



### Assessing the Ample Scope of Renewable Energy Sources in Rural India

#### Abstract:

*Renewable energy is the only option left for the developing countries to tap so as to fulfill their energy requirements at a low cost and complying with ecological norms. India, as a major developing nation and the to-be super-power of the 21<sup>st</sup> century, needs to concentrate on tapping of renewable energy sources efficiently, effectively and at the earliest. A huge amount of budget expense is spent after the extraction and refinement of non-renewable energy resources like crude oil, natural gas, etc. which cause a lot of ecological pollution. Preventive measures are taken to avoid the hazardous effects of such pollution but they are too costly for developing and highly populated nation like India.*

*India is a nation of villages where about 70% of its population resides. Even today they live in the lap of the Nature and utilize it to the optimum so as to fulfill their energy requirements. Most of them use resources, which are less efficient and causing health problems. There are number of renewable energy resources available in rural India, which can solve the problem of energy requirement without causing any ecological or hygienic problems.*

*This research paper makes an attempt to list such resources which are found in majority of the Indian villages' viz. cow-dung helping in formation of bio-gas, use of sun's energy i.e. solar energy, and use of water resources i.e. hydro energy. The main intention behind selection of only these resources is the amply availability of them in probably each and every village of India. With this, the cost-effective factor is also important in selection of these renewable energy resources. Through some figures relating to the economic parameters, this research paper attempts to show that long term investment in above resources is more fruitful than short term investment in non-renewable resources, which is presently carried out by most of the developing nations, including India.*

#### Introduction:

अस्यांप्रसूतौलेखिकावेदेभ्यःपर्यवरणविज्ञानस्योद्भवमसप्रमाणांप्रदर्शयतिदैवीप्रकृतिःऋतुरहस्यंप्रपच्चविभगपुथिव्यादिभुतानांसम्प्रत्ययःयज्ञस्यावधारणाइत्यादियन्विषयान्प्रतिपाद्यपर्यवरणसंरक्षणैतेषांस्थानंचविवुणोतिप्रस्तोत्री

Indian villages are a plethora of renewable energy resources. The Goddess Nature is too merciful to these people in providing them these resources. But with this, they face an acute problem of its utilization. In fact, the entire Indian sub-continent is largely depended on non-renewable energy resources to fulfill their energy requirements. The biggest disadvantage of these non-renewable resources is their limited supply as compared to the unlimited demand for the same. **With this**, the cost of procuring such resources, distilling them, dealing with the hazardous effects due to their usage, etc. enlarge the catalogue of their demerits. India, a rapidly developing country, needs energy resources to fulfill its ever-increasing demands so as to attain the status of **ECONOMICALLY DEVELOPED NATION**. As the non-renewable resources carry so much of demerits with them, it is necessary for India to look towards the renewable resources and tap them in a proper way so as to fulfill its energy requirement with optimum economic cost and minimum ecological hazardous.

#### NON-RENEWABLE ENERGY RESOURCES:

According to Investopedia.com, 'A resource of economic value that cannot be readily replaced by natural means on a level equal to its consumption is called as NON-RENEWABLE ENERGY RESOURCE.' Most of the fossil fuels like coal, crude oil, and natural gas are considered as non-renewable energy resources. As their formation takes billions of years, their

use is continuous and hence they will deplete from the Earth in near future. For instance, the total coal available in the world may last for another half a century or so.

The non-renewable energy resources are available in the form, which prevents its direct use. For instance, crude-oil is available in the form which is not used directly. It needs to go through a number of distillation or refining process so as to be made usable. They are made of hydrocarbon compounds. Their burning results in release of the carbon into the atmosphere of the Earth. Thus, a huge amount of budget expense is spent after the extraction and refining of the non-renewable energy resources, which cause a lot of ecological pollution.

#### **HAZARDS OF NON-RENEWABLE ENERGY RESOURCES –**

The burning of coal results in emission of carbon and sulphur in air, which becomes polluted. With this, the ash particles pollute not only air but the water resources also in the proximity. The extraction of Natural Gas requires use of huge amount of water with chemicals like benzene, toluene, xylene,, etc. which pollute the atmosphere. With this, all fossils consist of Methane Gas, which has high composition of Carbon, a greenhouse gas. Burning fossil fuel produces large amount of greenhouse gases. They are responsible for the rising temperature of the Earth, popularly known as **“Global Warming”**. This damages the Carbon Budget of the Earth. The result is Global Warming, rising levels of sea-water, flash-floods, drastic changes in rainfall and seasonal patterns, acid rains, etc.

According to the BBC, China’s one-third part is facing the problem of acid-rain. ([www.news.bbc.co.uk](http://www.news.bbc.co.uk)) According to New York Times, ACID rain falling on the Yucatan peninsula and much of southern Mexico is fast bringing destruction to the temples, colorful murals and aunting megaliths of the ancient Maya civilization, art historians and archeologists say. (Wilford, John Noble.). According to a report of World Bank Group, Bangladesh as one of more “potential impact hotspots” threatened by “extreme river floods, more intense tropical cyclones, rising sea levels and very high temperatures”. Cyclone Sidr exposed 3.45 million households to inundation. A potential 10 year return cyclone in 2050 could expose 9.7 million people to more than 3 meters of inundation affecting agriculture and lives. ([www.worldbank.org](http://www.worldbank.org)) A number of islands are under the threat of being completely submerged under sea-water – Kiribati, Maldives, Seychelles, Torres Strait Islands, Tegua, Solomon Islands, Micronesia, Palav, Cateret Islands, Tuvalu, Bangladesh, etc. The price for this destruction is beyond human calculation. No government, no company, no end user of the fossil fuels ever pay for their price. The pricing of the non-renewable energy resources does not take into account the ecological cost. For instance, the components of petrol price in India are:

Fuel Component + Central Taxes like Excise Duty and Customs Duty + State Government Taxes like VAT + Commission of the Agent. (Data according to a 2011 Question and Answer Session in Parliament), absolutely no one charges the cost of environmental damage nor anyone realized.

The damage to ecological is nearly irreparable in most cases. For instance, the oil spill in seas and oceans leading to death of the fishes and other seas creatures, the destruction of trees and other vegetation so as to extract coal, etc. costs much to the environment. No one realize this unless there is any hazardous incident or any natural disaster like Earthquake, Tsunami due to it. Preventive measures are taken to avoid the hazardous effects of such act which are too costly for a developing and over populated nation like India.

#### **RENEWABLE ENERGY RESOURCES**

Renewable energy is the only option left for the developing countries to tap so as to fulfill their energy requirements at a low cost and complying with ecological norms. India, as a major developing nation and the to-be super-power of the 21<sup>st</sup> century, needs to concentrate on tapping of renewable energy sources efficiently, effectively and at the earliest.

#### **DEFINITION OF RENEWABLE ENERGY RESOURCES**

Renewable energy is energy obtained from sources that are essentially inexhaustible (Bureau of Energy Efficiency). Examples of renewable resources include wind power, solar power, geothermal energy, tidal power and hydroelectric power. The most important feature of renewable energy is that it can be harnessed without the release of harmful by products.

According to the ancient Indian Philosophy, all things are made up of the five elements. Earth, Sky, Water, Wind and Fire i.e. **“Panch Mahabhuta”**. If we consider the energy resources in this perspective, they will reveal a new look of consumption. Non-renewable energy resources are those who only utilize the energy from the fossil fuels but do not return the elemental constituents to the Nature (atmosphere). In other words, they pollute the panch mahabhuta during their utilization. On the other hand, renewable energy resources are those who not only utilize the energy from the Natural Resources but return their elemental constituents to the Nature i.e. to the **Panch Mahabhuta** without polluting them. In this respect, the renewable energy resources are in lieu with the Indian conception of preservation and worship of Nature as divine.

India is a nation of villages & towns where about 70% of its population resides. Even today they live in the lap of the Nature and utilize it to the optimum so as to fulfill their energy requirements. Most of them use resources, which are less efficient and causing health problems. There are a number of renewable energy resources available in rural India, which can solve the problem of energy requirement without affecting any ecological or hygienic status of the Country. My paper makes an attempt to list such resources which are found in majority of the Indian villages’ viz. cow-dung helping in formation of bio-gas, and use of sun’s energy i.e. solar energy. The main intention behind selection of only these resources is the ample availability of them in each and every village of India. With this, the cost-effective factor is also important in selection of these renewable energy resources. Through some figures relating to the economic parameters, I’ll make attempts to show that long term investment in above resources is more fruitful than short term investment in non-renewable resources, which is presently carried out by most of the developing nations, including India.

#### **SOLAR ENERGY –**

Since the pre-historic times, the Sun has been the main source of energy to the Earth. In India, the solar energy is obtained, on an average, for 300 to 330 days a year. As a renewable source of energy, it can be used in two ways: one to utilize its heating capacity and second to convert the solar energy into electrical energy.

The heating capacity of solar energy can be tapped by various devices like solar water heater, solar cooker, solar air heater, etc. on individual as well as industrial basis. The city of Nagpur is selected for the Model Solar City. The Nagpur Municipal Corporation decided to give solar water heater to the citizens at a subsidized rate. The market price was about INR 19,000 while the NMC gave it at INR 7,500, including installation cost. The solar water heater is capable of saving about 90 units per month for a family of four. Considering average rate of electricity in Maharashtra as INR 6 per unit, the total savings will be INR 540 per month and about INR 6480. The subsidy given by the Government will be regained within the span of 2 years. Similarly, a box type family size solar cooker helps in cooking food for a family of four to five. It helps in saving about 3 to 4 cylinder per year. Its cost is about INR 1,000, after allowing for subsidy. In today’s time about INR 550 subsidy is given to each LPG cylinder. Hence, the usage of solar cooker results in average savings of INR 1950 per year. The subsidy on the solar cooker is about INR 2100.

The solar energy can be a substitute for the firewood and cow-dung cakes used in rural India. It takes a lot of time and energy for rural women to obtain these conventional energy resources. With this, they release highly toxic gases that can cause a lot of air pollution. They are fatal for the hygiene of the human beings using them and those living in the surrounding areas. Compared to that solar energy is cheap, clean and completely safe.

The other use of solar energy is in converting it into electric energy. It can be done by use of Photovoltaic solar cells. Each cell is capable of producing 1.5 Watts of power. A number of such cells are connected in series and parallel so as to produce the required amount of electric energy. Even solar water pump are run on solar electric energy as seen in the case of Punjab. The Punjab Energy Development Agency has set-up about 500 such plants to tap solar energy. When Madhya Pradesh accepted the bid of Himgiri Energy Ventures to supply solar power to the state grid at Rs 6.5 a unit, it was a figure to note even by the industry’s standards of smashing records by the season. MP tender brought the price of solar power closer to the price of thermal power — produced from coal or gas, and India’s largest source. For 2012-13, Delhi’s power utilities were projecting to buy conventional power at an average unit price of INR 5.71. In other words, at INR 6.5, solar is just 14 per cent above thermal. (Jai, Shreya.). In the past ten years, installation of renewable energy for electricity has grown at an annual rate of 25 per cent. It has reached 30,000 MW as of January 2014. With this, the

hazards and ecological pollution and their costs are something which are not taken into account of the thermal electric energy. The solar electric energy on the other hand is without any such pollution and hazards.

### **COW-DUNG AND BIO-MASS ENERGY –**

Agriculture and domestication of livestock is a major occupation in rural India. The by-products of these occupations are mainly agricultural waste, cow-dung, etc. These wastes are thrown away. They can be utilized in a better way through setting up of biogas plants. This helps in tapping of the bio-mass energy, which has multiple uses in daily life of a rural Indian. India possesses about 28% of total cow population of the world. It is about 289 million of cows, which generate about 1445 million tons of cow-dung per day. This helps in creation of about 57 million m<sup>3</sup>/day of bio-gas and about 1,000 million tons per day of bio-fertilizers. This capacity can be enhanced by use of agricultural waste, kitchen waste, solid waste collected by the local governing body via door-to-door waste collection mechanism, etc.

Biogas is rich in methane and is used in rural areas of India/Pakistan and elsewhere to provide a renewable and stable source of electricity. According to the International Energy Agency, bioenergy (biogas and biomass) have the potential to meet more than a quarter of world demand for transportation fuels by 2050. (<http://denmark.dk/en/green-living/sustainable-projects/cow-dung-a-source-of-green-energy/>) Patrick Serfass, Executive Director at the American Biogas Council, calls anaerobic digesters “optimized cow stomachs.” Farm operators make “slurry” out of the cow manure by combining it with water, and feed it into the machine, which creates a biogas comprised of about 60 percent methane and 40 percent carbon dioxide. The gas is then collected, treated, and piped to a gas use device. The leftover “digester byproducts” (cow dung without its gas) can be used for fertilizer or potting soil, which some of the farms are selling for some extra revenue. (Atkin, Emily)

The resulting biogas can be used to create:

Renewable electricity;

Renewable vehicle fuel (biomethane); or Renewable natural gas that can be injected into existing pipelines for a wide range of uses (heating, power plants).

Biogas is very good substitute for fossil fuels. A 2 m<sup>3</sup> biogas plant could replace, in a month, fuel equivalent of 26 kg of LPG (nearly two standard cylinders), or 37 liters of kerosene, or 88 kg of charcoal, or 210 kg of fuel-wood, or 740 kg of animal dung. The biogas comes with no danger of health hazards, no offensive odour. It burns with clean bluish soot less flame thereby making it non-messy to cooking utensils and kitchens. It removes the hazards of smoke due to burning of fire-woods and cow-dung cakes. On the economical level, it is cheaper than conventional LPG and is only fractionally more expensive than kerosene. (.Soma, D., I.H. Rehman, P. Malhotra and V. Ramana).

The model biogas plant is erected to generate biogas/electricity at the University of Agricultural Sciences-Bangalore campus. It generates 90 kg of cooking gas a day that is used to generate around 320 units of power a day and provides about 25% of the university's electricity requirement. It requires cow dung from around 175 cattle at the university apart from leftovers at the students' hostels. The plant requires 4.5 to 5 tonnes of organic waste a day for its operation. The entire cost of setting up the biogas plant is expected to be recovered in about two year. After this, the cost is nearly negligible.

(<http://www.thehindu.com/todays-paper/tp-national/tp-karnataka/a-model-biogas-plant-that-produces-320-units-of-power-a-day/article3879626.ece>)

Even though there are so many evident benefits in tapping the bio-mass energy, it is largely neglected in our country. Under the 12th FYP, a National Bioenergy Mission was announced to provide 20,000 MW biomass power by 2022. But the fact is about 60 per cent of the country's grid-connected power plants that run on biomass have either shut down or are on the verge of shutting down. The experience of the past few years show that major changes in policy and practice are required to make renewable energy a real solution for meeting the energy needs of the country.

In the 12<sup>th</sup> FYP, renewable energy resources in general are undermined. The total expenditure is estimated for the energy sector during 2012-17 is INR 10,94,938 crore. The outlay for the MNRE is INR 33,003 crore i.e. about 3 per cent of the total plan outlay for the energy sector plan. On the other hand, the Department of Atomic Energy is allocated double the outlay allotted to MNRE. The Atomic Energy produces about 2.5% of total energy production in India. Currently,

renewable energy accounts for about 12 per cent of the total electricity generation capacity and contributes about 6 per cent of the electricity produced in the country. More than a million households in the country, today, depend solely on solar energy for their basic electricity needs. But investment in renewables went down from US \$13.0 billion in 2011 to US \$6.5 billion in 2012. This was largely because of policy uncertainty—some say paralysis—within MNRE. Hence, much needs to be done to tap this boon of God so as to make ourselves self-reliant in energy requirements. (Ramachandra, T. V.)

## CONCLUSION:

A number of economic factors contribute to make renewable energy resources as the only hope of the future energy resources not only for India but for the entire world. India is the nation of villages and they can sustain independently by choosing to adopt these renewable energy resources. They are not only economically feasible but also generate healthy employment opportunities in the area. The renewable energy resources are feasible to the villages of India due to low fuel cost, easily available raw material for their working, one-time though high set-up cost which subsidized by Government of India, encouraging employment, low transmission and distribution cost, etc. The India villages have been worshipping these renewable resources since ages for their perennial energy supply. Now, it is the time to welcome them in their home so as to utilize them to tap their energies. Till now, these gods have enlightened their souls, now it is time for the people to enlighten their houses and lives with the help of these gods.

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