

# Renewable Energy – A Promise for Vijayawada, the Green Capital of Andhra Pradesh

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## ABSTRACT

Since the dawn of humanity, people have used sources of power to survive. The demand for power has been growing at a rapid rate and has overtaken the supply, leading to power shortages despite manifold growth in power generation over the years. Currently only about 16% of global energy consumption comes from renewable resources, with 10% of all energy from traditional biomass which is mainly used for heating, and 3.4% from hydroelectricity. Wind, solar, geothermal, and bio-fuels account for another 2.6%. These figures are projected to continue to grow strongly in the coming decade and beyond. This paper looks at different renewable energy resources, reviews their potential and stages of development across the world and in India, and advocates strongly the need to embrace this emerging technology for sustainable development in Vijayawada, the green capital of Andhra Pradesh in particular, and all human beings on this planet, in general.

## Keywords

Renewable Energy, Environmental Pollution, Sustainable development, Green infrastructure

## I. INTRODUCTION

Since the dawn of humanity, people have used many sources of energies to survive - like wood for cooking and heating, wind for driving ships over ocean waters, water for milling grains, and solar power for lighting etc. Prior to this, the other traditional sources of energy used were human labor and animal power. Of late, geothermal energy resources have also been added to this list. Good thing is that all these resources are replenished naturally and hence are available in plenty. These are popularly known as renewable sources of energies.

However, a little more than 150 years ago, people created the technology to extract energy from the fossilized remains of plants and animals, e. g. coal, oil, and natural gas. These super-rich but limited

sources of energy, termed as non-renewable resources, quickly replaced wood, wind, solar, and water power as the main sources of energies. The problem is that the rate at which we consume fossil fuels is much faster than the rate at which nature is replenishing them. Based on present rate of consumption, it is estimated that the world's oil will last for about another 40 years, natural gas for about 60 years and coal for about 200 years (1). Another problem with these energy resources is the release of products of combustion of sulphurous and nitrogenous matters and especially CO<sub>2</sub> gases which result in acid rain, corrosion and in increase of earth's temperatures causing hardships like inundation of low lying areas near coast. Also burning of these resources cause release of solid particulate matter in air that results in adverse health effects and reduced visibility etc. Accordingly, there is increased interest in development and use of renewable energy technologies and to increase their efficiencies.

Currently only about 16% of global energy consumption comes from renewable resources, with 10% of all energy from traditional biomass which is mainly used for biofuels account for another 2.6%.(2) These figures are projected to continue to grow strongly in the coming decade and beyond. Wind power, for example, is growing at the rate of 30% annually, with a worldwide installed capacity of 350 GW at the end of 2013 (3).

Let us have a look at these renewable energy resources one by one and review their potential and stages of development across the world and in India.

## II. SOLAR POWER

Solar power is captured either directly through photovoltaic (solar cells), or indirectly using concentrated solar power (CSP). There are no fuel costs or emissions during operation of these power stations.

Converting sunlight into electricity is a fast-growing technology doubling its capacity every couple of years. In recent years their efficiency has improved, thereby reducing the cost per watt as well as its payback time.

At the end of 2013, worldwide Photovoltaic capacity reached 139 GW. Germany remains the world's largest overall producer of photovoltaic power with a total capacity of 35.5 GW (4). Other significant contributors are Italy, China, Japan and the United States. Solar photovoltaic power stations also exist in Canada and in India. Concentrated solar power systems use tracking systems that follow the sun's daily path across the sky to generate more electricity than fixed-mounted systems. These systems are usually installed on multi-family apartment buildings. They meet a portion of the hot water needs of an estimated 50–60 million households in China alone and a total of over 70 million households on world wide scale (5).

Kenya is the world leader in the number of solar power systems installed per capita. More than

30,000 small solar panels are installed in Kenyan homes annually.

India is densely populated and has high solar ray incidence, an ideal combination for using this technology. While initial applications of solar power in India were for water pumping, large solar power project in the Thar Desert occupying an area of 35,000 km<sup>2</sup>, sufficient to generate 700 to 2,100 GW of electricity have also been implemented (6).

Launched in 2003, the 4-year Indian Solar Loan Program won the award for sustainability for helping to establish a consumer financing program for solar home power systems. Announced in November 2009, the Government of India launched its Jawaharlal Nehru National Solar Mission plan to generate up to 20 GW grid-based solar power covering over 20 million sq meters with collectors by the end of 2020. The Mission also aims to achieve grid parity, which means - electricity delivered at the same cost and quality as that delivered on the grid by 2020 (7).

## III. BIOMASS

Wood remains the largest biomass energy source today; examples include forest residues (such as dead trees, branches and tree stumps), yard clippings, wood chips and even municipal solid waste.

Plant energy is produced by crops specifically grown for use as fuel that offer high biomass output per hectare with low input energy. For example the grain from a wheat plant can be used for liquid transportation fuels while the straw can be burned to produce heat or electricity. Plant biomass can also be degraded from cellulose to glucose through a series of chemical treatments, and the resulting sugar can then be used as a first generation biofuel, which provide around 3% of the world transportation fuels. Bioethanol is an alcohol made by fermenting the sugar components of maize, and sugar cane. USA and Brazil are two main contributors of ethanol fuel. Nearly all the gasoline sold in the United States today is mixed with 10%

ethanol, a mix known as E10, and motor vehicle manufacturers already produce vehicles designed to run on E10 or much higher ethanol blends (8).

#### IV. BIODIESEL

Biodiesel is made from left over vegetable oils, animal fats or recycled greases and is most common biofuel in Europe. While Biodiesel can be used as a fuel for vehicles in its pure form, but it is usually used as a diesel additive to reduce levels of particulates, carbon monoxide, and hydrocarbons from diesel-powered vehicles in to the atmosphere.

Clean liquid fuels sourced from renewable feedstock are used for cooking and lighting in energy-poor areas in Ethiopia, Kenya, Nigeria and Mozambique.

Every year, about 55 million tons of municipal solid waste (MSW) and 38 billion liters of sewage are generated in the urban areas of India. In addition, large quantities of solid and liquid wastes are generated by industries. As more people migrate to urban areas and as incomes increase, the amount of waste generated in urban India will increase at approximately 1-1.33% annually. This has significant impacts on the amount of land that is and will be needed for disposal and also the economic costs of collecting and transporting waste. India has had a long involvement with anaerobic digestion and biogas technologies. Waste water treatment plants in the country have been established which produce renewable energy from sewage gas. However, there is significant untapped potential. In India official estimates of the Ministry of Power indicate that more than 50% of the households do not have access to electricity and clean and convenient cooking fuel. The fuel used in chulhas for cooking is fire- wood, agricultural residues or dung cakes, etc. The indoor air pollution caused by this fuel results in respiratory diseases. So biogas has great potential for application in India.

#### V. WIND POWER

Offshore and high altitude sites, where wind speed is generally double than that of the land, have been used for wind farms which house wind turbines. Wind power capacity of the globe stands at around 290 GW. China leads the word in wind power development which generates around 27% of the total global wind power. USA comes next at 21% of the total.

The development of wind power in India began in the 1990s, and has significantly increased in the last few years. Although a relative newcomer to the wind industry compared with China or the US, domestic policy support for wind power has led India to become the fifth largest installed wind power capacity in the world (9). As of December 2013 the installed capacity of wind power in India was 20GW, mainly spread across Tamil Nadu, Maharashtra, Gujrat, Karnataka and Rajasthan. Wind power accounts for 6% of India's total installed power capacity, and it generates 1.6% of the country's power. In its 12th Five Year Plan (2012-2017), the Indian Government has set a target of adding 11 GW of power using Wind Energy (10).

#### VI. HYDROPOWER

Hydropower is produced in 150 countries, with the Asia-Pacific region generating 32 percent of global hydropower in 2010. China is the largest hydroelectricity producer, with 721 terawatt-hours of production in 2010, representing around 17 percent of domestic electricity use.

Micro-hydro projects linked to mini-grids provide power in many houses in Ethiopia. Over 44 million households use biogas made in household digesters for lighting and/or cooking, and more than 166 million households rely on a new generation of more-efficient biomass cook stoves.

## VII. GEOTHERMAL ENERGY

Geothermal energy has been used for bathing since very old times but has been very recently used for power generation.

Geothermal power is cost effective, reliable, sustainable, and environmentally friendly, but has historically been limited to areas near tectonic plate boundaries.

In 2010, the United States led the world in geothermal electricity production with about 3 GW of installed capacity. Philippines follow the US as the second highest producer of geothermal power in the world, with 1.9 GW capacities.

## VIII. MARINE ENERGY

The movement of water in the world's oceans creates a vast store of kinetic energy. This energy can be harnessed to generate electricity to power homes, transport and industries.

The oceans have tremendous amount of energy. Total installed capacity of energy derived from ocean is around 520 MW. South Korea and France are the major contributors for this power and their share stand at 48 and 45% respectively. This technology is however not yet widely demonstrated to the rest of the world (11).

One of the primary challenges for India is to alter its existing energy mix, which is dominated by coal, to a larger share of cleaner and sustainable sources of energy. India is increasingly adopting a variety of renewable

Energy technologies for use in different sectors. According to the Renewable Energy Status Report released at the Green Summit 2014 in Bangalore in June 2014, the total renewable energy potential from various sources in India is 2.5 lakh MW. The installed capacity of renewable energy has touched 32.2 thousand MW or 12.95% of the total potential available in the country, as on March 31, 2014.

Renewable energy in India comes under the purview of the Ministry of New and Renewable Energy (MNRE). India has set a target of achieving overall renewable energy installed capacity of 41.4 thousand MW by 2017.

Recent researches have confirmed that barriers to implementing the renewable energy plan are "primarily social and political, not technological or economic". Renewable energy is an attractive option because renewable resources are available in plenty, and can supply significantly greater amounts of electricity than the total current or projected domestic demand in any country."

Though renewable offer significant potential, only a small portion of it has been tapped. For example it is estimated that only about 1% of the potential for solar flat plate collectors has been actually realized in India. In order to mainstream renewable in the future energy systems - significant efforts are required towards cost reduction, technology and system development and better installation and maintenance practices. This is the challenge facing our technologists and technicians. We have no alternative but to aggressively pursue energy efficiency and renewable if we wish to develop sustainable energy systems in the new capital for Andhra Pradesh.

## IX. REFERENCES

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