

IMPACTS OF EMERGING TRENDS IN TECHNOLOGY ON ENERGY SCENARIO: A HOLISTIC SURVEY

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Abstract: Currently the world is revolutionized by the growing effect of multidisciplinary technology across all dimensions of life: social, economic, political, & personal. The latest technology advancements aim at meeting the needs of growing population, speed, cost & environmental aspects. So, there is a great challenge imposed on the available energy resources for fulfilling these demands in a long run. As abundant and economical energy resource is the backbone of these developments, we must be equipped and known to all forms of energy resources on which the dependency of technology can be relied on. Also optimisation and conservation of energy is needed for sustainable energy development. This paper aims at providing the review of latest technological trends relying on diversity of energy sources. This paper also reviews the renewable energy scenario of India and the developments based on consumption, production and supply of power.

Keywords: Energy resource, sustainable energy, multidisciplinary technology, energy conservation.

1. INTRODUCTION

In today's world the development of any economy and civilization of any country depends on its technology. The backbone of any technology is the availability and sustainability of energy resources in abundance to meet the requirements. Sustainable energy development requires three major changes [1] [2]: Energy savings at consumer level, [3] efficiency in production and [4] replacement of non renewable by renewable energy resources. With the global industrialization and urbanization, the demand of new technology proportional to the demand of energy will continue to grow strongly [5]. As the emerging technology is running out of traditional energy sources, it is required to focus on the development of all other forms of energy resources. In contrast to the past, presently the world is highly dominated by the technology in all prospects: social, economical, political, and personal. Therefore it can be concluded that the transition from past to present technology directly reflects the transformation of the resources to costlier ones [6]. Driven by the aforementioned point, there

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comes a demand of fulfilling these energy hunger technologies in terms of overcoming various challenges offered by them. The dependency of any technology on energy sources mainly depends on the following [7]:

- Availability of energy resources
- Environmental Implications
- Cost effectiveness

This paper aims at reviewing the diverse energy resources from non renewable to renewable [8] and a number of emerging technologies relying on it. In addition to the above, the paper provides an integration of past and present energy scenarios, need of energy conservation and sustainable energy development. Also, an illustration of future outlook of India towards new alternate resources and various plans and missions working for the same is provided as a setback for other developing countries. A case study justifying our initiative in the direction of discussed issues is also mentioned.

2. ENERGY SUPPLY PICTURE

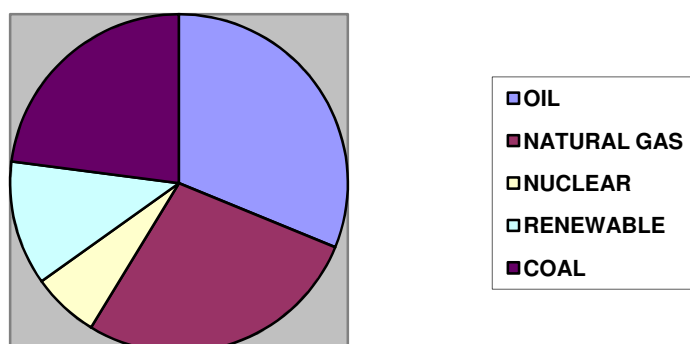


Figure 2.1: Energy distribution chart [8]

In the above figure, the pie chart shows the energy needs fulfilled by various sources in percentage: oil (34%), natural gas (30%), coal (25%), renewable (13%), & nuclear (7%). Clearly fossil fuels dominate the energy supply picture [11]. Renewable has only a small part of supply. The renewable part comprises of hydro, traditional (wood and animal waste), and other forms of renewable energy (Tidal, solar, wind, & geo thermal) [12]. Out of this hydro comprises the maximum consumption and other forms comprise minimum.

3. CORELATION OF ENERGY RESOURCES & DEMAND SECTOR

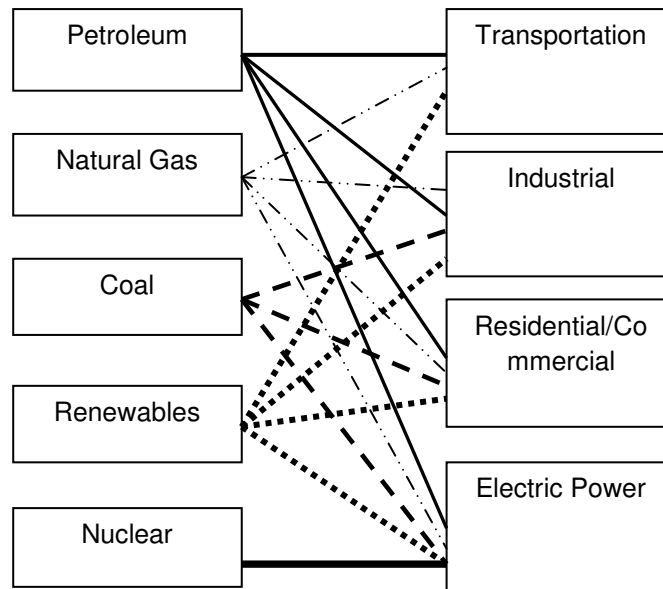


Figure 3.1: Correlation of energy sources and demand sector [9]

Since, the production cannot be understood independent of consumption [8] [9]; this section describes our primary energy consumption from petroleum, natural gas, coal, renewable & nuclear reactions. As illustrated in the figure 3.1, these energy resources fulfill four main sectors: transportation services, industrial processes, residential/commercial buildings, & electric power generation [11]. Each energy source can be taken as multiple sources, as there are a variety of reservoirs varying substantially in nature, and can be found in different parts of the world [12]. It can be noted from the figure that sources of electricity are diverse, from fossil fuels to renewable sources.

4. NEGATIVE ENVIRONMENTAL IMPACTS OF LARGE SCALE ENERGY SOURCES

Generally speaking, extraction, production and use of fossil fuels damage the environment. However, any type of large scale energy development can have environmental impacts. Different negative impacts from various sources are discussed below [11]:

- Coal: Alters landscapes, human life risk due to accidents while its extraction, emissions of pollutants on its combustion, contamination of rivers and streams.
- Oil: Danger of accidents to human and ocean life due to spilling.
- Natural Gas: Extraction is hazardous as leads to accidents due to leakages.
- Renewable sources: Emission of harmful gases on burning of bio mass fuels, environmental impacts due to disposal of photovoltaic cells used for storing solar energy,

bulky installation of plants lead to the use of larger land areas. Hydel power plants destroy wildlife habitats and thus effecting the environment.

- Nuclear Power Plants: Devastating accidents, contamination of air and water bodies due to disposal of highly toxic wastes, harmful radioactive emissions are also a great threat to environment.

Environmental impacts of energy sources is a complicated issue, thus, it can be concluded that all commercial energy production has negative impacts, only some are more environmental friendly than others.

5. ENERGY CONSERVATION:

As availability of energy is the backbone of any economy, a strong correlation is shared between energy use per person and standard of living in each economy. The energy demand is likely to increase at the rate of about 7.5% in the future [6] [11]. Therefore, energy conservation holds great significance for various developing and developed countries.

Any system implementing energy conservation planning should be maximum energy and cost efficient [12]. Energy conservation serves following main objectives:

- Improves energy efficiency
- Reduces energy use
- Reduces cost of using energy
- Reduces greenhouse gas emissions
- Cultivates communication on energy matters

6. FUTURE OUTLOOK FOR RENEWABLE ENERGY IN INDIA: A SETBACK FOR DEVELOPING NATIONS

As India is world's second most populous country, so, unsurprisingly the topic of energy supply is a key issue, and in particular its sustainability. Since there is a great dependency on volatile fossil fuels for catering the energy needs in various sectors we need to focus on judicious utilization of abundant renewable sources to overcome the energy crisis. Also it will also allow in mitigating climatic changes. In India, electric power generation is the main requirement which is offered by various alternative resources like solar, wind, hydel, biomass and wastes. Out of these solar energy has the highest potential energy that can be exploited to fulfill our energy needs [13] [15].

6.1 Growth drivers of solar energy based systems:

Firstly, India is endowed with large solar energy potential. India's land areas receive about 5000 trillion kWh energy per year with Global Horizontal Irradiance (GHI) Index of 4-7

kWh/m²/day in many areas. This vast solar energy can be harnessed by installing solar thermal plants and solar photo voltaic with huge scalability across the India. Secondly, there is zero threat of resource depletion etc. It is environmental friendly, as it is a clean resource with zero emission and most importantly, Sunshine available in India is for nearly 300 days in a year. Energy Security is maximized by this energy [13].

Solar energy has got tremendous potential energy that can be harnessed by variety of devices for industrial and domestic uses. The use of solar photo voltaic (SPV) cells provides direct conversion of sunlight to electricity. These can be used in various configurations to offer many applications, such as, energisation of pump sets for irrigation, drinking water supply and rural electrification covering street lights, community TV sets, medical refrigerators and other small power loads [14].

6.2 Government's Initiatives:

Government of India (GOI) has initiated many programs to achieve ambitious targets of producing over 1900 billion units of solar power annually, which is enough to meet the projected demand of entire country in 2030 [13]. Ministry of New and Renewable Energies (MNRE) of GOI is working effective energy conservation and transformation processes since 1981. Some of the major initiatives by GOI are mentioned as follows [13] [14]:

- Rural Electrification Program, in 2006, implemented off - grid solar applications.
- Semiconductor policy and Special Incentive Schemes initiated in 2007, to promote SPV production in Electronic and IT industries.
- Generation Based Incentive (GBI) scheme, 2008, promoted grid connected solar power plants.
- National Action Plan on Climate Change Energies (NPACC), 2008 aimed to overcome the shortcomings of GBI.
- Jawaharlal Nehru National Solar Mission (JNNSM), initiated in 2010, working under the MNRE and NPACC, aimed to develop solar industry.
- Formulation of solar policies at state level: Gujarat Solar Power Policy -2009, Karnataka Solar Power Policy (2011-16), Rajasthan Solar Power Policy – 2011, aimed to meet solar power requirements at state level.

7. VALIDATION

Followed by afore mentioned discussion on the use of renewable and environmental friendly energy resources, the students of our college (Atharva College of Engineering) are motivated on this part. An illustration of this motivation is explained in the following case study.

7.1 Case Study

Innovation and Entrepreneurship Development Centre (IEDC) was established in 2012, also IEDC-Atharva college of Engineering was funded by Department of Science and Technology (DST), New Delhi for first year with total grant of Rs 13.3 Lakhs. IEDC Mission is to “Develop Institutional mechanism to create Entrepreneurial culture in academic Institutions to foster growth of innovation and entrepreneurship amongst the faculty and students“. Every year student’s five projects are funded by DST.

Under this, our students have come up with two commercialized Renewable projects. i.e., Vertical Axis Wind Turbine & Solar Based Regenerative Street Lights Adverts. The projects were successfully completed in a year, and then they were launched for marketing and commercialization. In addition to above achievements, these students have also come up with an organization, named VenTech, serving especially in Renewable energy sector where they have designed a “Dual Axis Tracker Machine” for a special solar panel named as “Highly Concentrated Photo Voltaic (HCPV)” and “plug and play Solar Street Lights and Centralized system” for various corporate sector. Now the team is starting with various new proposals in Renewable Energy Sector like Micro Grid establishment and various rooftop business models. As the concern for any problem does not just lie in its discussion but in finding its solution and practicing it, so here, we try to inculcate in our students, social responsibilities and ethical values they need while practicing and learning any technology.

8. CONCLUSION

As discussed in the paper about a strong dependency shared between any nation’s economy, availability of energy resources and technology, so this raises a need of maintaining a sustainable energy development which in turn depends on energy efficiency and renewable sources. The rapidly growing energy use has already raised concerns over supply difficulties, exhaustion of energy resources and heavy environmental impacts (ozone layer depletion, global warming, climate change, etc.). We are already on the peak of exploiting these resources, whether they are renewable or non renewable. Also, the production of usable renewable energy is lagging to fulfill all the requirements of maintaining a sustainable energy scenario, and on the other side the non renewable will one day ultimately vanish of their existence. So, there is a need to expand the amount of renewable energy sources in supply system so that even our future generations can enjoy leisure of technology.

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