



## ACHIEVING ENERGY SECURITY BY RENEWABLE SOURCES OF ENERGY POLICY TRENDS IN DEVELOPING SUSTAINABLE ENERGY

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“The earth, the air, the land and the water are not an inheritance from our fore fathers but on a loan from our children. So we have to handover to them at least as it been handed over to us.” **Mahatma Gandhi**

This saying of Mahatma Gandhi way back, almost seven decades ago is becoming all the more relevant with each passing day. In a race to achieve progress and be developed, the impact of industrialization and environmental degradation got ignored globally. As a result, today world is witnessing the result of environmental imbalance on a global scale. Tornados<sup>1</sup>, hurricanes<sup>2</sup>, tsunamis<sup>3</sup>, unprecedented rains<sup>4</sup> etc are all results of nature’s fury. Thus it is the responsibility of each and every individual towards our planet, irrespective of where we live. We all belong to the earth first, and not that the earth belongs to us. It is the need of the hour to come together and put combined efforts globally. Since ages India has believed in this and has always been committed to participate in support of efforts

to save the environment on a local as well as global scale<sup>5</sup>.

India is going through a conflicting time. India needs to meet the growing energy demands for rapid industrialisation on one hand and on the other hand require attending to millions of people’s basic day today needs<sup>6</sup>. Thus the need of the hour is to put economic development on a climate-friendly path that meets the demands of the present without imperilling the needs of the future generations as expressed by Mahatma Gandhi. This principle leads the renewable energy sector spread its wing across India.

India’s energy sector is one of the most diversified in the world. Sources of energy generation range from conventional sources such as coal, lignite, natural gas, oil, hydro and nuclear power to viable non-conventional sources such as wind, solar, and agricultural and domestic waste. Traditionally India has mainly relied on coal for its energy needs as it has 4<sup>th</sup> largest coal reserves<sup>7</sup>. As conventional sources has its own disadvantages, viz ill effects on environment, non sustainability and cost factor, India is stressing policies to develop and use nonconventional affordable sources which are environment friendly, sustainable, secured and renewable to balance the economic growth and environment stability.

1 <http://fox2now.com/2017/03/01/devastating-images-of-tornado-damage-from-perryville-mo/>.

2 <https://www.nytimes.com/2017/08/26/us/hurricane-harvey-strikes-a-powerful-blow-to-texas-and-lingers.html>.

3 <http://timesofindia.indiatimes.com/event/2004-Indian-Ocean-tsunami/articleshow/55071172.cms>

4 <http://indianexpress.com/article/india/india-news-india/chennai-flood-death-toll-crosses-260-home-minister-says-situation-very-alarmin/>.

5 [http://unfccc.int/paris\\_agreement/items/9485.php](http://unfccc.int/paris_agreement/items/9485.php).

6 Renjish Kumar V K. Energy Consumption In India-Recent Trends, Vol: I. Issue XXXVI, APJR February 2016.

7 <http://coal.nic.in/content/coal-reserves>.



India geared up for energy security after two oil shocks in 1970s. As a result of it, government constituted Commission for Additional Sources of Energy (CASE ) in 1981. The Commission was charged with the responsibility of formulating policies and their implementation, programmes for development of new and renewable source of energy (NRES ) apart from coordinating and intensifying R&D in the sector.

Department of Non-conventional Energy Sources (DNES), that incorporated CASE, was created in the then Ministry of Energy in 1982<sup>8</sup>. This indicated that the stage of commercialization of NRSE devices had been reached, requiring a range of conducive policy measures. To facilitate commercialization and market development, the Indian Renewable Energy Development Agency Limited (IREDA) was established in 1987. The IREDA functions as the promotional and financing arm of the Ministry and has been able to tie up funds from domestic and international institutions for lending to end-users, manufacturers, financial intermediaries and entrepreneurs, predominantly in the private sector. In 1992, DNES was elevated into a separate Ministry of Non-conventional Energy Sources (MNES) reflecting the political commitment towards the promotion of NRSE<sup>8</sup>. The MNES with involvement of the private sector and NGOs was successful in creating one of the most broad-based renewable energy programmes in the world. The Ministry is broadly organized into six groups dealing with rural energy, solar energy, power from renewable, energy from urban and industrial

wastes, new technologies and administration and coordination.

It was realized that renewable energy has to play a much deeper role in achieving energy security in the years ahead. In October 2006, the Ministry was re-christened as the Ministry of New and Renewable Energy<sup>8</sup>. India is perhaps the only country to have exclusive ministry for renewable energy. Since then the Ministry has been facilitating the implementation of broad spectrum programs such as harnessing renewable power, use of renewable energy to rural areas for lighting, cooking and in urban areas for industrial and commercial applications<sup>9</sup>.

The Government of India has taken several initiatives to achieve “Power for All” by 2022<sup>10</sup>. It introduced the concept of solar parks, organized RE-Invest 2015—a global investors’ meet, launched massive grid-connected rooftop solar programmes earmarked Rs.38,000 crore for a Green Energy Corridor, increased eight-fold in clean environment cess from Rs.50 per tonne to Rs.400 per tonne, launched solar pump scheme with a target of installing 100,000 solar pumps and programme to train people for solar installations under the Surya Mitra scheme, levied no inter-state transmission charges for solar and wind power, made compulsory procurement of 100% power from waste to energy plants etc. The other significant initiatives are launching of improved cook-stoves initiatives; initiating coordinated research and development activities in solar PV and thermal; second generation bio-fuels, hydrogen energy and fuel cells etc. As a result today 1.2 million

8 Ali Reja Osmani, Conventional Energy to Renewable Energy: Perspectives for India, Vol XII, No. 2, TNJ, July - December 2014.

9 <http://mnre.gov.in/mission-and-vision-2/achievements/>.

10 <http://www.powerforall.org/blog/2016/2/28/infographic-indias-247-power-for-all-program>.



households are using solar energy to meet their lighting energy needs and almost similar numbers of the households meet their cooking energy needs from biogas plants. Solar Photovoltaic (PV) power systems are being used for a variety of applications such as rural electrification, railway signalling, microwave repeaters, mobile towers, TV transmission and reception and for providing power to border outposts <sup>11</sup>.

#### **Infrastructure development:**

Every State has a department, for implementation of renewable energy programmes of the Ministry, besides their own programmes of renewable energy. In addition, institutions namely National Institute of Solar Energy (NISE) at Gurgeon, National Institute of Wind Energy (NIWE) at Chennai, The Sardar Saran Singh National Institute of Bio-Energy (SSS- NIBE) at Jalandhar. Solar Energy Corporation of India (SECI) and Indian Renewable Energy Development Agency (IREDA) have been established to provide technical support to the renewable energy sector in the country. The reputed technical institutions i.e. IITs, NITs and Universities provide support for research and development work. A large domestic manufacturing base has been established in the country for renewable energy systems and products. Companies investing in these technologies are eligible for fiscal incentives, tax holidays and accelerated depreciation apart from the remunerative returns for the power fed into the grid. Further, the government is encouraging foreign investors to set up

renewable power projects with 100 % foreign direct investment <sup>12</sup>.

#### **Policy initiatives:**

Favourable regulatory policy initiatives such as Electricity Act 2003 <sup>13</sup>, renewable purchase obligation scheme under which each state has to set a state level target for renewable energy purchase by 'Obligated Entities'. The obligation can be met by either ways i) by directly purchasing renewable energy ii) by generating renewable energy. Launching of The Jawaharlal Nehru National Solar Mission (JNNSM) in November 2009 was marked as the foundation stone in India's endeavour to solar energy, popularly known as 'Sola India'. The renewable energy sector has always been given a 'Priority Sector' status by the Reserve Bank of India for the purpose of providing loans through banks. <sup>14</sup>

#### **Power from renewable: Grid interactive and off-grid renewable power Wind Energy Programme:**

Wind energy has emerged as most successful renewable energy option in India and is the fastest growing renewable energy technology for generating grid connected power amongst various renewable energy options. The Ministry's wind power programme covers wind resource assessment, facilitation of implementation of demonstration and private sector projects through various fiscal and promotional policies. India is the fourth largest wind power producer in the world, after China, USA and Germany.

11 Andrew J Apostoli and William A Gough, India's Energy-Climate Dilemma: The Pursuit for Renewable Energy Guided by Existing Climate Change Policies, *J Earth Sci Clim Change* 7: 362. DOI: 10.4172/2157-7617.1000362.

12 <http://www.makeinindia.com/sector/renewable-energy>.

13 The Electricity Act 2003, No 36, Acts of Parliament, 2003 (India).

14 <https://rbi.org.in/scripts/FAQView.aspx?Id=87>.



### **Technology Development and Manufacturing Base:**

Wind turbines are being manufactured by 21 manufacturers in the country with 55 models up to a capacity of 3.00 MW single turbines, mainly through joint ventures or under licensed production agreements. A few foreign companies have also set up their subsidiaries in India.<sup>15</sup>

### **National Solar Mission:**

India is endowed with a very vast solar energy potential. Most parts of the country have about 300 sunny days. Average solar radiation incident over the land is in the range of 4-7 kWh per day. The solar energy can be utilized through solar photovoltaic technology which enables direct conversion of sunlight into energy and solar thermal technologies which utilizes heat content of solar energy into useful applications. Over the last three decades several solar energy based systems and devices have been developed and deployed in India which is successfully providing energy solutions for lighting, cooking, water heating, air heating and cooling and electricity generation.<sup>16</sup>

### **Solar Parks and Ultra Mega Solar Power Projects:**

The scheme for development of Solar Parks and Ultra Mega Solar Power Projects has been conceived on the lines of the “Charaka Solar Park” in Gujarat which is a first-of-its-kind large scale Solar Park with contiguous developed land and transmission connectivity.<sup>16</sup>

### **Grid-interactive solar rooftop and small spv power plants programme:**

With an objective of increasing energy security, reducing fossil fuel imports and a cleaner environment, the Government of India has set a target of 1,00,000 megawatts (MW) of solar installations by the year 2022, out of which 40,000 MW are targeted for rooftop solar photovoltaic (RTS) systems. There is a large potential available for generating solar power using unutilized space on rooftops and wastelands around buildings. Small quantities of power generated by each individual household, industrial building, commercial buildings or any other type of building can be used to partly fulfil the requirement of the building occupants to replace the existing diesel generators and surplus, if any, can be fed into the grid. Ministry of Shipping plans to install 160.64 MW of solar and wind based power systems at all the major ports across the country by 2017, thereby promoting the use of renewable energy sources and giving a fillip to government's Green Port Initiative.<sup>17</sup>

### **Atal Jyoti Yojna (AJAY):**

Under this programme, Solar LED Street Lights in rural, semi-urban and urban areas will be installed across states of Uttar Pradesh, Assam, Bihar, Jharkhand and Odisha where the household electrification is less than 50% as per 2011 Census by March 2018. The installation of Solar LED Street Lights will ensure ample light in major roads, markets, public conveniences etc.

### **Million Solar Urja Lamp (SoUL) Program:**

India has one of the youngest populations in the world with 350 million children of less

<sup>15</sup> <http://mnre.gov.in/schemes/grid-connected/solar-thermal-2/>.

<sup>16</sup> <http://www.mnre.gov.in/solar-mission/jnsm/introduction-2/>.

<sup>17</sup> <http://pib.nic.in/newsite/PrintRelease.aspx?relid=134595>.





than 14 years of age, making school education essential for future of the country. However, 221 million people residing in India are still without electricity access and many more with poor quality of supply. Alongside 'Right to Education', it is desirable to provide 'Right to Clean Light' and hence there is a need for a country wide, self-sustainable solar lamp program. The Million Solar Urja Lamp (SoUL) Program developed and executed by IIT Bombay is to provide clean light for study purpose to each and every child in the country, with cost effective fastest possible way. One million SoULs were distributed during 2014-16 in 4 Indian states of Madhya Pradesh, Maharashtra, Rajasthan and Odisha, covering 23 districts, 97 blocks and more than 10,900 villages.<sup>18</sup>

#### **Deployment of the box and dish type solar cookers:**

One of the major energy consuming sectors is the cooking sector. In rural areas, cooking is still a mammoth task. People are still dependent on traditional fuel and method of cooking which are not only inefficient but also causes toxic indoor air pollution. This is an important programme leading to reduction in drudgery among the rural women and girls engaged in collection of fuel wood and reduction in the rate of deforestation and getting many health benefits.<sup>16</sup>

#### **Implementation of Solar Thermal Components including Solar Green House" in Leh and Kargil region:**

Kargil has natural advantage of having lots of sunshine in the winter months. The Green House is introduced which is designed to maximize the solar absorption in the day and to minimize the heat loss in the night.<sup>16</sup>

#### **Renewable Energy for Rural Applications:**

The Ministry has been supporting renewable energy programmes for rural areas of the country by deploying renewable energy systems such as family type biogas plants, solar water heating systems, solar cookers and other solar energy devices. In addition to family type biogas plants, the demonstration of integrated Technology package on Biogas-Fertilizer Plants (BGFP) for generation, purification/ enrichment, bottling and piped distribution of biogas. This highlights the biogas fuel applications to meet stationary, motive power, electricity needs including cooking and heating requirements.

#### **National Biogas and Manure Management Programme (NBMMP):**

Biogas is a clean cooking gaseous fuel, produced when biodegradable organic wastes are subject to a process called anaerobic digestion. At the end of the process organic enriched bio-manure is produced simultaneously as by-product from this process. The anaerobic digestion process is a low carbon generating technology for efficient management of organic wastes and sanitation. Biogas, thus produced, can be used for cooking, heating, generating electricity etc. The MNRE is implementing the Unnat Chulha Abhiyan (UCA) Programme for the promotion of improved biomass cook stoves in the country. Household biogas plants in addition to replacing the need of LPG, helps in reducing the pressure on forests and other conventional fuels like coal and kerosene. Small and marginal farmers benefit from biogas plants providing digested slurry with

<sup>18</sup> <http://www.iitb.ac.in/en/story/soul>.



high quantity and quality of Nitrogen, Phosphorus and Potassium (NPK) for use as organic bio-manure, which helps not only in sustaining soil health but also providing nutrients for obtaining higher crop yields. The biogas plants are thus potential source of helping farmers in adopting both conventional and organic farming without affecting environment.<sup>19</sup>

#### **Wind-Solar Hybrid Power:**

Wind and Solar Power being infirm in nature impose certain challenges on grid security and stability. Studies have revealed that wind and solar are almost complementary to each other and hybridizing of two technologies would help in minimizing the variability apart from optimally utilizing the infrastructure, including land and transmission system.<sup>16</sup>

#### **Renewable Energy for Urban, Industrial and Commercial Applications:**

The Ministry has been promoting the use of technologies for energy recovery from municipal, industrial and commercial wastes such as market wastes, slaughterhouse waste, agricultural residues and industrial wastes and effluents etc.<sup>20</sup>

#### **Energy efficient solar/green buildings programme:**

Buildings are major consumers of energy in their construction, operation and maintenance. Globally about 40% of energy consumption is estimated to be in building sector. Energy conscious architecture has been promoted which includes the use of solar passive design concept, use of eco-friendly and less energy intensive building

materials, integration of renewable energy and energy efficiency, water conservation, waste recycling etc. A GRIHA rating system has been developed in collaboration with The Energy and Resources Institute (TERI).<sup>16</sup>

#### **Development of Solar Cities Programme:**

The “Development of Solar Cities” programme aims at minimum 10% reduction in projected demand of conventional energy which can be achieved through a combination of energy efficiency measures while enhancing supply from renewable energy sources. The Ministry assists Municipal Corporations and Urban Local Bodies in preparation of a master plan for increasing energy efficiency and renewable energy supply in the city, setting up institutional arrangements for the implementation of the Master Plan and awareness generation and capacity building activities. The Ministry has a target to support 60 cities for Development as “Solar/Green Cities”. Eight cities; Bhubaneswar, Chandigarh, Gandhinagar, Mysore and Nagpur are being developed as ‘Model Solar Cities’. The MNRE has started promoting Akshay Urja Shops (earlier known as Aditya Sholar Shops) in major cities for the easy access and the after sale services of solar energy products.<sup>16</sup>

#### **Tariff Policy – Power from WTE plants:**

As per the amended National Electricity Tariff policy, in compliance with Section (3) of the Electricity Act, 2003, distribution Licensee(s) shall compulsorily procure 100% power produced from all the Waste-to-Energy plants in the State, in the ratio of their procurement of power from all sources

19 [http://mnre.gov.in/file-manager/offgrid-biogas/National-Biogas-Manure-Management-Programme\(NBMMP\)-12thplan.pdf](http://mnre.gov.in/file-manager/offgrid-biogas/National-Biogas-Manure-Management-Programme(NBMMP)-12thplan.pdf).

20 <http://www.climatechangecentre.net/pdf/renewableenergy.pdf>.



including their own, at the tariff determined by the Appropriate Commission under Section 62 of the Act.<sup>13</sup>

**Energy from Industrial and Agricultural Wastes/Residues including Biomass power and Bagasse Co-generation Programme:**

Biomass Power and Bagasse Co-generation Programme aims at efficient utilization of biomass such as agro-residue in the form of stalks, stems and straw; agro-industrial residues such as shells, husks, de-oiled cakes and wood from dedicated energy plantations for power generation. The potential for bagasse cogeneration lies mainly in sugar producing States, like Maharashtra and Uttar Pradesh.<sup>21</sup>

**Small hydro project:**

Small hydro projects are environmentally benign and normally do not encounter the problems usually associated with large hydro projects like deforestation and resettlement/rehabilitation due to submergence. The projects have potential to meet power requirements of remote and isolated areas. These factors make small hydro as one of the most attractive renewable source of grid quality power generation. 24 States of the country have policies in place towards private sector participation to set up SHP projects in their states.<sup>22</sup>

**Greening of Islands:**

The Ministry has formulated a scheme for setting up of 40 MW Distributed Grid-Connected Solar PV Power Projects in

Andaman and Nicobar and Lakshadweep Islands with the objective to develop Carbon Free Islands thus to contribute to the National Action Plan on Climate Change.<sup>16</sup>

**Research and Development:**

The Research and Development efforts of the Ministry are directed towards technology development and demonstration, leading to commercialization, apart from strengthening the capacity of R&D. The ultimate goal is to reduce the cost and improve efficiency in the near future.<sup>16</sup>

**International Solar Alliance:**

International Solar Alliance was launched as a special platform for mutual co-operation among the solar resource rich countries lying fully or partially between Tropic of Cancer and Tropic of Capricorn at COP21 in Paris on 30th November, 2015 to develop and promote solar energy, with its headquarter in India.<sup>5</sup>

**Support Programmes Information and Public Awareness Programme:**

Public awareness programmes are conducted to inculcate the importance of renewable energy amongst masses. The information is spread through a variety of media like electronic, print, exhibition etc. It also brings to the fore benefits, technological developments and promotional activities taking place in the renewable energy arena from time to time.<sup>23</sup>

**Human Resource Development :**

21 <http://www.iitk.ac.in/npsc/Papers/NPSC2010/7018.pdf>.

22 <http://mnre.gov.in/file-manager/hydro-scheme/Annexure-E.pdf>.

23 <https://yffpindia.wordpress.com/2015/07/12/scope-of-renewable-energy-in-india/>.



With the aim of 175 GW Renewable Power by 2022, the need of trained and qualified manpower in Renewable Sector has increased unprecedentedly. In view of the required manpower in Renewable Sector, the Human Resource Development division of the Ministry is engaged working in developing and promoting suitable framework in the country by supporting educational institutions working in Renewable Sector and other similar organizations to undertake such activities. Surya Mitra Scheme has been launched for creating trained solar photovoltaic technicians.<sup>16</sup> Ministry also supports to students for undertaking courses in renewable energy in select educational institutions by way of providing fellowships/stipend under National Renewable Energy Fellowship Scheme.<sup>24</sup>

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**Conclusion:**

India's well conceived and timely initiated "Energy Security Plan" to focus on renewable energy to balance today's requirement of clean energy with the development of economy is an example in itself. As a result, the Indian Renewable Energy Programme has received wide recognition internationally in the recent years. At home though several remote villages are getting electricity round the clock, there are still so many villages / places in the dark without electricity. No doubt the task is mammoth, but with Government's support and people's participation India is confident to achieve its dream of "Power for All".

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<sup>24</sup> <http://mnre.gov.in/schemes/human-resource-development/>.