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ENERGY AND CLEAN ENVIRONMENT-INDIAN PERSPECTIVE

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Abstract:—Atmosphere pollution is the major concern today among the environmentalists and technologists. The three major factors responsible for the pollution are power generation, transport and cooking, where major chunk of the fossil fuels is burnt. This huge burning of the fossil fuels also affects the energy security as the fuel reserves will not last long. So the need of the hour is to save the fuel reserve and environment. This is to be achieved by development of the technologies and fuels, which help in minimizing the environmental pollution and widespread use of the alternate sources of energy, which are inherently clean too. In this paper, the possibilities and the breakthroughs achieved in this direction are discussed in the Indian context.

I. INTRODUCTION

Some news headlines
Fumes choke lungs in Faridabad: Source: The Times of India, New Delhi, 15/6/2004
Pollution a serious public health hazard: Source: The Hindu, New Delhi, 9/6/2004
Fat children suffer more from air pollution: Source: The Pioneer, New Delhi, 8/6/2004
Lucknow: City gasping for fresh air!: Source: The Pioneer, Lucknow, 5/6/2004
Air pollution level in Varanasi alarming: Source: The Pioneer, Lucknow, 5/6/2004
Report to help tackle air pollution: Source: The Hindu, New Delhi, 22/5/2004
Mumbai: Your city's air is India's worst: Source: The Indian Express, Mumbai, 2/5/2004
Traffic polluting Palampur's environment: Source: The Tribune, New Delhi, 6/4/2004
These are only few of the endless headlines, which concern environment. The main factors responsible for the environmental pollution are motorized transport vehicles, power plants using conventional sources, industrial waste, burning wood and cow dung cakes and coal for cooking, burning oil for lighting and burning of crop remains by the farmers in their fields etc.

Energy is an essential ingredient of socio-economic development and economic growth. The developed countries have about 20% of the world's population and use 60% of the world's energy resources. Though the installed capacity in the country as on Nov.2011 stands at 182343 MW. India's per capita electricity consumption at 374 KWh (2000-01) is very low as compared to the European countries. The increased economic output and population imply increasing energy requirements. There are two types of energy – renewable and nonrenewable. Under the category of renewable energy or non-conventional energy some of the sources are – sun, wind, water, agricultural residue, natural geysers, firewood, animal dung, etc. The nonrenewable sources are the fossil fuels such as coal, crude oil and natural gas, wood to some extent, etc.[1]

Depending upon the increasing pollution and the life style of people the number of the vehicles are increasing tremendously as a result the traffic is very heavy particularly in cities and the peripheral villages, traffic jams are seen every where. The growth of the traffic can not be checked, but the traffic management by building over bridges and bypasses and by improving the combustion technology to the green one the environmental degradation can be checked. The environmental friendly fuel like bio-diesel, more and more electrically operated vehicles and solar powered vehicles can be used. The improvement in the power plant technology is must such as thermal power plants using coal and oil in order to minimize the emissions from these plants.

Renewable energy also provides national energy security at a time when decreasing global reserves of fossil fuels threatens the long-term sustainability of the Indian economy. With abundance of wind energy resources in many parts of the country, especially along the long coastline, electricity generation through wind energy provides a viable and environmental friendly option. Even among other applications of renewable energy technologies, power generation through wind has an edge because of its technological maturity, good infrastructure and relative cost competitiveness. Not only that, development of a basket of technologies is the only insurance against uncertainties.

The other non conventional sources like, energy generated from the sun is known as solar energy, that from water is hydel, from firewood, animal dung, city biodegradable waste and agro-residue known as biomass, is called biogas, and geothermal energy from hot dry rocks, magma, hot water springs, natural geysers, etc. All the renewable sources of energy are fairly non-polluting and considered clean. The total potential of renewable energy is estimated to be 100,000 MW in our country.

II. STEPS TAKEN IN FAVOUR OF RENEWABLE ENERGY

The conventional non-renewable energy generation and energy usage is to be made environment friendly and there is a strong need for it to be pollution free. Major steps are being taken all over the world in this direction. Some of the steps taken by Govt. of India in this direction are:

- India is the only country, which has a separate ministry for alternative energy.
- Renewable energy projects get one hundred percent accelerated depreciation in one year; fossil fuel projects get one-third the benefit.
- Renewable energy projects get a five-year income tax holiday. Nothing of that kind is offered for fossil fuel projects.
- In some renewable energy projects, the grant, subsidy and easy loan component equals the total project cost.
- A majority of wind energy projects have come up mainly to cash in on the tax breaks. Electric power generation is a secondary and often neglected priority
- As much as eight crore rupees is given as capital subsidy in the co-generation field with a maximum capacity of 20MW. Fifty percent of the capital cost of an electric power plant using sewage is doled out as a free grant.
- Up to twenty-two and a half crore rupees is to be doled out as capital grant for small hydro projects in the north eastern states and Sikkim.
- The table below gives status of non conventional energy in India[2].

Renewable Energy Monitor		*Source: **MNES, GOI***	
Sources of energy	Units	Potential	Installation
Wind Power	MW	45,000	1,870
Small Hydro Power	MW	15,000	1,519.28
Biomass Power	MW	19,500	537.17
Urban & Industrial Waste	MW	1700	25.75
Solar PV	MW/ sq km	20	
Solar Water Heating	Mn. sq m	140	0.70
Biogas Plants	Mn.	12	3.440
Improved Stoves (*Chulhas*)	Mn.	120	35.20

2.1 Wind Energy

Recognizing the importance of tapping renewable energy sources for power generation, India has been working in this direction for more than two decades. The Government of India realized the importance of private sector participation in the wind power sector as early as 1983/84. Accordingly, a national programme was initiated to tap the then estimated potential of 20000 MW by adopting a market-oriented strategy. This ultimately led to successful commercial development of wind power technology and substantial additions to power generation capacity in the country. Significant progress made in this sphere was the result of a range of policy support measures and incentives announced by the government for inducting state-of-the-art wind energy technologies on the one hand, while encouraging private entrepreneurs to take up commercial projects on the other hand.

- The Indian wind energy programme is one of the largest in the world, India ranks fifth in the world with a total wind power having an installed wind capacity of over 1870 MW. The government expects the sector to expand rapidly and pass its target of adding 5,000 MW of wind energy by 2012.
- The wind energy potential in India has been estimated at 45,000 MW
- Wind is one of the largest RE source in the country, based on mean annual wind power density
- The Wind Resource Assessment Programme (WRAP) carried out in India to reassess the wind potential was one of the largest programmes of this kind in the world covering around 900 wind monitoring and mapping stations in 24 states and union territories.
- States with high wind power potential are Tamil Nadu, Gujarat, Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh and Maharashtra. About 6.5 billion units of electricity have been fed to various state grids from wind power projects. Almost 80% of the power thus generated has been used for captive consumption, and the rest sold to the grid or to a third party. [3]
- At least 15 domestic companies are manufacturing wind power turbines and components, either in joint venture or license production from international collaborators, achieving an annual turnover of Rs. 1,500 crore. Wind electric generators ranging from 55 to 750 kW rating have been developed and manufactured in the country by using the latest technologies.
- State-of-the-art wind power technologies are now indigenously available in India. An annual production capacity of 500 MW has been established. Wind electric generators up to 750 kW unit capacity are now being manufactured. Blades, a crucial component of wind turbines, are manufactured in India. Nearly 80 per cent indigenisation has been achieved.
- R&D activities have been undertaken through research institutions, laboratories, and technical centers.
- Moreover, introduction of grid connected wind power projects results in direct and indirect generation of employment. It has been estimated that for each MW of installed capacity of wind farms, there is an employment potential of 3 skilled operators and 2 unskilled persons. The indirect employment opportunities are about 4 times of direct employment (i.e. 20 manpower). During the construction phase, lasting about 6 months, additional employment is available to 50 local people for civil and electrical work3.

- Technological maturity and introduction of machines, suitable for the Indian conditions (e.g. wind turbines designed for low wind regimes) that resulted in overall higher capacity utilization. This factor helped in attracting more investments from the private sector.

Other Factors in favour of wind energy are:

- Introduction of bigger capacity and more cost-effective wind turbines.
- MW size wind power systems.
- Wind machines for low wind regimes.
- Improved rotor blades and gear boxes.
- Advanced control systems.
- Development of cheaper materials.
- Integration of wind farms with weak grids.
- Power quality improvement.
- The MNES, India estimated that a 200-KW wind turbine replacing a thermal power plant will save 120 to 200 tonnes of coal.
- The estimate environmental benefits of installing wind farms would be reduction of the following emissions annually:

o CO_2 2100 metric tons/MW
o SO_2 2.5 metric tons/MW
o NO_x 1.7 metric tons/MW
o Total suspended particulate 0.5 metric tons/MW [4]

10.5 billion kWh of wind-generated electricity had been fed to the grid so far. As a matter of fact, power generation from wind has emerged as one of the most successful programmes in the renewable energy sector and has started making significant contributions to the overall power requirements of some states.

Large capacity wind turbines in the range of 1 to 1.25 MW are being produced in the country. The wind energy sector has grown significantly in India despite ups and downs. Today after having surmounted many a problems, wind in India is known to be a very mature industry. Presently, depending upon the experience gained by India in the last two decades the emphasis is on

- Higher capacity machines
- Low-wind regime turbines
- Higher tower heights
- Wider swept areas
- Equally important has been the ability of wind power producers in dealing with grid problems in the country.

In a number of countries, the utilities purchase renewable energy based electricity at prices higher than conventional electricity and pass this additional cost on to the customers who have opted for green power. Considering the fact that in a liberalized market, where ultimately competition would be for the least cost option, this mechanism may not be feasible. Under the circumstances, electricity produced from renewable energy resources like wind requires two kinds of support, namely,

- A price support mechanism that enables power producers to enter the market and make a reasonable profit and
- A stable regulatory environment that encourages renewables based power.

2.1 Solar Energy

"The surface of the Earth receives an amount of solar energy equivalent to roughly 10,000 times the world energy demand," [5]. Solar technology is currently divided into two categories, thermal and photovoltaic. Thermal solar power uses the heat of the sun, and photovoltaic, or PV, is the technology that converts its light directly into electricity. [6]

India receives solar energy equivalent to over 5000 trillion KWh per year, which is far more than total energy consumption in the country. Among top five countries in production of solar power, India is leading in the production of solar photovoltaic (SPV) products that are able to provide electricity to households in remote areas like Ladakh, Sunderbans and the Lakshadweep islands that are not connected to the power grid.[7] "Of the 121 MW of solar power production capacity in India, around 55 MW of photovoltaic modules has so far been exported to the US, Europe, Australia and neighbouring countries like Nepal, Bangladesh, Sri Lanka, [8]. Photovoltaics first came into use in 1958 when NASA needed a feasible power source for its spacecrafts and satellites, and has been used for this purpose ever since. [9]

India's biggest solar power success has been the electrification of the villages in the Sundarbans, the world's largest mangrove forest in West Bengal. Many of these villages are six kilometers from the mainland and could not have been electrified through the power grid. In addition, India is also working on an integrated thermal power generation projects. The turnkey contract for one of the largest such projects planned at Mathania village in Jodhpur district of Rajasthan is to be finalized by year-end. Now a number of power plants are being fed through SPV modules, generating 300 KW of electricity. In the case of Lakshadweep islands in the Bay of Bengal, the SPV is being used to generate 750 KW power to replace diesel used earlier to produce power. [10]

The Ministry of Non-conventional Energy Sources (MNES) is targeting cellular operators to sell solar technology. As a proponent of transition from conventional energy sources to solar power, the ministry is reaching out to mobile service providers to popularize the use of photovoltaic technology to power cell sites, responsible for transmitting cell phone signals.

Although photovoltaic technology requires higher onetime investment, the advantage is that there are virtually no recurring costs. A few mobile operators in Delhi and Rajasthan have experimented with using solar energy to power cell sites and appear to be satisfied with the results." MNES had tied up with leading banks to offer soft loans to cellular operators interested in powering cell sites with photovoltaic technology. The long-term cost-advantage offered by this technology should be sufficient reason for operators to go for it. The technology will enable cellular players to roll out networks without any problems in areas where grid power is not available. The Sun is everywhere and they can generate their own power. Using photovoltaic technology also made sense in urban pockets where power supply was unreliable. To give a leg-up to photovoltaic technology, the MNES will conduct programmes to bring vendors and mobile operators on a common a platform. Besides, the MNES is exploring other avenues where the technology can be marketed, for instance, defence establishments and railways come across as high potential clients.[11]

Brahma Kumari's World Spiritual University with its head quarter at Mount Abu (Rajasthan) has installed many Renewable Energy projects which include world's largest solar cooker, capable of 35,000 meals/day; over 500 KW of PV cells; and solar hot water systems creating over 40,000 liters of hot water a day. It is currently planning 200kW solar/diesel hybrid power plant, as well as being involved in many renewable energy projects throughout India.[12]There are currently over 500,000 solar cookers in use in India, including the solar cooking venue in Tirupati, which provides food for over 15,000 people each day.

Solar heating and solar electric systems can now generate thermal and electric energy over their service life up to 100 times the energy input during their manufacture. This ratio; the energy it will produce in its lifetime, compared to the amount of energy input to manufacture and maintain an energy system, has doubled in the last 20 years for most solar technologies. The ratio of energy out vs. energy in for solar systems has become so favorable that the economic and ecological viability of solar power is now beyond question.

A solar bowl concentrator system with non-tracking solar bowl concentrator of 15 m diameter integrated has been developed and installed at Centre for Scientific Research, Auroville for cooking food for around 1000 people under an R&D project sponsored by the Ministry.The system uses thermic fluid to transfer the energy collected by the receive. The oil could be heated up to 260^{o} C which is sufficient to generate steam for cooking food in the kitchen. Around 600 Kg of steam per day could be generated from this bowl which is sufficient to cook two meals for about 1000 people. The system was inaugurated by the H'ble Minister of state for Non-conventional Energy Sources, Govt. of India on 11th September, 2001.

A heat pipe based solar cooker was developed by IARC in association with Russian scientists. The cooker installed consists of a manually tracked solar concentrator kept outside in the sun and a heat pipe condenser system connected to the hot plate inside the kitchen for transferring heat from the concentrator. This type of the cooker could be useful for student hostels, staff canteens, ashrams, dharamshalas, tea shops etc.[19]

In India, in the household sector, the bulk of energy is spent on cooking. Although in the urban households, there is a gradual shift from fuelwood to LPG (liquefied petroleum gas), 32.7% (as per 1991 census) of the urban poor still use fuelwood. According to 1991 census, about 30% of urban population uses gas and another 30% uses firewood and chips, whereas in rural sector, about 78% of the population rely on firewood and chips. [10]

As per the NCAER (National Council of Applied Economic Research) survey conducted in 1978/79, cooking accounted for 85.2% of the total energy consumed in the rural domestic sector. The women in rural India, especially the poor have to trudge long distances to forage for scraps of firewood.

Solar cooker can help in a long way to minimize this problem. Apart from the above-discussed solar cooker of large size, there is a box type solar cooker, which has great potential if the people choose to adopt it. The box type cooker receives direct sunlight and takes a long time and cooks slowly. The food comes out much better in it. It preserves the nutrition better. There are no chances of burning the food if kept for a longer time. The cooking with it is physically less demanding. One may find it more arduous to stand in front of the gas stove straining to regulate the gas and see that the food does not boil over or catch at the bottom and respond to the whistles of the pressure cooker appropriately and generally be around in the kitchen on one's legs for a couple of hours or so. Visit to the kitchen is not a one-time stint in a day. Several visits are required. With the solar cooker one can load up to four or five items in as many boxes when the sun is up and one is free to attend to her other chores without a concern.

Our country is a country of bright people; a country with the largest scientific manpower; a country that has several premier technical and management institutions and national laboratories and no one has advocated solar energy for cooking seriously. We have a full-fledged Ministry of Non-Conventional Energy (MNES). They did make a serious effort to popularize the solar cooker many years ago. But they gave it up, all too easily, as something, which is not accepted by the people. They are gamely persisting with Adtiya Shops and State Nodal Agencies where, they say, cookers are sold, but it is more in name than in reality in many places[9].

Very few people in the country actually use solar cooker , most of them do not how useful it can be for them and the national development. It really needs attention and popularization very seriously.

2.3 Bio Mass

The use of biomass has dominated the world energy scene since the beginning of mankind, and continues to do so for a large part of the rural population in many developing countries. Photosynthesis provides 120 billion tonnes of biomass every year, corresponding to about five times the total world's energy need. Approximately 14% of World's Energy supply today is from biomass. There are several routes of converting biomass into useable energy form. Most conventional form is to burn it to produce heat. Bio-ethanol and bio-diesel are now produced which can be used to fuel vehicles.[2] Gasifiers which convert wood, charcoal and other biomass to a combustible gas, kept a million cars on the roads during World War II. Among the various technologies based on biomass, gasification is promising and is a reliable and convenient technology to energize small engine driven irrigation pumps in the 5 to 10 horsepower range.

Animal dung, firewood, and agricultural residue are all traditional fuels, which are renewable. When the collection of firewood exceeds the capacity of the forest to re-grow or renew, problems set in. Therefore, excessive use of firewood is not a very environment- friendly exercise and alternative fuels must be provided. The traditional chulha, which is used in Indian villages, is an inefficient way of using energy. Ninety per cent of the energy in the fuel is lost into the atmosphere; only ten per cent of the energy goes to actually heat the pot.

India's energy resources are phenomenal but poorly organized. Depending on how much dung can be collected, biogas can meet the cooking energy needs of nearly 40 percent of the rural households of the country. Out of the 287 million cattle in the country, if one-third (of total 2.8 billion tonnes) of the dung produced annually from these is available for biogas production and for recycling as farm manure, it can cook for 200 million people.[13] and we can save 18 million tonne of fuel wood per year.

By mid 2000, 1704 biomass gasifiers with an aggregate capacity of 34.36 MW had been installed, these power plants being ideal in rural areas for decentralized applications. Forty biomass combustion-based power projects aggregating 222 MW are either installed or under implementation.1000 MW of power can be generated from urban and municipal solid waste and up to 700 MW from Industrial waste in India.

One of the most 'successful' bio-mass projects in India is a co-generation project in Karnataka where a sugar mill has installed a 22MW electric power plant which uses the waste product bagasse as the fuel source. The 'first' co-generation project in Karnataka to evacuate power through the grid, the forty-four crore forty lakh rupee plant generates 'captive' power at rates, which are lower than what the sugar mill was paying the electricity board in Karnataka. From bagasse-based cogeneration 3500 MW power can be generated from the 430 sugar mills in India[14]

2.4 Small Hydro power plants

The biggest advantage of SHP (small hydro power) is that it is the only 'clean' and renewable source of energy available round the clock. It is free from many issues and controversies that continue to 'hound' large hydro, like the submergence of forests, siltation of reservoirs, rehabilitation and relocation, and seismological threats. Other benefits of small hydro are user-friendliness, low cost, and short gestation period. In some cases, rural dwellers have been able to manage the switch from firewood for cooking to electricity, thus limiting deforestation and also cutting down on carbon emissions. Even though SHP has had an early start, the pace of growth in this sector has been very slow vis-à-vis large hydro. However, with growing consciousness and concern about the environment, the focus shifted towards the development of small, user-friendly, and decentralized power projects with low gestation periods. The Ministry of Non-conventional Energy Sources is offering, through its normal budget, a host of incentives for surveys, investigations, preparation of detailed project reports, and execution of projects. With these new and exciting developments, small hydropower in India is poised to make a big splash; quite like wind power generation has made waves in the past recent years.[21].

2.5 Geothermal Energy

The potential of Geothermal Energy seems to be not much in India ,Avin Energy Systems Ltd has explored possibilities of setting up geothermal power projects in Gujarat. Plans are underway to set up the first 5 MW power generating plant using geothermal energy.Avin has already done most of the ground work in regard to geothermal power generation in Gujarat and in the coming future expects to set up geothermal power generating units in Gujarat in the order of 1000 MW capacity which should, in a way, feed the electricity requirements of not only the State but also the neighbouring States.[22].

III. NEW TECHNOLOGIES

Bajaj signs deal with aussie firm to reduce emissions: Source: The Financial Express, New Delhi, 4/5/2004
TN village a hit with drivers for cheap bio-diesel: Source: The Indian Express, New Delhi, 6/6/2004
Trains to run on vegetable, used frying oil: Source: Business Line, New Delhi, 27/5/2004
Mercedes completes trial run on biodiesel: Source: Business Line, New Delhi, 20/5/2004
Rs 15 crore biodiesel project coming up in Andhra Pradesh:The Financial Express, New Delhi, 10/5/2004
Bio-diesel project enters phase-II; talks on for tie-ups Source: Business Line, New Delhi, 8/5/2004
Powering unconventional business: Source: The Financial Express, New Delhi, 27/4/2004
'Centre to plant Jathropha tree in 50,000 hectares': Source: The New Indian Express, Bangalore, 8/4/2004
Stricter pollution control norms to be enforced Source: The Times of India, New Delhi, 15/6/2004
TERI moots sops for oil companies to produce cleaner fuels: Source: Business Line, New Delhi, 11/4/2004
For a group of Benaras Hindu University (BHU) scientists and the ministry of non-conventional energy sources, it is a breakthrough in cutting edge fuel technology achieved after a decade-long experiment. [23]

Electric power plants using fossil fuels have initiated steps to reduce sulphur and nitrogen emissions.
One study estimates that electricity generation increased by fourteen percent between 1989 and 1996 even as sulphur emissions declined by eighteen percent while nitrogen emissions went up a mere three percent. This was largely due to a fifty percent increase in the 'scrubbing' of coal by high-tech pollution control technologies and a fifty percent drop in the sulphur content of coal.

Practically all plants operated by the National Thermal Power Corporation (NTPC) now have pollution control mechanisms, which have reduced sulphur emissions by nearly forty percent.
The problem of high ash content in Indian coal is also being addressed with thirty 'washeries' being set up to clean coal before they reach power plants in the 1990s.
Renewable energy sources contributed to nearly seven per cent of total power capacity during the Eighth Five-Year Plan.
Estimated potential for small hydropower (up to 3 MW) in India is 10,000 MW by end 1999 the installed capacity was 210 MW.

In the 1990s, gas has emerged as the cleanest fuel, thanks to new combined cycle and co-generation technologies. Electric plants using combined cycle units could end up reducing emissions by fifty to ninety percent in most cases.

- Sulphur Dioxide 99%
- Nitrogen Oxides 81%
- Carbon Dioxide 58%
- Particulates 95%

The Ministry of Power estimates that electric power capacity using gas as the base fuel could go up to 25,000 MW by 2011-12.

New technologies have resulted in dramatic reduction in pollution and environmentally damaging emissions from fossil fuel based plants generating electric power in developed countries — particularly in coal. They are readily available for use in developing countries.

Gas and combined cycle technology using gas are emerging as the cleanest and cheapest source of electricity for the future. They will play a key role in reducing carbon emissions, an area of concern for global warming.

Despite optimistic forecasts to the contrary, non-combustion based renewable sources of energy contribute less than one percent of electric power generated in the world. In India, it is a healthier less than two percent.

"The power generation industry has made tremendous strides in reducing emissions at coal-fired power plants in recent years, and we expect that progress to continue in the future," says Arch President & CEO Steven F. Leer. "The ultimate goal is a zero emission coal plant, and we are increasingly confident that such a plant is achievable.".[15].

Zero emission coal technology is based on new applications of well-known science and has the potential to provide low-cost, clean and copious fossil energy to meet increased U.S. and world energy demands. The Department of Energy is a strong believer in the future viability of zero emission coal technology and has implemented a program entitled Vision 21 in pursuit of this objective.[15]

As far as Punjab and Haryana are concerned, the MNES sees immense possibilities in the small hydropower and biomass-based power generation sectors.

Estimated potential for small hydropower (up to 3 MW) in India is 10 000 MW by end 1999 the installed capacity was 210 MW.

In alternative fuels, bio-diesel saw lot of interest. Mercedes India completed its trial run of 5,900 km on bio-diesel, and plans are afoot by Council of Scientific and Industrial Research (CSIR) to expand the programme by including more companies, including Tata Motors and Indian Oil Corporation in phase II.

According to the International Energy Agency (IEA) the world's rich industrial countries could slash 30% of their energy use by 2010 by using more energy-efficient electrical appliances.

IV. CONCLUSION

According to the authors view for a sustainable development leading to a developed India the environmental control through the green energy is must today. As far as the wind energy is concerned we have made a good progress and we are expert in the field, the power generation progress is satisfactory. On the count solar energy and biomass, we have to travel a long as it has been seen that the progress in this field is very poor. Solar energy is the energy in which masses have to be involved through solar cookers and solar lanterns etc., which have a very large potential. In all the villages, the biomass energy which give good fertilizer also can be used extensively. The need of the hour is for the infrastructure development in transport field and the development and use of new green technologies in the fossil fuel energy plants.

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