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Exploring the Role of Non-Conventional Energy Resources in India's Energy Landscape

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ABSTRACT

Energy is the key input to drive and improve the life cycle. Primarily, it is the gift of the nature to the Mankind in various forms. The consumption of the energy is directly proportional to the progress of the mankind. With ever growing population, improvement in the living standard of the humanity, industrialization of the developing countries, the global demand for energy is expected to increase rather significantly in the near future. The primary source of energy is fossil fuel, however the finiteness of fossil fuel reserves and large scale environmental degradation caused by their widespread use, particularly global warming, urban air pollution and acid rain, strongly suggests that harnessing of non-conventional, renewable and environment friendly energy resources is vital for steering the global energy supplies towards a sustainable path. This paper describes in brief the nonconventional energy sources and their usage in India.

1. INDIAN ENERGY SCENARIO

India ranks sixth in the world in total energy consumption, whereas more than 70% of its primary energy needs are being met through imports, mainly in the form of crude oil and natural gas. Coming to the power generation in the country, India has increased installed power capacity from 1362 MW to over 112,058 MW since independence and electrified more than 500,000 villages. This achievement is impressive but not sufficient. It is a matter of concern that 44% of house holds do not have access to the electricity (Census 2009) and as many as 80,000 villages are yet to be electrified. The electricity supply is not even sufficient for those who have

been connected. The country still encounters peak and energy shortage of 7.7% and 12.3% respectively. The annual per capita consumption of 580Kwh is amongst the lowest in the world. The Ministry of Power has now drawn a road map to ensure 'power on demand' by 2012. The anticipated demand as per 16th Electric Power Survey requires an addition of 1, 00,000 MW. In other words, the achievements of more than five decades need to be replicated in the next decade.

This requires resources of Rs.8, 00,000 crores. The task is daunting but not unachievable. India has a vast hydro potential of 150,000 MW out of which only 17% has been tapped so far. Then there are coal reserves to last for more than 200 years along with other exploitable energy reserves such as oil and gas etc. Even the potential of renewable is 82,000 MW. It is significant that the ministry envisions adding 10,000MW up to 2012 through nonconventional energy sources alone. Till now, the total installed capacity based on these sources is only about 6422 MW consisting of 3595 MW wind, 1705 MW small hydro, 750 MW biomass, 264 KW solar, 66 MW gasifies and 42 MW from urban/industrial waste energy. This constitutes only 7.8% of total installed capacity in the country.

India has pioneered in the world in many administrative actions of renewable energy promotion, such as;

* Electricity regulatory commission within liberalized market, 1991
* Mandatory environmental audits for power projects, 1992
* Energy conservation bill, 2000
* Renewable energy promotion bill, 2005.

Today, India is among the leaders in the world in utilization of several RE technologies.

2. PREDICTIONS REGARDING FOSSIL FUEL RESERVES

Fossil fuels supply most of the energy consumed today. They are relatively concentrated and pure energy sources and technically easy to exploit, and provide cheap energy. Presently Oil 40%, natural gas 22.5%, coal 23.3%, hydroelectric 7.0%, nuclear 6.5%, biomass and others 0.7% provide almost all of the world's energy requirements.

However the reserves of fossil fuels are limited as under:

* Conservative predictions are that conventional oil production will peak in 2007.

* The pessimists predict a peak for conventional gas production between 2010 and 2020.
* There are today 200 years of economically exploitable reserves of coal at the current rate of consumption.
* The raw material for nuclear power i.e. uranium reserves will last for 50 years at the present rate of use.

(Though there are other alternatives raw materials such as thorium but this technology is yet to be developed.)

Hence the need was felt to explore and develop renewable energy sources to meet with ever growing demand of energy.

3. GENERATION OF ENERGY

All the energy we consume is generated by using the three fundamental interactions of nature: gravity, electromagnetism and the nuclear reaction to create force, fission and fusion. Most forms of terrestrial energy can be traced back to fusion reaction inside the sun. Geothermal energy is believed to be generated primarily by radioactive decay inside the Earth. Radioactive decay energy is generated by both the nuclear and electromagnetic force. Tidal energy comes from the gravity energy and kinetic energy of the Earth/Moon system.

4. NON-CONVENTIONAL AND RENEWABLE SOURCES OF ENERGY

To meet the future energy demands and to give quality and pollution free supply to the growing and today's environment conscious population, the present world attention is to go in for natural, clean and renewable energy sources. These energy sources capture their energy from on-going natural processes, such as geothermal heat flows, sunshine, wind, flowing water and biological processes.

Most renewable forms of energy, other than geothermal and tidal power ultimately come from the Sun. Some forms of energy, such as rainfall and wind power are considered short-term energy storage, whereas the energy in biomass is accumulated over a period of months, as in straw, and through many years as in wood. Fossil fuels too are theoretically renewable but on a very long time-scale and if continued to be exploited at present rates then these resources may deplete in the near future. Therefore, in reality, Renewable energy is energy from a source that is replaced rapidly by a natural process and is not subject to depletion in a human timescale.

Renewable energy resources may be used directly, such as solar ovens, geothermal heating, and water and windmills or indirectly by transforming to other more convenient forms of energy such as electricity generation through wind turbines or photovoltaic cells, or production of fuels (ethanol etc.) from biomass.

5.RENEWABLE ENERGY SCENARIO IN INDIA

India is blessed with an abundance of sunlight, water and biomass. Vigorous efforts during the past two decades are now bearing fruit as people in all walks of life are more aware of the benefits of renewable energy, especially decentralized energy where required in villages and in urban or semi-urban centers. India has the world's largest programme for renewable energy.

Wind Power

The origin for Wind energy is sun. When sun rays fall on the earth, its surface gets heated up and as a consequence unevenly winds are formed. Kinetic energy in the wind can be used to run wind turbines but the output power depends on the wind speed. Turbines generally require a wind in the range 5.5 m /s (20 km/h). In practice relatively few land areas have significant prevailing winds. Otherwise Wind power is one of the most cost competitive renewable today and this has been the most rapidly growing means of electricity generation at the turn of the21st century and provides a complement to large-scale base-load power stations. Its long-term technical potential is believed 5 times current global energy consumption or 40 times current electricity demand.

* India now has the 5th largest wind power installed capacity, of 3595 MW, in the world.
* The estimated gross Wind potentials in India is 45,000 MW.

In progress are wind resource assessment programme, wind monitoring, wind mapping, covering 800 stations in 24 states with 193 wind monitoring stations in operations.

Water Power

Energy in water can be harnessed and used, in the form of motive energy or temperature differences. Since water is about a thousand times heavier than air is, even a slow flowing stream of water can yield great amounts of energy. There are many forms:

* Hydroelectric energy, a term usually reserved for hydroelectric dams.* Tidal power, which captures energy from the tides in horizontal direction.
Tides come in, raise water levels in a basin, and tides roll out. The water is made to pass

through a turbine to get out of the basin. Power generation through this method has a varying degree of success.

* Wave power, which uses the energy in waves. The waves will usually make large pontoons go up and down in the water. The wave power is also hard to tap.

Hydroelectric energy is therefore the only viable option. However, even probably this option is also not there with the developed nations for future energy production, because most major sites within these nations with the potential for harnessing gravity in this way are either already being exploited or are unavailable for other reasons such as environmental considerations. On the other side, large hydro potential of millions of megawatts is available with the developing countries of the world but major bottleneck in the way of development of these large Hydro projects is that each site calls for huge investment.

Micro/Small Hydro Power

This is non-conventional and renewable source and is easy to tap. Quantitatively small volumes of water, with large falls (in hills) and quantitatively not too large volumes of water, with small falls (such that of canals), can be tapped. The estimated potential of Small Hydro Power in India is about 15,000 MW. In the country, Micro hydro projects up to 3 MW of total capacity of 240MW and 420 small hydropower projects up to 25 MW station capacity with an aggregate capacity of over 1423 MW have been set up and over 187 projects in this range with aggregate capacity of 521 MW are under construction.

BIOMASS

Solid Biomass

Plants use photosynthesis to store solar energy in the form of chemical energy. The easiest way to release this energy is by burning the dried up plants. Solid biomass such as firewood or combustible field crops including dried manure is actually burnt to heat water and to drive turbines. Field crops may be grown specifically for combustion or may be used for other purposes and the processed plant waste then used for combustion. Most sorts of biomass, including Sugarcane residue, wheat chaff, corn cobs and other plant matter can be, and is, burnt quite successfully. Currently, biomass contributes 15% of the total energy supply world wide.

In the area of small scale biomass gasification, significant technology development work has made India a world leader.

* A total capacity of 55.105 MW has so far been installed, mainly for standalone applications.
* A5 x 100 KW biomass gasifier installation on Gosaba Island in Sunderbans area of West Bengal is being
* successfully run on a commercial basis to provide electricity to the inhabitants of the Island through a local grid.
* A4X250 kW (1.00 MW) Biomass Gasifier based project has recently been commissioned at Khtrichera, Tripura for village electrification.
* A 500 KW grid interactive biomass gasifier, linked to an energy plantation, has been commissioned under a demonstration project.

Biofuel

Bio fuel is any fuel that derives from biomass - recently living organisms or their metabolic byproducts, such as manure from cows. Typically bio fuel is burned to release its stored chemical energy. Biomass, can be used directly as fuel or to produce liquid bio fuel. Agriculturally produced biomass fuels, such as bio diesel, ethanol, and bio gases (often a by-product of sugarcane cultivation) can be burned in internal combustion engines or boilers.India is the largest producer of cane sugar and the Ministry is implementing the world's largest co-generation programme in the sugar mills.

Biogas

Biogas can easily be produced from current waste streams, such as: paper production, sugar production, sewage, animal waste and so forth. These various waste streams have to be slurried together and allowed to naturally ferment, producing 55% to 70% inflammable methane gas. India has world's largest cattle population – 400 million thus offering tremendous potential for biogas plants. Biogas production has the capacity to provide us with about half of our energy needs, either burned for electrical productions or piped into current gas lines for use. It just has to be done and made a priority. Though about 3.71 millions biogas plants in India up to March, 2003 are successfully in operation but still it is utilizing only 31% of the total estimated potential of 12 million plants. The pay back period of the biogas plants is only 2/3 years, rather in the case of Community and Institutional Biogas Plants is even less. Therefore biogas electrification at community/Panchayat level is required to be implemented.

Solar Energy

Solar water heaters have proved the most popular so far and solar photovoltaics for decentralized power supply are fast becoming popular in rural and remote areas. More than 700000 PV systems generating 44 MW have been installed all over India. Under the water pumping programme more than 3000 systems have been installed so far and the market for solar lighting and solar pumping is far from saturated. Solar drying is one area which offers very good prospects in food, agricultural and chemical products drying applications.

SPV Systems

More than 700000 PV systems of capacity over 44MW for different applications are installed all over India. The market segment and usage is mainly for home lighting, street lighting, solar lanterns and water pumping for irrigation. Over 17 grid interactive solar photovoltaic generating more than 1400 KW are in operation in 8 states of India. As the demand for power grows exponentially and conventional fuel based power generating capacity grows arithmetically, SPV based power generation can be a source to meet the expected shortfall. Especially in rural, far-flung where the likelihood of conventional electric lines is remote, SPV power generation is the best alternative.

Solar Cookers

Government has been promoting box type solar cookers with subsidies since a long time in the hope of saving fuel and meeting the needs of the rural and urban populace. There are community cookers and large parabolic reflector based systems in operation in some places but solar cookers, as a whole, have not found the widespread acceptance and popularity as hoped for. A lot of educating and pushing will have to be put in before solar cookers are made an indispensable part of each household (at least in rural and semi-urban areas). Solar cookers using parabolic reflectors or multiple mirrors which result in faster cooking of food would be more welcome than the single reflector box design is what some observers and users of the box cookers feel.

Solar Water Heaters

A conservative estimate of solar water heating systems installed in the country is estimated at over 475000 sq. mtrs of the conventional flat plate collectors. Noticeable beneficiaries of the programme of installation of solar water heaters so far have been cooperative dairies, guest houses, hotels, charitable institutions, chemical and process units, hostels, hospitals, textile mills, process houses and individuals. In fact in India solar water heaters are the most popular of all renewable energy devices.

CONCLUSION

Keeping in view the reserves of the fossil fuels and the economy concerns, these fuels are likely to dominate the world primary energy supply for another decade but environmental scientists have warned that if the present trend is not checked then by 2100, the average temperature around the globe will rise by 1.4 to 5.8 degrees Celsius, which will cause a upsurge in the sea water levels drowning all lands at low elevation along the coastal lines. So the world has already made a beginning to bring about the infrastructural changes in the energy sector so as to be able to choose the renewable energy development trajectory. In developing countries, where a lot of new energy production capacity is to be added, the rapid increase of renewable is, in principle, easier than in the industrial countries where existing capacity would need to be converted if a rapid change were to take place. That is, developing countries could have the competitive advantage for driving the world market.

However, strong participation of developed countries is needed since majority of energy technologies in use in developing countries have been developed and commercialized in developed countries first. Nevertheless, India must give more thrust to the research and development in the field of non-conventional energy sources not only to mitigate greenhouse effect but also to lessen dependence on oil/gas import, which consumes major chunk of foreign exchange reserve. It is also clear that an integrated energy system consisting two or more renewable energy sources has the advantage of stability, reliability and are economically viable. Last but not the least, it is for the citizens also to believe in power of renewable energy sources, and understand its necessity and importance.

References

1. Overview of power sector in India 2008 – IndiaCore.com
2. C.R Bhattacharjee, "Wanted an aggressive Outlook on Renewable Energy," Electrical India, vol.45 No 11, pp. 147-150, Nov. 2005.
3. Pradeep K Katti, Dr.Mohan K. Khedkar, "Photovoltaic and Wind Energy," Electrical India, vol.45 No 11, pp. 151-155, Nov. 2005.
4. Kadambini Sharma, "Renewable Energy: The way to Sustainable Development," Electrical India, vol. 42 No 14, pp. 20-21, Jul. 2002.
5. E.C. Thomas, "Renewable Energy in India," Electrical India, Vol. 44 No 12, pp. 150-152, Dec. 2006.
6. Renewable Energy Technologies in Asia: A Regional Research and Assimination Programme by Diwaker Basnet.