



## Getting Petroleum Products to Market

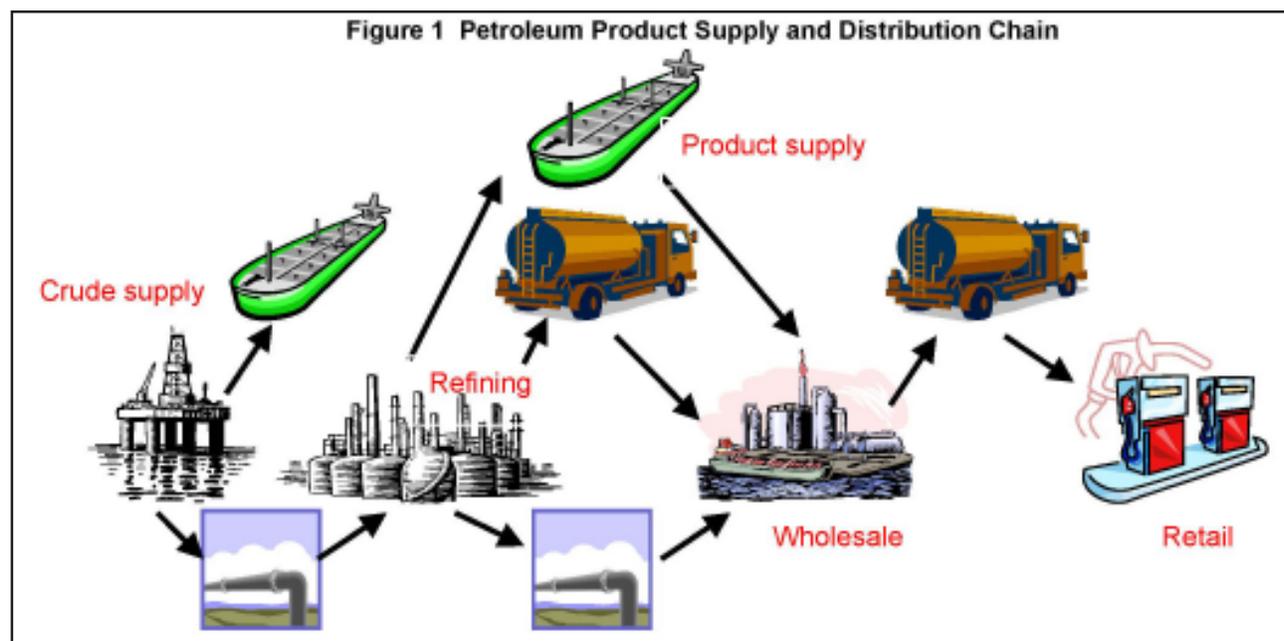
*The sharp price increases in the world oil market in 2007 and 2008 took everyone by surprise. And just as some oil analysts were forecasting US\$200 a barrel or even higher, the oil price collapsed in the last four months of 2008. The speed at which the price changes on the world market were transmitted to retail prices became the subject of much debate. Consumers the world over argued that something was not right with the way their petroleum markets were functioning, benefitting oil companies and harming consumers. What determines these prices? This briefing note provides an overview of the petroleum product supply chain and factors contributing to retail prices.*

Oil prices rose from 2004 to historic highs in mid-2008, only to fall precipitously in the last four months of 2008 and lose all the gains of the preceding four and a half years. The pace at which retail prices rose and fell during this period became the subject of much discussion. Consumers felt that retail prices caught up rapidly with world market prices as long as prices were rising, but fell all too slowly when the world oil price began to collapse. How does a petroleum product market work? What are the main determinants of retail prices? This note describes different stages in the petroleum product supply chain (Figure 1).

### Crude Oil Supply

The cost of crude oil is a major component in the

price of gasoline, kerosene, diesel, and other fuels. In 2007 in the United States, for example, the average retail price of regular gasoline was US\$0.74 per liter, of which the cost of crude was \$0.43 (or 58 percent), refining costs and profits \$0.13, distribution and marketing \$0.07, and government taxes \$0.11 [1]. Crude oils vary in price because they differ in quality. Crude oil is extracted and transported to a refinery, typically by ship or pipeline. Because each refinery is configured for specific types of crude, minimizing cost is not simply a matter of purchasing the lowest-cost crude. As [2] explains, the "sweeter" (less sulfur-containing) and lighter the crude oil, the more expensive it tends to be. Everything else being equal, the closer the refinery is to the source of crude oil, the lower the price of crude oil at the refinery gate.



## Refining

Crude oil is next processed into finished products in refining facilities. Refineries are generally large-scale and located near major markets with complex processing facilities adapted to the market requirements. These requirements include relative amounts of different fuels consumed—a market with high ownership of cars may consume more gasoline than one that is dominated by industrial activities requiring more fuel oil for boilers and diesel fuel for freight transport—and fuel quality such as the octane number of gasoline. Among Cambodia's neighbors, Singapore is the largest refining center. Spot prices (prices for immediate delivery and payment) of petroleum products in Singapore are quoted on a daily basis and set the benchmark.

## Product Supply

After refining, petroleum products of the required amount and quality are purchased and transported to storage facilities close to the final markets. This activity entails coordination of procurement and transport logistics, including considerations of volumes required, procurement methods, price, location, contracting terms, and supply reliability. Transport modes from refineries to secondary storage include marine tankers, pipelines, road tankers, rail, and barges. In Cambodia, the largest oil terminal in the country is at the site where there was once an oil refinery. Located some 10 kilometers north of the main port of Sihanoukville, the refinery opened in 1969 and was destroyed a year later at the outset of civil war. Sokimex holds a concession for managing the terminal. The pier serving the terminal is the primary point of entry for petroleum products and is managed by Sokimex Jetty Corporation. There are other smaller oil terminals in the country.

## Wholesale Distribution and Marketing

Wholesale distributors are generally synonymous with oil marketing companies, of which Sokimex is the largest in Cambodia. Other major wholesale distributors in the country include Tela, Total, and Caltex. Wholesale marketing involves the acquisition from the bulk supply link of petroleum products of the quality and in the volume appropriate to the market. Products are delivered by road tanker to the oil marketing companies' affiliated (branded) retail service stations, as well as to bulk consumers such as power generation plants, industry, large commercial customers, government agencies, and transport fleet operators such as trucking companies and bus operators. In other countries, oil marketing companies may also deliver petroleum products to independent retailers under supply contract sales arrangements. Oil marketing companies may own the assets used in its operations

(Sokimex runs its own fleet of road tankers) or outsource most of the road transport activities to independent owner-operators and use storage depots owned by others under throughput fee arrangements.

## Retail Distribution and Marketing

Retail marketing involves selling gasoline, diesel, and lubricants at service station outlets and kerosene and liquefied petroleum gas (LPG) through other shops. Depending on the arrangements with dealers, oil marketing companies have varying degrees of ownership of the assets of their own network. When an oil marketing company first enters a new market, it is common to start out with largely self-owned and operated facilities such as trucking and service stations, but many increasingly outsource such activities as the business matures. The degree to which oil marketing companies own and operate assets varies by company philosophy, strategy, and the level and duration of involvement in a particular market.

## Special Case of LPG

LPG can be sourced from a refinery or a natural gas processing plant. Natural gas is a mixture of several compounds including LPG components, and LPG is separated from the rest of natural gas during gas processing. Worldwide, 60 percent of LPG comes from natural gas. LPG is transported by large LPG carriers, pipelines, or trains to storage terminals which may be underground, refrigerated, or pressurized. LPG is next delivered by train, road, coastal tanker, or pipeline to cylinder filling plants and intermediate-size storage areas where it is generally stored in pressurized vessels or spheres. Cylinders are filled with LPG at bottling plants. Trucks transport LPG cylinders from the bottling plant to retailers as well as to bulk customers. LPG is available to end-users through cylinder sales points such as commercial stores and service stations.

LPG can be used for many different purposes: for cooking, heating, air conditioning, refrigeration, and as an automotive fuel. Because LPG is transported and stored in pressurized containers, it is more expensive to distribute than liquid fuels. To use LPG as an automotive fuel, the vehicle engine needs to be modified. There are three barriers to using LPG as a household cooking and heating fuel. First, the household needs to pay a down deposit for an LPG cylinder, which could cost upwards of US\$20 a cylinder. Second, LPG is not a cheap fuel. Its world price doubled between 2004 and 2008, and metal management—distributing and storing LPG in pressurized containers—adds to the cost of using LPG. Third, because LPG needs to be stored

under pressure, it is sold in discrete quantities matching the size of the LPG cylinder, typically in increments of 10–15 kilograms at a time for household use. A daily wage earner may have just enough cash to buy a very small quantity of kerosene for cooking every so many days, but such a purchasing pattern is not generally an option for LPG users. Introducing small LPG cylinders addresses this barrier to a degree, but international experience has been mixed. Because there are economies of scale in cylinder management, selling LPG in small cylinders substantially adds to the cost of fuel distribution, making LPG much more expensive on a weight basis.

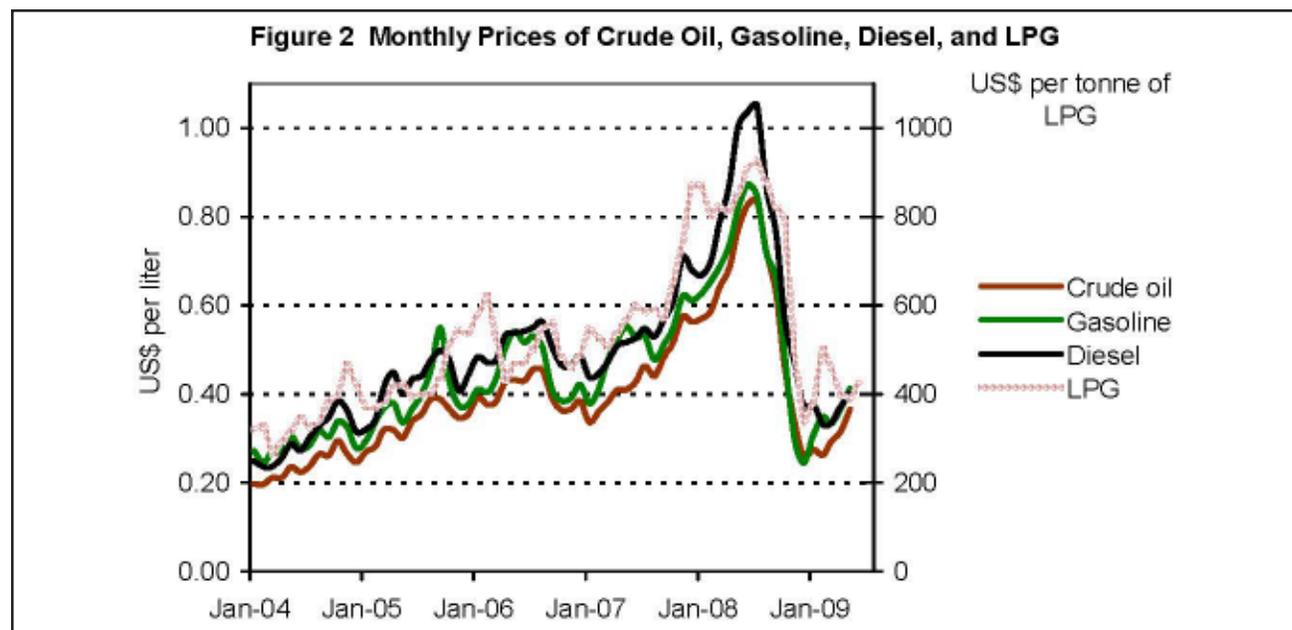
## Factors Affecting International Prices

Prices are determined by as much by the balance between supply and demand as by costs of production. This can be readily seen by considering the crude oil price movement since January 2004 (Figure 2). The price more than quadrupled by mid-2008, not because the cost of crude production had quadrupled, but because global demand for oil grew much faster than the rate of supply increase during this period, creating a tight market. Similarly, oil prices collapsed in the last four months of 2008, not because it suddenly became much cheaper to produce crude oil, but because demand for oil collapsed in the face of the world financial crisis.

Because crude oil accounts for most of the production costs of refined products (77 percent in the U.S. example given above), the prices of petroleum products rise in tan-

dem with crude oil prices, but even here there is no one-to-one correspondence between crude price and product price changes. This is apparent from comparing the prices of gasoline and diesel in Singapore in Figure 2. Their prices were the same in some months but diverged sharply in May–July 2008. Between January and June 2008, the average of three benchmark crude oil prices rose 45 percent, the price of regular gasoline in Singapore rose 39 percent, and that of diesel rose 55 percent. The much higher diesel prices reflect greater demand resulting in a much narrower supply-demand gap for diesel than for gasoline, driven in Asia in part by China reportedly building stocks of diesel ahead of the Beijing Olympics and coal shortages requiring more diesel use for power generation. Widespread power shortages generally increase demand for diesel fuel and drive up diesel prices. There are also seasonal variations in demand: gasoline is consumed more during the summer driving season in the northern hemisphere, and conversely demand for heating oil increases in winter. Demand fluctuations in large markets can affect global demand and hence world prices. Refineries can, to a degree, adjust production of different fuels to better match demand, but conversion of residual fuel oil to gasoline and diesel or a large increase in the production of diesel in the place of gasoline would require new processing units and large investments.

Looking to the future, (relatively) low oil prices and the financial crisis are resulting in delays and cancellations of oil projects, raising the specter of a supply shortage once the



**Sources:** Platts Oilgram Price Reports for crude oil, gasoline and diesel, Reuters for LPG.

**Note:** Crude oil is the average of West Texas Intermediate, Brent, and Dubai Fatah. Gasoline is 92 research octane number unleaded and diesel is 0.05 percent sulfur gasoil in Singapore. LPG is the average of Saudi Aramco contract prices for propane and butanes.

global economy begins to recover. Underinvestment today could indeed erode spare capacity with economic recovery and oil supply could begin to tighten again, taking the world oil market into a new cycle of high prices.

## Factors Affecting Domestic Prices

The landed prices of petroleum products are determined by the developments in the world oil market. Shipping petroleum products to Cambodia incurs costs for freight, insurance, wharfage (charge assessed against cargo for usage of a wharf or pier and its facilities), inspection, demurrage (charge for detaining a ship over and above the time normally given to unload), and marine transit losses (the amount unloaded in Cambodia would always be slightly less than the amount of fuel loaded). Congested ports, slow customs clearance, and any other factor delaying discharging of the fuel could incur large demurrage costs. Once landed and sent to a bulk oil terminal, petroleum products incur additional costs, including storage, transport, retailing, and wholesalers' and retailers' profit margins.

Because crude oil and petroleum products are quoted in U.S. dollars, exchange rate fluctuations affect domestic prices. However, the Cambodian economy is highly dollarized and the relationship between the riel and the dollar has been stable.

Taxes make up a sizable fraction of retail fuel prices in many countries. Taxes on petroleum products are a critical source of government revenue for low-income countries because taxing fuel is one of the easiest ways to get revenue: collecting fuel taxes is relatively straightforward and there is generally a robust relationship between consumption of fuels as a group and income—consumption tends to go up at the same rate as income [3]. In Cambodia, petroleum products are subject to import, excise, and value-added taxes and a small specific tax. The first three are in percentage terms, and as such price increases are magnified in absolute terms as international prices rise. For example, an excise tax of 33.3 percent on 900 riel is 300 riel, but becomes 900 riel if the fuel price triples. That is to say, taxes levied in percentage terms transmit any change in world oil prices to the final end-user prices. In contrast, specific taxes, which are set in riel instead of in percentages, are independent of the price of the fuel, making their “rates” relatively high when world oil prices are low (that is, when translated into percentage terms, the tax rate is high), and conversely low when world oil prices are high. In Cambodia, import, excise, and value-added taxes are based on reference prices rather than the actual landed costs, and the government froze the reference prices in 2004, keeping them artificially low when the world oil prices soared in the subsequent years. This step correspondingly prevented the retail prices from rising in tandem with world oil prices, benefitting consumers but at a significant cost to the treasury.

Relative magnitudes of the above components may be gleaned from the suggested retail price structure of refined products in Tanzania in November 2008. Taking kerosene as an example, kerosene at the port of loading cost US\$0.47 a liter, freight and insurance \$0.06, wharfage \$0.008, inspection upon landing \$0.006, and transit losses \$0.003. Local transport costs add \$0.008 a liter, oil marketing companies' margins \$0.083, and taxes and other government-imposed fees \$0.05, resulting in a suggested retail price of \$0.69 a liter; taxes and other levies on gasoline and diesel are much higher than for kerosene [4].

As with the prices on the global market, supply and demand interactions influence domestic prices. Fuel shortages cause retail prices to soar, and a large surplus tends to push down prices. The market structure and the level of regulatory enforcement matter—a lack of competition tends to keep prices higher than in a highly competitive market, and rampant commercial malpractice (short-selling, mislabeling, fuel adulteration) also affect price levels.

## Observations

Petroleum product prices are determined by demand and supply in the world and local economies. Global fuel demand is affected mainly by economic conditions, and also electricity supply shortages (for diesel) and the weather (for heating oil). A disruption anywhere in the supply chain could lead to fuel shortages and price hikes. In addition, the market structure and consumer behavior in the petroleum sector also affect the price movements, which will be the subject of the next briefing note.

## References

- [1] [www.eia.doe.gov/bookshelf/brochures/gasolinepricesprimer/printer\\_friendly.pdf](http://www.eia.doe.gov/bookshelf/brochures/gasolinepricesprimer/printer_friendly.pdf).
- [2] World Bank. 2007. “Introduction to Oil and Gas” Petroleum Sector Briefing Note No. 1, March.
- [3] Robert Bacon. 2001. “Petroleum Taxes.” <http://go.worldbank.org/FTOBS3ETC0>.
- [4] EWURA. 2008. [www.ewura.go.tz/pdf/Notices/2Petroleum%20Pricing%20Formula%20-%20November%202008.pdf](http://www.ewura.go.tz/pdf/Notices/2Petroleum%20Pricing%20Formula%20-%20November%202008.pdf)

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