Potential of Non-Conventional Energy Resources in Ahmednagar District

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Abstract: Energy is one of the most important building block in human development and as such, acts as a key factor in determining the economic development of all nations. India is blessed with an abundance of sunlight, water and biomass. Ahmednagar is one of the wildest rising metropolises in the state of Maharashtra. Ahmednagar is facing challenges of energy crises. Energy demand of urban is continuously increasing However, resource augmentation and growth in energy supply have failed to meet the ever-increasing demands exerted by the multiplying population, rapid urbanization and progressing economy. The potential of non-conventional energy resources in the study area has good opportunity. This scope has been mainly observed in this paper. This information generated in this study can help appropriately to assess the non-conservational energy benefits only if beneficial efforts for urban developers.

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1. Introduction

Energy is a basic requirement of the society. The development of varies sector and standard of living of the people is dependent on availability of power with reasonable charges. With the help of power, we can produce more jobs; bulk production of variety of commodity and can bring qualitative changes in varies social sectors. The ever-growing demand for electricity cannot be meeting from conventional energy sources. Therefore, nonconventional power resources can play a vital role for social and economic development.

Energy is an essential ingredient for human life on earth. It is used in all activities of society, for preparing meals, making cloth, building house and other activities. Human beings have needed and used energy at an increasing rate for their sustenance and well-being. One of the important requirements of energy for man is in the form of food. A brief explanation of the non-renewable energy resources is focused here in this article.

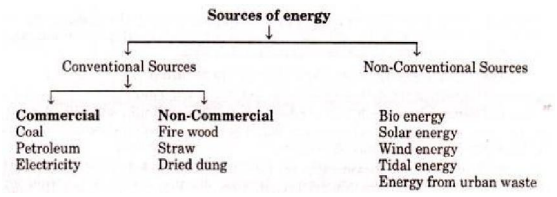

Fig 1.1 Showing types of energy (conventional and non-conventual) energy resources

Non-renewable energy (exhaustible) are available in limited amount and develop over a longer period of time. As a result of unlimited use, they are likely to be exhausted one day. These include coal, mineral, natural gas and nuclear power. Coal, petroleum and natural gases are common sources of energy being organic (biotic) in this origin. They are also called fossil fuels.

Non-conventional energy resources include wind energy, solar energy, biomass and other forms of bio energy, tidal energy, fuel cell, ocean-thermal and geo-thermal energy are important sources. Among these sources, though the first three renewable energy sources, namely, wind, solar and bio energy are being harnessed in a big way in India and in Maharashtra, the other sources have not yet reached a stage of commercial exploitation. The major share of this comes from wind energy followed by solar based electricity generation on fuel pumps and lastly, biogas for domestic purpose. It may be noted that investments in these plans have mostly come from private sector.

The study region has been selected for present study due to various reasons. Firstly, region has diversified relief and amount of rainfall and soil types. Secondly dry region lies in east, irrigated region in north and tribal dominant population dominant in west in study region. Thirdly north part has sugarcane cultivation in study region and fourthly researcher belongs to this study region hence familiar with study area. So, this will help him to generate the essential

data of the field as per as non-conventional energy resources concern.

Ahmednagar district is located partially in higher Godavari basin and partially in Bhima basin occupying in central west part in Maharashtra state. It extends from 180 10' to 200 00' north latitudes and 730 30' to 750 37' east longitudes (Fig.-1.2). It is flanked by Igatpuri, Sinnar and Yeola talukas in Nashik district in north, Vajapur, Gangapur and Paithan talukas of Aurangabad district and Georai, Beed and Ashti talukas of Beed district in east, Bhum and Paranda talukas in Osmanabad district and Karmala takuka in Solapur district in south, Junnar, Shirur, Daund and Indapur talukas of Pune district and Murbad, Sahapur talukas of Thane district in west. (DSA) of Ahmednagar (2011).

This research is focused on non-conventional energy resources and its potential of energy resources in Ahmednagar district. As the era of industrialization was begin the energy demand has been rapidly increasing.

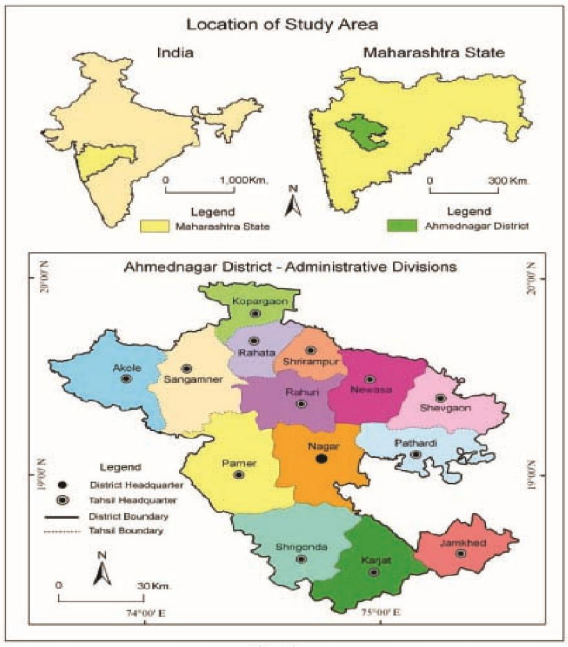

Figure 1: Showing location map of study area in Maharashtra State

2. Wind Resources

The wind is air in motion. It is caused by differential heating of land, water, hills and mountain slopes by sun rays. There is kinetic energy in wind. Even in ancient times the great sailors utilized kinetic energy of the wind in sailing their ships around the globe. The kinetic energy of wind is caused by its motion, the higher the velocity of wind the greater the kinetic energy in it. This velocity of wind is affected by solar radiation, which varies from season to season and from place to place. Strong winds blow in coastal plains and hill. The kinetic energy of the wind can be utilized by converting it into mechanical form. With this wind mills are operated. Large blades of wind mills can convert much of the wind energy into mechanical form.

The installation of wind power generation system depends upon extensive survey, site selection, construction and machinery plantation. The continuous supply of electricity generated from wind power needs installation of electronically operated black - boxes (Synchronus Generator) which are very costly. At times, there may be no wind and the power generation may stand still.

2.1 Progress in India

Wind energy is pollution free and a renewable source of energy. California with 17,000 turbines generating 1500MW is the world's largest producer of wind energy. India started utilization of the wind power during the period of the VII th five-year plan. It was found that on 80 per cent days' winds in Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra and Gujarat below 10Km / hour for more than 10 hours and 20 hours on 40 per cent days. Large scale research in this direction started in 1983. As a result, wind power farms were established in different parts of Indian states and union territories. In 1995, the total wind energy potential was estimated, around 20,000 MW.

2.2 Contribution of Wind Resources in Ahmednagar

The whole electricity is supplied by the Mahavitaran electrical board of Maharashtra. In Ahmednagar district, there are major three companies viz., Suzlon, Enercon, Ganesa is generating the wind electricity. Maharashtra Energy Development Agency is taking this energy and supply for the Indian Grid Network. Today wind Electricity in Maharashtra is 4500 MW in which Ahmednagar district is produce the 400 MW wind electricity. In this research, we are try to study the wind energy potential of Ahmednagar district by Geographical attitude.

2.3 Generation of Wind Electricity

Ahmednagar is one of the pioneer district for the wind energy. Out of the total wind electricity of the Maharashtra, 10% of the electricity is occur in this district. geographical condition is more suitable for the wind energy i.e. Western dhat and lava platform foundation, which can be gives the suitable support for the windmill. In this district, there is tropical dry Monsoonal climatic region. That's why wind density is suitable for the wind energy. Potential sites for the wind from in Ahmednagar – Kavda, Donger, Khandke, Kolgaon, Panpatta etc.

CLP India's Power Project at the Khandke, there was project start in 2006. This project is 50 MW. This

was the first project of CLP. This electricity is taken by the MSEDCL. Turbines of windmill made by Enercon whose rated output is 800KW. SJVNL wind energy project is public sector Hydropower major Satlluj Jal Vidyut Nigam. There are 56 Wind Power turbines which are developing 47 MW electricity at Khivire (Akola). This project is run by the Gamesa. Third project is located at Supa in Parner the wind turbine is made by Suzlon. At the Supa Bajaj Auto to set up 20 MW wind power project in which 20 wind generators of 1000 KW is working.

Kolgaon, taluka Shrigonda is one of the potential site for the formation of wind energy. Another one of the expected site is Kosegav then. In this district, there are strong wind are blowing in the Monsoonal period. that's why most of the electricity (70%) is generated in the month of the May to September. in this district, there is continuous mountain region of the western dhat, who's height is averagely 600 to 700 meters from the ground surface that's why transportation activity is more suitable. Due to the less rainfall, these land is barrel and less vegetation area.

Today there is 500 MW generation of the wind electricity in this district, but the potential capacity is more the 20 times. The Percentage of total feasible sites for wind resources in Maharashtra are shown below in graph details among different districts.

In the present study, we investigate herb species richness (spermatophyte) in terms of taxonomical diversity and species composition in relation to oak and pine forests in Central Himalayan forests.

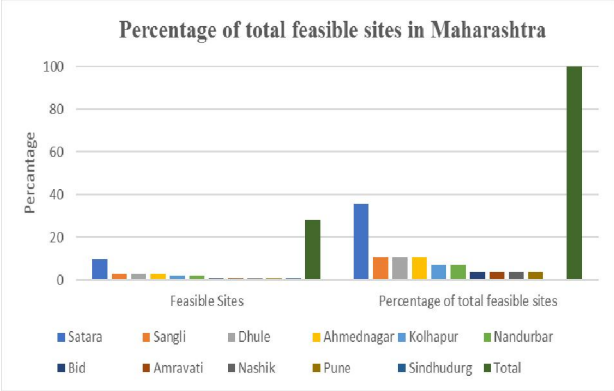

Fig. 2 Showing potential sites for wind resources in Maharashtra state among different districts

The most efficient site of potential for wind energy resources is Khandke, in the Ahmednagar, Kavadya Dongar in Parner and Kolgaon in Shrigonda talukas of Ahmednagar district has been observed. And details of this has shown below in graphs in details:

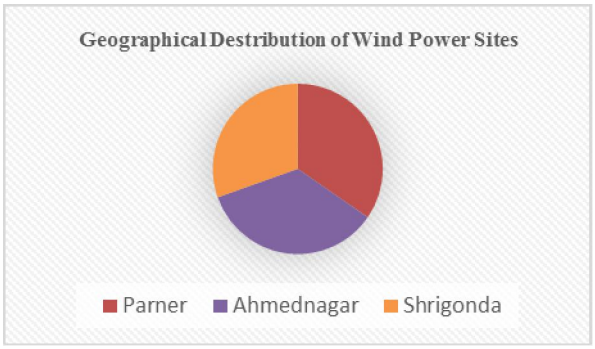

Fig. 3 Showing potential sites for wind resources in Ahmednagar district among different talukas

3. Solar Energy

The energy of sun called solar energy can be used effectively. The earth receives energy continuously from the sun at the rate of about 75,000 x 10 KWH of energy every day Green Plants have the capacity to trap the solar energy and they convert to solar energy into chemical form by a process called photo synthesis. Most part of solar energy is left unused. Just 0.1% of this could meet the total world energy requirements. Scientists have developed ways and means to trap solar energy artificially and convert into various forms like electrical, chemical and mechanical.

The solar radiation coming to the earth is called INSOLATION and it is in the form of electromagnetic waves. One square centimeter area on earth receives two calories of solar energy in one minute. It can be increased through artificial means to meet the energy requirement. Photo - chemical change involves changes due to heating effects of sun rays. e.g. during our child hood days, we might have played with leaves to burn papers by sun rays. Some chemical changes also can occur in objects that absorb solar energy. e.g. bright colour clothes fade away when put into strong sunlight continuously. Black surfaces absorb sunlight and thus get heated. Sun light also causes the synthesis of starch in green plants (Photosynthesis).

$$6Co2 + 12\ H2O\ \text{Sunlight}\ C6H12O6 + 6H2O6 + 6O2$$

When sunlight falls on some specific metals like sodium, potassium and lithium it activates the electrons inside it. The excited electrons after some time return to their original level after releasing the energy, it is called 'Photo Electric Effect'. All the above principles are used to convert solar energy into heat, chemical and electrical energy. Solar cooker, solar oven (developed by Jodhpur's Central Arid Zone Research Institute (CAZRI) space heating buildings during cold weather in USA signals at RS are examples of how solar energy can be used effectively.

3.1 Progress in India

Sun, the oldest source of energy, enriching life with all the basic amenities required to sustain life on earth from thousands of decades. The solar energy developments in this booming technological and commercially vigorous world has rendered engineers and scientists to harness it with a wide range of applications (lighting, heating, cooling, rural electrification, and many industrial applications). India being a tropical country is bestowed with ample solar energy with around 300 sunny days in a year. The total installed capacity of India as on March 31, 2016 is 298,060 MW in which solar along with other renewable sources contributes 38,822 MW. The solar radiation of about 5,000 trillion kWh per year is incident over its land mass with average daily solar power potential of 0.25 kWh per m2 of used land area with the commercially available. As on March 31, 2016, the total solar installed capacity of India is 6,762.85 MW. India expects to install an additional 10,000 MW by 2017 and a total of 100,000 MW by 2022. Renewable energy Akshay Uurja (2016).

Solar power systems installed in India: Number of solar street lighting systems: 55,795Number of home lighting systems: 42,607Solar lanterns: 560,295Solar photovoltaic power plants: 1566 kW Solar water heating systems: 140 km2 of collector area Box-type solar cookers: 575,000Solar photovoltaic pumps: 6,818 (Source: www.india-reports.com). Solar cookers, solar heaters, solar desalination plants, solar photovoltaic electric power, generators and solar pump sets are being used even in remote villages. The following organizations develop solar energy system.

1. Department of Non - conventional energy sources (DNES).
2. Rural Electrification Corporation.
3. Indian Institutes of Technology.
4. Department of Metallurgy of Pune Engineering College.

3.2 Contribution of Solar Resources in Ahmednagar

There is a huge potential of solar radiation in Ahmednagar District. As per as commercial level concern all most 10 out of 5 fuel pumps in the area has been using solar panels for generation of electricity on pump stations. As per as domestic or home level concern the small solar lantern has huge sell. As about the 10-15 solar lanterns has been sealed per day having coast of 600/- rupees each. So, monthly sell of about 300 to 400 lanterns in one month. So, it shows the increasing the awareness among the peoples in the investigation area during the research period of five years.

There is also sale of solar inviter in the study area but its coast affects the sale of it. Because it coasts 5000 minima to 50,000 maximum rupees for each piece. So, it makes difficult to purchase to the pupils in the research area. So, it need the governmental subsidy or it need finical assistance to increase the sale in future. To use full solar radiation potential has need countless sale in the research area in future. The last five years (2010 – 2014) data of solar radiation as shown below in graph detail.

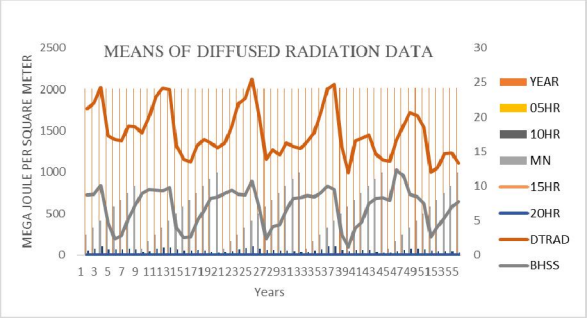

Fig. 4 Showing potential of solar radiation in Ahmednagar during a research period of five years

4. Solid Waste Resources

The volume of garbage in Indian cities is increasing. Indian cities and towns are estimated to generate about 80,000 metric tonnes of solid waste every day. Per capita solid waste generated is about 350-400 gms and in large cities it exceeds 500 gms. Only 60 per cent of this volume is collected, even less is transported and disposed off. Sanitary landfill or composting as methods of garbage disposal is limited to very few cities. Mumbai generates about 3200 tonnes of garbage of which about 97% is collected. In other cities, collection varies from about 90% in Delhi and Chennai, about 75% in Calcutta and Hyderabad, 68% in Bangalore and 70 % in Kanpur.

The collection is around 50% in smaller towns. In industrial areas of many cities, the municipal solid waste is getting mixed up with hazardous waste creating a serious problem, while the accumulation of garbage has become a common site in most of the cities. Most solid wastes that are collected end up in open dumps, sanitary landfill or drainage system, threatening both surface water and ground water quality. Solid wastes create one of the most visible environmental problems in low-income areas. These problems are directly linked to inadequate planning, finances and management capacity at the local level.

4.1 Agricultural Waste

Agricultural waste is another major non-commercial fuel consumed in the domestic sector. It is used more in the villages and it is the cheapest fuel. But the smoke of the agricultural waste directly affects human health and also it affects the environment through air pollution and deforestation.

Environment friendly disposal of waste, which is the need of the hour considering mass pollution everywhere. Generation of a fairly good amount of fuel gas, which will definitely support the dwindling energy resources.

4.2 Cow Dung

India is an agricultural country and has abundance of non-conventional energy in the form of agricultural and bio mass energy. When we consider biomass energy for rural areas biogas is the best option. But there are many other ways through which we can consume bio mass energy efficiently. The major constituent of bio mass is cow dung (including buffalo and cow). According to the Agriculture Ministry of India, about 4.06 million tonnes of dung (cow and buffalo) is daily produced. The Major portion of this cow dung that is, approximately 85 percent is used as a fuel mostly for households in the form of solid and dry cow dung cake and only 3.7 percent of this cow dung is used as a fuel in the form of biogas.

4.3 Bio Mass

Bio mass means dry weight of organic matter produced by plants, their derivatives and wastes. It includes plant parts, animals and animal wastes. As biomass is the product of Photosynthesis by plants, bio mass energy is regarded as another form of indirect use of solar energy. It is very cheap, renewable and almost pollution free. Bio-mass energy has from the following three ways.

1. By incineration or controlled burning of fuel wood and agricultural left over.
2. By converting bio - mass into alcohol through thermochemical process and using it in engines.
3. By making bio-gas (or Gobar gas) through bio-chemical conversion i.e., anaerobic (without air fermentation (digestion) of moist cattle.

The energy from bio-mass is very high. One cubic meter of bio-gas contains about 6000 calories which is equivalent to 0.8 liters of petrol, or 0.6 liters of crude oil or 1.5 m^3 of natural gas, or 1.4kg of charcoal or 2.2 KWH of electrical energy. Most of bio-gas is Methane (CH4) at normal temperature and pressure. It is highly combustible and gives non - luminous flame. Estimates show that it can produce 22,500 million cubic meters of methane (Gobar gas) and 206 million metric tons of organic manual every year.

Scientists have identified several species of plants (Petro - plants) that can be used as bio-mass sources. Green leaves, animal urine, animal fodder left over or waste and perishable food wastes are other bio - mass resources besides the animal dung. (Gobar) The only limitation of this energy source is its availability. Population explosion or urbanization has already put excessive pressure on available cultivable land. So where is the land for the creation of more bio - mass?

4.4 Bio gas

Biogas is a very good alternative fuel, but in a country like India where most of the areas are affected by draught, it is impractical to set biogas plant everywhere as it requires heavy investment for installation, huge amount of water and a large area for installing the plant. We use cow dung in the form of dry cake which produces lots of smoke and less efficient combustion occurs. Normally 2 cubic meters or 3 cubic meter bio-gas plants are constructed in the villages requiring a minimum of 3 cattle.

Biogas is a mixture containing methane 55 to 65 percent, Carbon dioxide 30 to 40 percent and impurities like H2, H2S and some N2. It is a clean but slow burning gas and has a calorific value between 5000 to 5500 kcal /kg. Biogas is also called 'Gobar gas'. Biogas is an environment-friendly cheap fuel for rural areas. It is obtained by anaerobic fermentation of organic materials. It can be used directly in cooking, reducing the demand for firewood. Moreover, the material from which biogas is produced retains its value as a fertilizer and can be returned to the soil. A Bio Gas Plant serves many purposes such as:

Generation of high quality manure, which would be weed less and an excellent soil conditioner. This is very important for replenishing fast decreasing resources of productive soils. It must be noted that the need for replenishing the soil with high quality organic manure has been identified in plan documents. Biogas is a colorless, odorless and inflammable gas. The gas generated in this plant can also be used as a source of natural gas. The production is about 0.25 to 0.35 cubic meters per kg of cake. According to Shete Shankar (2015), the potentiality biogas generation in study area showing the unbalance in Gobar gas generation and population ratio.

4.5 Progress in India

The department of Non - conventional energy sources launched a National Bio - gas Development Programme. The installation of these plants is going on all over the country at the block and panchayat level in rural areas. During the year 1984 - 1985 alone 1,50,000 Bio - gas plants were installed. Now it is estimated that about 3,30,000 bio-gas plants are working in India. In another successful programme, financial incentives were used in a biogas project in India where meeting of quality standards and durability of the biogas system were rewarded in the form of an additional bonus. A mechanism that is receiving growing attention is the provision of affordable micro-credit to households: if used to support the purchase of efficient appliances that

reduce fuel (and health) costs in the long term, this could be a powerful instrument for change.

4.6 Contribution of Ahmednagar in Solid Waste Resource Management

In Ahmednagar district Parner, Akole, Jamkhed, Karjat, Nevasa and Shevgaon tahsils are entirely rural in character. So, there is solid waste generation rate is low as compare to other urban areas of Ahmednagar. Total Municipal Solid Waste generation per day 106 metric tons. The houses to house collection of waste is done about 40% of total urban area. About 227 rack pickers are working for the corporation which are involved in the process of segregation at source for solid waste generations.

This is a self-producing modern fuel. Though its uses are varied, the sample households use it only for cooking purposes. Only 20 out of the 50 sample households (40 percent) established biogas plants in the study area. Among them, nine were out of order and twenty were functioning at the time of interview. Among the defunct plants, twelve were defunct due to cracks in the concrete domes and the remaining nine dues to corrosion of iron drums and irregular feeding.

5. Conclusion

Wind power is one of most important renewable source worldwide distributed and has a great potential of electricity. The non-conventional energy sources such as solar, biogas and wind affected very less. Wind power is one of the most important energy sources available, free of cost, abundant in nature and pollution free green energy without any waste. Today wind industry is fastest growing industry all over the world and study area also not way from it.

Solar energy from the sun emits about 3.8 x 1026 W of power in all the directions. Available of this around 1.7 x 1017 W is received by earth. The average solar radiation outside the earth's atmosphere is 1.35 kW/m2 varying from 1.43 kW/m2 (in January) to 1.33 kW/m2 (in July). In India, the annual solar radiation is about 5 kWh/m2 per day; with about 2300-3200 sunshine hours per year. Solar energy can be exploited for meeting the ever-increasing requirement of energy in our country.

Landfills are the most common practice of solid waste disposal throughout the study area. But, the increasing amount of solid waste is rapidly filling existing landfills, and new sites are difficult to establish, so in such circumstances open burning cases are mostly observed. Alternatives to landfills include the use of 3R principal's reduction, recycling, reuse by composting and incineration, as well as use of landfills. Incineration is utmost inexpensive if it comprises energy recovery from the waste. Energy can be recovered directly from waste by incineration or the waste can be processed to produce storable refuse derived fuel. Potentiality of biogas generation if it will be achieving, then reduce in firewood's and help in stopping deforestation and also reducing use of conventional energy resources like biomass (fuel wood) Kerosene, LPG gas etc. And it is also helping for better female health in the research area of the district.

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