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"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."

- Integrated Energy Policy , Government of India

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Executive Summary

Energy Security a growing concern for India

Energy security has been an important global policy issue for over four decades now, since the first oil crisis in the 1970s. According to the International Energy Agency's (IEA's) World Energy Outlook (WEO-2012) published in November 2012, the global energy demand is likely to grow by more than one-third over the period to 2035, with China, India and the Middle East accounting for 60% of the increase. Thereby, Energy security becomes a pertinent issue for a country like India where the dependence on import is increasing steadily.

Energy Security, as defined by the Integrated Energy Policy of India, encompasses three critical dimensions: (a) meeting India's large energy demand to sustain an annual economic growth rate of 8 to 9 percent through 2031-32, (b) meeting lifeline energy needs of all citizens to address social development, health and safety of the energy poor, and (c) to ensuring sustainability in energy supply and use. In the current context energy security also encompasses an overlapping element of energy efficiency across all aspects related to energy security. Energy Security thus entails a complex set of coordinated initiatives and the need for energy strategies, policies and regulations to align in making specific choices for the country in charting a low-carbon and energy-secure growth path for the country.

Demand and Consumption in India

India is the fourth largest primary energy consumer, after China, USA and Russia and it accounts for more than 4.6 % of total global annual energy consumption. In the last five years, India has averaged a growth rate of 8% and the demand for energy has been putting pressure on its supply sources. It is an established fact that if India continues to grow at 8% or so in the coming years a higher than average demand for energy will persist.

Coal is the mainstay of India's energy sector and accounts for over 50% of primary commercial energy supply and of the total power generated in the country, 69% comes from coal based thermal power stations. Next big share of energy portfolio in India is dominated by hydrocarbons and less than 10 percent of energy is accounted by other sources like hydro, renewables and nuclear. Demand for conventional energy in the past five years has demonstrated an increased pace with natural gas growing at highest rate of over 10% CAGR. While it is certain that India will see an increased escalation of energy demand, the question that surrounds India is at what scale and speed India's energy demand will expand and which fuels and technologies it will use.

With the increased consumption of energy, demand side management through increased efficiency has also gained prominence in the country. Energy conservation potential in India is estimated at ~ 23% and various initiatives have been taken to explore this potential. Several initiatives such as Super Energy Efficient Program, Smart Grid initiatives, National mission for Enhanced Energy Efficiency, PAT (Perform Achieve Trade) scheme, Standards & Labelling (S&L) Program, Energy conservation building codes, etc. have been undertaken to enhance energy efficiency of the nation and make energy sector economically as well as environmentally sustainable.

Challenges Related to Energy Security of the Country

Low hydrocarbon proven reserves and declining interest of foreign players in E&P: India has low proven hydrocarbon reserves with reserve to production ratio of ~18 years for oil and ~26.9 years for gas as per the current production levels. Approximately 34% of the total area of India's sedimentary basins is poorly explored to completely unexplored and India has seen diminishing interest from investors in exploration & production sector in the recent NELP bidding rounds with limited number of IOCs participating in the bidding. There is a need for India to establish and attractive fiscal regime to enhance the E&P activity and thereby domestic production levels.

Increasing import dependence both for oil and gas: The volume of crude oil imports has been increasing steadily in India and more than 75 percent of its total crude requirement in 2011. Similarly, gas imports are increasing steadily with lower than expected production from KG-D6. During the 12th Plan, import dependence on crude oil is expected to increase from ~76% in FY11 to ~80% in FY17 and import dependence on natural gas is expected to increase from ~21% in FY11 to 35% in FY17. High import dependence for energy amounts to high vulnerability and compromised energy security of the nation. As a result of this, GDP growth rate becomes dependent on external factors like oil prices. Also, it adds to concerns regarding continuously increasing fiscal deficit and depleting forex

reserves. In such a scenario, volatile prices and increased competition for resources outside India are making it all the more difficult for Indian companies to source energy at a competitive price

Stagnating supplies in Coal Sector: The coal sector has been facing challenges both in terms of domestic as well as imported supplies. The domestic production is stagnating in the coal sector as India's coal demand increased at CAGR of 8.5% while CIL's domestic production increased at a CAGR 4.6% only in 11th five year plan. Any additional coal requirement for new power plants would be unlikely met through FSAs with CIL, hence finding alternative sources is unavoidable. India's coal imports have more than doubled over the last five years. However, coal imports have concerns around limited supporting infrastructure, huge price difference between imported and domestic coal and changing regulations in the source countries. Also, different characteristics of coal typically permit existing power plants to blend imported coal with domestic coal only up to 10% to 15%. Further, there are concerns that there are very limited manufacturers of quality mining equipment and machinery. Coal as a sector is monopolistic and remains virtually closed to private sector participation except end use cases. With slower growth rate of production of CIL and SCCL, and issues around import of coal, Indian power sector is facing capacity utilization issues.

Renewable Energy and related challenges: Renewable sector has immense potential which needs to be explored going forward and is becoming an increasingly important part of India's energy mix. The installed capacity in the renewable sector is ~ 26 GW in 2012. Wind constitutes the highest share in the renewables because of existing potential in India and the feed in tariff approaching grid parity. Solar PV is another source which is gaining prominence in the energy mix. Besides National Solar Mission at the federal level there are various State level policies which are pushing for wider adoption of Solar PV as an active source in the energy mix. In addition, India has significant potential in the hydro sector but sector is currently faced by issues related to R&R, land acquisition, clearances and evacuation infrastructure.

Un-conventional sources of energy: With the thrust over un-conventional sources of energy globally, India is also gearing up to explore and develop domestic sources in terms of shale, CBM, tight gas, etc. While shale gas policy is still under formulation, exploration activities have already commenced for CBM. There is a need to formulate an attractive fiscal regime to incentivize investment in the un-conventional sources and attract foreign players. Currently, India is facing challenges in terms of availability of technology and skills/ competency in terms of manpower and service providers so as to provide quality service at a competitive cost. Also, this sector is expected to face challenges related to land acquisition, especially for shale gas as it requires large number of wells to be drilled and extensive use of land. Water availability, management for fraccing process and infrastructure related challenges in view of under-developed gas transmission grid are some other challenges which could be faced by the sector.

Nuclear Energy in Post-Fukushima scenario: Nuclear energy could play a critical role in addressing India's energy challenges, meeting massive energy demand potentials, mitigating carbon emissions and enhancing energy security through the reduction of dependence on foreign energy sources. India has the capability to achieve the complete fuel cycle – from uranium exploration, mining, fuel fabrication and electricity generation, to reprocessing and waste management. India has modest reserves of uranium and vast reserves of thorium and thus the three stage nuclear power programme is designed to achieve self-reliance by exploiting India's thorium resources. The Fukushima-Daiichi accident in Japan resulted in concerns over the safety of nuclear plants resulting in anti-nuclear sentiments in the country.

Policy and Regulatory Challenges in the Energy Sector: Pricing continues to remain a key concern in the India energy sector both in terms of hydrocarbon and coal sector. Since domestic energy prices are disconnected from the global trends, there is limited signalling mechanism for active demand side management. Resource allocation and fuel side concerns bring in another dimension to challenges faced by Indian energy Sector. There is a pressing need to bring in independent regulator in the coal sector and develop regulations around development of coal blocks at an improved pace. A new framework could be looked into the domestic captive coal mine based projects, linkage based projects and imported coal based projects. A few of the concerns are mostly cutting across the sectors: For instance delays in land acquisition,

rehabilitation and resettlement and obtaining environment and forest clearances have proved to be the prime concern in development of most energy sector projects. Health of distribution utilities is another element which requires attention of policy makers. Most of the private generating companies perceive increased payment default risk when negotiating PPAs with these utilities. This has a snowballing impact with commercial banks perceiving higher risks in these projects making cost of financing higher.

Similarly, the investment environment in the oil & gas upstream sector is getting affected due to regulatory uncertainties. At the moment, the Government is involved in contract administration, monitoring and review of investments and pricing decisions. The independent regulator could take up these roles, as recommended under the IEP. Pricing of major share of gas supplies in the Indian market is controlled and is not market driven and multiple pricing regimes exist. Controlled pricing may result in disincentivizing investments in the sector in terms of limited participation from foreign players, who have access to technology, much required in deep-water E&P activities. The downstream sector is evolving in terms of policies and powers of regulatory board and bidding framework for gas distribution. Controlled Pricing of certain petroleum products is another key issue faced by Indian oil and gas sector and as a result most of the OMCs are currently operating under heavy burden of under recoveries. Due to policy and regulatory challenges, India may lose on foreign investment, especially in areas like deep water E&P, Shale gas, CGD, fuel retailing, etc, despite being an attractive market in terms of demand. Stable and consistent regulatory environment and only need-based intervention from state is required to attract investment

Geo-Political Environment and Related Challenges

The energy sector is deeply interlinked to the geo political environment globally. Given the high import dependence of India, It is important for India to secure its supplies through energy diplomacy. Some of the recent happening which may have a long term affect the Indian energy environment are:

The Arab Spring: Some of the recent developments in the MENA (Middle East and North Africa) region including Iran & Iraq have impacted the oil dynamics of the region and ultimately the global hydrocarbon sector. India is heavily dependent on the region for its oil & gas supplies. The disruptions in the production in the region lead to significant price rise and the prices of hydrocarbon supplies are expected to increase in the long term due to the socio-economic environment of these countries.

The Golden Era of Gas: The Fukushima incident in Japan resulted in shift of focus from nuclear energy to other forms of energy, especially gas. There is an increase in demand of gas especially from Asian countries like Japan, South Korea, China, India and Taiwan. In addition, due to the shale gas revolution in the US and various other countries gas supplies are expected to improve in the future. With significantly higher global reserve to production ratio of gas as compared to oil and increasing environmental concerns around liquid fuels and coal, the share of gas in the global energy mix is expected to increase.

Changing Trade Flows: The global energy map is changing with recent rebound in US upstream sector because of non-conventional sources of energy. This may change international oil and gas trade flows, putting in focus the changing geopolitical environment, especially in context of the MENA region.

Acquisition of foreign coal assets: Experiences from recent acquisitions by a few of the private Indian companies have indicated that it has its own set of challenges. Other than the limited domestic mining experience of most of the companies except SCCL, CIL and its subsidiaries, there are other challenges related to political risk (like those which came to light in Indonesia). CIL had ventured in to acquisition of coal blocks overseas but there has been limited success in this space.

Geo-political challenges and options for India: India has faced significant challenges in the past in securing international supplies. There is an increased pressure on India to reduce its dependence on Iran due to Iran's non-participation in NPT; Iran Pakistan India pipeline project has been stalled. In terms of gas supplies from The U.S., rules are not favourable for exporting gas to non-FTA countries. In addition, India has lost out to China for securing supplies through transnational pipeline from Myanmar and also in securing assets in countries like Khazkhistan, Nigeria, Angola, Russia, etc. to China. China has been able

to use diplomatic channels to increase its chances of winning the bids. It has covered energy acquisition under layers of integrated packages of aid, concessional or low-interest loans as well as direct financing of infrastructure projects. Chinese companies like CNPC, CNOOC, Sinopec not only affect the energy sector but also makes social and economic impact in the region.

Way forward

Energy security shall remain an inter-play of demand and supply scenarios, which in themselves are influenced by a number of factors which need careful evaluation and consideration over the long-term. The Integrated Energy Policy document needs to be made more dynamic to reflect the changes in the global energy environment and also revisit some of the challenges related to policy making and implementation for the Indian energy sector. A truly integrated energy policy should clearly articulate implementation along with continued reforms and dynamism to accommodate rapidly changing global energy environment. Some of the factors which are critical to ensure long term energy security of the nation are listed below:

- Diversification of Energy Sources and avoiding over-dependence on any one fuel
- Supplier Diversity in terms of limited reliance on one supplier/ region/ country
- Security of Trade Flows/ crucial trade corridors instrumental in sourcing various forms of fuel
- Geo-politics and international economic/ political factors affecting supplies of energy
- Controlling the level of imports and developing indigenous capabilities
- Reliability of physical infrastructure facilitating energy flows
- Market/Price volatility as it may discourage long-term investment and creates a barrier to providing adequate energy supply
- Affordability of energy to various consumer segments
- Energy efficiency and Feasibility of energy supplies

At this crucial juncture, it is important for the Corporates, Industry experts and the policy makers to work together to create a healthy environment for the Energy sector. World Energy Council- India Energy Congress provides an opportunity to facilitate the discussion between various stake holders and synergize for a secured energy future of the country. India needs to collectively seek answers to some questions and work at multiple levels to have long term energy security

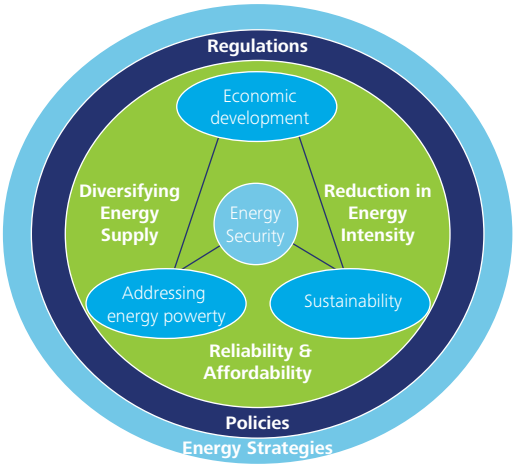
- What are the changes required in the Policy and Regulatory Environment in the energy sector?
- What could be done to establish a fair resource allocation and pricing mechanism of domestic resources?
- What could be done to secure international assets/ supplies through energy diplomacy?
- How could India address the technology and skill related challenges with respect to the energy sector?
- What steps could help India to achieve desired level of energy efficiency?
- How could India facilitate fast paced infrastructure development?
- What are the options for India to address financing related challenges in the sector

Strategic Context

Energy Security, as defined by the Integrated Energy Policy of India, encompasses three critical dimensions: (a) meeting India's large energy demand to sustain an annual economic growth rate of 8 to 9 percent through 2031-32, (b) meeting lifeline energy needs of all citizens to address social development, health and safety of the energy poor, and (c) to ensuring sustainability in energy supply and use. In the current context energy security also encompasses an overlapping element of energy efficiency across all aspects related to energy security implying efficient energy utilization across all spectrums.

Energy Security thus entails a complex set of coordinated initiatives and the need for energy strategies, policies and regulations to align in making specific choices for the country in charting a low-carbon and energy-secure growth path.

Figure 1: Dimensions of Energy Security



In particular, energy security choices would impinge upon supply side and demand side factors. Supply side factors include securing adequate domestic and international sources of energy and diversifying the country's energy mix to be able to address sustainability and to tide through disruptions and variations specific to a particular type of energy, supplier, region or trade. Demand side factors entail demand from existing consumption base, resultant demand on account of economic growth, improved living standard and efficiency in utilization of energy to reduce energy intensity across various segments of the economy. Energy security considerations involve investments and thus such choices are determined by long-range affordability for the economy as well as energy consumers.

Global Energy Context

Energy security has been an important global policy issue for over four decades now, since the first oil crisis in the 1970s. This is because global energy markets rely heavily on fossil fuels like oil, natural gas and coal that are finite in nature, sometimes difficult to exploit, concentrated with a few countries, etc. and hence brings with them issues related to investments & economics, geo-politics, trade and technology. These fuels provide a large majority of the globe's primary energy supply but being non-renewable in nature and skewed in its availability, they bring with them globally de-stabilizing effects, mainly through price shocks and geo-political tensions. Extensive worldwide use of fossil fuels has not only threatened global energy security, but has also caused serious environmental impacts and concerns. Thus, one of the key challenges confronting the developing world is in meeting their growing energy needs, which is vital for sustaining economic growth and at the same time doing so without facing destabilizing fiscal and environmental impacts.

According to the International Energy Agency's (IEA's) World Energy Outlook (WEO-2012) published in November 2012, the global energy demand is likely to grow by more than one-third over the period to 2035 in the New Policies Scenario (considered as our base case), with China, India and the Middle East accounting for 60% of the increase. Energy demand according to the WEO-2012, rises in OECD countries, although there is a pronounced shift away from oil, coal and in some countries, nuclear, towards natural gas and renewables. Despite the growth in low-carbon sources of energy, fossil fuels remain dominant in the global energy mix, supported by subsidies, particularly for oil, that amounted to USD 523 billion in 2011, up almost 30% on 2010 and six times more than subsidies to renewables.

The global energy scenario has undergone rapid changes over the last two years, with potentially far-reaching consequences for energy markets and trade. It is being redrawn by the resurgence in oil and gas production in the United States, retreat from nuclear power in some countries, continued rapid growth in the use of wind and solar technologies and by the global spread of unconventional gas production.

India's Energy Demand

Energy Consumption in India

India, the world's largest democracy, is the third largest economy in terms of Gross Domestic Product (GDP) in Purchasing Power Parity (PPP) terms after USA, China and Japan[1]. The fast paced growth of Indian economy has resulted in a surging demand for energy. This increase in energy consumption in India along with that of China, has added substantially to an already stretched global energy demand; so much so that the centre of energy demand is shifting from OECD countries to Asia.

India is the fourth largest primary energy consumer, after China, USA and Russia[2]. Total primary energy consumption in 2009 was 487.6 million tonnes of oil equivalent (mtoe) or 4.6 percent of total global primary energy consumption (Refer Table 1). As per Planning Commission of India, the primary energy consumption would reach 738.07 mtoe by 2016-17 of which approximately 38 percent would be met through imports..In terms of demand, India had the third largest energy demand in the world after China and the United States and just ahead of Russia.

With one-sixth of the world population, India's per capita energy consumption was 585 kilograms of oil equivalent (kgoe) in 2009, far lower than the global average. With expected high growth rate in the future, India's per capita energy consumption is expected to be more than double by 2031-32, around 1,124 kgoe, which will still be lower than the 2009 world average of 1,797 kgoe.

Energy security is a key concern in India today as its energy requirements are growing as a result of increasing population, economic activity and rising income levels. Given India's current energy mix, this has resulted in an increasing dependence on imported energy. The current GDP of India is estimated at $1.847 trillion for 2011 and although growth is expected to slow down in 2012, medium to long term projections still attribute 8% to 9% per annum growth in GDP. Energy is one of the most important catalysts for the development and growth of the economy. This means that India would see a rise in energy demand to meet these growth rate targets. For example, the Integrated Energy Policy has estimated that India's primary energy supply will need to increase by 4 to 5 times and its electricity generation capacity by 6 to 7 times over its 2003-04 levels to deliver a sustained growth rate of 9 percent through 2031-32 with primary energy

Table 1: Total Primary Energy Consumption of Top five countries in mtoe (2009)

Country	Primary Energy Consumption
China	2210.3
United States	2205.9
Russian Federation	644.4
India	487.6
Japan	474.0

Source: BP Statistical Review 2012

Table 2: Per Capita Energy Consumption (kgoe) - 2009

Country	kgoe
United States	7,034
Russian Federation	4,559
Japan	3,707
UK	3,184
China	1,698
Brazil	1,240
India	585
World	1,797

Source: IEA Key World Statistics 2011

1 Source: International Monetary Fund: India's GDP in purchasing power parity (PPP) stood at $4.46 trillion in 2011marginally higher than Japan's $4.44 trillion making India the third biggest economy after the United States and China.

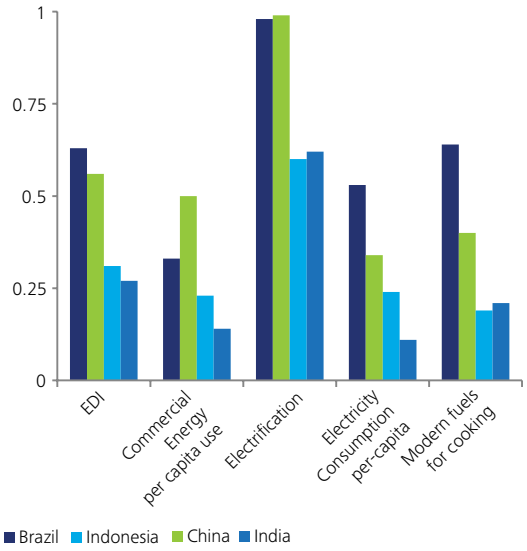
2 Source: India Brand Equity Foundation (http://www.ibef.org/industry/oil-and-gas.aspx) accessed on January 21, 2013

supply growth of around 5.8 percent per year. On the other hand, commercial energy supply would need to grow faster at about 6.8 percent per annum as it will incrementally replace non-commercial energy over this period.

In 2009, Energy Development Index (EDI), developed by IEA was calculated for 64 developing countries, including India. The graph below indicates India's performance on the index in comparison to Brazil, China and Indonesia. While India today is recognized as the fourth largest primary energy consumer in the world, the following graph shows the developmental gaps and the consequent future energy requirements for maintaining the developmental objectives.

Energy security cannot be achieved without ensuring reliable and affordable energy access at an individual level.

Figure 2: Energy Development Index, 2009



Source: World Energy Outlook 2010, IEA

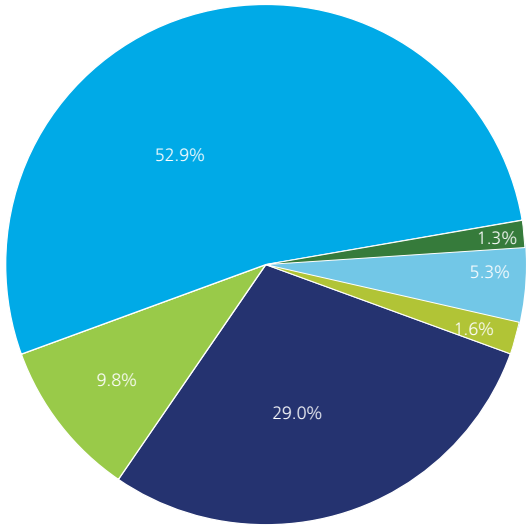
The primary energy consumption in India is dominated by coal and hydrocarbons, with less than 10 percent of energy accounted by other sources like hydro, renewables and nuclear. In 2011, oil and gas accounted for around ~40 percent of India's total primary energy consumption, next only to coal, which accounts for ~53 percent (Figure 3).

A growing India brings its own set of challenges and requirements. In the last five years, India has averaged a growth rate of 8% and the demand for energy has been putting pressure on its supply sources. It is an established fact that if India continues to grow at 8% or so in the coming years a higher than average demand for energy will persist. In such a scenario, it is expected that there will be continued pressure on supply sources in the next decade largely driven by increasing urbanization and increasing demand for consumption.

Demand for conventional energy in the past five years has definitely demonstrated an increased pace. An increased consumption pattern over a higher base indicates a dynamically increasing demand for energy in absolute terms. Increase in demand has been observed across the energy spectrum. The Planning Commission has acknowledged this and has outlined that for India to remove poverty and to meet its goals around human development needs, it will need to keep its pace for growth at 8%.

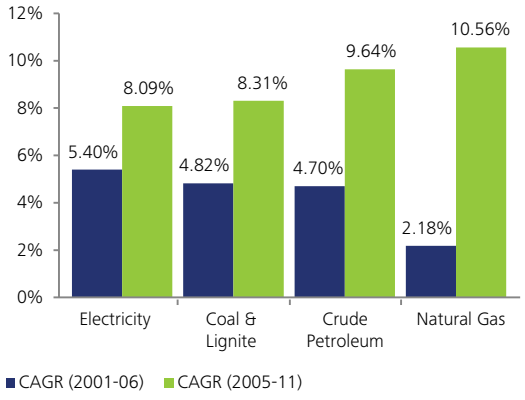
World Energy Outlook as per Economic Intelligence Unit forecasts clearly puts India in the limelight. As per one estimates India will have the maximum growth in demand for energy.

Figure 3: Indian Primary Energy Mix (2011)



Source: BP Statistical Review 2012

Figure 4: CAGR 2005-06 to 2006-11



Source: CSO, MOSPI

While it is certain that India will see an increased escalation of energy demand, the question that surrounds India is at what scale and speed India's energy demand will expand and which fuels and technologies it will use. This is the key for outlining the future canvas of India and to a certain degree the world energy market.

Table 3: World Energy Outlook (in mtoe: May 2012 - Economist Intelligence Unit)

	2010	2011	2012	2013	2014	2015	2016	2020	CAGR
US	2,245	2,260	2,273	2,289	2,302	2,318	2,337	2,393	0.71%
China	2,426	2,555	2,673	2,801	2,924	3,058	3,192	3,706	4.82%
India	716	755	795	834	878	923	969	1,178	5.69%
Russia	681	699	713	729	746	767	787	884	2.94%
Japan	477	455	481	512	545	574	597	658	3.64%
Germany	330	326	326	328	331	333	337	345	0.50%
World aggregate	11,654	11,950	12,277	12,641	12,905	13,285	13,685	15,311	3.08%

Demand side management through energy efficiency

As per the Integrated Energy Policy, energy conservation potential in India is estimated at ~ 23%. Maximum potential is envisaged in the industrial and agricultural sectors. To achieve this potential, the Government of India enacted the Energy Conservation Act, 2001 (EC Act). The Act provides for the legal framework, institutional arrangement and a regulatory mechanism at the Central and State level to embark upon energy efficiency drive in the country. Five major provisions of EC Act relate to Designated Consumers, Standard and Labeling of Appliances, Energy Conservation Building Codes, Creation of Institutional Set up (BEE) and Establishment of Energy Conservation Fund. The Energy Conservation Act became effective from 1st March, 2002 and Bureau of Energy Efficiency (BEE) operationalized from 1st March, 2002.

Energy efficiency institutional practices and programs in India are now mainly being guided through various voluntary and mandatory provisions of the Energy Conservation Act. Several initiates such as Super Energy Efficient Program and Smart Grid has been initiated by the Ministry of Power which will accelerate energy efficiency potentials and make energy sector economically as well as environmentally sustainable. Following schemes have been undertaken which are expected to further strengthen the energy efficiency road map:

- National mission for enhanced energy efficiency
- PAT (Perform Achieve Trade) scheme
- Standards & Labelling (S&L) Program
- Super-efficient equipment program (SEEP)
- Energy conservation building codes
- Smart grid initiatives

All of these above measure shall lead to better demand side management and shall aid in making more energy available and assessable to a wider community.

India's Energy Security Concerns

Hydrocarbon Reserves and Related Challenges

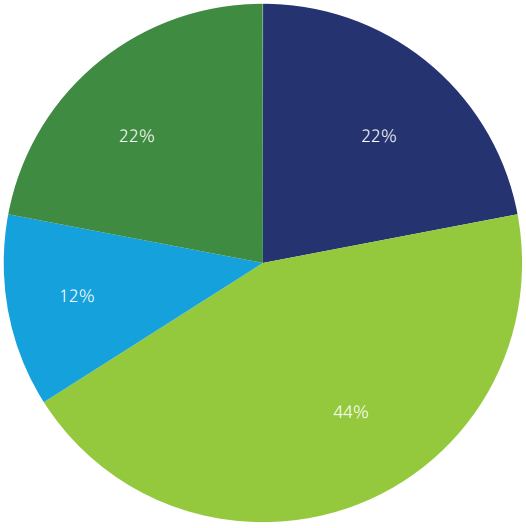
India has only 0.5% of world's proven oil reserves and it houses more than 15 percent of the world's population; the current reserve to production ration is ~18 years. In terms of Natural Gas, India has 1,241 billion cubic meters (bcm) of proven and indicated reserves, which are 0.6 percent of the world's total proven gas reserves. At existing production levels of 50.9 bcm per year, the country has a Gas R/P ratio of about 26.9 years. There are 26 sedimentary basins in India covering 3.14 million sq. km of area. Of these 26 basins, 22 basins fall into the three categories - of being prospective, having identified prospectivity and proven to be commercially productive. Of the total area of 3.14 million sq. km, 22 percent can be categorized as moderately to well explored. Exploration efforts have been initiated in 44 percent of the area and 34 percent remains poorly to completely unexplored (Figure 5). Currently, 1.06 mn sq km area is under active petroleum Exploration Licenses in 18 basins and a total of 35,601 sq km area is under Mining Lease.

India's Exploration and Production (E&P) sector was largely dominated by ONGC and OIL in the Pre-NELP era. Under the NELP I-IX rounds, the DGH has awarded 248 blocks covering a total area of 1,468,511 sq km. Participation by foreign exploration companies has increased since the first NELP-I bidding round in 1999 and in 2006, the number of foreign companies exceeded the domestic companies bidding under NELP VI.

India has seen diminishing interest from investors in exploration & production sector in the recent NELP bidding rounds also there has been only limited interest from foreign investors in NELP regime. Also, there is a need to address the gas pricing issues and, put a predictive policy framework in place to retain interest of foreign companies

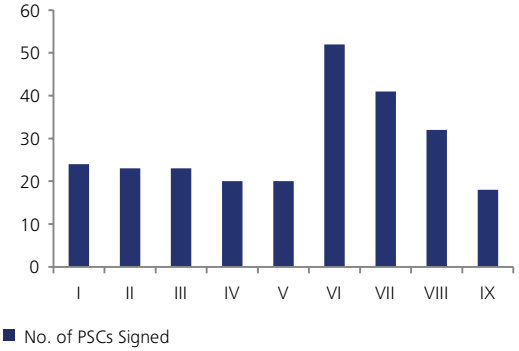
Open Acreage Licensing Policy (OALP): GoI is in the process of introducing new policy for bidding under which oil and gas acreages will be available round the year instead of cyclic bidding rounds launched under NELP to generate interest of investors. One of the pre-requisite and challenge for the formulation of OALP is to establish a data repository centre to provide quality and reliable geo-scientific data for evaluation by E&P companies. DGH has initiated the process of establishing a National Data Repository (NDR) for gathering all the available geo-scientific data in India under one roof so that it is easily accessible to all the agencies that require it, such as, E&P companies, research institutes and academia. In OALP, geological data would be made available to bidders through the NDR and it will enable bidders to bid for any oil & gas block throughout the year. This concept of bidding is expected to be implemented in India in near future.

Figure 5: Status of Exploration in the Indian sedimentary basins in 2010-11



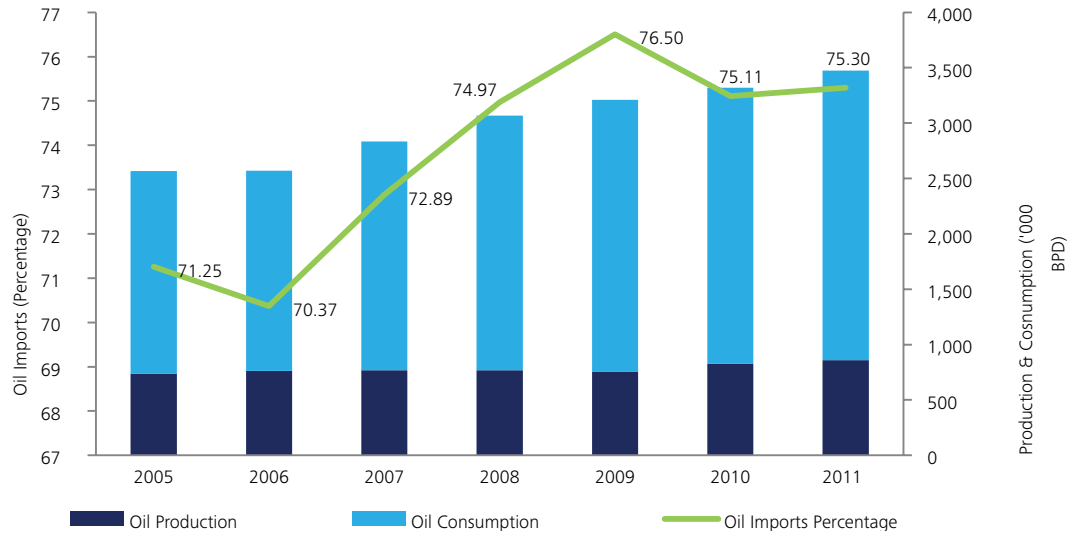
Source: Directorate General of Hydrocarbons, India

Figure 6: Number of PSCs signed in the NELP Rounds



Source: DGH, India

Figure 7: Production and consumption



Source: BP Statistical Review 2012

Oil Production and Imports

With Reserves to Production (R/P) ratio of 18 years, India's existing domestic production of about 858,000 barrels of oil per day (bopd) is less than 25 percent of its current consumption of 3,473,000 bopd, creating a wide gap to be met through imports. As a result, the volume of crude oil imports has been increasing steadily in India to more than 75 percent of its total crude requirement in 2011.

Domestic oil production is currently dominated by the state-owned exploration companies ONGC and OIL, which together accounted for ~74 percent of India's crude oil production in 2010-11. Crude oil production has increased by 12.5 percent to 37.68 million metric tonnes (mmt) in 2010-11 from 33.50 mmt in 2009-10 due to contribution of over 6 mmt from Barmer, Rajasthan and KG Basin. It is expected that in the near future, production from Cairn India's Rajasthan fields is set to increase, as they are yet to realize their full potential. In addition, ONGC and OIL India are already working on increasing production through Enhanced Oil Recovery (EOR) in their respective fields.

Crude oil is one of the important commodities in the import bill. As per Directorate General of Commercial Intelligence and Statistics, India (DGCI&S), crude oil and refined products made up over 28 percent of India's import of principal commodities in 2010-11. This resulted in India's outflow for importing these commodities to about USD 103 billion in 2010-11, compared to USD 86 billion in 2009-10, an increase of about 20 percent.

The gap between crude oil requirement and domestic production is expected to widen further as a result of India's forecast GDP growth rate over the next five years as per the draft approach paper on the 12th five year plan (2012-17). As per forecast made by the Working group on energy sector for the 12th Plan, the country requires energy supply to grow at CAGR of 6.5 percent to maintain the growth rate of 9 percent over the next five years. It is projected that the oil and gas requirement by the terminal year of the 12th Plan would reach 204.80 mtoe and 87.22 mtoe respectively. This demand for oil and gas would be fulfilled by import of 164.8 mtoe (or 80.5 percent) crude oil and 24.8 mtoe (28.4 percent) natural gas in 2016-17. During the 12th Plan, import dependence on crude oil is expected to increase from 76 percent in 2010-11 to 80 percent in 2016-17.

Natural Gas Production and Imports

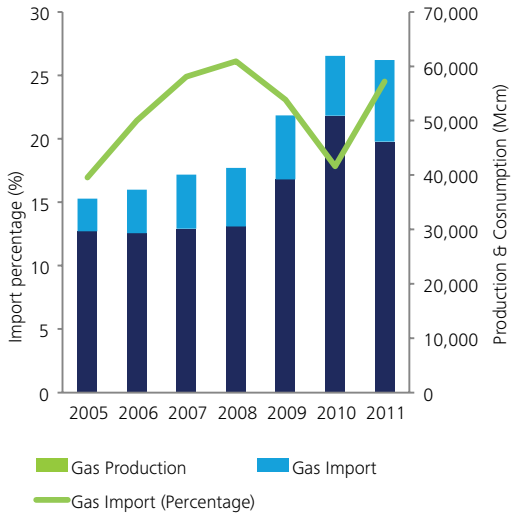
According to BP Statistical Review 2012, natural gas constitutes around 10 percent of India's total primary energy basket, which is well below the world average of 23.7 percent in 2011. By 2025, the share of natural gas in India's energy basket is likely to reach 20 percent (Ministry of Petroleum and Natural Gas estimates). The increased consumption of natural gas is expected to be fed both by increased domestic production and import of natural gas.

The natural gas supply, in India was about 180 mmscmd in FY11 as against an estimated demand of approximately 279 mmscmd in 2011 (as per 11th Five Year Plan). Domestic supplies are not matching with the demand of oil and natural gas in India. Mature gas fields like that of ONGC (Panna Mukta Tapti and Bassein) and Niko in Surat have declining production and mature Bombay High oil fields are also past their peak production levels.

In 2002, Reliance Industries Ltd made a large discovery in the Krishna Godavari Basin (KG Basin) with an estimated 337 bcm of gas reserves. Hence, there was a sudden jump in domestic supply in 2010 (45 percent increase over 2009). The field started production in started in 2009. The initial production estimates were 28, 53 and 62 mmscmd respectively for FY10, FY11 and FY12. RIL was able to meet the FY10 target by achieving a total production of 40 mmscmd, but after peaking at 61.5 mmscmd in March 2010, the production started declining alarmingly to the extent that the current production levels hover around less than 30 mmscmd. Geological complexity of the basin and high water and sand ingress are the indicated causes of the decline in output volumes.

Due to falling production of mature fields such as Bombay High and PMT, problems with securing supplies from KG-D6 field and increase in prices of alternate fuels the demand has continuously exceeded the production. This is leading to higher emphasis on imports including r-LNG and transnational pipelines. With a host of r-LNG terminals being commissioned by the end of 12th Five Year Plan, r-LNG is expected to take a large share in meeting gas demand in the country.

Figure 8: Production and consumption



Source: BP Statistical Review 2012

Import Dependence and Related Challenges

India is highly dependent on imports for both for crude oil as well as natural gas and with increasing demand and reducing domestic supplies, this dependence is expected to increase further. Currently, ~76% of the crude oil and ~21% of the natural gas is imported. Import dependence to increase to 80% by FY17 for crude oil and 35% by FY17 for Natural gas.

- High import dependence for energy amounts to high vulnerability and compromised energy security; The Arab spring in the recent past was a significant cause of concern for India, owing to high dependence on the region for energy supplies. As a fallout of high import dependence for energy security, the GDP growth rate becomes dependable on external factors like oil prices. Also, it adds to concerns regarding continuously increasing fiscal deficit and depleting forex reserves.
- Increased competition for resources outside India; both for oil & gas is making it all the more difficult for Indian companies to source energy at a competitive price.
- Volatile prices of crude oil and increasing spot prices of natural gas are adding to the challenges for Indian oil & gas sector. The increasing import bill for oil and gas and depreciating rupee against dollar are further adding to the concerns of policy makers
- Around 30-40% share of current supplies to Indian gas market is based on short term contracts or spot market. With the increase in demand in the Asian countries like Japan and South Korea, especially after the nuclear disaster, the prices in the spot market are expected to remain high for some time. Delays in addition of liquefaction capacities globally are further adding to the competition for spot gas available. This may pose problems for India to secure gas at a competitive price.

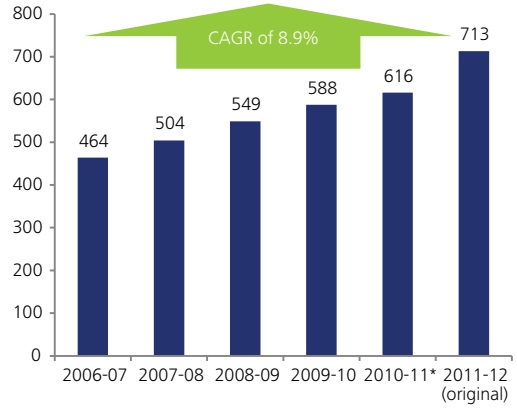
Coal Production and Related Challenges

Eleventh plan dramatically failed to achieve the target coal production – in fact even the revised target set below the initial target was not achieved. The actual achievement was only 540 million tonnes which is much below the revised target of 630 million tonnes. Scenario looks grim since demand in the terminal year (2011–12) of the Eleventh Plan was ~ 640 million tonnes which translates in to a large demand–supply gap of 100 million tonnes. To bridge this gap imports were made which were again inadequate to meet the requirement. This has adversely affected the coal supplies to end consumers, particularly the power sector. Limited availability of coal has impacted new power plants and also existing ones. It is estimated that out of capacity addition of 41894 MW, around 25000 MW of coal-based capacity commissioned is being sub-optimally utilized because of inadequate availability of domestic coal.

Coal is the mainstay of India's energy sector and accounts for over 50% of primary commercial energy supply and its availability or otherwise can hugely impact the energy balance of the country. Of the total power generated in the country, 69% comes from coal based thermal power stations.

Going forward, availability of coal remains a serious matter of concern. Although there is thrust to maximize generation from other conventional and non-conventional sources, coal based generation is likely to be the main stay of electricity generation for 12th and 13th Plan to support the targeted GDP. The coal based power generation capacity addition programme is worked out after taking into account the electricity generation availability from other sources i.e. Hydro, Nuclear, Gas, Lignite and renewable sources. As per the 12th Plan, in order to meet this generation requirement, coal requirement (at SPCC 0.73 Kcal/ Kg) works out to around 842MT. There has been continued increase in coal demand, however domestic production has not kept pace with the increasing demand. Historically, consumption of coal has increased at a higher pace compared to production as outlined in the figure 9.

Figure 9: Historical Coal consumption in million tonnes (Coal Controllers Organization)



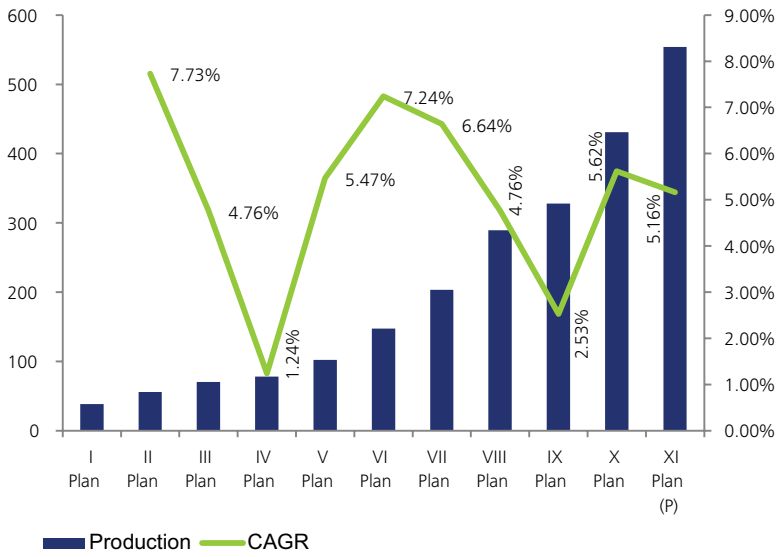
Over the period 2006-07 to 2011-12 coal consumption has increased at a CAGR of 7.40% year on year. Compared to this the production of coal has not kept pace on account of various challenges. It has been observed that coal production has only increased by 5.16% year on year basis. In the terminal year of the XIth plan domestic coal production was 554 million tonnes which is significantly lower than the actual coal consumption. Historical production of coal across the plan period is indicated below.

Going forward in to the 12th plan demand for coal is all the more going to increase. CEA has worked out demand on a year on year basis for each year of the 12th plan across the various usage include coking and non-coking. It is estimated that demand for coal in the terminal year of the 12th plan would be 913.22 MT. Year on year demand for coal is outlined below:

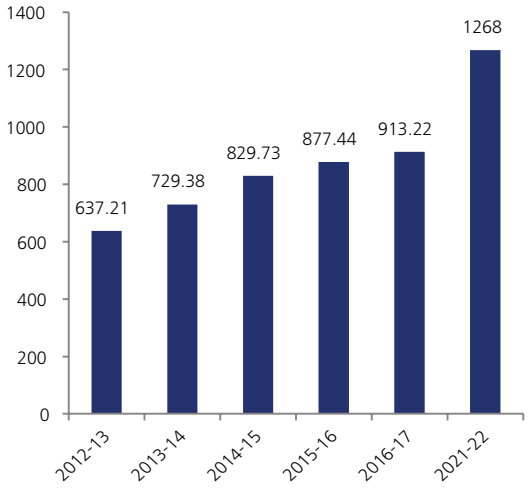
Table 4: Coal demand for power sector (Central Electricity Authority)

Year	In MT
2012-13	637.21
2013-14	729.38
2014-15	829.73
2015-16	877.44
2016-17	913.22

Figure 10: Historical Coal production in million tonnes (Coal Controllers Organization)



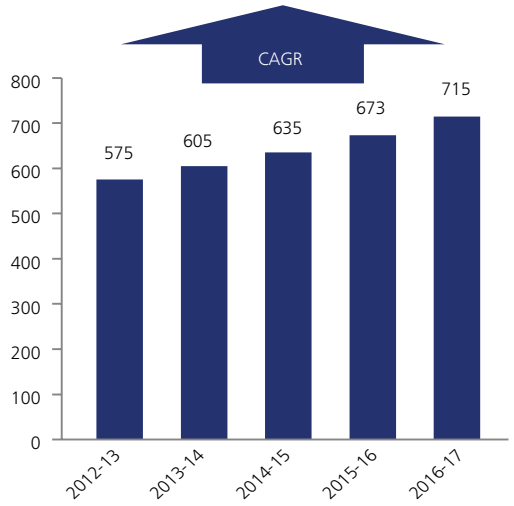
12th Plan: Non Coking Coal Demand in MT



Source: Coal Controller's Organisation

The demand for coal is expected to increase at a CAGR of 9.4% over the next five years and if we consider the estimated demand in the terminal year 2021-22 (terminal year 13th Year Plan) it is observed that demand shall increase at a CAGR of 7.9%. However, supply sources do not look prepared to meet this demand at least in the medium term over the 13th plan period. Projected supply from domestic sources are outlined in the figure below.

Projected production over XIIth Plan in million tonnes



Source: Coal Controller's Organisation

Challenges for coal sector

There are four major challenges in the coal sector which needs to be addressed through policy and regulatory interventions. These can be outlined as the following:

Stagnating domestic production

According to a press release by Ministry of Coal, India's coal demand increased at CAGR of 8.5% in the 11th plan. Compared to this, CIL's domestic production during this period increased at a CAGR 4.6% only. The cause for slow production is the time consuming procedure to obtain environmental and land permission from MOEF and state governments. CIL reported that 24 out of 44 of its currently delayed projects were due to land acquisition. The production shortage would continue to be a serious issue for the power sector. Recently, CIL agreed on the FSAs with power companies for those plants to be commissioned by March 2015. This would make CIL's total coal commitment amount to 555.56 Mt, nearly 250 Mt increase from the standing FSAs. The uncertainty over whether CIL can deliver the committed volume is definitely an area of deep analysis. Another concern is that any additional coal requirement for new power plants would be unlikely met through FSAs with CIL, hence finding alternative sources is unavoidable.

Increasing dependence on imported coal

India's coal imports have more than doubled over the last five years. Coal imports have concerns due to limited supporting infrastructure. Also, different characteristics of coal typically permit existing power plants to blend imported coal with domestic coal only up to 10% to 15% . Also, there is a huge price difference between domestic and imported coal. In addition the dynamism in the regulations of the countries from where coal is being imported pose further hurdles by way of political risks.

Infrastructure

There is a pressing need for a well-integrated infrastructure for coal supply chain, which includes railroads, importing ports and washeries. Delayed construction of railways by Indian Railways to connect mines, dispatch centres and end-use destinations, has already created a considerable bottleneck in coal supply in recent years (an immediate case of Pakribarwadih coal block in Jharkhand is an immediate example where rail linkage is yet to come after several years). Further, there are concerns that there are very limited manufacturers of quality mining equipment and machinery – there are two PSUs, BHEL and BEML (Bharat Earth Movers Limited) who are major suppliers to CIL.

Investment

Coal as a sector is monopolistic and remains virtually closed to private sector participation except end use cases. CIL and SCCL, have a monopoly on coal production for commercial sale – private participation is present only for captive production. The most problematic aspect in the coal sector is this lack of private investment. Where CIL and SCCL fail to achieve production targets, there are no alternative sources to make up the losses other than possible imports from countries like Indonesia, Australia etc. It is in this context that there has been increasing pace for acquisition of coal assets outside India by private players in India.

Source: CEA

Table 5: Indian Shale Gas reservoir properties

Basic Data	Basin/Gross Area (mi2)	Cambay basin (20,000)	Damodar Valley basin (1,410)	KG basin (7,800)	Cauvery basin (9,100)
Resource	Shale Formation	Cambay Shale	Barren Measure	Kommugudem Shale	Andimadam Formation
	Geological Age	Upper Cretaceous	Permian-Triassic	Permian	Cretaceous
	GIP concentration (bcf/mi2)	231	123	156	143
	Risked GIP (tcf)	78	33	136	43
	Risked Recoverable (tcf)	20	7	27	9

Source: EIA

Unconventional Sources of Energy and Related Challenges

An important part of unconventional energy portfolio is unconventional natural gas, where there has been a recent thrust. While industry's ability to access these unconventional energy sources is not new, its ability to do so economically and on a large scale is new. The proliferation of unconventional natural gas production is a game-changing event, especially in light of growing concerns about climate changes. With the increasing emphasis on these resources, Government had already commenced bidding rounds for Coal Bed Methane license while bidding frame work for Shale gas and Under Ground Coal Gasification are being formulated. Shale Gas has existed for quite some time now. Over the years, the technology has been developed, but this technology was not economically attractive. The low natural gas prices were not encouraging the investors to pump in their money into a nascent industry. Primarily three factors have come together in the recent past to make shale gas more attractive:

- Advancements in the horizontal drilling technology
- Advancements in the hydraulic fracturing technology
- A surge in the natural gas prices in the past few years as a result of increasing demand pressures

Currently, Shale gas is high on the agenda within the Indian hydrocarbon sector. Learning from the success of shale gas in US, India is considering shale gas as an option to address its energy security concerns. During the last decade, US shale gas production has increased from merely ~2% to ~17% of the total natural gas production.

India has about 290 trillion cubic feet (tcf) of shale gas-in-place, of which about 63 tcf are estimated to be technically recoverable (Table 5). India has plans to start licensing rounds for shale gas shortly after completing the assessment of shale gas resource potential. In this regard, Director General of Hydrocarbons, India (DGH) has constituted a Multi Organization Team (MOT) for the purpose of coordinating the National Oil Shale Program and has identified five sedimentary basins for detailed resource evaluation. Furthermore, DGH is also working on shale gas policy to create favourable environment for investments. GoI has signed MoU with US Geological Survey, Department of State in November 2010 to obtain technical assistance for characterization and assessment of shale gas resources, carrying out of technical studies and training of manpower.

Coal Bed Methane:

DGH has estimated prognosticated CBM resources at 4.6 tcm spread over twelve Indian states covering an area of 35,400 sq km. CBM exploration activities have already been initiated in 54 percent of the area, which is located in India's major coal and Lignite bearing basins in the central and eastern parts of India. Four CBM rounds have been completed till now and GoI has offered 36 blocks covering 18,600 sq km area out of which 34 blocks have been awarded including three blocks on nomination basis (two on nomination and one through Foreign Investment Promotion Board route). In CBM IVth round, GoI signed contracts for 7 blocks covering an area of 3727 sq.km. The estimated CBM resources of these 7 Blocks is about 330 BCM with expected production potential of 9 MMSCMD. Currently, CBM is commercially produced from five blocks in India, including Raniganj East, Raniganj South, Jharia, Sohagpur West and Sohagpur East. Current CBM

Source: IEA

Production is about 0.15 mmscmd that is to likely to increase in future. While there have been successes in CBM E&P, there is still considerable untapped CBM resource potential especially given India's large coal deposits and resource estimates of CBM.

Some of the consideration in terms of unconventional sources in India are: -

- An attractive fiscal regime to incentivize investment.
- Need for skills and competency in terms of manpower and service providers so as to provide quality service at a competitive cost
- Challenges related to availability of current technology of low cost drilling , multi-seam hydrofrac, comprehensive reservoir description at every phase through reservoir simulation and production technology to achieve faster dewatering
- Land acquisition may prove to be a significant problem both for shale and CBM production, especially for shale gas as it requires large number of wells to be drilled and extensive use of land.
- Water availability and management might prove to be a challenge as fraccing process requires significant quantities of water
- Infrastructure related challenges in view of under-developed gas transmission grid in the country to evacuate the gas produced in regions having rich source of unconventional gas.

Nuclear Energy and Related Challenges

Nuclear energy could play a critical role in addressing India's energy challenges, meeting massive energy demand potentials, mitigating carbon emissions and enhancing energy security through the reduction of dependence on foreign energy sources. Since the establishment of the Atomic Energy Commission in 1948 and the Department of Atomic Energy in 1954 India has had a long commitment to nuclear energy. India has the capability to achieve the complete fuel cycle – from uranium exploration, mining, fuel fabrication and electricity generation, to reprocessing and waste management. India has modest reserves of uranium and vast reserves of thorium. In view of this, Dr Homi J Bhabha designed three stage nuclear power programme to achieve self-reliance by exploiting India's thorium resources

The first stage of this strategy uses pressurized heavy water reactors (PHWR) fuelled by natural uranium to produce plutonium by reprocessing spent PHWR fuel. Plutonium is used as fuel in the Fast Breeder Reactors (FBRs) of second stage. India plans to introduce Thorium in these FBRs after substantial capacity of FBR's are build up to produce Uranium-233. The third stage reactors will use fissile Uranium-233 – Thorium fuel. To have industrial scale experience in thorium technologies, India is developing Advanced Heavy Water Reactor (AHWR) and related technologies in which two third of power will come from Thorium. India has successfully mastered the first stage with 17 pressurised heavy water reactors operating. Thus the focus of Indian nuclear programme is on indigenous technology development for the second stage and enlarge its installed capacity in near-term based on import of uranium, which could be used in the indigenous PHWRs or in LWRs to be set up in technical cooperation with other countries. While work on development of technologies for the third stage power programme is continuing, its deployment in large scale will happen only around the year 2050 onwards. Opening up of civil nuclear cooperation has enabled India to import uranium which can be used in the indigenous reactors or in LWRs set up in technical cooperation with other countries

India's current nuclear generation capacity is 4.8 GW and ranks 13th in the world, which account for only 1.2% of global nuclear capacity. Currently, four indigenously developed 700 MW PHWRs are under construction, two each at Rawathbhata in Rajasthan and Kakrapar in Gujarat. Several others are also planned. Construction of two 1000 MW VVERs, (a type of Light Water Reactor) at Kudankulam in Tamilnadu is nearing completion and one of the reactor is due to become critical any time. An Inter-Governmental Agreement with Russia has been signed for setting another four light water reactors of 1 GW each, in addition to the two being already under construction. India plans to import totally about 40 GWs of LWRs to accelerate the nuclear power deployment in the country. During the XII Plan about 5300 MW installed capacity will be added and several new 700 MW PHWRs as well as LWRs of varying capacities under international cooperation will be launched. In order to meet the fuel requirements to these reactors, related fuel cycle facilities are planned to be augmented. The target is to increase nuclear power capacity to about 60 GW by 2030.

Anti-nuclear sentiments

Anti-nuclear sentiments

The Fukushima-Daiichi accident in Japan resulted in

concerns over the safety of nuclear plants. The construction of a nuclear plant in Kudankulam, Tamil Nadu, brought the concerns around nuclear plants directly into the public domain in India. There has been wide public protest and the final completion of the plant has been delayed. The future of nuclear as an alternative is now awaiting a direction. Recent declaration of Japan that it is reviewing its plans to abandon nuclear power has improved sentiments in the nuclear space.

Renewable Energy potential and Related Challenges

Renewable energy has immense potential which needs to be explored going forward and is becoming an increasingly important part of India's energy mix. With vast potentials, renewable energy is no longer seen as an alternate energy source to conventional energy, but as a critical element in pursuit of key policy objectives. It enhances India's energy security by diversifying its energy mix and reducing import dependence on fossil fuels. According to the Planning Commission, solar power, especially, is seen as having the potential for India possibly to attain "energy independence in the long run". In providing energy access to India's people, renewable energy is expected to "supplement conventional power generation and meet basic energy needs, especially in the rural and remote areas". Besides, renewable energy has the potential of mitigating climate change risks. The mix of renewables in India's energy mix, combining biomass, hydro and other renewables, was approximately 26% in 2009, of which biomass accounted for the largest share. India had the fifth-largest capacity for wind energy in the world in 2011 and in 2010 India launched an ambitious plan to significantly augment its capacity of solar power. Although installed solar capacity remains quite small, it has promising potential for growth. Private investment has been the key driver behind the growth of renewables in India. As of now India has an installed capacity of 1 GW grid connected Solar PV.

Hydro again has a huge potential. As per CEA estimates, India has a potential of 148,701 MW of hydro capacity.

The energy of running water has been exploited for very many years. However, traditional approaches have suffered disadvantages due to reasons outlined below:

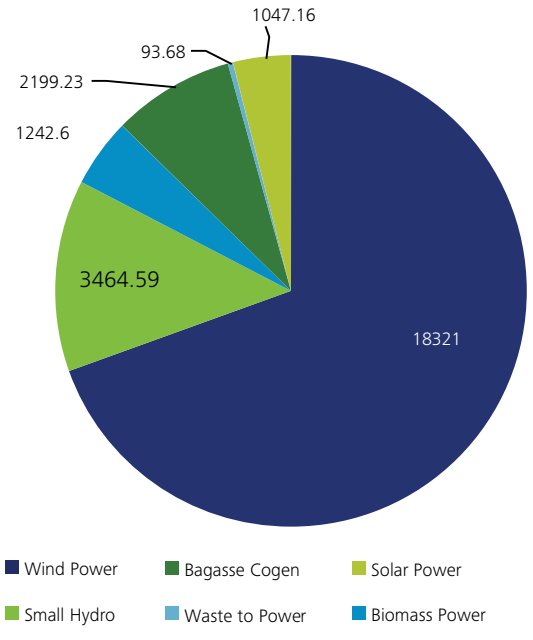
- Land acquisition has increasingly become an area of contention.
- R&R issues: R&R is a lengthy process with limited government support. This leads to delay in any project development which finaly leads to increase in capital cost of the project.
- Clearances: Delays in environmental clearances by MoEF.
- Infrastructure: Most hydro projects fall in a location where transmission and evacuation infrastructure is limited.

Table 6: Indian Hydro Potential

Basin / Rivers probable	Capacity in MW
Indus Basin	33,832
Ganga Basin	20711
Central Indian river system	4,152
Western flowing rivers of Southern India	9.430
Eastern flowing rivers of Southern India	14,511
Brahmaputra Basin	66,065
Total	148,701

Source: CEA

Installed Capacity in MW as of 30 Nov 2012



As of November 30, 2012 India had an installed generation base of 26, 368.36MW of renewable energy.

Solar PV is another source which is gaining prominence in the energy mix. Besides National Solar Mission at the federal level there are various State level policies which is pushing for wider adoption of Solar PV as an active source in the energy mix.

Regulatory Challenges in the Coal and Power Sector

Industry sources indicate that the present regulatory environment in the Indian context needs a dynamic approach in planning resource allocation, development and attracting investment. A few of the concerns are mostly cutting across the sectors: For instance delays in land acquisition, rehabilitation and resettlement and obtaining environment and forest clearances have proved to be the prime concern in development of most energy sector projects. There is a pressing need for well-coordinated actions to be taken by the Central and State Governments to ensure viable projects are taken forward. A few of the concerns in the sector are outlined below:

- Land Acquisition and Rehabilitation and Resettlement
- Environment & forest clearances
- Health of distribution utilities
- Fuel side concerns
- Concerns around competitive bidding framework
- Institutionalization of coal regulator

Most of these concerns require regulatory interventions for immediate resolution. Land acquisition continues to remain a limiting factor. Several projects have been held up largely on account of this particular reason. Lack of a transparent framework for valuation of private land and administrative inefficiencies in planning and implementing rehabilitation packages in most parts of the country, leads to a prolonged process for acquisition of land. The Government of India has finalised the Land Acquisition and Rehabilitation and Resettlement (LARR) Bill to introduce a framework for land acquisitions and to provide for a transparent compensation and rehabilitation mechanism. It has also implemented the Scheduled Tribes and Other Traditional forest Dwellers (Recognition of Forest Rights) Act, 2006. The industry has pointed out that overall this may lead to a rise in the cost of projects but is seen as the right way forward, if it simplifies the acquisition process. These measure need to be pushed adequately and speedily.

Environmental clearance often takes the longest time and causes maximum delays to projects. Cumbersome procedures for environmental clearance and public hearing, submission of incomplete information, poor quality of EIA/EMP, disproportionate details required with applications, delays in the meetings of the Expert Committees and site visit, etc., are the major reasons behind delays.

Fuel side concerns bring in another dimension to project implementation. There is a pressing need to bring in regulations around development of coal blocks at an improved pace. Fuel in India is not a result of non-availability rather it is a factor of non-exploration and exploitation of new coal blocks.

Health of distribution utilities are another element which needs to be looked in to. Reform measures need to be brought in to improve the financial health of these Utilities and make them viable and sustainable. Most of the private generating companies perceive increased payment default risk when negotiating PPAs with these utilities. This has a snowballing impact with commercial banks perceiving higher risks in these projects making cost of financing higher.

Finally, fuel supply conditions have necessitated a relook at the fuel supply related obligations and risks under the existing Standard Bidding Documents for Case 1 and Case 2 projects. A new framework needs to be looked in to the domestic captive coal mine based projects, linkage based projects and imported coal based projects.

Regulatory Challenges in the Hydrocarbon Sector

There is a need for India to have clear policies and stable regulatory environment across various elements of oil and gas value chain to make the sector attractive for investment. The investment environment in the upstream sector is getting affected due to regulatory uncertainties. While the upstream segment has a well-established framework in the form NELP, the latest round of auctions have experienced declining interest, particularly from foreign oil & gas companies. A more attractive set of framework may enhance interest levels in the Indian E&P segment. At the moment, the Government is involved in contract administration, monitoring and review of investments and pricing decisions. The independent regulator could take up these roles, as recommended under the IEP.

The downstream sector is evolving in terms of policies and powers of board and bidding framework for gas distribution. PNGRB had completed two rounds of bidding, while authorization in third round is still pending. The fourth round of bidding was called off and subsequent rounds have been suspended due to changes expected in the bidding structure. Also, there is a need to clearly define role and Power of downstream regulator.

Pricing of certain petroleum products and gas is another key issue faced by Indian oil and gas sector. Pricing of many refined products are controlled, including those which were announced to be decontrolled. Oil marketing companies are not allowed to sell products like diesel, LPG and Kerosene at market driven prices. Even for petrol, which got de-controlled in 2010, government approval is required before price revision. Most of the OMCs are currently operating under heavy burden of under recoveries and are likely to face the issues related to liquidity crunch. Such issues, if not addressed on priority may lead to problems in sourcing crude, lower the refinery utilization and ultimately disrupt the hydrocarbon supply chain in the country. Though private players are present in refining, their participation in Indian fuel retailing sector is abysmally low due to subsidized product pricing. A clearer policy regarding pricing of such products is required as the subsidy burden on the government/ PSUs is ballooning and controlled pricing may also result in inefficiencies in the sector.

In the gas sector, there are multiple pricing regimes existing including APM/ non-APM domestic prices and Long term, short term and spot LNG prices. Pricing of major share of gas supplies in the Indian market is controlled and is not market driven, as government approval is required before changing the price. Controlled pricing may result in disincentivizing investments in the sector in terms of limited participation from foreign players, who have access to technology, much required in deep-water E&P activities. Also, controlled pricing hampers the competitiveness of consuming sectors (power/ fertilizer/ domestic) to compete with global energy markets as it leads to low investments in energy efficiency on the demand side.

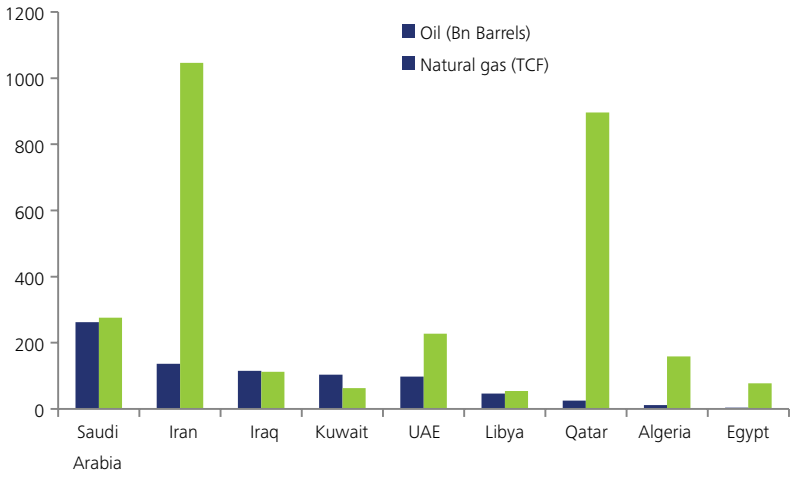
Due to policy and regulatory challenges, India may lose on foreign investment, especially in areas like deep water E&P, Shale gas, CGD, fuel retailing, etc, despite being an attractive market in terms of demand potential. Stable and consistent regulatory environment and only need-based intervention from state is required to attract investment

Geo-Politics and India's Options for Energy Sources

The Arab Spring and Indian Supplies

World is heavily dependent on the Middle East and North Africa region for its hydrocarbon supplies. It accounts for more than 45% of world's proven gas reserves and ~55% of oil reserves (including Iran & Iraq). The Arab spring consisting of widespread protests/ civil wars against the ruling governments, starting from late 2010 and ending towards the end of 2011, saw widespread unrest spanning across a host of countries including Egypt, Libya, Yemen, Iraq, Algeria, Syria, etc. It significantly impacted the oil dynamics of the region and ultimately impacting global hydrocarbon sector. Some of these protests like in Egypt were a consequence of falling oil production, depleting exportable surplus and thereby lack of funds for subsidies on food and fuel, resulting in widespread dissatisfaction and unrest. Below given graph shows the oil & gas reserves of major hydrocarbon producing countries in the MENA region (Including Iran and Iraq)

Figure 11: Dependence on the MENA Region for Energy Supplies (Proven Reserves)



The Arab Spring resulted in loss in Oil production; especially Libya lost major production as well as refining facilities. These disruptions in production lead to a significant price increase. While major protests were seen in only 5-6 countries, the heat of the Arab spring was felt by almost all the countries of the region. With the increasing consumption and depleting reserves, deficit of funds is increasing for almost all the oil producing countries in the region. As a result the price of oil is expected to increase in the long term to increase the income from the production. India also has a high import dependence on MENA region. India imports close to 60% of its crude from the MENA region. A long term increase in the prices and vulnerability of supplies in terms of stability of government may affect Indian economy in the long term.

Future Energy Mix Post Fukushima: The Golden Era of Gas

The Fukushima incident in Japan resulted in shift of focus of Japanese government from nuclear energy to other forms of energy. Japan's Fukushima had a cluster of six nuclear reactors, which produced around 4.7 GW of electricity; the total nuclear energy production in Japan was around 50GW from 54 plants. With Japanese government bid to close down nuclear plants, natural gas demand increased significantly for power generation. The demand is also increasing from other major consumers in the region like South Korea, China, India and Taiwan. Major suppliers of the gas to the region are Qatar, Indonesia, Malaysia and UAE. Some more liquefaction capacities are expected to be added in Indonesia, Malaysia, Australia and Algeria in short to medium term. However, the demand is also increasing at an equal or faster rate. The existing era is called as golden era of gas with its share of world primary energy is now 20%+ and it is expected to continue to rise towards a similar share of primary energy with coal and oil. Many countries are adapting to the new gas era with good regulation to ensure efficiency, transparency and fairness in their downstream operations. The shift in the energy mix can be attributed to the following factors among others: - Greater production of unconventional gas and lower gas prices Ambitious policy for gas use in China and other major consumers and long terms gas tie-ups Lower growth of nuclear power after Fukushima incident Environmental concerns around liquid fuels and coal and gas known to be a cleaner fuel

Non-Conventional Gas and changing trade flows

The global energy map is changing, with WEO 2012 predicting the turning in tide in energy flows of the United States to have far-reaching impacts well beyond North America and in energy choices and trade. The recent rebound in US oil and gas production, driven by upstream technologies that are unlocking light tight oil and shale gas resources, is spurring economic activity – with less expensive gas and electricity prices giving industry a competitive edge – and steadily changing the role of North America in global energy trade. By around 2020, WEO 2012 predicts the United States to become the largest global oil producer (overtaking Saudi Arabia until the mid-2020s) and starts to see the impact of new fuel-efficiency measures in transport. The result is a continued fall in US oil imports, to the extent that North America becomes a net oil exporter around 2030. This accelerates the switch in direction of international oil trade towards Asia, putting a focus on the security of the strategic routes that bring Middle East oil to Asian markets. The United States, which currently imports around 20% of its total energy needs, becomes all but self-sufficient in net terms – a dramatic reversal of the trend seen in most other energy importing countries across the globe.

Coal Mining and Acquisition of foreign assets

In light of domestic demand outstripping domestic supply sources for coal there has been increasing trend for acquisition of coal mines in other countries like Australia, Indonesia and a few of the other African Countries. However, experiences from recent acquisitions by a few of the private Indian companies have indicated that this strategy in fuel security has its own set of challenges. While the apparent challenge has been the lack of experience of most of these domestic private players in the domestic market (since coal continues to remain monopoly of CIL and SCCL), there are other challenges related to political risk (like those which came to light in Indonesia).

With these set of thoughts CIL had ventured in to acquisition of coal blocks overseas. However, there has been limited success in this space. CIL floated a global Expression of Interest (EOI) in July 2009 for selecting Strategic Partner(s) in preferred destinations like Australia, USA, South Africa and Indonesia to acquire stakes in existing or Greenfield coal resources. CIL proposed a structure under the following deal structures:

- Equity investment by CIL with a long-term off-take contract at a price less than the prevailing import price.
- Only long-term off-take contract on cost plus basis at a price less than prevailing import price, with financial assistance (if required) by way of loan from CIL for augmentation of production.
- Formation of JV for exploration, development and operation of coal assets in any of the destination countries.

Through the above deal structures, CIL proposes to import coal with the dual objective of ensuring security of supply and insulation from the volatility of global prices. However, presently no acquisition proposals are under consideration. Despite there being a gap of more than three years, above initiative has not resulted in to any tangible result on the ground.

Major investments to get access to fuel sources located in other energy resource-rich countries should be encouraged as an integral measure of overall government economic policy to strengthen energy security. This will cover coal, oil, gas reserves and uranium.

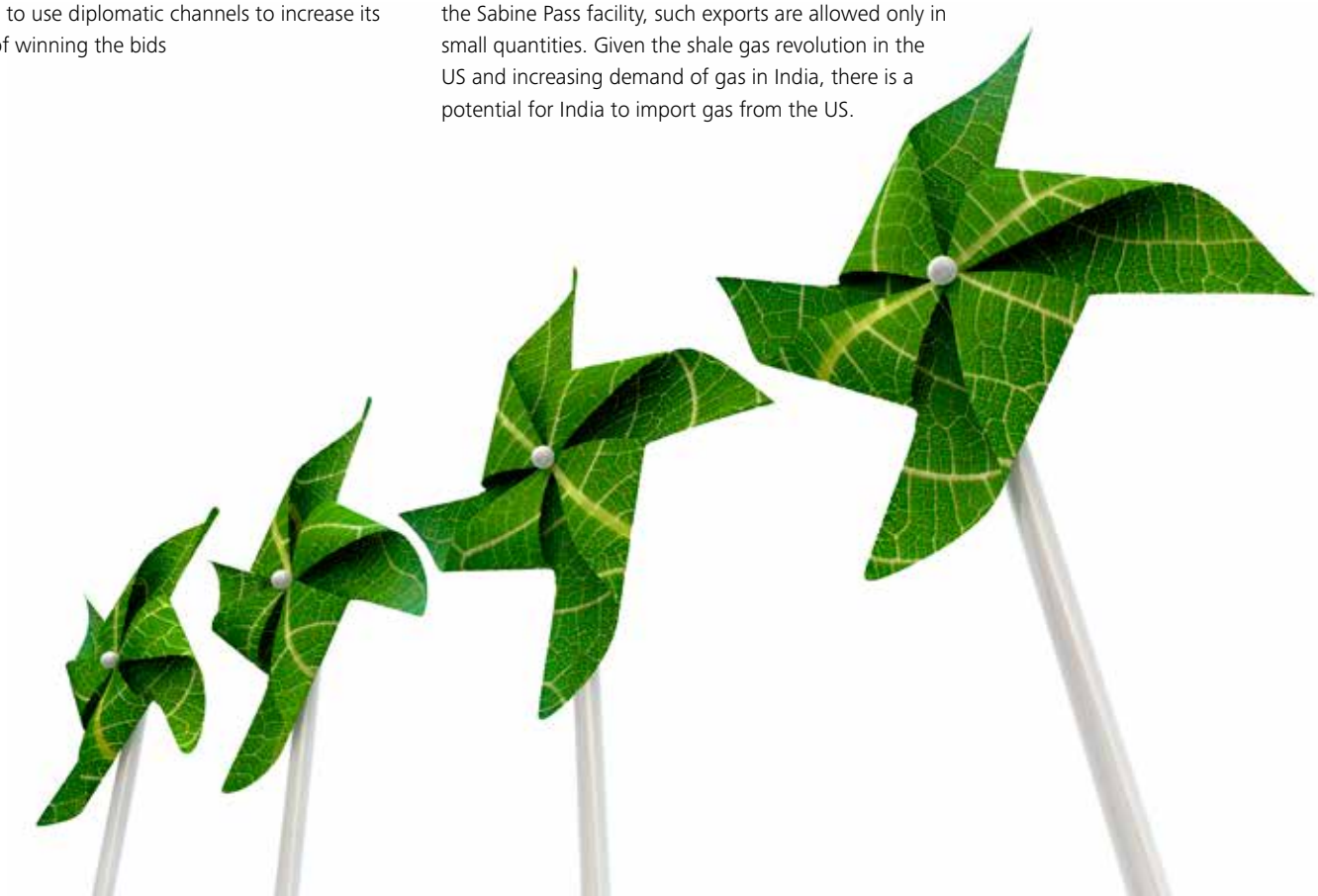
Both public and private investors should be encouraged to acquire such assets and develop supply sources in different parts of the world to augment domestic availability. International gas resources from liquefied natural gas (LNG) and through pipelines would supplement the energy requirements. The current LNG infrastructure should be further developed to access this. Domestic gas pipeline network should be expanded and a national gas grid should be promoted. The present policy of promoting investments in private sector in refineries and pipelines for transporting both oil and gas should be accelerated.

Energy Options for India and Geo Political Challenges

Given the high import dependence of India for Hydrocarbons, It is important for India to secure its supplies through bi-lateral ties and oil diplomacy. However, India has been facing significant difficulties in the past at multiple levels:

- Iran is a major exporter of crude oil to India and due to its non-participation in NPT there is a pressure on India to reduce the imports from Iran. India has already decreased its imports from Iran by 20-30% and Iran Pakistan India pipeline project has been stalled. If the sanctions are entirely applied then India will have to look for its oil and gas supplies from other Middle Eastern countries or Africa
- India has lost out in securing international supplies to countries that have been aggressive in securing their energy needs, especially China. India and China are emerging countries that have limited domestic source of hydrocarbon. To fuel the growth, both the economies look to import oil and/or acquire assets to tie-up long term supplies, resulting in competition for the same sources. In the past, India has lost out on bids to assets in countries such as Khazkhistan, Nigeria, Angola, Russia, etc. to China. China has been able to use diplomatic channels to increase its chances of winning the bids
- As there is an emphasis by Indian companies to invest in the assets outside India, there is a need for India to secure their interest in terms of any policy changes, tax structures, etc of the asset holding countries. With a case in point of Argentina nationalizing the assets of the Spanish oil major, there could be instances where diplomatic intervention is required by the government to secure the interest of Indian companies investing outside India.
- India has been part of sporadic negotiations with its neighbours for the 20 years and has yet to finalize any pipeline deals. The well-established, ancient trade routes from India to the Europe through the Silk Routes will also be the path of the energy corridor from Central Asia to India and further down to South-East Asia. While TAPI (Turkmenistan-Afghanistan-Pakistan-India) pipeline has made some progressions, IPI (Iran-Pakistan-India) pipeline has faced significant diplomatic challenges.India also lost to China for securing supplies through transnational pipeline from Myanmar.

In terms of gas supplies from The U.S., rules are not favorable for exporting gas to non-FTA countries. Though GAIL has signed a contract to import gas from the Sabine Pass facility, such exports are allowed only in small quantities. Given the shale gas revolution in the US and increasing demand of gas in India, there is a potential for India to import gas from the US.



Discussion Points

Need to revisit Integrated Energy Policy

The Integrated Energy Policy (IEP) is the foremost comprehensive energy policy and focuses across all sectors concerning energy. It is an integrated energy policy linked with sustainable development that covers all sources of energy and addresses all aspects of energy use and supply including energy security, access and availability, affordability and pricing, as well as efficiency and environmental concerns. The committee was set up in 2004; the draft report was released in August 2006; and, the cabinet finally approved the report in December 2008.

The most noticeable aspect of the policy is the focus on ensuring the transition to market economy where private companies can compete with public companies. There is a clear articulation around subsidies and pricing so that correct signal could outright be provided to the investors and consumers. However, challenges related to policy making and implementation still remain for the Indian energy sector. A truly integrated energy policy should clearly articulate implementation by way of addressing challenges related to pricing and investment in a dynamic manner. IEP needs to be looked in to more coherently specifically in the following areas:

- Downstream implementation policies: Integrated Energy Policy is considered as the mother policy which serves as a guidepost for long term planning. However, it does need periodic revisit, in the context of changing times. Further, it is also pertinent that most of downstream implementation level policies when made should be made with the clear ambit of the vision enunciated in the IEP. For instance, the National Solar Mission attempts to increase the installed capacity of solar PV generation plant. At the same time it also attempts to drive local manufacturing by considering certain element of local content for such solar projects.
- Continued reforms: Though the intent of the IEP has been to drive reforms through bringing in measure around transparent pricing and promoting investment, a lot of required reforms have not been undertaken till date. Coal is one such sector where there is a lot which needs to be undertaken on an immediate basis. For instance the Coal Mines (Amendment) bill, 2000 which could have paved the way for participation of private players in the mining sector, has been pending for quite some time.
- Pricing mechanism: Though transparent pricing of resources has been consistently reflected in the IEP, measures to implement the same have not been satisfactory. For instance, in 2012 pricing of coal was shifted to GCV from the earlier methodology of Useful Heat Value. However, immediately within a period of one month from the date of announcement Coal India rolled back to earlier methodology. It is pertinent to note that globally GCV based methodology is considered for coal pricing. Similar instances have been observed in pricing of petroleum.

There is another noteworthy aspect which needs to be addressed when it comes to structuring and following up with an Integrated Energy Policy – the aspect pertaining to promptness in how key global trends are incorporated and addressed. For instance, there has been developments around unconventional resources like shale, CBM, tight gas etc. which is finding increasing presence in energy basket of developed countries and this is a choice which India could also exercise. However, despite intense actions in other economies, there are limited actions at policy level in the Indian context. It is therefore pertinent that dynamism is brought in the Integrated Energy Policy framework and developments are periodically addressed. The IEP in the Indian context after being announced in 2008 has not undergone any revision to address global changes. It is therefore pertinent to relook in to the overall picture in view of the global changes and also the experience of the XIth plan.

Key Factors contributing to Energy Security

Energy security shall remain an inter-play of demand and supply scenarios, which in themselves are influenced by a number of factors which need careful evaluation and consideration over the long-term. These factors have been highlighted in the table below and a broad definition provided on how these would influence.

At this crucial juncture, it is important for the Corporates, Industry experts and the policy makers to work together to create a healthy environment for the Energy sector. World Energy Council- India Energy Congress provides an opportunity to facilitate the discussion between various stake holders and synergize for a secured energy future of the country. India needs to collectively seek answers to some questions and work at multiple levels to have long term energy security. Some of the questions are listed below: -

S. No	Key Factor	Definition and Relevance to Energy Security
1	Diversity of Energy Sources	Impact on energy security if there is an over-reliance on any one fuel (even domestically produced ones) as this increases the chance of widespread economic impact from a shortage or disruption. This has been observed post Fukushima nuclear crisis in developed countries with high dependence on nuclear power. A more balanced portfolio minimizes security risks.
2	Supplier Diversity	Impact on energy security if there is an over-reliance on any one supplier/ country or region if supplies disrupted from that supplier/ country or region leading to shortage.
3	Level of Imports	Global trade in energy increases global energy security by providing resources for which there is no readily available alternative domestically. However, there is a high risk to energy security from the fact that energy imports are beyond the importing country's control and can be regarded as potential sources of insecurity.
4	Security of Trade Flows	Energy imports today flow through trade corridors. The security of trading corridors is crucial to the security of imported energy supplies. Disruptions in these corridors could result in shortages. Therefore reducing volume of energy moving through these corridors could minimize risks, as could increasing the number of trading corridors or improving their protection.
5	Geo-politics & Economics	Impact on energy security if there international economic and political factors affect flow of supplies from producer nations to consumer nations as these factors raise questions about how economies will secure sources of energy.
6	Reliability	Impact on energy security if aging, neglect, disruptions to physical infrastructure, and mismanagement have adverse impact on energy delivery and reliability.
7	Market/Price Volatility	Impact on energy security as price volatility discourages long-term investment due to the uncertainty of the long-term direction of the market and creates a barrier to providing adequate energy supply.
8	Affordability	The relative affordability of energy is a critical component of energy security.
9	Energy Intensity	Positively impacts energy security as demand reduction accompanied by strong levels of economic growth (overall energy intensity improvements) insulates economy from the negative effects of energy price fluctuations.
10	Feasibility	Impact on energy security if present or emerging technology and energy supply growth plans appear challenging to achieve call into question the ability to provide adequate, reliable energy supplies.

Key challenges that needs to be addressed in the energy space

India has presence of dynamic private sector and a burgeoning middle class, however it faces growing challenges to maintain its economic growth. In the first quarter of 2012, the Indian economy grew by 5.3%, which is the lowest in the past ten years. With increase in trade and budget deficits, there are challenges associated with a depreciating currency. To continue with the economic growth an accelerated transition to an energy sector based on market economy is the call of the hour. There are two major trends appearing in India's overall energy sector: first, a serious energy shortage across different fuel sectors, ranging from coal, gas, and oil to uranium. The deficiency of these fuels is resulting in a considerable shortage of electricity, which hampers economic and social development. Second, there is an increasing need to import more energy as a result of the country's stagnating domestic production. While in the past crude oil used to be the main energy import, India now needs to import greater volumes of coal and gas also. However, due to considerable disparity between domestic and international prices for these fuels, actual imports might not take place, or will take place to a lesser degree than the actual fuel shortage might require. Moreover, increasing fuel imports will have negative implications on India's financial condition. To effectively address these two trends, India needs a functioning energy market, in other words, a system where national energy demand can be met by timely and adequate investment in a sustainable way and business entities operating in the energy market are commercially viable. To summarize there are three major challenges, which need to be resolved to create a functioning energy market:

- Players: Most of the energy players in the private sector are first generation. They have a lot to experience and learn and a greater breadth of competencies to be build. There are only a handful of companies who have the size and experience to match global energy players.
- Pricing: Pricing continues to remain a key concern going forward in to the 12th plan. Specifically, in the context of India there is a persistent need to look in to pricing mechanism. There have been instances to keep energy prices low, however going forward this may not be a sustainable practice. Since domestic energy prices are disconnected from the global trends, there is no signalling mechanism for active demand side management. It has been felt that low energy prices have limited benefit in terms of efficient usage.
- Ramping production: As per WEO estimates India would need USD 2306 billion on overall energy infrastructure. Noticeably, power and associate infrastructure needs a significant portion of the overall investment. How will this investment be mobilized is a concern which needs to be explored.

Besides the obvious requirement of investment there are technological challenges that needs to be addressed. Specifically when it comes to coal mining there are challenges with regard to underground mining. A significant portion of coal reserve could be mined if the underground mining technologies could be adopted. However, since such technologies are currently not accessed in the country a lot of coal lies inaccessible. Going forward challenges with regard to coal exploration is going to persist. Particularly on account of the fact that while more and more coal blocks are being allocated to CIL, development activities are not keeping pace. Following challenges are articulated which needs to be addressed going forward:

- Exploration and Project Formulation
  - Coal exploration to be speeded up exponentially to ensure availability of more explored coal blocks for mining by private and public sector.
  - A comprehensive study to classify country's coal resources as per international standards such as JORC / UNFCC should be taken up
- Clearances and licenses:
  - To expedite clearances a co-ordination committee at the Centre and State level should be set up (Single window concept) with senior representation from the concerned departments.
  - To ensure a leaner, transparent and efficient approval process, there is a need to ensure Forest and environmental clearances in a time bound manner. Also the number of levels and stages should be reduced.
- Clearances and Licenses – Land Acquisition and R&R
  - Enactment of a central legislation to ensure uniform R&R policy and speedy land acquisition
  - Creation of a mechanism to prevent permanent industrial establishments and habitation over coal bearing areas
  - Coal companies should actively restore post mining land and return back to the local communities.
  - Captive Coal Mining
  - To take appropriate measures for increasing coal

availability from captive coalmining blocks by amending Coal Mines Nationalization Act.
  - Future blocks should be allocated on the basis of a transparent bidding process,with bidders placed on a similar platform.
- Increasing underground mining activity in the Country
  - Coal companies should develop a comprehensive plan for improving its performance in underground mines
  - Government should consider options such as cost plus pricing, cross subsidies, fiscal incentives etc to improve the potential returns currently available from underground mining activities

How could India increase its domestic production and incentivize investment in the Upstream Hydrocarbon sector?

As discussed earlier, India's upstream sector has been driven by the 9 NELP rounds, through which 642 million tonnes of oil equivalent (mtoe) of oil and gas reserves have been established from 87 discoveries. However, 12% of the sedimentary area in the country still remains unexplored and 22% is poorly explored. Also, production is beginning to decline from some of the fields allocated in the Pre-NELP era (15 big fields that are contributing 80percent of ONGC's production are about 35-40 years old).To enhance the domestic production, efforts are needed both on enhancing production from existing fields, arresting the decline in production from the mature fields as well as attracting new investment from the sector

Enhanced Oil Recovery/Increased Oil Recovery (EOR/IOR) programs have been initiated to bring into production new marginal areas while improving the recovery from depleting assets. Oil E&P companies such as ONGC have undertaken/planning to undertake many EOR/ IOR schemes. Through EOR/IOR the Company has been able to recover 8.5 mtpa; when compared to the global decline of 4.5-5 percent per annum for producing assets, ONGC has been able to arrest it to 1.5-2 percent levels. The performance of EOR, IOR and Redevelopment schemes being implemented currently are expected to have major impact on maintaining production levels from existing large fields, while also bringing into production more marginal hydrocarbon plays.

Deep water and Ultra deepwater may prove to be the next frontiers in exploring the Indian hydrocarbon story. India has deep water potential with estimated sedimentary area of about 1.35 mn sq km. Deep water exploration has witnessed increased interest in the last 10 years. Around 80 blocks in deep water areas have been awarded since NELP I. ONGC, RIL and a clutch of other players are active in the eastern offshore deep water prospects. Deep water production is expected to gain momentum in the XIIth plan period as many discoveries are expected to be brought on production. While ONGC has signed an MoU with ConocoPhillips for deepwater efforts; RIL has entered into alliance with BP for development of various blocks including its KG offshore.

Need to incentivize fresh investments: An attractive fiscal regime incentivizes risk taking and promotes cost control, apart from capturing economic returns. While India's NELP rounds were able to attract investment to a certain extent, there is a need to re-look to further promote interest of foreign companies, especially in terms of ensuring sanctity of contracts and pricing of gas to incentivize the investments. India needs to seek answers to following questions to ensure required effort is being put in domestic production: -

- How to fill technological gaps, especially in case of Deep and ultra-deep water drilling?
- What should India do to cater to the shortage of oilfield services, particularly deep-water/ ultra-deep water rigs?
- What should India to bridge the gaps in terms of skilled human resources and building domestic expertise?
- What changes are required in existing PSC regime to attract further investments in the E&P sector?
- What are the steps required for attracting foreign investors?

In view of increasing dependence on hydrocarbon imports, could overseas acquisition act as a part of the solution?

The Government of India (GoI) has been taking steps to secure international supplies. It has mandated all its Public Sector Undertaking (PSUs) to acquire assets overseas with intent to increase strategic reserves through equity oil overseas. Indian companies are pursuing acquisitions in equity oil overseas. The strategic focus of the Indian players may be categorized on the following basis. NOCs are looking towards becoming integrated players – upstream players are considering downstream plays, while downstream players are considering entry into the upstream. The focus of the NOCs is to obtain oil & gas assets and products overseas to secure energy needs of the Country while hedging against a highly volatile hydrocarbon market situation. ONGC Videsh Limited is expanding aggressively with 30 odd projects in 15 countries including Middle East, Russia, Africa, South America and South Asia. Private oil companies, such as Reliance and Essar are looking towards overseas markets for their excess refining capacity, at the same time they are also looking at opportunistic upstream acquisitions on account of strong balance sheets. Large consumers in the Power (Lanco, Adani) and Fertilizer sectors (Indian Farmers Fertlizer Cooperative, Zuari, Nagarjuna, Rashtriya Chemicals & Fertilizers) are looking to acquire feedstock (gas & coal) for their plants. Some new entrants including Videocon, Welspun and Jubilant have entered the hydrocarbon space with intent to de-risk their other operations and are looking to acquire assets outside India India's NOCs and private sector companies in the hydrocarbon space have aggressive plans to invest and acquire assets abroad. Many companies have spelt out their strategic intent and the quantum of funds they plan to deploy for overseas acquisitions/investment. New frontiers in the hydrocarbon space are emerging in around the globe in deep-water and non-conventional oil (shale assets, oil sands and coal bed methane). These new prospects are at an initial exploratory stage. M&A has been one of the most efficient and effective routes for investments in the hydrocarbon sector in such instances. In view of increase focus on overseas acquisition, Indian companies need to have following considerations: -

- What should be India's strategy in view of increased competition for overseas acquisition?
- What are the Geographies Indian companies should focus upon in view of de-risking, costs and stability of the region?
- What role could Indian government play in supporting NOCs and private companies for overseas asset acquisition?
- What are the lessons India could learn from China in terms of overseas acquisitions?
- How should Indian players develop capabilities in terms of fund requirement, technology and skill requirement to compete with the Global oil & gas majors?

What should be India's approach to secure long term oil and gas supply contracts?

Indian companies, especially GAIL has been aggressively signing long term contracts for LNG supplies to the Indian market. Some of the recent contracts include a 20 year master sale purchase agreement with Sabine Pass Liquefaction LLC to source gas from Americas, other long term contracts signed are with Gazprom in Russia and Turkemgaz for the TAPI pipeline. However, India has lost out to China and other resource hungry nations in many cases due to aggressive bidding and usage of diplomatic channels. There is a need for government, NOCs and other players to work together and seek answer to the following questions: -

- What steps should be taken to build Bi-lateral tie-ups with resource rich countries and use oil diplomacy to India's advantage?
- Is there a possibility of co-operation rather than competition with the resource-scarce nations such as China? What could be the government's role in securing long term supplies?
- Could government play a role to support NOCs as well as private companies for overseas acquisition/ tie-ups?
- How should Indian PSUs/ OMCs operate in a highly competitive scenario to secure supplies?
- How should India reduce its dependence on the Middle Eastern Region for crude supplies?

How should India focus on developing gas related infrastructure in the country?

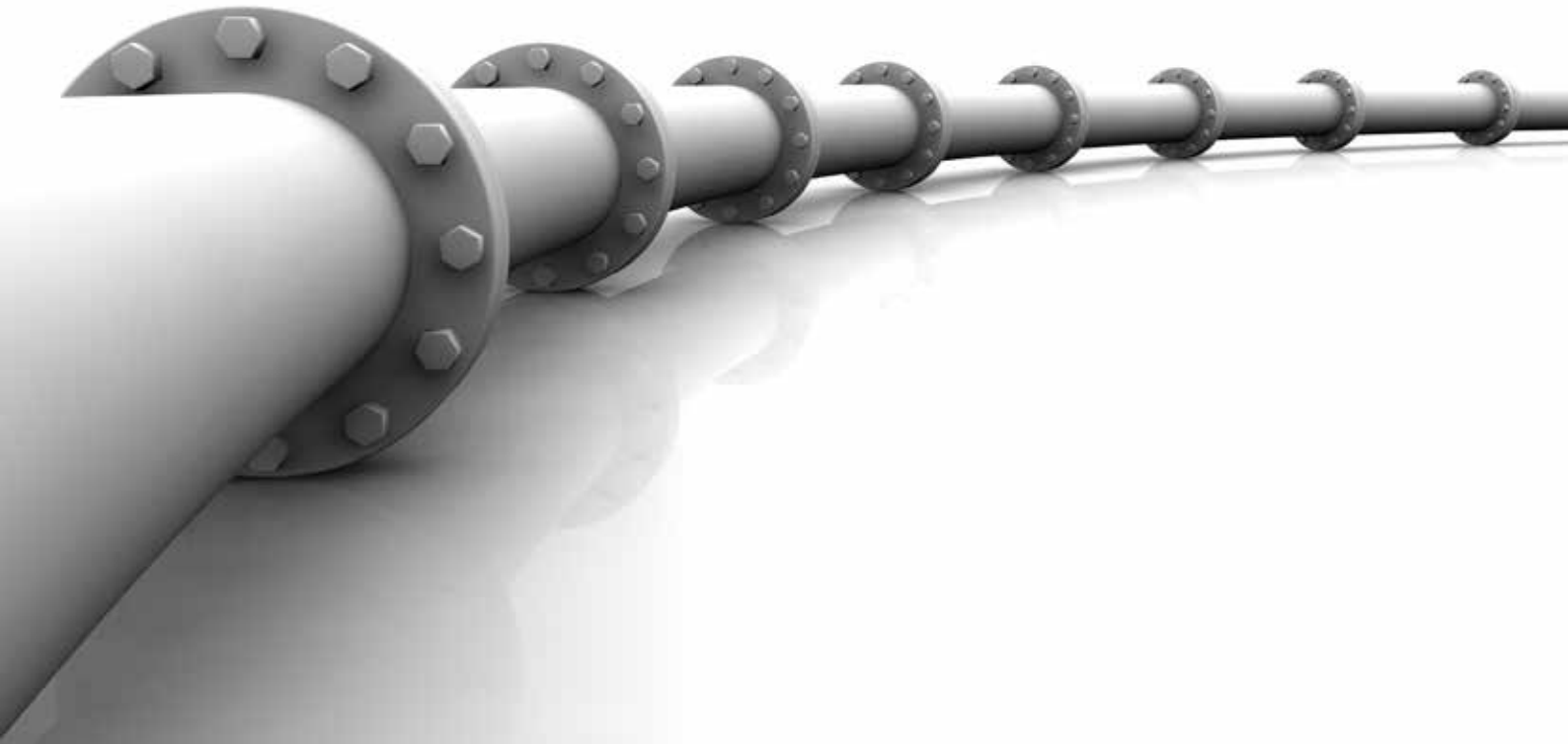
There is a need to develop the gas infrastructure at a fast pace owing to increased demand of gas in the country, especially in terms of LNG terminals, gas transmission network and CGD network. Due to limited availability of domestic supplies and increasing prices of alternative fuels, the focus of gas sector is shifting towards imported gas in terms of r-LNG. A lot of players in the oil and gas sector are planning to set-up LNG terminals to source gas from countries in Middle East, Africa and Australia and supply in the Indian markets. However, there have been delays in setting up gas transmission infrastructure in the country and CGD sector is currently going through an evolution phase. Following questions need to be considered: -

- Is there a need to re-look at the powers, roles and responsibilities of the downstream regulator for stable environment?
- What are the changes required in terms of bidding structure, marketing/ infrastructure exclusivity, eligibility criteria a robust CGD bidding structure?
- What steps could be taken to prevent delays in infrastructure projects?

How could India replicate the success of unconventional sources in the U.S.?

With depleting oil and natural gas reserves, there is an increased focus on unconventional sources to meet energy needs both globally and in India. Indian companies are focussing on making investments in unconventional sources, both by investing in E&P in India and buying assets outside India. Government has already commenced bidding rounds for Coal Bed Methane (CBM) license while bidding frame work for Under Ground Coal Gasification (UCG) and Shale gas are being formulated. Shale gas bidding is expected to commence towards the end of next year. India is currently producing 0.15 mmscmd of CBM and it is likely to reach 7.4 mmscmd in 2-3 years. A pro-investment environment, focus on improving infrastructure, stable fiscal regime, developed gas market could make unconventional sources of energy a large part in the India energy portfolio.

- What steps should be taken to build expertise in India with reference to unconventional source of gas?
- What steps should be taken to bridge the technological gaps, especially in terms of horizontal drilling and hydraulic fracturing?
- What are the salient features required in terms of fiscal regime and tax incentives required to attract investments?
- How should India handle land, water and R&R should related issues for shale gas?



What should be done to enhance the regulatory environment in the country?

There is a pressing need for the country to attract investment in the energy sector and one of the key impediments in this regard is existing regulatory environment.

- What are the changes required in the existing PSC regime and the role of upstream regulator in the hydrocarbon sector?
- How is the Rangarajan committee report expected to change the investment environment in the country?
- What could be done in terms of existing pricing mechanism of domestic natural gas, LPG, petrol, diesel, kerosene, etc.?
- What are the options with India in context of increasing under-recoveries of OMCs and controlled pricing of some petroleum products?
- What are the taxation related changes required for hydrocarbon sector in view of the proposed GST regime?
- How could India promote investment in non-conventional fuels such as shale gas, coal bed methane, etc.?
- What are the changes required in the downstream regulatory environment to speed up development of gas infrastructure in terms of transmission network, CGD, LNG terminals, etc.?
- What measures could be taken in terms of Land Acquisition and Rehabilitation and Resettlement, Environment & forest clearances, etc.?
- How could India address issues around financial health of distribution utilities in the country?
- What steps could be taken to improve the productivity of CIL?
- How could share of production from underground mines be increased, especially in terms of fiscal incentives to improve potential returns?

What steps could help India to achieve desired level of energy efficiency?

India faces formidable energy challenges and along with the supply side management, there is a need to invest in the demand side management to meet its energy needs while addressing local and global environmental problems. Some of the key questions that need to be answered are as follows: -

- What are the policy changes required in realization of the energy efficiency potential in the Indian economy?
- How could schemes such as PAT be made more effective in terms of stiffer targets, inclusion of more sectors, sorting out benchmarking related issues and confidence building among stakeholders?
- What could be done to enhance research and development (R&D) in the field of energy efficiency in India?
- How to bring about technology co-operation with international players having access to world class technology? What could be done to handle financial, technical and transactions risks associated with the adoption of new energy efficient technologies?
- What could be done to address the challenges related to availability of skilled manpower in the clean energy domain?
- What could be done to address infrastructure challenges such as lack of infrastructure in testing of super-energy efficient appliances, the nationally accredited labs, etc.?

Abbreviations

APM	Administered Price Mechanism
BCF	Billion Cubic Feet
BCM	Billion Cubic Meters
BEML	Bharat Earth Movers Limited
BHEL	Bharat Heavy Electricals Limited
BOPD	Barrels of Oil per Day
BP	British Petroleum
CAGR	Cumulative Average Growth Rate
CBM	Coal Bed Methane
CGD	City gas Distribution
CIL	Coal India Limited
DGCI&S	Directorate General of Commercial Intelligence and Statistics,
DGH	Directorate General of Hydrocarbons
E&P	Exploration & Production
EDI	Energy Development Index
EOI	Express of Interest
EOR	Enhanced Oil Recovery
FSA	Fuel Supply Agreement
FTA	Free trade Agreement
FY	Financial Year
GAIL	Gas Authority of India Limited
GCV	Gross Calorific value
GDP	Gross Domestic Product
GIP	Gas in Place
GoI	Government of India
GST	Gross Sales tax
GW	Giga Watt
IEA	International Energy Agency
IEP	Integrated Energy Plan
IOR	Increase Oil Recovery
IPI	Iran Pakistan India
JV	Joint venture
KCAL/KG	Kilo Calories per Kilo Gram
KG Basin	Krishna Godavari Basin
KGOE	Kilo Gram Oil Equivalent
LLC	Limited Liability Company
LNG	Liquefied Natural gas
LPG	Liquefied Petroleum gas
M&A	Mergers and Acquisition
MENA	Middle East North Africa

MI2	Miles Square
MMSCMD	Million Metric Standard Cubic Meter
MMT	Million Metric Tonnes
MTOE	Metric Tonne of Oil
MN	Million
MOEF	Ministry of Environment and Forest
MoPNG	Ministry of Petroleum and Natural gas
MOT	Multi Organization Team
MoU	Memorandum of Understanding
MW	Mega Watt
NDR	National Data Repository
NELP	New Exploration Licensing Policy
NOC	National Oil Company
NPT	Nuclear Proliferation treaty
OALP	Open Area Licensing Policy
OECD	Organization for Economic Co-operation and Development
OIL	Oil India Limited
OIL	Oil India Limited
OMC	Oil Marketing Company
ONGC	Oil and Natural Gas Corporation
PMT	Panna Mukta Tapti
PNGRB	Petroleum and Natural gas Regulatory Board
PPP	Purchasing Power Parity
PSC	Production Sharing Contracts
PSU	Public Sector Unit
R&R	Rehabilitation and Resettlement
R/P	Reserve/ Production
RIL	Reliance Industries Limited
R-LNG	Regasified- Liquefied Natural Gas
SCCL	Singareni Collieries Company Limited
SQ. KM.	Square Kilometer
TAPI	Turkmenistan Afghanistan Pakistan India
TCF	Trillion Cubic Feet
UAE	United Arab Emirates
UID	Unique Identification Number
UK	United Kingdom
USA	United States of America
USD	United States Dollars
WEO	World Energy Outlook

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