

Review Article

Energy Crisis, Resource Scarcity, and Innovations in Biofuels

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A B S T R A C T

Natural resources are scarce and there is a need to explore new resources to meet the rising demand for energy. There is also a need to meet sustainable development goals through proper planning and strategy. Fossil fuel has a finite supply and there will be a huge gap between demand and supply due to rising demand. There is a need to develop biofuel to replace fossil fuel. This paper gives a discussion about current issues and future directions in these sectors.

Keywords: Energy, Innovation, Resources, SDG, Biofuels

Introduction

The goal of human evolution is to develop our society and our systems to meet the challenges of changing times. It is the responsibility of every country to keep the well-being of its citizens in perspective and take up measures for development without compromising with the environment. Every country must prepare long term plans and strategies to meet the challenges of development. There is a growing demand for energy for development, however, meeting this growing demand itself is a big challenge. Those countries, which did not focus on proper planning, are now facing difficulties in meeting the energy requirements.

Those countries, which did not focus on sustainable development, are today facing huge environmental risks. The environment is now the top priority due to climate change and natural hazards. There is a need to create alternative sources of energy that are environment friendly.

No country can grow without focusing on the environment. The challenges of environmental management are more important today than at any time in the past. Countries like Nigeria were once exporting fossil fuels, but rising demand has converted these countries today as oil-importing countries (Adewuyi, 2020). Rising consumption of fossil fuel has been causing a huge imbalance in many countries. Lack of proper planning for meeting this challenge will prove to be disastrous for many economies.

Energy drives the world as most of the human activities are carried out with the help of energy. The world cannot survive without energy. Energy is needed in all activities today. Energy plays a very important role in the economic development of a country. If someone assumes that energy is in infinite supply, it would be a mistake. Like all resources, energy is dependent on some resources, which are not infinite. There are two types of resources that provide

energy: renewable and non-renewable. The substantial part of the energy comes from non-renewable sources of energy. However, there are possibilities of difficulties if energy is available in less quantity due to shortage of resources.

Energy crisis refers to the conditions due to the rising demand for energy and reducing natural resources that provide energy. The world has limited natural resources and they cannot replenish themselves. These natural resources are being used to meet the growing demand of energy for meeting the requirements of the industrial society. When the supply of energy is reduced due to a shortage of natural resources, there is a situation, which we call as the energy crisis. Many regions in the world have started facing an energy crisis. Countries like Venezuela have experienced it recently. However, this situation can happen in other countries also. It is expected that if timely corrective measures are not taken, there may be an energy crisis in the entire world. Countries like Pakistan have started the development of renewable energy resources to overcome the energy crisis. Raheem et al., 2016 concluded in their study that the development of renewable energy resources has been the best possible response to this crisis.¹⁷

The energy crisis can take place due to strikes by the union of companies supplying energy resources. An energy crisis can take place due to war, or accident or disaster or leakage of the pipeline, or other such reasons. However, this type of event may have a short term impact. This type of event will have an impact on a small region. Due to the Gulf Wars, the entire world witnessed an energy crisis. When the entire world would start facing a shortage of fossil fuels, there will be a global energy crisis. During 2008, the crude oil prices reached \$147.30 a barrel, and at this time, the high prices of crude oil created very difficult conditions. It was the beginning of symptoms of an energy crisis. Cultural factors play an important role in treating and recognizing the energy crisis (Wellum, 2017).

Every government must prepare plans to meet the challenges and to meet the needs of society. There are always some gaps between demand and supply, but through proper planning, these gaps can be bridged. There is a need to adopt a proactive approach to planning so that the gap between demand and supply is minimized. There are always limitations so far as natural resources are concerned. Human wants are increasing faster than what nature can offer. Human consumption is outpacing natural production. There will be a threat for the human being to survive due to over-exploitation of natural resources. There are many problems for mankind due to the over-exploitation of natural resources. Climate change and other such challenges have emerged due to rising human consumption. There is a need to develop a proper plan to meet the challenges of the future.

Mankind requires varied resources to lead a good life. These resources include the following:

- mineral resources
- forest-based resources
- non-renewable resources to provide energy
- renewable sources of energy

India is substantially dependent on fossil fuel for meeting its energy requirements. From 2008 to 2018, the import of coal increased by a CAGR of 13.44%. Electricity generation increased by 5.71%, but consumption increased by 7.39% and as a result, there was a huge gap between demand and supply. In this period, the import of petroleum products increased at a CAGR of 6.67%. Studies have reported that fossil fuel is having a major share in energy basket. For example, Malaysia has a 63% share by fossil fuel resources in the energy basket (Mahmudul et al., 2017).

Resource Scarcity

Indian coal deposits are estimated to be of 319.04 billion tonnes as on 31/3/18 and this is distributed substantially in Jharkhand, Orissa, Chhattisgarh, West Bengal, and a few other states. The total reserves of crude oil are estimated to be 594.49 million tonnes as on 31/3/18, which is located in Western Offshore, Assam and Gujarat and a few other states. These resources cannot last more than 50 years because per capita energy consumption is rising and industrial and transportation activities are also increasing at an alarming rate. The total stock of natural gas is estimated to be 1339.57 billion cubic meters (BCM) as of 31/3/18. Future generations will have great difficulties due to the impending energy crisis. The government of India has therefore started focusing on renewable energy sources. The total potential of renewable energy power generation is estimated to be 1096081 MW as on 31/3/18, out of which 68% is solar power and 27.58% is wind power. The total installed capacity of electricity generation in India is 3,99,000 MW as on 31/3/18.

The consumption of coal, crude oil, and natural gas has been increasing at a very fast rate. The production of coal in India increased from 492 MT in 2008-9 to 675 MT in 2017-18 registering CAGR of 3.2%. The consumption increased much more than production, so imports increased substantially. Limited fossil fuel-based resources will create a major threat for the human being if timely actions are not taken. An immediate suggestion is to use waste oil as a source of energy (Hajjari et al., 2017).

Rising energy requirements put a huge demand on scarce natural resources, and therefore the government of India has come up with a policy to boost development of alternative fuels. The government of India has introduced National Policy on Biofuels in 2018. This policy promotes development of biofuels from non-edible oils. The

government aims to achieve 20% blending of ethanol in petrol and 5% blending of biodiesel in diesel by 2030. This policy will enable India to meet the challenges of growing demand of petrol and diesel.

The tendency to consume and the tendency to exploit our natural resources is a big threat to our existence. There is a need to develop a rational approach to consumption. There is a need to respect the environment and to prepare a strategy that can protect the environment while ensuring material development at the same time. These are contradictory ideas, however, through the exploration of natural resources, new ways of using natural resources can be identified. Nature has finite resources, which can help every living being to meet the essential requirements. However, there is no limit to greed and exploitation. There is a need to have restraint in consumption and there is also a need to focus on innovations to meet the increasing human requirements.

Nature has its limitation. Nature has enough resources for the world, but the desire to consume more and more is the root cause of all problems. A few people consume so much that other people are left without resources. A few people store more than their requirement, resulting in shortage for the rest of the world.

Following resources are a few scarce resources that we have. These resources are decreasing due to over-exploitation by a few. There is a need for self-restraint in the use of these resources:

- Water
- Land
- Mineral resource
- Oil and Gas
- Forest Resources

A biobased economy is a vision for the future. It is an idea that we should not be dependent on fossil fuels. Thus bio-based economy would consist of those elements that can help in the development of an economy which is using the latest research and innovation to create technologies for solving our problems. There are four drivers to the bio-based economy:

- food security: which would be relating to food production, food quality, and food consumption
- Climate change issues: particularly the issues about adaptation and mitigation
- Resource security: issues about scarce material and meeting the energy requirements of the people
- Ecosystem services including issues relating to biodiversity.

The development of a bio-based economy requires a policy change and concerted actions. It requires investment in

research for the development of new technologies. The US and many countries in Europe have started developing biotech based industries that can help us in the development of new technologies - including biofuel.

The general public is now aware of the challenges of climate change. This awareness has created a desire among people to contribute to the development of a bio-based economy. People are coming forward to switch over to new products which are environment friendly. However, the governments have to give required boost through suitable policies, incentives, subsidies and support in the form of reduced taxes, etc. There is a need to raise awareness about the bio-based economy and how we can transform our economy.

There is a new ray of hope for the world in the form of production of biofuel from waste. Biofuels would reduce greenhouse gases and their use will reduce our dependence on scarce fossil fuel-based resources.

Scholars have compared injection pressure and diffusion combustion of edible and non-edible oil for the production of biofuel (Mardhiah et al., 2017). Production of biofuel from non-edible oil is more economical and useful. Used edible oil has also been used and found to be economical also (Karmee, 2017). Non-edible oil (Demirbas et al., 2016) has now been used in the production of bio-diesel and several studies have confirmed this (Singh et al., 2017). This will help in meeting the growing demand for diesel in the transportation sector. There are many crops like Jatropha, Tumba, Ambadi, etc. which are used in the production of bio-diesel. Detailed studies have been conducted on utility of Jatropha oil for CI Engine (Dubey et al., 2017) Rice Bran has also been found to be a good source for development of biofuel and research studies have found it to be useful in Engine performance (Chhabra et al., 2017). Mahua oil (Bassia Latifolia oil) (Pradhan et al., 2017), Sunflower Oil (Jain and Jadhav, 2018) Neem oil (Vinayaka et al., 2018), Linseed oil (Sharma & Dubey, 2016) and Castor Oil (on the performance of Castor oil for biodiesel, please see Mittal et al., 2018) have also been used in the production of biofuel with success (Velmurugan et al., 2020). These crops do not require much water and they can be grown in arid and semi-arid regions and un-irrigated regions also (for example Dubey et al., 2020). Bio-diesel can be mixed with diesel in some proportion and this blended oil can be used in the transportation sector. This is a ray of hope for under-developed countries like India. Bio-diesel is both environment friendly and economical. Development of bio-fuel will prove to be a great source of respite for the planners and policy experts, who are very perplexed due to the impending energy crisis.

Development of biofuel can become an important source of competitive advantage and it can also help in the attainment of sustainable development goals (Ghosh et al., 2019). New

technologies are being developed to produce biodiesel from vegetable oil (Khan et al., 2017). Scholars argue that it is important for every country to identify and develop biofuel to replace fossil fuel. This is a challenging task. There is a need to explore crops which can be used to produce biofuels (Darda, et al., 2019). India has an abundant supply of non-edible oil and agricultural produce that can generate non-edible oil. This oil can be used for the production of biofuel. There is a need to invest in the development of biofuel.

Conclusion

There is an impending energy crisis due to the rising consumption of energy. Fossil fuel has limited supply and it is not a renewable source of energy. There is a need to develop renewable sources of energy. There is a need to explore and develop new sources of energy. Biofuels are an important source of energy. There is a need to develop technologies and resources to prepare biofuels and use blended oil in vehicles and other machines that use fossil fuels. There is a need to invest in the development of technologies for converting non-edible oil into biofuels.

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