CSIBER INTERNATIONAL JOURNAL OF ENVIRONMENT(CIJE)

Vol. 2, Issue No. 1, March, 2025

CSIBER INTERNATIONAL JOURNAL OF ENVIRONMENT(CIJE)

A Bi-Annual Double-Blind Peer Reviewed (Refereed/Juried)
Open Access International e-Journal - Included in the International Serial Directories

EDITORIAL BOARD

CSIBER International Journal of Environment (CIJE)

CONTENTS

Comparative Study of Use and Environmental Implications of Renewable and Non-Renewable Energy Resources in India

Priyanka S. Chavan & Pooja M. Patil

Abstract
: Energy is a major driving force for country's economy. Today, we are standing at a point where we have to balance our energy demand with climate change mitigation goals by improving the energy efficiency. India's efforts to reduce emission of pollutants and promote use of clean energy are important steps for achieving sustainable development goals. Till 2024, India has installed 203 GW of renewable energy. "Viksit Bharat 2047" mission is committed to provide affordable and clean energy to all citizens. Now, we highly depend on non-renewable energy sources including coal, petroleum and natural gas for meeting our energy needs which cause emission of different pollutants including Sulphur dioxide, Nitrous oxide, Ozone and hydrocarbons. It can cause serious environmental damage including acid rain and photochemical smog. It can also have negative health effects like respiratory diseases and heavy metal toxicity. These energy sources are responsible for 75 percent of greenhouse gas emissions. So there is a urgent need to promote growth of renewable energy sector. More emphasis should be given on solar energy, biomass, wind energy and green hydrogen. In India, immense growth is observed in use of roof top solar panels since 2017-18, and the energy production has reached from 1.06 GW in 2017-18 to 14.45 GW in 2024-25. Along with this the use of wind energy and hydroelectric energy is increasing, which can proved to be environmentally feasible for the growth of Indian economy

Keywords: Energy, Economy, Pollution, Solar, Renewable etc.

Introduction

India is seventh-largest and most populous country in the world. So, the energy demand for various purposes including industries, residential areas and transportation is also very high. The energy sector has played a very significant role in the socio-economic growth of a country. India is the fourth largest producer of coal and it contributes to 61% of primary energy production. India is also the third largest consumer of oil and mainly relies on the import of crude oil to meet its manufacturing and transportation demands. The electricity demand of India is growing 5.8 percent annually. (BEE India, 2023-24) In order to meet this demand, the import of coal, crude oil and LPG is also increasing. Use of these conventional energy resources is a leading cause of overexploitation of natural energy resources and climate change. (Biswanth Behera et. al., 2023) Therefore, use of renewable energy is encouraged in order to attain sustainable development. The seventh Sustainable Development Goal also focusses on ensuring sustainable, reliable and modern energy for all in order to achieve environment friendly economic growth. (United Nations, 2015) India has set a target of producing 450 GW renewable energy by 2030. (Singh, 2021) India has high potential for producing renewable energy as it receives appreciable amount of sunlight due to its geographical location and has vast shoreline, hilly areas and huge network of rivers. All these factors can be helpful in the production of higher amounts of solar, wind, and hydroelectric energy.
India is a rapidly growing economy with increasing industrialization and urbanization. The demand for different electrical appliances and automobiles is increasing along with the rise in per capita income. (IEA, 2021) India is the third largest consumer of energy resources from which 80% of energy demand is met by coal, oil, and solid biomass. (IEA,2021) Due to this India has become the third largest carbon emitter in the world. According to UNEP, the greenhouse gas emission from fossil fuels was 37.5 GtCO2 in 2018 with an annual increase of 2 percent. (UNEP, 2019) The change in climatic conditions can be seen through increased temperature, changes in precipitation patterns, extreme weather conditions, and sea-level rise. Along with this the frequency and intensity of various climatic hazards like hurricanes, floods, heatwaves, wildfires and severe storms is increasing. (UNCCS 2019). Methane and Nitrous oxide are also major greenhouse gases that are released from agricultural and industrial areas. There is an urgent need for the energy sector to undergo a transition sector from fossil fuels to cleaner forms of energy and adopt innovative technologies to reduce emissions.

Distribution of Non-renewable Energy Resources in India:

Coal: Coal is a major source of electricity generation in India and its share in primary electricity generation is 61 percent. India stands at fifth rank in global coal reserve with 437 billion tonnes reserve. India's coal production has reached 998 million tonnes in year 2023-24.

Oil: The oil requirement in India is very high as India is third largest consumer of oil in world. India mainly relies on imported oil in order to meet energy demand for manufacturing, transportation and household consumption. The share of energy in primary energy supply in India is 29 percent. Domestic oil production in India is

continuously decreasing from 2016-17 at annual rate of 3 percent. (BEE, 2024) The import of oil is often connected to the trade balances, nation's economic health and nation's economic stability.

Natural Gas: It is considered as a clean fuel as compared to coal and oil as it helps to minimize greenhouse gas emission. Industrial sector is largest consumer of natural gas with 38 percent followed by transport and residential sector (20 percent), power generation (13 percent) and others (28 percent). Gas fields are also located in India at various locations including Mumbai high, Krishna-Godawari basin and Assam. India is a 4th largest importer of Liquified Natural Gas and it contributes to 7 percent of India's primary energy mix.

Effect of non-renewable energy resources on environment:
Non-renewable energy resources take thousands of years to form and replenish naturally and the dependence on these resources for energy production is very high. These fossil based resources are major contributor to climate change and the global temperature may rise by 2.6-4.8^{o}C till 2100 from pre-industrial levels. (World Energy Council, 2014) In 2010, the share of energy sector in greenhouse gas emission was 35 percent. SAARC nations have also highlighted that use of non-renewable energy resources cause higher carbon dioxide emissions, which is a major cause of global warming. (Akbar et al, 2024) In India, energy sector mainly relies on coal which has resulted in high carbon dioxide emissions. Expansion of coal based steel production may cause around 680 million metric tonnes of carbon dioxide emissions. Different types of natural resources emits carbon dioxide, but natural gas emits 50-60 percent less CO_2 as compared to coal. But extraction of natural gas from land results in leakage of methane which is also a potent green house gas. It is 34 times more potent than CO_2 in trapping heat. (MD Aslam Ansari et. al., 2017) Climate change can have adverse impact on different types of ecosystems resulting in loss of biodiversity and productivity. It is a major cause of rise in mean sea level and shift in global agricultural pattern. Along with this, combustion of these fossil fuels lead to emission of various air pollutants including nitrogen oxide, sulphur dioxide, particulate matter and some heavy metals which may have detrimental effects on air quality and human health. As Sulphur Dioxide is released from combustion of fossil fuel, it combines with rainfall and the pH of rainwater turns acidic which is corrosive and it also acidifies lakes and streams. (F. BARBI et al, 1990) It can be harmful to the aquatic organisms.
The mining activities conducted for fossil fuel extraction can cause various negative effects on local ecosystems including soil erosion, land degradation, habitat destruction, deforestation and water pollution. From the environmental perspective, these fossil fuel based energy resources are detrimental for both environment and living organisms. Thus its use should be discouraged.

Distribution of Renewable Energy Resources in India:
Renewable energy is playing significant role in energy supply of India and the share of wind and solar energy has been steadily increasing. This transition from non-renewable to renewable energy has been driven by government initiatives, substantial investment and technological advancement. From 2013-14 to 2023-24, the supply of energy from renewable energy resources has increased from 17.4 Mtoe to 31.1 Mtoe, increasing its share in total energy production to 3.4 percent. India is having high potential for energy generation from renewable energy resources from solar radiation and wind due to its geographical location and vast sea shore and hilly areas. According to the National Institute of Solar Energy (NISE), country's solar potential is 748 GW. National Institute of Wind Energy (NIWE) has stated that India's wind potential at 150 meters above ground level is 1164 GW. Along with this, additional 196 GW energy can be generated from hydropower plants and biomass. (BEE, 2024)

- Solar Energy: Total installed capacity of solar power in India is 102566.02 MW (Ministry of New and Renewable Energy, 2025). Government now aims to reach the target of generating 280 GW of solar energy by 2030. Solar parks are also established in India at various locations including Bhadla (Rajasthan), Pavagada (Karnataka) and Rewa (Madhya pradesh) in order to utilize solar radiations and reduce dependency on fossil fuels.
- Wind Energy: Total installed capacity of wind power in India is 48588.56 MW upto February, 2025. India aims to reach the target of generating 140 GW wind energy by 2030. Tamil Nadu, Gujarat and Maharashtra are leading states in installation of wind energy systems.
- Hydropower: India's installed hydropower capacity is around 46, 850 MW. India is having vast network of rivers and highest number of dams, which has been proved beneficial for increasing hydropower potential. India aims to increase hydropower capacity up to 70 GW by 2020.

Along with these resources biofuels, biomass and waste to energy approach are also used to generate renewable energy.

Effect of Renewable energy resources on environment:
Utilization of renewable energy resources by converting them into electricity, while ensuring environmental sustainability gives multiple benefits to renewable energy sources in terms of their use and environment protection. Renewable energy resources accounts for almost zero percent of greenhouse gas emissions. (UNEP, 2000). These energy resources generates electricity without emission of air pollutants like nitrogen oxides, sulphur dioxide and particulate matter. It also does not involve large scale mining, which prevents land degradation, water pollution and habitat destruction.
In life cycle of solar, wind or hydropower plant, it has insignificant amount of greenhouse gas emissions. (Dario Maradin, 2021). At the same time, these resources reduce dependence on import and use of fossil based energy resources. Thus it reduces carbon footprint, which in turn helps to combat climate change. Use of renewable energy resources also avoids overexploitation of other natural resources and provides source of sustainable form of energy. Thus it helps to achieve Sustainable Development Goal 7 which states about availability of reliable, affordable, sustainable and modern energy for all. Even waste material including biomass can be used to produce energy, which ensures environment friendly management of waste.

Conclusion:
From this study, it has been made clear that non-renewable energy resources are having several implications on environment as well as economy. The resources like crude oil and natural gas are mainly imported from middle East and other countries which can create economic instability due to volatility in their prices. At the same time it causes various environmental problems including global warming, sir pollution, land degradation and water pollution. Instead of these, use of renewable energy resources can be done in order to avoid these environmental issues. India is high potential of generating Energy from renewable energy resources including solar energy, wind energy, hydropower and biofuels. These resources can help to reduce carbon and methane emissions thus reduces the effect of global warming. They also helps to reduce air and water pollution and avoids overexploitation of natural resources . Along with this, the use renewable energy resources can be cost effective in long run. Government has taken various initiatives for promoting these resources. Due to awareness campaigns and several government initiatives, growth can be seen in use of these resources, especially in case of roof top solar panels which are growing at 45 percent annual rate. Some technological advancements and government initiatives should further encourage the energy production from renewable energy resources, so that energy production should become affordable and sustainable in long run.

References:
Behera et al., (2003). A blend of renewable and non-renewable energy consumption on economic growth of India: The role of disaggregate energy sources Environmental Science and Pollution Research https://doi.org/10.1007/s11356-023-31372-0

United Nations (2015) Transforming our World: The 2030 Agenda for Sustainable Development. Department of Economic and Social Afairs Sustainable and Development,
United Nations. https:// sdgs.un.org/publications/transforming-our-world-2030-agend a sustainable-development-17981.

Singh A (2015) Here are India's INDC objectives and how much it will cost | India News,The Indian Express. Retrieved November 4, 2021.

UNEP (2019) Emissions gap report. UN Environment Program, Nairobi. 22 Dec 2019

BEE (2024), India Energy Scenario, Edition II.

UNCCS (2019) Climate action and support trends, United Nations Climate Change Secretariat. https://unfccc.int/sites/default/fles /resource/Climate_Action_Support_Trends_2019.pdf. Accessed 20 Dec 2019.

Akbar A et al. (2024). Impact of Renewable and Non-Renewable Energy Resources on CO2 Emission: Empirical Evidence from SAARC. International Journal of Energy Economics and Policy, 14(1), 141–149. https://doi.org/10.32479/ijeep.15049.

Li *et al. (2022)* Nexus between renewable energy, natural resources and carbon emissions under the shadow of transboundary trade relationship from South East Asian economies, Energy Strategy Rev.

Ansari, A., College, J. J., & Koderma, J. (2018). Deforestation: Facts, Causes & Effects. Journal of Emerging Technologies and Innovative Research. [Online] Tersedia di https://www. jetir. org/view.

Barbir, F., Veziroğlu, T. N., & Plass Jr, H. J. (1990). Environmental damage due to fossil fuels use. International journal of hydrogen energy, 15(10), 739-749.

United Nations Development Programme. (2000), World Energy Assessment: Energy and the Challenge of Sustainability. United Nations: United Nations Development Programme.

Maradin, D. (2021). Advantages and disadvantages of renewable energy sources utilization. International Journal of Energy Economics and Policy, 11(3), 176-183.