RENEWABLE ENERGY POTENTIAL AND SUSTAINABLE DEVELOPMENT IN PRESENT SCENARIO OF GLOBALIZATION

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***Abstract*—An energy resource that is renewed by nature and whose supply is not affected by the rate of consumption is often termed as renewable energy. The need to search for renewable, alternate and non-polluting sources of energy assumes top priority for self-reliance in the regional energy supply. This demands an estimation of available energy resources spatially to evolve better management strategies for ensuring sustainability of resources. With the rising population need for energy increases. To meet the requirement we have to find out renewable energy potential. If we continue to use non renewable resources there will be nothing left for future generation. Rising international concern about global warming and the rapid development of the renewable energy industry over recent years has led to a need for sustainable development in renewable energy in present scenario of globalization.**

***Index Terms*—Hence, this paper focuses on mapping of renewable energy (solar, wind, bio energy and small hydro energy) potential and findings of recent developments.**

I. INTRODUCTION

Worldwide survey of 132 nations indicated that, the nations ranked high on sustainable development, tend to have higher usage of the renewable energy. Energy is essential for economic and social development of a region or a country. However, consumption of fossil fuels is the major cause of air pollution and climate change. Improving energy efficiency and de-linking economic development from energy consumption (particularly of fossil fuels) is essential for sustainable development. [2]

The central idea presented in this paper is review and study of different sector of energy and current sustainable development in each sector globally .For which infrastructure development is required to achieve sustainable development in the renewable energy sector in the era of globalization. For which first a look on different sources of renewable energy available.

A. Why Renewable Energy?

Renewable energy including biomass, geothermal, hydropower, solar, wind, tidal, and wave offers tremendous benefits for meeting global energy needs.[1] Building on a foundation of hydropower, biomass combustion, and geothermal power pioneered during the industrial revolution in the late 1800s, new forms of renewable energy began to be developed and commercialized, including solar, wind, and several forms of advanced bio energy.[3]

II. DIFFERENT SOURCES OF RENEWABLE ENERGY [10]

A. Solar Energy:

The sun is our most powerful source of energy. Sunlight, or solar energy, can be used for heating, lighting and cooling homes and other buildings, generating electricity, water heating, and a variety of industrial processes. Most forms of renewable energy come either directly or indirectly from the sun. For example, heat from the sun causes the wind to blow, contributes to the growth of trees and other plants that are used for biomass energy, and plays an essential role in the cycle of evaporation and precipitation that makes hydropower possible.[7]

B. Wind energy:

Wind is the movement of air that occurs when warm air rises and cooler air rushes in to replace it. The energy of the wind has been used for centuries to sail ships and drive windmills that grind grain. Today, wind energy is captured by wind turbines and used to generate electricity.[10]

C. Hydro power:

Water flowing downstream is a powerful force. Water is a renewable resource, constantly recharged by the global cycle of evaporation and precipitation. The heat of the sun causes water in lakes and oceans to evaporate and form clouds. The water then falls back to Earth as rain or snow, and drains into rivers and streams that flow back to the ocean. Flowing water can be used to power water wheels that drive mechanical processes. And captured by turbines and generators, like those housed at many dams around the world, the energy of flowing water can be used to generate electricity.[7]

D. Biomass energy:

Biomass has been an important source of energy ever since people first began burning wood to cook food and warm themselves against the winter chill. Wood is still the most common source of biomass energy, but other sources of biomass energy include food crops, grasses and other plants, agricultural and forestry waste and residue, organic components from municipal and industrial wastes, even methane gas harvested from community landfills. Biomass can be used to produce electricity and as fuel for transportation, or to manufacture products that would otherwise require the use of non-renewable fossil fuels.[6]

E. Hydrogen:

Hydrogen has tremendous potential as a fuel and energy source, but the technology needed to realize that potential is still in the early stages. Hydrogen is the most common element on Earth for example, water is two-thirds hydrogen but in nature it is always found in combination with other elements.

Once separated from other elements, hydrogen can be used to power vehicles, replace natural gas for heating and cooking, and to generate electricity.

F. Geothermal Energy:

The heat inside the Earth produces steam and hot water that can be used to power generators and produce electricity, or for other applications such as home heating and power generation for industry. Geothermal energy can be drawn from deep underground reservoirs by drilling, or from other geothermal reservoirs closer to the surface.[7]

G. Ocean Energy:

The ocean provides several forms of renewable energy, and each one is driven by different forces. Energy from ocean waves and tides can be harnessed to generate electricity, and ocean thermal energy—from the heat stored in sea water—can also be converted to electricity. Using current technologies, most ocean energy is not cost-effective compared to other renewable energy sources, but the ocean remains and important potential energy source for the future.

III. Global Scenario of Energy consumption

In 2008,total worldwide energy consumption was 474 exajoules (474×1018J) with 80 to 90 percent derived from the combustion of fossil fuels .This is equivalent to an average annual power consumption rate of 15 terawatts (1.504×1013W). Not all of the world's economies track their energy consumption with the same rigor, and the exact energy content of a barrel of oil or a ton of coal will vary with quality.

In 2009, world energy consumption decreased for the first time in 30 years (-1.1%) or 130Mtoe, as a result of the financial and economic crisis (GDP drop by 0.6% in 2009).This evolution is the result of two contrasting trends. Figure 1 shows the factors affecting demand for renewable energy climate change ,environmental issues ,energy security ,consumer demand increased reliability and local economic development specifically for United States ,Europe ,Japan and developing countries in the category high ,medium and low. Oil remained the largest energy source (33%) despite the fact that its share has been decreasing over time. Coal posted a growing role in the world's energy consumption: in 2009, it accounted for 27% of the total.

Figure 1 Key Market Drivers for Renewable Energy

[11]

	Factors Affecting Demand for Renewable Energy					
	Climate Change[1]	Environ-mental Issues	Energy Security	Consumer Demand	Increased Reliability	Local Economic Development
Europe	●	●	●	◑	○	◑
Japan	◑	●	●	◑	○	○
United States	◑	◑	●	◑	◑[2]	◑
Developing Countries	○	○	◑	●	◑	●

1. Government vs. individuals
2. Region specific

● High ◑ Medium ○ Low

IV. Indian scenario of Energy consumption

Coal is the predominant energy source (58%) in India, followed by oil (27%), natural gas (7%), lignite (4%), hydropower (3%) and nuclear power (0.22%). Energy consumption patterns in the Indian residential sector vary widely not only among the rural and urban areas but also across various income classes in urban areas. Approximately 86.1% rural households in India use fuel wood and dung cakes for cooking, 3.5% rural households use LPG for cooking, 50.6% of rural households use kerosene and 48.4% use electricity as a

primary source of lighting. The annual average fuel wood consumption is around 270–300 million tones, kerosene consumption is about 10.5 million tones out of which 60% is in rural areas. India's present energy scenario calls for the effective management of all available resources in order to attain national objectives. A well-balanced fuel mix, in which all energy resources are appropriately utilized, is essential for sustainable development.[5]

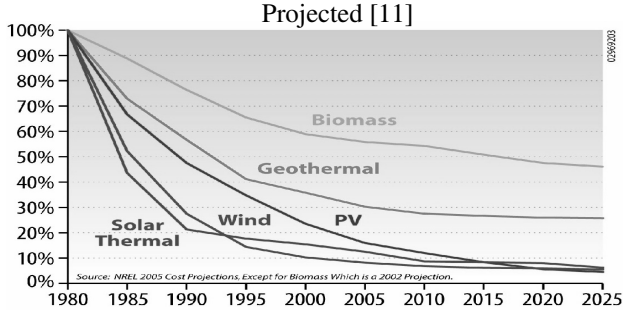
V. GLOBAL SCENARIO OF RENEWABLE ENERGY POTENTIAL AND RECENT DEVELOPMENT [11]

Renewable energy potential can be utilized by using modern technology by installing different plants and wind turbines ,solar panels set up for generation of electricity . Main requirement is in the field of electricity. Table number 1 presenting Top Countries with Installed Renewable Electricity by Technology (2009) in different sectors of renewables wind, Solar PV and Biomass. Figure 2 showing Renewable Energy Electricity Generation Costs as Percentage of 1980 Levels: Historical and Projected. It shows from 1980 to 2025 for Biomass ,Geothermal, wind, PV and solar thermal in the percentage of 0 to 100%.

Table 1 Top Countries with Installed Renewable Electricity by Technology (2009) collect data for 2011

Geothermal	wind	Solar PV	Biomass
1.U. S.	1.U. S.	1.Germany	1.U.S.
2.Philippines	2.China	2.Spain	2.Brazil
3.Indonesia	3.Germany	3.Japan	3.Germany
4.Mexico	4.Spain	4.U.S.	4.China
5.Italy	5. India	5.Italy	5.Sweden

Figure 2 Renewable Energy Electricity Generation Costs as Percentage of 1980 Levels: Historical and Projected [11]



Top Countries with Installed Renewable Electricity (2009)

1. China.
2. U.S.
3. Brazil.
4. Canada.
5. Japan.

Here summery for different renewable sources potential and installations.

A. Wind:

In the United States, installed wind energy capacity increased almost 14 times between 2000 and 2009**.** In the United States, wind experienced record growth in 2009 and nearly 10 GW of new capacity was added. Texas led the United States in wind installations in 2009, installing more than 2,292 MW of wind capacity. In 2009, China surpassed the United States as the world leader in annual installed wind capacity, with more than 13.8 GW added.

B. Solar:

Solar energy electricity generation has nearly quadrupled between 2000 and 2009, but still represents a very small part of overall U.S. electricity generation. Countries with aggressive solar policies such as Germany, Spain and lead the world in solar photovoltaic (PV) deployment. Similarly U.S. states with aggressive solar incentives lead the United State in installations.

U.S. manufacturers currently have a small share of the world PV market**.** China is the market leader with nearly 40% of the global PV cell production.

A number of concentrating solar power (CSP) plants came online in 2009, including 12 MW in the United States and 120 MW in Spain.

C. Geothermal:

U.S. geothermal energy generation has remained relatively stable from 2000 to 2009, with the past 10 years experiencing an average of 1.2% growth.

Geothermal energy generates power for between 5 and 10 cents / kilowatt-hour.

The United States leads the world in installed geothermal electricity capacity and generation, with most of that power installed in California.

As a base-load source of energy, geothermal is distinct from other renewables such as wind and solar, because it can provide electricity 24 hours a day, 365 days a year.

D. Bio power:

Bio power generation has remained steady during the past seven years, and currently accounts for 38% of all renewable energy generated in the United States (excluding hydropower). Biomass electricity primarily comes from wood and agricultural residues that are burned as a fuel for cogeneration in the industrial sector (such as in the pulp and paper industry).

E. Hydropower:

Hydropower capacity has remained constant between

2000–2009, with generation fluctuation depending on water supply. Hydropower remains the largest source of renewable energy generation, and an important component of the energy mix; primarily large-scale hydropower accounts for 6.9% of U.S. electricity generation.

F. Advanced Water Power:

U.S. interest in advanced water power such as tidal, river and ocean current, and ocean wave energy is just beginning to grow, with many prototype projects in testing stages and permits being filed at the Federal Energy Regulatory Commission (FERC).

One wave and two tidal plants came online in 2009 in New South Wales, Canada, and the United Kingdom.

VI. INDIAN SCENARIO OF RENEWABLE ENERGY POTENTIAL AND RECENT DEVELOPMENT

Renewable energy resources, which the country has in abundance, such as solar, wind, biomass, small hydro energy, etc., can effectively meet energy demand and are environmentally benign. About 3700 MW of power-generating capacity based on renewable energy sources has been installed in the country so far. This constitutes about 3.5% of the total installed capacity.

Review in India - Integrated energy planning was recognized as an essential element of development planning in India as early as the sixties. The Government of India constituted the Energy Survey of India Committee (ESIC) in 1963 to study ''the present and prospective demands and supplies of energy, both total and in respect of constituents of energy on a national, regional and sectoral basis''. The study was expected to provide the Government with the basic material for development planning in the field of energy up to 1981.

The Fuel Policy Committee (FPC) was appointed by Government of India in 1970 to prepare an outline of the national fuel policy for the next 15 years.

The Working Group on Energy Policy (WGEP) was another expert group constituted by the Government of India in 1977. WGEP was required to outline the national energy policy for the next 5, 10 and 15 years. The report of WGEP was finalized in 1979. WGEP made detailed projections of the demand for both commercial and noncommercial forms of energy up to the end of the century and suggested a number of corrective policy measures to manage the energy demand.

The Advisory Board on Energy (ABE) was set up in 1983 on the eve of formulation of the Seventh Five-Year Plan. In addition to several important recommendations on the technical, financial and institutional aspects of energy, the ABE also made detailed projections of energy demand in different regions till 2004 under assumptions of different macro-economic scenarios.

Table No 2 showing actual installed renewable base plants in India for different renewable sources like wind-form, wind-pumps, small hydro, bio mass gasifires and solar PV.

Table 2 Actual installed renewable based plants in India

Source	Units	Installed
Windfarms	MW	557
Windpumps	Nos	3289
Small Hydro	MW	122
Biomass Gasifiers	X 10 6	2.12
Solar PV	KW	825

CONCLUSIONS

Today, these renewable energy technologies are the fastest growing energy technologies (particularly wind and solar) and are cost competitive in a variety of grid, off-grid, and remote applications worldwide. They utilize locally available resources, off setting the need for costly fuel imports; are environmentally beneficial, without the harmful emissions of conventional energies; provide diversification to a country's energy mix; and create local job and income opportunities. Sustainable development of a region depends on the health of renewable energy resources like water, vegetation, livestock, etc..

The benefits of this sustainable development world power solution are proven:

- Decreased pollution from fossil and nuclear fuels
- Reduced hunger and poverty in developing nations
- Increased trade, cooperation and world peace
- Enables health care, communications and access to clean water
- Stabilized population growth.

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