INDIA-BRAZIL RELATIONS: ENERGY SECURITY AND ENVIRONMENT

A Thesis Submitted in Partial Fulfilment for the Degree of

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By

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DECLARATION

I, Josephine Dias, hereby declare that this thesis represents work which has been carried out by me and that it has not been submitted, either in part or full, to any other University or Institution for the award of any research degree.

Place: Taleigao Plateau Josephine Dias

Date:

CERTIFICATE

I hereby certify that the above Declaration of Ms. Josephine Dias is true and the work was carried out under the supervision of late Prof. Aparajita Gangopadhayay and myself and may be placed for evaluation.

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This thesis is dedicated to my Guide and Mentor

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In Our Hearts Forever

A Tribute to My Guide

'Sometimes you will never know the value of a moment, until it becomes a Memory'

Dr. Seuss

My greatest experience with Madam was not in never falling, but in rising every time I fell, because she saw to it that I never gave up. My M.Phil. and Ph.D. degree are a tribute to you Madam. You were a fan of Latin American nations especially Brazil and a much-cherished person whose impact knew no bounds.You passed away, leaving a void that words can hardly describe. You were a beacon of light in my academic venture, a guiding light I will forever hold dear. You had a genuine concern for my well-being even when I was critically sick even amidst your own challenges.

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'Death is not extinguishing the light; it is putting out the lamp because the dawn has come' ~ Rabindranath Tagore.

Lives of great people like you remind us, that we should make our lives, sublime and departing, leave behind us footprints on the sands of time.

That I must say good bye till the 'morrow' and for all the tomorrows to come…

To the Lady who was my Friend
To the Lady who was my Teacher
To the Lady who was my Mentor
To the Lady who Inspired me
To heights which I did not know I could achieve…..

In life we loved you and respected you. In death we love you and hold you in high esteem. In my heart you will hold a place no one would ever fill.

Rest in Peace Dear Ma'am, Your Legacy and Love Will Forever Live in My Heart.

"I think the environment should be put in the category of our national security. Defence of our resources is just as important as defence abroad. Otherwise, what is there to defend?"

~ Robert Redford

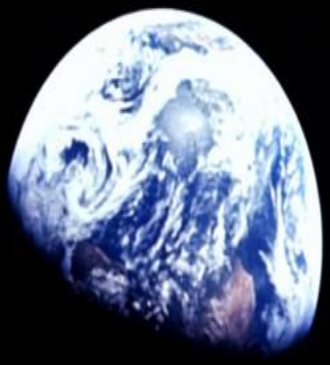

Photo Taken by Apollo 8 Astronaut Bill Anders on Christmas Eve in 19
Earthrise showed for the first time the delicate balance between our plan
beauty and the dark void in which it resides.
This photo had a profound effect on our global consciousness and in tu
gave birth to the modern environmental movement.

~ NASA Photograph by Wiliam And

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CHAPTER I: INTRODUCTION

1.1 INTRODUCTION

The prime source of natural energy to the planet earth is the sun. Any amount of variation in the production and utilization of this primary energy both by the flora and fauna greatly affects the general biogeochemical cycles on the earth surface. In the same manner humans also have greatly altered the natural surface of the earth in search of alternate sources of energy there by greatly affecting the natural rhythms. As acknowledged that the whole colossal engine works on energy, the use and misuse in turn greatly affects directly and indirectly the natural environment. Hence every nation of the world, gigantic or diminutive strives to be energy sovereign, since the whole economy of any given country runs on the two main wheels of energy and environment.

Thus, Energy security and Environmental concern are one of those inexorable issues that intrigue the people of the world and nations at large. The fear of depletion and absence of varied sources of energy is the fear of cold winters that forces the countries of the 'north' to rely heavily on fossil fuels for their consumption. It is this compulsion that might have cost the United States its global pre-eminence, and the exception that so often renders moralistic views of international relations indefensible. To most countries around the world, energy security is everything i.e., economies, defences and regime survival wrapped into one, topped up with the huge looming environmental trepidation.

Energy deprivation is a leading contributor to disease epidemics, underdevelopment, unemployment, social discontent, political unrest and instability- it threatens the energy haves as well as the have-nots. It is only in the recent years that energy poverty has moved up the global agenda with the United Nations devoting a section of its World Energy Outlook to energy poverty and declaring 2012 as the 'International Year for Sustainable Energy For All'. The most common concept illustrating energy poverty involves 'energy ladder' for services such as heating and cooking. One study defines the energy ladder as the percentage of population among the spectrum running from simple biomass fuels (dung, crop residues, wood, charcoal) and coal (or soft coke) to liquid and gaseous fossil fuels (kerosene, liquefied petroleum gas and natural gas) to electricity. The ladder is often described in terms of

efficiencies, with the more efficient fuels or sources higher on the ladder. For example, kerosene is 3 to 5 times more efficient than wood for cooking and liquefied petroleum gas is 5 to 10 times more efficient than crop residues and dung, depicts the energy ladder as synthesized from a variety of academic studies. These rungs of the energy ladder suggest a meaningful difference between how the rich and poor consume energy with implications on equity and affordability.

1.2 SCOPE FOR FURTHER RESEARCH

The theme of "Energy Security and Environment" is being increasingly studied nowadays. However, that doesn't translate into the exhaustion of topics for research in this area. Topics related to Energy Security and Environment will be a continuous assessment of areas and results which be explored in greater depth in years to come. The theme is already been explored and studied but it may be silage for yet other studies using the postmodern interpretative viewpoints and theories to discover still new layers of meaning into the same works. Inter-disciplinary works add yet another dimension to this fascinating area of study. Translation studies for the country data on Brazil could prove a prolific resource of work to be explored. The scope for reading into the transformative power of the ideas of the time as reflected in the writings of the day is yet to be explored.

As energy is the main "fuel" for social and economic development and since energy related activities have significant environmental impacts, it is important for decision makers to have access to reliable and accurate data in a user-friendly format. The world around us has changed significantly over the past 50 years. Energy use and environmental damage are inversely linked to each other. However, all economic growth needs energy. Competition and innovation are the key to meeting this need. Hence, Energy Security and Climate change remain as the major challenges for mankind today. Large scale mining of coal, oil and natural gas reserves from the earth's crust has instilled geological instability, caused massive deforestation, oil flares, and deep-water horizon blowouts as potential future disasters. According to (Duncan Richard 2001) for instance, a dragon in the form of high pressure exists in every deep-water oil reservoir, which have the potential for a disastrous blowout, for e.g. The Thunder Horse PDO floating oil rig of the Gulf of Mexico, the Hibernia oil platform in the Atlantic Ocean, the Liberty oil field of Alaska, the Tulip oil field off

the coast of Brazil, the Himalayan-Assam tectonically unstable belt, are grave environmental disasters with high oil yielding potential.

As per the statistics provided by (Time Magazine – Oil Squeeze 1979) an Era of difficult oil has begun. Politically stronger nations want to rule the coffers of the 'liquid black gold' that lie in the politically unstable regions of the world i.e., the Middle East. Virtually all new projects in the Gulf of Mexico are difficult and pose dangers to the environment (www.scientificamerican.com). The projects described above are not crimson picked to emphasize the difficulties. They are typical. These descriptions serve as examples of how astonishingly good modern methods of finding oil are as energy sources. Today there aren't many places for oil to hide. The oil projects described above could all be described as dangerous. They all have the potential of producing Deep water Horizon scale disasters. This potential is typical of new projects. It is not easy to drill oil in places like Iraq, Kazakhstan and Nigeria for reason needing no explanations. The difficulties of producing oil from Athabasca oil sands, not to mention the environmental costs are well known. Efforts to produce oil from shale continue. The run for energy continues. (Hammes David and Wills, Douglas 2005).

1.3. OBJECTIVES OF THE RESEARCH

The oil projects described above could be called as ingenious, but they could also be described as desperate, and a sign that the Age of Oil is drawing to a close. Seven out of eight of the largest corporations on the earth are oil companies. Wal-Mart is number three and BP is number four. Any major oil company could become involved in a Deep-water Horizon Scale disaster, since they are all driven by the profit motive. In India for instance, according to the (www.hccindia.com) the leading Hindustan Construction Co. Ltd has built over 25 percent of India's installed hydroelectric power capacity, over 50 percent of the country's nuclear power capacity, more than 350 bridges and 3500 lane kms of expressways and highways. Projects like Vizag Strategic Oil Storage Cavern, Kudankulam Nuclear Power Project, Delhi Metro, Delhi-Faridabad Elevated Expressway and the iconic Bandra-worli Sea Link have helped them to take the country forward. Overcoming challenges with use of energy has proved that India is not lagging behind in innovation. The completions of the Chutak Hydel power project in Kargil, Nimoo Bazgo Hydel Power

project in Leh and Pir Panjal Railway Tunnel besides the Uri-II Hydel Power project are examples of creating responsible and sustainable infrastructure for the country but at the cost of facing grave environmental constraints and other climatic challenges. It is safe to say that anyone reading this is an oil user. We live in the Age of oil. It is hard to say it, but we oil user cause these disasters which consistently affects the environment at large. Thus, a study on the energy-environment relationship can be strongly warranted since the energy industry makes two contributions to mankind: wealth and economic welfare of all citizens and world's environmental problems.

The study primarily has the following two objectives:

1. to study the co-relationship between energy use and environment deterioration; and

2. to analyse the efforts of Brazil and India in the field of Alternate sources of energy and Environmental Management.

1.4. REVIEW OF LITERATURE

As pointed out by (Martin Bekkeheien and Oystein Haland) people use energy through the application of technology to satisfy their needs for comfort. Light, mobility, processed products etc. this relationship between energy use and basic human needs makes energy a fundamental input to almost all aspects of human economic activity, as a necessary component of all household heating and cooling equipment, as a fuel for the world's fleet of cars, trucks, ships and airplanes, as the enabler of industrial processes. Historically, the link between energy and economic growth has manifested itself in the so-called Iron Law of energy demand. One percent economic growth leads to roughly one percent energy demand growth. However, all forms of energy transformation and use entail some form of pollution or environmental degradation. Unfortunately barring a utopian future, improving the environment will generally mean economic costs, a trade-off between material wealth and environmental wealth will have to be made.

A development based solely on the maximization of wealth and short-term welfare will not be ecologically sustainable. On the other hand, development based solely on the minimization of environmental impact will not be socially sustainable. Given the consumer trends driving the energy market, strong underlying energy

demand growth is likely to continue into the foreseeable future. According to the UN, less than 30 percent of the population of India lives in urban areas.

As stated by (Duncan Richard. C. 2001) an adequate availability of energy is one of the basic requirements for faster economic growth. To make growth truly inclusive, access to energy in rural areas and to urban poor has to be ensured. Ensuring certain minimum level of energy consumption for everyone is a critical requirement for providing basic amenities required by everyone. The overall availability of energy would need to be increased substantially to meet these twin objectives and to enable a sharp reduction in energy demand and supply gap.

In the coming decades, the energy sector will face an increasingly complex array of interlocking challenges such as economic, geo-political, technological, and environmental and not just in the OECD countries. As the developing world's population continues to expand, the energy needs of billions of additional people in rural and especially urban areas will have to be met. Meanwhile, supplies of conventional oil and conventional natural gas are expected to decline in the not-too-distant future, becoming increasingly concentrated in the Middle East (oil) and in such countries as Russia and Iran (gas). Meeting these challenges will require very long lead times. Indeed, renewing the existing patterns of energy production and consumption, transport and other technical infrastructure, the layout of cities, the nature of the industrial capital stock, current technologies, values and attitudes etc., could take as long as 50 years (Carlo C. Jaeger).

Brazil has a long history of bio-ethanol production and is often touted as the most successful national producer of bio-fuels. Brazil's interest and investment in bio-energy production mirrored that of the rest of the world, with periodic energy crises, rises in fossil fuel prices and nationalist urges to secure access to energy stimulating innovation in research and policy. As early as the 1940s, Brazil was experimenting with using various oils and fats to combust engines. Neat vegetable oils such as castor seed, cotton seed and coconut were trailed (Pousa et al. 2007). The ban on the exportation of cotton-seed oil, which was the main vegetable oil produced in Brazil at that time, as a means to keep the price commercially viable and thus make it possible to use as a fuel for trains, perhaps represented Brazil's first foray into state intervention in biofuel production.

In recent years, the area of energy, environment and sustainable development has drawn considerable attention of the national and global policy-makers and researchers. The context of the recent energy and environment studies has been the mitigation of greenhouse gas emissions. GHG mitigation studies have a recent history. Most initial studies originated from the developed nations. The analysis and results of these studies therefore pertained mainly to the developed country situations. These were oil guzzling nations.

Hence the surge of oil was coming, whether the world needed it or not. The flood of crude had arrived as concerns about climate change were growing and worldwide oil demand was slowing. But it is not coming from the usual producers, but from Brazil, Canada, Norway, and Guyana- countries that are either not known for oil or whose production has been lacklustre in recent years. This looming new supply has been the key reason why Saudi Arabia's giant oil producer Aramco has pushed ahead with plans for what could be the world's largest initial stock offering ever. The new rise in production was likely to bring cheaper oil, which could complicate efforts to combat global warming and wean consumers and industries off their dependence on fossil fuels, because lower gasoline prices could for example, slow the adoption of electric vehicles. Daniel Yergin, the energy historian who wrote 'The Prize: The Epic Quest for Oil, Power and Money', compared the impact of the new production to the advent of the shale oil boom in Texas and North Dakota a decade ago. Since all four of these countries are largely insulated from traditional geopolitical turmoil, they will add to global energy security according to Yergin.[1]

It is often pointed out that we should distinguish between level of consumption and the level of life. The former defined by access to cars, TVs etc. and the latter by some measure of the average enjoyment of life through the yardsticks of health, education and leisure. GNP is considered to be inadequate to represent all the values inherent in the meaning of 'standard of living'. Philosophers like Rousseau have proclaimed that a primitive society, in 'harmony with nature' uncluttered by the artefacts and unhampered by the strictures of civilization, has the highest standard or level of life. Anthropologists, however have shown that most primitive peoples lived short lives of fear and discomfort and that they appeared to live in harmony with

[1] The Times of India dated 5th November 2019.

nature only because their means for destroying nature were comparatively important. Since the days of Adam Smith, several persons have opposed the concept of the 'noble savage', contending that continuous growth in the use of energy and materials is the best state for man.

While many people consider it a fallacy to link the quality of life casually with per capita access to energy and materials is because this link has been the philosophical foundation of western industrial, technological, democratic society and political decision makers' act on the basis of its validity. Cook considers energy use, environmental sanity and the quality of life as independent variables. Each variable is considered to have at least one real limit. The limit on energy use is a maximum, measured as the rate of availability of useful energy that can be sustained during any chosen period. The two most threatening social costs of present energy systems are environmental degradation and social collapse due to the exhaustion of non-renewable resources.[2]

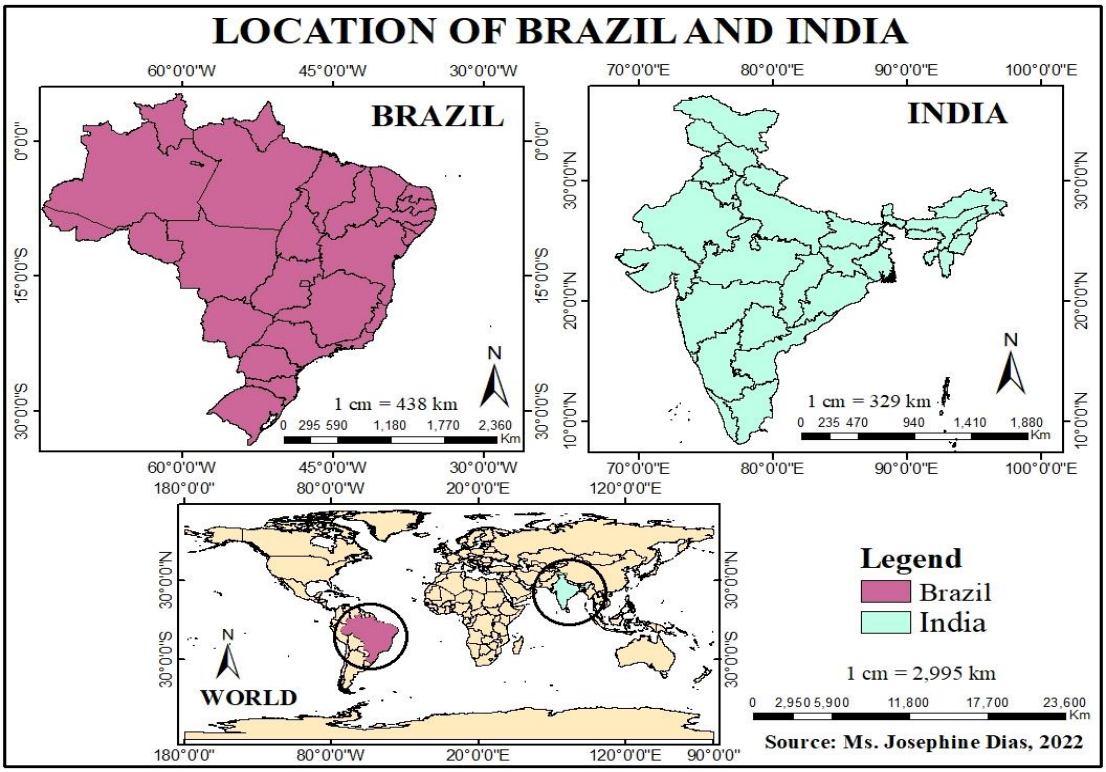
Beyond 2020

In many respects, 2010/2020 will prove to be a watershed in the transition of energy systems. A variety of forces are at work, and the world population will have increased by more than 2 billion people by 2050, with the vast majority living in cities in the developing world. Moreover, the OECD countries will be an increasingly smaller energy player in the world in terms of demand, production and trade, but nonetheless will remain an important as a supplier of technology. As pointed out by (Lutz W. W. Sanderson and S. Saherbov 1997) this transition of the world's energy sector could well accelerate over the period 2020-2050. The kind of energy systems that will emerge will be shaped by a multitude of opportunities and constraints. One of the major conclusions of long-term energy projections is that fossil fuels will still dominate the energy outlook for at least thirty to forty years. (According to the OECD report).

[2] James Smith., *Biofuels and the Globalization of risk- the biggest change in North-South relationships since colonialism*,(U.K, MPG books group, Bodwin and King's Lynn,2010) p.30.

Brazil – the case in study presents an interesting case as a rising power on the road to energy independence. Broadly speaking, Brasilia is able to adopt a foreign policy that is more flexible than some of its counter parts, particularly BRIC countries like China and India. Brazil learned an important lesson from the oil crises of the 1970's and as a result it has built up a domestic renewable energy industry that has now given its foreign policy a free hand. In the next decade, demand for energy is expected to increase by around 60 percent in Brazil, fuelled by millions of people spending more on consumer goods for their homes and cars, economic growth continuing to outstrip that seen in developed nations and heavy spending to improve infrastructure. According to the (IEA 1997- energy Technologies), Brazil is the world's 7^{th} largest economy, the 9^{th} largest energy consumer in the world and the 3^{rd} largest in the Western Hemisphere. Natural gas still plays a modest role in Brazil's energy mix, accounting for 9 percent of the commercial demand.

Figure 1: Location of Brazil and India



Source: Author, 2022

On the other hand, Brazil is by far the biggest world's supplier of a bio fuel called ethanol and aims to be a main producer of bio diesel. Ethanol comes from sugarcane while bio diesel comes from crops such as castor beans, soya beans and oil palms. This means that Brazil will save money by not having to import fuel from other countries. It exports a lot of ethanol to the United States and Europe. 4 percent of Brazil's energy comes from renewable resources. In the United Kingdom, the figure is 2 percent. Brazil also has a vast hydro-electric power potential in the form of the might river Amazon. The same waters of the river may be used several times, as and when several hydroelectric plants are installed along the same length of the river as noted by the (Swiss Federal Institute of Environment, Science and Technology).

India – India is a second case in study. As per the (www.worldenergycouncil.org, WEC) India produces 2.3 percent of total energy in the world. India accounts for 3.3 percent of the global energy consumption. Given the high economic growth rate (-7 percent) the demand supply mismatch is expected to worsen. Today India is the 5th largest economy overtaking UK and by 2030 India is expected to be the 3rd largest energy consumer. India is becoming a major oil importer and will soon become third largest importer of oil next to USA and China.

Technology innovations to improve efficiency of fuel use by automobiles, developing Mass Rapid Transport Systems for moving passenger traffic and also shifting goods transport from road to rail would result in large saving of oil and reduce import dependence. Major investments to get access to fuel sources located in other energy resource-rich countries will be taken up as an integral measure of overall government economic policy to strengthen energy security. Universal access to power for lighting and cooking energy is a basic requirement of all civilized societies. There are large gaps in the rural infrastructure of these energy sources. In spite of electrification of a large number of villages a very significant number of habitations continue to remain uncovered with grid network in India.

The 1970s energy crisis was a period in which the economies of the major industrial countries of the world particularly the United States, Canada, Western Europe, Japan, Australia and New Zealand were heavily affected and faced substantial petroleum shortages, real and perceived, as well as elevated prices. The two worst crises of this period were the 1973 oil crisis and the 1979 energy crisis, caused by interruptions in exports from the Middle East, for example in 1979 due to the Iranian Revolution. (As per the US State Dept. report) the crisis period began to unfold as a result of events at the end of the 1960s. It was during this time that petroleum production in major producing countries like US and some other parts of the world peaked. Subsequent to the Seventies, world oil production per capita peaked. Western countries relied on the resource of potentially unfriendly countries in the Middle East and other parts of the world. The crisis led to stagnant economic growth in many countries as oil prices climbed according to the (Time Magazine 1979). The 1973 oil crisis is a direct consequence of US production peak in late 1970 beginning 1971. The ‘embargo’ as described below is the “practical name” given to the crisis, allowing the US to “lie to itself” or hide its production peak towards its citizens. For the main Arab producers, the ‘embargo’ allowed to show to the ‘Arab street’ that they were doing something for the Palestinians. In real market terms (number of barrels) the embargo was almost a non-event, and trade was only from a few countries, towards a few countries, see for e.g. “The Age of Oil; The Mythology, History and Future of the world’s most Controversial Resources” (byLeonardo Mangeri pg. 113).

As the thesis is basically focusing on the environmental impact of energy usage, perhaps the most challenging environmental issue for the international community for the coming decades will be global warming and climate change. In recent years, and especially since the Rio Summit in 1992, many countries have taken new initiatives to address climate change. At the International level, the UN Framework Convention on climate change entered into force in 1994 and commits parties broadly to common objective of stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The convention commited both developing and developed countries to take climate change into account in their social, economic and environmental policy frame works, to co-operate in scientific, technical and educational matters, and to share information. It also commits parties to promote technology transfer and sustainable resource management. This gives rise to the problem of finding an optimal time path, new modes of international co-operation and innovative policy incentives to achieve such targets in a cost-effective way. A key will be to move towards non-fossil energy systems and to encourage consumers and producers to take environmental concerns into account in day-to-day decisions. Government policies will have an important role to play in ensuring that producers and consumers are provided with clear market signals and with incentives to make the transition to a future with low greenhouse gas emissions.

At the international level according to (Jean – Marie Bourdaire) the emergence of new players, the redistribution of power and especially the prospect of an ever-increasing energy role for developing countries make it imperative that new and stronger co-operative links be forged between OECD and non-OECD countries across the entire portfolio of every environment related issues. Oil will remain the dominant fuel as gas overtakes coal by 2020 and nuclear power will remain static and renewables will grow, but their scale will be huge. Over the period to 2020, decisions on new nuclear power plants will be made on mainly political rather than economic grounds. For most renewable, site-specific issues and political considerations will dominate economic considerations. The geographical pattern of energy demand is projected to shift from the OECD region to developing countries and these countries and China are expected to account for 68 percent of the increase in demand between 1995 and 2020.

Energy – The link to economic growth.

Economic growth is a major driving force for energy use. Faster growth would raise these projections and slower growth would lower them. The rising use of fossil fuels will place great strain on the environment. Much will need to be done at the local and regional levels to reduce emissions of particulates and acidic gases. Both the technology and the policies are available, and in use in many countries, for reducing these types of emissions. In general, they are likely to raise costs and limit the future use of fossil fuels. Similarly, the global issue of climate change is likely to have a major impact on energy supply and demand, moving the likely trend away from the business-as-usual projection. If the hypotheses of economic growth and energy efficiency improvements hold, the transition economies will probably meet their commitments by some margin. As remarked by (Arnulf Grubler and McDonald 1998) despite energy globalization, market exclusion remains a serious challenge. To date some 2 billion people do not have access to modern energy services due to poverty and a lack of energy infrastructures. Many regions are overly dependent on a single, locally available resource, such as traditional fuel wood or coal and have limited access to the clean flexible energy forms required for economic and social development.

The current global imbalance of energy supply and demand, compelled with the environmental consequences of carbon emissions, is causing mounting concern for the sustainability of our future development. While rapid economic-growth in developing countries stimulates the world economy, it also increases pressure on energy supply and the environment. One answer to this predicament is to find appropriate solutions based on system options, incorporating advanced technologies that can help overcome energy and environmental constraints while maintaining sustainable development**.** (OECD 1997). For example, New Earth 21 (Action Program for the 21st century) proposed by Japan in 1990, offers comprehensive long term system options that aim at restoring global environment conditions to a level equivalent to that before the Industrial Revolution in the 18th century and suggests possible ways to progress toward “no-regret” options.

The point of intersection between technology and energy as pointed out by (Chihiro Watanabe) is in fact no mere point but a dynamic system involving both the

economy and the environment. If national and social factors such as environmental and security concerns were internalized in energy system costs, the economic potential of renewable could improve and their contribution would grow significantly. *Population* and *income growth* are the key drivers behind growing demand for energy. By 2030 world population is projected to reach 8.3 billion which means an additional 1.3 billion people will need energy and world income in 2030 is expected to be roughly double the 2011 level in real term. World primary energy consumption is projected to grow by 1.6 percent from 2011 to 2030, adding 36 percent to global consumption by 2030. The growth rate declines from 2.5 percent per. annum for 2000-10 to 2.1 percent per. annum for 2010-20 and 1.3 percent per. annum from 2020 to 2030, according to the (BP- Statistical Review of World energy, UK 2012).

Explaining the Neglect of 'Sustainability' Within the Latin American Development Literature

There is considerable literature which addresses problems of the rural environment in Latin America. Some of it quite distinguished, but there have been few attempts to translate ecological issues into social and political terms, until very recently. (Vitale 1983; Redclift 1989). Recent attempts to do so- via the movements of resistance of the poor-have often been extremely illuminating (Hecht and Cockburn 1989; LAB 1989; Goodman and Hall 1990). Within the urban context more attention is now being paid to 'Green' issues, such as recycling, local community empowerment and the development of 'soft' technologies. These so-called new social movements are represented in Latin America. (Slater, 1985).

It is not difficult to point to examples of this neglect in the development literature, and our own work has often neglected the environment and sustainability dimension (Redclift 1978); Goodman and Redclift 1981). Andre Gunder Frank whose work was highly influential in Latin America (and even more so in Europe and North America) during the late 1960s and 1970s, wrote 'crisis in the world economy 'in 1980. Throughout this voluminous exegesis there is scarcely any reference to the environment, or the importance of ecological factors in the political economy of the area. Not until page 283 do we read that 'natural resources in the west, east and south, far from being conserved, are being ravaged more and more, if only because such

exploitation is considered temporarily necessary during the 'emergency' of the present economic crisis' (Frank 1980, 283).

Similarly, (Merilee Grindle), in what must be considered a bench mark study of agrarian policy in the region, state and country side: Development Policy and Agrarian Politics in Latin America (1986), makes a very few references to environmental factors in rural development. References is made to modern inputs into agriculture, although not at any length, but this extremely useful study refers neither to 'sustainable development' nor provides examples of such development from within the Latin American content.[3]

Similarly, the influential book by Alian de Janvry, 'the agrarian question and reformism in Latin America (1981) makes no reference to and attempts no analysis of sustainable development, or aspects of more sustainable agriculture, such as agro ecology. Other studies, like those of Yates (1981) and Sanderson (1986), pay a little more attention to the sustainability dimension, Sanderson even citing water rights management and crop insurance as means of increasing Mexico's food security, while devolving power to the rural poor. However, in these studies too, environment considerations are still treated as essentially marginal.

Why has sustainability received so little attention in discussion of Latin American development? Plus, less attention than it has received for example in the African and Asian development literatures. To answer this question, one inevitable need to have recourse to history. Three aspects of early Latin America help explain the neglect of the sustainability dimension: the importance of tenure relationships governed by rent in the way human and natural resources were exploited. The rapid urbanization of Latin America even in the colonial period, and the systematic destruction of devaluation of indigenous cultures and knowledge. Together, these processes help explain why, by the beginning of this century, Latin American countries were already set on a path that would scarcely be described as sustainable.

[3] David Goodman and Micheal Redclift., *Environment and Development in Latin America- The Politics of Sustainability*, (New York: Manchester University Press. 1991) p.5.

Any understanding of Latin America since 1492 must recognize the importance of rent. The colonization experience, especially in the lands conquered by the Spaniards, was marked by the virtual enslavement of much of the indigenous population or its destruction in the face of disease and epidemics (Crosby 1972). Land was in plentiful supply, but most of the early descendants of the Conquistadores were not intent on establishing a 'settler society' like those which came to characterize most of North America and Australia. They had come to Latin America in search of precious metals, and (at least at the beginning) their interest in the natural environment was largely channelled in the direction of extracting the most valuable resource (especially mineral deposits) as rapidly and efficiently as possible. Agriculture grew up, of course, and new crops were introduced, such as wheat and sugar, which were to transform culture as well as environments, but the emphasis in colonization lay in extracting a surplus and in harnessing labour to the production of this surplus. The 'men on horseback' who conquered Latin America were the descendants of a people who had only relatively recently pushed the Moors out of Spain and Portugal. Their culture was one which placed emphasis on land as a source of power and control of labour, and which saw conquest as a necessary part of civilization.

The early history of Spanish and Portuguese expansion in Latin America provides illuminating examples of the way in which the environment, far from being a 'given' natural phenomenon, is actually socially constructed. The most important introduction and a paradoxical one in that it probably had originated in South America before the Pleistocene was the horse. Horses could be used to herd other animals and so new grazing animals could be introduced to the plains and pampas of Latin America. (The environment of Latin America was an amalgam of what they discovered, what they introduced and what they fashioned for themselves). Urbanization was not merely a geographical phenomenon; it was a cultural one too.

The first people to face the full impact of the extractive economy were the indigenous people of Latin America, many of whom had evolved carefully balanced, but sustainable, systems of resource use. Societies characterized by what Murra (1975) calls 'verticality', the control of several ecological niches by population with diversified livelihood strategies, entered into exchange relations with other social groups, and managed the environment in a way that would today be described as

'sustainable'. These same environments are today among the most degraded in Latin America. If the early history of Latin America emphasized short-term gain over longer-term sustainability, later history only served to reinforce this model. During the early part of this century several Latin American countries made important strides in their industrialization, a process which was well advanced in countries such as Brazil, Argentina, Chile and Mexico by the 1940s.

The measure of a country's development was, not surprisingly, associated with the size and diversity of the industrial sector and Latin American governments assumed that pursuing industrial growth would enable the region to reduce its external dependency and eventually to develop a large internal market for the products of its own industries. Development was an attempted replication of the experience of the North, but it became clear that the industrialization of Latin America, within a 'dependency' framework, carried huge social and environmental costs. Today, most Latin American countries have large middle classes, urbanized and oriented towards private consumer goods, rather than publicly-owned natural resources.

Finally, critics of the Economic Commission for Latin America (UNEP/CEPAL) position, advocating alternative, sustainable 'styles' of development (CEPAL 1985; Rivera 1985) brand this approaches as hopelessly utopian. They argue that the environment in many parts of Latin America has already been transformed in ways that are irreversible, whether in terms of food systems, the utilization of technology or the distribution of population between rural and urban areas. A 'sustainable' future in Latin American countries, where tastes and consumption patterns have followed the fashion set in the developed countries, will require political conditions to change and the environmental demands contained in the UNEP/CEPAL position will need to become part of the political programme of social groups.[4]

Environmental Governance and Latin American

The Brazilian and Argentine examples highlight that even during democratic periods of governance, popular political leaders can mobilize the necessary support to

[4] Ibid,p,14.

change the basic legal framework of a country and alter significantly future political events through such actions. The defeat of fascism in Europe ushered in a new period of international concern and awareness that a global system of legal guarantees and mechanisms had to be established to promote and protect individual and collective rights. These desires found expressions in the promotion and Protection of Human Rights: the 1945 UN Charter and the 1948 Universal Declaration of Human Rights. These two founding documents were soon followed by a series of other more legally binding human rights instruments, most notably the International Covenant on Civil and Political Rights and the International Covenant on Economic, Social and Cultural Rights, both of which were enacted in 1966. Together, these instruments and those that followed them have created an international legal system for the promotion and protection of human rights, which comprises three sets, categories or generation of human rights.

The first set of rights includes civil and political rights, which uphold the sanctity of the individual before the law and guarantee his or her ability to participate freely in the political system. The second set of rights includes, social, economic and cultural rights, which include the right to a family, education, health, work and wellbeing. The third set of rights comprises what are usually called solidarity rights, which include rights to public goods such as development and the environment. This collection of rights seeks to guarantee that all individuals and groups have the right to share in the benefits of the earth's natural resources, as well as those goods and products that are made through processes of economic growth, expansion and innovation like (renewable energy). Many of these rights are transnational in that they make claims against rich nations to redistribute wealth to poor nations, cancel or reduce international debt obligations, reduce environmental degradation and help promote policies of sustainable development.

Of the three sets of rights, this final set is the newest and most progressive, and reflects a certain reaction against the worst effects of globalization, as well as the relative effectiveness of 'green' political ideology and social mobilization around concerns for the health of the planet. In light of these important developments, the

world at the turn of the 21st century has an international legal system in place that seeks to promote and protect a very broad range of individual and collective rights.[5]

Sustainability Dynamic - Graham Woodgate examines the concept of sustainable livelihoods within the context of small agricultural producers of highland Mexico. He explores what he calls the 'sustainability dynamic' which locate peasant farmers within both a process of economic accumulation and ecological degradation and presses on them from both sides. He concludes that 'co-evolutionary' development is the only development which can succeed in combating environmental degradation, while preserving the cultures themselves, dynamic and evolutionary in which local knowledge is enclosed.

Conventional development thinking in Latin America and specially Brazil in particular has burdened the continent with a set of problem and policies which do little to address the pressing needs of the poor, for whom the environment like the great Amazon Forest has always been of paramount importance. The bankruptcy of the existing development model has rarely been seriously challenged in Latin America. The purpose of this research is to take the debate forward into the next decade and to begin to explore the implications and the ambivalence towards sustainability from the perspective of different groups, policy makers, environmental activists, the urban and rural poor.

Future oil prices are very difficult to foresee. There is a possibility that oil demand will not increase, even with the maintenance of low prices prevailing during the first half of the 1990, as a consequence of risks associated with the growing accumulation of carbon dioxide in the atmosphere (Goldemberg et al., 1988). Other authors (Sopral, 1988) believe that demand will increase as a natural response to low prices, mainly in Third world countries, where more energy will be required and the form of energy will be mainly determined by its price.

In Brazil, several experiments with the use of straight or neat ethanol as a fuel for Otto engines have been done since the 1920s. Early investigations by E.

[5] Foweraker Joe, Todd Landman and Neil Harvey., *Governing Latin America,* (Oxford: Blackwell Publishing Ltd, 2003), p. 83.

Sabino de Oliveira, L.B. Siciliano and H.S. Mattos deserve special attention. In the 1920s, several public demonstrations with straight ethanol cars were carried out by the predecessor of the National Institute of Technology (INT) of the Ministry of Industry and Commerce (MIC). Several commercial formulations for alcohol fuels were used at that time, such as the so-called USGA and AZULINA containing ethanol and ether, and thousands of engines were converted for use of alcohol fuels. After 1975, when the ProAlcool was launched and larger amounts of ethanol became available, interest in straight ethanol engines increased. (The Brazilian Air Force Technical Centre) conducted investigations with several Otto engines fuelled with straight ethanol representing most of currently manufactured engines in Brazil. Several experiments with both methanol are now underway in the automotive industry and research institutes include the following approaches: fumigation technique, engine conversion to Otto cycle, fuel additives to increase cetane number, individual and simultaneous direct injection of alcohol-diesel oil and alcohol (methanol) dissociation.

1.5. RESEARCH METHODOLOGY

The research is multidisciplinary in nature and a product of multiple data sources, and would be basically culmination of both primary as well as secondary forms of data. Secondary Resources/Sources - refer to the available critical analysis through scholarly journals and books. Since the study includes political and environmental points of reference, journals and books both in print as also e-resources available in the relevant fields of study will form the basic premise. These will also include books written in the aftermath of the events such the International World Conferences on Environment and Energy, IPCC, Climate Change. Later and recent works in this regard are used as secondary resources were required to emphasize points made earlier or to provide access to areas hitherto ignored.

These include, Survey Report, TERI Reports, Publications, Research papers, Energy Survey Reports, Data published by Govt. of India and Govt. of Brazil, International Magazines., Published and Unpublished data, Miscellaneous sources like records, internet-based sources, newspaper, magazines. The newspaper would be an important source of current issues related to energy and environment.

The research design and methodology has been finalized keeping in view the major objectives and scope of the study. The research design consists of an initial desk research followed by collection of secondary data and field visit to important centers of energy generation. The data collected is tabulated and analysed by using various statistical techniques. Wherever necessary the data is represented with the help of suitable cartographic techniques like line graphs, pie-charts and bar graphs. Location maps of India and Brazil were prepared with the help of ArcGIS 10.10 / QGIS 3.14.0 software, satellite images and Google Earth.

1.6. HYPOTHESIS

1. Environmental Constraints and challenges can be overcome by the use of Energy.

2. Quality of life, material welfare, health, employment and income are all demonstrably affected by energy availability and cost.

3. Higher the Energy input higher is the rate of Development.

4. A minor oil supply imbalance can destabilize every aspect of a nation's lifestyle.

5. The point of supply of Energy provided by nature and the point of demand created by man have never matched. They are creating an imbalance or Energy Insecurity conditions.

As an economy enters into the phase of capital goods manufacturing heavy industries, its energy requirements greatly increase in comparison with the pace of growth of the national product. At the other extreme, the hypothesis that increasing amounts of energy input automatically led to higher rates of development do not hold good in perpetuity. Beyond a certain limit, as production and infrastructural efficiencies increase and as the relative product-mix of the economy shift from an emphasis on basic industry to one on electronics, food and other intricate though light industries, the country actually consumes less energy per unit of Gross National Product.

1.7 CHAPTERIZATION

The entire thesis is organized into five chapters to provide an even and logical flow of ideas and concepts related to India and Brazil's environment and energy security issues.

The first chapter is 'Introductory chapter', that envisages the concept and the dynamics of Energy, Environment. Followed by definitions, review of literature undertaken, the research methodology used, Hypothesis, detail chapterization and the preface. The conceptual aspects of environment have been discussed, highlighting the changing perception of development, and the different models of development. Various environmental management strategies are discussed with reference to the changing paradigms of sustainable development and environment. The chapter ends with a debate on what is important – 'Preservation or Development', thus paving the way for sustainable development to enter as the only reliable and relevant key to the solution.

The secondchapter includes the detail discussion on various connotations on environmental and energy aspects, meaning and definitions of Sustainable Development, Energy Security and Climate Change. It gives a brief outline of the sustainable development and its various Environmental Conferences held right from 1972 in Stockholm, Nairobi, Rio de Janerio, Johannesburg and subsequently at Rio once again. It also highlights that during the last two decades that followed, whatever transpired is going to pave its way for the next UN Summit in 2022 to be held in UK Scotland, which may solely count on the impeding impact of climate change on the mankind. One of the most important highlights of this Summit is going to be the Paris Agreement of 2015 and its implementation. The chapter ends with retrospect and prospects of the Summit and the North-South divide it created.

The third chapter exclusively accentuate the environment-energy development of rules and regulations from the early period (1972) to the most recent status of Brazil. It rationalize the Environmental and Political view, the initiatives undertaken by Brazil Government, its environmental programmes summed up with the recent initiatives on Environment, Energy and Sustainable Development. It establishes the connection between Latin America disparate development vis-à-vis Brazil's role after the Rio Summit. It also highlights Brazil's present environmental scenario and the

Brazilian government's initiatives with a critical overview of the various energy scenarios in Brazil and the huge success of the Ethanol fuel program of Brazil in the field of renewable energy. It also gives a critical update on the various agreement where Brazil is a signatory like the IBSA formation, the Copenhagen and Kyoto Protocol, BRICS and the Paris Agreement and its implementation by Brazil.

Thefourth chapter focuses on the efforts and undertakings initiated by India in the arena of Environment and Energy with close reference to sustainability and Climate Change and its role in the international arena. It throws light on the slow and steady progress made by India in the field of environment since 1972 and the response of the Indian Constitution keeping in mind environment and sustainable development. Internationalization of environment and energy issues in India and its key responses to IBSA, Copenhagen, Kyoto Protocol, BRICS and the Paris Agreement are dealt upon. The chapter also gives an update on the various environmental laws and legislations passed by India in response to the Summits adherence.

The fifth chapter gives a detail comparative analysis at the Local, Regional and International level. The analysis includes both the countries under appraisal namely India and Brazil. The chapter discusses in detail the various initiatives undertaken by Brazil at the local, national and international level in response to the environment and energy security issues. The second section of this chapter highlights the efforts India has roped in to combat environment related climate change challenges and the various strides India has taken in the field of energy at the local, national and international level.

The sixth chapter sums up with the final conclusion and summary of the research findings followed by a detail Bibliography.

1.8. Importance of the Study

This thesis is dedicated to the eight billion people who inhabit the planet earth. As mankind celebrates the World Environment Day on 5th of June every year, the theme "Eight billion dreams, One planet, Consume with care" gains colossal relevance. Our economic prosperity and wellbeing are dependent on how well we meet our future demand of energy and at the same time preserve our environment. 'Solar power,

Wind power, the way forward is to collaborate with nature - it's the only way we are going to get to the other end of the 21st century.

This study is shaped by the dramatic shifts that have taken place in the recent geopolitics and energy scenario of the world. Geopolitics focuses on the shifting balance and rising tensions among nations due to energy and environment related issues. Energy reflects far-reaching alterations in global supply and flows, driven in major part by the remarkable change in the energy position of oil producing countries and by the growing global role of renewables and the new *politics of Climate*. For more than a century, Energy - its availability, access and flows, has been intertwined with security and geopolitics. In the modern era, no other commodity has played such a pivot role in driving political and economic turmoil other than energy. This thesis has focused on how the momentum of climate polices - powered by research and observation, by climate models, and by political mobilization and regulatory power, social activism, financial institutions, and deepening anxiety- has transform the energy system.

Today climate concerns are reshaping the Energy Map and Energy transition from fossil fuels to renewables. Energy remains a globally-interconnected industry and the consequences of its impacts are still only part of the overall nexus of relation among nations on the environment. The world is being shaken by the collision of Energy, Climate Change and the clashing power of nations in a time of global crisis. World politics is now being upended, as a new cold war developed between United States, China, Ukraine and Russia. On the other side Middle East has been stunned by the two recent oil price collapses- and by the very question of oil's future for the rest of this century with E-energy making a gigantic revolution in countries like India and Brazil.

In the 20th century, oil supplemented by natural gas, toppled King Coal from his throne as the power source for the industrial world and pollution. Oil also became the basis of the great post-war suburbanization movement that transformed both the contemporary landscape and our modern way of life. In the 21st century, we became so dependent on oil, and oil was so embedded in our daily doings, that we hardly stopped to comprehend its pervasive significance. It was oil (energy) that made possible where we live, how we live, how we commute to work, how we travel. Oil

and natural gas were the essential components for fertilizers and agriculture depended on it, and making possible to transport food to the totally non-self-sufficient megacities of the world. And with more and more of the world's people demanding the 'right' to benefits of energy use, the stage was been set for a great balancing between, environmental protection and reduction of carbon and on the other hand, economic growth, the benefits of hydrocarbon society, and energy security.

The thesis is a chronicle of epic events that have touched all our lives from the time the first UN Conference of Stockholm was held in Sweden in 1972 till today, a half century down the lane. This is a chronicle of individual countries like India and Brazil, their powerful economic forces, technological changes, political struggles, international conflicts and indeed epic changes in their respective homelands. It is the researcher's hope that this narration of the economic, social, political and strategic consequences of our only world's reliance on energy and its consequences on the environment will illuminate the past, enable us better to understand the present and help to anticipate the future.

Whatever the twists and turns in global politics, whatever the ebb of imperial power and the flow of national pride, one trend in the decades following the World war II progressed in a straight and rapidly ascending line was the consumption of oil. If it can be said in the abstract, that the sun energized the planet, but today it is oil that powered its human population. Total world energy consumption more than tripled between 1949 and 1972. This research begins from there on. At this time another significant shift was taking place in the industrial countries. Man's view of the environment and his relationship to it was also changing, with the paradoxical effect of both increasing the demand for oil and regulating its use. Beginning in the mid-1960s, environmental issues began to compete successfully for their place in the political process.

Nothing else so much reflected the new environmental consciousness as the extraordinary wide and intense public response to the first UN Summit on Human Environment held in Stockholm in Sweden in 1972. If population, industrialization, pollution, food production, energy consumption and resource depletion (Oil and Natural gas) – continued unabated, that would make contemporary industrial civilization unsustainable and the limits to growth on this planet will be reached

sometime within the next hundred years. The conference had warned not only of resource depletion, but also of the environmental consequences of hydrocarbon burning, and the build-up of carbon dioxide in the atmosphere – Ozone hole which was a new concern about the present-day global warming. Because ours is a civilization that has been transformed by the modern and mesmerizing alchemy of petroleum.

Presently, the Middle East the sizzling seat of oil has been shaped, of course, not only by the Maps of Frontiers but by different kinds of maps - of Geology, of oil and gas wells, of pipelines and tanker routes. The revenues from oil and gas, riches and power that flow from them, remain central to the identity of the region. Yet the oil price collapse that began in 2014 has fed into a new debate about the future of oil. Not much more than a decade ago, the world worried about '*peak oil'*, the idea that oil supplies would run out (discussed in my 2nd chapter). The focus has shifted today to '*peak demand'*, i.e. how long consumption of oil will continue to grow and when it will begin to decline. The demand collapse for oil in 2020 (COVID19), has further fuelled the urgency for oil exporters to diversify and modernize their economies.

If there is one major factor leading to the idea that *demand not supply*, is the future constraint, it is related to the confluence of Climate policies and technology. The one market that seemed to be guaranteed for oil for a very long time was Transportation and specifically, the automobile. Now - no longer, not on the 'Roadmap' to the future. For oil now faces a sudden challenge from the 'New Triad'; the electric car, which uses no oil; 'mobility as a service', ride-hailing and ride-sharing, carpooling and cars that drive themselves. The result is a contest for dominance in a new trillion-dollar industry the 'Auto-Tech'.

According to the IPCC's 4th Report in 2007, it was stark clear that humanity was responsible for Climate Change and global warming went hand in glove with the Energy Transition. The 5th IPCC Report in 2014 put to rest the doubt that human influence on the Climate system is clear and emissions of GHG were the highest in history. This had set the stage for the Paris 2015 November COP21, which gave a whole new importance to Energy Transition. How fast the world or global economy must change and adjust to a changing climate and at what costs, is unlikely to be resolved in this decade. But the endeavour will take on greater urgency as public

opinion becomes more aroused and new policies seek to implement 'Net Zero Carbon'. All this take us to the '*Golden Revolution'* on '*Energy Transition'*, the shift from the world of today, which depended on oil, natural gas and coal for more than 80 percent of its energy- just as it did 30 years ago- to a world that increasingly operates on renewables. The Paris Agreement of 2015 has galvanized the march toward a lower carbon future. In deed in terms of energy and climate, there are two distinct eras. 'Before Paris' and 'After Paris'. Yet, while energy transition has become a pervasive theme all around the world, disagreement rages, both within countries and among them, on the nature of the transition, how it unfolds, how long it takes and who pays. 'Energy Transition" certainly means something very different to developing countries such as India and Brazil, where even today hundreds of millions of impoverished people do not have access to commercial energy.

Energy Transition is not a new concept for mankind. In ancient time, energy transition was primarily been driven by the need for technology, economics, environmental considerations, convenience and ease. Today Energy transition is accelerated by politics, policy and environmental activism. The first energy transition began in Great Britain in the 13th century with the shift from wood to coal, then came James Watt's much-improved Steam Engine in 1776 till the 1900, where coal supplied half of the world's energy demand. This was followed by the discovery of Oil in North-West Pennsylvania in1859 up to 1960's era to surpass coal as the world's number one energy source followed by natural gas dominating from 2000 onwards and now solar energy in a big way in 2020.

In India, where a billion people lack access to electricity; three billion do not have access to clean cooking fuels. The WTO calls these as the 'forgotten 3 billion'- who are subject to indoor air pollution caused by this poor fuels. India, with almost 20 percent of the world's population is by itself a case study for the challenges faced by a developing world. It shows how different the meaning of 'energy transition' is for a developing country compared to that of developed country. For in a country in which almost 300 million live on the equivalent of $1.25 a day, poverty and economic growth cannot be separated from energy. India will have an energy transition in its own way. The energy issues India faces reflect, in a giant-sized way, those of many developing countries like Brazil too. One focus is to replace diesel with compressed natural gas as fuel for cars and light trucks, to help reduce urban pollution. Today

India and Brazil are becoming major players in the global LNG market and purchase. And with Climate Change in mind, the Modi government in India and Lula's government in Brazil has set out ambitious goals for renewables. What has to be understood is that, what the developed countries think about energy transition with reference to 'dirty energy' is actually in the developing world a clean energy which is needed for healthier and better living.

On the other hand, Energy Transition and Environment protection to circumvent climate change has been a core area of my study spanning over the last five decades (1972-2022). The recent decades have seen the increasing intensity of natural calamities in the world like forest fires, drought, torrential-once-in a century rainfall occurrence, coastal flooding, heat waves, cyclones, polar ice cap melting. This alarming trend has been responsible to motivate the *Energy Transition*. Inevitably, today imports mean Energy.Energy fuels the global manufacturing platform that is the 'workshop of the world'. Rising incomes mean more buildings, more infrastructure, more cars, more air travel and ever-more energy use. On the other hand, for countries like India, Brazil and other maritime border nations, *Energy Security* is unlikely to be like another Persian Gulf in terms of supply and that the most important contribution to energy security is the secure passage of tankers through its waters. Yet all of this is coming at a moment when the future of energy has become less clear- and subject to increasing dispute.

The collapse that began in 2014 of oil prices in the International Oil market, coincided with a new global debate about the future course of Petroleum demand, embodied in the phrase '*peak demand'*. The argument is whether consumption of oil will flatten out and decline sooner than had generally been anticipated, leaving oil reserves 'stranded' in the ground, without value. This debate has been hastened by Climate Change Policies and greater efficiency in transportation, and by the rebirth, after a century of dormancy, of a vehicle that does not need oil - *the Electric Car*. But today the Electric Vehicle (EV) has become an existential question for the global automobile industry, which is rushing to make sure it can ensure its future. Will the power that moves people still emanate from oil wells or will it be from electric power lines? The answer will affect how billions of people move around and will have a profound impact on geopolitics, on jobs, on national economies, on the global economy- and the vast flows of money within it. *Climate Policies*, more than

anything else are today providing the great motive force for the adoption of electric vehicles. The future belongs to electric drive. Without EVs, we can't win the battle against Climate Change. To rely less on oil imports, the goal of the Indian and Brazilian economy should be more diversified, more competitive, more entrepreneurial, more innovative, more high-tech and much more integrated into the global economy.

In India and Brazil, there is also great enthusiasm for greater electrification- but a strong Government policy is key to determining what happens. Now the new era of Uber cars in USA, UK, Lyft, carpooling, DiDi in China, Gett in Europe, Ola in India- ride hailing has become a very big industry. Ride hailing on a massive scale could disrupt the century-old model of selling and servicing cars that run on oil fuels for personal use. The traditional model would give way to a whole new business model and indeed way of life- 'Mobility as a Service' (MaaS). Instead of buying a car, keeping it in the garage, driving it to work, leaving it in a parking lot and altogether only using the car that 5 or 10 percent of the day- people would not own a car at all instead they may buy mobility as they need it.

At present Brazil has 46.2 million and India has 48 million cars as compared to China's 240 million despite similar size of population. But economic growth will raise incomes and finance new infrastructure, and India's massive cohort of young people will end up having a huge impact on the global auto and oil industries and emerging Electric Vehicles. As stated by Daniel Yergin in *The Commanding Heights*, a world of great power competition, the fragmenting of globalization and the rethinking of supply chains, geopolitics will become part of the new energy mix, as it continues to be in the current energy mix.

As discussed in my subsequent chapters about the prediction on Hubbert's '*peak oil'*- the 'end of oil'- was near and that the world would 'run out' of petroleum. Now the discussion has turned over to '*peak demand'*- that is when will oil consumption hit the high point and begin to decline. Since the first oil well drilled in 1859 by Colonel Drake, the world's demand for oil has steadily risen, though with occasional dips due to recessions, depressions and price spikes. There was an understanding that at some point global demand would stop increasing, but 'peak demand' was something that was considered to be far off into the future and the

reason was simple- rising population and rising incomes would continue to push up demand. But the greatest demand collapse happened in 2020, when the world economies were lockdown in a way that had never happened before.

The 2022 IPCC report reiterates that the impacts of Climate Change on a warming planet will be catastrophic. The fact is, not just our world but even the energy market is on a boil- fuel prices have skyrocketed even before the Russian-Ukraine war broke out on February 23rd 2022. The question that arises today is whether this hike in prices will accelerate the move to a greener, cleaner energy future? Or whether the governments will backtrack and re-invest in the still-reliable fossil fuel energy system? When Narendra Modi became the Prime Minister of India in (2014), he focused on energy as an essential engine for economic growth and hence convened the Urja Sangam, a National Energy Summit in New Delhi at which he laid out a series of principles to guide energy development- access, efficiency, sustainability, energy security and since then has added *Energy Justice.*

The main driver today is not Energy Security, as in past decades, but Climate and the mobilization around it, particularly among younger people. For India and Brazil, the drivers also include pollution and the dependence on oil and gas imports. At the same time, however, for these two countries- today the second and third largest energy consumers in the world- searing energy supplies, including oil and natural gas is essential for fuelling the economic growth they need to lift the incomes of their population and to reduce pollution.

Environment, Energy and Climate Change are meticulously inter-related to each other. Climate change today is also projected to be a 'poverty multiplier' through food insecurity, higher food prices, income losses, lost livelihood opportunities, adverse health impacts and population displacements. According to IPCC report, poverty is expected to increase with rise in global warming. A very sure remark 'poverty is the greatest polluter' made by late Prime Minister Mrs. Indira Gandhi in 1972 at Stockholm in Sweden for the first UN International Environmental Summit makes it clear that energy equality may bring about poverty reduction.

The ensuing chapter will bring to the fore the changing perception of Sustainable Development, with its direct relevance to environment energy and the UN Summits.

CHAPTER II: CHANGING PERCEPTION OF SUSTAINABLE DEVELOPMENT

The focus of this thesis is to analyses the challenges and opportunities for sustainability in relation to environment and energy development in the less economically developed regions of the world namely India and Brazil. Fundamentally, this is because it is here that the majority of the world's poor reside. This is not to suggest that sustainable development is mostly a problem for the economically poor people residing in India and Brazil. But I would state that, most or virtually all pollution, for example is a result of affluence and not poverty. Furthermore, the prospects of sustainable development in any one location as in the past is shaped by forces and decision-making which are often situated at great distances away such that it is impossible to consider the developing world in isolation from the wider global community. Developed nations have part taken of a larger share of the resources of the planet in comparison to the developing nations. The resultant outcome is, the ecological footprint is larger for these nations than the developing ones. This chapter will discuss sustainable development in four parts explicitly. First it will give connotation to the genesis, objectives and definitions, followed by the changing perception of sustainable development in modern times. Part three will discuss sustainable development in connection to the UN Summits and finally the energy linkages in context with development, power and the north-south divide.

The word sustainable cannot be defined without making a reference to the future generation. Any attempt to define the word sustainable today will amount to evaluating costs and benefits on behalf of the future generations and today we are in no way equipped to figure out what the perceptions of costs and benefits will be for future generations, particularly because we have absolutely no idea what kind of technology, they will have access to. Often, development processes are characterized by the loss or degradation of primary environmental resources. In many countries, 'development reversal' is being seen, for example, with rising proportions of people below basic poverty lines and falling life expectancies. The concern continues that, many of the patterns and processes of development will not be able to supply the

needs of the world's population into the future and will not deliver the higher standards of living to the rising number of people essential for the conservation of the environment.

Thus, the pursuit of sustainable development is now stated as a principal policy goal of many of the major institutions of the world including the United Nations, the World Bank and the World Trade Organization. This is confirmation of how understanding of the global challenge of sustainable development has moved on to encompass the complex interdependencies between environment, social and economic development. In addition, the context in which sustainable development is being sought in the 21st century is quite different from that of the 1990s. In particular, an increasingly globalised world has brought new challenges as well as opportunities for the environment and for development. Ensuring that processes of globalization operate to reach the needs of the poor rather than to marginalize particular groups and places further, is central to the challenge of sustainable development, and herein lies the common challenge.

In order to understand the characteristics of resources use or human conditions in the developing world to allow more sustainable patterns to be supported, it is essential to identify the underlying processes of change. Some of these processes may operate solely at a local level, whilst others may impact across many places and constitute global forces of change. To some degree and in a certain way this, combination shape the interactions between people and environment and the relationships between people in different places. It is for these reasons that sustainable development is a common challenge for the global community as a whole.[6]

Today, humanity stands at a defining moment in history. It is confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill-health and illiteracy, and the continuing deterioration of the ecosystems on which humans depend for their well-being. However, integration of environment and development concerns and greater attention to them has led to the fulfilment of basic needs, improved living standards for all, better protected and managed eco-systems, a safer and more prosperous future. No nation can achieve this on its own; but together

[6] Jennifer, A. Elliot., *An Introduction to Sustainable Development*, (Oxon, New York: Routledge, 2010).p.3.

it can be, in a global partnership for sustainable development. All these elements of the environment can be studied, thought about, and worked with individually, but this analytic approach is inadequate for the understanding of the total environment, and it leads to difficulties when one overlooks or neglect the consequences of single purpose actions. This is because the elements of the environment do not occur singly in nature or in culture, but in complex interacting systems.

Often, the phrase 'sustainable development' is interchangeably used with 'ecologically sustainable' or 'environmentally sound development' and sometimes, sustainable development is interpreted as 'sustained growth', 'sustained change' or simply 'successful development'. The essence of 'sustainable' seems to be 'to limit' development. Sustainable development encompasses the economic, environmental and social dimensions of the development processes, which are reflected in the UN definition of sustainability: "Development is a multi-dimensional undertaking to achieve a higher quality of life for all people. Economic development, social development and environmental protection are interdependent and mutually reinforcing components of sustainable development". Ultimately, sustainable development can be achieved through optimal use of natural resources on a sustainable basis and adoption of sound ecological policies. In an ecological sense, sustainable development calls for development patterns that maintain the natural capital stock and overall ecological integrity. A meaningful operational definition of sustainable development also considers three crucial issues namely, economic development, equity and the environment. In addition, security, peace and stability are vital for sustainable development. [7]

2.1. GENESIS AND OBJECTIVES OF SUSTAINABLE DEVELOPMENT

The 'internationalization' of environmental problems was first observed at the UNESCO Conference on the Biosphere, held in Paris in 1968, and at the conference on the Ecological Aspects of International Development, held in Washington, DC in the same year. It was, however the United Nations Conference on the Human Environment (UNCHE), held in Stockholm Sweden in 1972, which contributed most in this regard. The UNCHE attracted representatives from

[7] Ramaswamy.S. and G.Sathis Kumar., *Environmental Sustainability –Approaches and Policy Options*, (New Delhi, Regal publications, 2010), p.2.

approximately 119 countries and 400 NGOs, and resulted in two widely circulated documents: The Stockholm Declaration on the human environment, emphasizing 'integrated development' and 'rational planning' and the Action Plan for the Human Environment, highlighting policies aimed at reducing the costs of environmental protection. The Stockholm conference was the first to bring underlying conflicts between what were later to be termed the 'North' and the 'South' to the fore and played a major role in the subsequent establishment of the United Nations Environment Program (UNEP) in 1972.

The term "Sustainable Development' was born and developed in the World Conservation Strategy produced jointly in 1980 by the International Union for the Conservation of Nature and Natural Resources (IUCN), World Wildlife Fund (WWF) and the United Nations Environment Programme (UNEP) and planned 'to help advance the achievement of sustainable development through the conservation of living resources'. It declared that 'Conservation, like development, is for people'. Conservation includes conservation of animal and all plant species which are primarily for human use. Thus, sustainable development means the management of the biosphere (the earth's crust and atmosphere where living matter is found) for human needs and that is conservation's primary concern. Sustainable Development is said to encompass (a) help for the poor, because they are left with no options but to destroy their environment (b) the ideas of self-reliant development, within natural resource constraints (c) the idea of cost-effective development using non-traditional economic criteria (d) the issue of health care, appropriate technology, food, self-reliance, clean water and shelter for all and (e) the notion that people- centered initiatives are needed.

The concept of 'sustainable development' first emerged three decades ago from the popular report called 'Our Common Future'. Put together by the World Commission on Environment and Development in 1987. The report argued that boosting the economy, protecting natural resources and ensuring social justice are not conflicting but interwoven and complementary goals. A healthful environment, as the theory goes, provides the economy with essential natural resources. A thriving economy, in turn, allows society to invest in environmental protection and avoid injustices such as extreme poverty. And maintaining justice, by promoting freedom of opportunity and political participation, for example, ensures that natural resources are

well managed and economic gains allocated fairly. Civilizations that have ignored these connections have suffered. For example, the Eastern Islanders, who by denuding their forests triggered a spiral of economic difficulties and strife that eventually led to their civilization's collapse. Yet even as sustainable development has become conventional wisdom over the past 5 decades, something has gone extremely wrong. Because the concept stresses the interconnection of everything. Sustainable development was the compass that was designed to show the way for a just and viable economics, but today it swings in all directions. The only way to fix this chaos with sustainable development is to return to Brundtland fundamentals. Today, sustainable development must be viewed afresh, as a framework for every aspect of governance rather than as a special interest. It could be revived by following 4 courses of action as follows: making a priority of alleviating poverty, dropping the environmental bias that has hijacked the entire movement, favouring local decisions over global ambitions and tapping into new technologies to spur sustainable growth. [8]

First and foremost, fundamental progress on sustainable development requires more success with economic development, in particular poverty alleviations. The other two issues of sustainability namely, environmental protection and social justice, will lack force until basic living standards are improved in the developing countries. This seriousness about sustainable development requires redrawing the lines of sovereignty. Since sustainable development is a universal concept, then governments all over the world have a universal responsibility to promote it. At the same time, it is also necessary to challenge the environmental bias that has dominated the sustainable agenda with special reference to the dominance of the nations of the 'north' on the nations of the 'south' with reference to climate aid and technology transfer. From the outset of the Brundtland Commission's work, developing countries have rightly feared that the developed world's concern about the environment would over shadow their interest in development. Any serious effort at sustainable development will also need to harness the technologies that most affect economic growth and mediate the consequences of growth for the environment. Unfortunately, the sustainable development apparatus has been strikingly ineffective on technological matters. The only technological area in which governments have set specific goals is 'technology

[8] David. G. Victor., *Recovering Sustainable Development*, Vol. 85, No. 1, January-February, (Foreign Affairs, Council of Foreign Relations, 2006) p. 91.

transfer', the handing over of hardware to developing countries, a gesture often championed in UN talks but rarely witnessed in the field. Such goals are largely pointless anyway because most technologies spread through markets rather than transfers between governments.

Governments have found it particularly difficult to set credible policies for the development and application of technologies that have a long commercial life. The problem is especially acute for investors in energy infrastructures who are contemplating new technologies that might help address the problem of climate change. Local needs and interests will vary, therefore the need arises to redefine sustainable development repeatedly, from the bottom up, wherever it is to be put into practice. Sustainable development has worldwide relevance and appeal, but only if it's original purpose of helping the poor live better, healthier and fairer lives on their own terms is restored.

The objectives of Sustainable Development identified by the WCED (World Commission on Environment and Development) were as follows: a) reviving growth b) changing the quantity of growth c) meeting essential needs for jobs, food, energy, water and sanitation d) ensuring a sustainable level of population e) conserving and enhancing the resource base f) reorienting technology and managing risk g) merging environment and economics in decision making h) reorienting international economic relations and i) making development more participatory.

Subsequently, the major broad goals of sustainable development included (i) a demographic transition to a stable world population of low birth rate and death rate (ii) an energy transition to high efficiency in production and use, coupled with increasing reliance on renewable resources (iii) a resource transition to reliance on nature's 'income' without depletion of its capital (iv) an economic transition to sustainable development and a broader sharing of the benefits of development (v) a political transition to global negotiations grounded in complementary interests between North and South, East and West and (vi) an ethical or spiritual transition to attitudes that do not separate us from nature or each other. Thus, sustainable

development encompassed the economic, environmental and social dimensions of the development processes, which were reflected in the UN definition of sustainability.[9]

The common man views sustainable development as a mechanism through which the community should enjoy the benefits of environmental resources, which perform different functions such as production function, carrier function, regulatory function and information function. It means that the present utilization pattern of environmental resources should not reduce the future availability of environmental resources for future generation. Further, the common perceptions is that community or society in future should not suffer from environmental pollution and scarcity of natural resources. Some major suggestions in this connection are: consult with the villagers, farmers and other participants, plan small scale and flexible projects, let the people benefiting from the project make the decisions, look for solutions that can be duplicated, provide education and training, particularly for young people and women, keep external inputs to a minimum, build on what people are doing right, access impacts of proposed changes, consider both inputs and outcomes, and maintain or improve the participants standard of living.

The starting point for the concept of sustainable development was the aim to integrate environmental considerations into economic policy. More profoundly, it was conceived as an attempt to bring environmentalist ideas into the central area of policy, which in the modern world is economics. The concept of sustainable development carefully balances environmental concern with endorsement of economic growth, at least in the 'South'. It was deliberately conceived as being something more palatable than the hard-line environmentalist message. Rather than challenging the idea of growth directly, it sought to modify the kind of growth strategies that were pursued. Therefore, 'Sustainable development' is a meeting point for environmentalists and developers. The environmentalist scientist Tim O'Riordan argued in his 1988 essay 'The Politics of Sustainability' which states that the reason for the popularity of the term sustainable development lay in the way that it could be used both by environmentalists, emphasizing the sustainable part, and by developers, emphasizing

[9] Definition: Sustainable development is a multi-dimensional undertaking to achieve a higher quality of life for all people. Economic development, social development and environmental protection are interdependent and mutually reinforcing components of sustainable development'.

the development part. Hence, sustainable development as a term gives priority to development, while the idea of sustainability is primarily about the environment.

2.2. DEFINITIONS OF SUSTAINABLE DEVELOPMENT

The World Commission on Environment and Development (WCED, 1987) defined sustainable development as 'a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional changes are made consistent with future as well as present needs'. The notion 'sustainable development' was conceived from an understanding that both economic development and environment problems arose from the same cause, namely, the excessive consumption of our planet's natural resources. The emergence of this concept is a manifestation of the realization that nature has limits to its endurance capacity and that greater attention has to be paid to the future implications of present economic policies.

In 1987, The World Conference on Environment and Development published their report entitled "Our Common Future" (WCED 1987), often known as the 'Brundtland Report', after its chair, the then Prime Minister of Norway, GroHarlem Brundtland. The report used the term 'sustainable development' widely and defined it as 'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. The report is said to have put sustainable development firmly into the political arena of international development thinking. Other definitions include, (Turner 1988) 'in principle, such as optimal (sustainable growth) policy would seek to maintain an "acceptable' rate of growth in per capita real income without depleting the national capital assets stock or the natural environment asset stock'. Literally, therefore sustainable development ultimately refers to maintaining development over time.[10]

It is interesting that the concept of sustainable development has emerged from those countries which themselves practice unsustainable resource use. While it is true that the present growth trends cannot be sustained for long, the concept does not articulate a well-defined strategy for action. It thus remains an accepted philosophical

[10] H.D.Kumar., *Energy and Natural Resources- Sustainability and Management*, (New Delhi, Vitasta Publishing Pvt Ltd. 2008), P.25.

approach but in a vacuum. There is a close association between sustaining world capitalism and sustainable development approach. Sustainable development is visualized as a solution to make available raw materials on a continuous basis so that the production system, the expanding market and the political system are not threatened. The raw materials in the developing countries need to be protected and their population growth curtailed so that resources would remain easily available. Bringing the notion of population growth and carrying capacity into our own national environmental strategy is tantamount to what the 'north' would consider a 'safe' approach to sustainable development with the obvious interest of watering down their own considerable responsibilities within a world context. In other words, the politics of sustainable development is that, at present it is anti-south, anti-poor and thereby anti-ecological.[11]

In 1992, the United Nations Conference on Environment and Development, also known as the 'Earth Summit' took place in Rio de Janeiro, Brazil. At the time, it was the largest ever International conference held, with over 170 government represented and a further 2,500 NGOs and 8,000 accredited journalists attending it. The central aim was to identify the principles of an agenda for action towards sustainable development in the future. However, it was evident through the decade of the 1990s, that there was substantial debate and contestation concerning the meaning and practice of sustainable development. For example, whilst the primary output of the Rio conference, the huge 'Agenda 21' document, carried much political authority and moral force, important tensions were evident through the proceedings at Rio such as between the environmental concerns of rich and poor countries, between those who wished to exploit resources and those who wished to conserve them and between the development needs of current generations and those of the future.[12]

In 2002, 104 heads of state once again met in Johannesburg, South Africa, for the World Summit on Sustainable Development (WSSD). The global challenge of sustainability was now understood to lie in the complex interdependencies of

[11] Nayar.K.R., *Politics of Sustainable Development*, Economic and Political Weekly, Vol.29, No. 22, May, (Economic and political weekly. 1994),P. 1327-1329.

[12] H.D.Kumar., *Energy and Natural Resources- Sustainability and Management*, (New Delhi, Vitasta publishing Pvt Ltd, 2008) .p.8.

environmental, social and economic development. Hence, some critical objectives and necessary conditions for sustainable development were identified by the World Commission on Environment and Development which includes as follows: Critical objectives like reviving growth and meeting essential needs for jobs, food, energy, water and sanitation. Besides ensuring a sustainable level of population, conserving, enhancing the resource base, along with reorienting technology, managing risk, merging environment and economics in decision making.

In the intervening period the Intergovernmental Panel for Climate Change was established in 1988. Following the footsteps eight Millennium Development Goals (MDGs) were framed by 189 participating countries namely 1. Eradication of extreme poverty and hunger 2. Achieve universal primary education 3. Promote gender equality and empower women 4. Reduce child mortality 5. Improve maternal health 6. Combat HIV/AIDS, Malaria and other diseases 7. Ensure environmental sustainability and 8. Develop a global partnership for development.

Subsequently, in September 2015, the UN adopted the 17 Sustainable Development Goals (SDGs) namely- 1. Elimination of poverty 2. Zero hunger 3. Good health and well-being 4. Quality education 5. Gender equality 6. Clean water and sanitation 7. Affordable and clean energy 8. Decent work and economic growth 9. Industry, innovation and infrastructure 10. Reduced inequalities 11. Sustainable cities and communities 12. Responsible consumption and production 13. Climate action 14. Conserve and sustainably use the oceans, sea and marine resources 15. Conserve life on land 16. Peace, justice and strong institutions 17. Partnerships for the goals. [13]

2.3. CHANGING PERCEPTIONS OF SUSTAINABLE DEVELOPMENT

Development is often discussed in relation to 'developing countries', but is a concept which relates to all parts of the world at every level, from the individual to global transformation. During the 1970s development thinking was influenced, strongly by the writings of scholars within the developing world itself, particularly from Latin America and the Caribbean (notably those regions most strongly linked to the United States). Through the 1970s, what became known as the radical or

[13] https://www.worldbank.org.mdgs accessed on 7th February 2022.

'Dependency' school of thought became dominant in development. This school is perhaps most closely associated with the work of Andre Gunder Frank (1967), who carried out much research in Central and Latin America. Finally, it was the report from the Commission in 1987 'Our Common Future' which gave the idea international prominence. Development concerns since then had been at the heart of the UN agenda from the onset of decolonization during the 1940s and 1950s, and environmental problems had come seriously into focus during the 1960s and 1970s. But it was not until the appearance of 'Our Common Future' (also known as the 'Brundtland Report'), that a conscious effort was made to conceptually link and morally bind environment and development.

By the time of the UN conference on the human Environment in 1972, the environmental movement had 'come of age' and environment issues were clearly on the international political agenda, as evidenced by the participation in Stockholm of 113 countries. Whilst the Stockholm meeting is often identified as the key event in the emergence of sustainable development, 'it was only partly and belatedly concerned with the environmental and developmental problems of the emerging Third world'. The primary impetus for the Conference had been the developed world's concerns about the effects of industrialization. Perhaps the most significant outcome of the Stockholm Conference was the creation of the United Nations Environment Programme (UNEP) in the following year. Some changing perceptions are discussed in the following section.

COMMON AGENDA

Coming just after the end of the cold war, the 1992 United Nations Summit on Environment and Development, in Rio de Janeiro, seemed to mark the beginning of a new era in global environmental politics. Most of the world's Prime Ministers and Presidents journeyed to the Earth Summit. The Rio meeting and surrounding sessions produced the ambitious 'Agenda 21' plan for sustainable development in the 21st century and it spawned a number of agreements that accelerated the development of global environmental law, including measures that ultimately led to the Kyoto Protocol on climate change and to the Cartagena Protocol on Biosafety, which governs trade in genetically modified organisms. The central concept introduced by

the Brundtland Commission was that of 'sustainable development'. The report wrote: sustainable development seeks to meet the needs and aspirations of the present generation without compromising the ability to meet those of the future. Far from requiring the cessation of economic growth, it recognizes that the problems of poverty and underdevelopment cannot be solved unless we have a new era of growth in which developing countries play a large role and reap large benefits. During the final years of the decade, another Commission was formed, the 'South Commission' chaired by the former President of Tanzania, Julius Nyerere, and it dealt with the situation of developing nations and in particular with the possibilities and needs of strengthening South-South cooperation. It presented its report, 'The Challenge to the South' in 1990. There is one basic common denomination in the thinking of all the four independent commissions and that is, there is no nation which can resolve its own problems without relying on others. The commissions spelled out the interdependence. They emphasized that nations must work together to be able to live in one world, to reach a common security, to have a common future.

THE GREEN FATIGUE

Ten years later in 2002, at the UN's World Summit on Sustainable Development in Johannesburg, the mood was palpably different. The excitement and optimism of Rio were long gone. Attendance was down and many government leaders were more inclined to back away from previously agreed upon goals and programs than to embrace new ones. There were no treaty signings or ambitious new agendas. The Johannesburg summit produced vague joint declarations and according to Green Peace an 'action plan' for the implementation of international commitments that lacked both a plan and action.[14] Long before the delegates gathered in South Africa in 2002, several cruel realities had combined to deflate the hopes and promises of Rio. The continuing degradation of the global environment, the growth of economic inequality and the decreasing availability of foreign-aid dollars. After 2001, terrorism had also begun to divert attention and resources away from environmental and social programs. At the same time, many people who had been involved in such endeavours came to see the treaties, declarations and freshly inked international laws as too circumscribed and too weak to tackle enormous problems. While it would be

[14] Van Deveer.D., Green Fatigue, The Wilson Quarterly, Vol.27. No.4 (Autumn 2003) pp.55-59.

wrong to say that the environmental community has turned away from international law, it's certainly true that the past few decades have encouraged it to look toward other means of achieving its goals. Thus, a sort of green fatigue was setting in globally among the nations.

Since the 1972 UN Conference on the Human Environment, in Stockholm, the number of environmental treaties, summit meetings and joint declarations by national leaders has increased dramatically. Some 500 regional and global treaties have been signed, dealing with such issues as pollution in shared rivers, lakes and seas, wetlands protection, fisheries management, transnational air pollution, desertification and trade in endangered species and hazardous wastes. Despite all the disappointments, there have been many successes in the past 50 years. Given the tremendous diversity of interest around the world, the fact that agreements have been achieved on so many treaties are in itself an accomplishment. Besides this there's been a big increase in cooperative research in many fields. The US administration under George W. Bush for example, had rejected both the Kyoto protocol and any serious domestic policy proposal to slow down, much less reduce, the rate of U.S. emissions of carbon dioxide and other climate change gases. If common citizens do not demand strong environmental policy from their own governments, no amount of treaties and summits will serve the planet. And then the polluting 'north' will move away without any penalties towards environmental consequences.

The UN conference contained so many explosive ingredients. A major confrontation loomed between the have and have-not nations over the responsibility and cost of preserving the global environment.[15] However, there was little discussion on one of the world's most critical problem, the supply of energy. The population crisis was dealt with only tangentially. India was distressed and Brazil was delighted that population was not on the formal agenda. Despite these depressing negatives, Stockholm was a plus, even an inspiring plus. There had to be an international beginning in confronting the damage man was doing to the only known habitable planet in the solar system, and Stockholm was it. Perhaps its most important achievement was the declaration that nations must assume responsibility for pollution

[15] Edward.P.Morgan., *Stockholm:The clean (but impossible) Dream*, Foreign policy, No. 8 (Autumn), (Washington Post, Newsweek Interactive, LLC,1972), pp. 149-155,

damaging other states. Maurice Strong saw this as the beginning of international law, which would, in effect, stop pollution travelling from one country to another as an 'invasion', and making the offender guilty of aggression. And possibly most significant in the long range, a spirit was developed at Stockholm in which the rich nations and poor alike came to terms regarding the magnitude and complexities of the problem as never before, and to get on with finding and providing solutions.

These institutional developments were reinforced by a series of widely publicized environment disasters- such as the toxic calamity in India known as the Bhopal gas tragedy, the Chernobyl nuclear accident in Ukraine and the Exxon Valdez Oil spill in Canada- along with a rapidly growing interest in more general ecological problems, such as global warming, the rise in sea-levels, deforestation, water pollution, soil erosion, ozone hole, international dispersion of toxic wastes, the decline in plant and animal species leading to extinction and the depletion of non-renewable resources, particularly oil and gas.

2.4. SUSTAINABLE DEVELOPMENT AND THE UN SUMMITS

The Stockholm Conference of 1972 was a milestone for international environmentalism. Environmental NGOs gathered in unprecedented number and they reflected the pervasiveness of 'North-South' division wherein southern NGOs accounted for only about 10 percent of those participating. The second international conference on environment and development (UNCED) also known as the 'Earth Summit' held at Rio de Janeiro, Brazil in 1992, focused the world attention on the idea that social, environmental and economic needs must be met in balance with each other for sustainable outcomes in the long run. It made significant progress towards defining a sustainable development agenda for the next century in the form of Agenda 21 and the 2 conventions on climate change and biodiversity. There were 6 main areas of international agreement namely, 1. Two framework Conventions a) The Convention on Climate change and b) The Convention on Biological Diversity, Statement of Forest Principles 3. Agenda 21 4. Rio Declaration 5. Sustainable Development Commission and 6. Finance.

There were three important Principles of the Rio Declaration[16] The developing countries deterioration in their terms of trade and rising debt levels have led them to over exploit their natural resource base and thereby degrade their natural environments. The environmental agenda adopted at UNCED presents the United States with significant opportunities to expand further its exports to developing countries. The United States is a world leader in many environmental technologies-energy-efficient lighting, clean coal combustion, water treatment, agricultural bio-technologies, for which there is a growing demand throughout the world. [17]

Hence this thesis addresses the nexus among development, energy security and climate change. Clean energy is at the center of the environment development nexus. Energy as an engine for development is at the heart of many development strategies, as was confirmed by the World Summit on Sustainable development. If one takes the objective of the United Nations Framework Convention on Climate Change seriously, the world should be heading towards a carbon constrained energy economy. However, the theses clearly indicate that we aren't there yet. The legal instruments like environmental impact assessment at the project or policy level seem to be largely developed through environmental legislation. The key lied in applying environmental legislation and soft law to the energy sector too.

The implementation of the Kyoto Protocol shed further light on evolving practices, which needed careful analysis. The market-based instruments like international emissions trading and the project based Clean Development Mechanism (CDM) were unprecedented in international agreements. If they went hand in hand

[16] Principle 1- The special situation and needs of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority. International actions in the fields of environment and development shall also address the interests and needs of all countries.

Principle 2-To achieve sustainable development and a higher quality of life for all people, states should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.

Principle 3-States should co-operate to strengthen endogenous capacity building for sustainable development by improving scientific understanding through exchanges of scientific and technological knowledge and by enhancing the development, adaptation, diffusion and transfer of technologies, including new innovative technologies.

[17] Mann Howard., *The Rio Declaration. Proceedings of the Annual Meeting*, Vol. 86, April, (American society of International law,1992) pp, 411.

with the abolition of environmentally harmful subsidies, major strides could have been made towards an environmentally sustainable energy future. Greater energy efficiency is the key for shifting a country's development paths toward lower-carbon economic growth. Especially in developing countries like India and transition economies like Brazil, vast potential for energy savings opportunities remains unrealized even though current financial returns were strong. Tapping more aggressively into the wealth of available, financially attractive energy saving renovation projects required mechanisms to develop and deliver large numbers of relatively small projects scattered among hundreds of thousands of industries and building complexes.[18] In the world as a whole, but especially in these rapidly growing developing countries, efficiency improvements to generate more economic output with less energy input was essential for reasons of energy supply security, economic competitiveness, improvement in livelihoods and environmental sustainability. Improving the efficiency of energy use is a leading option to gain better energy security, improve industry profitability and competitiveness and reduce the overall energy sector impacts on climate change. In the years since 1972, we have continued to apply our power wrongly, inflicting much damage on ourselves and on the environment.[19] Therefore, Sustainable development is more than environmental action. The principles in relation to sustainable development that are particularly relevant to the delivery of environmental health services are as follows.[20]

2.5. SUSTAINABLE DEVELOPMENT AND ENERGY LINKAGES

[18] Bradbrook J. Adrian and Richard L. Ottinger., *'Energy Law and Sustainable Development',* IUCN environmental Law Program, (The World Conservation Union IUCN, Gland, Switzerland and Cambridge, UK.2003) http://books.google.com/books ISBN =2831707269 accessed on 7th December 2016.

[19] Mostafa.K.Tolba., *Towards a Sustainable Development*, Ambio, Vol.24, No. 1, February, (Springer, Royal Swedish academy of sciences.1995) p.66.

[20] 1.Human beings are at the center of concern for sustainable development.
2. To achieve sustainable development. Environmental protection must remain as integral part of the development process.
3. Equity in the delivery of services is an essential part of sustainable development.
4. Environmental issues are best handled with the participation of all concerned citizens at all levels.
5. Effective environmental legislation should be enacted.
6. Both the precautionary approach and environmental impact assessment should be widely applied as tools in competent decision making.

The term ‘energy’ (from the Greek word energia meaning ‘capacity to do work) is reported to have been coined by Thomas Young (1773-1829), 80 years after Newton applied it to what is now called kinetic energy. Energy sources are divided into two groups- renewable, an energy source that can be easily replenished and non-renewable, an energy source that we are using up and which cannot recreate (petroleum for example was formed millions of years ago from the remains of ancient sea plants and animals). Most of our energy comes from non-renewable energy sources. Coal, petroleum, natural gas, propane and uranium are examples of non-renewable energy sources. They are used to make electricity, to heat our homes, to move our cars, and to manufacture all kinds of products. Renewable and non-renewable energy sources can be used to produce secondary energy sources, including electricity and hydrogen. Types of renewable energy sources includes solar, hydro, wind, geothermal, oceans, thermal energy conversion, tidal energy, hydrogen burning, and biomass burning.

The energy crisis, which we see through the eye of the news media, focuses on shortages of natural gas, gasoline, heating oil and the exponentially increasing demand that is bringing the nations to face shortages. In order to survive this energy crisis nations must do much more than find more resources. Countries must diminish the negative environmental impacts and choose between different energy conversions techniques and set priorities among end uses. Energy needs of man basically includes i) survival, ii) development and iii) self-fulfilment. The first two are material needs and require food, shelter and some freedom from back-breaking labour and a certain amount of leisure and comfort. The third need ‘self-fulfilment’ is satisfied only spiritually. Schemes designed to enable man to meet these needs are called ‘development’ schemes. Now the development programs for the highly industrialized countries of the ‘north’ like those of Western Europe and America are quite different from those of the vast underdeveloped countries of the ‘south’ like India and Brazil, which contain the vast majority of the people of earth. The strategy of the former is to invest more energy to produce ‘growth’ which is a measure of development. Another

approach to the understanding of the concept of energy is through two extremely important statements called the first and second laws of thermodynamics.[21]

The first law tells us that energy can be neither created nor destroyed. It can only be transformed from one form to one or more other forms. The second law tells us that some heat is wasted. With reference to this second law, recently in India a number of groups have proposed that every appliance sold should clearly state the power it requires. It may be just as desirable to state the average energy required per year by the device. This information should be of interest to the consumer, since it will provide him with a measure of the cost of operating the device and the relative effect of the device on the environment. Most of the large energy users in countries like India and Brazil provide for basic human needs such as food, heat and cleanliness. And if everyone demanded a constant level of power at all times, the task of meeting this demand would be much simpler. Unfortunately, our demands vary from hour, day to day and season to season.[22]

Energy has recently emerged at the forefront of sustainable development. The UN Development Program on World Energy Assessment (2000) has linked energy to most of the ills of modern society in both developed and developing countries. The World Summit on Sustainable Development (WSSD) in 2002 which selected energy as one of its five major agenda issues, devised a Plan of Implementation emphasizing the role of energy in eradicating poverty. That same plan calls for the establishment of policy and regulatory frameworks to promote the development and dissemination of alternative energy technologies. During the course of years, oil prices have increased rapidly, reaching the unprecedented level of $147per barrel in July 2008. Subsequently the prices crashed to $33per barrel in December 2008. Today the prices have soared triple times to $118per barrel[23]. These sharp fluctuations in oil prices have been generated mainly by demand and supply imbalances, with the subsequent slump linked closely to the ongoing global financial and economic crisis. Such high-energy price volatility has led to much introspection over the impact on economic

[21] 1. The first law of thermodynamics: whenever a process undergoes a cyclic change, energy is always conserved.
2. The second law of thermodynamics: it is impossible to construct an engine which, when operating through a complete cycle, will convert all of the heat supplied to it into work.
[22]R.K. Pachauri., *International Energy Studies*, (New Delhi: Wiley Eastern Limited.1980) p.46.
[23]https://www.oilcrudeprice.com, accessed on 30th June 2022.

growth and sustainable development in developing countries. This thesis also examines the issues facing developing countries and the international community in ensuring, through national and international measures that energy is a) accessible to households and industries b) affordable to all, especially the poor c) sustainably produced and consumed d) available for promoting development locally and globally. Addressing these challenges will open up new opportunities, including trading and investment prospects, for developing countries in enhancing the contribution of energy to development now and in the future. UNCTAD could also help to support global, regional and national efforts in this area, including efforts to strengthen cooperation on energy, trade and development issues.

Simultaneously the Johannesburg Plan of Implementation, adopted at the 2002 World Summit on Sustainable Development, called upon the international community to work together to improve access to reliable and affordable energy to facilitate the achievements of national and internationally agreed development objectives. Yet around 1.6 billion people, mainly in the 'south' lack access to electricity and 2.4 billion people lack access to modern fuels for cooking and heating.[24] In view of the imperative to mitigate climate change, a drastic 'decarburization' of energy generation and use by households and industries is also required. These challenges have been intensified by the recent high volatility in energy market trends, further complicated by the impact of the ongoing global economic and political crisis of Russia-Ukraine war.

Energy issues currently are very much at the focus of international environmental and development deliberations. We have come a long way from the Rio UN Conference on Environment and Development (UNCED) of 1992 and its Agenda 21 that barely mentioned energy's relationship to development at all. Ten years later in the 2002 Johannesburg UN World Summit on Sustainable Development (WSSD), energy was central to the world's development considerations. This remarkable shift in focus in just a decade was caused by many factors. High on the list were the findings of the World Scientific Community in the Intergovernmental Panel on Climate Change (IPCC) in 1990-91, that the prolonged human use of fossil

[24] Schapiro Mark.,'*Carbon shock: A Tale of Risk and Calculus on the Front Lines of the Disrupted Global Economy'*.(Chelsea Green Publishing, Green Press, Vermont, 2014).

fuel since the Industrial Revolution has threatened changes in climate that in turn has endangered the future of all living things on earth from agriculture to oceans to biodiversity represented by ecosystems and human and other animal survivability. The energy supply and demand system is of great importance for society, from economic, social and ecological viewpoints. The last decade in particular has seen rapid changes in the world of energy systems, and it is therefore now an important area for study, academic research and professional world.

Thus, it can be proven that there exist strong linkages between energy systems, environmental protection, economic development, human health and social issues. Energy is crucial to economic growth. Reliable and affordable energy enhances human productivity and living standards. At the same time, energy production and consumption can also have high negative impacts on human health as well as on the local, regional and global environment. A United Nations Environment Programme (UNEP) report says that much of the air pollution that kills an estimated 5,00,000 people each year comes from burning fossil fuels in electric power generation stations, industrial furnaces and motor vehicles. Air pollution also causes an estimated 4 to 5 million new cases of chronic bronchitis as well as millions of cases of other serious illnesses. The economic burden of this pollution is estimated at 0.5 to 2.5 percent of world GNP, some $150-750 billion a year. [25] On human development and social issues, statistics show that at present two billion people- one-third of the world's population still do not have access to affordable modern energy supplies.

The linkages between energy and sustainable development have been recognized since the Earth summit in 1992. One of the Earth Summit outcomes was the UN Framework Convention on Climate Change (UNFCCC), an agreement signed at the Summit by 154 governments. The ultimate objective of the UNFCCC which came into force on 21st March 1994 was to stabilize the atmospheric concentrations of greenhouse gases at safe level. At present 181 governments and the European Union are parties to the convention. All signatory countries of the convention have a general commitment to address climate change, adapt to its effects and report on the action they are taking to implement the convention. The signatory countries are divided into

[25] https://www.unep.org accessed on 30th June 2022.

2 groups- Annex I parties and non-Annex I parties. The Annex I parties are the industrialized countries of the 'north' that have historically contributed the most to climate change. Their per capita emissions are higher than those of most developing countries of the 'south', and they have greater financial and institutional capacity to address the problem. Therefore, they are committed to take the lead in modifying longer-term trends in emissions and to adopt national policies and measures aiming to return their greenhouse gas emissions to 1990 levels. They must also submit their climate change policies and programs as well as annual inventories of their greenhouse gas emissions.

Non-Annex I parties are basically, the developing countries of the 'south'. These countries also are required to report in more general terms on their actions to address climate change and adapt to its effects. The time frame for the submission of their initial National Communications, including their Emission Inventories, is less strict than for Annex I parties and is contingent on the receipt of funding from the conventions financial mechanism, operated by the Global environment facility (GEF). The UNFCCC was modified by the Kyoto Protocol in December 1997. The Kyoto Protocol calls for commitment of Annex I countries to legally binding reductions in emissions of 6 greenhouse gases. The Protocol contains several mechanisms to help reduce greenhouse gas emissions. These include the ability to trade GHG carbon credits, undertake joint emissions reduction projects to the benefit of countries involved and implement new policy instruments such as Clean Development Mechanism (CDM). As of February 2000, 84 countries had signed and 22 countries had ratified the Protocol. Major international efforts supporting the principles and objectives of the UNFCCC include the US Country studies program (USCSP), and the Asia Least-cost Greenhouse Gas Abatement Strategy (ALGAS) project. The USCSP is supported by the U.S. government and has supported 56 developing countries and countries with economies in transition to assist them technically and financially in developing inventories to their anthropogenic emissions of GHG, assessing their vulnerabilities to climate change and evaluating response strategies for mitigating and adapting to climate change. In addition, by building on the USCSP, the United States initiated a new activity called Support for National Action Plans (SNAP). SNAP provides financial and technical assistance to help countries use the

results of their climate change country studies and to develop action plans for implementing a portfolio of mitigation and adaptation measures.

The 1992 UN Framework Convention on Climate Change was built on this premise that the group of countries (Annex 1) responsible for creating the problem must create space for the rest to grow. But since the objective was to have a different growth pattern to avoid emissions of long-life carbon dioxide, developing countries would get money and technology. The current situation is very different. Countries which were required to cut emissions did not do so at the scale or pace needed. For example, USA 'peaked' its emissions in 2012. The situation was worse since the accounting for emissions was done on the basis of consumption and not production. And in that case the developed countries increased their emissions in this period because all they did was to export manufacturing to other parts of the world. So, the rich did reduce emissions, while the rest of the world increased emissions. While in 1992, Annex 1 countries contributed some 70 percent of the emissions, by 2014, they were down to 40 percent due to shift in production to the underdeveloped countries of the 'south'. The space is filled and now there is little left for future growth of all. This is where climate change negotiations are stuck. Therefore, equity is a pre-requisite for an effective agreement on climate change. In the early 1990's, as the negotiations began, environmentalists in India like late Mr. Anil Agarwal and others put forward the argument that since the atmosphere is a global common, we need equal entitlements to the space. It was argued that the only way countries would commit to reducing emissions-connected to economic growth-would be if there were limits for all, based on contribution to the creation of the problem. The Indian government must not use "equity" to block climate change negotiations. It must be proactive on equity and put forward a position on how to operationalize the sharing of the carbon budget-accounting for countries contribution to past emissions and allocating future space- in climate talks.

2.6. ENERGY PROGNOSIS

Though the advantage of using renewable energy is acknowledged and the world consumption of renewable energy is forecast to significantly increase in the future, its use in developing economies of the 'south' except Brazil and India has not progressed as rapidly as expected. Renewable energy options are not widely adopted

in APEC member economies, energy and economic planning and the role of renewable energy in their total economy energy supply is expected to decline in the future. There is an important intersection between sustainable development and the issue of climate change when it comes to the field of energy. This is because energy is a key driver for economic development and how it is used has a lot to do with the sustainable nature of development.

Since then, as the United Nations has become a more important forum on environmental matters, environmental organizations have become more involved in several ways and on several levels. Finally, environmental organizations were playing a growing role in delivering services at the local, regional and even national level, receiving and administering UN funds in the process. Of all the agencies and intergovernmental organizations affiliated with the United Nations, the World Bank was perhaps the most consequential in environmental terms. It maintains a lending portfolio on the order of $20 billion annually the orientation of World Bank lending also has important environmental consequences. Its emphasis on infrastructural development such as roads, bridges, dams and power stations has produced several ecological disasters. Several high-profile examples of bank-funded disasters, including the Polonoroeste colonization project in the Brazilian Amazon and the Sardar Sarovar dam in north-central India, were used to sharpen the critical focus and emerged as symbols of the Bank's failings.

The first step towards managing or overcoming any challenge is to measure it, because in life what gets measured gets managed. With that in mind, the IEA's (International Energy Agency) World Energy Outlook (2002) did a first ever assessment of energy and poverty and found that at that time 1.6 billion people had no access to electricity. For the very first time, the entire world understood the size and nature of the challenge of universal energy access. Since then, rapid economic development in several developing countries, increasing urbanization and ongoing energy access programs have led to some progress. Despite this, today nearly 1.3 billion people or around 4 times the population of the United States still do not have

access to electricity. Twice as many, around 2.6 billion people, rely on the traditional use of biomass for cooking and heating.[26]

This situation is intolerable and needs to change because energy is a critical enabler for all forms of development. In addition to its own tangible benefits, the positive multiplier effects of access to modern energy are huge. Remarkable, even the UN Millennium Development Goals of 2020 did not say a word about energy. Expertise opinion indicates that development efforts cannot succeed without a robust energy component. This is not just a problem for the poor, but a global concern. In short, ensuring universal access to modern energy services is a normal imperative that nations can no longer afford to ignore. [27]

2.7. COALITION DYNAMICS AND THE NORTH-SOUTH DIVIDE

The emergence of the concept of 'sustainable development' is sometimes said to have transcended traditional 'North-South' conflict on environment and development. UNCED revealed that deep 'north-south' divisions remain, and that they are not limited to governments. Effective 'north-south' alliances have been built where interests have converged, as in the World Bank campaign. With the 1972 UN conference on the Human Environment in Stockholm, the 1982 Nairobi follow-up organized by the UN environment programme, 1992 Earth summit, the 2002 WSSD, and the 2012 Rio Summit, countries are now at the point of institutionalizing global environmental summitry, which is effectively becoming 'grand strategy' in the quest for effective governance. As such, these summits are magnets for significant financial resources, diplomatic focus and activist energy. A brief view of the last four decades of the UN Summits and participations are as follows:

[26] IEA (International Energy Agency), (Paris, World Energy Outlook 2002), OCED/IEA.

[27] Antoine Halff, Benjamin K. Sovacool and Jon Rozhon (ed)., '*Energy Poverty-Global Challenges and Local Solutions*', Oxford University Press, UK, 2014).

Table 1: UN Environmental Summits and Participation

Year/Date	Country	Title	Number of NGOs	Number of Countries
1972 (5-16 June)	Stockholm Sweden	Human Environment	400	119
1982 (10-18May)	Nairobi Kenya	To review the Declaration and Action Plan for Equality, Development and peace	113	114
1992 (3-14 June)	Rio de Janeiro Brazil	Earth Summit on Environment and Development	2400	178
2002 (26 August -4 September)	Johannesburg South Africa	World Summit on Sustainable Development	8000	193
2012 (13-22 June)	Rio de Janeiro Brazil	Rio+20 People's Summit	9856	188
2022	Scotland UK	Stockholm +50		

Source: Compiled by Author, 2022

It was rather melancholy that the 1992 United Nations conference on environment and development held in Rio de Janeiro, Brazil, was widely viewed as the high point of the last 20 years of global environmental diplomacy (since the 1972 Stockholm conference). It was sad because the state of global environmental diplomacy seemed to have steadily worsened since then. As expected by many, the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa, turned out to be a pale and uninspiring shadow of the original Earth summit whose 10th anniversary it was commemorating. Indeed, the more distant we got from Rio, the more inspiring its legacy seemed to become. The most astounding testimony to Rio's legacy is that, even though the implementation of Rio's actual goals and products has been rather dismal, it still remains till today as a shining beacon of achievement in the public imagination. For the countries of the 'South', a key manifestation of these indirect outputs was the so-called Rio bargain. Although

difficult to define with precision and embraced with varying degrees of conviction by various parties, the Rio bargain was generally understood to be an attempt to bridge lingering 'north-south' differences through two key mechanisms, namely the concept of sustainable development and a set of design principles for global environmental agreements that accounted for the key concerns of the 'south'. The notion of sustainable development was a conceptual device used to lure the developing countries, which had been quite apprehensive about the environmental agenda emerging at the 1972 Stockholm conference, to the idea that environment would not be used as a reason to stall development in the 'south'. The official name of the Rio earth summit was also crafted, after some debate, to signify that 'environment and development' were complementary rather than contradictory categories. For developing country negotiators, the concept of sustainable development and the opportunity afforded by Rio to reopen the 'north-south' dialogue that had languished through the 1980s proved to be very enticing. Even those who could not shake off their instinctive doubts about the summit process found themselves compelled to cling to Rio, which they saw as the best available hope for moving towards a grand 'north-south' bargain that they had been striving for since the 1970s. In short, the developing countries that had entered the Rio process with many fears and some hesitancy managed to internalize the goals of the process by its end. This led to the formulation of the polluter pays principle.

This principle has deep roots in domestic environmental policy in the north and particularly in the United States. Linked closely to the previous 2 principles[28], this dictum ensures that the costs of environmental action, economic and other, will be borne by those who create the need for that action. As with the common-but-differentiated responsibility principle, the polluter pays principle is rooted in concerns about justice and fairness rather than in economic efficiency and constitutes a key component of the Rio bargain. However, this principle has also been steadily diluted in the 10 years since Rio. Consider for e.g. the Clean Development Mechanism (CDM), a provision of the Kyoto climate agreement that allows industrialized countries to meet some of their greenhouse-gas reduction responsibilities by investing in projects in the 'south'. In the name of efficiency, the CDM moves the focus of

[28] Refer footnote no,11.

climate action to developing countries where emission reduction are likely to be cheaper, rather than imposing the costs as well as the inconvenience and shame of clean-up on the polluters.

2.8. ENERGY-ENVIRONMENT ISSUES AND POLICY OPTIONS FOR DEVELOPING COUNTRIES

Brazil is an example of a rapidly modernizing economy and a populous country. It is another giant among rapidly modernizing societies with a high level of energy consumption and enormous sinks for carbon dioxide in the form of luxuriant Amazon Forest and biomass wealth. Asia (the Indian sub-continent) on the other hand will continue to remain the most important continent in terms of future energy policies and initiatives for minimizing the emissions of GHGs, since it is this continent which promises to achieve the highest rate of growth among all the regions of the world. Energy became a major international issue in 1970s, following the oil crisis. More recently, global climate change induced by excessive GHG accumulation in the atmosphere has emerged as a potential problem that further complicates energy issues.

In the past, industrial countries that faced a trade-off between economic growth and environmental preservation invariably gave higher priority to the former. These richer countries have awakened only recently to the environmental consequences of their economic progress and only after a broad spectrum of economic objectives have been reached. This model of economic and social development has been adopted by many third world regions. Therefore, until both developed and developing countries find a less material intensive sustainable development path, environmental protection efforts will be hampered.

The developing countries like India and Brazil share the deep worldwide concerns about environmental degradation and have already taken steps to improve their own natural resource management as an essential prerequisite for sustained economic development. However, they also face other urgent issues like poverty, hunger and diseases, as well as rapid population growth and high expectations. Ironically, both local and global environmental degradation might affect developing countries more severely since they are more dependent on natural resources while lacking the economic strength to prevent or respond quickly to increases in the

frequency, severity and persistence of flooding, drought, storms etc. The Brundtland Commission report (WCED, 1987), which has been widely circulated and accepted, has presented arguments along the theme of sustainable development, which consists of the interaction of two components: needs, especially those of the poor segments of the world's population and limitations, which are imposed by the ability of the environment to meet those needs.

Secondly as noted in the Brundtland Commission report, past growth in the industrialized countries has exhausted a disproportionately high share of global resources, suggesting that the developed countries owe an 'environmental debt' to the larger global community. This approach could help to determine how the remaining finite global resources may be shared more fairly and used sustainably. Finally, the economic efficiency criterion indicates that the 'polluter pays' principle may be applied to generate revenues, to the extent which global environmental costs of human activity can be quantified. If total emission limits are established (e.g., for carbon dioxide) then trading in emission permits among nations and other market mechanism could be harnessed to increase efficiency.

It can be seen that, as predicted by the World Energy Outlook (2006), over the coming three decades, energy consumption is set to go up by 60 percent and the bulk of this increase is set to take place in developing countries like India and Brazil. Under a natural business scenario, dominance of fossil fuels in the whole energy mix will continue and its consequences on environment, energy, health and economic security will be enormous. Though renewable energy will grow in absolute terms, its proportion will largely remain unchanged as 14 percent, the bulk of which is hydropower and traditional biomass at present. Moreover, despite such growth rates, in 2030, 1.4 billion of global population will be without electricity with a comparable amount continuing to depend on traditional biomass for their heating as well as cooking needs. Such a path is quite unsustainable for the globe to follow, particularly in a situation where rising prices of fossil fuels projected to remain high for the rest of the present decade and beyond.[29]

2.9. ENERGY AND DEVELOPMENT

[29] Azmal Hussain., *Renewable Energy- Global Perspectives*, (Hyderbad, Icfai Book University Press, 2010).

Energy is at the centre of the environment development nexus. Already consumption of commercial energy by the developing countries of Asia like India is growing at a faster rate than in OECD countries. The 1993 report of the World Energy Council task force on 'energy for tomorrow's world' estimated that by 2020 developing countries will need some $30 trillion of new investment in energy facilities if they are to meet their growing needs on the basis of current patterns of use and efficiency. This is nearly 50 percent greater than the entire world GNP clearly an impossible prospect. A massive commitment to energy efficiency is the only answer.[30]

In an attempt to catch up with the 'advanced' nations, countries of the underdeveloped 'south' have been guided by the beliefs that growth is progress and that the road to progress is only through increased energy use. They have therefore patterned their schemes of development on the Western industrial model, in the process of adopting their economic industrial values. Massive unemployment and wide income disparity are some of its consequences. Schumacher has shown that with increased use of energy at the present rate, there is little chance that the gap between the rich and the poor nations will narrow by the turn of the century. The industrialized nations need cheap energy not only to meet the needs of a growing population but apparently to maintain full employment. Thus 'energy' use is believed to be a means to 'happiness'. Thorndike has argued that happiness is proportional to increased energy use, leading to a greater material prosperity up to a point only. Beyond that the curve between happiness and energy begins to level off and may even fall, as the energy use is increased. Many of the Easterns settled in Western countries would testify to this truth. What has been the result of energy intensive development schemes and how far this has brought prosperity and happiness to the underdeveloped nations may be gauged by a study made by the Overseas Development Council, Washington. To measure how far a nation's prosperity has increased, they had developed an index called the 'Physical Quality Life Index' (PQLI). 'PQLI' is an indication of a nation's capacity to meet the elemental human needs of its people. Unlike the PQI, which indicates the sum total of a nation's goods and services, the

[30] Maurice Strong., The 'New South', The World Today, Vol, 51, No.11, November, (Royal Institute of International affairs, 1995), pp.215-219.

PQLI index of a country measures how far these needs of the people of that country have been met.[31]

STRATEGIES FOR BEYOND

As suggested by M. Hirose at the first Asian Energy Institute (AEI) conference at Jaipur and Bellagio in India at the panel discussion on 'Asia's contribution to GHG emissions and the policy responses for minimization of these emissions: a panel discussion: M. Hirose from (Japan) outlined the program for the next 100 years for the recovery of the planet from 200 years of accumulation of carbon dioxide and other GHGs. He stated that the first 50 years from 1990 to 2040 would be the period of introduction and development of environment friendly technologies and the next 50 years from 2040 to 2090 would be the years in which the future generations would recreate the green planet on the results of the first half. The first decade from 1990-2000 would be dedicated to intensive research to reduce uncertainties regarding emissions and encourage energy efficiency. In all efforts would be mobilized to increase the list of available technologies both in developed and developing countries. For instance, the spread of conversion measures to enhance the carbon dioxide sinks by way of reforestation and better forestry management. In the second decade, from 2000-2010 there would be a reduction in the use of fossil fuels through the introduction of non-fossil fuels for example safe nuclear power plants and renewable energy sources.

The third decade from 2010-2020 would see the spread of substitute for CFCs. Carbon dioxide fixation technologies and revolutionary low energy production processes. The fourth decade spanning 2020-2030 would be the decade of advancement in biotechnology whereby substantial gains could be achieved from reversal of desertification along with the usage of more conventional means to enhance the carbon dioxide sinks, example reforestation. The decade 2030-2040 would be an era of generation of future technologies, for example nuclear fusion, solar power plants, the electro steam generation, energy applications of super conductivity and other new energy technologies which would render fossil fuel unnecessary. This action program would result in the fact that by the latter half of the

[31] https://pubmed.ncbi.nim.nih.gov accessed on 18.02.2020.

21st century GHG concentrations would actually be decreasing. He said that this program should form the basis of a global partnership in which all countries, developing and developed, East and West, could come together and act in a united manner. The developed economies could contribute in terms of experience and financial help.[32]

On a questionary note, in 1956 Shell Oil company geophysicist M. King Hubbert had made a remarkable prediction on 'Peak Oil'. This was very significant with reference to energy use and depletion. The production of oil is governed by the Hubbert Curve. In any oil field, the annual production increases until about 50 percent of the reserve has been extracted. The production peaks at this point and thereafter declines because it becomes increasingly more difficult, and expensive to extract the remaining oil and then the fields are abandoned. The Hubbert Curve is applicable to countries and regions producing oil. The production in the US has peaked as far back as 1970 and ever since it has been declining. Oil companies, government agencies and economists dismissed Hubbert's prediction, but he was right. Oil production in the United States peaked in 1970 and has been declining ever since. The world peak may have been reached already, or it will do very soon. 'Oil peak' does not mean 'running out of oil', but it does signify the end of cheap oil. The countries of the Middle East now have most of the oil and when their production peaks, prices will soar. Any sharp increase in the prices of oil will, of course, deeply affect many aspects of our lives.[33] Hubbert's prediction remained accurate even after discovery of the Prudhoe Bay oil field (after 1971) with its great volume of oil still not enough to bring U.S oil production out of a long-term decline. Peak global oil production and its subsequent decline (based on optimistic assessment) were forecast to begin by about 2020 or later. After careful analysis, the Hirsch Report came to a number of conclusions and three possible scenarios. Oil peaking presents a unique challenge. Previous transitions were gradual and evolutionary, oil peaking will be abrupt and revolutionary. Government intervention will be required, otherwise the economic and social implications would be chaotic. Economic upheaval is not inevitable. Without

[32] Pachauri. R.K and Behl Abhilasha., *Global Warming- Mitigation Strategies and Perspectives from Asia and Brazil,* Asian Energy Institute, (New Delhi: Tata McGraw hill publishing company Ltd, 1991).

[33] Rajagopalan. R., *Environment,* (New Delhi; Oxford university press, 2011), p.71

mitigation, peaking will cause major upheaval, but given enough lead time, the problem will be resolved.

According to the Malthusian catastrophe analysis, obviously, the peaking of oil presents not only a number of questions but also a stark reality that the decline of oil production is not temporary. The day is fast approaching when the inability to meet demand will raise the cost of fuel. Concurrently, every sector of the economy will be affected in some way, whether it be a shortage of new materials for manufactured goods, or increasing costs associated with transporting those goods to market, storing them in climate-controlled facilities, purchasing the machinery used in the construction of those facilities (or structures of any kind), or fertilizers and pesticides used to maintain production yields in agriculture, among other dependencies too numerous to list here. And, while the lack of oil supplies will affect the manufacture or availability of all of these products and services, it is food that is likely to be affected the most. An adequate food supply is essential not only to maintain world peace and preventing famine but also to ensuring the health and wellbeing of the populace. A populace that is still increasing in size and will likely continue to grow even though the liquid fuel spigots are running dry, for good. This deadly doom and gloom scenario has been described, in somewhat related terms and meaning, as a Malthusian catastrophe. For our study purposes here, this term denotes a forced return to subsistence level conditions once energy use has out spaced energy production. The tragic irony is that if this occurs and we are not prepared, for the first time in history Third World subsistence economies will have the one-up on many of the rest of us who, in our lifetimes, have never planted, tended, or harvested any type of crop.[34] With the energy crisis pending, we have three choices. We can mine for more oil, we can aggressively pursue energy conservation, or we can develop renewable energies. Because of limited fossil fuel resources, increased demand, and environmental impacts, renewable sources of energy are needed.

Today, alternative energy is considered to be fuelled energy that is an alternative to fossil fuels and that does not use up natural resources or harm the environment. Examples of 'alternative' fuels throughout history, though, have included petroleum as an alternative to whale oil, coal as an alternative to wood,

[34] Ibid.p.7.

alcohol as an alternative to fossil fuels, and coal gasification as an alternative to petroleum. The key point in understanding the concept of alternative energy is that these fuels need not necessarily be renewable. Renewable energy is energy generated from natural resources-sunlight, wind, water(hydro), ocean thermal, wave and tide action, biomass, geothermal heat-which are naturally replenished (and thus renewable). Renewable energy resources are virtually inexhaustible, as they are replenished at the same rate as they are used, but they are limited in the amount of energy that is available per unit time.

Thus, in conclusion we can state that good environmental stewardship is the need of the hour. This stewardship encompasses a diverse group of motivating factors and behavioural outcomes centered on the idea that human beings have a responsibility to live sustainably and to promote an ecologically healthy environment by actively managing their behaviour through informed and conscientious use of the world's environmental resources. This concept was proposed by Aldo Leopold from USA in his 1949 collection of essays, 'A sand County Almanac'. In forming Leopold's ideas of the land ethic and today's concept of environmental stewardship is the ecological 'systems view' of nature. Environmental stewardship requires that humanity pays attention to these ecological connections to ensure that human behaviour does not adversely affect the health of the ecosystem. Environmental stewardship is a growing component of the broader environmental conservation movement and empowers individuals to contribute to sustainability. It charges the humans with the responsibility to act as stewards of, or caretakers for the Earth, by minimizing the potentially negative environmental impacts of human behaviours and actively engaging in the protection of ecosystems. Environmental stewardship can guide decisions at a wide array of scales, from individual behaviours to global institutions and international policy. Environmental concerns considered from this perspective will also include protection of rare and threatened species and habitats, ecosystems health and the environmental consequences of human behaviour such as food production, transportation and energy generation, distribution and consumption. Environmental stewardship is distinct from the popular environmental concepts of preservation, conservation and sustainability, although it is similar in many ways to conservation and sustainability.

Yet stewardship has unique contributions to and implications for consideration of the world's green energy choices. Because of its wide appeal to diverse, audiences and their many different motivating factors, environmental stewardship will be an important concept for promoting green energy options like ethanol, solar, wind in countries like Brazil and India. The word 'stewardship' incorporates a personal responsibility for care and maintenance, and in an environmental context, it means the immense human responsibility to consider and care for the Earth. This sense of responsibility for the health and sustainability of the Earth can be applied at many levels, from individuals and communities to companies and governmental and non-governmental organizations. According to the U.S. Environmental Protection Agency, environmental stewardship is manifested by a commitment to efficient use of natural resources, protection of eco-systems and where applicable, ensuring a baseline of compliance with environmental requirements.

With the above pre-emption's, the subsequent chapter strategies us to the 'South' where the stand of the country of Brazil and its initiatives on environment and energy issues will be deliberated. Being a pioneer nation right from the beginning of the 1972 era of global environmental awareness and a forerunner in the Rio 1992 and Rio+20 summit in 2012 and in terms of using ethanol as an alternative energy source, makes Brazil an interesting area of discussion.

CHAPTER III: BRAZIL ENERGY AND ENVIRONMENT: A CRITICAL VIEW

The period of the research on Brazil which is based on the last five decades involves selected two main aspects namely environment and energy. Given the fact that the world's hot spot namely the Amazon rain forest lies in Brazil and on the other hand, the country has played a significant role in the energy sector with reference to green fuel (ethanol) and had been the pioneer in this arena. Environment and energy have turned the wheels of the Brazilian economy in an astounding way and hence it warrants a discussion. Brazil is the biggest country in Latin America, and the 5th biggest in the world in terms of area (3286487 square miles). It also has the largest population of any Latin American country.[35] The magnitude of these basic statistics gives Brazil a qualitative as well as quantitative significance. Brazil had retained her territorial unity since gaining independence as a single successor colony of the Portuguese crown in Latin America, making the continental scale a bonus point from the view of environment. This unity was the result of a number of objective factors: the semi-feudal monopoly, ownership of land, combined with a highly commercialized exporting monoculture, the use of slave labour and the centralized state that such a social system entails and racial inter breeding.[36] During the period from 1964 to 1985 Brazil was governed by a military dictatorship and it attracted civilian technocrats and foreign investors to engineer an 'economic miracle' and thereby free the Brazilian society of radical social movements and the state and political system of traditional politics and environmental ethics. This period also marked three other significant years in Brazil's role in environmental awareness i.e., 1972 when the first UN Conference on Human Environment was held in Stockholm, the 1992 Rio Summit on Sustainable Development and subsequently the Rio+20 People's Summit in 2012 held in Rio de Janerio in Brazil.

[35] https://m.statistics.com, accessed on June 17th 2022. (In 1960 -72.7 million, 1964- 80 million, 1970- 94.5 million, 2008- 190 million, 2013-200.4 million, 2015-204.5 million, 2016- 209 million and 215 million in 2022.)

[36] Hagopian Frances., '*Traditional Politics and Regime Change in Brazil'*, (Cambridge University Press, 1996), p.122.

The ensuing chapter is sub divided into three sections. Section one primarily deals with the introduction to environment and the way environment has been approached by the country of Brazil. It will also highlight the impacts of environmental awareness that has taken place with reference to the historical evolution of environment in Brazil at the international level since 1972. Section two will discuss the role of green energy namely ethanol, the energy security aspects and the position of Brazil in the world energy market with reference to production and supply. The third sections end with a summary of selected environmental and energy polices in which Brazil engaged internationally.

Brazil derives its name from its first export product namely the Brazil wood (paubrasil), wherein the bark of this tree was used as a dye stuff in Europe.[37] As noted by Bernard Pierre, Brazil achieved its independence peacefully, it was also one of the last South American countries to become independent, the last to emancipate the slaves (1888) and the last to have a republican regime (1889). This retarded development helped to avoid fragmentation and preserve the unity of this continent sized country. The Brazilian society originally sprang from a fairly homogenous agrarian base, the sugar-planting latifundia.[38]

The foundation of the Gaucha Association for the protection of the natural environment in 1971 marked the appearance of the first social movement directly concerned about the green issues in Brazil. Close to this, the first UN Conference on Human Environment was held in June (5^{th} -16^{th}) in 1972 in Stockholm Sweden. This UN Conference had a manifesto that was focusing on the finite nature of the Earth's resources and the necessity for humanity to safeguard them. It also led to the formation of UNEP in December 1972 to coordinate global efforts to promote sustainability and safeguard the natural environment. At the UN conference, Brazil out right opposed any initiative the wealthy nations of the 'North' took, which would lay restrictions on its use of natural resources. In fact, the need to preserve the environment was not placed in opposition to economic development but in fact, their

[37] Prado Junior., *Historia, Mircea Buescu and Vincete Tapajo's Historia do Desenvolvimento Economico do brasil*, (Rio de Janeiro A casa do Livro, 1969) pp.29-31.

[38] Bernard Jean Pierre and others., *Guide to the Political Parties of South America,* (Australia, Penguin Books,1969).

interdependence was explicitly stated in principles 8 and 9 of the UN conference.[39] Actually, in the 1970's, Brazil adopted the position that pollution and environmental degradation were a price worth paying for development. Until recently, this view remained fairly common among the country's policy makers. There was also the view, which is still accepted in some circles, that the environmental question is more a weapon used by foreign powers to curtail the country's development. The views of developers and the 'conspiracy' theorists have left a strong imprint on Brazil, and only recently have begun to fade.

However, there was a paradigm shift in Brazil's dealings with the world post 1972. This led to the formation of the Brazilian Environment Policy in 1981, which was the first real breakthrough concerning environmental protection and sustainability. The free flow of information and civil dissent during this intervening period allowed in the political system the explosion of environmentally oriented non-government organizations (NGOs) onto the scene. These early NGOs in 1980s were largely local groups that sought to protect their environment from destructive and exploitive logging, damming, mining and other development projects undertaken by the Brazilian government, private corporations, foreign countries and international institutions such as the World Bank. Later the Cubato Tragedy in 1983 slowly led to a deep sense of environmental awakening in Brazil[40]. Thus, was set the first precedent for environmental awareness in Brazil. The opening of political space that accompanied Brazil's democratic transformation in 1985 was crucial to the emergence of the country's environmental movement and hence in 1986, the National Green party (Partido Verde) was formed and was later registered in 1988. In close connection to this green movements in 1988, the assassination of Chico Mendes on December 22nd who had taken active part in the 'Save the Amazon' demonstration and an internationally known leader of the Conselho Nacional dos Seringueiros (National Council of Rubber Tappers) saw the wrath from international NGOs. The Brazilian government was clearly shocked by the vehemence of reaction from abroad to this incident. The nexus between deforestation of the Amazon rainforest for other

[39] Principle 8: Undertake initiatives to promote greater environmental responsibility. Principle 9: Encourage the development and difusion of environmentally friendly technologies.

[40] https://contenttime.com.timemagazine,april91984 accessed on 30th June 2018

uses and Brazil's increasing pollution levels to eliminate poverty were however closely interlinked.

Brazil's Green Movement had strengthened substantially as the country's democracy also had deepened. Aid from international NGOs has also bolstered the efficacy of Brazil's environmental community. Brazilian NGOs still lacked adequate resources and support. Moreover, the country's pervasive poverty problem and pressure from the global capitalist market continued to exert tremendous pressure on Brazil's natural resources. Until the late 1970s, the environmental impact of Brazil's economic development was neglected by both policymakers and academics. This attitude changed considerably since the early 1980s as a result of the growing environmental protection movements in the advanced industrial 'North'. Not only did they have an impact on the policies in those countries, but they also encouraged such movements in other parts of the world and influenced the policies of such international organizations such as the World Bank, whose loans have been increasingly conditioned on the environmental impact of the projects it financed. By 1990 Brazil saw the birth of nearly 700 NGOs.[41] These environmental groups appeared and rapidly expanded within Brazil. Brazil's steps in recent years to control some of the polluting excesses of industrialization and of its excesses in developing its virgin territories reflect the increasing domestic and world ecological consciousness, which culminated in the 1992 United Nations Conference on the Environment held in Rio de Janeiro. Twenty years after the Stockholm conference, in late 1992 after President Collar left office the Ministry of Environment was created.

Environmentalism in Brazil was actually represented especially by the military, land owners, and big business, as an 'imperialist' first world doctrine, propagated with the aim of shackling the country's development. However, groups under threat from development projects, such as the rubber tappers, small farmers, garimpeiros, forest Indians had been evolving organized forms of collective resistance and self-defence during the later years of military rule. Popular movements in Brazil

[41] Baer Werner., *The Brazilian Economy- Growth and Development*, (London: Lynne Rienner publishers, 2008) p 337.

had actually helped to check some large-scale Amazonian development projects and thus assisted to slow down the rate of deforestation since the mid-1980s.[42]

3.1. BRAZIL AND THE AMAZON

Endowed with the great Amazon rain forest, the Brazilian government in 2006, created the Brazilian Forest Service with the aim to manage in a sustainable manner the Amazon Forest resources. It was ranked by WWF as the second most diverse ecosystem on the planet. The Atlantic Forest- or Mata Atlantica (in Portuguese) is teeming with thousands of plant and animal species. When the Portuguese had first arrived in Brazil in the early 16th century the forest covered more than 1.3 million square kilometers- an area roughly twice the size of France. Since then, however, nearly 90 percent of it has disappeared and is destroyed over centuries to make way for coffee plantations, sugar cane fields, mining, cattle grazing or cities. Coffee-sugar-gold combination of the Brazilian economy has seen large scale deforestation taking place of the Amazon. While the rate of deforestation has slowed down in recent years, according to SOS Mata Atlantica Foundation, the recent trends are contrary. Deforestation in the Amazon rain forest is seen as crucial cause of Climate Change which has soared to 278 percent year-on-year in July 2019 according to the National Institute for Space Research (INPE).[43]

Globally, the Environment of Brazil gains significance because the Amazon rainforests absorb a quarter of the 2.4 billion tons of carbon that forests around the world remove from the atmosphere every year. The forest stores about 86 billion tons of carbon, or more than a third of all carbon stored by tropical forests worldwide. Besides this, the Amazon is home to an estimated 30 percent of the world's plant and animal species. The rainforest contains 10 percent of all biomass on earth and thus stores vast amounts of carbon that is released into the atmosphere as deforestation takes place. These releases contribute to global warming. The Amazon contains an estimated 390 billion individual trees divided into 16,000 species. However recent history of major fire outbreaks starting from 6th August 2019, with official figures showing nearly 73,000 forest fires in the first eight months of 2019, have pushed the

[42] Miranda Schreurs and Elim Papadakos., *The A to Z of the Green Movement*, (Lanham, The Scarecrow Press. 2007), p.7.

[43] O Herald dated 18th August 2019.

Amazon in the new limelight as the 'Earth's Lungs on Fire'.[44] About 60 percent of the Amazon forest whose share lies in Brazil and remaining 40 percent which spans in other eight countries namely Bolivia, Colombia, Venezuela, Ecuador, Peru, Guyana, Suriname and French Guiana is considered as the 'vital lung' of the planet and had been in world news over the recent ragging forest fires that were initiated by the rural producers in the northern state of Para in Brazil who held a 'day of fire' on 10th of August 2019 in a show of support for the far-right leader's efforts to weaken environmental protection monitoring in the region. Official figures showed 78,383 forest fires that had been recorded in Brazil in 2019, the highest number of any year since 2013.[45] Deforestation of the Brazilian Amazon reached a record in June 2021. A total of 1,062 sq. kms. of forest was destroyed, an area almost the size of the city of Rio de Janeiro. This was up from 1,043 sq. kms according to the INPE Research Institute, which used satellite images to measure forest cover. In total, 3,609 sq. kms. of Amazon was lost in the first quarter of 2021. The figure was the highest for the month of June 2019 since the INPE stared gathering data in 2015. According to Global Forest Watch, 1.3 million hectares of forest, mostly in Brazil's Amazon region disappeared in (2018).[46]

The tipping point of this rainforest is defined as the moment when, deforestation becomes so high that the Amazon will not be able to sustain itself and trigger the dieback of the entire rainforest. In fact, the Amazon may be close to this point- though tropical rainforests are known for their power to sequester carbon dioxide, a GHG from the atmosphere and thereby act as a carbon sink, today the Amazon is a 'net 'source of emissions due to large scale forest loss. In July 2021, a study by Luciana Gatti at the National Institute for Space Research in Brazil, found that the Amazon rainforest, particularly the SE section is now emitting more carbon dioxide (Gtco2) a year, caused mainly by fires set to clear land for beef and soy production and made worse still by hotter temperature and droughts. The worrying trend is that the Amazon is emitting carbon even without fires. Speaking to British daily, The Guardian, said it was most likely the results of each year's deforestation and fires that were making adjacent forests susceptible the next year. The trees

[44] The Times of India dated 24th August 2019.
[45] O Herald dated 26th, 27th and 28th August 2019.
[46] O Herald dated 11th July 2021.

produce much of the region's rain; so fewer trees mean more severe droughts and heat waves, and then more tree deaths and fires, a vicious cycle. According to NASA scientist Sassan Saatchi who has developed a new tracking system, named the tropical forest vulnerability index (TFVI), to identify areas where rainforests are losing resilience to disturbances and are changing to an irreversible state, or a tipping point. It is based on observations of forest cover, carbon and water fluxes. In their study, published in the Journal 'One Earth' on July 23rd, Saatchi and other scientists found that the Amazon shows significantly more vulnerability to climate and land-use stressors than forests in Africa and Asia.[47] In view of this, protection of the environment gains high priority in the so called 'South', namely by the Brazilian government and the world now looks upon this nation as the Green Savior.

The Brazilian Environmental Policy (1981) was the first real breakthrough concerning environmental protection and sustainability. Therefore, from then onwards, polluters were responsible for all the damage they caused. Just after this policy was implemented, Laws were introduced that authorized public prosecutors to act in defense of the environment. The Brazilian Ministry of the Environment is the agency in charge of coordinating, supervising and controlling the Brazilian Environmental Policy. It is also responsible for promoting the use of sustainable natural resources and applying sustainable development within the formulation and implementation of national policies. Paradoxically in the late 1960s when the Amazon surge was beginning, Brazil already had a piece of legislation called the Forest Code of 1965, which had it been strictly applied, would have avoided the worst excesses that have taken place since that time. Environmental licensing was also a legal obligation before any potentially damaging and polluting activities could take place in any part of Brazil's territory. A framework had been created by the Federal government called the National Environmental System (SISNAMA), which included the local state government environmental agencies, the National Environmental Council (CONAMA) and the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) in order to facilitate the licensing process. The ministry has many departments which deal with climate change and environmental quality, biodiversity and forests, water resources, sustainable urban and rural development

[47] Down to Earth. Science and Environment Fortnightly, (New Delhi, 16-31 August 2021), p.50.

and environmental citizenship. Other authorities, such as the National Council on the Environment, the National Council of the Amazon, the National Council of Water Resources, the Chico Mendes Institute for Biodiversity Conservation (ICMBIO), the Brazilian Institute of Environment and Renewable Natural Resources are responsible for the implementation of environmental policies

By 1981, the Brazilian government had put into force the National Environmental Policy (NEP), through Law No. 6938. The main objective of this policy was to establish standards that make sustainable development possible, using mechanism and instruments that were capable of ensuring greater protection for the environment. Environmental issues in Brazil include, deforestation in the Amazon Basin, illegal wildlife trade, air and water pollution, land degradation and water pollution caused by mining activities, wet land degradation and severe oil spills among others. The Brazilian Ministry of Environment recently announced data showing a decrease in deforestation rates in the Amazon Rainforest since mid-2011. This is in part due to an increased awareness of the damaging effects of prolific logging practices and a shift toward sustainable forestry in Brazil.

On the global dais Brazil's environmental losses which had attracted a lot of attention recently with special reference to deforestation was a good forum for the 'debt-for-nature- swaps'. The specific feature of debt-for-nature swaps is that a country's debt is reduced in exchange for the debtor country's commitment to establish conservation or environment-related programs on specified land. For example, the current demise of tropical forests in Latin America was seen as an opportunity to trade off bad debts against habitat preservation. The danger of looking upon the Amazon, for example as a global resource, is that whatever the truth of this observation, few developed countries would agree to intervention in their environment on the grounds of global necessity. Brazil was presented debt-for-nature-swaps by the 'North', and agro ecological zoning, environmental concerns and public policy was intersected. This in itself was revealing, since it was for the first time that concern with the preservation rather than the exploitation of the natural environment had been instrumental in shaping public policy in the Brazilian Amazon. Debt-for-nature-swaps had a clearer genealogy than most development policy programs, because it owed its basic outline to an idea of Thomas Lovejoy, of The Smithsonian Institution in Washington, who in 1984 attended a number of congressional hearings

exploring the relationship between foreign debt and environmental damage.[48] First, the use of foreign debt as a policy lever, especially in Latin America and Brazil in particular, entails a moral and ethical dilemma. Although debt-for-nature was conceived and presented as a means of both aiding the environment and reducing foreign debt, the balance between the two is hardly symmetrical. Given the fact that it was formulated in the 'North', debt-for-nature-swaps had much more to do with nature conservation than it had with debt relief.

Amazon Climate Link: Deforestation and rising heat in the Amazone rainforest region has a direct correlation with wormer temperatures in Tibet according to researchers from Beijing Normal University, China. This correlation is due to the fact that the Amazone rainforest is a climate tipping element – as noted in a study published in the journal 'Nature Climate Change'.[49]

3.2. BRAZIL'S TRYST WITH ENERGY

Brazil's first major export product was sugar. Its cultivation was introduced around 1520, brought to the Brazilian continent by immigrant cane-milling artisans and sugar traders from the Portuguese held islands in the Atlantic. The rapid spread of sugar cultivation and exports soon developed into the first of a series of great primary export cycles, which were to dominate Brazil's economic growth until the 20th century.[50] Today the Ethanol production used to sustain the growing transport industry is a legacy of the far past. Sugar production expanded, mainly because of a growing domestic market. The slow export growth however was due to competition

[48] Thomas Lovejoy thought surely there is a way to help solve the debt crisis and help the environment at the same time. He then began a public debate by writing an article for the New York Times: 'Aid debtor nations' which was published on 4th October 1984. The idea behind debt-for-nature-swaps is essentially very simple, although the actual financial mechanisms can be extremely complicated to set up; (In a debt-for-nature exchange, conservation organization acquires commercial bank debt of a developing discount from the debt's face value or receiving it as a donation. The organization then agrees to cancel the debt in return for the borrower country's commitment of additional resources to local conservation').

[49] Down to Earth 16 – 28 February 2023, Pg – 11. Tipping elements have certain temperature thresholds that, when crossed, lead to large an often-irreversible changes in the climate system. This means even incremental changes in the Amazone might result in massive, abrupt and permanent changes to other areas. Global climate data from 1979 to 2019 was analyzed.

[50] Ronald. Dennis Hussey., '*Colonial Economic life', in Colonial Hispanic America,* Vol.IV of studies in Hispanic American Affairs, (Washington DC: George Washington University press, 1936), p.334.

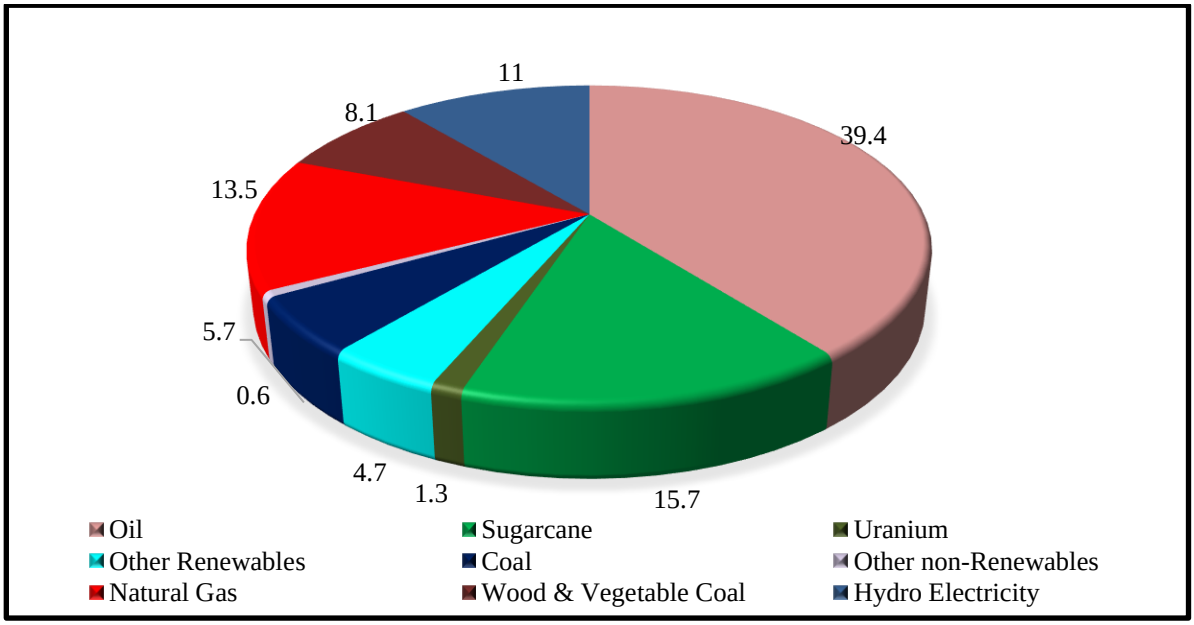
of beet sugar in protected European markets, to sugar production in the United States and to competition from lower-cost Cuban sugar.[51]

After the oil embargo of 1973, Brazil's rendezvous with sugarcane-based ethanol production basically called as the 'green fuel', made it a prominent nation in the 'South' with regards to energy production and usage. However, in the decades following World War II, there had been a dramatic reshaping of Brazil's sources of energy consumption. In 1946, 70 percent of the country's energy supply was drawn from firewood and charcoal. Half a century later in 2003, 92 percent of the supply was drawn from oil, ethanol and hydroelectric power. It is to be noted that the only known coal deposits were in the southern state of Santa Catarina and since this coal was of poor quality, about 65 percent of the metallurgical coal requirements of Brazil were met by imports.[52]

[51] Baer, Werner.,(6th ed) *The Brazilian Economy, Growth and Development*, (Colorado: Lynne Rienner publishers.2008), p.21.

[52] John Saunders., (ed), *Modern Brazil: New Patterns and Development*, (Gainesville: University of Florida press, 1971).

Figure 2: Brazil: Total Primary Energy Consumption by Fuel Type (2014)



Source: Compiled from BalancoEnergetico Brasileiro BEN (2015)

The figure 2 indicates the growing trend of energy usage in the field of renewables. As seen in the percentage shared by Sugarcane (Ethanol) (15.7) after oil that is 39.4 followed by natural Gas (13.5).

From the international point of view the Brazilian economy remained under Portuguese domination. However, after 1703, as a result of the Treaty of Methuen, England indirectly secured the transfer of this wealth.[53] Gradually UK established organizations enabling it, unhindered and openly to dominate the Brazilian economy during the Empire period and until the proclamation of the Republic. Brazil however was able to keep her place in the first rank of world sugar producers. It was only with the appearance of regions enjoying greater advantages that production in Brazil lost its importance on the international market, though this was no reflection on the efficacy of the system. This model of economic organization peculiar to Brazil was to introduce into the economic history of the country a monotonous succession of cycles, the sugar, the gold, the rubber and the coffee cycles. Each new product for export was thus enabling the development of a fresh region to go forward like sugar

[53] By this treaty Portugal became to all intents and purposes a British colony. As a result, Brazil was called on to make good Portugal's ever-increasing trading debt with her ally. The duration of this treaty coincides with the period of mineral exploitation. Up to the end of the 18th century the amount of gold sent to England on this account has been estimated at two hundred million pounds (sterling). In Arraes Miguel., *Brazil: The People and the Power*, (Penguin Books Ltd, England.1969), pg. 25-27.

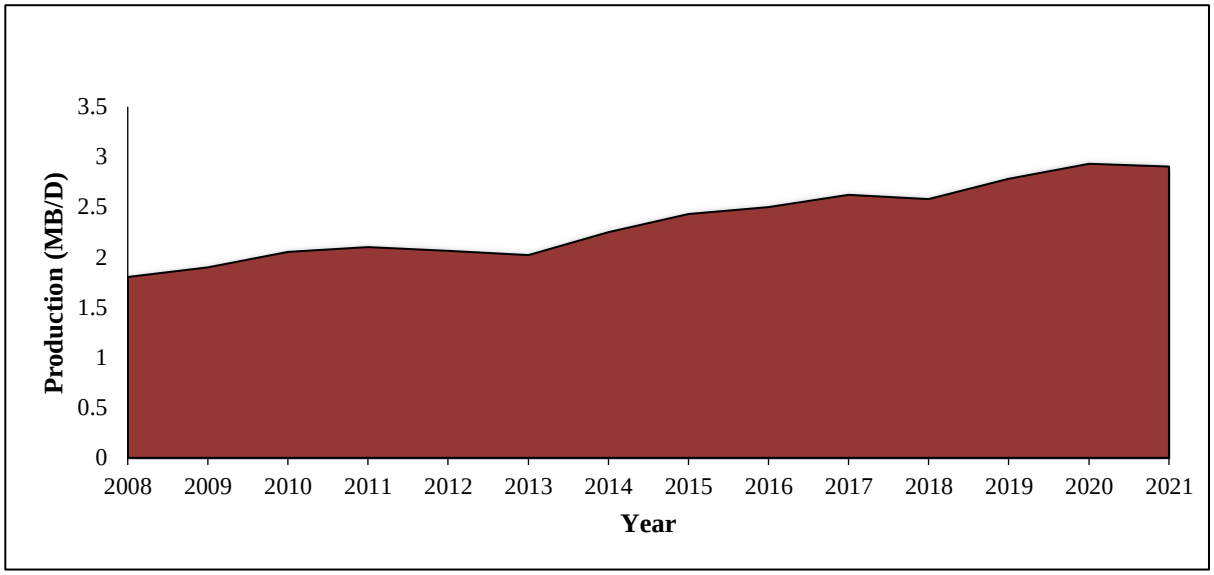
for the northeast, gold in Minas Gerais, coffee in Sao Paulo and rubber in the Amazon.

Currently, any discussion on Latin America's rise as an energy titan begins with Brazil, the region's most populous country and the recipient of a recent oil and gas windfall that has transformed regional and world energy markets virtually overnight. The speed and scale of the change that has occurred is hard to overstate. The world's largest oil discoveries in recent years have come from Brazil's offshore, presalt basins.[54]Large offshore oil and gas discoveries have confirmed Brazil's status as one of the world's foremost oil and gas provinces. The 'pre-salt' discoveries also prompted a change in upstream regulation, granting Petro bras the national oil company, a strengthened role in areas deemed strategic. Brazil's oil output was leveled out at just above 2mb/d since 2010 and pre-salt growth (fig. 3) was essential to re-attain the objective of net self-sufficiency in oil and to pave the way for Brazil to become a major oil exporter. Total primary energy consumption in Brazil has increased by more than one third in the past decade because of sustained economic growth.[55]

[54] Presalt oil is generally characterized as oil reserves situated exceptionally deep under thick layers of rock and salt and requiring substantial investment to extract. In 2005, Petrobras drilled exploratory wells near the Tupi field and discovered hydrocarbons below the salt layer. Further exploration showed that hydrocarbons deposits in the presalt layer extended through the Santos, Campos and Espirito Santo basins. First production was scheduled for 2017 with peak production of 1.3 million bbl/d by 2030. Brazil anticipates oil production from the presalt layer will account for most of the projected growth from 2020-30.

[55]. http://www.iea.org/countries. accessed on 25th March 2016.

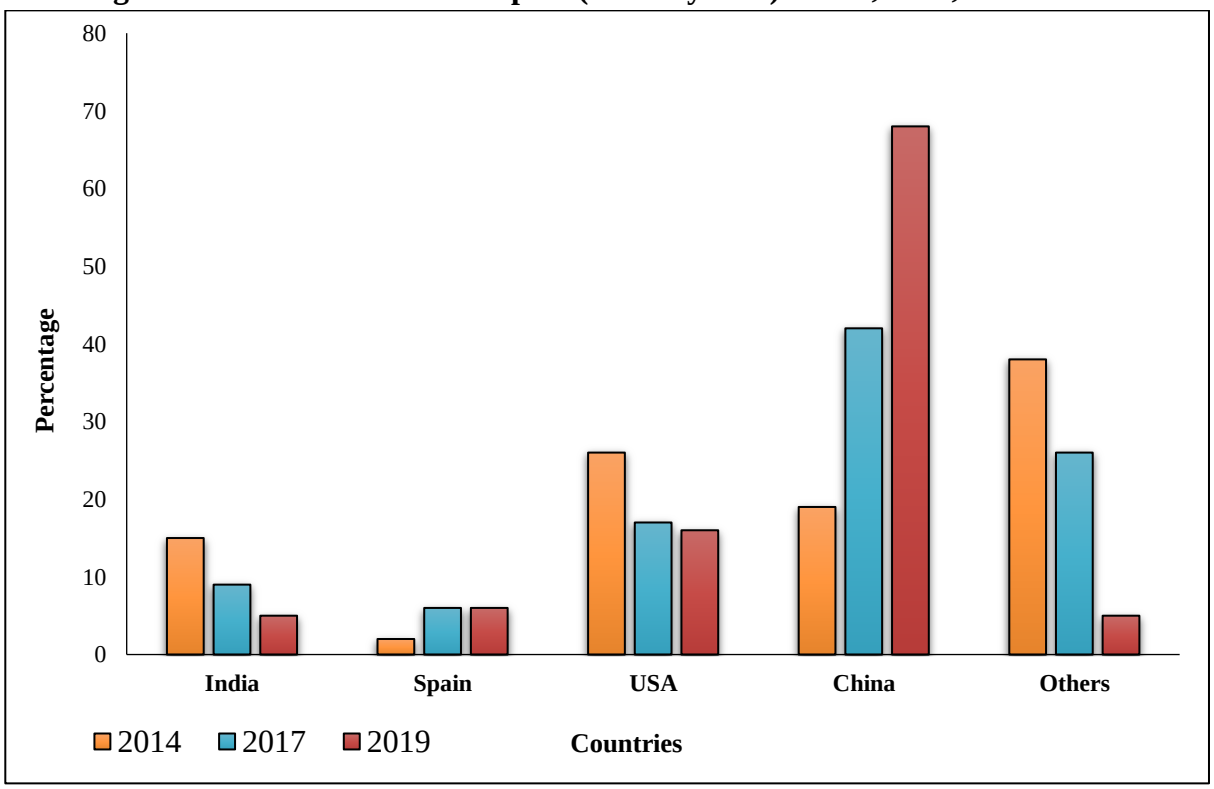
Figure 3: Brazil: Crude oil Production (2008 - 2021)



Source: OPEC: Crude Oil Production: Latin America: Brazil

The figure 3 indicates the rising demand for Crude Oil Production in the last decade (2008-2021) indicating the rising population and industrial growth. Currently Brazil is not only exporting energy resources to the neighbouring countries of Central and South America but is also exporting nearly 15 percent of its energy resources to India and other Asia –Pacific countries.

Figure 4: Brazil: Crude Oil Export (Country wise) - 2014, 2017, 2019



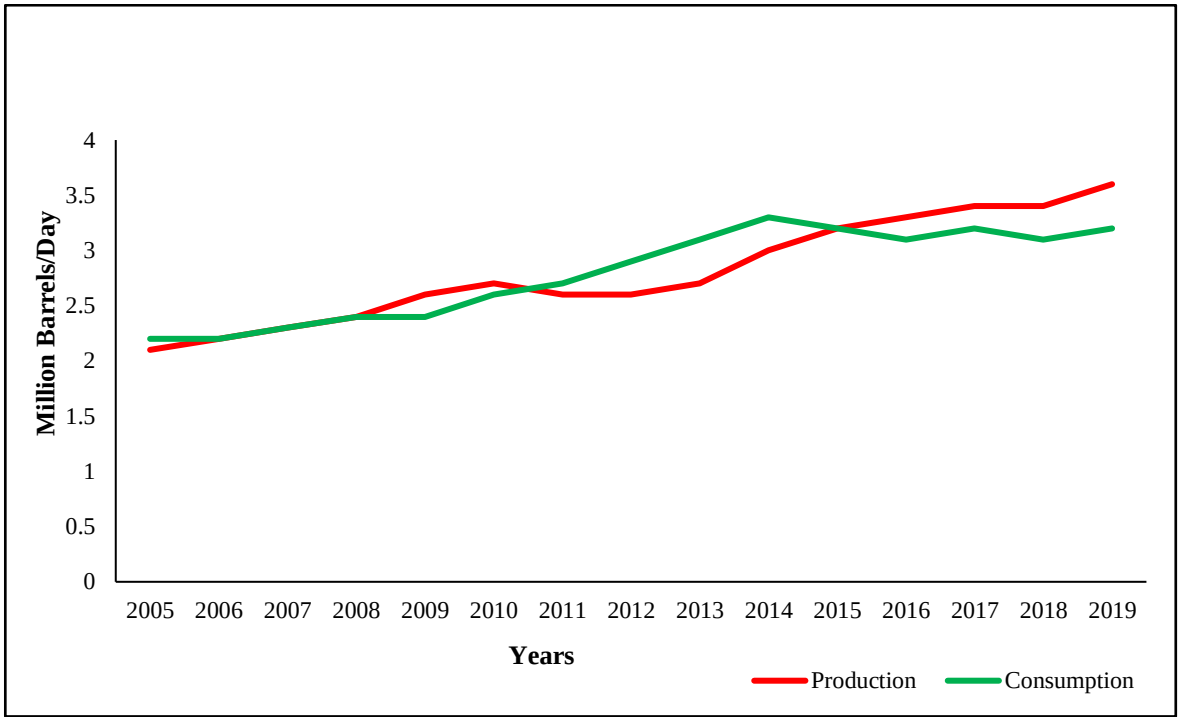
Source: Compiled from U.S. Energy Information Administration (EIA)

During the tenure of President Lula Da Silva and subsequently in the years to follow, Brazil diversified its exporting list of countries thereby making heavy strides in the extraction and export of energy resources. Indian imports however declined to 9 percent and China's imports rose to nearly 42 percent clearly indicating a shift in the economic production of other countries than India. Subsequently, post President Dilma Rousseff term and the present incumbent President Jair Bolsonaro, India's import share from the Brazilian oil fields further declined to 5 percent and the Asia-Pacific shares soared to nearly 75 percent.

Today, the main energy sources in Brazil are generated by hydro-power, oil, mineral coal and biofuels. Some other sources are used on a smaller scale such as natural gas and nuclear power. Energy sources are indispensable for a country's development. In Brazil, as the country expanded so did the national energy sector. Mineral coal energy which is used as a primary material for steel production was responsible for 33.9 percent of energy use in Brazil. According to the Empress de Pesquisa Energetica (EPE), ethanol production represented 19 percent of Brazil's total energy production compared to 15 percent a decade ago. Oil remained at an average of 41 percent of total energy production as total energy production increased to 36 percent in the past decade.[56] Brazil's liquid fuels production and consumption was also indicating a steady rise (refer figure 5).

[56]. Central Intelligence Agency, The World factbook.

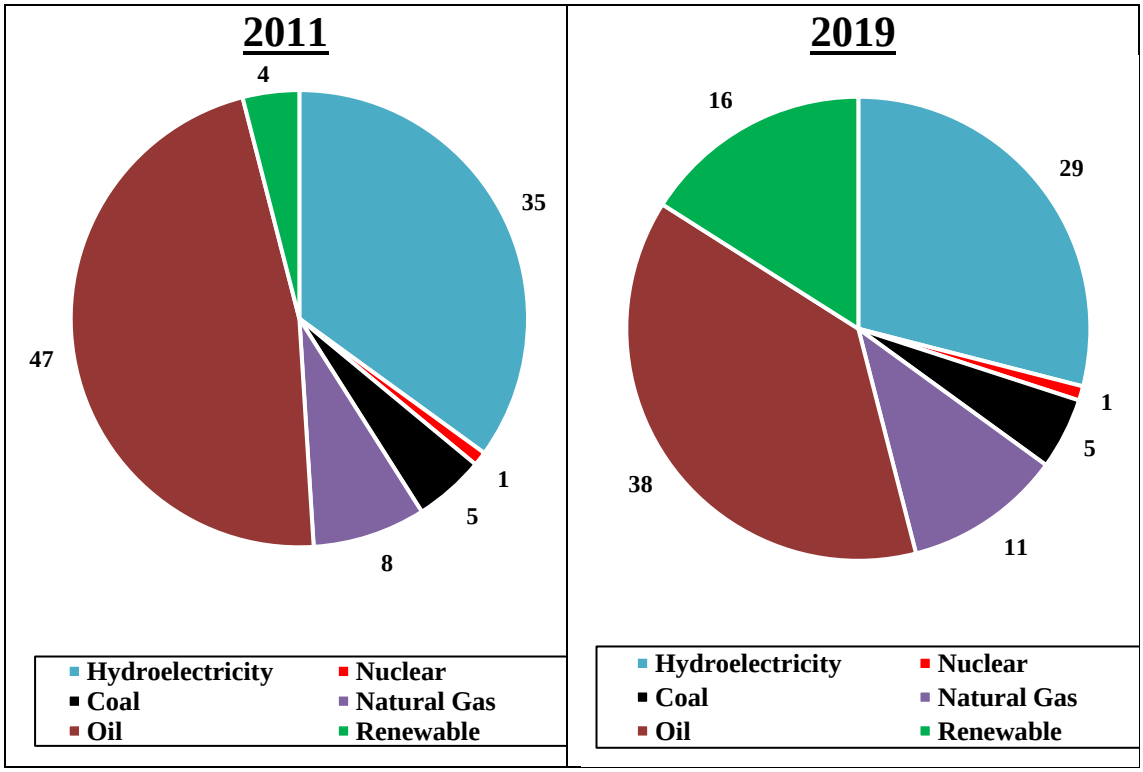
Figure 5: Brazil: Liquid Fuel Production and Consumption



Source: Compiled from U.S. Energy Information Administration (EIA)

Liquid fuel production has shown a steady increase from 2008 onwards indicating a strong and steady demand for the same.

Figure 6: Brazil: Energy Consumption (Fuel wise) – 2011 & 2019

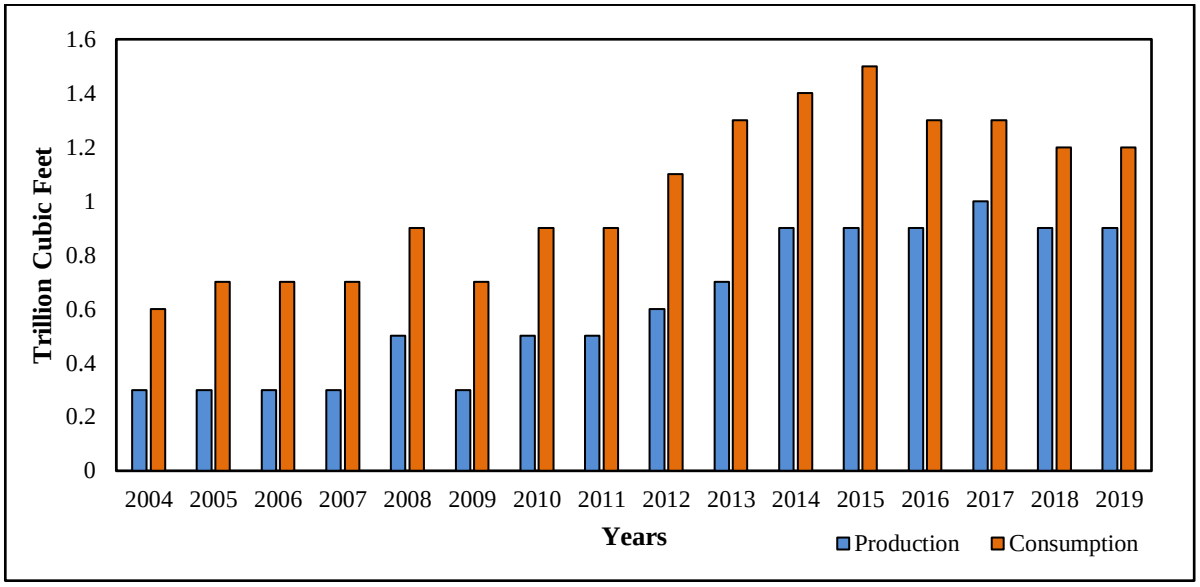


Source: Compiled from BP-Statistical Review of World Energy

A closer look at the primary energy consumption in figure 6, with special reference to renewable or green energy sources, Brazil's share in other renewables mainly ethanol and solar energy was mere 4 percent. However, in subsequent years post the tenure of President Lula Da Silva and Dilma Rouseff pro-environmental outlooks, efforts at increasing the renewable energy sector share rose to 16 percent. Today, renewable fuels like natural gas accounts for 8 percent of Brazil's total energy consumption and the country is the 2nd largest reserve in South America, located primarily in the offshore Campos Basin. Along with the potential to significant increase oil production in the country, the pre-salt areas are estimated to contain sizable natural gas reserves as well. Brazil imported 599 Bcf of natural gas in 2013, a 27 percent increase from 2012. Bolivia accounted for more than 68 percent of Brazilian natural gas imports.[57] Brazil's dry natural gas production and consumption and production was increasing for a period of 10 years.

[57] . UNCTAD statistical database.

Figure 7: Brazil: Dry Natural Gas Production and Consumption



Source: Compiled from U.S. Energy Information Administration (EIA), International Energy Statistics

Brazil's dry natural gas consumption has shown a spike in the figure 7 and there is a steady rise in the production and consumption in 2015, but subsequently the trend is slowing down.

Hydro Power - Brazil has the third largest electricity sector in America, after United States and Canada. According to Brazil's energy planning company, Empresa de Pesquisa Energetica (EPE), Brazil had an installed generating capacity of 127 megawatts. Hydroelectricity accounted for 86 MW of generating capacity, fossil-fuel sources contributed 37MW and small amounts from wind, solar and nuclear made up the rest. Brazil generated 405 billion kWh of hydroelectric power in 2013. Many of Brazil's hydropower generating facilities are located far from the main demand centers, resulting in high transmission and distribution losses. The world's largest hydroelectric plant by generation is the 14,000 MW Itaipu hydroelectric dam on the Parana River which Brazil maintains with Paraguay.[58]

Another interesting point to be noted is that, the hydroelectric potential of Brazil is one of the largest in the world, at an estimated 150,000 megawatts. Until the

[58] http://www.investidorpetrobras.com accessed on 25th March 2016.

post-World War II period, the best sites of potential hydroelectric power were considered to be too remote from the major population centers for development, but since the 1950s, the development of such sites had proceeded rapidly with the construction of the hydroelectric works at Paulo Afonso and Boa Esperanca in the North east, Furras and IIhaSolteira in the southeast and Tres Marias in the state of Minas Gerais.[59]Hydropower is the main source of electricity in Brazil. A report from the National Energy Balance estimates that around 70 percent of electricity consumed in Brazil comes from hydropower plants. Still, Brazil only uses 25 percent of its hydropower capability and also exports part of the energy that is generated. [60]

Biomass Energy– Brazil is considered to have the world's first sustainable biofuels economy and is the biofuel industry leader, a policy model for other countries of the 'South', and its sugarcane ethanol 'the most successful alternative fuel to date'. To address the country's dependence on oil imports and surplus of sugarcane, the Brazilian government had implemented policies to encourage ethanol production and consumption beginning in the 1970's. The National Alcohol Programme was created by Decree No. 76.593 of 14 November 1975 in order to satisfy the requirements of the internal and external markets and the motor vehicle fuel policy.[61] The turn of events in 1973 (Oil Embargo) prompted the Brazilian government to foster the development of domestic energy sources. Today, Brazil is the 2nd largest producer of ethanol in the world and is the largest exporter of the fuel. Over half of all cars in Brazil are of the flex-fuel variety, meaning that they can run on 100 percent ethanol or an ethanol-gasoline mixture.[62] More than half of the

[59] John Saunders., (ed), *Modern Brazil: New Patterns and Development*, (Gainesville: University of Florida press. 1971)Pg.6.

[60] The main Hydropower plants in Brazil are as follows

1 Usina Hidrelétrica de Itaipu, at Rio Paraná - with capacity of 14.000 MW
2. Usina Hidrelétrica de Tucuruí at Rio Tocantins - with capacity of 8.370 MW
3. Usina Hidrelétrica de Ilha Solteira at Rio Paraná - with capacity of 3.444 MW
4. Usina Hidrelétrica de Xingó at Rio São Francisco - with capacity of 3.162 MW
5. Usina Hidrelétrica de Foz Do Areia at Rio Iguaçu - with capacity of 2.511 MW
6. Usina Hidrelétrica de Paulo Afonso at Rio São Francisco - with capacity of 2.462 MW
7. Usina Hidrelétrica de Itumbiara at Rio Paranaíba with capacity of 2.082 MW
8. Usina Hidrelétrica de Teles Pires at Rio Teles Pires - with capacity of 1.820 MW9. Usina Hidrelétrica de São Simão at Rio Paranaíba - with capacity of 1.710 MW
10. Usina Hidrelétrica de Jupiá at Rio Paraná - with capacity of 1.551 MW

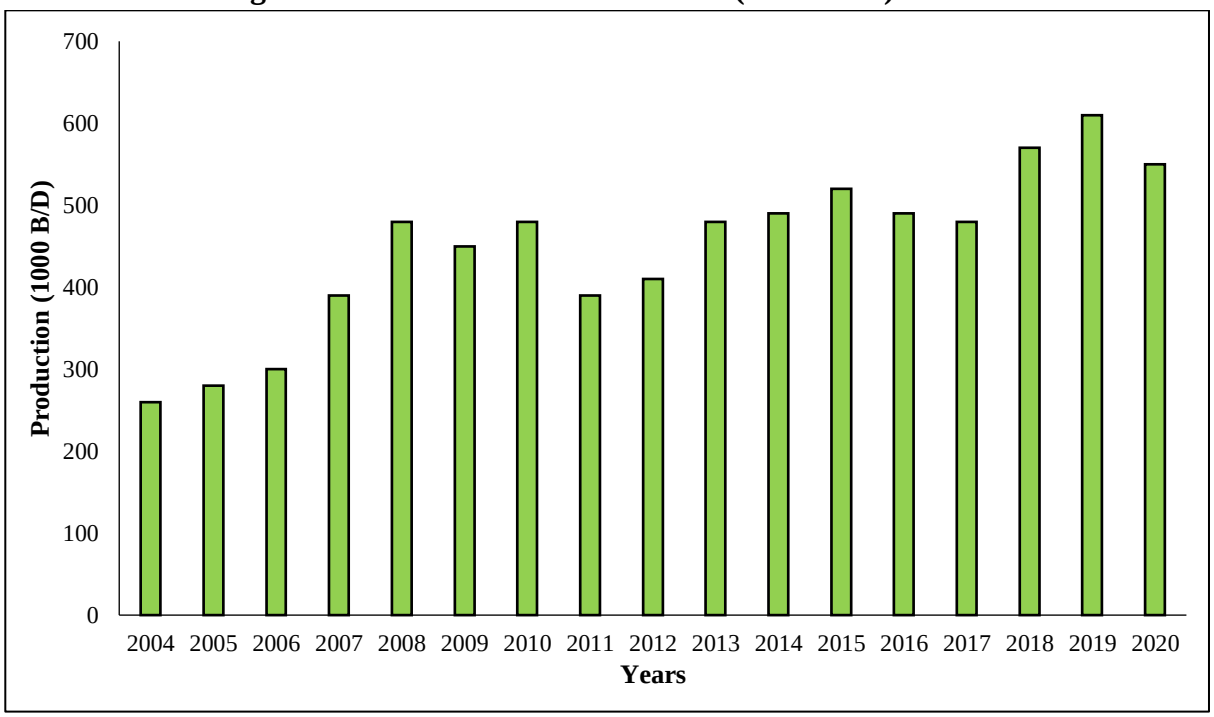
[61] Francisco Szekely., *Energy Alternatives in Latin America*, Vol.9, (Dublin: Tycooly International Publishing Ltd. 1983), P.115.

[62] R. K. Pachauri., *International Energy Studies*, (New Delhi: Wiley eastern limited.1980), p.120.

nation's sugarcane crop is processed into ethanol, which now accounts for about 20 percent of the country's fuel supply. Initiated in the 1970s after the OPEC oil embargo, Brazil's energy policy program was designed to promote the nation's *energy independence* and to create an alternative and value-added market for sugar producers. The government had spent billions to support sugarcane producers, develop distilleries, build up a distribution infrastructure, and promote production of pure-ethanol-burning and later, flex-fuel vehicles were able to run on gasoline, ethanol-gasoline blends, or pure hydrogen ethanol. While the costs were high, the program saved far more in foreign exchange from reduced petroleum imports.[63] Today, more than one million people in Brazil work in the production of biomass energy sector and this energy represents 27 percent of Brazil's energy matrix. Brazil is about 20 percent dependent on biomass. Similar to other nations, biomass as wood and charcoal is consumed in Brazil for cooking and heating in rural areas, but over half of the biomass is consumed as a commercial or an industrial fuel. Companies in mining, cement, paper, ceramic making and food processing rely on biomass as a fuel. Another unusual feature of biomass consumption is that most nations use coal to make steel, but Brazil has little in the way of coal reserves suitable for steel production. Hence there has been a steady rise in the production of ethanol for the last two decades and it is rising as seen in figure 8 (2004 – 2020). Consumption of energy by the rapidly growing giant transport sector grew significantly over the years. In 2013 this rapidly growing energy sector was supplied with ethanol, unlike 2012 when it was gasoline. Such energy demand is closely linked with the population growth in the country.

[63] Coyle, W., *The Future of Bio fuels: A Global Perspective*, (Amber, Waves November, 2007).

Figure 8: Brazil: Ethanol Production (2004-2020)



Source: Compiled from U.S. Energy Information Administration (EIA)

Today, Brazil along with USA accounts for 89 percent of world production of biofuels. The basic difference is that, United States relies on corn (maize) to produce ethanol, whereas Brazil relies on sugar. The development of the ethanol industry in Brazil was not entrepreneurial in nature, but was nurtured by decades of government support programs. Brazil also had a social challenge of doing something about the enormous number of idle workers in rural Centre-south and North-northeast regions of Brazil. The solution to both problems was*Bioethanol.* The Brazilian government implemented a three-fold program to stimulate ethanol production which in turn reduced the reliance on imported oil, provided job opportunities for large numbers of idle workers and converted fallow land to agricultural use. The government provided billions of dollars in low-interest loans for entrepreneurs to finance the construction of ethanol production plants and the conversion of mostly fallow and unused grazing land to sugarcane plantations. The government also required Petroleo Brasileiro SA (Petrobras), the state oil company, to purchase ethanol to blend a vehicle fuel with a minimum of 22 percent ethanol (E-22). Although Brazilian sugarcane growers were free to sell either the sugar or ethanol to the market, whichever was more profitable, however Petrobras was required to buy ethanol to ensure that the regulatory minimum content of ethanol in gasoline was satisfied. This created the domestic market for ethanol. However, during the latter part of the 1980s and 1990s, Petrobras discovered

offshore oil fields that would eventually make Brazil self-sufficient in oil, reducing the negative trade balance associated with oil imports. Brazil than decided to make the introduction of 5 percent biofuel in diesel (B5 fuel) mandatory from January 2010 instead of 2013 as was initially planned.

Brazil today has high hopes that its low-cost ethanol will replace high-priced gasoline in the world market and in turn help meet its obligations to cut carbon emissions under the Kyoto Protocol in addition to its concerns on *energy security*. If Brazil can realize its dreams of becoming the 'Saudi Arabia of Ethanol', perhaps ethanol's share of the world's gasoline supply could expand to 8-9 percent or more in 20 years.[64] The development of efficiencies in the Brazil bioethanol system, albeit over a period of three decades, meant that bio-ethanol petrol blended fuel was cheaper than petroleum. Of all biofuels that are currently available, Brazilian sugar-cane bioethanol provides the most favorable greenhouse gas (GHG) reduction of around 90 percent as compared to corn bioethanol. [65] The current trend is that Brazil's production of ethanol as the e-fuel is steadily increasing over the years as seen in figure 8.

Brazil's success can be presented as a model to other countries of the 'South' to follow, given that many of these countries like India already have significant sugar-cane plantations, which would allow domestic production and perhaps ultimately exportation. The potential of export and Brazil's growing demand for energy, risks triggering rapid expansion of sugar-cane production and rapid land use change. The amount of sugar cane under production, currently around eight million hectares, was projected to double by 2020, and output would be more than double over that time frame. This would create risks for other types of land use in Brazil because, approximately 20 percent of the current fuel used (alcohol, gasoline and diesel) in

[64] Roy.L.Nersesian., *Energy for the 21st Century,* (Tamil Nadu, Yes Dee publishing Pvt Ltd, 2011),p.59.

[65] James Smith., *Biofuels and the Globalization of Risk- The Biggest Change in North-South Relationships Since Colonialism*, (U.K, MPG books group, Bodwin and King's Lynn, 2010), pp.14-39.

Brazil is ethanol, and since Brazil is a middle-income economy with per capita energy consumption of only 15 percent compared to that of the US and Canada.[66]

Nuclear Power -The Nuclear power debate revolves around the controversy about the deployment and use of nuclear fission reactors to generate electricity from nuclear fuel for civilian purposes. The debate about nuclear power peaked during the 1970s and 1980s, when it reached an intensity unprecedented in the history of technology controversies in some countries. Brazil's nuclear program dates back to the 1930s, when scientists began researching nuclear fission. In the 1940s Brazil signed a mining agreement with the United States. In 1975, the Brazilian state firm Nuclebras signed an agreement with a West Germany company resulting in the transfer of nuclear technology and in the late 1970s, Brazilian President Figueiredo approved a clandestine parallel nuclear program: the Autonomous Program of Nuclear Technology (PATN). The Brazilian nuclear program underwent a series of notable changes in the 1980s as a direct result of changing political climate. Later Brazil signed the Treaty of Tlatelolco in 1967 and ratified it in 1968 with a reservation. Brazil removed its reservation on May 30th 1994 and 4 years later in 1998, Brazil signed the Non-Proliferation Treaty.[67]

On May 6th 2006, Brazil had inaugurated the controversial uranium enrichment facility at Resende, 90 miles to the West of Rio de Janerio. It however received attention during a 2004 dispute with the International Atomic Energy Agency (IAEA), when Brazilian authorities refused to give IAEA inspectors full visual access to the Resende uranium enrichment facility. As a member of the nuclear Non-Proliferation Treaty (NTP), Brazil was subject to IAEA safeguards including mandatory inspections of nuclear facilities, as stated in Article III of the NPT.[68] As the negotiations between the IAEA and Brazil continued, debates and allegations flared up in the international community over Brazil's nuclear intentions, while Brazil has continued to deny these allegations. The centrifuges at Brazil's Resende plant are

[66] http//www.ers.usda.gov/Amber/Waves/November 07/features/biofuels/htm.accessed on 27th November 2016.

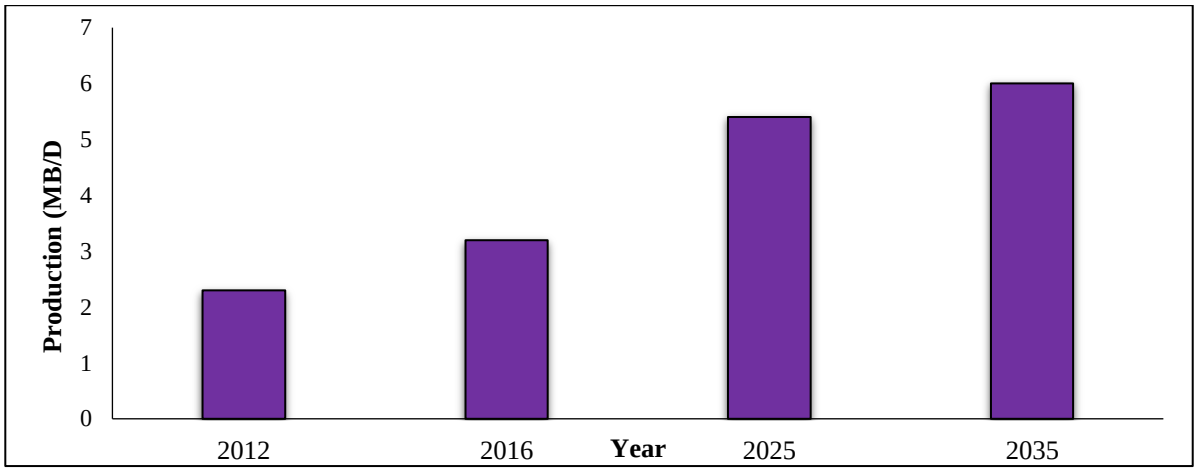
[67] Mackenzie. J. James., '*The Nuclear Power Controversy',* (The Quarterly Review of Biology, Vol.52, (4), 1977).

[68] Krasno Jean.,'*Non Proliferation* : Brazil's Secret Nuclear Program', (ORBIS, Summer, 1994).

considered not only commercially sensitive, but also as icons of Brazilian prestige and technological advancement. Brazil and Argentina are bound by IAEA safeguards under the 1991 Quadripartite Agreement. Today Brazil has a myriad of nuclear civilian's facilities including a number of power reactors, research reactors, uranium enrichment plants and uranium processing plants. The 2004 Brazil – IAEA dispute demonstrates the challenges facing non-proliferation efforts. [69]

The future of Brazilian economy based on energy is inclined towards deep water oil production which is going to increase in years to come and wherein Brazil is going to compete with the world in the field of renewable energy mix as seen in the projected bar graph in figure 9.

Figure 9: Brazil: Oil Production (Projected)



Source: BP-Statistical Review of World Energy

3.3. BRAZIL'S ENVIRONMENTAL POLICY

Brazil is probably the first developing country that initiated a programme of laying down laws that govern environment. In fact, the different states within Brazil too laid down specific laws in this regard. On 9 November 2009, Sao Paulo Governor Jose Serra signed Law No.13.798 the *Politica Estadual de Mudancas Climaticas* or the State Climate Change Policy. The law commits the state to reduce its carbon dioxide emissions by 20 percent by 2020 using 2005 emissions as a baseline.[70] The law also provided broad authority for land-use planning to serve various priorities, including the promotion of sustainable transportation and protection of watersheds to

[69] Katz Everett James and Onkar. S. Marwah., (eds), '*Nuclear Power in Developing Countries'*, (Lexington: D.C. Heath and Company,1982) p. 346.

[70]For greater details see Art. 32 (1).

mitigate the state's vulnerability to changing weather pattern.[71] This is reportedly the first emission reduction policy adopted by a state of any country from the 'South'.

A closer scrutiny of the Constitution shows that under the Brazilian laws of the General Principles of the Economic Activity (Article 170) states that environment protection includes "by means of different treatments in accordance to the environmental impact of products and service and their respective production and rendering", thus providing for the efficient management of its natural resources and biodiversity.[72] Similarly, Article 225 states that "every person has the right to an ecologically well-balanced environment. Its preservation and protection is a responsibility of the Public Power, as well as of the entire community". Although legislative competence on the environment is only attributed to Union and States, the Federal Constitution, in Article 23, Clauses VI and VII, establishes that the three administrative levels-Union, States and Municipalities-have administrative competence to protect the environment and oppose pollution.[73] Likewise, on 12 November 2009, Governor Sergio Cabral of Rio de Janeiro issued Decree No. 42.159 or popularly known as the 'Decree', instituting new procedures for environmental licensing in the state. The Decree creates a system known by the acronym "SLAM" (*Sistema de Licenciamento Ambiental* from the Portuguese for 'Environmental Licensing System') to replace 'SLAP' (Licensing system for Polluting Activities'). The Decree creates six classes of projects, with class I being small projects of insignificant pollution potential and class 6 being large projects of 'exceptional' pollution potential.[74] On 28 December 2009, Brazil's National Environmental Council (CONAMA) issued Resolution No. 420 (the 'Resolution', Resolucao 420/2009), establishing federal standards for the environmental management of contaminated sites. The Resolution contains monitoring and reporting requirements that apply to Brazilian facilities, which will be required to establish soil monitoring

[71]Reference Source (in Portuguese); Law No. 13,798 of 2009. (Art 16)

[72]Title vii, *The Economic and Financial Order*, Chapter I Artcile170 (vi)

[73]http://www.urbandrum.co.uk/earthsummit 2012. Accessed on 3 July 2016.

[74] Reference Source (in Portuguese); Decree No. 42.159 of 2009. Article no.19.

programs and submit technical reports on the results with each renewal of their environmental licenses.[75]

At the national level, President Luiz Inácio Lula da Silva signed Law No. 12.187 (the "Law"; *Política Nacional sobre Mudança do Clima*), on 29 December 2009 called the National Climate Change Policy, pledging a voluntary reduction of Brazil's greenhouse gas emissions of between 36.1 percent and 38.9 percent by 2020. The proposed reduction is relative to the country's projected emissions for 2020, as determined by a nationwide inventory of emissions that was completed in 2010.[76] The Law provided general objectives and principles, but did not establish binding obligations or order specific actions to achieve its stated objectives. Most details, such as reductions targets for the various economic sectors, remained to be determined by presidential decree. Apart from broad statements of policy, the Law names various institutions and programs as actors that will participate in the articulation and implementation of the federal response to climate change. Among others, the Law also promised to provide incentives for the trading of certified emissions reduction credits through the Brazilian Emissions Reduction Market, organized under the Brazilian equivalent of the U.S. Securities and Exchange Commission.[77]

In Brazil, public policies regarding the environment were generally advanced, although their implementation and the enforcement of environmental laws have been far from ideal. Laws regarding forests, water, and wildlife had been in effect since the 1930s. Brazil achieved significant institutional advances in Environmental policy design and implementation after the Stockholm Conference on the Environment in 1972. In 1981 the National Environment Policy was defined, and the National System for the Environment (Sistema Nacional do MeioAmbiente--Sisnama) was created, with the National Environmental Council (Conselho Nacional do MeioAmbiente--Conama) at its apex, municipal councils at its base, and state-level councils in

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75 See CONAMA Resolution No. 420 of 2009, available at www.bdlaw.com/assets/attachments/Brazil%20-%20CONAMA%20Resolution%20420%20of%202009.pdf (Art. 14) Accessed on 24 November 2016.

76 (Art. 12) Law No. 12.187 of 2009, available at www.bdlaw.com/assets/attachments/Brazil%20-%20Law%20No.%2012187%20of%202009.pdf

77 Ibid., Articles 6 and 9.

between. In addition to government authorities, all of these councils included representatives of civil society. Specialized environmental agencies were organized at the federal level and in some states, and many national parks and reserves were established. By 1992 Brazil had established thirty-four national parks and fifty-six biological reserves. On the other hand energy consumption also loomed large along with its environmental impacts, which warranted for energy security and independence.

3.4. NEED FOR ENERGY SECURITY AND POLICIES

It is widely accepted that energy is a critical input for economic and social development, Energy is used in every sector of human activity and energy consumption increases strongly in line with economic growth. Unsurprisingly, reliability of energy supply is a key objective of development policy. Shortages in the supply of energy, such as those experienced by the Brazilian economy in 1974 and 1978 (oil), 1990 and 1991(ethanol), and 2001(electricity), had a strong attenuating impact on economic growth. In the 1970s the oil shock led to significant gasoline and diesel rationing, or at least restricted access to these fuels. In 1990s, the changing relative prices of sugar and lack of internal support for ethanol production led to a shortage that shattered consumer confidence in this fuel. At the same time, the hydroelectric system and a more interconnected grid system that guaranteed for larger and larger parts of the country over the 1980s came to a near halt in its supply expansion in the 1990s, leading to the 2001 power shortage in the face of below average rainfall.

Since 1974, the economic imperatives have increasingly dominated Brazil's foreign policy which had direct repercussions on the energy security of the country. After oil prices rose to new high levels, Brazil had to set aside nearly two-fifths of its export earning to pay for foreign oil. From Itaipu to Bonn to Baghdad, Brazilian economic and diplomatic officials struggled to ease the burden of these energy costs on the national economy. In the process, Brazil stayed closer to energy producers than to the major consumer nations, thus taking an independent road on nuclear-energy development visa-a-via the United States, and dealt with the Soviet Union for turbines and cast pro-Arab votes in the United Nations. Economic pressure carried Brazil away from its traditional western industrial partners, and it made new dealings more

attractive, and placed a renewed emphasis on independence in foreign affairs reminiscent in content if not in style of the Quadros-Goulart era of the early 1960s. Thus, we can state that 'responsible pragmatism' had given way to 'no automatic alignments' and 'other options' as catch phrases of Brazilian foreign diplomacy.[78]

At present a major economic constraint on Brazilian energy-cum-foreign policy is the fact that Brazil must import nearly 80 percent of the crude petroleum it uses from Saudi Arabia, followed by Iraq, Algeria, Kuwait, and Iran. Venezuela furnishes roughly 2 percent of the oil Brazil imports; Peru and Ecuador provide substantially less. Brazil has found it prudent to favor the Arab countries in the Middle East crisis, and it has also chosen to step up its domestic search for oil and to seek new sources of imports from Africa as well as from the socialist bloc. The energy crisis had also influenced Brazil's energy-cum-foreign policy in other ways as well. For example, the Ilha Solteira hydroelectric complex, with a generating capacity of 3.2 million kilowatts, has had some effect on Brazil's relation with Argentina. However, the fundamental objective, frequently iterated by both military and civilian spokesman is, 'to transform Brazil into a developed nation in a single generation'. To make the development process self-sustaining, wherein Brazil can embark upon an aggressive quest for foreign markets for its manufactured goods, minerals and non-traditional agricultural exports.[79]

Today, Brazil alongside with China, Germany, India, Japan, Mexico, Netherlands, Spain and UK, generate more electricity from non-hydro renewable energy than from nuclear sources. According to 2011 projection by the IEA, solar power generators may produce most of the world's electricity within 50 years, with wind power, hydroelectricity and biomass plants supplying much of the remaining generation. Photovoltaic and concentrated solar power together can become the major source of electricity. Renewable technologies can enhance energy security in electricity generation, heat supply and transportation. But, the euphoria over availability of energy reserves and potential output had to be tempered with concern over the actual energy supply. This was the challenge for the 21st century in Brazil, a

[78] Ronald M. Schneider., *Brazil- Foreign Policy of a Future World Power,* (Colorado, West View Press, 1976), p.1-3.

[79] Riordan Roett., *Brazil in the Sixties,* (USA, Vanderbilt University Press, Missouri, 1972).

challenge that the famous 2001 power shortage served so well to expose.[80] Besides this, the LegislacaoBasica Do SetorEletrico Brasileiro (Basic Law of Brazilian Energy Sector), this guide reviews relevant Energy Legislation in Brazil. It is a recent comprehensive document published by Brazil's National Energy Agency (Agencia Nacional de EnergiaEletrica-ANEEL).[81] It contains the following Energy Laws in Brazil[82]

Federal Level:

- The Ministry of Mines and Energy (MME) sets, sector policies, executes, high level planning, authorizes the import and export of natural gas; the MME is also in charge of putting in place a 10-year plan for the expansion of the gas transportation system.

- The National council of Energy Policy (CNPE) approves the exploration blocks to be auctioned by the ANP and sets guidelines for the development of Brazil's energy resources.

- The National Petroleum Agency (ANP) organizes E&P auctions and gas transportation bids, monitors the execution of E&P activities, authorizes the construction of LNG import terminals and mediates conflicts involving producers, transporters, distributers and users.

- The Energy Planning Company (EPC) is responsible for forecasting long term energy demand as well and organize auctions for 3 and 5 year power capacity and availability,

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[80] Amann Edmund, Werner Baer and Donald.V.Coes., *'Energy, Biofuels and Development Compassing Brazil and the United States'*, (Routledge, New York, 2011).

[81] IBP, Inc., *Brazil Energy Policy, Laws and Regulations Handbook*, Vol.1. Strategic information and Basic Laws, International Business Publications, (USA, Washington DC, Publisher Lulu.com, 2015).

[82] 1. Brazil Law 10438 Energy
2.Brazil Law 10848/2004 Provides for the sale of electricity
3. Brazil Law 11097/97 The Regulation of the Petroleum Industry
4. Brazil Law 10295/2001 Provides for the National Policy for Conservation and Rational Use of Energy and other measures.
5. Gas Law of 2009.

Following are the main public Policies on energy efficiency[83]

The National Energy Policy, as defined by the new law of 1997 regarding the oil sector as regards hydrocarbons and the sector's authorities, is based on the following issues: promoting energy savings; protecting the environment and developing renewable energies; guaranteeing oil supplies; promoting the use of natural gas; promoting free competition and private investors; and finally increasing competition on international markets. The Brazilian Fuel Alcohol Programme which is also known as PROALCOOL or The Alchol Programme (PNA) was accepted by most of the country's population as the best action undertaken by the government, in Energy Policy to achieve energy independence and secure energy security till date. Experience with Alcohols as Fuels since the beginning of this century elsewhere have been well documented in the literature. The mandatory utilization of ethanol-gasoline blends in Brazil dates back to 1931, when, by law, for a given volume of imported gasoline, 5 percent of that volume in ethanol had to be obtained in the domestic market to be blended with gasoline before being sold in the automotive fuel market.

3.5. BRAZIL AND SELECT INTERNATIONAL TREATIES

The Brazilian Constitution is perhaps the first of its kind in Latin America to delineate general principles, guidelines and laws to govern issues such as environment in keeping with the swiftly changing times. Environmental management had gained momentum in the early half of the 1990s just before the threshold of the Rio Summit. Concern about the destruction of the tropical rain forests in the Amazon basin located in Brazil was one of the factors towards willingness to consider international agreements formerly regarded as prejudicial to national sovereignty. There also appeared to be a growth of environmental concern about environmental management of natural resources among the better-informed sections of the population in the developing countries including Brazil. However, this management required a commitment from the public at large and the government in general to

[83] PBE- Launched in 1984 (Applies to manufacturers and supplies. Programa Brasileiro Etiquetagem).
- PROCEL- Launched in 1985 (Programa Nacional de Conservacao de energia eletrica).
- CONPET - Launched in 1991.
- PEE-ANEEL- Launched in 2000 (Applies to electricity distribution utilities).
- Law 10,295 (Energy Efficiency Law) - Passed in 2001.
- PNEF- National Energy Efficiency Plan (Launched in October 2011).

achieve the desired results. Thus, efforts from the government side were most urgent to bring about the necessary grades in environment and its resource management. This led to the inclusion of 'environment' in the Constitution of Brazil.

Brazil and the European Union exchanged views on a number of bilateral, regional and global issues. On the historic occasions of their first summitin Stockholm in 1972, the EU and Brazil decided to establish a comprehensive strategic partnership, based on their close historical, cultural and economic ties. Both sides agreed on the need to identify and promote common strategies to tackle global challenges, climate change, biodiversity, energy security, sustainable development, fight against poverty and exclusion. Brazil and EU concurred that the best way to deal with global issues is through effective multilateralism, placing the UN system at it centre. Both sides welcomed the establishment of an EU-Brazil Political Dialogue, initiated under the German Presidency of the EU.

Reiterating its commitment to strengthen the multilateral climate change regime, Brazil had strived for an ambitious agreement on the second commitment period of the Kyoto Protocol as well as further action under the UNFCCC, including incentives for developing countries to take measurable, reportable and verifiable measures of different kinds. Brazil, cooperated more closely on the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by suitable transfer of relevant technologies. The implementation of the Convention as well as of the Protocol was completed at the Conference of the Parties to the Convention on Biological Diversity and by the meeting of the Parties to the Cartagena Protocol on Bio-safety in Bonn in May 2008.[84] Brazil and EU decided to cooperate to ensure the sustainable production, use and development of all forms of energy including bio-fuels, as well as to promote renewable energy sources and low carbon energy technologies.[85]

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84 EU – Brazil Summit- Lisbon, 4th July 2007- Joint statement.

85 It may be noted that an International Conference on Bio-fuels was held in Brussels on 5-6 July 2007. It was also agreed that the next International Bio-fuels Conference would be held in Brazil in the second half of 2008.

The Rio Summit of 1992 held in Brazil basically underlined the implementation of the Agenda 21 program in Brazil were in certain areas received high, medium and low priorities. Chapter 8 on Integrating Environment and Development in Decision-making was given medium priority. High priority was accorded to Chapter 9 on the Protection of the Atmosphere, besides Chapter 11 on Combating Deforestation. Medium National priority was given to Chapter 12 on Managing Fragile Ecosystems combating desertification and drought. However, very high priority was given to Chapter 15 on Conservation of Biological Diversity. High priority was also given to Chapter 17 on Protection of the Oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their resources.[86]

BRAZIL AND THE KYOTO PROTOCOL

Brazil was also committed to put into practice the commitments of the Kyoto protocol signed in 1997, to combat the potentially devastating impact of global warming. In the search for new, sustainable economic models, the international community has recognized the need for a radical perspective on sources of energy, and Brazil's effort at using clean, renewable, alternative energy sources was a prime example of such an innovative venture. More than 40 percent of Brazil's energy comes from "green" sources, in comparison with around 7 percent in rich countries. The ethanol Brazil produces from sugarcane is attracting worldwide interest, for it is one of the cheapest and most dependable types of fuel derived from renewable sources. Three-quarters of the cars now being produced in Brazil have "flex-fuel" engines, capable of running on either ethanol or petrol or any mixture of the two.[87] The Brazilian government has implemented environmental initiatives that are also bringing social benefits like the one on a bio-diesel project. Produced from oil-bearing plants, bio-diesel is significantly less polluting than conventional petroleum-based diesel and it can be easily produced by small farmers in some of the poorest

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86 http://www.un.org. Country Profile-Brazil. Accessed on 3 July 2016.

87 Artigo "Join Brazil in Planting Oil-Only Radical Solution Will Overcome the Energy and Environmental Crises While Promoting Equality" *Publicado no Jornal the Guardian* assinado pelo Presidente Luiz Inacio Lula da Silva.

regions of the country. The aim of the project was to combine environmental protection with rural development thereby reducing social inequality. Brazil is actively preparing itself for a new development paradigm that will meet the environmental and social challenges of the coming decades. Ethanol and bio-diesel are the key components of this approach and Brazil is determined to "plant the oil of the future".[88]

The Law also adopted Brazil's commitments to the UNFCCC and the Kyoto Protocol as standards of the policy.[89] Consistent with these agreements, Brazil has recently strengthened its approach to forest protection, particularly through the expansion and extension of its Amazon anti-deforestation program. Reducing or reversing reforestation is a means of reducing net greenhouse gas emissions, and Brazil's forest stock stands to gain value in the trade of emissions reduction credits. In view of this, President Lula da Silva vetoed three provisions of the Law as passed by the Congress. One of the vetoed provisions made a national goal of eliminating fossil fuels as a source of energy. Another provision deleted from the Law made federal budgets contingent on action to address climate change. The third vetoed provision was intended to provide incentives for hydroelectric power as a renewable source of energy, but was considered as controversial because it favoured small projects exclusively.

Brazil's commitment towards environment was clearly visible. The credible programmes that Brazil has initiated had also included joint ventures with a number of individual countries and group of nations, like the Brazil-France joint initiative and the Brazil-EU[90] joint programme to name a few. Brazil and France have initiated processes towards environmental preservation.[91] Both have agreed that climate

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88 Endereco; palacio Itamaraty-Esplanada dos Ministerios_ Bloco h- Brasilia/DF-Brasil-CEP 70.170-900. Article 174-Paragraph 3-States that the state shall favour the organization of the placer-mining activity in cooperative, taking into account the protection of the environment and the social-economic furthering of the placer-miners. Chapter III, Article 186-II-adequate use of available natural resources and preservation of the environment. Brazilian Laws-The Federal Constitution- The Economic and Financial Order.

89 Ibid., Article 5.

90 EU is used for convenience. Although prior to the Maastricht Treaty it was referred to as EC.

91 Common Position of the Government of the Federative Republic of Brazil and the Government of the FrenchRepublic on Climate Change. Dated, 14/11/09.

change is one of the most pressing challenges and combating it must be fully compatible with sustainable economic growth and the fight against poverty. The same was endorsed at the scientific findings of the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Reports. They have also agreed to reduce global emissions by at least 50 percent by 2050 compared to 1990, besides committing themselves to cooperating to strengthen the international climate change regime, through the enhanced implementation of the UNFCCC and its Kyoto Protocol. In this context, they agreed on the central importance of comparability of economy wide reducing targets among all Annex I countries, whereas, non-Annex I countries should pursue low carbon growth by implementing nationally appropriate mitigation actions (NAMAs) in the context of sustainable development, enabled and supported by developed countries with new and additional financing, technology co-operation and capacity building. They also highlighted the need for enhanced co-operation between developed and developing countries for the research, development, deployment, diffusion and transfer of environmentally sound technologies. Besides this, they underlined the need for ambitious results in reducing greenhouse gas emissions on a global scale.

IBSA AND BRAZIL

IBSA is a trilateral, development initiative between India, Brazil and South Africa to promote South-South cooperation and exchange. Recognizing the global nature of many environmental issues, the urgency of finding cost effective and lasting solutions that are coherent with the need for economic growth, the fight against poverty, besides noting that environmental degradation is among the major global challenges and considering the strategic role of clean technologies in addressing current global challenges and development needs and in wishing to promote mutually beneficial cooperation in the field of environmental management and sustainable development; reaffirming the principles of sustainable development agreed upon at the UN Conference on Environment and Development and the World Summit on Sustainable Development- a Memorandum of Understanding (MOU) was signed between the Governments of the federative Republic of Brazil, the Republic of South Africa and the Republic of India on co-operation in the area of environment under India, Brazil and South Africa (IBSA) Forum.

The objective of this trilateral MOU was to promote a common beneficial partnership among the parties in the field of environmental management and sustainable development. Forms of co-operation among IBSA were to be conducted in the form of exchange of information and documentation, exchange of visits by experts, scholars and delegations, undertaking collaborative projects subject to internal legal disposition regarding financial resources of the Parties, besides other forms of co-operation as mutually agreed upon.[92] In the aftermath of discussions between the Heads of State of IBSA countries at the G-8 meeting that took place in Evian in 2003, where the foreign ministers of the respective countries met, there by launching the IBSA Dialogue Forum which was formalized through the adoption of the 'Brasilia Declaration'.[93] and thus the first IBSA Summit took place in Brasilia on 13 September 2006. The second Summit took place on 15 April 2010. Since its establishment in June 2003, it has coordinated the mechanism in three emerging countries, three multi-ethnic and multicultural democracies, which are determined to contribute to the construction of a new international architecture, to bring their voices together on global issues and to deepen their ties in various areas. Within the working groups, agreements and MOUs were signed, in order to legally support the cooperation. As of 2010, twelve of such documents were in force such as bio-fuels, Eolic energy, health and medicine, environment, and social issues.[94]

COPENHAGEN AND BRAZIL

At the Copenhagen Summit on 9 December 2009 Brazil had proposed to reduce at least 36 percent of its carbon emissions by 2020. Apart from the destruction of the Amazon rainforest and the equally vulnerable 'cerrado' or Savannah lands of Central Brazil, of which only half remains un cleared, Brazil's record on environmental matters is relatively positive. It was estimated that if Brazil achieved its promised reduction in Amazon clearances of 80 percent by 2020, then Brazil's

92 Documents signed at the 3rd IBSA Summit- 15 October New Delhi, 2008, Ministerio das Relacoes.

93 http://ibsa.nic.in/ Accessed on 26 November 2016.

94 http://www.ibsa-trilateral.org/ Accessed on 26 November 2016.

total emissions would be reduced by 20 percent.[95]The limited achievements of the Copenhagen Summit were the result of the denial forwarded by the public in the developed countries that any final climate deal must be asymmetrical. It was unanimously felt that unless the general public grasped that in the developed world, especially in the United States, there would be no real progress. Most western leaders are aware of the history of development and its disastrous impact on the global environment.[96] This meant that the rapidly developing countries like China, India and Brazil, if they continue in the same path, will push the whole world into runaway warming to 'develop' their growing economies. Many experts voiced that, the only way to deal with this unfair history was that the developed countries must cut their emissions deeply and fast and give the developing countries enough money to cover the extra cost of growing their economies with the clean sources of energy that they must use instead of fossil fuels.[97] Brazil has followed a long and winding road to reach the 15th Conference of the parties to the UNFCCC or COP15 in Copenhagen. This journey had begun in 1972 in Stockholm. Brazilian perspective has undergone a tremendous change from the time at Stockholm where the Brazilian diplomat responsible for defending the country's position, Minguel Ozorio de Almeida had cautioned that "environmental protectionism should not stand in the way of economic development among the less developed countries".[98]

Currently, deforestation produces the vast majority of Brazil's greenhouse gas emissions and about 20 percent of the world's emissions. Consistent with the ambitious position it announced at COP-15 in Copenhagen, in February 2010, Brazil announced it would undertake a set of Nationally Appropriate Mitigation Actions (NAMAs) to assist with its goal of reducing greenhouse gas emissions by 36.1 to 38.9 percent by 2020. These NAMAs, in theory would equate to about a 25 percent reduction in emission by 2020 compared with 2005. There has not yet been significant action on implementing the NAMAs although the 2nd edition of the

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95 Brazil's Environmental Progress-Forbes.com. Accessed on 24 November 2016.

96 For two centuries, the countries that are now 'developed' got rich by burning fossil fuels. In the process they filled the atmosphere with their greenhouse gas emissions, to the point where it now has little remaining capacity to absorb carbon dioxide without tipping the world into disastrous heating.

97 http://www.brazzil.com/component/content/article/211-december 2009. Accessed on 24/11/16.

98 Brazil's Environmental Progress-Forbes.com. Accessed on 24/11/16.

National Climate Change Plan, released by the end of 2010, details the domestic actions Brazil has taken to implement these NAMAs.

BRAZIL AND THE PARIS AGREEMENT

The Paris Agreement had signatories from 195 participating countries. On 5th October 2016, the threshold for entry into force of the Paris Agreement was achieved. The universal agreement signed by 195 countries and the EU in Paris represents the most important multilateral environmental treaty of the 21st century, defining how society would tackle global climate change in the next decades, having as a central goal to limit the temperature rise below 2 degrees Celsius and attempting to achieve the target of 1.5 degree Celsius. The legally-binding nature of the Agreements was on developed nations to report progress on the climate finance being delivered to developing countries like Brazil and India on a biennial basis and mitigation targets with a five-year mechanism starting from 2018.

As the gavel came down on the Paris climate negotiations, nearly 200 countries agreed on a *historic deal* to address climate change. It was an unprecedented and welcome outcome after the failure of its predecessor in Copenhagen in 2009. And the outcome seems to have disappointed fewer people than is the norm at these negotiations. So, in a way, Paris was not just about an agreement to cut emissions, but also about how the world will operationalize equity. Both Brazil and India signed the Agreement on 22nd April 2016. However, Brazil submitted the Ratification on 21st September 2016 and subsequently the Paris Agreement came into force on 4th November 2016.

The Main Objectives of the Paris Agreement were as follows:

1. Limit global temperature rise in 2-degree Celcius and adopt common effort to achieve 1.5-degree Celcius, based on the actions adopted by all Parties (mitigation agenda).
2. Enhance the capacity to adapt to Climate change effects, foment climate resilience and low carbon development, without harnessing food security (adaptation agenda).
3. Create consistent financial flows to foster mitigation, adaptation, technology development and transfer (financing agenda).

The Paris Focus was mainly on the following mitigations:

1. Mitigation- NAMAs- Nationally Appropriate Mitigation Actions.
2. Mitigation- Climate Action 2020 microsite
3. Mitigation- REDD
4. Mitigation- LULUCF
5. Mitigation- Greenhouse Gad Data
6. Mitigation- The Kyoto Protocol and its Mechanisms
7. Mitigation- The Convention

Brazil's Contribution to the Paris Agreement was based on the above mitigations restricted mainly to:

1. Landuse, Landuse Change and Forestry (LULUCF)
    - Forest code implementation
    - Reduce illegal deforestation to zero in the Amazon until 2030
    - Compensate emissions from legal deforestation until 2030
    - Restore and reforest 12 million hectares of forests for multiple uses
    - Improve sustainable forest management

2. Energy
    - Increase the participation of sustainable biofuels to 18 percent, including bigger participation of advanced biofuels
    - Achieve 45 percent of renewable energy sources, including the use of sources not limited to hydropower, biomass, solar and wind
    - Achieve 10 percent of energy efficiency in the generation of electricity by 2030
    - Incentive actions that promote improvements on the public transportation infrastructure
3. Agriculture
    - Promote low carbon agriculture, considering the restoration of 15 million hectares of degraded pasture areas and 5 million hectares of crop-livestock-forest integration system until 2030.
4. Industry

- Promote new patterns for clean technologies, with incentive energy efficiency and the adoption of low carbon infra-structure in the industrial sector.

Thus, Brazil reviewed its current Climate Change National Policy (Federal Law No. 12.187/2009) among others sectorial policies in the years to come, as a way to fully implement the Paris Agreement and negotiation of all future decisions. Finally, the Paris Agreement embodies a huge global commitment for a low carbon economy and for Brazil, agriculture and the agenda of production and forest conservation would play a vital role in the country's efforts towards global climate governance.

Brazil is currently developing at an incredibly fast rate, only out- performed by countries such as China and India, both in terms of economic growth and recovery rate after the global financial crisis in the late 2000s. Recent economic policy changes, made since the founding of the New Republic, have allowed Brazil to start gaining international confidence. As part of Brazil's Environmental initiatives, it is party to the following International agreements. Antarctic-Environmental Protocol, Antarctic-Marine Living Resources, Antarctic Seals, Antarctic Treaty, Biodiversity, Climate Change, Kyoto Protocol, Desertification, Endangered Species, Environmental Modification, Hazardous Wastes, Law of the Sea, Marine Dumping, Ozone Layer Protection, Ship Pollution, Tropical Timber 83, Tropical Timber 94, Wetlands and Whaling.

Today, Brazil is also no longer referred to as a developing country, but as an emerging country, a newly industrialized country (NIC) and as a member of the BRICS economies. Likewise, the ensuing next chapter on India will highlight the role of environment and energy usage and the need for energy independence and security for a developing country like India will be dealt in detail. Energy transition has played a key role in the economy of Brazil and the similar impacts are observed in the emerging economy of India.

The subsequent chapter will highlight the Indian scenario with reference to the Environment and Energy security issues.

CHAPTER IV: INDIAN ENVIRONMENTAL AND ENERGY PERSPECTIVE

In the course of absence of documentation in the early days, the centrality of environment stability was maintained to its maximum extent during the Vedic period even up to the 18th century. With the emergence of British imperialism and colonialism on Indian soil, the eco-balance started deteriorating. British imperialism brought to India its high technology, use of modern machines, factory life and modern life complexities. Gradually the environment in India started getting disturbed. The British government through Penal code (1860), Water pollution and Atmospheric pollution code of (1898), Police act (1861), tried to maintain the balance between ecology and environment but their attempts failed as they were merely an eyewash.

This section of the thesis will deliberate on the Indian environmental and scenario. The matter is discussed under four sub topics, namely the basis of environmental significance and history with reference to age old traditions and political influences. Section two will deliberate on the role of energy in the domestic and international arena and the various initiatives taken by the Indian government to deal with energy transition. Section three will highlight the various environmental and energy policies initiated by the government to combat energy crises and create energy independence scenario in India. The fourth section deals with the select international treaties where India was a signatory and the efforts put in along with the role played by it.

In post-independence period (1947), the gravity of deteriorating ecology and environment was realized but no attempts were made till 1972, when the United Nations Conference on Human Environment was held in Stockholm. After 1972, the 42nd amendment was incorporated in the Indian Constitution which was committed towards the protection of environment. In the directive Principles of the State Policy, Article 48A was included, in which states were endeavoured to protect and improve the environment and safeguard the forests and wildlife of the country, (Article 48A) by the same amendment was created as a fundamental duty of every citizen under Article 51-A (g) ‘to protect and improve the natural environment including forests, lakes, rivers and wildlife and have compassion for living creatures’. The Indian parliament had also enacted several statutes like Water prevention and Control of

Pollution Act 1974, Air Prevention and Control of Pollution Act 1981, and the Environment Protection Act 1986.Therefore the amended Constitution of India casts a fundamental duty on the state as well as every Indian citizen to preserve, protect and maintain the purity of the environment in the country. These new constitutional provisions, together with the provisions under Part IV of the Constitution lay down a foundation of sustainable development by outlining a blueprint of social and economic improvement. To this end, the higher judiciary in the form of the Apex Court of India has given the fundamental right to life, guaranteed by Article 21 of the Constitution, an innovative and purposeful interpretation.[99]

People living in Indian villages have an ancient tradition of worshipping the Mother Nature and in this guise, they have been able to preserve some of the most pristine natural environs of the world in regions like the Western Ghats section of India and the Himalayas. The villages till today have preserved and worshiped mother nature in the form of 'Sacred Grooves' (Dev Rai) in the local language as they are known, where ancient trees still stand tall and bear a witness till today. Tribal population like the Red Indians in the Amazon Rainforest has also shown similar tendencies.[100]

4.1. ENVIRONMENT IN INDIAN CONSTITUTION

In India, poverty and population growth posed major threats to the environment. Pursuing development and adopting technologies without a coherent framework of social objectives, also produce unintended side-effects. Hence a committee on environmental co-ordination was set up in 1972 to look into these problems and suggest a solution, with experts and concerned ministries and departments of the government. Another committee was set up in January 1980 for reviewing existing legislative measures, administrative machinery for ensuring environmental promotion and for recommending ways to strengthen them. On the recommendation of this committee, the Department of Environment was set up in 1980. Subsequently it was made into a new Ministry of Environment, Forest and Wild

[99] Surya Narain Yadav., *Energy Security and Environment Sustainability,* (New Delhi, Global Vision Publishing House, 2010),p.76-79.

[100] Sen Geeti ., *Indigenous Vision- Peoples of India Attitudes to the Environment,* (New Delhi: Sage Publications 1992), p. 3-6.

Life in 1985 to serve as the focal point in the administrative structure for planning, promotion and co-ordination of environmental programs. The Environment Protection Act 1986 came into force from November 1986 with a set of rules and regulations.

India was the 1st country in the non-communist world to begin its post-independence development program employing comprehensive planning. Its development framework was deeply influenced by a complex set of political, administrative and other factors. Hence Indian development needs have to be studied and understood in the light of these factors.[101] British colonial rule from the middle of the 18th century marked a watershed in India's environmental history as the intensity of resource extraction increased and forest came under pressure from expanding agriculture. During the Mughal era, royal and state monopolies over valuable commodities such as ebony, sandalwood and teak had led to some over harvesting, but overall, a 'rough equilibrium' existed between the needs of Indian society and the availability of forest resources. Unlike Brazil which was during the period from 1822 to 1889 an independent country governed by a monarchical system whose head was an Emperor, Dom Pedro I and II. The population of Brazil in 1822 was just 3.9 million of which nearly 1.2 million were slaves. Brazil was sparsely populated by nomadic Indians, whose number declined due to diseases contracted from the early Portuguese colonist and who could not easily be disciplined or trained for plantation work. Hence there was dearth of man power and low economic for Portugal, which led to the decentralized political-economic-organization of this colony.[102]

Whereas, on the other hand, India came under the British East India Company rule in 1757 which lasted till 1858 until the Government of India Act 1858 as passed which led to the direct control of the Indian subcontinent in the form of the new British Raj and then started exporting products like cotton, silk, indigo dye, salt, spices, saltpetre, tea and opium. The British rule from 1757 to 1947 period (190) years in India and the Portuguese rule in Brazil from 1822 to 1889 (67) years are in sharp contrast. Brazil's exports were mainly dye and sugar, which were managed with

[101] Kartik .C.Roy., Clement.A.Tisdell and Raj Kumar Sen., *Economic Development and Environment-A case study of India,* (Calcutta: Oxford University press.1992), p.1.

[102] Mosley,Stephen., *The Environment in World History*, (Oxon, New York: Routledge. 2010), p.47.

the help of less indigenous people and more of slaves (4.9 million slaves were brought from Africa to Brazil during 1501 to 1866), India on the other hand had its own native population to work in the cotton and silk industry. India had 330 million people at the time of Independence in 1947. These 33 crores Indians were led forward by Gandhian ideas and principles of non-violence, khadi industry and handlooms, rural agriculture unlike plantations in Brazil and the non –commercial use of energy in India.

Gandhi prepared a plan of development for India which was non-violent and environmentally sustainable. During his lifetime and the great debate that ensued for India's independence on the appropriate planning framework for India, Gandhi's economics was scoffed at as faddy and unpractical, but subsequent experiences of planned development in India and in other countries, and the environmental degradation that the world has been experiencing have led to the rediscovery of Gandhian economics and its relevance in the current world environment. Gandhi used the term 'development' in a very broad sense to mean the total development of society. Although Gandhi never wrote on 'green philosophy' but he had a sound understanding of the human-nature relationship. He combined social, economic and environmental equity and ethical imperatives for obtaining political independence as well as economic salvation for millions of people in rural India.

What actually mattered was to understand, why Gandhi anticipated the environmental crisis more than half a century before the term 'sustainable development' was coined. This was primarily because his assessments were based more on core principles with material data merely as an add-on. Gandhi could predict that modern industry and consumption patterns would strip the planet like locusts because he saw that the edifice of modern industry was based on a disregard for means as long as the end objective was realized.

Hence, the beginning of the 20^{th} century was marked with ecological enlightenment across the globe. In India, the environmental activism, which started with the Chipko Movement, had a Gandhian slant, and it continued even with the Silent Valley protest in Kerala and the Narmada BachaoAndolan in Madhya Pradesh. Though each movement differed in their political ideologies and activism, the binding forces among all these movements were the adoption of Gandhian non-violence and

Satyagraha. Environmental historians like Ramachandra Guha have identified three different ideological trends in Indian environmental movements- crusading Gandhians, ecological Marxists and alternative technologists. But whatever stand or trend they represent, all these movements carried the Gandhian legacy of prudent use of nature and natural resources. Environmental protection was not a direct agenda in Gandhian programs. But most of his ideas can be directly related to environmental protection. Green movements and ecological movements have acknowledged their indebtedness to Gandhian philosophy. The second aspect of Gandhian environmentalism were his constructive programs. He envisioned 18 constructive programs to build a better India. Though the concept of sustainable development was alien to Gandhi, his constructive programs were the first expressions of such a development without destroying nature and natural environment.

4.2. ENVIRONMENTAL VIEW - ORIGIN OF GREEN MOVEMENTS IN INDIA

The 1900s were a time of revolution for under-represented groups in India and it was at this time that environmental movements began. Modernization and industrialization caused increased deforestation and abuse of natural resources, as these initially affected most immediately the rural population, it was they who first created ecological movements. Nothing could be closer to Gandhi's concept of Gramaswaraja than creating village ecosystem which is biologically diverse and self-reliant. In 1972, Jharkhand Mukti Morcha, literally meaning 'forest area' emerged. However, the movement diminished after being placated by Indira Gandhi's government's development programs. Close on heel was one of the India's most significant social movement which opposed commercial deforestation in Uttar Pradesh known as the chipko 'embrace' Andean movement, which emerged in 1973. Unique because its major constituency were women, including the well-known ecofeminist Vandana Shiva. The movement saw a major victory in 1980 when the then Prime minister Indira Gandhi passed a 15-year ban on green felling. These protests and subsequent victories spread to other regions in India, including the states of Karnataka, Rajasthan and Bihar.

The struggle of fisherman in the southern state of Kerala in the 1980s symbolized an even more active form of protest against an increasingly industrialized

and ecologically destructive state. The main reason for fighting was over the use of mechanized trawlers that caused increased destruction of marine ecosystem. The protests spread from Kerala up to the coastal state of Goa and Tamil Nadu. Today the fishing ban is in practice in the coastal states of India trying to strike a balance in the marine ecosystems thereby trying to achieve the Sustainable Development Goal number 14. Following this, the Indian National Green party, led by Prof. Priya Ranjan Trivedi, who was also the convener of the World Federation of Green parties, was officially registered with the Election Commission of India on 7th January 1999. The promotional scheme of the party was aimed at the youth, with catch phrases such as 'catch them young' and 'each one teach one'. Members believe that the youth can change the world if they learn to be both ecologically respectful and socially aware. The official charter of the Indian National Green party has a list of beliefs and goals including ecology, democracy, social justice, peace, sustainable development, meaningful work, culture, information, global responsibility and long-range future focus, all these are clearly reflected in the SDGs that were outlined in 2015.

In spite of this today the Western Ghats-bio hotspots in India have lost some 20,000 hectares (ha) of trees in the past 17 years, according to data from Global Forest Watch, which is an open-source web application of non-profit World Resources Institute. Of this, 10,000 ha was lost in the past five years in the four Karnataka districts that form the core of the Western Ghats- Dakshin Kannada, Uttara Kannada, Kodagu and Udupi. The repercussions of which are already visible. For example, the Cauvery River, which originates from this region and is crucial for the life and livelihood of over 100 million people in Karnataka and Tamil Nadu, has started drying up. The rapid tree loss has also resulted in 0.2 million tons of carbon emissions, according to Global Forest Watch. Rapid urbanization that has prompted mindless development activities, is the primary reason for the alarming decline in tree cover. There were many private plots of land which had many trees, but these have been turned into housing complexes or tourist's resorts, says C. P. Mutthana, a Kodagu-based wildlife conservation activists. The region is important for the entire Indian sub-continent because it influences the Southwest monsoon weather pattern during late summers. The United Nations Educational, Scientific and Cultural Organization (UNESCO), while conferring the status of World Heritage Site, listed the region as the world's eight "**hottest hot spots**" of biological diversity. Besides

Karnataka, the Western Ghats are spread across Kerala, Tamil Nadu, Goa, Maharashtra and Gujarat. According to the 2019 figures of State of India's environment as reported by DTE-CSE, there has been a 146 percent increase in forest land area that has been diverted for non-forest activities between 2016 and 2017.[103]

Economic Growth and Environment

The Indian paper industry has ruthlessly destroyed the forests of India. Paper companies in Karnataka, having destroyed all the bamboo forests, and are now getting their raw materials from the last major forested frontier of India- the Northeast. The Andhra Pradesh government has meanwhile set its sights on the forests of Andaman and Nicobar Islands for a paper mill that it wants to build in Kakinada. This shortage of raw materials for wood pulp has already forced the government to liberalize import of pulp for the country's paper industry, thus adding to the pressure on the forests of other Third world countries.[104]

It is the poor that are affected the most by such environmental destruction. The field experience of voluntary groups shows clearly that eradication of poverty in a country like India is simply not possible without the rational management of our environment and that, conversely, environmental destruction will only intensify poverty. The reason is simple though, seldom recognized. The vast majority of the rural households meet their daily household needs through biomass or biomass related products, which are mostly collected freely from the immediate environment. In short, they live within nothing other than a biomass-based, subsistence economy. Food, fuel (i.e., firewood, cow dung, crop wastes) fodder, fertilizer (i.e., organic manure, forest litter), building materials (i.e., poles, thatch), herbs and clothing, are all biomass products. Water is another crucial product for survival. Water is not biomass itself, but its availability is closely related to the level of biomass available in the surrounding environment. Once the forest disappears, the local pond silts up, the village well dries up and the perennial streams gets reduced to a seasonal one. The water balance gets totally upset with the destruction of vegetation, in a monsoonal climate like India with highly uneven rainfall over the year, it means greatly increased

[103] www.globalforestwatch.comaccessed on August 17th 2019.

[104] RadhakrishnaB.P. and K. K.Ramachandran., *India's Environment- Problems and perspectives,* (Bangalore: Geological society of India. 1986), p.73.

runoff and floods during the peak season and greatly increased drought and water scarcity in the lean, dry season. The three things that Indians need to understand to eliminate poverty and ensure sustainability are firstly, the need to finance development and eliminate poverty, secondly, the need to focus globally on the degradation and depletion of natural resources and thirdly, the need to bridge the technology gap between the rich and the poor.[105]

4.3. INDIA'S ENERGY SCENARIO

Energy is a critical input for the growth and development of any country. It is the lifeline of the national economy. In India, about one third of the energy comes from non-commercial sources. The rural population depends heavily on fuel wood, dung and animal waste. In urban areas, there are large numbers of non-motorized vehicles like bicycles, rickshaws, handcarts and animals' carts. Development process of a country is directly dependent on the uninterrupted support of the energy sector of that country. The fact that, energy is never available in abundance leaves before the nation the only option of managing properly the limited available energy for its optimum use. A minor oil supply imbalance is capable of sending shock tremors through every aspect of a nation's life style.

Energy demand of a country is not independent on its quality of living as consumption of energy normally increases with the rise in the GNP. Apart from playing the indispensable role in the energy sector, oil and gas are vital to the industry of petrochemicals and fertilizers and Indian economy being an agrarian economy greatly needs this in abundance. India's energy status is not promising. Presently, the country consumes about 100 million tons of coal and 32.5 million tons of oil annually. Official estimate report that 40 billion tons of coal are available but only one half of this is recoverable which means it is less than the projected demand of 23 billion tons of coal till the year 2020. India's oil deposit is about 400 million tonnes as against the world oil reserve of 750,000 million tonnes. Gas reserves of our country are about 100 million cubic meters, as against world's reserves of 63,000 million cubic meters. Here, we can conclude that the energy scenario of India is blank. India ranks 6th in the world in total energy consumption. India's per capita energy

[105]http://www.shvoong.com/business-management/mangement/1937558-climate-injustice-tackling-climate-change accessed on 18 June 2016.

consumption is 290 units (kg of oil equivalent), compared to 8,000 units in the US and 600 units in China. Though India has abundant coal reserves, it has very little oil. More than 25 percent of the country's primary energy needs is met by import of crude oil and natural gas. Of the commercial energy used in India, 51 percent comes from coal, 36 percent comes from oil, 9 percent from natural gas, 2 percent from hydropower and just 2 percent from nuclear plants.[106]

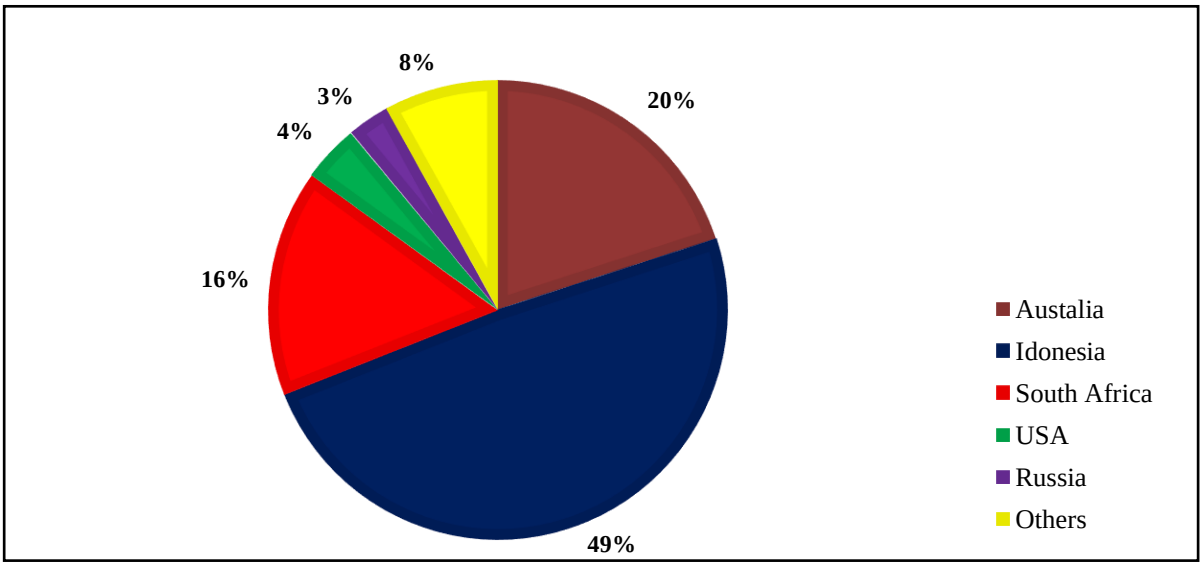
The phrase 'energy independence' had become a mantra since it was first articulated by Richard Nixon in USA four weeks after the 1973 embargo. India has long since crossed the stage of economic infancy and moved from rusticity into commercial energy usage since the British rule days. The establishment of railway using steam engines and textiles and other manufacturing industries based on steam boilers firmly set the country on the road to increasing energy consumption. Prior to this, the only fuels known to be used on the Indian subcontinent, with a reasonably high entropy state comparable to modern expedients, were vegetable oils and ghee, patronized in temples and homes all across the country since epic times. The purchase of petroleum from the market required cash outflow and was hence a drain on the meagre incomes of the people. Human and animal labor was the order of the day and the economy had attained a kind of energy equilibrium. The vegetable oils on the other hand were an easy option.

National security is holistic concept and energy security is one of its important ingredients. Energy security essentially implies ensuring uninterrupted supplies of energy to support the economic and commercial activities necessary for the sustained growth of the economy. The critical relevance of this concept for India emanates from the growing imbalance between the demand for energy and its supply from indigenous sources implying thereby the growing import dependence for essential requirements of the nation. When we talk of the energy future for a country like India, with a fast-exploding population problem all the forecasting techniques appear to bite dust. In terms of population, a 'second India' is in the offing within a few years. By the turn of the century, it is estimated over 530 million tons of coal and 92 million tons of oil would be required per annum for the nation. The major coal bearing state

[106] Radhakishna B.P. and K. k. Ramchandran., *India's Environment- Problems and Perspectives,* (Bangalore, Geological Society of India, 1986), p 37.

in the country are Bihar, Orissa, West Bengal, Madhya Pradesh, Andhra Pradesh, and Maharashtra, which together account for more than 99 percent of the total reserves in the country.[107]

Figure 10: India: Coal Import by Source (2019)

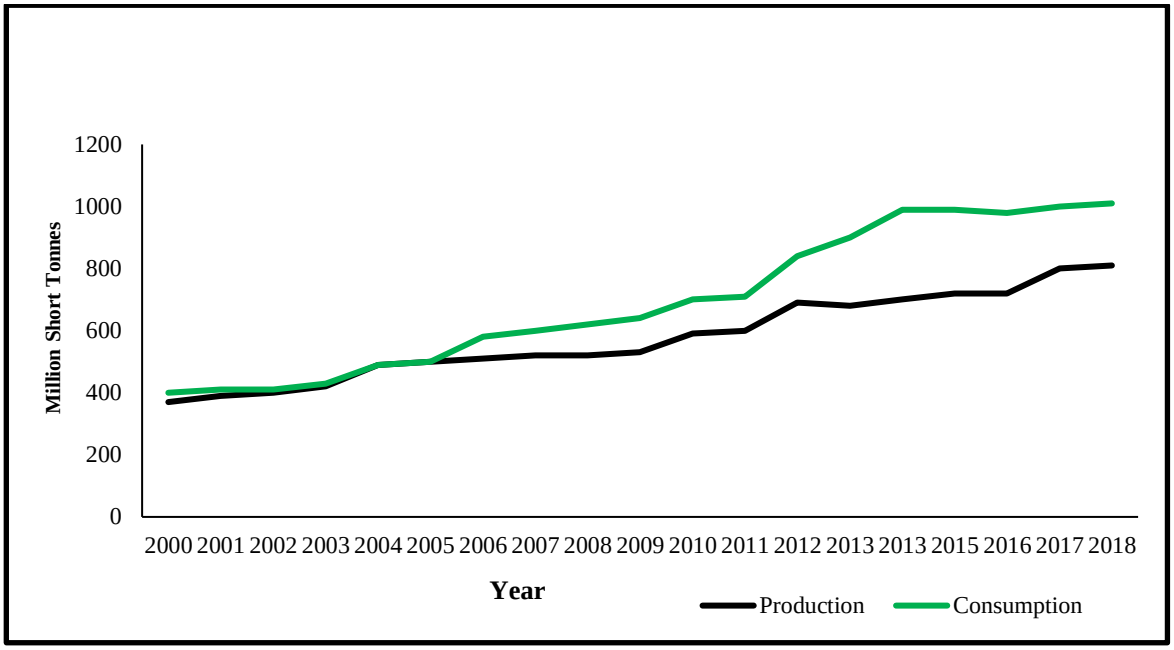


Source: US Energy Information Administration – Global Trade Tracker

The figure 10 indicates high dependence on imported coal reserves from countries like Indonesia and Australia, since the local coal available is of low grade in India.

[107] Ibid.p.49.

Figure 11: India: Coal Production and Consumption (2000 - 2018)



Source: Compiled from U. S. Energy Information EIA

In the figure 11, the coal production has decline from 2012 onwards, however, the demand for consumption has shown a steady rise.

The ratio of non-commercial (biomass) energy to commercial energy used in any country is an index of its development. For example, the use of non-commercial energy in developed countries is only 1 percent whereas the average consumption of non-commercial energy in the developing countries is 43 percent. In India about 40 percent of our total energy consumption is non-commercial energy, and our present rate of consumption is about 130 million tons of wood, 65 million tons of cow dung cake and 40 million tons of vegetable matter per year. [108]

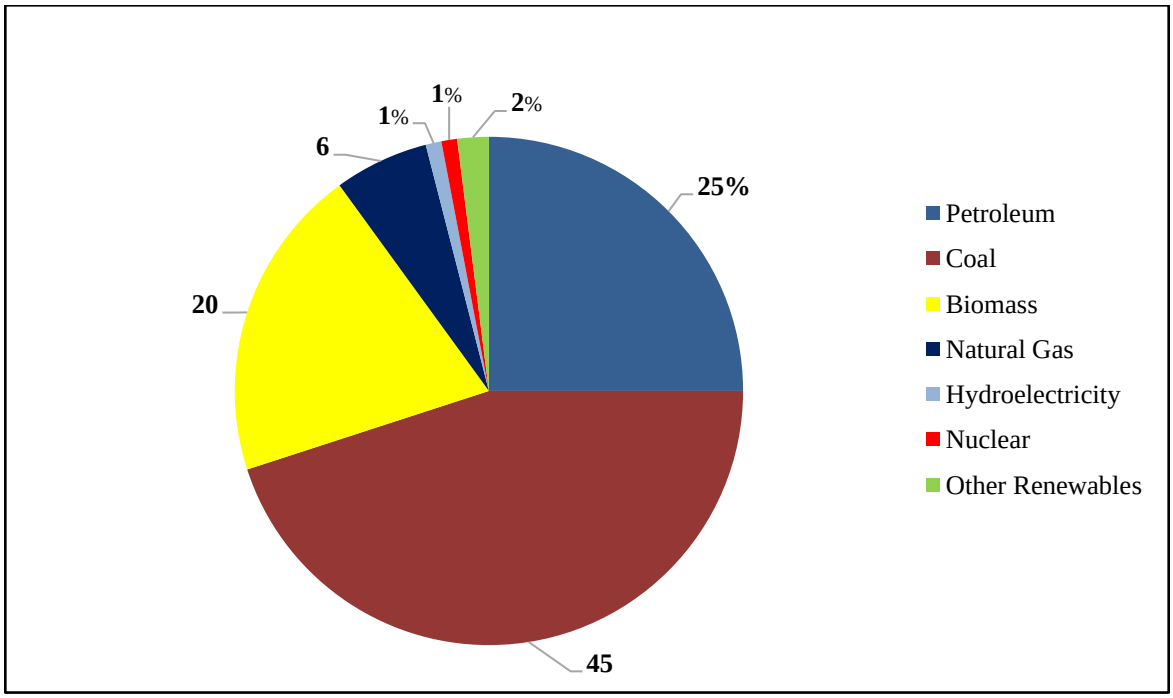
India is also not self-sufficient in terms of oil energy. It has to depend on imports, which mostly come from the Gulf. Despite this, energy security concerns are hardly considered to be important enough to figure in Indian Foreign policy. Only recently, due attention has been given, when the need of growing demand for energy imports was realized by the Government of India. This issue became so alarming following the Iraqi invasion of Kuwait (1991), which led to the oil price escalation.

[108] Subudhi. R.N., *Energy Options for 21st Century*, (New Delhi, Ashish Publishing House, 1993), p.1.

As a result, India was forced to take some bold measures in order to meet its energy requirements.[109]

In spite of India's meagre oil reserve, it became a victim of the propaganda of big oil companies. Imitating other western countries, India gradually increased its oil consumption and began neglecting coal as a primary source of energy. As a result, following the energy crisis in 1973, India was faced with an import bill of 1,200 crores for oil. Energy crisis, in turn brought about economy crisis. Fortunately, however, before many developed countries could recover, India recovered from the financial crisis by following a judicious fuel policy. Oil from Bombay off-shore came as an unexpected gift to tide over the economy crisis. Since India had a large potential reserve of coal and negligible reserve of oil and uranium, it was sensible to build India's future on coal as a primary source of energy. At present about 45 percent of our total commercial energy consumption comes from coal and 25 percent from oil and gas and 2 percent from hydroelectric and nuclear energy. Our per capita consumption of energy however is extremely low. The figure 12 clearly indicates the share of coal as a major source of fuel for the country and other renewables sharing a mere 1 percent of the total energy consumption.

Figure: 12 India: Energy Consumption (Fuel wise) 2019



[109] Malakar.S.N., *India's Energy Security and the Gulf*, (Delhi, Academic Excellence, 2006).

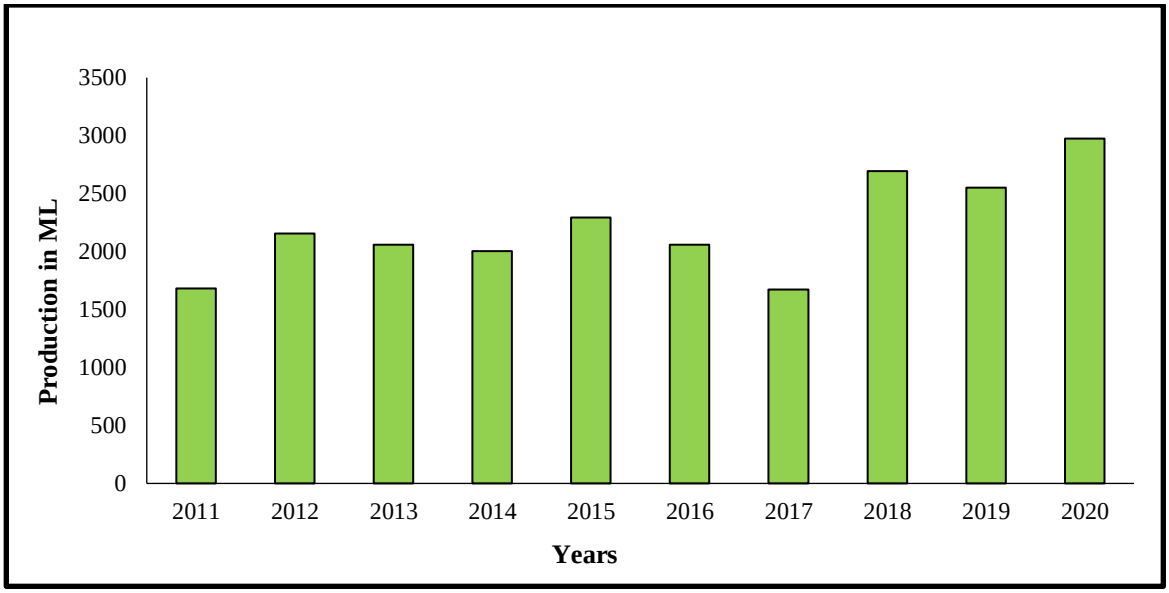
Source: International Energy Agency, World Energy Outlook, 2019

Energy consumption per head per year in the USSR is equivalent to 17 million tons of coal and in the USA to 16 million tons, whereas per capita consumption of energy in India is only 0.3 million tons.[110] Considering such circumstances, it was obligatory to raise the economy of the country to develop its energy resources as fast as possible. In similar instances, Brazil after the 1973 Oil crisis resorted to the production of ethanol, whereas India went ahead in search of more oil fields at this juncture. Due to robust economic growth in the last two decades, India has gained huge importance in terms of the energy landscape. In the future, India is likely to join the ranks of USA, China, Germany and Japan as the top five economies of the world. Besides this, India is also projected to have the largest energy demand globally. So, what happens in India is very important in terms of the global energy system and efforts to decarbonize. But alongside, the poor in India are particularly vulnerable in terms of energy poverty compared to the poor in more affluent societies. So it's even more important to plan for greater energy access.

For some inexplicable reason, energy security has traditionally not been a prominent issue on India's radar screens. In fact, even in the aftermath of the first major global oil crises of 1973, when the price of oil topped the US$60 to a barrel mark, India did not rouse up. This could be attributed to the vast usage of biomass-based fuels namely firewood and coal that were cheaply and abundantly available in India. Today, energy dependent India imports up to 73 percent of her energy requirements and this is expected to grow by at least 6 percent every year for the next 10 years. This means that India's energy needs will grow annually at an average of 4 percent as against a global average of 2 percent. India, already the 6th largest in terms of global energy consumption, along with China, Japan, and the US, is set to become one of the largest importers of oil and natural gas. Not until the middle of the last decade of 90's did the phrase 'energy security' found notable mention in public discourse. But then reality began to stare us in the face.

[110] Ballab Parikshit., *Global Warming*, (New Delhi, Cyber Tech Publications, 2009), p.46.

Figure 13: India: Ethanol Production (2011-2020)



Source: Statista 2022

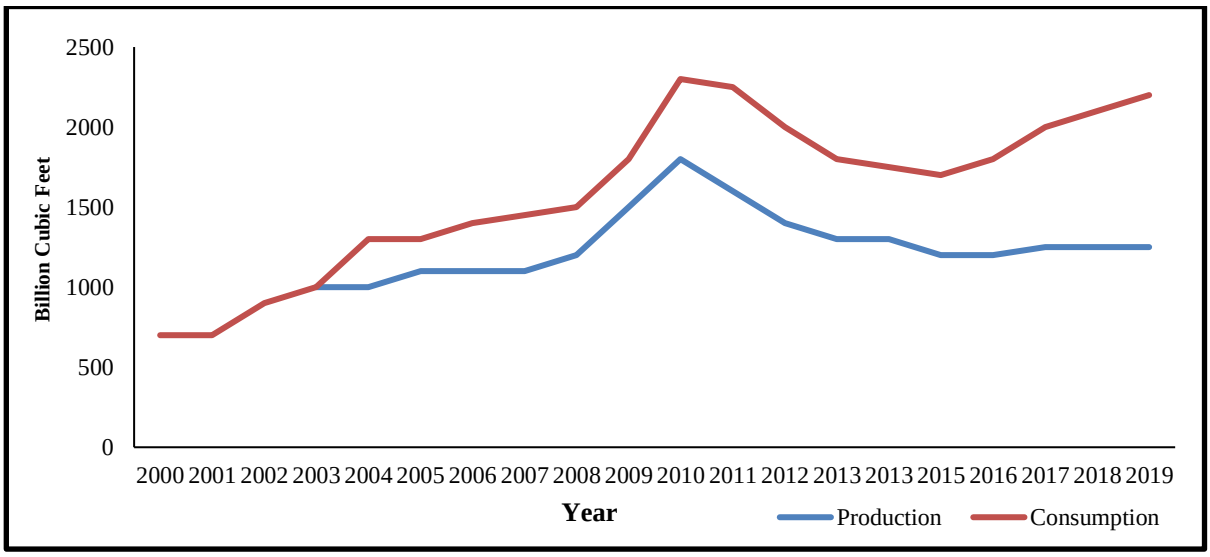
In the figure 13 the Ethanol production in India has been relatively slow and it dipped down in 2017, but later the production was steadily rising from 2018 onwards.

Energy equity is paramount to the right type of energy transition. We don't want a world that is powered by renewables but where energy poverty still impacts poor people harshly. India doesn't need an energy transition in terms of only emissions and technologies, it needs the right type of energy transition to empower millions. Energy equity is central to that. Energy inequity has profound implications for sustainability and women in India pay the heaviest price for energy poverty, spending several hours a day daily gathering firewood, collecting water and doing hard chores manually. Thus, it is clear why access to affordable, inclusive and clean energy is the UN's Sustainable Development Goal (SDG) 7. Energy inequity limits the lives, livelihoods and fulfilments of millions of people in India. As the world moves towards a transition with renewable energy, it must also ensure energy equity for those who've never had this.

In addition to its struggle to secure supply, India is becoming increasingly aware of the fact that its economy is highly vulnerable to supply disruptions. Till recently, India did not have an energy security policy or contingency plans to fall

back on in cases of crisis. Nor is it a member of any organization like the (IEA) International Energy Agency, which was born in the aftermath of the 1973 oil crisis to protect members from any further disruptions in the energy market. To minimize the impact of global fluctuations, India is only building a strategic crude oil reserve facility on its southern and eastern coasts. To tide the energy crunch, India can a**)** shift to natural gas and LNG. India will be a major importer of natural gas and LNG over the next few decades. The cheapest way to get supply of gas to India would be through pipelines from Central Asia and the Middle East, through Pakistan, but due to tense political relations with Pakistan the two countries have not been cooperating on energy schemes and such pipelines are politically infeasible. On the eastern coast, imports of small amount of natural gas from Bangladesh may be feasible. However, Bangladesh's internal party politics does not allow it to take a decision in favour of New Delhi.

Figure 14: India Dry Natural Gas Production & Consumption (2000-2019)



Source: Compiled from U. S. Energy Information Administration; India's PPAC; International; Energy Agency; BP Statistical Review 2020

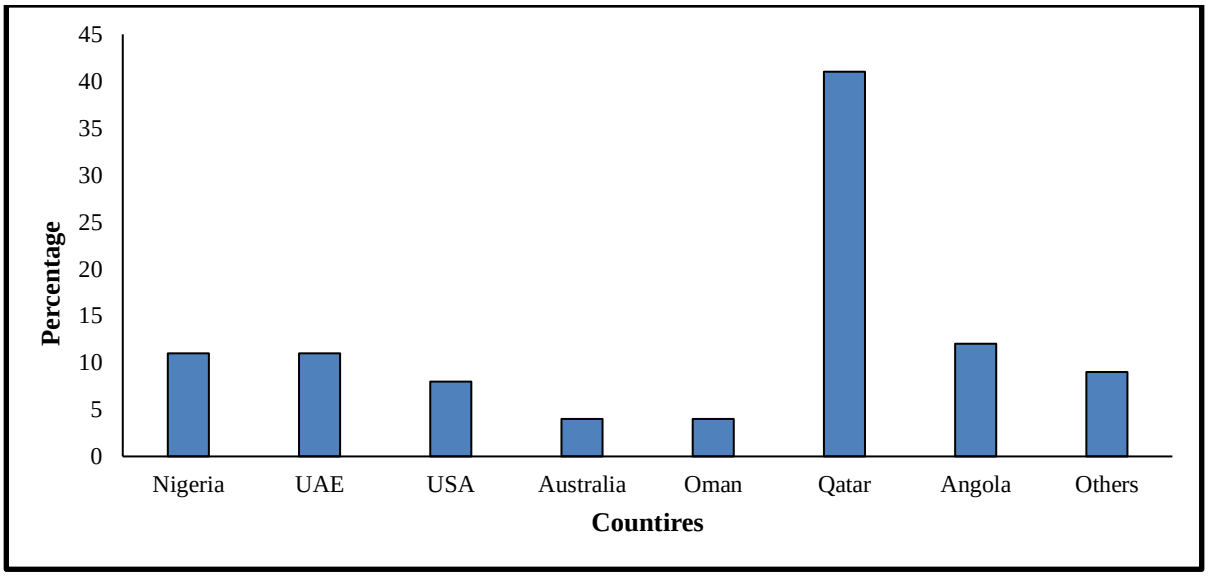
In the figure 14, India's natural gas production and consumption had peaked in 2010 and then steadily decline and now the consumption is more than the actual production.

Consequently, India is focusing on costlier LNG imports, especially from Oman and Qatar. This would require construction of LNG terminals which pose security risks and are attractive targets for the terrorists. b) Increase domestic production. In the past few years, the government has introduced a new exploration

licensing policy aimed to promote investment in the exploration and production of domestic oil and gas. It is premature to determine how much oil can be generated domestically and for how long, but privatization of the oil sector, removal of bureaucratic obstacles and improved business climate could improve India's energy security. c) Increase utilization of clean coal technology**.** Since the country is the third largest coal producer and holds 7 percent of global reserves of coal and it provides 56 percent of India's commercial energy supply. Application of the coal gasification combined cycle process is an emerging technology for clean and efficient coal fueled generation. d)Shift to next generation fuels and increase use of renewable sources of energy.

India is probably the only country with a full-fledged ministry dedicated to the production of energy from renewable energy sources. The Indian government is promoting the use of ethanol made from sugar cane and bio-diesel extracted from trees that are common in many parts of India, such as the Jatropha, Karanja and Mahua. Additionally, India is emerging as a growing market for solar, wind and hydroelectric power. According to a report by the American Wind Energy Association, India currently ranks 5th in the global wind energy production.

Figure 15: India LNG Imports by Source (2019)



Source: IGU 2020, World LNG Report

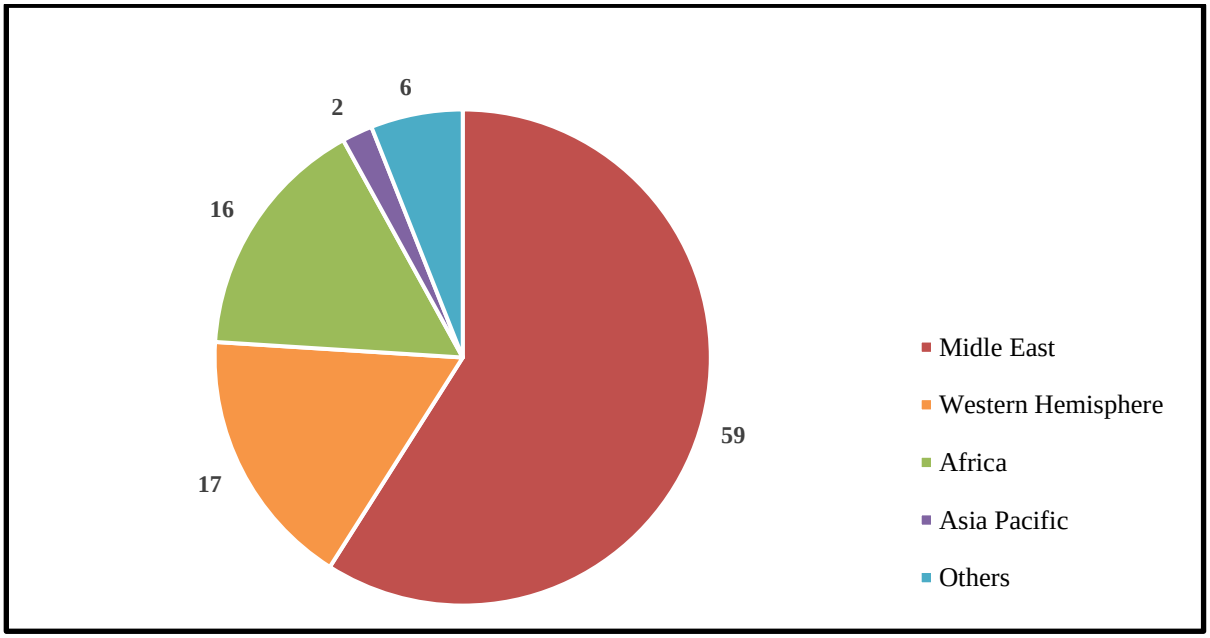
In the figure 15, the highest import of liquid natural gas came from the neighbouring country of Qatar.

Oil – India was the 1st country in which oil was struck in a commercially exploitable form and hence soon after Drake's discovery, the Assam Oil Company came into being in 1868. The onshore sedimentary area is significantly more expansive, the quantum of reserves is expected to be relatively much larger off shore, judging from the ever-increasing sizes of the Bombay High, Krishna-Godavari and Cauvery Basins. Of late the share of Gujarat onshore reserves is increasing, so that the gap in contributions between Assam and Gujarat over the period 1975 to 1986 has closed. The natural gas strikes at Tanot near Jaisalmer in Rajasthan and at Chintallpalli and Mandapetta in Andhra Pradesh appear to be promising.

India produces about 33 million tons of oil and 32 million tons of natural gas. India imports more than 90 million tons of oil that is over 70 percent of our oil needs. The oil import bill is about USD 90 billion. Besides this, the country boost of having major programs regarding renewable energy. UAE is India's third largest trade partner and the second largest export destination after the US. In 2021-22, bilateral trade between India and the UAE was valued at $ 72.9 billion with India's export accounting for $ 28.4 million. Total trade is expected to rise to $ 100 billion by 2026 under the recently signed Comprehensive Economic Partnership Agreement. About 60 percent of India's crude comes from the Gulf. India relies considerably on Gulf countries for crude oil imports, not only to fulfil its energy requirements but also for strategic and security purposes. According to the then petroleum minister Hardeep Puri, India required a total of 5 million barrels of oil per day and that 60 percent of it came from the Gulf.[111]

[111] The World Energy Outlook, published by the International Energy Agency (IEA), projects that India's dependence on oil imports will grow to 91.6 percent by the year 2020.

Figure 16: India Crude Oil Imports by Source (2019)



Source: US Energy Information Administration

The figure 16 indicates the major supply (59 percent) is coming from the Gulf countries and 17 percent coming from Venezuela the South American country.

Concerned about its growing reliance on oil from the Persian Gulf wherein around 65 percent of its energy is imported from this region. India is following in the footsteps of other major oil importing economies, and is now seeking oil outside the Gulf region. In view of this, Indian firm's investment in overseas oilfields is projected to reach $3 billion within a few years.

Nuclear Energy – The Atomic Energy Act of 1962- provides for the development, control and use of atomic energy for the welfare of the people of India and for other peaceful purposes and for matters connected therewith. Nuclear power is the 4th largest source of electricity in India after thermal, hydroelectric and renewable sources of electricity. As of 2013 India had 21 nuclear reactors in operation in 7 nuclear power plants, having an installed capacity of 6780 MW and producing a total of 30,292.92 GWh of electricity while 6 more reactors were under constructions and are expected to generate an additional 4300MW.[112] The use of nuclear energy in order to quench India's thirst for energy has often come under

[112] *The Atomic Energy Act, 1962*, Universal Law Publishing (2011, Co.Pvt.Ltd. New Delhi, India). (www.unilawbooks.com accessed on 14th December 2016.

intense scrutiny. The biggest challenge that the country faces here is the fact that India has an immense shortage of high-grade uranium. Indian uranium being low grade is about 7 times as costly as that available internationally. The known sources of uranium (at Jaduguda) are fast depleting and there is no willingness on the part of the government to start mining at two locations (Domiasiat and Nalagonda) in the southern Indian state of Andhra Pradesh, which have proven uranium reserves. On the other side, India has massive reserves of thorium and the need of the hour therefore is to bridge the gap between the shortage of natural uranium and the available thorium. This is what formed the crux of a plan for India's future energy needs, devised by Homi Bhabha, the father of the Indian nuclear program.

Like the other Asian energy importers, India is also looking to nuclear power development as an important source of electricity generation. Nuclear now accounts for less than 5 percent of electricity needs in India but 5-8 new plants are planned which would triple nuclear generation from 3 to 9 gigawatts (GW). Even so, nuclear power will only be able to meet a small fraction of India's energy and electricity needs. Nuclear energy accounts for only one percent of India's primary commercial energy consumption and 2.6 percent in power generation. India has limited quantities of uranium to produce only 10,000MW. Nuclear energy also involves a number of waste disposal and safety issues that have not been fully resolved. A point of observation is that India is the only known country with nuclear weapons which is not a party to the Non-Proliferation Treaty (NPT), but is still allowed to carry out nuclear commerce with the rest of the world. The OCED's International Energy Agency predicts that India will need some $1600 billion investment in power generation, transmissions and distribution by 2035.[113]

Renewable Energy – It was in the 1970s that the real potential of renewable energy sources was identified in India for sustainable energy growth. The contribution of renewable energy-except hydel energy and conventional biomass as a proportion of global energy output is pegged at a paltry 2 percent and was to increase to 5 percent by 2020. Since 1980, a significant thrust has been given to the development, trial and induction of a variety of renewable energy technologies for use

[113] Renewables 2015 Global Status Report, Renewable Energy Policy Network for the 21st Century, p.27, accessed 19-11-16.

in different sectors, such as biogas, biomass, solar energy, wind energy, small hydropower and other emerging technologies.In the sphere of the usage of solar energy, solar Photovoltaic (PV) and solar thermal technologies are being used for a host of industrial and commercial applications, as well as in Non-Electrified and Rural Zones (NERZ). The country has the world's largest assemblage of solar photovoltaic, consisting of about 5,00,000 PV systems, totaling to 39 MW, and encompassing over 30 variegated operations. The rate of growth of India's total installed solar capacity in 2015 was 80 percent. India added 3.6 GW to its capacity and its total capacity now stands at 8.1 GW.[114]

Hydro-Electricity – India is the 8th largest consumer of hydroelectricity in the world and it accounts only 5 percent of the country's total consumption of commercial energy. Currently, there is an installed capacity to produce only about 31,000 MW of energy. Though India has potential to generate 150,000MW of energy through hydro sources, there are certain constraints in achieving it like opposition on environmental and social grounds, as these projects can displace larger number of people and due to this reason projects clearances take time and hence World Bank and other agencies are reluctant to fund hydroelectricity projects.

Biomass Energy – India's biomass energy has a potential of 19,500 MW. Currently biogas accounts for 600 MW of power generated annually. About 36.5 lakh biogas plants had been installed by 2004. This is just over one-fourth of the estimated potential of 12 million plants in the country. The government is planning community-based biofuel programs using fast-growing, oil-bearing trees like Jatropha. This would provide power for approximately 25,000 remote and 175000 forest fringe villages. What sugarcane-based bioethanol is meant for Brazil, Jatropha is meant for India. The country has enjoyed one of the world's highest growth rates for several years. It has focused its biofuel policy on biodiesel, primarily derived from Jatropha, which was aimed to meet 20 percent of all demand from diesel beginning in 2011-12.

The risk of limited, or very expensive access to energy was putting the brakes on India's economic growth and this prompted the Indian government to launch a National Biodiesel Mission (NBM) in 2003. Jatropha was identified as the most

[114] Down to Earth, Science and Environment fortnightly, (16-30, September, 2016), p11.(Bridge to India,Consultancy and knowledge services provider in the Indian renewable market).

appropriate crop given its high yields of oil, its ability to survive on less fertile land (and therefore compete less with food production), and ease of management and harvesting. Hence the first stage of the Biodiesel Mission ran from 2003 to 2007 and sought to establish the viability of key activities within the value chain. 400,000 hectares of land distributed across 8 states were identified. India's highly decentralized bureaucracy means that many national and state institutions played a role in supporting the Biodiesel Mission.[115]

Unlike sugarcane bioethanol production, which exhibits large economies of scale (as we can see in the case of Brazil), biodiesel production may work as a small and medium size enterprise. Thus, there was scope for a variegated, decentralized system of Jatropha production that limits pressures on existing agricultural land and allows smaller-scale cultivators to benefit too. A constraint to this more decentralized approach, however was that, cultivators are reluctant to invest in Jatropha production without market assurances and proximity to processing facilities, and developers of processing facilities were reluctant to invest unless it was evident that feed stocks were readily available. The slow gestation of Jatropha orchards, coupled with the greater organization and entrepreneurship required to provide enough local processing facilities, meant that this approach was slow to evolve.

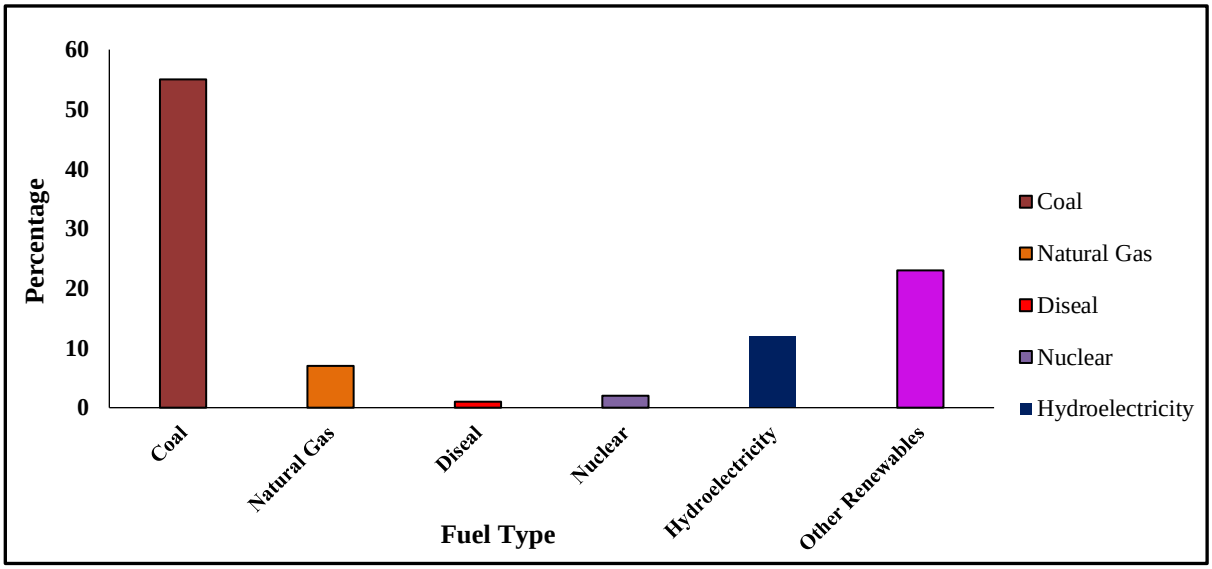
In some respects, the Brazilian model is held up as an example for India to follow. Notwithstanding the different feedstock, the technologies required and ultimately the fuel produced, the propellant of state intervention in a variety of ways and at a variety of points in the production chain is discernible in both cases. It is worth recollecting that the Brazilian model took over a decade to become relatively sustainable, and bioethanol boasts the most positive GHG balance over petroleum-based fuels. The Brazilian model, however, is not without its problems. The state sponsored large-scale land clearances used in Brazil to make land for sugar-cane production may be less palatable in India. Regardless, the Indian government has invested heavily in its biodiesel program and sees potential. In India, Biodiesel procurement started in 2014 after the launch of the NBM way back in 2003 and Biofuel from Jatropha was first used in aviation industry on 28th of August 2018.India

[115] James Smith., *Biofuels and the Globalization of Risk- The Biggest Change in North-South Relationships since Colonialism,*(U.K, MPG Books Group, Bodwin and King's Lynn,2010), p.27.

today has a renewable energy installed capacity of 69GW across states and private units. About 20 percent of India's capacity is in the form of renewable energy.[116]

Solar Energy – According to estimates, in one hour, the sun provides enough energy to power every vehicle, factory and device on the planet for an entire year. Solar panels can harness that energy to generate electricity during the day. Solar energy has long been used as a clean alternative to fossil fuels such as coal and oil, but it could only be harnessed during the day when the sun's rays are the strongest.[117]Even today, power shortages and blackouts continue to plague India's major cities and undermine the confidence of investors and foreign companies operating in India. These power shortages have been fueled by a combination of escalating growth rates, inefficiencies by the state-run power sector and power being stolen. The growing popularity of gas-guzzling, sport utility vehicles and multi-purpose vehicles in India is also placing strains on its energy needs.

Figure 17: India: Installed Power Capacity by Fuel (2020)



Source: US Energy Information Administration, India Central Electricity Authority

Figure 17 indicates a major dependence on Coal for its power supply, followed by other renewable sources of energy.

4.4 ENERGY INDEPENDENCE: IT'S NEED FOR SECURITY

[116] The Times of India dated 3rd August 2018.

[117] Energy Times, Vol.36, No. 24, January 21-27, 2014, Kolkata. P.8.

Energy has been called the fuel of economic progress and the ready availability of cheap energy serves to stimulate industrial development. Energy crisis can be defined as a great disruption in the supply of energy resources to an economy. Naturally, it will seriously affect the price situation. As a matter of fact, energy crisis refers also to the shortage of oil or electricity or for that matter other natural resources. In a broader sense, an energy crisis may be referred to as oil crisis, petroleum crisis, energy shortage, or electricity crisis. The key to energy security has been diversification. This remains true, but a wider approach is now required that takes into account the rapid evolution of the global energy trade, supply-chained vulnerabilities, terrorism and the integration of major new economies into the world market. Although in the developed world the usual definition of energy security is simply the availability of sufficient supplies at affordable prices, different countries interpret what the concept means for them differently. Energy-exporting countries focus on maintaining the 'security of demand' for their exports, which after all generate the over-whelming share of their government revenues. For Russia, for example, the aim is to reassert state control over 'strategic resources' and gain primacy over the main pipelines and market channels through which it ships its hydrocarbons to international markets. The concern for developing countries is how changes in energy prices affect their balance of payments. For Brazil and India, energy security now lies in their ability to rapidly adjust to their new dependence on global markets, which represents a major shift away from their former commitments to self-sufficiency.

After the Persian Gulf War, concerns over energy security seemed to recede. But 15 years later, prices soared, and fears of shortages dominated the energy markets. The answer was to be found in both markets and politics. The last decade has witnessed a substantial increase in the world's demand for oil, primarily because of the dramatic economic growth in developing countries, like Brazil and India. India's oil consumption is currently less than 40 percent of China's (compared on the basis of population), but because India has now embarked on what the economist Vijay Kelkar calls the 'growth turnpike', its demand for oil will accelerate. Income growth brings about an increase in the number and the use of vehicles. By 2030, India's urbanized population is estimated to grow to 45.8 percent and the number of vehicles is expected to be 200 million by 2030. As far as India's primary commercial

energy consumption is concerned, it is expected to increase to 812 million tons of oil equivalent by 2030 from 376 million tons of oil equivalent in 2008-09. In short, it can be stated that the economic growth has rapidly increased India's demand for energy consumption. Ironically, India's current high growth rates were partly triggered by the spike in oil prices during the 1990-91 Persian Gulf crisis. The resulting balance-of-payments shock left India with almost no foreign currency reserves, opening the door to the reforms initiated by then Finance Minister Manmohan Singh.

India is considered today to be one of the emerging economies on par with Brazil. India through her diverse religious background has, culturally, always had a healthy respect for the environment. With the ever-increasing demand for energy to support the burgeoning economy, there has also been a growing consciousness about pollution and economic imbalances. This developing consciousness has evolved into a policy to consider the five Es'-Ecology, Economics, Energy, Employment, and Equity. All over the globe, laborers, hand and cycle carts, bullock and horse drawn wagons, trucks, barges, ships, trains, conveyor belts, chutes, ropeways, cables and pumped pipelines are engaged in varying degrees to move different energy expedients to their several points of consumption. The main reason behind this has always been that the points of supply provided by nature and the points of demand created by man have never matched. It is a logical corollary that if the production of energy be the largest industry in the world, the transport of the product is a close second to it. This phenomenon had made fanatic communist writers during the 1973 crisis to describe the biggest segment of it, namely, petroleum extraction and transport, as the 'arch stone of capitalism'.

If developing countries like India have to achieve energy independence than the actual need lies in conserving the energy resources at the grass root level. Unlike the developed nations of the so called 'North', the emerging economies of the 'South' like Brazil and India have different tale to express. The energy scene in the developing countries provides a striking contrast to that in the developed countries. The energy crisis in the developing countries like India does not mean lowering the thermostat in winter or reducing the highway speed as it means in the developed countries like the United States. Hundreds of millions of people in India still light their homes with oil lamps and cook by burning cow dung cakes and dried leaves. These people hardly use any petroleum products, since they are too poor to afford the

luxury of commercial energy resources. They depend on non-commercial energy resources like wood, cow dung and vegetable waste. This type of energy is ‘free’ and does not cost them any money. But it must be ‘collected’ from the woods and pastures adjoining the villages. Their women folk and children must spend many hours each day roaming the country side searching for branches, twigs, leaves and cattle dung. The life of these people is a continuous struggle to procure fuel, food and water. In spite of the fact that they do not use any appreciable quantities of commercial energy like oil, coal and electricity, the energy crisis, caused by the hike in oil prices, has hit them very hard.

Besides new-energy additions, India now has two more things to look after, which seem to be very much related. First to check the heavy loss of energy through improved technology and a combined spirited effort and second, reducing substantially the environmental threats of power projects and modern machineries. That is to conserve energy and to protect ourselves and our surroundings. Energy saved is as good as energy generated according to the second Law of thermodynamics. What was needed and called for in India was the urgent need for mass awareness on the environment and energy conservation. A plan for compulsory education which is been achieved through the implementation of Supreme Court order on compulsory Environmental Studies syllabi been introduced in schools and higher education levels. Besides this, common man’s participation in energy conservation program and practical execution is also very important.

The growing imbalance between energy demands and supplies has compelled India to look for energy security and to seek effective energy security strategies. Energy security options available to India are a) deregulation and liberalization, b) strategic intervention, c) fuel substitution, d) oil diplomacy for equity and gas supplies. Oil diplomacy and diversification of petroleum supplies are other options available to India to attain energy security. Stakes in overseas exploration and production companies and equity in oil and gas blocks seems an answer to India’s susceptibility to volatile international oil prices because of its dependence on foreign oil. In fact, equity oil abroad ensures cheaper and reliable oil supply. India imports about 72 percent of its oil requirements from the Persian Gulf. But since this region is volatile it has compelled India to diversify its oil and gas supplies. Because energy security is mutually complementary, India will have to seek a holistic approach in not

only meeting its growing energy needs, but also to seek and expand its cooperation with the energy rich countries. Such cooperation will have to be political as well as economic. India will also have to adopt medium to long term strategies to combat problems of climate change, by promoting the use of renewable and improving energy efficiency.[118]

Since energy is the lifeline of modern economies, concurrently, the importance of energy security has become the essential part of economic growth and national security. The 'developed' world's concept of 'energy security' has evolved in the context of its excessive dependence on imported energy and the localization of supplies in the unstable regions of the world. But for developing countries like India new strategies have to be identified which suit the economies like for example, India is gradually planning an annual plan for the roll out of 'E20' (20 percent ethanol-blended petrol) by 2025-26. It has also set a target for 5 percent blending of biodiesel with diesel by 2030. Ethanol blending was started by former Prime Minister late Atal Bihari Vajpayee's NDA government under the then Oil minister Mr. Ram Naik. However, the program floundered during the two subsequent UPA governments, due to supply constraints of ethanol and its procurement pricing. As a result, blending stood at 2.3 percent at the time when the present government of incumbent Narendra Modi began its first innings in 2014. Separately state-run fuel retailers said the availability of ethanol for blending is expected to rise by 571 percent to 450 crores litters in the current ethanol supply year (ESY) from 67 crores litters in 2014. [119]

Today India stands on the brink of an energy revolution. Its reliance on fossil fuels is slowly diminishing as extraction is becoming too costly and technically too difficult and the vital search for alternative energy sources is on priority and which will not further aggravate climate change. Actually, this is a profound moment in human history. Modern civilization which was in many respects the product of burning fossil fuels, using their combustion directly for heating and transportation, and indirectly to generate most of the electricity, is now looking towards clean fuel sources. This is the environment in which biofuels have gained traction over the past

[118] Bhupendra Kumar Singh., *India's Energy Security- The Changing Dynamics*, (New Delhi, Pentagon Energy Press, 2010), p.188-197.

[119] The Times of India dated 6th June 2022.

decade, giving way to an environment of shifting exigencies and new perspectives. Biofuels have in many ways been seen as a new technology, clean, efficient, natural, to replace an outmoded technology, dirty, unsustainable, dying. The term itself, 'biofuel' invokes something natural, 'from life'. Biofuels are touted as a fuel of the future and are not novel. We have been unlocking the energy potential of biomass via fire for millennia, and indeed in some ways it is what defines us as human. For many this source of energy is unlikely to change soon, and this speaks of our inability to affect global change and to deal with underdevelopment. Somewhat paradoxically, this underdevelopment in itself provides a rationale for new sources of energy, and a large component of the recent promise of biofuels has been the possibility of energy provision in poorer as well as wealthier countries. Biomass (including fuel wood and crop residues) is currently used by an estimated 2.4 billion people worldwide to generate energy.[120]

4.5. ENERGY POLICIES – AN OVERVIEW

The focus of the energy policy in India prior to the oil shocks of the 1970s was based mainly on the supply management. Post the oil embargo shocks, the concept of energy security gained significance and its scope has widened to include demand management and investment in energy securing technologies as well as alternative sources of energy. The growing dependence on imported oil and gas has made the western concept of energy security unvaryingly important for India. Due to an ever-expanding population and an increase in the per capita income, the total demand for India's energy is on the rise. Currently, India is the most populous country in the world followed by China and accordingly its demand for energy is expected to increase up to 1,299 MTOE by 2030.[121] Fluctuations in oil prices, declining oil reserves, and uncertainties in future oil supply and growing concerns for climate change complicates the prospect of development in India. In order to achieve energy security, the Government of India has taken important steps both internally

[120] James Smith., *Biofuels and the Globalization of Risk- The biggest change in North-South relationships since Colonialism,* (U.K, MPG books group, Bodwin and King's Lynn, 2010), pp.14-17.

[121] Monga, G.S. and V.J.Sanctis., 1994, *India's Energy Prospects*, (New Delhi: Vikas Publishing House Pvt Ltd.1994), p,10.

and externally. As on 26th of December 2008, the cabinet has approved the Integrated Energy Policy 2006.[122]

The country thus recognized that a clear biomass policy was desperately needed, which recognized the competing uses for biomass in society, especially between biomass-based industry and poor house-holds. India today has the world's 4th largest urban population and before the end of the century it will be the largest. It is noted that India's present level of energy consumption is not only low, but substantial proportion of energy supply is accounted for non-commercial sources such as firewood, cattle dung, vegetable wastes and crop residue whose production and consumption data are quite scanty. It is a well-known fact that more than 80 percent of the energy consumed in villages comes from non-commercial sources, which comprise more than 40 percent of the total energy consumed in the country. According to Centre for Science and Environment New Delhi, women in many regions in India spend 14 to 16 hours working every day. A study conducted by the Gandhigram Rural University pointed out that the rural women spent 7 hours to collect 29 kg of firewood from Sirumalai Hills with the distance of 12 kms. Incomplete combustion of fuels such as fuel wood, agricultural wastes, dung cake leaves a pall of smoke vitiating the atmosphere for everybody and adversely affecting the health of the women.[123] Probably no other group is more affected by environment destruction than poor village women. Caught between poverty and environment destruction, poor rural women in India could well be reaching the limits of physical endurance. Thus, a strong Biomass policy will play a crucial role in meeting daily survival needs of the vast majority of the rural households in the country. Water is another crucial element in human survival and its availability is definitely related to biomass in a country where rain falls only four months in the year. When the biomass in the surrounding environment disappears, water sources like streams and ponds also tend to disappear soon after the monsoon.

Energy Conservation v\s Policies

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[122] Bhupendra kumar Singh., *India's Energy Security- The Changing Dynamics,* (New Delhi, Pentagon Energy Press. 2010), p.1.

[123] Subudhi.R.N., *Energy Option for 21st Century,* (New Delhi, Ashish Publishing House, 1987), pp. 102-111.

There is a natural limit to the number of resources on this planet and when a nation oversteps that limit, it will inevitably face an insurmountable hurdle. A nation can survive only if it uses energy much more efficiently and reduce its consumption levels. As of now there is no sign of this happening. If we look back, the first 115 billion barrels were taken out in 100 years (1859-1958) while the next 115 billion barrels were extracted in just 10 years (1959-1969), such has been the tremendous pressure on the fossil fuel resource. It is clear that we must conserve energy by improving efficiency at each of the stages, production, transmission and utilization. The Energy Conservation Act (2001) specifies energy standards and promotes energy audits. According to estimates we can save up to 40 percent of energy in India through conservation. The Bureau of Energy Efficiency (BEE) is the agency that implements the Act. Among other activities, BEE awards star ratings to brands of appliances such as tube lights, refrigerators, air-conditioners, and each tested brand gets a rating of 1 star (least energy efficient) to 5 stars (most energy efficient).

Environment Policies

One of the oldest environmental actions initiated by India was the implementation of the Indian Forest Act of 1927. The forest policy and management were introduced in India by the British government by setting up a Forest Department and enacting relevant legislation in the 19th century. The stated assumption of such a move was that local communities were incapable of scientific management and that only a trained centrally organized cadre of officers could properly manage forests. The concealed motive was commercial exploitation of the vast treasures that India's forests offered for industrial use back in Britain.

In 1972, after Indira Gandhi the then Prime Minister of India, the first person to attend the first ever global summit on Environment in Stockholm in Sweden led to the follow-up and the establishment of many environmental management and prevention of pollution Acts in India. The famous Chipko Movement of 1970s in Uttar Pradesh led by Sundarlal Bahuguna was an issue that gained worldwide popularity as it was discussed in the historical 1972 Summit. Today, India celebrates 5th of June as 'World Environment Day' ever since the Stockholm Conference of 1972. Between 1974 Water "Prevention and Control of Pollution" Act and 1997 National Environmental Appellate Authority Act, about two dozen acts have been

enacted in India exclusively for environmental pollution control. According to the Ministry of Environment and Forest, the Central Pollution Control Board, Sate Pollution Control Board and the Pollution Control committee of the Union Territories have filed with Government of India as many as 6624 cases under the Water and Air Acts. Various government agencies and NGOs in their efforts towards environmental protection and law, organize seminars and workshops involving the judiciary, advocates, academicians and students. These seminars and workshops discuss and suggest strategies on various aspects and issues involving problems and contraventions of environmental laws.[124]

The Department of Environment was established in India in 1980 to ensure a healthy environment for the country. This later became the Ministry of Environment and Forests in 1985. The constitutional provision is backed by a number of Laws, Acts, Rules and Notifications. The EPA (Environment Protection Act), 1986 came into force soon after the Bhopal Gas Tragedy and is considered an Umbrella legislation as it fills many gaps in the existing laws. Thereafter, a large number of laws came into existence as the problems began arising, for example Handling and Management of Hazardous Waste Rules in 1989. Following is the list of the environment legislation in four categories, namely, General, Forest and Wildlife, Water and finally Air.[125]

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[124] Muralikrishna.K.V.S.G and M.V. Venkata Rao, *Our Environment* (Kakinada, A.P.: Environment Protection
Society, National Institute of Ecology and Environment, 1998), p.237.

1. [125]**General**

1986-The Environment (Protection) Act.
1986-The Environment (Protection) Rules.
1989-The objective of Hazardous Waste (Management and Handling) Rules.
1989-The Manufacture, storage, and Import of Hazardous Rules.
1989-The Manufacture, Use, Import, Export and storage of hazardous Micro-organisms/GeneticallyEngineered Organisms or Cells Rules.
1991-The Public Liability Insurance Act and Rules and Amendments.
1995-The National Environmental Tribunal Act.
1997-The National Environment Appellate Authority Act.
1998-The Biomedical waste (Management and Handling) Rules.
1999-The Environment (Sitting for Industrial Projects) Rules, 1999.
2000-The Municipal Solid Wastes (management and Handling) Rules, 2000.
2000-The Ozone Depleting Substances (Regulation and Control).
2001-The Batteries (Management and Handling) Rules.
2002-The Noise Pollution (Regulation and Control) (Amendment).
2002-The Biological Diversity Act.

The Constitution of India has a number of provisions demarcating the responsibility of the Central and State governments towards 'Environmental Protection'. The State's responsibility with regard to environmental protection has been laid down under article 48-A of the Constitution, which reads as "the states shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country".[126] The 42nd amendment to the Constitution was brought about in 1974 which inserted two new articles namely article 48-A and Article 51-A(g) the former under Directive Principles of State government to protect and improve the environment and to safeguard the forest and wildlife of the country and the latter under fundamental duties making it the fundamental duty of every citizen to protect and improve the natural environment including forests, lakes rivers and wildlife and to have compassion for living creatures. There about two hundred laws dealing with environmental protection both before and after independence in India. However, the pre-independence laws did not deal exclusively with environmental protection. The Indian Penal Code (IPC) 1860 had a chapter (XIV) which dealt with

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2. Forest and Wildlife:

1927-The IndianForest Act and Amendment, 1984.

1972-The Wildlife Protection Act, Rules 1973 and Amendment 1991.

1980-The Forest (Conservation) Act and Rules, 1981.

3. Water:

1882-The Easement Act.

1897-The Indian Fisheries Act.

1956-The River Boards Act.

1970-The Merchant Shipping Act.

1974-The Water (Prevention and control of Pollution) Act.

1977-The Water (Prevention and Control of Pollution) Cess Act.

1978-The Water (Prevention and control of Pollution) Cess Rules.

1991-The Coastal Regulation Zone Notification.

4.Air:

1948-The Factories Act and Amendment in 1987.

1981-The Air (Prevention and Control of Pollution) Act.

1982-The Air (Prevention and Control of Pollution) Rules.

1982-The Atomic Energy Act.

1987-The Air (Prevention and Control of Pollution) Amendment Act.

1988-The Motor Vehicles Act. -Environment policymaking in India- The process and its pressure, TERI report.

Indian Environmental Legislations, list from the MOEF website.

Strengthening Environmental Legislations in India, document by Centre for Environmental Law, WWF.

[126]Government of India, *The Gazette of India: Extraordinary Part II- Section I, No.25* (New Delhi:Government of India Press, 2010).

offenses affecting the public health, safety and convenience, which covered aspects like water, air and noise pollution whereas some of the post-independence laws like those mentioned above dealt exclusively with environmental protection. Rapid deterioration of the environmental quality due to pollutions from industrialization and urbanization, necessitated the formulation of Pollution Control Acts, aimed at safeguarding the health and property of man. 'Think globally-work locally' was the slogan that came into vogue at this time.[127]

In the early 1980's India also faced critical global issue, which tested the national and international community's commitment towards sustainable development in actions and that was concerning - international debt. The debt burdens of many developing nations like India had two major implications for the prospects of sustainable development. First, the need to increase short-term productivity exerts pressure on countries to over-exploit their natural resources. In the long term, this raises the costs of correcting the environmental destruction inflicted now and reduces the potential for sustained development in the future of resources such as agriculture and forestry. As suggested by George Woodall in 1992, developing countries like India which deforested the fastest in the 1980s were the largest debtors at that time.[128] Another example was of Brazil which ranked number one in the amount of debt by the extent of deforestation in the 1980s with 23 percent of original forest already destroyed. In comparison, India ranked 4th in amount of debt and 8th in the extent of deforestation in the 1980s with 90 percent of original forest already destroyed. The Netherlands was the first country to convert the principles of sustainable development identified by Brundtland into concrete steps for action to change both production and consumption. By the early 1990s, virtually every country in the world including India had prepared a national report of some kind on its environment. In the developing world, this was generally under the guidance of and through funding from international donors. [129]

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[127] Muralikrishna. K.V.S.G. and M.V. Venkata Rao, *Our Environment* (Kakinada, A.P.: Environment ProtectionSociety, National Institute of Ecology and Environment, 1998), p.172.

[128]The Disaster of Deforestation. http://www.akhandjyoti.org Accessed on 18 June 2016.

[129]WRI (World Resources Institute), *People and the Environment*, Washington D.C., 1994-95.

At present the concern of the government of India for biodiversity conservation is expressed through various acts and legal documents which constitute environmental laws in India. Important amongst them are:

- The Indian Forest Act, 1927.
- Wildlife (Protection) Act, 1927 (amended in 1991).
- Environmental (Protection) Act, 1986.
- Forest (Conservation) Act, 1980 (amended in 1988).
- The Water (Prevention and Control of Pollution) Act 1974 (amended in 1988).
- The Air (Prevention and Control of Pollution) Act 1981 (amended in 1988).
- Notification on Coastal Regulation Zone, 1991.

The National Forest Policy 1988 and National Conservation Strategy and Policy statement on Environment and Development 1992, published by government of India also indicate furtherance of the cause of conservation. Interestingly, most of the efforts to ensure compatibility of conservation-oriented legal structures with the changed socio-economic conditions have taken shape from 1986 onwards. This had specific implications for the conservation movement in the country and added to its strength by buttressing the statutory support to the same. The Convention of International Trade in Endangered Species of Wild Flora and Fauna (CITES) and Export-Import (EXIM) Policy are operated by India to regulate its international trade in regard to biodiversity items like plants and wild animals and parts and products thereof. As signatory to the Convention on Biodiversity held in Rio in 1992, India was committed to the fulfilment of its various objectives with a determination to conserve and for the sustainable use of biodiversity for the benefit of the present as well as future generations. For example, when India undertook the construction of the world's largest hydroelectric and irrigation project based on 30 major, 135 medium and 3000 minor dams over the Narmada River, the US and World Bank objected against the project, though a sum of $70 million were planned to be held back, since the project would displace 2,00,000 population, submerge 2000 square kilometres of fertile land and 1500 square kilometres of prime Teak and Sal forests and would also eliminate historic sites and rare wild life. However, India went ahead with the Narmada project in the nameof development even though it was aware of the consequences on the environment. The 'Save Narmada Movement' was headed by the Indian social activist and environmentalist Medha Patkar. The Ganga Action Plan

was also formally launched in 1986. The Silent Valley Project proposed in the Nilgiri hills in 1965 was abandoned after much controversies and debates. The Dehradun Valley protection movement against limestone mining in the valley was also upheld by the Supreme Court on 12 March 1985.

4.6. INDIA'S RESPONSES AND CHALLENGES

In order to examine the direction of the path that India had travelled in the last two decades after the Rio 1992 Summit, on the road to sustainable development, three different indicators of sustainable development are considered namely,

- Hazardous Waste Management
- Urban Environment
- Air Pollution.

Hazardous waste-management was one of the most important issues discussed at the Rio Summit. The Rio Principles that were relevant to this issue were Principle 8, 10, 16 and 17.[130] It was around this time that when India participated in the Rio Summit in 1992, back home began the first round of trade liberalization, much of which was dictated by the World Bank and IMF. The glaring example of implementation was the fact that there were only four officers responsible for overseeing the implementation of hazardous wastes rules throughout the whole country. Even after five years after Rio Summit, till 1997, no authority in India had any idea on the quantity of wastes generated indigenously. And the data that was submitted were basically reports provided by the State Pollution Control Boards, who themselves based their assessment on figures furnished by the industries itself than on their own inspections and verifications thus showing the non-compliance to the Rio Principle. Even after two years after the Supreme Court banned the import of hazardous wastes, the same have continued to enter India illegally.

Concerning air pollution, today it is pointed out that 50-60 percent of it is due to automobile emissions. Air pollution in India can broadly be attributed to rapid industrialization, energy production, urbanization, commercialization and a rapid increase in the number of motorized vehicles. The AIIMS hospital in Delhi has stated that due to the lead in fuels, dangerous levels of lead are found in the blood of young

[130]http://articles.manupatra.com Accessed on 17 June 2016.

children in Delhi exposing them to serious health problems. No doubt in recent years much attention has been paid to emission levels and cleaner fuels and these matters are receiving a very positive response from various High Courts and the Supreme Court. It is because of such awareness that mass transit system like elevated rail lines in Chennai, the subway trams in Kolkata and the Metros in Delhi, Chennai, Mumbai, Kolkata are being used to keep in pace with our population growth and mobility.

4.7. INDIA AND SELECT INTERNATIONAL AGREEMENTS AND TREATIES

Stockholm Conference of 1972

India's foreign environmental policy has been mainly shaped in large measures by two main sources. First, Orthodoxy, established by Mrs. Indira Gandhi, regarding the way in which environmental problems in poor countries need to be viewed and the legacy of India's foreign policy. When Prime Minister Indira Gandhi addressed the 1972 UN Conference on Human Environment in Stockholm she established, an orthodoxy that has prevailed ever since in India's foreign environmental policy. She was the only head of government to speak at that conclave other than the host Olaf Palmer. Her address, which looked at environmental issues from a development perspective and at developmental challenges from an ecological standpoint, has gone into history as a milestone. One line in her historic speech at this conference 'poverty is the greatest polluter' was to bring home to the West that developing countries like India have their own pressing challenges to raise the standard of living of millions of their citizens. Many themes from her speech, including the need for international cooperation, became the part of the Stockholm Declaration. International support also helped to sustain the orthodoxy that emerged from Mrs. Gandhi's views. These views reflected and were reinforced by third world views on environment and development. Mrs. Gandhi's views also gained support from liberal elements in the 'North' who accepted as legitimate, priority that developing countries accorded to development. Thus according to B. Parikshit, the wide publicity given to Mrs. Gandhi's Stockholm speech reinforced the Indian government's espousal of the orthodoxy that emerged from it.[131]

[131] Ballab Parikshit., *Global Warming*, (New Delhi, Cyber Tech Publications, 2009), p.86.

The traditional foreign policy had a major influence on India's foreign environmental policy, because of the Congress Party rule in India for about 45 years since independence in 1947 and the leadership of the Congress party by 3 generations of the Nehru-Gandhi family. Foreign policy traditions have also been maintained because they were believed to have served the country well and have enjoyed strong cross-party support. This is illustrated by the lack of change in foreign policy despite changes in governments. Finally, the MEA's lack of environmental expertise and more generally, its defensives in terms of institutionalized forward thinking and policy planning, have made it particularly prone to fall back on tradition as a guide to policy.

India and the Rio Summit of 1992

Post Rio Summit in 1992 India witnessed some important multi-lateral environmental agreements (MEAs) that were being negotiated and signed at different stages and at various moments of time. The Rio Declaration on Environment and Development, the Statement of Forest Principles, and Agenda 21 were major highlights of the conference. MEF minister Kamal Nath led the Indian delegation at Rio. Soon India became a party to the Convention on Biological Diversity (CBD) in May 1994. India was constructive at Rio and in addition to its own proposals which were met with widespread support, the Indian delegation played a crucial role in bridging differences and building consensus on many important issues. The UNFCCC, which belongs to the extended forum of MEAs, through its instruments of COPs, under UN comprising of national governments, had given a clarion call for "Climate Summit" in Copenhagen in December 2009 leading to derive climate negotiations beyond Kyoto Protocol that left an enduring impact on Global economy and on all our lives in terms of tackling climate change in favour of climatic injustice.

After the Convention of Biological Diversity (CBD) was adopted by the United Nations, in June 1992, the contracting countries were required to integrate consideration of conservation and sustainable use of biological diversity into relevant legal procedures, programs and policies. The Biological Diversity Act was passed after a process of consultation among stakeholders. The Act provides for conservation of biological diversity, sustainable use of its components and equitable sharing of benefits arising out of the use of biological resources. Agro-biodiversity which is a

subset of total biological diversity is a major concern for the world food security and the issues of conservation and management of agro-biodiversity are one of the high priorities for a diversity-rich country like India.[132]

In India, the situation is definitely alarming. About 45,000 species of flora and 65,000 species of fauna are found in India, population of most of which is declining. Over 1500 species of flora and fauna are in the endangered category. As on today out of the total area of 329 million ha, 175 million ha of land in India is in a degraded condition because of erosion, salinity, alkalinity and various other factors indicating loss of biodiversity.[133] Similarly grasslands and pastures, just about 3.5 percent of the geographical area, are under severe degradation due to the pressure on account of a 500 million domestic animal population. The 75 million ha area of forest land in India has about 40 percent area under-stocked and under visible stress resulting in loss of biodiversity for one reason or the other. Wetlands and marine ecosystems rich in aquatic and bird-life are also facing problem of over-exploitation and pollution leading to loss of biodiversity.[134] All these warranted a specifically-oriented immediate action plan for biodiversity conservation supported by an effective legal framework not only suited to the present socio-political-economic situation prevalent in India but also duly aligned with the long-term strategies of development. The IUCN (the World Conservation Union), UNEP and WWF indicate that countries should have comprehensive system of environmental law to safeguard human rights as well as interest of future generations. The productivity and diversity of the earth should also be protected by this mechanism through recognition of the legitimacy of 'local approaches'.

India and the Kyoto Protocol

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132 Pratibha Brahmi, R. P. Dua and B. S. Dhillion, *The Biological Diversity Act of India and Agro-Biodiversity Management*, (1995), p. 659-664.

133 John C. Ryan, *Conserving Biological Diversity*: *State of the World*, World Watch Institute, 1992.

134 *Protected Area Network Management and Scientific Research on Biodiversity Conservation-Existing Status, Gaps and Future Needs* (Ministry of Environment and Forests, Government of India, 1994).

The Kyoto Protocol named after the city where it was agreed by negotiators in December 1997, was a treaty intended to implement the objectives and principles agreed in the 1992 UN Framework Convention on Climate Change. The core idea was that stabilizing the atmosphere (the UNFCCC's 'ultimate objective') required governments to agree to quantified limits on their greenhouse gas emissions, through sequential rounds of negotiations for successive 'commitment periods'. As of June 2007, 175 nations were parties to the Kyoto Protocol, representing approximately 60 percent of the global emissions for Annex-I countries.[135] Under the protocol, the developed countries were required to reduce their emissions of Greenhouse gases by an average of 5.2 percent below 1990 levels by 2012.

In response to the Kyoto Protocol, in India the National Green Tribunal Act 2010 received the assent of the President of India on 2 June 2010. Since India was a party to the decisions taken at the UN Conference in 1972, where in India participated, calling upon the states to take appropriate steps for the protection and improvement of the human environment. In the UN Conference in 1992 in which India participated, decisions were taken calling upon the states to provide effective access to judicial and administrative proceedings, including redress and remedy and to develop national laws regarding liability and compensation for the victims of pollution and other environmental damage.[136]

India and China, which had ratified the Kyoto Protocol, however were not obligated to reduce greenhouse gas production at the moment as they are developing countries, i.e., they weren't seen as the main culprits for emissions during the period of industrialization thought to be the cause for the contemporary global warming. This was a little odd given the fact that China is about to overtake the USA in emissions, but taken into account is the major difference in population and that much of the production in these countries is fuelled by the demand from the West and influence from the West on their own culture. As a result of this loophole, the West has effectively outsourced much of its carbon emission to China and India. This

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[135] Micheal Grubb and Kristen Hite, "*Kyoto Protocol in Encyclopedia of Earths*", in J. Cleveland Cutler, ed., *Environmental Information Coalition* (Washington, D.C.: National Council for Science and Environment, 2008).

[136] The Gazette of India-Extraordinary-Part II-Section I, No.25,(New Delhi, June 2010).

phenomenon, whether intended or coincidental was a major fallacy in the Kyoto Protocol.[137]

India was opposed to amending the Kyoto Protocol. Developing countries like India, China and Brazil were opposing attempts led by Tuvalu and Alliance of Small Island States (AOSIS) to add another protocol to the Kyoto Protocol at the December 7-18 Copenhagen Climate Change Summit. Environment minister Jairam Ramesh said that India will play a constructive role in the climate negotiations but slammed efforts of rich nations to make domestic emissions reduction claims by developing nations legally-binding and verifiable. He asserted that India's national voluntary domestic measures to tackle global warming were not up for global scrutiny and progress on these would be checked only by the country's Parliament.[138]

The threat of climate change that led to the Framework Convention on Climate Change (FCCC) at Rio is perceived differently by different countries. This fact has delayed any effective international agreement on how to deal with the problem. In the case of the Montreal Protocol covering ozone–depleting substances, there was a wide consensus and effective action was mobilized quickly. Thus, an understanding of perceptions and positions of different countries makes it easier to explore possibilities of effective action. In January 2001, the OECD held an expert seminar as part of a pilot project to investigate interactions between the long-term agenda for climate change and sustainable development strategies. Experts from both OECD and developing countries attended. Participants identified issues and approaches, based on their regional perspectives, relevant to an evolving, equitable regime for addressing climate change, given various national circumstances, political interests, institutions and capacities to achieve sustainable development framework. Discussions and presentations cantered around two broad themes.

- Synergies and trade-offs between sustainable development objectives and long-term strategies to limit climate change.
- How to build analytical and implementation capacity in developing countries to maximize synergies at local, regional and global levels of decision-making.

[137]http://www.carbonify.com/articles/Kyoto-protocol,htm. Accessed on 9 April 2016.

[138]http://www.carbonify.com/article/kyoto-protocol. html. Accessed on 9 April 2016.

> Unsustainable consumption patterns of the rich industrialized nations are responsible for the threat of climate change. Only 25 percent of the global population lives in these countries, but they emit more than 70 percent of the total global carbon dioxide emissions and consume 75 to 80 percent of many of the other resources of the world.[139]

In per capita terms, the disparities are also large; Indian citizen emits less than 0.25 tons of carbon per year, whereas a citizen of the USA, for example emits more than 5.5 tons which emphasizes the need for an equitable and efficient solution to climate change and suggest that efficiency can be obtained through a system of tradable emissions quotas and equity through equal allocations of global environmental space to all human beings. These findings were well received by developing countries and are echoed in the UNFCCC, which recognized the rights of developing countries to economic development and also the 'common but differentiated responsibilities' of different countries. India is concerned about climate change since this phenomenon might have substantial adverse impact on it. Not all possible consequences of climate change are yet fully understood, but the three main 'categories' of impacts are those on agriculture, sea level rise leading to submergence of coastal areas, as well as increased frequency of extreme events. Each of these poses serious threat to India's environment. However, these are long term issues. The overriding immediate concern for India is the fast pace at which negotiations are taking place on the climate front. India's main energy resource is coal. With the threat of climate change, India is called upon to change its energy strategy based on coal, its most abundant resource, and to use other energy sources (e.g., oil, gas, renewable and nuclear energy) instead, which may turn out to be expensive. The risks that India faces are: risk of lower agricultural production, risk of sea level risk, risk of extreme events like cyclones.

If India has to reduce, its carbon emission, it would mean a major reorientation of her energy strategy, especially if that warranted a shift from its current coal-based to oil and gas-based energy system. Directly or indirectly the efforts made by government as well as by people to reduce energy consumption have included: Emphasis of energy conservation, promotion of renewable energy sources,

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139 Parikh et al., "Setting The Stage: Climate Change and Sustainable Development", Assessment Report on Climate Change IPCC Third, 2001, pp.1-14.

abatement of air pollution, afforestation and wasteland development, economic reforms, subsidy removal and joint ventures in capital goods, fuel substitution policies.

The Biological Diversity Bill 2002 was passed by the Lok Sabha on 2 December 2002 and by Rajya Sabha on 11 December 2002.[140] This was a Bill to provide for conservation of biological diversity, sustainable use of its components and equitable sharing of the benefits arising out of the use of biological resources and for matters connected therewith or incidental thereto.

INDIA AND THE COPENHAGEN CONFERENCE

India's position at Copenhagen was that the UNFCCC is the legally binding, multilateral instrument on the basis of which international community will deal with climate change. Its principles and objectives continue to be fully valid and will govern all of India's future activities on the subject. The Kyoto Protocol remained in force post 2012. Only new emissions reduction targets for developed countries were being discussed and a second commitment period to achieve this post 2012. The Protocol did not expire in 2012, nor were developing countries expected to support sustainable development in developing countries through transfer of financial resources and technology.[141] The then minister of environment Mr. Ramesh also sought to allay apprehensions on account of a provision in the accord for 'international consultation and analysis', as well as mention of peaking for which no time-frame has been specified. Rejecting the Opposition charges about compromising the country's interest, he argued that India had to be flexible as it, along with China, Brazil and South Africa, did not want to be "responsible for failure" of the climate meet and become "blame boys". On speaking of emissions, Ramesh said no timeline has been fixed for it. He however, underlined that peaking would have to take place sometime in the 21st Century; otherwise "there will be no 22nd Century".[142] With regards to finance, he said India was not desperate for foreign funds for mitigation

[140]Bill No. 93-c-of 2002.

[141]http://www.climate–leaders.org/climate-change-resources/India-at-Cop-15. Accessed on 17 April 2016.

[142]http://www.zeenews.com/news589475.html. Accessed on 17 April 2016.

action. On concerns over technology transfer from developed countries to developing countries, he also said India did not require green technology as it had ample capacity in this regard.[143]

In the post-Copenhagen, the Indian government was clear that it shall maintain its stand based on the "polluter pays" principle that was the focal point of the 15th Conference of Parties (CoP) at Copenhagen in 2009, at which the international community determined the shape of climate change policy post 2012 when the Kyoto Protocol was set to expire. The government of India made it clear that what is being negotiated at CoP 15 is not a new international frame work for climate change or a post-Kyoto treaty. Rather, the government states that what is being negotiated is fresh emissions reduction targets for the developed nations along with a second commitment period under the Kyoto Protocol, and an Action Plan that would enable more effective implementation of the UNFCCC objectives.[144]

INDIA AND THE PARIS AGREEMENT

India formally joined the Paris Agreement on climate change by submitting its instruments of ratification to the United Nations in New York on Sunday (2nd Oct 2016), the birth anniversary of Mahatma Gandhi and also the International Day of Non-Violence, becoming the 62nd nation to ratify the Climate deal. The country, however, ratified the deal with certain conditions keeping its development agenda in mind. Though the country has not used the word 'condition', it made amply clear in its "declaration" that India would be able to take climate actions provided it got financial and technological support to move towards a low carbon growth path. India's declaration said, "The government of India declares its understanding that, as per its national laws, keeping in view its development agenda, particularly the eradication of poverty and provision of basic needs for all its citizens, coupled with its commitment to following the low carbon path to progress, and on the assumption of unencumbered availability of cleaner sources of energy and technologies and financial resources from around the world, and based on a fair and ambitious

[143]http://www.unep.org/Green Economy/Portals/93/documents accessed on 18 June 2016.

[144]Shyam Saran., "*Climate Change: From Back To Board Room-What Indian Business Needs to Know About India's Approach To Multilateral Negotiations On Climate Change",* (21 April 2008).

assessment of global commitment to combating climate change, it ratified the Paris Agreement".[145]

While India's declaration opened a window for the country to review its promises if other countries do not adhere to their pledges on finance and technology transfer. By putting Gandhi's seal on the deal, India has now urged the global community to adopt "Gandhian way of life" (shun extravagant lifestyles) to reduce their carbon footprints. "India led from the front to ensure the inclusion of climate justice and sustainable lifestyles in the Paris Agreement. India has put across this view based on Ghandian lifestyle at the climate conference (COP 22) held in Marrakech in Morocco. US President Barack Obama too invoked Gandhi while hailing India's decision, "Gandhi believed in a world worthy of our children. In joining the Paris Agreement, PM Narendra Modi and the Indian people carry on that legacy", he said.

India, accounting for 4.1 percent of total global emissions, became the 62nd country to ratify the Paris Agreement. With India on board, the total emission share of these countries reached the 51.89 percent mark- just 3.11percent less than the emission threshold to bring the Agreement into force. Once the European Union, accounting for 12.1 percent of global emissions joined, the deal entered into force after 30 days (early November). UN secretary general Ban Ki-moon said, 'what better way to commemorate Mahatma Gandhi and his legacy for people and planet… He reminded us that 'Earth provides enough to satisfy everyone's needs, but not everyone's greed'. Gandhi also challenged us to 'be the change we wish to see in the world'. Environmentalist welcomed India's move to ratify the Paris Agreement on climate change and urged the country to make the deal 'effective and equitable'. They also sought to remind the global community that the pledges made under the Paris Agreement were not enough to keep average temperature rise below 2 degrees Celsius compared to pre-industrial era.

India is committed to set a roadmap for the implementation of the 'Make in India' program by building a robust Research and Development infrastructure and promoting a synergy between industry and scientific research institutions. Some of

[145] The Times of India, dated 3rd October 2016.

the new initiative and efforts that India has taken are in this direction are, Mission- clean water, clean air, clean energy, clean environment and greener. Vision- Our vision is to have sustainable development, to have growth and environment protection, development without destruction, poverty eradication and green growth.

In its INDC, India had said it planned to achieve 40 percent cumulative installed capacity from non-fossil fuel-based energy resources by 2030. By December 2016, India had installed just over 50 GW of renewable power capacity, of which wind energy made up 57.4 percent and solar 18 percent. This gave renewable a 15 percent share in India's total installed capacity of just over 314 GW, while coal made up 60 percent, the remaining being large hydropower, nuclear, gas and diesel.

4.8. ENERGY POLICY OF INDIA

The Indian Electricity Act 1910, provided the basic framework for electricity supply in India. The broad vision behind the Energy Policy was to reliably meet the demand for energy services of all sectors at competitive prices.The Energy Policy of India is characterized by trade-offs between four major drivers, namely, i) rapid growing economy, with a need for dependable and reliable supply of electricity, gas and petroleum products, ii) Increasing household incomes, with a need for affordable and adequate supply of electricity and clean cooking fuels. iii) Limited domestic reserves of fossil fuels and the need to import a vast fraction of the gas, crude oil and petroleum product requirements and recently the need to import coal as well and iv) Indoor, urban and regional environmental impacts, necessitating the need for the adoption of cleaner fuels and cleaner technologies. [146]

[146]*Energy Policy, Laws and Regulations Handbook.* 2001, Vol. 1. Strategic Information and Renewable Energy, (International Business Publication, Washington DC, USA-India, 2001).

Table 2: UN Environment Summits: India and Brazil

Table 2 is a brief glance of the five-year decadal participation in the UN Summits by India and Brazil.

World Environment Summit	Host Country	INDIA (Prime Minister)	Tenure	BRAZIL (President)	Tenure	Highlights
1972	Stockholm in Sweden	Indira Gandhi	1966-1977	Emilio Medici	1967-1969	UNEP
1982	Nairobi in Kenya	Indira Gandhi	1980-1984	Joao Figueiredo	1979-1985	
1992	Rio de Jnaeiro in Brazil	P.V.Narasimha Rao	1991-1996	Fernando Collar	1990-1992	UNFCCC & Agenda 21 & UNCED
2002	Johannesburg in South Africa	Atal Bihari Vajpayee	1998-2004	Fernando Henrique Cardoso	1995-2002	Rio+10
2012	Rio de Janeiro in Brazil	Manmohan Singh	2004-2014	Lula da Silva	2003-2010	-
-	-	-	-	Dilma Rousseff	2011-2016	Rio+20, People's Summit &UNCSD
2022	UK in Scotland	Narendra Modi	2014- to date	Jair Bolsonaro	2019- 2022	5 decades 1972-2022

Source: Compiled by the Researcher 2022

The next chapter brings to the façade the initiatives taken by India and Brazil in the respective nations at the local, national and international level. This comparative analysis puts forth the involvement by the Heads of these nations to improve the progress in the field of environment and energy.

CHAPTER V: COMPARATIVE ANALYSIS OF INDIA AND BRAZIL: INITIATIVES ON ENVIRONMENT AND ENERGY ISSUES AT THE LOCAL, REGIONAL AND GLOBAL ECHELONS

It can be summarized that India and Brazil both have taken keen interest and initiatives in their respective fields of energy and environment to fulfil the targets laid down by the UN and UNFCCC to combat events like climate change, energy conservation and environment protection. Since the early 1970s, Brazil had experienced a rapid growth of non-government organization (NGOs) concerned with the environment. By 1990 there were some 700 NGOs, of which 90 percent were located in the urban centres of the southeast and south. Many are amateurish and ineffective, but a few were highly professional and had an impressive impact on domestic public opinion. Hence this section of the thesis will highlight the various accomplishments and goals attained by Brazil and India at the local, national and international level. The section will be merely comparative in nature and will deliberate on the outstanding criteria.

In 2005, after more than five decades of industrialization, Brazil was producing 2.4 million motor vehicles, 33 million tons of steel, 43.4 million tons of cement, 5.9 million television sets, 23.3 million cellular phones and 4.8 million refrigerators yearly. The country's paved road network increased from 36,000 kms in 1960 to about 1,90,000 kms in 2006. Brazil had 90,7000 megawatts of installed electric power capacity in 2004 and over 60 percent of its export consisted of industrial products. Since the mid-1990's Brazil's EMBRAER had become the world's 4th largest aircraft manufacturer, specializing in regional jets. At the same time planted pasture lands rose from 74 million hectares in 1985 to 197 million hectares in 2002. Brazil became the world's largest producer of sugar and concentrated orange juice and the world's largest exporter of soy, cattle meat and tobacco. These achievements, however did not transform Brazil into an advanced industrial society. In terms of the welfare of its many citizens Brazil remained a less developed country.

The Forest code of 1956- required all farms to maintain at least 50 percent of their area with its original vegetation cover and established strict rules for the protection of areas of high declivity of aquifers and other water bodies and of other environmentally fragile areas. It also had strict rules for the extraction of forest resources, both by industries that regularly transform raw materials from the forest (such as saw mills and paper and pulp plants) and those employing energy from forest resources (charcoal or firewood0. Recognizing the impossibility of applying the 50 percent rule to areas of the country already

settled at the time, the code established that those farms had to maintain only 20 percent of their areas in forest cover.[147]

Brief Overview of the Country Analysis

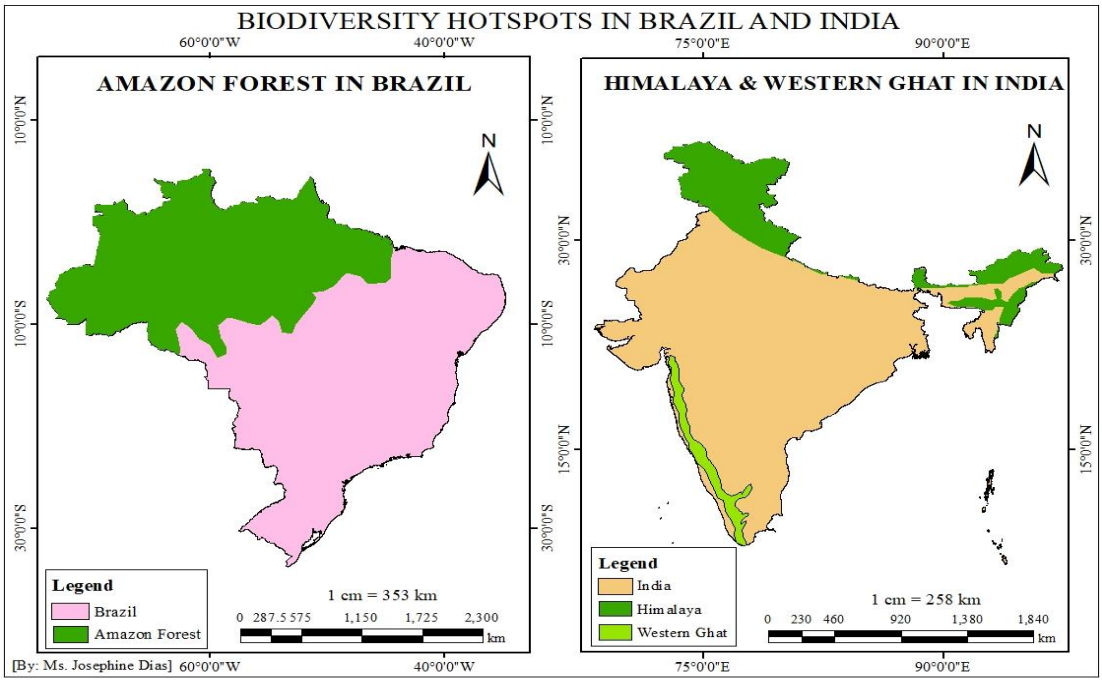
- Brazil is the 8th largest total energy consumer and 10th largest producer in the world.
- Brazil was the largest producer of petroleum and other liquids in South America in 2013.
- More than 91 percent of Brazil's oil production is offshore in very deep water and consists of mostly heavy grades.
- To address the country's dependence as oil imports and surplus of sugar cane, the government implemented policies to encourage ethanol production and consumption beginning in the 1970s.
- The world's largest oil discoveries in recent years have come from Brazil's offshore, presalt basins.
- Although natural gas accounted for 8 percent of Brazil's total energy consumption, the country has the second largest reserves in South America, located primarily offshore in the Campos Basin.

[147] Baer, Werner ., (6th ed) *The Brazilian Economy; Growth and Development*, (Colorado: Lynne Rienner publishers.2008)p.337.

- Brazil has the third-largest electricity sector in the Americas, behind the United States and Canada.

- Brazil is planning a new hydroelectric power project, such as the Belo Monte Plant, which upon completion will be the third largest hydroelectric power plant in the world.

Figure 18: Biodiversity Hotspots in Brazil and India



Source: The Researcher 2022

5.1. BRAZIL'S LOCAL INITIATIVES

a) Energy

Brazil being the world's 7th biggest greenhouse gas emitter, had the relevant tools and policies it needs to become a leader in the fight to deal with climate change. According to WRI, 'Bridging the gap between energy and climate policies in Brazil', reports that Brazil could act to change its energy mix and move toward a lower-carbon economy, but it still needs to strengthen existing policies to amplify their impact to join other key climate players including China, the United States and Mexico. Brazil's energy sector is now a major source of the country's emissions and continues to become more carbon intensive as a result of greater reliance on fossil

fuels. The country anticipates approximately $500 billion to be invested in energy infrastructure over the next decade, and how Brazil chooses to allocates these funds and lock in carbon-intensive infrastructure or advance Brazil's position as a leader in the low-carbon economy is to be seen. The report recommends that Brazil has the opportunity to speed its transition to renewable, ramp up energy efficiency improvements and leverage 'smart' integration of decentralized power into the grid. The analysis recommends that Brazil should invest in modern renewables like wind and solar as a priority, remove harmful incentives for fossil fuels and increase its renewable energy share goal from 20 percent by 2030 to a 30 percent share of wind and solar energy by 2030.

Brazil local solar power generation like one organisation called Revolusolar located in Babilonia, a Rio de Janeiro favela in the Leme region of the city, founded in 2015 by a group of six local residents, is aiming to bring green power to the people of the favela. Currently, a non-profit, Revolusolar is hoping to become a co-operative later in the year and is already supported by the organization of co-operatives in Brazil. A solar promise for Brazil is if panels were installed on the rooftops of every house in the country, solar energy could supply more than double the Brazilian residential demand, according to Rodrigo Sauaia, President of the Brazilian Solar Power association (Absolar). In 2015, Brazil had only 1,731 small scale solar systems connected to the grid, but it is expected that this number will grow to 1.2m in 2024.[148]

On the other hand, Brazil has one of the cleanest energy matrices in the world, with 41 percent of its overall energy production originating from renewable sources, and this number is decreasing, however because of recent droughts due to climate change, resulting in less hydroelectric power. However, in the last 6 years, Brazil has shifted its focus towards diversifying its matrix, seeking other renewable resources such as wind power, small hydro and biomass (ethanol from 1970). Since 2014, Brazil has also moved towards centralized solar energy to diversify electricity production.

b) On Environment and Deforestation

[148] The Guardian, May 24th 2016.

Brazil has done an exceptional job at curbing illegal deforestation, historically the largest source of its greenhouse gas emissions. But with fossil fuel emissions on the rise, Brazil needs to prioritize its energy sector to do its part to combat climate change, while continuing to curb land use emissions. Such measures would bring both local and global benefits. This new analysis offers guidance for an integrated approach to more effectively reconcile energy and climate needs. Brazil's INDC will indicate whether the country is committed to better climate and better growth, a pathway to drive economic growth and tackle climate change at the same time. Reducing illegal deforestation, implementing the Forest Code, creating a restoration economy and enhancing renewable energies, such as biofuels and biomass, as well as creating new public policies, which allow deepen the emissions reduction and adaptation practices in the land use and the agriculture sectors are vital for the future of sustainable development in Brazil.

5.2. BRAZIL'S NATIONAL INITIATIVES

Land-use, Land-use Change and Forestry (LULUCF). The rate of build-up of Carbon dioxide in the atmosphere can be reduced by taking advantage of the fact that atmospheric carbon dioxide can accumulate as carbon in vegetation and soils in terrestrial ecosystems. Under the UNFCCC any process, activity or mechanism which removes a greenhouse gas from the atmosphere is referred to as a sink. Human activities impact terrestrial sinks, through land use, land-use change and forestry (LULUCF) activities. Consequently, the exchange of carbon dioxide (carbon cycle) between the terrestrial biosphere system and the atmosphere is altered. Brazil is improving its forest cover after the massive deforestation and forest fires that took place in 2019.

Brazil's INDCs – Intended Nationally Determined Contributions

2015 was a historic year in which 196 Parties came together under the Paris Agreement to transform their development trajectories, so that they set the world on a course towards sustainable development, aiming at limiting warming to 1.5 to 2 degrees Celsius above pre-industrial levels. NDC are submitted every 5 years to the UNFCCC Secretariat, with the next round of NDCs (new or updated) being submitted by 2020.

Today, the world is set to invest $90 trillion in cities, land use and energy systems between now and 2030. This investment can continue supporting emissions-intensive infrastructure like coal plants and roadways, or it can finance greener options like renewable energy and safe affordable public transit. A new report, 'Better growth, better climate', finds that low carbon investments if done right could cost about the same as conventional infrastructure, but would deliver significantly greater economic, social and environmental benefits in the long run. The report was produced by the Global Commission on the Economy and Climate, which was made up of eminent economic leaders including former Presidents and Finance ministers, CEOs of multinational companies and heads of leading economic organizations. This shows that the world now faces an unprecedented opportunity for low-carbon growth, and in connection with this, Brazil which is one of the world's biggest GHG emission emitters, has a fundamental role in this scenario. The INDC submitted by the country has set an absolute emission reduction of 37 percent until 2025 and 43 percent until 2030, having as base 2005 level. Thus, the engagement of land use, renewable energy and low carbon agriculture sectors is key for the Brazilian commitments. This policy undertaken by Brazil briefly aims at analysing on how the Paris Agreement can craft land use dynamic in Brazil within the next 20 years, enabling continuous improvements, which promote the adoption of large-scale low carbon actions and boost the production of food, fibres, forests and energy, along with environmental protection.

Brazil achieved significant institutional advances in environmental policy design and implementation after the Stockholm Conference on the Environment in 1972. Specialized environmental agencies were organized at the federal level and in some states, many national parks and reserves were established. By 1992 Brazil had

established thirty-four national parks and fifty-six biological reserves. In 1981 the National Environment Policy was defined, and the National System for the Environment (*Sistema Nacional do Meio Ambiente--Sisnama*) was created, with the National Environmental Council (*Conselho Nacional do Meio Ambiente--Conama*) at its apex, municipal councils at its base, and state-level councils in between. In addition to government authorities, all of these councils include representatives of civil society.

The 1988 Constitution incorporates environmental precepts that were advanced compared with those of most other countries. At that time, the Chamber of Deputies (Câmara dos Deputados) established its permanent Commission for Defence of the Consumer, the Environment, and Minorities. In 1989 the creation of the Brazilian Institute for the Environment and Renewable Natural Resources (Instituto *Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis--Ibama*) joined together the federal environment secretariat and the federal agencies specializing in forestry, rubber, and fisheries. In 1990 the administration of President Fernando Collor de Mello (1990-92) appointed the well-known environmentalist José Lutzemberger as secretary of the environment and took firm positions on the environment and on Indian lands. In 1992 Brazil played a key role at the UN Earth Summit, not only as its host but also as negotiator on sustainable development agreements, including the conventions on climate and biodiversity. The Ministry of Environment was created in late 1992, after President Collor had left office. In August 1993, it became the Ministry of Environment and the Legal Amazon which took a more pragmatic approach than had the combative Lutzemberger. However, because of turnover in its leadership, a poorly defined mandate, and lack of funds, its role and impact were limited. In 1995 its mandate and name were expanded to include water resources--the Ministry of Environment, Hydraulic Resources, and the Legal Amazon. In 1997 the Commission on Policies for Sustainable Development and Agenda 21 began to function under the aegis of the Civil Household. One of its main tasks was to prepare Agenda 21 (a plan for the twenty-first century) for Brazil and to stimulate preparation of state and local agendas.

5.3. GLOBAL INITIATIVES BY BRAZIL

As part of Brazil's Environmental initiatives, it is party to the following international agreements. Antarctic-Environmental Protocol, Antarctic-Marine Living Resources, Antarctic Seals, Antarctic Treaty, Biodiversity, Climate Change, Kyoto Protocol, Desertification, Endangered Species, Environmental Modification, Hazardous Wastes, Law of the Sea, Marine Dumping, Ozone Layer Protection, Ship Pollution, Tropical Timber 83, Tropical Timber 94, Wetlands and Whaling. Besides this Brazil has joined the bloc called BRICS. Brazil, Russian federation, India, China and South Africa are the emerging and fast-growing countries within the renewable energy industry and had a total market value of $190,536.6 million in 2013. China was leading the renewable energy industry among the BRIC nations with a value of $197.816 million in 2018, followed by Brazil, India, and Russia with expected value of $66.736, $24.916 and $16.253 million respectively.

The success of the Brazilian Alcohol Programme (Proalcool) was significant not only for the country's economy but also to the global environment. The National Alcohol Program which was launched in 1975, was a nationwide program financed by the government to phase out automobile fuels derived from fossil fuels, such as gasoline, in favour of ethanol produced from sugarcane. This was done in order to foster development of an indigenous ethanol-based transport industry that would mitigate the country's dependence on fossil fuels, generate jobs and foster the development of technology. This technology is now being transferred to the international market.

Brazil has announced that it has set a target to reduce GHG by 37 percent until 2025 and by 43 percent until 2030. According to Forma President Rousseff this reduction was well beyond the country's 'contribution' to global-warming, and the deforestation rates in the Amazone region were reduced by nearly 80 percent and today Brazil has set a target of zero percent deforestation by 2030. Brazil has informed global leaders that low-carbon farming processes are being implemented throughout the country and that Brazil continues to expand its renewable energy matrix by replanting and restoring 12 million plants. The Paris CoP 2015 outcome has sent a strong signal to the international community that governments, businesses and civil society are decisively taking on the climate change (Refer Annexture I).

Brazil has reduced its emissions by around 41 percent as compared to 2005, and is on track to meet its 2020 target. Brazil has presented a fair and ambitious intended nationally determined contribution (INDC) that represents its highest possible effort beyond its current actions. It is based on the implementation of broad policies, including forestry, land-use, industrial and energy sectors. Brazil will pursue policies aimed at eliminating illegal deforestation, coupled with ambitious enhancement of carbon stocks through reforestation and forest restoration. For that purpose, Brazil intends to restore and reforest 12 million hectares of forests by 2030. In line with its goal to expand the use of renewable energy sources, Brazil intends that its total energy matrix reach, by 2030, a share of 28 percent to 33 percent from renewable sources (electricity and biofuels) other than hydropower. Brazil also intends to improve low carbon agricultural and grazing land practices through the promotion of sustainable agricultural and productivity enhancement, to promote new, clean technology standards for industry, to further promote energy efficiency measures and to expand the use of non-fossil fuel energy sources domestically.

Recognizing the need to accelerate the deployment of renewable energy to help power our economies, Brazil intends to increase the share of renewable beyond hydropower, in their respective electricity generation mixes to the level of 20 percent by 2030. The two Presidents of United States and Brazil have decided to launch a Joint Initiative on Climate change, which will be implemented through a new high-level Climate Change Working Group (CCWG) aimed at enhancing bilateral cooperation on issues relating to land use, clean energy and adaptation as well as policy dialogues on domestic and international climate issues.

5.4. INDIA'S – LOCAL INITIATIVES

In 2010, India made the leap to harness solar power to meet its ever-increasing energy demand. The decade has been a story of more successes than failures. Simultaneously the world also made significant progress in adopting solar energy. The International Energy Agency has projected a rapid increase in installed capacity of solar power by 2040, from 495 GW now to 3,142 GW, in its latest World Energy Outlook. Since Solar has the potential to surge ahead of coal and gas to become the largest source of installed power by 2035. As for generation, the share of renewable generation could nearly double, from 26 percent today to 44 percent in 2040,

surpassing coal-based generation in 2026. The three-phase Jawaharlal Nehru National Solar Mission (JNNSM) has set up an ambitious roadmap i.e., 22,000 MW of solar power by 2022. The clock is ticking fast for the first phase and presently 70 percent of the new generation capacities are added to the grid in India in the last three years which are mainly renewable. [149] Following are some select initiatives at the local level:

a) JNNSM – Azure power stated it has signed a memorandum of understanding (MOU) with the Rajasthan government to develop a 1,000 MW solar power project. The power plant is the largest capacity project won under the ambitious Jawaharlal Nehru National Solar Mission-Phase II (JNNSM) which was launched by the central government in 2010 to generate 20,000MW of solar power by the end of the 13th Five-year plan in 2022. With this project, the company has become the largest private solar investor in Rajasthan with a total investment capital over Rs. 1,300 crores.

b) TheMake in India initiative was launched by Prime Minister Narendra Modi in Sept 2014, as part of a wider set of nation-building initiatives. Devised to transform India into a global design and manufacturing hub. Make in India was a timely response to a critical situation. By 2013, the much-hyped emerging markets bubble had burst and India's growth rate had fallen to its lowest level in a decade. The promise of the BRICS had faded and India was tagged as one of the so-called 'fragile five'. India was on the brink of severe economic failure. Make in India was launched by the Prime Minister Narendra Modi against the backdrop of this crisis and quickly became a rallying cry for India's innumerable stakeholders and partners. It was a powerful galvanising call for action to India's citizens and business leaders and an invitation to potential partners and investors around the world.

c) India One – Solar thermal power project at the World Renewable Spiritual Trust (WRST), a registered charitable Trust / Solar research centre and a sister organization of the Brahma Kumaris, located at Abu Road, Rajasthan has set up a 1.0 MW solar thermal power plant in order to demonstrate and multiply this alternative technology for India. After detailed evaluation of various solar technologies, WRST

[149] Down To Earth, 1-15 January, 2020, pg. 36-37.

came to the conclusion to make use of the in-house developed 60 m^2 Scheffler parabolic dish in order to setup a solar thermal power plant near Shantivan Campus in Abu Road. The thermal solar power plant (solar only) was the first of its kind in the world in dish technology in direct steam generation mode, with full thermal storage for 16 hours continuous operation for base load.[150]

d) World's largest Solar Park functional in Kurnool – The 1,000 MW Kurnool solar park in Andhra Pradesh is fully grid-synchronised after its commissioning and hooking to the grid of 20MW and was developed by the Adani Group. The group was awarded a 50MW portion of the entire capacity, 30MW of which was commissioned by its subsidiary Prayatna Developers at the end of June 2017. Kurnool will remain the world's largest solar park for a long time as most GW-Scale projects globally are under development. Previously, the 648MW Solar Park at Kamuthi in Tamil Nadu was India's largest. India intends to generate 175GW of renewable energy till 2022 and out of this a 100GW would be from Solar power exclusively. Till May 2017, the country had achieved a target of nearly 12.28GW of solar energy.[151]After adopting its final National Electricity Plan (NEP) earlier in 2018 India remained on track to over achieving its '2 degree Celsius Compatible' rated Paris agreement NDC climate action targets.

e) Hotels in India check into greener power sources – Hotels in India are increasingly switching to clean energy as they look to move away from thermal power and high electricity costs. This green initiative is helping hotels reduce their carbon emissions even as guests prefer to check into environmentally friendly rooms. In the heart of Gurgaon (Mumbai) is home to the 20-room Oberoi and 136-room Trident hotels. The Oberoi chain, which also owns the Trident, has set up a 7.5 MW-solar farm, spread over 25 acres, in nearby Balasar in Haryana to meet the energy requirements of the two properties. Down south ITC Grand Chola in Chennai and ITC Gardenia in Bengaluru are completely run on wind power. The owner, the cigarette-to-chocolate maker ITC, has installed windmills in Kundadam Tamil Nadu and in Sindhigiri and Manikere both in Karnataka to power the two upscale properties. Accor, which owns Novotel and Ibis brands, is using biogas at two of its

[150] http://www.india-one.net accessed on 2nd January 2018.

[151] Down to Earth, Science and Environment Fortnightly, New Delhi, 1-15 August 2017, p.12.

hotels. At ITC, more than half (53percent) of its total electrical energy demand is met from 'captive renewable energy sources', as they are called. The Westin Mumbai is entirely run on wind energy procured from a third party and so is JW Marriott in Bengaluru.[152]

f) Plastic Ban – According to a report of the UN Environment Programme, as of July 2018, 127 out of 192 countries reviewed had adopted some form of legislation to regulate plastic bags. A 2015 study conducted by the Central Pollution Control Board in 60 major Indian cities estimated that these cities were generating around 4,059 tonnes of plastic waste daily. Extrapolating the data for the entire country, the figure would be 25,940 tons a day. Delhi topped the list with 690 tons of daily plastic waste, followed by Chennai, Kolkata and Mumbai. In India too, the government has notified the Plastic Waste Management Rules 2016. These rules prohibit carry bags made of virgin or recycled plastic less than 50 microns in thickness. There is complete ban on sachets using plastic material for storing, packing or selling tobacco products. As per Rule 17(3) of the rules, each State Pollution Control Board or Pollution Control Committee (SPCBs/PCCs) is required to submit annual reports to the CPCB by July 31st each year. Based on this, the CPCB is supposed to prepare a consolidated report on use and management of plastic waste.[153]

5.5. NATIONAL INITIATIVES

One of the oldest environmental actions initiated by India was the implementation of the Indian Forest Act of 1927. The forest policy and management was introduced in India by the British government by setting up a Forest Department and enacting relevant legislation in the 19th century. India has attempted to reduce emission intensity of its GDP by 20-25percent below 2005 level by 2020. However agricultural emissions did not form part of this accounting standard. Indian cities have begun to implement city action plans to cut the choking haze of pollution, crippling congestion and energy guzzling. This demands new term of debate and policy actions. This has created enormous need for knowledge and experience sharing for a range of strategies like bus sector reforms, implementation of bus rapid transit system, funding

[152] The Times of India dated 5th August 2019.

[153] The Times of India dated 17th August 2019.

mechanism for public transport, parking policy, tax measures to promote public transport, congestion reduction strategies, promotion of walking and bicycling and institutional reforms.[154] Besides these other initiatives like:

Digital India - an initiative of the Government of India to ensure that government services are made available to citizens electronically by improving online infrastructure and by increasing internet connectivity. It was launched on 1st July 2015 by the Prime Minister Narendra Modi.

Start-up India - an action plan aimed at promoting bank financing for start-up ventures to boast entrepreneurship and encourage start-ups with job creation. The campaign was first announced by the PM on 15th August 2015 on the eve of Independence Day celebration.

Skill India - was a campaign launched by PM on 15th July 2015 with an aim to train over 400 million people in India in different skills by 2022. The campaign was first announced on 15th August 2015.

Smart Cities - Government of India has a vision of developing 100 smart cities as satellite towns of larger cities and by modernizing existing cities with a capital outlay of USD 7 Billion.

Atal Mission for Rejuvenation and Urban Transformation (AMRUT) in a determined effort to recast urban landscape and make urban centres more liveable and inclusive. Government of India launched AMRUT initiative with a capital outlay of USD 7.69 Billion.

Pradhan Mantri Jan Dhan Yojna (PMJDY) - objective of PMJDY is to ensure access to various financial services like availability of basic savings bank account, access to need based credit, remittances facility, insurance and pension to weaker section and low-income groups.

Ujjwala scheme to provide domestic smokeless cooking chulas to households.

[154]*DOWN TO EARTH* (New Delhi), 16-28 February 2010, p.19.

5.6. NEW ENERGY FRONTIERS AND INITIATIVES IN INDIA

On the Energy front exclusively, India has taken various initiatives and have adopted new technologies in the energy sector which will help India to boost its economy and could reach out to 80-110 million more people by 2025, besides curbing 180 million to 220 million tons of carbon emissions. According to a December 2014 report from research firm McKinsey & Co, the adoption of smart metering and technologies for advanced energy storage for unconventional oil and gas and solar energy can generate a market valuation between $21 billion to $27 billion by 2025 with technologies in solar scaling up to 4 percent of total electricity supply in the country. It is estimated that India's energy intensity could be improved from 56 percent per kilogram of oil equivalent per dollar of GDP today to about 50 cents in 2025. Energy storage could create $5 billion to $10 billion of annual impact in 2025.[155]

Following are the contributions that India has put in to achieve new limits in the field of energy.

i. Renewable energy company Greenko has aimed to generated 800mw renewable energy in Telangana state by 2018. During the meeting, the CM said the government was keen to add fresh capacity in both thermal and in the renewable energy sector to overcome from the power crisis and make the state power surplus.[156]
ii. Visakhapatnam is the first solar power city in the country and Vijayawada a world class city. Nearly, 96,000 street lights in Visakhapatnam are solar and 85,000 such solar lights are installed.[157]
iii. The central government in New Delhi is on target to meet its ambitious goal to give uninterrupted electricity to all homes across India. Comprehensive state-specific action plans for 24x7 power to all homes is being prepared in partnership with respective states, encompassing generation, transmission and distribution, the power ministry had said in its year-end review. According to official estimates, 53

[155] Energy Times, Vol.37. No. 20, December 30th, 2014- January 5th, 2015, Kolkata. P.2
[156] Ibid.p.4.
[157] Ibid.p.7.

million homes in the country are not yet electrified and many offices and factories continue their operations on diesel gensets.[158]

iv. Funding for renewables increases. According to the Coal v/s Renewables 2018 report on lending to 54 energy projects that reached financial closure in 2018, released by Delhi based think tank Centre for Financial Analysis (CFA), has revealed 90 percent decline in coal power project finance lending in 2018 as compared to 2017. Figures show that 80 percent of all energy project finance went to renewable, while coal received merely 20 percent. Though such a push towards solar and wind may be in sync with India's target to have 175GW of renewable by 2022.[159]

v. Leading US based renewable energy firm SunEdison signed an agreement with the Karnataka government to generate 5 gigawatts (GW) of power over the next five years. Energy from these projects will be cost competitive with coal-based electricity without subsides or incentives and will ease the power deficit in the state.[160]

vi. Energy Conservation Campaigns. With the launch of the national level fortnight-long programmes, intensive campaigns are being undertaken to drive home the point of oil and gas conservation. Thousands participate in Energy Conservation Walkathon when they are held in various cities like Visakhapatnam as part of an energy conservation campaign. India's Oil and Gas Conservation Fortnight (OGCF) are being observed by several public sector oil companies.

vii. Brokers of the Sun. The central government has roped in spiritual gurus to promote its target of generating 40,000 MW of rooftop solar power. The government has asked spiritual leaders to install solar power units in their ashrams or hermitages and promote this renewable form of energy among millions of their followers. Union Ministry of New and Renewable Energy secretary Upendra Tripathi said that the gurus are in the best position to showcase the virtues of solar energy and promote the cause of green energy. Under the project, a data bank of

[158] Energy Times, Vol.37, No.21, January 6- 12-2015, Kolkata. P. 1.

[159] The Times of India dated 19th August 2019.

[160] Ibid.p.6.

over 100 large ashrams is being compiled to seek cooperation for setting up solar power projects in return for a 'commitment certificate'.[161]

viii. Breathe 'Davos' air in polluted Delhi. Thanks to an innovative green technique involving some 1,200 indoor plants adopted by a business centre in South Delhi, one can actually breathe 'Davos quality' air in the national capital, where the smog is 3 times worse than Beijing's. Plants used are- mother-in-law's tongue, areca palm and money plant. WHO estimates that indoor air pollution is India's second largest killer after high BP, leading to 1.3 million deaths annually. Besides this New Delhi has implemented the **odd-even scheme** to enforce nearly 15lakh vehicles off the roads as a measure to improve air quality. It was not possible to make such an initiative successful without public participation. [162]

ix. Liquid Petroleum Gas subsidy transfer scheme. Reviewing progress of the PaHaL scheme for paying consumers subsidy on cooking gas (LPG) directly into their bank accounts, PM.Narendra Modi, congratulated officials on coverage attained in the world's largest cash transfer programme. 'PaHaL' which covers more than 9,75 crores (90.75million) LPG consumers was perhaps the world's largest cash transfer programme as compared to similar programme the other countries such as China, Mexico and Brazil have.[163]

x. Solar dryers to prepare hygienic dry fish. As many as 99 ultra-modern solar dryers are installed for the first time in India, for making most hygienic dry fish by the women SHGs across Ganjam and Puri District in Orissa state, as an alternate livelihood initiative under the World Bank aided integrated coastal zone management project.

xi. National Solar Mission scaled up five-fold. According to Economic Survey 2014-15, India's National Solar mission has been scaled up fivefold to generate 1,00,000 megawatts of power by 2022, requiring an additional investment of $100 billion, which was tabled in parliament by Finance Minister Arun Jaitley.[164]

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[161] Down to Earth, Science and Environment Fortnightly, New Delhi, 1-15 October 2016, p.11.

[162] The Times of India dated 5th November 2019.

[163] Energy Times, Vol.37, No. 25, February 3-9 2015, Kolkata.p.2,6,7.

[164] Energy Times, Vol.37, No. 29, March 3-9 2015, Kolkata.

xii. Hydro-power is the key for energy security. With coal supply remaining erratic and controversies dogging nuclear energy, hydro-power could hold the key to India's energy security and put an end to power cuts, according to a study. Given India's tight domestic coal supply and increasing reliance on imported coal, hydro-electric capacity with foreign direct investment (FDI) can provide the country with adequate power, says the report by HSBC Global Research. While the thermal power producers have yet to be assured of uninterrupted fuel supply, nuclear power projects in Maharashtra and Tamil Nadu face uncertainties experts says. On the other hand, hydel power projects could attract FDI as proved in the 1,200 megawatts (MW) Teesta III project in Sikkim where 6 investors have invested Rs.750 crores. As per the Central Electricity Authority, hydro potential in India is estimated at 145 (gigawatts) GW, of which installed capacity is around 34 GW and another 12 GW is under construction. Nearly three-fourths of the balance 99GW falls in 4 states. In 2012 the than Minister of state for power K.C.Venugopal said that of the total identified capacity around 33,320.8MW (22.93 percent) has been developed. Remaining 66.66 percent of the total identified potential is yet to be developed.

xiii. India has taken a leap forward in the clean energy race with a 54 percent increase in investment in 2011 vaulting it from 10th to 6th place in G-20 in just one year, according to a new study. The wind sector led the way, attracting USD 4.6 billion out of a total USD 10.2 billion investment in India and spurring deployment of 2.8 GW during the year, a 38 percent increase in wind generating capacity according to research released by the Pew charitable trusts. 'On a number of measures, India has been one of the top performing clean energy economies in the 21st century, registering the 5th highest five-year rate of investment growth and 8th highest in installed renewable energy capacity', according to Phyllis Cuttino, director of Pew's clean energy programme. India's 'National Solar Mission' with a goal of 20 GW of solar power installed by 2020, will help to drive the seven-fold jump in solar energy investments to USD 4.2 billion. Globally investments grew to a record USD 263 billion in 2011, a 6.5 percent increase over previous year.[165]

xiv. Energy efficiency standard for power guzzling industries has been identified by the government for 600 units such as fertilizers, steel, cement and paper for which

[165] Ibid.p.6.

energy efficiency standards will be laid down. Planning Commission member B.K. Chaturvedi said, as part of the drive to achieve energy efficiency in the 13th Five-year plan (2017-22), the government has focused on setting up super critical and ultra-critical power plants. India, at present, is witnessing 30 percent urbanization which is set to reach 50 percent by 2040.[166]

xv. India has built the world's largest 4,000 MW solar project in the western state of Rajasthan. The ultra-mega green solar power project was built in two phases close to Sāmbhar Lake, about 75 km from Jaipur. The first phase was of 1000MW was commissioned in 2016.[167]

xvi. Energy planning tool and energy solutions for the nation called the Energy Planning Tool 2052 is being undertaken with inter and intra sectoral cooperation. It is modelled on the lines of British model-2050 Pathways, a tool which is used to explore how the UK can meet the 2050 emission reduction target using the web-based 2050 calculator. Besides this, Indian Oil is fully aligned to the country's aspirations to transit to clean energy and has planned Rs. 27,000 crores investment in alternative energy and sustainable development projects. Besides a target to raise its solar energy and wind-power portfolio to 260MW by the year 2020, the Corporation has initiated diversification into alternative, renewable energy and bio-fuels 2G and 3G ethanol, waste-to-energy and compressed bio-gas (CBG). As part of the SATAT (Sustainable Alternative towards Affordable Transportation) initiative launched during the year, Indian Oil has issued LOIs for 96 plants to supply 782 tonnes per day of CBG. In fact, the CBG programme has the potential to replace 62 million tonnes per annum of petroleum fuels as a waste-to-wealth measure.

Besides this, according to the five targets of SDG 7 - Affordable and Clean Energy, 94.57 percent of the households in India have been electrified (target was 100 percent). 43.8 percent households are using clean cooking fuel (target was 100 percent) and 17.51 percent was the renewable share in installed generating capacity (target was 40 percent).[168]

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[166][166] Energy Times, Vol. 36, No. 7, September 24-30, 2013, Kolkata.p. 2.

[167] Energy Times, Vol.36, No. 19, December 17-23, 2013, Kolkata. P. 1.

[168] Down To Earth, 1-15 June 2019, pg.51-52.

5.7. INDIA'S ENVIRONMENTAL INITIATIVES

Over the last two decades the Indian State of Environment (SoE), has reported experiences ranging from grassroots initiatives like wall posters and citizens report to media and academic documents and more formal government documents, while the quality of these outputs has been mixed, some of the processes adopted and products developed have been pioneering. Consequently, they have contributed to support policy and decision-making within the country and also for reporting to the global system. Forest cover in India is stagnating around 22 percent of land utilization statistics.[169] The SoE Report of 2009 had aimed to provide policy guide lines and strategies for resource allocation for the coming decades, based on analysis of the state and trends of the environment and provide guidance for national environmental action planning. The Report covers the state and trends of the environment (land, air water, biodiversity) and five key issues vis-à-vis climate change, food security, water security, energy security and managing urbanization.

The National Action Plan on Climate Change (NAPCC) was also launched by the government on 30 June 2008. The NAPCC identifies measures that promote development objectives while also yielding co-benefits for addressing climate change effectively. There are eight 'National Missions' which form the core of the national action plan. They focus on promoting understanding of climate change, adaptation and mitigation, energy, efficiency and natural resource conservation. Their 8 missions are: National Solar Mission. (NSM)

- National Mission for Enhanced Energy Efficiency. (NMEEE)
- National Mission on Sustainable Habitat. (NMSH)
- National Water Mission. (NWM)
- National Mission for Sustaining the Himalayan Ecosystem. (NMSHE)
- National Mission for a Green India. (NMGI)
- National Mission for Sustainable Agriculture. (NMSA)
- National Mission on Strategic Knowledge for climate change. (NMSKCC) [170]

[169]Source: Ministry of Environment and Forests and also see for further details and information http://www.indiaenvironment portal.org.in/files/images/nepalfeature.jpg. Accessed on 17 April 2016.

[170]http://pmindia.nic.in. Accessed on 9 April 2016.

- Meanwhile, 2014-24 is declared as the decade of Sustainable Development by the

UN And to the 8 National Missions, India has added another 4 Missions as follows: Wind Energy Mission, Human Health Mission, Coastal Resources Mission and Waste to Energy Mission, and 14th August is declared as Energy Conservation Day.

The government of India in response to the Rio Summit and all the other Summits took comprehensive initiatives. In continuation of its efforts to strengthen wild life protection in India, the MoEF has prepared a Draft Wild Life (Protection) Amendment Bill 2000 on 22 June 2010. This Bill, which is the product of extensive consultations with a wide spectrum of stakeholders, was intended to greatly strengthen the existing provisions for penalties, traps, and criminal procedures.

The Green India Mission Draft Document for a Green India was released and it was followed by a national consultation on 24 May 2010 in New Delhi, as one of the eight missions under the National Action Plan on Climate change. Among other initiatives, India has started a post-Copenhagen Domestic Action. It has also made a strong case for REDDt (Reducing Emissions from Deforestation and Forest Degradation), to join the Oslo Forestry Partnership. Report on India's GHG Emissions 2007 released along with the BASIC ministers discussed the roadmap to Cancun that emphasized equity on the 25th of April 2010. Meanwhile, India alongside the BASIC countries has called for fast-tracking climate negotiations under UNFCCC and Delhi become the first Indian state to launch action plan on climate change on 5 November 2009.

One of the most interesting initiatives launched by the Indian government was the Bachat Lamp Yojana (BLY) which became the world's third CDM PoA. It was launched in New Delhi on 29th of April 2010. The BLY conceived as CDM programme of activity (PoA) for mass distribution of compact fluorescent lamps (CFLs) in India, has been registered from India and only third in the world. This programme has enabled the state electricity distribution companies to distribute CFLs at about Rs.15 per piece and in return take back working incandescent lamps (ICL), thus promoting energy efficient lighting.

The National Green Tribunal bill was passed in Parliament on 5 May 2010, and has set up specialized environmental courts across the country. The Bill envisages the setting up of Green Tribunals comprising judicial and expert members to adjudicate substantial question of the environment, and award civil penalties. The Indira Paryavaran Bhawan, foundations were laid down in 2009. It is now the MoEF building and a book was launched titled "Indira Gandhi on Environment and Forests" published by the Ministry of Environment and Forests.[171] The legislation on Environment, Forests and Wildlife was updated in September 2009.[172]

Introducing CNG as fuel in the capital transport system in the late 1990's has shown the lone initiative taken by India to use renewable energy. The still functioning electric trams in Kolkata introduced by the then British empire in India indicates the environmental consciousness and the safety concerns the than Government and citizens of India had. Indians till today use the public transport system mainly the railways, which is the third largest system in the world after USA and Soviet Union. But contrary to this the automobile population is showing an increasing trend in a few states of India with globalization making forages in the Indian markets creating demand for foreign market.

India's strategy for the Policy Framework includes the encouragement of the development of renewable sources of energy by the use of incentives by the federal and state governments. Other example of encouragement by incentive includes the use of nuclear energy (India's Nuclear Cooperation Promotion Act) promoting wind farms such as Muppandal and solar energy (Ralegaon Siddhi). A long-term energy policy perspective is provided by the integrated Energy Policy Report 2006 which provide policy guidance on energy sector growth. Energy Conservation has emerged as a major policy objective and the Energy Conservation Act 2001 was passed by the Indian Parliament in September 2001. The Act required large energy consumers to adhere to energy consumption norms, new buildings to follow the Energy

[171] http://moef.nic.in/modules/Fellowships_and_awards. Accessed on 5 July 2016.

[172] Water Pollution, Air Pollution, Environment Protection, Coastal Regulation Zone, Delegation of Powers, Eco-marks Scheme, Eco-sensitive zone, Environmental Clearance- General, Environmental Labs, Environmental Standards, Hazardous Substances Management, Loss of Ecology, Noise Pollution, Ozone Layer Depletion, Water Pollution, 2-T Oil, Public Liability Insurance, National Environment Appellate Authority, National environment Tribunal, Animal Welfare, Wildlife, Forest Conservation, Biodiversity, IFS, ALL

Conservation Building Code, and appliances to meet energy performance standards and to display energy consumption labels. The Act also created the Bureau of Energy Efficiency (BEE) to implement the provision of the Act. The electricity industry has been restructured by the Electricity Act 2003, which unbundles the vertically integrated electricity supply utilities in each state of India into a transmission utility and a number of generating and distribution utilities.

5.8. ALTERNATIVE SOURCES

Bio-Diesel – The former President of India Dr. Abdul Kalam, was one of the strong advocates of Jatropha cultivation for the production of bio-diesel. In one of his speeches, the President said that out of the 600,000 sq.km of waste land that is available in India, over 300,000 sq.km is suitable for Jatropha cultivation. The plan for supplying incentives to encourage the use of Jatropha has been implemented and extraction of bio-diesel is done today along with ethanol from sugarcane.

Wind Power – The once impoverished village of Muppandal (Tamil Nadu) benefitted from the building of the nearby Muppandal wind farm, a renewable energy source, which supplied the villagers with electricity for work. The village had been selected as the showcase for India's $ 2 billion clean energy program which provides foreign companies with tax breaks for establishing fields of wind turbines in the area. The suitability of Muppandal as a site for wind farms stems from its geographical location as it has access to the seasonal monsoon winds. Other states like Rajasthan have wind power generation in the district of Jaisalmer.

Oil – The state-owned Oil and Natural Gas Corporation (ONGC) acquired shares in oil fields in countries like Sudan, Syria, Iran and Nigeria. These investments led to diplomatic tensions with the United States. Because of political instability in the Middle East and increasing domestic demand for energy, India is keen on decreasing its dependence on OPEC to meet its oil demand and increasing its energy security. Several Indian oil companies, primarily lead by ONGC and Reliance Industries, have started a massive hunt for oil in several regions in India including Rajasthan, Krishna-Godavari and north-eastern Himalayas. The proposed Iran-Pakistan-India pipeline is a part of India's plan to meet its increasing energy demand.

In view of this India is making strides to import ethanol to replace petrol and diesel fuel usage.[173]

Nuclear Power – India boasts a quickly advancing and active nuclear power program. It was expected to have 20 GV of nuclear capacity by 2020, though India currently stands at the 9th place in the world in terms of nuclear capacity. India has 17 nuclear power plants in operation as of 2008, while 6 others are under construction. An Achilles heel of the Indian nuclear program however, is the fact that it is not a signatory of the Nuclear Non-Proliferation Treaty. United States- India Peaceful Atomic Energy Cooperation Act seems to be a way to get access to advanced nuclear technologies for India and this Act along with other bilateral agreements allows US technology to be exported to India. India has been using imported enriched uranium and are under International Atomic Energy Agency (IAEA) safeguards, but it has developed various aspects of the nuclear fuel cycle to support its reactors. Currently India stands 9th in the world in terms of number of nuclear power reactors. The Nuclear Power Corporation of India had planned to generate 20,000 MW of power by 2020.

Solar Energy – India's theoretical solar potential is about 5000TkWh per year, far more than its current total consumption. Currently solar power is prohibitive due to high initial costs of deployment. However, India's long-term solar potential could be unparalleled in the world because it has the ideal combination of both high solar insolation and a big potential consumer base density. With a major section of its citizens still surviving off-grid, India's grid system is considerably under-developed. Availability of cheap solar power can bring electricity to people and bypass the need of installations of expensive grid lines.

Electricity – The Government of India had set up the Bureau of Energy Efficiency (BEE) on 1st March 2002 under the provisions of the Energy Conservation Act, 2001. The mission of the BEE is to assist in developing policies and strategies with a thrust on self-regulation and market principles, within the overall framework of the Energy Conservation Act 2001, with the primary objective of reducing energy intensity of the Indian economy. BEE co-ordinates with designated consumers,

[173] O Herald dated 4th September 2019.

designated agencies and other organizations and recognize, identify and utilize the existing resources and infrastructure, in performing the functions assigned to it under the Energy Conservation Act. The Energy Conservation Act provides for regulatory and promotional functions.

The Major Promotional Functions of BEE include:[174]

Besides this there are other Environment-Energy Acts such as, The Electricity Rules of 1956,The Atomic Energy Act, 1962, The Mines and Minerals (Regulation and Development) Act of 1970, The CEA Regulations of 1979,The Environment (Protection) Rules of 1986, The Environment (Protection) Act of 1986, The National Environmental Tribunal Act 1995, The Energy Conservation Act, 2001 No 52 OF 2001 (29th September 2001), The Electricity Act of 2003 (Act No. XXXVI of 2003), the Petroleum and Natural Gas Regulatory Board Act of 2006, National Energy Efficiency Programme (NEEP).[175]There is a Green Push for Indian Railwaysfor becoming net zero carbon emitter by 2030, and the companies that participated were Adani, ACME, NTPC, Renew Power, Hero Future Energies, Greenko Group, Azure Power and Tata Power. Indian Railways is now committed to utilise solar energy for meeting its traction power requirement of 20-GW from the vacant land besides the railway tracks and become a complete 'green mode of transportation'. With the ambitious plan of achieving 100 percent electrification for railways by the year 2030, Indian Railways energy consumption is set to become more than 33 billion units by

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Create awareness and disseminate information on energy efficiency and conservation
Arrange and organize training of personnel and specialists in the techniques for efficient use of energy and its conservation
Strengthen consultancy services in the field of energy conservation
Promote research and development
Develop testing and certification procedures and promote testing facilities
Formulate and facilitate implementation of pilot projects and demonstration projects
Promote use of energy efficient processes, equipment, devices and systems
Take steps to encourage preferential treatment for use of energy efficient equipment or appliances
Promote innovative financing of energy efficiency projects
Give financial assistance to institutions for promoting efficient use of energy and its conservation
Prepare educational curriculum on efficient use of energy and its conservation
Implement international co-operation programmes relating to efficient use of energy and its conservation

[175] Naseem Mohammad., '*Energy law in India'*, Rubby Kluwer Law International, Netherlands, www.kluwerlaw.com, 2010),

2030 from its current annual requirement of about 21 billion units. This would help in making Indian Railways green as well as 'Aatmanirbhar'.[176]

5.9. GLOBAL INITIATIVES

At the global level, India is party to the following international agreements- Antarctic Environmental Protocol, Antarctic Treaty, Biodiversity. Climate Change, Desertification, Endangered Species, Environmental Modification, Hazardous Wastes, Law of the Sea, Nuclear Test Ban, Ozone Layer Protection, Ship Pollution, Tropical Timber 83, Tropical Timber, Wetlands and Whaling. India has signed the above agreements but they were not ratified. India and energy-rich Qatar, home to half a million Indians has sealed six agreements in diverse areas, including an over-arching pact on cooperation in oil and gas exploration. The pact envisages cooperation in the areas of upstream and downstream oil and gas activities. It is expected to encourage and promote investment and cooperation between two ministries of oil and gas and through affiliated companies. Qatar which holds the world's third largest natural gas reserves after Russia and Iran has an LNG (liquefied natural gas) export capacity of 77 million tons a year and India buys 7.5 million tons of LNG from Qatar under a long-term contract.[177]

Now since India has been elected to the United Nations top human rights body for a period of 3 years beginning January 1st 2019, it reflects the country's standing in the international community.[178]Prior to this, the United Nations Environment Programme had honoured the incumbent Prime Minister of India Narendra Modi with the United Nations Top Environmental Award called the "Champions of the Earth". He has been recognized in the Policy Leadership Category for his exemplary leadership in championing the cause of environmental conservation and mitigating climate change. He has initiated the i) ISA – International Solar Alliance in which India heralded a global coalition of nations to tackle climate change by leveraging the power of solar energy. ii) Elimination of single-use plastic in India- Government of India's initiatives towards making the country free of single use plastics have been

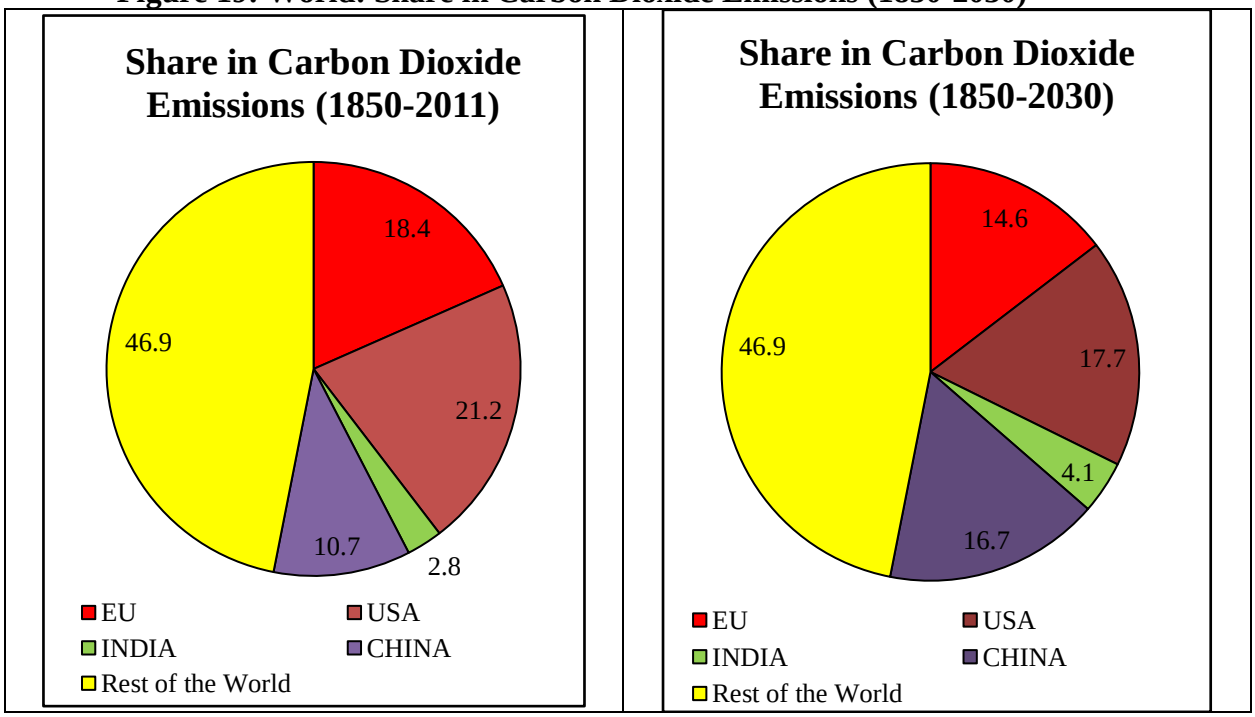
[176] O Herald dated 28th August 2020.

[177] Energy Times, Vol.34, No. 36, April 17-23, 2012, Kolkata.p.3.

[178] O Herald dated 13th October 2018.

appreciated by the United Nations. iii) Contribution to environment conservation as the Chief Minister of Gujarat- initiatives towards water conservation to provide water security, Multi-modal interventions has helped Ahmedabad city to reduce pollution drastically. And Pro-environment policies has led Gujarat to become a hub of renewable energy production. iv) India's efforts and leadership during COP21 at Paris were deeply appreciated globally. v) India has registered unprecedented growth in the production of energy through renewable sources. vi) Going a step ahead of discussing climate change, PM Modi is also an advocate of climate justice, which places a collective responsibility on the entire humankind to ensure that our future generations inherit a clean and green planet.

Figure 19: World: Share in Carbon Dioxide Emissions (1850-2030)



Source: Centre for Science and Environment, Down to Earth, 1-15 December 2019

The figure 19 clearly indicates a slow rise in the share of carbon dioxide emissions from India in the projected pie chart figure for 1850 to 2030.

When the world is in a dilemma on whether to focus on the environment or on the economy, India has shown to the world that environment and economy are not at odds, but are complementary to each other. India has successfully demonstrated this by implementing programmes like Swachh Bharat, LPG connections to the poor (under Ujjwala scheme), CNG and electricity-based transportation, among others.

Solar energy is sure, pure and secure and will be a major source of power in the 21st century.[179] India's solar policy and strategy reflects the government's thinking of 'keeping our environment, air, water pure'. India has made LED lights popular. This saves 38 million tons of carbon dioxide emissions per year. Smoke-free kitchens have been provided to over 80 million house-holds through the Ujjwala scheme. This is among the largest clean energy drives globally. Besides this India is attempting to eliminate the use of single-use plastics, expanding forest cover and encouraging a circular economy.[180]

Today all government programmes give priority to environmental protection and ease of living. India has resolved the economy versus ecology dilemma by focussing on solar energy and other environment-friendly measures. Economy and ecology are not contradictory but complementary to each other. Brazil with its Ethanol program and India with its a Gandhian Philosophy has shown the World that environment can be preserved and utilised for posterity. India and Brazil can grow differently because they are in an early stage of economic development. They can leapfrog to a low carbon economy using high end and emerging technologies and by being different. Thus, there lies the urgent need for cooperative efforts to save the only planet's Biodiversity and the catastrophic effects of Climate Change. In the words of Ban-Ki-Moon former secretary general of the UN on climate change '*There Is No Plan B Because There Is No Planet B'.*

[179] O Herald dated 11th July 2020.

[180] The Times of India dated 23rd November 2020.

CHAPTER VI: SUMMARY AND CONCLUSION

'A Country That Runs on Energy Cannot Afford to Waste It' Bruce Hannon. On a more optimistic note, it is not too late to act.

This chapter briefly adjudicates the first five chapters to summarize the aims and findings to enable a justification of the work undertaken not merely to justify this effort but also to assess its modest contribution to the body of research in the area of Environment and Energy Security studies related to India and Brazil in specific.During the period of my study, the world at large saw its second warmest year after 2016. 2010-21 was the warmest decade on record and 2015-2019 was the warmest five-year period on record as per WMO reports. In Asia, including India recorded its third warmest year after 2015 and 2017. Chaos and uncertainty were the characteristics of the natural world under the pressures being wrought by climate change periodically frequented by flash floods and flash droughts. Normal patterns of rainfall, temperature and extreme weather were changing so rapidly that past baselines for these primordial forces were less and less relevant. Scientists have a word for this state of flux. They call it 'the end of stationarity' a term with a powerful meaning. Nations can no longer rely on past events to predict future probabilities. The ground is shifting beneath the feet of mankind. Much of this is strongly co-related to the rampant use of fossil fuels for energy and the consequent depletion of the environment due to the elite lifestyles by the rich countries of the 'North'. The consequences and brunt borne by the poor and developing nations of the 'South'.

A logical attempt has been made to draw a line of comparison for the first time on the two countries i.e., India and Brazil on two major grounds namely, environment issues and energy security. Environment awareness and its concern for protection and sustainable development was first heralded with respect to the Amazon rainforest which was facing massive deforestation in the early 1980s due to rampant logging of trees for making agricultural land available for soy cultivation and in turn cattle ranching. Massive removal of the virgin Amazon jungles led to the very lungs of the planet been destroyed mercilessly. Indian forest too faced the axe in the guise of industrial development, food security, construction of hydro-electric projects all in the name of development. Thus, both the biodiversity hotspots in these two countries have to be protected. As the issues were raised in the international forum when the

environment destruction was rampant led to the Forest Code been implemented. Loss of forest cover brought into focus the depleting Ozone layer of the planet, Acids rains frequency showing, depletion of soil covers due to over usage of fertilizers and pesticides. Both being agriculture dominated nations, had to resort to novel methods of irrigation and harvesting to feed the dense home population. Thus, food security in turn was tuning the land-use pattern and what crops would be selected by the country farmers to tide over the crisis. Thus, in 1974 during the oil embargo, Brazil was deciding between sharing the land resource for sugarcane cultivation or sugarcane for ethanol production. Since this was the time, the country was facing the energy crisis from the ongoing Gulf war.

The following objectives delve into the matter of the topic:

1. To study the co-relationship between energy use and environment deterioration.
2. To analyse the efforts of Brazil and India in the field of Alternate sources of energy and Environmental Management.
3. The MoU's signed on Environment and Energy by India and Brazil.

The first objective forms the body of the five chapters as discussed in the thesis.

The second objective: To analyse the efforts of Brazil and India in the field of Alternate sources of energy and environmental management – in order to achieve this objective;

- India and Brazil has and should stress more on the energy mix of Biofuels along with other cleaner forms of energy to become self-sustainable in the ever growing transport sector. Simply by, introducing EVs (Electric Vehicles) which are fuelled from electricity supply generated from the use of fossil fuels is just not utilitarian and is not a real 'green solution' to the energy problem.
- Simply replacing traditional technology with new imported technology will not be an affordable and sustainable solution, since this will only make countries like India and Brazil more and more dependent on foreign countries for our energy security.
- Thus India's 'Make in India' is a good start-up initiative towards our local energy technologies and Brazil's ethanol flex fuel.

- Nations can commemorate the World Biofuel Day on August 10th.
- The Energy Development Agency and Resources Initiative Department from India and Brazil can initiate research on Bio fuels on these lines.
- Seed bombs can used for greening the environment,
- Creating Solar Villages at the grass root level so that thie renewable energy can be recruited.
- Reducing the ecological footprints and penalizing the invader country with a War Fine to be imposed by the UN body for the loss and destruction of the environment in the attacked country.

The Third Objective: The MoU's signed on Environment and Energy by India and Brazil - With reference to this

- The first state visit to Latin America was undertaken by Late Smt. Indira Gandhi the then Prime Minister of India on 23rd September 1968.
- On the Bilateral front the milestones visit of President Lula da Silva to India on 26th January 2004 as the Chief Guest at the Republic Day ceremony was historic since the visit appropriated after a period of 36 years.
- The former Indian Prime Minister Manmohan Singh had paid an official visit to Brazil from September 11th to 14th 2006. During their bilateral meeting on 12th September, the two leaders recalled that the bilateral relations have intensified and deepened.
- They acknowledged the significance and substantive importance of a bilateral visit to Brazil by an Indian Prime Minister after an interval of 38 years.
- For the first time Brazil and India recognize that their relationship has now reached the level of a strategic partnership.
- President Lula da Silva of Brazil and Prime Minister Manmohan Singh of India reviewed the bilateral agenda and exchanged opinions on various issues of the international agenda, as well as on the political and economic situation in their regions.
- They reaffirmed their commitment to work towards a qualitative upgrading of the broad-based bilateral relationship between the two large democracies that share a multicultural and pluralistic ethos and common developmental aspirations.

- The important outcome of this bilateral meeting was the decision to initiate a bilateral strategic dialogue covering regional and global issues of mutual concern such as energy security and the international security situation, including the menace of terrorism.
- The dialogue will be conducted by the National Security Advisor on the Indian side and the corresponding authorities in the Brazilian Government.
- The two leaders noted with satisfaction the growth of bilateral trade and investment between India and Brazil.
- The two countries also encourage establishment of business linkages in banking and other service sectors, and committed themselves to encourage the public and private sectors of their respective countries to increase and diversify the bilateral flow of goods and services.
- Heads of the two countries i.e., India and Brazil emphasized the significance of bilateral technological co-operation in all aspects of energy research and development, with a view to improve and diversify the energy supply and to develop more efficient, affordable and cost-effective energy technologies.
- In this context, they encourage the development and use of alternative sources of energy, particularly of biofuels to enhance sustainability and they reaffirmed that new forms of energy that are clean, safe and economically efficient should be fully explored.
- To this end, they also decided to create a Joint Committee on Biofuels.
- They also celebrated the signature of the Exchange Programme on co-operation in the field of Education during the joint Committee meeting in January 2006.
- India and Brazil announced that they would shortly be opening cultural Centre in Sao Paulo and in New Delhi.
- The two countries will also co-operate in promoting exchanges in the field of football and training of Indian players and coaches.
- It has also been agreed to organise Weeks of Indian Culture and Weeks of Brazilian Culture on a reciprocal basis from 2007.
- Both the countries have also agreed to station defence Attaches in each other's capital.
- Besides this, National Institute of Metrology, Standardization and Industrial Quality (INMETRO) and the National Physical Laboratory of India (NPLI) have

agreed on the content of MoUs, concerning scientific and technological cooperation in the areas of Chemistry, Physics and Engineering.

- Both the countries have reaffirmed that international terrorism constitutes one of the most serious threats to peace and security and emphasized the need for concerted and coordinated action by the international community, with the ultimate objective of eradicating terrorism in all its forms and manifestations.
- They both underscored the priority to reforming the UN to make it more effective and attuned to present day realities.
- India and Brazil have reaffirmed their commitment to fighting hunger and poverty, promoting democratic values and fostering economic development and emphasized the importance of implementing the Millennium Development Goals.
- India and Brazil have stressed their intention to continue working with the G-20 towards the resumption of the negotiations of the Doha Round.
- India and Brazil has also expressed the view that the IMF must be reformed to reflect the current realities of the global economy.

The talks were held in an atmosphere of warmth and trust, with the objective of further strengthening the friendly relations and multifaceted cooperation between the two countries. The outcome of the visit lead to the signing of the following bilateral Acts:

- Bilateral Agreement on Scientific and Technological Cooperation,Air Services Agreement.
- MoU on Cooperation in the field of Human Settlements.
- MoU on Plant Health Protection.
- MoU on Conduct of Weeks of Indian Culture in Brazil and Weeks of Brazilian Culture in India.
- MoU between Bureau of Indian standards and ABNT.
- MoU between Petrobras and ONGC-OVL.
- MoU between Bharat Earth Movers and CCL.

These Agreements and MoUs signed reflected the mutual desire to impart a strong impetus to the growing bilateral ties with a view to realizing the full potential of the relationship between the two countries.[181]

The following Hypothesis were formulated

1. Environmental Constraints and challenges can be overcome by the use of Energy.
2. Quality of life, material welfare, health, employment and income are all demonstrably affected by energy availability and cost.
3. Higher the Energy input higher is the rate of Development.
4. A minor oil supply imbalance can destabilize every aspect of a nation's lifestyle.
5. The point of supply of Energy provided by nature and the point of demand created by man have never matched. They are creating an imbalance or energy insecurity conditions.

The First hypothesis that environmental constraints and challenges can be overcome by the use of Energy is proved right because currently, Brazil and India have signed three MoUs in the field of bioenergy cooperation when the leaders met in New Delhi in January 2020.

The second hypothesis that quality of life, material welfare, health, employment and income are all demonstrably affected by energy availability and cost is proved precise because Brazil and India are two major developing economies where agriculture forms the backbone of their respective economies. Being tropical countries, the two largest producers of sugarcane in the world are, therefore well poised to spearhead together ethanol as a global commodity and pave the way for a new international market that favours developing countries in the first place. India today has already advanced its target of 20 percent blending of ethanol in petrol (E20) by five years to 2025 and the adoption of flex-fuel automobiles will certainly be a game changer. According to Brazilian Ambassador to India Andre Aranha Correa do Lago, constant cross-learning on the production, regulatory and technological aspects of ethanol supply chains and several bilateral initiatives have been organised by Brazilian and Indian institutions from the government and the private sector,

[181] https:/mea.gov.in accessed on 15th February 2022.

especially the Brazilian Sugarcane Industry Association (UNIC) and the Society of Indian Automobile Manufactures (SIAM) in order to tap into the true economic, environmental and social potential as a sustainable fuel.

The third hypothesis that higher the energy input higher is the rate of development do not hold good in perpetuity. Beyond a certain limit, as production and infrastructural efficiencies increase and as the relative product-mix of the economy shift from an emphasis on basic industry to one on electronics, food and other intricate though light industries, the country actually consumes less energy per unit of Gross National Product. Technologies cannot by themselves resolve an environmental problem. The integration of technologies, policies and regulation is required in order to realize their potential. Chinese investment in solar panels and their subsequent mass production has reduced the price of solar panels considerably and attracted investment for greater innovation. This suggest a much broader political and economic aspect for technology development and it is these aspects that will decide what technology becomes prevalent and influence the decisions that law and policy makers make, ultimately making the biggest impact on mitigating climate change. And now it's becoming increasingly clear that the volatility we're seeing in our natural world in turn is reshaping our financial world too.

The fourth hypothesis states that a minor oil supply imbalance can destabilize every aspect of a nation's lifestyle. This has been proved time and again precise by the wars fought by Arab-Israel, Iraq-Kuwait, Iraq-Iran, Syrian unrest, Russian-Ukraine invasions.

The fifth hypothesis points out that the supply of Energy provided by nature and the point of demand created by man have never matched. They are creating an imbalance or energy insecurity conditions. As an International Relations scholar, I would state that environmental politics leads to the systematic indirect study of the ruling government and the resultant security affairs related to the environment diminution due to policy resolutions taken by the government heads. Wars for example are fought for resources which a nation do not own and hence important government decisions have contributed to environmental degradation and in turn security issues. Resources and the environment therein are a source of internal and international conflicts. Resources are fixed in location and then traded to distant

places. Control of these locations gives a nation both greater self-sufficiency and in return it generates wealth. Few countries have the rain forest like Brazil's Amazon and India's Western Ghats and the Himalayas. These nations have the power to speed up or slow down the destruction of forests. But they are economically poor countries and they would benefit economically by exploiting the forest through lumbering, agriculture and mining. But today due to the North- South divide, the rich countries of the North want the poor countries to 'Save' the lungs of the very planet that they have choked due to rapid use of fossil fuels and have forced the 'debt-for-nature-swaps' on these developing nations. The ongoing Russia-Ukraine war has destroyed the 'bread basket of the world', the 1991 Gulf war between Iraq and Kuwait led to billions of oil wells to be blown up turning fuel to fire, the Syrian invasion led to total destruction of oil and natural gas reserves, and Arab-Israel embargo of 1973 quivered the very premises that these nations stood on. This in turn led for nations like Brazil to search for renewable energy options thus leading to the birth of the sugarcane based ethanol industry thereafter.

Therein lies the intricate relationship between Energy and Environment because this natural environment is not only a delicate ecosystem which requires guardianship and protection, but it is also the storehouse of all natural resources. Since the utilisation of these resources brings in wealth to the nation concerned, because they do not present as a collective goods problem and hence they in turn become the primary source of future international conflicts.

At the G-7 Summit held in Elmau Germany, the Prime minister of India in his session on 'Investing in a better Future: Climate, Energy, Health' highlighted India's track record of achieving the target of 40 percent energy capacity from non-fossil sources nine years before time. The target of 10 percent ethanol blending in petrol had been achieved 5 months before time. India today has the world's first fully solar power operated airport and India's huge railway system will become net zero in this decade. India for the first time was ranked 8th among the top ten countries in the Climate Change Performance Index (CCPI) which is being released annually after analysing four parameters namely, greenhouse gas emissions, renewable energy, climate policy and energy use. Brazil was ranked 38 in the list of the CCPI Index. The CCPI 2020 was released by three international NGOs- German watch, New Climate Institute and Climate Action Network, on the side lines of the UN climate change

conference (COP25). Referring to India, the CCPI report noted that the current levels of per capita emissions and energy use are still comparatively low in the country. The low per capita emissions and energy use along with 'ambitious 2030 targets' resulted in high ratings of the country in these two parameters. While India received an overall medium rating in the renewable energy category, India's 2030 renewable energy target is to increase the capacity by 500 GW which was rated very high for its well-below 2 degree Celsius compatibility.[182] Meanwhile Brazil would lead the growth of renewables in Latin America, which would add 319 GW by 2030, an increase of 460 percent in the installed capacity of solar and photovoltaic energy. And a 10 percent reduction in carbon emissions by 2028.

India and Brazil on 26th January 2020 has inked 15 agreements to ramp up co-operation in a wide range of areas and have unveiled an action plan to further broad-base strategic ties after talks between Prime Minister Narendra Modi and Brazilian President Jair Messias Bolsonaro. In the action plan, the two countries have set specific goals for deeper cooperation in areas of defence and security, trade and commerce, agriculture, civil aviation, energy, environment, health and innovation and have vowed to work together to conclude an agreement to deal with international terrorism. The 15 agreements will provide for cooperation in a wide range of areas including oil and gas, mineral resources, traditional medicine, animal husbandry, bioenergy, trade and investment. Despite the vast geographical distance, both Brazil and India are together on various global issues.[183]

Keeping in view the climate reality checks a just transition in India and Brazil will need policy and planning on five key elements, the five R's namely Restructuring of the economy and industries in fossil fuel-dependent districts/states. Repurposing of land and infrastructure, reskilling existing and skilling new workforce to avoid job loss and create a new workforce for the green industries. Revenue substitution and investments in Just Transition. This will require progressively moving taxes away from fossils and using fossil taxes like GST compensation cess (formerly coal cess) and District Mineral Foundation funds for Just Transition and Responsible social and

[182] The Times of India dated 11th December 2019.

[183] O Herald dated 26th January 2020.

environmental practices during the transition process to create a better world than today, besides the phasing out of fossil fuels is imminent and India has no choice.[184]

Besides this, Indian Prime Minister Manmohan Singh along with South African President Thabo Mbeki and Brazilian President Luiz Inacio Lula da Silva during the IBSA Summit of 2007 signed the following MOUs. This is on multilateral level basis like the IBSA and BRICS. The IBSA Dialogue Forum plays an increasingly important role in the foreign policies of India, Brazil and South Africa. IBSA Agreements signed so far are: MoU on Agriculture and Allied fields, MoU on Biofuels, Agreement on Merchant shipping and other Maritime Transport Matters, Action Plan on Trade Facilitation for Standards, Technical Regulations and Conformity Assessment and MoU on Framework for Cooperation on the information Society.The Stockholm conference of 1972 for the first time brought together world leaders and scientists to discuss growing international environmental concerns such as trans-boundary air and water pollution. Although there was widespread support for the pledges and principles agreed at that meeting however, in 1982 the UN Environment Programme (UNEP) which met in Nairobi for a 'Stockholm+10' conference concluded that there had been little in the way of follow-up. In 1987, the World Commission on Environment and Development popularized the term 'sustainable development' to bring the concepts of environment and development together in a way which had been absent at Stockholm. The second environment mega-conference (the United Nations Conference on Environment and Development-UNCED or the 'Earth Summit') held in Rio in 1992 redefined the issues identified at Stockholm into the new language of sustainable development in the Rio Declaration, and took on a far broader agenda, covering social as well as environmental issues. It produced Agenda 21, an action plan for sustainable development, and created the UN Commission on sustainable Development to oversee the implementation. Energy for the first time was included in the agenda in 2002. As before, however, the conflicting demands of developed and developing countries were not reconciled. The World Summit on Sustainable Development (WSSD) in 2002, 30 years later, wherein nations realized the huge repercussions of energy usage and its impact on the environment. Three good decades later the developed and developing nations of the

[184] The Times of India dated 11th August 2021.

‘north’ and ‘south’ sought to make amendments on this closely interlinked and intricate web of environment and energy. Thus, at Johannesburg Summit in 2002 energy was selected as one of its five major agenda issues for discussion for the first time. It devised a Plan of Implementation emphasizing the role of energy in eradicating poverty. That same plan calls for the establishment of policy and regulatory frameworks to promote the development and dissemination of alternative energy technologies. A decade later in 2012 in Rio once again, countries of the ‘South’ like Brazil and India strongly advocated for the alternative fuel usage as against the fossil-based fuels for the developed nations of the ‘north’ vice-versa the developing nations of the ‘south’. This was the decade which slowly started showing the global impacts of massive usage of fossil energy fallouts in the form of ‘Climate Change’ and a term called climatic emergency was declared when the UN Summit chalked out the “The Future We Want” report. The future 2022 UN Summit is awaited with much awe breathe by the entire human race on the blue planet.

Agenda 21 and now the 2015 Paris Agreement has been prime examples of how an environmental mega conferences can provide global leadership to lower tiers of governance. It was clear action plan for sustainability that governments could take home and put into practice at the national and local level. Key players of climate change impactors like the USA, Russia, Japan were forced to ratify their INDCs so that the brunt of the impact is not faced by the poor and non-contributing countries of the ‘south grid’. Mega-conferences are important progenitors of new environmental institutions. UNEP was formed at Stockholm, and was influential in preparing the way for UNCED. The UN commission for Sustainable Development (UNCSD), Inter-governmental panel on climate change (IPCC) were created to monitor the progress towards sustainable development.

Summits of this type also give periodic boosts to environmental ministries around the world through the adoption of national action plans such as Agenda 21, the Paris Agreement and giving policy makers the opportunity to make promises about environmental matters which would normally be side-lined. They are often accused of being elitist and remote from everyday realities, though they have become more inclusive overtime. UNCED has also established the formal participation of major stake-holder groups in society-namely women, children and youth, indigenous peoples, NGOs, local authorities, workers and trade unions, business and industry, scientific and technologies communities and farmers.

In the course of the last five decades (1972-2022), the world has seen significant environmental development progress, however, the substantial challenges have remained. Climate change has added to the many stresses faced by developing nations like India and Brazil. Climate-smart development policies are needed to both tackle the challenges of adaptation and mitigation and exploit the new competitive landscape created by climate change. During December 2009 when diplomats from nearly 200 countries gathered in Copenhagen to negotiate a successor to the 1997 Kyoto Protocol, which for the first time bound wealthy countries to specific cuts in greenhouse gas emissions, hopes were higher than ever for a break through climate deal. Therefore, Kyoto Protocol gains a significant place in the environment-energy security issues.

Highlighting two big initiatives spearheaded by India, the International Solar Alliance (ISA) and Coalition for Disaster Resilient Infrastructure (CDRI). India is encouraging a circular economy. It is making next-generation infrastructure such as metro networks, water-ways and more in addition to convenience and efficiency, which will also contribute to a cleaner environment. The ISA is the fastest growing international alliance with 107 countries as the signatories which includes Brazil also. It has plans to mobilise billions of dollars to train thousands of stakeholders and promote research and development in renewable energy, the ISA will contribute to reducing carbon footprint. On the other hand, the Coalition for Disaster Resilient Infrastructure has 18 countries and 4 international organisations as members. Infrastructure damage during natural disasters is a subject that has not got the attention it deserves. The poorer nations are especially impacted by this. Therefore, this coalition is important. Given the impact that climate change is having on the underdeveloped countries, this is going to be a significant coalition.

India and the United Kingdom in the presence of other heads of state governments has jointly launch the Green Grids Initiative - One Sun One World One Grid (GGIOSOWOG) a trans-national grid to transport solar power to different countries during world leader's summit at the beginning of the 26th session of the UN Climate Change Conference (COP26) in Glasgow, UK in November 2021. Implementation of the OSOWOG revolves around the concept that the 'Sun Never Sets' and is therefore, a constant at some geographical location, globally, at any given point of time. The ISA, which was jointly launched by India and France on the side-

lines of the COP21 in Paris in 2015, will be the implementing body of the global grid. After former US President Donald Trump had withdrawn support to the Paris Agreement, the US Secretary of Energy Jennifer Granholm was back on the climate conservation as a partner to the new initiative. As of today, 80 countries have combined their efforts to create more interconnected grids, endorsing the 'One Sun Declaration'.[185]

In energy and food security of Latin America in particular Brazil has become a regular new source for India's imports of crude oil in the last 15 years, supplying 15-20 percent of India's global imports. Crude oil is the largest global export of Latin America, which has the capacity to double its exports in the future. Having lost a substantial part of exports to the US (which has started shale oil production), the Latin Americans are now keener to diversify and penetrate large oil importing markets such as India and China. This fits in perfectly with India's strategic energy security policyto diversify its import sources and reduce over dependence on the volatile Middle East. In any case, the Latin American crude options have put pressure on the suppliers from Middle East (who had enjoyed undue monopoly in the past) to better their prices and terms of supply to India. While India has achieved self-sufficiency in cereals, there is perpetual shortage of edible oil and pulses which are being imported in ever increasing quantities. India has been sourcing soy and sunflower oil as well as pulses from South America. Since the gap between India's demand and production has been widening due to the relentless increase in population and consumption, India's import from South America will go up in the future. Indian agriculture faces daunting challenges caused by the diversion of agricultural land for other purposes (residential, commercial, industrial and infra structural uses), shortage of water and low productivity due to inadequate investment by most farmers whose land sizes are small. On the other hand, South America has vast tracts of fertile land, abundant water, advanced technologies and best practices with which the region has emerged as a global agricultural power house. Argentina and Brazil are world leaders in some areas of agricultural research and innovation. The region has the potential to bring in another 40 million hectares of land into agriculture and feed an extra 500 million people. Besides this, in 2017, Indian firms have increased their investment in Mexico

[185] O Herald dated 8th November 2021.

and Brazil especially in auto parts, IT and agrochemicals. It is interesting that UPL, the largest Indian agro-chemical company has more revenue in Latin America than in India. This is an opportune time for India to take the win-win economic partnership with Latin America to the next level, when the Latin America's are the most serious about India.

Meanwhile, on the environment front, deforestation has surged in Brazil under President Jair Bolsonaro, whom critics accuse of gutting environmental protection programs to benefit Brazil's powerful agribusiness industry. Since the far-right president took office in 2019, average annual deforestation in the Brazilian Amazon has increased by 75 percent from the previous decade, according to official figures. Its destruction is a disaster not just for Brazil, but for the world. The 'Mata Atlantica' which stretches down Brazil's eastern coastlost 121,642 hectares (53.479 acres) of forest cover from November 2020 to October 2021, up two-thirds from the year before, according to the report, which was based on satellite monitoring data and published by an environmental group. Research by Agence France press shows that the Atlantic Forest is one of the biomes that will have to be urgently restored if we are to reach the goal of holding global warming to 1.5 degree Celsius in line with the Paris climate accord.[186]

The road to a global treaty that contains the climate problem now appears to be clearly mandatory. If certain activities or institutions become global, like for example these 121 countries International Solar Alliance (ISA) will be seen as the future OPEC for meeting energy needs of the world. Currently, Oil cartel OPEC led by Saudi Arabia meets close to half of the world's oil needs. Solar power will play the same role that oil wells have played over the past few decades in meeting global energy needs. Humans have in the last 150-200 years relied on resources trapped below the earth's surface for meeting energy needs. But for a secure future, resources available above the ground like solar and wind energy also need to be harnessed. India wants to bring all UN members on board of ISA, stating that the focus must now be on renewable sources for meeting energy needs.[187] If there are more global linkages, global institutions, and global values, presumably this means that more

[186] O Herald dated 12th June 2022.

[187] O Herald dated 3rd October 2018.

people will have more in common. A movement called LIFE- Lifestyle for Environment was launched by the Indian Prime Minister Narendra Modi at Glasgow to encourage an eco-friendly lifestyle. The followers of this movement were called Triple-P i.e., 'pro planet people'. A large number of Triple-P people in our own country will be the greatest contribution to the coming generations. There is a misconception that poor countries and poor people cause more damage to the environment. But India's ancient history refutes this view. Today, as nearly 17 percent of the world's population resides in India, their contribution of global carbon emission is only 5 percent. The main reason behind this is the Indian lifestyle, which is based on the theory of co-existence with nature. The core theories of the circular economy have been an integral part of Indian culture and lifestyle.[188]

At the COP26, the Prime Minister announced India's commitment to 'Panchamrit' - five important inputs which are as follows: India will bring its non-fossil energy capacity to 500 GW by 2030, India will bring its economy's carbon intensity down to 45 percent by 2030, India will fulfil 50 percent of its energy requirement through renewable energy by 2030, India will reduce 1 billion tonnes of carbon emissions from the total projected emissions by 2030 and India will achieve net-zero by 2070.[189]

Taking a swift look at the comparative perspective, Brazil has incorporated environmental legislation into its Constitution like India. Brazil had been one of the first countries to take up environment related issues for discussion and implementation. It did its best to adhere to the Agenda 21 Programme however India could not come up to the mark. The 1992 Rio Summit being hoisted in Brazil denoted a significant change in Brazil's outlook, which 20 years earlier at the Stockholm Conference had been in the opposition side opposing any international environmental

[188] The Times of India and O Herald dated 28th June 2022.

[189] Down to Earth., Science and Environment Fortnightly, New Delhi, 1-15th December 2021, pg.12.While India did its bit, the country also reminded the Global North of its unfulfilled commitments. India told the world that while we all are raising our ambitions on Climate action, the world's ambitions on **Climate finance** cannot remain the same as they were at the time of the Paris Agreement. India expects developed countries to provide Climate finance of $1 Trillion at the earliest. P.M. also launched the Infrastructure for Resilient Island States (IRIS) which will work to achieve sustainable development through a systematic approach to promote resilient, sustainable and inclusive infrastructure in Small Island Developing States. A major boost for India-initiated International Solar Alliance (ISA) came when US special Presidential Envoy for Climate John Kerry announced at COP26 that the US has joined the ISA as a member country. The membership of ISA thus rose to *101*.

regulations and restrictions. However, after the Rio Summit platform were laid in the home country, Brazil's outlook towards the rapidly diminishing tropical rainforest in the Amazon and other grave environmental issues changed. Thus, Brazil's willingness to consider international agreements was regarded as prejudicial to the national sovereignty. Brazil was also in the forefront as a signatory to the implementation of the Agenda 21.

After the Summit, Brazil has taken sustainable development in its stride as one of the most pressing challenges. Today through the steady implementation of Agenda 21, concrete actions and measures and active partnerships between governments, business and civil society is underway and doing good progress. Brazil today has built its multi-sectoral partnerships with more than 80 countries under the UNDP. It also forges ahead in technology transfer to other developing countries like India and also exports promotion policies within the IBSA domain. Though the current rate of species extinction is accelerating, but the rate at which it is lost is be kept in check, however, Brazil has yet to go a long way to achieve this since the poor and most vulnerable groups of populations are residing in the environmentally most fragile areas like the Amazon and the processes like agriculture, commercial logging, have accelerated the tropical deforestation in recent years. Moreover, medical and technological advances have opened up the inaccessible forests for rapid illegal depletion by the commercial elite in Brazil.

The Brazilian government's launching of the National Plan on Climate Change has done efficiently well by encouraging more efficient performance in all sectors of the economy, in order to achieve best practices. It has also sought to maintain high proportion use of renewable energy like ethanol and solar energy in the national electric power network, thereby preserving Brazil's leading position in the international context. It has also encouraged the sustainable increase in the use of bio-fuels in the national transportation network and to work toward structuring an international market in sustainable bio-fuels. It has also sought to reduce the deforestation rates in all Brazilian biomes, until a zero rate of illegal deforestation is reached. Just in August 2019, the Amazon in Brazil lost 0.9 million hectares of forests to fires. It was found that between 2017 and 2019 about 0.45 million hectares of the forest was cleared, 65 percent of which came just in 2019.

It also seeks to eliminate the net loss of forest coverage which were destroyed in the massive fires of August to October 2019 in the Amazon, when the incumbent President Jair Bolsonaro took over the reins of the country, besides reinforcing the inter-sectoral action to reduce vulnerability among Brazil's population. Sustainable development of watershed management and reduction of greenhouse gases by 2020 are also in the pipeline. The Brazilian Constitution was perhaps the first of its kind in Latin America to delineate general principles and guide lines and laws to govern issues on environment and preservation. Environment protection was included as a major Article in the Constitution. Besides this, the fuel (ethanol) that Brazil produces is also attracting worldwide interest and also the "flex-fuel" engines which are capable of running on the bio-fuel. Ethanol and bio-diesel are the key components of this environment approach and social challenge that Brazil is committed to. Brazil has also undertaken many joint ventures with individual countries like France, India, and the Joint European Union program. Consensuses to build up wind, solar and biomass projects are auctioned out in large numbers. Signing of the MoU between IBSA has shown the positive attitude towards sustainable development.

India on the other hand though a participant in the Stockholm Summit and subsequently the Rio Summit did not actively participate back home in the governance matters dealing with the environmental sector. However, one of the important highlights of India is its Constitution which like the Brazilian one, incorporates environment protection as a law and an individual right, thereby showing the intentions of preservation by the Indian government. Subsequently, India framed many laws on environment related to different spheres such as general, forest, wildlife, air, water industries and so on. Today India has a separate Ministry of Environment and Forest and Climate Change to tackle various environment-energy crisis related issues. One notable point to be observed was the active participation of women in creating environmental awareness and bringing about protection of the environment. Today India has tried to move ahead by passing many laws and legislation on environment and trying to involve woman on the threshold of environment management as seen in the G20 Summit of 2023 held in India. India has been trying its best to preserve its hot-spots of biodiversity in the Western Ghats and the Himalayas under the UNEP, UNDP, and UNSECO programs. India has to emulate a lot from its contemporary Brazil and in order to emulate what Brazil has

achieved which will mean greater and consistent efforts on the part of India. Both countries being from the 'South', India is yet to achieve the successes that Brazil has in the environment sector. In India environment has gained significance when one closely scrutinizes the Five-Year Plans of the government since 1951 which clearly showed that environment was a totally neglected sector. It was only in the Tenth Plan (2002-07) that an increase in the forest and tree cover was recorded and showed that it had increased to 25 percent by 2007 and that all villages would be provided with sustained access to potable drinking water. The Twelfth Plan (2012-2017) foresees to ensure electricity connection to all villages and to increase the forest and tree cover by 5 percent. However, both Brazil and India have had their share of failures. One clear violation of their environment goal was visible when neither India nor Brazil had provided the CSD 18/19 National Reports to the United Nations after the Conference. However, after the ratification of the prominent Paris Agreement, India and Brazil have submitted their respective INDCs to the world body.

India and Brazil are developing countries facing the critical challenge of meeting their rapidly increasing demand for energy. With over a billion people, India ranks 6th in the world in terms of energy demands and Brazil ranking 10th close in line. India's economy is projected to grow seven to eight percent over the next two decades, spurring a substantial increase in demand for oil to fuel, sea and air transportation. India's energy consumption has been increasing at one of the fastest rates in the world owing to population growth and economic development. Thus, in recent years, the Government of India has recognized the energy security concerns and more importance is being placed on energy independence. India is probably the only country in the world with a full-fledged ministry dedicated to the production of energy from renewable energy sources (MNRE) Ministry of New and Renewable Energy Resources. The Indian government is promoting the use of ethanol made from sugar-cane and bio-diesel extracted from trees that are common in parts of India, such as Jatropha, karanja and Mahua. Additionally, India is emerging as a growing market for solar, wind and hydroelectric power. When the world is in a dilemma on whether to focus on the environment or on the economy, India has shown to the world that the *Environment* and *Economy* are not at odds, but are complementary to each other. India has successfully demonstrated this by implementing programs like Swachh Bharat, LPG connections to the poor (under Ujjwala scheme), CNG and electricity-

based transportation, among others. Besides, solar energy has proved that it is **sure**, **pure** and **secure** and will be a major source of power in 21st century.[190]

Summary and Conclusionties up the argument advanced in the thesis that energy usage brings about environmental destruction. Therefore, the need for alternate, renewable forms of energy forms the crux of the discussion. On the Bilateral front India and Brazil has for the first time has reached a strategic partnership which led to the two democracies sharing common multicultural and pluralistic ethos and common developmental aspirations. The heads of the two countries i.e., India and Brazil created a joint Committee on Biofuels in January 2006. Various MoU's, Agreements and Bilateral Acts signed by Brazil and India are also highlighted in this chapter. These Agreements and MoU's signed reflect the mutual desire to impart a strong impetus to the growing bilateral ties with a view to realizing the full potential of the relationship between the two countries. This validates that despite the vast geographical distance, both Brazil and India are together on various global issues.

This paradigm shift in energy is the need of the hour as India is the 13th most vulnerable country to climate change. While India and Brazil remain as one of the world's 17 'mega diverse' countries in terms of the number of species it houses, 10 percent of its wild flora and fauna are on the threatened list. The main causes for this were habitat destruction, poaching, invasive species, over exploitation, pollution and climate change. About one-third of India's and Brazil's urban population now lives in slums or favelas. However, India contributes only about five percent of the world's greenhouse gas emissions that are leading to climate change.[191]

NEED FOR ENERGY CONSERVATION POLICY

It would be presumptuous even to attempt to summarize anything of value at the end of thesis of this type. The most striking characteristics of the energy use in India is that not only does an Indian have very little energy to consume but that it consumes it very inefficiently. This characteristic is true not only in India and Brazil, but in all developing countries, the energy processes are very inefficient. The co-

[190] O Herald dated 11th July 2020.

[191] http://moef.nic.in/index.php.dt. Accessed on 9 April 2016.

operation of the people and therefore a solid public educational programme on energy conservation is a must. The government must also show its determination in the implementation of the energy conservation programme as one of the goals in the Energy Policy of India. Ministry of Energy and the Department of Science and Technology must issue a joint declaration to this effect and select at least one of the states in the country as the model energy efficient state in India. Energy Society of India or Brazil can be established with branches in their respective countries. Major action should be initiated towards the design of energy efficient Chula and an action plan to save bio fuel such as wood and dung and trying to avoiding massive wastage of electricity.

The Paris agreement has recognized that it is the world's poor who are worst hit, even though they are least responsible for the emissions that are leading the world to a climate precipice. The current draft only has some broad statements about the need for all governments to build resilient systems to adapt to climate change. India wants whatever accord comes out of Paris to be reviewed every 10 years. Brazil, like the US, favor's a five-year cycle.[192]

According to the Brundtland Report and UNEP report on 'environment perspective to the year 2000 and beyond', the environmental agenda for the future includes the challenges of the five Es- ecology, economics, energy, employment and equity. In the words of India's then Prime Minister Indira Gandhi, at the Stockholm conference in 1972, 'higher standards of living must be achieved without alienating people from their heritage and without despoiling nature of its beauty, freshness and purity so essential to our lives'. The same holds creditable in 1982, 1992, 2002, 2012 and 2022 also.

One general observation that can be drawn about Indian environmental movements is that, it was mostly spear-headed by the women unlike its Brazilian counter-part, for instance the first global Conference on Environment in Stockholm was attended by then Prime Minister Mrs. Indira Gandhi who also addressed the nations of the world at this international platform. The Chipko movement in the Gharwal Himalayas in Uttarakhand in March 1974 was led by the women of this area,

[192] The Times of India dated 11th December 2015.

similarly the famous Narmada BachaoAndolan led by Medha Patkar in 1986 are a few instances which indicate the female active environmental participation in India. Besides this, the Green, Blue and white Revolutions in India under taken by Indian farmers, fisherman and dairy folks has shown that local people are ready to incorporate environment friendly technology but it is the governing bodies and politics that plays grimy. Awareness among the elite people about the use of solar heaters, cookers, lamps is slowly picking up though highly viable in the Indian context is due to the high initial cost of installation, which means that the Western developed nations had been able to pass on the technology in communications but not in the basic amenities sectors thereby creating a continuous dependency on the developed nations.

As the world meets once again after 50 years in Sweden in June 2022 to mark five decades of the first UN Stockholm conference on 'the human environment' which marked the initiation of global consciousness on sustainability. Stockholm itself was deluged in contamination. At this juncture, besides the host country Sweden, the sole head of state was India's former Late prime minister Smt. Indira Gandhi who spoke at the meeting.[193] Until 1972, no country had an environment ministry. Norwegian delegates returned from the conference to set up a ministry for environment, the host Sweden took a few more weeks to do so. India too set up its Ministry of Environment and Forest a good 12 years later in 1985. The UN charter never had Environment as a domain to deal with. So, the first global conference on the Environment happened when Environment was not a subject of importance for any country or even a global concern. However scientific data was showing evidence of Acid rains, Ozone Hole, extinction of species like the Indian Bengal tigers, the humpback whales, mercury poisoning in the Minamata Bay in Japan were a few instances. However, at this point developing countries of the 'South' had expressed misgivings about plans for an environmental conference, believing that it would be dominated by interests of wealthier, industrialized countries of the 'North'. Brazil was the most vocal in its opposition to the conference calling it as a 'rich man's show'. Brazil opposed any initiative that could limit its sovereignty over its natural resources

[193] Down to Earth 16-31 May 2022 page 34., Prime minister Indira Gandhi legendary statement, 'We do not wish to impoverish the environment any further and yet we cannot for a moment forget the grim poverty of large numbers of people'. She went on to argue that poverty was the greatest polluter.

namely the Amazon and constrain economic growth and other Latin American countries supported Brazil.

Fifty years later more than 500 multilateral environmental agreements are being adopted. Most of today's conventions are related to planetary crises like the United Nations Framework Convention on Climate Change (UNFCCC), the Convention to Combat Desertification (UNCCD), the Convention on Biological Diversity (CBD) and a whole lot of other environmental regimes beings implemented through the UN system, trace their origin to the Stockholm Declaration.

This thesis has laid great significance on sustainable development of the environment and energy security issue for India and Brazil in particular. 'Sustainable Energy for all' was the issue that received the greatest personal attention from UN Secretary General Ban-Ki-moon in the Rio+20 run-up process, although the initiative had actually been launched in 2011. In Rio it was announced that more than one hundred commitments and actions have been already mobilized in support of his Sustainable Energy for All initiative, demonstrating powerful early momentum from governments, private sector companies and civil society organizations to achieve Sustainable Energy for all by 2030. The Sustainable Energy for All initiative brings together governments, business and civil society groups in an unprecedented effort to transform the world's energy systems by 2030. The UN Secretary General has set three complimentary objectives for the initiative, all to be achieved by 2030, namely: ensures universal access to modern energy services, doubles the global rate of improvement in energy efficiency and doubles the share of renewable energy in the global energy mix.

We're the first generation to be able to end poverty, and the last generation that can take steps to avoid the worst impacts of climate change. "Achieving Sustainable Energy for all is not only possible, but necessary. It is the *golden thread* that connects development, social inclusion and environmental protection" said Ban Ki-moon the UN Secretary General. Working together, we can provide solutions that drive economic growth, expand equity and reduce the risks of Climate change. Sustainable Energy for All or will be better known as the '***Golden Revolution'*** coined by the scholar herself has already achieved the following wherein, more than 50 governments from Africa, Asia, Latin America and the small Islands developing

states have engaged with the initiative and are developing energy plans and programs. Majority are from developing countries from the 'South' namely India and Brazil that have initiated or completed energy sector assessment and gap analyses, thus laying the groundwork to scale up action in priority areas, undertake strategic reforms where needed and attract new investments and financial support in crafting the *'Future We Want'* on this planet.

Every minute, every hour, every day - India rewrites her story. It isn't even a single story, it's a tapestry of stories, of a countless number of Indians, who do not let yesterday hold them back. All they know is that they can use today to script a tomorrow that they want. So, I hand it over to them, for only they can tell us where they will take the story next.

APPENDIX I:ACRONYMS AND ABBREVIATIONS

ALGAS - Asia Least-cost Greenhouse Gas Abatement Strategy

BEE - Bureau of Energy Efficiency

BECCS - Bio-energy Carbon Capture and Storage

CAT - Climate Action Tracker

CBG - Compressed Biogas

CCC - Climate Change Committee

CCS - Carbon Capture and Storage

CDM - Clean Development Mechanism

CEA - Central Electricity Authority

CFCs - Chlorofluorocarbons

CIL - Coal India Limited

CNG - Compressed Natural Gas

CONAMA - Brazil's National Environmental Council.

COP - Conference of the Parties

CSC- Carbon Capture Storage

CSD - Commission on Sustainable Development

CSE - Centre for Science and Environment

CT - Carbon Trust

CTI - Clean Technology Initiative

DACS - Direct Air Capture and Storage

EC Act - Energy Conservation Act 2001

EEI - Energy Efficiency Improvement

EPA - Environment Protection Agency

EPI - Environment Performance Index

ESCO - Energy Service Companies

ETIP - Energy Technology Innovation Project

FAO - Food and Agriculture Organization

FAME -INDIA- Faster Adoption and Manufacture of Hybrid and Electric Vehicles in India

FRB - Fuel Reserve Bank

GAIL - Gas Authority of India Limited

GDAM - Green energy Day-Ahead Market

GEF - Global Environment Facility

GFW - Global Forest Watch

GGIOSOWOG - Green Grids Initiative- One Sun One World One Grid

GHG - Green House Gases

IAEA - International Atomic Energy Agency

IBAMA - Brazilian Institute of Environment and Renewable Natural Resources. (Instituto Brasileiro do MeioAmbiente e dos Recursos).

IBGE - Brazilian Institute of Geographical Statistics.

IEA - International Energy Agency

INDC - Intended Nationally Determined Contributions

IOC - Indian Oil Corporation

IPCC - Intergovernmental Panel on Climate Change

IRENA - International Renewable Energy Agency

ISI - Import Substitution Industrialization.

IUCN - International Union for the Conservation of Nature and Natural Resources

LDCs - Less Developed Countries

MNRE - Ministry of New and Renewable Energy

MEAS - Multilateral Environmental Agreements

NAMAs - Nationally Appropriate Mitigation Actions

NDB - New Development Bank

NEP - National Electricity Plan

NGOs - Nongovernmental Organizations

NHPC - National Hydroelectric Power Corporation

NOAA - National Oceanic and Atmospheric Administration.

NOWA - National Offshore Wind Energy Authority

NSM - National Solar Mission

NSEFI - National Solar Energy Federation of India

NTCP - National Thermal Power Corporation

NZC - Net Zero Carbon

OECD - Organization for Economic Co-operation and Development

OIL - Oil India Limited

ONGC - Oil and Natural Gas Corporation

OPEC - Organization of Petroleum Exporting Countries

PNA - The National Alcohol Programme

PMUY - Pradhan Mantri Ujjwala Yojana

PQLI - Physical Quality Life Index

RRF - Renewable Regulatory Fund

SC - Spare Capacity

SEB - State Electricity Board

SECI - The Solar Energy Corporation of India

SNAP - Support for National Action Plan

SRT - Solar Roof Top

UN - United Nations

UNCED -United Nations Conference on Environment and Development

UNCHE - United Nations Conference on the Human Environment

UNCTAD - United Nations Conference on Trade and Development

UNDP - United Nations Development Programme

UNEP - United Nations Environment Programme

UNFCCC - United Nations Framework Convention on Climate Change

WCED - World Commission on Environment and Development

WEC - World Energy Council

WEHAB - Water and Sanitation, Energy, Health and Environment, Agriculture and Biodiversity

WEO - World Energy Outlook

WHO - World Health Organisation

WISE - World Institute of Sustainable Energy

WSSD - World Summit on Sustainable Development

WWF - World Wildlife Fund

WWI - World Watch Institute

ZEV - Zero Emission Vehicles

APPENDIX II:LIST OF CONFERENCE OF PARTIES (COPs)

1992 - Change in Rio	(Government craft UN Framework Convention on Climate to take steps, without specifying any, against climate change).
UNFCC	
1995 - COP1	Berlin, Mandate
1996 - COP2	Geneva, Switzerland
1997 - COP3	Kyoto Protocol
1998 - COP4	Buenos Aires, Argentina
1999 - COP5	Bonn, Germany
2000 - COP6	The Hague, Netherlands
2001 - COP7	Marrakech, Morocco
2002 - COP8	New Delhi, India
2003 - COP9	Milan, Italy
2004 - COP10	Buenos Aires, Argentina
2005 - COP11	Montreal, Canada
2006 - COP12	Nairobi, Kenya
2007 - COP13	Bali, Indonesia
2008 - COP14	Poznan, Poland
2009 - COP15	Copenhagen, Denmark
2010 - COP16	Cancun, Mexico
2011 - COP17	Durban, South Africa
2012 - COP18	Doha, Qatar
2013 - COP19	Warsaw, Poland
2014 - COP20	Lima, Peru
2015 - COP21	Paris, France
2016 - COP22	Marrakech, Morocco

2017 - COP23	Bonn, Germany
2018 - COP24	Katowice Poland
2019 - COP25	Madrid, Spain
2020-21 - COP26	Glasgow UK (Schedule to be held in Nov 2021) due to Covid-19
2022- COP 27	Cairo, Egypt
2023- COP28	UAE

APPENDIX III:THEME OF WORLD ENVIRONMENT DAY (5th June)

Year	Theme
2001	Connection to be done with the World Wide Web for the Life
2002	Give a Chance for the Earth
2003	Water - Almost Two Crore people are dying for it
2004	Seas and the Oceans which is Wanted - Dead or Alive.
2005	Cities are Green - Think for the Planet.
2006	Don't finish the Drylands
2007	Hot Topic – Melting Ice.
2008	CO2, Stop the Habit – Going Towards the Low Economy of the Carbon.
2009	Come Together to Combat change in the Climate – Our Planet needs us.
2010	One Future, One Planet, Many Species.
2011	Forest: Nature for all your Facility.
2012	Green Finance: Can it include you?
2013	Think, Save, Eat- Decrease your Footprint
2014	Small Islands for Improving States - Raise your Voice and not the level of the Sea.
2015	One Environment for One World.
2016	No Tolerance for the Trade which is Illegal
2017	Connecting People to Nature
2018	Beat Plastic Pollution
2019	Air Pollution.
2020	Time for Nature
2021	Ecosystem Restoration
2022	Only One Earth

APPENDIX IV: PRESIDENTS OF BRAZIL AND PRIME MINISTERS OF INDIA WHO MADE THEIR PRESENCE IN THE WORLD ENVIRONMENTAL SUMMITS.

Presidents of Brazil

1. Emilio Medici 1969-74 – 1972 Stockholm (Sweden)- UNEP

2. Ernesto Geisel 1974-79

3. Joao Figueiredo 1979-85 – 1982 Nairobi (Kenya)

4. Jose Sarney 1985-90

5. Fernando Collor de Mello 1990-92 – 1992 Rio de Janeiro (Brazil)-UNFCCC

6. Itamar Franco 1992-94

7. Fernando Henrique Cardoso 1995-02 – 2002 Johannesburg (South Africa)

8. Luiz Inacio Lula da Silva 2003-10

9. Dilma Rousseff 2011- 2016 Rio de Janeiro (Brazil)

10. Michel Temer 2016-18

11. Jair Bolsonaro 2019 (incumbent) –2022 Britain (UK)

Prime Ministers of India

1. Indira Gandhi 1966-77 - 1972 Stockholm (Sweden)- UNEP

2. Indira Gandhi 1980-1984 - 1982 Nairobi (Kenya)

3. P.V. Narasimha Rao 1991-96 - 1992 Rio de Janeiro (Brazil)-UNFCCC

4. Atal Bihari Vajpayee 1998-2004 - 2002 Johannesburg (South Africa)

5. Manmohan Singh 2004-14 - 2012 Rio de Janeiro (Brazil)

6. Narendra Modi 2022 (incumbent) (UK)

APPENDIX V:UN ENVIRONMENT CONFERENCES and IBSA SUMMITS

UN Environment Conferences

Year/Date	Country	Title	Number of NGOs	Number of Countries
1972 (5-16 June)	Stockholm Sweden	Human Environment	400	119
1982(10-18May)	Nairobi Kenya	To review the Declaration and Action Plan for Equality, Development and peace	113	114
1992 (3-14 June)	Rio de Janeiro Brazil	Earth Summit on Environment and Development	2400	178
2002 (26 August -4 September)	Johannesburg South Africa	World Summit on Sustainable Development	8000	193
2012 (13-22 June)	Rio de Janeiro Brazil	Rio+20 People's Summit	9856	188
2022	Scotland UK	Stockholm +50		

IBSA Summits

YEAR	LOCATION	HEAD OF STATE	COUNTRY
September 2006	Brasilia	Lula da Silva	Brazil
October 2007	Pretoria	Thabo Mbeki	South Africa
October 2008	New Delhi	Manmohan Singh	India
15th April 2010	Brasilia	Lula da Silva	Brazil

18th October 2011	Pretoria	Jacob Zuma	South Africa
16th May 2013	New delhi	Manmohan Singh	India
17th October 2017	Durban	Maite Nkoana Mashabane	South Africa

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O Herald dated:

Years	Month & Date
2015	June 18, December 1, December 9, December 22.
2016	September 4, September 14, October 3, November 15, December 6.
2017	April 7, April 23.
2018	September 3, October 3, October 13
2019	August 18, August 20, August 22, August 24, August 27, August 28, September 4, September 14, September 24, September 26, October 27, November 25, December 3.
2020	January 26, May 10, August 28.
2021	January 12, April 23, July 11, July 22, November 8.
2022	June 28.

The Times of India dated:

Years	Month & Date
2015	June 9, October 31, November 10, November 30, December 1, December 10, December 11, December 13, December 14.
2016	January 23, January 27, September 28, October 3, October 22, November 10, November 20.

2017	January 19, May 9, May 21, June 3, June 15, June 23, July 16, July 27, October 11, October 31.
2018	January 1, August 3, August 4, August 10, August 23, September 5, October 3, October 8, October 17, October 21.
2019	April 22, August 5, August 17, August 19, August 24, September 17, September 24, September 26, September 27, October 31, November 5, November 7, November 27, December 3, December 10, December 11, December 15, December 17.
2020	January 5, May 30, October 12, October 13, December 11, December 28.
2021	March 29, July 22, October 16, October 21, October 26, October 27, November 3, November 10.
2022	January 10, January 11, March, April 2, April 5, June 20.

MAGAZINES

Down to Earth, Science and Environment (Fortnightly), New Delhi

Years	**Month**	**Date**
2010	February	1 – 15 16 – 28
2014	November	16 – 30
2015	January	1 - 15
	February	16 - 29
	March	1 – 15 16 - 31
	April	1 – 15,
	August	1 – 15 16 – 31
	September	1 – 15 16 – 30
	October	16 – 31
	November	16 – 31
	December	1 – 15 16 – 31
2016	January	1 – 15
	February	16 – 29
	March	1 – 15
	May	16 – 31
	June	16 – 30
	October	1 – 15
	November	1 – 15
	December	1 – 15
2017	August	1 – 15
	December	1 – 15 16 – 31
2018	February	16 – 28
	June	1 – 15
	October	16 – 31
	December	1 – 15

2019	January	1 – 15
	April	16 – 30
	May	1 – 15
	June	1 – 15
	December	1 – 15
2020	January	1 – 15
	February	1 – 15
2021	February	1 – 15
	April	1 – 15
	May	1 – 15
	July	16 – 31
	August	16 – 31
	October	16 – 31
	December	16 – 31
2022	February	1 – 15
	March	16 – 31

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EIA. U.S. energy information administration

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www.wmo.ch (World Meteorological Organization)

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www.opec.org. OPEC Statistical Bulletin

www.ogj.com Oil and Gas Journal

www.IEA.org International Energy Agency

www.bp.org BP's Statistical Review of World Energy

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