



ENERGY AND NATURAL RESOURCES

India Energy Outlook

INDUSTRIAL MARKETS

Introduction

Roger Munnings

A rapidly increasing population and growing urbanization has put immense pressure on energy and natural resources in India, as traditional sources of energy such as fossil fuel reserves are depleting. Alternatives to traditional fossil fuel use are vital to help the country avert an impending energy crisis.

Coal will continue to be used as a resource for many years and clean coal technologies will provide a future for this abundant resource. Natural gas is a growing alternative, all out efforts should be made to harness this valuable resource and set up infrastructure for its supply and distribution. The role of nuclear power - already established in India - will increase pressure on the world's ability to provide technically skilled people and overcome public concerns.

Generating energy frequently contains an element of conflict between ecological and economical concerns. Increasing pollution in large urban metros has also resulted in demand for alternatives with low particulate emission as per internationally accepted norms. Investment requirements are therefore huge and it is essential that companies align their accounting and governance standards with international standards to meet the transparency that capital markets will demand if investments flows are to be maintained.

As India's economy rapidly grows along with other major countries

in the region, such as China and Saudi Arabia, the interdependencies between these emerging powers - in securing upstream assets and easing the bottleneck in downstream - will increase the politicization of its energy and natural resources markets. Governments will look to create bilateral and transnational agreements.

This paper summaries these issues and challenges - and I am pleased to introduce it. KPMG aims to contribute to the development of the energy industries around the world in our areas of competence, which include financial management and control, corporate management and governance systems, financial structuring and capital efficiency and information presentation and independent attestation - and have been built over many years.

KPMG's Energy and Natural Resources (ENR) practice has global coverage.

Our international credentials are based around having strong national capabilities in over 150 member firm network countries in which we are present together with the ability to work knowledgeably and efficiently across international boundaries.

KPMG in India has led the way, for instance in regional privatization experience, with the support of KPMG colleagues from around the world from the Global Energy and National Resources practice. We look forward to using our Indian based capability and our international experience to bring value to India and its companies in the future.



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Introduction

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India is emerging as a major economy in the world through a sustained GDP growth of around 8 percent over last few years. Increased economic activities have led to higher demand of energy resources. Along with China, India is driving the energy market of not only Asia, but the world as a whole. As demand for energy continues to outstrip production at home, India has emerged as a major buyer of energy, either through trade or investments in countries with rich fossil fuel sources around the world.

With a healthy and vibrant democracy and strong judicial system, India is becoming attractive destination for global companies. Energy sector has gone through major transformations over the years, through unbundling of the electricity companies into separate generation, transmission and distribution companies. Enabling legislative procedures have been introduced. While petroleum sector has been opened up for private participation and India is emerging as a possible hub for refining, India is yet to identify continued new 'finds' of hydrocarbons. Government is actively promoting private investments through auctioning of hydrocarbon blocks and past five rounds have resulted in an addition of 700 MMT of hydrocarbons. Next round of auctioning is presently open and the bidding would be completed by September 2006.

Following the continued economic upsurge, India has taken a number of

significant steps to achieve greater energy security. India is a part of the global initiative to develop commercially viable nuclear technology using fusion process. It has initiated to set up large thermal power projects of 4,000 MW capacity each, with active participation from private sector.

The Indian Government has taken strategic initiative to address the energy need in a holistic manner and not through silos of individual sources of energy. This would definitely pay a rich dividend in years to come. KPMG's experience in India and the Asia Pacific region has already helped power sector organizations — both multinational and Indian public and private sector — with their operations and strategies. Today, KPMG in India has more than 1,500 professionals on the ground in India with offices in Delhi, Mumbai, Chennai, Bangalore, Hyderabad, Pune and Kolkata.



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Acronyms Used

MT	Metric Tonne
MMT	Million Metric Tonne
MMSCMD	Million Standard Cubic Meter Per Day
NELP	New Exploration Licensing Policy
SKO	Straight Run Kerosene
NG	Natural Gas
MoPNG	Ministry of Petroleum and Natural Gas
MNES	Ministry of Non-conventional Energy Sources

Executive Summary: The India Opportunity in Energy Sector

As India continues to grow at the rate of 7-8 percent, energy security has become a core focus. To alleviate concerns over energy security, the Government of India has taken multiple steps in recent years which include encouraging private sector participation, a more holistic approach towards broad basing its supply base, and improving efficiency in the sector as a whole. Although India has made a start in this direction, the Government would need to further its initiatives in three areas:

- The Government would need to increasingly enter into alliances and partnerships with key nations in Asia, Africa, Latin America, etc. to diversify the energy supply base and improve long term supply security
- Currently, different energy segments are viewed independently from a policy and regulatory perspective. The importance of cross linkages between different energy segments is now being appreciated and the importance of developing an integrated energy policy to meet the common objective of energy security is recognized
- At an operational level, commensurate investment would be required in developing infrastructure viz. rail, road, port,



and power transmission which are critical for efficiency in the energy value chain.

Looking at the subject in totality, the Government has developed a comprehensive planning framework through the Indian Hydrocarbon Vision¹ 2025 that provides a detailed road map for Indian hydrocarbon industry to enhance the country's Energy Security. The principal objectives of the IHV 2025 include:

- Developing the sector as a globally competitive industry, ensure healthy competition and improve product standards
- Ensure energy security keeping in view strategic and defense issues
- Creating infrastructure to meet the demands for coal, petroleum products and natural gas
- Rationalizing tariff and pricing policy to promote investment

- Putting in place necessary regulatory system
- Exploring new resources of hydrocarbons such as CBM and Gas Hydrates

It is evident that one of the principal focus of the IHV is to draw private investments through structural and pricing adjustments in specific energy sub sectors. The following sections highlight the key opportunities in the different sectors:

Coal

India has vast reserves of coal and participation of the private sector in captive mining across different user industries is an immediate opportunity for investment. Coal fields with mineable coal reserves in excess of 1,000 million tonnes are proposed to be identified and are in the process of

¹ Hereafter referred to as 'IHV'

being allocated for captive mining. This may imply a total capital requirement of around USD 1.5-2 billion.

Oil

The Government policy of allowing full private participation in upstream exploration and production has already attracted a number of private investors. Five rounds of competitive bidding under the Government policy named New Exploration Licensing Policy (NELP) have already been done and reserves estimated at 700 MMT² of oil and gas have been discovered. In addition India presents a lot of potential in the refining sector due to strategic advantages of low cost and location and is already a net exporter of products. The downstream marketing sector is now also open to private participation.

Gas

Discoveries of gas to the tune of 700 bcm³ in the last decade in the country hold promise for gas reserves in India. Apart from domestic gas, significant focus is being placed on LNG as a means of ensuring supplies for domestic demand, resulting in a number of LNG terminal projects that are being planned in different parts of the country. Coal bed methane potential appears to be very promising and will probably exceed free natural gas reserves.

An emerging area on the demand side is auto CNG and piped gas which

together would account for about 7 percent of total demand in five years. In the next few years, at least 30 cities have been identified for city gas coverage by private and public sector players.

Draft gas pipeline policy gives support to the development of a national gas grid, which would create a common gas market across the country.

Nuclear

The growth of nuclear power in India as envisaged is possible provided robust technologies are developed for both the front end and the back end of the fuel cycle. India has one of the largest reserves of the nuclear fuel thorium, however till commercial production based on this fuel becomes feasible, the nuclear energy programme will be uranium based. There is a persisting need for developing techniques for economic and efficient extraction of uranium from lean sources e.g. sea water.

Hydro

India is endowed with hydro-potential of about 250,000 MW⁴. However, only 17 percent of the hydroelectric potential has been harnessed so far and 5 percent is under various stages of development. Private participation in the hydro sector will be important to meet the target of an additional 45,000 MW of hydro capacity addition in the next ten years. Various policy measures are being considered to attract private investment.

Renewable Energy

India has a vast potential for renewable energy, especially in areas such as solar power, biomass and wind power. The current installed capacity of renewable energy is around 7,100 MW, constituting about 6 percent of India's total installed generation capacity. The Government has set an objective of achieving an installed renewable based generation capacity of 10,000 MW by the year 2012, largely in the areas of wind and small-hydro. Technological breakthroughs for cost-effective photovoltaic technology could generate a quantum leap in the renewable energy sector as India is well endowed with solar insolation (average of 6 kwh/sq.mt./day).

Electricity

Generation

Based on Government's plans, by 2012, a capacity addition of 22,900 MW has been identified for the private sector out of total target of around 107,000 MW⁵. The opportunities in Generation are now very encouraging on account of the emerging power trading environment, the policy of open access on transmission and distribution networks and reforms in the power sector which is leading to improvement in the financial health of the sector. All new private sector generation projects in the country would need to be set up based on International Competitive Bidding.

² Ministry of Coal & Mines

³ Ministry of Petroleum & Natural Gas

⁴ MNES

⁵ Blue Print for Power Development, Ministry of Power

Transmission

Private investment in the transmission sector can be done either through an Independent Power Transmission Company (IPTC) or through a Joint Venture Company (JVC). These participations are envisaged largely in creation of the National Grid⁶ along with the state owned transmission utility. The private sector participation is expected to be in projects requiring a capital outlay of around USD 4.5 billion⁷.

Distribution

The Electricity Act 2003 provides for parallel and second distribution licensee in same area of supply. This opens up the distribution sector to potential competition and private sector participation; however such opportunities may be few and feasible only in areas where the existing network is grossly inadequate. Privatization of existing distribution utilities is possible, though good opportunities are few owing to the large risks involved. Privatization

opportunities in urban areas and franchising of certain distribution operations are possible areas to look out for.

Trading

Power trading as an activity is evolving rapidly in India. Traders can play the important role of managing risk apart from facilitating market development. Open access and the recent policy announcement of allowing 100 percent foreign direct investment in trading are expected to lead to growth of this sector.

Energy savings and demand side management

A study for the Asian Development Bank estimated an immediate market potential of energy saving of 54,500 million kWh and peak saving of 9,240 MW. This has an investment potential of USD 3 billion.

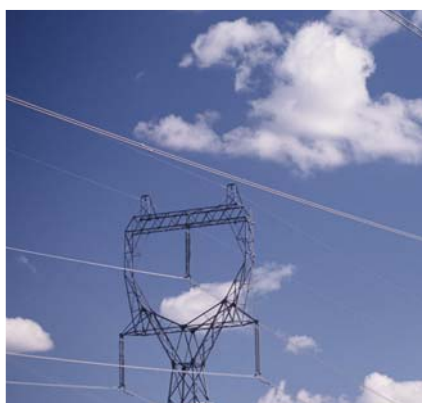
In spite of the above opportunities, lot remains to be done in terms of

strengthening/building the regulatory institutions that will allow Government to distance itself from operational decision making and make the reform process more transparent and sustainable. For example the demands for such a body in Gas as well as Coal sectors are long pending. If granted, it will lead to much desired information transparency and objective tariff setting. Similarly, the commissions in the power sector would need to be provided more independence to deal with tariff design, market structure development, etc and given an environment to operate without political interference.

In the following chapters, starting with an overview, each energy segment has been discussed in greater detail highlighting key issues and points of view of KPMG's ENR practice in dealing with them and the emerging areas for investment.

⁶ Formation of the National Grid is a plan for strengthening of the inter-state and inter-regional transmission network that will enable unrestricted flow of electricity across regions and enable development of a deep electricity market in India

⁷ Source: Ministry of Power, Government of India



Overview of India's Energy Position

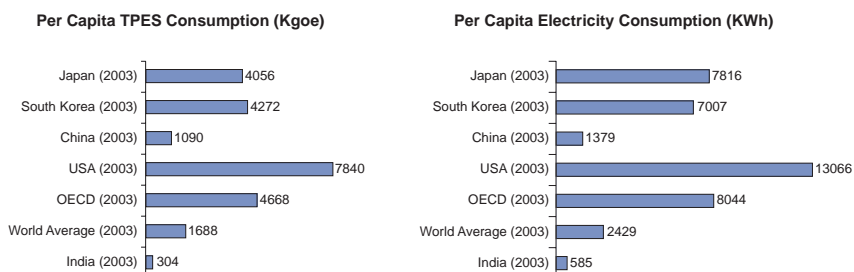
By world standards, India's current level of energy consumption is very low. The total annual energy consumption (commercial) for India is estimated at 327 mtoe (million tons oil equivalent) for the year 2003-04 and the per capita consumption stands at 304 kgoe (kilograms oil equivalent). (Exhibit 2.1)

However, with a targeted GDP growth rate of 7 to 8 percent, and an estimated energy elasticity of 0.80, the energy requirements of the country are expected to grow at 5.6 -6.4 percent per annum over the next few years. This implies a four-fold increase in India's energy requirement over the next 25 years and the country faces significant challenges to meet this.

India's Current Energy Basket

India is well endowed with coal. However, it is poorly endowed with

Exhibit 2.1: India's per capita energy consumption compared to other countries



Source: Planning Commission, Govt of India

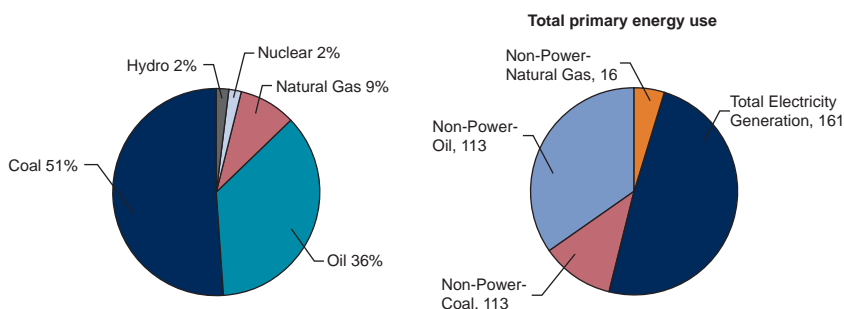
oil assets and has to depend on crude oil imports to meet a major share of its needs (around 70 percent).

The above exhibit reflects only primary energy sources that are commercially exploited. A large population of India in the rural areas depends on traditional sources of energy such as firewood, animal dung and biomass. The usage of such sources of energy is estimated at around 155 mtoe per annum or approximately 47 percent of total primary energy use.

Future Energy Requirements and Supply Options

At the projected growth rate in primary energy demand⁸, India needs to strategically evaluate its supply options to meet its energy requirements. Coal would continue to be its dominant energy source. However it would have to actively develop non-coal sources to meet its future needs. It is estimated that at a growth rate of 5 percent in coal production, India's extractable coal reserves would get exhausted in 40 years. Therefore, from a long-term perspective and in view of growing environmental concerns from use of coal, the country needs to look at developing other sources such as nuclear and renewable energy. India has vast reserves of the nuclear fuel thorium but technology is not yet developed for its commercial use. Renewable energy could also contribute usefully to India's energy

Exhibit 2.2: India's Primary Energy Resources and energy use



Source: Planning Commission, Govt of India

⁸ Please see Exhibit 2.2

requirement given that India is well endowed with solar energy. India's oil assets are meager but recent discoveries hold promise for India's gas reserves and coal bed methane. The following exhibit 2.4 depicts the estimated energy reserves/ potential for Different supply scenarios have been developed by India's Planning Commission to meet the future energy requirements. These scenarios look at energy efficiency as well as supply side options.

The energy efficiency options include:

- Energy efficiency in end-use: Efficient use of energy in industry, lighting, household appliances etc. can lower India's energy needs by 87 Mtoe in 2031-32 or 5.3 percent of the total energy requirement.
- Increase in rail road share of freight: Currently, road transport carries a major portion of freight traffic. If share of railways in freight increase from current level of 32 percent to 50 percent by 2031-32, it would contribute significantly towards energy saving.
- Increase in transportation efficiency: Use of mass transport system in cities, better utilization of motor vehicles (such as vehicle pooling) and increase in fuel efficiency of motor vehicles (possible to the extent of 50 percent with current technology). These measures can save about 69 Mtoe of energy or 4.2 percent.
- Efficiencies in thermal power generation: Currently, the efficiencies of thermal generation in India stand at 30.5 percent. An increase to 42 percent through use

Exhibit 2.4: Estimated energy reserves

Resource	Unit	Reserves
Coal (Extractable)	Mtoe	22540
Oil	Mtoe	739
Gas	Mtoe	4076
Uranium – Metal	Tonnes	61,000
Thorium – Metal	Tonnes	150,000
Hydel	MW	150,000

Source: Planning Commission, Govt of India

of super critical boiler technologies could lead to savings of 114 Mtoe or 7 percent

Together the energy efficiency measures can save 270 mtoe of energy or around 15 percent of India's energy requirements by 2031-32.

The supply side options include:

- Fully exploiting India's hydro potential of 150,000 MW from current level of 30,955 MW
- Scaling up nuclear generation by successfully developing the Fast Breeder Reactor (FBR) technology which uses uranium as fuel and developing Advance Heavy Water

Reactor for utilizing thorium, which India has abundant reserves.

- Development of natural gas sources and use of it for electricity generation, either through indigenous exploration or through initiatives of import through pipeline and as LNG
- Development of renewable energy, including solar power (India has very large potential) through cost effective photovoltaic technology, fuel wood, bio-diesel, wind energy

The range of utilization of different fuels in 2031-32 as compared to current levels is shown below:

Exhibit 2.5: range of utilization of different fuels in 2031-32 compared to current levels

Resource	Range of Utilization of Supply Sources (Mtoe) in 2031-32	Current Utilization of Supply Sources(Mtoe)
Oil	463 – 493	116.00
Natural Gas	114 – 224	27.65
Coal	573 – 1082	184.35
Hydro	5 – 50	<1
Nuclear	3 – 89	<1
Solar	1- 4	<1
Wind	0 – 12	<1
Fuel wood	0 – 69	115.44
Ethanol	0 – 4	<1
Bio-diesel	0 – 8	<1

Source: Planning Commission, Govt of India

Key Imperatives for India

To meet its large and growing energy needs, there are certain key imperatives for the Indian energy sector:

Provide impetus for Private Participation

Private participation in the form of financial, technological and managerial are needed to meet the challenging growth targets. This would also bring in right competition and efficiencies, needed in the sector. Recognizing this, the GOI has allowed private participation in Oil and Gas exploration and production, coal mining (albeit for captive use) and in hydro power and renewable energy. NELP for oil and gas allows 100 percent foreign equity investment and is liberal in allowing self-marketing by the investors.

To sustain continued private participation, a number of important steps have to be taken further.

- *Clarity in Policy Framework:* There is a need to evolve a clear policy framework for the energy sector. Clarity is required in matters related to pricing of energy, the target market structure, cross-border investments and imports and exports of energy products. In India, clarity is beginning to emerge in some of these areas and debates have been initiated in others.
- *Independent Regulatory Mechanism:* An independent regulator is required for the energy sector to determine prices in the

first instance and once competition develops to ensure that there is a level playing field for all. Today there is much inefficiency in energy sector pricing due to the monopolistic market structure. Prices are either self determined by the monopoly companies or in some cases inappropriately priced according to import parity prices. There has been adequate debate on this issue and it appears that sooner than later the country will have full fledged regulators for the energy sector.

- *Develop Energy Markets:* Well functioning energy markets are important to attract investments and bring efficiency in the sector. Currently, there is limited market activity (examples are an internet portal based trading for a limited quantity in case of coal and auctioning in case of gas for limited quantities). Markets will be facilitated and effective when there are many players and there is an organized marketplace for energy products.

Actively pursue cross-border investments in Energy Sector

Energy equity in overseas assets is part of India's strategy to acquire energy security. This includes Indian companies such as ONGC, Coal India, GAIL, Reliance etc. acquiring or seeking to acquire equity through joint ventures in oil and coal rich nations.

The Government is also pursuing strategic alliances with various

countries. The recent memorandum of understanding with China on this issue is an example. As per the Indian minister for petroleum and natural gas, *"We have realized that when we compete in an unhealthy manner to acquire oil fields in third countries, we only end up driving costs for each other. We have ended up paying billions of dollars more by trying to outbid each other everywhere. This will end, as co-operation will precede competition."*

Besides, the Indian Government is also seriously exploring the nuclear option to meet its energy needs and it is looking at co-operation in this area with the nuclear suppliers' group countries.

Create an enabling infrastructure for Energy Sector growth

Investments in ports, railways, pipelines and power transmission are urgently needed to attract energy sector investments in the first place and to enable efficient energy choices. Today, the capacities of these infrastructures are fully stressed and there is much inefficiency. Recognizing this, the Government has announced policies to involve private participation and the country is witnessing private investment in ports, pipelines and power transmission. Even in case of railways, the Government has recently announced a policy decision to open container transportation to private sector on a common-carrier principle using the existing railroads.

Rationalize taxes and subsidies to allow efficient pricing

The taxes and duties levied on energy products are lopsided leading to inefficient energy choices. Taxes on petroleum products such as aviation fuel for example are among the highest in the world while railway passenger tariffs are highly subsidized. Likewise, there are high subsidies for household cooking fuels such as kerosene and Liquefied Petroleum Gas (LPG) and even electricity for domestic consumption. The need for cost reflective pricing is being increasingly recognized as exemplified by the recent Rangarajan Committee Report, the Roadmap for LPG price rationalization by the Government as well as the recent notification of the power tariff policy of the Government.

Provide government support for energy efficiency

The Government needs to create a policy framework that provides incentives for energy efficiency. This could for example mean providing incentives in urban areas for mass transport systems, and promoting R&D in energy efficiency. The environment should encourage energy efficiency companies to come up and operate profitably. Awareness has been steadily increasing and policy makers are now thinking on how this can be achieved.

In parallel, India is also emerging as a significantly active market in terms of Clean Development Mechanism (CDM) projects being conceptualized and registered with the Executive Board (EB).

The growing awareness of the CDM benefits would make this an important area for investments in the Indian energy sector. CDM should also give the necessary fillip for energy efficiency measures in India.

The Government of India is recognizing the importance of private sector participation, and independent regulation in the energy sector. The future holds a lot of opportunities for international and domestic private participation. KPMG's Energy and Natural Resources practice present an analysis on each of the fuel sectors in the following chapters.



Coal Sector

The majority of the energy requirement in India is met by coal, largely mined in the eastern and the central regions of the country. In 2004-05, the total coal production in the country was around 350 million MT and majority of it catered to the core sectors of power, steel and cement.

Inspite of various policy initiatives to diversify the fuel mix, it is becoming increasingly evident that coal will continue to play the major role in sustaining the growth momentum of India. Based on estimates, the consumption of coal is projected to rise by nearly 40 percent over the next five years and almost to double by 2020.

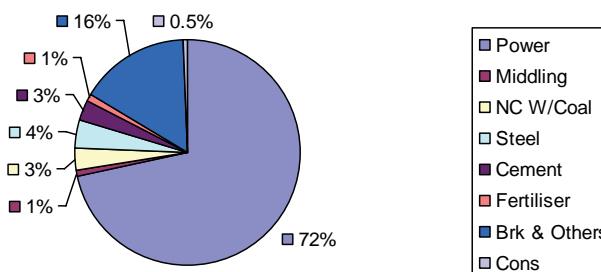
However, in the recent past, the coal sector in the country has come under pressure over its inability to meet demand (both planned and unplanned) of the user industries.

By Government’s own estimates, coal production will lag behind demand by about 100 million MT as of 2012 and by 250 million MT by 2020.

Key Issues Facing the Sector

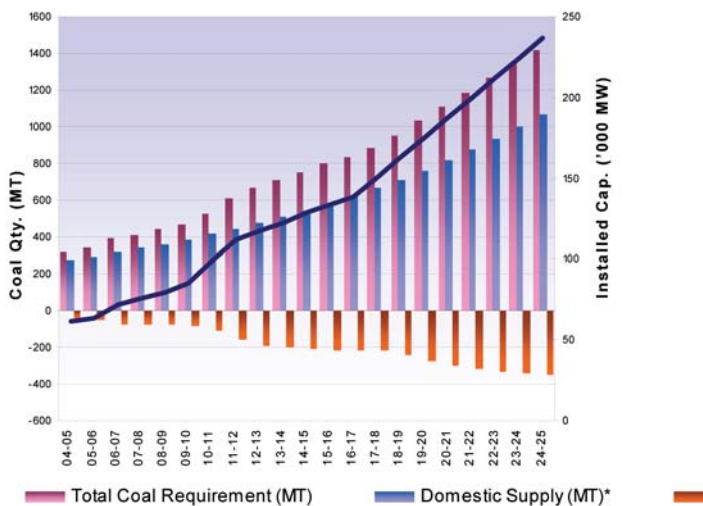
The critical issues facing the coal sector are highlighted below:

Exhibit 3.1: Consumption profile



Source: Infraline

Exhibit 3.2: Coal requirement vs availability



Source: Infraline

- Historically, opencast mining has been favored over underground mining⁹. This has led to land degradation, environmental pollution and reduced quality of coal as it tends to get mixed with other matter;
- In addition, current economic mining practices are generally limited to depths of 300 meters and 25 percent of the reserves of the country are beyond this depth¹⁰;
- Further, coal mining in India is associated with poor employee

⁹ During 2004-05, the production of coal from underground mining was only about 18-20 percent of the total production

¹⁰ The proven reserves of India is estimated to be around 248 billion MT (upto a depth of 1200 meters)

productivity¹¹. The output per miner per annum in India varies from 150 to 2,650 tonnes compared to an average of around 12,000 tonnes in the U.S. and Australia¹²; and

- Finally, India has still not been able to develop a comprehensive solution to deal with the fly ash generated at coal power stations through use of Indian coal¹³. Clean coal technologies, such as Integrated Gasification Combined Cycle, where the coal is converted to gas, are available, but these are expensive and need modification to suit Indian coal specifications.

The task of transformation of the coal sector is formidable given the size of investment requirement, and the level of political interference that is expected during such process. The following efforts can become the cornerstones of reform in the sector.

Deregulation of the coal sector

Deregulation and opening of the sector to private participation will spur state owned Coal India Limited (CIL) to improve performance, and help attract investments to the tune of USD 8-10 billion required to upgrade existing mines and open new ones in the next five to seven years. Recognizing this, Government has now decided to offer access to state-owned mining blocks

to investors. Simultaneously, Coal India is being encouraged to further identify coal blocks wherefrom coal extraction will be commercially viable. As soon as attractive blocks are offered and successes become visible, private sector investment would increase significantly.

An independent Regulatory body to govern investment and operation in the sector is required. Such a body will help create a level playing field and will allow the Government to distance itself from activities like allocation of blocks, approval for mines, etc. The body can also be expected to introduce competitive price regulation.

Improvement in operational efficiency of the coal companies

Coal India is in need of an organizational transformation to gradually align its operating costs to international standards. Mining costs of CIL are at least 35 percent higher than those of leading coal-exporting countries such as Australia, Indonesia, and South Africa. To match productivity, Coal India will need to invest in new technologies, improve processes in planning and execution of projects, and institutionalize a comprehensive risk management framework¹⁴.

Strengthening of logistics in coal distribution

In India, the logistics infrastructure such as ports and railways are overburdened and costly and act as bottlenecks in development of free market. Privatization of ports may bring the needed efficiencies and capacities. In addition, capacity addition by the Indian Railways is necessary to increase freight capacity from the coal-producing regions to demand centers in the northern and central parts of the country. On the Indian rail network, freight trains get a lower priority than passenger trains, a problem that promotes delays and inefficiency. Special freight corridors would raise speeds, cut costs, and increase the system's reliability.

Focusing on technology for future

India's numerous technology research institutes are working on energy-related R&D. However, there is a possibility that they are operating in a fragmented fashion. The Government may get improved recoveries on its investment by concentrating on few important technology areas. To start with focus may be applied for tighter emission standards and development of inexpensive clean-coal technologies viz. extraction of methane from coal deposits.

¹¹ Coal from Coal India Limited (and its subsidiaries), account for around 80 percent of the annual production of coal in India. Coal India Limited is also the second biggest employer in the world with around 500,000 employees

¹² Source: Tata Energy Research Institute, India

¹³ Around 90-100 MT of ash is generated at power stations in each year. India has been able to absorb only 11 percent of this ash compared to 25 percent by China.

¹⁴ A first step, providing a catalyst for improvement, would be to allow competition among mining subsidiaries of CIL. Another would be to encourage joint ventures with world leaders in coal mining.

Policy and Regulatory Framework

The coal industry in India has traditionally been characterized by state monopoly, lack of independent regulation and lack of transparency in tariff determination. The Government has now realized that a high growth rate in domestic production of coal cannot be sustained without carrying out structural reform and introduction of competition through participation of the private sector. In this regard, the Government has taken the following measures:

- Distancing of the Government from price determination of all grades of coal;
- Opening of captive coal mining for power, iron and steel, and cement to private investment. Foreign investment in Indian companies taking up coal mining for captive use has been permitted. The allocation of coal blocks are to be done on the basis of competitive bidding¹⁵;
- Allowing State Government companies or undertakings to carry out mining of coal (or lignite) reserves (either by opencast or underground method) anywhere in the country¹⁶;
- Reduction in customs duty on coal imports to 5 percent; and
- Downsizing of the budgetary support to the national coal industry.
- In addition to the above, the following measures, which have

been accepted in principle, are awaiting implementation:

- Freeing the sector from controls on distribution
- Establishment of a regulatory authority to resolve price disputes between producer and consumers of coal
- Granting of infrastructure status to coal sector
- Allowing public sector enterprises for joint venture projects with private sector.

The India Opportunity

The recognition of requirement for private investment in the sector and the acknowledgement for need of operational efficiency provides various opportunities for investment in the coal and related sectors in India.

Participation of the private sector in captive mining across different user industries is an immediate opportunity for investment. Coal fields with mineable coal reserves in excess of 1,000 million tonnes are proposed to be identified and are in the process of being allocated for captive mining. This may imply a total capital requirement of around USD 1.5-2 billion. However, it would need to be remembered that deposits, which are found on surface and easily extractable, may have already been largely explored. Now, agencies will need to address increasingly difficult terrain and search coal at greater depths with more sophisticated technology, requiring more capital and larger scale of operations.



They will also have to issue new regulations supporting a free market, allow the formation of joint ventures or other alliances, and encourage the development of a shared infrastructure, such as dedicated rail lines and power transmission networks. To achieve these goals, the Government will have to overcome opposition from strong political and business interests within the sector, which is a traditional source of political influence.

As related sectors, seaports that receive shipments of coal, railroads, etc would require USD 40-50 billion in investments to enable expansion in capacity in a harmonious manner. The Government's plan to invest USD 2 billion to increase capacity and remove bottlenecks at existing major ports is much lower compared to an estimated USD 30 billion that is in actual requirement. Similarly, a total USD 15-20 billion is required in new railway tracks to act as freight corridors and to integrate them with existing rail operations.

¹⁵ In view of lack of technical understanding, user industries are not expected to be directly involved in activity of coal mining. They will like to appoint a Mine Developer and Operator ('MDO') for the purpose. In this regard, the need of the hour is a framework that will allow for (a) free exchange of relevant information and (b) transparent evaluation of bids from prospective MDOs. The framework is expected to assist both parties in managing the risks that are involved in the activities of planning, development, exploration, etc in an effective manner.

¹⁶ Without the earlier restriction of isolated small pockets

Oil Sector

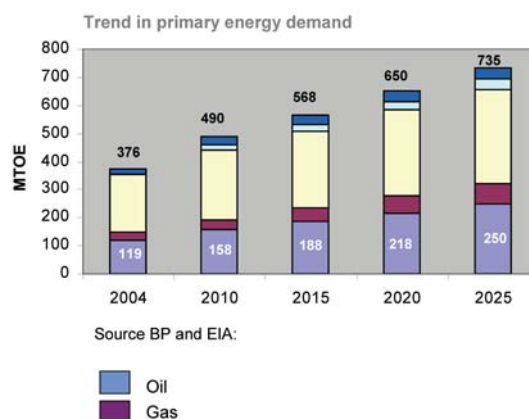
Oil comprises of 36 per cent of India's primary energy consumption at present, and expected to grow both in absolute and percentage terms driven by overall economic growth. The growth in demand expected to catapult the overall demand to 196 MMT in 2011-12 and 250 MMT in 2024-25.

The growing demand supply gap has led the Indian government to open up the E&P sector to private participants through NELP and develop a more holistic strategy for acquisition of equity oil abroad.

Key issues facing the Sector

- **Absence of statutory framework in the upstream industry:** India has significantly shied away from structural regulation; regulations in India are more focused towards use of standards in the areas of health, safety and environment, and certain critical aspects of operations and pricing. The scope of the proposed legislation through the recently drafted Petroleum Regulatory Board Bill is confined to the downstream industry. While upstream is still governed under a policy framework by the Directorate General of Hydrocarbons and notable absence of any statutory framework.

Exhibit 4.1: India's energy mix and outlook for oil



- Demand for oil is expected to grow from 119 MTOE from 2004 to 250 MTOE during 2025 at annual growth of 3.6 per cent

- During the same period domestic production from existing developed reserves expected to grow at approximately 2.5 per cent

- The gap in demand and output will catapult India to one of the largest consumers of crude oil along with China. The 2 countries will account for 35 per cent of the world's incremental energy demand

- **Lack of clarity in Open Access Policy:** Mandatory provision of surplus capacity¹⁷ to the open access pool in all new product pipelines subjects them to the risk of possible under-recovery of costs due to any unutilized/surplus capacity. Any unabsorbed costs on unutilized capacity might not be recoverable through levelised tariffs if the investor remains the main user of the pipeline. Alternatively treatment of unabsorbed cost as a regulatory asset for subsequent recovery from third party users on amortized basis might raise debate on cross subsidization issues and create disincentives for new shippers to contract capacity.
- **Incidence of cross subsidy due to social obligations:** Till recently the subsidy burden on LPG, SKO

and diesel were allocated to the national oil companies, but the incidence is been spread out across to the private sector. Although this phenomenon is likely to remain due to social obligations of the Government, a more transparent procedure for the allocation of subsidies would boost investor confidence further.



¹⁷ Current draft of the PRB Bill mandates all new product pipelines to provide 25 per cent additional surplus capacity in the open access pool.

Policy and Regulatory Framework

The current upstream regulation is provided by Director General of Hydrocarbons (DGH), more so on the technical aspects rather than on pricing front. Midstream and downstream sector is largely unregulated; however, downstream regulation is proposed to be introduced.

Over the past five to six years, the trend has been towards opening up the sector for greater investment, setting up an independent regulator to monitor post production activities, and enabling a transition from an administered to a market driven mechanism. This includes de-controlling of most of the petroleum products and allowing private sector companies to market them at the market-determined prices¹⁸.

Another significant trend in oil and gas regulation in India, and one which is likely to continue, is the opening up of the sector to private and foreign participation. A 100 percent Foreign Direct Investment is allowed in the exploration, pipeline infrastructure, refining and in downstream retailing (100 percent FDI in retailing is allowed subject to minimum investment of USD 445 million in midstream or upstream sector.), LNG and trading segments subject to approval. Combined with the attractiveness of the Indian market in the oil sector, this is likely to bring forth significant investments in the future.

On the pricing front, the government appointed committee on pricing and

taxation of petroleum products has recommended that the oil companies should shift from import parity based pricing to trade based pricing. It has also suggested reduction in custom duties on petrol and diesel from 10 per cent to 7.5 per cent and shifting excise duty from an ad valorem levy to a specific levy.

The India Opportunity

Investments under NELP

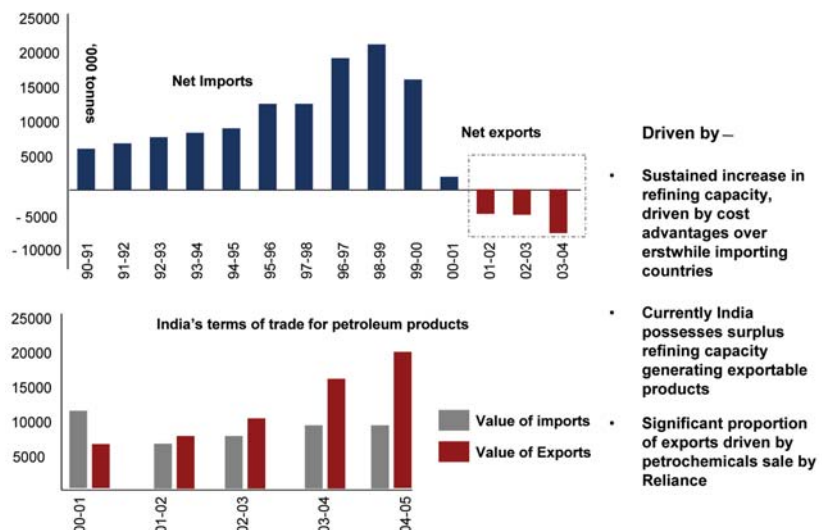
To increase investment in the upstream side, MoPNG has introduced a transparent bidding process for allocation of oil and gas blocks. The launch of NELP in 1997 and award of 120 production sharing contracts under five rounds may be hailed as a policy success. About 700 MMT of oil and oil equivalent gas are established through the five rounds. However, the recent rounds of NELP bidding are still dominated by public sector. To bring new technologies and international practices in the oil and gas exploration sector, government is keen on greater foreign participation under NELP process.

Destination India as refining hub

India possesses certain key advantages for developing itself as an export refining hub which include cost competitiveness and location advantage. India has significant lower cash operating costs mainly on account of cheaper power and labor costs as well as lower capital costs by as much as 25 to 50 percent over other Asian counterparts. Geographically, India is strategically located en route of Middle East crude for East Asian and Pacific rim markets. In fact, India possesses surplus refining capacity and has already turned a net exporter of products¹⁹.

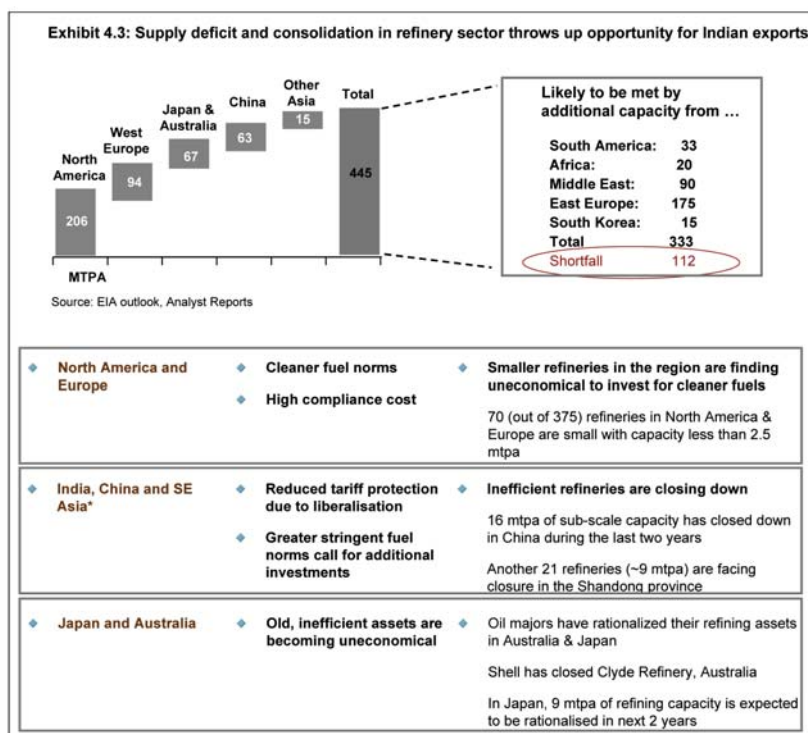
Certain areas of the country have been already demarcated for the development of export oriented refineries, and dialogues are underway between MoPNG and some of the oil companies on implementation of the strategy, which include building supporting infrastructure for enabling exports.

Exhibit 4.2: India's petroleum exports on the rise since 2001



¹⁸ Price of gasoline and diesel are still fixed by the Government, although the linkage to import parity price has strengthened significantly over the years

¹⁹ Source(Exhibit 4.2): ENI, Oil and Gas Outlook



By 2010, the expected world supply deficit in refining capacity would be around 112 MTPA because of shutting down of some of the smaller refineries in developed economies. Smaller refineries in North America and Europe are finding it uneconomical to invest for cleaner fuels because of high compliance cost and cleaner fuel norms. In Japan and Australia, oil majors have rationalized their refining assets as they are becoming uneconomical to operate.

Going forward, significant new investments are expected in refinery capacity in India for the purpose of exports. Besides, upgrading some of the existing refineries might be on the cards since most of these refineries have low complexity, which is now becoming an important

prerequisite to hedge against variation in crude supplies and achieve cost competitiveness by accommodating cheaper quality crude.

Building strategic petroleum reserve through public private partnership

Taking into account the oil security concern of India, the Government has decided to set up strategic crude oil storage at various locations in the country. This strategic storage would be in addition to the existing storage of crude oil and petroleum products with the oil companies and would provide an emergency response mechanism in case of short-term supply disruptions. Additionally, the government is also exploring the possibility of increasing the oil stockpile in the country through various innovative schemes such as leasing of storage space to

international oil trading companies, building of additional storage terminals through the concessions route etc that would potentially induce significant investments in storage and transportation infrastructure.

Acquisition of overseas oil assets

MoPNG has conceived a more coordinated approach to acquisition of overseas oil assets through joint foray (compared to the current fragmented approach), bilateral engagements with other countries to benefit from each others strengths in areas of technology transfers, R&D, safety and training, as well as multilateral engagements such as the Asian Round Tables, International Energy Forum etc. Recently India has signed an MoU with China for joint bidding of hydrocarbon blocks.

Competition in the downstream (retail and institutional) segment

As per Petroleum Regulatory Board ('PRB') Bill, all upcoming pipelines would have mandatory open access. Creation of open access capacity would drive competition in the retail and the institutional segment.

In anticipation of competition, major oil firms are expanding their retail network and forming alliances with a host of product and services companies to offer non-fuel products and services as part of their overall proposition. On the institutional segment, incumbents are focusing on profitable segments for subsidized products like LPG (commercial & non-domestic) as well as on specialty products like Hexane.

Gas Sector

India is a relatively new entrant into the natural gas market when compared to mature NG based economies like Japan, Korea, and the United States. However, the increasing significance of the fuel in the Indian context can be gauged by the fact that by 2025, the country is expected to rival both China and Japan in having the largest NG demand in Asia. Demand in each of these countries is expected to be in the range of 350 MMSCMD²⁰.



The significant potential for NG demand, especially in the context of India's projected 7-8 percent growth, is being driven by a few key factors

- The share of natural gas in India's energy basket is only around 8.9 percent, as compared to the world average of around 24 percent. More than 50 percent of NG volume goes to sectors where it is a substitute to petroleum products and the rest goes to the power sector where it would substitute coal. In this context, NG volume in the country will partly be driven as a substitute to petroleum products since it is cheaper and cleaner. In addition, reforms in the power sector would also encourage NG to be used as a cleaner substitute to coal in the long term. The share of NG in the fuel mix expected to go up from 8.8

percent currently to 22 percent in 2031-32.

- Per capita consumption of NG in India is currently amongst the lowest in the world, at 29 cu m as compared to a world average of around 538 cu m²¹.
- Demand for natural gas (more than 120 MMscmd) in the country has far outstripped supply (about 66 MMscmd), and there is an increasing trend of new NG demand emerging as well as conversion from existing fuels to NG²².

Key Issues

India's gas supply issues are different from that of oil, mainly because domestic onshore and offshore gas has been contributing to meet more than 90 percent of demand so far.

Except for the LNG terminals at Hazira and Dahej, all other gas requirements for the country are being met through domestic sources. However, existing onshore and offshore fields are facing a declining trend in production (production in 2015 may be less than 50 percent of current production²³) and are unlikely to contribute to growth in supply. The identification of new sources of gas supply would be critical to sustaining the demand for gas in the country.

- Domestic reserves/ production will not be sufficient: While there have been new finds of about 70 Bcm a year in the last decade, production has not increased correspondingly largely due to unattractive market prices. However, significant shortfall will mean that one way or the other these reserves will have

²⁰ Energy Outlook 2004, HV 2025

²¹ Draft Report on the Expert Committee on Integrated Energy Policy, 2005

²² GAIL - Infraline - Natural Gas in India 2005

²³ Referred from LTGP statistics of DGH

to start being utilized. Significant incentives are being offered by the government through its NELP programs to attract greater investment in this area.

- Cross-border gas pipelines are still facing uncertainty: While initiatives related to cross-border NG pipelines with Myanmar, Turkmenistan, Iran, etc. have been under discussion for quite some time, the political environment and international climate has been unfavorable, thus delaying these projects indefinitely. Even when they do materialize, the country may face potential supply disruption if political issues emerge over medium term. Given these constraints, LNG may be the answer to the Indian NG supply issue.
- Inability to take international prices: Due to the distinctive nature of the Indian market, current international prices cannot be passed through to major NG users viz. power and fertilizer sectors (which constitute over 70 percent of demand). These customers have traditionally been buying gas at administered prices of less than USD 3 per MMBtu. In the short term, however, even at about USD 6 per MMBtu, NG does become relatively affordable for existing power and fertilizer plants largely because they are being impacted by shortages, and industrial customers because of the high prices of Naphtha, FO or LPG. Further, reforms in the power sector will lead to greater ability to take higher prices in the longer term.

Policy and Regulatory Framework

Over the past six years, the trend in natural gas regulation has been towards opening up the sector for greater investment, setting up an independent regulator to monitor post production activities, and enabling a transition from the administered control regime to a market driven mechanism. Significant regulatory issues which do or will impact the gas sector in India include:

- Gas Linkage Committee: The Gas Linkage Committee (GLC) was established to manage the allocation of gas (given limited supplies) to eligible customers. This was linked with the administered price mechanism which depressed domestic gas prices for certain sectors. However, new fields under the National NELP are already exempt from the purview of the GLC and can trade at market prices.
- Petroleum and Natural Gas Regulatory Bill: The Petroleum and Natural Gas Regulatory Board Bill tabled in Parliament in 2003 will define the regulatory framework for the sector. The Board, once in place, will have powers extending across all activities post production of natural gas, and including setting up of LNG terminals, building and operations of transmission pipelines on a common carrier principle, laying down regulation of city gas networks, laying down guidelines for fair practices in marketing of natural gas etc. In the interim, until the Bill is passed, the modified gas

pipeline policy is currently in effect, which allows companies with the least terms of transportation tariff and most efficient operations to operate inter-state pipelines.

- Foreign Direct Investment in NG Sector: Foreign Direct Investment of 100 percent is allowed in the exploration, pipeline infrastructure, LNG and trading segments subject to approval. Combined with the attractiveness of the Indian market in the NG sector, this is likely to bring forth significant investments in the future. The integrated LNG policy is currently under discussion and is likely to be put in place soon.

The India Opportunity

Domestic exploration of NG

The government sees significant potential in domestic exploration as an option for matching supply with demand. On an average, reserves of more than 70 bcm a year have been discovered over the past decade. The NELP provides significant benefits to private players in terms of allowing 100 percent FDI, a seven year tax holiday, free marketing rights in the domestic market etc. which are likely to attract



a number of players to the next round (NELP VI). However, unless significant finds are made (similar to KG basin) the country will still have to deal with a domestic shortage of gas.

LNG may be the answer

Given the shortages and uncertainties related to international pipeline gas, LNG may be the answer. A significant focus is being placed on LNG to secure supplies resulting in a number of LNG terminal projects that are being planned including Kochi, Dabhol, Ennore, Mangalore and expansion of Dahej. However, issues related to pricing and the limited potential sources of LNG supply (Qatar, Iran, Australia) to India need to be sorted out. In the long-term, this is likely to be one of the most significant areas of investment in the NG sector, with the most attractive areas being those where pipeline gas is not expected in the near future.

Coal Bed Methane (CBM) and Underground Coal Gasification Opportunities

With proven reserves of 765 Mtoe and

indicated reserves of between 1,260 - 2,340 Mtoe²⁴, CBM as an opportunity could be larger than either oil or natural gas. CBM exploration has already been taken up seriously with more than 16 blocks awarded so far and more to be taken up as part of the CBM-III and NELP VI initiatives. Compression of CBM and marketing as CNG could be exploited in potential industries as a substitute to conventional natural gas. A related exciting technology is that of underground coal gasification, which is already being exploited in Russia at a small level. Given India's large coal reserve, the UGC technology could potentially produce volumes of multiples of India's free natural gas reserve. For example Gujarat's coal reserves could produce as much as 70 times ONGC's current free gas reserves²⁵.

Emergence of the retail gas user

Increasingly, due to environmental and economic considerations, gas is reaching the retail user segment as a fuel for domestic and transportation purposes. The growth of Auto CNG

and Piped domestic gas in major Indian urban centers has sparked off a new demand spurt for NG. Auto CNG and piped gas together would within five years account for about 7 percent of total demand up from the current 2 percent. The fast pace of growth can be assessed from the fact that in the next few years, at least 30 cities have been identified for city gas coverage by private and public sector players, as compared to the six cities that currently have these facilities. Supporting regulation related to conversion of public transportation to CNG in some major cities has helped this growth significantly.

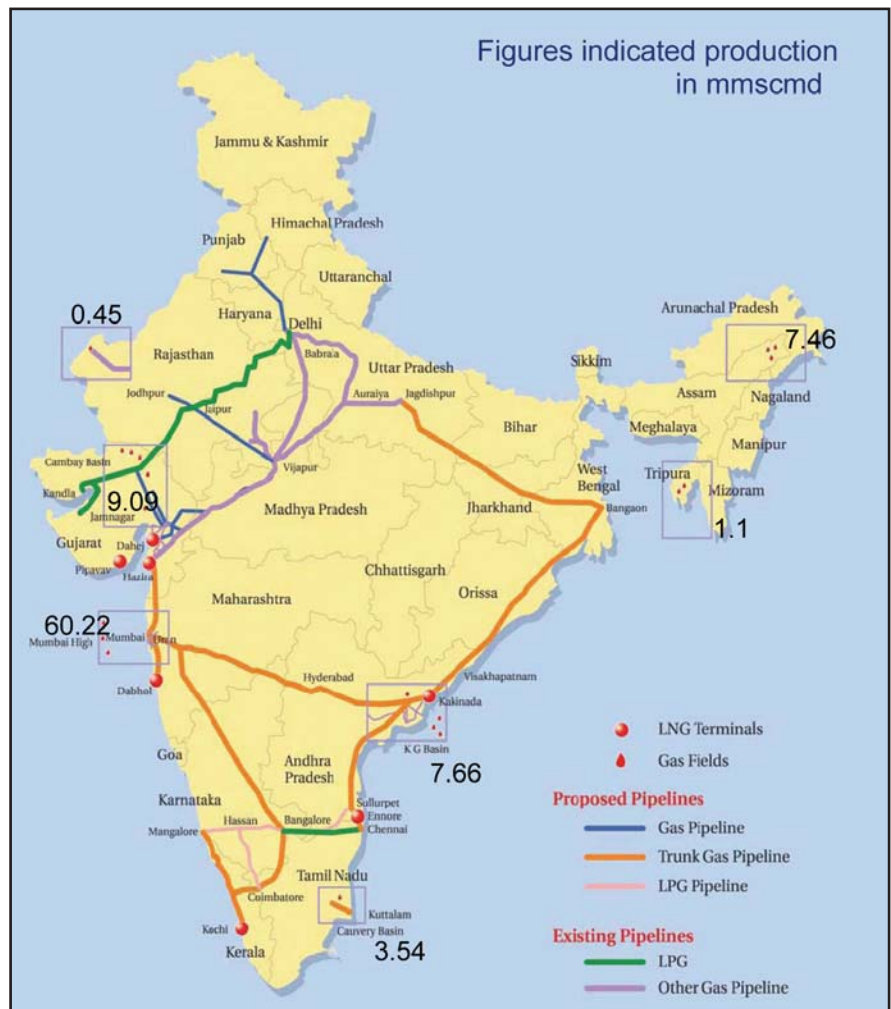
Development of common gas market through National Gas Grid

The growth in each of the end user industries as well as the wide spread of the retail segment would need to be supported by the appropriate infrastructure. At present, gas transmission and distribution infrastructure in India is still at a nascent stage, with only one cross-country pipeline (HVJ pipeline) in

²⁴ Draft Report of expert committee on Integrated Energy Policy
²⁵ Infraline report on status of CBM in India (April 2005)

existence apart from a number of regional and city networks, which have been growing significantly in the last five years. The draft gas pipeline policy in 2003 gave support to the development of a national gas grid, which would create a common gas market across the country, as opposed to the regional markets in existence today. Private and public sector players increasingly see this area as an attractive opportunity to connect markets that could not be tapped so far.

With the setting up of the Petroleum and Natural Gas Regulatory Board, and the coming of a regulator for pipeline infrastructure, it is likely that private interest would increase in the pipeline infrastructure segment. Reliance's recent initiative to develop a cross-country pipeline connecting the KG basin to markets in North India is an indicator of the potential that private players can exploit in this area²⁶.



²⁶ Map of India: www.mapsofindia.com

Nuclear Energy

India presently has fourteen Nuclear power plants in operation comprising two Boiling Water Reactors & 12 Pressurized Heavy Water Reactors (PHWRs) with an installed capacity of 3,310 MWe. Another eight reactors comprising 3,420 MWe are under construction which includes six PHWRs and two 1,000 MWe LWRs. All the above reactors are under the control of Nuclear Power Corporation of India Ltd.



Additionally, a new public sector company BHAVINI was created to carry out the construction and operations of Department of Atomic Energy's (DAE) first 500 MWe proto-type Fast Breeder Reactor (FBR). The fuel for this reactor will be plutonium bred from indigenously available Uranium.

In its quest for attaining energy security through use of nuclear energy, India has formulated a three-stage nuclear power programme, consisting of setting up of (PHWRs) in the first stage, Fast Breeder Reactors (FBRs) in the second stage and reactors based on Uranium 233-Thorium 232 cycle in the third stage. The FBRs in stage two will be fuelled by plutonium and will also recycle spent uranium

from the PHWRs for breeding additional plutonium fuel for electricity generation. Thorium irradiation in stage two (FBRs) will produce uranium 233 to start stage three. It is also envisaged that in the first stage of the program, capacity addition will be supplemented by electricity generation through Light Water Reactors (LWRs).

A beginning has been made in the introduction of LWRs with the inter-governmental agreement between India and the Russian Federation for co-operation in setting up of two 1,000 MWe LWRs at Kudankulam, Tamil Nadu. However, in the long run it is planned to indigenize the initiative.

Strategic importance of nuclear energy

The nuclear energy production must expand by a factor of fourteen to meet the "Sustainable Development (SD) Vision Scenario" of the International Energy Agency (IEA)²⁷.

India's long-term energy requirements and availability of energy sources imply that it will have to build 250,000 MWe of nuclear capacity by 2050. This will not only enhance energy security but will also yield rich dividends by reducing carbon emissions.

A study conducted by DAE²⁸ points out the inevitability of developing fast breeder technology and thorium fuelled

²⁷ Published in 2003, the vision focuses on 3 goals. First, the IEA plans to stabilize the atmospheric concentration of greenhouse gases (GHGs) to 'safe' level, which translates into a quantitative target of 60 percent of the world's primary energy coming from 'zero-carbon' sources by 2050. The second focus area is to secure and diversify existing energy sources, which translates into a target for reducing oil's share of the total transport energy demand from 95 percent in 2003 to less than 40 percent by 2050. Finally, IEA seeks to expand 'access to energy' by providing access to electricity to at least 95 percent of the world's population by 2050

²⁸ R.B. Grover and Subhash Chandra, "A strategy for growth of electrical energy in India", DAE internal note, 2004.

reactors to provide energy security to the nation as the presently known extractable coal reserves will have been exhausted by 2050.

Key issues facing the sector

The key issues facing the sector are as follows:

- Limited Uranium resources: The known reserves of uranium in the country can support about 10,000 MWe of installed electricity capacity based on PHWRs for a life-time of 40 years at 80 percent capacity factor. If the ongoing exploration efforts in the country locate additional uranium reserves, PHWR programme can also be expanded beyond the envisaged plan.
- Plutonium required to fuel 2nd Stage: PHWR program must provide the initial inventory of plutonium needed to seed the Fast Breeder Reactor (FBR) program.
- Reduction of capital cost and improved efficiency: New developments in case of FBRs should aim at reducing the capital

cost, O&M and fuelling costs, while improving safety. Long design life of about 60 years would also reduce the lifetime cost and the cost of decommissioning. Further, thermal efficiency improvements by 4 to 5 percent are also needed.

- Waste disposal and Safety systems: Indian reactors have demonstrated a fairly good record of safety and have sound waste disposal systems. However, with increased share of Nuclear energy in the coming years these aspects will need increased focus.

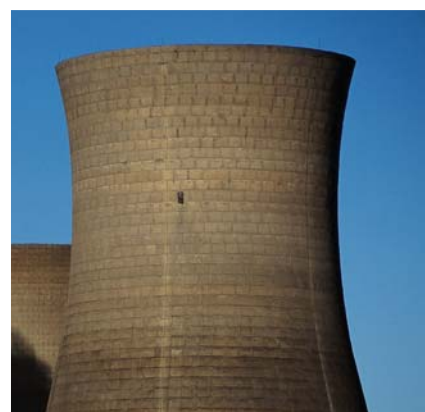
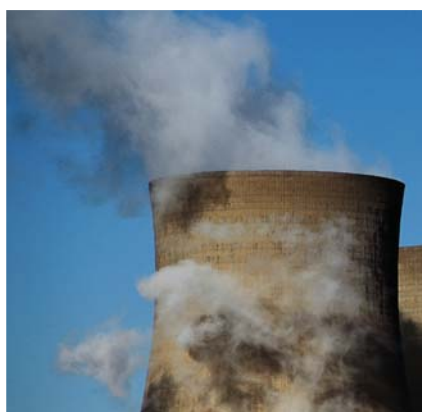
The India Opportunity

The growth of nuclear power in India as envisaged is possible provided robust technologies are developed for both the front end and the back end of the fuel cycle. Presently, the known uranium reserves in India are modest and uranium production needs to be augmented manifold to realize the planned growth of PHWRs.

There is a persisting need for developing techniques for economic

and efficient extraction of uranium from lean sources and it should be done by research groups jointly with state owned Uranium Corporation of India Ltd. Sea water can be an important source of uranium on a long-term basis and R&D for recovery of uranium from sea water should be systematically pursued.

Within the next three to four years, India will achieve an installed capacity of 6,730 MW of nuclear power. The country has set itself a target of achieving an installed nuclear capacity of 20,000 MWe by 2020 and 64,000 MWe by 2032. Further India needs to reach 250,000 MWe by 2050. This corresponds to a share of 10 percent of the country's installed capacity by 2032 and 20 percent in 2050 from the present share of 2.7 percent. This capacity could consist of imported LWRs which run on imported fuel, domestic PHWRs which run on imported fuel and domestic fuel and FBRs. Progressively power reactors running on thorium would get added to this list.



Hydro

The installed capacity of Hydro power projects in India is 32,135 MW. India has a large hydro potential and fully exploiting it is an important element in India's pursuit of energy security.

Key Issues

Government of India is addressing various issues relating to development of hydro power. Private sector participation is also being encouraged in a big way.

- **Funding:** Hydro projects involve high initial costs with one of the lowest lifetime cost of power generation. To meet the funding requirements, the Government has decided that all Central Sector projects will be provided budgetary support. It is also proposed to levy a Power Development Cess in the country to fund hydro projects.
- **Geological risks:** Hydro projects present geological surprises when construction starts and this leads to increase in project cost presenting additional risks to the investors. Survey and investigation of the potential hydro sites based on advanced scientific techniques are an essential requirement for the future.
- **Long delays in obtaining clearances:** Projects are delayed due to time taken in acquiring land, obtaining



clearances and issues related to rehabilitation and resettlement. To resolve this, it is proposed that new projects will initially be taken up by Government owned companies for investigations, updation of DPRs, obtaining the necessary clearances and pre-construction activities. After these stages, the projects could be offered to the private sector for execution either on 'stand alone' basis or for joint venture participation with the state owned companies.

- **Delays due to disputes between the states:** In case of hydro projects involving more than one state, disputes between states has led to substantial hydro power potential remaining locked up. Many mega hydro projects could not be taken up for implementation, even though

these projects are well recognized as attractive and viable.

- **Simplified procedure for transfer of clearances:** The immediate requirement would be to transfer the clearances already accorded to non-starting hydro projects in the State Sector to Central Sector or Independent Power Projects (IPP) or Joint Ventures between IPPs and central sector.

Policy and Regulatory Framework

The key policy initiatives in the hydro sector are:

- **Rationalization of Hydro Tariff:** Recognizing the difficulties in execution of hydro projects, the Government has decided to rationalize the existing hydro tariff norms, improve the incentives

for better operation and evolve a solution to the contentious issue of computing the completion cost.

- Estimates on Completion Cost (Geological Risks): A realistic estimate of completion cost has to take into account the geological and hydrological risks, cost escalation and natural occurrences of land slides, rock falls etc.
- Promoting Hydro Projects with Joint Ventures: With a view to bring in additional private investment in the hydro sector, there has been emphasis on schemes through joint ventures between the public and domestic / foreign private enterprises. Relaxation in certain rules pertaining to mandatory sharing of power with neighbouring states is provided in case of joint venture projects.

- Support for Acquisition, R&R, Catchment Area Development: The acquisition of forest and private land involves Government procedures and difficult negotiations with land owners. It is now the responsibility of the State Government to acquire the land (Government/Private/ Forest) for the project and also negotiate at its own terms with land owners as per the policy adopted by it. In case any cost is incurred by the developer it shall be considered as cost to the project and allowed to be considered for tariff determination.

The India Opportunity

India ranks fifth in terms of exploitable hydro-potential in the world. As per assessment made by Central Electricity Authority (CEA), India is endowed with economically exploitable hydro-power

potential to the tune of 148,700 MW. The basin wise assessed potential is²⁹:

In addition, 56 number of pumped storage projects have also been identified with probable installed capacity of 94,000 MW. In addition to this, hydro-potential from small, mini & micro schemes has been estimated as 6,782 MW from 1,512 sites. Thus, in totality India is endowed with hydro-potential of about 250,000 MW. However, only 17 percent of the hydroelectric potential has been harnessed so far and 5 percent is under various stages of development. Thus, 78 percent of the potential remains without any plan for exploitation. While private participation is currently low at 3 percent, private participation in future will be important to meet the ambitious target of 45,000 MW capacity addition in the next ten years.

Basin/Rivers	Probable Installed Capacity (MW)
Indus Basin	33,832
Ganga Basin	20,711
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: Narmada Hydroelectric Development Corporation website

²⁹ <http://www.nhdcindia.com/avd.html>

Renewable Sources

Renewable energy sources (RES) is an important element of India's power policy to meet the needs of power in an environmentally friendly way and to provide power to remote areas. India is the first country to have a dedicated ministry for developing and promoting non-conventional energy sources in the country. Certain forms of renewable energy sources (wind energy, small-hydro and biomass) have been able to establish a strong presence. There is relatively strong participation of private sector in response to the policy and incentives extended to the participants (for example a significant share of the wind-power based generation capacity has been set-up by private sector).

During the last couple of years considerable activity has been witnessed among RES-based power generators for availing benefits under the Clean Development Mechanism (CDM) for their projects.

Key Issues Facing the Sector

- Relatively high capital cost and low plant load factors make renewable energy more expensive. There is a need to balance environmental and financial considerations for which support from Government and the Regulatory Commissions is crucial. Technological development to bring



down costs and increase availability are key imperatives.

- Low plant load factors and seasonal nature of generation mean that grid support is required to maintain a reasonable supply level to the consumers. Hybrid systems in remote areas where extension of grid may not be feasible may emerge.
- Coordination between various ministries of the Government is required to maximize the benefits under various programmes for rural electrification, renewable energy sources development and village energy security program
- Regulatory certainty on tariff and other conditions of power procurement will continue to remain crucial for maintaining private sector interest in this area
- Adoption of renewable energy technologies in certain cases may lead to increased competition for

land use which will need to be managed, as and when usage of such technologies becomes more wide spread.

Policy and Regulatory Framework

- Some of the key legislative, policy and other measures initiated by the various stakeholders for promoting RES are:
- The Act provides for State Commissions to fix a minimum percentage for purchase of energy from such renewable energy sources. Some of the State Commissions have already initiated measures in this direction. Also the recently notified National Tariff Policy (NTP) mandates that such minimum percentage should be made applicable latest by April 1, 2006

- The policy recognizes that renewable sources of energy should be offered a preferential tariff till the time that technologies evolve so that they can compete with other conventional sources of electricity generation
- The policy encourages generation and distribution of electricity in notified rural areas without any need for obtaining a licence from the SERCs
- A number of fiscal benefits in form of duty exemptions, income-tax holidays, accelerated depreciation norms etc. have been extended. In addition, Indian Renewable Energy Development Agency has also been extending financial support to the interested investors

The current installed capacity of around 7,100 MW³¹ constitutes about 6 percent of India's total installed generation capacity. And given that only a small percentage of it has been utilized, it offers an exciting opportunity for various participants (including generator and equipment manufacturers) to explore and establish a strong presence.

The new draft policy on renewable energy released by the Ministry of Non-conventional Energy Sources (MNES) has set an objective of achieving an installed renewable based generation capacity of 10,000 MW by the year 2012.

- Certain forms of renewable energy sources viz. wind energy, small-hydro and biomass have been able to establish a strong presence in India in the renewable energy landscape. With an installed capacity of around 4,400 MW³²

of wind-based power generation, India is the fourth largest wind power generator in the world. India ranks second in the world with an installation base of 3.8 million biogas plants.

- Some State Governments have provided a lot of encouragement for renewables such as bio-diesel for which cultivation of crops such as jatropha has been encouraged on a large scale.
- Development and introduction of cost-effective technologies in areas like Solar Photovoltaic can play a pivotal role in wider proliferation of the same in India (there are about 300 clear sunny days in a year in most parts of India and the daily average solar energy incident over India varies from 4-7 kWh/m², depending upon location).
- Planning Commission, in a recent document³³, has suggested a number of policy measures to promote specific renewable energy alternatives including bio-diesel, ethanol and solar thermal water heaters. The emphasis is on creating a market for these alternatives by specifying some sort of purchase obligation for other participants like oil companies and Government agencies.
- The policy initiatives as described earlier including the recommendation for sourcing power from renewable energy sources on a competitive basis will provide the required impetus for the growth of the this sector.

The India Opportunity

India has an enormous potential of renewable energy across the various sources as indicated in the table below.

RES	Potential ³⁰	Existing Installed Capacity*
Wind	45000 MW	~4400 MW
Small Hydro (upto 25 MW)	15000 MW	~1700MW
Biomass power / cogeneration	19500 MW	~950 MW
Solar Photo Voltaic Power	20 MW/sq. km	Very low exploitation.
Solar Water Heating	140 million sq. m collector area	1.5 million sq. m collector area
Urban and Industrial Waste-based power	2700 MW	Very low exploitation.
Biogas plants	12 million	3.8 million
Improved Biomass Chulhas (Cook-Stoves)	120 million	

SOURCE: MNES Website

³⁰ Source: MNES website

³¹ Source: Presentation by MNES

³² Source: Presentation by MNES

³³ Draft Report of the Expert Committee on Integrated Energy Policy, Planning Commission, December 2005

Electricity

As per the Constitution of India, “electricity” falls within the concurrent jurisdiction of the Centre and the States. In most states in India, the sector consists of vertically integrated State Electricity Boards - most of which are now unbundled into Generation, Transmission and Distribution companies which continue to be state-owned. In a few States, private licensees for power distribution are also in operation. Currently only 10.6 percent of the total installed capacity is in the private sector. Distribution is privatised in the state of Orissa and some cities such as Delhi, Kolkata, parts of Mumbai, Ahmedabad and Surat in the western state of Gujarat.

Demand Supply Position and Expected Trends

The projected elasticity of electricity w.r.t. GDP is 0.95. With this, the growth rate in electricity consumption

Year	Installed Cap. Req. (GW) ³⁵	Energy Req. (Billion kWh) ³⁶
2003-04	131	633
2006-07	153	761
2011-12	220	1097
2016-17	306	1524
2021-22	425	2118
2026-27	575	2886
2031-32	778	3880

³⁴ Ministry of Power, Government of India
^{35,36} Draft Report of the Expert Committee on Integrated Energy Policy, December 2005
³⁷ Draft Report of the Expert Committee on Integrated Energy Policy, December 2005



is expected to be 7.6 percent. The per capita consumption presently stands at 606 kWh (2005), far below the world average of 2,429 kWh. At an 8 percent GDP growth, the per capita consumption of India in 2032 is estimated to be 2,643 kWh, which is just comparable to the present day world average.

With an installed capacity of 123 GW, the country currently faces energy

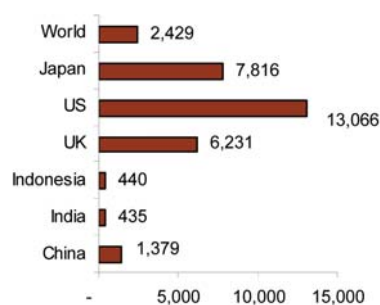
shortage of 8 percent and a peak demand shortage of 11.6 percent. In order to sustain a growth rate of 8 percent, it is estimated³⁷ that the power generation capacity in India would have to increase to 306 GW in the next ten years which is 2.5 times current levels.

Key Issues Facing the Sector

Socio-Political Influences

Over the decades, the power sector in India has become an instrument for implementation of State Government’s social policies. It is characterized by heavy subsidies, mostly poorly targeted and State Government’s involvement in functioning of the power utilities. The agricultural sector is a major consumer of electricity and together with other economically weaker sections of society has led to large costs for the

Exhibit 9.1: Per capita consumption KWh, 2003



Source: IEA

utilities in serving these consumers. This combined with poor state of State Government finances led to inadequate compensation to the power utilities contributing to degradation of the financial position.

High level of network losses

The power utilities in India suffer from a very high level of network losses of around 40 percent largely due to theft, pilferage and non-collection of dues and also due to the state of the network involving long low voltage lines. Non-realization of revenue for power generated has led to financial degradation and spiral of worsening performance.

High level of financial losses

Due to the reasons mentioned above, the power sector in India suffers huge financial losses to the tune of USD 6 billion an annum. These losses have accumulated over time and resulted in inadequate financial resources for capacity augmentation.

Inadequate Generation and Transmission Capacity

Inadequate resource generation for investments has led to generation capacity shortfall of over 15 percent. Payment security mechanisms for private players have been difficult to provide on account of the financial situation. Likewise, inadequate transmission capacity in the country has led to a situation where regional surpluses remained unutilized to meet deficits elsewhere.

Poor Quality of Supply

Inadequate generation capacity and the poor quality of the distribution network have resulted in poor quality of supply. Supply is characterized by planned and unplanned interruptions and deviations in voltage and frequency from prescribed parameters. There has been some improvement in these parameters in recent years owing to penalties and incentives for utilities for deviations.

Lately, availability of fuel for power generation is becoming a significant constraint. Coal shortages are increasing and gas shortages are leading to a situation where plants are not able to operate to full capacity.

Policy and Regulatory Framework

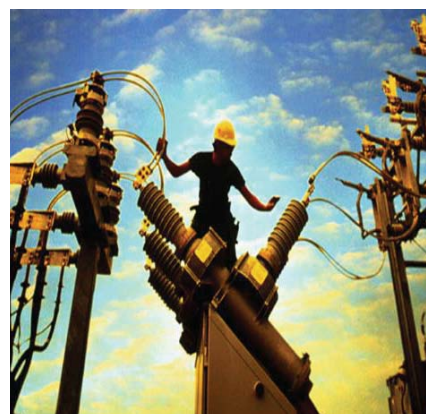
Electricity being a concurrent subject under the Constitution of India, a Central level as well as a State level jurisdiction is envisaged. The policy framework now hinges on bringing in competition, private sector participation and independent regulation (especially attempts bringing in independence from Government interference in state owned utilities). There is also a new emphasis on rural electrification a national programme for the same has been taken up.

The regulatory system now consists of a Central Electricity Regulatory Commission (CERC) regulating all matters pertaining to more than one state, State Electricity Regulatory Commissions (SERC) for matters

within a state and an Appellate Tribunal (being the higher court of appeal against the two regulators). In addition, there is a Central Government authority - the Central Electricity Authority (CEA) responsible for power planning for the country and according approvals for large hydro projects.

The legislative framework is governed by the Electricity Act, 2003. This along with subsequent policies including the National Tariff Policy, the National Electricity Policy and the Rural Electrification Policies define the policy landscape. The main enablers for competition are:

- All new generation in private sector has to be contracted through competitive bidding and even in case of public sector the same should be done in five years time. Regulated pricing applies only when competitive bidding has not been adopted.
- Open access on common carrier principle is allowed on transmission networks and will soon be phased in on distribution networks. This enables competition in procurement of bulk power as well as in retail supply to large consumers who will



soon be able to contract supply on their own. There are issues related to cross-subsidy surcharge in retail supply which is a surcharge payable by the supplier or consumer to the incumbent to compensate for loss of cross-subsidy.

- Provisions for parallel competitive distribution networks in existing areas are made. However, parallel networks are likely to come up only in areas where the existing network is in very poor state and the consumer profile is very favorable.

The policy now also requires reduction of cross-subsidies in tariffs and better targeting of Government subsidies.

The policy allows 100 percent Foreign Direct Investment (FDI) in generation (other than atomic reactor power plants), transmission, distribution and trading. There is no limit on the project cost and quantum of FDI. The categories which would qualify for such approval are: (i) Hydroelectric power plants (ii) Coal / Lignite based thermal power plants and (iii) Oil / Gas based thermal power plants.

The India Opportunity

Generation

In generation segment, opportunities exist due to the large demand-supply shortfall. A number of private projects have come up in recent times. While most of the generation would be sold through long-term contracts, there is a policy focus on enabling open access

that would allow generators to sell directly to large consumers. This and the evolving power trading market imply generators can also look at the possibility of setting up merchant plants or at least set aside a part of the capacity for merchant use. We are beginning to see instances of merchant plants coming up in the country.

The Government has also announced the setting up of ultra mega power projects (projects of size greater than 4,000 MW). The concept involves a Government agency doing the preparatory work related to land acquisition, environmental clearances etc. and then awarding the projects to private developers on a competitive basis. The policy now also allows generators to take up coal mining for captive use. These measures along with fiscal concessions for large generation projects such as waiver of customs duty make this a very attractive opportunity.

The opportunity for generators appears to be brighter than what it was earlier with more focus on improving the health of existing distribution segment and also opening up of new market for industrial/ high value consumers through open access.

Based on Government's plans, by 2012, a capacity addition of 22,900 MW has been identified for the private sector out of total target of around 107,000 MW.

Transmission

Private investments in transmission can be through Independent Power Transmission Company (IPTC) or a Joint Venture Company (JVC). Under the IPTC route, the private promoter will have 100 percent ownership, whereas, in the JVC route a minority holding will reside with the state owned Central Transmission Utility (CTU) viz. PGCIL.

Both forms of private participation are envisaged in creation of the National Grid³⁸ along with the CTU. The required capital outlay for this purpose is around USD 4.4bn. There are issues relating to payment security and obtaining right of way (ROW), environmental clearances, etc. that need to be addressed to promote private investment.

Distribution

While the experience of private participation in this segment has not been to the expected level, the recent policy initiatives provide adequate signals in terms of attractiveness of this segment for private investment. The Act provides for parallel and second distribution licensee in same area of supply, which enables setting up parallel distribution lines (and arguably more efficient ones) in specific areas³⁹.

Privatization of existing distribution utilities is possible, though good opportunities are few owing to the large risks involved. Till risks related to measurement of operational parameters such as losses (due to

³⁸ Formation of the National Grid is a plan for strengthening of the inter-state and inter-regional transmission network that will enable unrestricted flow of electricity across regions and enable development of a deep electricity market in India

³⁹ However, to be specified by the Commission

inadequate metering), regulatory risks (due to relative immaturity and lack of sufficient independence from Government), information risks (state of assets in the ground) and political risks (preventing cost reflective tariffs) are not minimized, the privatization opportunities may be limited. However, privatization of urban areas might be a possible opportunity in the future (privatization of Delhi distribution in 2002 is an example) as also opportunities related to franchising of certain distribution operations.

Trading

Power trading volumes in India, though small, have been growing steadily over the years. Investment opportunities arise due to the following:

- Open access in transmission and distribution networks will facilitate trading and enable direct sales to large consumers. Efforts at establishing a national power exchange are on and this will facilitate trading to a great extent.

- The policy of allowing 100 percent FDI in power trading will result in entry of foreign players in the trading market and the depth and maturity of the market will increase.
- While inadequate transmission is a constraint at present, efforts of the Government to enhance transmission capacity including inviting private participation and setting up of National Grid are expected to address this.
- There is an emerging trend of new private generators selling power to traders rather than financially weak distribution utilities. Traders are in a better position to manage risks relating to payments and demand uncertainties. Besides, with rising short term prices of electricity, traders have the potential to earn larger returns. However, there are issues relating to regulating trading margins which are the current subject of much debate.

Energy savings and Demand Side Management

A study for the Asian Development Bank (ADB, 2003) estimated an immediate market potential of energy saving of 54,500 million kWh and peak saving of 9,240 MW. This has an investment potential of over USD 3 billion. Additional savings are possible by reduction of auxiliary consumption in generation plants. Investment in this area is also likely to aid in reducing carbon emissions and therefore, part of the investments can also be financed through the Carbon Credits generated.

Equipment manufacturing

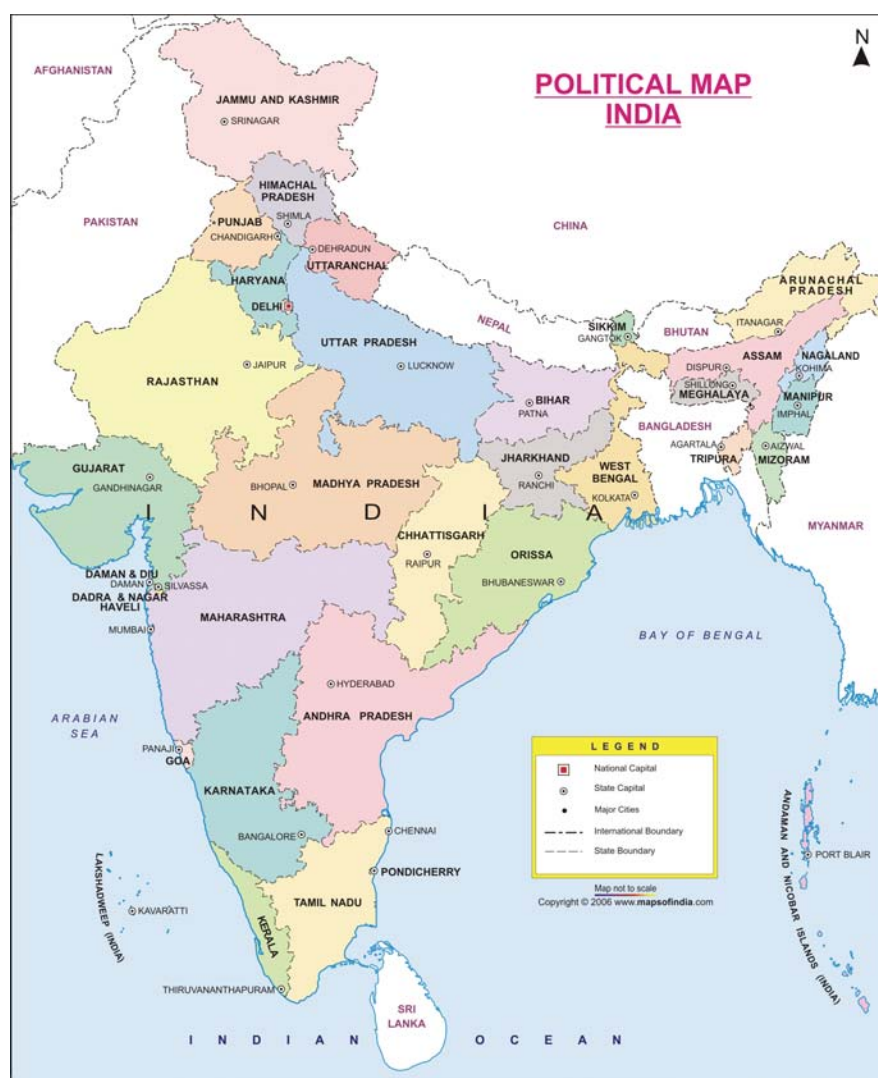
The large growth needs implies growing demand for generators, lines and equipment, meters, etc. While it is estimated that the existing manufacturing capacity in the country can support addition of about 6,000 MW of capacity, the future requirement is 15,000 MW every year for the next ten years.



Appendix: Few Major Players in India

No	Company
Coal Sector	
1	Coal India Ltd
Oil Sector	
Exploration and Production	
1	ONGC
2	Oil India Limited (OIL)
3	Cairn Energy plc
4	BG Group plc
5	Reliance Industries Limited
6	GSPC-Niko
Refineries	
1	Indian Oil Corporation Limited (Indian Oil)
2	Reliance Industries Limited
3	Bharat Petroleum Corporation Limited (BPCL)
4	Hindustan Petroleum Corporation Limited (HPCL)
Gas Sector	
Exploration and Production	
1	ONGC
2	OIL
3	Cairn Energy plc
4	BG Group plc
5	Reliance
6	GSPC-Niko
LNG Terminals	
1	Petronet LNG
2	Royal Dutch Shell
Transmission and Distribution	
1	GAIL
Electricity Sector	
Generation	
1	NTPC Limited
2	National Hydroelectric Power Corporation (NHPC)
3	Nuclear Power Corporation (NPC)
4	BBMB
5	NEEPCO
6	GVK
7	GMR
8	Lanco
9	Essar
Transmission	
1	Powergrid Corporation (PGCIL)
Generation & Transmission	
1	DVC
Generation, Transmission & Distribution	
1	Tata Power
2	Reliance Energy
3	CESC Limited

Appendix: India Demographics



Source: Maps of India - www.mapsofindia.com

Population:	1.08 billion (July 2005 est.)
Geographic Size:	3.28 million square kilometer
Ethnic groups:	Indo-Aryan 72 percent, Dravidian 25 percent, Mongoloid and other 3 percent (2000)
Languages:	English; Hindi is the national language and primary tongue of 30 percent of the people; Other languages: Bengali, Telugu, Marathi, Tamil, Urdu, Gujarati, Malayalam, Kannada, Oriya, Punjabi, Assamese, Kashmiri, Sindhi.
Religions:	Hindu 80.5 percent, Muslim 13.4 percent, Christian 2.3 percent, Sikh 1.9 percent, other 1.8 percent
Climate:	varies from tropical monsoon in south to temperate in north
Currency:	Indian Rupee (INR)
Key memberships:	ASEAN (dialogue partner), G-6, G-15, G-24, G-77, International Labor Organization, International Monetary Fund, SAARC, SACEP, SCO (observer), WHO, WIPO, WMO, WToO, WTO

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