



Exploring ways to find energy solutions

Overview 06 | Energy scenario 07 | Key challenges to energy security 09 |
Key initiatives in energy security 11 | Conclusion 13

Rising above the sub-optimal **Exploring ways to find energy solutions**





Foreword



Availability, accessibility and affordability of energy resources are the three key elements that determine energy security and are regarded as the pre-requisites for ensuring accelerated growth of the Indian economy. However, with domestic supply of energy resource remaining way below the increasing demand, our import dependence has reached insatiable levels. Therefore, India faces huge challenge to ensure energy security, amidst the persisting international uncertainties.

We at FICCI share the serious concern of stakeholders and wish to play a catalysing role to address all the hydrocarbon related concerns in a defined & phased manner. FICCI through its **sustained campaign on National Energy Security** endeavours to sensitize all the stakeholders including policy makers, parliamentarians, industry, civil society, economists and media and suggest a dynamic policy framework for the future.

Some of the recent initiatives taken up by the committee include 1st National Seminar on Energy Security, which focused on defining the issue of Energy Security in the Indian context; media interaction on Emerging Energy Crises; submission of “Six Point Agenda” to the Hon’ble Prime Minister of India to address the impending crises of oil & gas sector components of energy resources; detailed recommendations to the Committee Chaired by Dr. C Rangarajan on the Design of Future Production Sharing Contracts, and detailed presentation to the Committee on the Design of Future Products Sharing Contracts; recommendations on the draft policy for Exploration & Exploitation of Shale Oil & Gas in India.

The 2nd **National Seminar on Energy Security** is a step further to address the national concern, debate on the role of each stakeholder in evolving the national strategy on energy security and a coordinated policy response.

The knowledge paper “**Rising above the sub-optimal - Exploring ways to find energy solutions**” jointly prepared by FICCI & PwC sets out the current energy scenario in the country, which is characterised by rising energy demand leading to high import dependency and its impact. It also analyses the challenges and the key initiatives taken for attaining energy security.

We hope that this paper will set the context for the deliberations and facilitate us in implementing the action points identified during the Seminar. FICCI looks forward to a successful Seminar and commits itself to follow up with action on the conclusions of the deliberations.

Dr A Didar Singh
Secretary General
Federation of Indian Chambers of
Commerce & Industry



Preface



This **National Seminar on Energy Security** organized by FICCI provides a good platform for all the stakeholders to come together and brainstorm on the issues related to energy security and planning a roadmap for the future. The FICCI Hydrocarbon Committee has taken steps for consultation and advocacy on the subject.

PwC, as Knowledge Partner, assisted in putting together this background paper titled '**Rising above the sub-optimal - Exploring ways to find energy solutions**'. The paper sets out the current energy scenario in the country characterized by rising energy demand leading to high import dependency and its impact. It also analyses the key initiatives taken and challenges for attaining energy security. We hope that this paper sets a context for the deliberations during the seminar.

The seminar intends to touch upon all areas of possible action for achieving the goal of securing an affordable and reliable energy resource. PwC is privileged to be assisting FICCI in providing the context to the deliberations of the seminar through this background paper, summarize proceedings, collate recommendations made during the seminar and then support FICCI in advocating them. We sincerely thank FICCI for providing us this opportunity to be Knowledge Partner for this event.

As always, PwC will be glad to receive any feedback and suggestions the readers have.

A handwritten signature in black ink, appearing to read 'Deepak Mahurkar', with a stylized flourish at the end.

Deepak Mahurkar
Director, Leader Oil & Gas Industry
PricewaterhouseCoopers India Private
Limited

Overview

Economic growth of a country depends on the long-term availability of energy from the sources that are affordable, accessible and environment friendly. For developing countries, the energy sector assumes critical importance in view of the ever-increasing needs, which require huge investments.

The Integrated Energy Policy (IEP) report of the Planning Commission describes energy security as follows: “We are energy secure when we can supply lifeline energy to all our citizens irrespective of their ability to pay for it as well as meet their effective demand for safe and convenient energy to satisfy their various needs at competitive prices, at all times and with a prescribed confidence level considering shocks and disruptions that can be reasonably expected.”

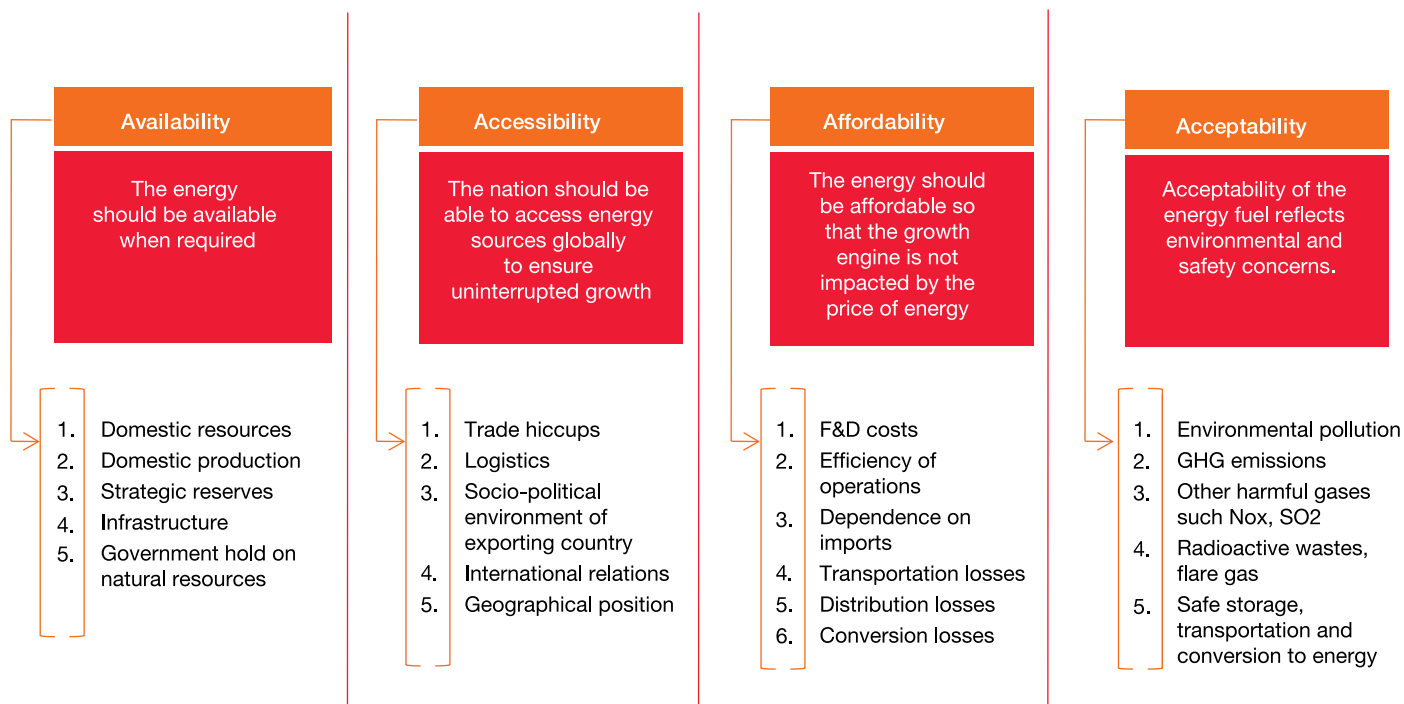
Energy security is essentially encapsulated in the four elements given in the diagram below.

The energy needs of rapid growth will pose a major challenge since these requirements have to be met in an environment where domestic energy prices are constrained and world energy prices are high and likely to rise further. For the GDP to grow at 9%, commercial energy supplies will have to grow at a rate between 6.5 and 7% per year. Since India’s domestic energy supplies are limited, dependence upon imports will increase. Import dependence in the case of petroleum has always been high and is projected to be more than 80% in the Twelfth Plan (2012-17.) Even in the case of coal, import dependence is projected to increase as the growth of thermal generation will require coal supplies, which cannot be fully met by domestic mines.

As regards the world energy consumption in 2011, the strong growth momentum of 2010 could not be sustained in 2011 and witnessed an increase of 2.2% only compared to 4.9% in 2010. OECD countries were impacted by the economic crisis and their energy consumption fell by 1.3%, in line with the

3.2% drop in the European Union and the stagnation in North America (-0.7% in the United States). In China and India, energy consumption continued to grow steadily at 7.7% and 6.2%, respectively. Energy demand in Japan fell by 6.6% as compared to a 6.3% hike in 2010, limiting the growth in energy demand in Asia to 5.1% in 2011 despite a growth in demand in many Southeast Asian countries. The dynamic trend in Africa and Latin America (3.1% and 5.1%, respectively, in 2010) stalled in 2011 (less than 1% growth)¹.

In 2011, India was the fourth-largest energy consumer in the world, with consumption of 559 million tonne oil equivalent (MTOE) after China (2,613 MTOE), United States (2,269 MTOE) and the Russian Federation (686 MTOE). Accordingly, the per capita consumption of energy is about 450 kilogramme oil equivalent (KGOE) in India. This is quite low as compared to the per capita energy consumption in some other countries, such as Japan (3,728 KGOE), South Korea (5,367 KGOE), China (1,942 KGOE) and the United States (7,280 KGOE)².



Source: PwC analysis

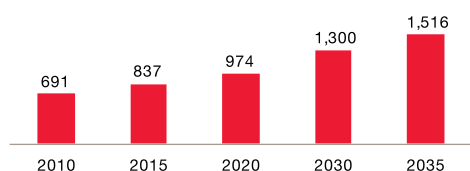
1. Enerdata: Global Energy Statistical Yearbook 2012
 2. BP Statistical Review June 2012, Population Reference Bureau, USA and PwC Analysis

Energy scenario

With 17.5% of the world's population and estimated annual GDP growth of 8%, India has a dire need for energy. However, the country lacks sufficient domestic reserves of energy, particularly petroleum and natural gas. The primary energy consumption of the world is expected to grow 1.6% annually from 2008 to 2035; whereas India's primary energy consumption is expected to increase by 3.2%, followed by China at 3% and Brazil at 2.8%, during the same period. According to the Integrated Energy Policy (IEP) report of the Planning Commission, India's primary energy requirement will be between 1,536 and 1,887 MTOE in 2031-32.

In the coming decade, the transport sector in India will be one of the biggest consumers of energy. The share of the sector in the energy consumption is expected to be as high as 18% in 2035, primarily due to the increasing middle class population in the country. The energy consumption in the commercial segment is expected to grow at a CAGR of 4% and in other segments in the range of 2 to 3% in 2035³.

India's primary energy consumption (MTOE)



Source: World Energy Outlook, 2012

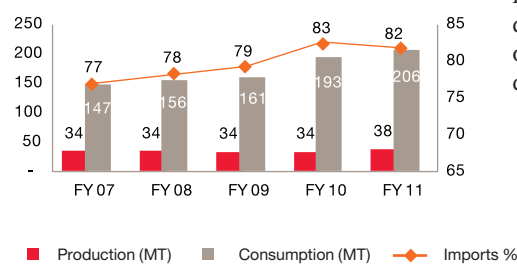
There are three major constituents of energy sector - oil, gas and coal.

Oil

Despite the increase in exploration and production activities in the country, its dependence on imported oil is almost 82% of the total domestic demand. The domestic oil production has been almost flat over the years due to limited prospects, delays in commissioning of projects and declining

production from existing maturing fields. As of 1 April 2011, the Ministry of Petroleum and Natural Gas revealed that the total domestic oil reserve is 757 million metric tonnes (MMT). The crude oil production will remain almost stagnant in the Twelfth Five Year Plan. In 2031-32, the consumption is expected to be in the range of 350 to 486 MMT and the import dependency will be in the range of 90 to 93%.

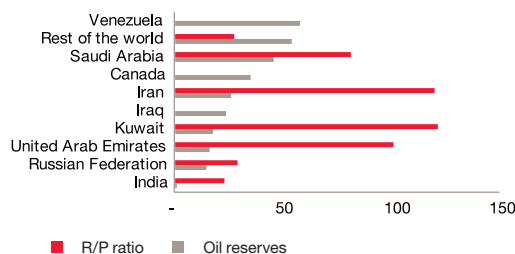
India's oil production and consumption pattern



Source: Ministry of Petroleum & Natural Gas

The proven oil reserves in the world at the end of 2011 were 234 billion tonnes, which are sufficient to meet 54.2 years of global production. Venezuela, Canada and Iraq have the highest reserve-to-production (R/P) ratios, with reserves that will meet more than 100 years of production. On the other hand, India has oil reserves to meet its demand only for 18.2 years.

World oil reserves by country at the end of 2011 (billion tonnes)

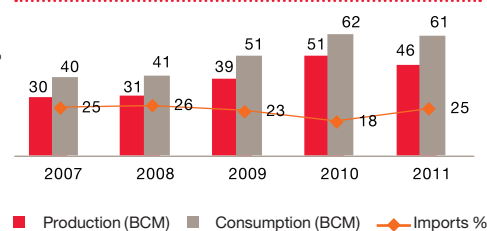


Source: BP Statistical Review 2012

Gas

The discovery of natural gas in the Krishna Godavari (KG) basin by Reliance Industries Limited (RIL) was a promise for India which remains unfulfilled. Natural gas production from the KG-D6 field was estimated to yield 80 million standard cubic metres per day. However, the current production is less than 28 mmscmd. Though India's production and consumption of natural gas has increased over the years, its consumption has increased at a more rapid pace, leaving a gap to be filled by imports. There was substantial decline in production in 2011, mainly on account of lower output from the KG deepwater basin.

India's natural gas production and consumption pattern



Source: BP Statistical Review 2012

In India, natural gas is a minor part of the overall energy mix, accounting for only 10% of the total energy consumption in 2011. The natural gas consumption is poised to increase and will account for 11% of the total energy consumed in India in 2035⁴.

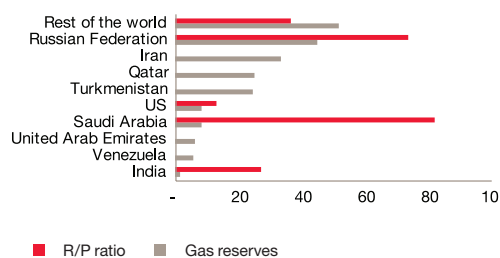
India's natural gas consumption is expected to be in the range of 100-197 MMTOE in 2031-2032. Thus, imports will account for up to 49% of the total gas consumed⁵.

3. International Energy Outlook, 2011 and PwC Analysis

4. International Energy Outlook, 2011, and PwC analysis

5. Report of the working group on P&NG sector for the 12th Five Year Plan (2012-17)

World natural gas reserves by country at the end of 2011 (trillion cubic metres)



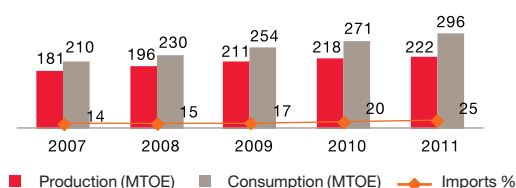
Source: BP Statistical Review 2012

The proven natural gas reserves in the world at the end of 2011 were 208 trillion cubic metres, which is sufficient to meet around 64 years of production. Venezuela, United Arab Emirates, Turkmenistan, Qatar, Iran have R/P ratios of over 100 years. The proven natural gas reserves in India at the end of 2011 were sufficient to meet around 27 years of production at the current level.

Coal

India ranks third in the world in consumption of coal and its demand continues to grow much faster than the world average. The demand grew at a CAGR of almost 7% from 2001 to 2011, while the production grew by only 5%. Given the strong growth in thermal generation projected in the Twelfth Plan, the aggregate demand for coal by the end of the 2017 is likely to be 407 MTOE depending upon the pace of implementation of power capacity. As against this, the domestic output is unlikely to exceed 317 MTOE, leaving a shortfall of over 90 MTOE⁶.

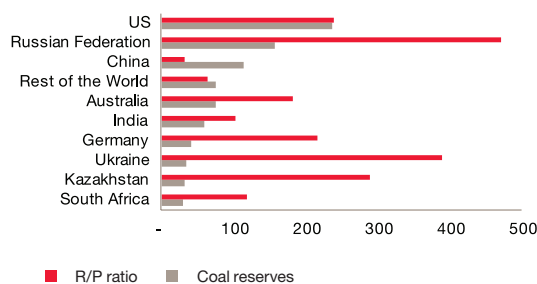
India's coal production and consumption pattern



Source: BP Statistical Review 2012

The world's proven reserves of coal in 2011 were sufficient to meet 112 years of global production, which is by far the largest R/P ratio for any fossil fuel. The Russian Federation has the highest R/P ratio (471), followed by Ukraine (390) and Kazakhstan (290). The proven coal reserves in India at the end of 2011 were sufficient to meet around 103 years of production at the current level.

World coal reserves by country at the end of 2011 (billion tonnes)



Source: BP Statistical Review 2012

Other fuels

Conventional energy forms a major chunk of the energy mix in India. Other fuels, which include nuclear energy, hydroelectricity and renewable energy sources, constituted only 8.3% of the total energy mix in India in 2011. Nuclear energy currently constitutes 1.3% of the total primary energy consumption of the country and its share in the primary energy mix is expected to increase only marginally to about 3% by 2035, indicating limited potential for nuclear fuels in India. Hydroelectricity constituted 5.3% and renewable energy constituted 1.6% of the total primary energy consumption in India in 2011. Thus, non-conventional energy sources have a great potential to grow in India.



Key challenges to energy security

India faces grave challenges in meeting its energy needs and in providing adequate energy of the desired quality to users in a sustainable manner and at reasonable costs. The quality and quantity of energy required is bound to increase exponentially in the future. India faces many challenges to energy security, which can be broadly classified into three types: demand and supply-side challenges, policy-side challenges and global risks.

Demand and supply-side challenges

- 1. Import dependency:** By 2031-32, India's import dependency on fossil fuels is likely to be between 91 and 94% for oil, between 40 and 50% for gas and between 40 and 50% for coal. Such high import dependency is likely to strain India's foreign exchange reserves and balance of payments position and will result in rupee depreciation, fiscal deficits and inflation. To counter these challenges, the monetary policy may have to raise interest rates, which will have a negative effect on growth, investments and job creation.
- 2. Energy intensity:** The primary concern in managing domestic demand is to develop an energy-efficient economy so that the energy intensity of the GDP goes down. In the context of climate change, this objective has assumed major importance and most countries are undertaking measures to achieve it. According to the IEP, India's energy intensity was 0.16 kg of oil equivalent (KGOE) per dollar of GDP expressed in purchasing power parity (PPP) terms. This is significantly lower than 0.23 KGOE of China, 0.22 KGOE of the US and the world average of 0.21 KGOE. Although India's energy intensity is low, it is mainly due to energy deprivation. Hence, although action on demand-side management must continue, efforts to arrest deprivation must be strengthened.
- 3. Lack of exploration and production:** Almost 40-50% available oil is already explored. But the natural gas reserves in India have remained largely unexplored⁷. Similarly, for coal, success of exploration efforts has been limited, with activities starting only in 100 blocks out of 208 blocks.
- 4. Technology-dependent operations:** As the era of 'easy oil' is getting over, new finds will have to be made in areas that are geographically difficult to reach. Our domestic oil and gas companies are challenged by capabilities in deep-water technologies, etc. This will necessitate joint ventures and partnerships with global oil and gas majors and service providers. Thus, our regulatory environment should be conducive enough to attract investments from them.
- 5. Absence of market-determined pricing mechanism:** Indian consumers are artificially insulated from the vagaries of international pricing by the government-controlled pricing regime. This leads to inefficient use of energy owing to the lack of appreciation for real economic value of fuel. Unfortunately, the absence of free markets acts as a disincentive to investors, consequently resulting into a weakening of the supply side.
- 6. Losses in transmission and distribution:** According to estimates of the Finance Commission, by the end of 2011-12, the aggregate technical and commercial (AT&C) losses will cross 60,000 crore INR and may go beyond 1,00,000 crore INR in the subsequent five years. In addition, there are technical losses that are equivalent to the losses in generation. Efforts are being made to reduce losses through the Restructured Accelerated Power Development & Reforms Programme (R-APDRP) and the activities of the National Electricity Fund. Several states are also undertaking privatisation of distribution utilities or handing them over to franchises. Privatisation has helped in reducing losses to some extent but requires more encouragement and incentives. Measures in this regard, however, are still quite inadequate and yet to make a significant impact. This is an area that is primarily in the domain of the state governments and needs enormous attention and commitment. National Electricity Fund.
- 7. Geopolitical tensions:** The recent Libyan crisis and embargo on Iran has brought focus on the vulnerability of large consumers like India (which imports more than half of its oil and gas from the Middle East) to geopolitical tensions.
- 8. Maritime Security:** India has to manage the security of the sea lanes through which much of its energy imports pass. Given India's burgeoning hydrocarbon imports (crude oil, LNG, LPG, etc.) as well as rise in refinery exports (Gasoil, Euro V Gasoline, etc.), the security of Indian seas becomes one of paramount importance in order to ensure access to foreign oil and gas as well as the consuming markets. Additionally, the importance of promoting domestic marine logistics (ports, jetties, tankers, etc.) cannot be ignored. For example, recently during the trade embargo sanctions on Iran, the Indian government found itself in a challenging situation wherein the insurance cover to ships transporting crude oil from Iran was stopped by the IG Clubs—a 13-member group which insures around 95% of the world's tankers—placing a 1 billion USD limit on individual claims that involve pollution damage and wreck removal. Further, the emergency cover offered by the public company United India Insurance Co. Ltd. was not accepted. Such instances call for attention to not only strengthen the existing facilities but also prepare for exigencies of this nature.

Policy-related challenges

- 1. Pricing of domestically produced natural gas:** The gas sector in India holds tremendous potential. However, its growth is constrained due to pricing and marketing policies of the government with respect to gas produced domestically. Gas produced by PSUs and RIL from the KG block is priced at 4.2 USD per million metric British thermal units (mmbtu) whereas gas produced from some of the blocks has been allowed to be sold at slightly higher rate. This has caused a sense of uncertainty in investors' minds.
- 2. Insufficient gas supply to various sectors:** Infrastructure in the downstream gas market is very underdeveloped and needs a significant policy impetus to bring in the investments. However, attracting both private and public players for investments needs a more transparent and stable regulatory framework.

3. **Pricing of petroleum products:** The country has become extremely dependent on imported crude oil. One of the major challenges in the oil and gas sector is a subsidy for sensitive petroleum products (kerosene, LPG and diesel), which has led to large under recoveries and accounted for huge loss.
4. **Lack of clear policy in E&P sector:** The government has not been able to attract investors in the exploration and production (E&P) sector due to uncertainties in areas of pricing and allocation of hydrocarbon resources, complexity in granting of approvals and various clearances, interpretation of the terms of the production sharing contracts (PSCs) and other framework agreements.

Global risks

Over the past year, the uprisings and political unrest in the Middle East and North Africa (MENA) region will have not only political impact but also economic impact on the world. Libya and Iran are the two major oil-producing countries which have seen political problems, at a time when the world economy was hit by a global recession. The production in these countries has been badly hit, giving rise to shortages in the supply of oil and natural gas around the world.

- **Libya**
With almost 47 billion barrels of oil reserves, Libya holds the largest oil reserves in Africa as of 2011. In 2010, before the civil war hit Libya, it was producing 1.66 million barrels oil per day, of which approximately 1.5 million barrels per day were exported. However, after the crisis, the production was badly hit and decreased to 0.48 million barrels oil per day. Its oil exports to nearly all destinations tumbled in 2011. As of May 2012, crude oil production had been restored to an estimated 1.4 million barrels per day, which is an impressive pace of recovery. However, production still remains well below peak levels of over 3 million barrels per day achieved in the late 1960s. Foreign capital and expertise are needed for sustaining output at pre-crisis levels or increase it further, but the permanent return of staff and commitment of additional resources is contingent on a more favourable security environment

and greater political certainty. Upstream exploration has been limited in the current environment—particularly by foreign firms—and is likely to remain so until the sector finds firmer footing. This too could impact Libyan oil production in the near to mid-term, as new projects will eventually be needed to offset a decline in the existing fields.

Just like the oil sector, Libya's natural gas industry is recovering from disruption related to the civil unrest and political upheaval that began in 2011. Libya's rank as a producer and reserve-holder is less significant for natural gas than it is for oil. At the end of 2011, it had 52.8 trillion cubic feet (tcf) of proven reserves of natural gas, which is 0.7% of the total world reserves. In 2010, Libya consumed an estimated 242 bcf of dry natural gas. With only about 40% of Libya's dry natural gas supply consumed domestically, the remainder was available for export. Libya exported 352 bcf of natural gas in 2010, relatively unchanged from 2007-2009 levels.

Iran

Iran is the second-most oil rich country in the Middle East, with 151 billion barrels of oil reserves (9.1% of the total world reserves) after Saudi Arabia (which has 265 billion barrels of oil reserves) as of 2011. Iranian Heavy crude oil is Iran's largest crude export followed by Iranian Light. According to OPEC, Iran exported 878,000 barrels of oil per day to Europe in 2010, which reduced to 741,000 barrels of oil per day in 2011. After the oil embargo from EU in July 2012, Iran's oil export has been affected badly, unemployment rate is very high and inflation is in double digits. The largest importers of Iranian crude oil before July 2012 were China (20%), Japan (17%), India (16%), Italy (10%) and South Korea (9%)⁸. Although the US has issued waivers to certain countries, including India, South Korea and now China, these countries have significantly reduced their oil purchases from Iran. According to China's General Administration of Customs, China bought 454,500 barrels per day of Iranian crude in July 2012, against 632,618 barrels per day in June 2012. South Korea used to import a quarter of a million barrels per day of Iranian crude oil, which has now been cancelled. Japan is also cutting back radically. India is another significant

buyer that is reducing its oil imports from Iran.

At the end of 2011, Iran had 1,168.6 trillion cubic feet (tcf) of gas, comprising 15.9% of the total world reserves, next only to Russia. In 2010, Iran produced an estimated 6 tcf of marketed natural gas and consumed an estimated 5.1 tcf. A sizeable volume of the gross natural gas produced was re-injected (1.2 tcf). As Iran implements its plans for increased crude production through enhanced oil recovery techniques, however, the share of natural gas used for re-injection is expected to increase dramatically. Iran's natural gas exports are likely to be limited due to the rising domestic demand.

Comparison – India and China

- *Over the years, India and China have been emerging as economic giants in the world. In 2011, the average annual GDP growth rate at market prices was 6.9 percent in India and 9.3 percent in China⁹. With both countries' governments being fully committed to the goal of high economic growth and poverty reduction, the current development momentum is expected to continue for decades to come. The uncertain global economic environment may slow the two Asian giants in the short run but their remarkable economic transformation is a long-term trend.*
- *India's primary energy consumption in 2011 was 559 MTOE (4.6% of the total world consumption) while 2,613 MTOE was for China (21.3% of the total world consumption). Coal forms 52.9% of India's energy mix whereas it forms 70.4% of China's. China has 13.3% and India 7% of total proved reserves of coal in the world. India imported around 80% of oil while China imported only around 56% of the total domestic demand for oil in 2011¹⁰.*
- *India and China both have been following the energy expansion strategies. China relies on its state-owned energy companies to access new resources at home and abroad, whereas there are several private players in the Indian energy sector. However, the Indian government plays an important role in diplomatically supporting the international expansion of its energy sector.*

8. Iran oil sanctions pour money into the Gulf, *Albawaba Business*, 2nd September 2012

9. *World Bank Indicators*, 2011

10. *BP Statistical Review, 2012, and Population Reference Bureau, USA*

Key initiatives in energy security

Currently, government-owned companies dominate India's energy industry, although the private sector is actively capturing market share and even investing in state-owned companies. However, the policy and planning is largely controlled by the central government in India's federal political set up. The August 2006 report of the Expert Committee on the IEP analysed the resource options for the country's energy needs. According to the policy, the country's hydrocarbon resources will be grossly inadequate to meet its demand. The government has taken certain steps to build infrastructure for energy security.

- India is yet to finalise the policy on shale gas, the discovery is still a far-off affair but many Indian companies have gained exposure to shale gas business through investments outside the country. China launched a second round of shale gas auctions and is targeting 6.5 billion cubic meters of annual production by 2015, from close to none this year. The Chinese Ministry of Finance is encouraging shale development by offering subsidies of 2.10 USD per cubic feet of production till 2015.
- In January 2006, India and China signed five memorandums of cooperation in the energy sector, covering a full scope of areas, including strengthening the exchange of information when bidding for oil resources in a third country, enhancing upstream exploration and production, refining and marketing of petroleum products and petrochemicals, laying of national and transitional oil and gas pipelines, fostering frontier and cutting-edge research and development, and promoting environment-friendly fuels. Both countries' national oil companies (NOCs) agreed to bid jointly for stakes in companies and blocks as part of a larger set of energy cooperation.

Strategic petroleum reserves

A country should have a strategic oil reserve of at least 30 days. However, many countries maintain oil reserves of up to 90 days, which they also use as a buffer stock against price fluctuations. India, currently, has stock for about 85 days of requirement excluding line-pack and the strategic stocks for the defence department that are maintained by Indian Oil. This generally includes only 15 days of crude reserves. However, these stocks are more in the nature of raw material and finished goods inventories (for which facilities had been built during the comfortable cost-plus regime) and not in the nature of strategic reserves.

India is in the process of creating its own strategic petroleum reserve to cater to potential supply disruptions. Based on recommendations of the Planning Commission in the IEP, the government has set up the Indian Strategic Petroleum Reserves Ltd (ISPRL), under the Ministry of Petroleum and Natural Gas. The ISPRL, a government company, is building three huge underground caverns that can hold beneath the earth that can hold 14 days worth of oil. The storage, carved out of underground rock at Mangalore and Udipi in Karnataka, and Visakhapatnam in Andhra Pradesh, will be buffers against short-term disruptions. The new facilities will have a combined capacity of 5.33 million tonnes (39 million barrels).

The new strategic reserves proposed by IEP are as follows:

Project	Visakhapatnam crude cavern
Storage capacity	1.33 million tonnes
Work started in	January 2008
To be commissioned in	January 2012
Project	Mangalore crude cavern
Storage capacity	1.50 million tonnes
Work started in	April 2009
To be commissioned in	June 2013
Project	Padur (Udipi) crude cavern
Storage capacity	2.50 million tonnes
Work started in	May 2010
To be commissioned in	August 2013

Source: Business Today, 1 May 2011

Even though GAIL and other gas companies have gas in their pipelines, these inventories kept by the oil and gas companies cannot be treated as strategic reserves but as operating stocks. The carrying cost of the proposed reserve is high and may go up if oil prices increase. The cost of inventory itself may be around 3 billion USD with annual carrying costs of around 1,500-2,000 crore INR. In case of 90 days of inventory, the carrying cost may be even higher (10,000-12,000 crore INR). Further, the cost of construction will have to be separately accounted for. Clearly, there is a need to think of innovative methods to develop these storages reserves.

Overseas upstream asset acquisition

Acquiring energy assets abroad is the most viable way of achieving energy security. As part of its energy security strategy, India has carefully entered into cooperative relationships with several oil-producing countries in Africa and the Middle East. India has also allowed public sector companies such as Oil and Natural Gas Corporation (ONGC) and Oil India Limited (OIL) to secure ownership of oil and gas fields and companies overseas.

Asset acquisition in oil and gas sector¹¹

To secure hydrocarbon resources for the country, the government has been encouraging national oil companies (NOCs) to aggressively pursue equity stake in overseas oil and gas companies. The ONGC Videsh Ltd (OVL) has invested 11 billion USD abroad. In addition, a number of other investors, both public sector undertakings and private players, have also invested in 50 other projects in 19 countries. The combined production from these is 9.36 MTOE of oil and gas in 2010-11, and OVL's share was 8.78 MTOE of oil and gas from its assets abroad in Sudan, Vietnam, Russia, Syria, Colombia and Venezuela. The OVL oil equity so far accounts for only 9% of India's current oil import requirements. If these assets were to meet at least 10% of the requirements in 2031-32, the investments will have to be increased six times.

To obtain natural gas, LNG terminals have been set up at Dahej and Ratnagiri and a new one is under implementation at Kochi. Imports of 7.5 million tonne of LNG on a long-term supply basis for 25 years have been planned by Petronet LNG at Dahej

under an agreement with Qatar. Another 1.5 million tonne has been planned through a tie up with Exxon Mobil for 20 years from Gorgan LNG project in Australia.

Asset acquisition in coal sector

Presently, the import requirements of coal are limited but expected to expand rapidly. India will have to import large quantities of coal in the future. Though Coal Videsh has been formed under the Ministry of Coal, it has done very little business so far. Thus, there is a need to give a very strong push to the mining investments abroad and a number of private players have invested in mines in Indonesia and Australia. By 2031-32, the country's power requirements are expected to reach over 950,000 MW. Around 70% of this will be from coal. Therefore, it is important to step up investments and develop coal mining resources abroad in the next two decades.

Sovereign Wealth Fund

The Sovereign Wealth Fund (SWF) was first proposed by the Planning Commission to support India's energy security by acquiring energy assets abroad. The government proposed to set up a 10 billion USD SWF from the disinvestment proceeds to team-up with state-run companies for acquiring overseas raw material and energy assets including crude oil, gas and coal. About one-third of the proceeds from the sale of government equity will be channelised into this fund, and it could also maximise its equity to raise debt, thereby increasing the corpus. The fund will be financed through the budget. The government is planning to centrally allocate 4,500 crore INR in the first year. It will be a rupee fund and forex will have to be bought from the open market. Also, the budget division has proposed that large PSUs such as ONGC have reserves that can be used by this fund for acquiring energy assets abroad. This can be a second source of funding. The third source of funding can be the RBI's forex reserves. But this still needs to be debated, as the RBI may not be in favour of this¹².

Countries such as China and Singapore have already set up their sovereign wealth funds. Recently, even China has acquired considerable assets in foreign land through its 400 billion USD investment fund¹³.

Energy efficiency

It is clear that while energy efficiency has an important role to play in the national energy strategy, renewable energy will become a key part of the solutions. It is likely to play an increasingly important role in the augmentation of grid power, providing energy access, reducing consumption of fossil fuels and helping India pursue its low-carbon developmental pathway. India's energy efficiency is the fifth-lowest in the world. Therefore, it is imperative to have a consistent energy policy, relentlessly pursue energy efficiency and conservation, maximise coal production, improve the rail and port infrastructure and develop alternative infrastructure for coal transportation such as coastal rivers. There is also an urgent need to fully exploit the hydroelectric and nuclear potential of the country. As per the Petrotech - PwC India survey report 'Fuel for thought' published in 2012, 94% of the survey respondents were of the view that oil diplomacy has now become a norm rather than an exception. Thus, India needs to vigorously raise the level of international diplomacy to gain a foothold in the exploration of oil, coal and other hydrocarbon resources at the global level. It needs to step up its efforts in coal gasification, carbon sequestration and undertaking projects for bio-fuels.

Initiatives under NELP

To increase domestic exploration and production, the government introduced the New Exploration and Licensing Policy (NELP) in 1997-98 which brought about major changes in the structure of the Indian oil industry and increased the rate of exploration of the sedimentary basin from 11% to more than 44%.

The NELP conducted nine rounds of exploration bidding from 2000 to 2011 and opened the country's oil and gas sector to private companies through international competitive bidding for blocks under a production sharing contract with the government. Though, the NOCs continue to account for a major share of crude oil and natural gas production, there has been a significant increase in private participation. All 10 oil discoveries in 2007-08 were

made by private oil companies such as RIL, Cairn and Essar Oil Ltd. The ninth round of bidding under the NELP attracted investment commitments of more than 827 million USD. The government also plans to move towards an Open Acreage Licensing Policy (OALP), wherein oil and gas acreage will be available round the year instead of cyclical bidding rounds launched under the NELP.

Promoting renewable energy

The conventional sources of energy are not able to meet the rising demand and the demand-supply gap in the energy sector has been increasing rapidly over the years. Currently, the share of renewable energy in the total commercial energy use is around 10% and may go up to 15% by 2020. Most renewable energy sources are significantly more expensive than conventional power. However, technological developments are reducing the cost of renewable energy generation and it is widely predicted that by 2019 the cost of solar electricity generation, which is currently six times costlier than coal-based electricity, will become approximately equal to the latter. However, this equalisation is expected to occur partly due the significant rise in the cost of conventional fuels¹⁴.

The demand-supply gap for power is currently at 10.3 % and is one of the key drivers of renewable energy, which is not being utilised to a large extent in India. As part of India's goal of diversifying the sources of electricity generation and increasing the country's capacity, the government also plans to increase the use of hydroelectric power. International organisations such as the World Bank are funding a variety of hydroelectric projects around the country. However, lack of reliability and environmental and land-use concerns surrounding the construction activities may make it difficult to capitalise fully upon this domestic energy resource. While India holds the potential for developing other renewable power sources, such as geothermal, solar and wind power, cost concerns and an underdeveloped transmission and distribution network are likely to hinder their expansion.

12. India's sovereign wealth fund plans gaining momentum, Moneycontrol, 25 August 2011

13. The Economic Times, 8 September 2011

14. An Approach to the Twelfth Five Year Plan, Planning Commission, Government of India



Conclusion



Economic constraints are compelling India to reduce dependency on oil and gas imports and develop capabilities in domestic hydrocarbon exploration and production. The oil and gas sector in India has untapped potential, calling for more intense exploration activities. Hence, there is a meritorious case for catalysing actions leading to the development of domestic hydrocarbon E&P industry. Given the need to boost development of domestic oil and gas industry in an energy starved nation, the government needs to proactively encourage public-private partnerships for developing the oil and gas industry. India's dream of energy security may turn into reality if the policies are aligned to meet the challenges the sector is facing.



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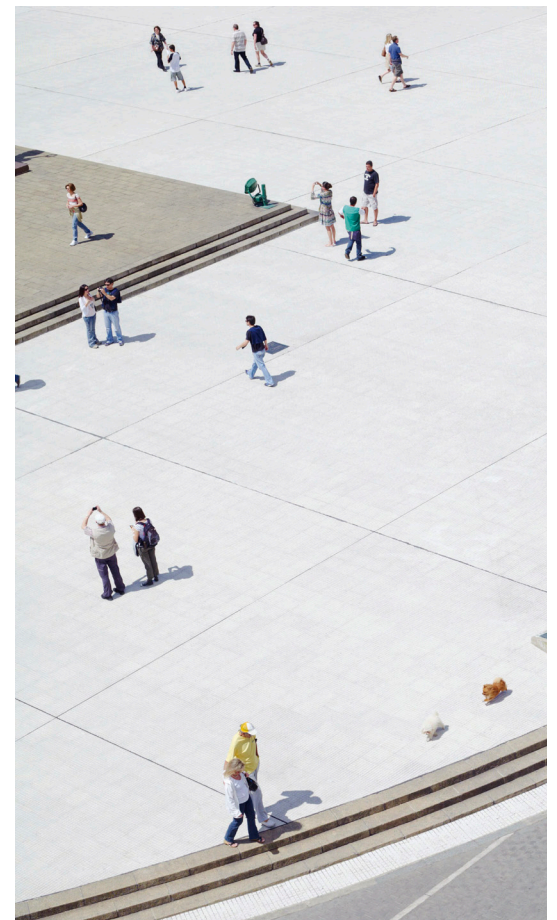
To be the thought leader for industry, its voice for policy change and its guardian for effective implementation.

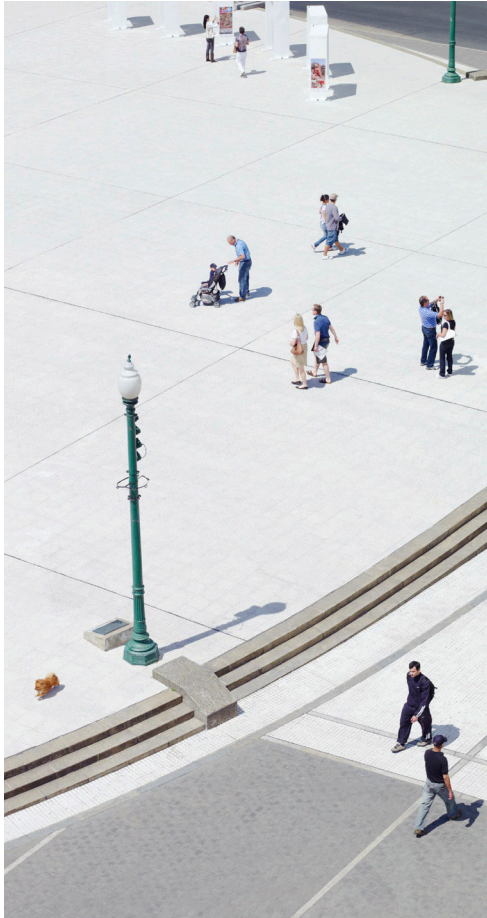
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Designed by: PwC Brand and Communications, India