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"A COMPARATIVE STUDY ON SUSTAINABLE DEVELOPMENT, GLOBAL WARMING AND GREENING OF ENERGIES."

AUTHORED BY: MS. AKSHITA GOYAL (B.A.LL.B (HONS)), SYMBIOSIS LAW SCHOOL, PUNE.

Email ID: 18010125412@symlaw.ac.in.

I. ABSTRACT:

"The threat to mankind has been nurtured by mankind itself. Sustainable development is the sole solution if mankind wants to continue its existence on Earth; the planet that has been an abode for all human life for millions of years and now being taken for granted by those it gave birth to. Sustainable development has evolved over multiple Earth Summits attended by countries from all over the world and is the saviour that the human race needs right now. Global warming, and with it climate change, is affecting every being in every part of the world and this vicious cycle doesn't seem to stop. The usage of alternative energy resources, i.e. green energies, can be a mode to reduce the pace that global warming is picking up and beat it in its own race. The researcher has chosen a universe residing in Bangalore, ranging from the age group of 10-65, predominantly 19-35, and analysed the awareness that residents of Bangalore have about a pressing issue that contributes to global warming and reduces the potentially available natural resources for generating green energies-, encroachment of lakes in Bangalore, through an empirical study. Imposition of sanctions, reduced scope for arbitrariness, tracking of funds, etc., if implemented efficiently, have been recommended by the researcher.

Keywords: *Sustainable development, Earth Summit, Global warming, green energies, encroachment, Bangalore."*

II. INTRODUCTION:

Earth has been the sole refuge for human life for millions of years. It has been the home for not only humans but also every other living being that has existed over the billions of years. However, with the growing population all over the planet and the unending desires that humans have, the planet that is sheltering them, or what critics might deem as handling their burden, is taking a toll. Many scholars and experts for over 5 decades have been warning the leaders of various nations in the hope that something can be done to at least slow the process of environmental degradation down, if not successfully stop it entirely. There have been predictions of wars over natural resources taking place in the coming years, and the most commonly floated idea is that of a water war or one over oil. This not only proves the obvious inference from it, of how greedy humans can be, but also that the natural resources will be depleted to such an extent that there will not be enough for everyone's basic needs, let alone their desires.

Industrial Revolution, though a boon for the technological sector, has definitely been a bane for the environment in its entirety. The rapid increase in the usage of technology and with it, machinery, has led to an increase in the number of industries, which has been one of the biggest contributing factors to air pollution. Industries became the path to the growth of each nation's economy and "modernization" became the guise under which people justified the mass deforestation that took place in the past 2 centuries. The ever-increasing population has also made the atmosphere, a victim of one of the inventions the humans pride themselves on- automobiles. These have been a source of air pollution almost since their invention, as their demand shot up the second the people realized its utility. The dependency that people have on transportation in order to ensure convenience, had led them to turn a blind eye towards the pollution that their actions were causing.

The protection of the environment has always been at loggerheads with infrastructural growth, for example, the necessity of constructing a dam versus the damage to the water body and the forced migration of the people living around the area. The future generations' lives

are undoubtedly at stake here, as, at this point, it is uncertain whether the planet will even be able to inhabit humans anymore, by the next 100 years. The present generation is essentially stealing the future generations' resources for their own personal greed with absolute disregard towards their needs. With the current pace of growth in every aspect of a nation, i.e. the population, economy, infrastructure, etc., the environmentalists cannot hope for the growth to stop, and that is not the solution for the problem at hand either. What can be achieved is the successful execution of the concept of sustainable development that has been advocated by multiple research scholars who have in-depth experience in the field of environmental related research. Achieving sustainable development in the current situation that Earth is in, is not an option, but an imperative. In order to execute the potential solution to environmental degradation, the concept of sustainable development must be comprehended.

III. WHAT IS SUSTAINABLE DEVELOPMENT?

Sustainable Development has evolved and developed as a concept over four major international conferences, also popularly referred to as World Summits, that were held in, Stockholm, Nairobi, Rio De Janeiro and Johannesburg, held over the period from 1972-2002. The definition of sustainable development that is universally accepted is, "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*"[1] The word "needs" here refers to the world's poor's needs, which are very basic, and are food, shelter, and clothing. The Earth has just enough to provide for every human on this planet even with an ever-increasing population, if and only if, everyone's needs were to be this basic in nature. This is corroborated by the fact that living within the humans' environmental limits is one of the central principles of sustainable development.

Sustainable development must go hand in hand with:

a) social progress (People),
b) economic development (Profits),
c) environmental protection (Planet);

[1] Brundtland Commission, Report of the World Commission on Environment and Development: Our Common Future, un-documents (1987) p 16.

These are called the 3 P's and sustainable development must ensure that a balance is maintained between all three of these key imperatives of sustainability. At the environmental level, sustainable development helps prevent the exhaustion of precious natural resources that even if renewable, would take hundreds of years to replenish themselves. Sustainability in this area would call for protection, preservation, mindful and judicial usage of these resources in order to ensure their continued existence. At the social level, sustainable development would contribute to a fairly reasonable quality of life, potential equal distribution of natural resources, development of human resources, etc. Similarly, at the economic level, sustainable development does not mean regression of the lifestyle that people currently have, but only opting for a more environment-friendly lifestyle that will continue its contribution to economic growth.

Economically, it also looks at ensuring equal distribution of wealth to all and not prioritizing the rich over the poor; it plans on doing this without harming the environment at all. Financial investments in the areas of environmental protection that would support the cause of sustainable development are also one of the key factors in promoting the attainment of Sustainable Development Goals (SDGs), otherwise also known as Global Goals. The SDGs were born at the United Nations Conference on Sustainable Development in Rio De Janeiro in the year, 2012.

The United Nations Development Programme then, came up with 17 SDG's that were unanimously adopted by 193 member states at the UN General Assembly Sustainable Development Summit in New York, in September, 2015 and came into effect from January, 2016. These are an ambitious set of goals that aim to banish social and environmental evils by the year, 2030. India, along with other countries, has signed the declaration on the 2030 Agenda for Sustainable Development. These include no poverty, zero hunger, good health and well-being, quality education, gender equality, clean water and sanitation, affordable and clean energy, decent work and economic growth, industry, innovation and infrastructure, reduced inequalities, sustainable cities and communities, responsible consumption and production, climate action, life below water, life on land, peace, justice and strong

institutions, and lastly, the most important of them to all to ensure their successful attainment-partnership for the goals. The then UN Secretary General, Ban Ki Moon said that "*They are a to-do list for people and planet, and a blueprint for success,* while addressing wiping out of poverty, inequality and tackling climate change over the next 15 years.

III.I EVOLUTION OF SUSTAINABLE DEVELOPMENT:

The concept of sustainable development received its first major international recognition at the UN Conference on the Human Environment held in Stockholm, Sweden, from June 5th to 16th in 1972. Although the term was not exclusively used, the notion of the concept had originated from this international conference attended by representatives of around 113 member states. The leaders at this conference acknowledged and highlighted the concerns for preserving and enhancing the environment. They also advocated to protect the biodiversity and while the developing countries argued that development was their priority, the developed countries put environmental protection as their prime priority. The conference marked a transition from a national focus to an international one.

In 1982, the Nairobi Summit was held, wherein the member states reviewed the progress over the past decade since the 1972 Stockholm Conference and they called upon various national governments and their leaders to intensify their efforts towards protecting the environment and reducing the over usage of natural resources, therefore burdening planet Earth. However, due to 1982 being one the peak periods of the Cold War that persisted between Union of Soviet Socialist Republics (USSR) and the United States of America (USA), the countries failed at their commitment and progress towards reaching a definitive Nairobi action plan that they could follow in the future.

Then in 1983, the World Commission on Environment and Development, popularly known as the Brundtland Commission, was created and was chaired by Dr. Gro Harlem Brundtland, who served as the Prime Minister of Norway three times and subsequently went on to become the Director General of the World Health Organization from 1998 to 2003. It was

established after the passing of the 1983 UNGA Resolution 38/161, "*Process of preparation of the Environmental Perspective to the Year 2000 and Beyond*."[2] The establishment of this commission was an outcome of the realization that there was heavy deterioration of the environment and a vast reduction of the available natural resources. In May, 1984, the Secretary-General, Jim MacNeill was appointed, to help guide the commission's work, and members of the commission were representatives from 21 different countries, both developed and developing. The Brundtland Commission officially dissolved in December 1987 after releasing *Our Common Future,* also known as *Brundtland Report, 1987*. The term "sustainable development" was first coined in a paper in this report. The Brundtland Report argues against the assertions of the Stockholm Conference and seeks to say that environment can be better understood in relation to development and development can be better understood in relation to the environment, and hence the two are inseparable. It insists that development isn't solely about developing countries doing something to ameliorate their situations, but development implies, both developing and developed countries working together to do something in order to ameliorate the conditions of the entire common world that they reside in.

The Brundtland Report points out two key concepts that are involved in sustainable development; they are

a) the concept of "needs" in particular the essential needs of the world's poorest people, to which they should be given overriding priority; and
b) the idea of limitations which is imposed by the state of technology and social organization on the environment's ability to meet both present and future needs.[3]

Most scholars agree that the central idea of the Brundtland Report is intergenerational equity, which by the term suggests, advocates for each generation respecting the other generations' needs and working towards ensuring that the future generations' needs are not compromised

[2] UNGA Resolution 38/161, Clause 8.
[3] Brundtland Commission, Report of the World Commission on Environment and Development: Our Common Future, un-documents (1987) p 47.

due to the present generations' demands. Furthermore, the word, "equity" implies that the concept does not advocate for equality, i.e. treating everybody, regardless of their differences, equally; but advocates for equity, i.e. recognizing the differences that exist among people and treating them accordingly with the goal to ensure fair distribution of resources.

The Earth Summit was held at Rio De Janeiro, Brazil, in 1992, by the United Nations Framework Convention on Climate Change (UNFCCC), and representatives from 172 member nations came together in order to unanimously adopt the Agenda 21 for the 21st century and pass the Rio Declaration to further intensify the efforts to enhance environmental protection, forest management principles, and the adoption of treaties on both climate change, and biodiversity. The first principle of the Rio Declaration states that, "*human beings are at the centre of concerns for sustainable development.*"[4] The Declaration also highlights the "polluter-pays principle" that seeks to hold the developed countries liable for the outcome of their industrialization, i.e. pollution, among other things, and the "precautionary principle" which basically means prevention is better than cure.

In other words, if any threat is deemed to exist to the environment, precautionary measures must be taken to ensure that further deterioration of the environment does not take place and the threat is neutralized. Furthermore, Agenda 21 is a comprehensive blueprint of actions to be implemented over the 21st century in order to ensure sustainable development. It also highlights the concept of "common but differentiated responsibilities" wherein the developed countries should take the lead in combating climate change and enhancing environmental protection as the priorities for developing countries are rather different and they shouldn't be asked to suffer the brunt of the development that took place in developed countries.

The 2002 Johannesburg World Summit was an outcome of the lack of progress after the adoption of Agenda 21. This World Summit put the thrust on public-private partnerships and tried to attempt a different angle on attaining sustainable development. This was followed by

[4] The Rio Declaration on Environment and Development (1992), Principle 1.

another conference in Rio De Janeiro, Brazil, in 2012, exactly after a decade, wherein the SDGs were introduced and subsequently adopted. The famous and most recent step taken towards sustainable development is the Paris Climate Change Agreement adopted by most countries in December 2015, which seeks to maintain the global temperature to be below 2° C.[5] Sustainable development, constantly continues to battle multiple obstacles as the environment, if tweaked a little by the application of human minds, is equipped with different methods of combatting such obstacles, for example, greening of energies to combat one of the major threats to sustainable development- global warming.

Global warming is a natural cycle that has been rapidly paced up by human activities, especially subsequent to the Industrial Revolution. In the past century, the amount of greenhouse gases released into the atmosphere has outgrown the amount that the atmosphere and the ozone layer can handle. The notion of sustainable development originated due to the realization of the negative impacts of global warming. It is one of the major threats to the attainment of sustainable development as it is progressing faster than the actions for sustainable development are being implemented, and soon the former will devour the weaker. The rapid unpredictable climate change that is taking place is taking a toll on a lot of animals' lives as their bodies may not be suited to such paced climate change, that is also destroying their habitat.

This will result in not only destruction of even, potential attainment of sustainable development in the future, but also adverse climate change and impacts on human health due to ever-increasing global warming without a means to undo it, let alone, stop it. However, one of the paths that can be explored in order to reduce global warming and work towards sustainability, is that of the greening of energies, wherein non-renewable resources can be used judicially and new alternatives for energy production can be looked into and achieved, for example, wind energy, hydroelectricity, etc.

[5] Paris Agreement (2015), Article 2 (1)(a).

IV. GLOBAL WARMING: THE OBSTACLE TO SUSTAINABLE DEVELOPMENT:

Most scientists agree that the main cause for global warming trend is the human expansion of the "greenhouse effect" i.e. the global warming that occurs when the Earth is unable to release to space, the heat that is trapped in it.[6] The effects of this warming up of the earth were noticed by scientists all over the world and they warned the leaders of various countries of the coming bleak future. As a result of this, World Summits started taking place and the notion of sustainable development evolved, that would help battle global warming altogether. A layer of greenhouse gases, commonly called the ozone layer, primarily constitutes water vapour and acts as a thermal blanket that absorbs the heat radiated from the earth to the sun and maintains the average temperature of the earth to about 15^{o} C, which is said to be life supporting.

However, certain gases like nitrous oxide, carbon dioxide, and methane, commonly known as greenhouse gases, prevent the heat from escaping the atmosphere and result in warming up the earth and increasing the average temperature of the globe to be over 15^{o} C. Nitrous oxide, also known as the "laughing gas", is one of the most powerful greenhouse gases and is ranked third behind carbon dioxide and methane in contributing to global warming. It is regulated under the Kyoto Protocols and according to the United States Environmental Protection Agency; the gas is 310 times more effective in trapping heat than carbon dioxide.[7]

It is produced by soil cultivation practices, like the usage of fertilizers and pesticides, and its most common source is fossil fuel combustion. Carbon dioxide is released through, both natural and man-made processes, like respiration and deforestation respectively. Humans have increased atmospheric carbon dioxide by more than a third since the Industrial Revolution began in the 18th century, and the levels are at their highest in 650,000 years.[8] Methane, on the other hand, has an atmospheric warming potential of 28 times more heat per

[6] Holly Shaftel, Global Climate Change, climate.nasa.gov (13th January, 2018) https://climate.nasa.gov/.
[7] BC Upham, Nitrous Oxide's Global Warming Impact No Laughing Matter, triplepundit.com (6th April, 2010) https://webcache.googleusercontent.com/search?q=cache:ZhGup30LaNgJ:https://www.triplepundit.com/2010/04/nitrous-oxides-global-warming-impact-no-laughing-matter/+&cd=1&hl=en&ct=clnk&gl=in.
[8] Shaftel, *supra* note 6.

mass than carbon dioxide and has been rising sharply since 2006. Methane emissions are increasing by about 25 teragrams, i.e. one teragram equals 1.1 million US metric tons, every year.[9]

The effects of global warming are clearly seen in how each aspect of our lives is being directly or indirectly affected. The most direct impact of global warming, can, of course, be noticed in the changing trends in the environment, for example, the minimum sea level is rising by 3.2 millimetres per year and the global average sea level has risen by about 178 millimetres over the past 100 years.[10] Sea level rise is primarily caused by factors related to global warming, like the expansion of seawater as it warms and the increased quantum of water due to the melting of glaciers. The Arctic ice minimum has been reducing by 12.8 percent per decade, i.e. every ten years, and in 2012, the Arctic summer sea ice shrunk to its lowest extent on record.[11] This is one of the major contributing factors to the melting of glaciers that result in the rise in sea level. The continuous rise in sea level has led multiple scholars to predict that island nations like the Maldives, might get entirely submerged within the next 50 years.

Climate change is one of the leading and most endangering outcomes of global warming. The UNFCCC is one of the pioneer international agreements on this subject. It was one of the three conventions adopted at the Earth Summit in Rio, 1992. It has been ratified by 195 countries. The second commitment period of the Kyoto Protocol, that occurred after the ratification of the Doha amendment, and began from January 2013, will go on till 2020. This seeks to reduce emissions of participating countries by at least 18% compared to the 1990 levels. The Paris Climate Change Agreement that was made effective from 4th November, 2016, primarily deals with greenhouse gas mitigation and maintaining average temperatures throughout the globe. Just like these, multiple international treaties and conventions have been signed and ratified by various countries, for example, the 1979 Geneva Convention on

[9] Carol Rasmussen, NASA-led study solves a methane puzzle, climate.nasa.gov (2nd January, 2018) https://climate.nasa.gov/news/2668/nasa-led-study-solves-a-methane-puzzle/.
[10] Shaftel, *supra* note 6.
[11] Shaftel, *supra* note 6.

Long-Range Transboundary Air Pollution, that seeks to regulate the emission of noxious gases. Similarly, the amended 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, legally obliges the parties that have signed and ratified it to phase out chlorofluorocarbons (CFCs) as they are one of the leading causes of rapid global warming. In an Intergovernmental Panel on Climate Change, in its Fifth Assessment Report, a group of 1300 independent scientific experts concluded that there's a more than 95 per cent probability that human activities are the cause for rapid global warming over the past 50 years.[12]

V. GREENING OF ENERGIES: THE PATH TO SUSTAINABLE DEVELOPMENT:

The greening of energy refers to the process of extracting, generating and consuming energy that does not harm the environment in any manner. Green energy sources lie in the smart and judicial usage of present natural resources in order to ensure mitigated usage of fossil fuels that are not only non-renewable, but their combustion is also one of the leading factors of increased nitrous oxide in the atmosphere, contributing to global warming. Combustion of fossil fuels is also the single largest cause of air pollution around the world. The employment of green energy sources is imperative to combat global warming and subsequently, working towards sustainable development. Green energy or eco-friendly energy sources emanate through hydroelectricity, tidal energy, wind energy, geothermal energy, solar power, etc.

These alternative sources of energy seek to help reduce the added high carbon dioxide emissions due to the ever-increasing usage of fossil fuels all over the world.

As most agree, there are primarily three generations of renewable technologies:

a) First generation technologies emerged from the Industrial Revolution and include hydropower, biomass combustion, heat and geothermal power.
b) Second generation technologies include solar heating and cooling, wind power, solar photovoltaics and bioenergy.

[12] Holly Shaftel, A Blanket Around the Earth, climate.nasa.gov (13th January, 2018) https://climate.nasa.gov/causes/.

c) Third generation technologies include advanced biomass gasification, biorefinery technologies, ocean energy, concentrating solar thermal power and hot dry rock geothermal energy.

While the first and second generation technologies entered the market, the third generation renewable technologies still require long years of dedicated research and resources to attain the desired results.

Green energy is usually a more reliable source than traditional sources of energy, as energy systems, like solar and wind power, are distributed over a large geographical area with multiple units of equipment. This means that problems with a singular piece of equipment, or terrible weather in one area, will not result in much harm throughout the energy system. The Organization for Economic Cooperation and Development (OECD), and the International Energy Agency (IEA) have released a joint study[13] that talks about the positive implication of transforming towards a green energy sector. Furthermore, according to a report[14] by the International Renewable Energy Agency (IRENA), green energy production created around 10.3 million jobs in the year, 2017. It is no secret to the common man that water from pollution from fossil fuels can cause breathing problems, cancer, heart attacks, etc.; this can be prevented by the usage of green energy that would not harm humans' health in any manner.

This seeks to project that green energy production needn't be only beneficial to the environment in the reduction of global warming, but it can also be beneficial to humans. Green energy also means that most of their energy production need not be imported from other nations, as it emanates from the usage of natural resources available in their own country. This promotes a nation's independence when it comes to one of the main driving forces of their economy- energy production and consumption.

[13] OECD Green Growth Studies, 2011.
[14] Renewable Energy and Jobs: Annual Review 2018, International Renewable Energy Agency (May, 2018) https://irena.org/publications/2018/May/Renewable-Energy-and-Jobs-Annual-Review-2018.

Green energies have received immense recognition globally. The International Court of Justice (ICJ) in the Gabcikovo-Nagymaros Project, a dispute between Hungary and Slovakia[15] regarding a hydroelectric project on the river Danube, held that projects like these have to designed keeping in mind the balance that has to be maintained between economic development and environmental protection. In 1981, the UN Conference on New and Renewable Sources of Energy was held in Nairobi and the Nairobi Programme of Action for the Development and Utilization of New and Renewable Sources of Energy was accepted by most countries.

As per the 1982 United Nations Convention on the Law of the Sea (UNCLOS), states have sovereignty over offshore natural resources and the right to exploit marine natural resources including renewable energy ones (tidal, geothermal, wave). Furthermore, the 1987 Brundtland Report, refers to renewable energy as an 'unstoppable potential' and the report has a whole chapter dedicated to reiterating the importance of absolute domination by the renewable energy sector.[16]

In light of the then newfound and burgeoning focus on clean energy, in 2001 the World Council for Renewable Energy was established with a mission to 'be a global voice for Renewable Energy.' Former UN Secretary General, Ban Ki Moon launched the Sustainable Energy for All (SEforALL) in 2011 to ensure:

a) Universal access to energy services
b) Doubling the rate of energy efficiency improvement
c) Doubling renewable energy in the global energy mix from 15 to 30%

Goal 7 of the SDGs is to "*Ensure access to affordable, reliable, sustainable and modern energy for all.*" 2014-2024 has been declared as the "UN Decade of Sustainable Energy for All."

[15] Hungarv v. Slovakia (Gabcikovo-Nagymaros Project) (1997) ICJ Rep 7.
[16] Brundtland Commission, Report of the World Commission on Environment and Development: Our Common Future, UN-Documents (1987) Chapter 7.

VI. INDIA: GREENING OF ENERGIES V. GLOBAL WARMING:

India ranks 11th in 2019's Climate Change Performance Index, which though not a bad rank, still shows scope for major improvement that India can undertake when it comes to mitigation of global warming.[17] India will potentially be one of the worst-hit countries if the wrath of global warming intensifies. The Air Quality Index (AQI) in India poses a major threat to the health of residents in India, as it is much higher than the permissible limit; according to the World Health Organization (WHO) global air pollution database released in Geneva, India has 14 out of the 15 most polluted cities in the world with Kanpur in the lead. Furthermore, one of India's Lakshadweep islands, Parali I, has already submerged entirely and four others are shrinking due to rising sea levels as an inevitable outcome of global warming and it is predicted that more than 50 million people will be directly affected by the rise in the sea level and associated coastal flooding. Due to India's inclination towards an agricultural based economy, India will also be one of the unfortunate victims of reduced economic growth and the subsequent drastic fall in the Gross Domestic Product (GDP) of the country, due to the flooding that will destroy all the crops, as a result of rising sea levels. The increase in the frequency of natural disasters taking place in India, ranging from floods in Chennai to cyclones in Odisha, can only be seen as a warning from mother nature that if human activities contributing towards global warming don't stop, the entire country could be destroyed.

India is a signatory to all major International agreements and has been taking steps to ensure the attainment of sustainable development, through the increased usage of green energies. Due to the availability of a diverse and vast spectrum of natural resources, India has immense potential in the renewable energy sector. States like Haryana and Tamil Nadu have made solar panels on rooftops mandatory for all new buildings, in order to promote the usage of renewable energy sources. The Indian rooftop solar energy sector already surpassed the 1 GW mark in 2017, with Tamil Nadu, Maharashtra and Gujarat leading in solar energy

[17] Germanwatch, The Climate Change Performance Index 2019, India Environment Portal (12th December, 2018) http://www.indiaenvironmentportal.org.in/content/460032/the-climate-change-performance-index-2019/.

production. The seventh area of intervention where the objectives to promote renewable energies to be applied in the National Energy Policy in India, is the "*installation, generation and distribution of renewable energy.*" Furthermore, Section 3 (1) of the Electricity Act, 2003, requires the Central Government to formulate policies, in consultation with the State Governments, for the "*development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy.*" Hydro and thermal generation of electricity have also been given due emphasis in the Electricity Act, 2003. India has set a target of reaching a 175 GW mark produced solely through renewable energy sources, by the year 2022, out of which, 100 GW is to be sourced from solar power alone.

India, like many other countries, has understood the devastating impact that global warming will have on its inhabitants and has started working towards attaining sustainable development. The higher judiciary has been one of the leading advocates of environmental protection and sustainable development in India, for example, in a Supreme Court case,[18] the honourable judges directed the party to make amends for the destruction of a lake by providing for a lake of a similar size in the same area or the vicinity of it, in order to ensure that the environment is upgraded. Whilst directing this, the Hon'ble Judges also reiterated the importance of lakes, ponds and other water bodies, in ensuring sustainable development. The Supreme Court also referred to the 1972 Stockholm Declaration as the Magna Carta of our environment.[19]

India also has an entire ministry with its own manpower dedicated to the promotion of renewable energy- the Ministry of New and Renewable Energy, currently headed by R.K. Singh. The Ministry was previously known as the Ministry of Non-Conventional Energy Sources established in 1992, and it adopted its new name in October 2006.

[18] Hyderabad Urban Devt. Authority (HUDA.) and Ors. v. S.B. Kirloskar and Ors. 2018 (10) SCJ 609.
[19] Essar Oil Ltd. v. Halar Utkarsh Samiti and Ors., AIR 2004 SC 1834.

The National Green Tribunal (NGT) in India specifically deals with legal disputes that are in relation to the environment. In one of its landmark judgments, the NGT invoked the polluter-pays principle;[20] in another, it shut down a massive hydropower project in order to save the habitat of birds.[21] The famous environmental protection principle- polluters-pay principle was applied by the Supreme Court on multiple occasions as well.[22] This shows that while the judiciary holds sustainable development through the adoption of renewable energy technologies at a high pedestal, it doesn't seek to compromise other species over it, and maintains a balance in the ecosystem.

One of the largest, most populated and technologically advanced cities in India is Bangalore. This is the capital city of the state, Karnataka, in the southern part of India. One of the pertinent issues in Bangalore is that of the encroachment of lakes. Lakes in a country, are important freshwater resources that support huge biodiversity and help maintain the ecosystem. Encroachment and vanishing of lakes can contribute to global warming and reduce the potential availability of natural resources required to generate green energies.

VII. ENCROACHMENT OF LAKES IN BANGALORE: A CASE STUDY OF A PRESSING ISSUE:

Bangalore is located at an altitude of 920 meters above sea level, delineating into three main watersheds; they are- Koramangala-Challaghatta, Hebbal and Vrishabhavathi watersheds. Bangalore in earlier days was, in addition to being known as the "Garden City", was also known as the "City of Lakes." Records show that till 1960, there existed 262 water bodies in Bangalore and now the figures have declined to project only 81, of which a mere 34 are recognized as live lakes. These figures dangerously show a reduction of water bodies to be as high as 35%. While water bodies like the River Ganga attaining the status of a 'living entity', lakes in Bangalore are used for infrastructural growth, being completely oblivious to the impact that its encroachment will have on the environment.

[20] Samir Mehta v. Union of India and Ors. MANU/GT/0104/2016.
[21] Save Mon Region Federation and Ors. v. Union of India and Ors. MANU/GT/0040/2016.
[22] M.C. Mehta and Another v. Union of India and Ors. (1987) 1 SCC 395; Indian Council for Enviro-Legal Action v. Union of India, (1996) 3 SCC 212; Subhash Kumar v. State of Bihar & Ors. (1991) 1 SCC 598.

Lakes have a high rainwater storage capacity and also play an important role in the recharge of groundwater. In addition to this, lakes are home for birds, flora, fauna and fish. The fact that the city of Bangalore does not have a perennial river and is almost entirely dependent on the Cauvery river for water, which is about 140 kms away, only increases the city's dependence on its lakes. In addition to air pollution causing global warming, the encroachment and vanishing of water bodies like lakes, can contribute to the rapid pace of global warming, as natural water cycles will be disrupted and the biodiversity that the lakes once held, will have no place else to go. Since the numbers of lakes in Bangalore have drastically reduced, the burden of the consequence of global warming, like increasing water temperature, declining water quality, etc., will have to be bored by the few live lakes that remain.

Global warming is already leading to climate change and the city that prided itself on having a moderate temperature throughout the year is now experiencing random bouts of climate change that have the long-time residents of the city, astonished. This sudden change in the weather pattern may not be well adapted to by the water bodies in the city and extreme hot weathers could lead to the drying up of lakes. This could also affect the livelihood of the dependant population, for example, fishermen. About 22% of the lakes have been victims of illegal landfilling activities and now, lake beds are being used as dumping yard for either building debris or municipal solid waste.[23]

Lakes have been encroached for commercial purposes, to create residential sectors, illegal buildings, conversion to layouts, building stadiums, industries, playgrounds, bus stands, etc. The Dharmambudi Lake was converted into the Kempegowda bus terminus, and the Sampige Lake became the ever famous Kanteerava stadium. Transportation and sports took priority over an undeniably important source of life- water. Similarly, the Koramangala Lake is being used as the National Dairy Research Institute and the Akkithimannahalli Lake has been

[23] ETR 101, Wetlands: Treasure of Bangalore (2016) http://wgbis.ces.iisc.ernet.in/energy/water/paper/ETR101/2-Bangalore%20lakes_intro_01jan2016.pdf.

converted into a hockey stadium. Recent studies reveal a 925% increase in the built-up area and a 79% decrease in the quantum and presence of water bodies.[24]

Lakes act as carbon sinks. They contain roughly 10-14% of the carbon present. Their rich soil and plants store the carbon dioxide instead of releasing it into the atmosphere. This, in turn, helps mitigate the emission of greenhouse gases that would result in climate change and global warming; but the encroachment of these lakes will only take away this natural gift that the earth has provided for, to save its own atmosphere. Additionally, the lakes helped in preventing flooding and treatment of wastes. Increased natural disasters, like floods, are anyway a consequence of global warming, and the paucity of lakes to help prevent the same, only poses a bigger threat to the residents of Bangalore. The city is already known for its failure in handling the garbage dumping situation, and now with the reduction in the number of lakes, natural methods of treating waste that the planet has devised for itself, will no longer apply. Poor governance driven by electoral power greed, lack of a sense of belonging and poor implementation of regulatory norms are said to be leading causes of the encroachment of lakes in Bangalore.

After a survey conducted by Prof. Ramachandra from IISc, Bangalore, it was concluded that only four lakes remain in an acceptably good condition. The numbers of lakes in Bangalore have gone down from a three digit number to a single numerical, in lesser than a century. The study also found that 98% of the lakes were encroached by a mafia.

Bangalore gets its power from hydel/hydro, thermal, and non-conventional sources of alternate energy like sun and wind. Additionally, it also gets power from Central Generating Stations (CGSs) like the Neyveli Lignite Corporation. Together, these sources have a capacity of producing 12000 MW of power. There are 14 hydel power stations in the state of Karnataka, of which Bangalore Electricity Supply Company (BESCOM) gets 12% of the

[24] ITR 101, *supra* note 23.

share for its entire area which extends to the outskirts of the city, Bangalore.[25] The encroachment of lakes would reduce the availability of water required for the production of electricity through hydel power plants in and around the city. This would prove to be an obstacle in achieving absolute domination of renewable green energies in the path of attaining sustainable development. This is a city that breathes on lakes; the death of them will be the death of the city, in the blink of an eye.

VIII. INDIA AND THE RAMSAR CONVENTION:

The Ramsar Convention signed in Iran in 1971, came into force in 1975, with 168 Contracting Parties. This Convention on Wetlands is an intergovernmental treaty that provides for the framework for international cooperation and national action for the wise use and conservation of wetlands. Since wetlands are the transition between dry land and wetland, they include within their ambit lakes as well. The Convention came into force in India from 1st February, 1982, and so is applicable to the current situation in Bangalore in relation to the encroachment of lakes. As per the convention, "*Wetlands play a vital role in climate change adaptation and mitigation. Progressive encroachment on, and loss of, wetlands cause serious and sometimes irreparable environmental damage to the provision of ecosystem services.*"

India presently has 26 sites designated as Wetlands of International Importance, also popularly called, Ramsar sites, with an approximate surface area of about 6,89,131 hectares. Out of the 26 Ramsar sites, 10 of them are lakes, and this seeks to reiterate the importance of lakes in an ecosystem. Encroachment of lakes must, therefore, be stopped, in order to move closer to the attainment of sustainable development and its goals. This can also help in ensuring that adequate natural resources exist to generate alternative green energies.

[25] Navya Pak, Where does Bangalore's power come from? (5th November, 2012) http://bengaluru.citizenmatters.in/4648-bescoms-power-sources-4648.

IX. LEGAL RECOMMENDATIONS:

The researcher believes that the adoption and implementation of these recommendations could better the current scenario in relation to global warming and greening of energies:

- ***Replace the word 'may' with 'shall':***

  The word 'may' if used in any environmental legislation that is equipping member countries to use their discretion in the adoption of a certain provision that is absolutely necessary for the betterment of the subject at hand, should be replaced with the word 'shall' so as to obliterate any discretion that might provide scope for arbitrariness.

- ***Tracking of funds:***

  Ensuring proper and adequate allocations of funds is not enough. The authorities must also keep in check the flow of money and ensure that it reaches the desired hands. The purpose for which the funds were allocated must be benefitted by this allocation and the money should not be lost in paperwork after the allocation.

- ***Establishment of single authority:***

  A single authority must be established who would be the custodian of every matter when it comes to disputes regarding encroachment of lakes. This authority must be appointed without political interference and should be free from bias of any sort. The authority can have a re-election period of 3 years as his/her appointment will not clash with elections, thus freeing the process from any vote bank politics.

- ***Weighing the benefits and the losses:***

  Each proposed infrastructural project before being approved by the higher authorities must be transparently scrutinized and the benefits of the establishment of the project should be weighed against the losses that it might incur to the environment. This process should be made mandatory so that there is scope for considering the impact of the project on the environment as well.

- ***Punishments for illegal activities***:

  Illegal encroachment of lakes, and other illegal activities like poaching of animals, non-approved deforestation, etc., should be highly fined and imprisonment can be a punishment too for the perpetrator. Land grabbing can thus be made, a cognizable non-bailable offence. The enforcement of such enhanced punishments must take place without delay and hesitation.

- ***Sanctions:***

  Sanctions should be imposed on those that withdraw from treaties without reasonable cause and evidence to support their cause. They must also be imposed on those who do not incorporate and implement the international convention into their municipal law despite ratification.

X. CONCLUSION:

Sustainable development has evolved as a concept and global warming is a major threat to its attainment. Global warming results in, among many destructive consequences, climate change. This is a threat to the existence of mankind and can only be combatted if everyone, all around the globe, regardless of their economic status, race, creed, etc., chooses to work towards adopting renewable energy technologies, researching about the third generation renewable technologies and bringing them into the market. Like the local issue of encroachment of lakes in Bangalore, innumerable issues exist not only in India, but around the world, that is contributing to rapid global warming, without being noticed. The words of Robert Swan, "*the greatest threat to our planet is the belief that someone else will save it.*," must be followed and everyone must do their personal part in ensuring zero negative impacts on the environment around them.

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