



**INDIA-TECH
FOUNDATION**

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Let's energise

Meeting India's growing fuel demand



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Foreword

Promoting energy security



The promise of energy security is compelling for a developing country like India. For a nation of over 1.2 billion people, riding on the hopes and aspirations of a thriving economy, satiating energy needs forms the nucleus of inclusive growth. With India importing 80% of its oil and gas requirements, the country has always been infinitely conscious that diversification remains the cornerstone for achieving energy security. Any effort at enhancing domestic discoveries has to be matched with the acquisition of international acreages in parallel, to complement domestic production. As a frontrunner in this field, ONGC Videsh is focussed on expanding horizons by entering newer geographies and overcoming the challenges which are the norm for the exploration and production (E&P) industry. Close coordination with the Indian government authorities and partnership with service players and investors is proving to be very rewarding in the current context. The Indian government is pursuing oil diplomacy by fostering alliances with hydrocarbon-rich nations; this will be advantageous to the Indian economy in the long run.

We believe decisive and differentiated actions are vital in the present environment of low oil prices. The stage is set to pursue acquisitions of lucrative overseas assets and cheaper services from international providers. Currently, strong activity has been observed in the form of the opening up of newer geographies like Mexico and New Zealand.

Exploration has become challenging and competitive in recent years. We believe that the value lies in discovering and establishing reserves in exploratory blocks through innovative thinking and applying of new ideas for accretion of reserves and long-term growth. We are present in different geographies and face multiple challenges which need continuous interventions due to different geo-political environments, regulations and contractual agreements. We require world-class geoscience abilities, skills to function in demanding environments, robust business development networks and the financial discipline to manage risks effectively. Although overseas production may not directly result in enhanced domestic oil supplies, overseas acquisitions do supplement the energy security of the country by assuring an energy secure future. We also intend to explore unconventional resources further, for which persistent advancements and skills innovation are imperative.

We hope that this paper will stimulate discussion on approaches for achieving energy security and differentiating between exploring assets overseas and acquiring equity oil. We look forward to a successful convention and are committed to following up with actions on the deliberations.

Narendra K Verma

Managing Director & CEO
ONGC Videsh

Preface



The 4th National Oil & Gas Convention organised by India-Tech Foundation is a platform for all stakeholders to assemble and brainstorm on issues related to energy security while planning a roadmap for the future. PwC is privileged to be associated as the knowledge partner for this event.

The National Steering Committee of this convention has invited leaders in the spheres of policy making. This will give them access to the stakeholders' viewpoint while also making them available for consultation.

To achieve this objective of the convention, PwC has put together this background paper titled 'Let's energise: Meeting India's growing fuel demand.' The paper sets out the current energy scenario in the country, which is characterised by rising demand and high import dependency, and its impact. It also sets out the challenges faced by India in the quest for energy independence. Further, it outlines the importance of equity oil for ensuring energy independence. The paper highlights some of the distinguishing features of India's refining sector from the perspective of meeting the country's hydrocarbon energy needs.

We sincerely hope this paper sets the context for deliberations and leads to recommendations on actions to be taken.

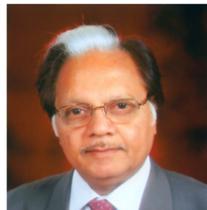
PwC will be privileged to assist India-Tech Foundation in further summarising proceedings and collating recommendations made during the convention.

I hope the convention is a grand success.

Deepak Mahurkar

Leader, Oil & Gas
PwC India

Message



Over the years, the global oil and gas industry has gone through a number of cycles and changes that have required the industry to adapt and evolve. India is no exception. As a developing country with a population of over 1.2 billion and a growing economy, our already high dependence on imported oil has soared to 80%. India's energy sector is at a critical juncture. There is, on the one hand, a growing demand for energy and, at the same time, a set of challenging resource constraints which call for the reshaping of the matrix of our energy policy. This will definitely happen gradually and eventually—over the coming decades—but it poses urgent questions today. Our nation's response and the time that we will need to develop new technologies and reset the overall energy matrix will have to be carefully calibrated. This calls for coordinated action, efficient planning and massive investment.

The Indian oil and gas industry, in the last decade, has seen robust growth in domestic production. The refining sector in India, too, has witnessed a silent revolution. India has, over the years, developed into a major export hub. The emergence of major consumers in Asia, mainly India and China, has fundamentally changed the global energy equations. The global nature of these challenges and the growing symbiotic connect between producing, consuming and transiting countries require a strengthened partnership between all state actors to enhance global energy security.

India's oil industry has been able to meet targets for the introduction of improved quality fuels. This has had a salutary effect on the ambient air quality in our cities. Another significant step by the oil industry towards reducing pollution and improving the environment is the substitution of petroleum products with natural gas.

It is vital for the industry to enhance collaboration between national oil companies, international oil companies, service providers, as well as other industry stakeholders, to help further streamline the industry and discuss views on the industry's future.

It is essential to maintain R&D initiatives and to continually develop technologies that can help in discovering, extracting and producing more hydrocarbon reserves in an ever more cost-effective and sustainable manner.

Apart from pricing and sourcing, R&D of new technologies is another area that requires special attention. The traditional oil majors can no longer remain complacent about extensive reserves, refineries and distribution networks being their mainstay. As a matter of fact, many successful oil and gas companies have a grip on emerging new technologies. Many industry solutions are being provided by jointly funded research in universities.

The Ministry of Petroleum and Natural Gas and the Department of Science and Technology, Government of India, actively support R&D projects undertaken by academic institutions as well as industry players.

The status report on the oil and gas sector by our knowledge partner, PwC, combining important industry-focussed data compilation, in-depth sector analysis, expertise of professionals, and the latest developments and modern technologies, presents the best, appropriate and relevant solutions, which will make operations efficient for optimum production at the lowest costs.

The challenges confronting this sector are many, but I am confident that our oil sector has, over the years, acquired the maturity and vision to surmount these challenges.

The oil and gas industry needs to pursue the application of advanced and innovative but affordable technologies—adapted to our specific conditions. A healthy and viable hydrocarbons sector can help alter our growth trajectory. The 4th National Oil & Gas Convention, with the dual theme 'Opportunities for Indian companies in exploring oil and gas overseas' and 'Role of the refinery sector in India's energy security', will enable our professionals, both managers and technologists, to keep abreast of the latest developments at the global level. The Indian hydrocarbon and petroleum sectors must be equipped to responsibly deliver ever cleaner, ever more reliable and ever more affordable energy. I am sure the domestic oil and gas industry will place sustainable development at the core of its business decisions. This means placing safety, the environment and community interest at the centre of its policies, thus making the health, safety and environment aspects relevant to the tenets of corporate social responsibility. I am confident that the deliberations at the convention will contribute to the building of a vibrant energy sector in India, which can be the bedrock of growth and prosperity.

Indra Mohan
President, India-Tech Foundation

Introduction

The promise of energy security is alluring. For an import-dependent country like India, import independence is seemingly impossible to achieve, yet worth pursuing. Hydrocarbon exploration successes over the last decade have given India the confidence of achieving this dream. Though it takes the hydrocarbon exploration sector decades to convert policies into outcomes, the outlook for the future is positive. Industry captains often state that the challenges of dealing with energy security are immense, but they also agree that the rewards of achieving energy security are considerable.

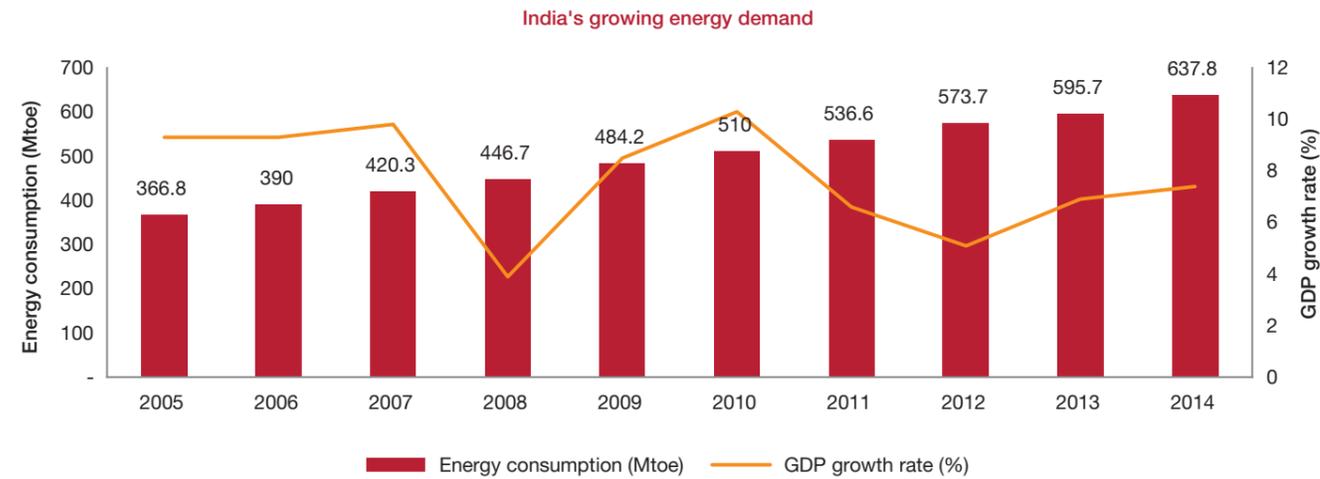
This paper looks at the impact that oil has on the Indian economy and the growing significance of oil in India's otherwise coal-dominated energy basket. With a growing appetite for oil, the country's supply-demand gap has widened to a point where India has to import about 80% of its oil from overseas. If this trend continues, by 2020, India's import dependence is likely to reach 90%. To complicate things further, India's major oil suppliers are in the unstable regions of the Middle East and Africa, leaving the country vulnerable to a host of risks ranging from geopolitics to volatile prices.

This conference proposes to discuss and address the key issues and challenges emanating from our quest for energy independence. A conference on energy security would be incomplete if downstream refining is not talked about. As a net exporter of finished petroleum products, the Indian refining industry has come a long way since the first refinery was set up at Digboi in 1901. Given this context, the organisers of this conference have taken a pragmatic approach by setting a dual theme. On the one hand, the conference looks at the 'Opportunities for Indian companies in exploring oil and gas overseas', while on the other hand, it explores the 'Role of the refining sector in India's energy security'. The conference touches upon an entire gamut of topics ranging from strategy, finance, regulatory, tax, technology, human capital, trading, and health safety and environment (HSE).

This paper attempts to present the facts and ground realities of the Indian oil and gas sector. The following chapters have been structured with the aim of putting into perspective various sessions of the conference. The first chapter presents the energy scenario of India, detailing the growth in energy demand and increasing import dependence. Further, it outlines the importance of equity oil and its increasing role in ensuring energy independence. The next chapter focusses on equity oil, detailing the efforts of various national oil companies (NOCs). It then goes on to identify certain key risks that are attached to equity oil. The final chapter highlights the refining scenario in India. In the downstream sector, India has sufficient refining capacity to meet the domestic demand successfully. In fact, India is a net exporter of refined petroleum products. While this is a good beginning, the refining sector has a long way to go in terms of improving efficiencies and meeting various technological challenges.



India's energy scenario

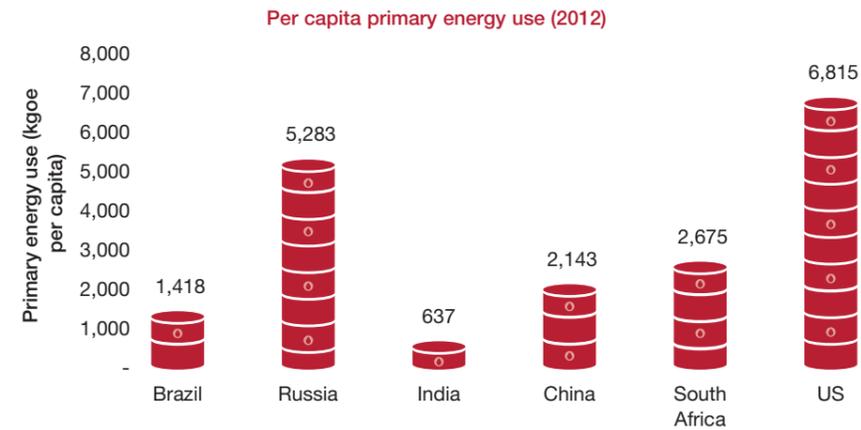


India has a population of over 1.2 billion, accounting for more than 17% of the world's population. It is the seventh largest country in the world, with a total land area of 32,87,263 sq km. India is the fourth largest consumer of energy in the world after China, the US and Russia. India's energy consumption stood at 638 Mtoe in 2014-15, a growth of 7.1% from the 2013-14 levels. A large and growing population, coupled with an uptick in economic activities, will only add to the growth of energy consumption in the coming years.

and become a 10-trillion USD economy by 2034¹. With an increase in economic activity, the services and industrial sectors are expected to contribute more towards the GDP. The share of agriculture will go down further, thereby shifting more people from rural to urban centres. As of 2014, about 68% of the Indian population lives in rural areas and

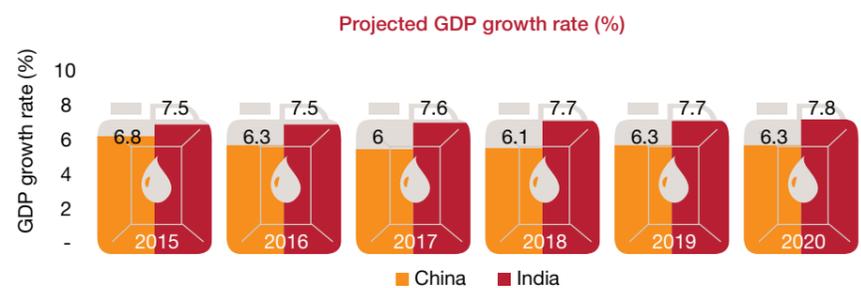
depends upon non-commercial sources to meet its energy needs. According to the 2011 India Census, more than 80% of rural households use traditional biomass (including firewood and crop residue) as the primary fuel for cooking. Given this scenario, the primary energy demand of India is expected to maintain its upward trend in the next few years.

While India's energy consumption might seem to be high in absolute terms, it has one of the lowest per capita primary energy consumption among the developing economies of the world. India's per capita consumption of primary energy stood at 637 kgoe in 2012, which is significantly lower than the global average (2,500 kgoe), indicating significant growth potential of the energy demand in the country.



Drivers for increasing energy demand

With economic activity picking up across various sectors, the Indian economy is expected to benefit from increased infrastructure spending, easing policy norms and a focus on 'Make in India'. International Monetary Fund (IMF) projection expects the Indian GDP to overtake that of China in 2015. India has the potential to achieve a 9% growth rate

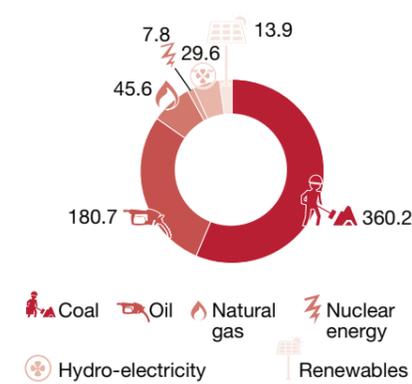


India's energy basket

India's energy basket is highly skewed towards coal. Currently, 56% of India's primary energy requirement is met through coal. The power sector is the biggest consumer of coal, with coal-fired power plants contributing to 60% of the total national installed capacity. India's over-reliance on coal is primarily due to its easy availability. With 60.6 billion tonnes of coal reserves, India has the world's fifth largest coal reserves, or 6.8% of the world's total coal.² The next big contributor of primary energy



Primary energy consumption by fuel type (Mtoe)



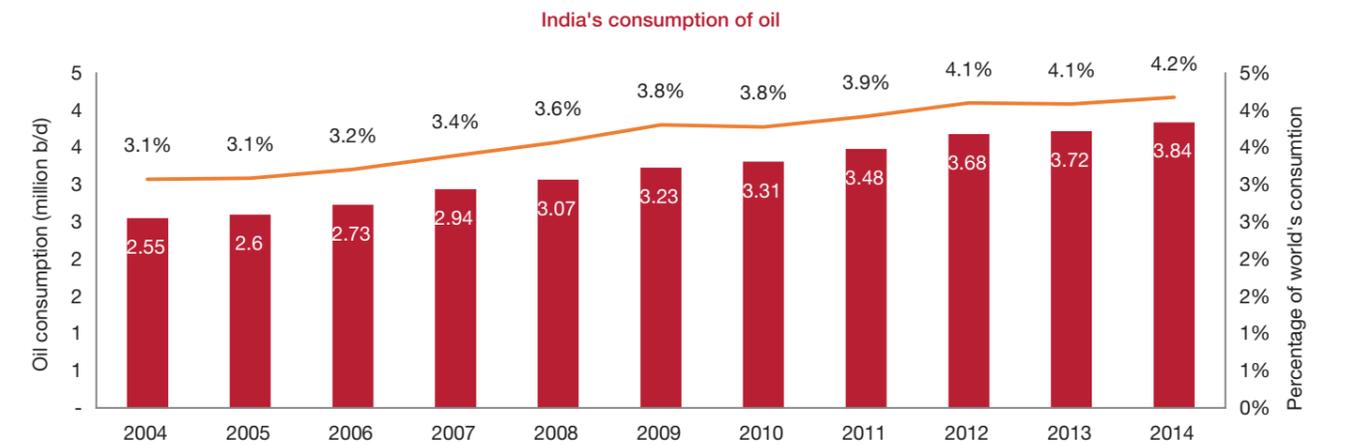
Source: BP Statistical Review, June 2015

is crude oil, accounting for nearly 28% of the total energy basket. India's crude oil consumption has been growing at a steady pace, with the transportation sector being the major source of consumption.

India's crude oil consumption

Currently, India is the fourth largest oil consumer in the world, after the US, China and Russia. India's crude oil consumption in 2014 stood at 3.8 million b/d, up 3% from the previous year. India's share of global crude oil consumption has seen a steady rise from 3.1% in 2005 to

4.2% in 2014. As per Energy Information Administration's (EIA) Annual Energy Outlook, India's consumption will increase to nearly 5.2 million b/d by 2025. The International Energy Agency estimates that India will become the world's largest oil importer by 2020.



Source: BP Statistical Review, June 2015

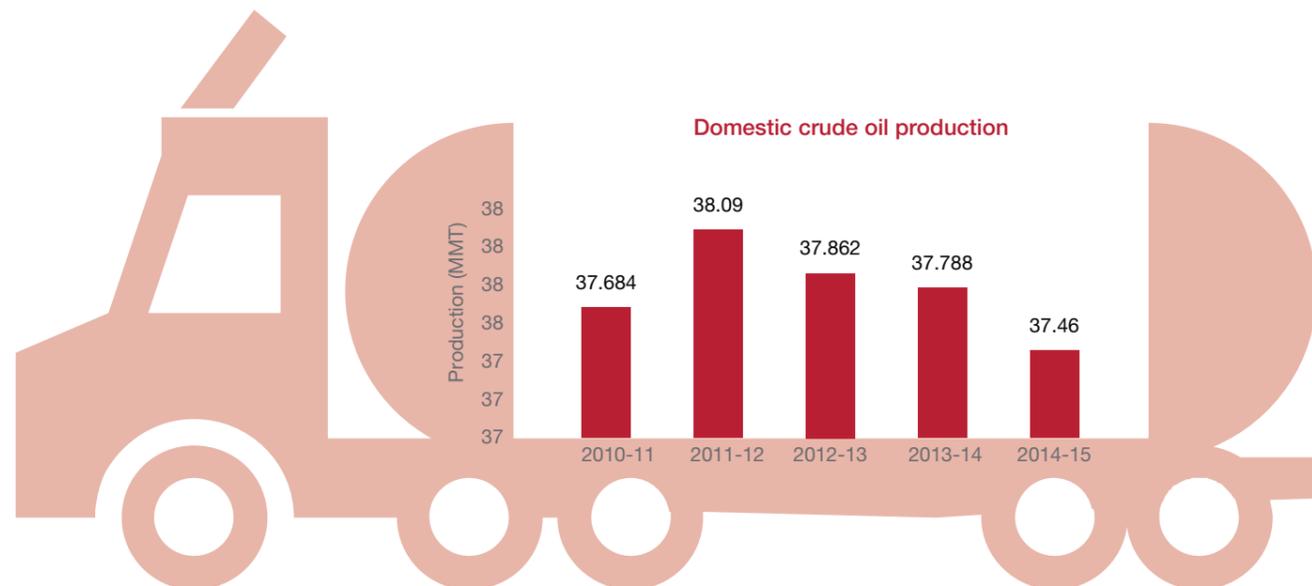
1. 'Stuck in low global growth and India overtaking China - Is this the "new normal"?' The Guardian, 15 April 2015

2. BP Statistical Review of World Energy, June 2015

Crude oil production

India's oil production over the last few years has remained more or less stagnant. While no new producing fields have been brought online over the last few years, Indian oil companies, through infusion of advanced technologies, have tried to arrest the natural decline in the existing

ageing fields. Currently, NOCs account for nearly 70% of domestic production, with the remaining 30% coming from private/joint venture (JV) companies. In order to increase domestic production, the Indian government has been encouraging private investment in the oil and gas sector through New Exploration and Licensing Policy (NELP) bidding rounds.



Source: Ministry of Petroleum & Natural Gas (MoPNG) Annual Report

India's domestic exploration efforts

India has 26 sedimentary basins covering an area of 3.14 million sq km. Of this, 57% of the area is in deep water and the remaining 43%, on land and in shallow offshore areas. Currently, 18 basins are under various stages of exploration. These sedimentary basins have been divided into four categories and deep water.³

India's proven oil reserves have remained more or less stagnant. With less than 1% of global proven reserves and more than 4% of global consumption, the Indian oil and gas sector faces the daunting task of meeting the domestic demand. This has led to India increasingly relying on crude oil imports to meet its domestic energy demands. With growth in demand and

domestic production remaining stagnant, India's dependence on imports has been rising steadily. Currently, about 80% of India's crude is imported from overseas. The increasing import dependence has left the Indian economy highly vulnerable to price shocks and supply disruptions. The Indian government has tried to mitigate the effects of supply disruptions by setting up Indian Strategic Petroleum Reserves Limited. The first phase of these reserves is expected to hold 5.33 MMT of oil. The subsequent phases are expected to add an additional 13 MMT of crude oil storage.

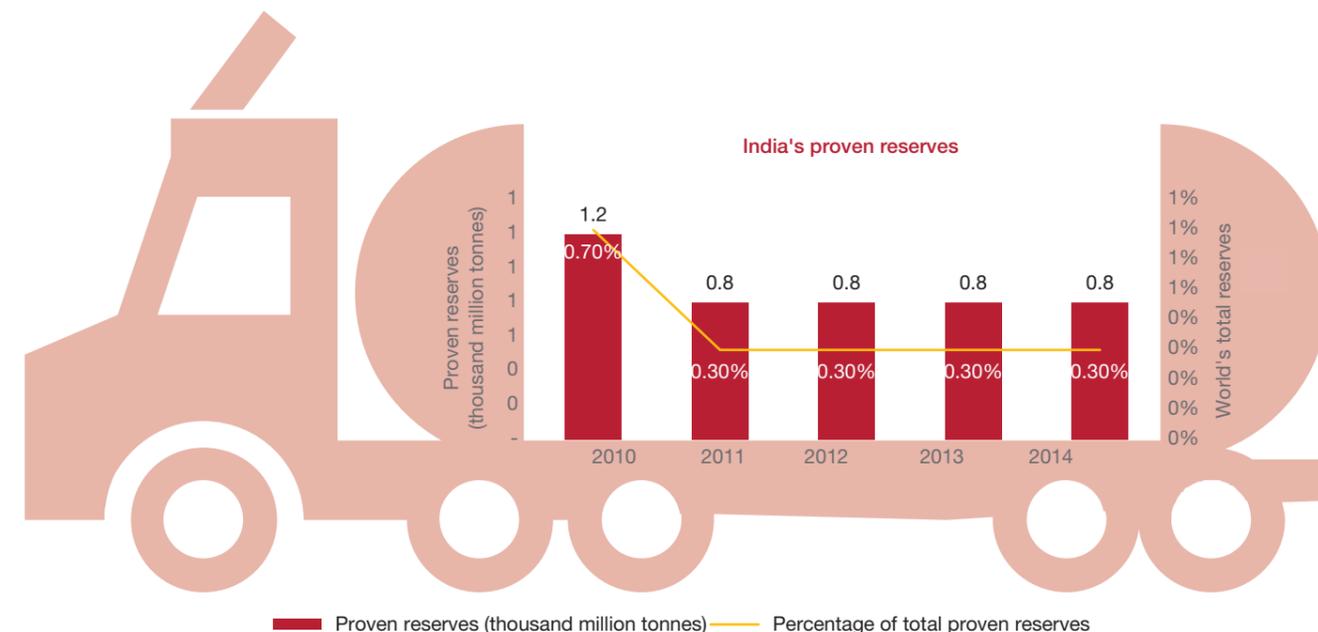
Cost of India's energy import dependence

India pays a heavy price for its high oil import dependency. Oil imports, as a percentage of aggregate imports, have

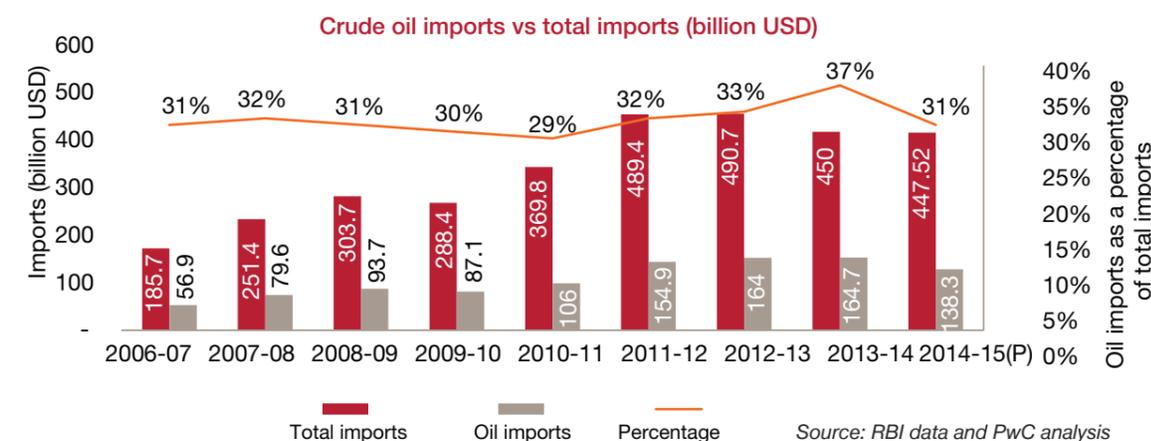
risen through the years, implying that a large part of India's foreign exchange is being consumed by oil imports. In 2011-12, oil imports accounted for almost 30% of India's total import bill. The oil trade deficit of India has risen over the years and currently accounts for around 60% of the country's total trade deficit. India's spending on oil imports as a percentage of its aggregate GDP has increased over the years. The average spending on oil imports as a percentage of the country's GDP has increased over time and is highly dependent upon crude oil prices. The inelastic nature of oil imports implies that the higher the percentage of GDP being spent on them, the higher is the vulnerability of the Indian economy to external shocks.

Type of basin	Area (million sq km)	Prospectively	Basins/regions
Category 1 (7 basins)	0.5	Established commercial production	Cambay, Assam Shelf, Mumbai offshore, Krishna Godavari, Cauvery, Assam-Arakan fold belt and Rajasthan
Category 2 (3 basins)	0.18	Known accumulation of hydrocarbons but no commercial production yet	Kutch, Mahanadi-NEC and Andaman and Nicobar
Category 3 (3 basins)	0.66	Indicated hydrocarbon shows that are considered geologically prospective	Himalayan foreland, Ganga, Vindhyan, Saurashtra, Kerala-Konkan-Lakshadweep and Bengal
Category 4 (6 basins)	0.46	Uncertain potential which may be prospective by analogy with similar basins in the world	Karewa, Spiti-Zanskar, Satpura-South Rewa-Damodar, Narmada, Deccan Syncline, Bhina-Kaladgi, Cuddapah, Pranhita-Godavari, Bastar, Chhattisgarh
Deepwater	0.13		East and west coast from 400-m water depth to Exclusive Economic Zone (EEZ)

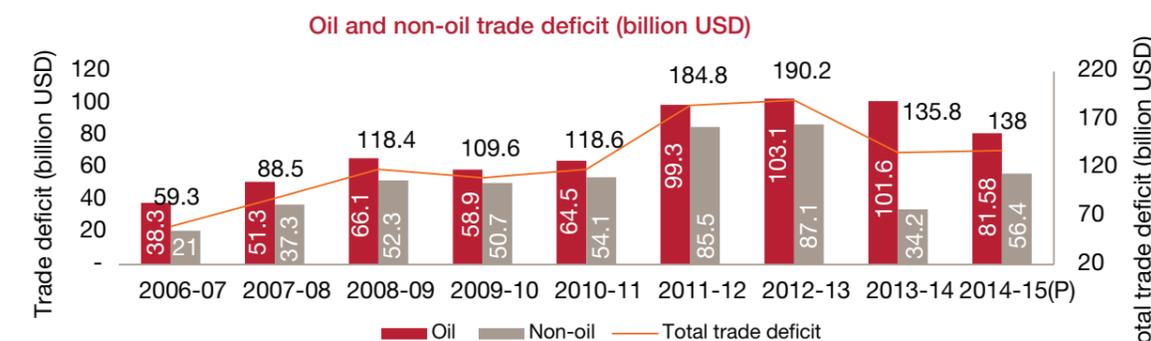
3. Annual Report 2014-15, MoPNG



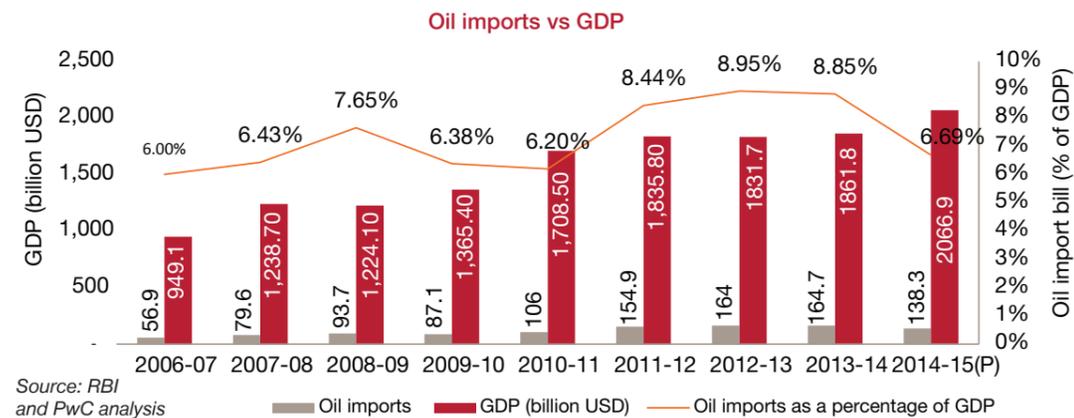
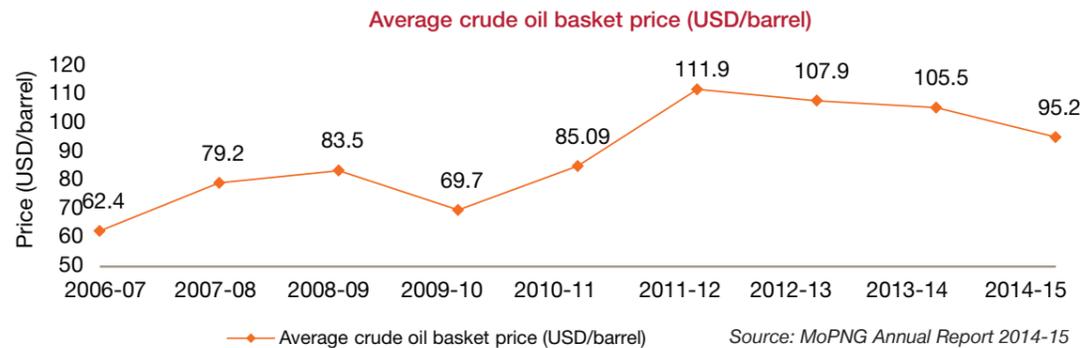
Source: BP Statistical Review, June 2015



Source: RBI data and PwC analysis



Source: MoPNG Annual Report 2014-15

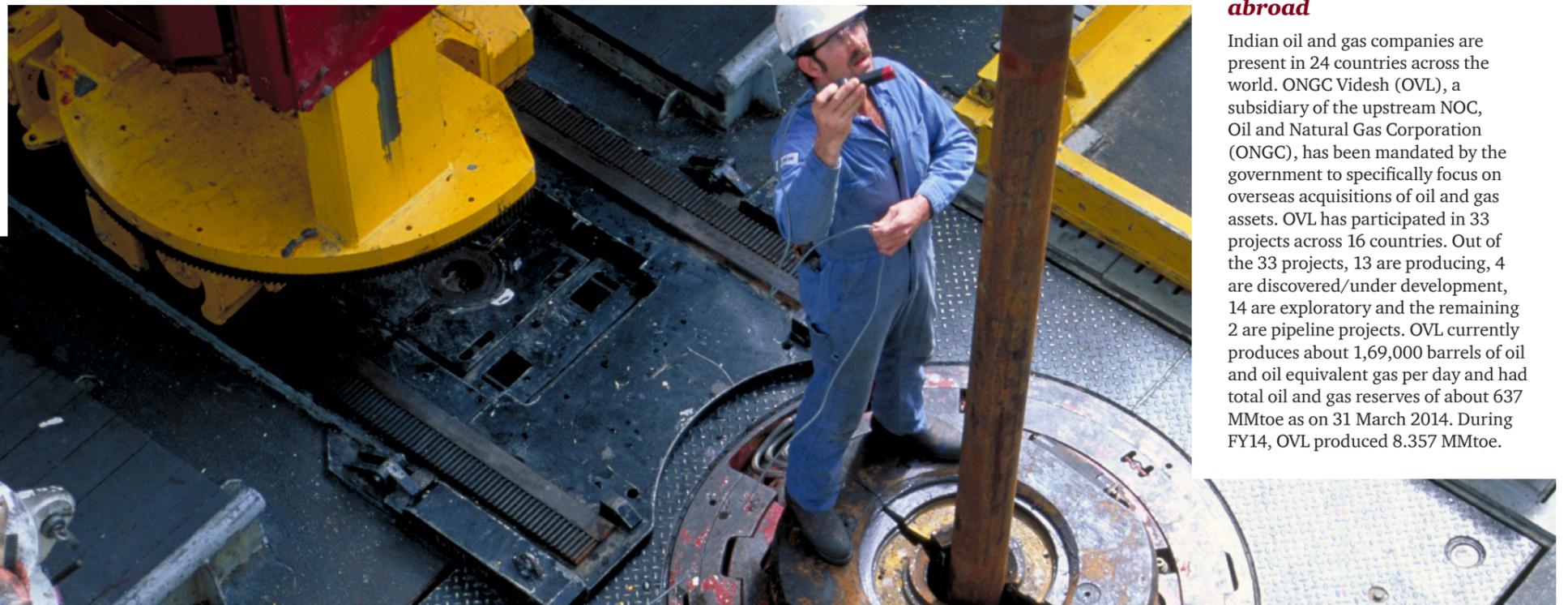


Conclusion

Given the current trend in domestic oil production, dependence on imports is expected to reach 90% in the next two decades. A higher percentage of GDP will need to be spent on oil imports, further increasing India's vulnerability to price shocks. Though the economy cannot be fully insulated against external shocks, the impact of such shocks can be limited if dependency on oil imports is reduced. This essentially calls for an increase in domestic oil production as well as the securing of more reserves overseas.

While increasing domestic oil production has its limitations, the focus should be on diversifying India's energy basket through alternative fuels such as coal bed methane, hydrogen, shale gas and ethanol blended fuel, as well as improving extraction efficiency by infusing technology and bringing new domestic discoveries into production.

At the same time, significant efforts should be undertaken to shore up India's overseas oil reserves by encouraging Indian oil companies, especially NOCs, to scout for potential oil reserves in foreign countries. Given that oil is a perfectly traded commodity, equity oil helps offset the effect of stagnating domestic production and acts as a hedge against rising oil prices. The slump in global oil prices is a good opportunity for India to acquire assets overseas. If India needs to reduce its import dependence, this window of opportunity should not be missed.



Equity oil

Representing 17% of the global population, India has less than 1% of the world's oil and gas reserves and 6.8% of the world's coal. India's import dependence to meet its energy demands has intensified concerns that without reliable, affordable energy, it will be unable to sustain high economic growth. To mitigate risks from growing import dependence, India has encouraged oil public sector undertakings (PSUs) to acquire overseas upstream assets. Equity oil is important for India since it strengthens our energy security by diversifying the supply base, enabling internal capability building and international exposure for NOCs, and serving as a long-term price hedge for crude oil. In the case of our neighbour China, the Big Three state-owned oil and gas companies—China National Petroleum Corp., China Petroleum & Chemical Corp. (Sinopec) and China National Offshore Oil Corp.—have been some of the most active buyers over the past several years. In 2013, China remained the largest buyer in the global oil and gas market, spending 22.2 billion USD.

Given that India has a relatively low share of hydrocarbon resources, there is a need

Proven international reserves for global NOCs (2013-14)⁴

National oil company	Country	Proven reserves (M BOE)	Percentage of total
Petronas	Malaysia	3,238	24%
PetroChina	China	2,283	10%
Statoil	Norway	1,686	30%
ONGC	India	1,339	20%
KNOC	Korea	1,330	99%

to put in place both a robust strategy and a mechanism for acquisition of equity oil through investments in oil and gas acreages abroad. The Kelkar Committee Report highlights the following institutional measures to support acquisition of equity oil abroad:

Creation of an International Sourcing Group (ISG): The report suggests creating a consortium between Indian companies and institutions to pursue international investments or partnership opportunities in the oil and gas sector. The combined entity has the advantage of higher financial strength, bargaining power and improved skill sets, thereby providing an attractive proposition for the host and ensuring project success.

Institution of energy diplomats: The report highlights the importance of

placing energy diplomats in key cities across the world which are hubs for oil and gas transactions. These diplomats can help support the cause of Indian companies seeking to acquire stakes in oil and gas assets by nurturing relationships with key stakeholders.

Acquisition of stakes in oil and gas prospecting companies: Given the vast geographical spread of oil and gas assets, it is important for Indian companies to be constantly updated with prospective locations which have promising oil and gas reserves. The report highlights the importance of 'active environment or landscape scanning', which can be achieved through buying stakes in oil and gas prospecting companies.

Indian oil and gas assets abroad

Indian oil and gas companies are present in 24 countries across the world. ONGC Videsh (OVL), a subsidiary of the upstream NOC, Oil and Natural Gas Corporation (ONGC), has been mandated by the government to specifically focus on overseas acquisitions of oil and gas assets. OVL has participated in 33 projects across 16 countries. Out of the 33 projects, 13 are producing, 4 are discovered/under development, 14 are exploratory and the remaining 2 are pipeline projects. OVL currently produces about 1,69,000 barrels of oil and oil equivalent gas per day and had total oil and gas reserves of about 637 MMtoe as on 31 March 2014. During FY14, OVL produced 8.357 MMtoe.

4. Roadmap for reduction in import dependency in the hydrocarbon sector by 2030, Kelkar Committee Report

Australia

Bharat PetroResources (BPRL) holds a 27.8-percent participating interest in onshore block EP-413, operated by Australia's Norwest Energy. The Hindustan Petroleum Corporation's subsidiary Prize Petroleum holds an 11.3-percent stake in the T/L1 gasfield and a 9.8-percent stake in the T/18P gasfield, both located in the Bass Basin and operated by Australian company Origin Energy.

Azerbaijan

ONGC Videsh holds a 2.72-percent stake in the Azeri-Chirag-Guneshli field and a 2.36-percent interest in the Baku-Tbilisi-Ceyhan pipeline.

Bangladesh

ONGC Videsh and Oil India each hold a 45-percent participating interest in offshore blocks SS-04 and SS-09 with ONGC Videsh as the operator.

Brazil

ONGC Videsh holds a 27-percent participating interest in offshore block BC-10, operated by Shell. ONGC Videsh holds a 25-percent participating interest in offshore block BM-SEAL-4. IBV Brasil, a joint venture between Indian independent Videocon and BPRL, holds a 20-percent participating interest in three offshore blocks in Sergipe Alagoas, operated by Brazil's Petrobras. IBV Brasil holds a 12.5-percent participating interest in one offshore block in the Campos Basin, operated by US company Anadarko. IBV Brasil has a 10-percent participating interest in two offshore blocks in the Potiguar Basin, both operated by Petrobras. Colombia ONGC Videsh has a joint venture with Chinese company Sinopec. The joint venture is called Mansarovar Energy.

Colombia

ONGC Videsh operates offshore block RC8 with a 40-percent interest. ONGC Videsh holds a 50-percent interest in offshore block RC9, operated by Ecopetrol. ONGC Videsh is the operator of block RC10 with a 50-percent interest. ONGC Videsh operates onshore block CPO-5 and holds a 70-percent interest. ONGC Videsh holds a 50-percent interest in onshore block SSJN-7, operated by multinational Pacific Rubiales Energy. ONGC Videsh fully owns and operates offshore block Gua Off-2. ONGC Videsh holds a 50-percent interest in onshore block Llanos-69.

East Timor

BPRL holds a 20-percent participating interest in offshore block JPDA-06-103, operated by Australian company Oilex. Oil India and the Indian Oil Corporation each hold a 12.5-percent interest in block K.

Gabon

The Indian Oil Corporation and Oil India each hold a 50-percent interest in onshore block Shakthi.

Indonesia

BPRL holds a 12.5-percent participating interest in the offshore Nunukan production-sharing contract, operated by Indonesia's Pertamina.

Iran

ONGC Videsh and the Indian Oil Corporation each hold a 40-percent interest in the Farsi offshore block. Oil India holds the remaining 20-percent interest in the block, which is operated by ONGC Videsh.

Iraq

ONGC Videsh fully owns block 8 in Iraq's Western Desert.

Kazakhstan

ONGC Videsh holds a 25-percent participating interest in the KazMunayGas-operated Satpayev block located in the Caspian Sea.

Libya

ONGC Videsh fully owns and operates offshore contract area 43. Oil India and the Indian Oil Corporation both hold a 50-percent interest in the Area 86 and 102/4 blocks, operated by Oil India. Oil India and the Indian Oil Corporation each hold a 25-percent interest in onshore area 95-96, which is located in the Ghadames Basin and operated by Sonatrach.



Mozambique

ONGC Videsh owns 16 percent, Oil India has 4 percent and BPRL holds 10 percent of offshore gas block Rovuma Area-1, operated by Anadarko.

Myanmar

ONGC Videsh holds a 17-percent share and GAIL holds an 8.5-percent participating interest in offshore blocks A-1 and A3. ONGC Videsh holds a 97-percent participating interest in onshore blocks B-2 and EP3. ONGC Videsh holds an 8.35-percent participating interest in the Onshore Gas Pipeline Transportation project through its joint venture South-East Asia Gas Pipeline Company. Oil India operates offshore block M-4 with a 60-percent stake. Oil India operates offshore block YEB with a 60-percent stake.

New Zealand

ONGC Videsh fully owns and operates offshore exploration block 14TAR-R1.

Nigeria

Oil India and the Indian Oil Corporation each hold a 25-percent stake in onshore block OML 142.

Russia

ONGC Videsh holds a 20-percent interest in offshore Sakhalin I, operated by ExxonMobil. ONGC Videsh owns the Imperial Energy Corporation, an independent upstream exploration and production company. Oil India holds a 50-percent participating interest in onshore oil licence 61.

South Sudan

ONGC Videsh holds a 24.1-percent interest in onshore block 5A, which is jointly operated with Malaysia's Petronas.

Sudan

ONGC Videsh holds a 25-percent interest in the Greater Nile Petroleum Operating Company, which operates blocks 1, 2 and 4. ONGC Videsh and Oil India, in a 90/10 partnership, have constructed a 12-inch, 741-kilometre multi-product pipeline from the Khartoum refinery to Port Sudan.

Syria

ONGC Nile Ganga, a subsidiary of ONGC Videsh, holds 16.7-18.8 percent shares in four production-sharing contracts in the Al Furat Project. ONGC Videsh holds a 60-percent share in the onshore block 24.

US

Oil India holds a 20-percent working interest and the Indian Oil Corporation holds a 10-percent interest in Niobrara shale joint-venture asset. GAIL holds a 20-percent interest in Eagle Ford shale assets through a joint venture with US company Carrizo Oil & Gas.

Venezuela

ONGC Videsh holds a 40-percent participating interest in the San Cristobal Project, jointly operated with state company Petróleos de Venezuela. ONGC Videsh holds an 11-percent share, Oil India has a 3.5-percent stake and the Indian Oil Corporation owns a 3.5-percent interest in the onshore Carabobo Project-1.

Vietnam

ONGC Videsh holds a 45-percent participating interest in offshore block 06.1, operated by TNK Vietnam. ONGC Videsh fully owns and operates offshore block 128.

Yemen

Oil India and the Indian Oil Corporation each hold 12.8-percent stakes in onshore blocks 82 and 83.

Oil and gas assets



Source: The Oil and Gas Year Book



Source: The Oil and Gas Year Book



Risks associated with equity oil

Acquiring equity oil abroad comes with a set of risks that oil companies need to factor in while making the investment decision. A robust risk mitigation framework is needed to identify and analyse the impact of these risks and put in place a well-defined mitigation plan. Certain key risks associated with equity oil have been identified below.

Geopolitical risks

Risks arising from political changes or instability in a country are termed as geopolitical risks. The oil and gas industry operates in a world of high uncertainty and geopolitical risks are the major contributor to this uncertainty. The main reason geopolitical risks are complex in nature is due to the presence of unpredictable elements and influencing

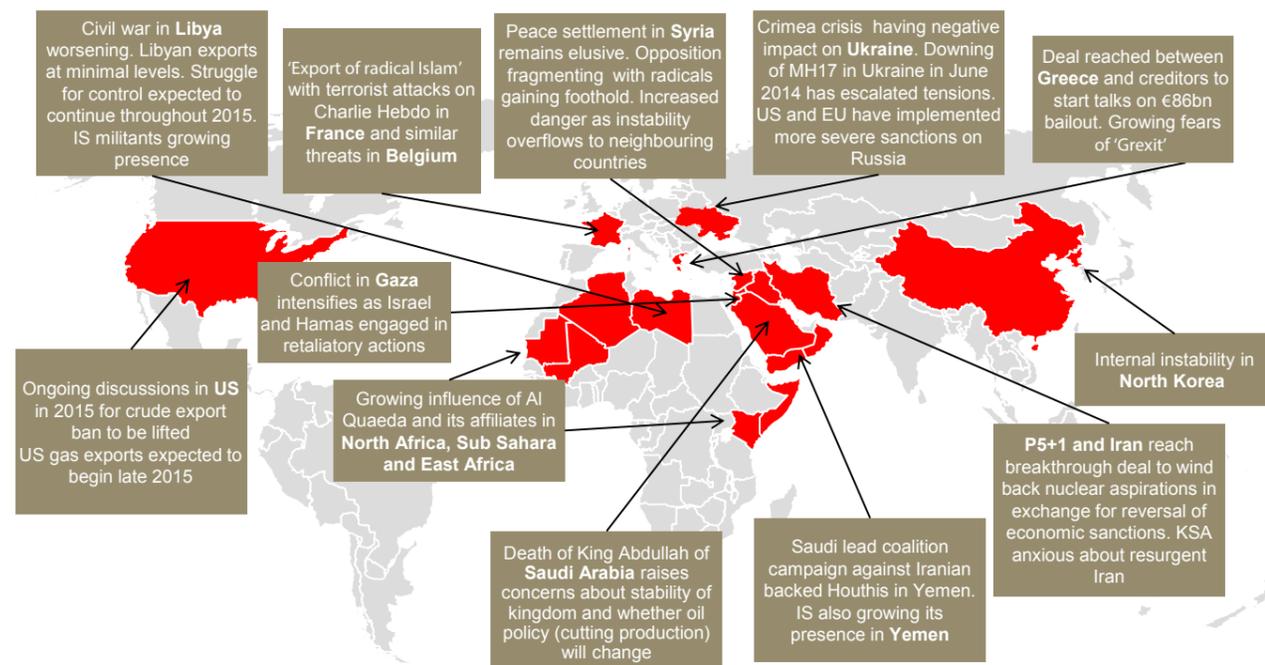
factors. Given the unpredictability, it is difficult to control or prepare for the fallout of these risks. As oil operations move towards more unstable parts of the world, exposure to geopolitical risks is at an all-time high.

Bribery and corruption

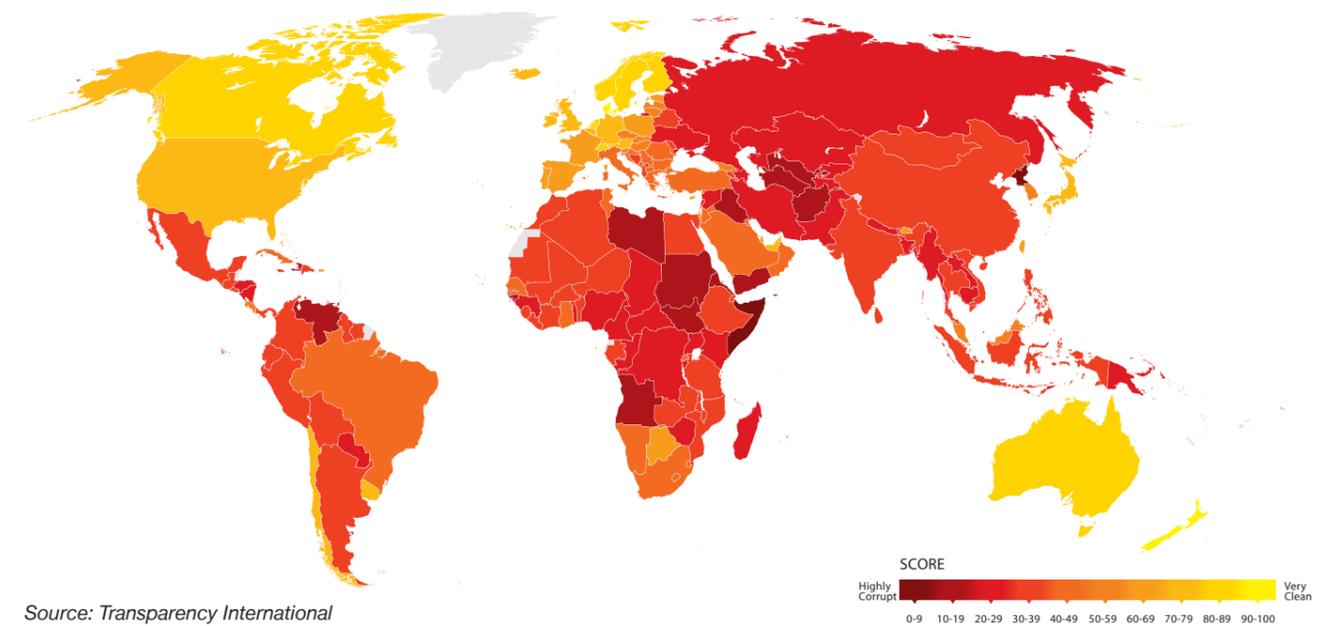
Given that most of the oil and gas reserves found in developed nations are under various stages of exploitation, oil and gas exploration and production is increasingly moving towards third world countries with huge reserves. Regions such as Africa, the Middle East, Russia and South America each have their unique challenges, ranging from political instability to cultures in which

gift giving is a standard business practice. Due to this, the oil industry is far more exposed to the risk of corruption than other kinds of business. Western oil majors such as Shell, Total and Eni have been operating in Nigeria (Africa's largest producer) for decades. However, it is noteworthy that Nigeria ranks 136 out of 175 in Transparency International's 2014 Corruption Perception Index. Angola,

another big African crude exporter where BP has a number of big projects, is at 161.⁵ The issue is particularly acute for oil companies, given the multimillion-dollar procurement contracts for their projects. Constant vigilance is required to ensure that such contracts are awarded to qualified companies and not to firms wielding political or monetary influence.



Source: Deutsche Bank; Press Search; Eurasia Group; Strategy & research



Source: Transparency International

5. 'Oil and gas has the highest bribery rate', Financial Times

Regulatory risks

Regulatory risk may be defined as the risk associated with changing regulatory laws in a host country. The impact that changing regulations have on the investment of a company is an important factor to be considered while making any investment decision. Potential fallout of regulatory risks may include litigation and reputation damage and inability to meet shareholder and institutional accountability demands. Clarity in rules and regulations is essential for ensuring an investment-friendly climate. While host countries strive to provide a stable regulatory regime to attract investments, investing companies should nevertheless be prepared to handle unexpected situations that threaten their investments.

Skills shortage

Oil and gas is a technology-intensive industry and requires people with high-quality skills. As companies move their exploration and production efforts abroad, sourcing local talent for setting up and running operations is a growing concern. Often, host countries have clauses requiring oil and gas companies to source local talent and content. However, as oil and gas operations move towards developing countries, finding skilled manpower has become more and more challenging. Inability to find skilled manpower is increasingly becoming an operational risk. To overcome these challenges, companies have started training and skilling local people to meet their standards and create a constant pool of skilled manpower.

Terrorism

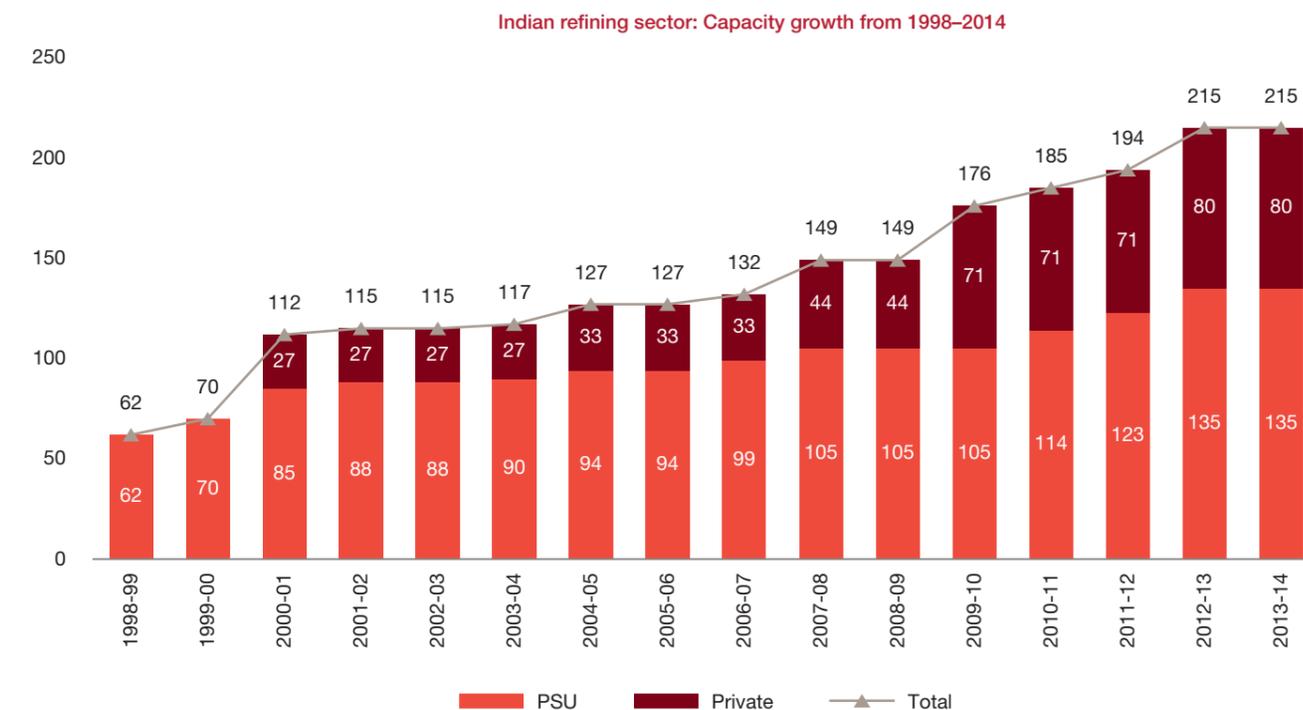
Recent terror attacks on oil and gas installations in the Middle East and Africa have highlighted the risk of terrorism in the industry. In a bid to acquire promising reserves at a discount, oil and gas companies are increasingly venturing into areas which are known terror hubs. Terrorism can have significant economic impact on companies. Terrorists can target critical oil and gas infrastructure and thus not only disrupt supplies but also create a significant environmental challenge. While it is difficult to evaluate the risk of terrorism or predict terrorist attacks, oil and gas companies are increasingly relying upon inputs from global security agencies while making investment decisions.

Conclusion

For companies operating in multiple countries, it is imperative to identify which risks they are exposed to and where those risks exist. Having a compliance programme in place may not completely eliminate risks. For example, a parent company that has a compliance programme may still be subject to enforcement action as a result of alleged misconduct, such as an improper payment made by a foreign subsidiary, even if the parent company was not aware of it. While rigorous risk assessment needs to be undertaken of the JV entity or the business partner, it is also important to perform detailed reviews of the consultants, distributors and sub-contractors. Sufficient third-party controls and monitoring should also be in place to ensure that the parent company is well-protected from risks arising out of the actions of other stakeholders.



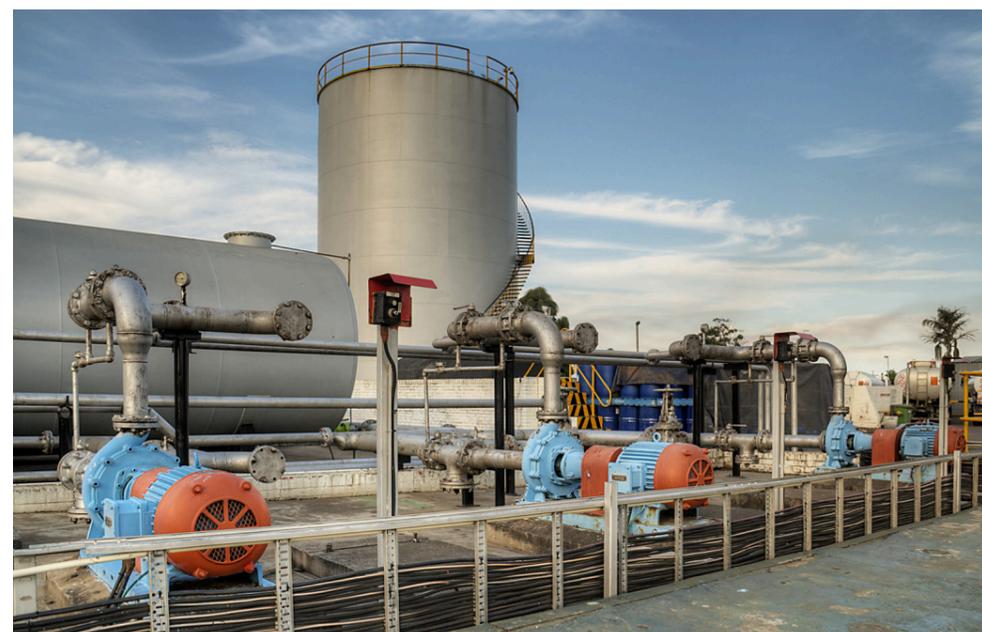
Role of refining sector in India's energy security



Indian refining sector: An overview

The petroleum refinery sector was delicensed in June 1998, which enabled a private or public company to set up a refinery anywhere in India, depending on the promoters' assessment of its viability. Since then, India has emerged as a refinery hub. Refining capacity in the country now exceeds the domestic demand. The capacity has increased from 62 MMTPA in 1998–99 to 215 MMTPA⁶ in 2014–15, out of which about 135 MMTPA are owned and operated by Indian PSU oil companies.

At present, there are 23⁷ refineries operating in the country, out of which 18 are in the public sector, 3 in the private sector and 2 are JVs. Out of the 18 public sector refineries, 9 are owned by Indian Oil Corporation Limited (IOCL), 2 each are owned by Chennai Petroleum Corporation Limited (CPCL; a subsidiary of IOCL), Hindustan Petroleum Corporation Limited (HPCL), Bharat Petroleum Corporation Limited (BPCL) and Oil and Natural Gas Corporation Limited, and 1 by Numaligarh Refinery Limited (NRL; a subsidiary of BPCL). The private sector refineries belong to Reliance Industries Limited (RIL) and Essar Oil Limited.



6. Data from MoPNG, Government of India

7. Includes the newly commissioned IOCL's Paradip Refinery



India's first refinery, Digboi Refinery, was commissioned in 1901 by Burmah Oil Company Ltd (later Assam Oil Company Ltd). IOCL took over the refinery and marketing management of Assam Oil Company Ltd with effect from 14 Oct 1981, and created a separate division. This division had both refinery and marketing operations.

The present capacity of the refinery is 0.650 MMTPA. Digboi Refinery is the oldest operating refinery in the world and produces premium grade paraffin wax and micro-crystalline wax.

Indian refining sector: Installed capacity

Company	Refinery	Year of commissioning	Installed capacity ⁸
<i>As of April 2015 (in MMTPA)</i>			
IOCL	Digboi	1901	0.7
	Guwahati	1962	1.0
	Barauni	1964	6.0
	Koyali	1965	13.7
	Haldia	1975	7.5
	Bongaigaon	1979	2.4
	Mathura	1982	8.0
	Panipat	1998	15.0
	Paradip	2015	15.0
CPCL	Manali	1969	10.5
	Nagapattinam	1993	1.0
HPCL	Mumbai	1954	6.5
	Visakh	1957	8.3
	New Refinery (Rajasthan)	-	-
BPCL	Mumbai	1955	12.0
	Kochi	1966	9.5
NRL	Numaligarh	2000	3.0
Mangalore Refinery and Petrochemicals Ltd (MRPL)	Mangalore	1996	15.0
ONGC	Tatipaka	2001	0.1
Joint venture			
Bharat Oman Refineries Ltd (BORL)	Bina	2011	6.0
HPCL-Mittal Energy Ltd (HMEL)	Bhatinda	2012	9.0
Private sector			
Reliance	Jamnagar	1999	33.0
	SEZ	2008	27.0
Essar	Vadinar	2006	20.0
Grand total capacity			215.1

India's energy needs

The refining capacity is not only sufficient for domestic consumption but also has a substantial surplus for the export of petroleum products. Since 2001–02, India

is a net exporter of petroleum products. During the year 2014–15, the country had exported 63.9 MMT⁹ of petroleum products worth 47 billion USD.

However, with the indigenous production of crude oil in India not keeping pace with the increased refining capacity, import dependency has been increasing and reached 77.6% in 2014–15 from 68% in 1999–2000. During 2014–15, the estimated indigenous production of crude oil was 38 MMT, and a total of 189 MMT of crude oil, valued at 112 billion USD, were imported by Indian refineries. As per the BP Statistical Review of World Energy 2015, as a country, India is the third largest importer of crude oil, accounting for almost 10% of global crude oil imports.

India's energy security

The current per capita consumption of primary energy in India is only 500 kgoe, which is much lower than the world average of 1,800 kgoe.¹⁰ With the Indian economy growing at around 7% per annum and the rising income levels of people, the consumption of petroleum products is set to further increase significantly.

Efficient and reliable energy supplies are, therefore, a precondition for accelerating the growth of the Indian economy. Indigenous available crude oil, though growing, is not sufficient to meet the energy needs of the country.

The challenge before Indian companies is to take effective measures for enhancing the exploration and production of petroleum resources. Simultaneously, the infrastructure for refining, distribution and marketing, import, export and conservation of petroleum products must be improved to ensure uninterrupted supplies of petroleum products across the country and to different sectors of the economy.

To enhance the country's energy security on the supply side, Indian oil companies are aggressively pursuing equity oil and gas opportunities overseas. Today, oil PSUs have a presence in more than 20 countries, with a total investment of over 13 billion USD.¹¹ MoPNG continues to pursue oil diplomacy with hydrocarbon-rich countries across the world to strengthen its interests.

On the demand side, the consistency of import parity/trade parity pricing policy at the 'Refinery Gate' and policy decisions on FDI have enabled the country's refining capacity to grow more than threefold from 62 MMTPA in 1998–99 to 215 MMTPA presently.

The growth in refining capacity has transformed India from a net importer of petroleum products till 2000–01 to one of the world's largest exporters of refined petroleum products in 2014–15.

The actions taken by Indian companies to strengthen India's energy security on the upstream side have been discussed in earlier sections. From the perspective of augmenting energy security on the downstream side, the key objectives, as defined by MoPNG,¹² applicable to the refining sector are as follows:

- Maintain self-sufficiency and enhance the export capability of petroleum products through enhancement of refining capacity and technological upgradation of refineries;
- Increase availability of quality fuels at reasonable prices;
- Improve consumer services through better retailing practices and competition.

Refining sector's role in India's energy security

The refining sector plays an important role in energy security by ensuring that the total energy demand for petroleum fuels is met from domestic and overseas supplies in a timely manner. The key steps taken by refining companies to enhance their role in energy security are described below.

Increase in refinery capacity

Recently, IOCL has planned to expand its Barauni Refinery in Bihar from its existing capacity of 6 MMTPA to 9 MMTPA. BPCL, Mumbai, has engaged Engineers India Ltd (EIL) to assess the feasibility of expanding its 3-MMTPA Numaligarh Refinery in Assam. Under the separate agreements, which were signed during the past year, EIL was to provide detailed feasibility reports for both the expansion of Numaligarh Refinery as well as for a 1,400-km (about 870-mile) crude oil pipeline connected to the project that would extend from the port of Dhamra on India's eastern coast to Numaligarh.

In addition, BPCL has plans for a new industrial gas complex at its Kochi Refinery. To be built on a 'build-own-operate' basis, the gas complex will supply industrial gases (hydrogen, nitrogen and oxygen) for Kochi Refinery's integrated expansion project, which will increase the refinery's capacity from 9.5 MMTPA to 15.5 MMTPA and produce fuels that meet Europe's latest emissions standards.

Indian refining sector: Existing and projected capacities¹³

Company	Refinery	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Public sector							
IOCL	Digboi	0.7	0.7	0.7	0.7	0.7	0.7
	Guwahati	1.0	1.0	1.0	1.0	1.0	1.0
	Barauni	6.0	6.0	6.0	6.0	9.0	9.0
	Koyali	13.7	13.7	13.7	18.0	18.0	18.0
	Haldia	7.5	7.5	8.0	8.0	8.0	8.0
	Bongaigaon	2.4	2.4	2.4	2.4	2.4	2.4
	Mathura	8.0	8.0	8.0	8.0	11.0	11.0
	Panipat	15.0	15.0	15.0	15.0	15.0	15.0
	Paradip	-	15.0	15.0	15.0	15.0	15.0
		54.2	69.2	69.7	74.0	80.0	80.0
CPCL	Manali	10.5	10.5	11.1	11.1	17.1	17.1
	Nagapattinam	1.0	1.0	1.0	1.0	1.0	1.0
		11.5	11.5	12.1	12.1	18.1	18.1
HPCL	Mumbai	6.5	6.5	8.2	8.2	8.2	8.2
	Visakh	8.3	9.0	15.0	15.0	15.0	15.0
	New Refinery (Rajasthan)	-	-	9.0	9.0	9.0	9.0
		14.8	15.5	32.2	32.2	32.2	32.2
BPCL	Mumbai	12.0	12.0	13.5	13.5	13.5	13.5
	Kochi	9.5	9.5	15.5	15.5	15.5	15.5
		21.5	21.5	29.0	29.0	29.0	29.0
NRL	Numaligarh	3.0	3.0	3.0	3.0	9.0	9.0
MRPL	Mangalore	15.0	16.0	16.0	18.0	18.0	18.0
ONGC	Tatipaka	0.1	0.1	0.1	0.1	0.1	0.1
Total		120.1	136.8	162.1	168.4	186.4	186.4
Joint venture							
BORL	Bina	6.0	6.0	7.2	7.2	9.0	9.0
HMEL	Bhatinda	9.0	9.0	9.0	9.0	9.0	9.0
Total		15.0	15.0	16.2	16.2	18.0	18.0
Private sector							
Reliance	Jamnagar	33.0	33.0	33.0	33.0	33.0	33.0
	SEZ	27.0	27.0	27.0	27.0	27.0	27.0
		60.0	60.0	60.0	60.0	60.0	60.0
Essar	Vadinar	20.0	20.0	20.0	20.0	38.0	38.0
Nagarjuna	Cuddalore	-	6.1	6.1	6.1	15.0	15.0
Total		80.0	86.1	86.1	86.1	113.0	113.0
Grand total capacity		215.1	237.9	264.4	270.7	317.4	317.4

HPCL plans to expand its Mumbai Refinery from 6.5 million tonnes to 10 million tonnes and Vizag, from 8.33 million tonnes to 15 million tonnes by 2017–18.

Among private players, RIL has plans to increase its production capacity for ethylene as well as other petroleum-related products at its Jamnagar

Refinery. In the third phase of its ongoing development, RIL intends to expand its ethylene cracker complex, gasification plants as well as para-xylene plant. In 2015, Essar Group announced plans to invest 6,000 crore INR over three years towards brownfield expansion of its existing oil refinery at Vadinar in Gujarat.

8. Ready Reckoner, June 2015, Petroleum Planning and Analysis Cell (PPAC)

9. Data from Petroleum Planning and Analysis Cell, MoPNG

10. Data from Federation of Indian Chambers of Commerce and Industry (FICCI)

11. Strategic Plan 2011-17, MoPNG

12. Strategic Plan 2011-17, MoPNG

13. Planned as per the XII Five Year Plan, data from the MoPNG Annual Report 2013-14 and recent developments

Improvement of refinery performance

With the increase in global refining capacity, the addition of refineries in the Middle East and India's dependence on crude oil from the Middle East, Indian refiners have sharpened their focus on improving their performance through modernising and upgrading their refinery configurations.

Along with expansion plans, IOCL is moving ahead with other improvement works at Barauni Refinery which are designed to boost performance and ensure long-term viability. As part of its high-sulphur crude maximisation (HSCM) project, IOCL has undertaken a revamp of the refinery's 0.6 MMTPA Coker A as well as the installation of a new bitumen processing plant at the site to improve the reliability and safety of the unit.

BPCL has focussed its efforts on conservation of energy and upgrading its refineries to produce clean automotive fuels. HPCL has taken up energy conservation measures by modernising refinery equipment and was one of the first oil companies in the country to initiate and implement full-fledged automation of off-site facilities at its refineries.

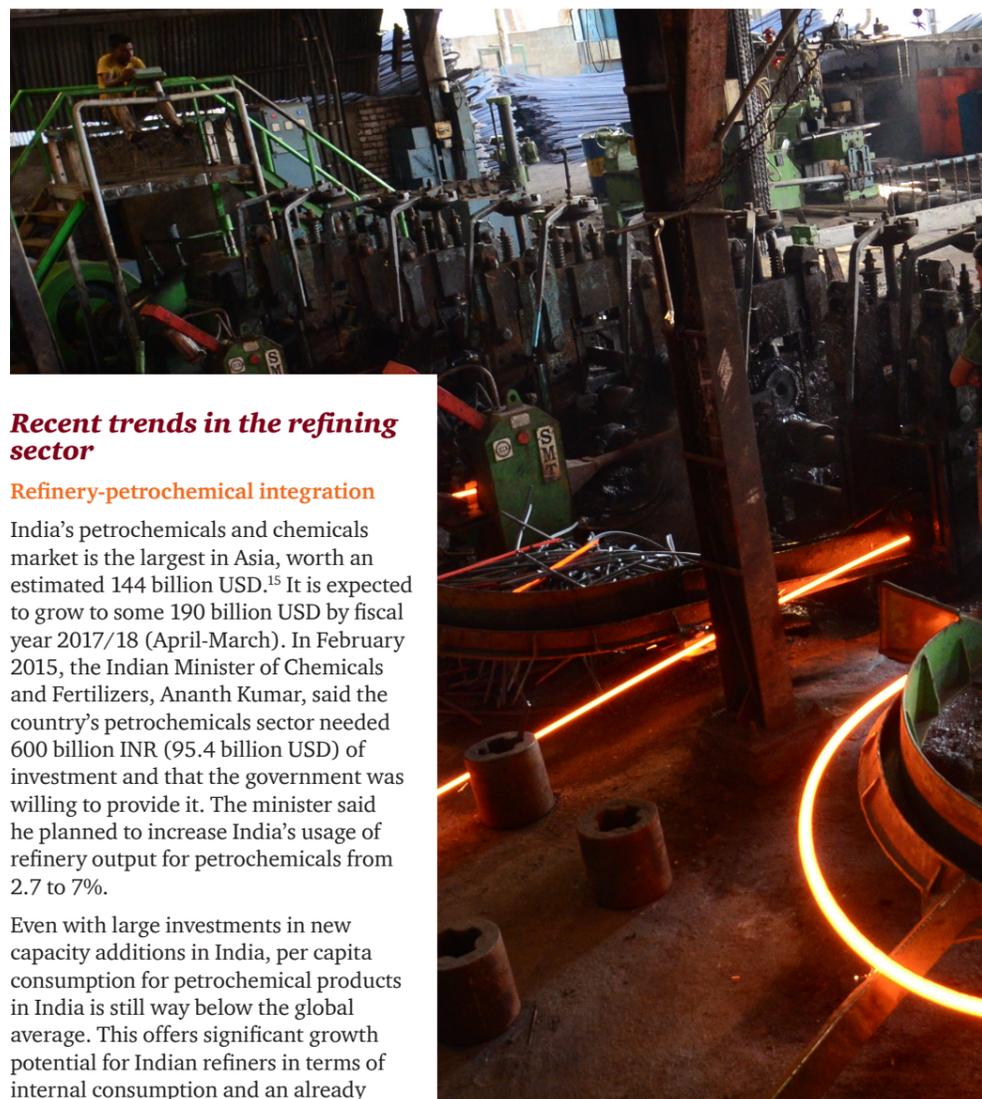
Ensuring availability of petroleum products across India

Energy security for a common citizen implies fulfilment of his/her energy needs in a timely and cost-effective manner and hence, logistics remains a critical dimension for refining and marketing companies.

Towards this end, HPCL commenced operations of the Awa-Salawas Pipeline and commissioned the Bahadurgarh-Tikrikalan Pipeline, taking the total cross-country pipeline network to 2,572 km, with a capacity of 23.5 MMTPA. HPCL strengthened its primary distribution infrastructure by adding 3,00,000 kl of product storage capacity through commissioning of new depots and revamping of existing facilities.

IOCL is implementing 13 projects at a cost of over 6,800 crore INR to further expand its network of crude oil and product pipelines during the XII Plan period. This will result in additional throughput capacity of about 15.5 MMTPA and a pipeline length of over 3,200 km. In the LPG segment, IOCL has launched several customer-friendly initiatives, such as portability of LPG connection within and across companies and sale of 5-kg free-trade LPG cylinders through select retail outlets and kirana stores.

PAHAL, the new avatar of the Direct Benefit Transfer for LPG (DBTL) scheme, was launched on 15 November 2014 in 54 districts and in the rest of the country, on 1 January 2015. Through their coordinated efforts, MoPNG and oil marketing companies (OMCs) have been able to bring 13.92 crore¹⁴ households under PAHAL. These consumers will have the subsidy on their purchase of domestic LPG cylinders directly transferred into their bank account, as per their entitlement in terms of the eligible number of subsidised cylinders.

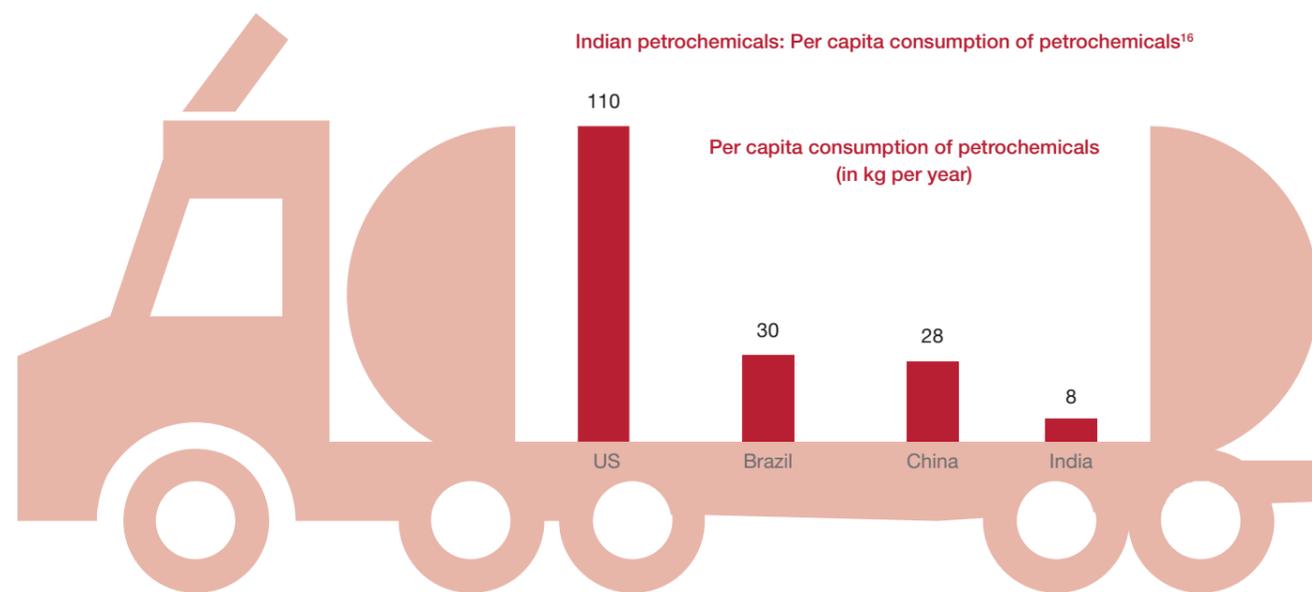


Recent trends in the refining sector

Refinery-petrochemical integration

India's petrochemicals and chemicals market is the largest in Asia, worth an estimated 144 billion USD.¹⁵ It is expected to grow to some 190 billion USD by fiscal year 2017/18 (April-March). In February 2015, the Indian Minister of Chemicals and Fertilizers, Ananth Kumar, said the country's petrochemicals sector needed 600 billion INR (95.4 billion USD) of investment and that the government was willing to provide it. The minister said he planned to increase India's usage of refinery output for petrochemicals from 2.7 to 7%.

Even with large investments in new capacity additions in India, per capita consumption for petrochemical products in India is still way below the global average. This offers significant growth potential for Indian refiners in terms of internal consumption and an already established supply chain network.



14. MoPNG website

15. Source: 'Fertile Sector', The Oil and Gas Year 2015

In 2014, IOCL confirmed that it had commissioned a newly upgraded fluid catalytic cracking unit (FCCU) at its Mathura Refinery. At a cost of 167 million USD, the upgrade project has increased the FCCU's processing capacity to 30,000 b/d from 20,000 b/d and maximised the refinery's production of propylene.

RIL has taken up a 818-billion INR (13-billion USD) Jamnagar 3 Expansion project to set up a third refinery-cum-petrochemicals complex. Jamnagar 3 also includes expanding Jamnagar's gasification plants, ethylene cracker complex and para-xylene plant.

Refinery complexity improvement

Set up initially as basic refining units, the existing Indian refineries have gradually evolved into large and complex units, primarily driven by increased demand and discovery of indigenous crude oil. Indian refineries now have large capacity and high complexity, with increasing process integration to achieve energy optimisation in addition to generating products that meet stringent international specifications. The driving forces for the change in refinery configurations have been:

- Crudes being processed in the refineries
- Changing product demand
- Increasing competition and the need to be profitable
- Environmental stipulations and improvement in product quality

Indian refineries are adopting additional technological changes required to further process heavy oils that are cheaper and can increase profit margins. In line with these developments, refineries need to construct coker units and improve complexity so that they can process heavier crudes and refine additional products.

For instance, Essar's refinery had a Nelson complexity index of 6.1 in 2008, which increased to 11.8 after a four-year upgrade programme. Higher complexities allow refineries to process crudes with very low API gravity,¹⁷ high sulphur and a high total acid number (TAN), which are cheaper than light and sweet crude, therefore increasing a refiner's profit.

'Newer refineries designed with higher Nelson complexity indices fare better in gross margins, as they have the ability to process lower priced, difficult-to-process crudes.'

– Nishi Vasudeva, Chairman and Managing Director, HPCL¹⁶

Petrochemicals have been identified as a prime driver of future growth by IOCL. The corporation has plans to invest 30,000 crore INR in the petrochemicals business in the next few years. Beginning with low-investment, high-value projects such as methyl tertiary-butyl ether (MTBE) and butene-1 at Gujarat Refinery, Vadodara, IOCL has set up a world-scale linear alkyl benzene (LAB) plant at Gujarat Refinery and an integrated paraxylene/purified terephthalic acid (PX/PTA) plant at Panipat. A naphtha cracker complex with downstream polymer units is also in operation at Panipat.

Indian refineries: Nelson complexity index

Company	Refinery	Complexity index	Company	Refinery	Complexity index
Public sector					
IOCL	Digboi	11.0	CPCL	Chennai	7.9
	Guwahati	6.7	HPCL	Mumbai	-
	Barauni	7.8		Visakh	-
	Koyali	10.0	BPCL	Mumbai	5.6
	Haldia	10.4		Kochi	6.0
	Bongaigaon	8.2	NRL	Numaligarh	-
	Mathura	8.4	MRPL	Mangalore	9.5
	Panipat	10.5	ONGC	Tatipaka	-
	Paradip	12.2			
CPCL	Chennai	8.2	10.5	11.1	17.1
Joint venture					
BORL	Bina	9.1			
HMEL	Bhatinda	12.0			
Private sector					
Reliance	Jamnagar	12.6			
Essar	Vadinar	11.8			

16. Source: Report of the Sub-group on Chemicals & Petrochemicals for the 12th Five Year Plan

17. The American Petroleum Institute gravity, or API gravity, is a measure of how heavy or light a petroleum liquid is compared to water: If API gravity is greater than 10, the liquid is lighter and floats on water; if less than 10, it is heavier and sinks.

Technological upgrades for Bharat Stage 4 (BS-4) standards

Technological upgrades in Indian refineries have been initiated by the evolution of fuel quality standards in the country. The Indian government seeks to decrease pollution by ensuring compliance with BS-4 standards. The refiners will thus have to supply petrol and diesel meeting BS-4 requirements—equivalent to Euro 4 emissions standards—to the entire country by 2017.

‘Improving the quality of fuels to meet Euro 3 and Euro 4 specifications with the Bharat Stage standards is the main driver of advances in India’s refining sector.’

– B Ashok, Chairman and Managing Director, IOCL¹⁸

BS-4 fuel was first introduced in the Indian market in 2010, catering to 13 cities. By 2014, it was available in 26 cities. Indian refiners have focussed on implementing technologies that enable production of ultralow sulphur diesel and petrol (meeting BS-4 and BS-5 specifications). India’s refiners are working to ensure that facility expansions also include the necessary upgrades to produce BS-4 petrol and diesel.

IOCL has said all of its refineries will meet the standards by April 2017, and that new builds will be BS-5 compliant. Capacity expansion at BPCL’s Kochi Refinery and HPCL’s Mumbai and Vizag refineries will also be BS-4 compliant.

Improving the gross refining margins (GRMs)

The Indian economy is primarily driven by diesel, a middle distillate, and India’s energy demands mandate developing this segment of its refining technology. Indian refineries have been focussing on improving the quality of distillates to meet the market demand and increase refinery profitability.

As mentioned earlier, reducing energy consumption will not only lead to improved refinery performance by saving

operational costs but also augment the GRMs. Indian refiners are now benefitting from an advance in technology that enables the processing of various types of crude oils. These improvements also serve to maximise streams capable of generating petrochemicals, allowing for the advanced production of more value-added commodities.

In 2014, MRPL, a subsidiary of ONGC, commissioned the long-delayed Phase 3 expansion and upgrading at its refinery at Mangalore. The Phase 3 expansion is designed to increase the refinery’s complexity and profitability by increasing refining capacity as well as equip the plant to process lower cost heavy, sour and high-TAN crudes.

‘The key aspect (of phase three) was to process crudes with high total acid numbers, which at times are available in the spot market with a high discount compared to the regular market crudes.’

– H Kumar, Managing Director, MRPL¹⁸

Process efficiency improvement

Refining margins are highly dependent on the spread between the prices of crude oil and those of the petroleum products made. With oil prices hitting six-year lows, improving internal processes such as inventory management has become important for ensuring strong GRMs.

Further, refining companies are driving efficiencies in manpower allocation, as an organisation excels when it optimises its resources. Some Indian refineries have taken up a comprehensive assessment of manpower at their refineries, primarily

- To establish time standards for all regular activities, job descriptions for the activities and competency mapping
- To arrive at the manpower requirement in the non-management category based on best-in-class practices in India/abroad based on activities

Other areas that are being looked at to drive process efficiencies are maintenance reliability and asset management.

Future outlook

The Indian refining sector has been an important pillar in India’s energy security and companies have invested heavily to meet the country’s future energy demands. Given the size of India and its growing population of more than 1.2 billion people, the demand for petroleum products ensures that the country’s large refining sector will continue to undergo constant development. India is geographically close to petroleum exporting countries in the Middle East, such as Saudi Arabia and Kuwait, making them attractive venues for the sourcing of crude oil for the country’s numerous refineries.

With a possible recovery in growth in 2015–16, controlled levels of inflation and a rising economy, the energy demands of India can see quick growth in the

next two to three years. Specifically, the penetration of LPG is increasing in India through an increase in new connections and double bottle connections. India being an LPG deficit nation, this will have a direct impact on the LPG volumes imported. Going forward, from India’s energy security perspective, one of the key areas of interest for refining and marketing companies will be to ensure uninterrupted supplies of LPG to Indian consumers.

Overall, Indian refining companies have performed exceptionally well and have contributed significantly to the country’s economy and job creation. Both India’s talent pool and its technical expertise contribute to the competitiveness of its refining sector. As these continue to develop, the country is better positioned for the export of petroleum products to Asia and Africa. With volatilities in crude pricing and uncertainty over market expectations, the Indian refining sector’s integrated capacity will prove to be a great asset going ahead.

Energy security



18. From interviews in The Oil & Gas Year 2015

Abbreviations

b/d	Barrels per day
kl	Kilolitre
kgoe	Kilogram of oil equivalent
MMT	Million metric tonnes
MMTPA	Million metric tonnes per annum
Mtoe	Million tonnes of oil equivalent

India-Tech: An introduction

India-Tech Foundation is a public trust and apex Indian industry association for technology up-gradation through international techno-economic cooperation. The foundation was registered in March 1999 and for over 15 years now, it has been serving the oil and gas, power, and infrastructure construction sectors.

Leading CEOs from both government and private sector companies are office bearers of India-Tech. Its Governing Council, with the assistance of its 'expert committees', reviews government policies and developmental aspects of the Indian economy. There are separate expert committees for the power, oil and gas, and infrastructure construction sectors. Senior government officials as well as some top corporates from these sectors are members of the committees.

We believe that exhibitions and conferences provide the right platform for both manufacturers as well as policy makers. Not only can the latest technologies be displayed, but international experts can also share their views on various subjects and highlight tech innovations in products/services. Further, they help government officials and ministries to receive instant feedback from the user segment.

Also, exhibitions are a powerful, flexible and highly cost-effective marketing tool. Worldwide, they play a vital role in the development of business and industry and are a major contributor to national and local economies. Exhibitions bring sellers face-to-face in a neutral sales environment and provide a three-dimensional platform for product display and demonstration. They are highly targeted, offer fast penetration into new markets and direct access to the export market.

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