

## **Clean energy as a Reality in India**

Manas Ranjan Panda<sup>1</sup> & Ardhendu Sekhar Nanda<sup>2</sup>

### **Abstract**

Quest for clean and green energy is still a nightmare for India. Situations on a day to day basis changes with advance technologies and hence, it affects the life of people in a significant manner. Sustainability should be maintained and therefore, renewable sources are seen as the source of clean energy. There is no bargain or embarrassment faced by the ecology in the process of extracting energy which protrudes the need for it being desperate. The CSR (herein referred to as Corporate Social Responsibility) of a particular firm in the Clean-Energy sector will also be very satiated with the performance of its firm as it is equalized with the good activities for promoting the low-carbon-concept. Thus, there is an overall profit and the symbiotic relationship between humans and nature would continue for a longer period of time which is efficacious. The bottleneck on the path is the economic condition as well. It can be assessed and judged on the country's development and the prospective strategy taken to govern the ecology. The demolition and dilapidated condition of the nature in the name of evolution has overwhelmed the necessity of renewable and "no-emission" theory. Making the judiciary come to play in the middle, it shows up the advisory jurisdiction from the National Green Tribunal for the cases against the damage to nature as in the water pollution by the industrial effluents in the riversides, air pollution in the industrial belts and a lot more. Rectification in the form of greenery has to be put up with investments in smart grid systems denoting the efficient energy plans and promoting the individual concept of energy production will introduce a concept of prosumers, both producers and consumers. This can help to solve a lot many issues which will again provide a green home.

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<sup>1</sup>Student, KIIT School of Law; Kalinga Institute Of Industrial Technology.

<sup>2</sup>Student, KIIT School of Law; Kalinga Institute Of Industrial Technology.

## **Introduction**

Clean energy is the form of renewable energy which is proved to have more energy intensity and less pollution causing capacity which is a kind of beneficiary for our ecology. The environment is polluted out of levels. People can't breathe pure or drink pure and hence, the age of human beings is on a huge problem. Every moment, the hue and cry for energy runs across the globe and hence, it formulates the requirements of the deep invasion of our ideas to formulate the needs of clean energy. To strive the growth and development, we need to step for the earthly resources available in a chunk and hence, production can be on a progressive basis. Efforts taken are for the survival and sustenance of the organisms and putting a future portrayal of the limited resources in the planet, we have to follow and create new footsteps. Increasing prices, scarcity of water and clean air and a lean economic growth shows the disloyalty and disaffection towards to nature. The major effect is by the CO<sub>2</sub> emissions and this has effects like increasing temperature on Earth, increasing sea level and many more. Incurable process of outputs and blind methods to run for energy and luxury has landed upon this stage, where Fire is competing against Water just as in the like poles repel each other. It may seem fashionable to deregulate and privatize all forms of available energy for the industrial growth and profit, but, it doesn't seem so to be like that. Arrays created for the poor performance and stagnant prices won't entertain in the future. As a consideration and friendly point of view in between various nations across the world, we need to formulate and run the various energy policies which can help to run a green and safe planet.

## **Non-Renewable Energy vs. Renewable Energy**

Oil surplus, low prices and the extravagant and increasing use of energy are in stark contrast to efforts to control and reduce carbon dioxide emissions to try to mitigate destabilization of the weather machine. Over-optimistic assessment of the potential for renewable energy and disaffection with nuclear energy will plunge hopes of reducing carbon dioxide emissions unless capital instruments such as carbon taxes are introduced and society's attitude to clean energy consumption reversed. By the middle of the next century oil, and probably gas, will be running into short supply and reducing carbon dioxide emissions will have become a stark necessity. 'Clean energy', that is a mix of renewable and nuclear energy will become the way ahead.

There seems to be a surplus of fossil fuel energy at present but every year the world consumes fossil fuels that took two million years to form and 20% of the world's population consume 80% of world energy. In the developing world fuel, wood, a non-commercial form of energy, provides high percentages of overall energy demand. Yet this renewable fuel source is now running out in parts of India, south-east Asia and South Africa. One of the perpetual problems of our times is fuel poverty. One-third of the world's population is in the fuel poverty trap; they do not have a connected electricity supply and neither do they have safe drinking water. Emissions from fossil fuels are polluting the world. The damaging effect of this kind of pollution can be seen on the Taj Mahal where the brilliant white marble is turning yellow due to emissions from a petroleum plant. The difficulty here is that the polluter doesn't pay. Perhaps the most disturbing pollution emission from burning fossil fuels is carbon dioxide. This is responsible for some 60% of the greenhouse effect. The result of global warming, according to the latest report of the International Panel on Climate Change, will be a steady 0.2 to 0.3 C rise in global temperature each decade. There will be an associated 5-8cm rise in sea level each decade. Increase in extreme weather incidents such as hurricanes and storm surges are already evident. The carbon dioxide problem was discussed in Kyoto in 1997 and a protocol developed which involves reducing CO<sub>2</sub> emissions. The US is a particular culprit where 5% of the world population emits 25% of world CO<sub>2</sub>. The UK is committed to a 20% reduction. This will be extraordinarily difficult to achieve and even then hardly begins to attack the problem. To restore the atmosphere to its pre-industrial immaculate state will require strict legislation and policing. It is the steady increase in temperature, going hand in hand with a steady buildup of CO<sub>2</sub> in the upper atmosphere, which is beginning to destabilize the weather machine.

Renewable energy Worldwide some 19% of world energy is renewable; 12% comes from biomass, 6% from hydro and around 1% from the new renewables, solar, wind and so on. Hydro power provides about a sixth of world electricity, as does nuclear energy, both without generating CO<sub>2</sub>. Hydroelectricity requires large up-front costs when new dams are to be developed. The Three Gorges Dam, on the river Yangtse in China, is a good example. It will cost \$25bn but once built, it will generate 18,000 megawatts of power and will be a formidable supplier of electricity in the Chinese market. Although hydro-electric power appears to be benign, every now and again dams burst causing extensive loss of life and the fishing lobby also campaigns against the building of hydro-electric stations. Wind power has a high profile but it is not acceptable in some countries due to the environmental impact of

large numbers of wind turbines. Growing crops for fuel is an interesting possibility. Rape seed and flax are possible fuel options and can be used after some chemical treatment as diesel fuel but it is expensive. In this particular case extremely expensive when compared with diesel fuel from crude oil. There is some hope however, that genetically modified plants will provide bio diesel at realistic prices. One of the most concentrated forms of renewable energy is wave energy.

This will really affect the plans for the future of India.

### **India's Energy Challenges**

India is a rapidly expanding large economy and faces an alarming challenge to meet its energy needs in a responsible and sustainable manner. To sustain India's 8% average annual economic growth and to support its growing population, India needs to generate two to threefold more energy than the present (IEA 2007b). This means an increase in energy supply from 542 million tons of oil equivalent in 2006 to 1,516 million tons of oil equivalents in 2031-2032 (GOI 2006a). The nature, dimensions, and complexities of achieving this challenge are analyzed based on the present energy capacity, context, and potential.

The country is rich in coal and abundantly bestowed with renewable energy in the form of solar, wind, and hydro generated energy, bio energy, and large reserves of thorium. Unfortunately, reserves of hydrocarbon, gas, and uranium are meager. At the current level of production and consumption, India's coal reserves are estimated to last more than 200 yr. India is currently the third largest coal producing country in the world (behind China and the USA) and accounts for about 7.5% of the world's annual coal production (IEO 2008). India is also currently the third largest coal-consuming country (behind the China and the USA) and accounts for nearly 9% of the world's total annual coal consumption (MoC 2009). More than half of India's energy needs are met by coal, and about 80% of India's electricity generation is now fueled by coal. The annual demand for coal has been steadily increasing over the past decade. Despite a production increase from 70 million tons in early 1970s to 456 million tons in 2007-2008 (CIL 2009), India continues to face shortages of high quality coal for steel manufacturing (44 million tons in 2007-2008) which is imported. Over the last 7 yr, imports have doubled from 20 million tons in 2000-2001 to 44 million tons 2007-2008 and are expected to triple in 2030 (EIA 2008).

The country has made significant progress toward the augmentation of power infrastructure with an installed capacity of 147,457 MW as of January 2009. Of this, 93,392 MW is accounted for by thermal power plants (coal, gas, diesel), 36,762 MW by large hydroelectric plants, 4,120 MW by nuclear, and the remainder from renewable sources (CEA 2009). Despite the significant growth in electricity generation, significant problems persist, such as poor quality, power shortages, load shedding, fluctuating voltage, erratic frequency, and frequent power cuts. On top of this, currently 400 million Indians are reported to have no access to electricity (IEA 2007b). Even after the signing of a nuclear cooperation treaty with USA, India's nuclear contribution to the energy mix is at best expected to be 3-4% unless vast thorium resources are exploited. It is estimated that India has only 0.4% of the world's proven reserves of crude oil. The production of crude oil in the country has increased from 6.82 million tons in 1970-1971 to 34.12 million tons in 2007-2008 (MoP 2009). However, India's oil consumption increased by 5.7% per annum from 1980 to 2001 periods to 11.9% from 2001 to 2006, and it now stands at 156 million tons, or 3% of global oil consumption (IEA 2007b; MoP 2009). In India, oil provides energy for 95% of transportation needs and the demand for diesel is fivefold higher than the demand for petrol. Over 80% of passengers and about 60% of freight are transported by road. With the increased economic growth and expendable income over the last two decades, demand has also increased for all transport services by road, rail, and air. Vehicle ownership has increased, with the number of private motor cars growing by 16%, two wheelers by 20%, and goods vehicles by 13%/yr from 1991 to 2003. The latest available statistics indicate that the total number of vehicles has increased more than threefold, from 1991 to 2007-2008 and projected to grow by 12-15% reaching 373 million in 2035 (Fig. 1). This growth is expected to fuel 5-8% in the demand for petroleum-based energy in India (GOI 2006b; MoP 2009)

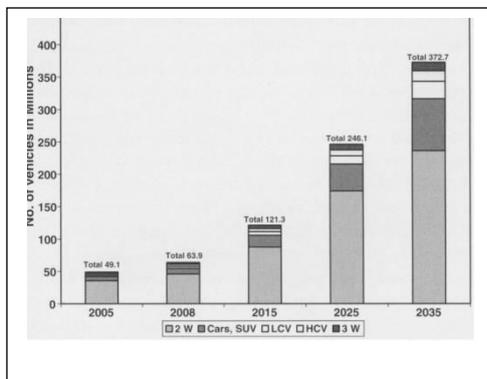


Figure 1. Projected growth of automobiles in India. 2W motorcycles, 3W 3 wheeler, HCV heavy duty commercial vehicle, LCV light duty commercial vehicle, SUV sport utility vehicle

In India, natural gas is currently a minor fuel in the overall energy mix, representing 10% of total primary energy consumption in 2008. Natural gas demand has been growing at the rate

of about 6.5% during the last 10 yr. Industries such as power generation, fertilizer, and petrochemical production are shifting toward natural gas. Although recent discoveries are expected to boost gas production to bridge a growing share of gas requirements need to be met by imports.

Today, India has one of the highest potentials for the effective use of renewable energy (Table 1). India is the world's fourth largest producer of wind power after Denmark, Germany, and Spain. There is a significant potential in India for generation of power from renewable energy sources such as small hydro (less than 25 MW), biomass, and solar energy. The country has an estimated small hydro power potential of about 150,000 MW. India produces 13,242 MW renewable energy excluding large hydro power (MNRE 2009) representing 9% of total electricity production. Other renewable energy technologies, including biomass, wind, solar, small hydro (less than 25 MW), bagasse and waste to energy are also growing.

Despite increasing dependence on commercial fuels, sizeable quantum of energy requirements (40% of total), especially in the rural household sector, is met noncommercial energy sources, which include fuel wood, crop residue, animal waste, and human and draft animal power. Regardless of the progress achieved after national independence, around 86% of rural households and more than 20% of urban households still rely primarily on traditional fuels to meet their cooking needs. Biomass the domestic fuel used for cooking and consists of mainly of agricultural waste, gathered woods, and cow dung. Biomass is also used as industrial fuel by small cottage industries. The use of traditional fuels continues to cause health problems arising from indoor air pollution. India also has a 40-yr-old biogas program with 3.7 million installed plants providing energy requirements for the rural households; however, only half of these are in use.

### **Energy Demand and Supply**

Table summarizing the electricity demand and supply in India<sup>3</sup>

Fiscal Year (FY)	Energy	Peak Demand
	(MU)	(MW)

<sup>3</sup>Central electricity authority (CEA), Government of India.

	Demand	Availability	Shortage	%	Demand	Met	Shortage	%
2002-03	545,983	497,890	48,093	8.8	81,492	71,547	9,945	12.2
2003-04	559,264	519,398	39,866	7.1	84,574	75,066	9,508	11.2
2004-05	591,373	548,115	43,258	7.3	87,906	77,652	10,254	11.7
2005-06	631,024	578,511	52,513	8.3	93,214	81,792	11,422	12.3
2006-07	693,057	624,716	68,341	9.9	100,715	86,818	13,897	13.8
2007-08	737,052	664,660	72,392	9.8	108,866	90,793	18,073	16.6
2008-09	777,039	691,038	86,001	11.1	109,809	96,785	13,024	11.9
2009-10	830,594	746,644	83,950	10.1	118,472	102,725	15,747	13.3

However, the Indian Power Ministry has been trying to increase its generating capacity by adding to it every year.

Generating capacity addition during the Tenth Plan (2002-2007) & Anticipated generating capacity by the end of the Eleventh plan (2007-2012) (in MW)<sup>4</sup>

	Hydro	Thermal	Nuclear	RE	Total
Installed Capacity as on 31 March 2002	26269	74429	2720	1628	105046
addition during 10th plan	7886	12114	1080	6132	27212
Installed Capacity as on 31 March 2007	34654	86015	3900	7760	132329
Proposed addition during 11th plan	15627	59693	3380	14000	92700
Total capacity anticipated as on 31 March 2012	50281	145708	7280	21760	225029

### **Energy laws in India**

<sup>4</sup>Planning Commission, Government of India, available at [www.planningcommission.nic.in](http://www.planningcommission.nic.in).

Energy is neither created nor destroyed and hence, conservation of energy for the future sense of action is a pretty big deal as we can save it judiciously for the future. Similarly, Laws are necessary for the proper restrictions on the use of resources. The fundamentals of federal energy laws in a state is pretty necessary whether it may be Atomic and Nuclear Energy or the Thermal Energy or anything else. Comparing the Ecology, and the effects of production of energy, we have many pros and cons when we deal with the economic development of a country as well.<sup>5</sup>

Energy laws are not very strict in India and it just includes the Electricity Act, the redressal in the Tribunal and Regulatory Commissions. Although, being enriched with an efficient structure to energy deals, still then, there are a lot of legal issue running through the line of it. The Electricity Act was followed by the Electricity Regulatory Commissions Act in 1998, which mandated the creation of the Central Electricity Regulatory Commission (CERC) and state electricity regulatory commissions (SERC). The CERC is mainly a regulatory body, in contrast to CEA which is mainly an advisory body. Both CERC and SERC have certain advisory functions to foster competition, efficiency and investment even after their primary functions. The Electricity Regulatory Commissions Act was followed by the Energy Conservation Act in 2001. This Act mainly provided for the establishment of the Bureau of Energy Efficiency (BEE). BEE was constituted to reduce the ‘energy intensity’ of the Indian economy. One of the key functions of BEE is to provide policy framework and direction to national energy efficiency and conservation efforts and programs. The products and appliances are also seen BEE rated showing the efficiency. This helps to boosts up the judicious use of energy in law in various sectors. Even if, the types of renewable energy sources are to be given a thought for a clean environment. In 2003, the Electricity Act was enacted, which regulates generation, distribution, transmission and trading in power. It replaced the legislation that are mentioned above, such as the Indian Electricity Act, 1910, the Electricity (Supply) Act, 1948, and the Electricity Regulatory Commissions Act, 1998. CERC has been granted its quasi- judicial status under section 76 of the Electricity Act. From a regulatory point of view, CERC is a key player in the Electricity sector. CERC press releases and orders are the key to understand regulations in the Indian power sector.

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<sup>5</sup>Odom, Howard T, “*Energy, Ecology, and Economics.*” *Ambio*, vol. 2, no. 6, 1973, pp. 220–227. *JSTOR*, JSTOR, [www.jstor.org/stable/4312030](http://www.jstor.org/stable/4312030).

The FDI in the energy sector has increased rapidly and has seen a sea change in the recent years. The tax and policy incentives taken by the Government has helped a lot to the Solar and Wind Sectors.<sup>6</sup> The energy produced in Gigawatts has helped to run a million homes, even also the FDI market has also increased helping to boost up the startups and economic development. The churn of the startups has lessened denoting profits and the legality of the firms has increased showing the ease towards business related to energy sector.

## **Role of Government**

### **Ministry of Power<sup>7</sup> is responsible for:**

- i) General Policy in the electricity sector and issues relating to energy policy;
- ii) Matters relating to hydroelectric (except small/mini/micro hydro projects of and below 25 MW capacities) and thermal power, and the transmission system network;
- iii) Research, development and technical assistance relating to hydro-electric and thermal power, and the transmission system.
- iv) Administration of the Electricity Act, 2003, the Damodar Valley Corporation Act, 1948 and the Bhakra Beas Management Board as provided in the Punjab Re-organisation Act, 1966;
- v) Matters related to both the Central Electricity Authority and the Central Electricity Regulatory Commission;
- vi) (a) Rural Electrification, (b) Power Schemes in Union Territories, and issues relating to power supply in the States and Union Territories;
- vii) Administrative control of Public Sector Undertakings, Statutory and Autonomous Bodies functioning under the Ministry;
- viii) Other Public Sector Enterprises in energy except projects specifically allotted to any other Ministry or Department;
- ix) All matters concerning energy conservation and energy efficiency pertaining to the sector.

### **Ministry of new and renewable energy<sup>8</sup>**

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<sup>6</sup>Oliver Gonsalves, India's Solar and Wind Power Industries: Scope for Investors, March 15, 2018, <https://www.india-briefing.com/news/india-solar-wind-industry-scope-investors-16346.html>/<https://www.india-briefing.com/news/india-solar-wind-industry-scope-investors-16346.html/>.

<sup>7</sup>Ministry of Powers, Government of India, available at [www.powermin.nic.in](http://www.powermin.nic.in).

<sup>8</sup>Ministry of New & Renewable Energy, Government of India, available at [www.mnre.gov.in](http://www.mnre.gov.in).

MNRE is the nodal Ministry of the government of India for all matters relating to new and renewable energy and the administrative ministry for policies and programs in this area. The Ministry itself is organized into several parts dealing with different technologies and applications.

The programme of the ministry is largely implemented through State Nodal Agencies. All major States have set up energy agencies for the non-conventional energy programme.

### **Ministry of coal**

It is accountable for policies and strategies with respect to investigating and developing coal reserves, approving important projects and determining related issues.

### **Ministry of oil and gas**

It has the overall responsibility of exploration and production of oil and gas, along with their refining, distribution and marketing, import, export, and conservation.

### **Planning Commission**

The Power and Energy, Energy Policy and Rural Energy Division of the Planning commission guides the energy policies of the country.

### **Central electricity authority (CEA)**

The CEA assists the Ministry of Power in all the technical and techno-economic matters.

### **Government agencies**

#### **Indian Renewable Energy Development Agency (IREDA)**

The IREDA was established in 1987 as a non-banking financial company under the administrative control of the Ministry of Non-Conventional Energy Sources (MNES), to provide loans for renewable energy projects. Subsequently energy efficiency and energy conservation projects were added to its portfolio.

#### **Bureau of energy efficiency (BEE)**

The BEE, entrenched under the Energy Conservation Act of 2001, has launched labeling requirements and building codes to reduce the energy intensity of GDP growth. For instance, the Energy Conservation Building Code (ECBC) is aimed at maximizing energy

utilization in commercial buildings, by using Leadership in Energy and Environmental Design (LEED) certification standards, and customizing buildings based on location temperatures. The BEE consists of ministers from Central and State energy-related agencies. The BEE is working with key industries, including cement, aluminium, and paper and pulp, to establish voluntary EE practices. It is also drafting standards for energy labeling, building codes, and certification programs, among other initiatives.

In February 2011, India's Bureau of Energy Efficiency (BEE) adopted new quality standards for solid state lighting, a process greatly accelerated as a result of SEAD, facilitated technical exchange between BEE and the United States Department of Energy. These standards are in the process of being notified through the Bureau of Indian Standards. In March, India also launched new internationally harmonized efficiency labels for laptops, drawing from the Energy Star programme.

### **Suggestions and Advices**

India's Policy can be widely stretched to a longer thing and yet, this is an astronomical touch. The profound works done by the researchers and other agents towards the efficiency in consuming energy is helping a lot. With that level of care and concern, signing multi-lateral agreements with different sectors regarding the judicious use of energy and also formulating pacts with private companies who focus in these industries. Mostly, the success is achieved by the solar power and the industrial affairs related to it. India has to achieve 20,000 MW of solar energy as estimated this year. The companies as in Adani Solar, SunEdison Energy, Renew Power and a lot many more.<sup>9</sup> India has witnessed the International Solar Alliance (ISA) Summit and it was announced there, a Project Preparation Facility (PPF) has been set up by India to guide its development partner countries towards preparation of viable projects that can be considered for concessional financing under Lines of Credit. The PPF fills the capacity gap in identifying a need, conceiving a project and preparing a proper proposal. Delhi Solar Agenda was passed after this and it was seen that ISA summit has enhanced many points and started affordable finance, access to appropriate, clean and environment-friendly technology and undertake capacity building, including forging mutually beneficial partnerships with reputable international institutions and reputable financial institutions for the benefit of

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<sup>9</sup>Anindya Upadhyay, *India solar goal has a secret weapon: Rooftops of small business*, Mar 06, 2018, Economic Times.

developing countries. To a positive response, many startups were encouraged to set their feet in this industry and help in the promotion of Green Energy.

The philosophical steps can be taken by the people itself by respecting the Mother Earth and using the resources judiciously. We all know, within the boundaries of law, people need to analyze the use of law and act within it in good faith. To give effect to the government policies, various procedures and laws have been initiated which include statutory stringent regulations, development of environmental standards, control of pollution generated through vehicles, spatial environmental planning including industrial estates and looking throughout the world. The policies made for protection of environment from pollution by adopting means of renewable energy has to be promoted by us. It lays emphasis on preventive aspects of the future time and hence, it can be concluded that countries won't be compared in the terms of cleanliness, life expectancy and all can be put on the same line with no discrimination and a happy social life.