



## CLIMATE CHANGE, ENERGY SECURITY AND SUSTAINABLE DEVELOPMENT

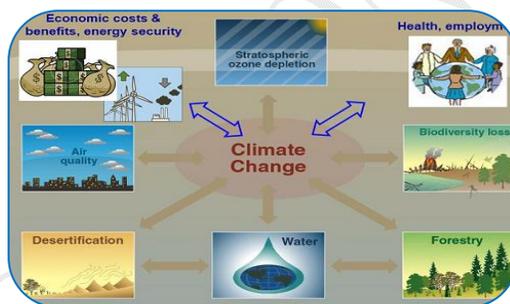
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### ABSTRACT :

*“There has been considerable work on the politics of climate change and energy security as separate issue, but much less on the relationship between energy security and climate change. From studies of the climate change, energy security and sustainable development relationship between these concepts in individual states and a comparison of media coverage of energy security in differing states, there appears to be little consistent connection between discourses on and policies for energy security and climate change.*

*Climate change considerations appear to be constructed to promote elite and special-interest interpretations of energy security. It is concluded that efforts at a local, national and global level should be oriented towards promoting climate change objectives to capture energy policy. Otherwise, nationality based conceptions of energy security are likely to predominate over climate change objectives. In the very simple words sustainable means something that has a longer life or pertaining to a system that maintains its own viability and that can be carried forward. In the today's world the concept of development has been replaced by the term 'Sustainable Development'. It is because we all have realized that we are chasing the wrong goals on the name of development. Today, even a breath of fresh air, pure drinking water is becoming a luxury because of over exploitation of resources and unorganized pattern of development. Market driven consumerist life style and the greed of man are in itself destructive. So to save our planet, human race, and non-human species, it is much required to make ahead in the sustainable manner with applying Gandhian Philosophy of development”.*



**KEYWORDS :** *Climate Change, Sustainable Development, Energy Security, Green House Gas, Carbon Emissions, Water Scarcity, Markets and Constructivism.*

### INTRODUCTION:

In the last 50 years, world has witnessed day an unprecedented increase in population growth leading to continuously rising human needs for meeting day to day life, putting stress on existing resources and severely affecting their carrying capacity. The world had 3.32 billion in people in the year 1965 which were increased to 7.32 billion in 2015.<sup>1</sup> By 2050, this number could rise o more than 9 billion (FAO, 2009). Over the decades, worldwide concern on global climate change has become pivotal issue for mankind at various international platforms. The global climate change has emerged as a complex challenge to ecological health, human well-being and livelihood security.

Continuously rising anthropogenic CO<sup>2</sup> emissions, Green House Gases (GHGs) emissions and their impacts are posing the urgent need of combating the problem of climate change. The present paper discusses about the urgent need of intervention by the global academic community and decision making community for tackling the current and future earth challenges of climate change and energy

security for sustainable development.<sup>2</sup> This paper provides an optimistic vision to combat with global problems like climate change and maintaining the levels of development by adopting an multidimensional approach of sustainable development and clean energy.

UN has passed resolution to implement Sustainable Development Goals on 25 September, 2015 adopted by 193 countries of the UN General Assembly. Successful COP 21 Paris Agreement was completed in December 2015. Towards global sustainability, the discipline of social sciences promotes trans-disciplinary research incorporating co-design processes, facilitating engagement with and involvement of different stakeholders together with developing scientific networks under Science-Policy Interface (SPI).<sup>3</sup>

### AIM AND OBJECTIVES

The main objective of the study is know to energy security, global warming, climate change and its impact on human life. This paper is based on the following objectives:

1. To understand security awareness on issue related to environment, development and energy.
2. To analyze recent changes in the environment and development.
3. Since energy security is becoming the world's biggest challenge in the present situation. So what kind of safety should be. The main purpose of this research paper is to study this fact.
4. To find out the major challenges on ecosystem and nature.
5. To find out some beneficiary steps taken by the deferent countries at global level.
6. To find out some beneficiary steps taken by the Indian government to remove challenges.
7. To analyze relation between climate change, energy security and sustainable development.

### HYPOTHESIS

The pollution haven hypothesis posits that, when large industrialized nations seek to set up factories or offices abroad, they will often look for the cheapest option in terms of resources and labour that offers the land and material access they require. However, this often comes at the cost of environmentally unsound practices. Developing nations with cheap resources and labour tend to have less stringent environmental regulations, and conversely, nations with stricter environmental regulations become more expensive for companies as a result of the costs associated with meeting these standards. Thus, companies that choose to physically invest in foreign countries tend to (re) locate to the countries with the lowest environmental standards or weakest enforcement. Three scales of the hypothesis:

1. Pollution control costs have an impact at the margins, where they exert some effect on investment decisions and trade flows.
2. Pollution control costs are important enough to measurably influence trade and investment.
3. Countries set their environmental standards below socially-efficient levels in order to attract investment or to promote their exports.

Scales 1 and 2 have empirical support, but the significance of the hypothesis relative to other investment and trade factors is still controversial. One study found that environmental regulations have a strong negative effect on a country's FDI, particularly in pollution-intensive industries when measured by employment. However, that same study found that the environmental regulations present in a country's neighbours have an insignificant impact on that country's trade flows.

### RESEARCH METHODOLOGY

To gather the information about the above objectives secondary data is used. The research paper, journals, magazines and newspaper are studied to get the relevant information about the topic. This paper is based on the conceptual nature. Every effort has made for getting the relevant information about the concept.

### **Climate Change and Environment: A Global Issue and Local Risk**

Global climate change has emerged as a worldwide risk which causes substantial stress on glaciers, agriculture, livestock, biodiversity and water resources. Over the years, climate change has severely altered the productivity in human and natural system which in turn has affected the functioning of environment. Climate change is also the main triggering mechanism behind the increased frequency and intensity of hydro-meteorological disasters. Worldwide, the percentage of occurrences of flood was highest amongst all disasters (43 percent) with 3062 occurrences of the total disasters during the years 1995 to 2015 and drought with 5 percent. The hydrological and meteorological disasters are causing loss of about US\$250 million every year. The analysis of losses due to natural disasters show that hydrological and meteorological disaster have increased rapidly after 1990's. Between the years 2009 to 2013, floods have caused losses amounting US\$ 5.3 billion in Indian agriculture sector.<sup>4</sup> The global mean temperature increase of 4°C or more above pre-industrial levels would pose severe risks like massive impacts on vulnerable species, fragile ecosystems and their functioning, large risks to global and regional food security, and the day to day natural and human activities (IPCC, 2014).

### **Climate Change: Vulnerability Concern of Developing Countries**

Developing countries are found to be the most vulnerable to the impacts of climate change due to poverty, lack of resources and technology to mitigate the impacts of climate change. Other constraints like social, technological, financial and demographic challenges resulted into further increase in the vulnerability profile of developing countries (UNFCCC. 2007). There is an urgent necessity for strengthening the global cooperation between developed and developing countries by providing technological and economic assistance for reducing the GHG emissions and meeting their energy needs. Effective cooperation is needed to develop capacity building programme and to transfer of green and clean technology and funds for the development of non-renewable sources of energy as alternative sources of energy.

### **Emerging Need of Sustainability during 1970s-1980s**

In the year 1972, United Nations Conference on Human Environment was held, even after the years of the conference, most of the growing global environmental issues had clearly not been adequately addressed. It would cause acute challenges ahead in the world. Mushrooming socio-environmental threats like poverty, inequality and early signs of climate change like pollution, acid rain, deforestation, desertification and the depletion of the ozone layer had attained the worldwide attention because we can not afford to neglect them anymore.

After the launch of world Conservation Strategy of the International Union for the Conservation of Nature and Natural Resources in the year 1980, the UN initiated an independent commission with the objective of providing an analysis of growing socio-environmental problems and ideas as their remedial measures. By the year 1984, on the recommendation of the Secretary General of the United Nations, an Independent organization of the UN named Brundtland Commission came into existence with special emphasis environmental and developmental issues and challenges, and providing remedial measures as their solutions. The Brundtland Commission aimed to create a united front of global community with shared responsibility in moving together on the path of sustainability.<sup>5</sup>

### **Emergence of Sustainable Development**

In the year 1987, Brundtland Commission published the first volume of "Our Common Future" which proved to be the milestone of Sustainable Development. In the report of World Commission on Environment and Development, popularly known as "Our Common Future" attempted to address the growing problem of conflicts between Environment and development goals by devising the definition of sustainable development: "Sustainable development is development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

The Rio Summit held in the year 1992 was the first step put forwarded for the foundations of global institutionalization of sustainable development. The focal theme of the conference was global environment and sustainable development. The conference focused on the maintenance of harmonious relationship between the developments in economy, technology, policy based decision making and environment. For the first time in world, sincere efforts were taken to tackle with global environmental problems. The stakeholders of world shared the common concern but differentiated responsibilities is setting out actions for social and economic aspects of sustainable development. Agenda 21, the Rio Declaration on Environment and development, the Statement of Forest Principles, the United Nations Framework Convention on Climate Change and the United Nations Convention on Biological Diversity came as some pioneering instruments from the Rio Summit of 1992 for tackling the global socio-environmental problems<sup>6</sup>

Since Rio Summit of 1992, some significant global conferences on sustainable development have been held like the 1997 Earth Summit on Sustainable Development (WSSD) in Johannesburg. The focus of these meetings was to address the issues like food security, biodiversity, water security and climate change and their reviews of progress and development in attaining the global sustainability; and challenges related to not implementation of policies and remedial measures at the regional, national and international level.

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2007), point out the linkages between climate change and sustainable development as the lock and key. On the other hand Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2014) suggests the immediate need to harness and explore the alternative sources of energy other than conventional sources of energy.<sup>7</sup> It emphasizes on ensuring access to affordable, reliable and sustainable energy for all, making cities inclusive, safe, resilient and sustainable and revitalizes the global partnership for sustainable development.

### Energy Security and Environmental Sustainability

Developing countries are facing dual challenges like energy insecurity and failure in meeting global partnership in reducing their carbon emissions. Growing concerns over sustainable development and energy security are leading to greater intervention by global stakeholders for the development of clean sources of energy as alternative sources over conventional sources of energy. It has been anticipated that world energy consumption will rise up to 815 Quadrillion British Thermal Units (BTU) by the year 2040. Significant growth in worldwide energy consumption has been projected over the 28 years period from the 549 Quadrillion BTU in the year 2012 to 815 Quadrillion BTU in the year 2040 (IEO, 2016).<sup>8</sup>

In the year 2014, fossil fuels account for 82 percent of total power energy supply and it has also been noted that annual CO<sub>2</sub> emission from fossil fuels combustion touched 32 GtCO<sub>2</sub> (Gigatonnes of Carbon dioxide) in the same year (IEA, 2016). In the year 2013, amongst fossil fuels, coal contributes the largest share of 41.3 percent for meeting the world electricity demands and also it is one of the major sources of electricity production in the developing nations. Amongst the various sources of electricity, it has been witnessed that share of Coal in electricity production has been increased by 3 percent from the 38.3 percent in the year 1973 to 41.3 percent in the year 2013, between the time span of 40 years. The share of oil has been declined sharply with 20.4 percent from the 24.8 percent in the year 1973 to 4.4 percent in the year 2013, while the share of hydro power has declined by 4.6 percent from the 20.9 percent in the year 1973 to 16.3 percent in the year 2013.<sup>9</sup> On the other hand, share of natural gas in energy production has been increased by 9.6 percent from 12.1 percent in the year 1973 to 21.7 percent in the year 2013 while share of nuclear energy has been increased by 7.3 percent from 3.3 percent in the year 1973 to 10.6 percent in the year 2013.

Around 1.6 billion people of the world or one-in-fourth people in world do not have access to electricity, majority of them are concentrated in developing countries of Africa and Asia. Problems of erratic or negligible supply of electricity are causing serious challenges for the socio-economic development in the developing nations. In the developing countries due to lack of technology and

financial constraints, coal is considered as one of the most promising sources of energy to meet electricity demands. Developing nations of Asia and Africa have easy access to their coal reserves in an affordable and feasible way as compare to other source of electricity to empower the growth in their electricity supply (World Energy Council, 2013).

Coal plays a vital role in the economy of developing countries for meeting their electricity access to millions of population in the developing world (Bruce et al, 2000; World Energy Council, 2013). At the same point, coal also accounted for the largest share of 46 percent in the share of global CO2 emissions from fuel consumption has been increased by 10.1 percent from 35.9 percent in the year 1973 to 46 percent in the year 2013.<sup>10</sup> On the other hand, share of Natural Gas has increased by 5.4 percent from 14.4 percent in the year 1973 to 19.8 percent in the year 2013. The share of oil in CO2 emission from fuel consumption has been decreased by 16.1 percent from 49.7 percent in the year 1973 to 33.6 percent in the year 2013 (IEA, 2013).

### Way towards Modern and Clean Energy

Clean and modern energy carries immense potential to play a vital role in sustainable development goals like ensuring access to affordable, reliable, sustainable and modern energy for all and making cities inclusive, safe, resilient and sustainable are among 17 SDGs, provides the insightful vision of global decision and policy making community (ICSU and ISSC, 2015). Around 60 percent of GHG emissions. (IRENA, 2016). This also set as challenging issue among the top priority list of action plans for combating with climate change at the 21<sup>st</sup> Conference of the Parties (COP21) which was held in Paris in December 2015. Development in the area of renewable energy sector can be recognized as one of the substantial possible solution to achieve the targets set at the COP21 (Center for Climate and Energy Solution, 2015). The report of International Energy Outlook provides an optimistic vision of projected patterns of increasing share of renewable energy in energy sector in future, which in itself is a hopeful indicator of substantial reduction in GHG emissions and reliability on conventional sources of energy in the future (Table 1).

**Table 1:**  
**World net electricity generation by energy source, (trillion kilowatt hours)**  
**Projected Patterns (2020-2040)**

S.N.	Type of Energy	2012	2020	2025	2030	2035	2040
01.	Renewable	4.73	6.87	7.89	8.68	9.64	10.63
02.	Natural Gas	4.83	5.26	6.30	7.47	8.78	10.14
03.	Nuclear	2.34	3.05	3.40	3.95	4.25	4.50
04.	Coal	8.60	9.73	10.07	10.12	10.31	10.62
05.	Liquids	1.06	0.86	0.69	0.62	0.59	0.56

**Source: The International Energy Outlook 2016.**

A substantial growth in terms of investment in renewable sources of energy has been witnessed by the world over the last decade, which presents sincere growing efforts for tackling the challenges of climate change and energy security for meeting the needs of global new investment for the development of Renewable Energy between the years 2004 to 2015 have shown bright future ahead. A decade back, the development and use of renewable energy used to be confined only in the developed countries of the world because of its expensive technology and high cost of maintenance of the sophisticated technology. In the year 2015, world has witnessed for the first time, a completely new trend, when developing countries outshined the developed nations in terms of global new investment in the renewable energy sector.<sup>11</sup> There is declining drift between the developed and developing countries of the world in terms of investment in renewable energy sector.

### **Growing Mega Cities: Challenges Sustainable Development**

The percentage of global urban population to total population increased drastically from 30 percent in the year 1950 to 54 percent in the year 2014 and it has been projected that it continues to grow in future (World Urbanization Prospects, 2014). Globally, it has been witnessed that, trend of multiplying urban population is the product of substantial migration to urban areas in search of better employment opportunities, education and medical needs as well as for other opportunities which lacked in rural areas. The mushrooming of mega cities in the world portray the sizeable shifting of human population towards them. In the year 1970, there were 3 mega cities in the world attained phenomenal growth and increased to around three times and rose to 28 in the year 2014. The numbers of mega cities are projected to rise by 41 by the year 2030. In the year 2014 out of 28 mega cities, developing countries accounted for share of more than three fourth (World Urbanization Prospects, 2014).

Especially in case of developing countries, the rapid expansion of mega cities and haphazard urbanization are putting severe pressure on the existing infrastructure, environment, health and wellbeing, and socioeconomic resources of these cities. With the constantly rising drift between urban and rural population, people's day to day demands for basic amenities such as water, energy and infrastructure are also increasing correspondingly. The haphazardness and unsustainable nature of cities can easily be observed through available facts, as they just occupy 2 percent of the Earth's land but account for over 70 percent of both energy consumption and carbon emission. Rising urbanization, industrialization and other developmental activities are the major drivers of constantly multiplying energy demands that contribute substantially to global environmental change.<sup>12</sup> The situation is most alarming in unplanned cities of developing countries. Cities are known as the economic engines of the growth, providing 80 percent of the world economic output at the cost of substantial environmental foot print. Around 75 percent of global GHG emissions are contributed b cities.

### **India's Vision towards Current and Futuristic Challenges of Sustainable Development**

India has set its commitment to combat with the challenges of energy security by achieving the target of 175 GW of Renewable Energy (RE) capacities by the year 2022. Ensuring energy accessibility, utilizing the potential sources of renewable energy and mitigating the climate change impacts are some major driving forces behind the development of India's vision to shift from traditional fossils or conventional sources of energy to clean energy technologies. (NITI AAYOG, 2015). The government of India has also proposed the creation of around 100 smart cities as a mission for urban renewal and renovation, during the union budget for 2014-15. Smart cities are proposed to be comprehensive in nature with economically dynamic, techno-friendly and promoting harmony between economic growth and natural environment. The concept of smart cities aim to achieve several objectives, such as mitigating climate change, achieving energy security, increasing energy accessibility and promoting inclusive economic growth. The smart cities are characterized by some special characteristics like economically dynamic with environment friendly outlook, efficient and easily accessible mobility and citizen friendly nature.<sup>13</sup> Citizen friendly nature of cities adds other values to life of people like developing environmental aesthetics, self-awareness, sustainability, healthy and decent life style for everyone. Indian Smart cities are projected to mitigate with modern day challenges of cities by providing smart solutions to complex city problems.

### **Implementation of Paris Agreement by the Government of India**

India is the world's fourth-largest carbon emitter. The country with the population of 1.3 billion people ratified the Paris agreement on climate change and became the 62<sup>nd</sup> nation to join the deal on the 2<sup>nd</sup> October 2016, on the auspicious occasion of Gandhi Jayanti. The Paris agreement requires the associated member countries to make binding commitments towards curtailing CO<sub>2</sub> emissions in order to balance the global average temperatures from rising above 1.5 C as compared to the pre-industrial years. In order to maintain the rhythm between environment and development, India is coming forward to develop sustainable model of economic development by harnessing the available, mobilized

and potential clean energy sources in the coming years. India has developed a vision to reduce its carbon emission intensity- emission per unit of GDP – by 33 to 35 percent from 2005 levels within the target of 15 years. The country is also stepping forward to produce 40 percent of its mobilized and installed electricity capacity by the year 2030 from non-fossil fuels with the enhancement or development of modern day green and clean sources of energy. All these forward looking steps signify the country's commitment to shift significantly from coal-based power generation to modern day renewable or green or clean sources of energy.<sup>14</sup> Further, the country is planning extensively, targets with aims to harness 100 gigawatt of energy from solar power, 60 gigawatt of energy from wind, 10 gigawatt of energy from biomass and 5 gigawatt of energy from small hydropower by the year 2022. The country is also standing firm with its commitment in the treaty, to increase its forest cover by five million hectare along with enhancement in the quality of green cover of an equal measure by the year 2030 (Government of India, 2016).

### **Sustaining Future Earth-Contribution Towards New India**

It is well to be noted that, throughout the history, creativity is the only fuel behind every invention alone with strong determination. Based on the day to day geographical observations and reflections, some of the creative ideas are put up as the suggestions to think upon, reflect on and bring them in practice.<sup>15</sup>

### **Bringing Energy Ratings**

The industries could be ratified on the basis of their Best Management Practices (BMPs) towards their approach of bringing together economic advancement and enhancement of nature with the help of clean energy. On the basis of their ratings in Best Management Practice, these industries can be awarded with appropriate bonus rewards like subsidies, tax rebates and other promotional incentives. The entire idea runs around the theme of pursuing others also to think creatively to cope with the futuristic challenges.

### **Dedicating Daily Energy Saving Hours**

Few hours in a day could be dedicated as energy saving hours in which heavy electrical appliances could be turned off, for example, turning off heavy electrical appliances like Air Conditioners in Private and Government institutions for some hours may result into significant saving.<sup>16</sup>

### **Construction of Smart and Green Buildings through Public Private Partnership (PPP)**

The concept of smart energy efficient and nature friendly buildings need to be brought out in practice. The construction of smart buildings could also be done more effectively through Public Private Partnership model.<sup>17</sup> The corporate sector could be encouraged to participate actively in the construction of smart buildings or renovation of existing building into smart building with the effective coordination with Private Real Estate agencies as part of Corporate Social Responsibility.

### **Electricity and Water usage**

Attention need to be paid on the haphazard consumption of electricity and water usage which should not be considered as freely available resources to exploit well. There is a need to put on check the wasteful consumption of electricity and water with appropriate measures and to make these resources accessible to all.<sup>18</sup>

### **Extensive Promotion of Research and Development**

Young research scholars could be encouraged in the projects and research problems aims to provide the holistic solutions of energy security challenges. There is an urgent need to promote the active research for utilizing the country's existent potential renewable sources of energy.<sup>19</sup> The active participation of academic community, policy based decision making community and Public Private

Partnership model may prove to be fruitful in the harnessing of India's potential renewable energy sources.

### Nourishing Young Minds

The seeds of creative thinking for mitigating the futuristic challenges could be first sown in the schools itself. The restlessness of students could be turned towards the contributions and service towards society by engaging them in Socially Useful Productive Work (SUPW) in activities like nature conservation projects, awareness campaigns, labour contribution towards nature and promoting nature based scientific learning rather than increasing their weight of bags.<sup>20</sup>

### CONCLUSION

The potential sources of clean energy carries the immense scope to meet the rising demands of energy needs, mitigating climate change impacts and ensuring sustainable development, especially while the world population has been anticipated to reach around 9 billion mark with their energy consumption of 815 Quadrillion BTU by the year 2040. The fossil fuel accounted for 82 percent of total power energy supply and annual CO<sub>2</sub> emissions from fuel combustion touched 32 GtCO<sub>2</sub> in the year 2014, poses the emerging challenges of environment and sustainable development, while the Global society has made its commitment to tackle these challenges in a positive, constructive and forward looking manner. The various collaborative international platforms are setting the pitch for fostering the investments in the field of renewable energy and bridging the technological, financial and knowledge drifts among developed and developing countries for the development of clean energy sources. There is an urgent necessity to shift towards the development of sustainable and clean sources of energy for tackling the complications of climate change and maintaining levels of development by ensuring energy security and sustainable development, Clean energy could play a major role in providing holistic solution to the problem of maintaining the balance between energy demands for fueling the economic growth and reducing GHG emissions by stressing on the innovations and development to harness renewable sources of energy as alternative to conventional sources of energy. India is also moving on the way to combat with the challenges of energy security and mitigating the climate change impacts by achieving the target of 175 GW of Renewable energy (RE) capacities by the year 2022. Indian initiative could play key roles in developing capacity building with the integration of local knowledge and scientific technology by bringing together the ideas, skills and technology of global, national, regional and local communities.

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