



**Dialogue on**  
**Globalization**

**BRIEFING PAPER**  
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## **GLOBAL ENERGY SECURITY**

### **India's Energy Security**

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### 1 Introduction

With a population of around 1.1 billion, India is the world's second most populous country and ranks fifth in the world in terms of primary energy consumption, accounting for about 3.5 per cent of the world's commercial energy demand. With a GDP growth rate of around 8% during the Tenth Five Year Plan of the Government (2002-2007), India is currently one of the fastest growing economies of the world. The future levels and patterns of energy use in India therefore have important implications – at the national level in terms of environmental impacts of energy use, issues of access and equity, and at the global level in terms of geopolitics of energy supply and GHG emissions related to the combustion of fossil fuels.

### 2 The challenge of unmet energy demands

According to World Bank estimates, around 35% of the country's population subsists below the poverty line (\$1/day, 2000 PPP) and does not have access to basic amenities and clean energy forms. Even by 2001, around 44% of households did not have access to electricity (Census of India, 2001). The country continues to face electricity shortages, with an overall power shortage of 8.4% and a peaking power shortage of 12.3% in 2005/06.

Despite gradual urbanization, around 72% of the country's population resided in rural areas in 2001. The rural urban divide in India is manifest not only by the differences in the levels of energy requirement but also in the availability and choice of fuel and technologies to meet the same useful energy needs and services. Energy demands of several households, especially those in the rural areas, continue to be met primarily by inefficient traditional energy forms like fuel wood, crop residue, and animal waste as depicted in Figure 1. These fuels are not only inconvenient to use and cause indoor air pollution, but also adversely affect the health of women and children who are exposed to the use of these fuels.

On a per capita basis, India's energy consumption is still a fraction of that in developed countries. In 2003, India's primary energy consumption was 439 kgoe per capita, compared with 1090 in China, 7835 in the US and a world average of 1688.

### 3 Trends in energy demand and supply

In spite of the low per capita energy consumption levels, and the fact that a large section of population does not even have access to energy forms of adequate quality and quantity, India's total primary energy supply has increased from around 150 mtoe in 1970 to 438 mtoe in 2001/02. Moreover, the share of non-commercial energy has decreased from 59% in 1970 to 32% in 2001, with households shifting to the cleaner and efficient commercial energy

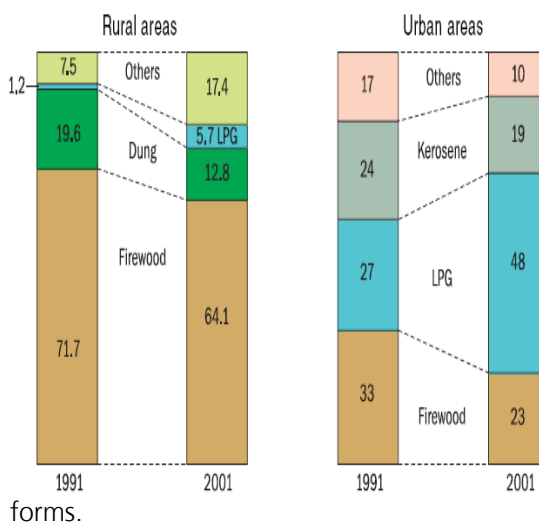


Figure 1: Fuel use patterns in rural and urban households in India (Figures represent percentage of households) Source: Census of India 2001

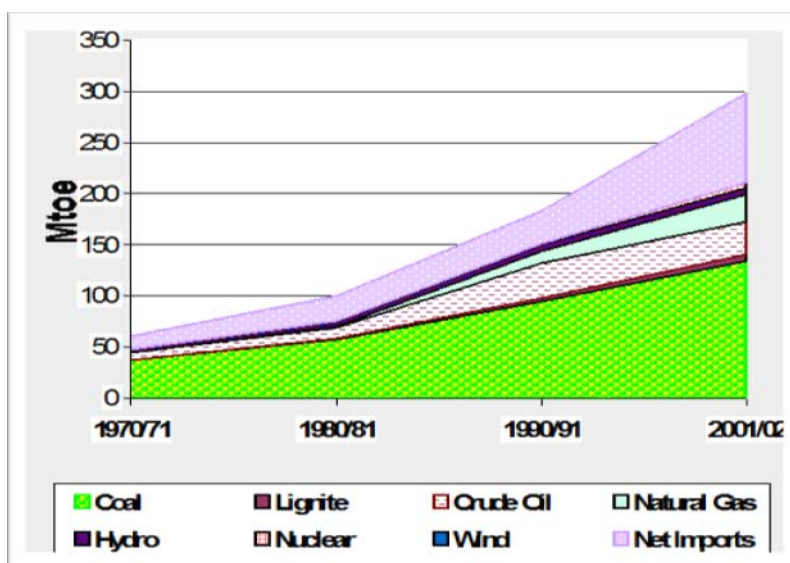
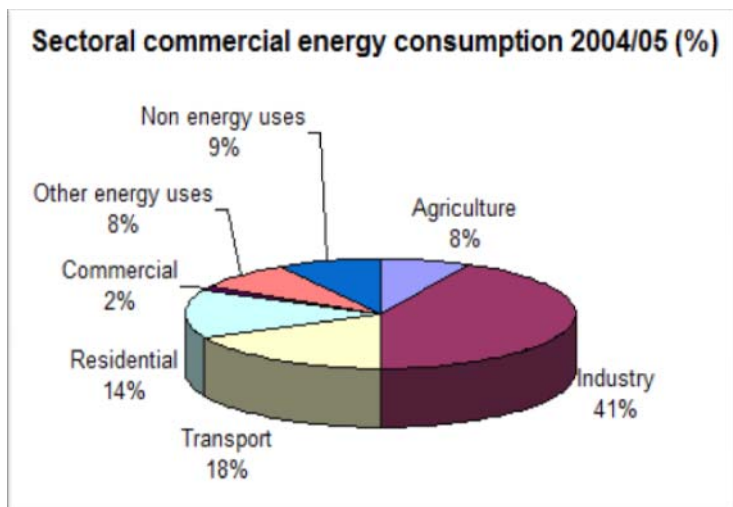


Figure 2: Fuel-wise commercial energy mix

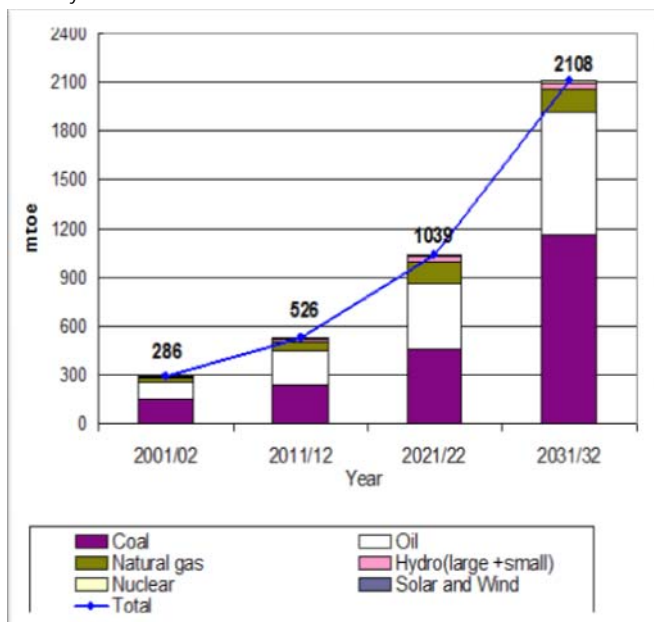
On the demand side, the industrial sector continues to remain the largest consumer, accounting for more than 40% of the total commercial energy, followed by the transport sector (Figure 3).



**Figure 3: Sectoral commercial energy consumption in India**

#### 4 Future energy needs

Various estimates indicate that India would need to increase its primary energy supply by at least 3 to 4 times and its electricity generation capacity by 5 to 6 times of the 2003/04 levels, by the year 2031.

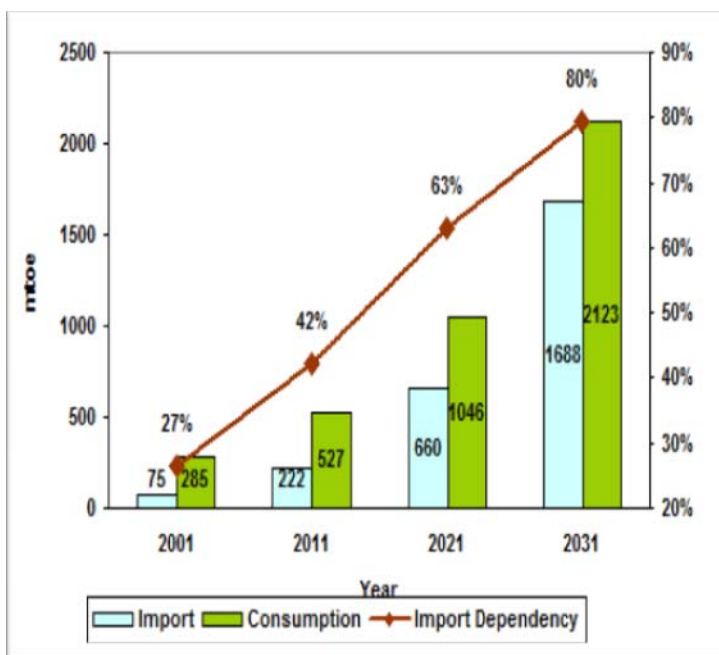


**Figure 4: Commercial energy requirements for India**

The Integrated Energy Policy report brought out by the Planning Commission estimates that under an 8% GDP growth scenario, India's total energy requirements would be in the range of 1536 mtoe to 1887 mtoe by 2031 under alternative scenarios of fuel and technological diffusion. TERI's analysis based on the MARKAL model, indicates that under a 8% GDP growth scenario with current plans and policies of the Government, commercial energy needs would increase to 2108 mtoe by 2031/32 (Figure 4). In reality, the Government of India would like to achieve a GDP growth of above 10% per annum!

Given the current statistics of energy access and shortages and the likely needs for energy in the future, India faces a formidable challenge in meeting its energy needs and providing adequate and affordable energy to all sections of society in a sustainable manner.

Although India has considerable coal reserves, with the current coal production technology, it is estimated that India's domestic coal production could increase to a maximum level of around



**Figure 5: India's likely Energy Dependency (BAU scenario)**

600 MTPA. Oil production has stagnated at around 33 MT in the past few years and is not expected to increase significantly. Further, while natural gas has emerged as a relatively clean option in the past decade, there is uncertainty regarding the level of its indigenous availability. Accordingly, under a business-as-usual (BAU) scenario, the country is expected to increasingly

become reliant on imports of all forms of commercial energy, with total energy import dependency increasing to around 80% by 2031. Although the country has been dependent on oil imports for several decades, imports of coal and gas have started during the last decade. By 2031, TERI estimates indicate a dependency of 78% for coal (over a billion tonnes), 93% for oil (~700 million tonnes) and 67% for gas (~93 BCM) with current estimates of future availability of indigenous energy. This is clearly an unsustainable trend with implications not only in Figure 5. India's likely Energy Dependency (BAU scenario) terms of the large monetary outflows that the country would have to bear but also in terms of the infrastructural requirements for port development, handling and transportation of this energy- not to mention access to these resources in, and inputs on, global markets.

## 5 Policy Initiatives in India

Given the bleak current energy scenario and the future prospects, the Government of India has put in place several measures that it hopes would lead to an easing of the shortages in the country and a more even distribution of access to energy. Some key initiatives along these lines are listed below:

*Structural and regulatory reforms:* The oil and gas sector was one of the first sectors in which the Government tried to introduce a much higher level of autonomy by allowing the public sector enterprises to work as corporate entities with their own Boards of Directors that would manage the companies at an arm's length distance from the Government. Private Sector participation in refineries was also introduced as a result of which the private sector body has a share of nearly 30% in India's refining capacities today. In the exploration and production areas, the Government has progressively refined its terms and conditions for sharing the benefits with the private sector under various rounds of the New Exploration Licensing Policies (NELP). As a result, there is now increasing interest on the part of the private sector to engage in exploration and production activities in India. For example, Reliance Industries Ltd. (RIL) – one of the largest private sector companies - has had unprecedented success in discovering gas reserves in deep sea basins in India.

The Government has also unbundled the functioning of erstwhile Oil Coordination Committee that was responsible for the complete supply planning and procurement of oil and gas in the country, into two entities – Petrofed which is a

trade association for oil and gas and the Petroleum and Natural Gas Authority which is an independent regulator in the sector. Unfortunately, one of the weakest points of the regulator in this sector is the fact that it does not have a right to regulate the prices which continue to be in the domain on the Government.

In the case of power sector, reforms were introduced in the early 1990's and, through a process of learning, India has finally reached a stage where it has enacted the Energy Conservation Act in 2001 and the Electricity Act in 2003. The Energy Conservation Act requires the establishment of a Bureau of Energy Efficiency as a deemed statutory autonomous body that would work towards encouraging energy efficiency in the country. The broad objectives of BEE are to provide a policy framework and direction to national energy conservation and efficiency efforts and programs; to coordinate energy efficiency and conservation policies and programs and take it to the stakeholders; to establish systems and procedures to measure, monitor and verify energy efficiency results in individual sectors as well as at the macro level.

The Electricity Act 2003 requires the functional unbundling of erstwhile vertically integrated state electricity boards and puts in place regulatory commissions both at the federal and state level. These electricity regulatory commissions have significant powers and have the responsibility to determine not only the tariff structures in their areas of jurisdiction but also to satisfy quality of supply and service norms and create a competitive environment apart from several other functions.

The coal sector, unfortunately, is one sector that has not made adequate progress on reforms.

*Enhanced Private sector participation:* Private sector interest in the oil and gas sector has built up and much more significantly than in the case of electricity sector because it got an early start and because distortions in the case of these sectors were not severe as in the case of electricity. Despite several efforts towards encouraging private sector participation in electricity generation and distribution the response from the private sector has been grossly inadequate. This has largely been because of the inability of the distribution business to generate adequate revenues to provide an adequate return or indeed comfort that the services would be paid for! Once again, learning from the past experiences and the need to quickly add significant capacities, the Government of India launched the Ultra

Mega Power Project (UMPP) scheme that identified seven sites for setting up large-scale power plants with each site having a capacity of 4000 MW. The attractiveness of these projects is that it addresses the challenge of fuel supplies head on by either linking the generation projects to captive coal fields or enabling coal imports. Through this move, the Government found a loophole in the Legislation on Coal that allow coal exploration and production by public sector entities alone unless it is for captive purposes. Apart from this scheme, private sector interest is limited to the generation segment with little or no movement in the transmission and distribution businesses.

*Universal Service:* The performance of the country in providing clean petroleum products like LPG, kerosene to the deprived rural populace of the country has been dismal. This has continued to remain so largely because of the reluctance to rationalize subsidies on these products and to ensure an effective delivery system that would result in plugging leakages – it is for this reason that nearly 90% of the rural household continue to depend on biomass energy for meeting their cooking energy needs whereas only the top 25% of Indian population enjoy nearly 70% of the subsidies on these products.

As far as electricity is concerned, the challenge of universal services remains daunting for nearly 400 million people having no access to electricity supply in the country. Under a scheme launched by the Government called the Rajiv Gandhi Gramin Vidyutikaran Yojana (RGGVY), the Government is facilitating the extension of electricity infrastructure to rural areas through a high capital subsidy but linked to the establishment of franchise distribution arrangement at the local level. This particular scheme takes advantage of a provision of the Electricity Act 2003 that has delicensed generation and distribution of electricity in rural areas. The attractiveness of RGGVY schemes lies in its design where in the local level entrepreneur would be allowed to recover tariffs from its consumers on the basis of their ability to pay and require the distribution licensees to provide electricity to such entrepreneurs at those prices. Any loss that the distribution licensee would incur for such supplies would be borne by the larger consumers urban and industrial areas.

*Transport Initiatives:* Recognising the growing role of the transport sector in energy demand, the Government of India has started another scheme JNNURM (Jawaharlal Nehru National Urban Renewal Mission) that is providing support to city bodies to plan their transportation and in-

frastructure in the most efficient manner taking into account size, density and spread of the city. A number of State Governments have now come up with proposals for integrated urban transport system that rely heavily on the development of public or mass transit systems.

## 6 Energy and Climate Change

In the above energy and development scenario, it is highly unlikely that India would commit to any quantitative emission reduction targets. However, faced with the huge challenge of meeting its rapidly increasing energy demand, India is focusing sharply on both energy efficiency improvements as well as tying up energy resources at the global level – either through purchases on the international markets or through equity investments in global assets.

India would also be keenly interested in acquiring clean and efficient energy technologies. However, it would have to be extremely sensitive to the costs of such technologies. The Indian consumers, specially the very large percentage that today do not have an access to electricity, are extremely price sensitive and the Government would need to take into account not only the ability of such people to pay for energy services but also to its own ability to absorb the costs of energy subsidies. Energy subsidies, specially for the deserving, are provided by almost every country in the world – developed or developing. The key difference for a country like India is the fact that it already suffers from the significant fiscal deficit which only in 2007 it was able to bring down. As such, India would be able to more readily accept those technologies that it considers 'affordable' or those that may be made available at concessional terms.

The option of using the clean development mechanisms (CDM) also exists but has thus far been focused primarily on the "low hanging fruit". It would be interesting to look at the possibility of apply the public-private-partnership model towards the financing of clean technologies for a large scale energy production and consumption in the country.

India would also be quite interested in participating in international initiatives to further develop solar and biomass technologies given its large endowments as well as strong technical skills that it has available within.

## 7 India and the "Petersburg Declaration"

As it is apparent from the above discussion, India is almost completely in line with the core principles of the Petersburg action plan with a small differentiation in its approach to climate change and sustainable development. India is clearly pursuing aggressively the path of sustainable development which by itself has been well recognized both in the third and fourth Assessment reports of IPCC (Intergovernmental Panel on Climate Change) as having strong linkages with climate change.

While several of the policies and measures implemented by the Government of India are aimed towards increasing the transparency and stability of the energy markets in the country, political compulsions continue to have a dampening effect particularly on stability of policies. This is one key reason for the lukewarm response of the private sector to the energy sector development in the country.

India is also strongly aligned with the principle of open, transparent and competitive markets with the exception of coal sector. Competitive bidding processes have been introduced in all segments of the other energy sectors. However, a key weak point comes to the fore when such processes run into disputes. What is required in such instances is to have strong and independent dispute resolutions mechanisms. The Government cannot assume onto itself this role – especially when a large part of the energy sector continues to be in the public sector.

In a similar fashion while the dialogue between the Government and the various stakeholders in energy developments have increased substantially as compared to a decade ago, the challenge of informing and educating consumers of energy products and services still remains daunting. This is apparent both in the public consultations held by the Electricity Regulatory Commissions as well those that are part of the Environment Impact Assessment processes in the country.

One key principle of the Petersburg declaration that needs focused attention, relates to the safeguarding of critical energy infrastructures. While it is easy to identify such critical infrastructures on a point basis, India has not undertaken any exercise to identify and prioritise critical points along its networks.

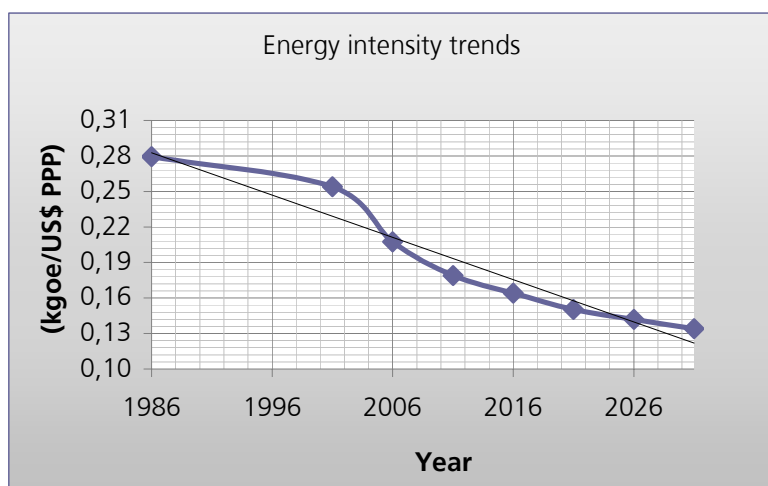
## 8 In Conclusion

The Indian Government has already undertaken or planned for several policies and initiatives that encourage sustainable energy growth – both in terms of improved efficiency of use and in terms of its environmental implications. Several policies and measures have for example focused on improving energy efficiency, enhancing renewable and clean energy forms, bringing about power sector reforms, promoting clean coal technologies, promoting cleaner and less carbon intensive fuels for transport, and addressing environmental quality.

The Indian Government has actively been pursuing a multi-pronged strategy for the promotion of renewable energy sources. Against a target of 3,075 MW, the country added 4,613 MW capacity based on renewables during the Tenth Plan. During the Eleventh Plan period, the MNRE aims to have 10% of grid interactive power generation installed capacity and 4% of the electricity mix based on renewables.

The study of alternative sources of fuels has become increasingly important in recent years. TERI's pioneering work in terms of exploring *Jatropha curcas* as a biodiesel plant and in associating with the National Mission on Biofuels to study the techno-commercial viability of biodiesel production from its seeds constitutes an important step in this area.

As reflected in Figure 6, not only has there been considerable improvement in commercial energy intensity during 1986-2006, but the intensity is

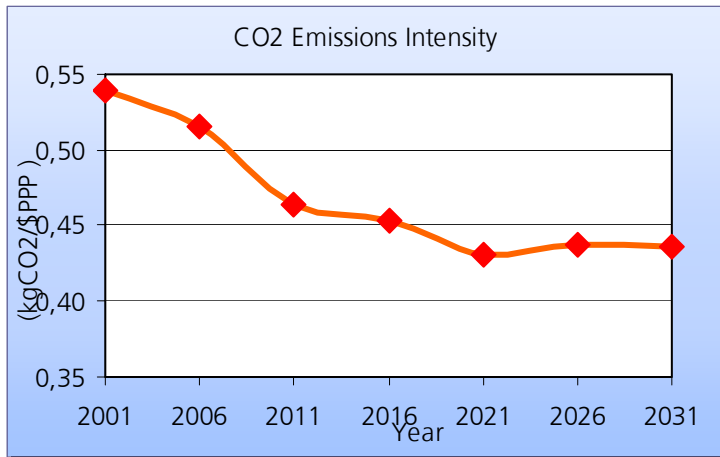


**Figure 6. Energy intensity trends** (Source: TERI analysis)

also likely to improve further if the current plans and policies of the Government are implemented, revealing the decoupling of energy and

economic growth over time in the Indian economy.

Similarly, Figure 7 indicates that despite an absolute increase in CO<sub>2</sub> emissions over time, the CO<sub>2</sub> emission intensity is decreasing with more efficient and cleaner alternative options making their way into the country's energy mix.



**Figure 7: CO<sub>2</sub> emission intensity** (Source: TERI analysis)

There are several examples of efficiency improvements and technological leapfrogging in many of the large industry sectors.

In sum, energy sector developments in India are very much aligned to the Petersburg Declaration but any international processes that could accelerate progress, in line with national priorities and with respect to national sovereignty issues, would be welcomed.

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