Petroleum Federation of India

Recommendations on the Terms of Reference of Expert Group on Pricing of Petroleum Products

August 29, 2013

McKinsey & Company Report to Petrofed

Recommendations on pricing of petroleum products

Background :

The Government of India has set up an Expert Group under the leadership of Dr. Kirit S Parikh, former member, Planning Commission, with the following Terms of Reference:

■ To revisit the current pricing methodology of petroleum products and recommend a pricing mechanism benchmarked to export parity pricing, which also relates to the actual freight on board (FOB) export realisation of the petroleum products exported from India by private refiners

■ To suggest a fair formula to compensate for the under-recoveries of both the domestic suppliers of petroleum products and the oil marketing companies (OMCs)

■ To examine the operational and procurement efficiencies of the OMCs and suggest ways to improve the same.

McKinsey& Company was asked by the Petroleum Federation of India to provide an independent point of viewon each of these areas, taking into account inputs provided by PetroFed and its member companies.

In addition to interactions with the industry, we have:

■ Studied global pricing practices and their application to India's situation

■ Benchmarked Indian refining industry economics versus global refiners

■ Analysed the profitability of Indian refineries under various pricing regimes

■ Assessed India's ability to be self-reliant in refining given the Indian and globaldemand–supply outlook

■ Examined the current payment and sharing mechanismfor subsidy by the oil and gas industry

■ Understood operational improvements undertaken by the industry, and potential improvements from further initiatives and the application of global best practices.

SUMMARY OF RECOMMENDATIONS

A key element of energy security for India is a viable and efficient oil and gas sector. We believe that to set prices of wholesale petroleum products, India needs to balance two key factors.

■ First, it must incorporate free market pricing signals to drive operating efficiencies

■ Second, it must enable a minimum threshold of industry profitability to ensure supply security,that is, allow the industry to service capital commitments – almost 29 MMTPA of additional refining capacity that is expected to come on stream by 2017, and the USD 7 to 8 billion of expansions, upgrade and new capacity like CPCL, BORL, HMEL's Bathinda refinery that have come onstream recently – and further invest to add the 30 to 40 MMTPA of additional capacitythat will be needed in the next 7 to 8 years[1]and make the necessary technology upgrades needed.

Therefore, corresponding to the three terms of reference of the committee, we would suggest that the committee urges the government to:

1. Let the market determine product prices at both the refinery gate and the retail level. In case the government decides to continue to regulate prices, then in order to achieve India's dual objectives of efficiency and industry viability, it should price the controlled products (diesel, kerosene and LPG) at import parity price (IPP)[2] or more. This is required to overcome the structural

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[1] 30 to 40 MMTPA of additional capacity would be needed over the next investment cycle of 7 to 8 years; this is a conservative estimate that is based on the growth estimate put forth by FACTS. If the Planning Commission's demand estimates were to materialise, then additional capacity of 85 to 95 MMTPA will be required.

[2]IPP: Import parity price denotes the price at which buyers have an alternative choice to import. Hence, as per trade flows from the Arab Gulf to Singapore for diesel, diesel prices in India should be FOB (Arab Gulf) + insurance + sea freight + duties and taxes + receiving charges + inland freight. EPP: Export parity price denotes the price at which sellers have an alternative choice to export; for the purpose of this report we have used the current PPAC definition that defines EPP as FOB (Arab Gulf), which needs to be adjusted at an individual country level to reflect true export parity prices. EPP, or export parity pricing, is defined as the producers' alternative, i.e. the price which the producer is likely to get if he were to export instead of selling in the domestic market. Hence, this should ideally mean the price of the product in the international market which could be a potential buyer for his products (can be estimated by looking at international product trade

disadvantage in refining margins worth USD[3]4.5/bbl to USD 6.5/bbl that the Indian refining industry faces as compared to international refining hubs. Of the 17 Indian refineries that we assessed, we found that if status quo was to continue (diesel at TPP, kerosene and LPG at IPP), at 2012–13 prices of crude and products (which is the middle of the current refining cycle), only 2 out of 17 refineries – 30 to 40 per cent of refining capacity– generate net refinery margin (NRM, that is, GRM less cost of refining) of more than USD 3/bbl (needed to cover the cost of working capital), with the average NRM of these 15 refineries near zero (USD 0.4 to 0.5/bbl).

2. Recognise the precarious energy security and fiscal situation that has been caused by the current practice of under-recovery compensation from within the industry (today the government takes 94 to 95 per cent of the surplus generated by upstream companies; after adding the statutory levies (USD 17 to 21/bbl) and corporate tax (USD 3/bbl), the government take became USD 80 to 83/bbl, or 94 per cent of gross surplus (gross surplus being crude price [USD 110 to 111/bbl] minus cost of production [USD 23 to 25/bbl]). To restore viability to the industry, the government should implement an upstream crude pricing formula that ensures a USD 65/bbl crude realisation for upstream companies, which is the minimum, required to redevelop depleting Indian reservoirs, and invest sufficiently in exploration and overseas assets. This is bound to go up as we increasingly move offshore into deeper waters and the domain of unconventional oil. Not doing so would significantly reduce crude production and the resultant government tax revenue, increase foreign exchange outflows, and substantially increase India's overall cost of crude since it will need to be

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flows) less all the cost required to get the product there. Using this, the EPP for diesel in India should be the price of diesel in international markets less (shipping cost + loading/unloading + port charges + inland freight + insurance + any other cost of getting the product on the ship). However, currently, India defines EPP as the FOB price of diesel at Arab Gulf. This appears to assume that, if India were to export diesel, it would export to the Arab Gulf. Moreover, the cost of getting the product to Arab Gulf would be free of any cost. This is not reflective of world reality. As of today, trade flows suggest that net diesel product flows from Arab Gulf to Singapore (trade hub). This is further strengthened by price differential between diesel price indices (as reported by Platts), which shows the price of diesel at Arab Gulf as consistently lower than that at Singapore (difference being similar to the cost of getting the product to Singapore). This suggests that the EPP of diesel for India should also be set with reference to Singapore and the destination of the product. Hence, EPP of diesel for India should be equal to FOB price of diesel at Singapore less (shipping cost + loading/unloading + port charges + inland freight + insurance + any other cost of getting the product on the ship). To keep the formula simpler, and to avoid any differentiation between different refineries, the formula may be simplified as EPP (diesel) = FOB (diesel at Singapore) - Sea Freight (from relevant port to Singapore).

[3]Given the extreme volatility that we are observing in the forex market, for the purpose of this calculation the exchange rate has been assumed to be around Rupee 55-57 to USD; this will need to be adjusted once the market stabilises.

imported at USD 90 to 110/bbl. Funds required to compensate the industry for under-recovery should be made up from consumer price increases and, if necessary, through adjustments in the central and state government taxes and not through passing the burden to any segment of the industry as at present.

3. Accelerate industry wide improvements in procurement, and operational and marketing efficiency as an on-going process. These can be brought about through measures taken by the government (for example, crude procurement policies hemmed in several cases by Government policies, shipping restrictions, clarity on a roadmap for product specifications, and funding of safety stocks) and by the industry (for example, integrated margin management through crude and product optimisation, inventory rationalisation, refinery operational improvements, etc.).

The rest of this document details the rationale behind each of these recommendations.

1. CONTROLLED PRODUCTS SHOULD BE PRICED AT IMPORT PARITY

Let the market determine product prices at both the refinery gate and the retail level. In case the government decides to continue to regulate prices, then in order to achieve India's dual objectives of efficiency and industry viability, it should price controlled products (diesel, kerosene and LPG) at IPP or more. There are several reasons for this, including India's need for new refining capacity and, therefore, sufficient return on refining investments; global experience of markets that are deficient in crude and/or products; structural cost disadvantages faced by Indian refiners relative to international refining hubs; and the practical prospect of a large number of existing refineries facing even greater financial stress than at present with a change in pricing formulae. These reasons are elaborated below.

1.1 Refining self-sufficiency is a prudent goal for India

India has followed a policy of maintaining refining self-sufficiency for several years. This policy remains a prudent one in today's global oil industry for four economic and strategic reasons:

■ The cost of freight for importing crude is lower than freight for importing products, since products are more voluminous, more in number and typically transported in smaller parcels. Therefore, it is more economical to import crude than products. For example, the sea freight to transport crude oil from the Arabian Gulf to India is only USD 0.8 to 1.0/bbl versus USD 1.8 to

1.9/bbl for diesel; similarly, the average inland freight cost in India for products is USD 0.2 to 0.4/bbl higher than that for crude.[4] This translates to an annual additional expenditure of USD 1.2 billion to 1.9 billion at India's current crude import levels of 1.3 billion bbl/year (Exhibit 1).

■ Global crude markets are deeper than product markets. Therefore, buying crude offers India better supply security and greater flexibility on energy policy. For example, crude volumes traded over the last 10 years were 6 to 8 times that of diesel volumes traded globally, and 10 to 16 times that of petrol volumes traded globally. Further, thevolatility of crude oil volumes is 5 per cent compared with 15 per cent and 19 per cent for petrol and diesel, respectively (Exhibit 2). India's relatively large consumption has the potential to swing shallow product markets to the country's disadvantage. This is especially relevant as large consumers like India and Japan have been subjected to similar price swings (that have challenged their supply security) in essential commodities like fertiliser and gas, respectively. Refining is a low margin business globally (Exhibit 3), with refining capacity shutting down across multiple geographies (Exhibit 4), putting further pressure on the depth of product markets.

■ Refining crude oil in India adds substantial value to the economy:

   – Domestic refining has a substantial part of India's GDP, since value addition activity occurs within the country and also has a large positive multiplier effect. In addition, domestic refining directly reduces the current account deficit by reducing foreign exchange outgo, since the value of crude imported is lower than the value of products which would have otherwise been imported

   – Refining generates employment, both directly (total employment generation of the downstream petroleum industry is 90,000 to100,000 in 2013) and indirectly (likely to be 5 to 6 times direct employment) for a total of about 600,000 to 700,000 jobs

   – The refining sector's net contribution (net of subsidies) to the government exchequer has always been positive. For example, the refining sector's cumulative net contribution to the government in 2011−12 was about INR 35,000 crore (net of subsidy and under-recoveries).This does not include additional contribution to the government in the form of income taxes on earnings and indirect taxes (of company employees and ancillary units).

[4]Benchmark sea tanker freights based on Worldscale and Bloomberg.

■ Refining is a key building block for the growth of the chemicals industry (Exhibit 5). With over 90 per cent of the global petrochemicals capacity being co-located with refineries, refining becomes a key building block for several crucial petrochemicals chains, including olefins (ethylene and propylene and their polymers), vinyls (EDC, VCM, PVC and chloro-chemicals), aromatics (benzene, toluene, xylene, PX/PTA, polyester), acrylics, engineering plastics and other downstream derivatives.

EXHIBIT 1

Cost of freight is lower for crude than for products
USD/bbl

Cost to importing 1 barrel of crude oil vs. 1 barrel of products

Crude oil logistics costs | **Products logistics costs**

USD 0.9-1.4 /bbl
or INR 0.34-0.53/l

Logistics cost savings to the tune of USD 1.2-1.9 Bn[2]

Crude oil logistics costs:
- Sea freight[1]: 0.8-1.0
- Inland freight: 0.7-0.9
- Total: 1.5-1.9

Products logistics costs:
- Sea freight[1]: 1.8-1.9
- Inland freight: 0.9-1.1
- Total: 2.4-2.9

1 Sea freight from AG to India; 2 Estimated for current levels of crude import at about 1.3 billion barrels of crude oil per year

SOURCE: Bloomberg; Worldscale; McKinsey benchmarks; Expert interviews; McKinsey analysis   McKinsey & Company |

EXHIBIT 2

Global crude markets are much deeper than product markets

XX Size of market relative to crude

Volume of crude oil, diesel and petrol traded globally[1]

Mn bbl/yr

Volume Volatility[2]

Crude oil — **5%**

6-8x

10-16x

Diesel — **19%**

Petrol — **15%**

2002 2004 2006 2008 2010 2012

1 Crude world market defined as combined imports and petrol, diesel markets defined as combined exports of 104 countries covered by JODI
2 Defined as ratio of standard deviation to mean

SOURCE: JODI Crude and Petroleum Product Balance Data; McKinsey analysis

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EXHIBIT 3

Internationally, refining is a cyclical and low margin business

Average variable refining margin for different types of refineries in Singapore (Dubai Crude)

USD/bbl

Hydrocracking   Visbreaking   Hydroskimming

2.50 – Average variable refining Margin for medium complexity refineries

1995   2000   2005   2010   Mar 2013

SOURCE: Platts; Bloomberg; Worldscale; McKinsey analysis

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EXHIBIT 4

Globally 70+ refineries have shutdown in last 3 years, with many oil majors reducing commitment in downstream

ILLUSTRATIVE

North America
- **Number of refinery shutdowns:** 13
- **Total capacity of shutdown:** 50 MMPTA
- **Aug 2012:** BP sells refinery & retail assets to Tesoro
- **Oct 2012:** BP sells Texas refinery, and US Southeast retail and logistics assets to marathon

Asia and Australia
- **Number of refinery shutdowns:** 37
- **Total capacity of shutdown:** 85 MMTPA
- Shell sells downstream business in New Zealand (incl. 229 stations)

Cumulative capacity of refinery shutdown
- >25 MMTPA
- 10-25 MMTPA
- <10 MMTPA

South America
- **Number of refinery shutdowns:** 4
- **Total capacity of shutdown:** 39 MMTPA
- **Apr 2011:** Shell sells downstream business sin Chile to Quinenco

Europe
- **Number of refinery shutdowns:** 18
- **Total capacity of shutdown:** 91 MMTPA
- **Jan 2010:** Exxon sells downstream business in Austria (incl. 135 stations)
- **Mar 2011:** Chevron sells UK refinery, 1000 retail stations to Valero

Overall 70+ refinery closures totaling ~270 MMTPA capacity over last 3 years

SOURCE: Company strategy presentations; IHS Herold; McKinsey analysis

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EXHIBIT 5

Refining is a key building block for growth of petrochemicals

Share of petchem cracking[1] and refining capacity for top 20 countries – by Refining capacity

Percent

	% of world refining capacity	% of world petchem[1] capacity
United States	21	18
China	11	11
Russia	6	2
Japan	5	5
India	5	3
Korea (South)	4	5
Italy	3	1
Saudi Arabia	2	10
Brazil	2	3
Germany	2	4
Canada	2	3
Iran	2	4
United Kingdom	2	2
Mexico	2	1
Spain	2	1
France	2	2
Singapore	2	2
Taiwan	2	3
Venezuela	1	0
Netherlands	1	3

Saudi Arabia, Mexico and Venezuela do not use Naphtha as feedstock – hence exceptions

Most countries use Naphtha from refining as feedstock for petchem units – hence significant presence of petrochemicals capacity can be seen along with refining capacity

1 Naphtha cracking capacity

SOURCE: CMAI; World bank data; McKinsey analysis

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1.2 Indian refiners have structural and regulatory cost disadvantages

Indian refineries suffer from material structural cost disadvantages compared to deep refining hubs like the US Gulf Coast (USGC) and Singapore. These disadvantages amount to USD 4.5 to 6.5/bbl, which is equal to or greater than the total gross margin available to the industry on average. In addition, inconsistencies in regulation and taxation within the industry adversely impact several refineries and result in even higher disadvantages relative to global refiners.

■ Disadvantages due to structural reasons, worth USD 4.5 to 6.5/bbl(Exhibit 6):

– Shipping and port charges: Shipping costs to and from India are higher (for similar distances) than other locations due to the limited flexibility to charter shipping lines to transport crude; for example, the cost of shipping crude from the Arab Gulf to Singapore is about USD 1/bbl, while it is USD 0.8/bbl to India, despite the shipping distance being nearly half. Further, due to constrained infrastructure, the various port-related charges are higher than other countries; for example, wharfage for unloading crude oil is INR 12/MT at Mumbai (it can range from INR 12 to 100/MT across the country; the weighted average is around INR 50/MT), while it is SGD 0.20/MT at Singapore, that is, INR 9 to 10/MT

– Locational disadvantages: With almost 20 to 25 per cent of India's total refining capacity located inland, exporting products can lead to an additional inland transportation cost of USD 1 to 1.5/bbl (along with higher working capital since some crude is perpetually blocked in the pipeline system)

– Higher interest rates: Higher interest costs on working capital and projects imply a need for higher returns to profitably pay back capital. For example, the prime lending rate (PLR) in India is 10.25 per cent compared with a PLR in Singapore of 5.38 per cent

– Low asset complexity: India has older refineries that are often less complex and have structurally lower operational yields (Exhibit 7)

– Costlier power: Poor grid availability and reliability makes refineries dependent on fuel oil or naphtha-based captive power units; this leads to an additional cost of USD 1-2/bbl (some international hubs, like the Arab Gulf, also enjoy the benefits of abundant, cheap natural gas)

– Procedural issues: The current procurement processes at PSUs lead to low flexibility and multiple inefficiencies for both commodities and capital. For crude procurement, for instance, India is one of only three countries in the

world that continues to rely on a tender- based system that constrains flexibility in procurement, negotiation and timing of purchase, and introduces substantially high lead times and margin uncertainty for refiners

– Other factors which put pressure on margins include high marketing costs due to universal service obligation; underdeveloped road, rail and port infrastructure; and the National Contingency Calamity Development Board charges (INR 50/MT or around USD 0.10/bbl plus 3 per cent cess).

■ Disadvantages due to regulatory and taxation practices and inconsistencies for several refineries:

– Refineries located in the north-eastern part of the country face inconsistent taxation and pricing as compared to the rest of the country. First, VAT at 5 per cent and an entry tax at 2 per cent arecharged on domestic crude, making it more expensive than imported crude. This impacts 3 of 4 refineries disproportionately since they use only domestic crude (around 75 per cent of total crude consumption of refineries in the region is domestic). While entry tax concessions on products are available, the net negative impact remains about 5.8 per cent.

– Several other refineries processing domestic crude oil suffer disadvantage of irrecoverable VAT/CST.

– Standalone refineries incur higher cost compared to integrated, multi-location OMCs on account of CST (effective 2.25 per cent as CST is payable on base price and excise duty) and coastal freight. Also, with increase in refinery transfer prices the incidence of CST under recovery will increase. This applies only to standalone refineries since they do not have multiple stocking points in states to allow stock transfer (for example, CPCL incurs an additional cost of USD 0.4 to 0.5/bbl). This difference in cost may range up to USD 2.7/bbl to USD 3/bbl for CST and USD 0.4/bbl to USD 1.0/bbl for coastal freight. Standalone refineries, unlike the OMCs are more structurally disadvantaged due to lack of marketing. Integrated OMCs incur a lower CST due to their sales in destination states taking place after the stock transfer. Standalone refineries,like CPCL, MRPL, BORL, HMEL (Bathinda), EOL, RILand NRL, are unable to do so and end up incurring effective 2.25 per cent CST.

EXHIBIT 6

Indian refineries are at a structural cost disadvantage

Legend:
- ■ India refinery advantage
- ■ Singapore refinery advantage
- ▢ Singapore refinery advantage (only against inland refineries)

Difference in costs between refinery at India and refinery at Singapore

USD/bbl

> Approx. USD 6.4/bbl disadvantage for inland and USD 4.6/bbl for coastal Indian refineries respectively

Category	Value
Crude sea freight[1]	0.2
Crude inland freight[2]	0.7
Operating costs[3]	1.2
Working capital[4]	2.0
Cost of product basket[5]	2.9-3.6
Product inland freight[6]	1.1
Product sea freight[7]	1.7
Structural disadvatage for Indian refineries	4.5-6.5

1 Sea freight from AG to Singapore assumed at USD1/bbl for crude; AG to India assumed at USD0.8/bbl for crude
2 Freight from port to inland refinery; based on expert interviews
3 Use of higher cost naphtha based power in India due to unreliable coal/ gas based grid power; additional burden like NCCD taxes
4 Working capital estimated for 45-60 days of crude inventory and 25-30 days of product inventory at 12-14% cost of capital for India; Only crude inventory taken for Singapore at 6% cost of capital
5 Cost of total basket of products made from 1 barrel of crude oil
6 Freight from inland refinery to port; estimated to be 1.5x of crude inland freight, based on expert interviews
7 Sea freight from India to Singapore of USD1.7/bbl for diesel

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EXHIBIT 7

Indian refineries are of low to medium complexity

Current refining capacity in India (MMTPA)		Complexity (NCI index number)	
Jamnagar SEZ	27	Jamnagar SEZ	13.5
Bathinda	9 9	Bathinda	12.5
Essar Vadinar	20	Essar Vadinar	11.8
Jamnagar DTA	33	Jamnagar DTA	11.0
Numaligarh	3	Numaligarh	9.5
Guwahati	1	Guwahati	9.4
Bina	6	Bina	8.9
Mumbai HPCL	7	Mumbai HPCL	7.7
Digboi	1	Digboi	7.5
Barauni	6	Barauni	7.3
Mathura	8	Mathura	7.1
Koyali	14	Koyali	6.5
Visakhapatnam	8	Visakhapatnam	6.5
Haldia	8	Haldia	6.4
Panipat	15	Panipat	6.3
Mumbai BPCL	12	Mumbai BPCL	6.1
Kochi	10	Kochi	6.0
Manali	11	Manali	5.0
Tatipaka	1	Tatipaka	5.0
Mangalore	15	Mangalore	4.5
Bongaigaon	2	Bongaigaon	4.4
Nagapattinam	1	Nagapattinam	1.0
Total	**216**	**Average**	**7.1**

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1.3 Global experience suggests the need for import parity pricing

A close look at large consuming countries with crude and product deficits shows that they price their products around import parity (Exhibits 8 and9). For products in deficit, the pricing is at import parity whereas even surplus products arepriced significantly higher than the export parity price (that is, FOB price of the relevant trading hub adjusted for freight). To guard against any supply shocks, some of these countries with large crude deficits maintain strategic stock at the government's cost, to offset any disruptions caused by stressed refining supply chains – typically, strategic stock in deficit countries is 160 to 220 days of imports, compared with India's 54 days (Exhibit 10).

EXHIBIT 8

Countries with crude deficit and product surplus price their products either at import parity or at FOB of nearest trading hub (1/2)

Global pricing regimes

Import parity
(Petrol)
FOB (hub)
(Diesel)
No evidence of any country's prices near EPP
Export parity

Product balance (+ : Surplus; - Deficit)
Refinery output

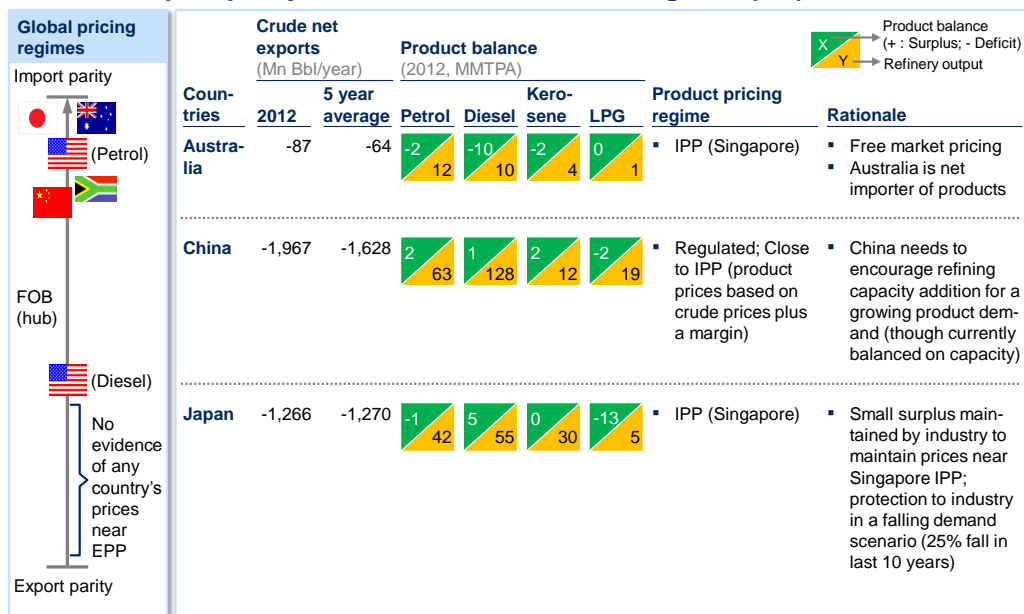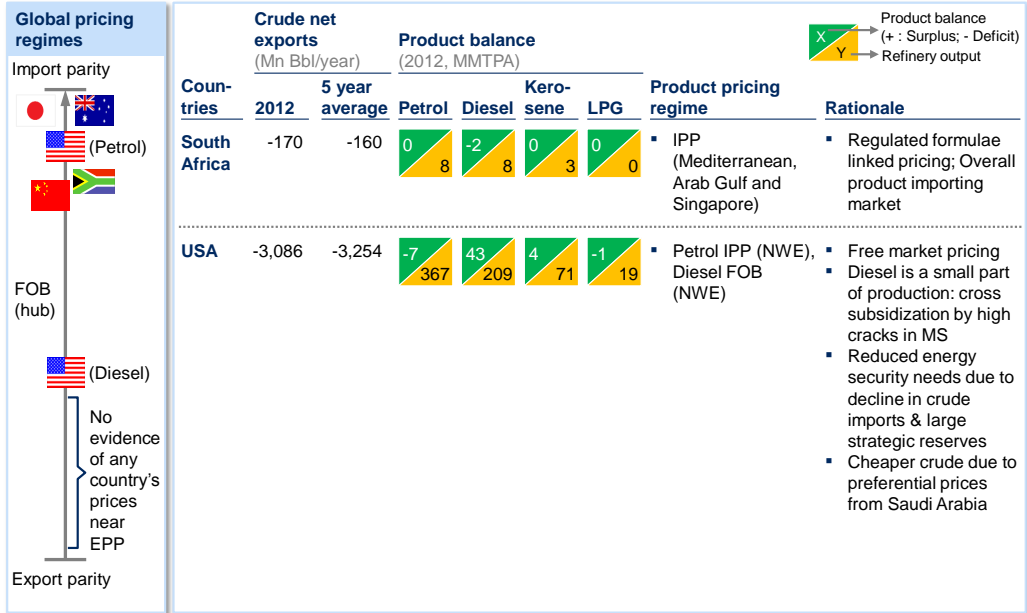| Countries	Crude net exports (Mn Bbl/year) 2012	5 year average	Product balance (2012, MMTPA) Petrol	Diesel	Kerosene	LPG	Product pricing regime	Rationale
Australia	-87	-64	-2 / 12	-10 / 10	-2 / 4	0 / 1	▪ IPP (Singapore)	▪ Free market pricing ▪ Australia is net importer of products
China	-1,967	-1,628	2 / 63	1 / 128	2 / 12	-2 / 19	▪ Regulated; Close to IPP (product prices based on crude prices plus a margin)	▪ China needs to encourage refining capacity addition for a growing product demand (though currently balanced on capacity)
Japan	-1,266	-1,270	-1 / 42	5 / 55	0 / 30	-13 / 5	▪ IPP (Singapore)	▪ Small surplus maintained by industry to maintain prices near Singapore IPP; protection to industry in a falling demand scenario (25% fall in last 10 years)

SOURCE: JODI Crude and Petroleum Product Balance Data; Expert interviews; McKinsey analysis

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EXHIBIT 9

Countries with crude deficit and product surplus price their products either at import parity or at FOB of nearest trading hub (2/2)

Global pricing regimes

Import parity

(Petrol)

FOB (hub)

(Diesel)

No evidence of any country's prices near EPP

Export parity

Product balance
(+ : Surplus; - : Deficit)
Refinery output

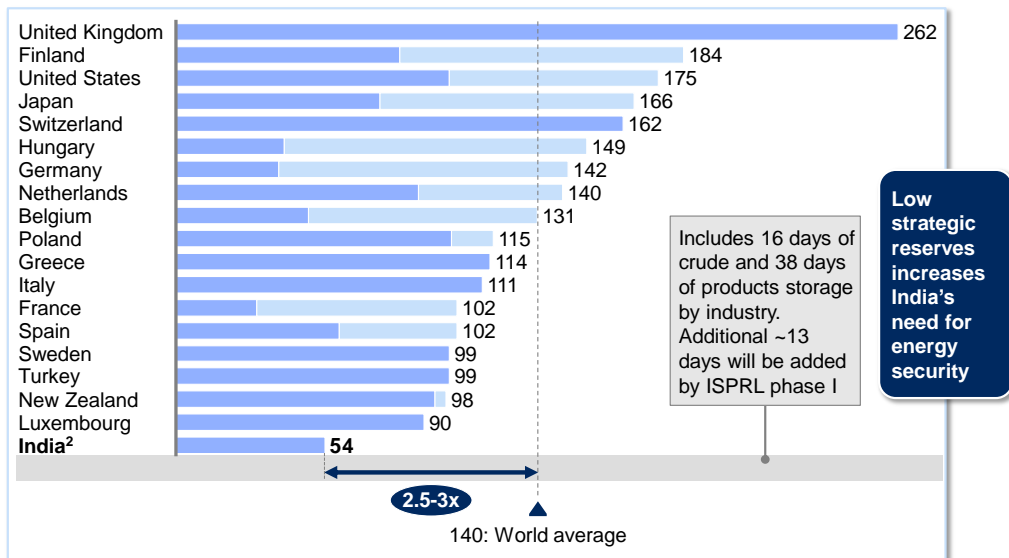| Countries	Crude net exports (Mn Bbl/year)		Product balance (2012, MMTPA)				Product pricing regime	Rationale
	2012	5 year average	Petrol	Diesel	Kerosene	LPG		
South Africa	-170	-160	0 / 8	-2 / 8	0 / 3	0 / 0	▪ IPP (Mediterranean, Arab Gulf and Singapore)	▪ Regulated formulae linked pricing; Overall product importing market
USA	-3,086	-3,254	-7 / 367	43 / 209	4 / 71	-1 / 19	▪ Petrol IPP (NWE), Diesel FOB (NWE)	▪ Free market pricing ▪ Diesel is a small part of production: cross subsidization by high cracks in MS ▪ Reduced energy security needs due to decline in crude imports & large strategic reserves ▪ Cheaper crude due to preferential prices from Saudi Arabia

SOURCE: JODI Crude and Petroleum Product Balance Data; Expert interviews; McKinsey analysis

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EXHIBIT 10

Most large, crude importing countries have taken steps to ensure energy security; e.g., creating strategic reserves

Equivalent to days of net crude import, Jan 2013

■ Industry
■ Government

United Kingdom 262
Finland 184
United States 175
Japan 166
Switzerland 162
Hungary 149
Germany 142
Netherlands 140
Belgium 131
Poland 115
Greece 114
Italy 111
France 102
Spain 102
Sweden 99
Turkey 99
New Zealand 98
Luxembourg 90
India² **54**

2.5-3x

▲ 140: World average

Includes 16 days of crude and 38 days of products storage by industry. Additional ~13 days will be added by ISPRL phase I

Low strategic reserves increases India's need for energy security

1 Industry stocks include commercial and obligatory strategic stocks;   2 1 MMT of crude is equivalent to ~3 days of net imports of India

SOURCE: IEA; Expert interviews; McKinsey analysis

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India needs to be compared against a set of countries that share the following characteristics – large product demand (when compared to the size of market for traded products), significant crude deficit (India imports about 80 per cent of its crude oil consumption), high need for energy security, and similar geo-political influence. Japan, Australia, South Africa and China are countries in a situation comparable to India. The US, while not directly comparable – because ofstrong geo-political influence and anincreasingfuture energy securitydriven by shale oil and liquids production from shale gas – was also evaluated.

1.3.1 Large consuming countries with crude and product deficits/in-balance are priced near IPP levels:

- **Australia** is deficit and follows free market pricing; the wholesale prices follow IPP, that is, Singapore's FOB product price plus freight and handling (Exhibit 11).

  a) Crude: The overall crude consumption in 2012 was about 30 MMTPA of which about 12 MMTPA was imported

  b) Product situation: The overall product demand in 2012 was45to 50 MMTPA of which 16 to 18 MMTPAwas imported. The total diesel consumption was about 19 MMTPA of which about 10 MMTPA wasimported; petrol consumption was about 14 MMTPA of which 2 to 3 MMTPA was imported; kerosene consumption was about 6 MMTPA of which about 2 MMTPA was imported; and LPG consumption was about 2 MMTPA with marginalimports

  c) Diesel, petrol, LPG and kerosene are all priced at Singapore FOB product price plus freight and handling.

- **South Africa** is deficit in both crude and product; the pricing is regulated and marked at IPP to Mediterranean and Singapore hubs (Exhibit 12).

  a) Crude: The overall crude consumption in 2012 was about 24MMTPA all of which was imported

  b) Product situation: The overall product demand in 2012 was 24 to 25 MMTPA of which about 2 MMTPA was imported. The total diesel consumption was 9 to 10 MMTPA of which 1 to 2 MMTPA was imported; petrol consumption was 7to 8 MMTPAof which 0.5 to 1 MMTPA was imported; kerosene consumption was about 2 MMTPA with marginal imports; and LPG consumption was about 0.5 to 1 MMTPA with marginal imports

c) Regulated pricing set at IPP with the following components: FOB spot price in international markets (50 per cent Mediterranean, 50 per cent Singapore), freight cost to South Africa, demurrage, insurance, ocean loss, wharfage, coastal storage and stock financing.

- **China**, despite its balanced position, needs new (and more efficient) capacity to support high demand growth. It controls product pricing to give IPP-like returns. China also maintains a strategic stock for 150 to 160 days (Exhibit 13).

  a) Crude: The overall crude consumption in 2012 was 460to 470 MMTPA of which 260 to 270MMTPA was imported

  b) Product situation: In 2012, the overall imports of 4 per cent were on a refining product consumption base of 460 to 470 MMTPA. The demand–supply situation for diesel, petrol, kerosene and LPG is broadly balanced (plus/minus 10 per cent of consumption for each product)

  c) Regulated pricing at the wholesale level is set at the crude price (at weighted average FOB for a basket of crudes), plus transportation cost (CNY 110/MT, or about USD 2.5/bbl), plus refinery operating costs (CNY 200/MT, or about USD 4.5/bbl), plus a variable mark-up (maximum of 5 per cent)that varies with crude price to generate IPP-like returns.

1.3.2 Large consuming countries with crude deficits and product surpluses are priced between the FOB of the nearest hub to import parity:

- **<u>Japan</u>** has a large but declining demand, high need for energy security and its refineries have a structural cost disadvantage due to higher local operating costs and smaller capacities. Therefore, despite having a slight product surplus, the product prices follow IPP to Singapore prices (Exhibits 14 and15)

  a) Crude: The overall crude consumption in 2012 was 160 to 170 MMTPA, all of which was imported

  b) Product situation: The overall product demand in 2012was 240 to 245 MMTPA of which about 40 MMTPAwas imported. The total diesel consumption was about 40 MMTPA and Japan exported about 5 MMTPA; petrol consumption was 40 to 45 MMTPA of which about 2 MMTPA was imported; kerosene consumption was 25 to 26 MMTPA with marginal exports; and LPG consumption was about 16 MMTPA of which 13 to 14 MMTPA was imported

c) Diesel, petrol, LPG and kerosene are all priced at Singapore FOB product price plus freight and handling.

EXHIBIT 11

Australia is deficit and follows free market pricing; prices follow IPP (Singapore)

Net crude exports/ (imports)

MMT per month

Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13 Apr-13 Jul-13

Net export as a % of demand – 2012

-40%

Net diesel exports/ (imports)

MMT per month

Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13 Apr-13 Jul-13

Net export as a % of demand – 2012

Diesel production as a % of total production[3] – 2012

-53%   **34%**

Australia (diesel) follows IPP pricing owing to product deficit situation in a free market

Diesel price differential: Australia refinery price[1] minus Singapore price (Singapore FOB)[2]

USD/MT

xx Average difference

110

Avg. Freight 35 USD/MT

Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12 Jul-12 Oct-12 Jan-13 Apr-13 Jul-13

1 Estimated by subtracting taxes and duties from spot wholesale prices at terminals
2 Based on Platts 50 ppm till Dec 08 and 10 ppm quotes from Jan 09 in line with Australian domestic market regulation
3 Total product output, i.e., Diesel, Gasoline, Kerosene, Residual fuel oil, etc.

SOURCE: JODI; Platts; Worldscale; Bloomberg; Expert conversations; McKinsey analysis

McKinsey & Company

EXHIBIT 12

South Africa is deficit in both crude and product; pricing is regulated and marked at IPP (Mediterranean and Singapore)

Degree of regulation

Govt. fixed price —— Formula based —— Free market pricing

Stated policy objectives
- Promoting an efficient manufacturing, wholesaling and retailing petroleum industry
- Facilitating an environment conducive to efficient and commercially justifiable investment
- Creating employment opportunities and small businesses in the petroleum sector

Product wise surplus

MMTPA

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Motor Spirit	4	1	1	(0)	(0)	(0)	(0)	(1)	(1)	(1)	(0)
Disel Oil	1	1	2	2	(1)	(1)	1	(1)	(1)	(1)	(2)
Kerosene	0	0	0	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)
LPG	-	-	0	-	(0)	(0)	(0)	-	0	0	0
Crude Oil	(17)	(18)	(68)	(21)	(19)	(21)	(22)	(18)	(19)	(20)	(21)

Price setting mechanism
- South Africa has a regulated fuel pricing regime with basic fuel price linked to FOB price at Mediterranean (50%) and Singapore (50%), along with the following components: freight cost to South Africa, demurrage, insurance, ocean loss, wharfage, coastal storage and stock financing
- The Central Energy Fund recalculates the petrol price on a monthly basis to keep it up to date and this new price is then put into effect on the first Wednesday of every month
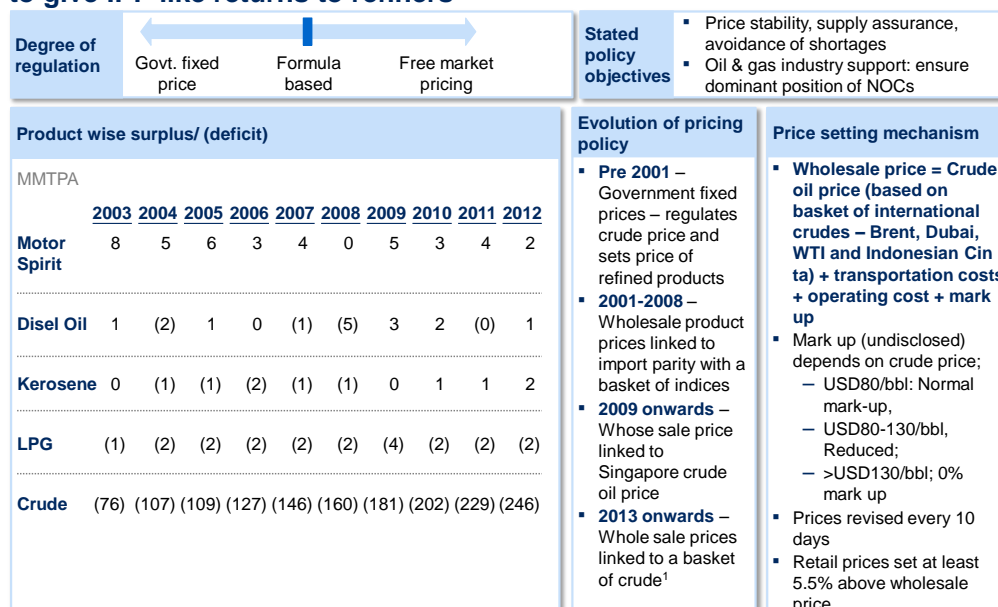- Fuels are priced differently in coastal and inland regions

SOURCE: JODI; Expert interviews; Web and press search; McKinsey analysis

McKinsey & Company |

EXHIBIT 13

China, despite its balanced position, controls product pricing to give IPP like returns to refiners

Degree of regulation

Govt. fixed price —— Formula based —— Free market pricing

Stated policy objectives
- Price stability, supply assurance, avoidance of shortages
- Oil & gas industry support: ensure dominant position of NOCs

Product wise surplus/ (deficit)

MMTPA

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Motor Spirit	8	5	6	3	4	0	5	3	4	2
Disel Oil	1	(2)	1	0	(1)	(5)	3	2	(0)	1
Kerosene	0	(1)	(1)	(2)	(1)	(1)	0	1	1	2
LPG	(1)	(2)	(2)	(2)	(2)	(2)	(4)	(2)	(2)	(2)
Crude	(76)	(107)	(109)	(127)	(146)	(160)	(181)	(202)	(229)	(246)

Evolution of pricing policy
- **Pre 2001** – Government fixed prices – regulates crude price and sets price of refined products
- **2001-2008** – Wholesale product prices linked to import parity with a basket of indices
- **2009 onwards** – Whose sale price linked to Singapore crude oil price
- **2013 onwards** – Whole sale prices linked to a basket of crude[1]

Price setting mechanism
- **Wholesale price = Crude oil price (based on basket of international crudes – Brent, Dubai, WTI and Indonesian Cin ta) + transportation costs + operating cost + mark up**
- Mark up (undisclosed) depends on crude price;
  - USD80/bbl: Normal mark-up,
  - USD80-130/bbl, Reduced;
  - >USD130/bbl; 0% mark up
- Prices revised every 10 days
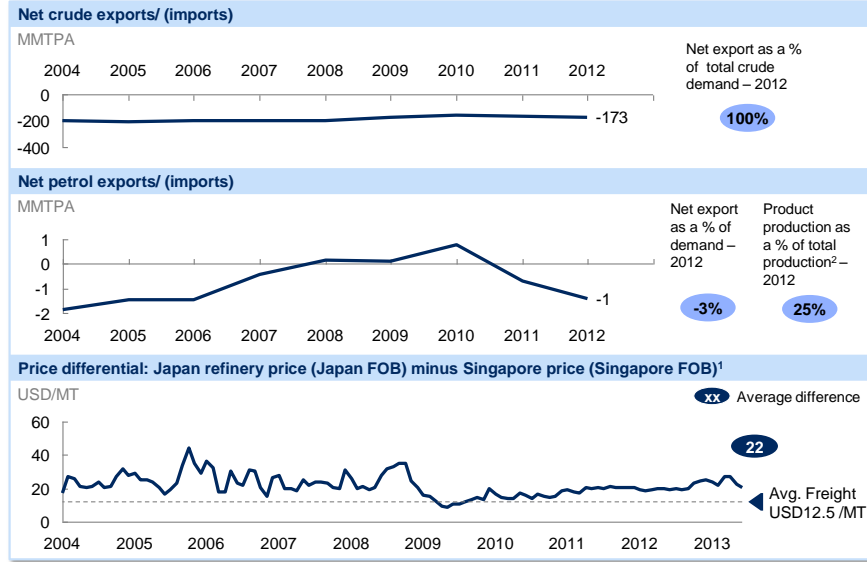- Retail prices set at least 5.5% above wholesale price

1 Based on weighted average basket of Dubai, Oman, Brent, WTI and Cinta

SOURCE: JODI; Expert interviews; McKinsey analysis

McKinsey & Company |

EXHIBIT 14

Japan product prices follow IPP (Singapore) like prices, despite having slight product surplus (1/2)
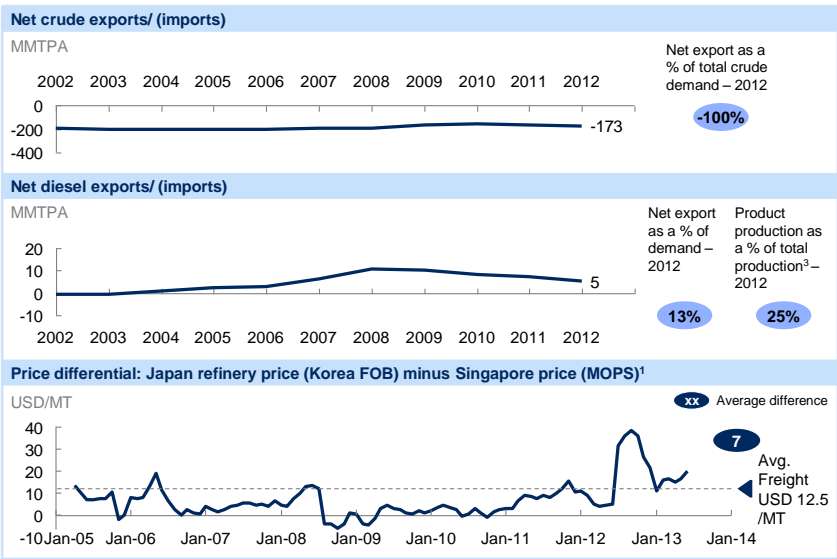
Net crude exports/ (imports)

MMTPA

| 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |

Net export as a % of total crude demand – 2012

-173   **100%**

Net petrol exports/ (imports)

MMTPA

| 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |

Net export as a % of demand – 2012

Product production as a % of total production[2] – 2012

-1   **-3%**   **25%**

Price differential: Japan refinery price (Japan FOB) minus Singapore price (Singapore FOB)[1]

USD/MT

xx Average difference

22

Avg. Freight USD12.5 /MT

| 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |

Petrol in Japan is priced near IPP, being a free market with product deficit

1 Both based on Platts quote for Petrol 95 RON
2 Total product output, i.e., Diesel, Gasoline, Kerosene, Residual fuel oil, etc.

SOURCE: Platts; Worldscale; Bloomberg; Expert conversations; McKinsey analysis   McKinsey & Company |

EXHIBIT 15

Japan product prices follow IPP (Singapore) like prices, despite having slight product surplus (2/2)

Net crude exports/ (imports)

MMTPA

| 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |

Net export as a % of total crude demand – 2012

-173   **-100%**

Net diesel exports/ (imports)

MMTPA

| 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |

Net export as a % of demand – 2012

Product production as a % of total production[3] – 2012

5   **13%**   **25%**

Price differential: Japan refinery price (Korea FOB) minus Singapore price (MOPS)[1]

USD/MT

xx Average difference

7

Avg. Freight USD 12.5 /MT

| Jan-05 | Jan-06 | Jan-07 | Jan-08 | Jan-09 | Jan-10 | Jan-11 | Jan-12 | Jan-13 | Jan-14 |

- **Historically Japan was a net importer with IPP pricing**
- **In last 10 years it saw 25%+ demand drop, prompting industry to cut back production to maintain very low exports, thus keeping IPP pricing**
- **Govt. of Japan promotes this behavior to protect the industry health**
- **Thus, prices remain linked to IPP in spite of it becoming surplus from 2003**

1 Both Platts quote for Diesel 5,000 ppm
2 Total product output, i.e., Diesel, Gasoline, Kerosene, Residual fuel oil, etc.

SOURCE: Platts; Worldscale; Bloomberg; Expert conversations; McKinsey analysis   McKinsey & Company |
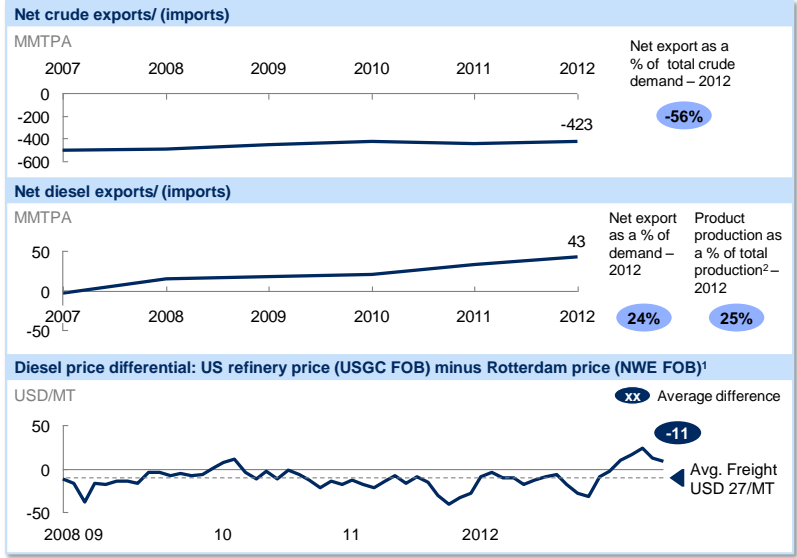
1.3.3 The US market is net surplus on products, enjoys significant geo-political influence, gets discounted crude from Saudi Arabia and is expected to become liquid surplus in the near future. However, the prices for the major product which is gasoline have stayed near FOB Northwest Europe [NWE] plus freight. High crack spread for products like MS more than compensate for the somewhat lower prices of surplus products like HSD (Exhibits16 and 17).

   a) Crude: The overall crude consumption in 2012 was 750 to 760MMTPA of which 420 to 430MMTPA was imported

   b) Product situation: The total diesel consumption was 180 to 185MMTPA and the US exported 40 to 45 MMTPA; petrol consumption was 370 to 380 MMTPA of which about 7 MMTPA was imported; kerosene consumption was 65 to 70 MMTPA and the US exported 3 to 4 MMTPA; and LPG consumption was 40 to 42 MMTPA of which about 1 MMTPA was imported. The growth in products demand has been stagnant

   c) At an aggregate level, the US' prices have stayed near FOB at NWE. The US' diesel prices are USD 11/MT (40 per cent of US–Rotterdam freight) lower than NWE FOB based on 2008–2012 average prices.

   d) Further, the US has strong geo-political influence, specifically in the Middle East where it gets a discount on crude supply from its biggest supplier, Saudi Arabia, of about USD 3/bbl (largely offsetting crude transportation cost)

   e) Going forward, North America is expected to have crude surplus with shale oil (Light Tight Oil [LTO]), and strong liquids production from shale gas. Further, the US holds strategic stock for 175 days (of which 75 days are held by the US government). Finally, unlike India, the US faces declining product consumption and hence lower product security concerns

1.3.4 The definition of IPP/EPP also needs to be periodically adjusted to account for both changes in direction of trade flow and product quality. Today some of the private sector players get export realisations that are higher than that derived from the PPAC formula; Further the hub prices also need to be adjusted for fuel quality. For example in the case of HSD, density (max) for HSD benchmark Platts grade is 0.865 whereas that for HSD BS III/BS IV is 0.845.

EXHIBIT 16

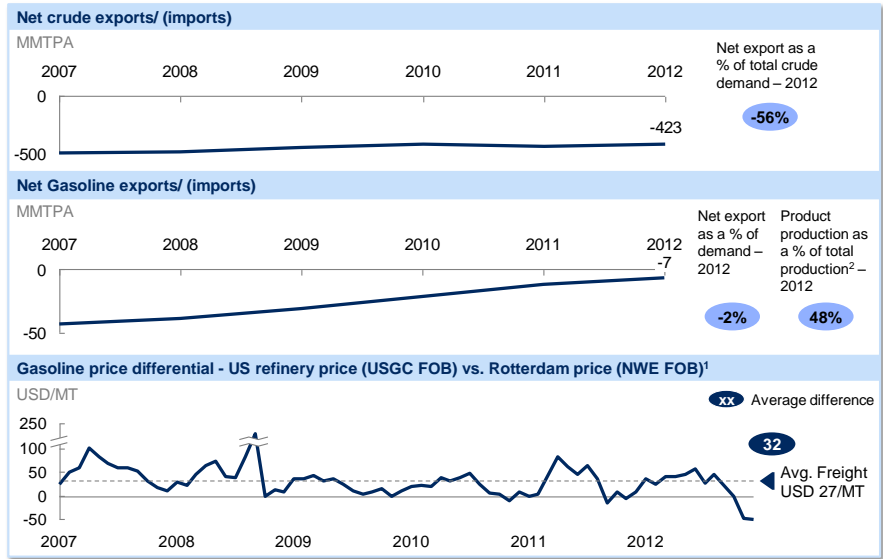## US is a net exporter of diesel and prices are USD11/MT (40% of freight lower than FOB (Rotterdam)

Net crude exports/ (imports)

MMTPA

| 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |

Net export as a % of total crude demand – 2012

-423

-56%

Net diesel exports/ (imports)

MMTPA

| 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |

43

Net export as a % of demand – 2012

Product production as a % of total production[2] – 2012

24%   **25%**

Diesel price differential: US refinery price (USGC FOB) minus Rotterdam price (NWE FOB)[1]

USD/MT

xx Average difference

-11

Avg. Freight USD 27/MT

2008 09   10   11   2012

- US diesel is priced near FOB NWE due to a mix of reasons
  – Free market pricing
  – Diesel is a small part of production and thus cross subsidized by high cracks in MS
  – Reduced energy security needs due to decline in crude imports & large strategic reserves
  – Cheaper crude due to preferential prices from Saudi Arabia

1 Platts quote for Diesel ULSD; 2 Platts quote for Diesel 10 ppm
2 Total product output, i.e., Diesel, Gasoline, Kerosene, Residual fuel oil, etc.

SOURCE: JODI; Platts; Worldscale; Bloomberg; Expert conversations; McKinsey analysis

McKinsey & Company |

EXHIBIT 17

US is a net importer of petrol and prices are USD32/MT (20% more than freight) higher than FOB (Rotterdam)

Net crude exports/ (imports)

MMTPA

| 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |

Net export as a % of total crude demand – 2012

-423

-56%

Net Gasoline exports/ (imports)

MMTPA

| 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |

-7

Net export as a % of demand – 2012

Product production as a % of total production[2] – 2012

-2%   **48%**

Gasoline price differential - US refinery price (USGC FOB) vs. Rotterdam price (NWE FOB)[1]

USD/MT

xx Average difference

32

Avg. Freight USD 27/MT

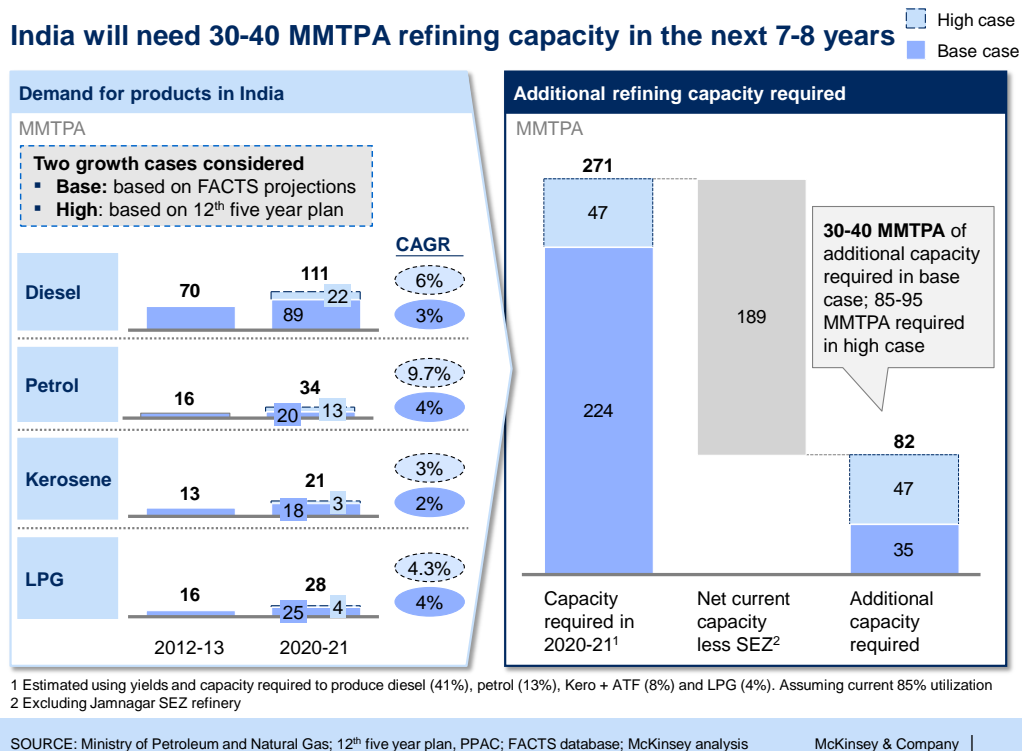2007   2008   2009   2010   2011   2012

US petrol is priced above FOB (NWE), being deficit in petrol and having free market pricing

1 USGC FOB platts prices for 89 Octane quote and NWE FOB quote for 95 RON quote
2 Total product output, i.e., Diesel, Gasoline, Kerosene, Residual fuel oil, etc.

SOURCE: JODI; Platts; Worldscale; Bloomberg; Expert conversations; McKinsey analysis

McKinsey & Company |

1.4 India needs refining capacity additions; hence pricing policies must ensure sufficient returns

India is one of the few large energy consuming economies expected to see continued growth in refined product demand in the foreseeable future (Exhibits 18 and 19). Although India's refining capacity is currently greater than demand, sustained demand growth of 5 to 8 per cent could result in a substantial deficit by 2020. A closer review of India's refined product supply and demand balances and the government's stated policy suggests that India will need an additional 30to 40MMTPA of incremental refining capacity over the next 7 to 8 years[5] (possible more over the next years, as India's demand continues to grow).

EXHIBIT 18

India will need 30-40 MMTPA refining capacity in the next 7-8 years

High case
Base case

Demand for products in India

MMTPA

Two growth cases considered
- **Base:** based on FACTS projections
- **High:** based on 12th five year plan

			CAGR
Diesel	70	111 / 22 / 89	6% / 3%
Petrol	16	34 / 20 / 13	9.7% / 4%
Kerosene	13	21 / 18 / 3	3% / 2%
LPG	16	28 / 25 / 4	4.3% / 4%

2012-13   2020-21

Additional refining capacity required

MMTPA

271
47
224

189

30-40 MMTPA of additional capacity required in base case; 85-95 MMTPA required in high case

82
47
35

Capacity required in 2020-21[1]	Net current capacity less SEZ[2]	Additional capacity required

1 Estimated using yields and capacity required to produce diesel (41%), petrol (13%), Kero + ATF (8%) and LPG (4%). Assuming current 85% utilization
2 Excluding Jamnagar SEZ refinery

SOURCE: Ministry of Petroleum and Natural Gas; 12th five year plan, PPAC; FACTS database; McKinsey analysis   McKinsey & Company |

[5]30 to 40 MMTPA of additional capacity would be needed over the next investment cycle of 7 to 8 years; this is a conservative estimate that is based on the growth estimate put forth by FACTS. If the Planning Commission's demand estimates were to materialise, then additional capacity of 85 to 95 MMTPA will be required.

EXHIBIT 19

India is expected to see continued growth in liquids demand across sectors

Liquid demand, Mbd[1]

■ Increase

	2011	2025
Light-duty vehicles	0.5	0.5 1.0
Medium and Heavy trucks	0.5	0.1 0.6
Chemicals	0.4	0.3 0.7
Buildings	0.6	0.2 0.8
Air transport	0.1	0.2 0.3
Power	0.1	0 0.1
Iron & Steel	0	0 0
Refining	0.2	0.1 0.3
Pulp & paper	0	0 0
Other industries	0.9	0.2 1.1
Total	3.3	1.6 4.9

1 Million barrels per day, demand in for all liquids, including biofuels. Base case GDP scenario with real oil price of USD90-100/bbl

McKinsey & Company |

1.5 At a minimum, only import parity pricing gives the industry any chance to earn returns sufficient for reinvestment

Our analysis shows that existing refineries in India need minimum gross refining margins (GRM) of USD 5 to 6/bbl just to pay for the costs of refining (USD 2.5 to 3/bbl) and working capital (USD 2.5 to 3/bbl). In other words,a net refinery margin (NRM, that is, GRM less cost of refining) of USD 2.5 to 3/bbl is required to pay for interest cost of working capital. Expansions and major upgrades need an additional margin of USD 7 to 8/bbl to meet the cost of any capital investment (for example, HMEL (Bathinda), BORL (Bina), CPCL, Essar (Vadinar); Exhibit 20).We assessed multiple pricing scenarios and observed that if India does not move to free market pricing, the minimum that the Indian refinery sector will need are IPP prices to ensure that the industry has a chance to make the economics of new investments work.

1) The current pricing mechanism and subsidy mechanism has certain limitations:

a. Other than free market pricing, any notional formula-based pricing mechanism does not fully transmit the right price signals and brings in

distortions and inefficiencies that result in the misallocation of resources

b. Artificially limiting or determining relative prices of fuels cause distortions and inefficiencies that result in the misallocation of resources. For example, diesel prices internationally are higher than petrol; however, Indian prices are distorted to make diesel cheaper than petrol

c. In addition, the formula as it is applied today does not create a level playing field between the standalone refineries &the integratedOMCs

d. Finally, the logic of using the 80:20 ratio, while possibly reflecting the domestic to export capacity ratio at some point in time, has no underlying economic linkage to domestic market forces.

2) We assessed the economics of 17 Indian refineries across three scenarios. We found that at 2012–13 prices of crude and products (which is the middle of the current refining cycle), even with all three products at IPP, only 7 out of 17 refineries generate positive NRMs, only 4 out of 17refineries generate NRMs more than USD 3/bbl (to cover the cost of working capital), and none generate any margin to incentivise reinvestment (Exhibit 21). The Indian refining industry, compared to its peers across the globe, makes one of the lowest returns (ROIC comparison).

a. Scenario 1 with diesel at TPP, kerosene and LPG at IPP[6]: Only 2 of the 17 refineries (30 to 40 per cent of refining capacity[7]) studied are able to generate NRM above USD 3/bbl, with the average NRM of these 15 refineries near zero (USD 0.4 to 0.5/bbl).

b. Scenario 2 with diesel at EPP, kerosene and LPG at IPP: Only 1 of the 17 refineries (7 to 10per cent of refining capacity) studied was able to generate NRM above USD 3/bbl, with the average NRM at USD (-)2 to (-)1/ bbl (which may necessitate shutting down of some refineries)

c. Scenario 3 with diesel, kerosene and LPG at IPP: Only 4 of the 17refineries (40 to 45per cent of refining capacity) studied are able to generate NRM above USD 3/bbl, with the average NRM at about USD
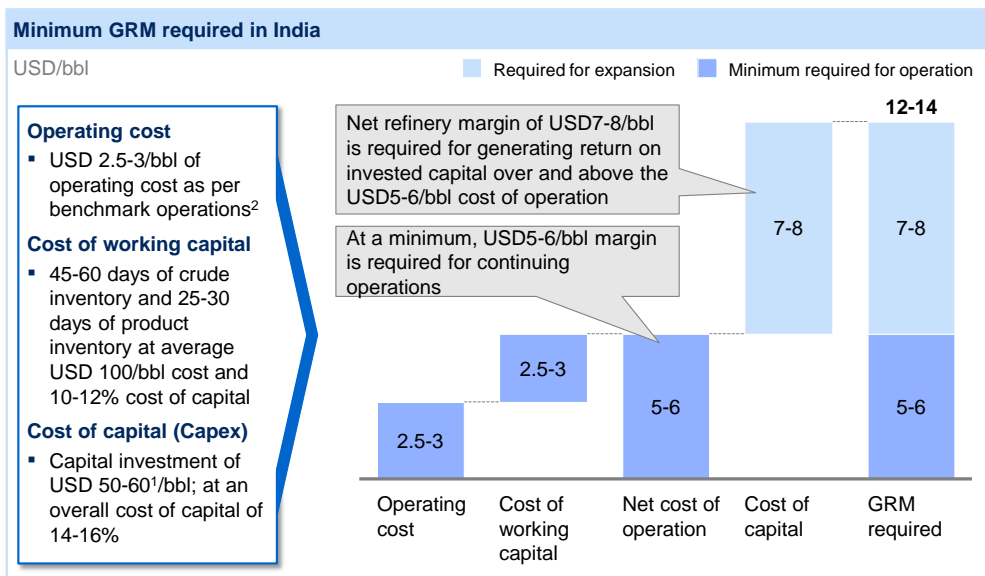
[6]This scenario reflects the current market situation where the TPP is calculated as a weighted average of 80 per cent IPP and 20 per cent EPP.

[7]Represents 30 to 40 per cent of 17 refineries.

1 to 1.50/bbl. Even in the IPP case, several standalone (and other) refineries are below the threshold level of profitability, and are unlikely to survive in the longer term unless margins improve. In case margins reduce any further, either due to pricing formulae changes or worsening market conditions, the situation will worsen.

EXHIBIT 20

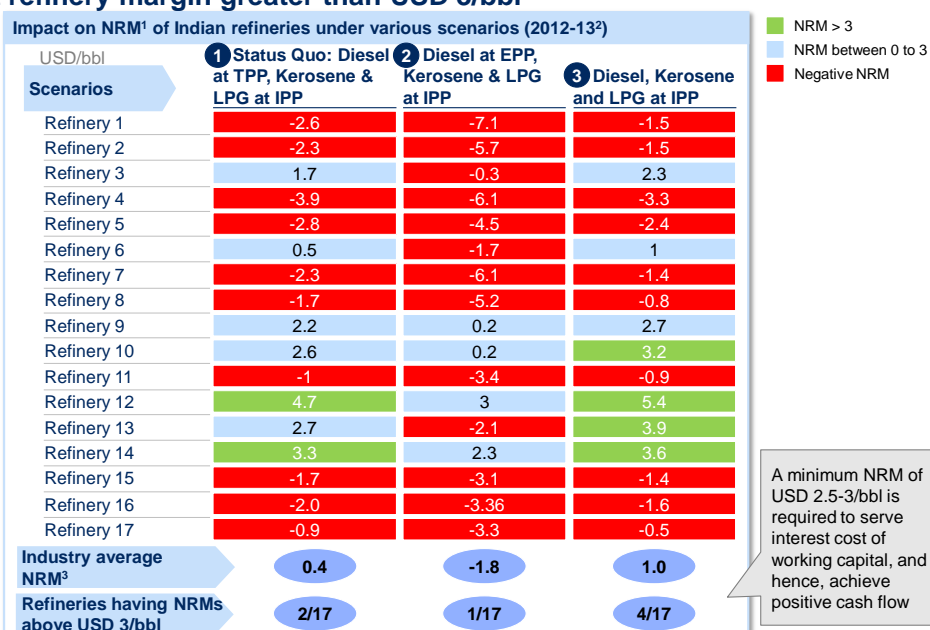**Indian refiners need a GRM of at least USD5-6/bbl to cover operating cost; and an additional USD7-8/bbl to generate an adequate return on capital**

Minimum GRM required in India

USD/bbl

☐ Required for expansion   ■ Minimum required for operation

Operating cost
- USD 2.5-3/bbl of operating cost as per benchmark operations[2]

Cost of working capital
- 45-60 days of crude inventory and 25-30 days of product inventory at average USD 100/bbl cost and 10-12% cost of capital

Cost of capital (Capex)
- Capital investment of USD 50-60[1]/bbl; at an overall cost of capital of 14-16%

Net refinery margin of USD7-8/bbl is required for generating return on invested capital over and above the USD5-6/bbl cost of operation

At a minimum, USD5-6/bbl margin is required for continuing operations

12-14

2.5-3	2.5-3	5-6	7-8	7-8
				5-6
Operating cost	Cost of working capital	Net cost of operation	Cost of capital	GRM required

1 Based on recent brownfield, greenfield refinery expansions in India   2 Normalized to refinery complexity of 10

SOURCE: Expert interviews; McKinsey analysis   McKinsey & Company |

EXHIBIT 21

Even after pricing all products at IPP, only 4/17 refineries achieve a net refinery margin greater than USD 3/bbl

DISGUISED CLIENT DATA

Impact on NRM[1] of Indian refineries under various scenarios (2012-13[2])

- 🟩 NRM > 3
- 🟦 NRM between 0 to 3
- 🟥 Negative NRM

USD/bbl Scenarios	① Status Quo: Diesel at TPP, Kerosene & LPG at IPP	② Diesel at EPP, Kerosene & LPG at IPP	③ Diesel, Kerosene and LPG at IPP
Refinery 1	-2.6	-7.1	-1.5
Refinery 2	-2.3	-5.7	-1.5
Refinery 3	1.7	-0.3	2.3
Refinery 4	-3.9	-6.1	-3.3
Refinery 5	-2.8	-4.5	-2.4
Refinery 6	0.5	-1.7	1
Refinery 7	-2.3	-6.1	-1.4
Refinery 8	-1.7	-5.2	-0.8
Refinery 9	2.2	0.2	2.7
Refinery 10	2.6	0.2	3.2
Refinery 11	-1	-3.4	-0.9
Refinery 12	4.7	3	5.4
Refinery 13	2.7	-2.1	3.9
Refinery 14	3.3	2.3	3.6
Refinery 15	-1.7	-3.1	-1.4
Refinery 16	-2.0	-3.36	-1.6
Refinery 17	-0.9	-3.3	-0.5
Industry average NRM[3]	0.4	-1.8	1.0
Refineries having NRMs above USD 3/bbl	2/17	1/17	4/17

A minimum NRM of USD 2.5-3/bbl is required to serve interest cost of working capital, and hence, achieve positive cash flow

1 Net Refinery Margin: Calculated by subtracting per barrel crude costs and operating costs from per barrel product revenue
2 Based on 2012-13 actual data; only product pricing of diesel, kerosene and LPG changed;   3 Including 17 Indian refineries totaling 138 MMTPA |
SOURCE: Submissions by individual companies; McKinsey analysis

McKinsey & Company |

Ideally, product prices should be market determined both at the refinery gate and at the retail level. In case the government decides to regulate the prices, our analysis shows that the average petroleum product prices over an investment cycle will need to be higher than the current IPP (Scenario 2) to give the refineries a chance to make the economics of new investments work. Anything lower than IPP will damage the immediate and long-term health of the industry.

In addition, a few inconsistencies faced by north-eastern and several other refineries on account of VAT and entry tax on domestic crude and standalone refineries on CST and coastal freight need to be addressed.

2. NEED TO ELIMINATE SUBSIDY BURDEN ON THE OIL AND GAS INDUSTRY

The Ministry of Petroleum & Natural Gas vide resolution no. P-20029/22/2001-PP dated March 28, 2002 dismantled the APM in the hydrocarbon sector w.e.f April 1, 2002 and announced the following decisions:

1) Consumer prices of motor spirit (MS) and high speed diesel (HSD) will be market determined w.e.f April 1, 2002. Consequently, the pricing of

petroleum products, except for PDS Kerosene and domestic LPG will be market determined w.e.f April 1, 2002.

2) The subsidies on PDS kerosene and domestic LPG will be borne by the Consolidated Fund of India from April 1, 2002. These subsidies will be on specified flat rate basis, scheme for which will be notified separately. These subsidies will be phased out in the next 3 to 5 years.

3) The price of indigenous crude oil of ONGC and OIL will be market determined w.e.f April 1, 2002.

However, the subsidy burden has been transferred substantially to the industry in an ad hoc and non-transparent manner. The upstream share has varied between 30 and 42 per cent while downstream contribution has gone up at times upto 70% which is highly exorbitant. (Exhibit 22).

This practice has led to energy companies facing a constant cash crunch, high debt to equity positions, uncertain cash flow and profitability, and an unremitting source of management distraction. These increase the risk of energy security and, subsequently, might lead to a higher burden of subsidy. Therefore a transparent, predictable, stable system is needed, as described below.

2.1 Contribution to under-recoveries is leaving upstream companies unable to invest to sustain or increase production

The contribution of upstream companies to under-recovery has increased considerably over the years, given the soaring overall under-recovery and low downstream contribution. In FY12, the subsidy sharing mechanism was significantly modified when the government decided to levy USD 56/bbl on ONGC and OIL. ONGC's effective contribution turned out to be USD 63/bbl due to the inclusion of gas condensate in crude production while determining ONGC's contribution to under-recovery. After adding the statutory levies (USD 17 to 21/bbl) and corporate tax (USD 3/bbl), the government take became USD 80 to 83/bbl, or 94 per cent of gross surplus (gross surplus being crude price [USD 110 to 111/bbl] minus cost of production [USD 23 to 25/bbl]). Further, 33 per cent of PAT is distributed to the government as dividend and OID cess was also increased considerably (from INR 2,500/MT to 4,500/MT) in 2012.

EXHIBIT 22
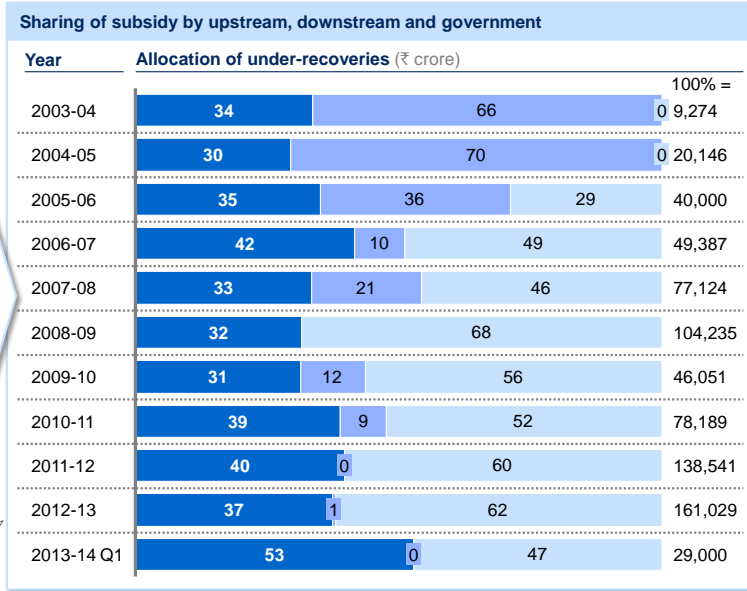
Current under-recovery (subsidy) sharing mechanism

Upstream
Downstream
Governement

Sharing of subsidy by upstream, downstream and government

Year	Allocation of under-recoveries (₹ crore)			100% =
2003-04	34	66	0	9,274
2004-05	30	70	0	20,146
2005-06	35	36	29	40,000
2006-07	42	10	49	49,387
2007-08	33	21	46	77,124
2008-09	32	68		104,235
2009-10	31	12	56	46,051
2010-11	39	9	52	78,189
2011-12	40	0	60	138,541
2012-13	37	1	62	161,029
2013-14 Q1	53	0	47	29,000

Formal subsidy sharing policy[1]

- **Upstream companies:** 33%
- **OMCs:** 33%
- **OMC cross subsidization:** 33%
- **Government:** Nil

Subsidy contribution of upstream companies in 2012-13[2]
- ONGC: USD 63/bbl
- OIL: USD 56/bbl

1 Based on MoP&NG notification dated 30th Oct'03
2 For nomination block crude production only

SOURCE: McKinsey analysis

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This leaves them at a significant disadvantage compared to their peers globally, for whom the government's take rate for concessions range between 55 per cent and 65 per cent (for countries in the 2nd quartile; Exhibit 23).

EXHIBIT 23

India's effective government take rate is 94-95% from upstream oil companies – one of the highest globally

Take rate = percent of company surplus (revenue – cost[1]) delivered to government

NOT EXHAUSTIVE

| Bottom quartile | Second quartile | Third quartile | Top quartile |

Effective take rate of India: 94-95%

Ireland
US GOM deepwater
Australia
China 56
Brazil
Denmark 59
12
42
49

Q2 average: 59.6%

UK 65
Russia JV & Conc 70
Angola PSC 71
Norway 74
Indonesia 75

Malaysia 81
Angola Concession 84
India 94
Iran 99

1 Cost of production, excluding levies

SOURCE: Wood Mackenzie GEM; McKinsey analysis

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This has significantly impacted both the profit and cash position of Indian upstream oil companies and rendered them unable to invest to sustain or increase production. This has also impacted investor confidence and minority shareholders of upstream companies, including FIIs, have regularly expressed their reservations. Upstream oil companies need margins to be able to redevelop existing fields, invest in exploration and acquire international resources. For example, ONGC requires a bare minimum discounted price of USD 65/bbl[8] to make additional production viable, invest in domestic exploration and acquire resources abroad (Exhibit 24).

For GAIL, a mid-stream company that does not enjoy any incremental revenue due to increase in oil and gas prices and also pays the market price for gas as determined by the Ministry of Petroleum and Natural Gas, the rationale to bear the subsidy burden does not exist. During FY11, FY12 and Q1FY14, GAIL's LPG business segment had incurred losses of INR285 crore, INR513 crore and INR 200

[8]Given the extreme volatility that we are observing in the forex market, for the purpose of this calculation the exchange rate has been assumed to be around INR55 to 57 to USD; this will need to be adjusted once the market stabilises.

crore respectively after providing discount for LPG subsidy. Therefore, after sharing the subsidy burden at current levels, the production of LPG by GAIL has become unsustainable.

Limiting government take rate to 2nd quartile average implies a subsidy share of USD 5-7/bbl from current USD 56-63/bbl

Subsidy share[1] and government take rate for upstream oil companies

USD/bbl, FY 13

	Current situation @ 94% take rate	Potential situation @ 60% take rate
Gross price	110-111	110-111
Cost of production[2]	23-25	23-25
Gross surplus	85-88 (100%)	85-88
Discount (Subsidy share)	56-63	5-7
Statutory levies[3]	17-21	28-30
Corporate tax[4]	3	18
Net surplus	5 (6%)	37-38 (40%)

- Current high take rate leaves little capital with upstream companies to spend on capacity expansion, modernization and acquisitions
- India should target limiting take rate to 55-65% in order to stay in 2nd quartile
- This implies a upstream subsidy share of USD 34-36/bbl

1 Subsidy share taken in form of price discount to nomination block crude sold to refineries
2 Based on estimated cost of production of OIL, as discussed in interviews
3 Current numbers based on actual figures as reported by OIL, ONGC; royalty assumed proportional to net realisation less cost ; other components assumed constant
4 Corporate tax rate on net realization (Gross price – discount – cost of production – statutory levies) at 33.99%

SOURCE: ONGC; OIL submissions to expert group; Interviews with company representatives; McKinsey analysis   McKinsey & Company |

2.2 OMCs financial health is precarious

OMCs are not in a position to share subsidy due to their precarious financial condition. Globally, the refining industry is a break-even business, with profits made mostly during up-cycles. Most integrated oil companies have been exiting/reducing footprint in the downstream sector over the last decade. Significant capacity has been shut down across geographies.

In India, the industry is facing difficulties due to factors not entirely in its control: refining overcapacity in the Asian market, structural disadvantage compared to hub refineries, high cost of capital, exchange rate fluctuation and volatility in margin due to volatility in prices of crude as well as products. Further, uncertainty and delay in compensation of under-recovery leads to higher borrowing and associated interest cost (for example, major OMCs estimate cost of delayed

compensation at about USD 1.75/bbl). This impacts investor confidence and minority shareholders of OMCs have expressed concerns about subsidy sharing and delay in compensation of under-recovery.

2.3 Need to eliminate subsidy burden on the oil and gas industry

For the upstream companies, the formula for sharing the subsidy burden could be linked to crude price such that under no condition should the discounted price for crude post subsidy be less than USD 65/bbl. Keeping government take rate at the average of the 2nd quartile (about 60 per cent) will lead to upstream companies' subsidy share of USD 5 to 7/bbl at 2012–13 prices of crude (a discounted price of USD 103 to 105/bbl). Also, the rationale for GAIL, a midstream player, to bear the subsidy burden even though it is not an upstream company needs to be examined.Further, over the next few years, the downstream companies will be unable to contribute to subsidy sharing due to low or negative profitability. As a matter of principle, price control and subsidies on fuel generally introduce market distortions, incentivise less energy efficient behaviour and wrong trade-offs. The consumer prices in India are lower than almost all comparable economies (Exhibits 25 and 26). If required, consumer price increases can be moderated by adjusting the central and state government tax rates (for example, the effective tax rate for diesel is around 18.5 per cent on retail price in Delhi which includes excise duty, VAT, air ambience charges and education cess), and ultimately being made free market.

EXHIBIT 25

Field (re)developments will become unviable at net realisation less than USD 65/bbl

Major assets planned to be (re) developed	Estimated crude production by 2030 (MMT)	Minimum net realisation required for IRR 14% (USD /bbl)
Mumbai High South Phase-III	32.8	68
NMFD North Tapti	9.9	53
Assam	6.7	79
Mehsana	3.7	57
Others	6.9	43
Total	60.0	63.8

Any formula chosen for subsidy sharing must ensure at least USD 65/bbl required for viability of redevelopments

SOURCE: ONGC

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EXHIBIT 26

Diesel retail price in India is amongst the lowest in the world (in the 1st quartile amongst 164 countries)
US cents/litre

Bottom quartile	Second quartile	Third quartile	Top quartile

Diesel price in India is amongst the lowest in the world

Norway 235
UK 227
Australia
Japan
South Korea
France 178
Japan 161
163
South Africa
157
142
Singapore 126
Pakistan 120
Brazil
US 105
Thailand 102
Bangladesh 97
Indonesia
India 86
Egypt 76
Saudi Arabia 47
Venezuela 18
7
1

SOURCE: GIZ report commissioned by Federal ministry of economic cooperation and development, Germany, 2013

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3. DRIVING EFFICIENCIES IN THE DOWNSTREAM SECTOR

In our discussions with industry executives, there was an overwhelming consensus on using the tough market conditions to structurally improve the cost position, aspire for the next wave of operations excellence, harness cross-functional synergies, and re-energise structural initiatives to avoid downsides and generate cash for growth.

Over the last few years, the industry has made significant operational improvements, for example, reduction in energy consumption at refineries, implementation of norms for crude and finished goods inventory, etc. (Exhibit 27).

EXHIBIT 27

Petrol retail prices in India is also towards the lower side, falling into 2nd quartile amongst 164 countries
US cents/litre

SOURCE: GIZ report commissioned by Federal ministry of economic cooperation and development, Germany, 2013   McKinsey & Company

However, there are a few areas that the industry and government can pursue to achieve the next level of improvement:

3.1 Integrated margin management in refining and marketing

In a challenging external environment, in addition to building new assets for the future, it is equally important to optimise the existing ones to maximise margins by reducing operating cost, optimising the product/crude slate and improving

yields. An assessment of some of the Indian refineries reveals that their operating performance has been improving due to multiple initiatives that they have undertaken (Exhibit 28). On an ongoing basis, the refineries in India are making efforts to address their crude slate optimisation, improve operations, reduce energy consumption, improve reliability of operations using modernised methods of inspection and maintenance.

EXHIBIT 28

Operational efficiencies of refineries has been improving over last few years

ILLUSTRATIVE

	Company 1	Company 2	Company 3

Distillate Yield Percent

Company 1: +6% p.a. — 73.8 (FY08), 78.1 (FY13)
Company 2: +2% p.a. — 84.7 (FY09), 91.1 (FY13)
Company 3: +1% p.a. — 72.4 (FY08), 73.3 (FY13)

Crude inventory Days

Company 1: -4% p.a. — 41.0 (FY11), 38.0 (FY13)
Company 2: -33% p.a. — 15.0 (FY09), 3.0 (FY13)
Company 3: -14% p.a. — 23.0 (FY09), 13.0 (FY13)

SOURCE: Company presentations; McKinsey analysis   McKinsey & Company |

■ **Opportunity to rationalise operations costs:** A top–down benchmarking of operations costs indicates that improvement opportunities for some of the refineries and petrochemical units still exist, for example, finished goods inventory (Exhibit 29). The key challenge in improving operations at some refineries would be managing the diversity in size, complexity and scale of the refineries, and the work culture.

■ **Opportunity to optimise product/crude slate and maximise yield to enhance profitability:** In addition to optimising the operations costs, the refiners should look for opportunities to maximise margins through adjustments in product slate and crude slate, enhance focus on product quality and maximise yield. Some of the critical initiatives they should pursue for this are: (i) optimise the product slate further by ensuring maximum exchange of

streams between refineries, (ii) diversify the number of crudes used to perform LP runs to minimise loss in margins due to differences between planned crude runs and actual crude runs, (iii) invest in R&D to ensure no/marginal loss in quality of products during transportation, and (iv) maximise yield by ensuring the highest levels of reliability in the refineries and petrochemical units.

EXHIBIT 29

15-20% cost reduction potential exist for finished goods inventory at select refineries

DISGUISED
INDIAN EXAMPLE

Finished goods inventory at refineries

Days

Refinery 1	Refinery 2	Refinery 3	Refinery 4	Refinery 5	Refinery 6	Refinery 7	Pacesetter
32.0	15.0	12.4	15.0	19.0	12.0	18.2	12.0

-20% 15.0 (Average)[1]

Potential for 15-20% reduction in inventory levels at refineries

1 Excluding outlier refinery 1

3.2 Optimising end-to-end supply chain

For some of the refiners, pursue cross-departmental (refineries, marketing, pipelines and R&D) efforts to rationalise crude and finished goods inventory, and structurally reduce supply chain costs.

■ **Address structural constraints in optimising crude inventory:** Crude levels across some of the refineries are higher than necessary because of structural issues like un-pumpable stock (for example, due to technical constraints of floating roof tanks), inventory locked in at intermediate storage points, etc. Capturing these opportunities will not be easy. This would require a cross-functional effort between refineries, R&D and the pipelines functions to assess the efficiency of the crude supply chain network and optimise the inventory.

■ **Optimise finished goods inventory:** Variations exist between the finished goods inventories across the industry (Exhibit 30). Even within a refining company, there are massive variations in inventory days across different storage locations. Lowering finished goods inventory to median levels in these high storage locations could help reduce inventory at depots/terminals by 20 to 25 per cent (equal to 3 to 4 days). However, there are significant technical and commercial challenges in capturing this opportunity, like (i) constraints regarding minimum batch size for transportation of oil through pipelines, and (ii) optimum parcel size to rationalise freight for water-borne deliveries.

■ **Optimise supply chain costs and rationalise depots and network:** At both levels of an individual company and the overall industry, there exist opportunities to rationalise the network by exploring infrastructure sharing and network rationalisation options, that is, closing/combining depots, etc. This has become even more relevant in the context of the recent MBLal committee report.

EXHIBIT 30

Global experience indicates improvement opportunity for typical refineries

CLIENT DATA

Potential percentage costs saving based on size and starting quartile (based on Solomon index) of refinery

Size 1000 bbl/day	Starting quartile	Fixed costs Percentage saving	Variable costs Percentage saving
>250	4	30	8
>250	3	41	21
>250	4	45	38
>250	1	18	7
150-250	2	30	10
150-250	2	32	11
150-250	3	30	12
150-250	3	33	20
150-250	3	26	25
150-250	2	21	15
75-150	2	33	8
75-150	4	30	17

Ø 31   Ø 16

▪ **Typical levers**
  – Crude procurement optimization
  – Operations
  – Energy
  – Maintenance
▪ **Actual potential can be estimated only after a detailed diagnostic for specific refinery**

SOURCE: McKinsey

McKinsey & Company |

3.3 Government support crucial to unlock efficiencies

The government can support the refiners by addressing some of the structural challenges (for the PSU refiners this needs to happen within the context of CVC/ CAG guidelines) being faced by the industry, as described below.

■ Permit public sector refiners to procure crude through the non-tender route. The bulk of spot crude oil is traded over the counter through negotiations between buyers and sellers. The PSU process takes much longer and is a costlier transaction. Furthermore, market opportunities like the procurement of distress cargoes cannot be captured

■ Support capex and opex procurement through soft loans to reduce the adverse impact of high cost of capital. For example, Oil Industry Development Board may increase the cap (currently 25 per cent) of concession loans for capital projects for oil companies. Further, the external commercial borrowing option (to meet working capital requirements) open to three OMCs (IOCL, BPCL and HPCL) can be extended to other refineries

■ Permit public sector refineries to source crude oil on a cost and freight (CFR) basis. Procuring cargoes only through FOB results in a higher freight and reduced access to certain crude oil grades available only on CFR, for example, Brazil, Ecuador, Canada, etc. This would be, of course, subject to Central Vigilance Commission guidelines.

■ Provide clarity on the product specification roadmap so that future expansions and new refineries can be established in light of the expected specification upgrade. Upgrading the existing units requires unprofitable incremental capex. An example is the recent investment to upgrade product quality by CPCL and MRPL.

■ Provide support for depot and retail outlet rationalisation, which often encounters socio-political resistance at various levels

■ Fund safety stocks at ISPRL from the government budget or through special grants, to ensure energy security for the country and uninterrupted crude supply for the refining industry, without resorting to industry funding

■ Make timely payments of the cross-subsidy to better manage cash flow as long as under-recoveries continue

■ Support the setting up of infrastructure to successfully export downstream petroleum and petrochemical products in a period of surplus.

We believe that the government and industry need to work together to address structural issues like crude procurement policies, shipping restrictions, sharing of

infrastructure, accelerating procurement improvements, and unlocking operational and marketing efficiencies. The best way to ensure efficiency in the long term is to provide free market prices and a level playing field for all players.

□   □   □

While the country today is self-sufficient in diesel, petrol and kerosene, the industry fundamentals are weighed down. Given the weakness in the Asian markets, structural disadvantages faced by the Indian industry, servicing of debt for new capacity being set up/recently commissioned and the need to build additional capacity, the industry fundamentals can quickly come under stress in case of any tightening in the pricing regime, and could pull down the economics of the entire oil and gas sector resulting in product shortages, higher current account deficit and increase in crude imports. Any pricing policy decision should ensure that the oil and gas industry remains financially healthy to sustain the investments needed to maintain India's energy security.