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Petroleum Imports and Coastal Zone Management

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Abstract

With its growing net petroleum import position, the U.S. must accept continued dependence on tankers plying its coastal areas. Tankers also carry product exports, of course, a critical component in balancing supply and demand efficiently, and tankers and tank barges distribute oil along the coasts. Vessel owners have responded to oil spill legislation such as the Oil Pollution Act of 1990, however, with increased emphasis on safety, maintenance and spill prevention, thus reducing both the likelihood of a spill and its potential impact. This paper will review the data and trends in petroleum imports and coastwise transport.

Waterborne Oil Imports

Historical Trends

U.S. waterborne imports of oil increased sharply in the late 1980's, after a dip in the early part of the decade when the success of infill drilling kept U.S. production high and the price increases of 1979-80 kept demand low. From a low of 4.5 million B/D in 1983, waterborne imports had increased to 7.1 million B/D by 1989. The high prices in the Autumn of 1990 as the Persian Gulf conflict played itself out combined with sluggish economic activity to dampen imports. In 1990, the average fell below the 1989 level. While prices rapidly declined in early 1991, the economic recovery remained just over the horizon, so demand, and hence imports, fell again in 1991. The import rise in 1992 reflects the continuing U.S. production decline (U.S. crude oil and NGL

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supplies fell about 200 thousand B/D in 1992) and modest increase in petroleum demand (300 thousand B/D). (See Figure 1).

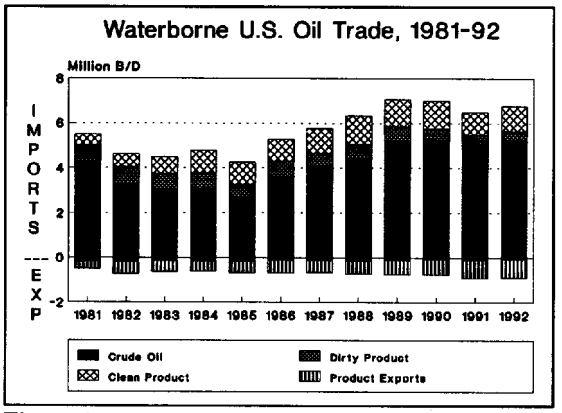

Figure 1

During the 1980's and into the 1990's, the source of U.S. imports shifted away from, and then back to, the long-haul Middle East suppliers. The pro-rationers of world production during the market tests of the early 1980's were first the OPEC nations, and finally, Saudi Arabia. Imports from OPEC at their nadir, 1.9 million B/D in 1983, were only 30% of their late 1970's peak. Middle East/Saudi Arabia bore the brunt of the decline, with a steeper and longer fall. By 1985, U.S. imports from Saudi Arabia were less than 200 thousand B/D, 12% of their prior 1979 peak. (Levels in 1991 and 1992, while Saudi Arabia has been virtually the only Middle East supplier to U.S. markets, have outstripped this 1979 high point, as discussed below).

The mix of product imports has shown a new trend in the last decade. The traditional product import was low-valued residual fuel oil coming to the East Coast from Caribbean refineries. But demand for residual fuel oil has fallen since the late 1970's, and imports have fallen to a small share of their early 1970's peak. In 1981, imports of residual fuel oil and other "dirty" products totalled about 775 thousand B/D, 60% of all product imports. By 1992, dirty products, at 375 thousand B/D, accounted for only 25% of the product total. The East Coast now accounts for almost 60% of all clean product imports, including supplies from the U.S. Virgin Islands. The region accounts for 90% and more of the imports of main finished products; other regions import a greater share of unfinished oils for further processing at refineries.

Imports in 1992

In 1992, the United States imported a total of 7.8 MMB/D, 6.8 of it waterborne. Crude oil accounted for more than three-quarters of the

waterborne imports, with the Middle East and trans-Caribbean[2] providing the highest regional shares of crude oil (almost one-third each) and trans-Caribbean shipments dominating product imports.

Crude Oil

As shown in the following graphs, the Middle East, the longest haul source, provided almost one-third of waterborne crude oil imports. The region's contribution was dominated by Saudi Arabia; supplying 1.6 MMB/D to its own Star Enterprise (which accounted for about 30% of the total), as well as other refiners, it has provided virtually all of the crude oil imported from the Middle East since the Iraqi invasion of Kuwait in 1990, and was the largest individual supplier of crude to the U.S. See Figure 2.

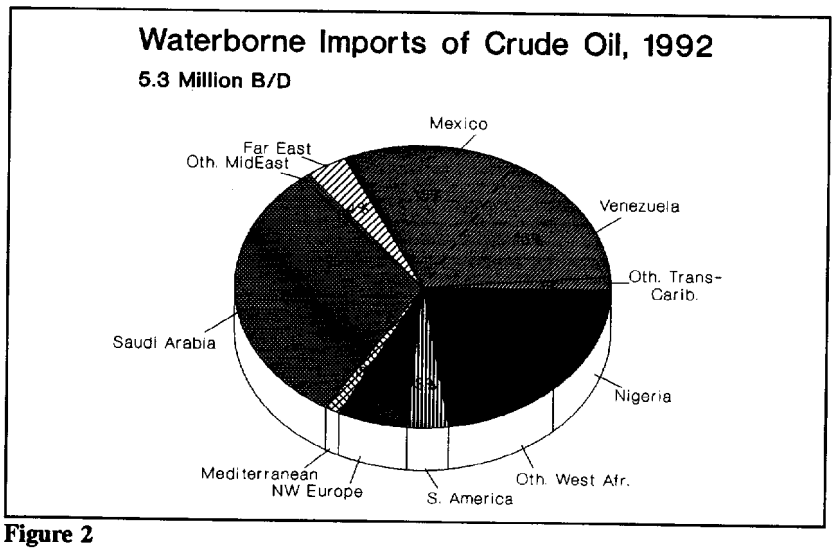

Figure 2

[2] The Energy Information Administration's country-of-origin data discussed in this section have been divided into tanker routes, rather than the conventional continental or political splits. Supplies from Venezuela, Mexico, the Caribbean Islands, and Central America are put together as "Trans-Caribbean." All of the countries ringing the Mediterranean or with access to it are combined: North Africa, southern Europe, etc.

Of course, the Middle East's exports to the U.S. have been constrained by U.S. policy (Iran), international policy (Iraq) and by physical capabilities (Kuwait and to some extent, Iraq). In its last six months of exports, Iraq supplied about 700 thousand B/D of crude oil to the U.S., well above its historical rate. (In 1988, for instance, Iraq exported less than 350 thousand B/D to the U.S.) Kuwait's crude oil supplies to the U.S. also boomed in the very late 1980's, quintupling from less than 20 thousand B/D in 1984-86 to more than 100 thousand B/D in 1987-89. UN sanctions continue to prohibit Iraq's oil exports as of this writing, and it is possible that U.S. prohibitions may continue after the UN's are lifted. Kuwait's oil facility rebuilding has proceeded rapidly. Expected to reach 2.2 MMB/D by the third quarter 1993, crude oil production capacity will then be restored to its pre-invasion level. Both nations will eventually be fully re-integrated in oil markets. The U.S. has long maintained sanctions/restrictions on imports of Iranian crude oil, which have limited supplies from that nation as well. Dependence on the Middle East will rise when each of the producers is again a supplier, and the overwhelming dominance of Saudi Arabia will decline. In the long term, dependence on the region will rise further, a reflection of the Middle East's geological pre-eminence.

U.S. also receives significant crude oil supplies from short-haul sources: Venezuela and Mexico rank second (at 820 thousand B/D) and third (780 thousand B/D) among countries supplying waterborne crude. Big buyers of Venezuela's crude oil are its joint venture refineries designed to run on these low gravity feedstocks: Citgo and Uno-Ven, which together account for 45% of U.S. crude imports from Venezuela. (It is interesting to note that Lyondell Petrochemical, the last of Venezuela's U.S. acquisitions and still under negotiation, received only a small share [3%] of Venezuela's crude imports in 1992.) Mexico's two largest U.S. customers, Chevron and Mobil, each accounted for less than 20% of the 1992 total. (When Pemex's joint venture with Shell at its Deer Park, Texas refinery is complete, that facility, too, will be a major customer.) These two nations dominate waterborne crude oil imports originating in the Western Hemisphere. The next largest supplier in the region, Colombia, provides less than one-eighth its neighbor's volume to the U.S. Nigeria's light, sweet crude oil, whose trans-Atlantic voyage is short-haul in tanker terms, maintains its traditional role as a key supplier, the fourth largest in 1992.

These four nations -- Saudi Arabia, Venezuela, Nigeria and Mexico -- together provided about three-quarters of the U.S. waterborne crude oil imports in 1992.

Product

As they have for decades, trans-Caribbean shipments (including Venezuela) dominate the product import trades; the region supplied half of all clean products and almost 60% of all dirty product imports in 1991. It is clear that the area will maintain its role. The Amerada Hess refinery on the U.S. Virgin Islands has its natural (and integrated) market on the U.S. East Coast; Venezuela, with a long history of supplying U.S. product demand, has made clear in its refinery investment plans that it will continue to meet more stringent U.S. quality specifications. See Figure 3.

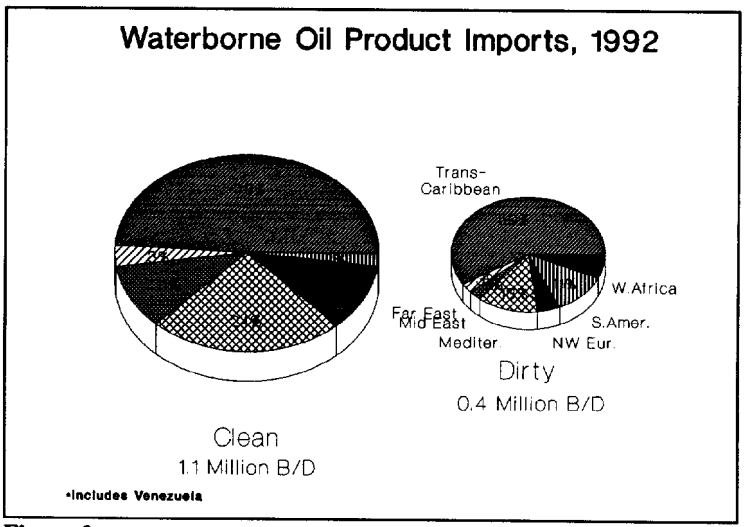

Figure 3

The Mediterranean also supplies significant product volumes. Algeria, for instance, is almost alone in providing non-utility customers in the Northeast with low pour low sulfur residual fuel oil for steam generation. Another component is Algeria's supplies of unfinished oils and petrochemical feedstocks.

Clean products, at 1.1 MMB/D, account for 75% of all waterborne product imports, and as noted, the largest category is unfinished oils, at 430 thousand B/D. The big consumption products, gasoline (with imports of 220 thousand B/D) and distillate (160 thousand B/D), take up much of the remainder.

Waterborne Exports

Historical Trends

The United States has of course not been a net exporter of oil for generations, and will not be again. Product exports have been rising rapidly since Federal controls were lifted in 1982. Amounting to 260 thousand B/D in 1980, the year before price and allocation controls were lifted, they doubled to 580 thousand B/D in 1982 when export controls were eased, and in 1992, were 950 thousand B/D. See Figure 4. Until the late 1980's, exports of surplus high sulfur residual fuel oil from the West Coast were the only important component. Recently, supply-balancing exports of light products out of the Gulf Coast have grown.

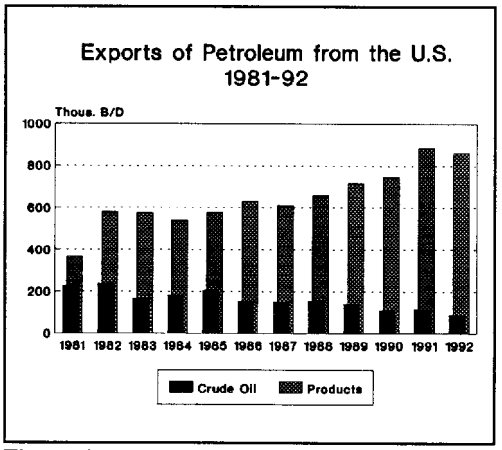

Figure 4

Crude oil "exports," never decontrolled, appear to decline because of shifting trade exchanges with Canada. Crude shipments to the U.S. Virgin Islands, classified as exports, have recently declined from 110-125 thousand B/D to less than 100 thousand B/D, moving down with Alaskan production. The only actual exports of U.S. crude oil have been the special regulatory exceptions provided to production from Cook Inlet in southern Alaska, which amounted to about 15 thousand B/D before availability and logistics changes made the deal uneconomic, and, currently, for some California crude oil, which amounted to only one thousand B/D in 1992.

The reasons for increasing product exports will remain throughout the 1990's: the globalization of world oil markets. Product exports are induced by economics -- regional prices reflect the regional supply/demand balance; exports obviously offer the opportunity for the market to correct. Electronic pricing information and worldwide futures markets have quickened price discovery, instantaneously transmitting price signals throughout world markets. The refiners' rapid response around the world has increased the efficiency of the oil market, and in the highly competitive refining environment ahead, companies will have to continue to maximize those efficiency gains.

Product Exports in 1991

Excluding the shipments to Canada, product exports reached 775 thousand B/D in 1992. The Persian Gulf conflict was a contributing factor to the large boost over 1990, as Kuwait-dependent consuming markets jostled for product imports. These consuming areas were hit doubly hard -- they had to scramble for crude oil to fill their refineries, and had to increase utilization to make up for lost product, but the local refineries did not match the sophistication of the shuttered Kuwaiti facilities, leading to a heavy fuel oil surplus in regions like the Far East. Europe and the Caribbean, too, bid supplies away from other areas. For the first time, the U.S. was a net exporter of distillate fuel oil on an annual basis in 1991; taking account of waterborne shipments only, it remained so in 1992.

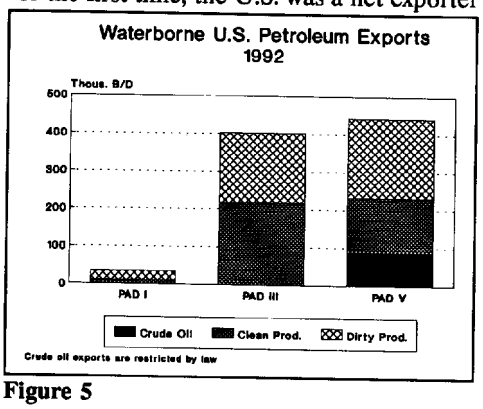

Figure 5

PAD III and PAD V are significant export regions. Excluding PAD V's "exports" of Alaskan North Slope crude oil, to the Virgin Islands, however, we see that the Gulf Coast dominates the clean product trade. Clean product exports from the region were about 220 thousand B/D in 1992, almost 60% of the total. PAD V exports of clean products approximately tripled between 1990 and 1992, to almost 150 thousand B/D. Dirty product exports from the Gulf Coast, having risen substantially in 1991 as market readjusted to the loss of Kuwaiti supplies, fell back in 1992 to the 1990 level. The West Coast, facing the Far Eastern glut of residual oil in 1991, has had approximately unchanged dirty product since 1990. Dirty product accounted for more than half of the product export total, a share eroded by the 1991-2 surge in clean product exports. See Figure 5.

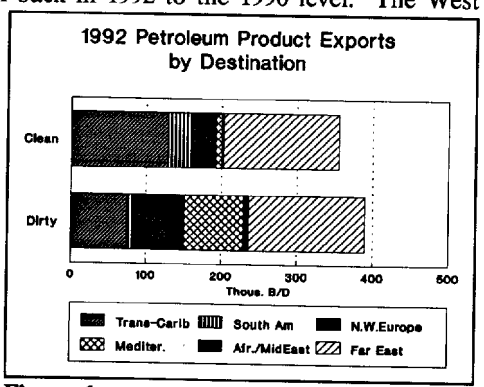

Figure 6

Figure 6 shows the destination of U.S. product exports. The largest recipients are the Far East (which takes about 40% of both dirty and clean

product exports) and the trans-Caribbean region (36% of clean products and 20% of dirty). The importance of the Caribbean region is recent. An important component is Mexico's new steady demand for U.S. product.

Waterborne Oil Movements within the U.S.

In addition to the highly publicized (and politicized) import traffic, oil is carried in tankers and tank barges between and within U.S. ports. The movements between PAD Districts, at 785 thousand B/D in 1992, is only a share of the total volume moved. Within PAD Districts, barges ply the waters along the East Coast, carrying both imported and domestic product, and along the Gulf Coast.

The Merchant Marine Act of 1920 (Jones Act) requires that all transit between U.S. ports be in U.S.-built, U.S.-flag vessels. The largest ships and greatest capacity carry Alaskan North Slope crude oil from Valdez to the West Coast and to Panama for transit to the Gulf Coast. (These Alaskan shipments to the Gulf Coast comprise the only significant inter-PAD waterborne crude oil movements; the shipments from Valdez to the West Coast remain within PAD V.) Smaller tankers and tank barges move product along the coasts.

Waterborne Shipments between PAD Districts

Pipelines are the first choice of oil transporters, since they are cheaper, and now, present less risk. Most oil movements from refining to consuming districts or from coastal to inland areas are by pipeline. Tankers, and to a lesser extent, tank barges, are used where pipelines are unavailable, or to transport heavy oils that cannot be pipelined, like residual fuel oil. Waterborne inter-PAD movements, 785 thousand B/D according to Energy Information Administration data, accounted for just 14% of total flows of oil between PAD's in 1992. The Gulf Coast's refineries are the largest source of product and the consuming regions in the East Coast and the Midwest are the big recipients of the inter-PAD trade.

As shown in Figure 7, the only major waterborne movements of crude oil between PAD's is Alaska's North Slope crude oil moving to the Gulf Coast. At 150 thousand B/D in 1992, it is past its peak. In future years, declining Alaskan production will shrink the West Coast surplus. (There are also pipeline shipments of Alaskan and Californian crude across the Southwest from California, not shown here.)

By far the largest waterborne product shipments between PAD's is the 390 thousand B/D of clean product going from the Gulf Coast to PAD I. These shipments, which are two-thirds gasoline, go primarily to Florida (Atlantic and Gulf Coasts) and other southeastern states. This Gulf Coast-East

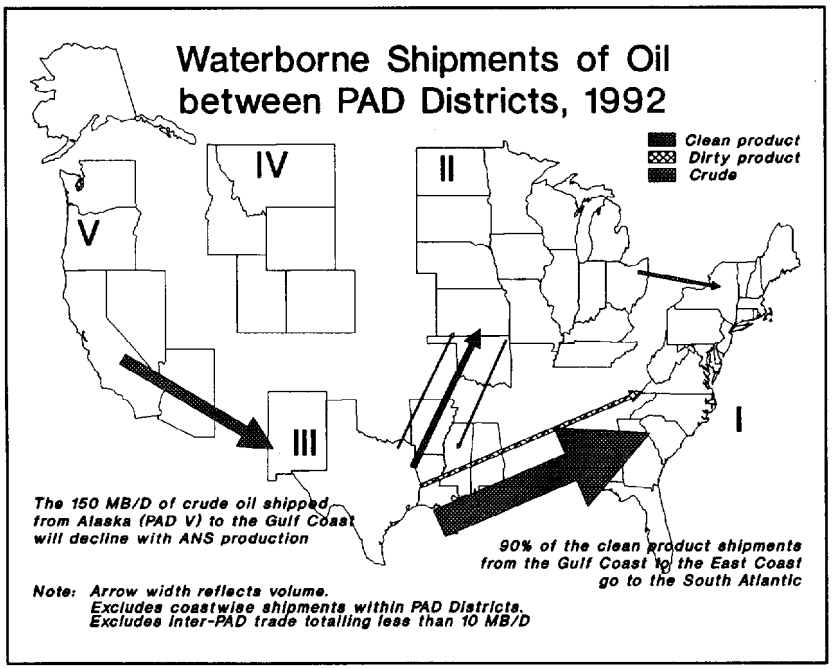

Figure 7

Coast traffic accounts for three-quarters of all the clean product movements, and virtually all of the coastwise movements between PAD's; the other inter-PAD movement are by inland barge, along the Mississippi or other river systems.

Waterborne shipments of dirty product out of PAD III to PAD I, 57 thousand B/D as reported by EIA,[3] constitute a small share of the total inter-PAD coastal traffic, about 10%. An additional 16 thousand B/D of dirty product moves between PAD's II and III, via inland barge.

The Outlook for Waterborne Commerce

Growing import dependency is inevitable, and a look at the Department of Energy/Energy Information Administration's *Annual Energy Outlook, 1993* illustrates one view of the level and pattern of demand and supply. EIA's

[3] Market intelligence indicates that the EIA's data may understate shipments of residual fuel oil between the Gulf Coast and the East Coast in spite of EIA's validation efforts. The missing flows would all be waterborne.

forecast for light product demand is more robust than many; this year's Reference Case falls at the high end of the range of published forecasts. In particular the EIA has very rapid light product demand growth, especially in the Sunbelt. The EIA's outlook leads to high estimates of necessary vessel traffic in the years ahead. I have overlaid EIA's regional demand forecasts with its national supply/demand estimates to illustrate the implications of EIA's forecast for regional imports.

EIA's Demand Forecast

In its Reference Case, EIA shows U.S. oil demand growing by 4.0 million B/D between 1990 and 2010, from 17.0 to 21.0 million B/D; two-thirds of the growth is in the three main light products, gasoline, distillate and jet fuel. The largest volume growth is in gasoline, with 1.3 million B/D incremental demand over the period; both the volume and the rate are similar to that experienced in the 20 years ending in 1990, a period of historic upheaval in oil markets and a period that ended with different equipment efficiencies and use patterns than it began with. Distillate outperforms gasoline substantially in percentage terms: in line with other forecasts, the use of distillate in the transportation sector continues to climb, dampened by the declining use of distillate for heating. Residual fuel oil demand shows significant growth, about 400 thousand B/D, or more than 30% over the period. The growth for residual fuel oil is a reversal, brought about by higher utilization in oil-fired power plants as a generation of nuclear and other electricity facilities are retired.

EIA's point of view is not the only one possible. In particular, its rapid growth in gasoline demand outstrips other estimates, and drives the need for incremental oil shipments. In the face of less robust growth, or even stagnant demand, the transportation growth -- feeding imported crude to refineries and transporting product to consuming markets -- is dampened. EIA's forecast also seems to have a high survival rate for refineries. If, as some others expect, the environmental product quality and facilities challenges cause refinery capacity to close, incremental oil transport will be imported, not coastwise.

On a regional basis, the pattern of EIA's forecast is very clear. As shown in Figure 8, the growth is primarily in the South and West. The lowest growth areas are the two Federal regions in the Northeast (Regions 1 and 2 on the map), the traditional oil importers. A move away from oil in the residential/commercial sector makes these two the only regions with a decline in distillate consumption over the period. While the rate of growth in the Rocky Mountain States is impressive, the region's volume remains unimportant in overall balances. The robust growth regions are in the Sunbelt -- the South Atlantic/Gulf Coast the middle Southwest, and California/Arizona. EIA estimates that these regions will have rapidly rising light product demand.

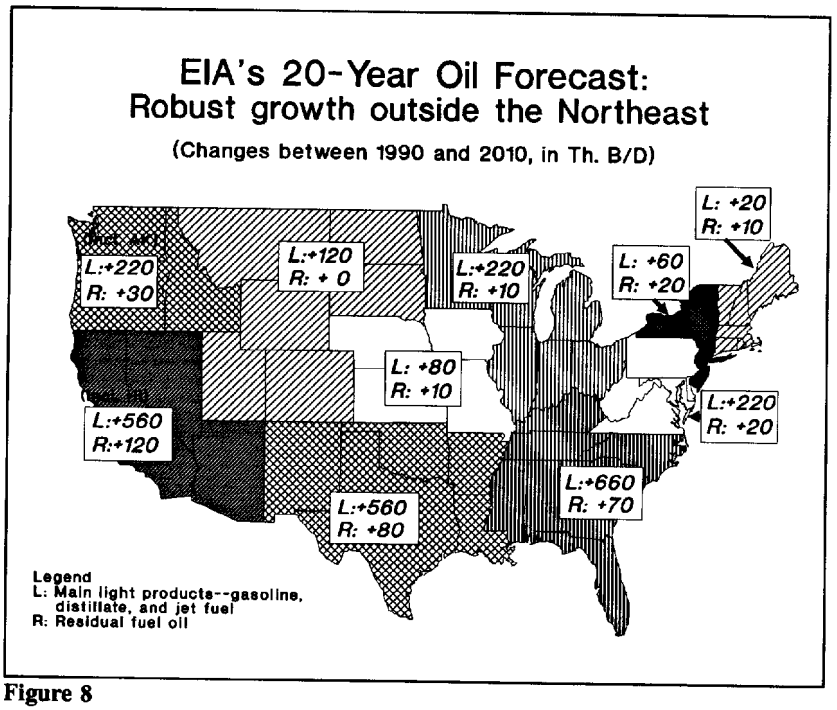

Figure 8

These regional patterns carry implications for coastwise shipping:

- The Sunbelt's growing product demand will require additional barge traffic in the Gulf Coast and Southeast, at least in the short term. Existing pipeline capacity is full, and announced expansions of the largest line, Colonial, to its southeastern markets will not fully accommodate EIA's forecast regional light product growth.

- The need for "black oil" (dirty) barges may also move South. However, incremental demand for residual fuel oil has traditionally been met from imports, a pattern likely to continue.

EIA's Supply/Demand Balance

EIA is forecasting increased oil imports and import dependency, just like other observers of the market. The trends at work were set in motion decades ago, briefly arrested in the early part of the 1980's, and resumed in the last five years. By 2010, imports in EIA's Reference Case will reach 13.1 million B/D, with net imports of 12.2 million B/D, for a net import dependency of 58%. EIA's outlook for domestic production includes sharp drops in Alaskan production (to 740 thousand B/D in 2010, cutting it to 42% of the 1990 level) and in Lower-48 production (the 660 thousand B/D decline, to just under 5 million B/D in 2000, is moderate in comparison).

The decline in U.S. production and the increase in demand falls directly on the balancing item: crude oil imports rise by 2.5 million B/D, or 40+%, over the 1990-2010 period, and product imports, in EIA's balance, rise by a staggering 2.6 million B/D, more than doubling.

EIA's balance for 2010 shows crude oil exports at about the 1992 level. (It is more likely, however, that these Virgin Islands-bound volumes would be pulled back to satisfy crude-short West Coast demand.) Product exports, driven by refining economics and world markets, remain at about the 1992 level as well.

EIA's forecast does not include a regional supply/demand balance, but we have made some broad assumptions to allow us to generalize about where the incremental imports will be going. The result is shown in Figure 9. The specifics of this exercise are less important than the overall image: big increases in product imports will be necessary on each of the three coasts, and crude oil increase will be split between the Gulf and West Coasts.

Crude Oil

The Gulf Coast, which feeds PAD II as well, must import to replace the decline in Lower-48 production and the cessation of Alaskan crude shipments to the Gulf Coast (both tanker and pipeline), and to supply increased demand. The region therefore takes about half of the increase in total imports, and all of the shift from pipeline to waterborne. PAD V imports have to replace Alaskan supplies. The shift in sourcing is not reflected in total tanker traffic: what used to come from Alaska in Jones Act ships will now come from abroad, probably in foreign ships. The East Coast gets a relatively small share of the incremental crude oil imports -- its refinery capacity is unlikely to expand, and it has traditionally been a net "importer" of product both from the Gulf Coast and abroad. The shifts in regional trade volumes will obviously impact the maritime industry's focus on different State laws.

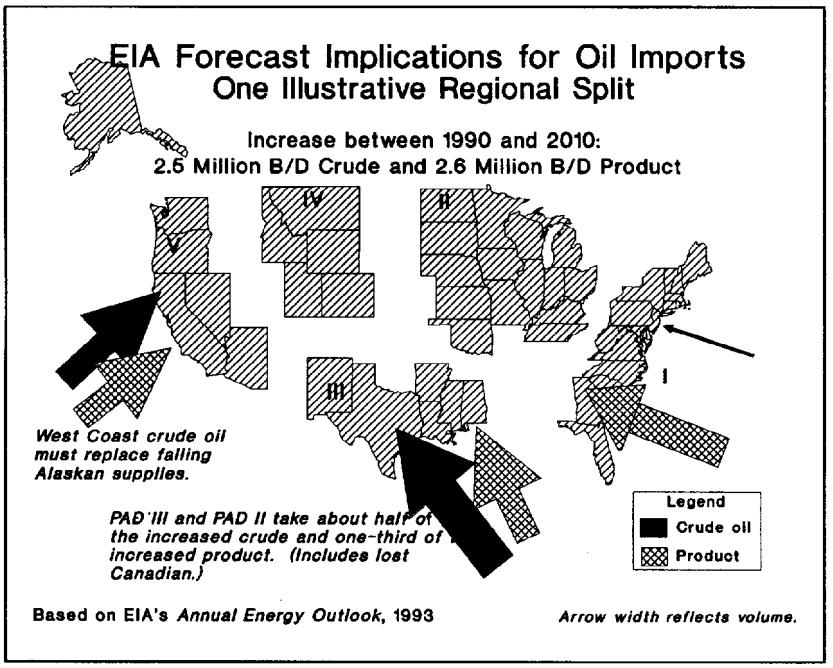

Figure 9

Products

Increased product imports are split about evenly among the three coastal regions. Because of EIA's very rapid demand growth in the Sunbelt, the East Coast's increase will be in the South Atlantic region. As noted, EIA's regional forecast is not based on PAD districts. Region 4, one of those with very rapid growth, straddles PAD I, PAD II and PAD III. The States included in the Region but not in PAD I -- Kentucky, Tennessee, Alabama and Mississippi -- accounted for almost 40% of the region's demand in 1989, the latest State-by-State data available. While on our map we have shown imports into Region 4 as East Coast volumes, it is likely that some fairly significant share of the increment will come into the Gulf Coast, not the East Coast.