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Impact Of Renewable Sources Of Energy, Its Sustainability Issues And Its Mitigation On Climate Change

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Abstract

There is a greater requirement of all sources of energy in day-to-day life amongst all the populations in the world. This has made the concept of world to turn into a great global village. Despite all these changes, the earth is still in its same form. To satisfy social, economic development as well as development of humans, there is a hike in the demand for energy and its other services. For a sustainable livelihood, the main challenges related to the energy sector are controlling those energy contribution related to the climatic change and to secure a good supply of energy. During late 90s, there was a sharp increase in the price of oil, which established the need for alternative energy sources. Thus, there was a huge demand for renewable sources of energy comprising of ocean energy, wind, hydropower, geo-thermal energy, solar energy and bio energy. Since these renewable sources of energy are dependent on climate, its usage to implement it properly requires a proper control method of optimization, planning and a complex design. As the technology is advancing, it is helping the scientific researches to use the renewable sources of energy judiciously and meticulously. There is a direct relationship existing between sustainable development and renewable sources of energy. The positive aspects of using renewable sources of energy are reduction in health and environmental impacts, mitigates climatic change, energy access, socio-economic development and provides energy security. Using renewable sources of energy acts as a boon in those countries having low emission of carbon energy resources. Since to tap the renewable sources of energy, there is a need to alter the disruptive energy systems. The main aim of this paper is to know whether renewable sources of energy are sustainable or not and changing from the usage of fossil fuels to renewable sources of energy would help to mitigate the impact on climate change. The paper concludes by stating that to combat the climate change, there is a need for technologies which are environmentally friendly, using innovative ideas, access

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towards science thereby, establishing a cordial agreement amongst the less developed, developing and developed countries.

Keywords: renewable sources of energy, sustainable development, climate change, fossil fuels.

Introduction

There is a greater requirement of all sources of energy in day-to-day life amongst all the populations in the world. This has made the concept of world to turn into a great global village. Despite all these changes, the earth is still in its same form. To satisfy social, economic development as well as development of humans, there is a hike in the demand for energy and its other services. Humans depend on various energy services to fulfil the basic necessities such as communication, mobility, space comfort, cooking, lighting, health and render as a generative process. For a sustainable livelihood, the main challenges related to the energy sector are controlling those energy contribution related to the climatic change and to secure a good supply of energy. Around 1.4 billion population are deprived of getting electricity connections, and around 85 percent of these people dwell in the rural areas. Due to this, there is an excessive demand for using the traditional sources of biomass energy which has been estimated to increase from 2.7 billion at present and 2.8 billion by the end of 2030 [1].

In 1750, the first coal mining took place at Richmond, Virginia. Compared to charcoal and firewood being used as the bio-mass fuels, the most established fuel to run the steam engines are coal. The cleaner and cheaper fuel over the past decades was coal. As the population is accelerating, there is a huge dependency on fossil fuels such as gas, oil and coal. This has posed a severe global challenge leading to a high rise of carbon dioxide emissions. In 21st century, the greatest threat to nature is that of the climatic change. To combat this, the most important measure is to change the current usage of the energy systems. The alternative measure is to adopt renewable sources of energy which replaces the emissions due to green-house effect mainly coming from the power generations by using fossil fuels and hence changing the climate. To combat this huge crisis, most of the countries have adopted

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Sustainable Development Goals. The Assembly of United Nations, enforced a set of Sustainable Development Goals which comprised of 169 targets and 17 goals at the United Nations in New York. In 2015, in the month of March, the UN also adopted 330 indicators in the Goals of Sustainable Development [2]. Compared to goals of Millennium Development, the more effective plan was in Sustainable Development Goals. Due to the climate change, there is a huge demand for water provision, health, food, renewable energy to correctly monitor the socio-economic and environmental disastrous effects.

During late 90s, there was a sharp increase in the price of oil, which established the need for alternative energy sources. Thus, there was a huge demand for renewable sources of energy comprising of ocean energy, wind, hydropower, geo-thermal energy, solar energy and bio energy. This led to the idea of establishing sustainability across the globe. So, both inter-governmental agencies and governments are giving more attention to achieve a sustainability in the near future replacing fossil fuels with renewable sources of energy. By introducing the global SDGs, there has been a good climate change not only for the present generations but also for the future generations as well.

Sustainable Renewable Sources of Energy

Renewable sources of energy are those which do not get depleted. The best forms of renewable sources of energy are ocean energy, wind energy, solar energy, geo thermal energy, hydro power and bio energy. According to Tester sustainable energy are “a dynamic harmony between the equitable availability of energy- intensive goods and services to all people and preservation of the earth for future generations”. Continuous usage of fossil fuels has led to its depletion, fluctuations in the fuel price, military – geo political conflicts, emissions of greenhouse gases which has posed a severe threat to the energy sources across the world. If these problems are not curtailed then, there would be a severe threat for the human beings to survive in the society. So, the only solution for this is the usage of renewable sources of energy. In 2012, the world’s total generation of energy from renewable sources was 22 percent. The benefit of using renewable sources of energy is that it lowers the greenhouse gas emissions. Since these renewable sources of energy are obtained from nature itself, it is more sustainable. For

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example, using biofuel will not rise the net emissions of carbon di oxide, thereby no harm to the food security nor destroy the bio diversity. Since these renewable sources of energy are dependent on climate, its usage to implement it properly requires a proper control method of optimization, planning and a complex design. As the technology is advancing, it is helping the scientific researches to use the renewable sources of energy judiciously and meticulously.

The relationship between climatic change and renewable sources of energy

At present the main concept discussed around the world is "climate change". Climate is changing since its existence but in recent years, its speed of variations is very much alarming. This might turn as a severe threat to the earth. According to the United Nations Framework Convention on Climate Change defines "climate change as being attributed directly or indirectly to human activities that alters the composition of the global atmosphere and which in turn exhibits variability in natural climate observed over comparable time periods". The main agenda is to keep the global warming to a low level of less than 2^0 C. From 1850 onwards, there has been a hike in the usage of fossil fuels leading to an exuberant growth of carbon di oxide emissions. The data recorded by the end of 2010 revealed that the major cause of hike in the emissions related to greenhouse was continuous usage of fossil fuels. The advantages of using renewable sources of energy are it reduces the environmental impacts, generates a very low secondary waste and provides a sustainable socio-economic need. Renewable sources of energy reduce global warming and mitigates the excessive emissions of greenhouse gases [3].

Technology related to renewable sources of energy

Renewable sources of energy are natural and there is a continuous flow of energy in the environment. They comprise of ocean energy, wind energy, hydro power, geo thermal energy, solar energy and bio energy.

1. Hydro power

Hydropower is generated when the water moves from a high level to low elevated levels, which turns the turbines and produces electricity. These projects related to hydropower include in-stream projects, run-of-river, reservoirs comprising of dam projects and covers a wide range in the project scale. Hydropower are pollution free,

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has a capacity to store water for many hours and can quickly upgrade. The technical annual potential of generating hydropower is 14,576 Twh. But in reality, the present installed capacity across the world is less than its capacity level. USA, Canada, Brazil and China are the four countries that have 50 percent of its capacity to install hydropower. Due to climatic change, there might be changes in the hydropower potentiality. According to recent estimates, it has been found that there is 0.1 percent level decrease in the production of hydro power owing to the climate change.

Social and Environmental impact due to hydropower

The generation of hydro power does not emit greenhouse gases. So, it comes under the green energy resource [4]. There are both disadvantages and advantages owing to the usage of hydropower. Under the social impact, majority of the people are displaced from their houses to implement it. Due to the introduction of hydropower, there would be creation of artificial reservoirs which leads to flood in the natural environment. In addition to this, water is removed from water courses and lakes. These are then transported across the channels comprising of large distances which links to pipelines and ultimately it goes into the turbines which are perfectly visible sometimes; they are also connected to mountains by creating the tunnels interior to it. The structures of hydroelectricity affect the river water bodies ecologically by disturbing the migration of the fishes, disturbs the continuity of transporting the sediments ecologically. Due to the implementation of dams across tree covers or plants, it might lead to floods. Here the plants which are destroyed; rotten and release methane gas either directly or when water is flown across the turbines [5].

2. Bioenergy

Bio energy is considered as one of the renewable sources of energy. These energy sources are extracted from the biological sources of energy. The uses of bioenergy resources are enormous. They are useful for transport purposes using biodiesel, generating electricity and also for heating and cooking. The electricity which is got from bioenergy are due to various sources which includes residue of animal husbandry mainly the cow dung, wood residues, wastes from sugarcane. The main advantage of using bioenergy is that it is often got from waste product, residue or from a by-product coming

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from the given above resources. There is no competition between fuel land and land for food in it. The usage of biofuels is not much high, but it is now gaining prominence slowly [6]. In 2006, the consumption of biodiesel annually was 15 billion litres. By the end of 2012 it has grown up to 30-50 percent per year. The usage of biomass helps in reducing the green house gases. At the same time, it also ensures fuel supply for future purposes as well. According to Turkenburg, Eickhout de Vries, Faaij and Hoogwijk, the bioenergy potential on the earth's surface is around 3500EJ/year. It is in Baltic states and Common Wealth of Independent States around 45-199 EJ/year, Carribean and in South America around 47-221 EJ/year were there is a high potential of biomass. The usage of biomass and its yield differs across the countries [7].

Social and Environmental impact of Bioenergy

Most of the countries are in a confused state whether to use animal and plant source as a fuel because there are some countries who requires food aid[8]. From the environment, about 99.7 percent is obtained as human food, whereas from the aquatic species, it is around 0.3 percent. There are both negative and positive socio-economic and environmental effects of using the bioenergy. Due to excessive usage of bioenergy, it has led to vegetation degradation and worsening of the soil, which is mainly due to water overuse, removal of forest residue, too much of exhaustive crop, over exploitation of forest and orthodox forestry systems and agriculture. Hence, there is a need to diversify the crops or using the land mainly for bio energy production which induces food security and food commodity prices [9]. There is a need for a judicious operational management which will help to bring some positive effects such as improved productivity in soil, increase of soil carbon and enhanced bio diversity.

3. Solar Energy

Solar energy derives energy directly from the sun. The electricity is generated using the technology coming from the solar energy by installing photovoltaic cells. World Energy Council has stated that "the total energy from solar radiation falling on the earth was more than 7,500 times the World's total annual primary energy consumption of 450 EJ" [10].

4. Geothermal Energy

Geothermal energy is derived from the interior part of the earth as the source of heat

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energy. Heat is available in the interior part of the earth in huge amounts. But these are not distributed evenly [11]. These are also rarely concentrated and it is very difficult to exploit it mechanically. The average geothermal energy is 30^0 c/km. Using geothermal reservoirs, heat is extracted from the wells and other tools. Those reservoirs which are permeable and adequately hot are termed as hydrothermal reservoirs. Those reservoirs which are satisfactorily hot can be enhanced with the system of hydraulic stimulation are termed as enhanced geothermal systems. Once these are drawn to the upper level, electricity can be generated using the fluids of different temperatures and for other purposes which mainly use the heat energy.

5. Wind Energy

Wind energy is one of the renewable sources of energy. Wind energy is present almost everywhere around the world. Using the kinetic energy coming from the moving air, wind energy can be harnessed. Using the wind energy technology, the electricity can be generated by moving the wind turbines [12].

6. Ocean Energy

When wind moves over the ocean, the surface waves are generated. As the wind speed goes on becoming faster and faster, the wind travels at a greater distance and a greater wave energy is generated. Through heat currents, tide and waves, there is a huge demand for power. The first commercial ocean energy devices were implemented in Portugal-Pelamis and the UK-SeaGen. There are four modes of harnessing energy generated from the areas of wide seashores, mainly from shallow sea water, waves, tides and from wind [13].

Relationship between Sustainable Development and Renewable Sources of Energy

There is a direct relationship existing between sustainable development and renewable sources of energy [14]. The positive aspects of using renewable sources of energy are reduction in health and environmental impacts, mitigates climatic change, energy access, socio-economic development and provides energy security. The benefits of using renewable sources of energy are:

1. Security of energy

For the economy to function very well, there is a need for a continuous energy supply to

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maintain energy security. Of late many countries across the world are knowing the significance of energy consumption and economic growth. This has proved to be a big challenge for both developing and developed countries because if this matter is not taken seriously, then there would be misfunctioning for the societies. Compared to non-renewable sources of energy, there is even distribution of renewable sources of energy. The positive impact of renewable sources of energy are that it reduces the energy imports and decrease the price volatility and enhances security of energy across the world. To enhance the security, there is a need for combining energy sources with a good design system and with a well efficient management skills.

2. Socio-Economic development

There is a strong positive correlation between energy consumption and economic growth. Over the last few decades, the most important factor for increase in energy consumption are per capita income with their usage of per capita energy. Due to the employment of the renewable sources of energy technologies, it has enhanced environmental safety, gender equality, education and improved health.

3. Access to energy

Since renewable sources of energy are distributed worldwide, the goals of sustainable development can be met that ensures clean energy which is accessible to everyone, available and affordable to all. In rural areas, there is a high competition in using the distributed grids which mainly focuses on renewable sources of energy.

4. Mitigation in climatic change and reduction of health and environmental impacts

The benefits of using renewable sources of energy are it minimizes health complications, due to pollutants emitting from the non-renewable energy sources such as fossil fuels, decreases environmental complications, mitigates climatic changes and finally reduces greenhouse gases. During 1990-2012, there has been a decline in the emissions of greenhouse gas by 14 percent in 13 EEA countries, the GHG emissions decreased and in 11 EEA countries it was increased. Between 1990-2012, the per capita GHG emissions reduced by 22 percent in the EEA countries.

Problems faced by using renewable sources of energy

Using renewable sources of energy acts as a boon in those countries having low emission

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of carbon energy resources [15]. Since to tap the renewable sources of energy, there is a need to alter the disruptive energy systems. During the early half of the 21st century, there was a major challenge to organize the energy transition from using the non-sustainable sources of energy to using renewable sources of energy. The major barriers of using the renewable sources of energy depends upon the country's policy which affects both the technological innovations and the cost. This leads to a failure in the markets and less usage of the renewable sources of technology. Thus, there is a need for effective policies for renewable energy which connects the supplies of renewable energy and sustainability [16]. To mitigate the climate, change the following policies are recommended in this study:

a. All regions and sectors must invest in the technologies related to the renewable sources of energy and this would reduce higher dependency on non-renewable sources of energy [17].

b. There is a need to reduce the carbon footprint through changing in the behaviour and lifestyle patterns. Thus, these patterns help to mitigate the climate change.

c. There is a need for research mainly on innovative technologies which reduces the land use and also decreases the accidents coming out from renewable sources of energy. For example, there is bioenergy which substitutes consumption of food with the production using energy resources.

d. There is also a need to enhance the support and international cooperation mainly for upgrading the technology and expanding the infrastructure mainly for most of the developing countries. Thus, there arises a need for using the services related to sustainable energy thereby combating the climate change and its effects.

Conclusion

To improve economic growth, productivity and enhancing the human development, the main source of requirement in our daily life is energy. In order for sustainable development, there is a need to return to renewable sources of energy. There is very limited knowledge related to the relationship between renewable energy and sustainable development. The main aim of this paper is to know whether renewable sources of energy are sustainable or not and changing from the usage of fossil fuels to renewable sources of energy would help to mitigate the

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impact on climate change. Using renewable sources of energy, it limits the excessive emissions of greenhouse gases. But the market conditions, political environment, price and the cost have become obstacles by preventing the developed countries and less developed countries to fully use its potentials. Hence, there is a need for international cooperation which supports both the developing and less developed countries through the operation of using the renewable sources of energy as these are clean energy resources and high energy efficiency which will help to reduce the renewable energy costs and eliminates the barriers that avoids a good energy efficiency and helps in mitigating the climate change. This study has illustrated the benefits of using renewable sources of energy such as decrease of environmental impacts, mitigates climate change, develops the social and economic factors, access to energy and energy security. There are the obstacles that hinders the usage of renewable sources of energy and its effects to mitigate the climate change. These are: using energy not judiciously, lack of information and market failures. From the statements above, certain suggestions can be listed that improves the usage of sustainable renewable sources of energy:

- Increasing the research of using renewable sources of energy.
- Improving the awareness and education on mitigating the climate change, early warning, impact reduction and adaptation.
- To combat the climate change, there is a need for technologies which are environmentally friendly, using innovative ideas, access towards science thereby, establishing a cordial agreement amongst the less developed, developing and developed countries.

If the above suggestions are followed then, we can address the renewable sources of energy and its sustainability. By following these, we can fulfil the seventh and thirteenth Sustainable Development Goals that seeks to undertake its access for implementing modern energy, sustainable, reliable and affordability to combat the climate change and its negative consequences to the environment.

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