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SUSTAINABLE ENVIRONMENT THROUGH RENEWABLE ENERGY

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ABSTRACT

Energy has been a vital input into the economic and social development. However, one third of the world population, living in developing and threshold countries, has no access to electricity. These people mostly live in remote and rural areas with low population density, lacking even the basic infrastructure. Renewable energy is generally defined as energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat. Renewable sources of energy are an essential part of an overall strategy of sustainable development. They help reduce dependence of energy imports, thereby ensuring a sustainable supply. Furthermore renewable energy sources can help improve the competitiveness of industries over the long run and have a positive impact on regional development and employment. Renewable energy technologies are suitable for off-grid services, serving those in remote areas of the world without requiring expensive and complicated grid infrastructure.

Keywords: Renewable energy, Sustainability, Wind Power, Solar Power, Hydroelectricity, Biomass

Introduction:

Energy has been a vital input into the economic and social development. Energy is an essential ingredient of socio-economic development and economic growth. It is a basic necessity for survival and a critical factor affecting economic development and employment. Energy crisis has drawn attention of planners, on the impact of energy costs on economic growth, industrial production, employment, etc. It is the key element in the production process, and shortage of energy has serious impact on the economy. However, one third of the world population, living in developing and threshold countries, has no access to electricity. These people mostly live in remote and rural areas with low population density, lacking even the basic infrastructure. Energy development is a field of endeavor focused on making available sufficient primary energy sources and secondary energy forms to meet the needs of society.

The term sustainable development was coined by the UN Bruntland committee to describe a development, which satisfies the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development demands the clean and pollution free environment and enshrines the good quality natural resources for both present and in the future.

Increasing negative effects of fossil fuel combustion on the environment in addition to limited stock have forced many countries to explore and change to environment friendly alternatives that are renewable to sustain the increasing energy demand. Changing to renewable sources and implementation of effective conservation measures would ensure sustainability. RE also provides national energy security at a time when decreasing global reserves of fossil fuels threatens the long term sustainability.

Types of energy:

Classified according to the energy reserves of the energy source used and the regeneration capacity with:

Renewable: When the energy source used is freely regenerated in a short period and there are practically limitless reserves; An example is the solar energy that is the source of energy from the sun, or the wind used as an energy resource. Renewable energies are: original solar natural wind (atmospheric flows) natural geothermal, oceanic tidal, natural waterfall (hydraulic flows), natural plant: paper, wood, natural animal: wax, grease, pack animals and sources of mechanical energy

Non-renewable: They are coming from energy limited sources on Earth in quantity and, therefore, are exhaustible. The non-renewable energy sources include, non-exclusively: fossil source: petroleum, natural gas, coal original mineral/chemical: uranium, shale gas.

Energy from Renewable sources:

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energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat. New renewables (small hydro, modern biomass, wind, solar, geothermal, and bio-fuels) account for another 3% and are growing rapidly. At the national level, at least 30 nations around the world already have renewable energy contributing more than 20% of energy supply. Many renewable energy projects are large-scale, renewable technologies are also suited to rural and remote areas and developing countries, where energy is often crucial in human development. United Nations' Secretary-General Ban Ki-moon has said that renewable energy has the ability to lift the poorest nations to new levels of prosperity.

Renewable Energy Technologies and Environmental Imapcts:

Renewable energy — wind, solar, geothermal, hydroelectric, and biomass — provides substantial benefits for our climate, our health, and our economy. All energy sources have some impact on our environment. Fossil fuels — coal, oil, and natural gas — do substantially more harm than renewable energy sources by most measures, including air and water pollution, damage to public health, wildlife and habitat loss, water use, land use, and global warming emissions. It is still important, however, to understand the environmental impacts associated with producing power from renewable sources such as wind, solar, geothermal, biomass, and hydropower. The exact type and intensity of environmental impacts varies depending on the specific technology used, the geographic location, and a number of other factors. By understanding the current and potential environmental issues associated with each renewable energy source, we can takes steps to effectively avoid or minimize these impacts as they become a larger portion of our electric supply.

Wind Power:

Wind (*primary renewable natural*) power harnesses the power of the wind to propel the blades of wind turbines. These turbines cause the rotation of magnets, which creates electricity. Wind towers are usually built together on wind farms. There are offshore and onshore wind farms. Global wind power capacity has expanded rapidly to 336 GW in June 2014, and wind energy production was around 4% of total worldwide electricity usage, and growing rapidly.

Harnessing power from the wind is one of the cleanest and most sustainable ways to generate electricity as it produces no toxic pollution or global warming emissions. Wind is also abundant, inexhaustible, and

affordable, which makes it a viable and large-scale alternative to fossil fuels. Despite its vast potential, there are a variety of environmental impacts associated with wind power generation that should be recognized and mitigated.

Solar Power:

Solar energy, radiant light and heat from the sun, is harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaic's, solar thermal electricity, solar architecture and artificial photosynthesis. Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy.

Like wind power, the sun provides a tremendous resource for generating clean and sustainable electricity. The environmental impacts associated with solar power can include land use and habitat loss, water use, and the use of hazardous materials in manufacturing, though the types of impacts vary greatly depending on the scale of the system and the technology used — photovoltaic (PV) solar cells or concentrating solar thermal plants (CSP).

Geothermal Energy:

The most widely developed type of geothermal power plant (known as hydrothermal plants) are located near geologic "hot spots" where hot molten rock is close to the earth's crust and produces hot water. In other regions enhanced geothermal systems (or hot dry rock geothermal), which involve drilling into the earth's surface to reach deeper geothermal resources, can allow broader access to geothermal energy. Geothermal plants also differ in terms of the technology they use to convert the resource to electricity (direct steam, flash, or binary) and the type of cooling technology they use (water-cooled and air-cooled). Environmental impacts differ depending on the conversion and cooling technology used.

Geothermal power is cost effective, reliable, sustainable, and environmentally friendly,[140] but has historically been limited to areas near tectonic plate boundaries. Recent technological advances have dramatically expanded the range and size of viable resources, especially for applications such as home heating, opening a potential for widespread exploitation. Geothermal wells release greenhouse gases trapped deep within the earth, but these emissions are much lower per energy unit than those of

fossil fuels. As a result, geothermal power has the potential to help mitigate global warming if widely deployed in place of fossil fuels.

Biomass for Electricity:

A bio-fuel is a fuel that contains energy from geologically recent carbon fixation. These fuels are produced from living organisms. Examples of this carbon fixation occur in plants and microalgae. These fuels are made by a biomass conversion (biomass refers to recently living organisms, most often referring to plants or plant-derived materials). This biomass can be converted to convenient energy containing substances in three different ways: thermal conversion, chemical conversion, and biochemical conversion. This biomass conversion can result in fuel in solid, liquid, or gas form. This new biomass can be used for bio-fuels. Bio-fuels have increased in popularity because of rising oil prices and the need for energy security.

Biomass power plants share some similarities with fossil fuel power plants: both involve the combustion of a feedstock to generate electricity. Thus, biomass plants raise similar, but not identical, concerns about air emissions and water use as fossil fuel plants. However, the feedstock of biomass plants can be sustainable produced, while fossil fuels are non-renewable. Sources of biomass resources for producing electricity are diverse; including energy crops (like switch grass), agricultural waste, manure, forest products and waste, and urban waste. Both the type of feedstock and the manner in which it is developed and harvested significantly affect land use and life-cycle global warming emissions impacts of producing power from biomass.

Hydroelectric Power:

Hydroelectricity is the term referring to electricity generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water. The cost of hydroelectricity is relatively low, making it a competitive source of renewable electricity. Hydro is also a flexible source of electricity since plants can be ramped up and down very quickly to adapt to changing energy demands. However, damming interrupts the flow of rivers and can harm local ecosystems, and building large dams and reservoirs often involves displacing people and wildlife. Once a hydroelectric complex is constructed, the project produces no direct waste, and has a considerably lower output level of the greenhouse gas carbon dioxide (CO_2) than fossil fuel powered energy plants. Hydroelectric power includes both massive hydroelectric dams and

small run-of-the-river plants. Large-scale hydroelectric dams continue to be built in many parts of the world (including China and Brazil), but it is unlikely that new facilities will be added to the existing U.S. fleet in the future.

Benefits of renewable energy use:

Little to No Global Warming Emissions:

Electricity production accounts for more than one-third of U.S. global warming emissions, with the majority generated by coal-fired power plants, which produce approximately 25 percent of total U.S. global warming emissions; natural gas-fired power plants produce 6 percent of total emissions. In contrast, most renewable energy sources produce little to no global warming emissions. According to data aggregated by the International Panel on Climate Change, life-cycle global warming emissions associated with renewable energy—including manufacturing, installation, operation and maintenance, and dismantling and decommissioning—are minimal.

Compared with natural gas, which emits between 0.6 and 2 pounds of carbon dioxide equivalent per kilowatt-hour (CO2E/kWh), and coal, which emits between 1.4 and 3.6 pounds of CO2E/kWh, wind emits only 0.02 to 0.04 pounds of CO2E/kWh, solar 0.07 to 0.2, geothermal 0.1 to 0.2, and hydroelectric between 0.1 and 0.5. Renewable electricity generation from biomass can have a wide range of global warming emissions depending on the resource and how it is harvested. Sustainably sourced biomass has a low emissions footprint, while unsustainable sources of biomass can generate significant global warming emissions.

Improved Public Health and Environmental Quality:

Generating electricity from renewable energy rather than fossil fuels offers significant public health benefits. The air and water pollution emitted by coal and natural gas plants is linked to breathing problems, neurological damage, heart attacks, and cancer. Replacing fossil fuels with renewable energy has been found to reduce premature mortality and lost workdays, and it reduces overall healthcare costs.

Wind, solar, and hydroelectric systems generate electricity with no associated air pollution emissions. While geothermal and biomass energy systems emit some air pollutants, total air emissions are generally much lower than those of coal- and natural gas-fired power plants. In addition, wind and solar energy require essentially no water to operate and thus do not

pollute water resources or strain supply by competing with agriculture, drinking water systems, or other important water needs. In contrast, fossil fuels can have a significant impact on water resources. For example, both coal mining and natural gas drilling can pollute sources of drinking water. Natural gas extraction by hydraulic fracturing requires large amounts of water and all thermal power plants, including those powered by coal, gas, and oil, withdraw and consume water for cooling.

Biomass and geothermal power plants, like coal- and natural gas-fired power plants, require water for cooling. In addition, hydroelectric power plants impact river ecosystems both upstream and downstream from the dam. However, NREL's 80 percent by 2050 renewable energy study, which included biomass and geothermal, found that water withdrawals would decrease 51 percent to 58 percent by 2050 and water consumption would be reduced by 47 percent to 55 percent.

A Vast and Inexhaustible Energy Supply:

Throughout the United States, strong winds, sunny skies, plant residues, heat from the earth, and fast-moving water can each provide a vast and constantly replenished energy resource supply. These diverse sources of renewable energy have the technical potential to provide all the electricity the nation needs many times over. Estimates of the technical potential of each renewable energy source are based on their overall availability given certain technological and environmental constraints. In 2012, NREL found that together, renewable energy sources have the technical potential to supply 482,247 billion kilowatt-hours of electricity annually. This amount is 118 times the amount of electricity the nation currently consumes. However, it is important to note that not all of this technical potential can be tapped due to conflicting land use needs, the higher short-term costs of those resources, constraints on ramping up their use such as limits on transmission capacity, barriers to public acceptance, and other hurdles. Today, renewable energy provides only a tiny fraction of its potential electricity output in the United States and worldwide. But numerous studies have repeatedly shown that renewable energy can be rapidly deployed to provide a significant share of future electricity needs, even after accounting for potential constraints.

A More Reliable and Resilient Energy System:

Wind and solar are less prone to large-scale failure because they are distributed and modular. Distributed systems are spread out over a large geographical area, so a severe weather event in one location will not cut off power to an entire region. Modular systems are composed of numerous

individual wind turbines or solar arrays. Even if some of the equipment in the system is damaged, the rest can typically continue to operate. For example, in 2012 Hurricane Sandy damaged fossil fuel-dominated electric generation and distribution systems in New York and New Jersey and left millions of people without power. In contrast, renewable energy projects in the Northeast weathered Hurricane Sandy with minimal damage or disruption.

The risk of disruptive events will also increase in the future as droughts, heat waves, more intense storms, and increasingly severe wildfires become more frequent due to global warming. Renewable energy sources are more resilient than coal, natural gas, and nuclear power plants in the face of these sorts of extreme weather events. For example, coal, natural gas, and nuclear power depend on large amounts of water for cooling, and limited water availability during a severe drought or heat wave puts electricity generation at risk. Wind and solar photovoltaic systems do not require water to generate electricity, and they can help mitigate risks associated with water scarcity.

Sustainability:

The environmental movement has emphasized sustainability of energy use and development. Renewable energy is sustainable in its production; the available supply will not be diminished for the foreseeable future - millions or billions of years. "Sustainability" also refers to the ability of the environment to cope with waste products, especially air pollution. Sources which have no direct waste products (such as wind, solar, and hydropower) are brought up on this point. With global demand for energy growing, the need to adopt various energy sources is growing. Energy conservation is an alternative or complementary process to energy development. It reduces the demand for energy by using it efficiently.

Conclusions:

Renewable sources of energy are an essential part of an overall strategy of sustainable development. They help reduce dependence of energy imports, thereby ensuring a sustainable supply. Furthermore renewable energy sources can help improve the competitiveness of industries over the long run and have a positive impact on regional development and employment. Renewable energy technologies are suitable for off-grid services, serving those in remote areas of the world without requiring expensive and complicated grid infrastructure. Extending hope and opportunity depends on a stable supply of energy that keeps nation’s economy running and environment clean. Many wind/solar farms are

located in remote areas served by low capacity radial distribution networks. These networks often have insufficient capacity to ship the power to demand centers when the turbines are generating at full capacity.

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