

# Challenges of Energy and Sustainable Development in India

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## Abstract:

*This paper seeks to explore the energy challenges of India, the cause and effect relationship between energy and economic development, and the sustainability of its environment for its millions of poor populace. Energy security and sustainable development are critical issues to ensure India's economic growth and its human development objectives. In real sense of the Indian context, the issue of sustainability is larger compared to OECD countries as India has to address the basic needs of teeming millions today, before it can start thinking about tomorrow? India should focus on holistic energy policies, diversification of fuel mix, clean technologies, R&D, energy efficiency, creating awareness and strengthening governance for Sustainable Development at the local and national levels.*

**Keywords:** Economic growth, Energy, India Sustainable development.

## 1. INTRODUCTION

This earth provides enough to satisfy every man's need not every man's greed" said Mahatma Gandhi. Development of India to a large extent depends on the development of its villages. India's GDP growth over the last decade has been unprecedented but at the same time India's ranking in terms of Human Development Index (HDI) as well as Environmental Sustainability Index (ESI) has been dismal. India is an agrarian based economy and 70% of its population still resides in the rural villages. Energy is the prime mover for the growth of Indian economy and in order to ensure adequate energy generation to meet the demand India has to depend on the natural resources indigenously or through imports. The energy consumption of India has gone up manifolds since its independence in 1947. In order to meet its energy needs the country has tried to harness energy from various natural resources including wood, coal,

natural gas, hydro, wind, solar etc. Technological innovation and industrialization has led to the overexploitation of natural resources beyond limits to satisfy the insatiable lust of greed by humans worldwide. Apart from fulfilling their basic needs all have been driven by greed to go to extremes, to lead not just a quality life but an over ambitious, luxurious life? Everyone has become individualistic and materialistic. Quality of life is not just fine; but everyone is interested in a high standard of living. Starting from basic lighting appliances everything in homes has got sophisticated. People love to be in an air-conditioned atmosphere rather than enjoying the fresh natural air. The per capita energy consumption in India is one of the lowest compared to world average but nonetheless it's highly energy intensive and ranks poorly in terms of energy efficiency. Most of the energy generation is based on coal which is again a big contributor towards the green house gas emissions.

## 2. ENERGY CHALLENGES FOR INDIA

Energy is the building block of life. Today the two most important issues facing the world are the energy security and the environmental concerns. Out of the 6 billion people on the earth, around 2.5 billion people still depend on biomass for their daily energy needs. Worldwide OECD countries have had a major contribution towards the energy consumption, but the future demand is predicted to come from mainly non OECD Asia, specifically China and India. With a fast GDP growth rate of these two countries the energy demand has been increasing regularly and this has created great amount of international imbalance with regard to the energy supply and demand gap. The fight amongst the two Asian superpowers to secure energy for their future needs poses serious energy challenges for both of them. Moreover in other developing countries also the demand has been increasing due to their growth in infrastructure, transportation, industries, real estate etc. Across the

countries, America and Europe happen to have high per capita energy consumption. Countries like Japan and Korea also have high per capita energy consumption, but comparatively, the energy intensity is the lowest in these two countries due to their process efficiency, improvement in technology, and energy conservation measures adopted by them. The developing countries on the other hand happen to have very low per capita energy consumption but at the same time their energy intensity happens to be the highest due to inefficiency and lack in technology; India one of the fastest developing countries faces the same problem. This inefficiency further results in high amount of pollution and GHG emissions contributing to global warming and climate change. India today happens to be amongst the largest producers and consumers of energy in the world. The energy use here is highly intensive and happens to be amongst the highest, whereas the per capita consumption of energy is lowest compared to the OECD countries and even most of Asian countries. India today happens to be ranked sixth in terms of energy consumption. The per capita energy consumption of world is 2600, whereas for India it happens to be just over 600 units a year, even much below some of the developing countries. The sad part is that even today about 35% of the population in India lives below 1 dollar per day. India is one of the fastest growing economies in the world with brilliant performance in the 10th Five year plan. The pace of growth unfortunately has not been able to match the supply and demand and as such India is still a net importer of energy. India today imports around 25% of its primary energy. India is highly dependent on imports for meeting its petroleum needs and as such 70% of its petroleum products are imported mainly from Middle East countries. Energy security of late has become one of India's biggest challenges. To mitigate the risk of supply disruption from the Middle East countries, it has started diversifying its sources of fuel from other African countries also. India has also started bidding and buying oil stakes in foreign countries.

India along its border is surrounded by Pakistan, Afghanistan, Nepal, Bhutan, China, Bangladesh and Sri Lanka. Over a period of time rapid changes in the world have taken place causing a metamorphosis in the socio-economic and political environment. The change has been evident in the recent years making it incumbent on the part of every nation to react to events with caution and responsibility. Regional Cooperation with its neighboring countries is crucial for ensuring the availability of required natural resources for meeting its present and future energy needs. Within the country itself the distribution of energy resources is highly skewed and concentrated in few states- Hydro energy is available in North and

North East, hydrocarbons mainly in western region, coal reserves in the eastern region and lignite mainly in the south. The skewed distribution of the resources creates situations of scarcity or surplus seasonally or throughout the year. Indian energy sector is structurally handled by five separate ministries (Coal, Petroleum and Natural Gas, Atomic Energy, Power and Non-Conventional Energy Sources) which work in silos and make independent policy and decisions which are neither optimal nor in the best interests of the country. In order to build the much needed infrastructure for power generation, oil and gas and transportation of energy from the supply point to the point of demand, will require the mobilization of public and private funds within the desired investment framework. The rising energy demand is putting enormous strain on India's infrastructure. Earlier, as mentioned by India's Prime Minister, "India is undergoing a major transformation. Our economy is expanding rapidly. Our financing requirements for the building of massive infrastructure in the next five years are estimated at over \$500 billion". Public funds will not be sufficient to support rapidly growing energy demand and to increase energy access. Also some of the world's biggest banks and private equity funds had announced dedicated infrastructure funds for India, but unfortunately today India's investment program is struggling to find private investors to participate in expanding infrastructure due to the financial crunch.

The term Sustainable Development has various meanings when interpreted from various dimensions of environment, ecology, economics, technology and sociology, cultural and political aspects. The term sustainability would encompass a number of aspects - for business it would mean sustainability of profits and for environment it would mean sustainability of natural resources which can be used by the future generations or has regenerative value. The most pertinent definition and

World well accepted across the globe is that given by Bruntland Report "Sustainable Development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The following lines of former Prime Minister Indira Gandhi, aptly explain the dilemma of all the developing countries. While addressing the United Nations Conference on the Human Environment, at Stockholm in 1972, she said: ...there are grave misgivings that the discussion on ecology may be designed to distract attention from the problems of war and poverty. We have to prove to the disinherited majority of the world that ecology and conservation will not work against their interest but will bring an improvement in their lives. Now in the Indian perspective, where majority of

Indians lie at the bottom of the pyramid living on less than one dollar per day subsistence and are not able to meet their basic needs, the challenge is much larger. These helpless souls are deprived of food, education, safe drinking water, lack basic health and sanitation, are inflicted with the disease of poverty, suffer from malnutrition and maternal and child death. Poverty and a degraded environment are closely interrelated, especially where people depend for their livelihoods primarily on the natural resource base of their immediate environment (S. Bahuguna) The notion of Sustainable Development has been there in India since centuries. Great philosophers and leaders like Mahavir, Buddha, Tagore & Gandhi all believed in the concept of maintaining a healthy and close relationship with Mother Nature. India strongly believes in the Oriental philosophy of being friendly with nature. India worships nature and firmly believes natural resources are the most valuable wealth of humanity. The Constitution of India embodies in itself a greater national commitment to preserve and protect the environment. The Constitution mandates the State to “endeavor to protect and improve the environment and to safeguard forests and wild life of the country.” Since the liberalization of economic policy of India in 1990, India has moved forward from a closely regulated company to a more open economy in terms of better access to goods and services. The emphasis on sustainability has gained momentum as the country has been brought to crossroads wherein it needs to make a tradeoff between the urge for development and to protect the environment from irreparable damage.

### **3. ENERGY & SUSTAINABLE DEVELOPMENT**

India's energy and economic development has a cause and effect relationship. With India being a growing economy, there is external resistance for sacrificing economic growth for the sake of protecting environment in the future. But India needs to keep up the pace of economic growth to ensure the good of its masses. Its initial five year plans mostly focused on the urban development as a result of which there has been no equitable distribution of wealth across the urban and rural or across the rich and the poor. Of late it has veered towards the inclusive growth of the neglected and marginalized sections of society. India needs economic growth and development to free itself from the evil clutches of poverty and hunger. To ensure the desired rate of growth of the economy it also needs adequate energy either indigenously or by means of import. This entails that in order to maintain the required economic growth India would have to exploit the

natural resources in the form of coal, hydro, gas nuclear, and wind. But the challenge is how it can harness the energy resources so as to ensure its energy needs and at the same time make it sustainable for its future generations. Majority of Indians still use traditional fuels such as cow dung, agricultural wastes, and firewood as cooking fuel. India's Integrated Energy Policy Report 2008 lays stress on the energy security aspects as well diversification of its fuel mix coupled with indigenous use of resources to meet its energy challenges and its efforts to raise its level of human development. “India faces formidable challenges in meeting its energy needs and in providing adequate energy of desired quality in various forms in a sustainable manner at competitive prices. India needs to sustain an 8% to 10% economic growth rate, over next 25 years, if it is to eradicate poverty and meet its human development goals”. In order to deliver a sustained growth of 8% through 2031, India would at least need to grow its primary energy supply by 3 to 4 times whereas the electricity supply needs to grow at the rate of 5 to 7 times the present consumption. In real sense of the Indian context, the issue of sustainability is larger compared to OECD countries as we as a nation have to address the basic needs of teeming millions both today as well as tomorrow. Environmental taxes, green taxes, carbon taxes, and subsidies etc. needs to be levied so as to affect choices of end users. India can have differential taxes if they can appropriately reflect environmental externalities. “A consistent application of the polluter pays principle or consumer pays principle should be made to attain environmental objectives at least cost where prescribed environmental norms are either not applied consistently or not being adhered to”. Industries are energy intensive and by simply increasing the energy efficiency by use of technology is important for ensuring its energy security and abatement of pollution. To meet the demand for energy, India has to depend largely upon coal. Coal today accounts for 50% of India's commercial energy consumption and around 78% of the domestic coal production is dedicated to power generation. Coal shall remain the most dominant energy source till 2031-32 and possibly beyond. Coal for instance, will dominate India's energy basket in terms of catering to its present and future needs considering the volatility of crude oil both in terms of price and supply disruptions. By the end of the 15th Plan (Year 2032), India's coal power capacity has to increase to at least 400GW as planned. This would need almost 900 more 500 MW sized plants. The incremental cost alone would be \$104 - 159 billion (around INR 5.55-7.98 trillion), depending on the technology chosen, with annualized investments in the range of \$4-8 billion. (Arunabha Ghosh)

World Hydro has a potential of 150,000 MW in India. Though the contribution to the overall energy requirement is small, its flexibility and suitability to as peaking power makes it very valuable. But along with the exploitation of hydro potential arise the environmental concerns and the problems of resettlement and rehabilitation of project affected people. The issue of resettlement and rehabilitation has often caused great amount of social and political agitation and needs to be handled in a better way to avoid future public outbursts. Nuclear energy offers India powerful means for long term security. It needs to develop its thorium cycle for nuclear power. India and USA recently have signed a historic nuclear deal. This will help India in removing the hurdles that it faced in procuring nuclear fuel and technology in the future. This is a win-win from India's perspective as this will enable India to build more nuclear plants to meet its future energy needs. This will also enable India to reduce its dependence on foreign oil and gas.

Renewable will need to play a greater role to maximally develop domestic supply options as well as the need to diversify energy resources. Solar power, wind energy, biofuels etc will have to play a big role to ensure energy security as well as being environment friendly. If India exploits entire renewable sources, it will be able to meet only 5 percent of its total requirement with the existing technologies. As such renewable can be used as a supplement but not as a supplant. These can be stand alone systems and as such can do well for the rural poor people by providing them with energy for their economic growth as well provide them with means of earning their livelihood. With regard to the energy basket, liquid fuel dominates the basket followed by coal and natural gas. Transportation sector plays a crucial role in creating a huge amount of demand for the liquid fuels as in the present scenario most of the vehicles are designed to run on liquid fuel. With the rising income the urge to own and use one's own vehicle has further added to the problem. Further the energy security in terms of availing the energy resources from energy rich countries is another big challenge due to the risk of volatility either in terms of price or supply. The need is to strengthen regional cooperation and better infrastructure development for safe transportation of the fuel. Transportation has to be more environmental friendly, energy efficient and economical. India has to opt for vehicles powered by bio-fuels, renewable, and electricity and other clean fuels. India has to shift back from road to rail as transporting by rail has huge potentials for saving in terms of not only fuels but it also helps to reduce India's trade deficit and help reduce GHG emissions. Transportation of passengers as well as freight needs to be done through railways. Mass rapid transport

system, surface and metro rails will further have to be promoted for environmental concerns. India needs to establish energy markets so as to optimally utilize indigenous resources and externally trade energy sources to meet the demand at affordable prices with environmental responsibility. The restructuring of the energy sector is urgent in the near future. The restructuring process needs to be strengthened with theoretical knowledge and rich international experience, so as to develop globally competitive, efficient and environmentally compatible operations. Energy Conservation (EC) Act 2001 provides for institutionalizing and strengthening delivery mechanism for energy efficiency services in the country and provides the much-needed coordination between the various entities. Energy saving is a national cause and all the citizens will have to join hands and make all efforts in making India an energy efficient economy and society. This will help make India remain competitive within its own market and also would empower it to compete in the international market. Further, the high level of energy intensity in some of the sectors is a matter of concern. In such a scenario efficient use of energy resources and their conservation assume great amount of significance and is essential for reduction of wasteful consumption and sustainable development. The efficient use of energy and its conservation is in fact recognized as the least-cost option to meet the increasing energy demand. As per estimates, India has a saving potential of more than 25,000 MW annually by adopting energy conservation measures. This saving alone could help India in bridging the present demand supply gap. The energy intensity in India is high compared to the world average and this provides good opportunity for energy conservation measures and energy efficiency initiatives. The Government of India set up Bureau of Energy Efficiency (BEE) in 2002 under the provisions of the Energy Conservation Act, 2001 who assist in developing policies and strategies with a thrust on self-regulation and market principles, within the overall framework of the Energy Conservation Act, 2001 with the primary objective of reducing energy intensity of the Indian economy. This can be achieved with active participation of all stakeholders, resulting in accelerated and sustained adoption of energy efficiency in all sectors. As an example the Case Study of Haryana state in India is worth mentioning with reference to energy conservation initiatives. Haryana Renewable Energy Development Agency (HAREDA) has been designated by the Govt. of Haryana to co-ordinate, regulate and enforce the provision of the said EC Act, 2001 in the State of Haryana. The Haryana Government World has identified energy conservation as one of the thrust areas and many initiatives have been taken in this regard. The

Government of Haryana has issued a comprehensive notification for adoption of various energy conservation measures namely, mandatory use of solar water heating systems, compact fluorescent lamp (CFL) and energy efficient tube lights in government buildings/ government aided institutions/ boards/ corporations, use of ISI marked motor pump sets and accessories and promotion of energy efficient building design in government / government aided Sector. Haryana is one of the first States in the country to adopt comprehensive energy conservation measures to conserve electricity in domestic, commercial, industrial & agriculture sectors along with energy audit of government buildings. The State Government has also ensured that all the new buildings to be constructed after July 2006 in Government/ Government aided sector, will incorporate energy efficient building design concepts including renewable energy technologies to encourage incorporation of Energy Efficient building features in Govt. buildings. HAREDA along with Management Development Institute (MDI) has jointly launched the Bal Urja Rakshak Mission (BURM) to sensitize the school children on energy conservation, renewable energy, climate change, global warming and sustainable development related issues. During 2007-08 the State with its initiative could save 86 MW electricity (which is approximately equivalent to \$100 million) through various energy conservation measures and its contribution was recognized by awarding it with the National Award for Best State Category for its Energy Conservation programme on National Energy Conservation Day, 14th December 2008. India has to invest in Research and Development (R&D) so as to promote energy efficient fuels and machines. India would find it increasingly harder to import the required commercial energy as India's share of the incremental world supply of oil & gas could be as high as 20% since its demand is growing faster than that of industrialized nations. R&D in the energy sector is critical to augment its energy resources, to meet India's long-term energy needs, to attain energy independence, to promote energy efficiency and to enhance its energy security. R&D requires sustained and continued support over a long period of time. The Indian power sector is highly inefficient with unsustainable technical and commercial losses. Subsidy and free power for political gains has often resulted in huge financial losses for the states. The financial losses in the state electricity boards due to high political interference, huge inefficiency in billing and collection, electricity thefts etc. has caused one of the highest technical and commercial losses which is simply unsustainable. The government enacted the Electricity Act(EA), 2003 to consolidate the laws relating to generation, transmission and distribution, trading and use of

electricity and for taking measures conducive to the electricity industry, promoting competition therein, protecting interest of consumers and supply of electricity to all areas, rationalization of tariff, ensuring transparent policies regarding subsidies etc.

The Electricity Act has been instrumental in introducing significant changes in the overall electricity industry structure of India. India's household consumption has increased drastically and it's important that energy efficiency, and conservation forms a part of the consumers life. The biggest challenge is to provide electricity and clean fuels to all, particularly rural populations. The Indian government has come up with the National Action Plan for Climate Change (NAPCC) in 2008, which outlines the national strategy to enable the country to adapt to climate change and enhances the ecological sustainability of India's development path. The action plan mentions eight missions for mitigating climate change including use of solar energy, adopting energy efficiency measure, sustainable habitat etc. Though the initiative for the NAPCC is commendable it suffers from the fact that there is no timeline mentioned for its implementation. The integrated energy policy, 2008 lays focus on sustainable development by promoting energy efficiency, renewable energy, encouraging mass transportation, implementing afforestation, enforcing pollution abatement, rationalizing tariff energy pricing, use of CDM, clean fuels and technologies. Concern for the threat of climate change has been an important issue in formulating the energy policy. Even though India is not required to contain its GHG emissions, as a signatory to the UN Framework Convention on Climate Change and a country where the impact on its poor due to climate change could be serious, this policy has suggested a number of initiatives that will reduce the green house gas intensity of the economy. These are- energy efficiency in all sectors, emphasis on mass transport, active policy on renewable energy including bio-fuels and fuel plantations, accelerated development of nuclear and hydroelectricity, technology missions for clean coal technologies and focused R&D on many climate friendly technologies.

#### **4. CONCLUSION & RECOMMENDATIONS**

The absence of holistic energy policies as well as the lack of effective leadership and political will has not resulted in the desired outcomes for India as far as energy and sustainable development is concerned. Primary concern is to supply to the poor people in the form of clean fuel. More focus should be on supply of subsistence level of energy. The five

separate ministries should be integrated into one Energy Ministry so as to frame holistic policies for the best interests of the nation. To ensure sustained GDP growth India has to grow its primary energy and electricity supply manifold. India in the last few years has come out Energy Conservation Act 2001, consolidated Electricity Act 2003, National Action Plan for Climate Change and the Integrated Energy Policy 2008 which are the right steps as far as government policies are concerned. But, the ineffective enforcement of law is the main lacunae and needs to be strengthened to ensure effectiveness of the policies. Adequate technologies and allocation of funds for energy related R&D needs to be promoted for developing indigenous solutions which are typical to India. The country should explore and invest in new energy technologies like gas hydrates, coal to liquid, Coal Bed Methane (CBM) etc. India should make use of novel technologies to extract coal efficiently which is economically viable and sustainable. India will also need to seek new and clean coal technologies so as to tap its existing coal reserves which are at present difficult to extract economically using the available conventional technologies. The lack of energy transportation and distribution infrastructure needs to be addressed. Adequate port and shipping facilities needs to be built. Public investments alone cannot meet the growing infrastructure demands for power generation, oil and gas and transportation of energy. The government has to make efforts to attract private capital into infrastructure. An important step in these initiatives would help achieve the objectives of high economic growth coupled with equity on a sustainable basis. With the worst financial downturn in the history, India needs to put in extra efforts so as to tide over this financial tsunami. As of now managing energy and making adequate investments in the infrastructure sector could be an opportunity worth pursuing to get itself out of the recession and to enable it to achieve energy secured future. The regulatory mechanism needs to be improved drastically. The regulator needs to be empowered so as to facilitate creation of markets and setting up of effective tariffs. The pricing mechanism in the energy sector is distorted and also there is an irrational tax structure for the petroleum and diesel products which makes the business unsustainable. The pricing and the tax structure as such needs to be rationalized to make the energy sector financially viable and sustainable. In order to improve energy security, India needs to adopt energy efficiency measures, go for Demand Side Management in the entire value chain and reduce import dependence by domestic fuels. Energy efficiency is important from cradle to grave as most of the processes are highly energy intensive. India should also go abroad and acquire some oil fields. Being a late starter, India lost

many overseas acquisitions to China. India has already started planning for Strategic Oil Reserves (SOR), but it's pertinent that the plan for SOR be implemented at the earliest so as to further mitigate risks against supply disruptions and price volatility. Village is the nucleus of economic development as far as India is concerned. Keeping in view the millions living in the villages and thriving on conventional fuels for cooking and lighting, the Ministry of Environment and Forests who is entrusted with the issues related to Sustainable Development needs to take up the challenge of meeting their objectives in a time bound manner. Basic education which promotes functional literacy, livelihood skills, understanding of the immediate environment and values of responsible citizenship is a precondition for sustainable development. Such education must be available to every child as a fundamental right, without discrimination on the basis of economic class, geographical location or cultural identity. Several traditional practices that are sustainable and environment friendly continue to be a regular part of the lives of people in developing countries. These need to be encouraged rather than replaced by more 'modern' but unsustainable practices and technologies. (S. Bahuguna) Further the sustainability of the natural resource base can be ensured by recognizing the role of all stakeholders, and by strengthening governance for Sustainable Development at the local and national levels. India further needs to strengthen its health care systems so as to avoid environment related health risks. The Planning Commission of India who has outlined Human Development Goals in line with the UN Millennium Development Goals is highly ambitious and as such special focus needs to be there to ensure its effective implementation. Energy policies are in place and there needs to be an increased importance of Sustainable Development discourse in public policy. India has to have successful environment policies to protect the earth's ecosystem, there has to be more participatory approach for fighting the global menace and each and every individual needs to think green. India's high rise in energy consumption and unprecedented economic growth has to be sustainable in the sense of catering to both present and future needs of people acknowledging the fact of limited potential of the Earth to regenerate. For India, the best approach for economic growth and sustainability of its environment is to adopt clean energy efficient technology along with energy conservation measures to ensure sustainability of the planet in the years to come.

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