

Non-conventional Energy Sources

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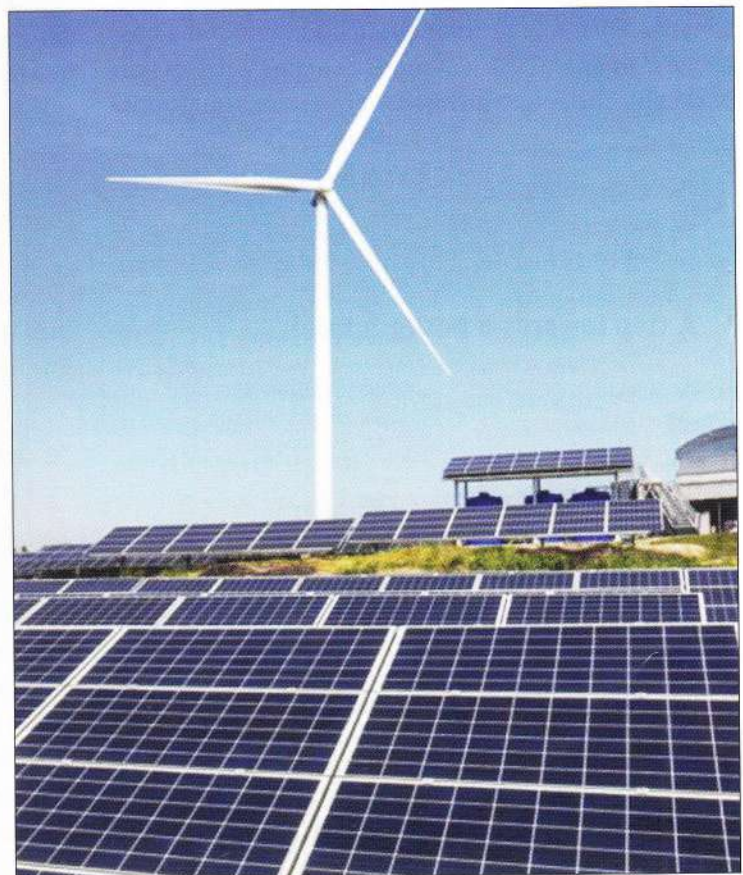
India is gradually transitioning from conventional sources to non-conventional sources of energy, for its needs. This is particularly significant as being one of the fastest growing countries in the world and fifth largest economy, as on date, India holds a strategically important position in the global arena and India's efforts in climate change will pave a direction for the future generation.

Energy occupies a pivotal position to facilitate the dream of a sustainably developed India. With erratic monsoons and frequent droughts, global warming is no longer a mere threat but a reality. Source of energy play a dominant role in determining the pace of global warming. Conventional energy sources such as the burning of fossil fuels including coal is the largest contributor to global climate change. In fact, fossil fuels account for about 75 percent of the total global greenhouse emissions and about 90 percent of the total carbon dioxide emissions. Apart from adverse ecological implications, excessive reliance on conventional sources of energy will result in their exhaustion as well, as it is a non-renewable energy source.

In the past few decades, there has been extensive research on the global climate change phenomenon and how the usage of conventional sources of energy particularly fossil fuels may be reduced. These researches also led to the formation of United Nations Framework Convention on Climate Change (UNFCCC), an international environmental treaty, in 1992 to combat the excessive greenhouse emissions. One of the first major measure undertaken under UNFCCC was the Kyoto Protocol which was signed in 1997. The Kyoto Protocol made the industrialised countries and economies to commit and reduce emission of Green House Gases as per their agreed individual targets. Subsequently, the Paris Agreement was also signed wherein around 196 countries signed a global framework to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. Despite all these efforts, the carbon-dioxide

emissions are alarming and calls for a shift towards non-conventional sources of energy.

India is gradually transitioning from conventional sources to non-conventional sources of energy, for its needs. This is particularly significant as being one of the fastest growing countries in the world and fifth largest economy, as on date, India holds a strategically important position in the global arena and India's efforts in climate change will pave a direction for the future generation. Also, considering the developmental requirements of India and growing energy needs, shifting to non-conventional sources of energy is essential for the country's sustainable and holistic development.



Non-conventional energy sources refers to those renewable sources of energy that are obtained from the nature and are replenished at a rate faster than its consumption unlike the conventional energy sources like coal, natural gas etc. In other words, the energy sources do not get depleted when used. They constitute clean and inexhaustible source of energy. The most important characteristic of non-conventional sources of energy is the way they impact the environment, which is much less hazardous compared to conventional sources of energy.

The popular sources of non-conventional energy sources in India are as follows:

Solar Energy

Solar energy refers to the energy received from the sun in the form of light and heat. It can be harnessed by converting solar energy into electric energy in solar plants. India, being a tropical country and its geographical location makes it a conducive source of energy. There has been a significant impact of the solar energy in India in recent years. Solar energy has penetrated to the rural belts of the country making regular activities like cooking, lighting and other energy needs eco-friendlier and cheaper. Further, the solar energy sector in India has evolved as one of the key sunrise sectors with lots of potential. The country's need for the solar energy has

resulted in Production Linked Incentive scheme for manufacturing of solar Photo-Voltaic (PV) modules with an outlay of Rs. 24,000 crores. The scheme supports setting up of integrated manufacturing units of high efficiency solar PV modules by extending support through Production Linked Incentive (PLI). It is expected that the scheme will create additional 10,000 MW capacity of integrated solar PV manufacturing plants. It will further reduce imports of solar PV cells and modules and provide adequate impetus to Research and Development to achieve higher efficiency in solar PV modules.

Recently, India has achieved 5th rank globally in solar power deployment by surpassing Italy. Also, the efforts of the Government have resulted in increase of solar power capacity by more than 11 times in the last few years.

Wind Energy

The kinetic energy of wind in motion is used to generate wind energy. The expansion of the wind industry in the country has created a strong ecosystem with efficient project handling and operation facilities and manufacturing base of about 10,000 MW per annum. As on 31st March, 2021, India with total installed capacity of 39.25 GW has the fourth highest wind installed capacity in the world.

India with its long coastline of around 7,500 km has immense potential in harnessing offshore wind energy. The government has installed over 800 wind-monitoring stations across the country and has issued wind potential maps at 50 m, 80 m, 100 m and 120 m above ground level. The recent assessment by the government has indicated a gross wind power potential of 302 GW in the country at 100 meter and 695.50 GW at 120 meter above ground level.

Tidal Energy

The energy produced from the surge of ocean i.e from rise and fall of waves is called tidal energy. Tidal energy is yet to take in a full fledged form for commercial purposes and is still in the research and development phase. Relatively high cost and limited availability of sites with sufficiently high tidal ranges or flow velocities poses constraints on its total availability.

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Geothermal Energy

The energy generated from the heat derived from sub surface of earth is called geo-thermal energy. The gradual decline of radioactive particles in earth's core generates geo-thermal energy.

Hydropower

Hydropower, or hydroelectric power or hydel power, is considered to be one of the oldest and largest sources of renewable energy. It generates electricity by harnessing the flow of water.

Biomass Energy

Biomass energy is generated by living organisms or organisms that lived earlier. Biomass is an organic material and contains stored energy obtained from the sun. Burning of biomass results in release of chemical energy in biomass in the form of heat.

According to Ministry of New and Renewable Energy (MNRE), about 32 percent of the total primary energy use in India is still derived from biomass and more than 70 percent of the country's population depends on bio-mass fuel to cater to their regular energy needs. In a recent study by MNRE, it was estimated that the present bio-mass availability in India is around 750 million metric tonnes annually.

Fuel Cell

This refers to the source of energy which uses hydrogen and oxygen to generate electric power. Through chemical reaction with oxygen, fuel cells convert hydrogen obtained from diverse sources, into electricity. Water is the only end product of this process, making it a clean and sustainable energy source.

Significance of Non-conventional Sources of Energy

Transition to non-conventional sources of clean energy ensures the attainment of three Es that often finds mention in energy policies- energy security, economic development and environmental sustainability. The shift towards non-conventional sources of energy will make this planet a better place to live. Apart from addressing the issue of climate change and global warming, transition to renewable sources of energy will reduce air pollution and will further contribute to better public health outcomes.

Additionally, thrust on non-conventional sources of energy can fetch economic gains to India. The shift towards non-conventional sources of energy can bring down the cost of energy supply and can also ensure enhanced delivery of affordable clean energy that is accessible to all. The realisation of India's AatmaNirbhar Abhiyaan also depends on the enhanced accessibility and affordability of green/clean energy sources.

Apart from environmental aspects, the economic benefits are also significant. The transition to renewable energy sources will aid Indian economy to delink itself from volatile international oil prices. It can also ease out subsidy burden of government currently spend on conventional energy sources including kerosene. Further, the transition to non-conventional sources of energy results in more employment and entrepreneurship opportunities in the domain of renewable energy. India can also lead in exports of non- conventional energy sources such as wind electric generators, bio-mass gasifiers, solar energy systems, electric vehicles etc. Further, India could also handhold other developing nations to explore the path of sustainable development via making best utilisation of non-conventional sources of energy.

Governmental Interventions to Foster Renewable Energy Sources

In recent times, non-conventional sources of energy have received greater momentum with government taking numerous measures to facilitate the transition to clean sources of energy that can lead India's de-carbonisation initiatives.

As per government sources, as on February 2022, a total of 152.90 GW of renewable energy capacity projects have been installed in India which comprise of 50.78 GW from solar power, 40.13 GW from wind power, 10.63 GW from Bio-power, 4.84 GW from small hydro power and 46.52 GW from large hydro power. With greater momentum, India is committed to achieving 500 GW of non-fossil fuel-based energy capacity by 2030. The governmental efforts are aligned with making substantial progress in achieving Sustainable Development Goal 7, which calls for "affordable, reliable, sustainable and modern energy for all" by 2030. The government initiatives along with contributing to long term energy security

needs and reducing carbon footprint, will also generate large direct and indirect employment opportunities.

Some of the recent governmental interventions for facilitating transition to renewable sources of energy are as follows:

- Permitting Foreign Direct Investment (FDI) up to 100 percent under the automatic route for renewable energy projects, including offshore wind energy projects.
- Setting up of ultra-mega renewable energy Parks to provide land and transmission to renewable energy developers on a plug and play basis.
- Waiving of Inter State Transmission System (ISTS) charges for inter-state sale of solar and wind power for projects to be commissioned by 30th June 2025.
- Laying of new transmission lines and creating new sub-station capacity for evacuation of renewable power etc under Green Energy corridor scheme for evacuation of renewable power.
- Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahabhiyan (PM-KUSUM): PM-KUSUM aims for de- dieselisation of the farm sector along with providing energy security and increased income to farmers. The Scheme with a financial support of over Rs.34,000 crore from Central Government has aimed to create additional 30.8 GW of solar capacity. It has 3 components (i) creation of 10,000 MW of Decentralised Ground mounted grid connected solar power plants, (ii) solarisation of 15 lakh grid connected agriculture pumps and (iii) installation of 20 lakh agriculture pumps powered by solar energy.
- Rooftop Solar Phase – II Programme: Under this Programme 4000 MW rooftop solar (RTS) capacity addition is targeted through Central Financial Assistance (CFA) in residential sector including for households in rural areas.
- National Hydrogen Mission: The mission aims in making India, a green hydrogen hub, aiding India to fulfil its target of production of five million tonnes of green hydrogen by 2030 along with allied development of renewable energy capacity. The Mission proposes a framework for inter alia generating demand for Green Hydrogen in sectors such as petroleum refining and fertiliser production; support for indigenous manufacturing of critical technologies. In tune with the National Hydrogen mission, recently in August 2022, India's first indigenously developed Hydrogen fuel cell bus developed by KPIT-CSIR was launched.
- National Offshore Wind Energy Policy was notified by Government of India on 2015 for the development of offshore wind power in the country. Post notification, Government through National Institute of Wind Energy has also issued guidelines for Offshore Wind Power Assessment Studies and Surveys. These guidelines are expected to enable private sectors to carry out offshore wind resource assessment.
- National wind solar hybrid policy was adopted in 2018 by MNRE and it aims at providing a framework for promotion of large grid connected wind-solar PV hybrid projects for optimal and efficient utilisation of transmission infrastructure.
- Ministry of New and Renewable Energy sources has also implemented numerous schemes to foster bio-energy such as scheme to support Promotion of Biomass based cogeneration in sugar mills and other industries, Programme on Energy from Urban, Industrial and Agricultural Wastes/ Residues, Biogas Power (Off-Grid) Generation and Thermal application Programme (BPGTP), New National Biogas and Organic Manure Programme (NNBOMP) etc.

The initiatives of Government in facilitating transition to renewable energy sources has been echoed in the international forums as well. In COP 26 summit held at Glasgow, Hon'ble Prime Minister, depicting India's efforts to cope up with climate change, has announced 'Panchamrit' (five nectar elements) which lays great emphasis on non- conventional energy sources. It includes the following; (i) India will take its non-fossil energy capacity to 500 GW by 2030, (ii) India will meet 50 percent of its energy requirements from renewable energy by 2030, (iii) India will reduce the total

projected carbon emissions by one billion tonnes from now till 2030. (iv) By 2030, India aims to reduce the carbon intensity by more than 45 percent. (v) By the year 2070, India aims to achieve the target of Net Zero which effectively means to completely negate the production of greenhouse gases.

Thus, much emphasis has been placed on the development of non-conventional energy sources to fight global warming. Over the years, development of renewable energy in India has attained greater momentum. India, today ranks 4th in the world in installed renewable energy capacity. India's non-fossil fuel energy has increased by more than 25 percent in the last 7 years and now it has reached 40 percent of our energy mix.

Challenges in Transition to Non-Conventional Energy Sources

The transition to non-conventional energy sources is a transformational step necessitating a system overhaul and hence poses many challenges. Ensuring an enabling infrastructure and conducive ecosystem for facilitating a smooth transition to renewable energy is a matter of concern. This also includes the challenge of expanding power infrastructure to permit increased use of diverse energy sources and ensuring system flexibility. Massive investment is inevitable for facilitating smooth transition to non-conventional energy sources. Ensuring viable financing mechanism to raise long term funds at low interest rate to facilitate this transition is thus a formidable challenge. International green finance flows to India are gradually increasing but are still relatively low while compared to India's lofty climate goals. The landscape of green finance is marred by issues like long gestation gaps, increased capital cost, potential risk factors associated etc. Further, investment in renewable energy sector is disproportionate in nature. For instance, despite its growth potential, wind energy sector attracts relatively fewer international investments as compared to solar energy sector.

Another impediment pertains to resolving the issue of low credit worthiness and resulting lack of investor confidence in the renewable energy sector. Renewable energy sector merits individualistic attention and it should be ensured that investments

in conventional energy sources does not crowd out renewable energy investments. Leveraging private sector investments to its optimal level to foster the transition to clean energy is also a prevalent challenge. The poor financial strength of some of the distribution companies and their resulting inability to make timely payments to renewable energy developers is also a formidable hindrance. It can also affect the viability of renewable energy sector and further slow down its space of development.

Further coping up with immediate job and revenue loss due to switch from fossil fuels will also be a challenge. Addressing this requires strategic planning for raising necessary finance and upskilling of our human resources.

Way Ahead

Facilitation of transition to non-conventional energy sources holds the key for India's developmental aspirations. A revolutionary shift to non-conventional energy sources can bring about transformational opportunities for sustained economic development. It will also ensure energy security and disaster resilience, apart from generating employment, improving health outcomes and offering other societal benefits. To facilitate a smooth and sustainable transition to non-conventional sources of energy, mobilisation of green finance needs to be adopted at a faster pace. Greater deployment and optimal utilisation of innovative financial instruments like green bonds, crowd funding, infrastructure debt bonds can help in this regard. Further facilitating increased public private partnership for funding and meeting necessary technological requirements is also needed. This also necessitates a conducive regulatory and institutional setup which is responsive to the dynamic needs of renewable energy sector. The existing government policies in this sector goes a long way in mitigating these challenges.

It is also important to further escalate research and development spending on the domain of clean energy sources, so as to come up with sophisticated enabling technologies. It will foster innovation, and aid in the creation of energy systems that are resilient to future economic and environmental shocks. Incentivising non-renewable sources of energy via fiscal tools and incentives

can further provide greater vigour to facilitate the transition to renewable energy sources. Further, ensuring greater synergy among all the concerned stakeholders through a participatory approach and awareness generation, can further help to fasten the pace of shift towards renewable sources of energy. Transition to non- conventional sources of energy is a crucial enabler for sustainable development and climate resilience paving its way towards creation of a more equitable, inclusive and sustainable society. The facilitation of such a transition is indeed possible with greater synergy and untiring efforts from all the concerned stakeholders and sectors involved.

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