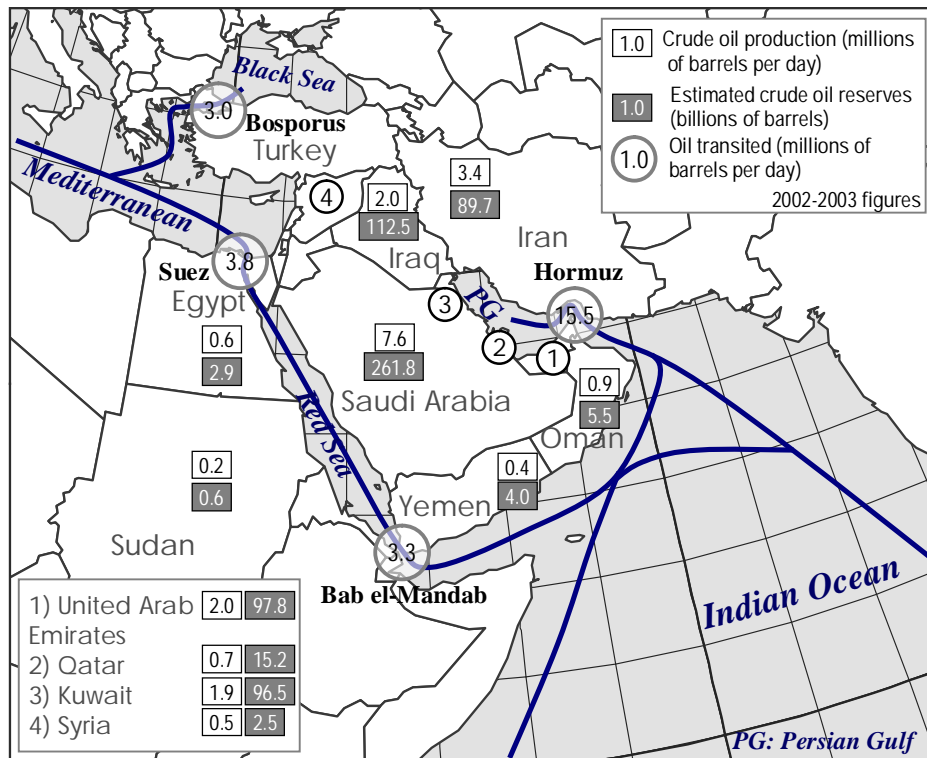


Figure 5 Shipping Lanes and Strategic Passages in the Middle East

3.1 Strait of Hormuz

The Strait of Hormuz forms a strategic link between the oil fields of the Persian Gulf, the Gulf of Oman and the Indian Ocean (Figure 5). It has a width between 48 and 80 km, but navigation is limited to two 3 km wide channels, each exclusively used for inbound or outbound traffic. Circulation in and out of the Persian Gulf is thus highly constrained, because the sizable amount of tanker traffic makes navigation difficult along the narrow channels. In addition, islands that insure the control of the strait are contested by Iran and the United Arab Emirates. The security of the strait has been often compromised. Between 1984

and 1987 a “Tanker War” took place between Iran and Iraq, where each belligerent (Iran-Iraq War of 1980-1988) began firing on tankers, even neutrals, bound for their respective ports. Shipping in the Persian Gulf dropped by 25%, forcing the intervention of the United States to help secure the oil shipping lanes.

About 88% of all the petroleum exported from the Persian Gulf transits through the Strait of Hormuz, bound to Asia, Western Europe and the United States. Its importance in global oil circulation cannot be overstated. For instance, 75% of all Japanese oil imports transit through the strait. There are thus very few alternative outlets to oil exports from the Persian Gulf if the traffic of about 14 Mb/d going through Hormuz was compromised (Figure 6). In addition, a no-notice closure of the strait would trap about 7 to 10% of the global VLCC fleet in the Persian Gulf.

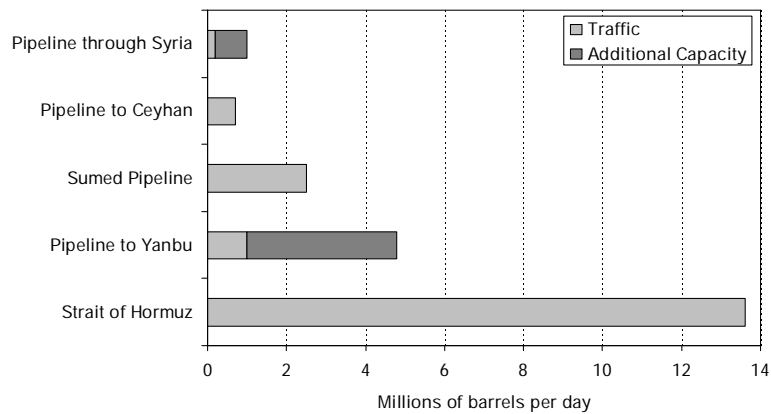


Figure 6 Oil Exports from the Persian Gulf by Outlet, 2002

The only other significant outlet for Persian Gulf oil is the pipeline to the Saudi Arabian port of Yanbu on the Red Sea, which can handle about 4.8 Mb/d. The Sumed pipeline, which roughly runs parallel to the Suez Canal is also indirectly an outlet of the Persian Gulf but would be dependent on the capacity to ship Middle Eastern oil (mainly Saudi) to the Red Sea either by pipeline (Yanbu) or through Bad el-Mandab. The other two pipelines link northern Iraq (Kirkuk region) to Syria or Turkey (port of Ceyhan on the Mediterranean) and do not offer any significant additional capacity.

3.2 Suez Canal and Strait of Bab el-Mandab

The opening of the Suez Canal in 1869 brought forward a new era of European influence in Pacific Asia. The journey from Asia to Europe was considerably reduced by saving 6,500 km from the circum Africa route. The canal has no locks, because the Mediterranean Sea and the Gulf of Suez have roughly the same water level. In 1874, Britain bought the shares of the Suez Canal Company. According to the 1888 agreement, the canal was to be open to vessels of all nations in time of peace or in war. However, Great Britain claimed the need to control the area to maintain its maritime power and colonial interests (namely in South Asia). In 1936, it acquired the right to maintain defense forces along the

Suez Canal, which turned out to be of strategic importance during World War II to uphold Asia-Europe supply routes for the Allies.

The second half of the 20th century saw renewed geopolitical instability in the region with the end of colonialism and the emergence of Middle Eastern nationalisms. In 1954 Egypt and Great Britain signed an agreement that superseded the 1936 treaty and provided for the gradual withdrawal of all British troops from the Canal Zone. All the British troops were gone by June 1956 as the canal was nationalized by Egypt. This triggered problems with Israel, as Israeli ships were not permitted to cross the canal. This threat was also extended to France and Britain, the former owners of the canal because they refused to help finance the Aswan High Dam project, as initially promised. Israel, France and Britain thus invaded Egypt in 1956. Egypt responded by sinking ships in the canal, effectively closing it between 1956 and 1957. An agreement about the usage of the canal was then reached.

However, geopolitical problems persisted as tensions between Israel and Arab nations increased in the 1960s. The Six Days War between Israel and Egypt and the invasion of the Sinai Peninsula by Israel caused the closure of the Suez Canal between 1967 and 1975. This event significantly destabilized international transportation and favored the development of ever larger tankers to use the long circum Africa route. The canal was finally re-opened in 1975 and Egypt agreed to let Israel use it. Significant improvements were made between 1976 and 1980, mainly the widening of the canal to accommodate VLCC of 200,000 tons supporting the oil trade between Europe and the Middle East. The minimum width of the channel is 60 meters and ships of up to 16 meters (58 feet) of draft can make the transit. This means that ULCC cannot pass through the Canal when fully loaded. A common practice is to unload parts of Mediterranean bound ships and use Sumed pipeline. With additional deepening and widening projects, the depth of the canal is expected to reach 22 meters by 2010.

The canal has the capacity to accommodate up to 25,000 ships per year, but handles about 14,000, on average 38 ships per day, which roughly account for 14% of the global trade. Since the canal can only handle unidirectional traffic, crossings must be organized into convoys of about 10-15 ships. Three convoys per day, two southbound and one northbound, are organized. Missing a convoy involves supplementary delays to the point that many maritime companies will skip a port call to insure that their ship arrive on time at the Suez Canal to be part of a specific convoy.

Controlling access to the Suez Canal is the Strait of Bab el-Mandab, a strategic link between the Indian Ocean and the Red Sea. The sizable amount of tanker traffic makes navigation difficult along the narrow channels. A closing of this strait would have serious consequences, forcing a detour around the Cape of Good Hope and in the process demanding additional tanker space.

3.3 Bosphorus

The Passage of Bosphorus has a length of 30 km by of width of only 1 km at its narrowest point linking the Black Sea to the Mediterranean Ocean (Figure 5). Its access was the object of two conflicts, the War of Crimea (1854) and the battle of the Dardanelles (1915). The passage was fortified by Turkey after the Convention of Montreux in 1936

which recognized its control of Bosphorus but granted free passage in peace time to any commercial vessel without inspection. With the passage of the Dardanelles, Bosphorus forms the only link between the Black Sea and the Mediterranean Ocean. In the current context, the Bosphorus represents a passage of growing strategic importance, notably after the fall of the Soviet Union. The Caspian Sea has vast oil reserves and a large amount must likely transit through the Black Sea and Bosphorus to reach external markets, namely around the Mediterranean Ocean. Although pipelines offer an alternative, the cost differentials clearly advantage the use of maritime transportation. For instance, the cost of moving oil along the Baku – Ceyhan pipeline ranges between \$1 and \$2 per barrel while shipping oil by tankers through the Black Sea costs 20 cents per barrel (Brito, 1999).

About 50,000 ships, including 5,500 tankers, transit through the passage each year, which is getting close to capacity. The physical limit of the strait permit tankers of a maximal capacity of 200,000 dwt. Oil transiting through the Bosphorus has growth substantially in recent years with the exploitation of oil fields around the Caspian Sea and about 3.0 Mb/d were transiting through the passage in 2003. The future growth of petroleum circulation through Bosphorus is thus highly problematic, notably the risk of collisions and oil spills in the midst of Istanbul. In response, the Turkish government forbade in 2002 the use of the passage during the night by large tankers.

3.4 Strait of Malacca

The Strait of Malacca is one of the most important strategic passages of the World because it supports the bulk of the maritime trade between Europe and Pacific Asia, which accounts for 50,000 ships per year (600 per day). It measures about 800 km in length, has a width between 50 and 320 km (2.5 km at its narrowest point) and a minimal channel depth of 23 meters (about 70 feet). It represents the longest strait in the world used for international navigation. About 30% of the world's trade and 80% of Japan's, South Korea's and Taiwan's imports of petroleum transits through the strait, about 11.0 Mb/d in 2003. As the main passage between the Pacific and the Indian oceans Malacca is an unavoidable bottleneck with the Strait of Sunda (Indonesia) being the closest alternative (figure 7).

For centuries, the Strait of Malacca has been part of the Arab trade routes linking the Middles East, Southeast Asia and China. By the early 16th century the Portuguese conquered the stronghold of Malacca, a key trading center after which the strait bears its name. In 1867, England formally took control of the passage with Singapore as a main harbor and other important centers such as Malacca and Penang, forming the Strait Settlements. This control lasted until the Second World War and the independence of Malaysia in 1957. As the Pacific trade increased considerably after the Second World War, so did the importance of the passage. Singapore, located at the southern end of the Strait of Malacca is one of the most important ports in the world and a major oil refining center. Dredging is one of the main problems of the Strait of Malacca, since some sections are barely deep enough to accommodate ships of about 300,000 deadweight tons. The Strait being between Malaysia, Indonesia and Singapore, an agreement is difficult to reach about how the dredging costs should be shared and how fees for its usage should be levied. Political stability and piracy along are also major issues for the safety of maritime circulation, especially on the Indonesian side.

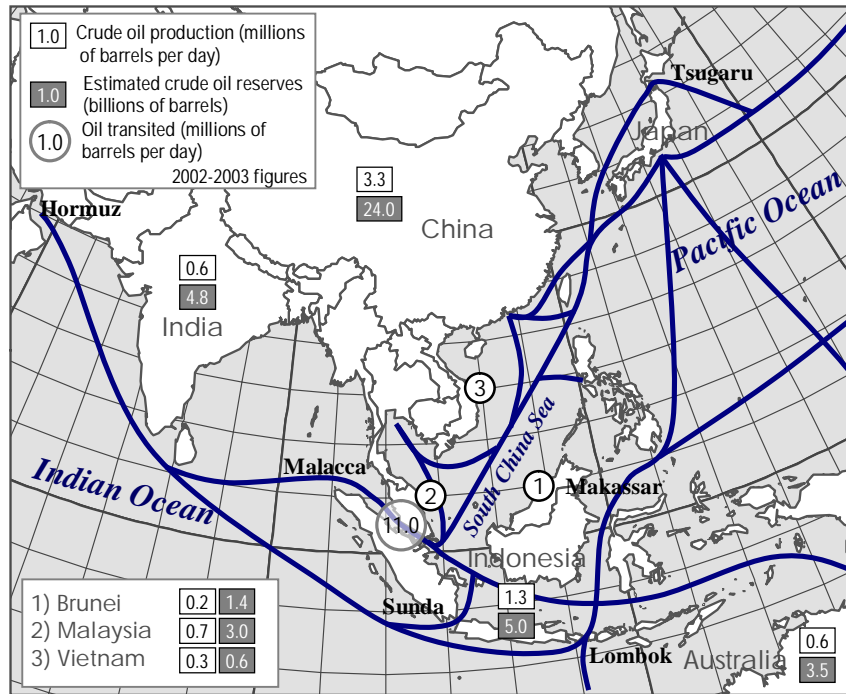


Figure 7 Shipping Lanes and Strategic Passages in Pacific Asia

The Strait of Malacca leads to the South China Sea, another extremely important shipping lane and a region subject to contention since oil and natural gas resources are present. The Sparty¹¹ and Paracel groups of islands are claimed in whole or in part by China, Vietnam, Malaysia, Indonesia, Brunei and the Philippines. The region has proven oil reserves estimated at about 7.0 Bb with oil production accounting for 2.5 Mb/d. With the substantial economic growth taking place in the region large flows of oil, liquefied natural gas and other raw materials (iron ore, coal) are transiting towards East Asia. About 25% of the global shipping fleet transits through the region each year, underlining the importance of the South China Sea as an extension of the Malacca chokepoint.

3.5 Panama Canal

The Panama Canal joins the Atlantic and Pacific oceans across the Isthmus of Panama in Central America. Running from Cristobal on Limon Bay, an arm of the Caribbean Sea, to Balboa, on the Gulf of Panama, the canal is slightly more than 64 km in length. Its operational characteristics involve a minimum depth of 12.5 m and a minimum width of 91.5 m. Its construction ranks as one of the greatest engineering works of all time as it prevents a long detour around South America, thus supporting the maritime flows of world trade. The Panama Canal is of strategic importance to the United States as it enables to link the East and the West coast more quickly by maritime transport, saving about 13,000 km (from 21,000 km to 8,000 km). It is composed of three main elements, the Gatun Locks (Atlantic

¹¹ A group of about 230 uninhabitable islands totaling a mere 8 square kilometers.

Ocean access) the Gaillard Cut (continental divide) and the Miraflores Locks (Pacific Ocean access).

In its 90 years of existence, more than 800,000 vessels transited the canal, carrying 6 billion tons of cargo. About 13,000 ships transit the canal every year, with an average of 35 ships per day. However, the canal has the capacity to handle 50 ships per day. Grains account for about 43% of the traffic transited, while containers and petroleum products account for 11% and 10% of the transited traffic respectively, with a oil traffic of about 0.6 Mb/d. The Panama Canal Authority collects tolls on all ships crossing the canal. A loaded ship pays about \$2.57 per net ton and the average toll is about \$45,000. The introduction of super-tankers at the beginning of the 1950s forced the reconsideration of its strategic importance as economies of scale in petroleum shipping are limited by the size of the canal. It is synonymous of a standard in maritime transport related to capacity, the Panamax standard, which equals to 65,000 deadweight tons and a draft of 12 meters.

The canal handles about 12% of the American international seaborne trade. Under the control of the United States until 1979, its administration was entrusted to the State of Panama by the Panama Canal Treaty of 1977. In December 1999, the canal became again property of Panama and is managed by the Panama Canal Authority. The same year, the Hong Kong port operator, Hutchison-Whampoa, leased terminals on both the Atlantic (Cristobal) and Pacific (Balboa) sides of the Canal with a 25 years lease. This raised concerns within the American government as it was perceived that the control of the canal was falling into foreign interests, namely to a company perceived to be a façade for the Chinese government. There is also the improvement of the rail line between the two ports to handle the growing containerized traffic. This rail line is important as it offers an alternative to the size limitations of the canal, preventing large – “post-panamax” – containerships to go through. The same rationale applies to oil circulation with the trans-panama pipeline that resumed its operations in 2003, but the additional capacity this pipeline conveys is only about 1 Mb/d. New oil development projects, namely in Ecuador and Peru, are likely to increase the importance of Panama in global oil distribution.

Table 1 Chokepoints: Capacity, Limitations and Threats

Chokepoint	Usage (ships / day, 2003)	Additional Capacity	Limitation	Threat
Hormuz	50	Limited	Narrow corridors	Iran / Terrorism
Suez	38	Some	200,000 dwt and convoy size	Terrorism
Bosporus	135	Very limited	Ship size and length; 200,000 dwt	Restrictions by Turkey; navigation accident
Malacca	600	Substantial	300,000 dwt	Terrorism / Piracy
Panama	35	Limited	65,000 dwt	No significant

4. Conclusion

Increased demands and tighter supplies are unavoidable consequences of the geography of petroleum production, distribution and consumption. The global economy is starting to see the full extent of a growing oil scarcity with all its economic and geopolitical consequences. Current estimates place the peak of global oil production around 2008-2010 (Deffeyes, 2001; Greene *et al.*, 2003). Meanwhile, oil consumers are struggling to diversify their oil supplies, but the location of the majority of the remaining oil reserves is dominantly in the Middle East, a region which will remain the focal point of global oil shipments. Although an energy transition is taking place towards renewable and more environmentally friendly resources, such as natural gas and eventually hydrogen, a move away from petroleum is likely to be decades away (Rifkin, 2002). Even a transition to natural gas, which accounts for substantial reserves, would be very costly as entirely new distribution infrastructures would be required, including additional LNG carriers, terminals and processing facilities. Meanwhile, an era of insecurity and vulnerability is likely to prevail as petroleum circulation increases, with strategic chokepoints bearing the brunt of the tension. Similar to the limited additional petroleum production capacity, the circulation capacity mainly dictated by the chokepoints of oil circulation does not leave much additional room to accommodate growth (Table 1). These geographical constraints cannot be easily bypassed and will be a significant factor in the global insecurity of oil supplies in terms of who will get preferential access to these limited resources. The situation is likely to become very tense with large consumers such as the United States and China in the second decade of the 21st century increasingly competing as the outlets of the Middle East handle the last large volume supply routes of the petroleum era. It is clear that solutions for petroleum distribution, namely the use of chokepoints, will require a rationalization of their use, as additional economies of scale in maritime shipping are difficult to achieve¹² and as alternative routes using pipelines are limited and insecure. In spite of all the challenges linked with oil circulation, “The Spice must flow”.

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¹² Not necessarily because of ship size, but because of terminal access.

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