



Energy Security in India

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ABSTRACT

Energy is the base for all human development. India is a vast economy and its energy requirements are huge. But India's installed power capacity is far less than its energy demand. Various factors are responsible for this gap in demand and supply of energy. The major factors include depleting reserves of coal, shocks in the supply of imported crude, volatility of international prices of crude oil, highest transmission & distribution losses etc. Renewable resources are not developed to their full potential and require great thrust on R&D in a time-bound manner to ensure energy security of country. Government has started various missions and a comprehensive Integrated Energy Policy 2031-32 (IEP- 2031-32) covering the entire energy sector together for the first time. To complement the efforts of Governments, people's participation and awareness is must to achieve the goal of energy security and sustainable development in India

KEYWORDS : Energy Security, Renewable, Energy resource, Green Technology

INTRODUCTION

Energy is the force which drives the whole universe. Just like life is driven by energy, so any country or economy is also driven by energy. Even the development of human civilization also started with the "Discovery of Fire" by Man. As the developmental activities diversify, so the demand for energy is also increased accordingly. Initially man required energy only for food, then along with the development of human civilization, the need for energy increased for household activities, agriculture, transportation, manufacturing industries and for other various services and activities. Thus we can say in short, that energy is the life-line of all living beings and it is the premises on which human civilization is stood. All development and progress have been made possible only with the energy.

What is Energy Security?

In modern times, all the development depends on the energy. So, if a country has to be developed, then the country should have energy security. Energy security can be defined as "A country can be energy secure, when it can supply life-line energy to its all citizens, across all sections of the society and across all regions of the country for a considerable long time - period."

Energy security is based on four pillars -

- 1. Availability of Energy-** Energy should be available sufficient-ly at all times.
- 2. Stability of supply-** Supply of energy should be stable without fluctuations or shortages from season to season or from year to year.
- 3. Accessibility or Affordability of Energy-** People should have adequate financial resources in order to obtain sufficient amount of energy.
- 4. Quality and Safety or Green Energy-** The energy should be eco-friendly and should be sustainable in the long run. If, all these conditions are fulfilled, then we can say a country to be energy secure.

Need for Energy Security in India:-

The question of energy security is very alarming for India. India is a very vast country geographically and is the second largest populated country of the world. India is pioneer among the developing countries and trying hard to club into the developed countries of the world. So, to fulfill the needs of one of the largest population of the world and also to increase the rate of growth and development in the agriculture and associated activities, manufacturing industries and also for the service- sector, India needs huge amount of energy.

Electricity constitutes a major chunk of this energy demand and is notably related to the socio-economic development of the country. India is growing at a rate of around 8%, but, ironically, over 400 million people don't have access to electricity and nearly 84740 villages are un-electrified which constitute 14.3% of the total villages of the

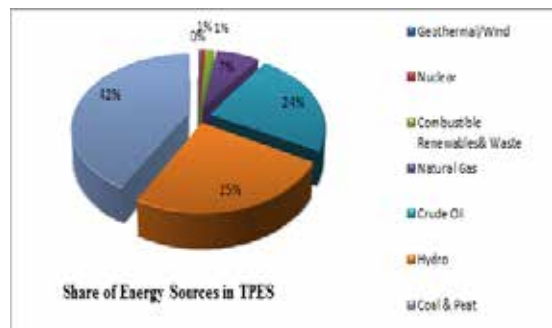
country.

But, India has some serious issues related to energy security. India has less installed power capacity in comparison to its demand. Volatility in the global energy prices makes India vulnerable to increased financial burden. And finally abrupt supply disruptions are of strategic concern.

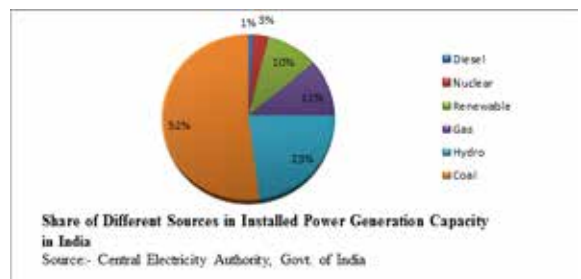
Present Energy Scenario in India :-

Energy is used in two ways directly as the primary source of energy and in the form of electricity or power.

In India, there are many sources of primary energy. The present scenario of Total Primary Energy Supply (TPES) in India can be show through this diagram



Energy in the form of electricity or power is used for almost all economic and household activities .This form of energy is more efficient and eco- friendly and suitable for sustainable development. The present installed power generation capacity of India is given in the following diagram-



Present Status and Future Estimates of Energy in India

In India, existing power capacity is of 200000 MW but actual generation is only around 150000 MW. It is estimated that by 2031-32, the power demand is likely to be a mammoth 800000 MW. It will require addition of 1.5 Lac MW in each of the next 4 five -year plans beginning with the twelfth five-year plan.

Presently, coal is the primary source of energy and also would be primary source of energy accounting for 60% even by 2031-32. 47% of thermal power generation will be based on coal alone. The second important source of energy is petroleum. By 2031-32, petroleum will account for 25% of energy requirements. Presently, 70% of petroleum is imported and by 2031-32, 90% of our requirements will be imported.

Presently, hydro power is an important component of India's energy - mix. But, if we harness the full potential of hydro power even then, 150000 MW can be generated which will be 20% of the energy-mix by 2031-32. By 2031-32, nuclear energy will not be able to meet more than 5% of energy - mix.

Non - Conventional and renewable source of energy contribute negligibly in the present energy-mix. These include solar energy, wind energy, bio- gas , ethanol etc. But in the future, if they are developed to their full potential, they can meet the local requirements, which will be very helpful.

Problems of Energy Sector in India

Thermal power is the prime component of the present energy-mix and would be in the future also. It has a major structural problem. Generation, transmission and distribution of power are all bundled together through the State Electricity Boards (SEBs). This sector requires unbundling of these three activities. State and Central Governments should be kept at distance from the power sector.

India has the highest Aggregate Transmission and Distribution (AT&D) losses of 25% which is very serious issue. There are other issues like under-pricing, power theft, concept of free power etc. Coal mining has to be opened up to the foreign investors to get the state - of - the - art technology and improving mining skills. The pricing of coal should be market - determined to reflect the scarcity value of coal.

As India is heavily dependent on imports for petroleum which make India the most vulnerable to supply shocks and price volatility. In India, there is very low level of awareness about energy conservation which makes the problem of power - shortage or energy shortage even more worrisome.

Major Challenges in the Achievement of Energy Security

These are the major challenges that need to be addressed to attain energy security in India.

- Energy companies should emphasize on R&D to improve the energy technology.
- Not only technology but managerial expertise should also be improved to achieve efficient and effective results from the energy companies.
- The pricing in the energy sector should be market-determined to ensure commercial viability of energy companies and also to reflect the scarcity value of energy.
- There is a urgent need to focus on the development of state-of-the-art green technology and for this huge investments and R&D are required.
- Necessary policy framework should be developed so that private and foreign investments can be attracted in the energy sector especially in creating the energy infrastructure.
- An effective implementation of energy policies is required through the improvement of bureaucratic and administrative processes. Truly integrated and consistent energy policy is critical to guide and direct India's energy sector and ensure investment.
- Strong political will is a pre- requisite to successfully cope with the energy sector challenges. The power sector faces a shortage of fuels, insufficient infrastructure and financial weaknesses of the state owned power companies due to distorted pricing mechanisms and a systematic weakness to enforce legitimate revenue realization.

Future Plans and Energy Policies in India

Government is very concern to achieve the energy security for India in the recent past. Government has initiated several missions, docu-

mented visions and comprehensive energy policies to achieve energy security. Some of the major steps taken by Govt. in this direction are as given below-

NELP (New Exploration and Licensing Policy) -

NELP was introduced in 1999 to accelerate exploration and development of hydrocarbon resources in India. The NELP awards exploration blocks through international competitive bidding and allows 100% foreign and private participation. NELP was renewed in 2009.

IHV-2005-

India Hydrocarbon Vision-2025 (IHV-2025) was introduced in 2001 to layout long -term vision for the oil and gas sector with the objectives of enhancing energy security and promoting a free market and competition within the sector. IHV-2025 confirmed the importance of foreign investments, but also emphasized the critical role of Indian PSUs by increasing their operational flexibility and autonomy.

IEP-2031-32-

Integrated energy policy- 2031-32 has been announced. The importance of this policy lies in the fact that for the first time the entire energy sector is brought together in one policy and developing a long term vision. Its other importance lies in the fact that it is bold in accepting realities and challenges for the govt. in future.

UMPPs-

Government has announced setting up of Ultra Mega Power Plants (UMPPs), each with a capacity of 4000 MW, by the private sector companies.

FSAs-

To ensure the steady supply of coal to thermal power plants, govt. has asked Coal India Limited (CIL) to sign Full Supply Agreements (FSAs) with power plants.

Jawaharlal Nehru National Solar Mission-

The govt. has also focused on solar energy for energy security and has announced ambitious National Solar Mission.

Target Set By National Solar Mission

Solar Mission	Target		
	Phase1 (2010-13)	Phase2 (2013-17)	phase3 (2017-22)
Utility Grid Power (Including Roof - top) MW	1,000- 2,000	4,000- 10,000	20,000
Off - Grid Solar Application (MW)	200	1,000	2,000

Source: - Jawaharlal Nehru National Solar Mission, Government of India

Possible Solutions/Strategies for Energy Security-

India is a geographically vast and diverse country. Its rich diversity in terms of relief, climate, land and water resources, mineral resources, agricultural and forest resources can be tapped to achieve the challenging goal of India's energy security.

First thing we should do is to change the attitude. We should have such an eye that can see the unseen or hidden opportunities / solutions that are spread around us in the nature and its diversity.

Then, we should have proper state- of-the-art technology that can harness the hidden solutions in the nature. The political will and citizen's awareness and active participation are the necessary pre- requisite for achieving the energy security for the country.

Intensive decentralization and efficient power generation are basic requirements for energy security. The scarce fossil fuel based centralized capacity addition is expected to be further expensive, inefficient, polluting and unsustainable. Though Mega Hydro Projects share 23% of the generation capacity, further increase would mean increased environmental disturbances. Nuclear energy is vital but hazardous for environment and security.

Renewable sources contribute only 10% to the nation's power basket where coal is the dominant source. Currently, India is ranked 5th in the world with 15691.4 MW grid connected and 367.9 MW off-Grid re-

newable energy based power capacity, hinting at a slow clean power transition compared to other developing countries like China. By and large, it is imperative to boost our renewable energy based power generation capacity, especially through solar power.

Solar Energy :-

India's latitudinal location is very favourable for receiving one of the highest solar insolation. But it has very meagre installed capacity in comparison to its potential. To utilise the India's solar energy potential for achieving energy security. National Solar Mission was launched in January, 2010. To achieve the ambitious target of 20000 MW grid-connected solar power generation, it is imperative to identify the solar hotspots in the country.

The identification of hotspots of solar potential hastens the establishment of grid-connected SPPs (Solar Power Plants) and SPV and CSP based off-grid SPPs. It encourages decentralized power generation with reduced Transmission and Distribution (T&D) losses and will meet the major part of energy demand of the country.

These regions of solar hotspots are favourable for attracting investment, generate employment, abate GHG emissions and to establish a sustainable power generation mechanism. To achieve the goal of a "Solar India", the pre-requisite step is to assess the solar resource potential and its variability in the country.

Bio- Energy :-

About 70% of Indian Population lives in rural area where 75% of the primary energy demand are supplied by bio-energy resources. 22% of the urban households also depend on fire wood, 22% on kerosene and 44% on LPG for cooking in India. While 70% of the rural population depends on the bio-energy for their domestic needs. Bio-energy resources are renewable and their combustion couldn't produce poisonous gases and also provide sufficient amount of oxygen supply. Bio-energy sources include fuel-wood from forest, bio- gas, bagasse, agricultural residue, livestock residue, feedstock residue, solid waste etc. Bio- energy is used as primary energy which can substitute the non renewable energy sources.

Bio-energy production is estimated to be about 1842 TWh/year which constitutes 25% of the total energy consumption in India. 95% of the present bio-energy production relates to agricultural and forest residue (117 and 137 million tonnes (dry) respectively). Improved cook - stoves are expected to be used in future which will increase the efficiency and cleaner bio-energy.

Bio- fuels: -

Algae based bio- fuels present a larger scope for use as transportation fuel as compared to 1st and 2nd generation bio fuels. Transportation fuel is a bio fuel relevant market that has critical implication on the nation's economy given the huge burden placed by the crude oil import bill (6000 Billion Rupees).

Small Hydro- Electric Power Stations (SHP):-

The installed capacity of Small Hydro Power Stations in the country is 3686 MW as of 30th June, 2013. It constitutes nearly 14% of installed renewable energy capacity. SHP is already cost competitive with conventional power and increased efficiencies and CUFs would make it even more viable in the future. To enhance further the total power generation from SHPs, it is necessary to harness all potential sites. This source of energy is more widespread than wind & solar energy in many cases. Required efforts and enhanced capacity utilization will lead to a quick increase in overall SHP generation resulting in 115 TWh by 2047 and 29.9 GW by 2047.

Onshore Wind Power: -

The installed capacity of wind power in the country is 17353 MW as on 31st March, 2012. It contributes to 70% of the total renewable energy capacity. It is located in the southern and western high solar potential states of T.N, Karnataka, Maharashtra, Gujrat and Rajasthan. Various studies estimate that actual potential for grid- connected wind power could be anywhere between 500-1000 GW. It indicates that the wind resource availability is not a constraint for wind power development. The uptake of wind power may be limited by factors like availability of land, transmission infrastructure and reliable integration of variable generation of power.

Energy from Municipal Waste: -

India holds huge potential in the conversion of Waste to Energy (W t E) both in urban and rural areas. It produces useful energy in a number of ways. The installed capacity of Municipal Solid Waste (MSW) based W t E projects was 96 MW in 2012. In the W t E projects, energy is generated through bio-chemical conversion or combustion. The capacity of energy generation will depend on levels of segregation of waste and its collection efficiency. It is estimated that by 2047, both urban & rural areas will have MSW collection efficiency of approximately 100% and segregation levels of approximately 90% and 70 % respectively. It indicates the increasing share of MSW in power generation through multiple technologies.

Oceanic Energy: -

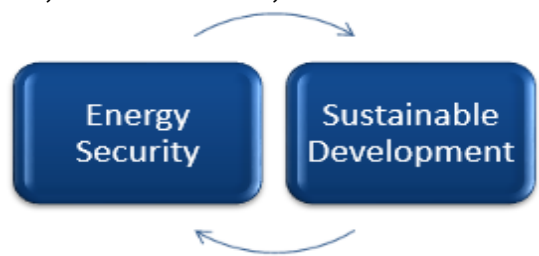
Around 71% of earth surface is covered by oceanic water and it presents energy potential in many ways. Some of them are given below-

- OTEC (Ocean Thermal Energy Conversion) - There is always a difference in the temperature of the bottom layers and surface layers of oceanic water. This thermal difference may be up to 20 °C at some places. This thermal difference can be tapped and can be converted into Oceanic Thermal Energy. This Oceanic thermal energy can be converted into more useful form of electricity.
- Tidal & Wave Energy- Dynamic energy of oceanic waves, oceanic currents and tides can be used to generate electricity.
- Oceanic Bio-Fuels- Huge quantities of oceanic algae will provide advanced Methane Bio-fuel which will be endless source of bio-fuel.
- Marine Deuterium - Marine Deuterium is also known as Heavy Hydrogen. Deuterium is an isotope of hydrogen. It is a very rich source of nuclear energy. Experiments are going on the Nuclear Fusion of Deuterium in a controlled manner. Whenever these experiments will succeed, they will provide energy for millions of years.
- India has a great potential in Oceanic energy as India has very long coastline and large territorial sea area and EEZ. India should focus on research and development of cost- effective, competitive eco-friendly and sustainable technology to tap the vast and renewable oceanic resources.

Energy Security and Sustainable Development-

The ultimate aim of all nations of the world is to attain Sustainable Development. To ensure sustainable development, the uninterrupted supply of energy and green energy is the fundamental requirement for a country as all the developmental activities are based on energy. Thus, energy security is pre-requisite for sustainable development.

Energy security and sustainable development are positively co-related. They reinforce each other in a cyclic manner.



Energy security leads to sustainable development and in turn sustainable development results in energy security of the country.

Role of Common Man :-

A common man can also contribute in the energy security. He can save energy by efficient and optimum usage of energy resources. Saving of energy is equal to production of energy. Thus, he can contribute in ensuring the energy security. But, a common man can only contribute in energy security when he is aware and informed citizen who understands his social responsibility. For this to happen, government should run extensive campaigns to spread awareness about the value of energy, its scarcity value and their role and correct attitude towards energy security.

Conclusion :-

India is a large developing country. Its energy requirements are huge. Excessive dependence on coal, depleting reserves of coal, heavy dependence on crude oil, shocks in the supply of imported crude and volatility of international prices of crude oil, highest AT& D, power theft, Under-pricing of power, free power concept etc. are major threats to India's energy security. The Govt. should sort out all these major issues for ensuring energy security in the country.

India should diversify its energy sources, be it conventional or non-conventional, renewable or non-renewable. The focus of Govt. should be on the cost-effective research & development of solar energy, bio-energy, energy from waste, SHP, wind energy and oceanic energy. These renewable sources can help in fulfilling the requirements of energy at local level. India should also diversify its energy trade - partners and suppliers to avoid any external supply shocks.

Apart from the gov't's efforts for ensuring the energy security, people's participation and awareness is must as they are the end-users of energy.

Thus, the combined efforts and strong will of both the Govt. and Indian citizens is required for achieving the energy security for India.

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