Role of Green Governance and Green Finance in Regulating the Environmental Pollution

Tripura Sundari C.U.[1*], T. Kadalarasane[1]

Abstract

The first step of a green economy is to protect the environment through green finance, funds for this investment have to come from private and public sectors, comprising both domestic and international sources. The current paper attempts to study the impact of pollution on India and the need of future Green finance, Secondary data of various sources from Sustainable Development report, water pollution report, Carbon dioxide Information Analysis, World Bank, etc., is collected. Simple graphs, growth rate, percentage analysis, data visualization techniques are used to verify the above aim, based on which we provide policy suggestions.

Keywords: *Environmental Pollution, Green Governance, Green Finance, Green Economy, Data Visualization Technique*

1. Introduction

India is the fourth highest largest emitter of carbon dioxide in the world, accounting for 7 percent of global emissions in 2017. Because of the advancement of industrial revolution the polluted gas is pumped into the atmosphere which leads to warming the planet, rise in sea level and leading to severe food shortage. The carbondioxide (CO_2) emissions include a myriad of toxic air pollutants which is the most important human-produced climate-altering greenhouse gas. Green finance is defined as comprising "all forms of investment or lending that consider environmental effect and enhance environmental sustainability" (Volzet al., 2015: 2). "Green", means green projects and activities. The first step of green economy (Green banks, green bonds, green loans, green finance, etc.)

[1] **Tripura Sundari C.U., T. Kadalarasane,** Faculty, Quantitative Finance, Department of Statistics, Pondicherry University, Puducherry-605014
* Corresponding Author Email: tsundari30@gmail.com

should attempt to involve environmental and social considerations. We must protect the environment through green finance, funds for this investment has to come from private and public sectors, comprising both domestic and international sources. The first Japanese green bond issuance of EUR 250 million in October 2014 engaged the Development Bank of Japan (AllensLinklaters, 2015). Singapore has entered the First Catastrophe bond market for insurance-linked securities for ILS Expansion in Asia-Pacific (Ralph, 2017). Financial authorities in Bangladesh, the PRC, Hong Kong, China, India, Indonesia, Japan, Mongolia, Singapore and Vietnam have already taken concrete steps to support the financial system or parts of it with sustainable development goals. It is our fundamental rights to tussle for a clean and healthy environment - green governance is an emerging field which is defined as sustainable development. It is defined as long-term economic, social and environmental sustainability (Post et al., 2011).

Figure 1 depicts the sector wise world's Electricity generation from renewables by source and it is clear from the graph that since 1990 to 2016, hydro power is the leading electricity generation in the world.

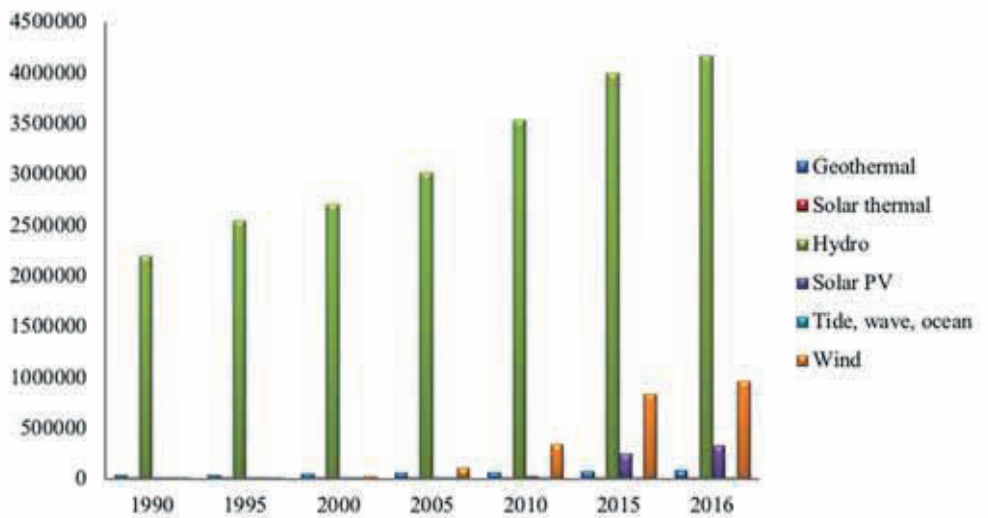

Figure 1: Electricity Generation from Renewables by Sources

Source: IEA Renewables Information 2018 - https://webstore.iea.org/renewables-information-2018.

1.1 Green Investment

As per the United Nations list of countries by Urbanization levels, "India ranks 160th with around 34 percent of its population live currently in Urban area" (World Economic Forum, Jan., 2019). The living standard has risen in urban India, where middle-class consumers extend their purchasing power beyond their basic needs which creates new opportunities for international businesses connecting digital technology. Infrastructural investment need for Asia by sector wise from 2016 to 2030 is forecast by ADB and is provided in the Table 1 and Figure 2. It is clear from the table that overall 26.2 trillion USD dollar is the need of infrastructure investment in Asia, the maximum amount sanctioned for power sector is 14.7 trillion USD dollars and that of Transport sector is 8.4 trillion USD dollars and that of telecommunications sector 2.3 trillion USD dollars. it clearly reveals this in the Figure 2 below.

Table 1: Asia Infrastructure Investment Needs by Sector, 2016–2030 (in trillion USD)

Sector Wise	(in Trillion USD)
Transportation	8.4
Telecommunication	2.3
Sanitation	0.8
Power	14.7
Total	26.2

Source: ADB (2017).

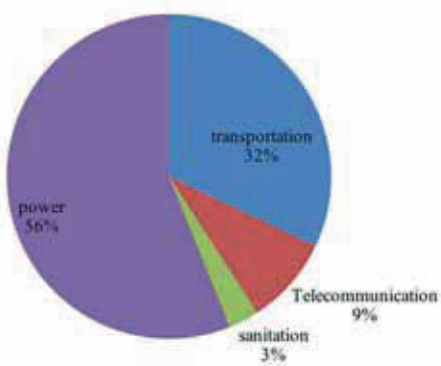

Figure 2 : Asia Infrastructure Investment Needs by Sector, 2016-2030

Source: Computed from ADB (2017).

Recent studies by the researchers on the green bonds/finance/investment are many, few like Morlotet al., (2012), Lalon (2015), Voica (2015), Kaur (2016), Sahooet al., (2016), Goodness and Ebruvwiyo (2017), Hoshenet al., (2017), Menonet al., (2017), Shaumya and Arulrajah (2017), Tripura Sundari (2017), Reddy (2018), Volz (2018), Noh (2019), Sachs et al., (2019) focused on global investment and green finance.

2. Motivation of the Study

According to the recent UN report, 'Economic Losses, Poverty and Disasters for 1998-2017', "India suffered economic losses of about Rs 6 lakh crore in the last two decades because of natural disasters, India is one of the top five countries to have reported absolute economic losses, which hurt the global economy by $3 trillion during the 20-year period from 1998 to 2017". The United Nations Office for Disaster Risk Reduction (UNISDR) noted that "climate change is increasing the frequency and severity of extreme weather events such as tsunamis, floods and storms, particularly in lower-middle countries like India. The economic losses from extreme weather events are unsustainable and a major brake on eradicating poverty in hazard exposed parts of the world". The report also added that "the number of climate-related disasters between 1998-2017 at over 6,600, which killed 1.3 million people and left 4.4 billion injured and homeless". According to a WHO study, 13 of the 20 most-polluted cities in the world are in India. The latest urban air quality database released by the WHO says that "India ranks among the world's worst for its polluted air". India's air quality ranks among the lowest five countries in the world, according to a Yale University (2016)study that assessed 178 nations. Average level of Particulate matter (PM 2.5) Pollution for 2018 is presented in the graph and we can clearly see it.

3. Objective and Methodology

Based on the above theory the current paper attempts to study the impact of pollution on India and the need for future Green finance, secondary data of various sources from Sustainable Development Report, water pollution report, carbon dioxide Information Analysis, World Bank, etc., is collected. Simple graphs, growth rate, percentage analysis, data visualization technique are used to verify the above aim. Introduction, motivation and objective and methodology of the study is provided in section I, section II briefly

explains the data analysis with the help of table and data visualization techniques. The need of green finance is discussed in Section III and finally the conclusion and policy suggestions are provided in section IV.

4. Data Analysis and Interpretation

As per the Carbon Dioxide Information Analysis Center, "China, India and the European Union represent 40 percent of global carbon emissions and the top 10 emitters were China, the US, the EU, India, Russia, Japan, Germany, Iran, Saudi Arabia and South Korea". As per the first round of Paris Agreement in 2015, these economies will achieve more than what they agreed to review the commitments made during Paris Agreement. In 2017, China (27 percent), US (15 percent), the European Union (10 percent) and India (7 percent) covered 58 percent of global emissions and the rest of the world contributed 41 percent (The Hindu Business Line).

As per the Health Effects institute: State of Global Air 2018, the data on death because of Air Pollution (Age - Standardized deaths per 100,000 people attributed to air pollution (2016), death percent in Afghanistan due to air pollution is about 31, the main reason is because of fuel and pollution due to household works and that of India is 15 percent. Figure 3 presents the India's Total Fossil-Fuel Emissions (1950-2014), and it is clear from the chart that from 1980 onwards there is an increase in the Fossil-Fuel Emissions.

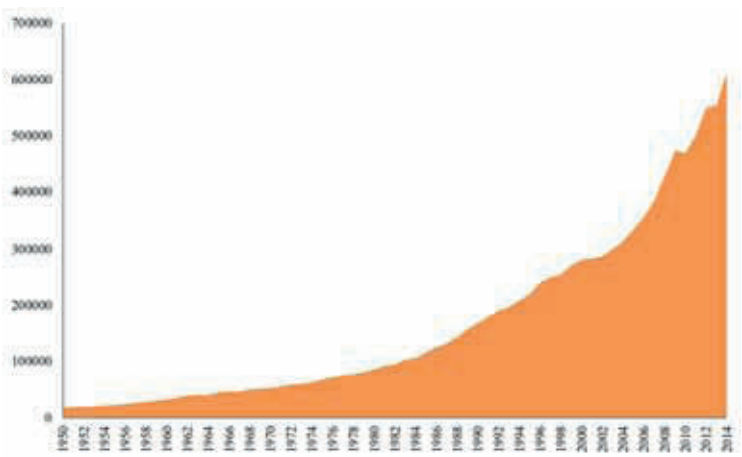

Figure 3: India's Total Fossil-Fuel Emissions (1950-2014)

According to the WHO study (2016), 13 of the 20 most-polluted cities in the world are in India. The latest urban air quality database released by the WHO says that "India ranks among the world's worst for its polluted air". India's air quality ranks among the lowest five countries in the world, according to a Yale University (2016) study that assessed 178 nations. The average level of Particulate Matter (PM 2.5) pollution for 2018 is presented in the Figure 4 and it is clear that the top 15 cities of India emits consistent pollution.

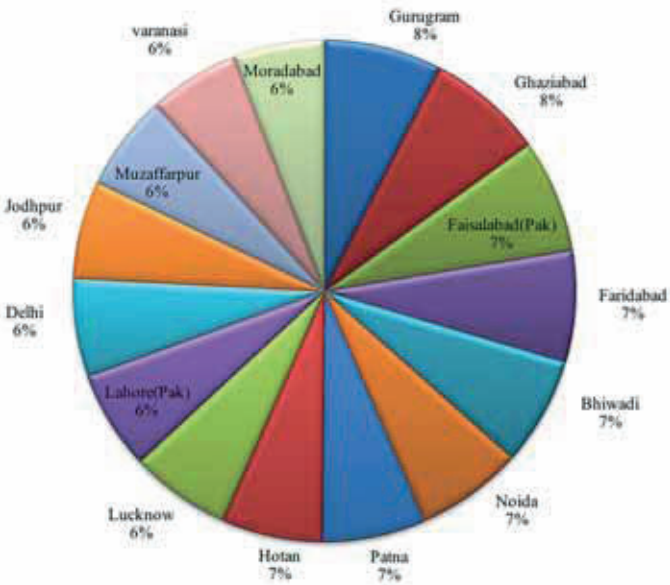

Figure 4: Highly Polluted Cities of India

Source: Computed from Health Effects Institute: State of Global Air 2018

Figure 5 depicts the India's CO_2 emission in all sectors and it is clear from the graph that energy sector releases the highest pollution among the other sectors. According to World Resources Institute (WRI), the world's water systems face formidable threats. More than a billion people currently live in water-scarce regions, and 3.5 billion could experience water scarcity by 2025". Regarding waterless economies, just 10 countries accounts for 60 percent of the global population without access to clean water. As per the report of "The Water Gap-The State of the World's Water 2018" that India accounts for 19.33 percent, which is the foremost waterless economy.

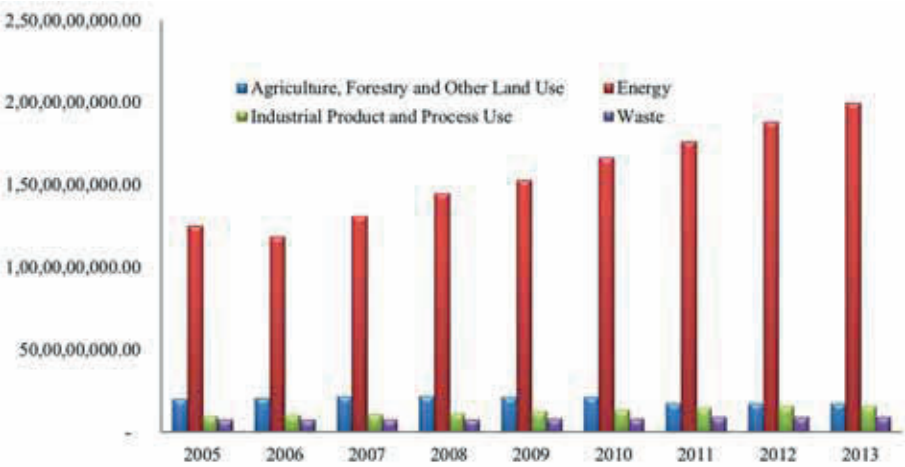

Figure 5: India's CO_2 Emission in all Sectors

Source: Computed from Carbon Dioxide Information Analysis

Figure 6 reveals the Total Damages crops, Houses and public utilities in India from 1953 to 2016. It is clear that the when compared to total population, the damage caused is implausible since 1998. As per GLOBAL CLIMATE RISK INDEX 2018, we find the death toll in 2015 to be 2119, the Deaths per 100,000 inhabitants is 0.16, Absolute losses in million US$ (PPP) is 21,482.79 and Losses per unit GDP is 0.247 percent.

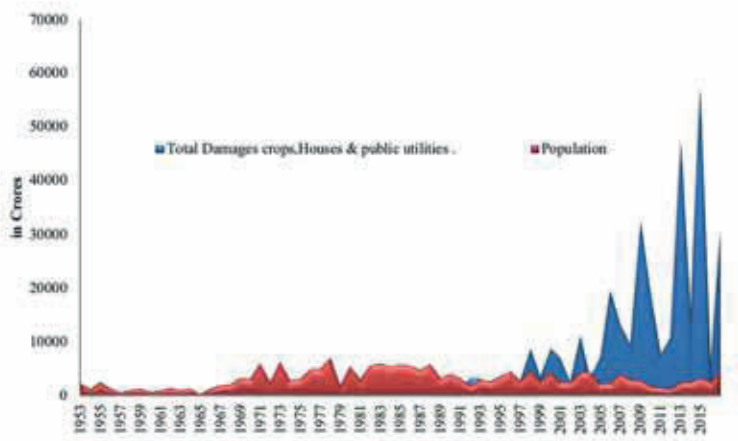

Figure 6: Damage Due to Flood and Heavy Rainfall in India

Source: Computed from Global Climate Risk Index 2018

As per ILO estimates based on data from the ILOSTAT database and the HadGEM2 and GFDL-ESM2M climate models, the total (primary, secondary and tertiary sector) working hours lost due to heat stress, in Southern Asia, 1995 and 2030 is 4.02% and 5.29% and that of India is 4.31% in 1995 is estimated to increase to 5.8% in 2030. This concludes that when compared to South Asia in India the working hours lost due to heat stress is estimated to be high (Figure 7)

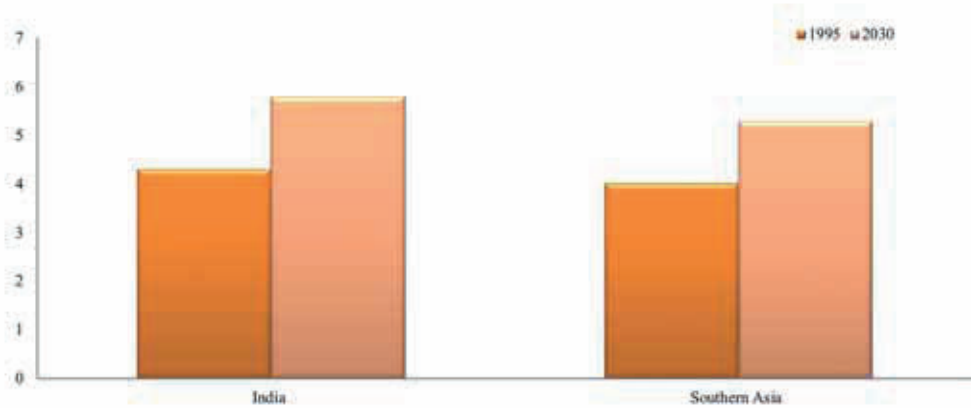

Figure 7: Total Working hours lost due to heat stress in India and Southern Asia, 1995 and 2030

Source: Computed from ILO estimates based on data from the ILOSTAT database and the HadGEM2 and GFDL-ESM2M climate models

As per IEA, Energy Access Outlook 2017, the energy access in Developing Asia for 2016, in rural is 97 percent and urban is 74 percent, and the population with electricity access is 239 million. Figure 8 presents the Electricity capacity from renewable energy sources 2010-2030 (GW), it is clear from the chart since 2010 and in future solar is the only renewable energy sources for a green and sustainable future. Figure 9 reveals that wind and solar is the most renewable capacity target in India.

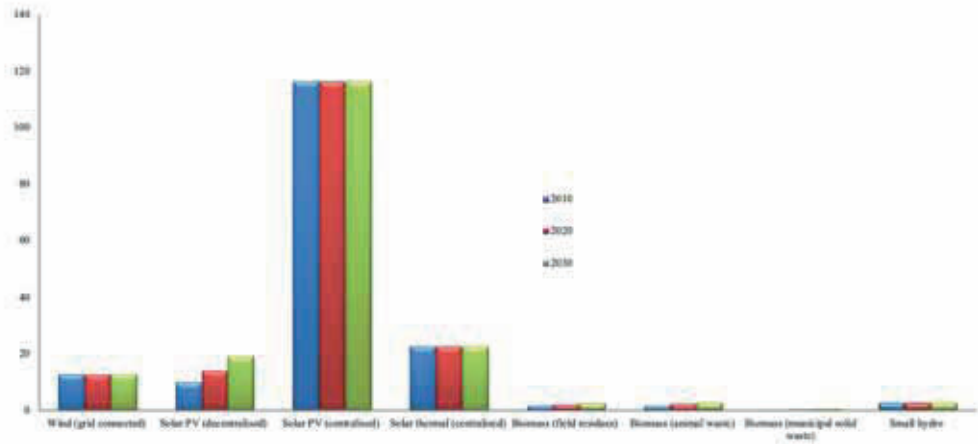

Figure 8: Electricity Capacity from Renewable Energy Sources 2010-2030 (GW)

Source: Farooq and Kumar (2013)

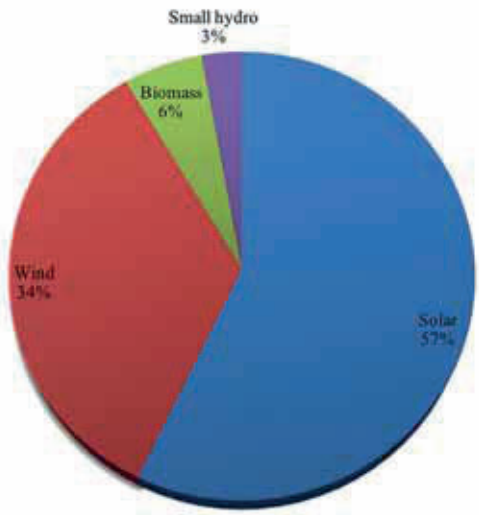

Figure 9: India's Renewable Capacity Target

Source: India's intended nationality determined contributions

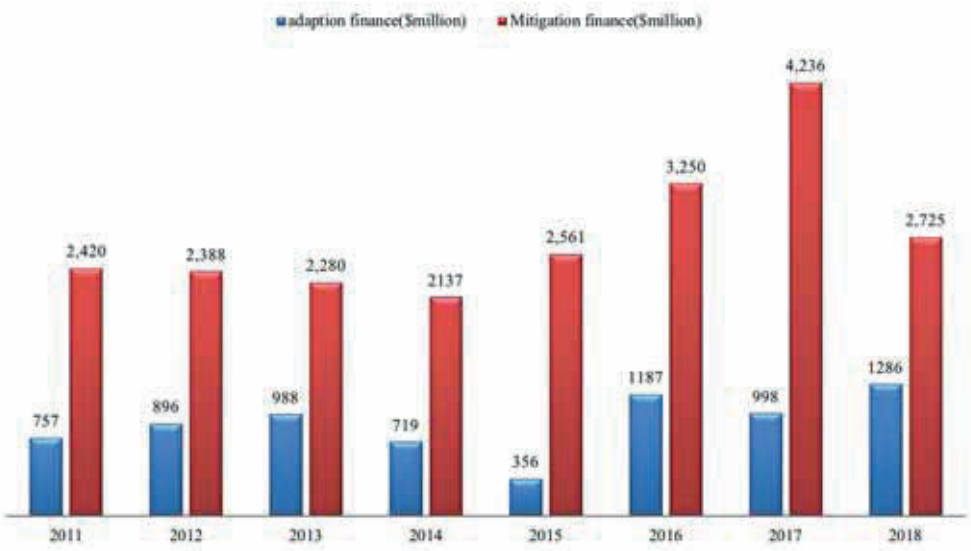

Figure 10: ADBI Historical Climate Finance ($million)

Source:Climate Change Financing at ADB (2018)

Figure 10 presents the ADBI Historical climate Finance ($million) regarding adaptation fiancé and Mitigation Finance since 2011.The carbon intensity of selected countries are provided in figure 11, it is clear from the chart that the carbon dioxide emission of people Republic of China in 1993 was 2.44 and it gradually decreased to about 1.24 in 2014 this must be the country which has undertaken the sustainable development goal and working on it so China must be appreciated for this. India's carbon dioxide emission in 1950 was 1.39 and has declined to 1.05 in 1993. Other countries like Pakistan, Malaysia and Thailand is more or less following a consistent trend in maintaining the carbon dioxide emission. One among the top five countries which is experiencing the Leading Environmental Threat of global economy is India $3 trillion during the 20-year period from 1998 to 2017 and the total losses have increased by 120 percent compared to the previous 20 years.

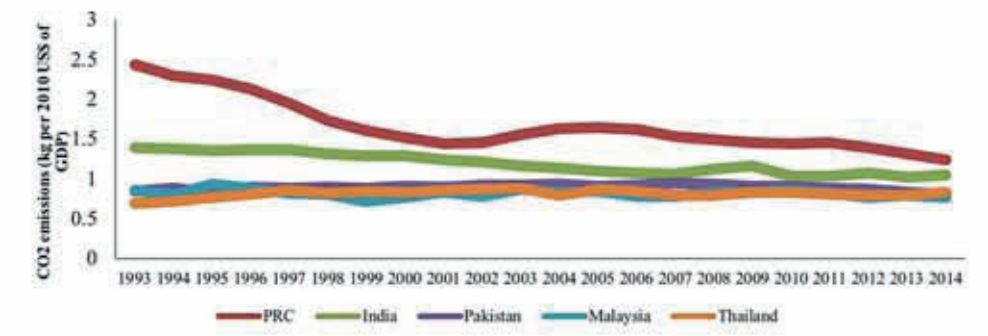

Figure 11: Carbon Intensity of Selected Asian Countries

Source: Compiled with data from World Development Indicators (December 2017)

As per the data of Banking on climate change fossil fuel finance report card 2019, it is clear from figure 12 that fossil fuel financing is provided since 2016-2018 for total 33 banks. This clearly reveals the green Investment and bond in Asia and India.

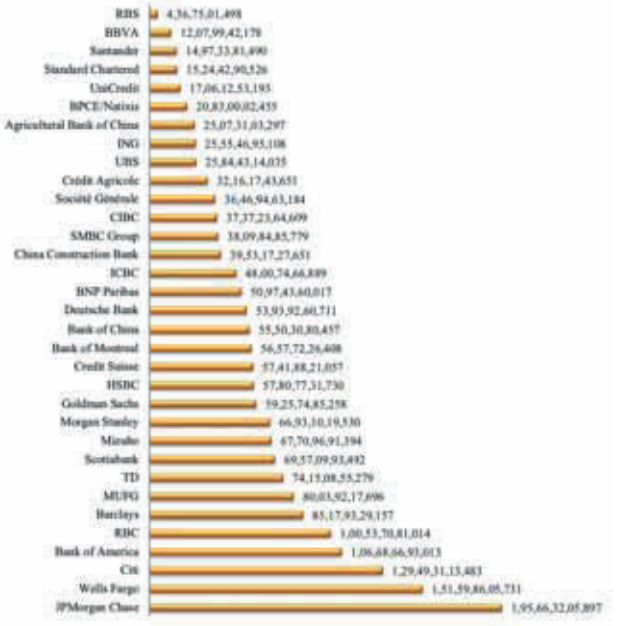

Figure 12 : Banking on Fossil Fuel Financing($)

Source: Banking on Climate Change Fossil Fuel Finance Report Card 2019

As per RBI data in 2016, we provide the Renewable energy financing in Table 2. The renewable energy target and capacity for each outlook is specifically provided.

Table 2: Renewable Energy: Financing Outlook in India

Renewable Energy (RE) Targets	Capacity
Installed Renewable Energy (RE) Capacity	45 GW
Target RE Capacity (by 2022)	175 GW
RE Capacity to be Commissioned	130 GW
Cost of Financing & Existing Exposures	USD billion
Cost of Installation (assuming ~ USD 1 million per MW)	130
Non-equity Financing Requirement (@ 70:30 Debt-equity)	90
Aggregate Exposure of Banks/FIs to Power Sector	152
Scheduled Commercial Banks	86
Power Finance Corporation (PFC)	36
Rural Electrification Corporation (REC)	30
Source: RBI; Exposure Data as on March 31, 2016	

Figure 13 reveals the India's investment trend and the green investment is increasing since 2016.

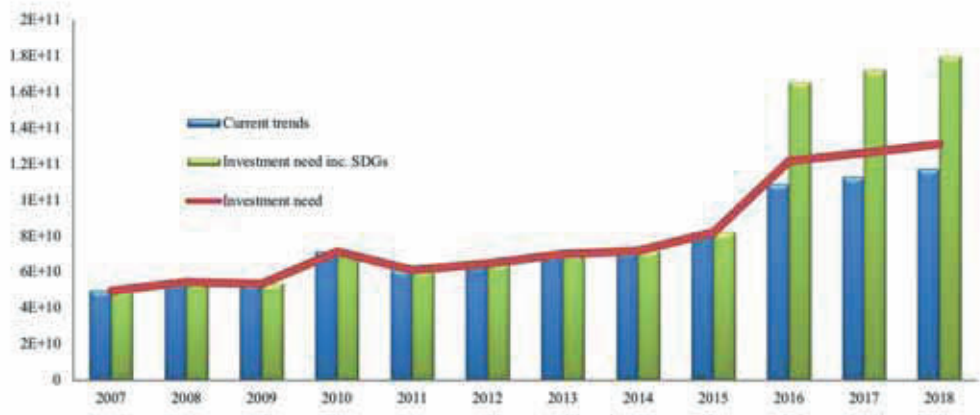

Figure 13 : India's Investment Trend

Source: Outlook.gihub.org and Global Infrastructure Outlook

The Power Generation Capacity by Type in India in the New Policies Scenario, is provided in Figure 14, which clearly reveals the situation in 2014 and 2040.

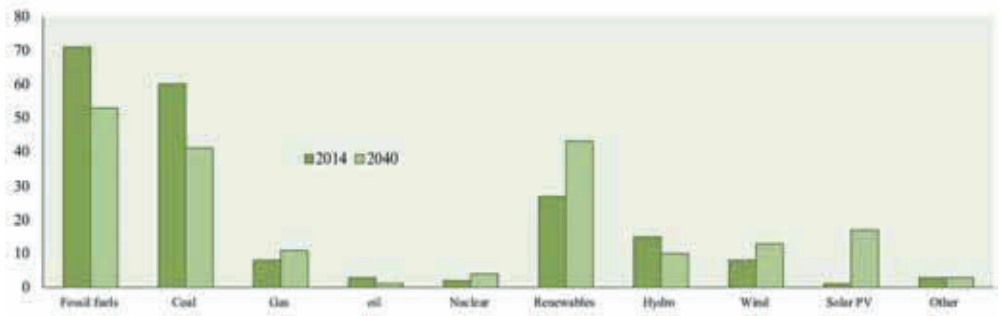

Figure 14: Power Generation Capacity by Type in India in the New Policies Scenario

Source: IEA (2015)

5. Conclusion

Air pollution is the top killer in the world (Thomson Reuters, 2018), every year all countries face heavy natural calamities disaster which results in huge human loss and financial losses leading to global inequality and environmental injustice. Increase in CO_2 emissions produces more heat, directly affecting the natural resources which results in more disease and increase in water level. Tropical deforestation and human activities are the primary cause of global warming. European cities are clean now than generation ago. In 1960 California had the highest pollution levels in the world, measures to tackle pollution by adopting eco-friendly policies and investment we can reduce the pollution (World Economic Forum, March 5, 2019). India's electricity and heat producing sector releases the highest pollution since 1981. There is a huge gap between the current trend and future Investment trend, so the need of the study is clear, the gap must minimized to attain the goals of sustainable development agenda 2030. According to United Nations climate change panel, just 100 companies have been the source of over 70 percent of the world's greenhouse gas emissions since 1988 (IPCC,2017), and the major players contributing to climatic changes are coal, oil and gas companies. Based on the above exploration we can follow the following policies (i) protecting Mangroves, (ii) making water resource management more efficient, (iii) improving dry land agriculture,(iv)

adopting eco-friendly policies and investment we can reduce the pollution(v) energy-efficient technologies must be implemented in Industries and businesses. Hence, there is a need of green finance/green bond for the sustainable development in India.

References

1. AlapatiSaiBharath Reddy (2018).”Green Finance-Financial Support for Sustainable Development”, International Journal of Pure and Applied Mathematics. 118(20),645-652, ISSN: 1314-3395 (on-line version), url:http://www.ijpam.eu.Special Issue.
2. Boden, T.A., G. Marland, and R.J. Andres. (2017). Global, Regional, and National Fossil-Fuel CO2 Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334/CDIAC/00001_V2017.
3. Chang, Y. (2019). “Green Finance in Singapore: Barriers and Solutions”. ADBI Working Paper 915. Tokyo: Asian Development Bank Institute. Available:https://www.adb.org/publications/green-finance-singapore-barriers-and-solutions carbon trust 2019.CDP supply chain report 2019
4. “Data : India - Environmental Performance Index[EPI] - Development”, Yale University. 2016.
5. Discussion Paper on Carbon Tax Structure for India 2018.Shakthi sustainability energy foundation and EY building a better working world.
6. Global infrastructure outlook 2017 report, https://outlook.gihub.org
7. Goodness C. Aye and Prosper EbruvwiyoEdoja(2017).”Effect of economic growth on CO2 emission in developing countries: Evidence from a dynamic panel threshold model”. Cogent Economics & Finance, 5(1), 1-22,https://doi.org/10.1080/23322039.2017.1379239.
8. Griffin Paul. (2017),The Carbon Majors Database. CDP Carbon Majors Report 2017
9. ILOSTAT database and the HadGEM2 and GFDL-ESM2M climate models, “Working on a WARMER planet The impact of heat stress on labour productivity and decent work”, International Labour Organization 2019 Geneva.
10. Manpreetkaur (2016). “GreenBanking: NeedoftheHour”, International Education & Research Journal [IERJ], 2(6),44-48.
11. Marian CatalinVoica,PanaitMirela and Irina Radulescu(2015).”Green Investments - between necessity, fiscal constraints and profit”, Procedia Economics and Finance, 22(1), 72 – 79,https://doi.org/10.1016/S2212-5671(15)00228-2.
12. Dileep G Menon, S G Sreelakshmi andAvinashShivdas(2017). “Green banking initiatives: A review of Indian banking sector”. IEEE International Conference on Technological Advancements in Power and Energy (TAP Energy),557-563.
13. Jan Corfee-Morlot, VirginieMarchal, Celine Kauffmann, Christopher Kennedy,Fiona Stewart, Christopher Kaminker and Geraldine Ang(2012), “Towards A Green Investment Policy Framework- The Case of Low-Carbon, Climate-Resilient Infrastructure”, OECD Staff consultation draft, 18 June 2012.
14. Noh, H. J. (2018), “Financial Strategy to Accelerate Green Growth”, ADBI Working Paper 866.Tokyo: Asian Development Bank Institute. Available:https://www.adb.org/publications/financial-strategy-accelerate-green-growth.
15. Post, C.,Rahman, N.,Rubow, E.(2011),“Green governance: Boards of directors’ composition and environmental corporate social responsibility”. Business and Society, 50(1), 189–223.
16. RaadMozibLalon 2015.”Green Banking: Going Green”. International Journal of Economics Finance and Management Sciences, 3(1),34-42. doi: 10.11648/j.ijefm.20150301.15
17. Sachs, J. D., W. T. Woo, N. Yoshino, and F. Taghizadeh-Hesary. 2019. Why Is Green Finance Important? ADBI Working Paper 917. Tokyo: Asian Development Bank Institute.Available: https://www.adb.org/publications/why-green-finance-important.
18. Shaumya1, K and Anton Arul rajah (2017).”The Impact of Green Banking Practices on Bank’s Environmental Performance: Evidence from Sri Lanka”.Journal of Finance and Bank Management, June 2017, Vol. 5, No. 1, pp. 77-90, ISSN: 2333-6064 (Print), 2333-6072 (Online), Copyright © The Author(s). All Rights Reserved. Published by American Research Institute for Policy Development, DOI: 10.15640/jfbm.v5n1a7, URL: https://doi.org/10.15640/jfbm.v5n1a7
19. SabujHoshen, NajmulHasan,SanuarHossain, Abdullah Al Mamun,AbdulMannan, Abdullah Al Mamun (2017) “Green Financing: An Emerging Form of Sustainable Development in Bangladesh”.IOSR Journal of Business and Management,19(12)VII, 24-30.

20. SahooBibhu Prasad, Amandeep Singh andNeerajJain . (2016). "Green Banking In India: Problems and Prospects". International Journal of Research -GRANTHAALAYAH, 4(8),92-99. http://doi.org/10.5281/zenodo.61169
21. The Special Report on Global Warming of 1.5 °C (SR15) was published by the Intergovernmental Panel on Climate Change (IPCC) on 8 October 2018. The report, approved in Incheon, South Korea, includes over 6,000 scientific references, and was prepared by 91 authors from 40 countries, www.ipcc.ch.
22. The water gap: the state of the world's water (2018). This report reveals Papua New Guinea, Uganda, Niger, Mozambique, India and Pakistan are among the countries where the highest percentage or largest number of people cannot get clean water within a half-hour round trip.https://apo.org.au/node/137041
23. Tripura Sundari C.U. (2017) "An Empirical Analysis to Examine the Causal Nexus between Economic Growth and Environmental Pollution in India", Journal of Global Engineering Problems and Solutions , Sinani Publishing house, 2(1),24-30.
24. United Nations Office for Disaster Risk Reduction (UNISDR) and Centre for Research on the Epidemiology of Disasters (CRED) 2018."Economic Losses, Poverty and Disasters for 1998-2017".
25. U.S. Environmental Protection Agency (EPA). (2012). "Global Non-CO2 GHG Emissions: 1990-2030." Washington, DC: EPA. Available at: https://www.epa.gov/global-mitigation-non-co2-greenhouse-gases/non-co2-greenhouse-gases-international-emissions-and.
26. Volz, U. (2018). "Fostering Green Finance for Sustainable Development in Asia", ADBI Working Paper 814. Tokyo: Asian Development Bank Institute. Available:https://www.adb.org/publications/fostering-green-finance-sustainable-development-asia.
27. Volz, et al., (2015): Financing the Green Transformation – How to Make Green Finance Work in Indonesia, Hound mills and Basingstoke: Palgrave Macmillan.
28. World Bank. 2017. World Development Indicators. Washington, DC. Available at: http://data.worldbank.org/.