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# A Study on Need of Inclusive Development and Environment Sustainability in India

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***Abstract:*** **-- With 1.2 billion people living and expected to increase by another 300 million in coming decades, India is definitely going to face lofty demands of resources to satisfy the needs of its people. Having realized that the existing non-renewable resources are not sufficient for the current as well as the future needs, it is very important for India to avail its immense treasure of renewable resources by adopting sustainability. Procuring sustainability is a hard row to hoe. This paper mainly focusses on the situation of India and the challenges it is facing in utilizing the available natural and non-renewable resources in an efficient way to reduce the stress on these resource utilization, keeping in mind the needs of the future generation. Various aspects such as water risk management, adoption of renewable energy, waste management have been discussed in this paper. Finally an attempt is made in this paper to drive the attention of the aspiring and growing companies towards sustainable development. In this context, this paper presents some examples of successful corporate of India who are triumphant in employing sustainable development industries by giving problem-based-solution and explains the methodologies adopted by them to contribute towards the 175GW of energy goal of India.**

***Index Terms:*****—RE, Sustainable, Waste, Water**

## I. INTRODUCTION

Just 90 companies across the world contribute to 67% of greenhouse gas emission which is responsible for climate change.[1] The decline in the global environmental status and climate change has made us realize that the renewable energy (RE) plays a critical role in stabilizing the decline and achieving sustainable development. The installed capacity of RE remained moderate until 2014 with 31.70GW in 2013 to 33.79 GW. However, there was a sharp increase in during 2014-2015 where it increased from 33.79GW to 42.75GW by March, 2016.At the current rates of urbanization, industrialization and infrastructural developments in India, the power consumption is expected to hit 2230TWh by 2030. Transforming to 100% RE is a hard plight. Hence gradual increase in the use of renewable energy is suggested. The goal for 2022 is 175GW from RE and 300 – 350 GW by 2030.

Water is one of the basic need of human life, with the rise in population there is boost in the requirement for it. In India, the annual precipitation (ofabout 4000 km3) is sufficient enough to satisfy the needs of the people. But due to inadequacy in availability of technology at all the places, we are unable to utilize the resources to their full potential. Also, whenever we are utilizing water resource, we should compensate in order to prevent a negative impact on the environment. Agriculture is a sector which accounts 80% of the total water requirement and hence it is very important to employ water smart agriculture in order to conserve and preserve.

The main driver for domestic waste is the haphazard development along with quick urban agglomeration that is likely to transform India into an urban majority country. Rural waste is largely agricultural in nature and is dispersed over half-a-million. The rapid growth of the Indian industry has led to increased industrial waste generation[2]. Waste from thermal power stations accounts for more than two thirds of the total of all industrial waste.

Now days, the generation of E-waste has increased exponentially leading various health and environmental problems. It is very important for us to understand that waste produced is not actually "waste'', it can be utilized in some other form. The waste for one can be the raw material for another. Initiatives should be taken by industries to step towards zero discharge industries i.e. circular economy.

## II. RENEWABLE ENERGY IN INDIA

Solar and wind energy have immense scope in the western parts of India. Also, it is said that at any particular moment there is at least one part of the dessert on which the sun is shining. Hence the potential of

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"desserts" should be utilized to its fullest. About 200km x 200km of solar panels are capable of producing the total world's power.

RE100 is a global initiative of influential businesses committed to 100% Renewable power. [3] The RE goal for 2022 aims for 100GW from solar, 60GW from wind, 10GW from biomass and other 5GW from small hydel projects.[4]However, the current hurdles in adoption of RE are as follows:

***Lack of awareness and inertia to adopt to RE***

Although most of the companies are aware about the advantages of RE, yet express inertia in adopting it due to gap in the implementation of central policies at state level also are often found in the dilemma of selecting the vendor. There is a need for capacity building, i.e., to develop awareness among non-technical people who don't fully understand its implementation. Most of the companies have postponed this initiative because of continuous development and anticipation of new renewable energy technology and more cost-effective technologies i.e. they are waiting for these technologies to become more economical.

***Feasibility***

(a) Unequal availability of the resources, (b) storage of excess power generated by RE, (c) feeding of power to the grid have been identified as the main technical constraints in the implementation of renewable energy. Technical evaluation of large-scale deployment of solar PV systems in India encounters barriers due to lack of testing facilities and qualified experts who can test and certify solar products, as well as the capability to qualify and demonstrate viability of solar modules based on local conditions.

***Implementation***

Implementation phase of renewable energy generation encounters hurdles in a) land acquisition and space availability, b) identification of vendor, c) lack of awareness of the related policies. Solar and wind renewable energy systems demand large space per unit of power generation. Furthermore, investors find it difficult to identify the appropriate vendor in the current vendor environment.

***Economy***

High capital cost and low cost effectiveness of RE, particularly solar power technology, acts as a major hurdle in investment. Investment in renewable energy is yet to become a profitable business case that is economically sustainable for corporate. It is to be noted that the initial installation costs are high but in the long run the efficiency is good.

***Policy adoption***

The fault for implementation of national policies lies with the state government, but the adoption of national policies on renewable energy by states is low in India. Even though Open Access and Net Metering have been introduced in the national renewable policy, in states like Maharashtra, there is a lack in the implementation. No energy banking was allowed in open access in Maharashtra as per Distribution open access policy 2014. The lack of these policies implementation in Maharashtra has resulted in reduced cost effectiveness of renewable energy and increased cost of captive generation of renewable energy at the demand side. It is a general observation that strong implementation of regulations will ensure renewable energy growth even if renewable energy captive generation does not make an immediately profitable business case.The following are some of the solutions that will cause metamorphosis of RE in India:

1) Development of land bank by states, streamlined and quick procedure of land acquisition and providing deemed status of non-agricultural land upon acquisition of private land for RE.

2) Provide single window clearance, time-bound turn-around time for approvals and clearances and specific timeline for facilities that are to be provided by state authorities.

3) Providing "must-run" [5] status for renewable energy projects.

In addition, availability of information in systemic manner, better incentive structure will increase ease of doing business and encourage investments. Although the availability of potential is the key criteria for the magnitude of renewable energy development, it is understood that the relevant state policies around renewable energy plays a significant role in the development of renewable energy in the state.

In view of the fact that most of the corporate are concentrated in Maharashtra, it has high potential of investment in renewable energy. Maharashtra needs a favorable renewable energy policy and vibrant eco-system for the development of renewable energy in the state. Based on the study of other states policies on

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renewable energy- wind and solar, following can be considered as key takeaway especially for the state of ***Maharashtra are:***

Land - Identification of sites, developing land for solar parks availability of state's land bank for the implementation and easy approval of land for projects can act as major boost for renewable energy in Maharashtra.

Status of renewable energy power - Status of "Must –run" for solar power plants should be given, thus removing the principle of "merit order dispatch" [6] for the power from solar projects. Declaration of solar power under "must-run" can encourage investors as it will remove the ambiguity, if any, in the selling power price.

Clearance and approvals - Unlike states like Rajasthan, Karnataka, Telangana and Tamil Nadu where the timeline for the approval and clearance has been specified, the renewable energy policy of Maharashtra does not specify any time line or turn-around period for the application, approval and clearance. Furthermore, there is no single window clearance system in Maharashtra. Providing single window clearance system and specifying turn-around time for the applications shall improve the interaction between government and project developer and thereby, increasing the investment and implementation of solar and wind energy in Maharashtra. Currently, there are approximately 6 different permits and clearances are required for solar and wind project installation.

Open access - Though open access has been allowed in Maharashtra, sourcing of power from multiple renewable energy generator through open access is not allowed. No exemption is provided in wheeling and transmission charges of renewable energy power. Furthermore, in the current open access policy 2014, energy accounting is done in 15 minutes time-slot, thus no power banking facility is available for the renewable energy generation for captive consumption facilities. This has acted as hurdle in implementation of wind and solar power plants in Maharashtra. All other aforementioned states, apart from Gujarat, allow power banking for billing cycle or yearly basis.

"Must run" status, meaning they should be backed down as little as possible.

"Merit order" effect describes the lowering of power prices at the electricity exchange due to an increased supply of renewable energies.

## III. WATER RISK MANAGEMENT

Water stress is defined as the ratio of usability and availability of water in a particular region. According to the international norms, a country can be categorized as 'water stressed' when water availability is less than 1700 m3 per capita per year whereas classified as 'water scarce' if it is less than 1000 m3 per capita per year. In India, the availability of surface water in the years 1991 and 2001 were 2309m3 and 1902 m3. However, it has been projected that per capita surface water availability is likely to be reduced to 1401 m3 and 1191 m3 by the years 2025 and 2050, respectively. The Per capita water availability in the year 2010 was 1588 m3 against 5200 m3 of the year 1951 in the country. [7]

Almost 80% of water requirement is generated from agricultural sector. 50% of the urban needs as well as the 85% of the rural demands are met by ground water. This has led to decline in the water table. Also, various contaminants such as arsenic, phosphates, sulphates etc. are being reported in ground water making it unfit for consumption. In spite of heavy dependence on groundwater it is shocking to know that only 20% of ground water is recycled. The current goal is to achieve 20% efficiency in agriculture.

These hurdles can be overcome by continuous measuring and mapping the resource that is being used. Big companies must encourage the vendors to use sustainable energy. Also companies which exploit the natural available resources should compensate by constructing various reservoirs, check dams, bunds, etc. which check that the level of ground water is maintained. Also use of micro irrigation and drip irrigation have proved efficient in conserving water in agricultural sector.

The major step involved in managing the risk of water stress is by Measuring and Mapping the available resource. This can be done by India Water Tool. The India Water Tool [8] is an easy-to-use, online tool for companies and other users to understand their water-related risks and prioritize actions toward sustainable water management. IWT 2.1 combines data from Indian government agencies and water stress indicators from the World Resources Institute and Columbia Water Centre. IWT 2.1 is an advancement of IWT Version 2.0that allows companies, and other users' answer

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questions like:

- How many of my sites are in over-exploited or critical areas?
- Is my site in an area where the groundwater level is rising or declining?
- What have been are the pre and post-monsoon ground water levels in my area in the last 8 years?
- Which of my sites are in areas where the concentration of inorganic contaminants (fluoride, chloride, nitrate, iron, electric conductivity, arsenic) in ground water is above permissible limits for drinking water?
- What is the net groundwater availability and projected demand for groundwater in the areas where my sites are located?
- What is the total annual rainfall at my sites?
- What is the annual availability of surface water in the basin in which my site is located?
- How many of my sites are in high risk areas as estimated by water stress indicators?
- Purpose of Water risk management software
- The India water tool software allows:
- Companies to measure and map water risk associated with their sites to prioritize individual locations for further analysis and site-specific water-management improvements.
- Users to access to an easy to use platform for comprehensive water data of water availability, quality, and water stress.
- Generates a water inventory containing water risk and indicators.

Based on the India water tool, the major three stress maps prepared[9] as shown in Fig.1 (a), (b) and (c).Source- http://www.wri.org/

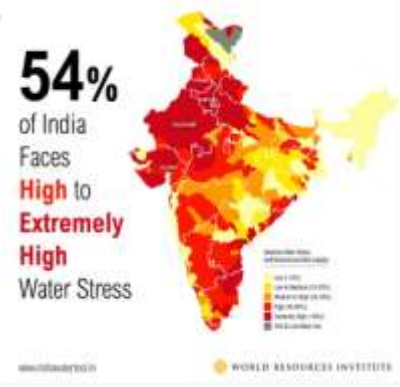


***Fig. 1(a) Water stress map highlighting the areas facing extremely high water stress***

Red and dark-red areas are highly or extremely highly stressed, meaning that more than 40 percent of the annually available surface water is used every year.

Note, in particular, the extremely high stress area blanketing Northwest India. The region is India's breadbasket. The states of Punjab and Haryana alone produce 50 percent of the national government's rice supply and 85 percent of its wheat stocks. Both crops are highly water intensive.

Source- http://www.wri.org/

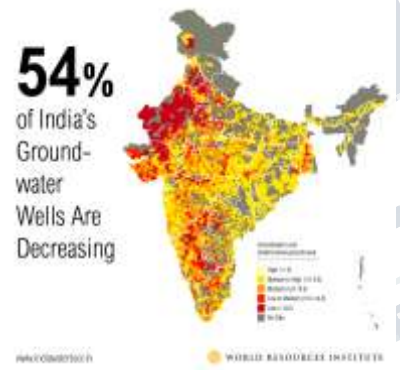


***Fig. 1(a) Water stress map highlighting the decrease in ground water wells***

Groundwater levels are declining across India. Of the 4,000 wells captured in the IWT 2.0 showing statistically significant trends, 54 percent dropped over the past seven years, with 16 percent declining by more than 1 meter (3.2 feet) per year.

Farmers in arid areas, or areas with irregular rainfall, depend heavily on groundwater for irrigation. The Indian government subsidizes the farmers' electric pumps and places no limits on the volumes of groundwater they extract, creating a widespread pattern of excessive water use and strained electrical grids.

North-western India again stands out as highly vulnerable. Of the 550 wells studied in the region, 58 percent have declining groundwater levels.

Source- http://www.wri.org/

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***Fig. 1(b) Water stress map highlighting the population getting extremely poor quality water***

The IWT 2.0 measures water quality with an Indian-government standard called Bureau of Indian Standards (BIS) limits. Surface and groundwater are both below par in many areas.

Among the IWT's 632 groundwater quality districts, only 59 are above BIS limits. Whenever a particular pollutant concentration exceeds BIS limits, drinking water is considered unsafe. The yellow and red areas below indicate places where chlorine, fluoride, iron, arsenic, nitrate and/or electrical conductivity exceed national standards.

These districts also are extremely populous. 130,600,000 people live in districts where at least one pollutant exceeded national safety standards in 2011. And more than 20 million people lived in the eight districts where at least three pollutants exceeded safe limits. Bagalkot, Karnataka, is the most polluted, with five of six groundwater quality indicators at unsafe levels. Only arsenic falls below the government-recommended concentration level.

Tools such as the India Water Tool may be only a first step in a long process of risk reduction and mitigation, but they are an essential one. Only with ongoing efforts to improve data transparency and accessibility may India advance toward a sustainable water future.

***Case Study – Mahindra Group [9]***

The Mahindra Group focusses on enabling people to rise through solutions that power mobility, drive rural prosperity, enhance urban lifestyles and increase business efficiency. Mahindra believes that Integrated Watershed Management Program (IWMP) is the only solution to address climate change as it conserves fertile soil, harvest runoff, recharge ground water table, create green belts, increase crop productivity etc. along with community development. It has undertaken IWMP in the Damoh district 31st March 2014 of Madhya Pradesh, comprising of 32 villages. The program necessitates a total investment of INR 500 lakh. Process of which began with creating awareness about the programme and enrolling participants from the community followed by baseline survey and planning of the project area.

Owing to the construction of 28 check dams, 37 ponds and tanks, the community now has an incremental storage capacity of 1,486.65 million litre. Additionally, 1100 soil and water conservation structures like stone outlets and gully plugs have been built. Trenches & bunds of a stretch of 318 Kms have been constructed. More than 2,790 farmers received an improved variety of seeds in the Rabi (Wheat and Chickpea) and Kharif cycle (Paddy, Pigeon pea, Black gram, and Soybean). Also, vegetative plantations increased to 130.38 hectares of land and the tree cover has increased by 30,000 trees. Farmers have registered productivity acceleration by 25–30 per cent. Furthermore, 384 Self Help Groups (SHG) have been constituted and 318 individuals have been directly linked to economic activities.

***Key takeaways for companies***

Mahindra is successful in achieving reduced water risk due to: Efficiency- Measuring and Mapping of the available resources and challenging the basic process. Recycling- SWT, CTP, ETP, Bio filter (70% water conservation) and underground leakage checks and toilet flushes. Harvesting- 2.6 lac cubic meters of water is harvested (shirdi 4.2 crore litre pond) and farm ponds, check dams, storm water management, water shed management, ground water recharge- geophysical survey. Behavioural management- Informing the end user (people) about water management and water week celebration.

Source-

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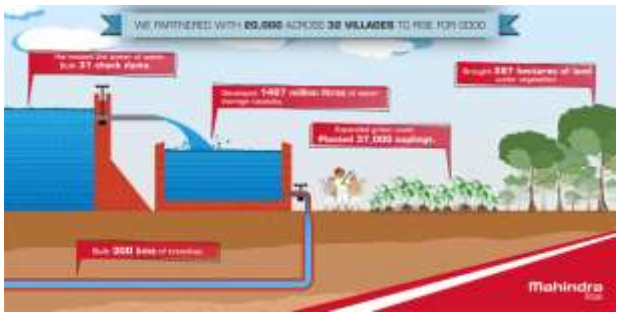


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## IV. WASTE MANAGEMENT

Waste management is all the activities and actions required to manage waste from its inception to its final disposal. The management of waste is a key component in a business' ability to maintaining ISO14001 accreditation. Companies are encouraged to improve their environmental efficiencies each year by eliminating waste through resource recovery practices, which are sustainability-related activities. One way to do this is by shifting away from waste management to resource recovery practices like recycling materials such as glass, food scraps, paper and cardboard, plastic bottles and metal.

The first step is the segregation of the waste generated into hazardous and non-hazardous waste. Waste when segregated, 80-85% of it has market value. The non-hazardous waste can be recycled and used to generate power or as a raw material in some other industry. For example, the swach bharat machine installed at the church gate station in Mumbai recycles the plastic bottles to be used in the manufacturing of polyester shirts. The cost of the machine is about 4 lacs. About 1 tonne of plastic is capable of producing 1.7 GW of energy. Segregation of the waste at the landfills is a very time=e consuming task. Hence, there is need for segregation at homes i.e. at the source itself.

Almost 70% of the total waste being produced is E waste. With its volume increasing exponentially, E waste is now becoming a serious problem in India [11].rapid growth in the technology sector as well as increased demand in the consumption of the electronic products as led to the generation of E waste. E-waste typically includes discarded computer monitors, motherboards, cathode ray tubes (CRTs), printed circuit board (PCB), mobile phones and chargers, compact discs, headphones, white goods such as liquid crystal displays (LCD)/ plasma televisions, air conditioners, refrigerators etc. E-waste accounts for approximately 40 percent of the lead and 70 percent of heavy metals found in landfills. These pollutants lead to ground water and air pollution and soil acidification. High and prolonged exposure to these chemicals/ pollutants emitted during unsafe e-waste recycling leads to damage of nervous systems, blood systems, kidneys and brain development, respiratory disorders, skin disorders, bronchitis, lung cancer, heart, liver, and spleen damage, the study added.

In order to check the disposal and recycling of e waste, various laws and policies are put up by the Government of India. No matter how well the policies are introduced and implemented benefits will only arise provided end users are prepared to accept introduced policies and adhere to them

Waste management emphasize the need for scientific disposal of waste and policies to encourage waste minimization and adoption of cleaner technologies. Various activities initiated by the Government of India to meet these objectives are listed and discussed below:

- Identification of hazardous waste disposal sites
- Educating and training people about identification and treatment of hazardous waste.
- It has been decided to impose a ban on import of hazardous wastes containing beryllium, selenium chromium (hexavalent), thallium, pesticides, herbicides and their intermediates/residues based on recommendations by an Expert Committee constituted at the national level for advising in matters related to hazardous wastes
- Non-hazardous waste when properly identified can be used to generate power.
- Organic waste can be channeled down to be used as a raw material in the bio gas plants.
- Proper utilization of the construction debris that can be used in landfills or can be recycled and again used in construction of buildings or roads.

***Case Study- A War On Waste: Tata Steel[12]***

Tata Steel has laid great emphasis, over the years, on creating a green environment in and around its plants and on utilising the waste generated in the process of manufacturing steel.The company generates roughly 700kg of various wastes (excluding fly ash) in the process of producing one tonne of crude steel. Of this, 83.16 per cent is utilised either through recycling and reuse in the company's own processes or they are sold as

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raw material to other industries. The remaining waste is sent for safe land filling.

There are roughly three types of waste that are left behind namely; blast furnace slag (BF), BF flue dust and BF Sludge, with LD slag, mill scale, fly and bottom ash from the power plants. BF slag is used in cement making, in the manufacture of slag wool, soil conditioner, aggregate manufacture and road construction.

As BF flue dust and BF sludge is not suitable for recycling within the process, a part of it is sold for low-value applications such as making briquettes for use as domestic fuel. Efforts have also been made to use LD slag as a soil conditioner in paddy fields, tea gardens, etc.The coarse mill scale is completely recyclable and Tata Steel uses this in its blast furnaces and sinter plants. However, part of the mill sludge contains very high levels of oil and R&D trials have been conducted to remove the oil. The company expects to bridge the gap very soon on this front.

A number of companies today look to Tata Steel for guidelines on efficient waste management, and the company is confident that its 'war on waste' will have far-reaching effects.

## V. CONCLUSION

The impact of environmental factors are recently being taken into consideration by the industries who conventionally only focused on gaining profits. In its broadest sense, the strategy for sustainable development aims to promote harmony among human beings and nature. It is very important for the industry, society and the government to come together and walk towards a sustainable future. Without which, the goal of 175GW of RE is an impossible task. This paper throws light on the hurdles faced in adoption of RE as well possible solutions to it. Also, how to utilize the available resources to its maximum efficiency by Reuse and Recycle is discussed. Companies aspiring to switch to RE must keep in mind the points mentioned in this paper as it will help them to come up with the best possible solution of the problem. Lastly, it is very important for the society to be aware about the measures taken by the government as well as the industries in ensuring a better future and hence the society should also play its role in the same as it is said that “Companies never succeed in a society that fails.”

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