CHAPTER III

DISCUSSION & CONCLUSIONS

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Comparison of various Energy Sources

A very brief summary of advantages and disadvantages of different types of energy sources are discussed in Table - 2.

S. No.	Energy Source	Type of energy source	Advantages	Disadvantages
1	Coal	Conventional Non-renewable	• Extensively available • Efficient Conversion to electricity	• Polluting source • Bulky to transport
2	Oil and Natural Gas	Conventional Non-renewable	• Easier to transport (tankers) • Basis of petrochemical industry	• Depletion of oxygen due to oil spillage and gas leakage • Pollutants released causes acid rain • Exploration of new fuel is not easy
			• Easier to transport (Pipelines) • Cleaner than oil and coal • Cheaper than oil	
3	Fire wood	Conventional Non-renewable	• Easy access • Provides energy to a large number of people	• Collection is time consuming • Polluting • Promoting green house effect • Deforestation
4	Hydro-power	Conventional Renewable	• Non-polluting • Promotes irrigation and fishing • Cheap	• Displacement of local community • Inundates low • Expensive to setup
5	Nuclear energy	Conventional Non-renewable	• Emits large amount of energy	• Generates radioactive waste • Expensive
6	Solar energy	Non-conventional Renewable	• Inexhaustible • Non-polluting	• Expensive • Diffused source, so gets wasted
7	Wind energy	Non-conventional Renewable	• Non- polluting • Low cost production of electricity once setup • Safe and clean	• Noise pollution • Wind mills costly to setup • Disturbs radio and T.V. reception • Harmful to birds
8	Tidal energy	Non-conventional Renewable	• Non-polluting • Inexhaustible	• Destroys wildlife habitat • Difficult to harness
9	Geothermal energy	Non-conventional Renewable	• Clean eco-friendly and always available	• Located far away from cities and so costly to transport the electricity
10	Bio gas	Non-conventional Renewable	• Low cost • Easy to operate • Make use of bio waste	• Causes green house effect

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Energy Resources Conservation and Management

- **Energy** is a necessary component of economic progress. **Agriculture, industrial, transportation, commerce, and household** sectors of the national economy all require energy inputs.
- To stay functioning, the economic growth plans enacted since Independence have needed growing amounts of energy.
- As a result, **energy consumption** in all forms has been continuously increasing throughout the country. In light of this, it is critical to design a long-term energy development strategy.
- The twin pillars of **sustainable energy** are energy conservation and growing utilisation of renewable energy sources.
- The **Energy Conservation (EC) Act** was passed in 2001 with the purpose of lowering the Indian economy's energy intensity.
- The **Bureau of Energy Efficiency (BEE)** was established as a statutory entity at the federal level in 2002 to aid in the execution of the Energy Conservation Act.
- It reports to the Ministry of Power.
- Between 2013 and 2030, India's energy consumption is predicted to quadruple to almost 1500 million tonnes of oil equivalent.
- The **Energy Conservation Act of 2001 (ECA)**:
- The Act establishes regulatory requirements for equipment and appliance standards and **labelling, commercial building energy conservation** rules, and energy consumption standards for energy-intensive sectors.

India Energy Outlook 2021

- The **India Energy Outlook** is a country-specific version of the **International Energy Agency's** (IEA) **World Energy Outlook.**
- India will overtake the European Union as the world's third-largest energy user by 2030, according to the analysis.

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- By 2040, **India's industrialization** will be a key driver, with the country accounting for about 20% of worldwide growth in industrial value-added and leading global growth in industrial final energy consumption, particularly in steelmaking.
- By 2030, India's oil import bill may have doubled.
- By 2040, **natural gas** consumption will have tripled, if not exceeded.
- **Coal** dominates India's energy industry, with consumption expected to climb from 590 MT to 772 MT by 2040.
- India's main energy consumption is predicted to quadruple by 2040, as the country's **Gross Domestic Product (GDP)** rises to $8.6 trillion.
- India has the fastest-growing global energy consumption between 2019 and 2040, accounting for about a quarter of it.
- It has the second-highest rate of renewable energy expansion. China is in first place.
- By 2030, India will have surpassed the **EU** in terms of its energy grid.
- Given its five-fold rise in per capita **automobile ownership,** India will lead the world in oil demand growth by 2040.

National policy regarding biofuels—2018

Modernization has generated an opportunity for a stable change in the use of bioenergy in India. MNRE amended the current policy for biomass in May 2018. The policy presents CFA for projects using biomass such as agriculture-based industrial residues, wood produced through energy plantations, bagasse, crop residues, wood waste generated from industrial operations, and weeds. Under the policy, CFA will be provided to the projects at the rate of INR 2.5 million (USD 35,477.7) per MW for bagasse cogeneration and INR 5 million (USD 70,955.5) per MW for non-bagasse cogeneration. The MNRE also announced a memorandum in November 2018 considering the continuation of the concessional customs duty certificate (CCDC) to set up projects for the production of energy using non-conventional materials such as bio-waste, agricultural, forestry, poultry litter, agro-industrial, industrial, municipal, and urban wastes. The government recently established the National policy on biofuels in August 2018. The MNRE invited an expression of interest (EOI) to estimate the potential of biomass energy and bagasse cogeneration in the country. A program to encourage the promotion of biomass-based cogeneration in sugar mills and other industries was also launched in May 2018. Table 22 shows

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how the biomass power target and achievements are expected to reach 10 GW of the target of 2022 before the end of 2019.

Major government initiatives for renewable energy

Technological initiatives

The Technology Development and Innovation Policy (TDIP) released on the 6th of October 2017 was endeavored to promote research, development, and demonstration (RD&D) in the renewable energy sector [59]. RD&D intended to evaluate resources, progress in technology, commercialization, and the presentation of renewable energy technologies across the country. It aimed to produce renewable power devices and systems domestically. The evaluation of standards and resources, processes, materials, components, products, services, and sub-systems was carried out through RD&D. A development of the market, efficiency improvements, cost reductions, and a promotion of commercialization (scalability and bankability) were achieved through RD&D. Likewise, the percentage of renewable energy in the total electricity mix made it self-sustainable, industrially competitive, and profitable through RD&D. RD&D also supported technology development and demonstration in wind, solar, wind-solar hybrid, biofuel, biogas, hydrogen fuel cells, and geothermal energies. RD&D supported the R&D units of educational institutions, industries, and non-government organizations (NGOs). Sharing expertise, information, as well as institutional mechanisms for collaboration was realized by use of the technology development program (TDP). The various people involved in this program were policymakers, industrial innovators, associated stakeholders and departments, researchers, and scientists. Renowned R&D centers in India are the National Institute of Solar Energy (NISE), Gurgaon, the National Institute of Bio-Energy (NIBE), Kapurthala, and the National Institute of Wind Energy (NIWE), Chennai. The TDP strategy encouraged the exploration of innovative approaches and possibilities to obtain long-term targets. Likewise, it efficiently supported the transformation of knowledge into technology through a well-established monitoring system for the development of renewable technology that meets the electricity needs of India. The research center of excellence approved the TDI projects, which were funded to strengthen R&D. Funds

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