Green Bonds

Green Machine – Global Green Bonds Primer

Thematic Investing

Bank of America Merrill Lynch

Equity | 12 December 2017

A Transforming World: Green Bonds

As part of our work on A Transforming World, we update our ongoing work on the earth-, innovation- and markets-focused theme of Green Bonds with this equity/credit Primer, setting out the challenges and opportunities ahead.

Climate change: #1 global risk & the new great cause

As detailed in our climate change primer, extreme weather is the #1 global risk today, with environmental challenges acting as the ultimate risk multiplier. The 16 warmest years on record have occurred in the 21st century and 2017 is on track to be the 41st consecutive year where global temperatures are above the 20th century average. Extreme weather also now covers 10-12% of the globe as opposed to 0.2% during 1951-1980. In order to maintain a 2°C (3.6°F) warming trajectory, seen as the threshold of avoiding catastrophic climate change, carbon emissions must peak in three years and rapidly fall by 50% by 2050. Green technologies such as renewables, energy efficiency, electric vehicles, battery storage, and big data-enabled analytics have the potential to deliver climate mitigation impact.

$700bn-1.4tn pa investment gap – Green Bonds are a tool

The investment gap to reach the 2°C trajectory is around US$16tn through 2040E including US$9tn for low-carbon power and US$7tn for end-use efficiency. This translates to US$700bn pa, and is around US$1.4tn higher than current annual levels of investment. We see Green Bonds, fixed income instruments where proceeds are earmarked for environmental solutions, as critical tools for mobilising private capital for solving environmental challenges. Celebrating their 10Y anniversary in 2017, green bonds have matured to become an asset class in their own right, providing investors with opportunities for de-risking, scale and liquidity for climate finance.

$110-120bn issuance in 2017, 5th consecutive record year

Over US$106bn of green bonds were issued in the first 10 months of 2017, annualising to US$110bn-120bn for the year. The size of the outstanding market is crossing the US$300bn threshold, with the universe now comprising 550+ issuers, from 45 countries, in 29 currencies. Issuers range from national governments, to supranational agencies, banks, real estate, tech giants, energy conglomerates and automakers, to pure play cleantech companies. The market continues to diversify with 135 new issuers coming to the market, including 13 new countries. Green bond developments from ratings agencies, exchanges, benchmark indices, and ETFs are also harmonising standards while pushing for greater transparency.

Up to $160bn in 2018 issuance and a $1tn LT opportunity

We project US$110-135bn of issuance in 2018E as a base-case scenario, assuming moderate growth for corporates, governments, and EMs. This rises to US$135-160bn in a bull-case scenario which assumes significant developments from emerging areas such as sovereigns, municipal "green city" bonds, and green asset-backed securities, as well as resumed growth from major players such as China. To meet the 2°C trajectory, green bonds have the potential to reach US$1tn of annual issuance by 2020E, playing a major role in boosting countries' national commitments to tackle climate change.

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Refer to important disclosures on page 82 to 84.

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TransformingWorld
Thematic Research

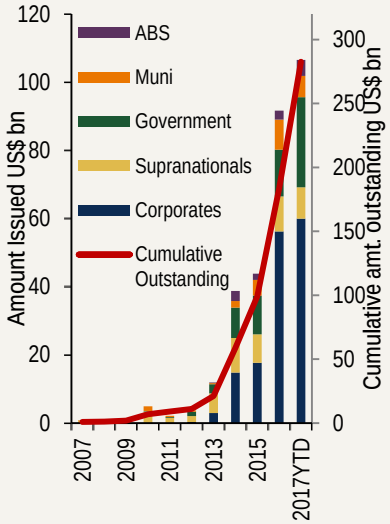
Global
Thematic Investing

Beijia Ma, CFA >>
Equity Strategist
MLI (UK)
+44 20 7996 9070
beijia.ma@baml.com

Sarbjit Nahal >>
Equity Strategist
MLI (UK)
+44 20 7996 8031
sarbjit.nahal@baml.com

Felix Tran >>
Equity Strategist
MLI (UK)
+44 20 7996 7010
felix.tran@baml.com

Chart 1: Corporates leading growth in "Use of Proceeds" green bonds YTD (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

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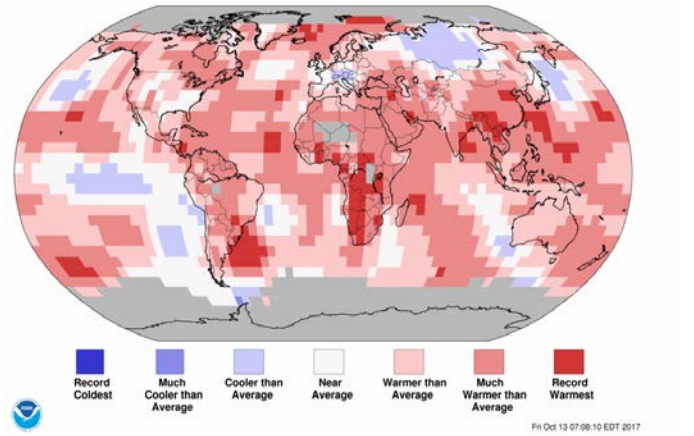
Green Bonds for an energy-resilient future

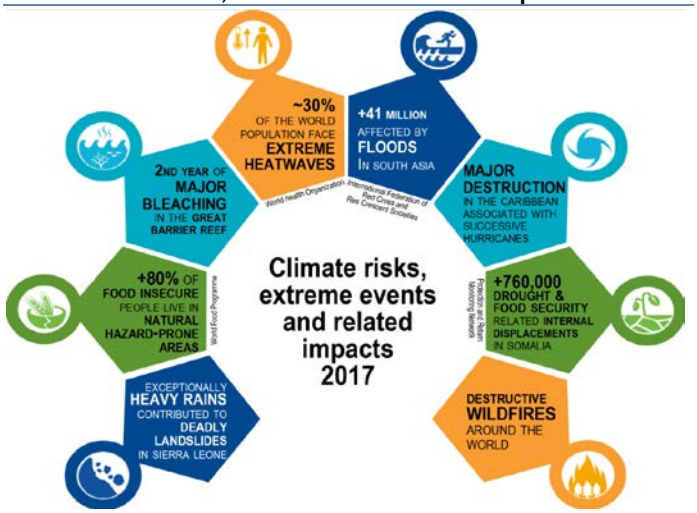
Climate change and extreme weather are becoming the new normal. Extreme weather is the #1 global risk today, with climate change acting as the ultimate risk multiplier. The 16 warmest years on record have occurred in the 21st century and 2017 is on track to be the 41st consecutive year where global temperatures are above 20th century average. Extreme weather is also rising, and now covers 10-12% of the globe at any one given point. In order to maintain a 2°C (3.6°F) warming trajectory, seen as the threshold of avoiding catastrophic climate change, carbon emissions must peak in 3 years and rapidly fall by 50% by 2050. Green technologies such as renewables, energy efficiency, electric vehicles, battery storage, and big data-enabled analytics have the potential to deliver climate mitigation impact.

Exhibit 1: Land & ocean temperature percentiles as at September 2017



Source: NOAA 2017

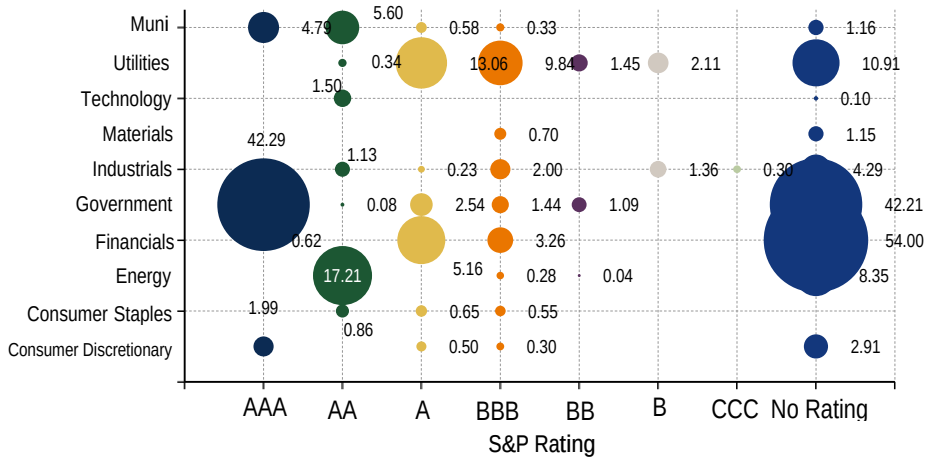
Exhibit 2: Climate risks, extreme events and related impacts in 2017



Source: World Meteorological Organization 2017

Globally, we are facing a US$700bn-1.4tn/year investment gap, and Green Bonds are a tool to facilitate financing. The investment gap to reach the 2°C trajectory versus countries' new policies is around US$16tn through 2040, with a US$9tn gap for low-carbon power and US$7tn for end-use efficiency. This translates to a US$700bn p.a., and is around US$1.4tn higher than the current average annual levels of investment 2010-2016 (Source: IEA World Energy Outlook 2017). Green Bonds, fixed income instruments where proceeds are earmarked for environmental solutions, are key to mobilizing private capital for environmental needs. They provide derisking, scale and liquidity for climate finance in both developed and emerging economies. Green Bonds have the potential to scale to US$1tn of annual issuance by 2020, boosting progress on national climate commitments and catalysing change (Source: Figueres et al 2017)

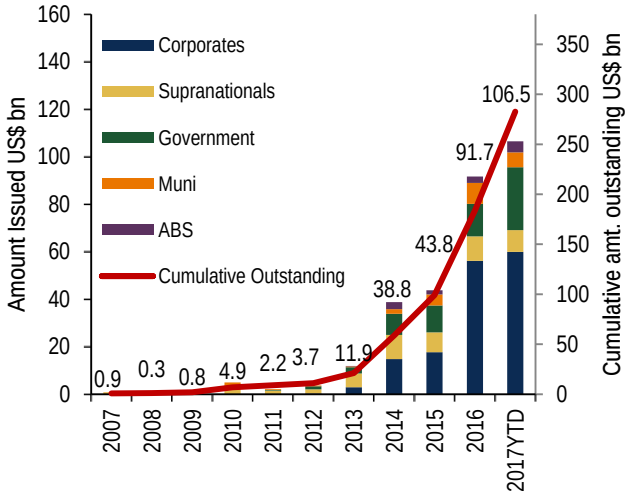
Chart 2: Green Bond Universe by sector and rating, outstanding issues (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings

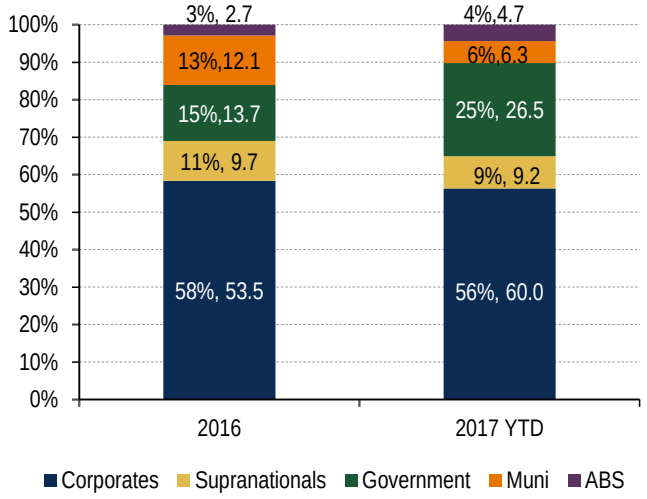
2017 is the 5th consecutive year of record green bond issuance with a projected US$110bn-120bn of new bonds for the year, bringing the size of the outstanding market close to US$300bn. Over US$106bn of green bonds were issued in the first 10 months of the year. The universe now comprises 550+ issuers, from 45 countries, in 29 currencies. Issuers range from supranational agencies, banks, real estate, tech giants, energy conglomerates and automakers, to pure play cleantech companies. The market continues to diversify with 135 new issuers coming to the market, including 13 new countries. Green bond developments from ratings agencies, exchanges, benchmark indices, and ETFs are harmonizing standards while pushing for greater transparency.

Chart 3: Corporates leading growth in "Use of Proceeds" green bonds YTD (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Chart 4: Issuance by issuer type, 2016 and 2017 YTD (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

We believe that green bond issuance could reach up to US$160bn in 2018 in a bull-case scenario. This assumes significant growth from emerging areas such as sovereign green bonds, green municipal bonds and green ABS, all of which can rise by 10-25%. This also assumes China resumes a growth trajectory versus remaining flat in 2017. We project US$110-135bn of issuance as a base case scenario, assuming more moderate growth for each of the issuer classes. To meet the 2°C trajectory, green bonds have the potential to reach US$1tn of annual issuance by 2020, playing a major role in boosting countries' national commitments in climate change

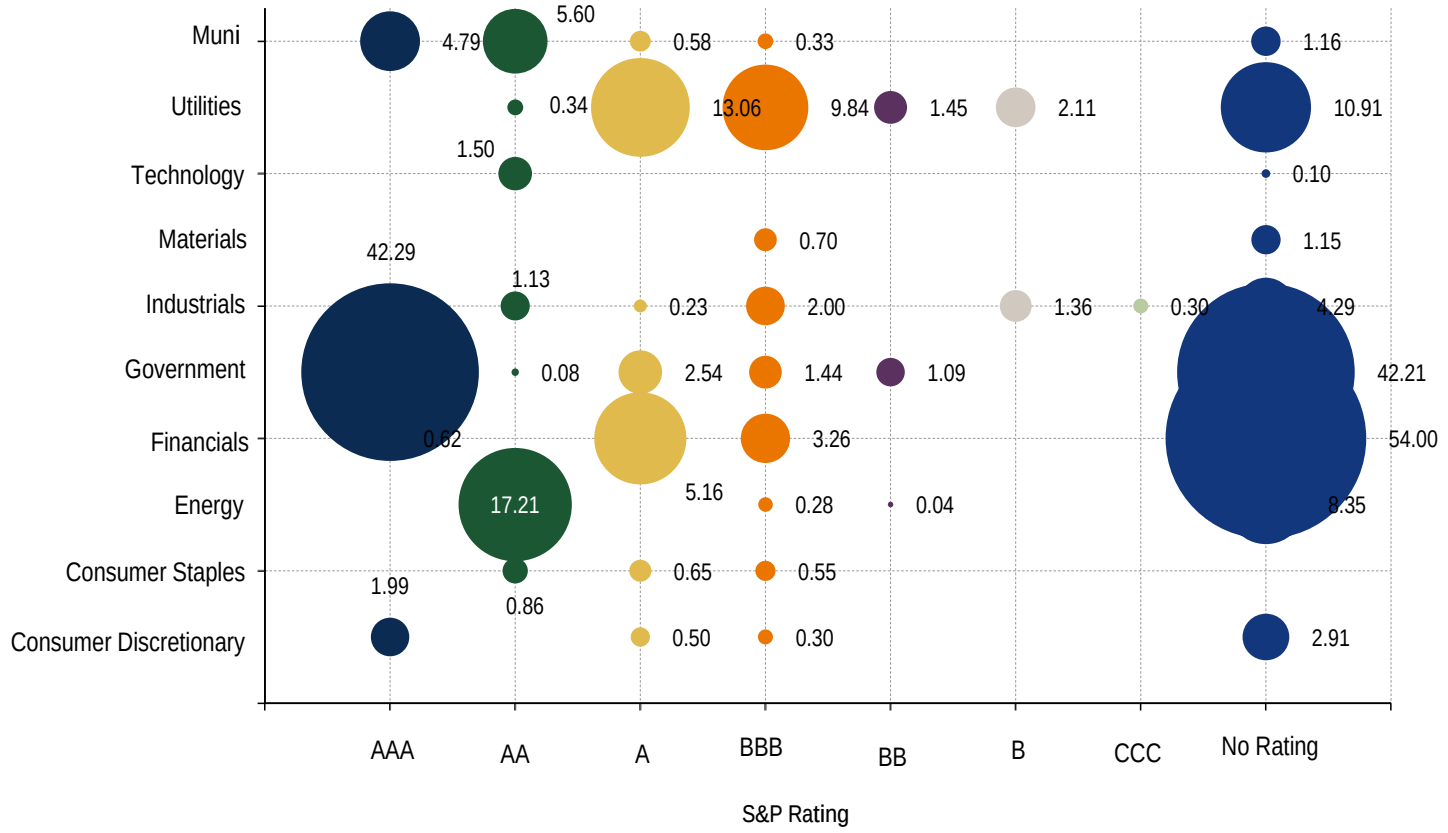
Current state of Green Bonds

2017 was the 5th consecutive record year of Green Bond issuance. The Green Bond market stands at US$282.5bn as of October 31 2017, augmented by cUS$106.5bn of issuance YTD. The universe is now comprised of 550+ issuers, from 45 countries, in 29 currencies. A wide range of issuers tapped the Green Bond market in the last 12 months, including national governments, mortgage providers, energy conglomerates, banks, airports, and real estate companies. We project US$110-135bn of issuance in 2018 as a base-case scenario, rising to US$135-160bn in a bull-case scenario.

Celebrating its 10Y anniversary in 2017, green bonds have matured to be an asset class in its own right, providing de-risking, scale and liquidity for climate finance. Green bond developments from ratings agencies, exchanges, benchmark indices, and ETFs are helping to harmonizing standards while pushing for greater transparency as the market grows.

In the long run, Green Bonds help drive the reallocation of financial resources to meet climate goals, rather than funding as pure philanthropy. As such, Green Bonds have the potential to reach US$1tn of annual issuance by 2020, and could have profound impact on steering the trajectory of the world.

Chart 5: Green Bond Universe by sector and rating, outstanding issues (through October 31 2017)



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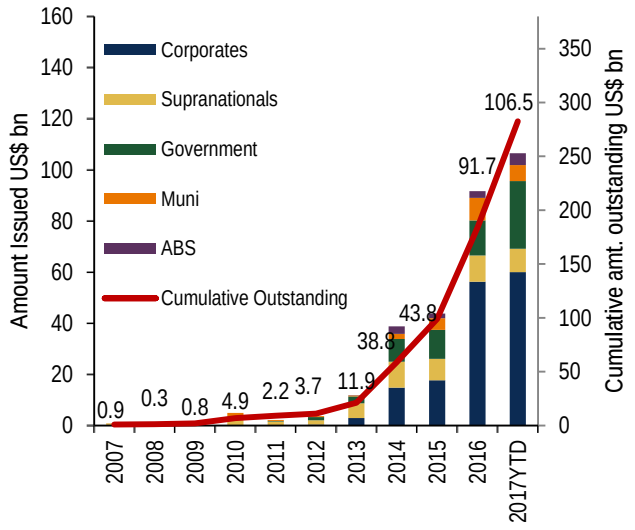
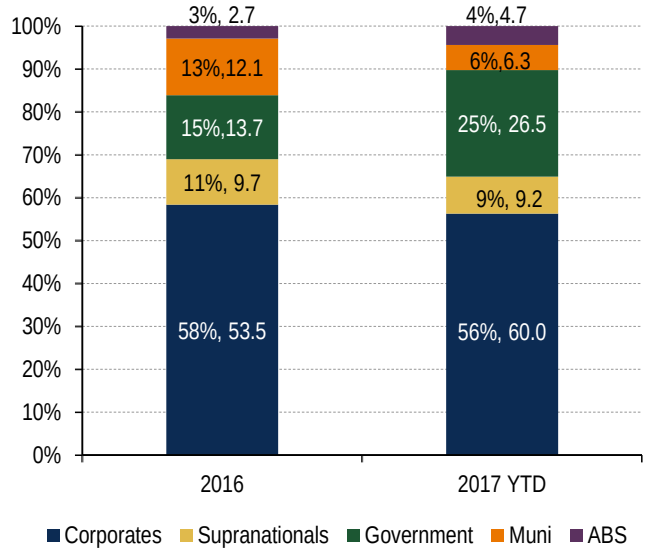


Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Chart 7: Issuance by issuer type, 2016 and 2017 YTD (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

On track for US$110bn-120bn in 2017, crossing the US$300bn threshold

The size of the green bond market now stands at US$282.5.bn, having broken the US$200bn earlier in 2017. To date, over US$305.3bn of green bonds have been issued. At this rate, we are likely to see US$110-120bn of total issuance in 2017, or +5-25% YoY.

Table 1: Top 20 issuers (through October 31 2017)

Issuer	US$ mn
European Investment Bank	22,810
KFW	14,473
International Bank for Reconstruction & Development	9,997
French Republic Government Bond OAT	7,558
Bank of Communications Co Ltd	7,370
International Finance Corp	6,843
Iberdrola International BV	6,241
Mexico City Airport Trust	6,000
Electricite de France SA	5,311
Shanghai Pudong Development Bank Co Ltd	5,280
TenneT Holding BV	4,982
China Industrial Bank Co Ltd	4,913
Toyota	4,600
Asian Development Bank	4,428
Nordic Investment Bank	3,874
Bank of China Ltd	3,531
GDF Suez	3,427
New York Metropolitan Transportation Authority	3,352
Nederlandse Waterschapsbank NV	3,290
Engie SA	3,103
Other	173,986
Total	305,370

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.
*Highlights indicate a new issuer since Jan 1 2017

Table 2: Top 20 issuers 2017 YTD (through October 31 2017)

Issuer	US$ mn
French Republic Government Bond OAT	7,558
European Investment Bank	4,302
KFW	4,192
Mexico City Airport Trust	4,000
Engie SA	3,103
Bank of Communications Co Ltd	3,015
China Development Bank	2,852
Iberdrola International BV	2,482
TenneT Holding BV	2,185
Bank of Beijing Co Ltd	2,181
Industrial & Commercial Bank of China Ltd/Luxembourg	2,151
New York Metropolitan Transportation Authority	1,981
SNCF Reseau	1,940
International Finance Corp	1,567
China Three Gorges Corp	1,545
Fannie Mae-Aces	1,485
Asian Development Bank	1,407
Enel Finance International NV	1,325
Berlin Hyp AG	1,149
Chongqing Longhu Development Co Ltd	1,030
All other issues in 2017	55,056
Total	106,505

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.
*Highlights indicate a new issuer since Jan 1 2017

135 new issuers: national governments make a splash

There were 135 new issuers that entered the market in 2017 through October, which compares to 125 new issuers in 2016. This includes 13 new countries and regions – Argentina, Switzerland, Luxembourg, Mauritius, Chile, Greece, Hong Kong, Lithuania, Malaysia, Singapore, Slovenia, Taiwan, UAE. The largest note came from the

government of France, which issued a 22-year EUR7bn bond, the single largest in the history of Green Bonds.

Table 3: Top 10 new issuers 2017 YTD

Issuer	US$ mn	Type of Issuer	Country	Currency
French Republic Government Bond OAT	7,558	Government	France	EUR
Engie SA	3,103	Corporate	France	EUR
China Development Bank	2,852	Government	China	CNY
Bank of Beijing Co Ltd	2,181	Corporate	China	CNY
Fannie Mae-Aces	1,485	Mtge	United States	USD
Enel Finance International NV	1,325	Corp	Netherlands	EUR
Chongqing Longhu Development Co Ltd	1,030	Corp	China	CNY
Banco Nacional de Desenvolvimento Economico e Social	1,000	Govt	Brazil	USD
Greenko Dutch BV	1,000	Corp	Netherlands	USD
Senvion Holding GmbH	880	Corp	Germany	EUR
Other	8,277			
Total	30,691			

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Table 4: New countries entering the Green Bond market in 2017

Issuer	Currency	Amount Issued USDmn	Issue Date	Country	Maturity date
Provincia de la Rioja	USD	400	24-Feb-17	Argentina	24-Feb-25
Province of Jujuy Argentina	USD	210	20-Sep-17	Argentina	20-Sep-22
Inversiones CMPC SA	USD	500	04-Apr-17	Chile	04-Apr-27
Terna Energy Finance SA	EUR	70	21-Jul-17	Greece	21-Jul-22
MTR Corp Ltd	HKD	43	27-Jul-17	Hong Kong	17-Jul-47
MTR Corp Ltd	USD	100	27-Sep-17	Hong Kong	27-Sep-47
Lietuvos Energija UAB	EUR	344	14-Jul-17	Lithuania	14-Jul-27
Alpha Trains	EUR	268	17-Jan-17	Luxembourg	17-Jan-36
Klabin Finance SA	USD	500	19-Sep-17	Luxembourg	19-Sep-27
Tadau Energy Sdn Bhd	MYR	58	27-Jul-17	Malaysia	Jul 19-33
Quantum Solar Park Semenanjung Sdn Bhd	MYR	236	06-Oct-17	Malaysia	Apr 19-35
Neerg Energy Ltd	USD	475	13-Feb-17	Mauritius	13-Feb-22
Azure Power Energy Ltd	USD	500	03-Aug-17	Mauritius	03-Nov-22
CDL Properties Ltd	SGD	72	18-Apr-17	Singapore	18-Apr-19
DBS Group Holdings Ltd	USD	500	25-Jul-17	Singapore	25-Jul-22
Gen-I Sonce	EUR	15	02-Mar-17	Slovenia	02-Mar-24
RePower	EUR	54	23-Jan-17	Switzerland	13-Jan-25
Helvetia Environnement Groupe SA	CHF	79	26-Jul-17	Switzerland	26-Jul-22
E.SUN Commercial Bank Ltd	USD	60	19-May-17	Taiwan	19-May-47
Bank Sinopac	USD	45	19-May-17	Taiwan	19-May-47
CTBC Bank Co Ltd	TWD	33	19-May-17	Taiwan	19-May-20
KGI Bank	TWD	33	19-May-17	Taiwan	19-May-20
First Abu Dhabi Bank PJSC	USD	587	30-Mar-17	UAE	30-Mar-22

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Up to US$160bn in issuance in 2018 in bull case

We believe that green bond issuance could reach up to US$160bn in 2018 in a bull-case scenario. This assumes significant growth from emerging areas such as sovereign green bonds, green municipal bonds and green ABS, all of which can rise by 10-25%. This also assumes China resumes a growth trajectory versus remaining flat in 2017. We project US$110-135bn of issuance as a base case scenario, assuming more moderate growth for each of the issuer classes. In a bear-case scenario, we estimate issuance of US$95-110bn, which assumes that additional sovereign green bond issuance fail to materialize, and corporate and EM issuance growth is anemic.

Table 5: Issuance expectations for 2018

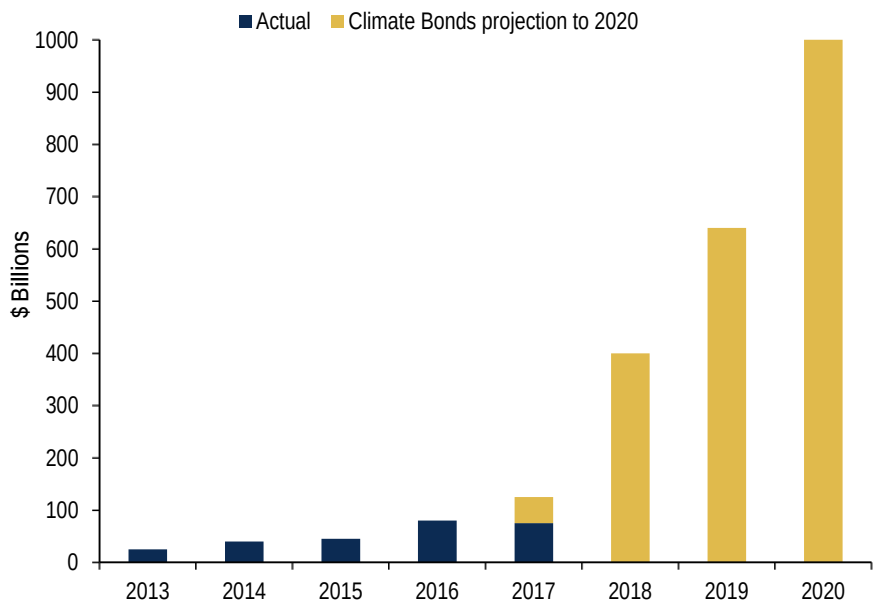
Scenario	Issuance (in US$)	Assumptions
Bull	$135-160bn	+10-25% for government issuance (new countries issue sovereign green bonds), +15-30% for corporate, +10-25% for munis and ABS ("smart city" bonds, etc), +15-30% for China (growth resumes)
Base	$110-135bn	+5-15% for Government issuance, +5-10% for corporate, +10-25% for munis and ABS, China maintains strength
Bear	$95-110bn	-40-50% for Government issuance (France sovereign bond was one-off), -5-15% for corporate issuance, China and other EMs fail to grow

Source: BofA Merrill Lynch Global Research estimates

US$1tn annual Green Bond opportunity

To meet the 2°C trajectory, some industry leaders believe annual green bond issuance would need to scale to US$1tn annually by 2020, or nearly 10X the current rate of issuance. Former UN Climate Chief Christina Figueres had made a list of six milestones for urgent action by 2020 in order to avoid more catastrophic climate change. Growing the green bonds market as a way to boost progress NDCs and implementing country-level climate plans was one of the key pillars (Source: Figueres et al 2017)

Chart 8: $1 trillion a year of green issuance by 2020 to meet 2°C trajectory

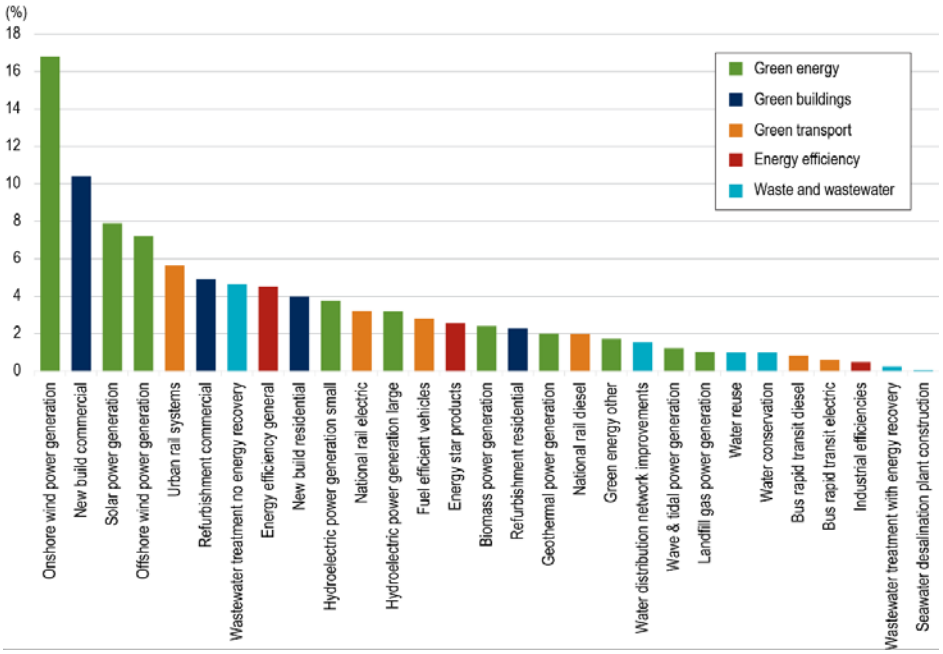


Source: Climate Bonds Initiative 2017

Renewables and buildings are largest use of proceeds

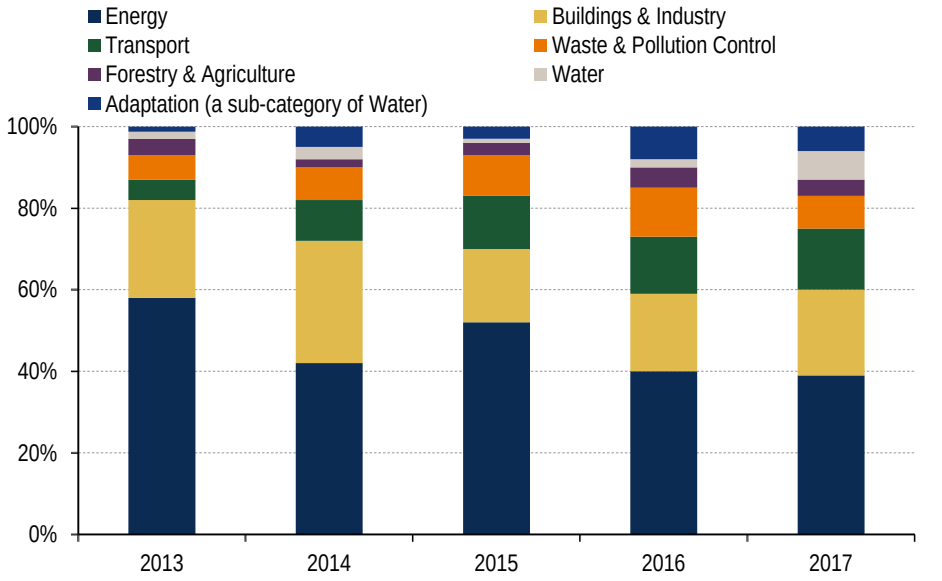
Looking at the latest breakdown of projects that green bonds are funding, renewable energy comprise nearly half (47%) of the total, followed by green buildings (22%), transport (9-15%) and water and waste (15%). (Source: S&P Global 2017, Climate Bonds Initiative 2017). The use of proceeds continues to diversify, where allocation to transport and water projects have seen the largest percentage increase versus previous years (Source: Climate Bonds Initiative 2017)

Exhibit 3: Breakdown of proceeds by technology (%)



Source: S&P

Chart 9: Green bonds use of proceeds - project types are diversifying

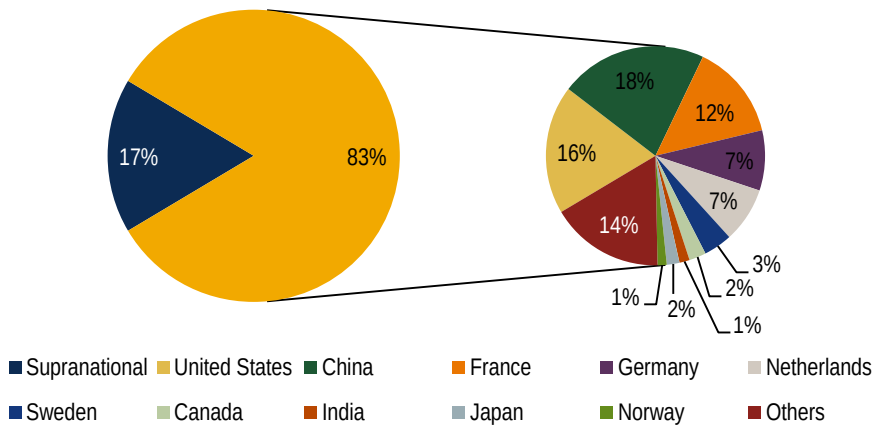


Source: Climate Bonds Initiative 2017

China remains #1 Green Bond issuer

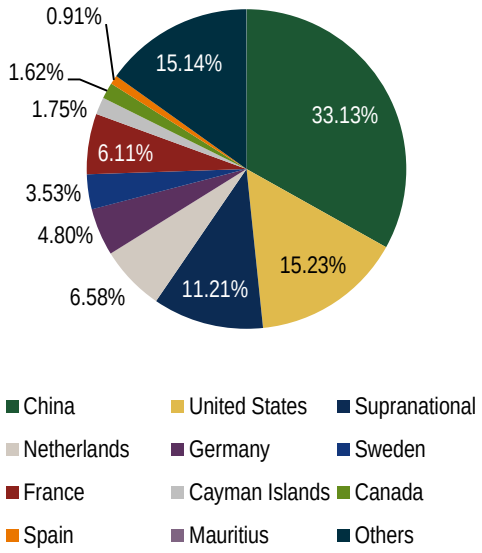
China continued to be the largest issuer of green bonds in the world in 2017. The country issued over US$23bn in green bonds in the first 10 months of year, or c22% of total issuance. Although this is lower than the US$30bn (33% of total) from 2016, green bond issuance activity maintains its momentum from last year.

Chart 10: Distribution of outstanding Green Bonds by country (through October 31 2017)



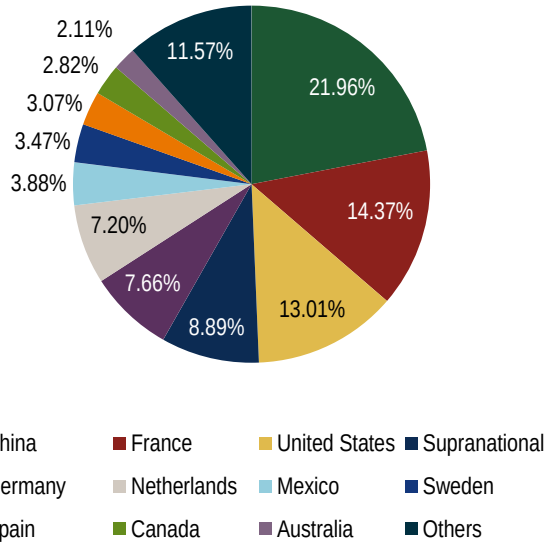
Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Chart 11: Distribution of Green Bonds by country FY 2016



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Chart 12: Distribution of Green Bonds by country YTD (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Financials make up bulk of issuance

Financial services companies continue to comprise the greatest percentage of issuance. 26% out of US$27.9 issuance in 2017 have been financials, and together they make up over US$38.9bn or 71% of total Chinese issuance to date.

Table 6: All bonds issued by China 2017 YTD (through October 31 2017)

Issuer	Currency	Sector	Amt. Issued US$ mn	Issue Date
Bank of Communications Co Ltd	CNY	Financials	3,015	Oct-17
China Development Bank	CNY	Government	2,852	Feb-17, May-17, Sep-17
Bank of Beijing Co Ltd	CNY	Financials	2,181	Apr-17
Industrial & Commercial Bank of China Ltd/Luxembourg	EUR	Financials	2,151	Oct-17
Chongqing Longhu Development Co Ltd	CNY	Financials	1,030	Feb-17, Mar-17
China Three Gorges Corp	CNY	Utilities	819	Jun-17, Aug-17
Wuhan Metro Group Co Ltd	CNY	Industrials	746	Jul-17, Aug-17
China Huadian Corp	CNY	Utilities	742	Jun-17, Jul-17, Aug-17
China Longyuan Power Group Corp Ltd	CNY	Utilities	737	May-17, Aug-17
Bank of Changsha Co Ltd	CNY	Financials	736	May-17, Jul-17

Table 6: All bonds issued by China 2017 YTD (through October 31 2017)

Issuer	Currency	Sector	Amt. Issued US$ mn	Issue Date
Bank of Nanjing Co Ltd	CNY	Financials	725	Apr-17
Harbin Bank Co Ltd	CNY	Financials	725	Apr-17, May-17
Leshan City Commercial Bank Co Ltd	CNY	Financials	600	Jun-17, Aug-17
Bank of Zhengzhou Co Ltd	CNY	Financials	462	Sep-17
Ping An Guiyang Public Transport Receivables Green Asset Backed Securities	CNY	Industrials	385	Mar-17
Guangzhou Development Group Inc	CNY	Energy	367	Sep-17
BAIC Motor Corp Ltd	CNY	Consumer Discretionary	338	Jul-17
Bank of Dongguan Co Ltd	CNY	Financials	306	Sep-17
Beijing Enterprises Water Group	CNY	Utilities	305	Apr-17
Pingxiang Huifeng Investment Co Ltd	CNY	Financials	305	Sep-17
Guangdong Huaxing Bank Co Ltd	CNY	Financials	301	Aug-17
China Huarong Financial Leasing Co Ltd	CNY	Financials	292	Feb-17
Shaanxi Xixian New Area Fengxi New City Development & Construction Group Co Ltd	CNY	Industrials	225	Aug-17
Danyang Investment Group Co Ltd	CNY	Financials	222	Jul-17
Kaifeng Development Investment Co Ltd	CNY	Financials	200	Sep-17
Hebei Financial Leasing Co Ltd	CNY	Financials	196	Jan-17, Aug-17, Oct-17
Huishang Bank Corp Ltd	CNY	Financials	154	Sep-17
CGN Wind Energy Ltd	CNY	Energy	152	Sep-17
Jiangsu Hongze Lake Shenzhou Tourism Development Co Ltd	CNY	Industrials	149	Aug-17
Qingdao Rural Commercial Bank Corp	CNY	Financials	149	Aug-17
Beijing Capital Co Ltd	CNY	Utilities	146	May-17
Bank of Luoyang Co Ltd	CNY	Financials	145	May-17
Jingjiang Binjiang Xincheng Investment Development Co Ltd	CNY	Industrials	144	Jul-17
Yiwu State-owned Assets Operation Co Ltd	CNY	Financials	118	Jul-17
Dongjiang Environmental Co Ltd	CNY	Industrials	87	Mar-17
Yunnan Water Investment Co Ltd	CNY	Utilities	81	Jun-17
Xuzhou Economic Technology Development Zone State Owned Asset Management Co Ltd	CNY	Financials	77	Sep-17
Wuhai Bank Co Ltd	CNY	Financials	73	Feb-17
Shanxi International Energy Group Co Ltd	CNY	Utilities	72	Oct-17
GCL New Energy	CNY	Energy	55	Aug-17
CECEP Wind-Power Corp	CNY	Energy	46	Sep-17
Guangdong Nanhai Rural Commercial Bank Co Ltd	CNY	Financials	45	Aug-17
Total			22,657	

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings Shading indicate new issuers in 2017

China green bond market is maturing: verification, indices

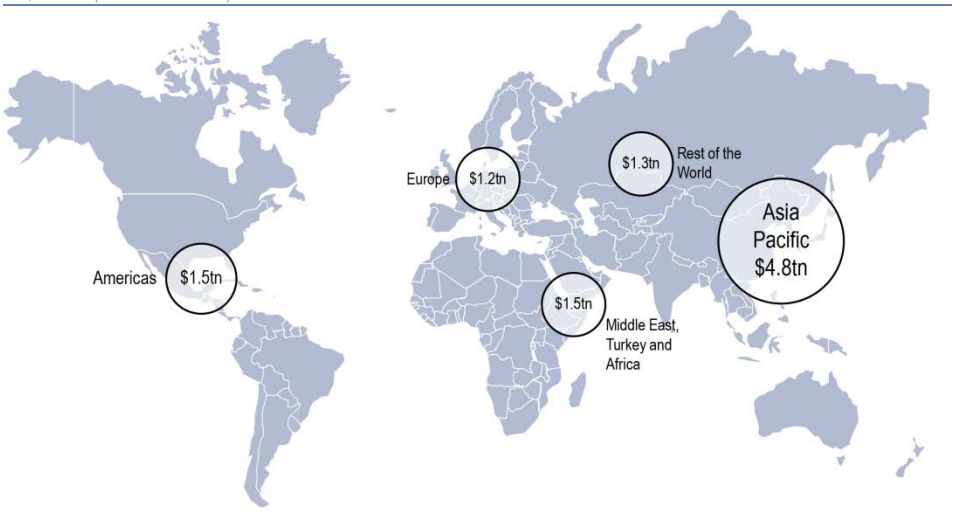
The Chinese green bond has also been maturing and gaining credibility, with 3rd party verification and ratings, as well as indices growing rapidly. Golden Credit Rating International developed China's first green bonds credit rating system that quantifies the impacts of the bond. There are numerous Chinese green bond indices including China Bond Green, Climate Aligned Bond Index, CUFE-CNI Green Bond Index Series, and The Shanghai Stock Exchange Green Bond Index. This has helps create investor benchmarks to help spur on additional growth (Source: UNEP 2017)

Looking East: Asia expected to drive future growth

Asia Pacific region is projected to account for the lion share of investment with China (US$2.8tn) and India (US$1.2tn) accounting for US$4tn of investment, or nearly half of the global total. This makes it a natural market for Green Bonds. China will have around 3/4 of spending going into renewables, while 2/3 of Indian investments will go into solar. (Source: Bloomberg New Energy Finance 2017). India has also shown strong growth, jumping 7% in 2016, cementing its position as the 3rd largest country in energy investments behind China and United States (Source: IEA 2017).

Exhibit 4: investment in new power generation by region (2017 – 2040)

US$ trillion (real 2016 dollars)



Source: Bloomberg New Energy Finance 2017

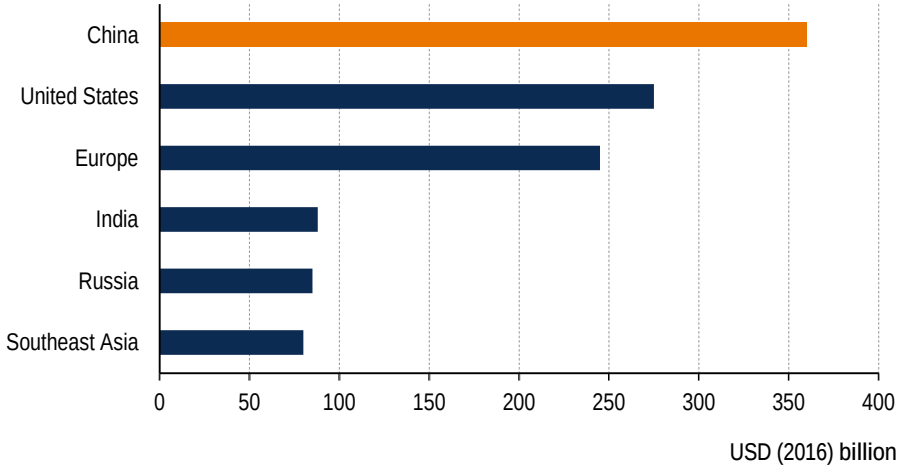
China showing the greatest growth

China is projected to account for **US$1 out of US$3** invested in renewables through 2040
Over 50% of EV demand is projected to come from China
Fastest growth in energy efficiency investment

China has the potential have the greatest climate mitigation, with avoided coal use in country as the largest contributor to global emission savings (Source: IEA World Energy Outlook 2017). The country will be the largest driver of renewables investment, with wind and solar capacity increasing 8-fold to 2040. The country is projected to invest US$100bn annually into renewables (Source: Bloomberg New Energy Finance 2017). The country is also a leader in energy efficiency, electric vehicles, smart grids, and nearly all other cleantech solutions.

Chart 13: Energy investment in selected markets

China remains the first destination of energy investment in 2016. China represented 21% of global energy investment, supported by electricity supply and networks; despite a sharp decline in oil and gas, the US total share rose significantly



Source: IEA World Energy Investments 2017

Major legislative tailwind, momentum to continue?

Much of the recent Green Bond issuance has been driven by the People's Bank of China (PBOC), which published separate green bond standards and quotas in December 2015. China needs RMB2-4tn (US$315-630bn) in green investments, of which the public sector could only provide for a maximum of 15%. The majority of investment must come from green financing and the private sector, with green bonds as an important tool.

While it is unclear whether 2016 and 2017's momentum will continue through 2018, major changes will greatly affect global issuance given the sheer size of the Chinese green bond market.

India issuance continuing at slower pace

India has issued over US$3bn worth of green bonds to date. While this pales in comparison to China's strong ascent, we are seeing increasing innovation and diversification within the Indian market. Given the long-term need for climate investment, we continue to see green bonds as a major opportunity for the country.

Table 7: All bonds issued by India (through October 31 2017)

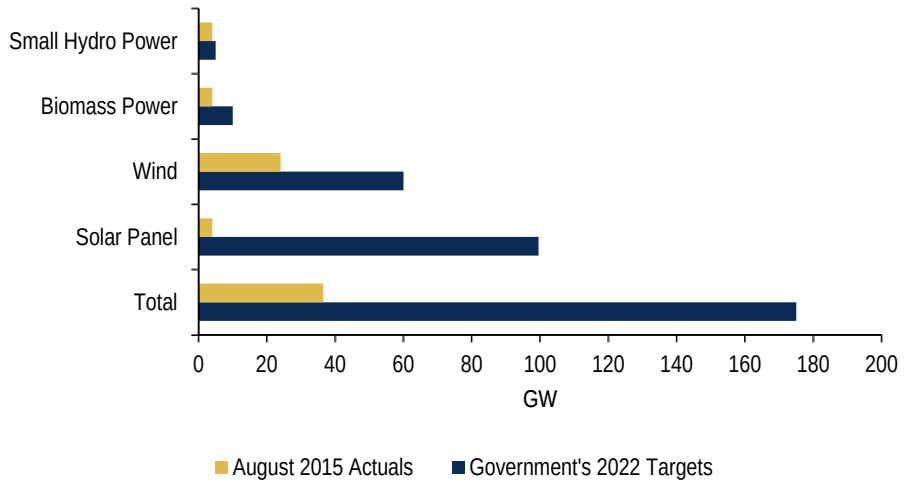
Issuer	Currency	Amt. Issued US$ mn	Issue Date
Axis Bank Ltd	INR,USD	862	Jun-16, May-16
Export-Import Bank of India	USD	500	Mar-15, Feb-13, Feb-16
Greenko Investment Co	USD	500	Aug-16
Rural Electrification Corp Ltd	USD	450	Jul-17
Indian Renewable Energy Development Agency Ltd	INR	376	Mar-17, Oct-17
IDBI Bank Ltd/DIFC Dubai	USD	350	Nov-15
NTPC	INR	300	Aug-16
Yes Bank Ltd	INR	258	Dec-16, Feb-15, Aug-15
CLP Wind Farms India Pvt Ltd	INR	90	Sep-15
Hindustan Powerprojects Pvt Ltd	INR	59	Oct-15
Hero Future Energies	INR	44	Feb-16
Hero Wind Energy Pvt Ltd	INR	29	Feb-16, Jan-16
Bajaj Finance Ltd	INR	1	Jul-16
Total		3,522	

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings

India: 3rd largest GHG emitter, needs US$200bn for renewables alone

Renewable energy and sustainability has been a key focus area for the Modi government. India is currently the world's third largest GHG emitter, and needs up to US$200bn to meet its renewables installation targets alone. The government plans on building out 175GW of renewable energy by 2022, consisting of 100GW of solar power and 60GW of wind power, 10GW of biomass, and 5GW from small hydro (Source: IFC 2017). This is seven times the country's current capacity of 25GW. At the same time, India's renewable energy is 24-32% higher than US or Europe because of higher debt costs according to the US Agency for International Development. Much of the growth can be funded from the debt market.

Chart 14: Indian Government's ambitious renewable energy targets will drive green bond issuance
Installed Renewables Capacity, GW



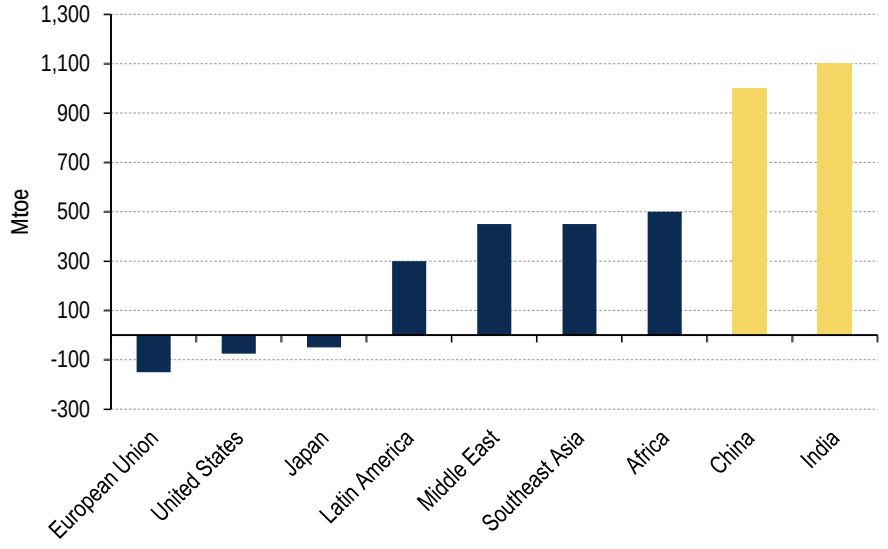
Source: Govt. of India, Ministry of New and Renewable Energy; Moody's

Rising energy demand

India will account for 25% of global energy demand growth to 2040E

By 2040E alone, India's absolute energy demand is expected to roughly equal that of the US, even though demand per capita remains 40% below the world average. It is expected that India will account for 25% of global energy demand growth, an increased demand of c1000mtoe, by 2040E alone. New infrastructure, an expanding middle class and 600mn new electricity consumers mean a large rise in the energy required to fuel India's development, especially in urban cities where most of this growth is expected to occur (source: IEA).

Chart 15: Change in energy demand in selected regions, 2014-2040



Source: IEA 2015

US$2.5tn needed through 2030E for low carbon

India has aimed to cut carbon intensity by 33-35% by 2030E from 2005 levels, and aims to grow to 40% the share of power generated from renewables. This would require

US$2.5tn to achieve, much of which will need to come from private capital and assistance from developed markets.

Australia continues growth

To date, Australia has issued cUS$4.4bn worth of green bonds from entities ranging from governments, to banks, to universities. In July 2016, Victoria became the first government in Australia to issue green bonds. The state raised AUD300mn for investments in energy efficiency, renewable power generation, low carbon transport, and water treatment.

Table 8: All bonds issued by Australia (through October 31 2017)

Issuer	Currency	Amt. Issued US$ mn	Issue Date
Westpac Banking Corp	AUD	787	Jun-16, May-17
National Australia Bank Ltd	AUD	775	Dec-14, Mar-17
Queensland Treasury Corp	AUD	576	Mar-17
Commonwealth Bank of Australia	AUD	496	Mar-17
Australia & New Zealand Banking Group Ltd	AUD	463	Jun-15
Stockland Trust Management Ltd	EUR	375	Nov-14
QBE Insurance Group Ltd	USD	300	Apr-17
Treasury Corp of Victoria	AUD	225	Jul-16
Monash University	AUD	163	Dec-16
Investa Office Fund	AUD	114	Apr-17
Flexi Trust	AUD	77	Apr-16, Feb-17
ICPF Finance Pty Ltd	AUD	75	Apr-17
Total		4,425	

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings *Issued through Cayman Islands subsidiary Anstock II Ltd.

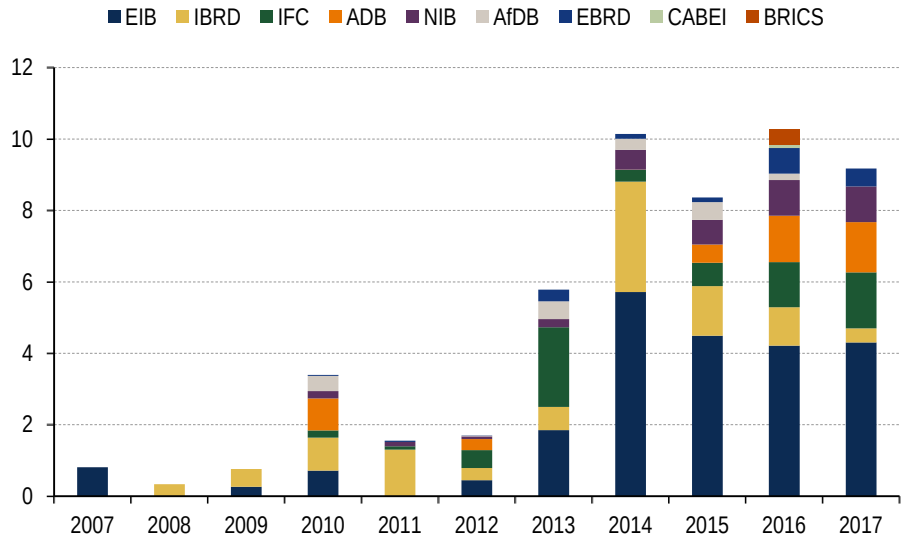
Growth materializes in other APAC markets

In addition to more developed APAC Green Bonds markets, we have seen new regions entering the space in 2017 including Singapore, Hong Kong, and Taiwan. Given the environmental investment needs, we believe that Green Bonds will likewise turn more mainstream for the rest of Asia.

Supranational/multilaterals: first movers

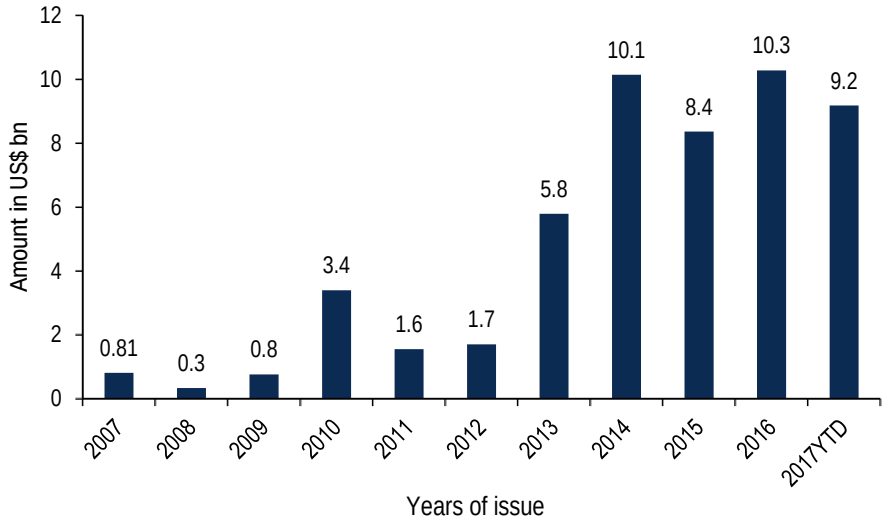
Supranationals, sub-sovereigns, and agencies (SSAs) historically have been the largest group of Green Bond issuers, and were also the first movers. Today, SSAs comprise a smaller share of the Green Bond market, with around $9.2bn issuance YTD, but their issuance tend to be relatively stable at US$8-11bn annually. Bonds are not tied to specific projects, but are pooled, with the issuers committing to match the proceeds with low-carbon lending. While most of incremental growth in recent years has been outside SSAs, they continue to be standard setters within the space. To date, the largest issuers in the Green Bond market remain multilateral banks such as the World Bank and European Investment bank.

Chart 16: Total Annual Green Bond Issuance for Rated Supranationals (As Of October 2017)



EIB = European Investment Bank, IBRD = International Bank for Reconstruction and Development, IFC = International Finance Corporation, ADB = Asian Development Bank, NIB = Nordic Investment Bank, AfDB = African Development Bank, EBRD = European Bank for Reconstruction and development, CABEI = Central American Bank for Economic Integration. Source: Climate Bonds Initiative

Chart 17: Supranational Green Bonds (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

SSAs provide backing for smaller Green Bonds

The potential of supranationals, multilateral banks, and other institutions with strong balance sheets and credit ratings to help backstop smaller projects and entities has been a major area of interest. This is potentially another area where we can achieve additional funding for green projects versus relabeling of existing projects that could have been funded without the Green Bond label. There has been progress this past quarter as several SSAs moved to lend their balance sheet to raise cheaper funds from mainstream investors and pass on the proceeds to smaller players that may not have been able to raise the capital, or as cheaply, otherwise.

Asian Development Bank to provide support for Aboitiz in Philippines

The Asian Development Bank (ADB) has received approval to provide a loan and a partial credit guarantee to support Aboitiz Power Renewables in issuing the first Green Bond in the Philippines. Aboitiz's parent company is one of the largest power generators in the Philippines, with 1/3 of its assets in renewables such as hydro and geothermal power. Aboitiz is aiming at issuing a Ps10.7bn with tenor of up to 10 years, which will be used to refinance and improve operation of its existing renewable power plants. Concurrently, ADB will also provide for an additional loan of up to Ps1.8bn. ADB issued its own inaugural US$500mn Green Bond in March 2015, with proceeds going towards promoting climate change adaptation.

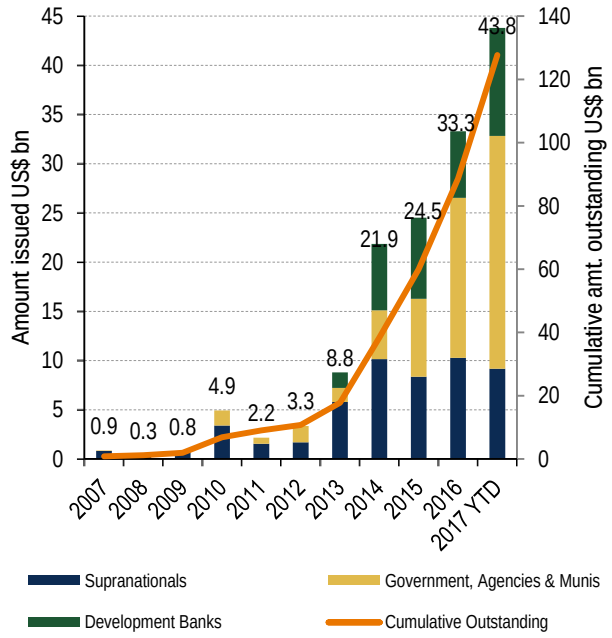
IFC investment in Yes Bank Green Bonds

Similarly, in August the IFC raised Rs315 to invest in Yes Bank green bonds. The rupee-denominated "masala" bonds were listed on the London Stock Exchange and are part of IFC's US$3bn masala bond programme where the bank sells a range of tenors in the offshore rupee bond market. The AAA-rated IFC was effectively able to tap into its cheap cost of funding and channel proceeds to emerging markets such as India.

Multilateral banks slow down, governments step up

Issuance from supranationals and development banks has been fairly slow in the past two years, hovering at US$16-20bn. However, this has been made up by increased issuance from municipalities and other governmental, which has tripled from US$8bn in 2015 to US$23.5bn 2017. This is projected to further increase as national governments increase sovereign green bond issuance.

Chart 18: Supranationals, Governments, Quasi-Government, and Multilateral Bank issuance YTD (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Table 9: Top Green Supranational, Government & Muni Bonds issued 2017 YTD (through October 31 2017)

Issuer	2017 YTD US$ mn
French Republic Government Bond OAT	7,558
European Investment Bank	4,302
New York Metropolitan Transportation Authority	1,981
SNCF Reseau	1,940
International Finance Corp	1,567
Fannie Mae-Aces	1,485
Asian Development Bank	1,407
Nordic Investment Bank	1,001
Municipality Finance PLC	626

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings
*Highlights indicate a new top issuer since Jan 1 2017

Sovereigns enter with a bang

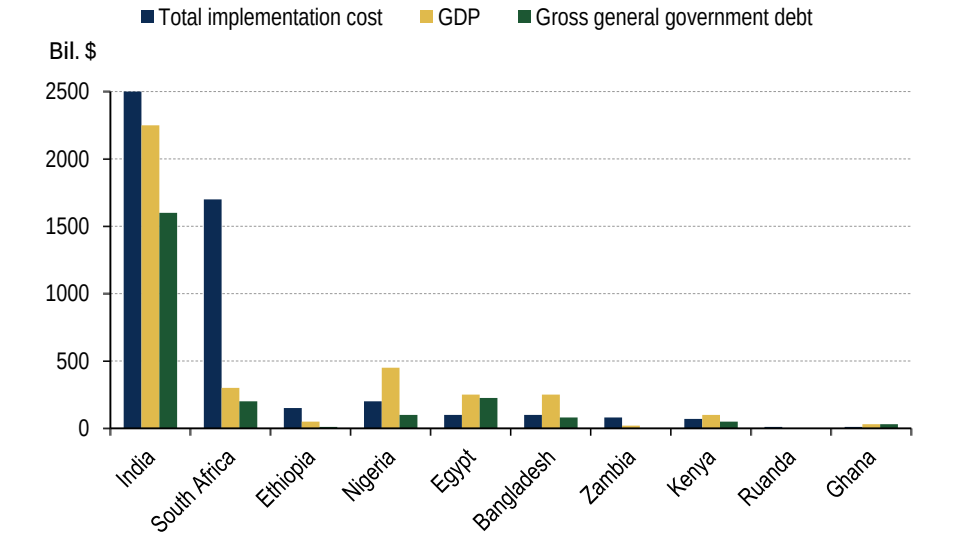
The biggest development in 2017 has been the emergence of sovereign green bonds. Poland was the first to enter the market in December 2016 with its EUR750mn 5-year note, with proceeds goings towards renewable energy, clean transport, sustainable agriculture and conservation. This is a major step in the right direction, for a country that generates 90% of its electricity using coal. France made an ever bigger splash with its 22-year EUR7bn green bond. The figure could grow further this year, as the government

had identified EUR13bn worth of green expenditures for the year, with the potential for up to EUR11bn of issuance by year-end. In October 2017, Fiji joined the group of sovereign green bond issuers with its US$50bn bond. Half a dozen other countries, including Nigeria, Kenya, Morocco, Bangladesh, and Sweden, are also rumoured to have projects in the pipeline.

The case for sovereign green bonds

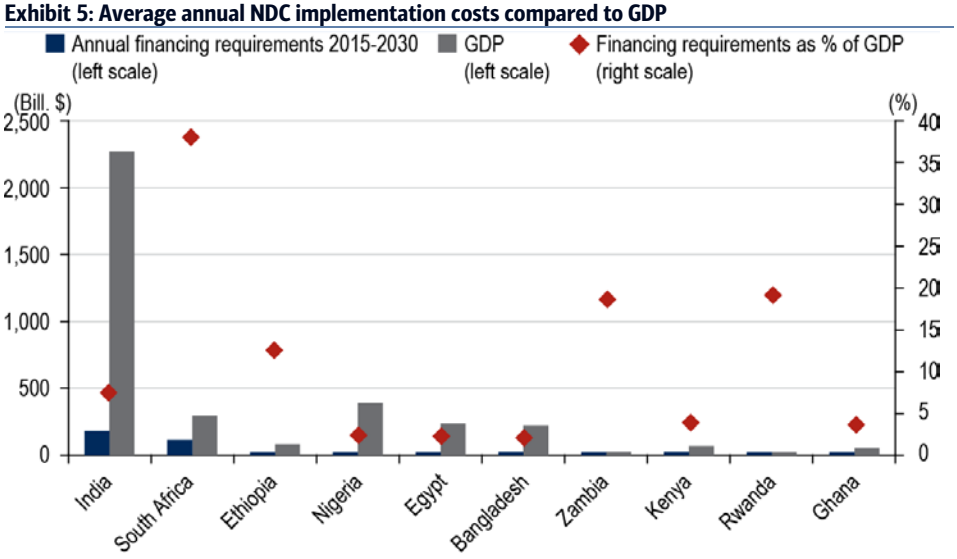
Raising environmental funding through sovereign green bonds make a lot of sense as the total cost of implementing nationally determined contributions (NDCs) total around US$5.3tn. For many emerging market nations, the cost would surpass gross general government debt, as well as GDP in some cases (Source: S&P Global 2017)

Chart 19: Sovereign with highest nationally determined contributions, GDP and Debt



Source: Standard & Poor's Financial Services LLC

Exhibit 5: Average annual NDC implementation costs compared to GDP



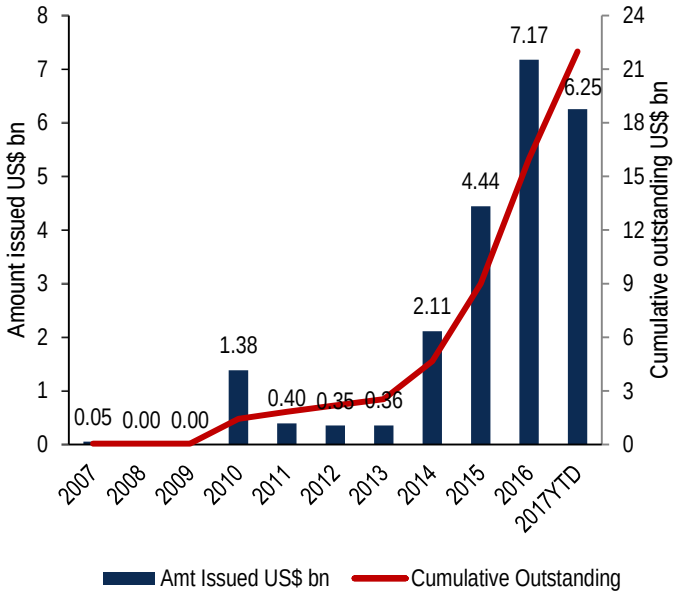
Source: S&P 2017

US muni green bond issuance maintains strength

101 municipalities, cities, and states have issued green bonds by the June 2017, the majority from US issuers (Source: Climate Bonds Initiative 2017)

Issuance of US municipal green bonds has experienced remarkable growth in recent years. Issuance has gone from US$2.11bn in 2014 to $7.17bn in 2016. While issuance has slowed to US$6.25bn in 2017 so far, it remains an important way of financing climate abatement projects on a local level. By the end of June 2017, municipalities, cities and states had issued green bonds, with the majority coming from US issuers (Source: CBI 2017)

Chart 20: US Muni issuance (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Table 10: Top 10 Green US Muni Bonds 2017 YTD (through October 31 2017)

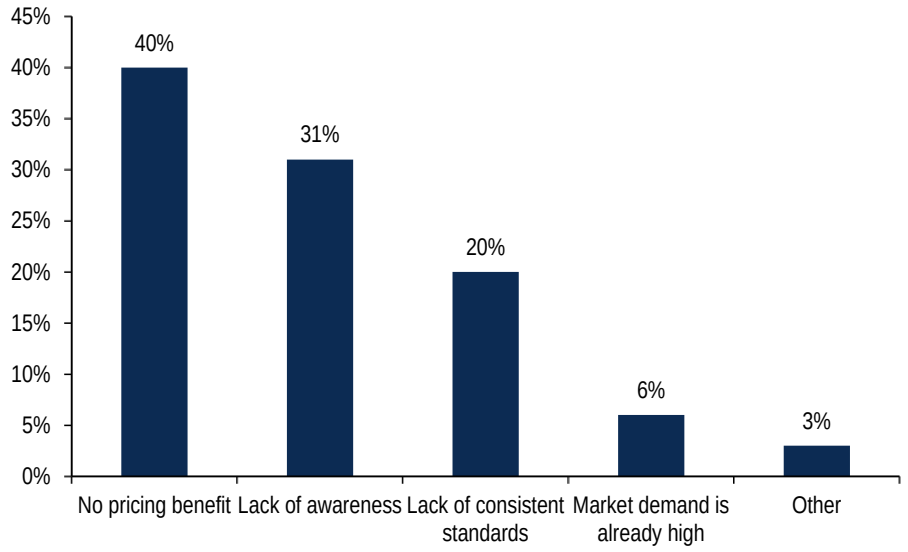
Governments	2017 Amt Issued US$ mn
New York Metropolitan Transportation Authority	1,981
Los Angeles County Metropolitan Transportation Authority	471
City of Los Angeles CA Wastewater System Revenue	450
California Infrastructure & Economic Development Bank	450
California Health Facilities Financing Authority	408
San Francisco Bay Area Rapid Transit District	356
Massachusetts Water Resources Authority	255
State of Connecticut Clean Water Fund - State Revolving Fund	250
New York State Housing Finance Agency	230
California Pollution Control Financing Authority	228
Others	1,733
Total	6,812

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings
*Highlights indicate a new issuer since Jan 1 2017

We believe that this could be the tip of the iceberg. Of the US$320bn of municipal bonds issued in the first three quarters of 2017, only around US$6bn (2%) were specifically labelled as green bonds (Source: Moody's 2017). Greater awareness and education can spur on growth for the market.

Chart 21: What is the biggest factor holding back municipal green bond issuance?

Polling conducted at the Moody's / CBI Climate Week briefing on September 20th



Source: Moody's

Room for "Smart City" bonds

New York City as a potential smart city issuer:
Climate commitment: 80% reduction in CO2 emissions by 2050
Total bond issuance last 5Y: Total issuance since 2012 exceeding $10bn
Planned/current climate infrastructure projects:

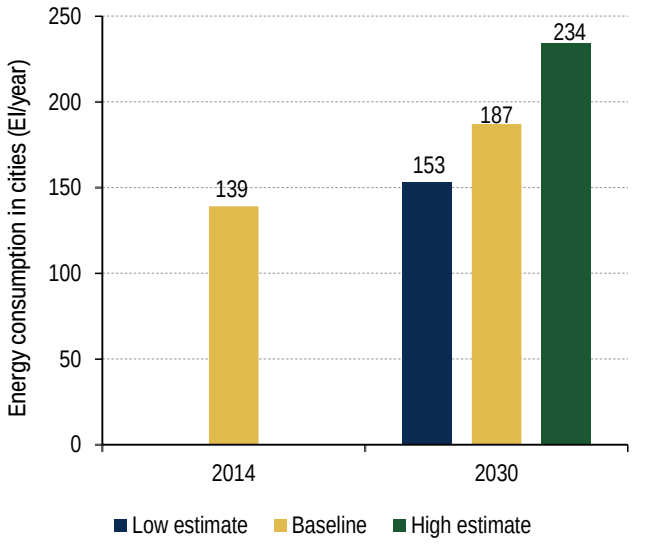
- $1.7bn subway expansion
- $315mn wastewater adaptation

Estimated potential for green bond issuance: Significant (>$1bn p.a.)
(Source: CBI 2017)

Cities account for 71-76% of GHG emissions and 67-76% of global energy use, with the latter expected to rise to 80% by 2040E (source: The Global Commission on the Economy and Climate 2015, Shell/Booz & Company). Green Bonds can be central in helping to finance climate infrastructure in cities. The importance of the transition towards Smart Energy cuts across multiple Smart City segments with energy consumption from both Buildings and Mobility in cities set to rise by up to 68% from 2014-30E (source: IRENA, REMap). The worst offenders among major cities in terms of GHG emissions per capita are Sydney, Washington DC, Boston, Los Angeles and Shanghai (source: World Bank).

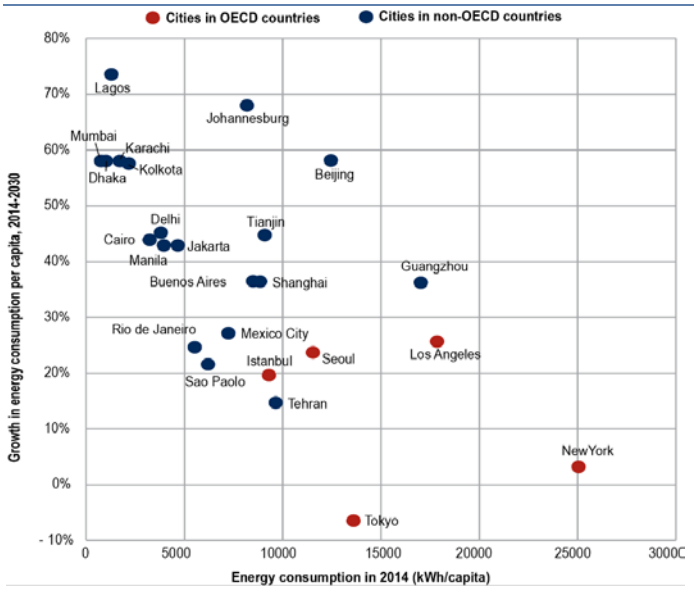
40 of the world's leading cities alone need US$375bn in climate-resilient infrastructure investment to 2020E and US$1tn by 2050E (source: World Bank 2016 GFDRR, C40 Cities-Arup 2016). Eighty-five percent of cities are dealing with temperature increases/heatwaves and 53% report these risks as serious and near term (source: C40 Cities). The world's 10 most vulnerable cities to flooding are Guangzhou, Mumbai, Kolkata, Guayaquil, Shenzhen, Miami, Tianjin, New York-Newark, Ho Chi Minh City and New Orleans (source: Nature Climate Change 2013).

Chart 22: Energy use in buildings and for transport in cities, 2014 and 2030



Source: IRENA

Exhibit 6: Energy use and growth in energy use per capita in the world's largest cities
2014 – 2030E



Source: IRENA

[Thematic Investing: 21st Century Cities: Global Smart Cities Primer 02 March 2017]

180+ bonds have come to market, more growth possible

Since the first labelled green city bond was issued in 2013, 180+ green city bonds from 13 countries have come to market. This spans cities, municipalities, transport authorities, water utilities, and municipal banks. Given urbanization trends, population growth pressures, resources challenges, we believe that an integrated approach, such as that offered by the "smart city" framework will be the most effective in climate mitigation. We foresee more growth from the area of green city bonds.

Greening buildings gaining traction

Green bonds are emerging to be a key tool in financing green growth within buildings and real estate. This is especially important as building account for 1/3 of carbon emissions. In addition to issuance from traditional real estate companies, there are new financial tools such as green construction bonds, green mortgages, energy efficient mortgages, green building insurance, and green building certification pricing break (Source: IFC 2017). Globally accepted green building certifications include BREEAM, LEED, Energy Star, Green Star, just to name a few. Green building projects across commercial and residential are included and span both the construction of new buildings and the retrofit of existing buildings. Some examples of projects include:

- Energy-efficient heating, ventilation, and air conditioning systems
- Double glazing of glass windows/walls to improve thermal insulation
- High-efficiency pool equipment
- Smart meters
- High-efficiency water heating; and
- Roof and wall insulation (Source: S&P Global 2017)

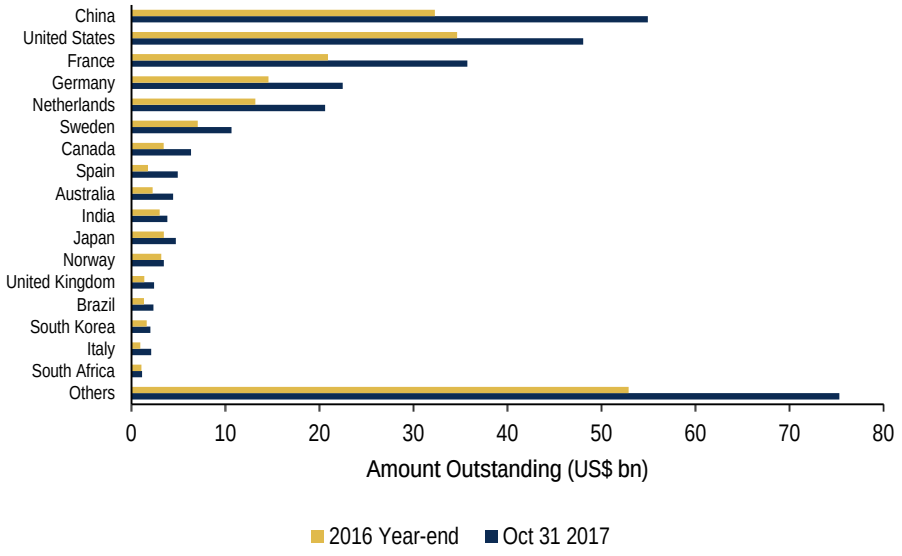
First mortgage green bonds issued

Green mortgage backed securities (MBS) is a nascent market that allow individuals to invest in energy efficiency improvements for their homes. Berlin Hyp and Rabobank were some of the first issuers of green mortgage securities. Fannie Mae, the US Federal Mortgage Association, has been actively issuing green MBS in the past year. Properties can qualify if they meet one of two criteria: possess a nationally recognized Green Building Certification, and/or make property improvements that target reductions in energy and/or water use. Fannie Mae believes these types of green renovations could lower credit risk, increase property value, create higher quality and more durable housing, while lowering energy and water use.

Europe and US remain largest issuers, but declining

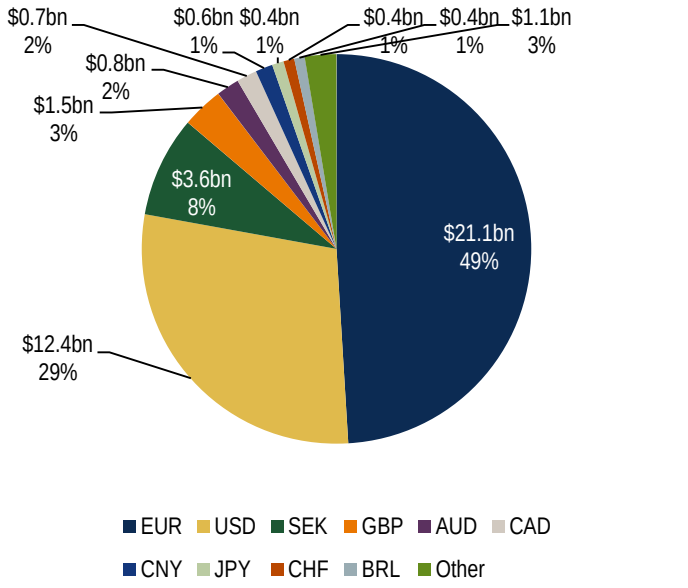
As a region, Europe remains the most developed Green Bond market and has some of the largest issuers. France, Germany, Netherlands, Sweden, Norway, UK, and Italy comprise around 33% of the total outstanding market. EUR denominated Green Bonds make up around 32%, down from roughly half the market earlier in 2014. Increase in issuance from the US has driven a rise in USD denominated bonds, which now comprises 35%, surpassing EUR as the dominant currency for green bonds. CNY-denominated green bonds has taken off since 2016 as Chinese green bonds rose in prominence, and now comprises 16% of the market and is now the #3 currency. Overall, green bonds have been issued in 29 different currencies.

Chart 23: Country distribution of outstanding Green Bonds



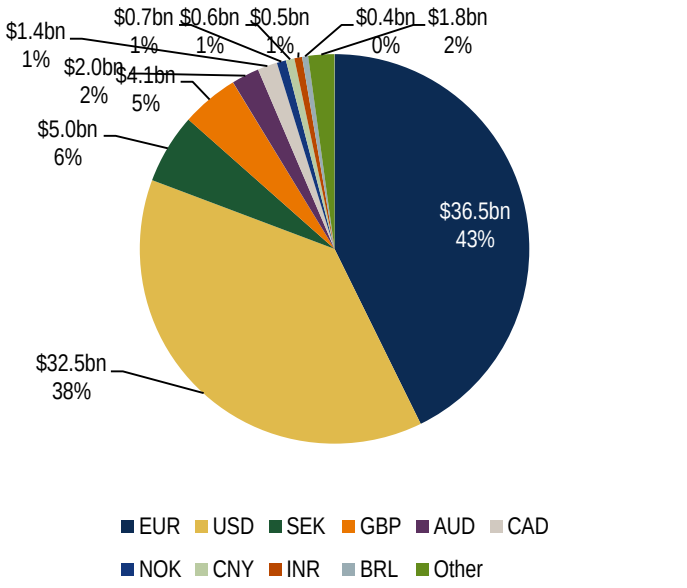
Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Chart 24: Currency distribution of outstanding Green Bonds (Dec 31 2014)



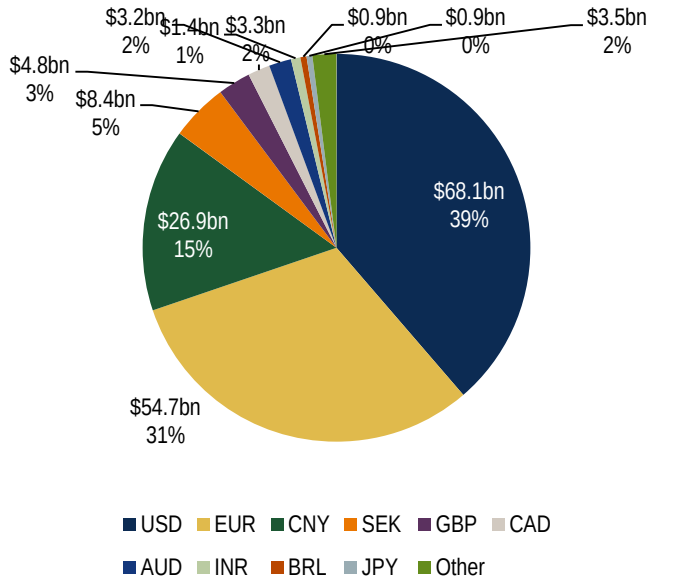
Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Chart 25: Currency distribution of outstanding Green Bonds Dec 31 (2015)



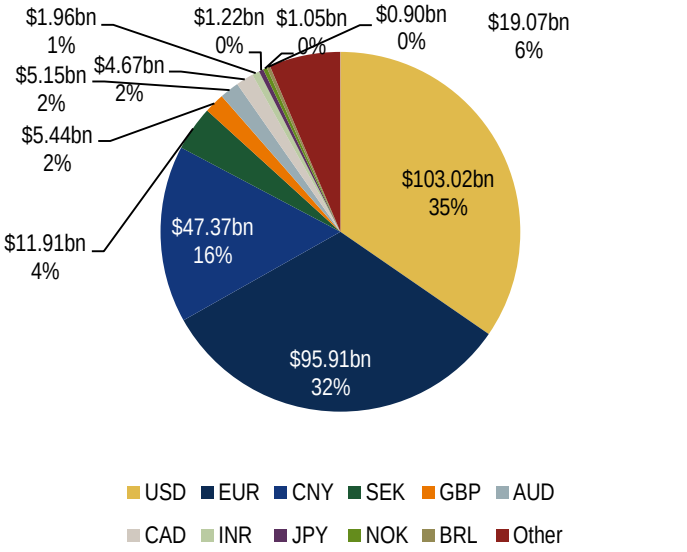
Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Chart 26: Currency distribution of outstanding Green Bonds (Dec 31 2016)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Chart 27: Currency distribution of outstanding Green Bonds (October 31 2017)

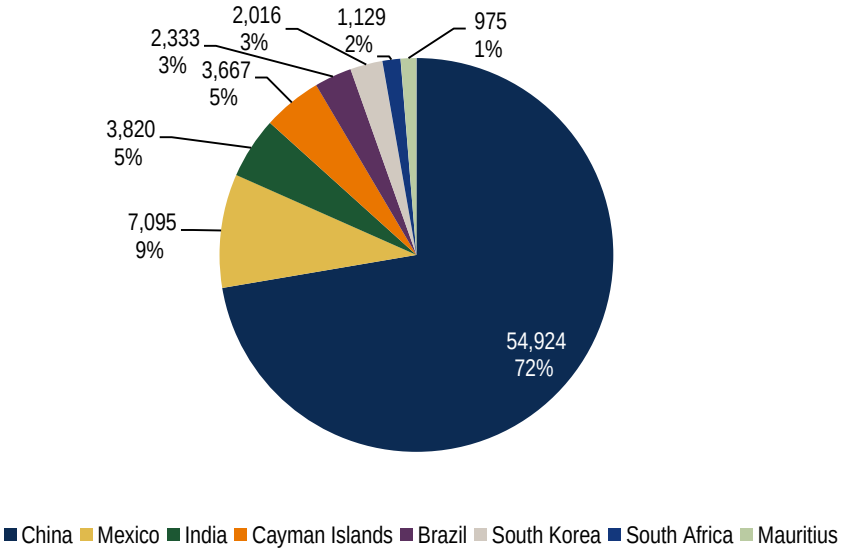


Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

EM growth outside of China

China is not the only EM region that has been active this year. We have seen new green bonds from Inversiones (Chile), Tadau Energy (Malaysia), Quantum Solar Park (Malaysia), Banco Nacional de Desenvolvimento Economico e Social (Brazil), just to name a few.

Chart 28: All bonds issued by Emerging Markets (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Table 11: All bonds issued by Emerging Markets excluding China and India (through October 31 2017)

Issuer	Currency	Amt. Issued US$ mn	Country	Issue date
Mexico City Airport Trust	USD	6000	Mexico	Sep-16, Sep-17
Export-Import Bank of Korea	USD, INR	1000	South Korea	Feb-13, Feb-16, Aug-17
Banco Nacional de Desenvolvimento Economico e Social	USD	1000	Brazil	May-17
Suzano Papel e Celulose	USD, BRL	788	Brazil	Jul-16, Nov-16
Republic of Poland Government International Bond	EUR	779	Poland	Dec-16
MTR Corp CI Ltd	USD, HKD	733	Cayman Islands	Nov-16, Sep-17
China Three Gorges Corp	EUR	726	Cayman Islands	Jun-17
Fibria Overseas Finance Ltd	USD	700	Cayman Islands	Jan-17
Nacional Financiera SNC	USD, MXN	603	Mexico	Nov-15, Sep-16
First Abu Dhabi Bank PJSC	USD	587	UAE	Mar-17
Industrial Development Corp of South Africa Ltd	ZAR	577	South Africa	Oct-12
BRF S.A.	EUR	545	Brazil	May-15
Korea Development Bank/The	AUD, USD	516	South Korea	Nov-15, Jul-17
Azure Power Energy Ltd	USD	500	Mauritius	Aug-17
Banco Nacional de Costa Rica	USD	500	Costa Rica	Apr-16
Hyundai Capital Services Inc	USD	500	South Korea	Mar-16
Inversiones CMPC SA	USD	500	Chile	Apr-17
Link Finance Cayman 2009 Ltd/The	USD	500	Cayman Islands	Jul-16
Modern Land China Co Ltd	USD	500	Cayman Islands	Oct-16
Mexico City (CDMX)	MXN	492	Mexico	Dec-16
Neerg Energy Ltd	USD	475	Mauritius	Feb-17
Provincia de la Rioja	USD	400	Argentina	Feb-17
Lietuvos Energija UAB	EUR	344	Lithuania	Jul-17
Nedbank	ZAR	338	South Africa	Aug-12
Anstock II Ltd	USD	300	Cayman Islands	Jul-14
Turkiye Sinai Kalkinma Bankasi AS	USD	300	Turkey	May-16
Quantum Solar Park Semenanjung Sdn Bhd	MYR	236	Malaysia	Oct-17
AP Renewable	PHP	225	Philippines	Feb-16
Province of Jujuy Argentina	USD	210	Argentina	Sep-17
Renew Financial	USD	208	Cayman Islands	Oct-17
Energia Eolica SA	USD	204	Peru	Dec-14
Bank Zachodni WBK	EUR	153	Poland	May-17
Banque Centrale Populaire	EUR	150	Morocco	Jun-17
Davivienda	COP	147	Colombia	Apr-17
City of Johannesburg South Africa	ZAR	137	South Africa	Jun-14

Table 11: All bonds issued by Emerging Markets excluding China and India (through October 31 2017)

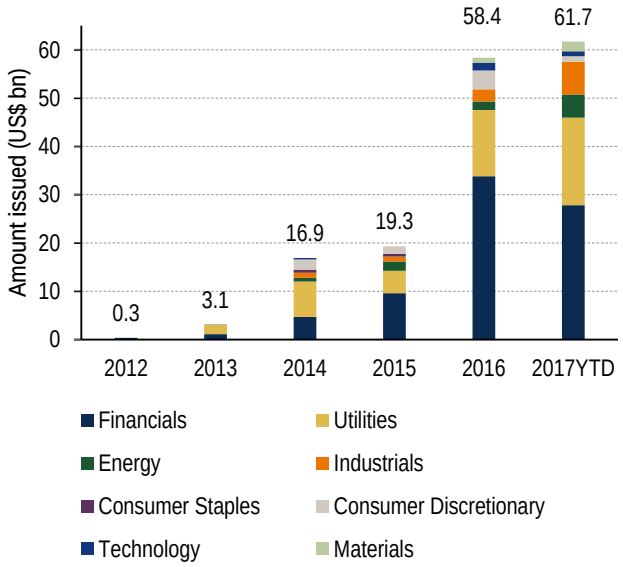
Issuer	Currency	Amt. Issued US$ mn	Country	Issue date
Moroccan Agency for Solar Energy	MAD	117	Morocco	Nov-16
Bancolombia	COP	115	Colombia	Dec-16
Latvenergo AS	EUR	113	Latvia	Jun-15, Apr-16
Beijing Enterprises Water Group	CNY	106	Bermuda	Aug-16
City of Cape Town South Africa	ZAR	77	South Africa	Jul-17
Terna Energy Finance SA	EUR	70	Greece	Jul-17
Banco de Comercio Exterior de Colombia SA	COP	67	Colombia	Aug-17
E.SUN Commercial Bank Ltd	USD	60	Taiwan	May-17
Tadau Energy Sdn Bhd	MYR	58	Malaysia	Jul-17
Nelja Energia AS	EUR	56	Estonia	Jun-15
Banque Marocaine Du Commerce Extérieur	MAD	50	Morocco	Nov-16
Bank Sinopac	USD	45	Taiwan	May-17
CTBC Bank Co Ltd	TWD	33	Taiwan	May-17
KGI Bank	TWD	33	Taiwan	May-17
Attistibas Finansu Institucija Altum JSC	EUR	24	Latvia	Oct-17
Gen-I Sonce	EUR	15	Slovenia	Mar-17
Total		22,913		

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings *Highlights indicate a new issuer since Jan 1 2017

Corporate issuance a key driver of growth

The majority of growth in the past 2-3 years was driven by corporate issuance, which made up around 56% of total issuance in 2017. While utilities were the first corporate entrants in the green bond space, they make up only 29% in YTD 2017 issuance within corporates, and the outstanding market.

Chart 29: Corporate bonds by sector (through to October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings

Table 12: Corporate issuers of 2017 YTD (through October 31 2017)

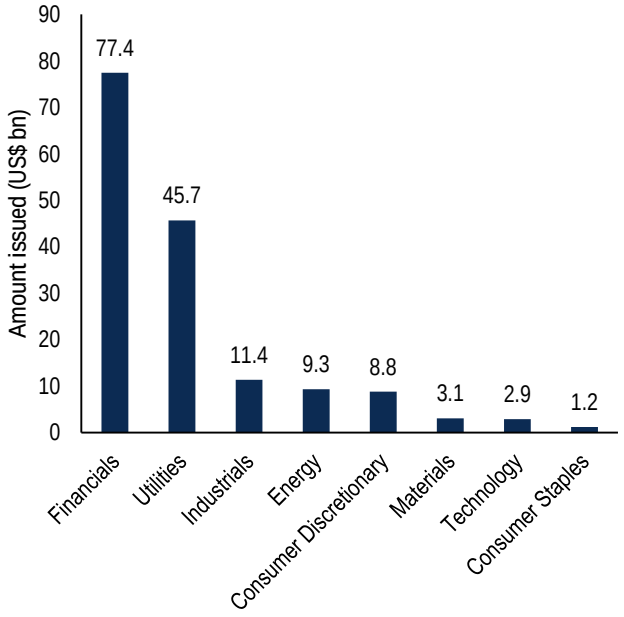
Corporates	US$ mn
Mexico City Airport Trust	4,000
Engie SA	3,103
Bank of Communications Co Ltd	3,015
Iberdrola International BV	2,482
TenneT Holding BV	2,185
Bank of Beijing Co Ltd	2,181
Industrial & Commercial Bank of China Ltd/Luxembourg	2,151
China Three Gorges Corp	1,545
Enel Finance International NV	1,325
Berlin Hyp AG	1,149
Chongqing Longhu Development Co Ltd	1,030
innogy Finance BV	1,008
Toronto-Dominion Bank/The	1,000
Apple Inc	1,000
Greenko Dutch BV	1,000
Senvion Holding GmbH	880
MidAmerican Energy Co	850
Wuhan Metro Group Co Ltd	746
China Huadian Corp	742
China Longyuan Power Group Corp Ltd	737

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Banks largest green sector

The financial services sector is the single largest corporate issuer. It accounted for 45% (US$27.9bn) of 2017 issuance. This is because banks and investment banks are a natural conduit to funnel private capital for smaller environmental projects. This is particularly true for China, where 71% of the market is made up of issuance from the financials sector. Real estate companies can also easily issue green bonds for energy efficient renovations.

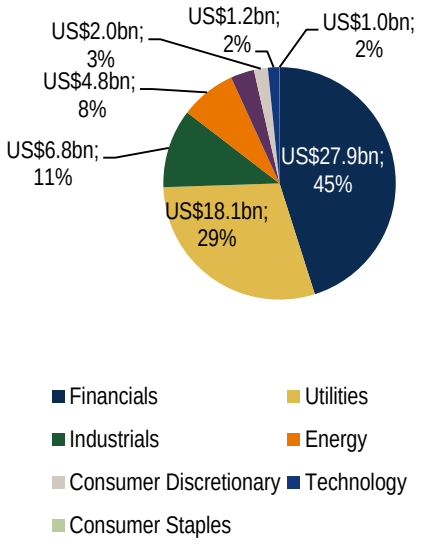
Chart 30: Green Bonds by sector (through to October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings

Chart 31: Green Bonds by sector 2017 YTD (through October 31 2017)

Amount issued and % of total



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings

Table 13: Top 20 Financials issues to date* (through October 31 2017)

Issuer	Amt. Issued US$ mn
Bank of Communications Co Ltd	7,370
Shanghai Pudong Development Bank Co Ltd	5,280
China Industrial Bank Co Ltd	4,913
Bank of China Ltd	3,531
Industrial Bank Co Ltd	2,902
Berlin Hyp AG	2,272
Bank of Beijing Co Ltd	2,181
Bank of America Corp	2,100
Unibail-Rodamco SE	1,556
Credit Agricole Corporate & Investment Bank SA	1,508
Toronto-Dominion Bank/The	1,453
ING Bank NV	1,396
Vasakronan AB	1,302
Bank of Qingdao Co Ltd	1,193
Deutsche Kreditbank AG	1,159
ABN AMRO Bank NV	1,120
Societe Generale SA	1,091
Chongqing Longhu Development Co Ltd	1,030
Agricultural Bank of China Ltd	995
Axis Bank Ltd	862
Others	29,492
Total	74,708

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings
*Highlights indicate a new issuer since Jan 1 2017

Energy efficient buildings driving growth for Real Estate

In addition to banks issuing Green Bonds for energy efficient buildings, pure-play real estate companies have also been driving the issuance activity within the financial services sector. To date, over US$10bn worth of Green Bonds have been issued, with the largest issuers being Unibail-Rodamco (France), Vasakronan (Sweden), and Chongqing Longhu Development (China).

Table 14: Current outstanding amount issued by Real Estate (through October 31 2017)

Issuer	Amt. Issued US$ mn	# of Bonds
Unibail-Rodamco SE	1,556	2
Vasakronan AB	1,302	21
Chongqing Longhu Development Co Ltd	1,030	5
ICADE	713	1
Fonciere Des Regions	561	1
Digital Realty Trust LP	500	1
Link Finance Cayman 2009 Ltd/The	500	1
Modern Land China Co Ltd	500	1
Vornado Realty LP	450	1
Stockland Trust Management Ltd	375	1
Rikshem AB	331	10
Fabege AB	294	6
Atrium Ljungberg AB	275	5
Regency Centers LP	250	1
Entra ASA	241	2
Svensk FastighetsFinansiering AB	231	5
Cambridgeshire Housing Capital Plc	228	1
Nya Svensk FastighetsFinansiering AB	156	2
Humlegarden Fastigheter AB	143	2
Stangastaden AB	126	3
Castellum AB	116	2
Investa Office Fund	114	1
Wallenstam AB	107	2
Fastighets AB Forvaltaren	79	2
ICPF Finance Pty Ltd	75	1
CDL Properties Ltd	72	1
Uppsalahem AB	59	1
Vardar AS	41	1
Stockholms Kooperativa Bostadsforening	32	1
Total	10,457	84

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings

Emerging interest from automakers

Thematic Investing: Overdrive – Global Future Mobility Primer 16 February 2017
Global Automobiles: Global Electric Vehicle Primer: Fully charged by 2050 04 October 2017

Issuance from automakers is a major area of potential growth. Globally, we are investing US$18.8tn cumulatively through 2040, or US$784bn annually in energy efficiency solutions. Out of that, around 70% will be focused on the transport sector, which will be responding to more stringent fuel economy standards. BofA Merrill Lynch Autos research team believe that 9 out of 10 cars could be a new energy vehicle (NEV) by 2025. Within this, we expect pure EVs (electric vehicle) sales to reach 12%/34%/90% of Global LVs (light vehicles) in 2025/30/50. Tapping the Green Bonds market for the financing of nextgen vehicles could the next major area of development.

Table 15: All bonds issued by auto issuers (through October 31 2017)

Issuer	Currency	Amt. Issued US$ mn	Country	Issue date
Toyota	USD	4600	Japan, United States	Mar-14, Jun-15, May-16
Beijing Automobile Co Ltd	CNY	722	China	Apr-16, Jul-17
Hyundai Capital Services Inc	USD	500	South Korea	Mar-16
Zhejiang Geely	USD	400	China	May-16
LTC GB Ltd	USD	400	China	May-16

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings

Asset backed Green Bonds: a new area

€77bn (US$84bn) of green asset-backed securities can be issued annually in the EU by 2035E for renewable energy, energy efficiency, and electric vehicles (Source: OECD, Climate Bonds Initiative 2017)

Securitization is an important tool in helping to finance fragmented and smaller low-carbon assets and projects. It is an alternative to relying on solely on the balance sheets of developers, banks, and the public sector, which may be insufficient. The Asset Backed Green Bond market kicked off in 2013 with five deals from four issuers, raising a total of US$2.08bn. For Green Bond ABS, the securities' cash flows come from receivables such as loans, leases and PPAs, which are also related to green projects. The underlying assets used to securitise the bond can be green or something else of value. The issuers included Hannon Armstrong Sustainable Infrastructure, Toyota, SolarCity, and Western Riverside Council of Governments, with assets underlying them ranging from solar and wind assets to car loan payments.

Table 16: ABS Green bonds issued (through October 31 2017)

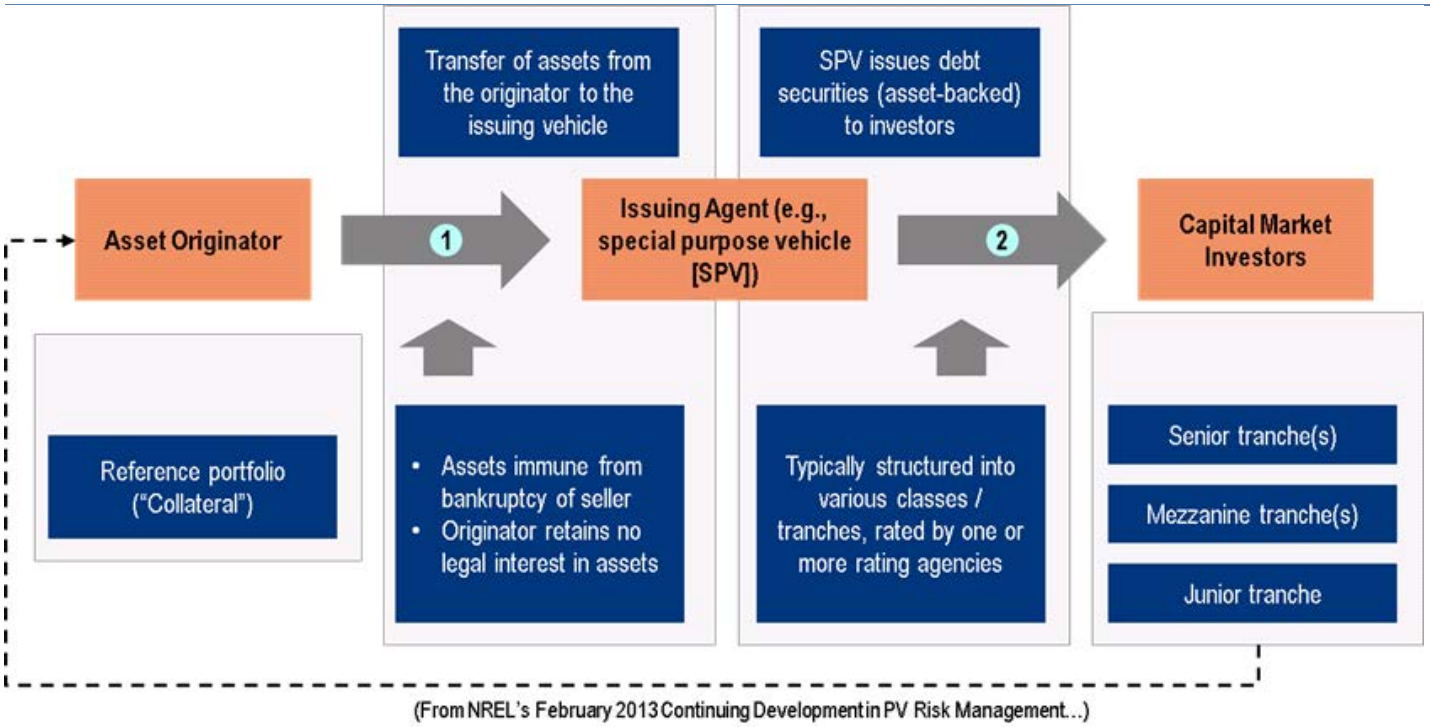
Issuer	US$ mn
2017	
Fannie Mae-Aces	1,485
Green STORM 2017 BV	668
Solar Mosaic	446
HERO Funding Trust	437
Renew Financial	432
Ping An Guiyang Public Transport Receivables Green Asset Backed Securities	385
Beijing Enterprises Water Group	305
Goodgreen 2017-1 Trust	176
Hannon Armstrong	84
CSAIL 2017-C8 Commercial Mortgage Trust	72
Flexi Trust	38
2016	
Toyota	1,110
HERO Funding Trust	501
China Industrial Bank Co Ltd	407
Renew Financial	115
Flexi Trust	38
2015	
Toyota	1,250
HERO Funding Trust	202
Hannon Armstrong	168
SolarCity Corp	124
Hindustan Powerprojects Pvt Ltd	59
Renew Financial	13
2014	
Toyota	1,750
Xing Yuan Loan Asset Backed Trust	450
SolarCity Corp	272
Western Riverside Council of Governments	233
State of Hawaii Department of Business Economic Development & Tourism	150
Goldman Sachs Japan Co., Ltd	63
Connecticut Clean Energy and Finance Authority	30
2013	
Hannon Armstrong	100
SolarCity Corp	54
Goldman Sachs Japan Co., Ltd	20
Total	11,637

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings
*Based on green loans from Industrial Bank
Note: JRE Mega Solar Project Bond Trust 1, Kurimoto Mega Solar Project Bond Trust, JAG Mega Solar Project Bond Trust 1 - Shibushi Solarway and JRE Mega Solar Project Bond Trust 2* - Hasaki Solar Plant are Goldman Sachs Japan financed projects

Issuer credit rating less of an issue

An issuer can put a collection of projects into a special purpose vehicle (SPV), which collects principal and interest payments and passes them through to the bondholders. By securitising the bonds with underlying assets, the credit exposure will be to the value and cash flow of the assets instead of the issuer itself. This unlocks capital for many developers because they would otherwise lack the credit rating to issue bonds themselves.

Chart 32: Overview of Securitization – How it works



Source: CERES, US National Renewable Energy Laboratory

Table 17: Asset classes suitable for green securitization

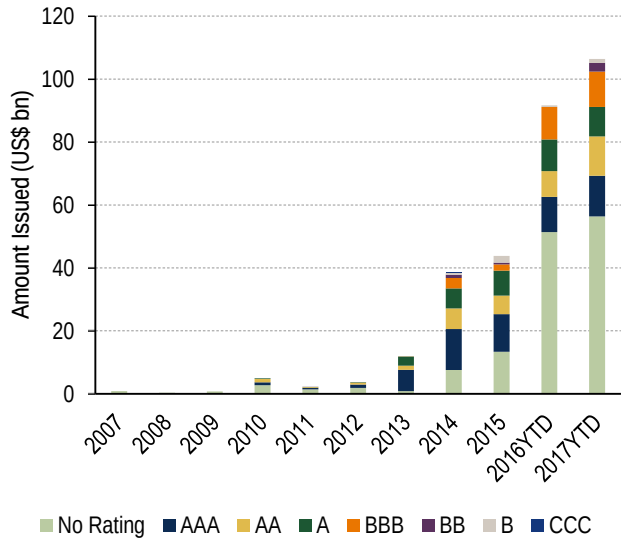
Within asset classes already being securitised	New asset classes
Mortgages to green buildings (low carbon, energy efficient, NetZero)	Cash flows from solar and small-scale wind assets, biogas, hydro projects with storage
Car loans to electric vehicles and hybrids	Loans for energy efficiency upgrades
Loans to green small and medium sized enterprises (SMEs)	Loans to battery and storage projects

Source: Climate Bonds Initiative 2017

Investment grade green bonds remain the focus

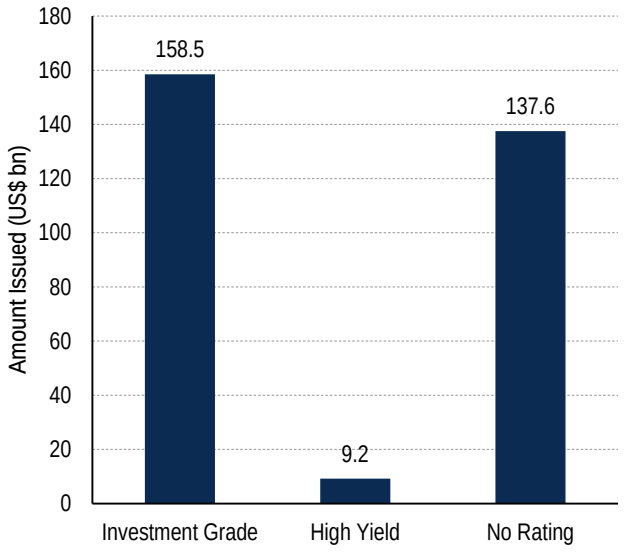
Despite a flurry of issuance from speculative grade issuers in 2014 and 2015, the HY portion of the market remains frozen. Deteriorating credit conditions for the US solar sector are a major focus of the overall bond market. Of the green bonds that have ratings, 95% are of investment grade.

Chart 33: S&P ratings distribution of Green Bonds (through October 31 2017)



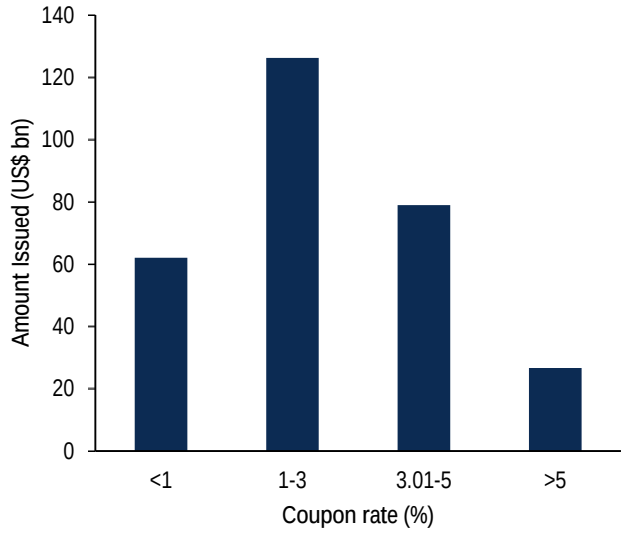
Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Chart 34: High Yield vs Investment Grade Issues (through October 31 2017)



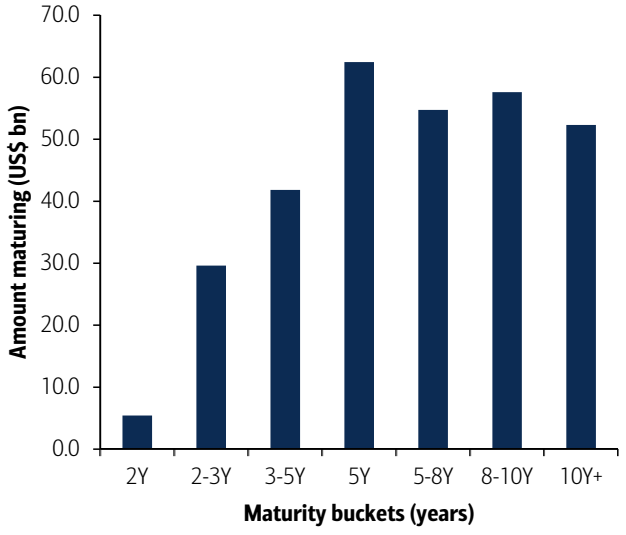
Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Chart 35: Coupon distribution of Green Bonds (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings

Chart 36: Maturity distribution of Green Bonds (through October 31 2017)



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

Green things to come: Nigeria, Kenya, UAE

The pipeline appears robust, and as such we expect the issuance the issuance of sovereign green bonds to continue. Nigeria is expected to be the next major entrant, and France is likely to follow up their inaugural EUR7bn bond later this year.

Table 18: Green Bonds in the pipeline

Issuer	Amount	Country	Detail	Source
Deutsche Hypo	EUR500m	Germany	"has a green Pfandbrief of around EUR500m in the pipeline expected to be closed in the following months, which will bring Germany's total green covered bonds to two"	Climate Bonds Initiative
Indian Railways Finance Corporation (IRFC)	US$300-500mn	India	"looking to raise $300 million to $500 million by selling green bonds maturing in ten years"	Economic Times India
Korea Electric Power (KEPCO)	US$500mn	South Korea	"South Korea's state-run utility company Korea Electric Power Corp. (KEPCO) is seeking to issue green bonds worth US$500 million (557.75 billion won)"	BusinessKorea.kr
Nigeria	N/A	Nigeria	"President Muhammadu Buhari has disclosed that Federal Government will finally launch the first African Sovereign Green Bond in December 2017"	BusinessPost.ng
UAE	N/A	UAE	"There has been a lot of discussion in the Middle East around the potential for green sukuk – which is simply an ordinary sukuk except that the assets involved are green	Zawya.com
Indonesia	N/A	Indonesia	"We have seen green sukuk issued in Malaysia, and we know the Indonesian government is keen to do the same and we believe that further issuances will occur in 2018,"	Zawya.com
Kenya	N/A	Kenya	Nairobi Securities Exchange (NSE) has set April 2017 as Kenya's debut for green bonds. Kenya Bankers Association and Nairobi Securities Exchange to Partner with IFC To promote green finance innovation.	Ipsos
Bangladesh	N/A	Bangladesh	"Bangladesh Bank says green bonds are key to country's green economy"	Environmental Finance
Sweden	N/A	Sweden	"Sweden has recently announced they will issue green bonds"	Environmental Finance
France	N/A	France	France plans to issue more than 20 billion euros ($21 billion) within three years of a class of bond that specifies proceeds must be used for environmental projects in areas like renewable energy	Climate Bonds Initiative

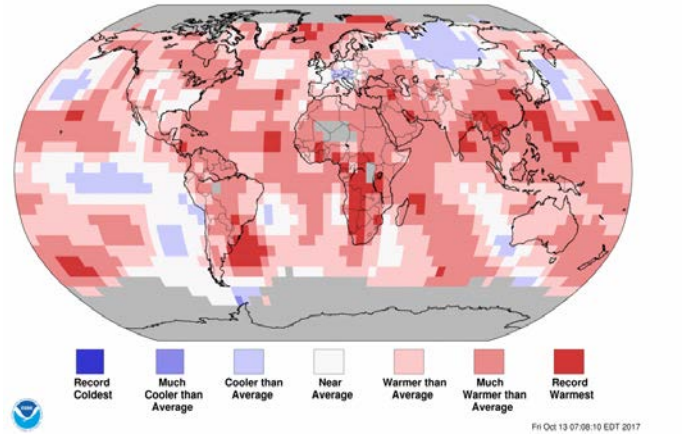
Source: Various press sources

Climate Change and the $700bn-1.4tn p.a. gap: new investment vehicles needed

Thematic Investing: The Clean Revolution – Global Climate Change Primer
12 December 2017

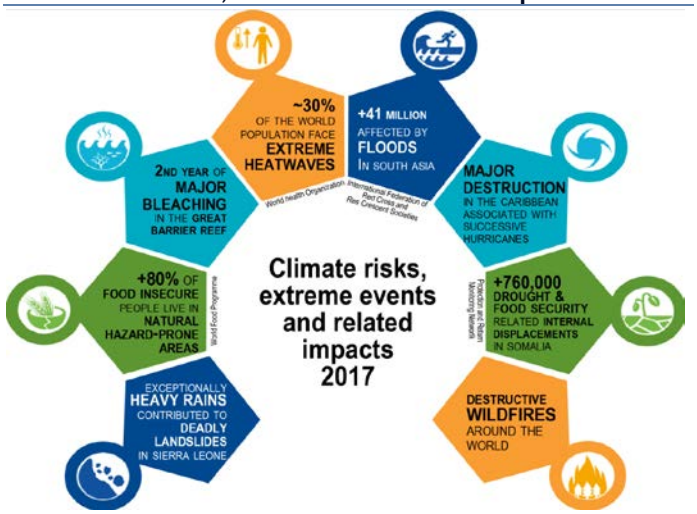
Climate change and extreme weather are becoming the new normal. Extreme weather is the #1 global risk today, with climate change acting as the ultimate risk multiplier. The 16 warmest years on record have occurred in the 21st century and 2017 is on track to be the 41st consecutive year where global temperatures are above 20th century average. Extreme weather is also rising, and now covers 10-12% of the globe at any one given point. In order to maintain a 2°C (3.6°F) warming trajectory, seen as the threshold of avoiding catastrophic climate change, carbon emissions must peak in 3 years and rapidly fall by 50% by 2050. Green technologies such as renewables, energy efficiency, electric vehicles, battery storage, and big data-enabled analytics have the potential to deliver climate mitigation impact.

Exhibit 7: Land & ocean temperature percentiles as at September 2017



Source: NOAA 2017

Exhibit 8: Climate risks, extreme events and related impacts in 2017



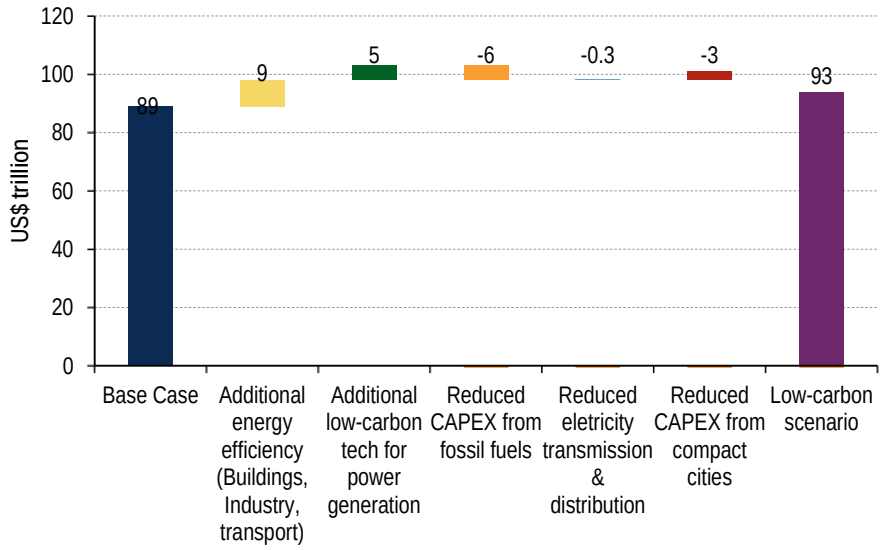
Source: World Meteorological Organization 2017

US$93 trillion worth of infrastructure to revamp in low carbon world

Around US$93tn in infrastructure investment is needed by 2030E to achieve global growth expectations. That is equivalent to around US$6tn per year, but current annual global investment is estimated at only around US$1.7tn (Source: IEA 2017). About 60% of the investment needed is in emerging and developing countries. As shown below, global aggregate infrastructure investment requirements to 2030E are projected to be around US$89 trillion. Shifting to low-carbon infrastructure would add about US$4tn in investments, an extra increase of just less than 5%, to achieve sustainable growth (source: New Climate Economy)

Chart 37: Global investment requirements 2015-2030, US$ trillion, constant 2010 dollars

Including operating expenditures would make a low-carbon transition even more favourable leading to a further reduction of US$5 trillion, for overall potential savings of US$1 trillion.



Source: New Climate Economy

114 countries have renewable energy as official commitments

The nationally determined contributions (NDCs), or national climate commitments has been a major catalyst for spending. For instance, 114 countries are targeting renewable energy, sending a strong signal to investors and corporates (Source: IFC 2017).

Table 19: Number of countries targeting renewable energy in their NDC

Region	Renewable Energy	Solar	Wind	Hydro	Biofuels	Geothermal	Solar-Utility Scale	Waste-to-Energy	Ocean	Waste
East Asia and Pacific	24	15	10	9	14	6	5	1	4	-
Europe and Central Asia	7	5	5	6	2	2	-	1	-	-
Latin America and Caribbean	22	9	13	9	11	6	-	4	2	1
Middle East and North Africa	14	10	8	2	1	3	1	4	1	1
Oceania	2	-	-	-	-	-	-	-	-	-
South Asia	6	4	4	4	5		3	3	1	1
Sub-Saharan Africa	37	32	24	32	23	6	8	4	-	-
Western Europe	2	-	-	-	-	-	-	-	-	-
Total	114	75	64	62	56	23	17	17	8	3

Source: IFC 2017

US$5.3tn to meet NDCs alone

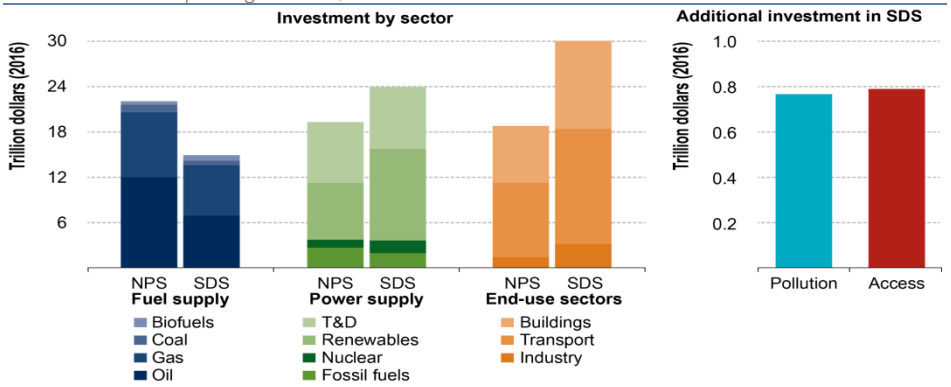
The total cost for countries to meet their NDCs as part of the Paris Agreements stands at US$5.3tn, which only covers around 1/3 of the climate abatement need. Over US$800bn needs to be invested annually through 2020in renewable energy, energy efficiency, and low-emissions vehicles alone (Source: S&P Global 2017).

Up to US$700bn-US$1.4tn /year investment gap

The investment gap to reach the 2°C trajectory versus countries' new policies is around US$16tn through 2040, with a US$9tn gap for low-carbon power and US$7tn for end-use efficiency. This translates to a US$700bn annual investment gap, and is around US$1.4tn higher than the current average annual levels of investment 2010-2016. Universal energy access would require an additional US$793bn, and US$772bn for pollution reductions. While some of this could be offset by the US$8tn cumulative decline in fossil fuel investment, additional capital is likely to be needed. (Source: IEA World Energy Outlook 2017)

Exhibit 9: Cumulative investment needs by sector in the New Policies and Sustainable Development Scenarios 2017 – 2040

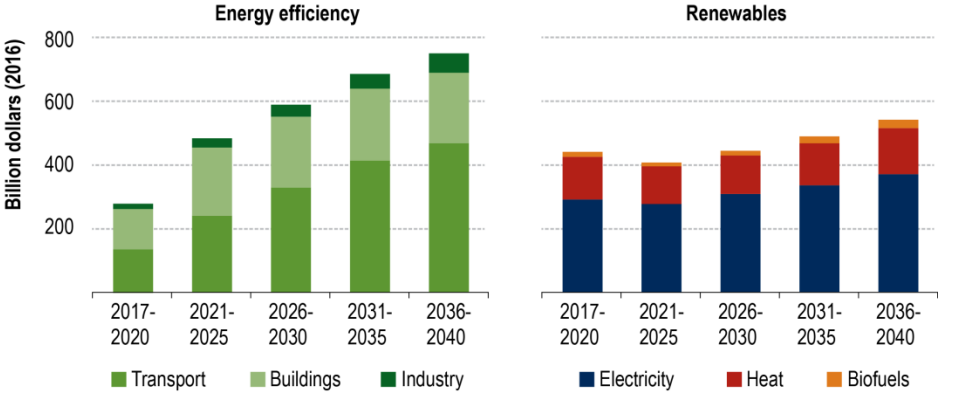
The energy transition is driven by higher investment in energy efficiency and low carbon technologies in end use sectors and power generation, fossil fuel investment declines



Source: IEA World Energy Outlook 2017. Note NPS = New Policies Scenario, SDS = Sustainable Development Scenario

Exhibit 10: Average annual global energy efficiency and renewables investments in the New Policies Scenario

Investment in renewables is broadly constant to 2030 and then increases, while investment in energy efficiency ramps up to exceed renewables by the early 2020s



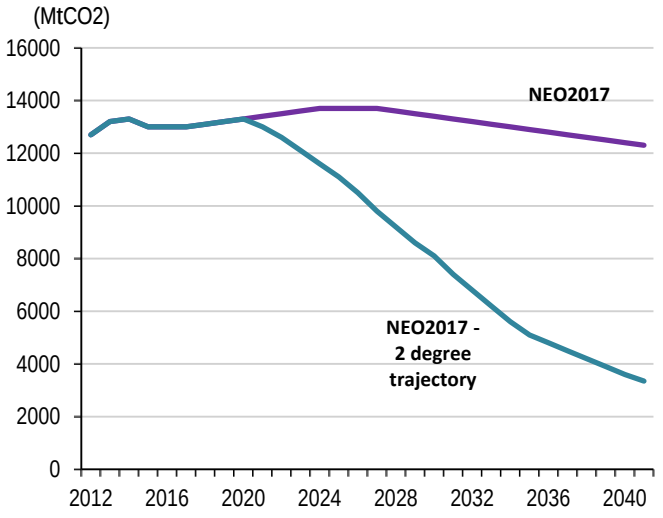
Source: IEA World Energy Outlook 2017

US$14.1tn renewables investment opportunity to 2040E

Over 100 major companies are creating markets by committing to go 100% renewable energy. (Source: IFC 2017)

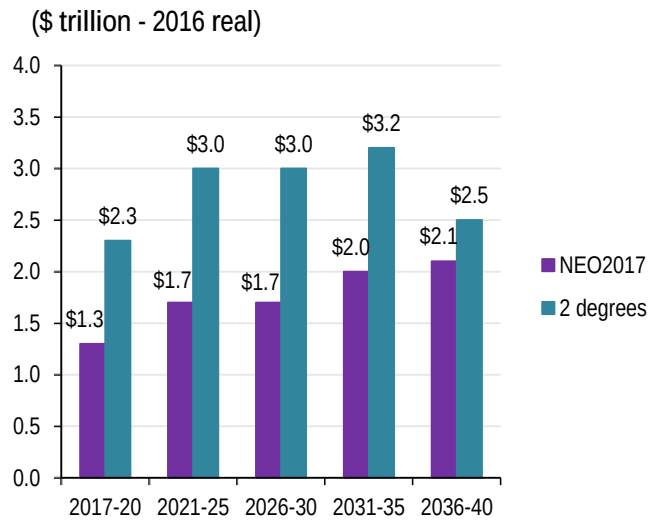
There is an US$14.1tn investment opportunity in renewables 2017-2040 if we aim to stay on the 2°C trajectory. There is around 980 GtCO2e remaining in the carbon budget post-2014 with around 300 GtCO2e for power generation, which suggests 10.9TW of zero-carbon power generation must be installed by 2040. This means new investments should be in the range of US$579bn annually in the next four years, and peaking at around US$637bn for an average annual investment of US$608bn over the next 23Y. (Source: Bloomberg New Energy Finance 2017)

Chart 38: Global Power sector CO2 emissions



Source: Bloomberg New Energy Finance

Chart 39: Total investment in zero-carbon electricity generating capacity



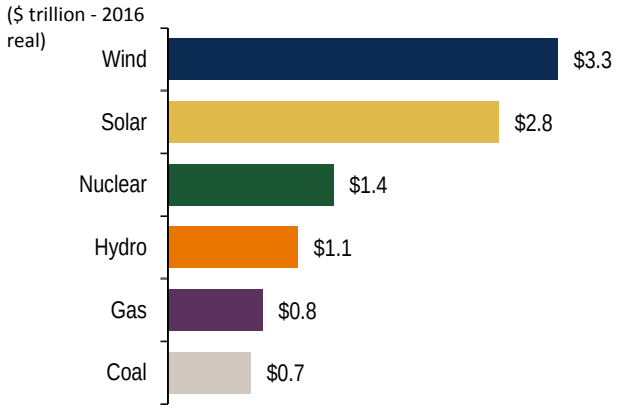
Source: Bloomberg New Energy Finance

US$8.7tn projected investments in zero-carbon through 2040

Annual renewables investments is around 5x the levels of 2004

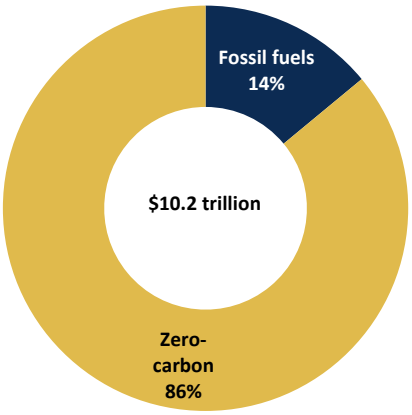
According to latest projections, around US$10.2tn will be invested in new power generation worldwide through 2040, with US$8.7-9tn going into zero-carbon solutions and US$7.4-8tn into renewables. Annual investment is estimated to rise from US$300bn in the 2010-2016 period to around US$400bn by 2040. Solar and wind will account for around US$8 out of US$10 investment, reaching US$2.8tn and US$3.3tn of investment during this period respectively. Wind will growth faster than solar at a CAGR of 3.4% through 2040 vs. 2.3%. Overall, renewables will attract 4x as much investment as fossil fuels (Source: Bloomberg New Energy Finance 2017, IEA 2017)

Chart 40: Investment, by technology, 2017-2040



Source: Bloomberg New Energy Finance

Chart 41: Investment, by technology, 2017-2040

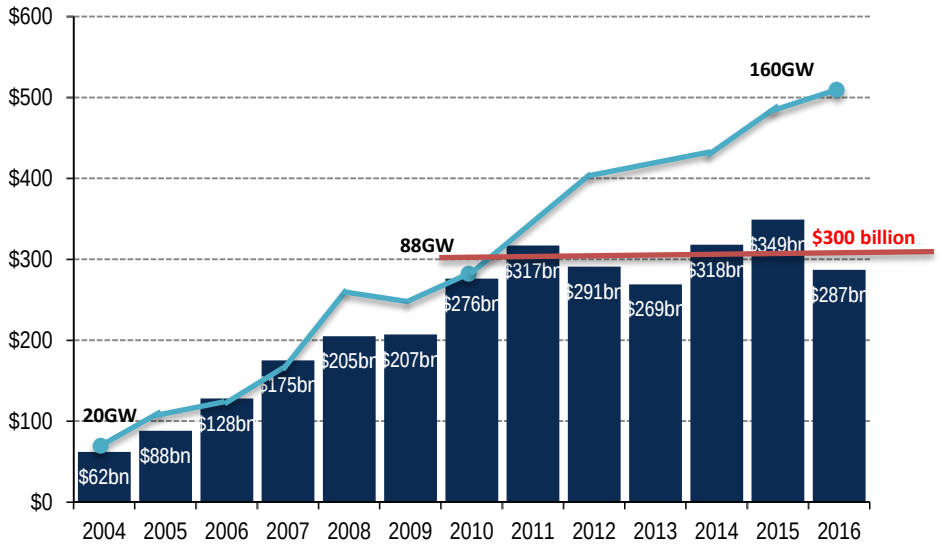


Source: Bloomberg New Energy Finance

Despite investment levels remaining steady since 2010, the amount invested now funds projects that generate 1/3 more electricity thanks to cost reductions and technological advancements (Source: IEA 2016).

Chart 42: Global new clean energy investment and capacity installations

Total values include estimates for undisclosed deals. Includes corporate and government R&D, and spending for digital energy and energy storage projects (not reported in quarterly statistics). Excludes large hydro



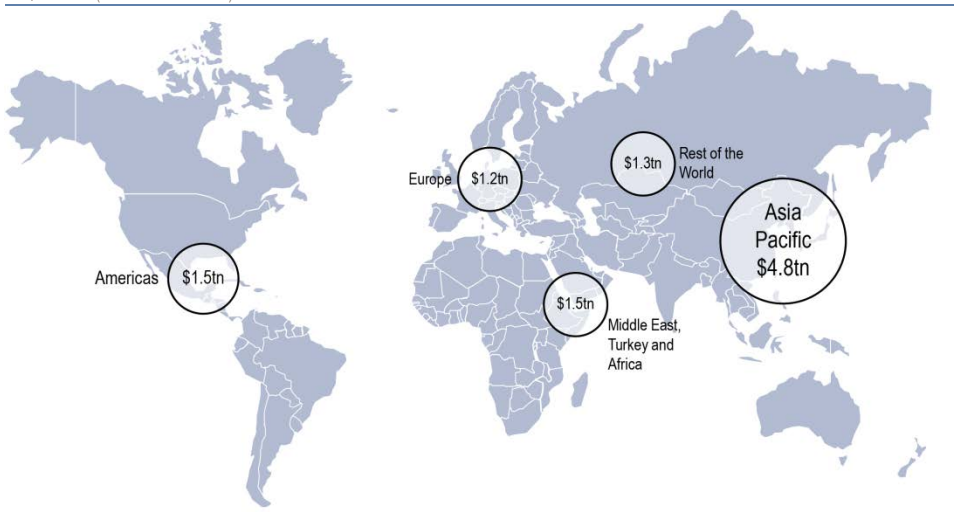
Source: Bloomberg New Energy Finance

Asia Pacific region is projected to account for the lion share of investment with China (US$2.8) and India (US$1.2tn) accounting for US$4tn of investment. China will have around 3/4 of spending going into renewables, while 2/3 of Indian investments will go into solar. (Source: Bloomberg New Energy Finance 2017)

> China is projected to account for **US$1 out of US$3** invested in renewables through 2040

Exhibit 11: investment in new power generation capacity by region (2017 – 2040)

US$ trillion (real 2016 dollars)

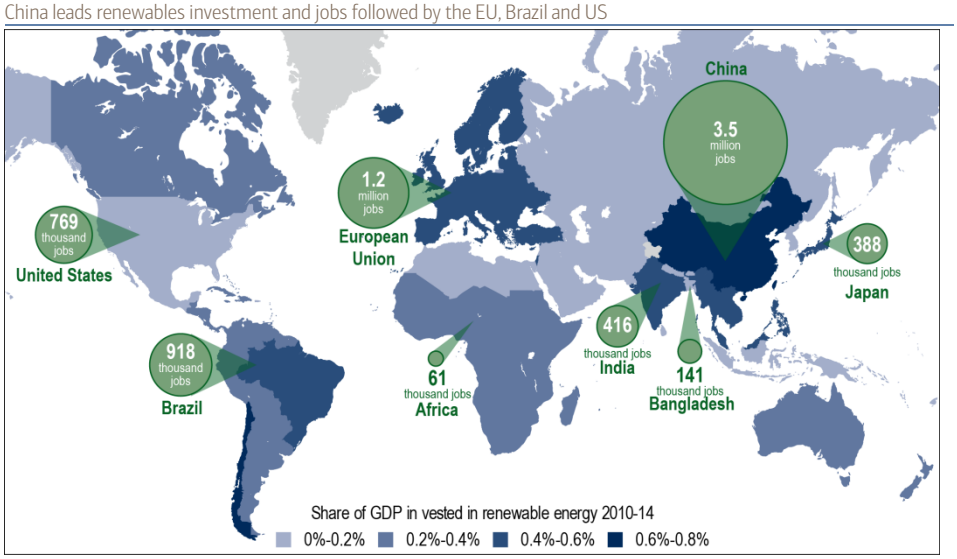


Source: Bloomberg New Energy Finance 2017

Emerging markets are also projected to invest the highest proportion of their GDP into renewables, which China as one of the highest. (Source: IEA 2016)

Exhibit 12: Average renewables investment as a share of GDP (2010 – 2014) and renewable energy jobs in selected regions (2015)

China leads renewables investment and jobs followed by the EU, Brazil and US



Source: IEA 2016, IRENA 2016

US$5.3-6tn investment gap in renewables, US$223bn-253bn annually

Despite the high growth in renewables, there is still an investment gap of around US$223-253bn annually through 2040 in order to meet targets to avoid more catastrophic climate change. This would fund 3.9TW of renewable capacity, and is around 61% higher than our current projections. Hence, more needs to be done despite recent progress (Source: Bloomberg New Energy Finance 2017, IEA 2017)

Up to US$19-30tn investments needed for energy efficiency to 2040E

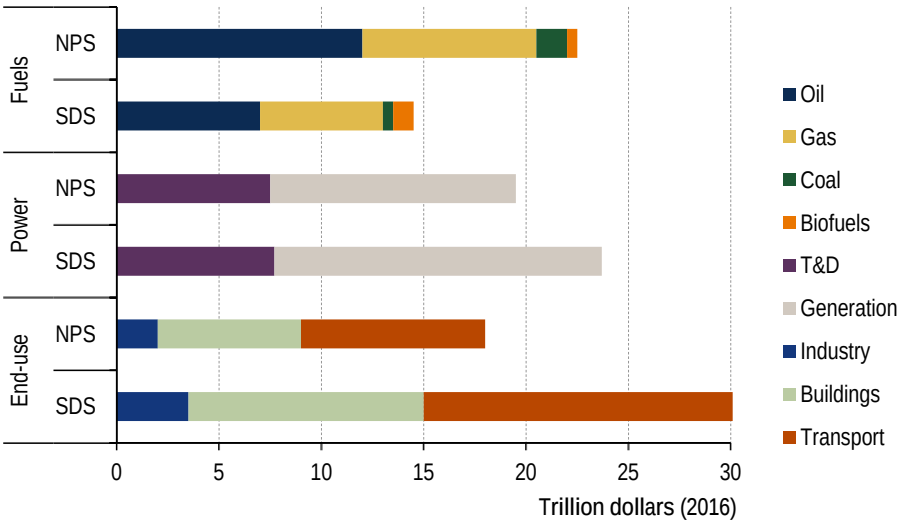
> A US$300bn investment in efficiency for the industrials sector could avoid US$450bn of investment in the power generation (Source: IEA 2016)

Energy efficiency represents the "low hanging fruit" in energy, given that 80% of energy is lost along the value chain, every dollar spent means US$2-4 in lifetime cost savings, and two-thirds of the economic potential to improve energy efficiency remains untapped (source: ABB, IEA).

According to IEA's "New Policies" base line projections, we are investing around US$18.8tn cumulatively through 2040, or US$784bn annually in energy efficiency solutions. Out of that, around 70% will be focused on the transport sector, which will be responding to more stringent fuel economy standards. In the "Sustainable development" for the 2°C trajectory, investment must be 61% higher, reaching US$30.3tn through 2040, or US$1.26tn annually. (Source: IEA World Energy Outlook 2017)

Chart 43: Cumulative global energy investment by scenario, 2017-2040

Investment in the power sector is substantially larger than spending on oil and gas supply in the Sustainable Development Scenario



Source: IEA World Energy Outlook 2017. Note: NPS = New Policies Scenario; SDS = Sustainable Development Scenario; T&D = transmission and distribution

Table 20: Global energy investment by type and scenario, 2017-2040 ($2016 billion)

	2010-16	New Policies		Current Policies		Sustainable Development	
	Per year	Cumulative	Per year	Cumulative	Per year	Cumulative	Per year
Fossil fuels	1103	24713	1007	29932	1247	15496	646
Renewables	297	7950	331	6350	265	12828	534
T&D	236	8025	334	8524	355	8145	339
Other low-carbon	14	1127	47	1095	46	2325	97
Supply	1650	41276	1720	45901	1913	38795	1616
Power sector share	41%		47%		41%		63%
Oil and gas share	54%		50%		55%		35%
End-use	295	18809	784	11912	496	30340	1264

Source: IEA World Energy Outlook 2017. Notes: The methodology for efficiency investment derives from a baseline of efficiency levels in different end-use sectors in 2015; the historical value for end-use spending includes only 2016. T&D = transmission and distribution. Other low-carbon includes nuclear and CCS. Oil and gas share includes upstream, transportation and refining. The elements not covered by the percentages for oil and gas and power shares include biofuels supply and coal mining and transportation

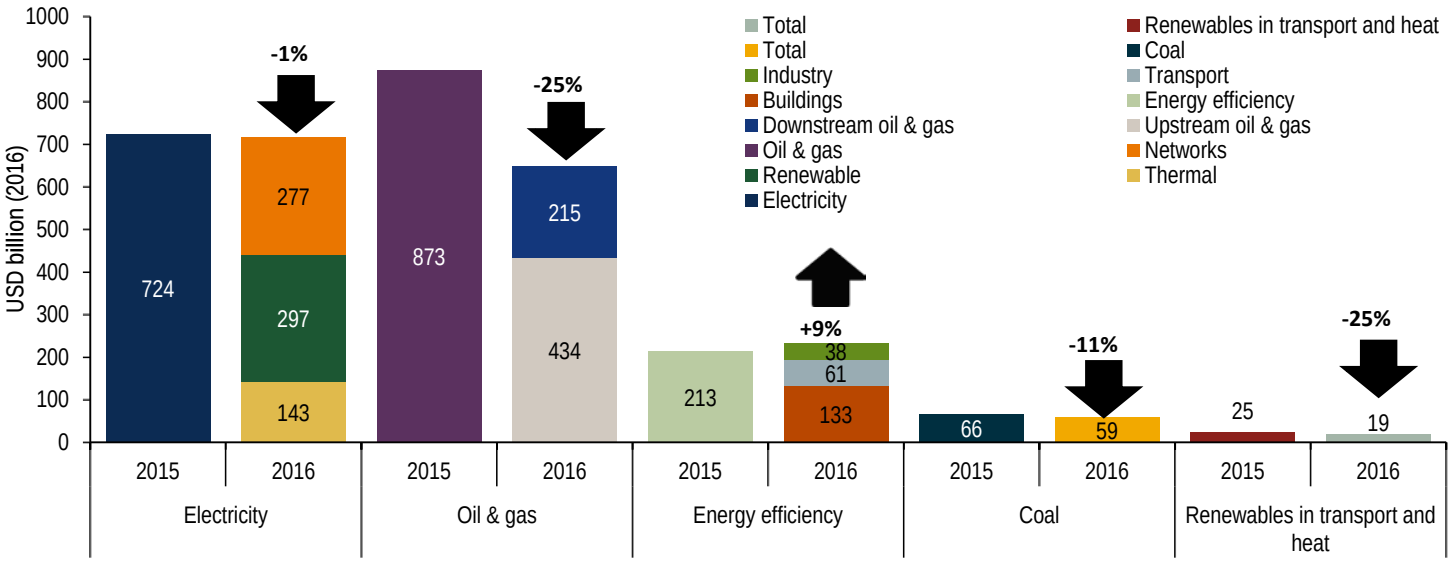
Efficiency is biggest growth sector within energy

Energy efficiency investments rose 8.5% in 2016 to reach US$231bn or 10% of global total energy investment. Europe accounts for the highest spending accounting for US$1 out of $3 invested, while China exhibits the fastest growth given strengthening energy efficiency policies. Over half (US$133bn) of investments has gone into the buildings sector, which accounts for 1/3 of energy demand (Source: IEA World Energy Investment 2017).

While overall investments in energy and renewables fell around 8-12% in 2016, energy efficiency actually saw a YoY rise of 9% (Source: IEA World Energy Investment 2017, Bloomberg New Energy Finance 2017)

Chart 44: Global energy investment fell 12% in 2016, a second consecutive year of decline

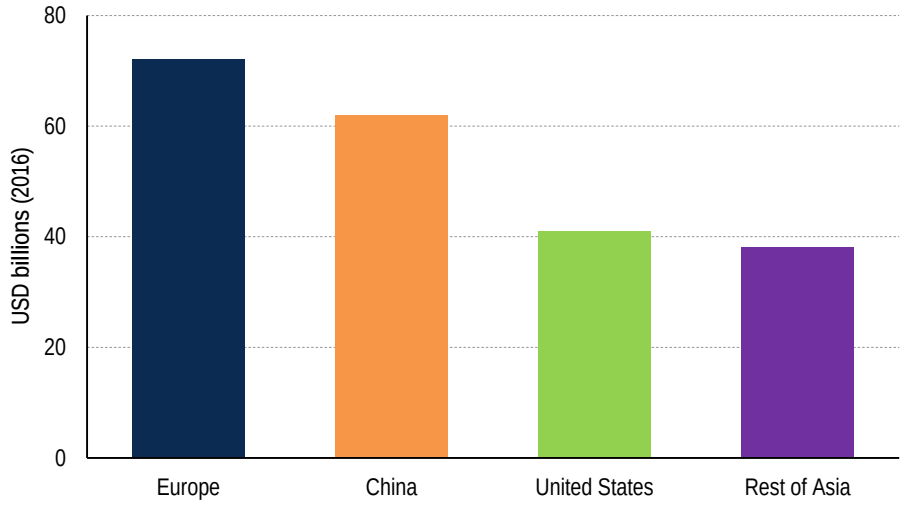
Total energy investment was $1.7 trillion in 2016. Electricity sector investment overtook oil and gas for the first time, while energy efficiency was the biggest growth sector



Source: IEA World Energy Investments 2017

Chart 45: Europe leads efficiency spending but China is set to overtake it by 2018

Policy continues to underpin efficiency spending, especially in buildings insulation, heating systems and home appliances. Much of the growth in transport efficiency spending is in electric vehicles



Source: IEA World Energy Investments 2017

Annual gap of US$480bn-US$1tn, policy can help close it

Bans on sales of internal combustions engine (ICE) vehicles:

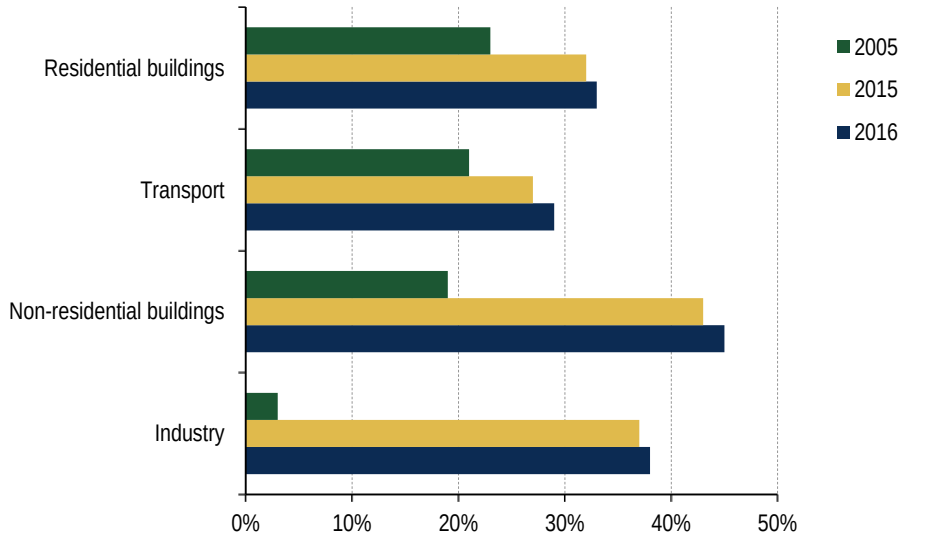
- **UK by 2040**
- **France by 2040**
- **Norway by 2025**

The investment gap in energy efficiency is the highest, where we are looking at a US$480bn annual shortfall between 2°C trajectory and in the baseline projections, US$969bn shortfall between that and recent average annual investment levels. Policy

makers globally have been globally have been introducing increasing stringent efficiency regulation covering sectors including buildings, industry, and transport. As of 2015, nearly 1/3 (31.5%) of final energy consumption is now covered under mandatory energy efficiency regulation (Source: IEA 2017). We see this as a positive catalyst for change.

Chart 46: Share of global final energy consumption covered by mandatory efficiency regulations by sector

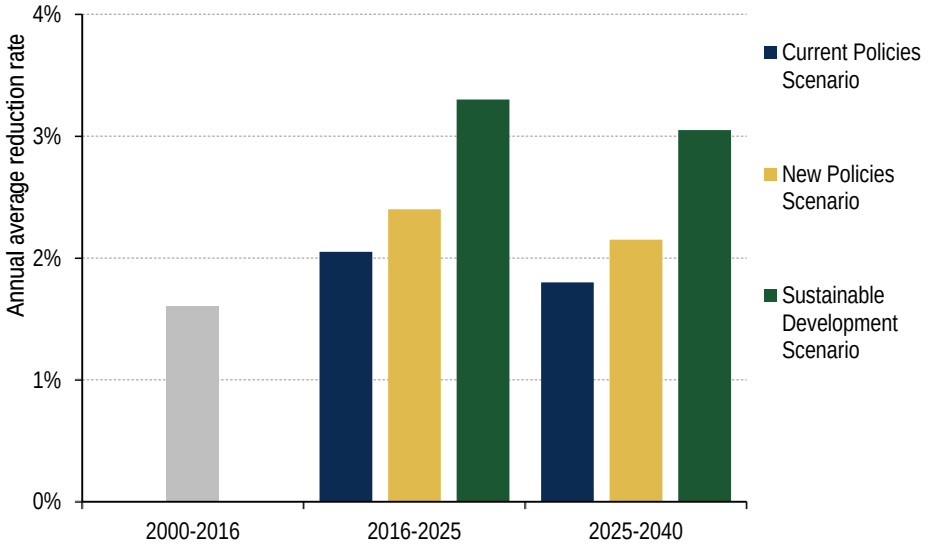
Over 68% of global final energy consumption remained uncovered by mandatory efficiency codes and standards in 2016



Source: IEA World Energy Outlook 2017; Total final energy consumption also includes agriculture and non-energy use, such as industrial feedstocks

Chart 47: Global energy intensity reduction by scenario

Energy efficiency boosts the rate of energy intensity reduction



Source: IEA World Energy Outlook 2017

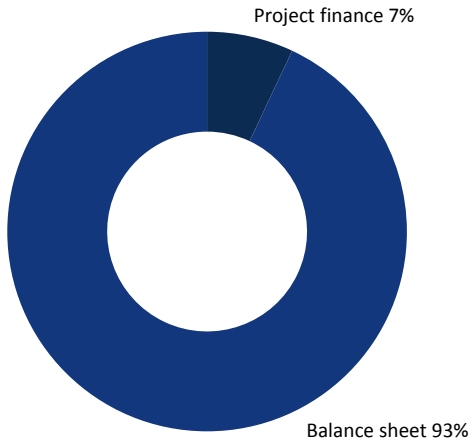
Universal energy access and pollution reduction would require US$1.56tn of additional investment through 2040, or equivalent to 2 years of US military spending (Source: IEA WEO 2017, Institute for Policy Studies)

Public sector footing the bill, but rising private participation

Historically, the leading providers of capital have been governments, national and multilateral development banks, and commercial banks. While governments and state-owned enterprises (SOEs) account for 42% of all investments, this share has been edging down over time. Today, private sector investments account for the greatest share at 47%. Public-private collaboration is also becoming increasingly important. While the cost of government energy efficiency programs are around 15% of energy efficiency spending, through mechanisms such as loans, this can generate private spending that could be 2X this level. (Source: IEA World Energy Investment 2017)

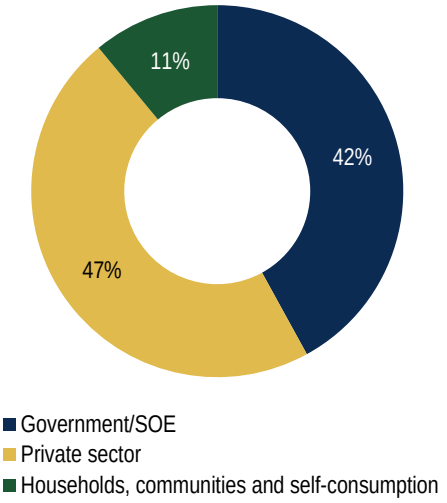
Newer mechanism for raising capital, such as through green bonds and projects bonds, are enabling investors to tap into larger pools of private capital. This is especially important for the financing of small-scale projects such as energy efficiency and distributed power generation.

Chart 48: Sources of finance for the USD 1.7 trillion of energy investments in 2016



Source: IEA World Energy Investment 2017

Chart 49: Sources of finance for the USD 1.7 trillion of energy investments in 2016

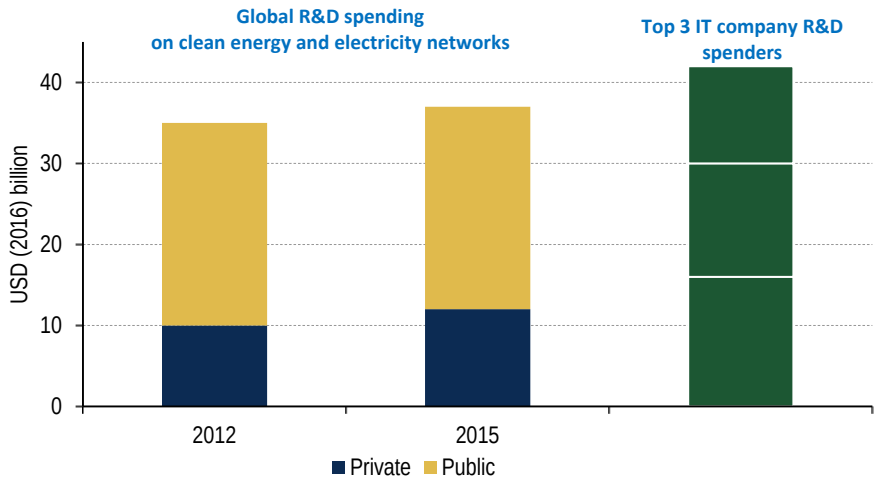


Source: IEA World Energy Investment 2017

More than 2/3 of institutional investors are planning to increase low-carbon investments. (Source: IFC 2017)

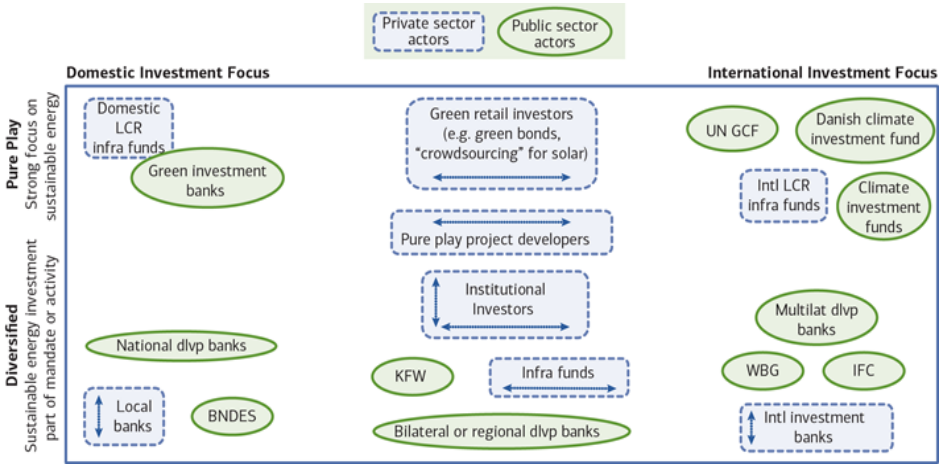
Chart 50: Global clean energy R&D funding needs a strong boost

We've tracked a steady $37 billion/year of clean energy and electricity networks R&D spending, with room for growth from the private sector. As a share of GDP, China now spends most on energy R&D



Source: IEA World Energy Investments 2017

Exhibit 13: Existing public and private entities that finance sustainable energy



Source: OECD

Future capital must come from private actors

Given the strains on government budgets and capital requirements on banks' balance sheets, prior sources of funding could be hard pressed to support billions of dollars of new capital. Their resources alone are insufficient to meet the US$700bn-1.4tn of additional annual investment required, raising the need for new sources of capital.

Table 21: A focus on instruments and funds

Financial Capital Type	Financial Instruments		Funds
	Capital Market Securities	Cash	
Debt	Sovereign, Supranational and Agency (SSA) bond Project bond Corporate bond Covered bond Asset-Backed Security (ABS) Collateralised Debt Obligation (CDO)	Senior Secured Loan Senior Unsecured Loan Subordinated Loans Junior Loan	Infrastructure debt funds (listed and unlisted) Private debt funds (targeting companies) Special Purpose Vehicle Bond fund Exchange Traded Funds Mutual Fund

Bank of America Merrill Lynch

Table 21: A focus on instruments and funds

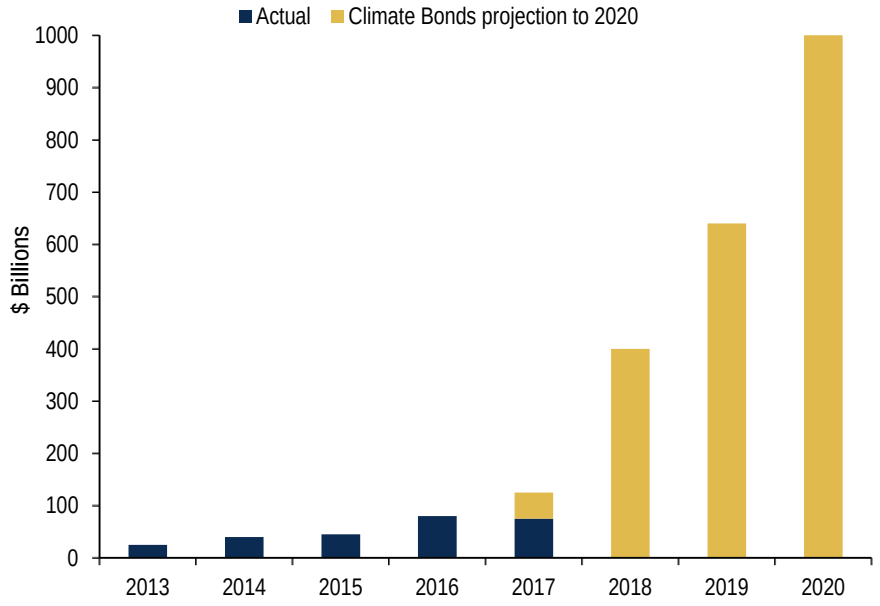
Financial Capital Type	Financial Instruments		Funds
	Capital Market Securities	Cash	
	Structured Note		
Mixed	Convertibles (equity and debt) and Mezzanine financing		Mixed debt and equity funds
Equity	Stock (share)	Unlisted Share	Infrastructure equity funds (listed and unlisted) Private equity funds (targeting companies) Venture capital funds (targeting companies) Special Purpose Vehicle Exchange Traded Fund Mutual Fund YieldCo and other listed structures

Source: OECD

Green bonds could be US$1tn annual opportunity

The UN advisory group SE4All believe that instruments like green bonds could account for around US$120bn in incremental annual investment by 2020E. To meet the 2°C trajectory, some industry leaders believe annual green bond issuance would need to scale to US$1tn annually by 2020, or nearly 10X the current rate of issuance (Source: Figueres et al 2017). Other key tools include structures that help derisk projects, insurance products, and aggregation and pooling approaches to scale smaller projects (Source: SE4All). Much of this can already be bundled with green bonds, or can be offered as stand-alone measures.

Chart 51: We need a $1 trillion a year of green issuance by 2020



Source: Climate Bonds Initiative 2017

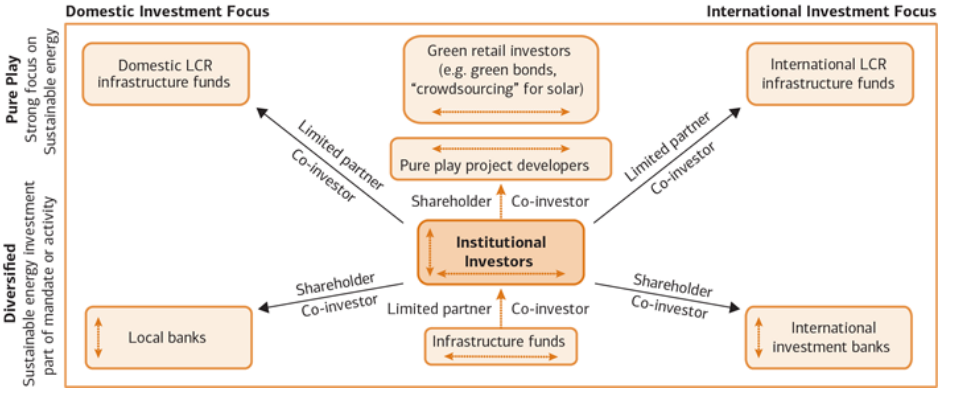
Government framework can help

Given the greater need for investment, policy makers can provide for stable and transparent environment to help scale up private participation. According to the OECD, this should include:

- Preconditions for institutional investment and favourable framework conditions for long-term investment financing.

- Stable, transparent, integrated "investment-grade" policy environment addressing key barriers by institutional investors
- Improve risk-return profiles of sustainable energy projects by addressing market failures while improving market design.
- Facilitate development of liquid markets for environmental projects included green bonds, YieldCos, and funds.
- Reduce transaction costs associated with sustainable energy investment.
- Facilitate the development and application of risk mitigants

Exhibit 14: Institutional investor interactions with private sustainable energy finance providers



Source: OECD

Exhibit 15: Illustration of achieving an optimal risk allocation for a solar investment in a developing country

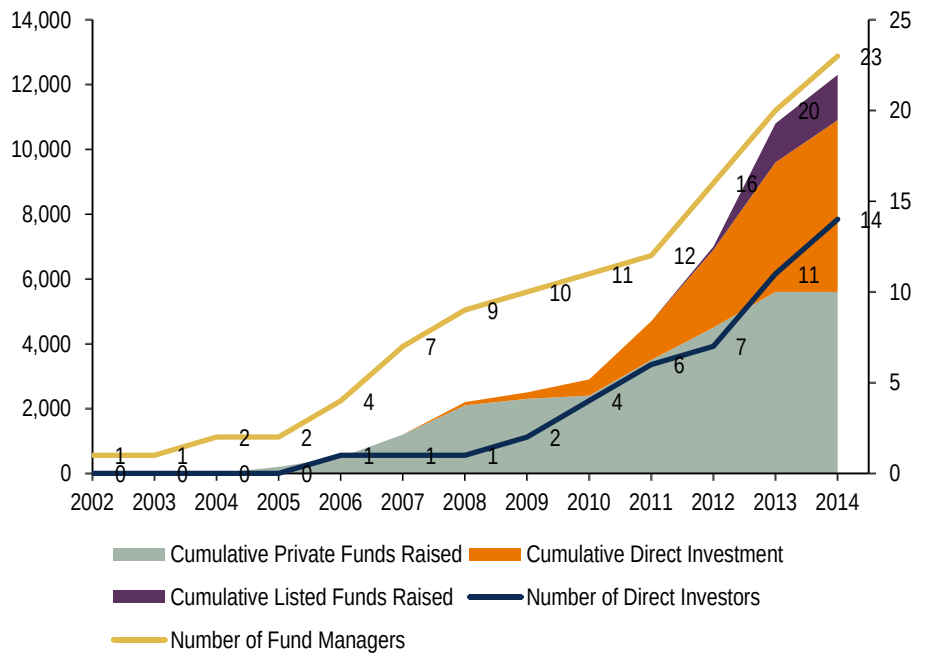
Source: IFC 2017

Asset finance has provided the biggest proportion of clean energy funding

Global expenditure on environmental solutions can be broken down into two main categories of investment – direct in infrastructure projects and indirect through debt and equity of companies. Asset finance often entails the direct financing of projects such as the construction of renewable power plants, carbon capture and storage, and related infrastructure. Investors can offer financial arrangements for individual projects or lend out their balance sheets for more general use.

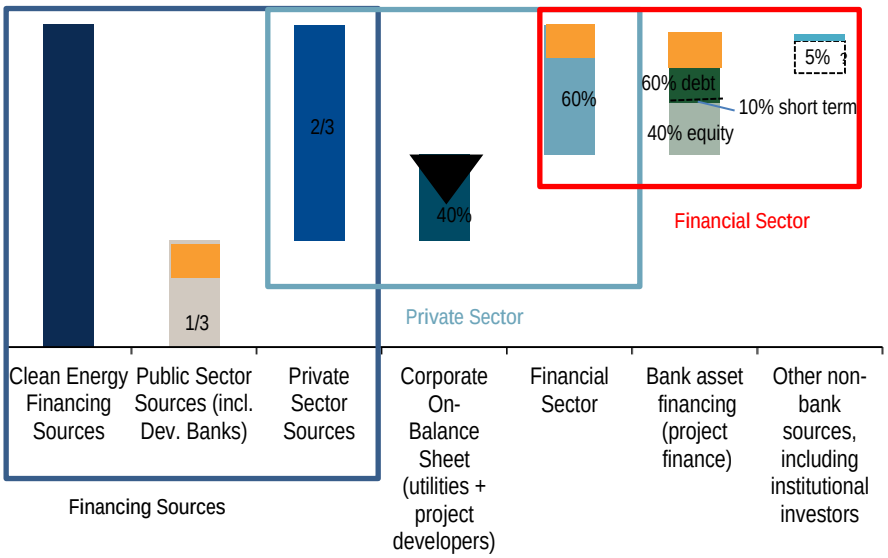
Bank of America Merrill Lynch

Chart 52: Evolution of EU renewable power sector investment by institutional investors (2002-14)



Source: Murley (2014); OECD

Chart 53: Landscape of investment financing sources for sustainable energy and dynamics across the OECD 2008-14 (illustrative example, varies by country)



Source: OECD

Note: orange boxes indicate where investment financing has decreased and are figurative representations that do not present actual magnitudes. The black triangle represents a cap and downward pressure on corporate sources of financing.

Direct finance inaccessible to many institutional investors

While asset finance and the direct investment of projects allows for precise capital deployment, many investors cannot engage in this due to regulatory constraints, liquidity or risk constraints, and/or insufficient funds (source: CERES).

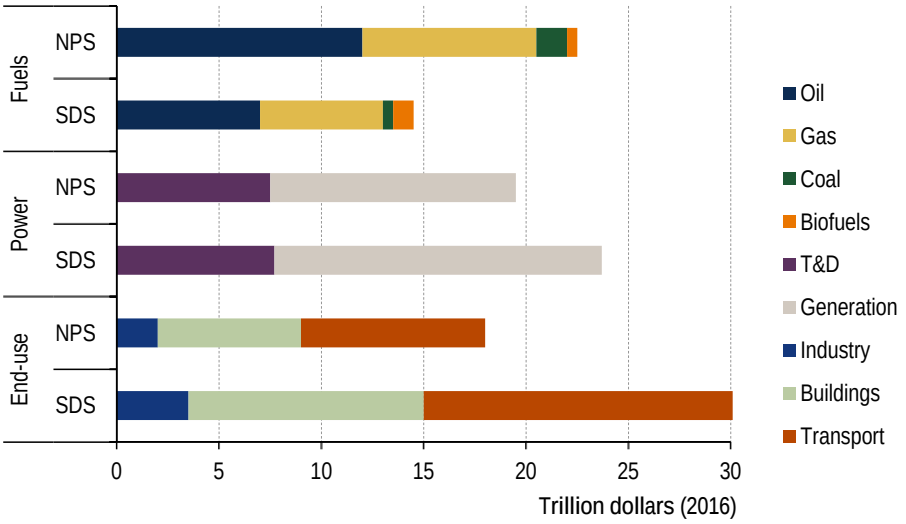
Liquidity: publicly traded securities can reach a wider audience

Alternatively, investors can go through the public markets and invest in the debt and equity of companies or projects that are involved in environmentally sustainable

ventures. Investment in publicly traded securities offers the greatest potential given their lower level of constraints versus direct investment. The bond market in particular is more attractive given its investment profile, size, and the current lack of green opportunities. Historically, this has only comprised a fraction of total clean energy financing (source: BNEF). As more investment options in green debt and equity come to market, this area could drive the most growth.

Chart 54: Cumulative global energy investment by scenario, 2017-2040

Investment in the power sector is substantially larger than spending on oil and gas supply in the Sustainable Development Scenario

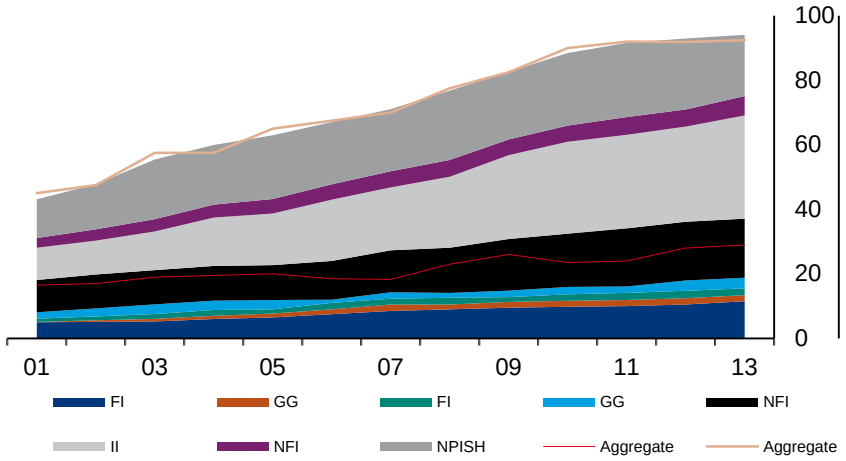


Source: IEA World Energy Outlook 2017. Note: NPS = New Policies Scenario; SDS = Sustainable Development Scenario; T&D = transmission and distribution

US$100tn bond market, greatest growth potential

The characteristics of clean energy infrastructure projects and the investment profiles of fixed income investors are highly compatible. Infrastructure projects provide stable cash flow, inflation hedging, low correlation to other asset classes, and a long time horizon. This matches the requirements of most pensions and insurers. Considering the bond market now has US$100tn outstanding, it offers the size, liquidity, and regulatory freedom to become an additional source for capital for green solutions (source: Bank for International Settlements).

Chart 55: Estimated size of global debt securities market(US$ tr)



Source: Bank for International Settlements
FI = financial corporations; GG = general government; II = international institutions; NFI = non-financial corporations; NPISH = non-profit institutions serving households

Large and stable source of funding needed

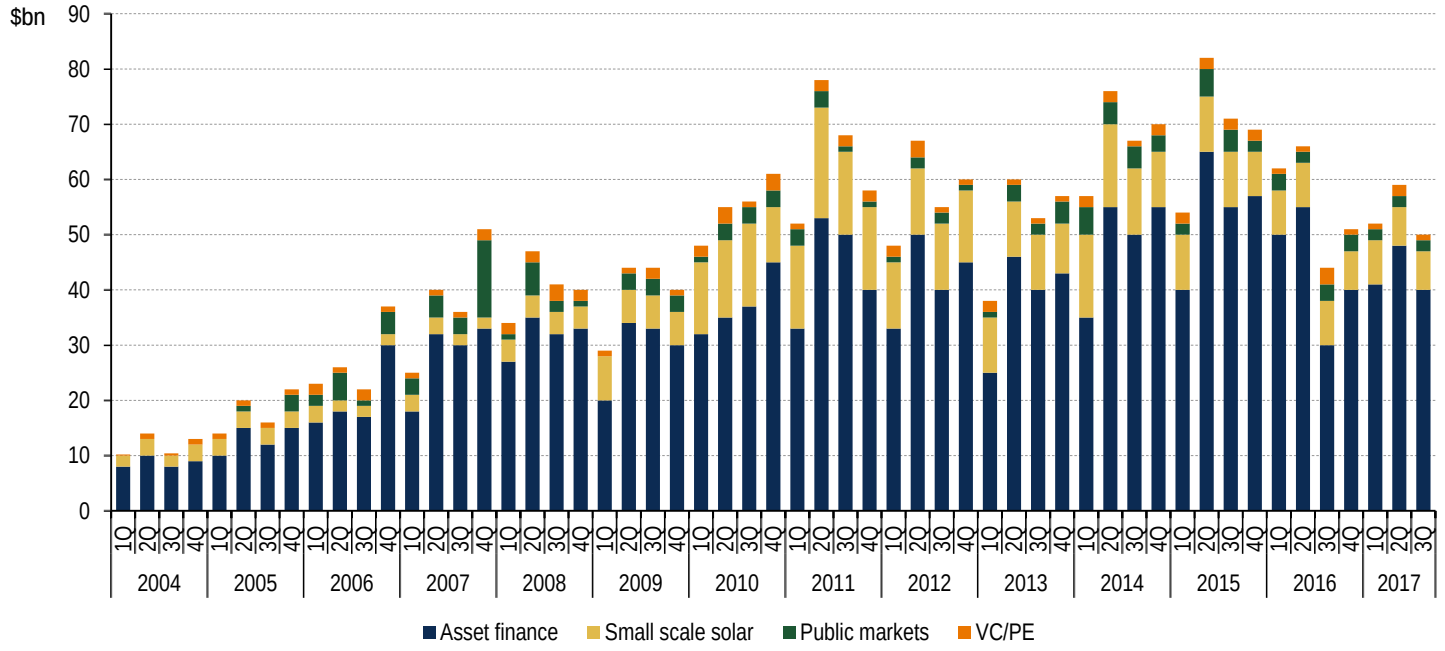
Low-carbon environmental infrastructure and equipment are often highly capital intensive and require significant upfront investment. The average cost of building a wind farm in Europe is €140mn, and the cost of implementing a smart grid distribution network for 1m households is estimated to be €2.6bn (source: Accenture, BNEF). Securing a stable financing stream with low volatility and low correlation to investor confidence and business cycles will be crucial for environmental capital deployment.

Green Bonds a game changer in unlocking private capital

Green Bonds are a game changer in connecting private capital with the US$700-1.4tn/year funding gap in environmental financing. By broadening the pool of potential investors and enabling access to longer-term debt, Green Bonds allow issuers to access a lower cost of capital. Adaptation within the existing capital market framework and the introduction of innovative financing solutions will be necessary. The development of the Green Bond market will improve the awareness of both issuers and investors, enhance replicability for future issues, and strengthen the integrity of the bonds and their proceeds. Enhancing access to the capital market through Green Bonds is critical for the financing of the 2°C scenario, in our view.

Chart 56: Global New Investment in Clean Energy, by Asset Class

Dollar investment via asset finance and small-scale solar projects has been affected by sharp reductions in PV costs



Source: Bloomberg New Energy Finance 2017

Derisking balance sheets

While asset finance has historically been the primary funding vehicle for low-carbon technology (LCT), banks, governments, and supranationals can offload the risk from their balance sheet in the form of Green Bonds. Loans for infrastructure assets and others can be structured into asset backed securities and be sold into the secondary market. Green Bonds have the potential to meet a significant proportion of the funding requirements as a securitised debt backed by low-carbon assets.

Expanded issuance needed

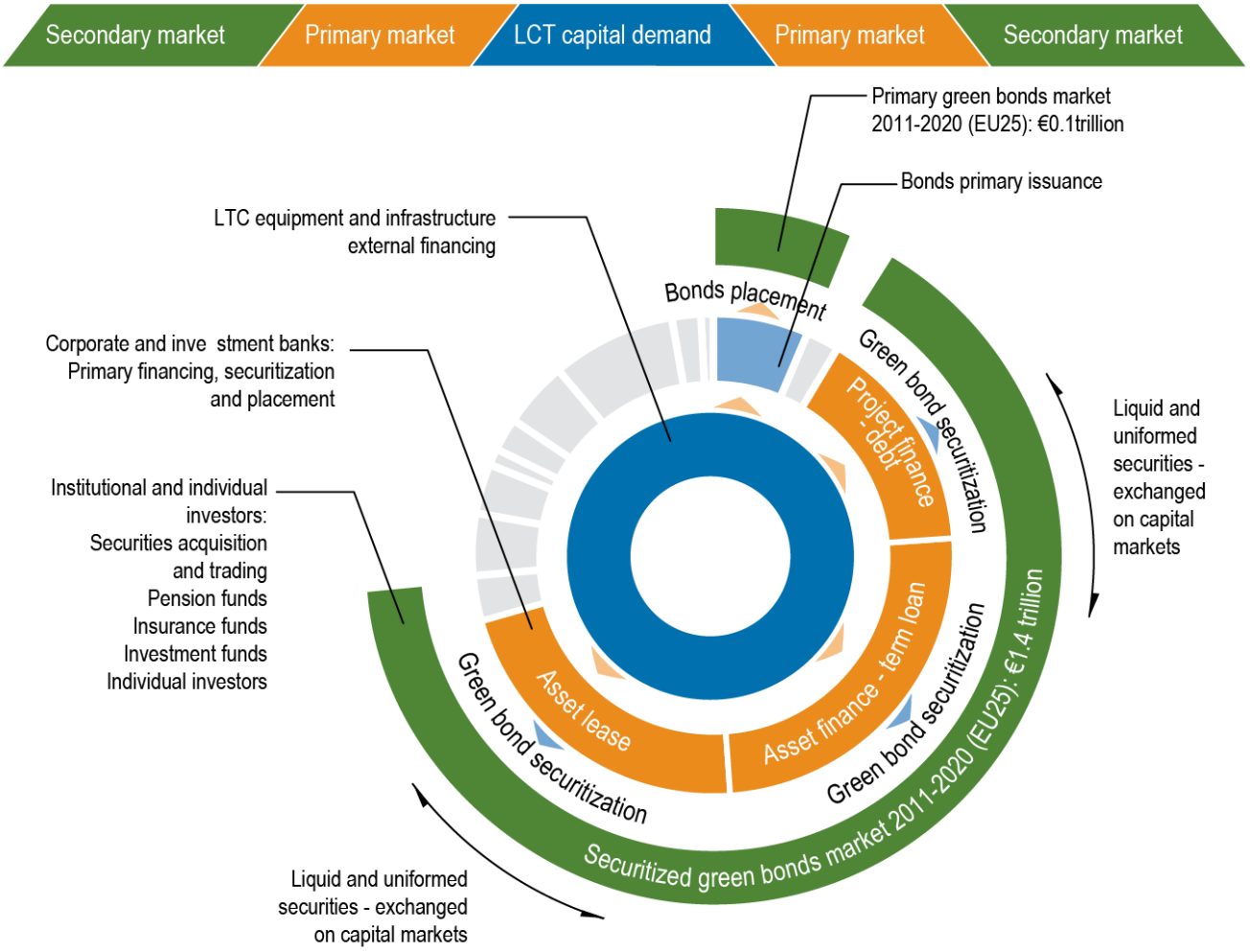
Maturing of the Green Bond market with increased liquidity, scale, size, and creditworthiness is crucial. Expanding the issuance of Green Bonds would broaden the universe of available options, which would make it easier for investors to allocate capital to low-carbon environmental investments. Improving the size of issuance and

creditworthiness of the issuer would make Green Bonds accessible to a more mainstream investor base. At the same time, a larger Green Bond investment universe would also provide for more detailed historical data, enabling more accurate rating and pricing of the bonds.

Need for standardisation

Defining what constitutes a Green Bond will be critical in attracting capital – minimising due diligence on the part of investors and reducing the transaction costs of investing in green solutions (source: CERES). Standardisation reassures buyers of the green credentials behind the bond, thereby increasing comparability, liquidity, and ultimate investor demand. Conforming to a common standard also facilitates liquidity in the secondary market. At the same time, it minimises the possibility of "greenwashing," when bonds are issued under a climate-themed, or green label without linking the proceeds to carbon mitigation.

Chart 57: The "Green Bond" Secondary Market (Cumulative 2011-2020, EU25)



Source: Accenture Carbon Capital

What makes a bond "Green"

A critical issue regarding Green Bonds is devising a universal definition that would increase transparency and disclosure, while ensuring market integrity. Standards in the markets include the Green Bond Principles, Climate Bonds Standards, and that provided by various Green Bond indices. Nonetheless, Green Bonds are a self-labelled title, with no legally binding guidelines to ensure investors of the legitimacy of the issuer's claims.

Table 22: Evolving guidance in the green bond market

	Green Bond Principles	Climate Bonds Standard	Green bond indices
Who developed it?	A group of over 50 large financial institutions.	The Climate Bonds Initiative, an international investor-focused not-for-profit organization.	Each index is run by a bank or credit rating agency, sometimes in collaboration with another party (e.g. a research organization).
What is it?	A set of principles that outlines good practice for the process of issuing a green bond, including: Use of proceeds: the principles recommend issuers define and disclose their criteria for what is considered 'green', i.e. what projects, assets or activities will be considered 'eligible' and what funds will be spent on. Project evaluation and selection: what process will be used to apply 'green' criteria to select specific projects or activities. Management of proceeds: what processes and controls are in place to ensure funds are used only for the specified 'green' projects. Reporting: how projects will be evaluated and progress reported against both environmental and financing criteria.	A standard that issuers can have their green bond certified to. The standards define what is considered 'green' and the technology specifications for certain types of climate-related projects. Currently standards are available only for wind and solar energy generation projects. Standards for green buildings, transport, biomass, water and agriculture/forestry projects are being developed.	A growing number of green bond indices launched by investment banks or credit rating agencies including: •Barclays/MSCI •Standard & Poor's/Dow Jones •Bank of America Merrill Lynch The indices are designed to help investors benchmark green bond performance. Inclusion on a green bond index could improve issuers' reputation, credibility and visibility to investors. Each index has different requirements for eligible green bonds. For example Barclays/MSCI excludes large-scale hydro projects and corporate energy efficiency projects, despite these being labeled green by some issuers and considered green by some investors.
Is it voluntary?	Yes	Yes	Yes
Is third-party assurance required?	Recommended	Yes	Varies due to different listing requirements of each index

Source: KPMG

Standardisation through Green Bond Principles

The primary set of guidelines for the market is the Green Bond Principles (GBP), which were introduced by four investment banks in January 2014. GBP is centralised by the International Capital Markets Association, and is a voluntary set of recommendations intended for the broad use of the market. They provide issuers with guidance on the key components in launching a credible Green Bond, including availability of information necessary to evaluate the environmental impact of their Green Bond investments. By December 2017, the number of supporters has grown to 151, including 46 investors, 42 issuers, and 63 underwriters (source: ICMA, BNEF, CERES).

Types of Green Bonds

GBP defines Green Bonds as instruments whose proceeds will be applied exclusively to projects and activities that promote climate and other environmental sustainability purposes. There are four distinct types of Green Bonds:

- **Green Use of Proceeds Bond** – Standard recourse-to-the-issuer debt obligation; proceeds are ring-fenced by the issuer and attested to by a formal process that links the issuer's lending and investment operations for projects.

- **Green Use of Proceeds Revenue Bond** – Standard non-recourse-to-the issuer debt obligation with credit exposure to the pledged cash flows of the revenue stream; proceeds are ring-fenced by the issuer and attested to by a formal process that links the issuer's lending and investment operations for projects.

- **Green Project Bond** – Project bond in which the investor has direct exposure to the risk of the project with or without potential recourse to the issuer.

- **Green Securitized Bond** – Bond collateralised by specific projects such as covered bonds, ABS, and other structures. The first source of repayment is the cash flows of the assets.

Four areas of GBP guidelines

The Green Bond Principles describe four main areas of guidelines: Use of Proceeds, Process for Project Evaluation and Selection, Management of Proceeds, and Reporting.

Part 1: Use of Proceeds

The cornerstone of a Green Bond is the utilisation of the proceeds of the bond for Green Projects (including other related and supporting expenditures, such as R&D), which should be appropriately described in the legal documentation for the security. All designated Green Projects should provide clear environmental benefits, which will be assessed and, where feasible, quantified by the issuer. In the event that all or a proportion of the proceeds are or may be used for refinancing, it is recommended that issuers provide an estimate of the share of financing vs. re-financing, and where appropriate, also clarify which investments or project portfolios may be refinanced.

GBP recognises several broad categories eligible for Green Projects

- Renewable energy (including production, transmission, appliances and products)

- Energy efficiency (including efficient buildings, energy storage, smart grids, district heating)

- Pollution prevention and control (including waste water treatment, reduction of air emissions, recycling, soil remediation, waste reduction, waste-to-energy

- Environmentally sustainable management of living natural resources and land use (sustainable agriculture, smart farms inputs, sustainable fishery and aquaculture, sustainable forestry)

- Terrestrial and aquatic biodiversity conservation

- Clean transportation (including electric, hybrid, public, rail, non-motorised, multi-modal transportation, infrastructure for clean energy vehicles)

- Sustainable water and wastewater management

- Climate change adaption (including information support systems, such as climate observation and early warning systems)

- Eco-efficient and/or circular economy adapted products, production technologies and processes (such as development of environmentally friendlier products)

- Green buildings which meet regional, national or internationally recognized standards and certifications.

Part 2: Process for Project Evaluation and Selection

The issuer of a Green Bond should clearly communicate to investors:

- the environmental sustainability objectives;

- the process by which the issuer determines how the Projects fit within the eligible Green Projects categories identified above;

- the related eligibility criteria, including, if applicable, exclusion criteria or any other process applied to identify and manage potentially material environmental and social risks associated with the Projects.

Part 3: Management of Proceeds

The net proceeds of the Green Bond, or an amount equal to these net proceeds, should be credited to a sub-account, moved to a sub-portfolio or otherwise tracked by the issuer in an appropriate manner, and attested to by the issuer in a formal internal process linked to the issuer's lending and investment operations for Green Projects.

The GBP encourage a high level of transparency and recommend that an issuer's management of proceeds be supplemented by the use of an auditor, or other third party, to verify the internal tracking method and the allocation of funds

Part 4: Reporting

Issuers should make, and keep, readily available up to date information on the use of proceeds to be renewed annually until full allocation, and as necessary thereafter in the event of material developments. This should include a list of the Projects to which Green Bond proceeds have been allocated, as well as a brief description of the projects and the amounts allocated, and their expected impact.

Assurance, an increased focus

A particular focus for the updated Green Bond Principles was also on assurance. The topic of ensuring "Green-ness" and preventing "greenwashing" has been a major focus for investors as well as issuers. While the first edition of GBP introduced the idea of assurance and the concept of 2nd party reviews, audits, and 3rd party certifications, the GBP update highlighted greater emphasis on the need for verification. It details how external reviews and consultations can be used, especially in terms of conveying transparency to investors and to the general public. Investors tend to use assurance as well as other independent research to formulate an opinion of "green-ness".

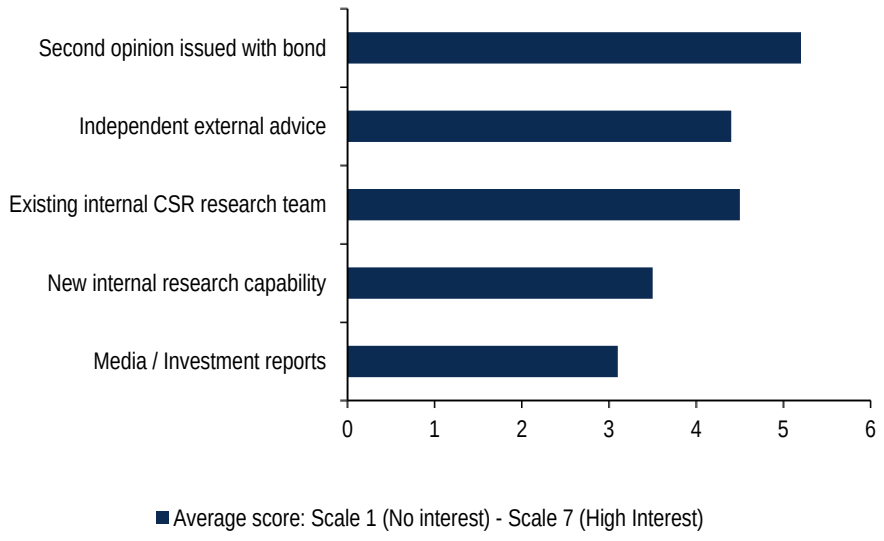
- Consultant Review: An issuer can seek advice from consultants and/or institutions with recognised expertise in environmental sustainability or other aspects of the issuance of a Green Bond, such as the establishment/review of an issuer's Green Bond framework. "Second party opinions" may fall into this category.

- Verification: An issuer can have its Green Bond, associated Green Bond framework, or underlying assets independently verified by qualified parties, such as auditors. In contrast to certification, verification may focus on alignment with internal standards or claims made by the issuer. Evaluation of the environmentally sustainable features of underlying assets may be termed verification and may reference external criteria.

- Certification: An issuer can have its Green Bond or associated Green Bond framework or Use of Proceeds certified against an external green assessment standard. An assessment standard defines criteria, and alignment with such criteria is tested by qualified third parties/certifiers.

Rating: An issuer can have its Green Bond or associated Green Bond framework rated by qualified third parties, such as specialised research providers or rating agencies. Green Bond ratings are separate from an issuer's ESG rating as they typically apply to individual securities or Green Bond frameworks/programmes.

Chart 58: Ranking of tools' usefulness when analyzing green bonds' credentials



Source: Euromoney

Several second-party opinions available

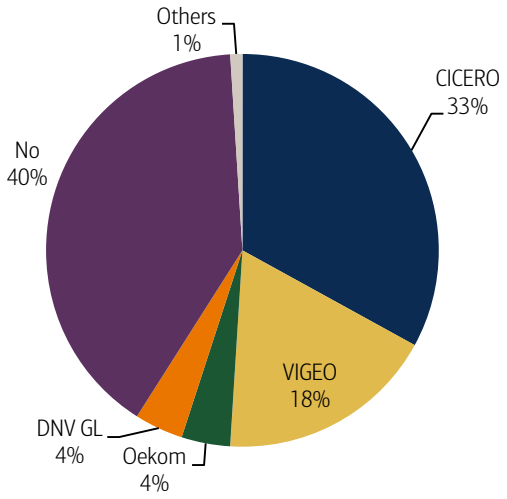
There are several second-party opinion providers that help issuers meet environmental objectives and follow GBP guidelines, ranging from non-profit to certification companies. Second-party consultants provide an opinion, not a verification of greenness. Issuers use them as an additional layer of assurance to investors regarding the green integrity of the bond. The major providers are:

- **CICERO** – Centre for International Climate and Environmental Research at the University of Oslo. Non-profit environmental research institute established by the Norwegian government; mandated by Skandinaviska Enskilda Banken (SEB) to provide secondary opinions on Green Bonds underwritten by the bank. CICERO's opinion is restricted to whether the issuer's mechanism or framework for selecting eligible projects meets its environmental goals.

- **DNV GL** – Norwegian Testing, Inspection & Certification (TIC) company that provides Green Bond services including advice for compliance with GBP criteria, screening for inclusion within Green Bonds, independent verification.

- **Vigeo** – French leading expert in the assessment of environmental, social, governance (ESG) issues.

Chart 59: Significant providers of second party reviews



Source: CBI HSBC

New entrants emerge, but Cicero and Vigeo are primary sources of 2nd opinion

Currently, around 60% use a 2nd party review. While there have been new entrants in the space including Oekom, Sustainalytics and KPMG, Cicero (33%) and Vigeo (18%) still take the largest market share. Other new entrants include Oekom and CH2M HILL, which entered the market as second party assurance. For issuers such as real estate companies that have reference certified assets such as LEED rated buildings, the ratings will often stand in place of a 2nd party opinion to verify the green credentials of the bond.

Table 23: New Green bond service providers

Organisation	Location	Background
KPMG	Netherlands	Professional services organisation with accounting expertise
Oekom	Germany	Private business that assesses companies based on their environmental, social and governance (ESG) performance
CH2MHILL	US	Environmental consulting and engineering firm
Trucost	UK	Environment data firm that assesses sustainability reporting of large corporations

Source: BNEF

Opinion is not certification of greenness

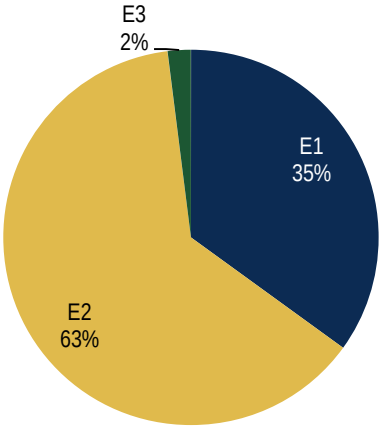
Second-party consultants have their own proprietary guidelines and base their opinions on documentation and information provided by the issuer themselves. CICERO and DNV develop their own interpretation of GBP, which they use to assess the issuer's framework and projects (source: DNV, CICERO). Vigeo takes the issuer's own stated framework for assessing greenness and then decides if it is following it (source: Vigeo). Generally, second-party consultants consider the firm's overall procedures rather than the greenness of a particular project. In all cases, secondary consultants are neither responsible for how the framework or the projects are implemented, nor the ultimate outcome of the eligible projects.

98% of green bonds scoring well

Despite lack of a binding framework, green bonds are scoring well with regards to "greenness". S&P Global has a Green Evaluation framework assessing green bonds based on governance, transparency, and environmental impact – scoring bonds between 0 and 100. E1 equate to 75-100, or the highest quality of greenness, followed by E2 (50-74), E3 (25-49), and E4 (0-24). S&P believes that around 35% of all green bonds would score E1, and another 63% as a E2, with the total universe averaging around a score of 70. This

would be above average in "greenness". Nearly half (42%) of the E2 scores could improve to an E1 with better governance and transparency (Source: S&P Global 2017).

Chart 60: Breakdown of overall scores by quartile (%)



Source: S&P 2017

Climate Bonds Certification Scheme, third-party verifier

The Climate Bonds Initiative (CBI) – a non-profit company focused on mobilising the bond market for climate change solutions – has been studying the development of the climate-change-themed bond market. It has established a Climate Bonds Taxonomy, along with a Climate Bond Standard and Certification Scheme. The scheme has a transparent multi-stakeholder structure with working groups to advise on technical criteria to determine what would be deemed climate-credible Green Bonds. It enables certification of a project, portfolio, corporate and sovereign bonds that are tied to environment friendly assets (source: Climate Bonds Initiative). Its ultimate goal is to reduce market friction and improve risk differentiation among green investments.

Climate Bonds Taxonomy

CBI created the Climate Bonds Taxonomy as a way to define Green Bonds and provide use of proceeds guidelines for prospective climate bond and Green Bond issuers and potential investors. The Taxonomy and Standards are consistent with the Intergovernmental Panel on Climate Change (IPCC) AR4 report. The guidance is meant to be broad; it is subject to ongoing refinement and updated in accordance with IPCC findings (source: Climate Bonds Initiative).

Exhibit 16: Climate Bonds Taxonomy

ENERGY	TRANSPORT	WATER	LOW CARBON BUILDINGS	INFORMATION TECHNOLOGY & COMMUNI-CATIONS	WASTE & POLLUTION CONTROL	NATURE BASED ASSETS	INDUSTRY & ENERGY-INTENSIVE COMMERCIAL
Solar ✓	Rail ✓	Built (grey) infrastructure ✓	Residential ✓	Solar ●	Recycling ●	Agricultural land ●	Manufacturing ●
Wind ✓	Vehicles ✓	Green and hybrid Infrastructure ●	Commercial ✓	Broadband ●	Other Recovery ●	Forests (managed and unmanaged) ●	Energy efficiency processes ●
Geothermal ✓	Mass transit ✓		Retrofit ✓	Resource efficiency ●	Disposal ●	Wetlands ●	Energy efficiency products ●
Hydropower ●	Bus rapid transport		Products for building carbon efficiency	Teleconferencing ●	Prevention ●	Degraded lands ●	Retail and wholesale ●
Bioenergy ●	Water-bourne transport ●				Reuse ●	Other land uses (managed and unmanaged) ●	Data centres ●
Wave and Tidal ●	Alternative fuel Infrastructure				Pollutiona Control ●	Fisheries and aquaculture ●	Process & fugitive emissions ●
Energy distribution & management						Coastal Infrastructure ●	Energy efficient appliances ●
Dedicated transmission						Land Remediation ●	Combined heat & power ●

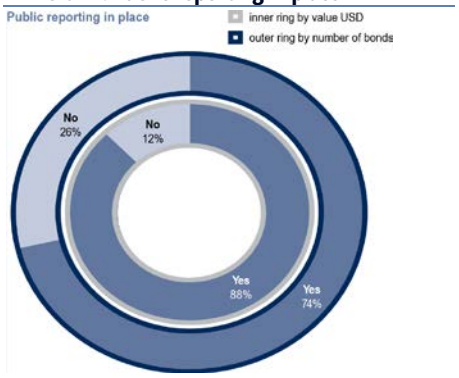
✓ Certification Criteria approved
● Criteria under development
● Due to commence

Source: Climate Bonds Initiative

Transparency on the rise: majority of bonds providing reporting

Nearly 3/4 (74%) of all green bonds provide public reporting post-issuance, together comprising 88% of the green bonds universe by value. While the level of detail and complexity vary widely, this is certainly evolving in the right direction. Governmental agencies and SOEs have nearly universal reporting, with commercial banks also showing a high degree of transparency. Corporate green bonds, green ABS and sub-sovereigns typically have lower levels of reporting. Of the 30% corporate bonds where reporting was not available, 1/3 were private placements. Excluding private placements, reporting would rise to 78% (Source: Climate Bonds Initiative 2017).

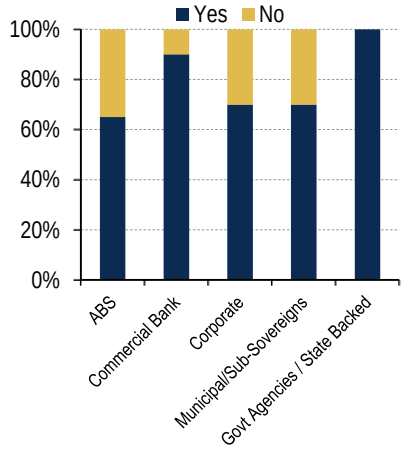
Exhibit 17: Public reporting in place



Source: Climate Bonds Initiative 2017

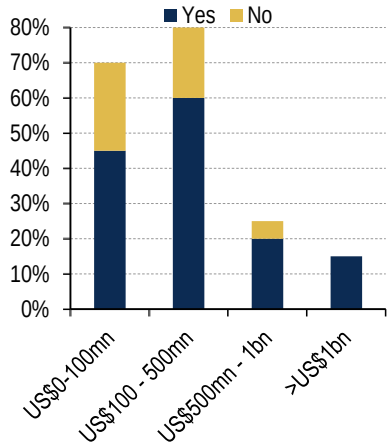
Chart 61: Reporting by issuer type

Measured by number of green bonds



Source: Climate Bonds Initiative 2017

Chart 62: Reporting is more common for bonds >US$500mn

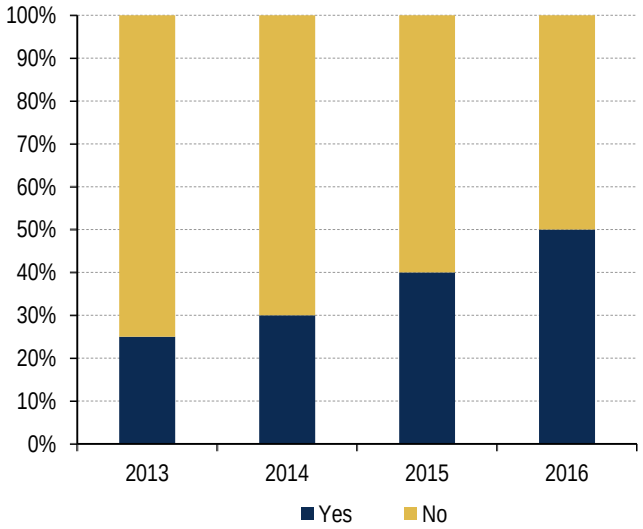


Source: Climate Bonds Initiative 2017

Impact reporting is on the rise

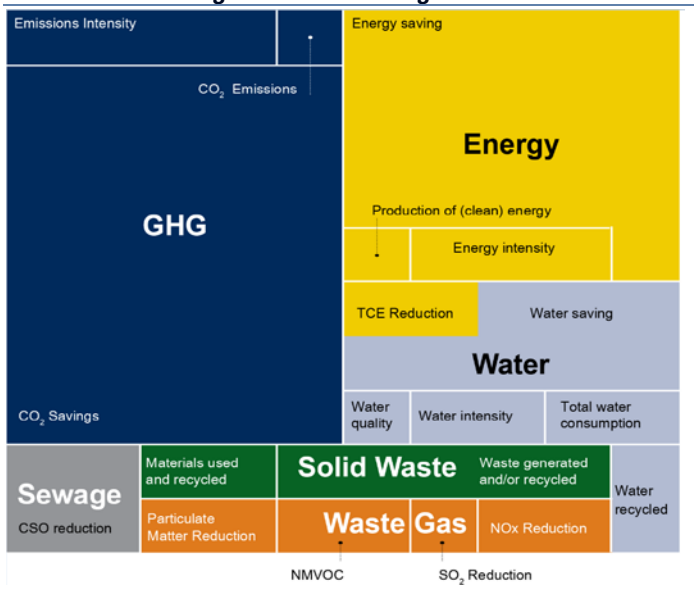
Impact reporting, quantifying the climate impact of the project/asset numerically, has been gaining prominence. Of the green bonds that conduct post-issuance reporting, 38% included impact reporting. This percentage has been rising, where for 2016, half of all bonds have been quantifying impact. This been an important metric in preventing "green-washing" as the range of issuers expand into new regions, sectors, and asset classes. However, many market participants may see it as a burdensome task that could turn away potential issuers (Source: Climate Bonds Initiative 2017).

Chart 63: Impact reporting is increasing year on year



Source: Climate Bonds Initiative 2017

Exhibit 18: A wide range of metrics are being used



Source: Climate Bonds Initiative 2017

General reporting standards

Table 24: Summary of key reporting frameworks

	Green Bond Principles	Climate Bonds Standard	Country guidance
1. Reporting frequency	Annual	Annual	PBoC: quarterly SEBI: annual Japan: annual
2. Availability of reporting	'Readily available'	Mandatory to bondholders and Climate Bonds Standard Secretariat Public reporting encouraged	PBoC: disclose 'to the market' quarterly,report to the PBoC annually SEBI: public with annual and quarterly financial results Japan: public
3. Location of reporting	• Annual report and accounts • Annual sustainability reporting • Separate section of website • Investor letter • Separate green bond report	• Annual report and accounts • Annual sustainability reporting • Separate section of website • Investor letter • Separate green bond report	PBoC: not specified SEBI: 'along with annual report and financial results'
4. Period of reporting	Until allocation is complete	For the life of the bond	PBoC: duration of the bond Japan: until full allocation SEBI: not stated
5. Use of proceeds information to include	Mandatory: Broad categories and % allocated to each Recommended: • List of projects and assets if not commercially sensitive • Description of projects • Expected impact of projects	• Nominated assets and projects detailed in full 'in line with confidentiality agreements' • Percentage of refinancing • Description of projects • Expected impact of projects	SEBI and Japan Broad categories and % allocated Recommended: List of projects and assets if not commercially sensitive; description of the projects; expected impact of projects PBoC: Proceeds allocation; assessment to green projects (recommended); associated environmental benefits(recommended)
6. Allocation information	• Amount allocated to projects • Percentage of bond to refinancing	• % of bond allocated to date • Percentage of bond to refinancing • Details of unutilized proceeds	SEBI: details of unallocated proceeds Japan: details of unallocated proceeds PBoC: amounts allocated
7. External verification	Recommended	Recommended	SEBI: mandatory PBoC: recommended

Source: Climate Bonds Initiative 2017

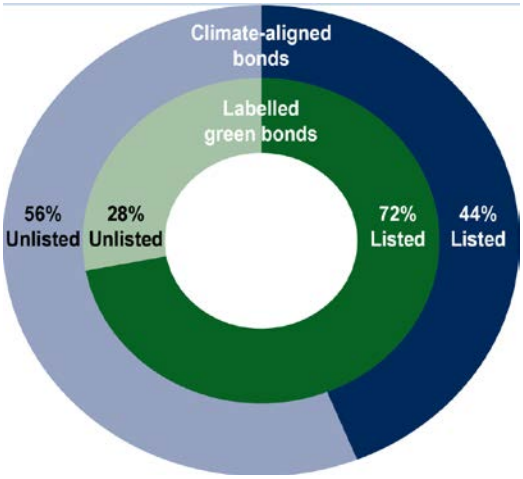
Increasing role of exchanges, indices, ETFs

Governments, exchanges, ratings agencies, and ETFs are all increasing their involvements with green bonds, which brings better transparency and standardization for the markets.

Exchanges promote harmonization of standards

Exchange can play an important role in leverage existing standards and guidelines to promote international harmonization and comparability. Exchanges can encourage the application and development of robust standards. By increasing disclosure, reporting, and transparency, they can help support the integrity and growth of the market. Several exchanges from all over the world, ranging from London to Stockholm to Mexico City have introduced segments dedicated to green bonds (Source: Climate Bonds Initiative 2017).

Exhibit 19: A high proportion of labeled green bonds are listed on exchanges



Source: Climate Bonds Initiative 2017

Table 25: Exchanges with a dedicated green bond list/segment

Exchange	Type of dedicated list/segment	Launch date
Oslo Stock Exchange	Green Bonds	January 2015
Stockholm Stock Exchange	Sustainable Bonds*	June 2015
London Stock Exchange	Green Bonds	July 2015
Mexico Stock Exchange	Green Bonds	August 2016
Luxembourg Stock Exchange	Green Bonds	September 2016
Borsa Italiana	Green and Social Bonds	March 2017

Source: Climate Bonds Initiative 2017. Note including bonds related to climate change mitigation, adaption, enhancing or protecting biodiversity

Introduction of Green Bond indices

Indices serve as investment benchmarks for investors. 2014 was the year when benchmark indices came into fruition. Several Green Bond indices had also been launched, with S&P Green Bond Index, S&P Green Project Bond Index, and Barclays MSCI Green Bond Index and Solactive AG Green Bond Index as some of the first movers. There are differences between indices. For instance, the Solactive index includes only Green Bonds as defined by the Climate Bonds Initiative, while S&P Green Project Bond index includes unlabelled bonds whose cashflows come from solar, hydro, wind, and energy efficiency projects (Source: S&P, Barclays MSCI, Solactive, BNEF).

Table 26: Examples of green bond indices

- Solactive Green Bond Index Series	- ChinaBond China Green Bond Index Series
- S&P Dow Jones Green Bond Index	- ChinaBond China Climate-aligned Bond Index
- Barclays & MSCI Green Bond Index	- CUFE-CNI Green Bond Index Series
- ICE BofAML Green Bond Index	

Source: Climate Bonds Initiative 2017

Green bond ETFs launched to meet investor demand

Green bond ETFs are becoming key investment vehicles to provide access for the market, especially for individual retail investors who lack the resources versus institutional investors. Investor appetite for environmental solutions has increased sharply in recent years. A Merrill Lynch Wealth Management surveys show that 93% of Millennials show a high preference for impact investing. Hence it is no surprise that we have seen launches of green bond ETFs in recent months. These ETFs track the Solactive Green Bond USD IG Index and the S&P Green Bond Select Index.

Other investment vehicles – the non-visible part of the iceberg

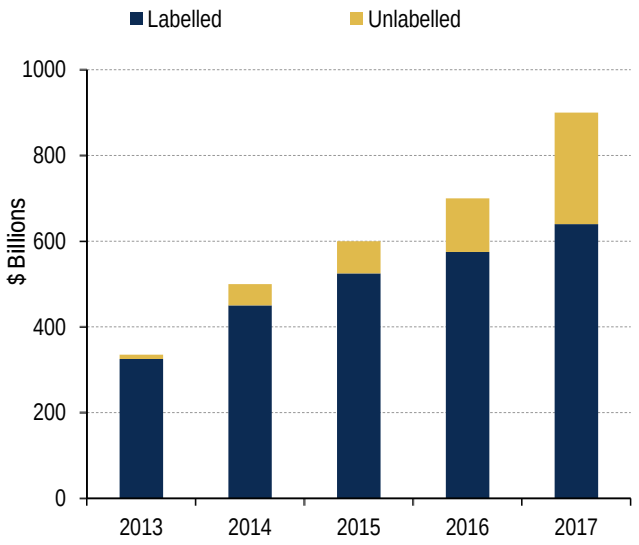
Climate themed bonds balloon to cUS$900bn

The Climate Bonds Initiative (CBI) has been studying the development of the climate-change-themed bond market. It defines this as a market where proceeds are used to finance the transition to a low carbon economy beyond obvious "green" projects. The latest study from the CBI showed that the universe of climate-themed bonds stood at $895bn as of June 30 2017, representing a US$200bn increase the previous year. Climate-themed bonds include around 1,128 issuers across seven climate themes with 3,493. Around US$144bn of issuance had come from new issuers (Source: CBI 2017)

Green Bonds have been major driver of growth

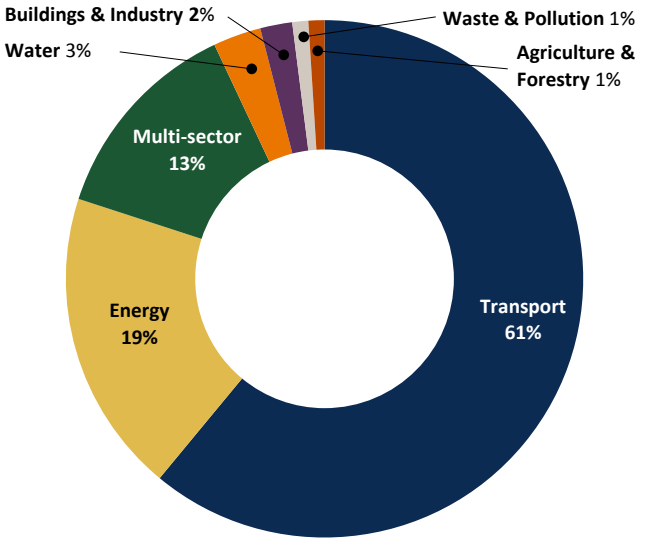
Growth of the labelled green bonds has been a major contributor of growth. Today, around 25% of the climate-aligned bond universe is now made up of green bonds, versus only US$7.2bn or less than 5% of the universe in 2012. (Source: CBI 2017)

Chart 64: Labelled green bonds account for a growing proportion of the climate-aligned universe



Source: Climate Bonds Initiative 2017

Chart 65: Transport and Energy account for 80% of the universe

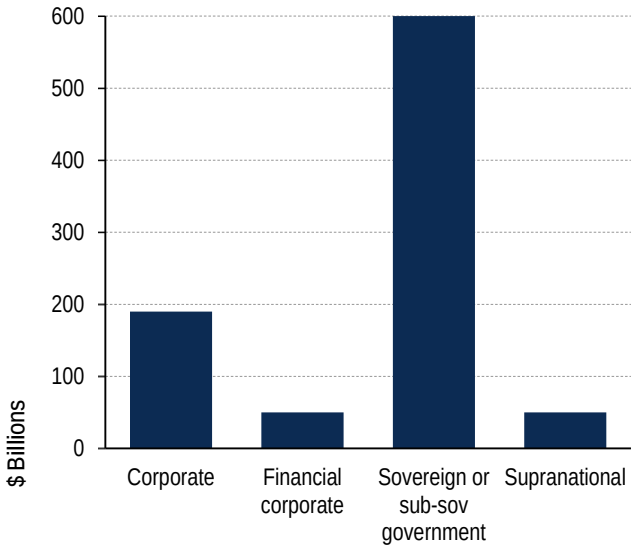


Source: Climate Bonds Initiative 2017

Transports and China make up majority of climate bonds

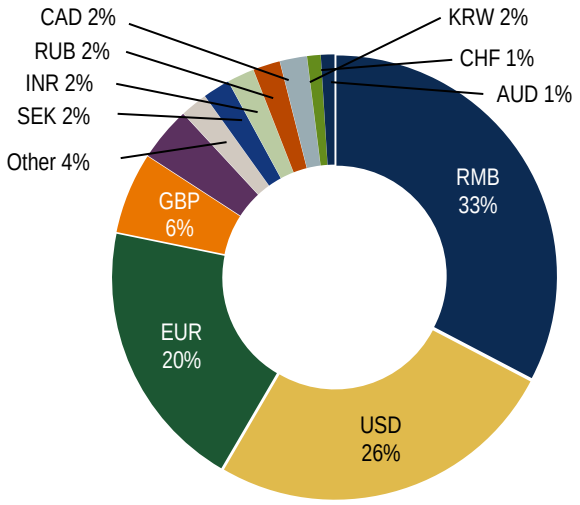
Within the universe, Transport continues to make up the largest proportion of the universe at US$418.8bn, 95% of which are rail companies that tend to be backed by state entities. Energy is the 2nd largest at US$118.4bn, including renewable energy such as hydropower, wind, solar, bioenergy, geothermal and nuclear. China and RMB-denominated bonds comprise the largest slice of the pie at around 32% of the total. This is due to the high volume of rail and hydro bonds originating from China.

Chart 66: Sovereigns and sovereign entities make up the majority of the universe



Source: Climate Bonds Initiative 2017

Chart 67: RMB, USD and EUR account for the majority of issuance



Source: Climate Bonds Initiative 2017

Introducing Social Bond Principles (SBPs)

In order to expand impact beyond climate solutions, standards has been recently introduced for social bonds and sustainability bonds, following similar guidelines that has been set for green bonds. In 2017, the International Capital market Association (ICMA), the secretariat that provides the administrative duties for the Green Bond Principles (GBPs), formally introduced the Social Bond Principles (SBPs). In mirroring the green bonds, the SBPs have the same four pillars: use of proceeds, process for project evaluation and selection, management of proceeds and reporting.

Social Project categories include, but are not limited to, providing and/or promoting:

- Affordable basic infrastructure (e.g. clean drinking water, sewers, sanitation, transport)
- Access to essential services (e.g. health, education and vocational training, healthcare, financing and financial services)
- Affordable housing
- Employment generation including through the potential effect of SME financing and microfinance
- Food security
- Socioeconomic advancement and empowerment

Examples of target populations include, but are not limited to, those that are:

- Living below the poverty line
- Excluded and/or marginalised populations and /or communities
- Vulnerable groups, including as a result of natural disasters
- People with disabilities
- Migrants and /or displaced persons

- Undereducated
- Underserved
- Unemployed

Rising interest

Although the size of the social bonds markets is at less than US$10bn, there is growing appetite for additional types of responsible investing (Source: DLA Piper). One of the many catalysts have been United Nations' Sustainable Development Goals (SDGs) introduced in 2016. The mission is to bring the world together in tackling 17 major problems including poverty, education, and inequality, in addition to climate change.

Sustainability bonds (SBG) a mix of both

In addition to the Social Bond Principles, the ICMA has also introduced the Sustainability Bond Guidelines (SBGs), which are meant for bonds whose proceeds are aligned with both GBPs and SBPs, a mixture of green and social projects. Within this, social projects need to follow the Social Bond Principles and the green projects need to follow the Green Bond Principles (Source: ICMA 2017).

YieldCos: cheaper capital with green assets

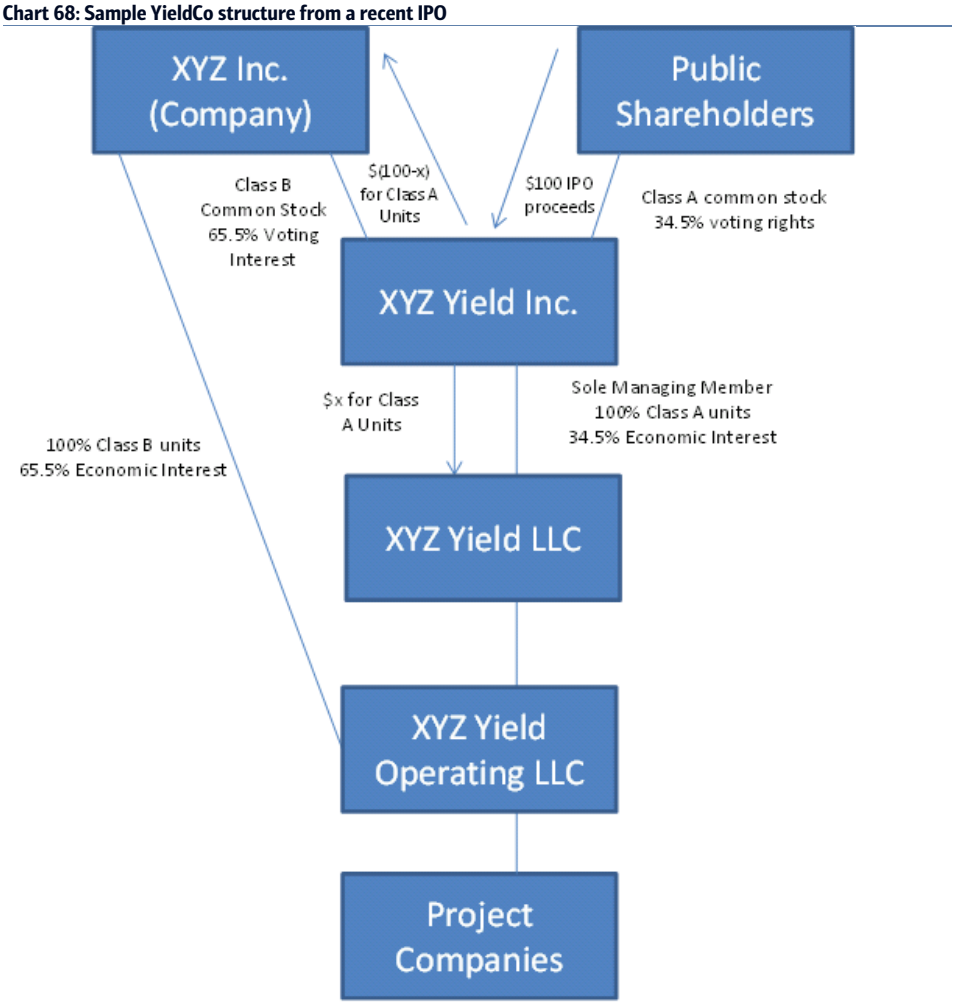
On the equity side of the renewable energy capital space, YieldCos have been another transformational development, gaining traction in the past 12 months as a cheaper way of financing. YieldCos are financial roll-ups of long-term contracted power-generating assets that are primarily renewable. The parent raises equity capital through the IPO of the YieldCo, and in turn the investors receive a dividend stream funded by the cash flows of the power assets.

YieldCos are heavily contracted dividend growth vehicles

US Electric Utilities & IPPS: YieldCo: Getting Pricey Once More for Less Growth 23 October 2017

A YieldCo is a corporation composed of long-term contracted power and infrastructure assets created by a larger parent company. It is designed to have a certain set of characteristics. The heavily contracted assets that form the YieldCo produce predictable cash flows over contract durations that typically at onset last 15-25 years. YieldCos commit to issuing dividends equal to 80-90% of their stabilized free cash flow after requisite debt payments, which is a metric commonly referred to as cash available for distribution (CAFD). Management teams typically target dividend per share growth rates of 10-20% annually, which are financially engineered mainly through the acquisition of additional contracted assets.

Chart 68: Sample YieldCo structure from a recent IPO



Source: SEC

Dividend growth is paramount and financially engineered

YieldCos trade primarily on dividend yield, and very little forecast distribution growth is organic. Acquisitions made by the company to grow the dividend are financed through a combination of project debt, and cash or share issuance. Initial growth acquisitions are for assets owned by the parent not originally made part of the initial portfolio. Often, these assets are part of a Right of First Offer (ROFO) Agreement, the covenants of which require the parent to offer the assets to its YieldCo before any third party. Most ROFO "runways" last two to three years and are similarly sized to, if not larger than, the YieldCo's initial portfolio.

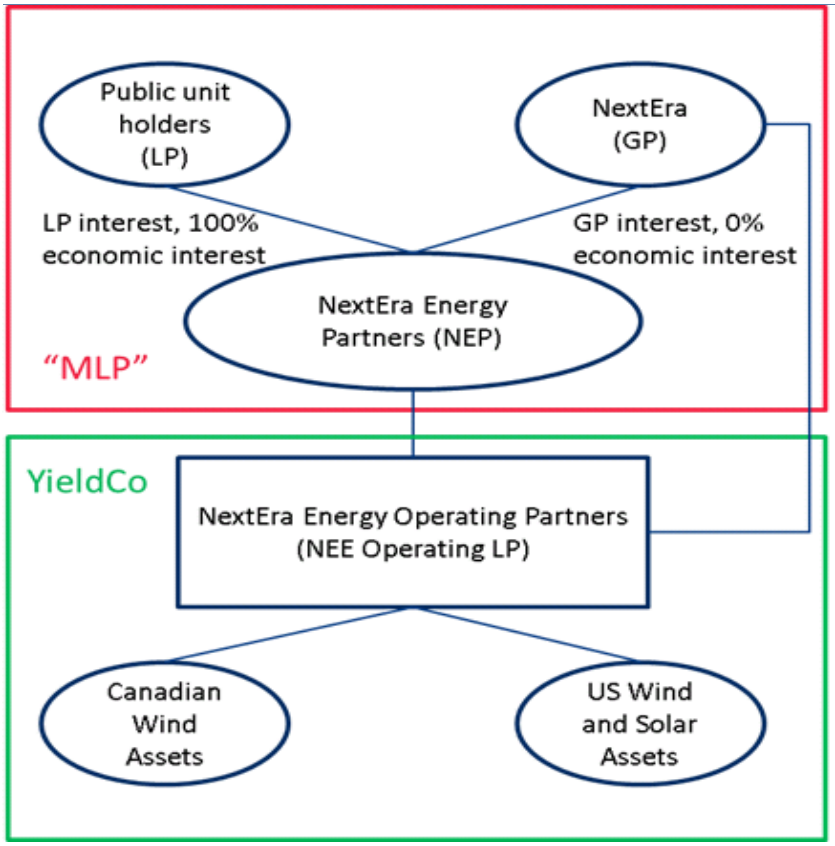
MLP-like attributes

> With the MLP Parity Act fully stalled in Congress, the YieldCo has emerged as an attractive capital alternative for contracted renewable asset growth

YieldCos are not Master Limited Partnerships (MLPs), although the two structures share important features. These include an emphasis on dividend growth and visibility, high payout ratios, a large potential market, and dividend yield based valuation. Certain YieldCos are also organized as partnerships, although structured as 1099 c-corps, as the underlying renewable assets are not eligible for MLP tax treatment. Like dropdown MLPs, YieldCos offer investors the potential for both capital appreciation and dividend

income. Both structures also offer exposure to important investment themes like the rise of low-cost renewables (YieldCos) and domestic fossil fuel production (MLPs).

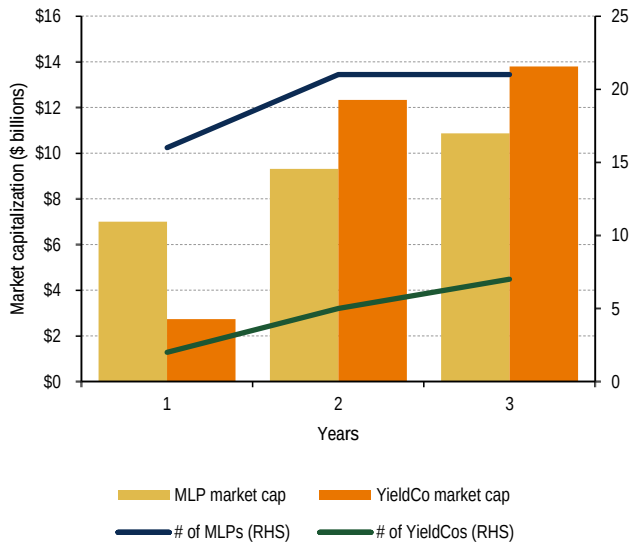
Chart 69: NextEra YieldCo vs MLP



Source: BofA Merrill Lynch Global Research

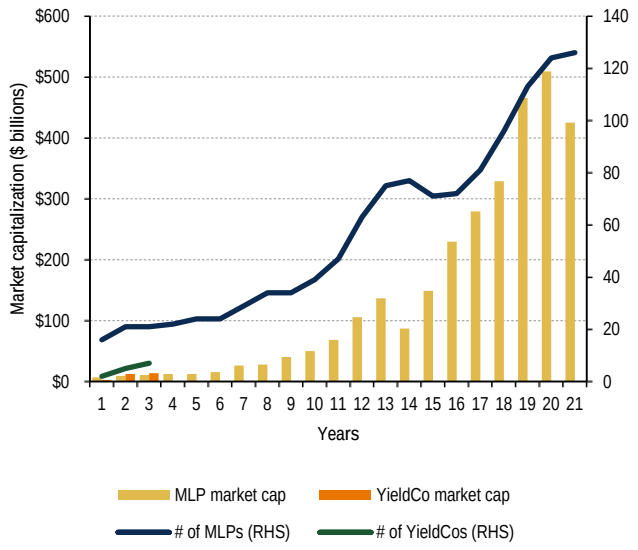
In our view, commonalities between YieldCos and MLPs are strong enough to highlight the growth potential YieldCos may have as an equity class. The sector's market capitalization has demonstrated strong growth in its early years similar to that of MLPs. As noted, we believe the market for underlying assets is also large, growing, and underpenetrated. If YieldCos are to experience a similar magnitude of growth as MLPs from their early years, the sector could come to represent 30-40 companies and $400 billion+ in equity capitalization by the early-to-mid 2030s.

Chart 70: Growth in YieldCo market cap is similar to MLPs in their early years. Year 1 corresponds to 2013 for YieldCos, 1995 for MLPs



Source: Bloomberg, Alerion

Chart 71: The number of MLPs has grown roughly 8x from 1995-2015, while the sector's market cap has increased by a factor of nearly 61x



Source: Bloomberg, Alerion

YieldCos claim temporary tax protection via depreciation

While YieldCo structures are *not* themselves housed within a tax advantaged vehicle, unlike MLPs, they do benefit from multiple aspects that limit tax exposure typically. YieldCos often have 10+-year tax shields as a result of accelerated depreciation for tax purposes through the Modified Accelerated Cost Recover System (MACRS). Accelerated depreciation tax treatment is not exclusive to YieldCos (it is available to all industries), but since electricity-oriented YieldCos operate in a capital-intensive industry they can benefit from this treatment more than most others. By acquiring additional assets that qualify for MACRS treatment, YieldCos are able to roll their tax protected status forward. This also means YieldCos must eventually pay back that deferred tax liability, but this is pushed out beyond most investor time horizons. Separately, a sale of an asset by a parent to the YieldCo often produces taxable gains on asset sales for the parent; this often is used by the parent to harvest Net Operating Loss Tax Carryforwards more quickly.

YieldCos are *not* Master Limited Partnerships

Although they share numerous investment characteristics, YieldCos and Master Limited Partnerships (MLPs) are substantially different in certain ways. "YieldCo" is *not* a formal designation for tax purposes like an MLP. YieldCo companies are C-corporations that issue 1099 tax forms to investors rather than the K-1 forms issued by MLPs. The term YieldCo reflects an informal name for a company structured with a common set of characteristics designed to partly replicate the MLP structure.

Accretion through acquisition is the main driver of growth

As long as the YieldCo, by virtue of it being composed of the most contracted and stable cash flows, trades at a valuation premium to its parent, then the parent can sell assets to the YieldCo at valuations that are accretive to both parties. For example, if the parent trades at 8x EBITDA, and the YieldCo at 12x, then the parent can sell assets and the YieldCo purchase assets at 10x EBITDA. Growth beyond ROFO transactions between parent and YieldCo is driven primarily by third party acquisitions by the YieldCo, or in select circumstances by assets at the parent that are not part of the initial ROFO Agreement.

Of course, dividend growth and accretion through acquisitions is not a sustainable value driver. But, unsustainable growth can be persistent for several years if a sector, like power, is ripe for consolidation and in need of capital discipline.

Exposed to interest rates and valuation

> Some YieldCos more closely approximate MLP structures than others, but in general, the high payout ratio and advantageous tax position of YieldCos drive valuations akin to MLPs'

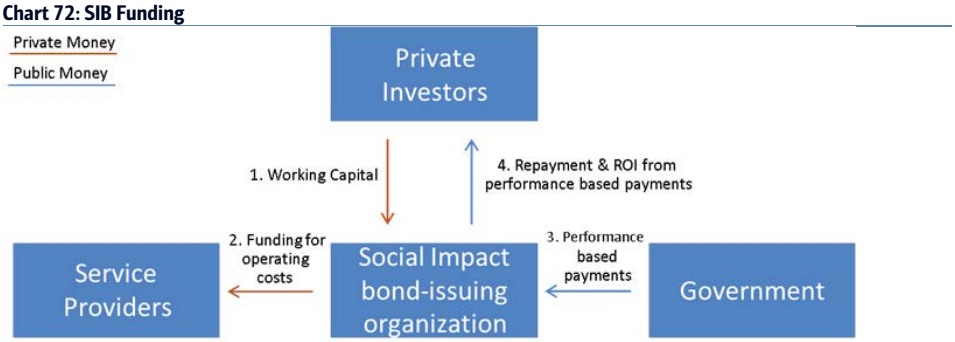
YieldCos are bond-like instruments, more so than their parent utilities or other sponsors. If interest rates go up, in theory YieldCo valuations should fall. Secondly, if YieldCo valuations drop below parent valuations, then no accretive acquisition opportunities exist. Such a scenario can conceivably arise in the power space if: 1) the economy is growing quickly; 2) commodity prices are rising, and 3) interest rates are rising. This would significantly curtail the financial engineered growth outlook. Other shared risks include exposure to natural gas prices, global renewable subsidy programmes, and foreign asset valuation discounts where applicable.

SIBs: private funding for public programmes

Social Impact Bonds (SIBs) are an investment scheme in which investors take on financial risk and provide upfront funding for social and public health programmes. The growing list of SIB applications includes: recidivism, homelessness, workforce development, pre-natal care, and elderly services. However, the term SIB is a misnomer. Instead of a debt investment, SIBs are a multi-stakeholder partnership involving a series of contracts (source: McKinsey, Center for American Progress). The basic structure involves four key players:

- **Private investors** – provide funding to the SIB-issuing organisation, and recoup their investment with potential for additional profit if performance targets are met.
- **SIB-issuing organisation** – raises funds from private investors and distributes to service providers.
- **Service provider** – paid by SIB-issuing organisation to deliver services to meet the ultimate performance targets
- **Government** – makes payments to the SIB-issuing organisation only if the performance targets are met.

Chart 72: SIB Funding



Source: Center for American Progress

Multi-stakeholder structure

While the ultimate financial burden is shifted from the public sphere to the private investor, the programmes benefit everyone. Social programmes receive much-needed funding, communities are able to achieve improvements in social and public health services, governments have no obligation to pay unless targets are met, and investors have potential to profit while providing a social good.

Nascent market, more development needed

The first SIB was introduced in 2010 in the UK, raising £5mn to fund a recidivism programme for the Peterborough Prison (source: Novethic). As of 2014, the US market is the largest, with US$50mn outstanding (source: Novethic). A lack of historical data, complexity of instruments, outcome assessment are all issues that hinder greater adoption of SIBs and will need to be addressed to stoke growth in the market (source: Foundations for Social Impact Bonds).

Why expand Green Bonds issuance

Growth and development of the self-labelled Green Bond market provides great benefits for issuers and investors, as well as the overall environment. While most of this issuance is relabelling of existing investment, one-third, could be new annual investment in renewable energy and energy efficiency catalysed by Green Bonds by 2020 (source: SE4ALL).

We are seeing the alignment of interest from various stakeholders. The asset class has received increasing recognition at G20 level in the Green Finance Study Group (GFSG) and the EU High-Level Expert Group (HLEG). (Source: CBI 2017). We are seeing corporates, governments, regulators, and investors coming together to support growth of the asset class.

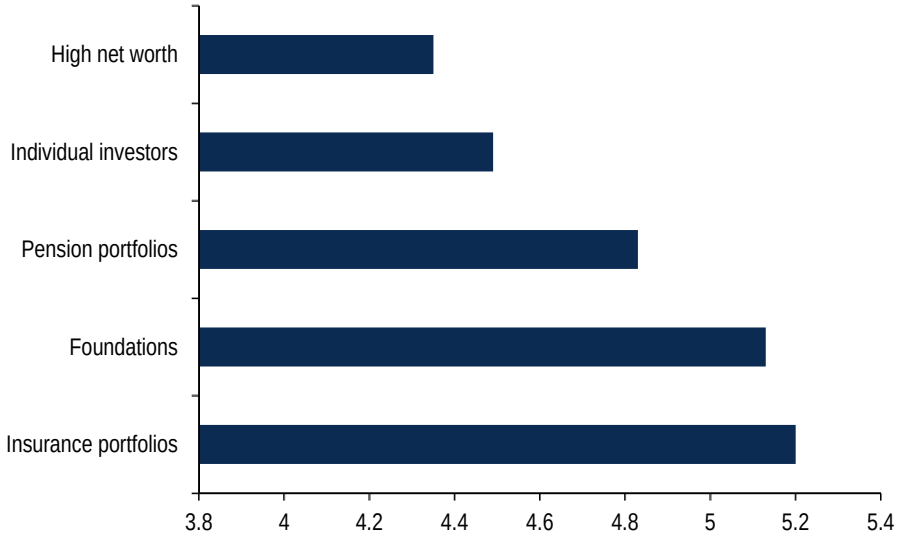
Breaking down the Green Bond investor interest

Buyers of Green Bonds span a wide range including institutional clients like insurance and pensions, to individual investors.

- Investors with dedicated Green Bond funds, although this is more focused on the SSA space at the moment, given the volume of Green Bond outstanding relative to the other Green sectors
- Investors who anticipate developing dedicated Green corporate and/or FIG funds
- Investors who are mapping their ESG/SRI focus in their equity investments to their fixed-income investments
- Or simply credit investors with traditional corporate bonds funds who either 1) need to invest cash in primary deals (green or not), or 2) wish to support the growth of the Green Bond market

According to a 2015 Euromoney survey on 40 fixed income fund managers, insurance and foundations still make up the largest proportion of interest.

Chart 73: Please rate the interest in green bonds among the following stakeholder groups



Source: Euromoney

Investors: low carbon opportunities > stranded asset risk

Institutional investors are becoming increasingly important actors in ensuring the success of the global effort to rein in emission and transition to a low carbon economy.

- **110 investors from €11tn in AUM have become members of the Institutional Investors Group of Climate Change (IIGCC)**, a collaborative platform to encourage public policies, investment practices, and corporate behavior that address long-term risks and opportunities associated with climate change.

- **Over 60 institutional investors have signed the Montreal Climate Pledge**, under which they commit to measure and publicly disclose the carbon footprint of their investment portfolios on an annual basis. It aims to attract commitment from portfolios totalling US$3tn in time for the Paris climate talks.

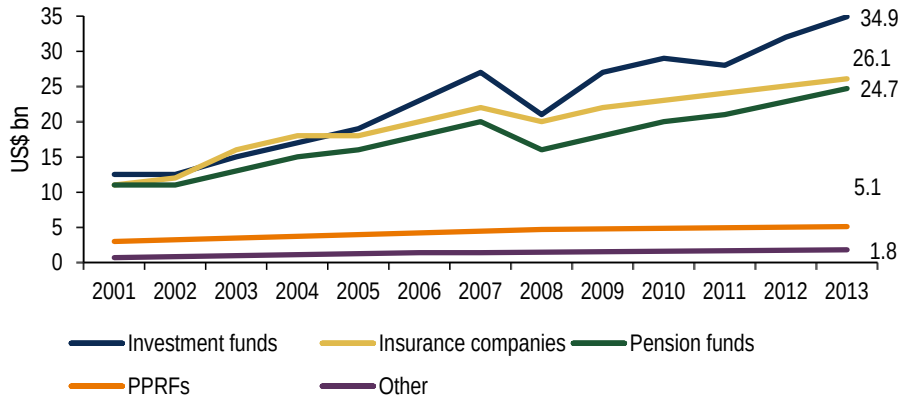
- **Investors are looking to reduce climate-risk in their portfolios via select divestment, shareholder engagement/resolutions and new products and services** that favour low-carbon and environmentally sustainable business approaches (e.g. BlackRock's iShares CRBN ETFs, State Street's LOWC: low-carbon ETF).

- **Existing collaborative emissions reduction initiatives involving companies, cities and regions are on course to deliver the equivalent of 3Gt of CO2 by 2020E**. That's more than a third of the 'emissions gap' between existing government targets for that year and GHG emissions levels consistent with avoiding dangerous climate change (source: CDP).

Institutional investors important potential source of "green" funding

Institutional investors in OECD countries collectively manage around US$92.6tn of assets, but less than 1% are allocated to infrastructure projects, and only 0.1% to clean energy infrastructure projects (source: OECD). In emerging markets, sovereign wealth funds hold US$6tn in assets as of January 2014. In 2004-11, only 2.5% of total clean energy asset finance, or US$22bn, came from pensions and insurance companies (source: OECD, CERES). While investor awareness of ESG issues and investment in environmental solutions has been rising, there is still a huge for potential for growth.

Chart 74: USD 92.6 trillion in assets under management by institutional investors in the OECD (2013)



Source: OECD Global Pension Statistics, Global Insurance Statistics and Institutional Investors databases, and OECD staff estimates.
Note: Book reserves are not included in this chart. Pension funds and insurance companies' assets include assets invested in mutual funds, which may be also counted in investment funds. As 2013 annual data for investment funds, insurance companies and other institutional investors are not yet available, 2013 Q4 data have been used instead when available.

US$819bn institutional capital available for green projects

According to a study by Climate Policy Initiative, there is US$819bn of institutional capital available for investment in renewable energy projects. The study takes into

Bank of America Merrill Lynch

account the liability constraints, risk limits, and diversification requirements of the institutional client base, and considers both direct and indirect investments (source: Climate Policy Initiative).

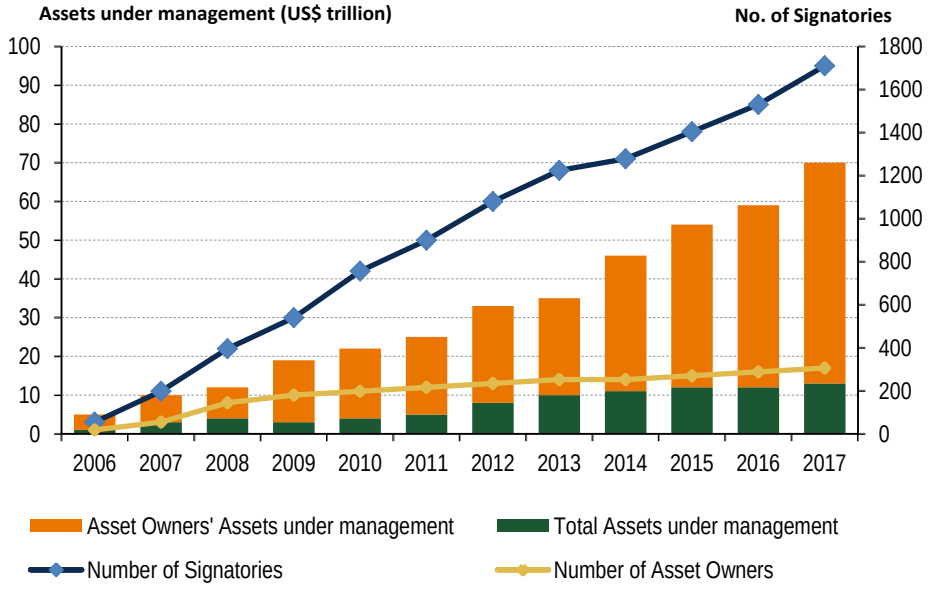
Growth of Responsible Investment client base

The United Nations-supported Principles for Responsible Investment (PRI) initiative is an international network of investors that make the link between sustainability and investments in practice. The UN PRI are voluntary and aspirational, allowing each organisation to tailor ESG solutions that fit its own investment strategy, approach, and resources. As of April 2017, PRI has accumulated 1,714 signatories with US$68.4tn assets under management. As a consequence, investors are increasingly mapping their investments to an ESG/SRI focus, and are focusing on Green Bonds as a key component of their fixed income portfolios. The six principles are:

- Incorporate ESG issues into investment analysis and the decision-making process
- Be active owners and incorporate ESG issues into ownership policies and practices
- Seek appropriate disclosure on ESG issues by entities in which they invest
- Promote acceptance and implementation of Principles within the investment industry
- Work together to enhance effectiveness in implementing the Principles
- Each member will report on their activities and their progress towards implementing Principles.

Of the signatories, 94% have a responsible investment policy in place, 90% have collaborated with one another on RI-related topics, and 71% have asked companies to integrate ESG information into their financial reporting. As investors increasingly align their portfolio with climate issues in mind, there should be a natural demand for green investment vehicles.

Chart 75: Growth of the UN PRI (Principles for Responsible Investment) initiative



Source: UN PRI

ESG is a major force to be reckoned with

Globally, around US$21.4tn of assets are sitting in funds that are focused on socially responsible investing (SRI) or are incorporating environmental, social and corporate governance (ESG) considerations. Of this, around 2/3 come from Europe, with nearly 1/3 (30%) from the US. While values based investing is currently a bigger focus in Europe, where it is an investment consideration in over 60% of managed assets according to a 2014 report by the Sustainable Investment Alliance, the US has been growing at the fastest pace.

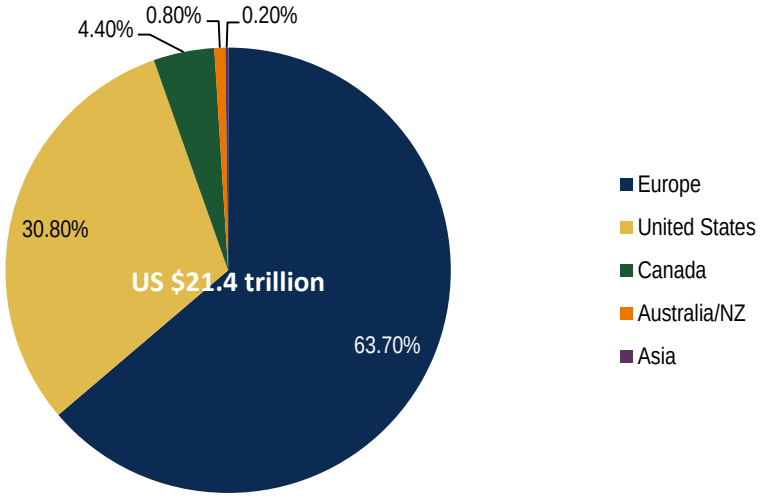
US is a growth area

The AUM of US-domiciled SRI strategies has grown 33% over the past two years, from US$6.57tn at the beginning of 2014 to US$8.72tn at the start of 2016 —and by nearly 14x since 1995 (13% CAGR). The nearly $9tn of SRI investments represents ~22% of the $40.3tn in total AUM tracked by research and analytics firm Cerulli Associates. The landscape in Europe represents what the US could get to over time.

Performance could play a role in this. Based on BofA Merrill Lynch analysis of US companies with ESG scores that declared bankruptcy, an investor who only held stocks with above average-ranks on both Environmental and Social scores would have avoided 15 of the 17 bankruptcies we have seen since 2008

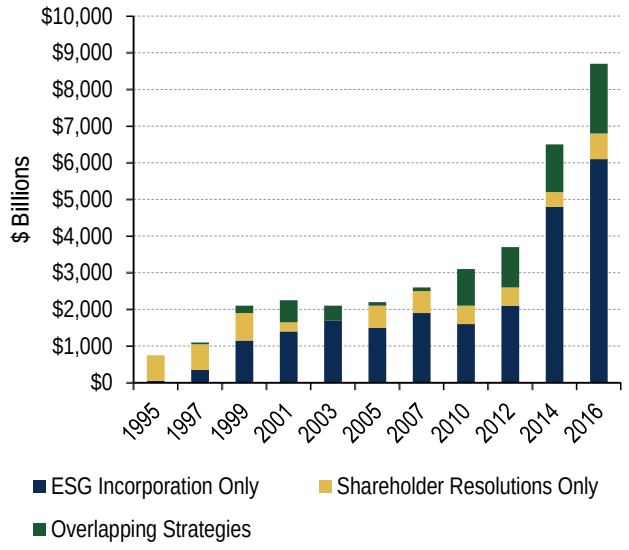
Applying recent growth rates to the estimated $8.7tn currently invested in ESG strategies in the US implies almost $3 trillion of asset inflows over the next twelve months, and assets potentially doubling by the end of 2018.

Chart 76: Proportion of global SRI assets by region (2014)



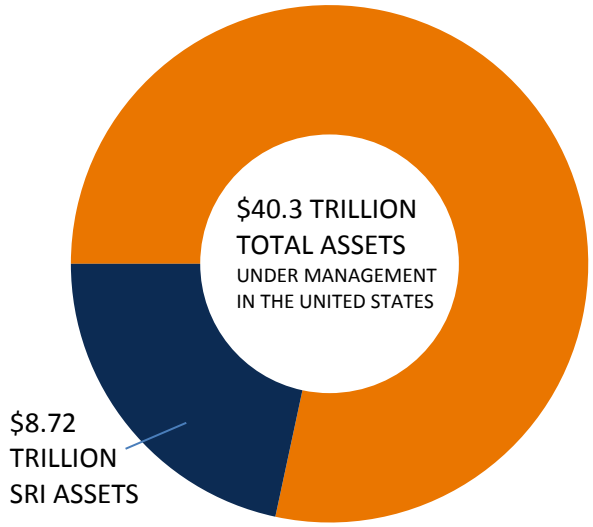
Source: Global Sustainable Investment Alliance (2014 Global Sustainable Investment Review)

Chart 77: Sustainable, Responsible and Impact Investing Trends in the US, 1995-2016



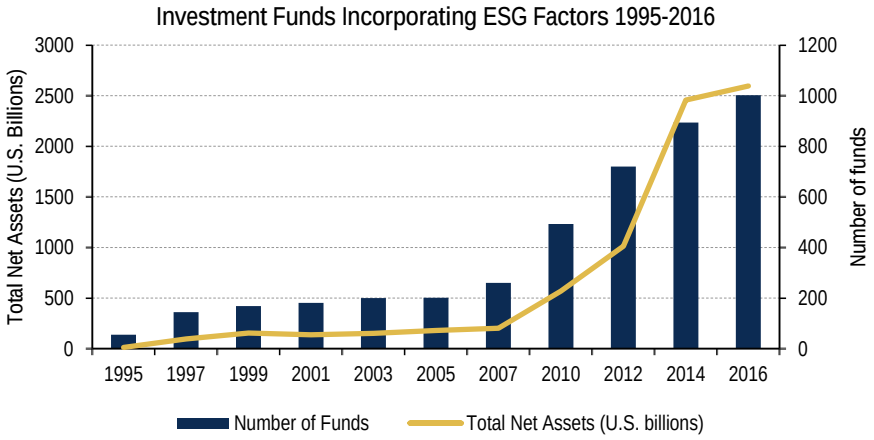
Source: US SIF Foundation Note: Based on a survey by US SIF of 1) 477 institutional investors, 300 money managers and 1043 community investment institutions that apply ESG criteria in investment analysis/portfolio selection, and 2) institutional investors or money managers that filed/co-filed shareholder resolutions on ESG issues at publicly traded companies from 2014-2016, eliminating double counting of assets between the two samples

Chart 78: Size of Sustainable, Responsive and Impact (SRI) Investing, 2016



Source: US SIF Foundation, Cerulli Associates

Chart 79: Investment funds incorporating ESG factors, 1995-2016



Source: US SIF Foundation
NOTE: ESG funds include mutual funds, variable annuity funds, closed-end funds, exchange-traded funds, alternative investment funds and other pooled products, but exclude separate accounts, Other/Not Listed, and community investing institutions. From 1995-2012, separate account assets were included in this data series, but have been excluded since 2014, in order to focus exclusively on commingled investment products.

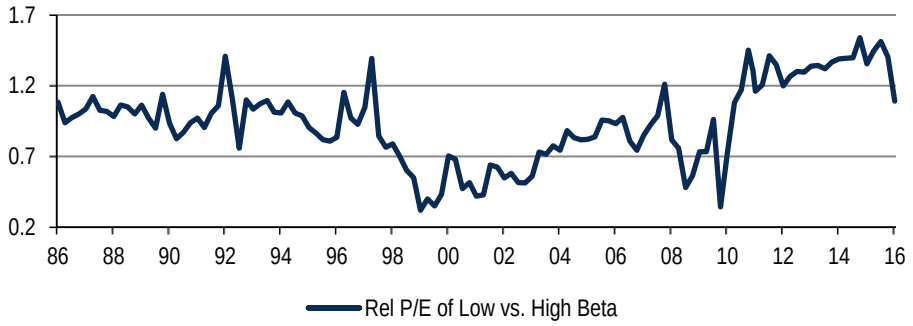
Pension funds have just begun to rebalance into ESG

Institutional managers are increasingly considering ESG factors. For example, the California State Public Employee Retirement System (CalPERS) recently issued a statement that it would evaluate all managers along ESG lines. But there could be much more to go: a 2014 survey by the Commonfund Institute of 200 university endowments revealed that just 53 are "actively engaged in responsible investing," with just 17 having formally incorporated ESG criteria.

A case study of how fund flows can drive returns is shown below, where low beta stocks re-rated from 12.5x earnings in 2009 to 19x earnings in 2016 amid the building interest in "Low Vol" strategies.

Chart 80: Inflows into low volatility funds created extreme levels of valuation

Next Year Est. Relative P/E by S&P 500 Low Beta vs. High Beta Quintiles, 1986-11/2016



Source: BofAML Global Research

Growth of Green Bond-specific funds

There have been a many public pledges over the past several years from underwriters, issuers, and investors to grow the Green Bond market. Many investors have made explicit commitments to buy Green Bonds directly, leading to growth of specialized funds that are focused on Green Bonds. Their success and future growth would also be tied to the maturation of the overall Green Bond market.

Table 27: Green Bond Funds

Name	BBG ticker	AuM Today (USD mn)	Description
SPP Gron Obligationsfond	SPPGOBL SS Equity	386	SPP Gron Obligationfond is an open-end fund domiciled in Sweden. The Fund's objective is long-term capital appreciation. The Fund invests in green bonds and other fixed income securities with explicit sustainability themes, having a positive impact on the environment and climate. The Fund invests mainly in SEK denominated instruments. Target duration is three years, +/- two years.
Union Investment Luxembourg SA - LIGA Portfolio Concept	LIGAPTC LX Equity	212	Liga Portfolio Concept is an open-end fund incorporated in Germany. The Fund's objective is to achieve a performance which leads to a capital appreciation. The Fund invests in international equities, convertible bonds, corporate bonds, governmental bonds, index loans, green bonds and options.
Allianz Green Bond	ALGRBDI LX Equity	190	Allianz Green Bond is an open-end fund incorporated in Luxembourg. The objective is to generate long-term capital growth. The Fund invests in investment-grade interest-bearing securities denominated in currencies of OECD countries. The Fund invests in Green Bonds issued by global companies, governments, etc, that address environmental solutions to reduce their own environmental footprint.
Mirova Funds - Mirova Global Green Bond Fund	MIGSIAE LX Equity	184	The Mirova Global Green Bond Fund is an open-ended fund domiciled in Luxembourg. The investment objective of the Sub-Fund is to outperform the green bond market over its minimum recommended investment term of three (3) years.
NN L - Euro Green Bond	NNEGICE LX Equity	162	NN L - Euro Green Bond is an open-end fund incorporated in Luxembourg. The Fund aims to generate returns by managing a portfolio of mainly green bonds and money-market instruments mainly denominated in Euro. Green bonds are types of bond instruments where the proceeds will be applied to finance in part or in full new and/or existing projects that are beneficial to the environment.
Amundi Impact Green Bond	AMIGBID FP Equity	160	Amundi Impact Green Bond is an open-end fund registered in France. The Fund's objective is to select "green bonds" that respect Green Bond principles and whose issuers and financial projects respect ESG criteria. The Fund can invest up to 100% in all types of green bonds issed by governments, supranationals, or corporations. The Fund can invest in debt rated AAA to BBB- by S&P.
Parvest Green Bond	PARGBCD LX Equity	117	Parvest Green Bond is an open-end fund incorporated in Luxembourg. The Fund's objective is to increase the value of its assets over the medium term. The Fund invests in global green bonds denominated in hard currencies. Green bonds are bonds supporting environmental projects, being issued by corporate, supranational sovereign agencies, local entities and/or governments.
SEB Green Bond Fund	LUXIOEI LX Equity	105	SEB Green Bond Fund is an open-end investment fund incorporated in Luxembourg. The Fund's objective is to achieve an adequate return while minimizing risk and taking ecological, social and cultural investment criteria into consideration. The Fund invests primarily in green bonds globally, where the proceeds are allocated to projects that have a benefit on the environment.

Table 27: Green Bond Funds

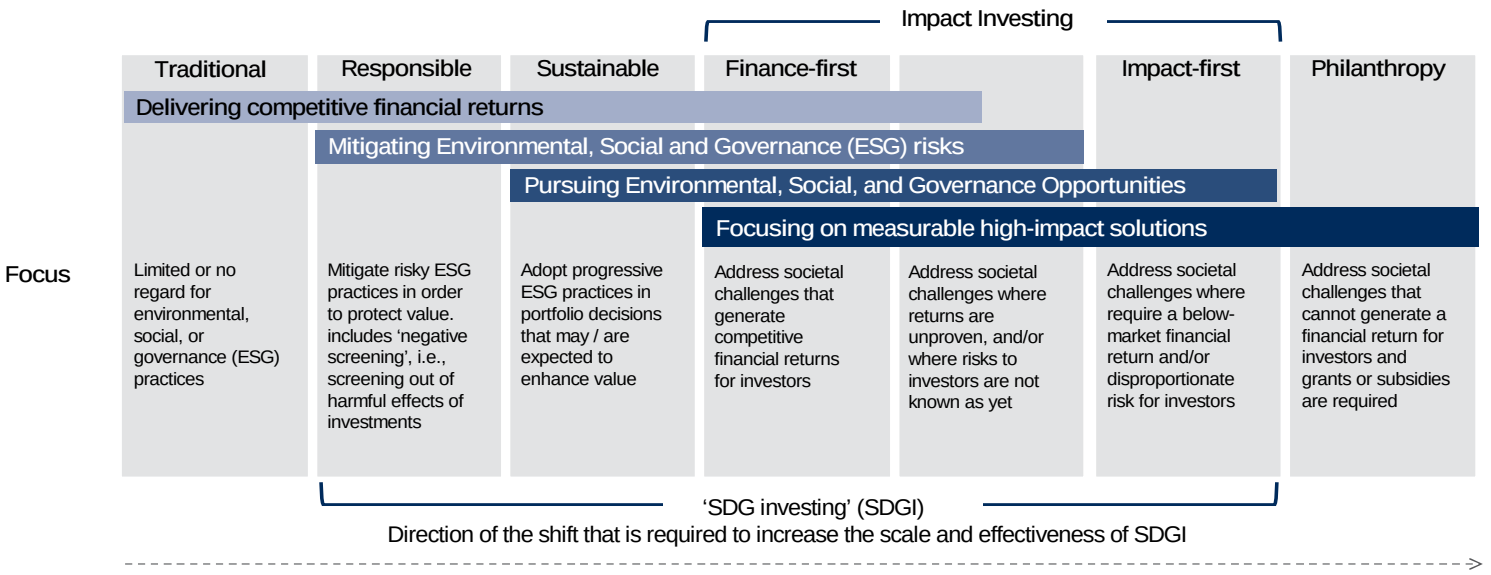
Name	BBG ticker	AuM Today (USD mn)	Description
Calvert Green Bond Fund	CGAFX US Equity	100	Calvert Green Bond Fund is an open-end fund incorporated in the USA. The Fund's objective is to maximize income. The Fund invests at least 80% of its net assets typically invests in bonds with at least 65% of its net assets in investment grade, U.S. dollar-denominated debt securities, as assessed at the time of purchase.
Amundi Green Bonds	AMDGBID FP Equity	48	Amundi Green Bonds is an open-end fund registered in France. The Fund's objective is to outperform the Barclays Global Green Bond Index over the recommended investment period. The Fund can invest up to 100% in diverse types of bonds issued by governments, supra-nationals, or corporations. The Fund invests at least 66% in "Green Bonds".
Uniinstitutional Green Bonds	UNIGRBD GR Equity	35	Uniinstitutional Green Bonds is an open-end fund incorporated in Germany. The Fund's objective is long-term capital appreciation. The Fund invests primarily in "Green Bonds" of international issuers.
Nikko AM Global Umbrella Fund - Nikko AM World Bank Green Fund	NKWGRAU LX Equity	35	Nikko AM World Bank Green Fund is an open-end fund incorporated in Luxembourg. The investment objective of the Fund is to achieve income and capital growth over the mid to long term through investing in bonds denominated in different currencies. The Fund will primarily invest in bonds issued in multiple currencies by the World Bank with its main focus on "Green Bonds".
iShares Green Bond Index Fund	BLGBDEA ID Equity	30	iShares Green Bond Index Fund is an open-end fund incorporated in Ireland. The Fund's objective is to provide Shareholders with a total return which reflects the total return of the Euro hedged version of the Barclays MSCI Green Bond Index. The Fund invests in fixed income securities and fund projects that includealternative energy, pollution control, or sustainable water.
Mirova Global Green Bond Fund	MGGAX US Equity	26	Mirova Global Green Bond Fund is an open-end fund incorporated in the USA. The Fund seeks total return, through a combination of capital appreciation and current income, by investing in green bonds. "Green bonds" are bonds and notes all of the proceeds of which are used to finance projects which the Adviser believes will have a positive environmental impact.
Credit Suisse Lux Green Bond Fund	CRRREEB LX Equity	18	Credit Suisse (Lux) Green Bond Fund is and open-end Fund incorporated in Luxembourg. The Fund`s objective is to generate a regular overall income in the respective reference currency. The Fund synthetically replicates the risk-return dimensions of a traditional bond investment.
Richelieu Bond - Euro Green Bonds	RICHPAC LX Equity	17	Richelieu bond - Euro Green Bonds is an open-end fund domiciled in Luxembourg. The Fund's objective is to grow investment in the medium-term and invests in euro green bonds and money-market instruments. The Fund mainly invests in invest ment grade bonds and invests up to 10% in high-yield bonds with credit ratings h igherthan B and up to 10% in UCI/UCITS. The Fund may use derivative instruments.
Nikko AM Shenton World Bank Green Bond Fund	DBSSDBF SP Equity	10	Nikko AM Shenton World Bank Green Bond Fund is an open-end unit trust established in Singapore. The Fund seeks to achieve medium to long-term capital growth by tapping opportunities in the global bond market. The Fund invests in bonds issued by governments and blue chip corporations of the G-7 countries and is actively managed to capture swings in interest rate and currency trends.
CROWD - Green Bond Impact Fund	MICGBIA LX Equity	6	CROWD - Green Bond Impact Fund is an open-end fund incorporated in Luxembourg. The Fund's objective is to achieve income as well as a long-term increase in value while ensuring a sustainable impact. The Fund invests in bonds denominated in Euro.
Aviva Nikko AM Shenton World Bank Green Bond Fund	AVASDBS SP Equity	5	Aviva Nikko AM Shenton World Bank Green Bond Fund is an investment-linked insurance fund established in Singapore. The Fund's objective is to maximize medium to long-term capital growth & to outperform the Citi G7 Government Bond $. The Fund is a feeder fund to DBS Shenton Dynamic Bond which invests in bonds issued by the government and blue chip corporations of the G7 countries.
BfS Nachhaltigkeitsfonds Green Bonds	BFSRSEB GR Equity	#N/A N/A	BfS Nachhaltigkeitsfonds Green Bonds is an open-end fund incorporated in Germany . The Fund's objective is to achieve capital appreciation. The Fund invests in fixed income securities of first-class issuers domiciled in a Member State of the European Monetary Union.

Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg

End clients are asking for impact investing

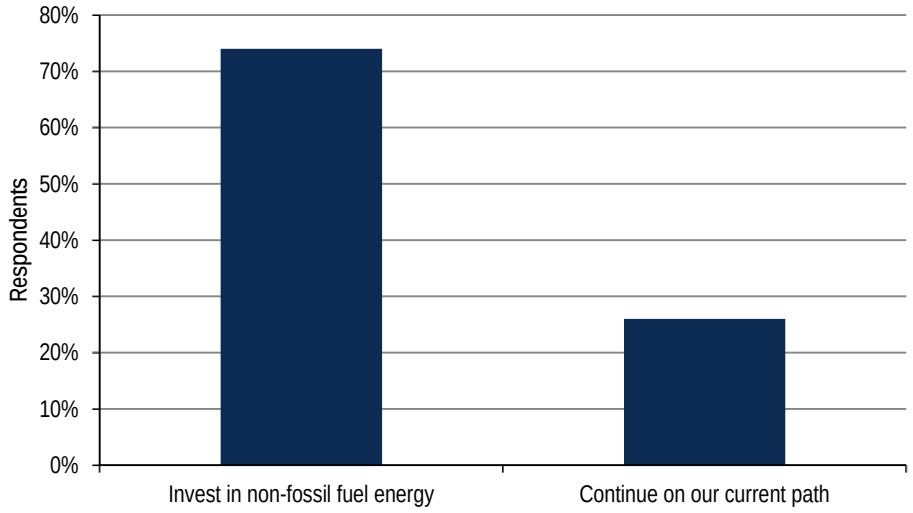
We are also seeing increasing interest from the individual retail investor. Millennials – now the largest demographic cohort in the US – think the debates over environmental protection and fossil fuel divestment are a defining feature of their generation. They believe stakeholders must embrace the need for major investments in clean(er) energy technologies to maintain a more sustainable economy. Seventy-four percent of Millennials surveyed in the US believe we need to invest now in non-fossil fuel related energy vs. just 26% saying we should continue on the current global energy path (source: American Progress).

Exhibit 20: Spectrum of Sustainable Development Goals Investing (SDGI)



Source: C-Change for UN DESA 2017

Chart 81: Millennials believe we must seize the energy opportunity



Source: American Progress

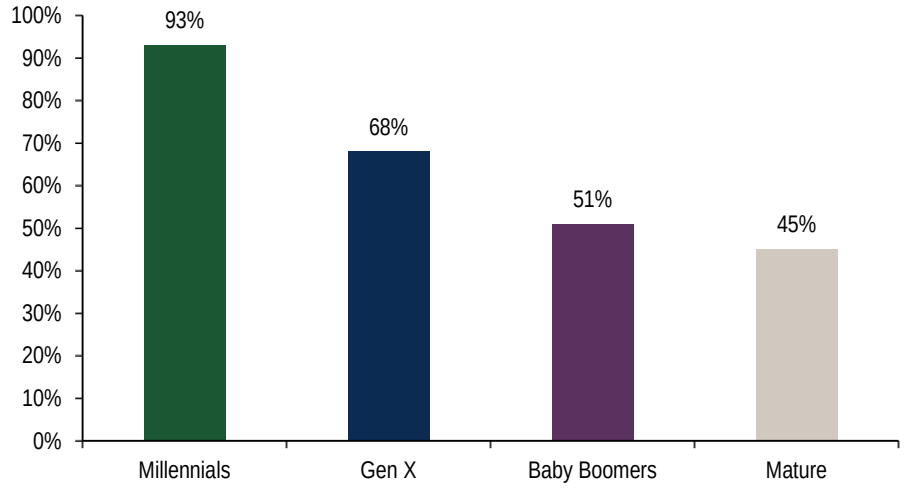
Impact investing: Millennials' key investment criteria

Using conservative estimates, Millennials could drive $15 to $20tn of asset inflows into ESG type strategies over the next two to three decades. This amount represents the current market capitalization of all S&P 500 companies ($19.5tn)

Among the 18-29 year-old cohort, 93% consider "impact investing" (i.e., ESG, thematic and "impact first" solutions) an important part of investing, and 85% say their investment decisions are a way to express their social, political and environmental values, according to the 2016 U.S. Trust Wealth and Worth Survey. In fact, the same survey finds that millennials are 1.5 times more likely than older generations to believe that market-rate returns are possible through "impact investing". And they are already well on their way: Millennials have the highest percentage of assets deployed in "impact investing" out of all cohorts surveyed.

What kind of growth can Millennials drive? Assuming an increase in wealth in the US of around $4tn per decade, as well as the transfer of wealth beginning in the late 2020s of $30-40 trillion of financial and non-financial assets, inflows could become parabolic. Given that 85% of Millennials either own or are interested in adding exposure to "impact investing" vehicles, assuming that a conservative 30-40% of their wealth increase is invested in equity ESG funds, this equates to $15 to $20tn of asset inflows over the next two to three decades.

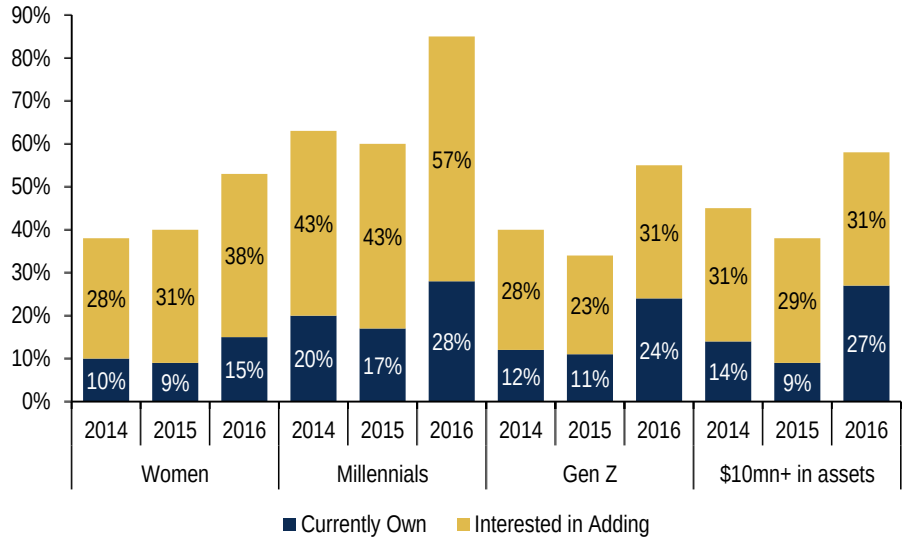
Chart 82: 93% of Millennial indicates that a company's impact in social, political and environmental areas is an important consideration when they make investment decisions



Source: 2016 U.S. Trust Wealth and Worth Survey

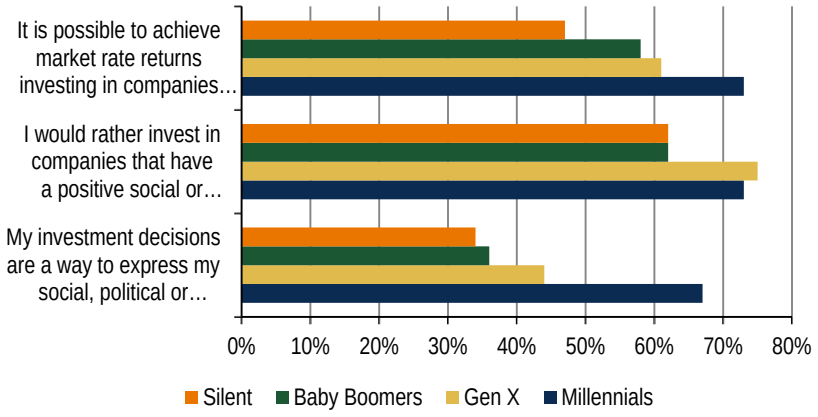
In addition to Millennials, 68% of Gen Xers and 51% of Baby Boomers some the same type of preferences in ESG investing.

Chart 83: Momentum building for Impact Investing in bellwether demographic segments



Source: 2016 U.S. Trust Wealth and Worth Survey

Chart 84: Investor attitudes to social impact investing



Source: US Trust

Global investment portfolios could lose up to 45%

Global investment portfolios could lose up to 45% of their value to 2020E as a consequence of climate change, technological change, asset stranding, weather events, and longer-term physical events (source: University of Cambridge and Investment leaders Group). Looking further out, average annual returns could erode by 26-138% by 2050E. More than 2/3rds of the world's proven reserves of fossil fuels could be unusable by 2050 if certain regulations are passed in accordance with the 2°C goal (source: IEA). This causes the assets to be "stranded," and could affect the valuation of fossil fuel companies by as much as 60-80% (source: CERES).

Green bonds offer diversification and a climate hedge

Conversely, renewables have the greatest potential for additional returns (6-54% over 35 years) (source: Mercer). Incorporating Green Bonds into investor portfolios could potentially offer diversification as well as minimising climate risk originating from holding stranded assets. Clean energy infrastructure investment vehicles could offer cash flows with low volatility and low correlation with other assets. Investments that promote a low-carbon and clean energy economy could reduce overall portfolio risk while aligning investors' financial interests with the need to tackle the challenge of climate change (source: Mercer).

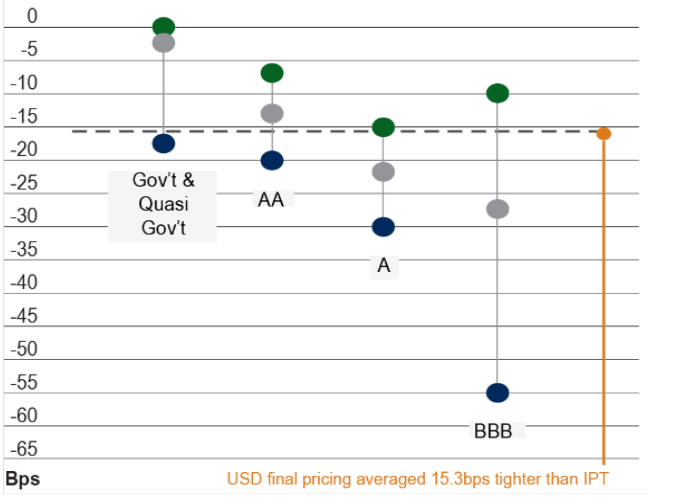
Green bonds vs non-green pricing differential

The performance and demand of green bonds are broadly in line with their vanilla counterparts, according to a recent study by the Climate Bonds Initiative (CBI). This is promising as investing in green does not entail giving up any additional yield or performance.

There is some evidence that green bonds outperform after issuance. Seven days after issuance, 70% of green bonds had tightened more than their corresponding index, and 71% outperformed after 28 days. USD-denominated bonds priced 22.2bps tighter than Initial Price Talk (IPT) when compared to 16-17bps for vanilla bonds during the same period. However, EUR corporate green bonds priced on average 13.4bps tighter than IPT, which is in line with their non-green counterparts.

Exhibit 21: USD green bonds price even tighter

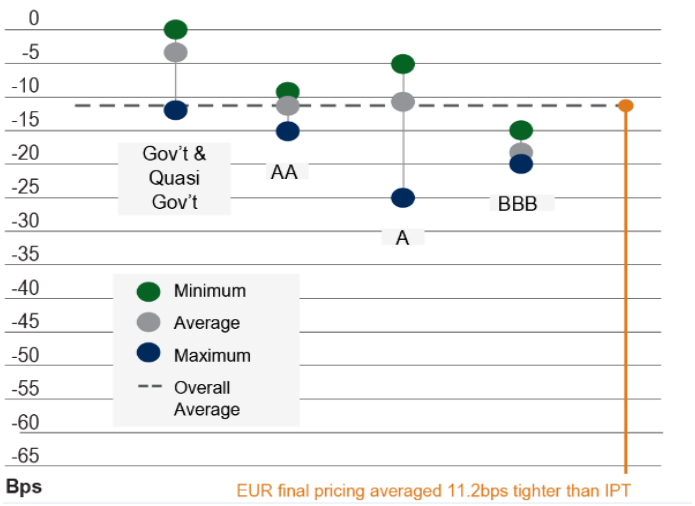
Final pricing average is 15.3bps tighter than IPT



Source: S&P, CBI

Exhibit 22: EUR bonds price tighter than expectations

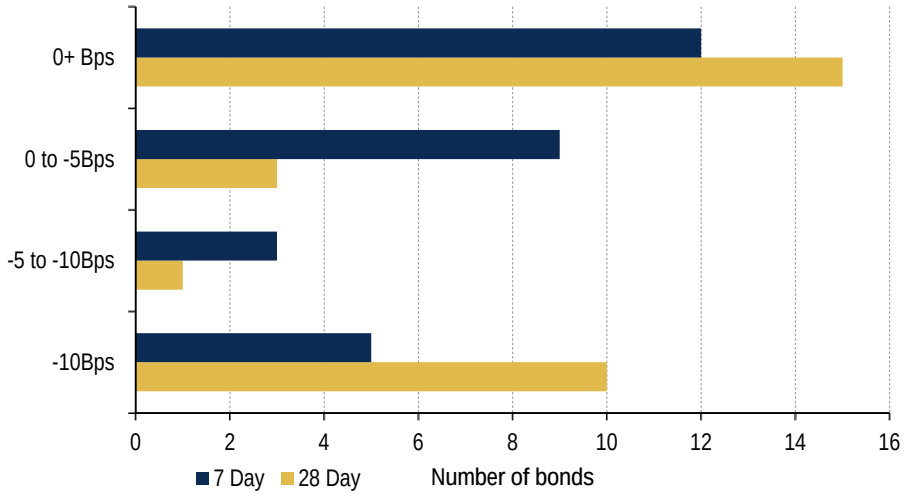
Final pricing average is 11.2bps tighter than IPT



Source: S&P. CBI

Chart 85: Spread performance

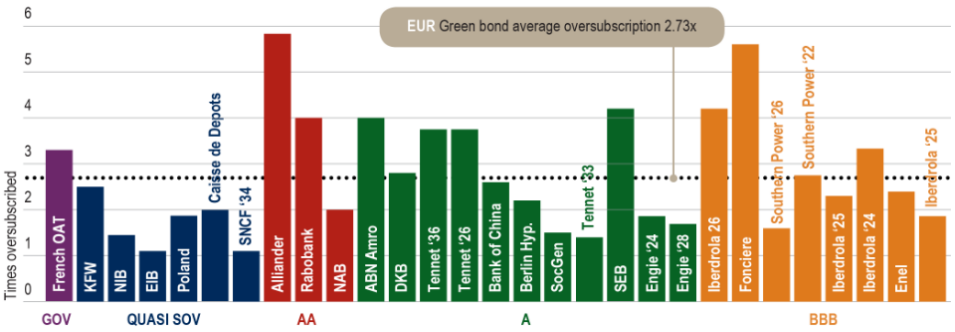
55% of the USD green bonds in the sample tightened 7 days after issuance; almost 50% tightened further after 28 days in immediate secondary market



Source: S&P, CBI

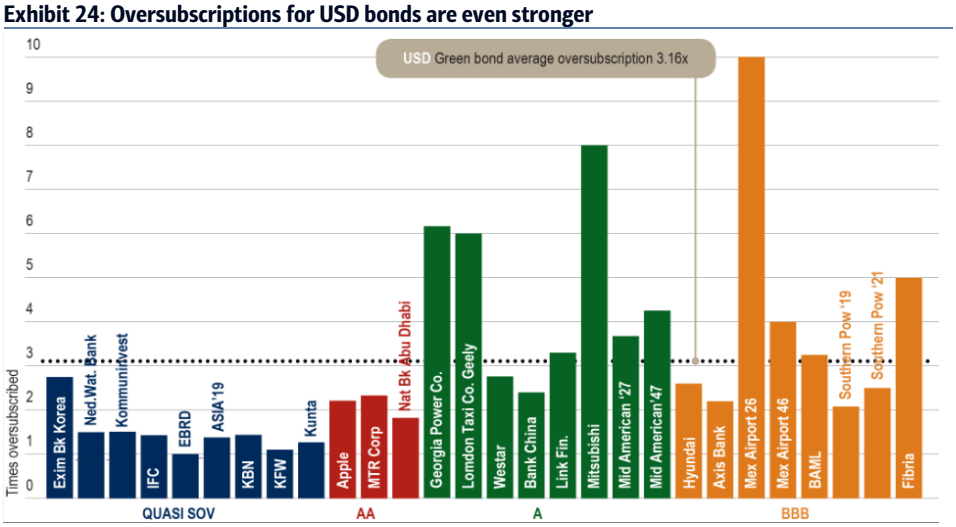
EUR-denominated green bonds were 2.7x oversubscribed, while USD bonds were 3.16x oversubscribed. This is broadly in line with the broader market where 3-4x oversubscription is normal as underwriters are likely to plug the gap or pull the bond until market conditions improve. Some of the biggest subscriptions included Mexico City Airport Trust (10x), Mitsubishi (8x), Georgia Power (6.15x) and Alliander (5.8x) (Source: Climate Bonds Initiative 2017).

Exhibit 23: Oversubscriptions for EUR bonds show strength of investor demand



Source: CBI

Exhibit 24: Oversubscriptions for USD bonds are even stronger

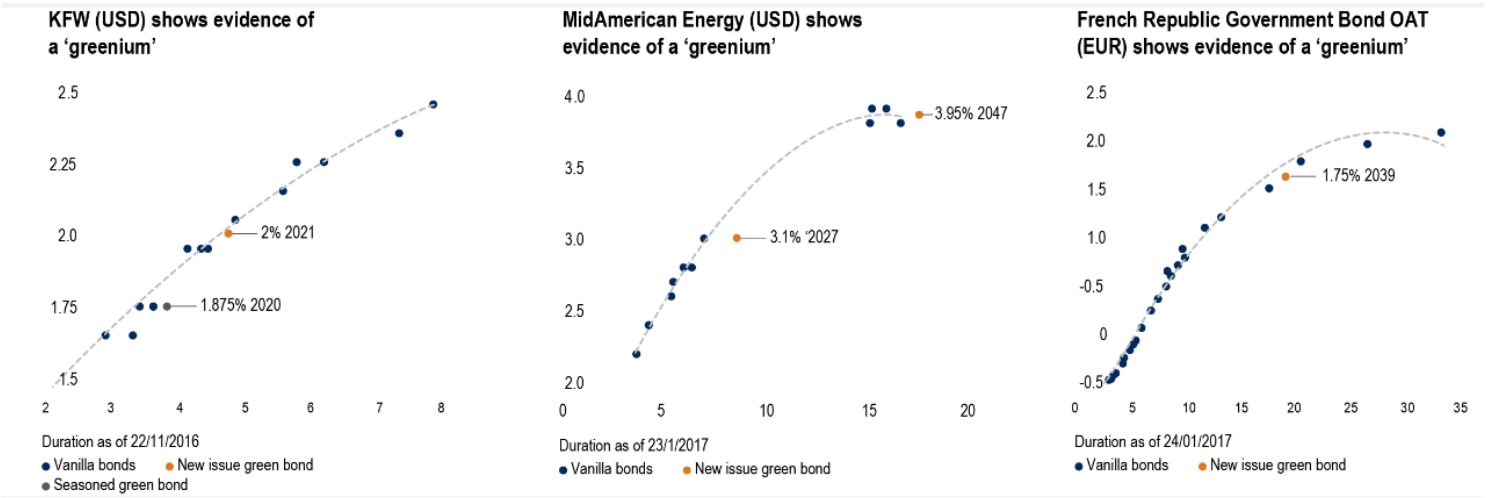


Source: CBI

In primary market pricing, some green bonds priced inside their own credit curve, while many also priced on or outside their credit curves. This is broadly in line with non-green counterparts.

Exhibit 25: New Issue Premium – Green vs. Vanilla Bonds

Examples of those companies who priced inside their own yield curve in CBI sample

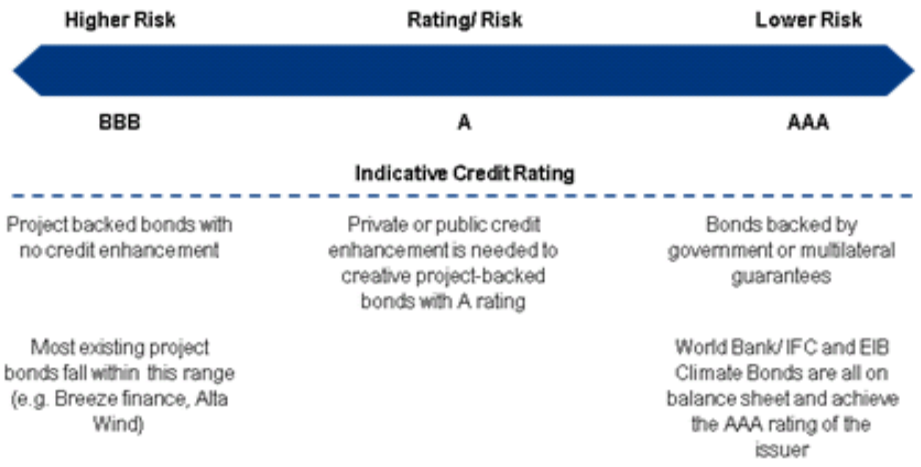


Source: S&P, CBI. Note: 14 bonds analyzed in the sample of which 10 priced inside their own yield curve vs. 4 priced outside their own yield curve

Issuance by SSAs links private capital to developing countries

Green Bonds issued by SSAs, with the highest credit ratings, are able to raise capital at a low cost, and then disperse the funding to all emerging and frontier markets that would not normally have access to private capital (source: Accenture, BNEF, IFC). Supranationals often secure Green Bonds they issue with their balance sheets, giving them AAA ratings. SSAs such as IFC, World Bank, EIB, then take on the responsibility of identifying eligible projects, ascertaining Green Bond eligibility, dispersing the bond proceeds, and ensuring the green targets are met.

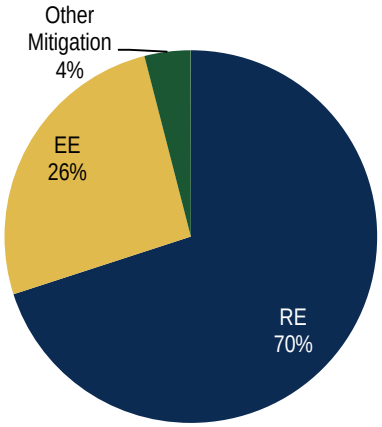
Exhibit 26: The spectrum of climate bonds



Source: Accenture Carbon Capital

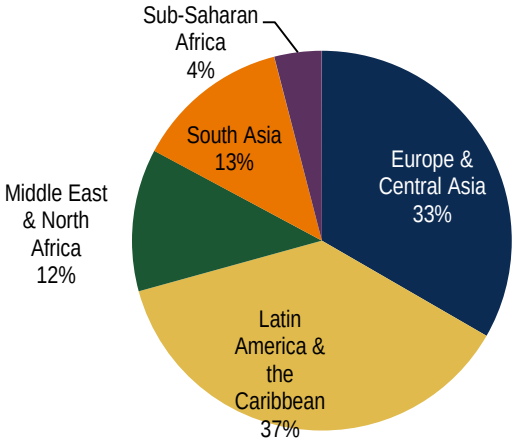
SSAs invest a significant proportion of their capital in emerging markets, and much of it is to fund smaller projects. The IFC, for example, allocated 66% of its FY15 commitments in emerging markets including Latin America, Africa, and South Asia (source: IFC).

Chart 86: IFC FY15 Commitments by Sector



Source: IFC

Chart 87: IFC FY15 Commitments by Region



Source: IFC

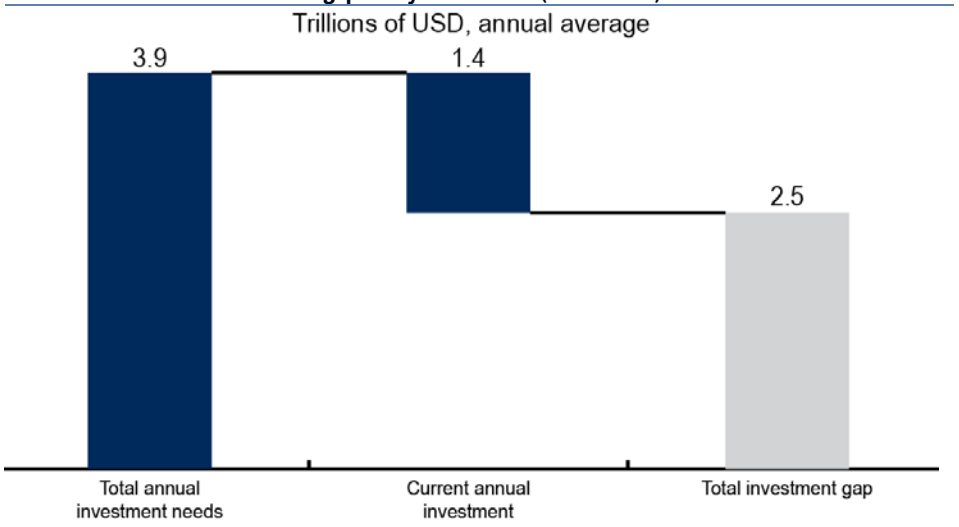
Key to fighting poverty and enhancing prosperity

> 3bn of the world's "energy poor" suffer the health consequences of inefficient combustion of solid fuels in inadequately ventilated buildings, as well as the economic consequences of insufficient power for productive income-generating activities and for other basic services such as health and education

The UN has recognised the critical role of energy efficiency. The Secretary General's Advisory Group on Energy and Climate Change provides that reduction in energy intensity as one of its two key policy recommendations. While the link between a well-performing energy system and economic development is well established, the challenge is partly financial. An additional US$30-35bn of energy efficiency capital is required for low-income countries and US$140-170bn for middle-income countries annually until 2030, above the IEA's reference case (source: IEA). Moreover, the costs of energy efficiency are typically front-loaded, with the benefits accruing over time. This means that low-income countries and their consumers often have access to only limited and expensive capital and energy options (source: UN).

Beyond climate change, countries globally had introduced a set of 17 goals with targets in 2015 to be achieved by 2030, with the aim to end poverty, protect the planet and ensure prosperity for all, these became known as the Sustainable Development Goals (SDGs). The annual investment gap to meet SDGs is even wider as US$2.5tn annually 2015-2030. The shortfall within infrastructure (e.g. power, renewables, transport), telecommunications, water, and waste totals US$1.6tn a year. (Source: OECD 2016). Green Bond and Social Bonds could be potential funding solutions to fulfil SDG goals.

Exhibit 27: Estimated investment gap in key SDG sectors (2015-2030)



Source: UNCTAD 2014

Green Bonds are an investment theme for SE4ALL

> Over 106 countries and the European Union have chosen to pursue SE4All objectives & 50+ High Impact Opportunities (HIOs) have been identified

Sustainable Energy for All initiative (SE4ALL) has identified Green Bonds as one of four major investment themes to scale up green financing in both OECD and emerging markets. SE4ALL was launched by United Nations in September 2011 as a multi-

stakeholder initiative to achieve universal access energy, improvement in energy efficiency and an increase in the share of renewable energy. Businesses and investors have committed more than US$50bn towards SE4All's objectives. The initiative has participation from more than 75 governments, benefitting more than 1bn people. SE4ALL's latest Finance Committee Report from July 2015 maintained Green Bonds as one of the primary investment vehicles in linking untapped pools of capital to sustainable energy opportunities in emerging markets.

Table 28: Progress on SE4All objectives

	OBJECTIVE 1		OBJECTIVE 2	OBJECTIVE 3
	Universal access to modern energy services		Doubling global rate of improvement of energy efficiency	Doubling share of renewable energy in global energy mix
Proxy indicator	Percentage of population with electricity access	Percentage of population with primary reliance on non-solid fuels	Rate of improvement in energy intensity	Renewable energy share in TFEC
Historic reference 1990	76	4	-1.3	16.6
Starting point 2010	83	59		18.0
Objective for 2030	100	100	-2.6	36.0

Source: SE4All

Special emerging markets considerations

Growth of Green Bond issuance by SSAs not only provides direct funding for high impact investment in emerging markets, but can also derisk projects by providing credit enhancements or loans to get the project off the ground. The balance sheets of multilateral banks alone are not large enough to support all green ventures in developing countries, but can drive additional private capital into the market (source: SE4ALL).

Table 29: Risks and barriers are heightened for institutional investment in emerging markets and developing countries

Market risks	Developer risk	Desire for proven track-record of asset developer, or guarantee from a larger parent or sponsor to backstop development risk
	PPA counterparty credit risks	Desire for high quality off-taker of energy, be it a nationalized energy company or investor owned utility; for prepayments, concern about being paid back in falling rates environment without attracting reinvestment alternatives
	Currency and rate risks	Ability of non-OECD investors to hedge foreign exchange risk if investment is outside OECD jurisdictions; concern about interest rate fluctuations and impact on market value of debt
	Concentration risk	Lack of investor depth requires significant hold position on original lender's balance sheet
	Liquidity risk	Concern on ability to exit investment, particularly for smaller-size opportunities
	Market risk	Concern about the borrower's ability to weather extreme fuel price dynamics that could undermine specific sustainable energy technology's competitiveness relative to alternatives
	Business model and execution risk	This concern is most pronounced for impact investors considering opportunities in energy access
Political risks	Retroactive policy change risk	Change in regulatory of legislative support for green investment undermines economic outlook for underlying credit of investment asset by changing revenue, tax or contract profile
	Sovereign risk	The degree of state-owned ownership in the energy sector is cited as a deterrent by many investors but it can also be a risk mitigant when SoEs are co-investors in projects. There is also a lack of creditworthiness of many state-owned power utilities as off-takers Currency convertibility and availability; repatriation and expropriation risks
	Communication risk	An absence of coherence and communication between investors and the respective public institutions can lead to sub-optimal policy development
Technology risks	Aversion to new platforms	Preferring evolutionary improvements on equipment platforms that have already undergone due diligence
	Scale concerns	Concerns about whether investment deal flow will be significant enough to justify investment of time to learn the sustainable energy sector

Source: OECD; Adapted from Bank of America Merrill Lynch, BNDES and World Bank (2014).

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Investment rating	Total return expectation (within 12-month period of date of initial rating)	Ratings dispersion guidelines for coverage cluster*
Buy	≥ 10%	≤ 70%
Neutral	≥ 0%	≤ 30%
Underperform	N/A	≥ 20%

* Ratings dispersions may vary from time to time where BofA Merrill Lynch Research believes it better reflects the investment prospects of stocks in a Coverage Cluster.

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