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Green Bonds: A Catalyst for Sustainable Development

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ABSTRACT

There is a need to cut down CO_2 emissions by at least 45% by the year 2030 to attain a net zero. There is a need around the globe for a wide ranging shift to a low carbon foot print economy with a view to restrict the rising earth temperature status within 1.5 to 2 degrees. To achieve this objective one needs to support technological shifts and advances as well implementation of government policies on climate controls in the form of carbon taxes, green growth policies. Green bonds are instruments aimed at encouraging sustainability and to help build up on projects focused at environmental protection and implementing other climate related projects. The paper aims at studying comprehensively the global operation of green bond markets and its ongoing development. The result predicts that there is positive impact of these projects on the sustainable development. Use of Renewable Capacity From Solar, Wind And Hydro Technologies has been used that decreases Co_2 Emission and thus significantly impacting the environment.

Keywords: Green bonds, Renewable energy, climatic changes

1. INTRODUCTION

Green Bonds are designated bonds intended to finance the eco-friendly project which help to support efficient use of energy, controlling and preventing pollution, greener agriculture, fish farming and forestry, conservation of terrestrial and aquatic ecosystems, sustainable transportation, clean water management and finding environment friendly technologies. [1][2]. Green bond financing has a well defined purpose of addressing climate change and is an open option for whosoever can meet those objectives (Humphreys, Electris & Roswell, 2015). The investment plans must be made clear and open which would certainly boost up the sale of green bonds [3][2]. Green bond stake holders includes Green Bonds issuer(s), Green Bonds investor(s), intermediaries in markets (such as stock exchanges), Green Bonds partner, Credit rating agencies and auditors, Regulators encouraging transparency in development of green bond market [4][5]. The green bond issues are invariably required to define and quantify the extent of environmental benefits of all bond categories. if bond proceeds are to be used for Green house Gas(GHG) reduction, it must be quantified in terms of per ton of CO_2 equivalent. These benefits must also be measured against suitable counterfactuals. This qualifies the trustworthiness of green bond standards and helps to hedge against accusations of green wash, and risking reputation.

Tax incentives, tax exemptions and tax credits are the three very unique features of green bonds which provide these an upper edge over other comparable categories of taxable bonds. To qualify for this kind of monetary incentives, such bond issues have to be certified by the Climate Bond Standard Board testifying that the bonds fulfil the defined purpose to fund climate friendly projects. As the demand for green bonds increases the borrowing cost gets lowered[6]

1.1 Conceptual Framework

Idea of issuance of green bonds was initiated by The World Bank and European Development targeting environmental health (Greenleaf investors, 2016). Subsequently the "Strategic Framework for Development and Climate Change" was launched by the World Bank in 2008 with the soul purpose of coordinating and stimulating public and private sector activity to wage a war for climate (The World Bank 2017). Large number of entities like European Bank for Reconstruction and Development (EBRD), the International Finance Cooperation (IFC) & some other public entities (governments, agencies and municipalities) Came together and issued green bonds worth USD 4 bn.. This innovative move gathered momentum between 2007 and 2012 when governments from many countries joined hands with international organisations and introduced series of their own green bonds. The market was joined by Municipalities and local governments when the first time issuance by Ile de France (the Paris region, France) in 2012 followed by Gothenburg (Sweden), Massachusetts (USA), State of California (USA), Province of Ontario (Canada). So, direct intervention of the UN helped in the growth of green bond market. Until 2013, the issuance was dominated by small transactions. Nevertheless, the public sector issuers used the time to raise awareness and develop frameworks for transparent reporting on the use of green bonds for green investment. This was further boosted by issue of corporate green bonds by Electricity de France and Bank of America in 2013. The same year, the market evolved beyond Sub-sovereign, Supranational and Agency (SSA or MDBs). During 2013 the market size of Green bond market increased and reached up to USD 11 bn. Since then there has been an increase in the market. In 2014 the market of green bond reached till USD 36.6 bn. The green bonds were subjugated by energy, consumer goods and real estate sector. In 2015 Paris Climate Change Conference played a vital role in binding together a group of 200 countries, to work on a common platform for a common objective, which is to combat global warming issue and arrest the rising temperature to a 2 degree less than the present level (Levy, 2017). It is estimated that to achieve this target an amount of minimum 100 trillion dollars is required over coming 14 years to promote green bonds [7][8]. In 2015 many countries joined the race of issuing Green bonds. It includes Mexico, Brazil, China, Denmark, India, and Estonia. The total contribution in green bond projects by these countries was USD 41.8 bn. Further In 2016 the green bond market increased to USD 65.4 bn. In 2017 it increased to USD 155.5 bn in 2017 that increased to USD 409bn in 2018.

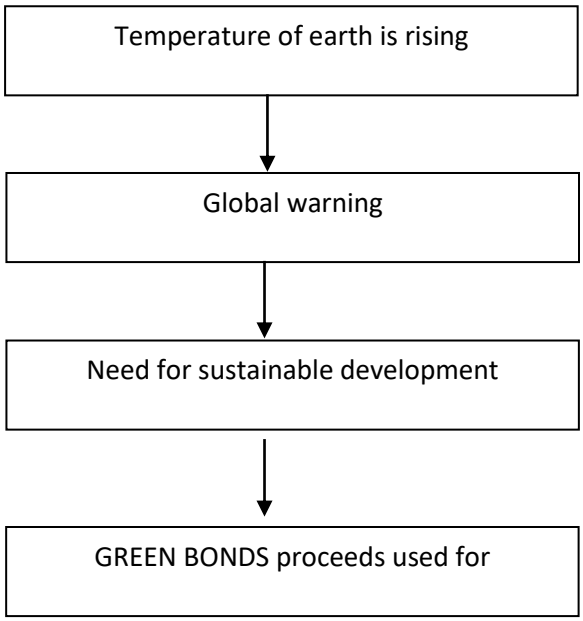
2.1 Theoretical framework

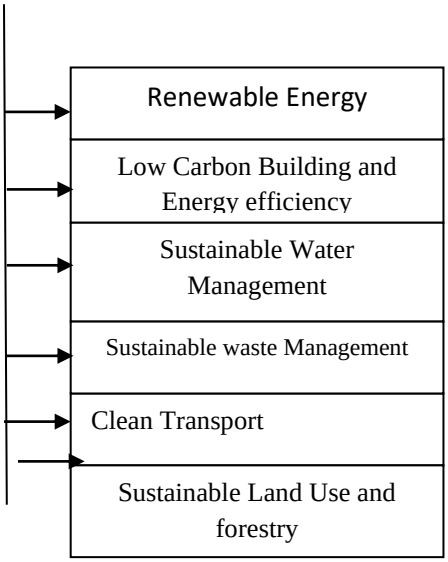
There is a need to cut down CO_2 emissions by at least 45% by the year 2030 to attain a net zero. Extreme weather patterns are on the cards as predicted by statistical models on climate models and the Intergovernmental Panel on Climate Change (**IPCC**) reports the fact that the planet is already 1 degree warmer than the pre-industrial phase levels (Wong, 2018). Further an enhancement of 1.5 degrees could lead to risks like an irreversible situation for oceanic

coral islands running the risk of 70% to 90 % reduction (OECD 2017; Heineken, 2016). Likewise, arctic summer could be ice-free if temperature rises at 1.5 degree and beyond leading to the rise in the sea levels rise by 10cm inundating the costal zones rendering millions homeless and jobless (Obradovich and Zimmerman 2016). The 10 countries which falls in this category are India, China, Vietnam, Bangladesh, Indonesia, Japan, Egypt, Thailand, US and the Philippines. To add more a study by climate change vulnerability index estimated human vulnerability to extreme events triggered by climate changes and variations in vital parameters of climate over next 30 years predicting that 15 countries are fast growing cities at extreme or high risk as India, Lagos, Kinshasa, Luanda, Addis Ababa, Jakarta, Manilla, Shanghai, Guangzhou, Kabul, Cairo, Khartoum, Beijing, Karachi, Mumbai, Chennai etc [9].

These climatic changes lead to destruction of crops and disruption of food storage and transport resulting into an alarming food scarcity situation beyond control [10], [11]. In the summer of 2018, the worst effects of weather changes caused by hurricanes, storms and wildfires which severely damaged buildings and other infrastructure could be seen. Further, asset values dipped low and power supplies disrupted adversely impacting the supply chain services and reduction in per acre agriculture yield [1]. There is a need to cut down CO_2 emissions by at least 45% by the year 2030 to attain a net zero. There is a need around the globe for a broad based transition to an economy which is low-carbon with a view to restrict the global warming status within 1.5 to 2 degrees as defined in the Paris Agreement [12]. To achieve this objective one needs to support technological shifts and advances as well implementation of government policies on climate controls in the form of carbon taxes, green growth policies. This may also require a change from fossil fuel energy to renewable, increased energy efficiency and green infrastructure. Since there is every likely hood that the changes may severely impact corporate valuations and profitability, the most viable solution has been found is Green Bond market [13]. Implementing the Green bonds projects have positive impact on the environment. Green Bond Principle recognised the broad categories included under the Green bond project. It includes Clean transportation; Efficiency in usage of Energy; Preventing pollution in the environment; Sustainable use of water resources; Adopting Eco friendly products;

Figure 2





3. OBJECTIVE

a) To study the brief overview of the functioning of the green bond market globally and its ongoing development ;

b) To study the investment made by the World bank in Green Bonds and its impact on Environment on reducing environmental pollution.

c) To study the status of Post issuance Reporting system by World countries

d) To study the analysis of impact reporting in different sector that includes Energy, Transport, Buildings, Water, Waste, Energy, Adaption, Agriculture, Land use and forestry.

4. RESEARCH METHODOLOGY

The paper uses secondary data. The data has been collected from various sources like European Commission, World Bank report, Climate bond initiative. Adding further to give a comprehensive overview of the functioning of the green bond market globally and its ongoing development, the data has been collected from the World Bank reports, climate bond initiative over the years. Impact reporting method is used to discover and establish and to measure change in the outcome of an asset or or a group of assets caused due to green bond financing. A group of relevant indices has been used to measures the actual impact on environmental health. IFI Harmonized Framework and the Nordic Public Sector Issuers reporting metrics has been used at an annual frequency. CO_2 points to carbon dioxide impact of resources, measurement, whereas GHG (Green house gas) indicates at scale of greenhouse gases taken into account and then converted to CO_2 equivalent.

Once the green bond has been issued, its proceeds used after the opening and closing of bond, the post issuance reporting includes all publically available data. The data has been collected through reports on green bonds, yearly reports, emissions reports, etc. Consideration was

given to all the bonds notwithstanding the fact that allocations were provided when issuance happened. The study on post issuance by Climate Bonds Initiative in the green bond market has been used in this study. More focus has been on creating such reporting practices which helps in understanding the degree of adoption of reporting on the use of proceeds (UoP) and metrics of environmental impact. The main aim of Impact reporting is to give an insight of the effects on environment of green bond financing. The aim is to make measurable alterations seen in the performance of portfolio, project or a resource, with respect to a set of applicable indicators.

5. DATA ANALYSIS AND INTERPRETATION

5.1 Issuance of Green Bonds and the World Countries

Green bonds assign receipts for environmental or climate projects and get labelled as 'green' by the issuer. Table 1 shows the green bond investment in different sectors from 2016 to 2018. In 2016, USD87.2bn of labelled green bonds was issued which increased to USD 155.5 bn in 2017. In 2018 it further increased to USD 409bn. Moving towards the sector wise investment, Renewable energy is at the top having 40% in 2018 followed by buildings with Low Carbon foot print and efficient use of energy with 24% investment. Green transport contribution is at 15%, Sustainable Water Management, 11%, greener ways of Waste Management, 4%, environment friendly Land Use and forestry, 3% and Adaption to Climate change, 3%.

Table 1
Green bond investment in different sector

			in %
Sector	2016	2017	2018
Renewable Energy	38	33	40
Low Carbon Building and Energy efficiency	21	29	24
Clean Transport	15	15	15
Sustainable Water Management	14	13	11
Sustainable waste Management	5	4	4
Sustainable Land Use and forestry	2	3	3
Climate Change Adaptation	5	3	3
Total amount spent	USD87.2bn	USD 155.5 bn	USD 409bn

Source: Climate bond Initiative, 2018

Table 2 shows the Top 5 countries investment in 2018 in green bond market. USA is at the top with USD34.2bn followed by China (USD31bn), France (USD14.2bn) is on the third. Fourth is on Germany (USD 7.6bn) whereas Netherlands (USD 7.4 bn) is at fifth position.

Table 2

Top 5 in 2018: Green Bond issuance Rankings					
No.	1	2	3	4	5
Country	USA	China	France	Germany	Netherlands
Amount	USD 34 bn	USD 31 bn	USD 14 bn	USD 7.6bn	USD 7.4 bn
Market Share	20%	18%	8%	5%	4%

Source: Climate Bond initiative,2018

Table 3 presents the top 10 Developed Market(DM) country ranking with respect to green bond issuance. USA stands first followed by france(second) and germany(third position). The list is further enumerated in the table as below:

Table 3
Top 10 Developed market country ranking

		2018 issuance			
2018 Rank	Country of Risk	USD bn	Deals	Change from 2017	% DM issues
1	USA	34.1	1159	decrease	34
2	France	14.2	20	decrease	17
3	Germany	7.6	19	decrease	9
4	Netherlands	7.4	8	increase	6
5	Belgium	6.3	3	increase	2
6	Sweden	6.1	58	increase	5
7	Spain	5.8	10	decrease	5
8	Canada	4.3	9	decrease	3
9	Australia	4.2	9	increase	3
10	Japan	4.1	29	increase	3

Source: Climate Bond initiative,2018

Table 4 presents the results of Top 10 Emerging Markets (EM) issuers cumulative for periods of 2012-2018, excluding China, where republic of Poland is on the top on second place is Greenko Investment co and followed by Export import bank of Korea. The list is further enumerated in the table 4

Table 4
Top 10 Emerging Markets issuers (cumulative 2012-2018, ex-China)

Country	**Issues**	**Amount (USD m)**	**Sector(s) funded**
Poland	2	2023	Energy, Buildings, Land use
India	8	2151	Energy
Korea	4	1350	Power, Infrastructure (buildings and transport), Water waste, Industry

Indonesia	1	1250	Power, Infrastructure (buildings and transport), Water waste, Industry
Brazil	6	2895	Energy, Buildings, water, land use
Lithuania	2	695	Energy, Transport, Waste
South Africa	1	651	Buildings

Source: Climate Bond initiative,2018

5.2 Project status of WORLD BANK and its impact on environment as of June 30, 2018
Table 5 depicts the amount allocated & outstanding and committed by the World Bank in different projects with different countries in the world Sector wise as of June 30, 2018.

ISSUANCE: The last decade has been the decade of green bond bonanza that witnessed the launch of 147 green bonds in 20 currencies by the World Bank, which are valued at US$11 billion approximately. The main purpose of this fund raising has been to finance and support projects for transition to low-carbon and climate resilient growth. As of June 30, 2018, US$8.5 billion of Green Bonds were outstanding.

6. COMMITMENTS AND DISBURSEMENTS:

The fiscal year 2018 ended with a wholesome 91 committed projects with qualified eligibility valued at a total of US$15.4 billion. Green Bond proceeds worth US$8.5 billion were allocated and disbursed to support such eligible projects in 28 countries. Another allocated amount of US$6.9 billion was almost ready for disbursement.

About 69% of Green Bond commitments covered the largest sectors of Renewable Energy and Energy Efficiency and Clean Transportation projects portfolios.

Table 5

Amount invested in different projects by WORLD BANK as on June 30, 2018(Sector wise)

Figures in Billion US dollars (rounding off done)	Pledged			Assigned and outstanding
	Mitigation	Adaptation	Total	
Renewable Energy and Energy Efficiency	6.0	0.10	6.10	3.70
Clean Transportation	5.01	0.20	5.2	2.2
Water and Wastewater	0.10	1.20	1.30	0.80
Solid Waste Management	0.10	0.0	0.10	0.10

Agriculture, Forests, Land Use and Ecological Resources	0.50	1.20	1.80	0.90
Resilient Infrastructure, Built Environment and Other	0.30	0.70	0.90	0.70
Total	12.0	3.40	15.40	8.50
Percentage	78%	22%	100%	

Source: world Bank group

Table 6 represents the sum total of green bonds issued in the world with World Bank assistance as on June 30, 2018. The East Asia and Pacific Region at 38% was the largest regional exposure by share of commitments in the Green Bond eligible project portfolio. The next major issuer for green bonds is Latin America and Caribbean contributing around 25% followed by South Asian countries which is at 18%. Europe and Central Asia is at 12% with Middle East and North Africa is at the lowest at 6%.

Table 6
Sum total of green bonds issued in the world by world bank assistance

countries	**Amount in US$ Billion**		
	Committed	**%**	**Allocated and Outstanding** [b]
East Asia and Pacific(EAP)	5.89	38	3
Europe and Central Asia(ECA)	1.89	12	1.31
Latin America and Caribbean(LAC)	3.89	25	2.61
Middle East and North Africa(MNA)	0.89	6	0.31
South Asia(SAR)	2.78	18	1.40
Total	15.39	100	8.51

Source: World Bank, 2018

Note: a) committed amount net of cancellations for eligible projects for which the loans are

Disbursing b) green Bond proceeds supporting financing of disbursements to eligible projects net of

Loan repayments. Not adjusted for matured bonds that were not replaced with new green bonds.

Since 2008, The World Bank Has Now Issued USD 13 Billion Equivalent In Green Bonds Through 150 Transactions In 20 Currencies. It has 91 eligible World BANK projects , 5 additional projects for green bond financing and completed a total of 30 projects in FY18. Table 7(A) represents the status of renewable energy and energy efficiency project

completed out of which 3 projects has been completed in financial year 2018. Further it represents the positive impact of these projects on the sustainable development. 2,094 MW Renewable Capacity From Solar, Wind And Hydro Technologies has been used making Co_2 Emission From 780tons Of Burned Coal Avoided Every Year thus significantly impacting the environment.

Table 7(A)
ENERGY EFFICIENCY PROJECTS & RENEWABLE ENERGY PROJECTS COMPLETED(3 IN FY18)

The total Energy Saved during the year is 68,050 GWh	Equals to	• Total Electricity generated In 2018 In Chile. • Less emission of Co_2 which is equivalent to 50,644 Tons.
The energy produced from Wind, solar and Hydro technology is **2,094** MW	Equals to	Co_2 Emission From 780tons Of Burned Coal Avoided Every Year

Source: World Bank, 2018

Table 7(B) represents the impact report of Water, Wastewater & Solid Waste Management Projects completed status of the world bank, out of which one project got completed in Financial year 2018. The results show a positive impact of the project on the climate. Untreated Wastewater was stopped flowing into the rivers which is equalivalent to 4,800,000 Tons in China. Further in Brazil twentyeight Waste Dumps & Morocco Closed or Rehabiliated making a positive change on the environment.

Table 7(B)

Wastewater , Water and Solid Waste Management Projects (Completed 1 In Fy18)

In Tunisia, Dominican Republic, and Indonesia 442,650 Hectares of land has been Rehabilited or restored for irrigation services.	In china Untreated Wastewater totalling 4,800,000 Tons has been stopped from flowing in rivers	In Brazil and Morocco twenty eight has been shut down or Rehabiliated

Source: World Bank,2018

Table 7(C) represents the impact report of Agriculture, Landuse, Forests, Ecological Resources, Resilient Infrastructure & Built Environment Projects completion status of the world bank in Financial year 2018. The results show a positive impact of the project on the climate. **774,600** Hectares of Forest has been Restored or Reforested In China & Mexico and **6,600,000** People had benefited From Flood Protection In China

Table 7(C)

Agriculture, Landuse, Forests, Ecological Resources, Resilient Infrastructure & Built Environment Projects Completed

In Mexico and China 774,600 Hectares of Forest has been Restored	**In Mexico 6,000,000** Tons Of Co_2 Emissions has been Reduced because of Reforestation	Equals To	Preventing pollution from More than 1.2 Million Cars off The Road For complete One Year
In China 6,600,000 People has been Benefited due to protection from Floods	In Serbia and Macedonia there has been **15%** Increase In Insurance Coverage due to some Catastrophe		

Source: World Bank,2018

Table 7(D) represents the impact report of Clean Transportation Projects Completed(1 In Fy18) of the world bank, in Financial year 2018. The results show a positive impact of the project on the climate as a Fleet Of
52,000 Bicycles Implemented both In Xi'an, China. Additional **60,000** People have Access To Quality Urban Transport Services in Xinjiang, China.

Table 7(D)
Clean Transportation Projects Completed(1 In Fy18)

There has been decrese in 25% travel Time For four Million passengers travelling by Public Transport.	+	Trend of using Bicycles by implementing **52,000** Bicycles On the road	In china and Xi'an.
40% Increase in trips of Annual Passengers	+	**60,000** People has been provided access To good Urban Transport facility	In China and Xinjiang

Source: World Bank, 2018

5.3 Post issuance reporting system of the world countries

Table 8 presents the status of reporting scenario of the developed markets. The countries like Japan, UK, boast of 100% reporting where as Italy and Spain at 99%, Germany at 94%, France at 92%, and Sweden at 90%. Most of the countries lie in 90-100% bracket. It is surprising that the countries having issue of USD1 bn have below 90% reporting that includes USA (71%), Canada (77%), and Netherlands (69%) as on 31 June, 2018.

Table 8
Reporting scenario of developed markets

Country	Reporting %
Japan	100
UK	100
Sweden	90
France	92
Germany	94
Italy and Spain	99
USA	71
Canada	77
Netherlands	69

Source: Climate Bond Initiative

Table 9 presents reporting status of small markets. South Africa, Malaysia, Vietnam, Estonia, Belgium, Slovenia, Ireland have not reported as yet. Green bond market is less than USD 1bn for almost all such countries which have poor reporting levels. Outstanding in them is South Africa: none of the three bonds (USD860m) have reporting in place as on 31 June, 2018.

Table 9
Reporting status of Minor markets

Country	Reporting % (by amount)	Non-reporting amount (USDbn)	Non-reporting bonds
South Africa	0	0.861	All
Malaysia	0	0.291	All
Vietnam	0	0.031	All
Estonia	0	0.061	All
Belgium	0	0.051	All
Slovenia	0	0.011	All
Ireland	0	0.011	All
Colombia	35	0.221	2 out of 3
Switzerland	41	0.081	1 out of 2
Argentina	49	0.081	1 out of 2

Source: Climate Bond Initiative

5.4 Analysis of impact reporting

5.4.1. Energy: With reference to Energy sector metrics presented in table 10A, it depicts reductions in greenhouse gases equivalent to 375 tonnes of CO_2 as the biggest category of metrics in power sector, at the same time the second segment concerns with measuring

additional generation capacity as an outcome of funding of green bond equivalent to 280 MWh/GWh.

The amount of energy reduced or avoided or a sum of the two is known as energy savings, which is one of the most frequently reported data by the issuers. The other two aspects of energy sector are generation of electricity and a reduction in environmental air pollutants, which too make a part of the impact metrics. While electricity generation metrics are similar to energy generation category, air pollutants are indicated through air quality indices, such as "PM 10 or 2.5" for particulate pollutant, "NOX", "NO2", "SO2", "TCE", "dust" and "ash" are included. Reduction in particulate pollution usually is concerned with replacing energy from fossil-fuel to renewable sources.

Table 10A

Energy Sector Metrics		
Generation capacity installed	280	MWh/GWh
Energy generated	173	MWh/GWh
Energy saving	206	MWh/GWh
Electricity generation	132	MWh/GWh
Pollutants	35	particulate matter (PM)
GHG reduction	375	tonnes of CO_2e

Source: Climate Bond Initiative

Transport

Table 10B represents transport metrics wherein the GHG emission reductions visibly dominates the impact reporting pattern which is equivalent to 184 CO_2e p.a. Metrics associated with energy savings figure at second place in the list. Talking about the top five categories specific to transport, the measuring parameters are number of mass transport vehicles purchased using green bond funds and thus bringing down the road the number of personal vehicles. It also includes extension of rail lines supported by green bond funding. To highlight, Republic of Poland, the first to issue green bonds, put forward figures on the length (in kilometres) of railway improved and the count of up gradation in crossings of railroads. The IFI Harmonized Framework has rightly included air quality indicator as a core reporting parameter for assessing green financed transportation projects switching usage of personal vehicles consuming fossil fuel engines to vehicles with greener options such as battery operated vehicles and/or public transport options. In the context of low-carbon transport projects the relevant metric is the generation of electricity about which the North Rhine-Westphalia (Germany) set an example by using its green bond proceeds in constructing a solar PV carport structure that includes 10 parking lots, 4 charging stations that generate 34 MWh of power each year.

Table 10B

Transport Sector Metrics		
GHG reduction	184	tCO_2e p.a

Energy saving	30	MWh/GWh
Air Quality	22	Decrease in air pollutants includes: sulphur oxides (SOx), particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NOx), and non-methane volatile organic compounds (NMVOCs)
Length of Rail Tracks	8	Passenger-kilometres in new means of transportation
Number of buses or trains	11	Purchased by the funds generated from green bond that resulted in decrease in the number of vehicles on road.
Electricity generation	3	MWh/GWh

Source: Climate Bond Initiative

5.4.3 Buildings

Table 10C refers to building metrics. The dominating metrics of low-carbon buildings is reduction in GHG emission, stiffly competed by energy savings. Building sector includes how the dry waste and material of the buildings could be recycled, the technique used to save water

Table 10C

Building Sector Metrics		
GHG reduction	279	tonnes of CO_2e
Energy saving	245	MWh/GWh
Waste & Materials recycled	23	m^3/a
Water saving	33	m^3/a
Energy intensity	33	MWh/GWh

Source: Climate Bond Initiative

5.4.4 Water: Water metrics, table 10D, reflects indicators that impact in the water sector which concerns with Quality of water resources and also their treatment and management. The basic parameters of water quality being pollutant reductions for example “suspended solid (SS)”, “pollutant”, “COD”, “BOD”, “TOC” and “TOD”, also including chemicals which have to be taken into account to monitor quality of water, such as phosphates and ammonia.

Next in the list is the volume of treated water in or population equivalent (PE), population equivalent is the most frequently used category captured. Harbin and SPD Bank in China assess this on actual numbers.

Some of them have used time-period to measure the same as in case of Beijing Enterprises and National Bank of Abu Dhabi. Water Group has measured water treated on a daily basis while MuniFin has done so on an annual basis. The other two measurement groupings are energy conservation and sewage capacity, wherein the volume of sludge treated and on few occasions the length of new sewage built are included. When the water treatment facilities

themselves are more energy-efficient then it as an indicator of energy saving . Nordic Investment Bank (NIB) used measure of anaerobic digestion as measure of energy recovered from wastewater.

Table 10D

Water Sector metrics		
Pollutants reduction	132	particulate matter (PM)
Water treatment	130	m^3/a
Energy saving	14	MWh/GWh
Water management	102	m^3/a
Water treatment (2) – sewage capacity	5	m^3/a

Source: Climate Bond Initiative

5.4.5 Waste

Waste metrics (table 10E), is all about bonds issued for financing the waste management sector projects like reduction in water pollutants, energy production, GHG emissions and reduction of waste. This category of waste processing consists of numerous kinds of metrics wherein the issuers'' impact reports focus mainly on improved efficiency of waste processing.

Since decomposition of waste is the rich source of methane emissions, it is rightly included in the GHG category being a highly dominant greenhouse gas. This gas is mostly associated with the waste dumping process. However, paradoxically California Pollution Control Finance Authority covered methane as a separate indicator only in one of its report.

While we talk about reporting waste-to-energy facilities, we find that the focus is on waste reduction rather than improved waste processing because it is only the reduction that would help environment by reducing the generation of methane gas.

In some of the cases the industrial waste processing was also carried out with the sale proceeds of such bonds. As an example, it was applied on the Brazilian pulp and paper company Suzano Papele Celulose and the project was treated under "water pollutants" category and the metrics used measure liquid oxygen or chemical used and the quantity of pollutant treated.

Table 10E

Waste Sector Metrics		
Energy production	17	MWh/GWh
Water Pollutants	3	m^3/a
Waste reduction	3	m^3/a
Waste processing	103	m^3/a
GHG reduction	33	tonnes of CO_2e

Source: Climate Bond Initiative

5.4.6 Industry

Table 10F represents industry metrics most part of which is related to energy saving. It is so because industry projects financed by green bonds focus on greenhouse gases, air pollution and water. Herein the energy savings are included in annual or absolute terms.

Power generation metrics are scarcely traced in such reports. Kalbin, a Brazilian paper company is one of those rare examples who revealed the figures of improved generation of power in one of their facilities which metric is not covered in energy conserving reports.
The other three categories connected are gaseous pollutants, water savings and water quality. Air pollutants included NOX, SO_2 and particulate matter (PM) in general. Water conserved was reported in actual volume. The water constitution metrics found in the statement covered a generic term for "water quality" as well as the industrial solvent TCE.

Table 10F

Industry Sector Metrics		
GHG reduction	92	tonnes of CO_2e
Gaseous Pollutants	3	particulate matter (PM)
Energy saving	94	MWh/GWh
Water saving	3	m^3/a
Water quality	85	m^3/a

Source: Climate Bond Initiative

5.4.7 Agriculture, land use and forestry

Out of the three main categories of agriculture, land use and forestry sectors, forestry sector projects are the first most important and dominating sector that covered protected or restored areas. 'New Green Spaces' is a fresh metrics introduced by the City of Paris in impact reporting. New green spaces are a mechanism devised to curb the heat island effect in urban areas by modifying the iconography of cities whereby tree grooves are organised in selected localities, known a green patch in common language.
World Bank also used in its impact reporting qualitative improvements in productivity of crop and pliable outcomes which are quantified by the dimension of rebuilt irrigation in areas affected by disaster. This is also a new kind of metrics. All such protected or restored areas are measured in hectares or percentages interchangeably.
Another category is CO_2 impact metrics which largely concerns issuers in the agriculture, land use and forestry sectors. The second in list is the metrics of water saving which is expressed in the units of m^3/a tonnes/day or gallons.

However, the World Bank used an extra metric which expressed water quality with reference to reduction of pollution diminishing nutrient load (in tonnes/year) of waterways. This came out as result of project on domestic animal and crop related waste management in China.
Another main indicator relate to avoidance of emissions through seclusion and carbon capturing process. Segregation pertains to forestry where the carbon sinks with the help of active resources.

Table 10G

Agriculture/land use/Forestry Sector Metrics		
Area protected/restored	91	(m^2 or km^2)
CO_2 sequestered/captured	7	tonnes of CO_2e
CO_2 emissions avoided	13	tonnes of CO_2 e
Water saving	16	m^3/a

Source: Climate Bond Initiative

5.4.8 Adaptation

Banks like IFC, World Bank, Harbin Bank, Bank of Luoyang in China have raised funds for adaptation and resilience projects through Climate Bonds. This in turn has mustered an expert group on Adaptation and Resilience to have a deep insight and to develop good practice across all sectors.

Restoration and rehabilitation metrics found in this area of interest relate largely to post-disaster. Protection from flood is one of the crucial areas of concern. CO_2 emission avoided metrics are expected to be more prevalent as investment. According to a Dominican Republic World Bank project report 95 miles of power lines to "disaster-resistant" standards were restored while 252MW of damaged hydropower facilities were also rebuilt as a part of the same project.

While generally flood protected areas were as matter of practice measured in hectares, Bank of Luoyang unveiled a metric illustrating slowing down of flow rate as a positive outcome of putting up a barrage.

IFC has homogenised the measurable pointers for its investment classification, Mozambique set an benchmark of an adaptation project involving renewable energy offering dual mitigation-adaptation benefits.

Table 10H

Adoption Sector Metrics		
Restoration	83	(m^2 or km^2)
Area protected (from floods)	81	(m^2 or km^2)
CO_2 emissions avoided	9	tonnes of CO_2e

Source: Climate Bond Initiative

6. DISCUSSION

There has been an increasing trend in the issuance in the green bonds. In 2016, USD87.2bn of labelled green bonds was issued which increased to USD 155.5 bn in 2017. In 2018 it further

increased to USD 409bn. Moving towards the sector wise investment, Renewable energy is at the top having 40% in 2018 followed by sustainable buildings and efficiency of energy with 24% investment. Green transport contribution is at 15%, Sustainable Water Management (11%), Sustainable Waste Management (4%), Sustainable Land Use and forestry (3%) and Adaption to Climate change (3%).

Since 2008, The World Bank has issued USD 13 Billion Equivalent Green Bonds through 150 Transactions in 20 Currencies. It has 91 eligible World BANK projects , 5 additional projects for green bond financing and completed a total of 30 projects in FY18. The results show a positive impact of the project on the climate due to the adoption of green bonds ventures taken by the world bank with world countries. The result predicts that there is positive impact of these projects on the sustainable development. Use of Renewable Capacity From Solar, Wind And Hydro Technologies has been used that decreases Co_2 Emission and thus significantly impacting the environment.

Reporting levels of 90% or higher have been seen in the countries which have huge green bond markets. The green bond has been issued by many countries. Out of those, eleven countries have issued only one bond that includes Chile and Lithuania. They have binary reporting on 0% or 100%. The countries like Japan, UK, boast of 100% reporting whereas Italy and Spain at 99%, Germany at 94%, France at 92%, Sweden at 90%. Most of the countries lie in 90-100% bracket. It is surprising that the countries having issue of USD1 bn have below 90% that includes India (63%), Netherlands (69%), USA (71%) and Canada (77%).

7. CONCLUSION

It is important to manage climate risks. For this use of green bonds having low-carbon emission plans is a must that focus on both on mitigation and adaptation part of the same. Also only then these instruments can be rated an effective tool (Michael, 2016; Sophie, 2017). It is also important to assess issuer's responsibility on the strategic plans to protect the investments against climate risks as well ensure to meet the targeted results in an ever changing scenario where global policies and consumer demands always stand the risk of shifts and hence may adversely affect their business in terms of profit and assets.

However, we need to work on developing tools for harmonization and comparative study of data for navigating climate risks. As a principle, the investments are required to suit the Sustainable Development Goals and Paris Agreement with risks duly assessed, which is the core of business management. As predicted by IPCC in their report of 2018, there is a very limited amount of time left for us to deal with global warming and its serious consequences (Bloomberg, 2016).

There could be many questions relating to effectiveness of green bonds with respect to managing climate risks. Apart from financial risk, there could be lapses in funding the low-carbon transition plans, leaving unattended some more vulnerable areas to climatic threats. If we take the case of rising sea levels then a large part of South-east Asia is deemed a high risk area and hence unsafe to invest as such safety risks can not be insured. This would mean leaving the areas to its fate without making an effort to improve the conditions. While we

ready to invest trillions to reduce tonnes of Co_2 emissions, we fail to invest in new businesses. The question is 'is it worth the cost'? If we install wind farms how do we ensure that these wind mills do not run the risk of inclement weather conditions. We already have had examples of enervated solar parks in the US which could not withstand the rough and gushing winds. This poses another question mark on the authenticity of theses transitions efforts. Do such installations further need protective measures such as storm and flood management. In other words what exactly can be done to deal with unexpected and extreme weather conditions? Further, what if we have to deal with 4 degree Celsius rise v/s 2 degree rise? So the green bond market has to be extended beyond expected impacts and financially associated activities [14]

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