



### 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 on Green Bonds with this equity/credit Primer, setting out the challenges and opportunities offered ahead.

#### Climate change: unprecedented damage

2015 will be the hottest year since records began in 1880. Extreme weather is now recognized as the #2 risk worldwide and affects 10% of the globe (vs. 0.1-0.2% in 1951-80). Global average temperatures are entering uncharted territory, with +1°C of warming (vs pre-industrial levels) by the end of 2015. This is halfway to the +2°C warning sign, regarded as the threshold of catastrophic climate change. Without action, the cost of climate change could rise to 1-5% of GDP pa, while global investment portfolios could lose up to 45% of their value to 2020E. However, world leaders, corporates, and investors are uniting to support positive change in the clean energy transition and energy efficiency.

#### \$650-860bn pa investment gap – Green Bonds are a tool

We require around US\$93tn of investment in low-carbon infrastructure through 2030E, or US\$6.2tn annually to achieve global growth expectations. 60% of this will take place in EMs. China requires RMB2.9tn (US\$450bn) per year, and India needs US\$165bn annually through 2030E to meet climate targets. This translates into an additional US\$650-860bn in investments pa through 2030E, and up to 85% of that must come from private capital. 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 and other innovations could enable around US\$120bn of incremental annual investment by 2020E.

#### Record issuance in 2015, market doubles to US\$100bn

2015 has been the 4<sup>th</sup> consecutive record year for Green Bond issuance. We saw US\$42.3bn issued through November 27, surpassing US\$38bn of issuance in 2014, the year Green Bonds took off. The universe now includes 600+ bonds, from 24 countries, in 23 currencies, spanning both the IG and HY sides of the spectrum. Issuers range from multilateral banks and supranationals, to banks, property companies, car makers, food producers, conglomerates, and to traditional cleantech companies. Development banks are first movers in the space and continue to drive innovation. However, corporates are now the #1 source of Green Bonds, making up around 45% of 2015 issuance.

#### US\$60bn issuance in 2016, driven by corporates and Asia

We expect issuance of US\$50-60bn of Green Bonds in 2016, implying a CAGR of 10-30%. In a bull case, this could be as high as US\$80-90bn, which would be a doubling of issuance. We believe incremental growth will be driven by 1) increased issuance by corporations in investment grade and high yield; 2) emerging markets issuers, primarily China and India; 3) market innovations including green ABS, project bonds, guarantees, mortgages, and 4) increased standardization in guidelines and impact reporting.

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Refer to important disclosures on page 108 to 109.

Global  
Thematic Investing

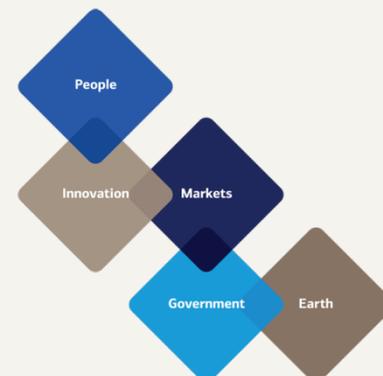
**Beijia Ma, CFA >>**  
Equity Strategist  
MLI (UK)  
+44 20 7996 9070  
beijia.ma@baml.com

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

**Phil Galdi**  
Research Analyst  
MLPF&S  
+1 646 556 2908  
phil.galdi@baml.com

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

#### A Transforming World



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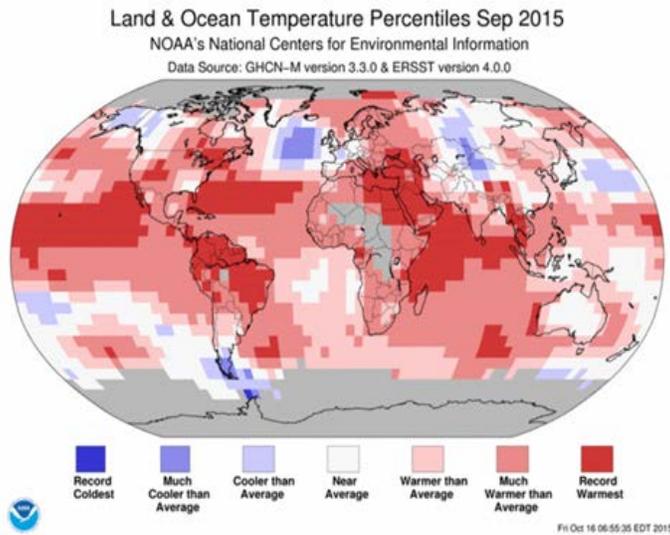
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# Green Bonds – Introduction

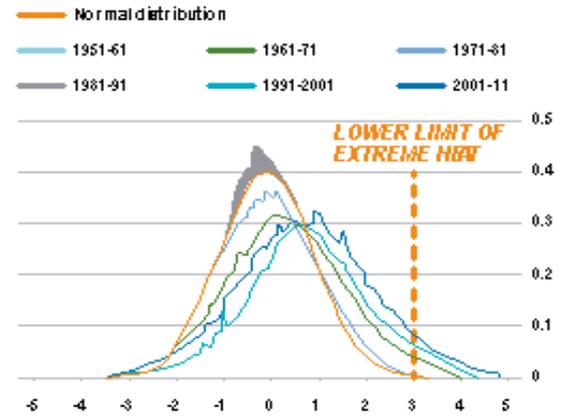
Climate change and extreme weather are causing unprecedented damage. 2015 will be the 39<sup>th</sup> consecutive year where global temperatures are the hottest on record. Extreme weather is now the #2 global risk today and affects 10% of the globe (vs. 0.1-0.2% in 1951-80). Global average temperatures are entering uncharted territory with +1°C of warming (vs pre-industrial levels) by the end of 2015, midway to the +2°C warning sign, seen as the threshold of catastrophic climate change. Without action, the global cost of climate change could rise to 1-5% of GDP/year, while global investment portfolios could lose up to 45% of their value to 2020E. However, we are seeing world leaders, corporates, and investors uniting to support positive change in the clean energy transition and energy efficiency.

**Exhibit 1: Land & ocean temperature percentiles at September 2015**



Source: NOAA

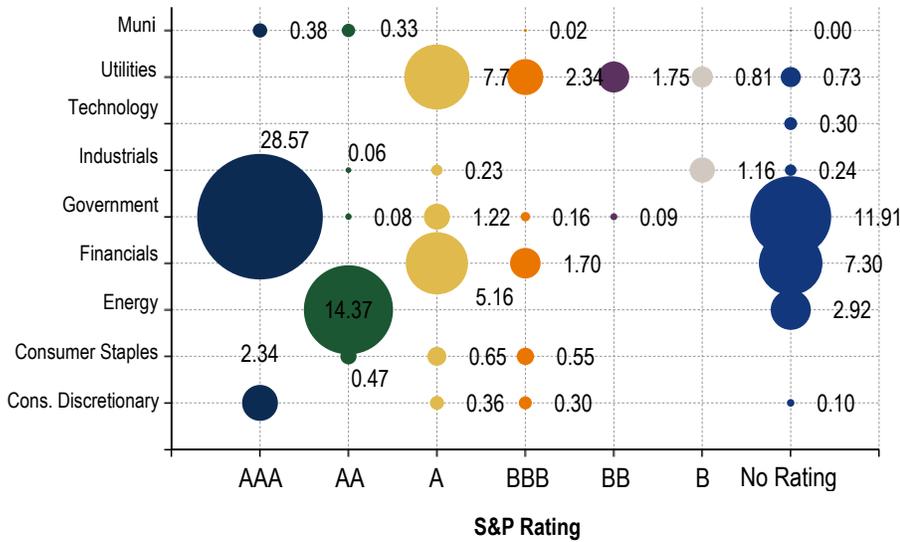
**Exhibit 2: Global temperature deviations from June to August (frequency)**



Source: Goddard Institute for Space Studies, Temperature deviation from the 1951-80 reference period in 250km wide cells around the Earth's surface.

Globally, we are facing a US\$650-860bn/year investment gap (source: SE4All), and Green Bonds are a tool to facilitate financing. We require around US\$93tn of investment in low-carbon infrastructure through 2030E, or US\$6.2tn annually to achieve global growth expectations. 60% of this will take place in EMs. China requires RMB2.9tn (US\$450bn) per year, and India needs US\$165bn annually through 2030E to meet climate targets. This translates to an additional US\$650-860bn in investments annually through 2030E, and up to 85% that must come from private capital. 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 and other innovations could enable around US\$120bn of incremental annual investment by 2020E.

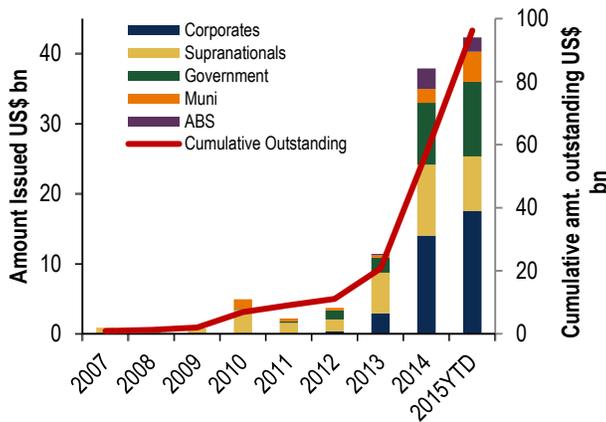
**Chart 1: Green Bond Universe by sector and rating, outstanding issues (through November 27 2015)**



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

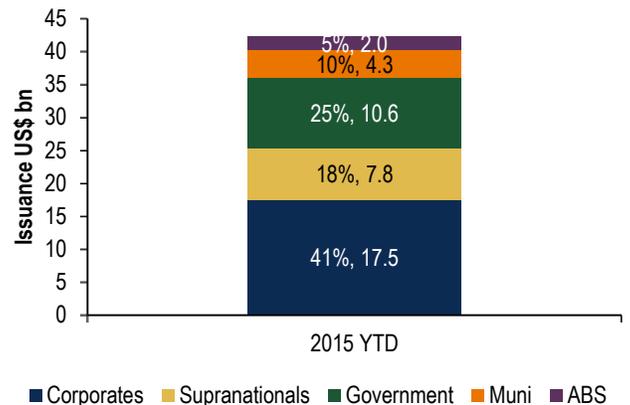
2015 has been another year of record issuance, with the total size of the outstanding market doubling to nearly US\$100bn versus the end of 2014. We saw US\$42.3bn issued through November 27, surpassing US\$38bn of issuance in 2014, the year Green Bonds took off. The universe now includes 600+ bonds, from 24 countries, in 23 currencies, spanning both the IG and HY sides of the spectrum. Issuers range from multilateral banks and supranationals, to banks, property companies, car makers, food producers, conglomerates, to traditional cleantech companies. Development banks are first movers in the space and continue to drive innovation. However, corporates are now the #1 issuer of Green Bonds, making up around 45% of 2015 issuance.

**Chart 2: Corporates leading growth in "Use of Proceeds" green bonds YTD (through November 27 2015)**



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

**Chart 3: Issuance by issuer type, 2015 YTD (through November 27)**



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

We see US\$50-60bn in Green Bonds issued in 2016, implying a CAGR of 10-30%. In a bull case, this could be as high as US\$80-90bn, which would be a doubling of issuance. We believe that incremental growth will be driven by 1) increased issuance by corporations in both investment grade and high yield; 2) emerging markets issuers, primarily China and India; 3) market innovations including green ABS, project bonds, guarantees, mortgages, 4) increased standardization in guidelines and impact reporting

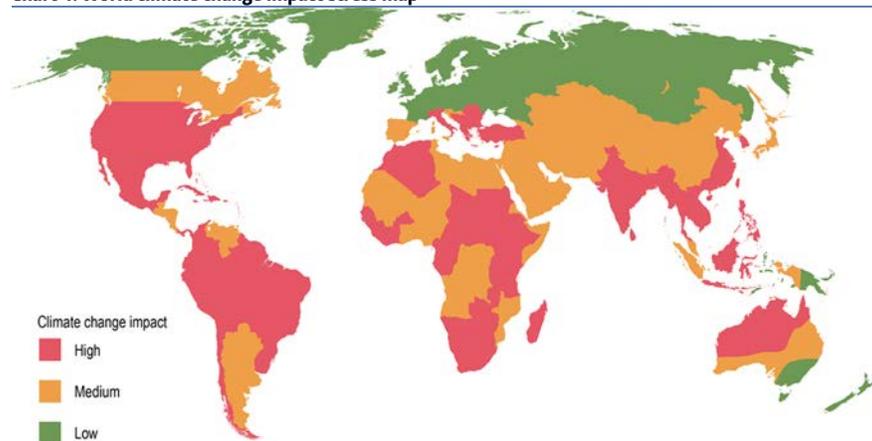
# An energy-resilient future, Green Bonds as an enabler

## On track for a 2-4°C (3.6-7.2°F) warmer world

Analysis from the UN Intergovernmental Panel on Climate Change (IPCC), the World Bank, and peer-reviewed literature finds that global warming of close to 1.5°C above pre-industrial times – up from 0.8°C today – is already locked into Earth’s atmospheric system by past and predicted greenhouse gas emissions. Without further action to reduce greenhouse gas emissions (GHGs), there is consensus among scientists that the world is on track for 2°C warming by mid-century and 4°C or more by 2100.

“Past emissions have set an unavoidable course of warming over the next two decades, which will affect the world’s poorest and most vulnerable people the most. We cannot continue down the current path of unchecked, growing emissions.” - Jim Yong Kim, President of the World Bank

Chart 4: World climate change impact stress map

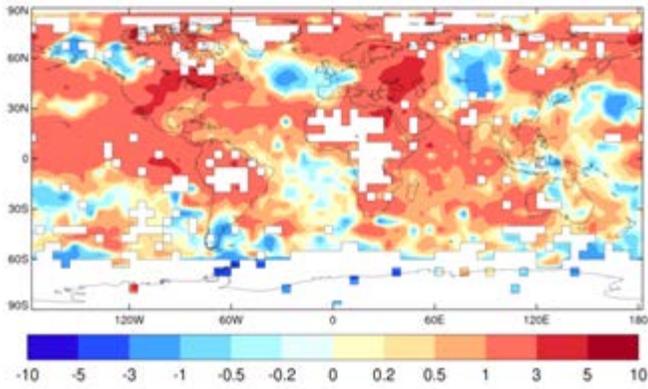


Source: Syngenta, UNEP, Cline

## Global average temperatures set to rise 1°C above pre-industrial levels in 2015

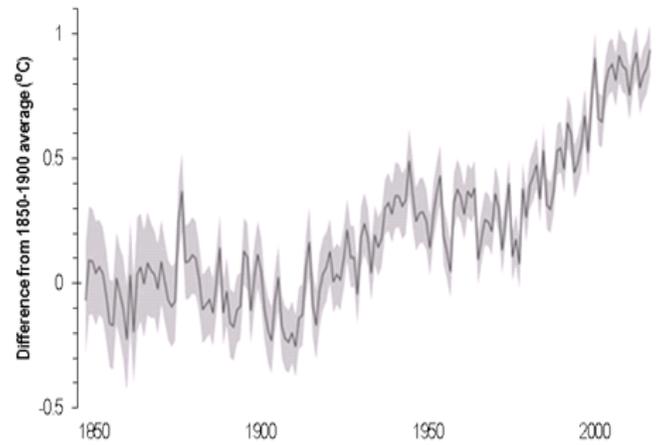
Climate change is set to pass the milestone of 1°C (1.8°F) of warming since pre-industrial times for the first time by the end of 2015 – representing “uncharted territory” according to November 2015 research by the UK’s Met Office. Its “HadCRUT” database showed that from January to October 2015, temperatures were already 1.02°C above the average between 1850 and 1900 (pre-industrial era). The 1°C mark is a significant milestone because it implies that the planet is already midway towards the 2°C warming “warning sign” by 2100E, which is generally seen as the threshold of catastrophic climate change.

**Exhibit 3: Surface temperature anomaly (Celsius) difference from 1961-90**



Source: UK Met Office

**Exhibit 4: Global average temperature anomaly (1850-September 2015)**



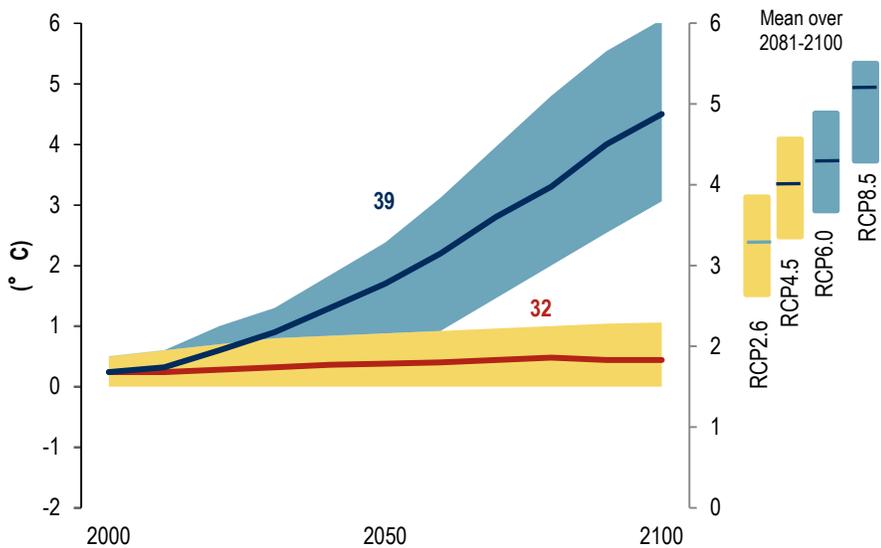
Source: UK Met Office

“We’ve had similar natural events in the past, yet this is the first time we’re set to reach the 1°C marker and it’s clear that it is human influence driving our modern climate into uncharted territory” - Professor Stephen Belcher, UK Met Office

**1.5–4.5°C by 2100E: high degree of confidence**

In its latest and most comprehensive assessment report (AR5 / 2014), the IPCC forecasts that the equilibrium climate sensitivity (ECS) is likely to range from 1.5°C to 4.5°C by 2100E with a high degree of confidence. The IPCC finds values of ECS exceeding 6C to be very unlikely.

**Chart 5: Global average surface temperature change (relative to 1986-2005)**



Source: IPCC

## Impacts of emissions scenarios: 6°C vs. 4°C vs. 2°C

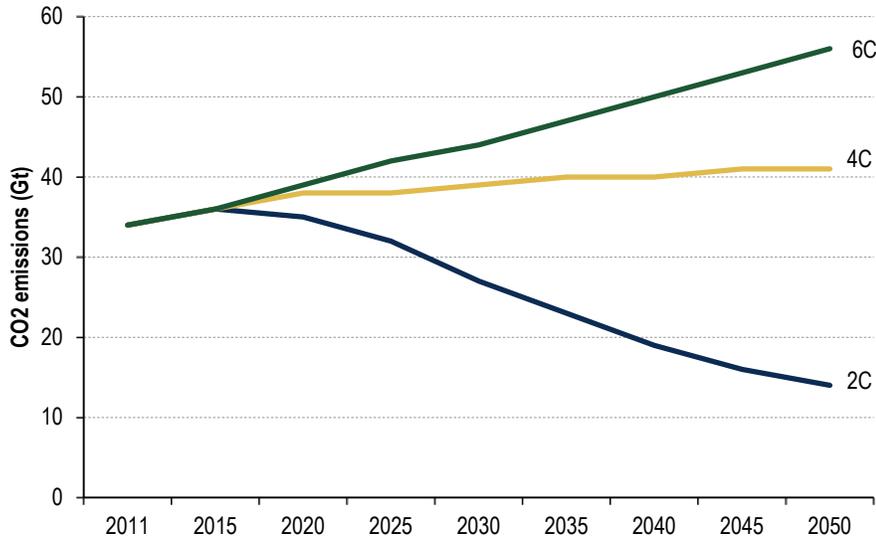
[Thematic Investing: A Call to Action – Climate Change Solutions Primer 27](#)  
[November 2015](#)

The IEA has outlined a range of climate scenarios, which highlights the relationship between energy demand, energy mix, energy efficiency, and the resulting environmental effects.

### Three CO2 emissions scenarios

- **2°C Scenario (2DS)** – this outlines a pathway to deploy an energy system and emissions trajectory consistent with what recent climate science research indicates would give at least a 50% chance of limiting the average global temperature increase to 2°C. The 2DS sets the target of cutting energy- and process-related CO2 emissions by almost 60% by 2050E (compared with 2012) and ensuring they continue to decline thereafter. It identifies changes that help to ensure a secure and affordable energy system in the long run, while also emphasising that transforming the energy sector is vital but not solely capable of meeting the ultimate goal. Substantial effort must also be made to reduce CO2 and GHG emissions in non-energy sectors. The 2DS is broadly consistent with the “450 Scenario” (referring to concentration levels of 450ppm in the atmosphere).
- **4°C Scenario (4DS)** – this is in many respects already an ambitious scenario that requires significant changes in policy and technologies compared with the 6DS (below). The 4DS takes into account recent pledges made by countries to limit emissions and step up efforts to improve energy efficiency, thereby helping to limit the long-term temperature rise to 4°C. This long-term target also requires significant additional cuts in emissions after 2050E, yet with the average temperature likely to rise by almost 3°C by 2100E, it still carries the significant hazard of bringing forth drastic climate impacts.
- **6°C Scenario (6DS)** – this is largely an extension of current trends or business-as-usual. By 2050E, primary energy use grows by almost two-thirds (compared with 2012) and total GHG emissions rise even more. In the absence of efforts to stabilise atmospheric concentration of GHGs, the average global temperature rise above pre-industrial levels is projected to reach almost 5.5°C in the long term (i.e. after 2100E) and almost 4°C by 2100E. Already, the impact of a 4°C increase within this century is likely to be severe, with rising sea levels, reduced crop yields, stressed water resources and disease outbreaks in new areas.

**Chart 6: IEA CO2 emissions scenarios to 2050E**



Source: IEA 2015

**Table 1: Key physical impacts of different climate pathways by 2100E**

Impacts by 2100	Physical systems	Human systems	Biological systems
<b>2°C</b> global mean surface temperature change (relative to 1850–1900).	<ul style="list-style-type: none"> <li>Sea levels rise by around 40 cm.</li> <li>20% less water availability.</li> <li>40% increase in the strongest North Atlantic cyclones</li> </ul>	<ul style="list-style-type: none"> <li>Heat waves similar to recent years, causing heat related deaths, forest fires, and harvest loss.</li> <li>Aggregate negative impacts on food production and price stability.</li> <li>Individual locations will benefit from increased yields at this temperature.</li> </ul>	<ul style="list-style-type: none"> <li>Low to medium risk of decline in fish stocks.</li> </ul>
<b>3°C</b> global mean surface temperature change (relative to 1850–1900).	<ul style="list-style-type: none"> <li>Sea levels rise by around 50 cm.</li> <li>30% less water availability.</li> </ul>	<ul style="list-style-type: none"> <li>Increased chance of famine.</li> <li>Potential for increased agriculture yields eroded.</li> </ul>	<ul style="list-style-type: none"> <li>Permanent loss of arctic sea ice.</li> </ul>
<b>4°C</b> global mean surface temperature change (relative to 1850–1900).	<ul style="list-style-type: none"> <li>Sea levels rise by around 70 cm.</li> <li>Coastal inundation.</li> <li>50% less water availability.</li> <li>80% increase in the strongest North Atlantic cyclones.</li> </ul>	<ul style="list-style-type: none"> <li>High temperatures and humidity compromise normal human activities (e.g. growing food or working outdoors).</li> <li>Risk to marine fisheries poses risk of reduced food supply and employment.</li> </ul>	<ul style="list-style-type: none"> <li>Very high risk of damage from wildfires.</li> <li>Medium to high risk of a decline in fish stocks.</li> <li>Ocean acidification risk to marine ecosystems.</li> </ul>

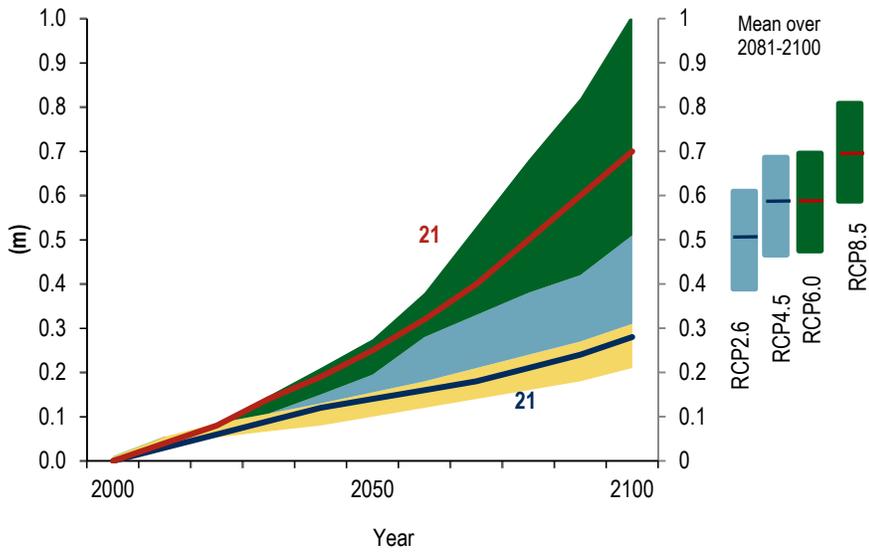
Source: Mercer

**2°C warming = submerge 280 million people, 4°C = 600 million people**

Even a “best-case” 2°C warming of the Earth’s temperature would submerge land currently occupied by 280 million people

Even a “best-case” 2°C warming of the Earth’s temperature would submerge land currently occupied by 280 million people, while 4°C would flood homes lived in by more than 600 million currently (source: Climate Central). According to another study, the world’s 136 largest coastal cities could risk combined annual losses of US\$1tn from floods by 2050E unless they drastically raise their adaptation and flood protection defences now, whereas today they would incur losses of only US\$6bn (source: Hallegatte et. al., Nature Climate Change 2013).

**Chart 7: Global mean sea level rise (relative to 1986-2005)**



Source: IPCC

### Climate change risks

Climate change is a global phenomenon and has potential to affect all companies, sectors and countries across the world – as such, it is one of the most financially significant environmental concerns facing investors today. While most risks are region-specific, the overall consequences of climate change are negative.

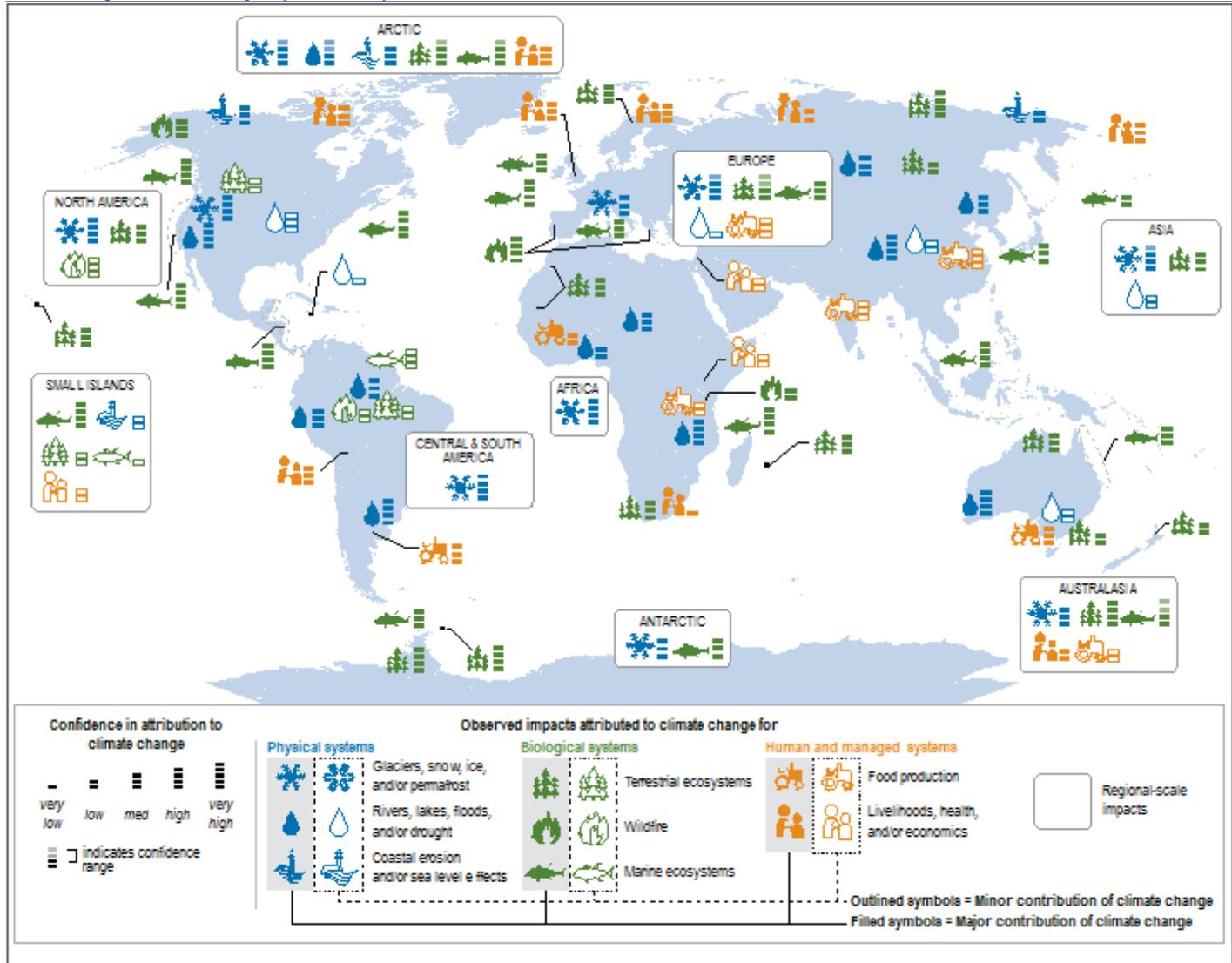
#### Direct risks

- Increases in the frequency of extreme weather events
- Greater risk of flooding
- Higher risk of droughts;
- Increased risk of water stress;
- Greater number of extreme temperature events;
- Changes in the distribution and activity of parasites;
- Altered agricultural productivity;
- Changing fish stocks and migratory patterns;
- Disturbance of complex ecological systems (source: University of Cambridge).

#### Indirect risks

Indirect risks can be broadly classified into four categories: trade, finance, people and bio-physical (source: Benzie, 2015).

Chart 8: How global climate change impacts various parts of the world

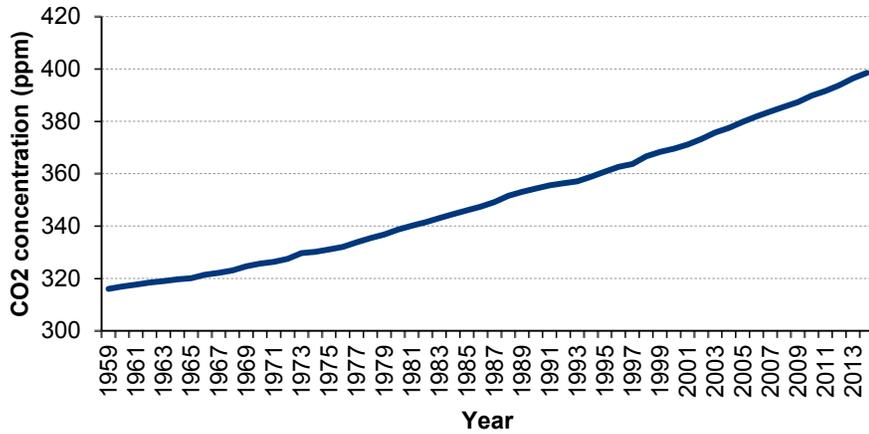


Source: IPCC

### 2016 set to be first year that atmospheric concentration of CO<sub>2</sub> > 400ppm

The World Meteorological Organisation (WMO) estimates that 2016 will be the first year in which the atmospheric concentration of CO<sub>2</sub> will be over 400ppm on average – up 43% since pre-industrial times – with 2015 set to break the GHG emissions record again.

**Chart 9: CO2 concentration in atmosphere (ppm) between 1958 and 2014**

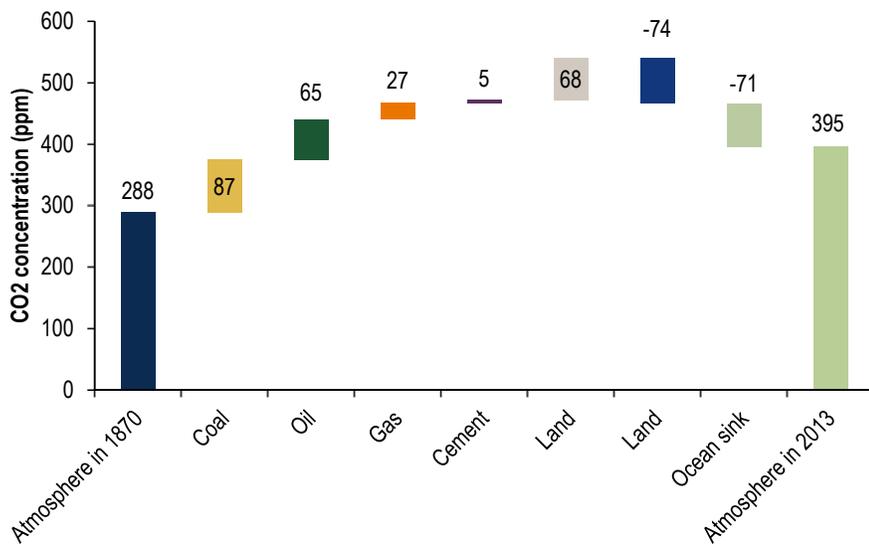


Source: NOAA-ESRL

**Rate of change: >2ppm per year and increasing**

The levels of CO2 concentration in the atmosphere are rising at a rate of approximately 2ppm/year and accelerating fast.

**Chart 10: Cumulative contributions to the global carbon budget from 1870**



Source: Global Carbon Budget

In fact, the daily average concentration of atmospheric CO2 at NOAA's Mauna Loa Observatory exceeded 400ppm for the first time in recorded history on 10 May 2013.

**Table 2: Increase in concentration of atmospheric CO2**

Decade	Total Increases	Average Annual Rates of Increase
2005—2014	21.06 ppm	2.11 ppm per year
1995—2004	18.67ppm	1.87 ppm per year
1985—1994	14.24 ppm	1.42 ppm per year
1975—1984	14.40 ppm	1.44 ppm per year
1965—1974	10.56 ppm	1.06 ppm per year
1960—1964	3.65 ppm	0.73 ppm per year (5 years only)

Source: NOAA

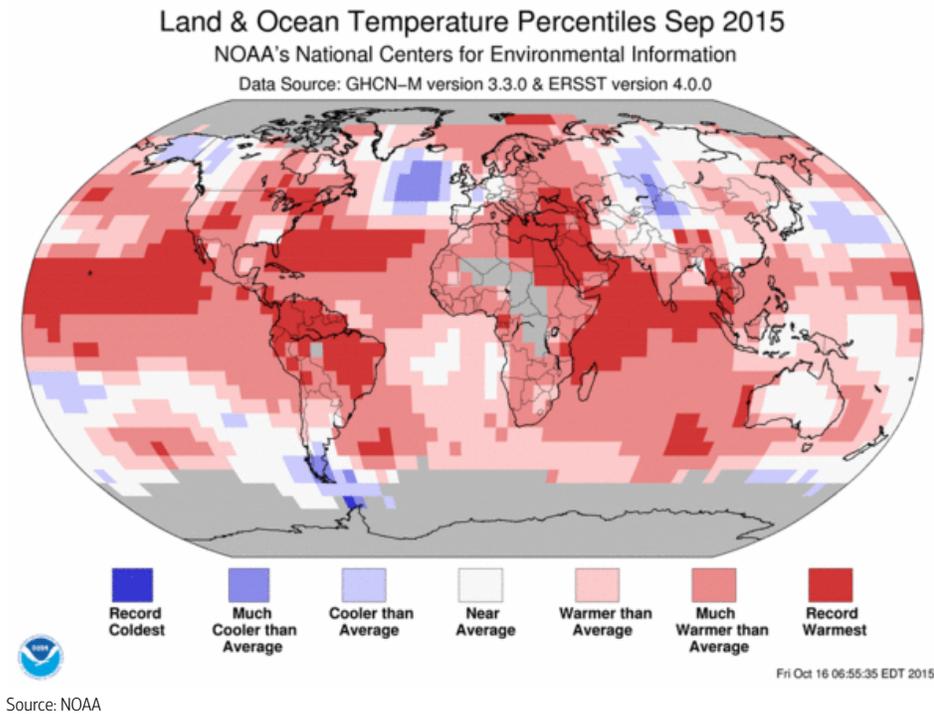
### Unprecedented rates of change

Separately, a study by the Pacific Northwest National Laboratory (PNNL) found that “by 2020E, human-caused warming will have moved the Earth’s climate system into a regime in terms of multi-decadal rates of change that is unprecedented for at least the past 1,000 years – with the rate of warming for the Arctic projected to quickly exceed 1.0°F (0.55°C) per decade.”

### It’s getting hot: 14/15 warmest years on record since 2000

2014 was the warmest year on Earth since records began in 1880, the 38th consecutive year (since 1977) that yearly global temperatures were above the 20<sup>th</sup> century average. 2015 is well on track to break this record again – with September 2015 global temperatures the highest month in 136Y of records (source: NOAA).

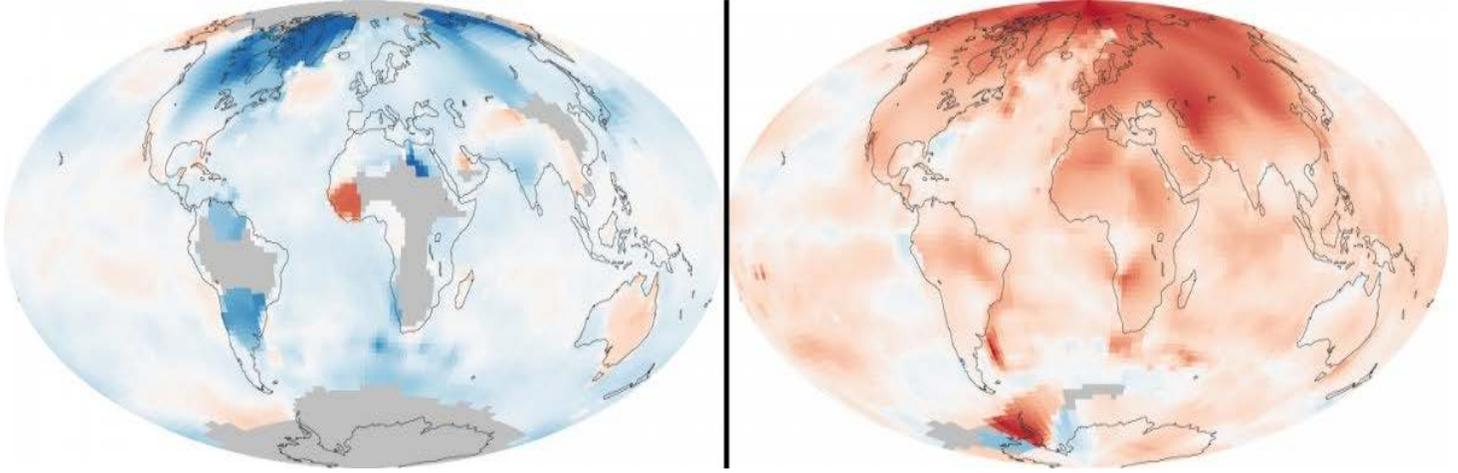
**Exhibit 5: Land & ocean temperature percentiles at September 2015**



### 14 out of 15 warmest years on record have occurred since 2000

Fourteen of the 15 warmest years on record have occurred since 2000. Since 1880, the Earth’s average surface temperature has risen by about 1.4°F (0.8°C), largely driven by the increase in CO<sub>2</sub> and other human emissions into the planet’s atmosphere. The majority of this warming has occurred in the past three decades.

**Exhibit 6: Global regional temperatures, 1951 vs 1980 - Earth's average surface temperature has increased by about 1.3°F since 1880**



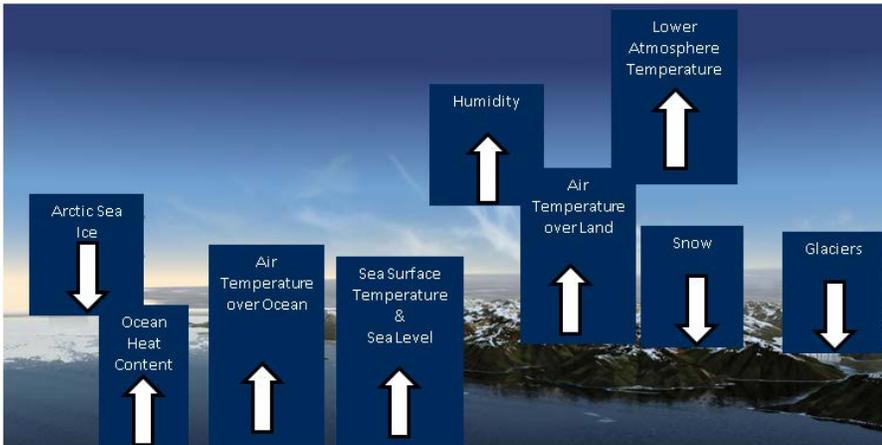
Source: NASA

**All indicators show that the world is warming**

According to the US National Oceanic and Atmospheric Administration (NOAA) – a federal agency focused on the condition of the oceans and the atmosphere – there are 10 broad variables which indicate that the world is warming. Seven out of 10 have a positive correlation with global warming, while 3/10 have a negative correlation. NOAA data over the past few decades show that the relationship between these variables and global warming has been strengthening:

- **7/10 indicators are increasing:** sea surface temperature; air temperature over oceans; ocean heat content; humidity (water vapour); sea levels; air temperature over land; and air temperature of the troposphere.
- **3/10 indicators are decreasing:** the Arctic's sea ice; glaciers and ice sheets; and snow cover globally.

**Exhibit 7: Ten signs of a warming world**

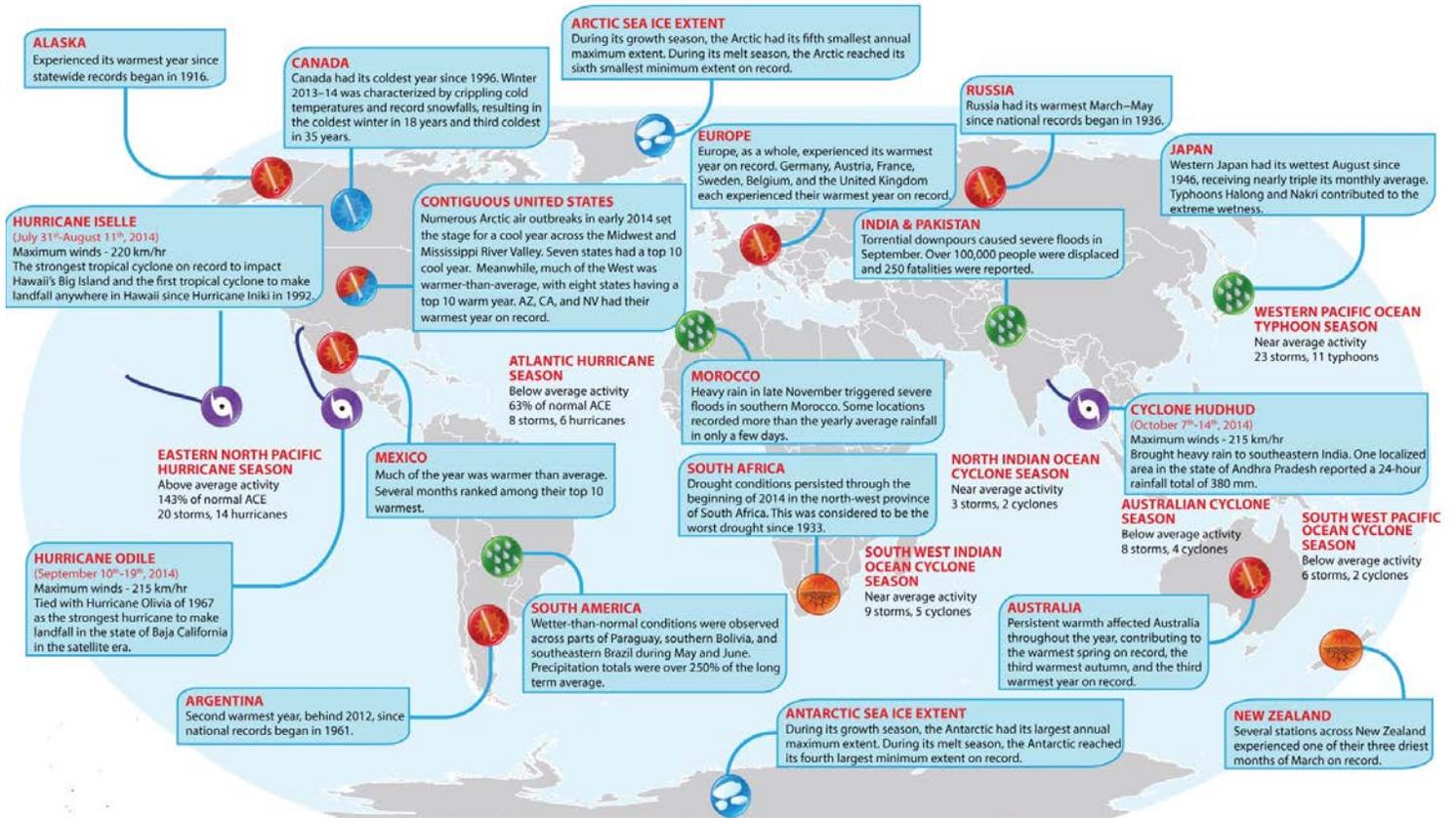


Source: NOAA

**Climate anomalies on the rise globally in 2014-15**

In 2014, most areas of the world experienced higher-than-average annual temperatures, including most of North and South America, most of Europe and Africa, and western, southern, and far north-eastern Asia. Meanwhile, most of Alaska, far western Canada, central Asia, parts of the eastern and equatorial Pacific, southern Atlantic, and parts of the Southern Ocean were notably cooler than average. Additionally, the Arctic experienced a record-breaking ice melt season, while the Antarctic ice extent was above average (source: NOAA National Climactic Data Center).

**Exhibit 8: Selected significant climate anomalies and events in 2014**

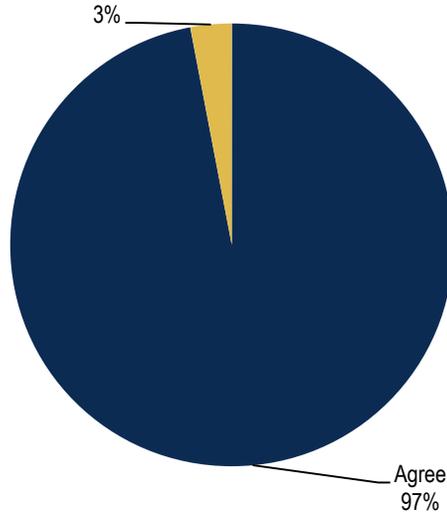


Source: NOAA

**Scientific consensus: near unanimous support**

Some 97% of climate scientists agree that climate-warming trends over the past century are very likely due to human activity, and most of the leading scientific organizations worldwide have issued public statements endorsing this position (source: NASA et. al.). The UN IPCC's 2014 climate change report stated that it is more than 95% certain that humans are the "dominant cause" of the increase in concentrations of greenhouse gases (GHGs) in the atmosphere (source: IPCC).

**Chart 11: % of scientists who agree that Global Warming is very likely due to human activity**

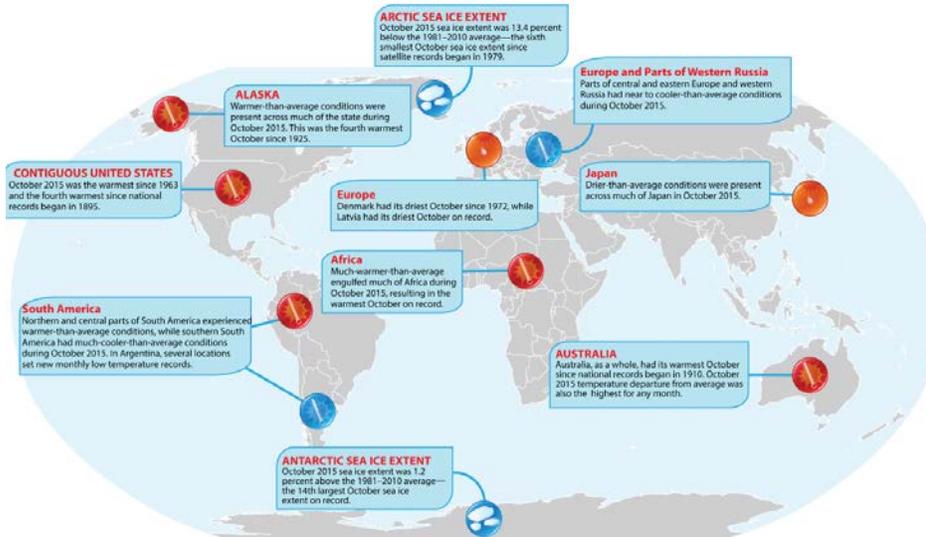


Source: John Cook et al; NASA; UCSUSA

**Extreme weather: #2 global risk today**

Extreme weather events were recognised as the #2 global risk in terms of likelihood in the World Economic Forum’s (WEF) Global Risks 2015 report. Climate anomalies are on the rise globally, with 2014 marking the warmest year across global land and ocean surfaces since records began in 1880 and also the 38<sup>th</sup> consecutive year (since 1977) that the yearly global temperature was above average, with 2015 on track to continue this trend (source: NOAA).

**Exhibit 9: Selected climate anomalies and events of significance**



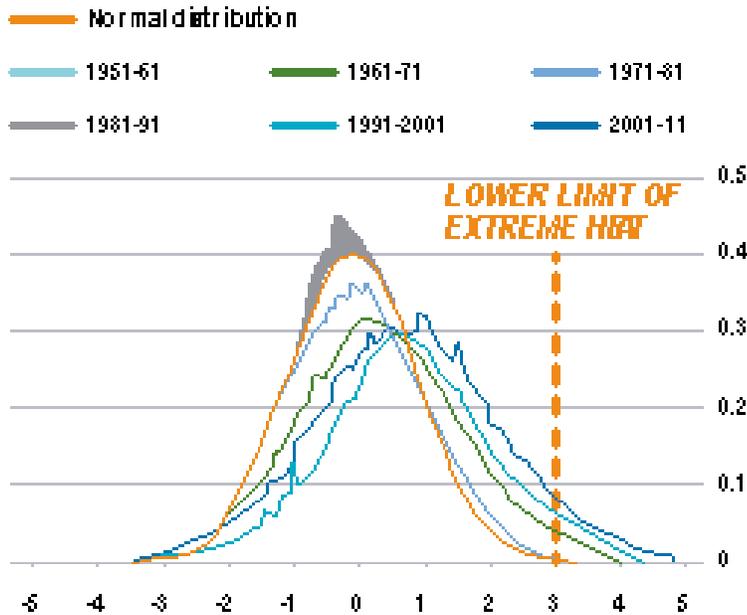
Source: NOAA

- 2014 was the warmest year across global land and ocean surfaces since records began in 1880
- 9/10 warmest years in 135Y of record have occurred in 21st century
- 6/10 of the warmest months in recorded history were in 2015 alone
- October 2015 was warmest month ever recorded (source: NOAA)

### Extreme weather is new normal: 10% of global land area

Peer-reviewed climate modelling – and, more importantly, actual statistical observations of past extreme weather events and temperatures – increasingly show a direct link to climate change. NASA climatologists estimate that extremely warm temperatures now cover 10% of the globe vs. 0.1% to 0.2% from 1951-80. There is a growing belief that such events will become more frequent and severe in the coming years. Sceptics remain – but this work reinforces evidence that climate change is occurring and that it is increasingly harmful.

Exhibit 10: Global temperature deviations from June to August (frequency)



Source: Goddard Institute for Space Studies. Temperature deviation from the 1951-80 reference period in 250km wide cells around the Earth's surface.

### Growing focus on extreme weather vs. climate change link

While it is all too easy to link any and all incidents of extreme weather events to climate change, scientific evidence increasingly points to the worsening of: warming in high latitudes (including unprecedented high-temperature extremes in the tropics), sea level rises and flooding (with the tropics higher than the global mean), increases in tropical cyclone intensity (especially in low-latitude regions), and rising aridity and drought, especially in tropical and subtropical areas (source: World Bank).

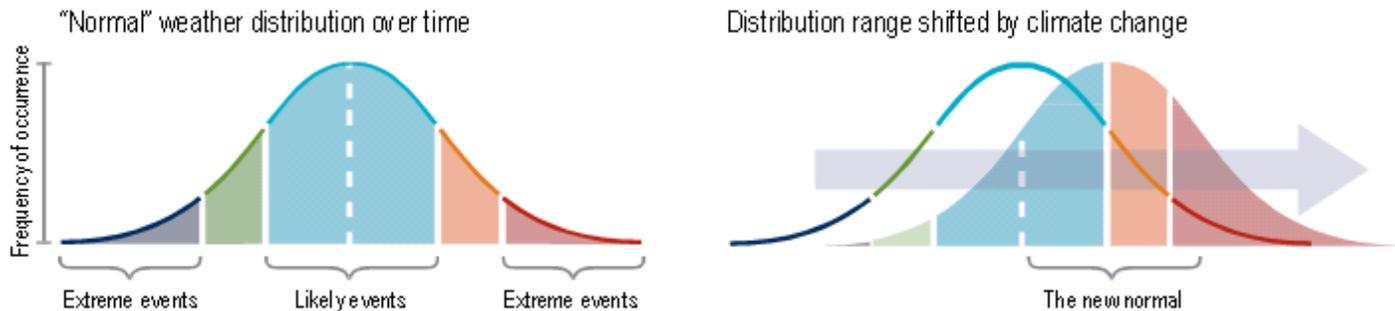
“A world in which warming reaches 4°C above preindustrial levels would result in unprecedented heat waves, severe drought, and major floods in many regions, with serious impacts on human systems, ecosystems, and associated services”

*Turn Down the Heat, World Bank*

## 40% of global land area could face extreme heat by 2040E

While no single incident can be definitively attributed to climate change, there is overwhelming scientific evidence that we should expect more damaging weather events, with up to 40% of global land area at risk from extreme heat by 2040E (source: Coumou et al, Environmental Research Letters, 2013). Over the same period, the researchers believe that more extreme “five-sigma events”, or unprecedented heatwaves, could emerge and cover 3% of the global land surface by 2040E.

### Exhibit 11: How extreme weather events become the new normal



Source: Risky Business Project

### Impact of long-term weather extremes would be devastating and irreversible

As temperatures rise, the World Bank's "Turn Down The Heat" 2014 report set out some of the projected effects, including:

- **Highly unusual and unprecedented heat extremes** similar to those experienced in Russia and Central Asia in 2010 and the US in 2012. The sub-tropical Mediterranean, northern Africa, the Middle East, and the contiguous US are likely to see monthly summer temperatures rise by more than 6°C.
- **Rainfall regime changes and substantial adverse effects on water availability:** Central America, the Caribbean, the Western Balkans, and the Middle East and North Africa stand out as hotspots where precipitation is projected to decline 20-50% in a 4°C world. Conversely, heavy precipitation events are forecast to intensify in Central and Eastern Siberia and north-western South America, with precipitation intensity increasing by around 30% and flooding risks rising substantially in a 4°C world.
- **Significantly diminishing ecosystems** with projected increases in heat and drought stress, together with continuing deforestation, substantially raise the risk of large-scale forest degradation (e.g. Amazon rainforest could turn into a source of carbon rather than acting as a carbon sink). With a 2°C warming, methane emissions from permafrost thawing could increase by 20-30% across boreal Russia.
- **Substantial adverse effects on marine ecosystems and their productivity** are expected, with rising temperatures, increases in ocean acidity, and likely reductions in available oxygen due to their combined effects. Observed rates of ocean acidification are already the highest in 300 million years, while sea level rises are also the highest they have been for 6,000 years.
- **Sea level rises:** sea levels are projected to increase by 0.36m (range of 0.20m to 0.60m) in a 1.5°C world and by 0.58m (range of 0.40m to 1.01m) in a 4°C world over the period 2081-2100 vs. the reference period 1986-2005. Rising sea levels pose a particular threat to urban communities and important infrastructure situated along coastlines. Due to the lag in the response of both the oceans and the Greenland and Antarctic ice sheets to atmospheric temperatures (thermal inertia), sea levels will continue to rise for many centuries beyond 2100.

## Technological advancements lower emissions

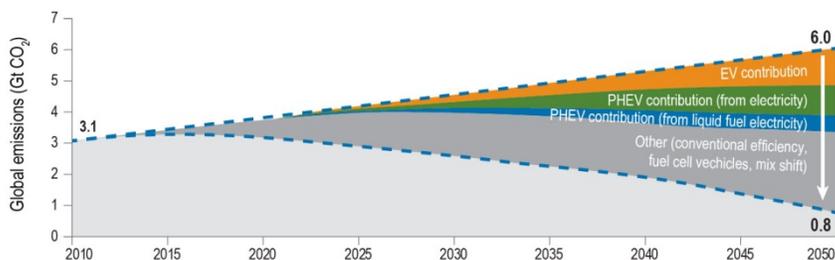
GHG emission intensity per unit of GDP and per capita has declined in most OECD countries thanks to technology and energy mix, but it has not been enough to offset population growth (source: OECD). While per capita primary energy increased by 30% from 1970-2010, total energy rose 130% over the same period (source: IPCC AR5). Further technological advancements, including lowering energy intensity and increasing energy efficiency, would be an important step towards climate change mitigation.

### Technology roadmap for addressing 2DS

The IEA and other institutions have developed technology roadmaps to address the global challenge of energy security and climate change. They highlight some examples of technologies that corporations, governments, and consumers could adopt for mitigation:

- **Bioenergy for heat and power** – bioenergy is the largest source of renewable energy today and could provide 3000TWh of electricity or 7.5% of world generation by 2050. This could result in 1.3Gt CO<sub>2</sub>-equivalent (CO<sub>2</sub>-eq.) emission savings per year by 2050.
- **Carbon capture and storage (CSS)** – critical component of low-carbon energy technologies, contributing to a 1/6th of total CO<sub>2</sub> emissions reductions required in 2050 under the 2DS scenario.
- **Energy storage** – valuable means of decoupling energy supply and demand and key to support electricity decarbonisation. Around 310GW of additional grid-electricity storage capacity would be needed in the US, Europe, China, India. Further development is required to reduce costs and accelerate development.
- **Electric vehicles** – 30% of CO<sub>2</sub> emissions reductions can be achieved via efficiency improvements. The IEA expects the sale of electrical vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs) to grow rapidly after 2015, reaching a combined 7m a year by 2020 and 100m by 2050. EVs also improve oil security, urban pollution and noise.

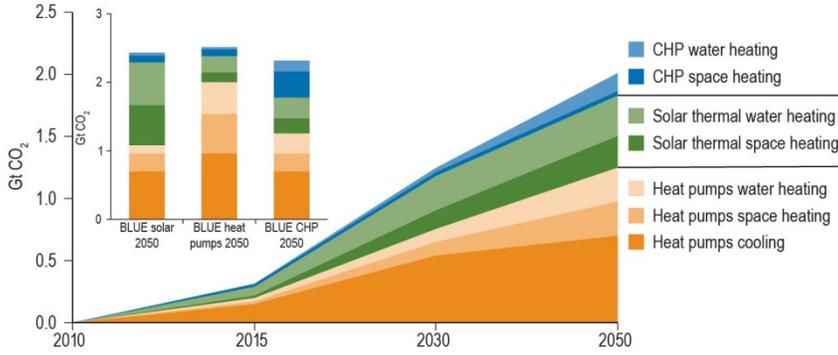
Chart 12: Electric and Plug-in Hybrid Electric Vehicles Roadmap



Source: IEA Roadmap

- **Energy efficient buildings** – energy efficient and low carbon heating and cooling for buildings have the potential to result in up to 2Gt CO<sub>2</sub>-eq emission savings per year and save 710mn tonnes of oil equivalent Mtoe energy by 2050. Most of the technologies are available today.

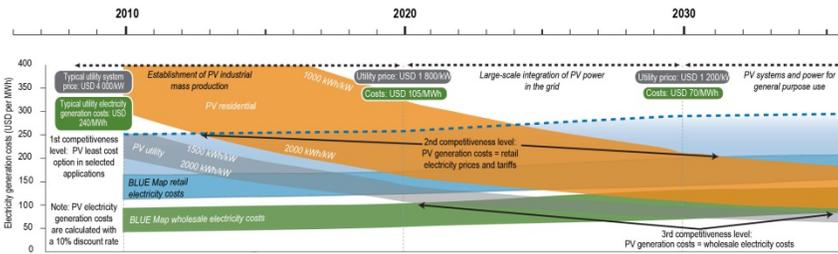
**Chart 13: Energy Efficient Buildings Heating and Cooling Roadmap**



Source: IEA Roadmap

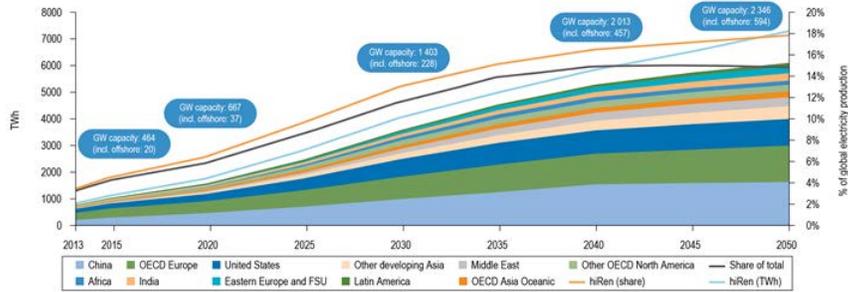
- **Renewables including hydro, wind, solar** – photovoltaic solar (PV) power can provide 11% of global electricity production and avoid 2.3Gt of CO<sub>2</sub> emissions per year. The current target is for wind power to comprise 15-18% of global electricity production by 2050 vs 2.5% now.

**Chart 14: Solar photovoltaic roadmap**



Source: IEA Roadmap

**Exhibit 12: Regional electricity production from wind power in TWh and share of global electricity**



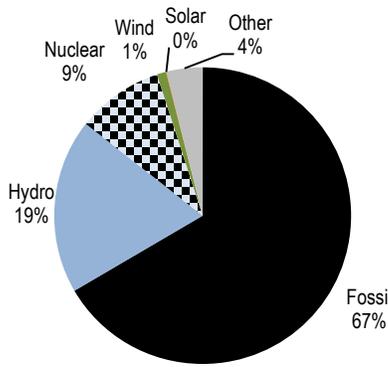
Source: IEA Roadmap

## Global energy transition is underway: cleantech & efficiency

Wind and solar PV to account for 70-80% of new build to 2030E

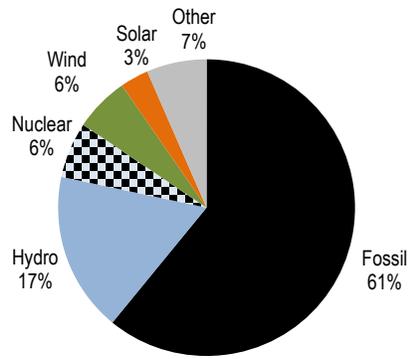
The global energy transition towards low carbon sources is already underway, with the cost of cleantech falling every year, and coal increasingly being recognised as a stranded asset. We believe that a variety of low carbon solutions – energy efficiency, wind, solar, nuclear, hydro, biomass, geothermal et. al. – should be considered in order to not overshoot 2°C of warming.

**Chart 15: 2003 world generation capacity mix**



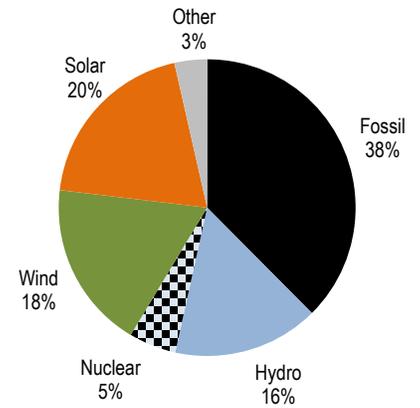
Source: IEA data, BofA Merrill Lynch Global Research approximations

**Chart 16: 2014 world generation capacity mix**



Source: IEA data, BofA Merrill Lynch Global Research approximations

**Chart 17: 2030E world generation capacity mix**

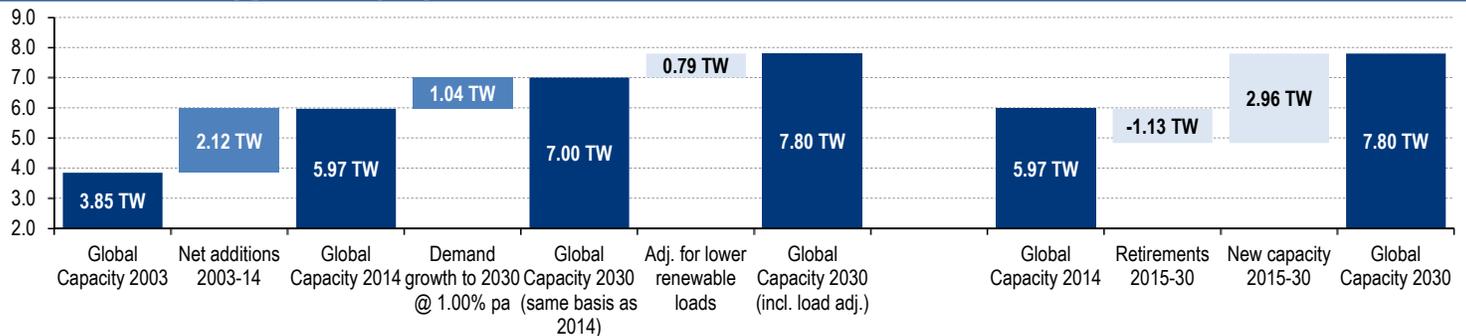


Source: BofA Merrill Lynch Global Research forecasts

### New energy mix by 2030E: cleantech > fossil fuels

If our top-down analysis of significantly more renewable installations to 2030 plays out, then the world's generation mix will change substantially. Wind and solar aggregate capacity has risen from only c.1% in 2003 to c.9% by 2014 while that of fossil fuels has fallen from c.70% to c.60%. By 2020, we see wind + solar PV representing almost one-third of total global electricity generation capacity while the share of fossil fuels could fall towards 40%. In absolute terms, we see fossil capacity falling by c.18% to 2030.

**Chart 18: Global electricity generation capacity outlook to 2030 (BofAML scenario)**



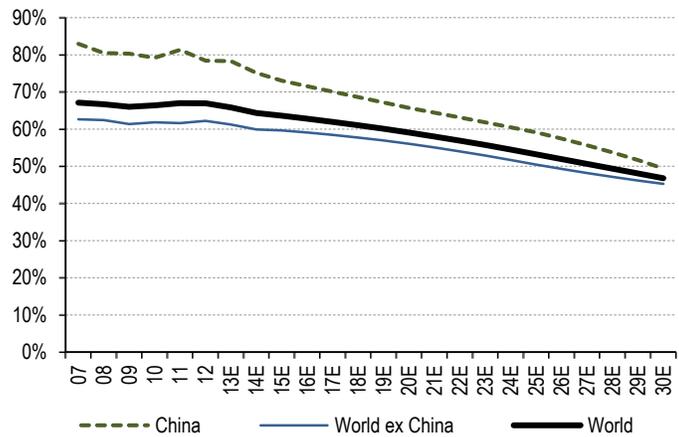
Source: BofA Merrill Lynch Global Research, NB: TW = Terawatts

### Wind and solar PV to play major role (70-80% of new build)

We estimate that 70-80% of all new capacity additions globally will be from wind and solar PV. This seems very high at first, but wind/solar represented >50% of capacity additions in recent years. We believe the share of new thermal capacity additions is likely to fall significantly (from 57% in 2004-13 to 11% in 2015-30E).

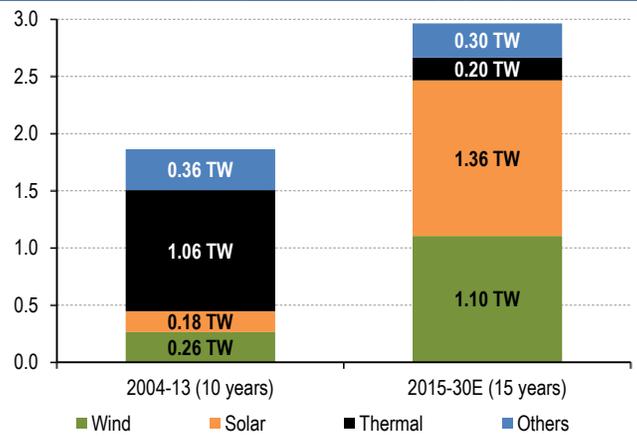
**Chart 19: Fossil share in electricity generation (%)**

Fossil share has been relatively steady till 2012 but we see a fall to 2030



Source: IEA, country data, 2013-30 forecasts from BofA Merrill Lynch Global Research

**Chart 20: Additional capacity - wind and solar to play major role**

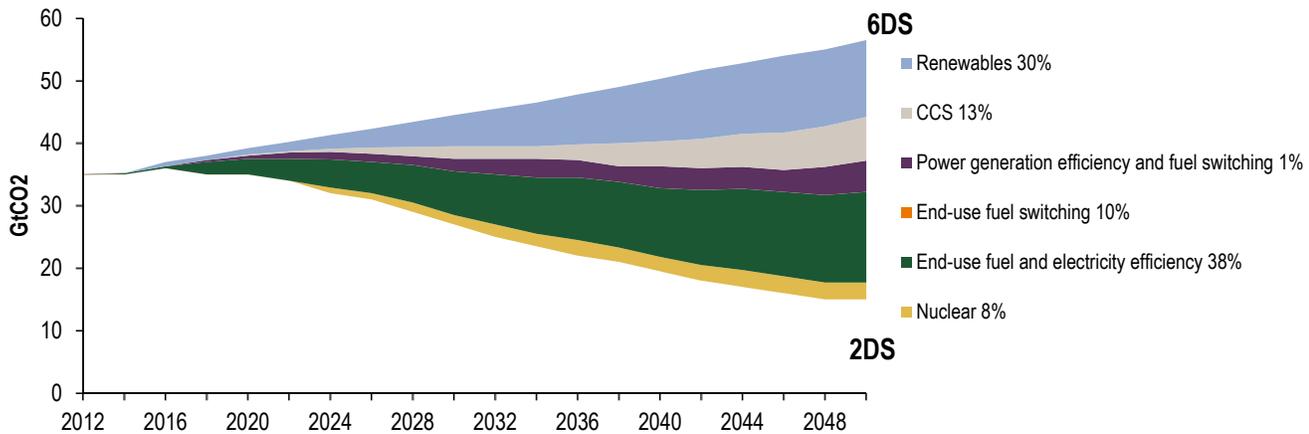


Source: historical data from IEA, forecasts from BofA Merrill Lynch Global Research

**Energy efficiency & cleantech could take us 2/3 of the way to the 2°C goal**

Renewables and energy efficiency could reduce CO2 emissions by 68% to 2050E, and thus help move us over 2/3 of the way towards a safe 2°C warming scenario (source: IEA). In addition the IEA also believes that perhaps the greatest opportunity lies in Africa – which could become the first region in the world to power its economic development on renewable energy rather than fossil fuels such as coal in contrast to the industrialisation of Europe, US and China.

**Chart 21: Contribution of technology area to global cumulative CO2 reductions**

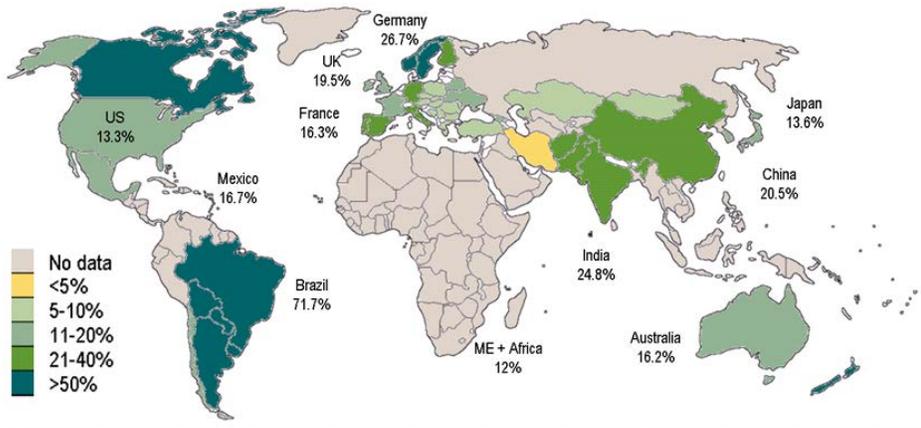


Source: IEA 2015

**Renewables: 50% of new power generation in 2014**

Renewables accounted for nearly half of all new power generation capacity in 2014, led by growth in China, the US, Japan and Germany, with investment remaining strong (at c.US\$300bn) and costs continuing to fall (source: IEA).

**Exhibit 13: Renewable energy as a % of power generation 2014 (incl. hydro)**

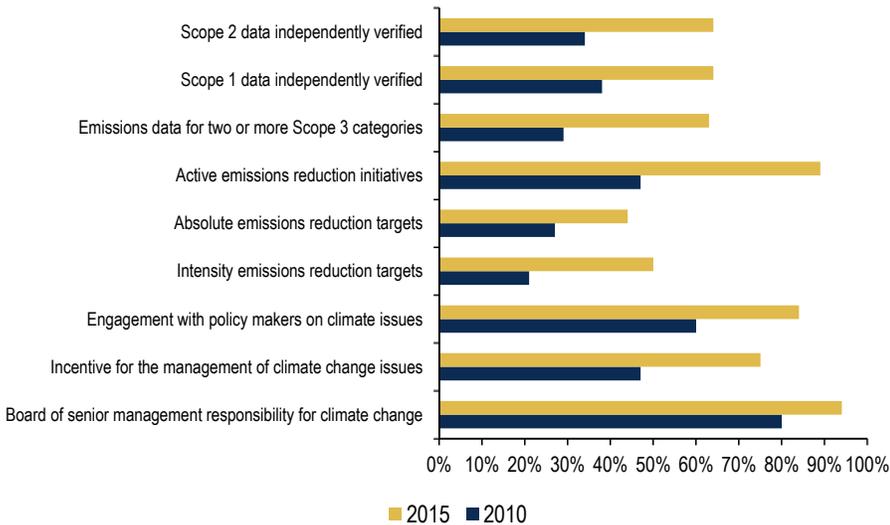


Source: Bloomberg New Energy Finance

**Corporates are becoming a catalyst for climate action**

The case for corporate action on climate change has never been stronger and better understood. With the scientific evidence of man-made climate change becoming ever more incontrovertible, leading companies and their investors increasingly recognise the strategic opportunity presented by the transition to a low-carbon global economy (source: CDP). A November 2015 report by CDP – on behalf of 822 investors with US\$95tn in AUM – shows that corporates and investors have become important catalysts for climate action.

**Chart 22: Improving climate actions globally**



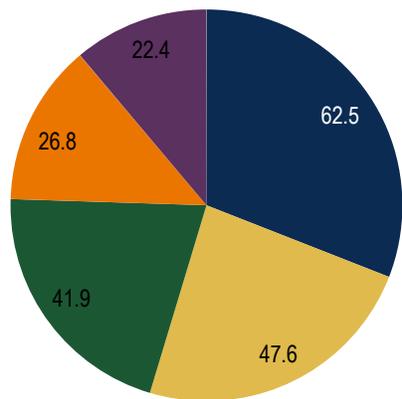
Source: CDP 2015  
Based on responses by 1,997 companies

- **89% increase in activities that reduce carbon emissions over the last 5Y.**
- **Governance is improving, with 94% of companies allocating responsibility for climate issues to the board or senior management in 2015 (vs. 67% in 2010).**
- **Companies disclosed 8,335 projects or initiatives to reduce emissions in 2015, up from 7,285 in 2011. The three most frequently undertaken types of project are: improving energy efficiency in buildings and processes; installing or building low carbon energy generators; and changing behaviour, such as introducing cycle to work schemes, recycling programs and shared transport.**

- **Companies actively working to reduce their greenhouse gas emissions have increased from 52% to 96%** in 2015. 44% no set goals to reduce their total GHGs (vs. 27% in 2010). Even more – 50% have goals to reduce emissions per unit of output (vs. 20% in 2010).
- **435 companies disclosed using an internal price on carbon in 2015**, a near tripling of the 150 companies in 2014. Meanwhile, an additional 582 companies say they expect to be using an internal price on carbon in the next two years.
- **75% of companies are incentivising employees to meet energy efficiency or carbon pollution reduction targets** (vs. 49% in 2010) (source: CDP).

**Chart 23: Industry leaders on CDP disclosure are larger by market capitalization**

Average market capitalization \$ billion



■ Top performers (Q1) ■ Q2 ■ Q3 ■ Q4 ■ Non-responders

Source: CDP

**Table 3: Mega-caps over \$100 bn that score well versus industry group on CDP disclosure, and their market capitalization**

Company	Mkt Cap US\$ bn
Apple Inc	\$612 billion
Microsoft	\$370 billion
Johnson & Johnson	\$290 billion
Wells Fargo and Company	\$267 billion
Wal-Mart Stores, Inc.	\$245 billion
Chevron Corporation	\$244 billion
JP Morgan Chase & Co.	\$223 billion
Pfizer Inc	\$186 billion
Bank of America	\$168 billion
Philip Morris Int	\$133 billion
Cisco Systems	\$127 billion
The Home Depot	\$125 billion

Source: CDP

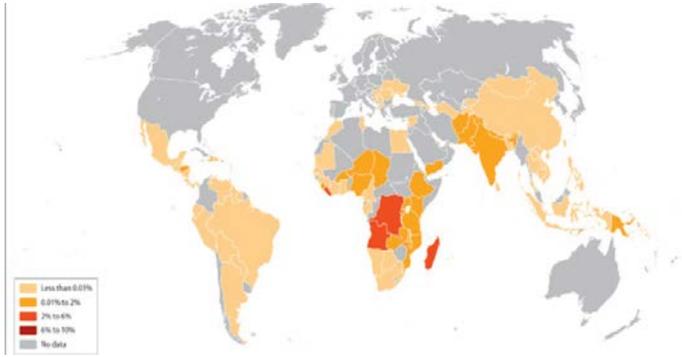
## Costs impacts: unprecedented damages to financial stability

Climate change is already causing unprecedented damage to the world economy, as well as having large-scale human impacts. Together with the carbon-intensive economy, it is a leading global cause of death today, responsible for 5 million deaths each year – 400,000 due to hunger and communicable diseases aggravated by climate change and 4.5 million related to carbon economy, mainly air pollution, hazardous occupations and cancer (source: DARA and Climate Vulnerable Forum).

**Weather-related losses: US\$4tn in global damages over 30 years.** Over the past 30 years, natural disasters have taken the lives of more than 2.5 million people and resulted in almost US\$4tn in damages (source: World Bank). Economic losses are also rising, from US\$50bn each year in the 1980s, to just under US\$200bn each year in the past decade. Eight out of 10 of the costliest natural catastrophes have occurred since the turn of the millennium, including Hurricane Katrina, which was the most expensive catastrophe measured by insured losses since 1950 at US\$62.2bn (source: MunichRE).

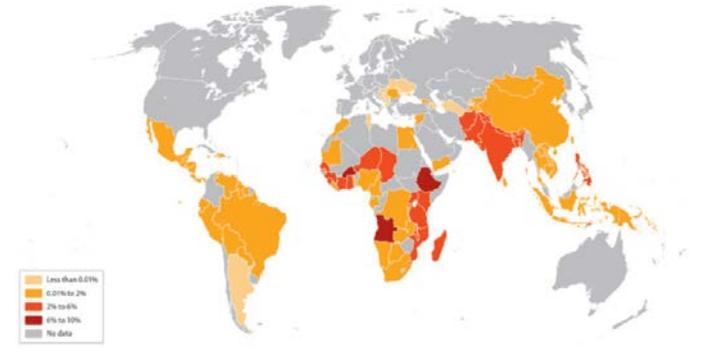
**EMs and the poor will be hit hardest.** Of the 10 countries most affected by climate change and extreme weather, nine are EMs, while only one was classified as an upper-middle-income country (source: Global Climate Rise Index 2015). Recent analysis by the World Bank flagged that, without the right policies to keep the poor safe from extreme weather and rising seas, climate change could drive over 100 million more people into poverty by 2030E, most of them currently living in EMs.

**Exhibit 14: Increase in extreme poverty (% of population) due to climate change in "Prosperity" scenario**



Source: World Bank

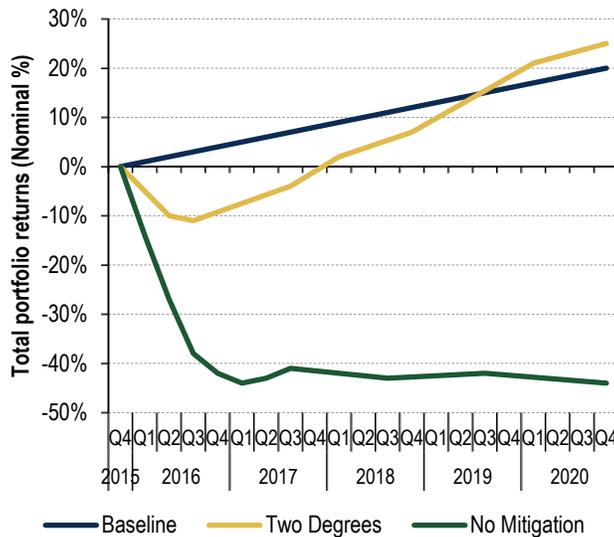
**Exhibit 15: Increase in extreme poverty (% of population) due to climate change in "Poverty" scenario**



Source: World Bank

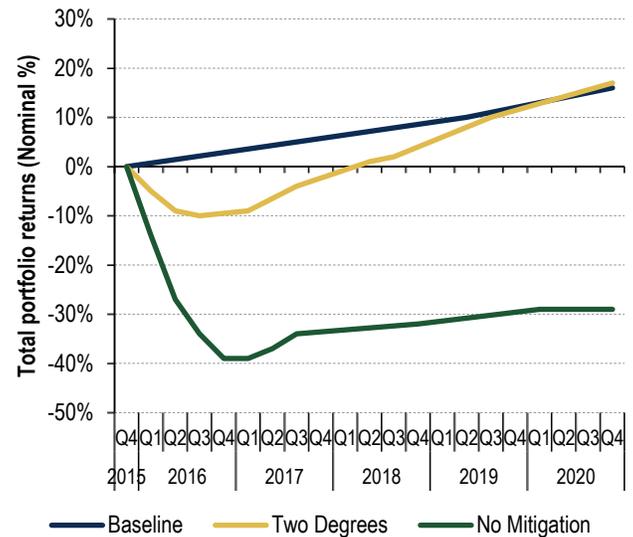
**Climate change risk will have an impact at the level of asset class, industry sector and sub-sector.** Global investment portfolios could lose up to 45% of their value to 2020E as a consequence of financial tipping points for which investors are currently not prepared, including climate change policy, 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, while renewables have the greatest potential for additional returns (6-54% over 35 years) (source: Mercer). By 2100E, up to US\$14tn (present value loss) in manageable financial assets could be at risk (source: EIU).

**Chart 24: Total portfolio returns (Nominal %) - Aggressive**



University of Cambridge

**Chart 25: Total portfolio returns (Nominal %) - Balanced**



University of Cambridge

**Climate change could affect long-term financial stability.** There are three ways in which climate change could affect financial stability: physical risks, such as claims from floods and storms; liability risks that could arise if those suffering climate change losses sought compensation from those they held responsible; and transition risks resulting from the revaluation of assets caused by the adjustment to a lower-carbon economy.

Without strong action, the costs of climate change will be equivalent to at least 5% of GDP each year, according to the Stern Review. Including a wider range of risks and impacts could increase this to 20% of GDP or more. Overall, it is estimated that global mean losses could be 1-5% of GDP for 4°C of warming, but regional losses could be substantially higher (source: Stern et al). We examine a number of the wider risks including growing economic inequality, demographics (fewer babies), pandemics, and ‘Climageddon’ (increased human conflict) further below.

“The challenges currently posed by climate change pale in significance compared with what might come. The far-sighted amongst you are anticipating broader global impacts on property, migration and political stability, as well as food and water security. So why isn’t more being done to address it?” (source: Mark Carney, Governor of the Bank of England)

#### Climate change already costs US\$1.2tn/year: 1.6% of GDP

A 2012 study by DARA and Climate Vulnerable Forum – commissioned by 20 governments around the world – found that climate change is already causing unprecedented damage to the world economy, as well as large-scale human impacts:

- **Climate change and the carbon-intensive economy are a leading global cause of death today**, responsible for 5 million deaths each year – 400,000 due to hunger and communicable diseases aggravated by climate change and 4.5 million related to carbon economy, mainly to air pollution, hazardous occupations and cancer.

**Table 4: Number of deaths from climate change (2010 and 2030E)**

		2010	2030
Climate	Diarrheal Infections	85,000	150,000
	Heat & Cold Illnesses	35,000	35,000
	Hunger	225,000	380,000
	Malaria & Vector Borne Diseases	20,000	20,000
	Meningitis	30,000	40,000
Carbon	Environmental Disasters	5,000	7,000
	Air Pollution	1,400,000	2,100,000
	Indoor Smoke	3,100,000	3,100,000
	Occupational Hazards	55,000	80,000
	Skin Cancer	20,000	45,000
<b>World</b>		<b>4,975,000</b>	<b>5,957,000</b>

Source: DARA and Climate Vulnerable Forum

- **Climate change already costs the world economy 1.6% of GDP** amounting to US\$1.2tn in forgone prosperity a year. Climate change was responsible for just under 1% of GDP losses or US\$700bn, while the carbon-intensive economy cost the world another 0.7% of GDP today.
- **By 2030E, researchers estimate that the cost of climate change and air pollution combined will rise to 3.2% of global GDP**, with the world's least developed markets forecast to bear the brunt, suffering losses of up to 11% of their GDP. But major economies will also take a hit, as extremes of weather and the associated damage – droughts, floods and more severe storms – could wipe out 2% of the US’s GDP by 2030E, while similar effects could cost China US\$1.2tn (source: DARA and Climate Vulnerable Forum).

**Table 5: Overall costs of climate change (2010 and 2030E)**

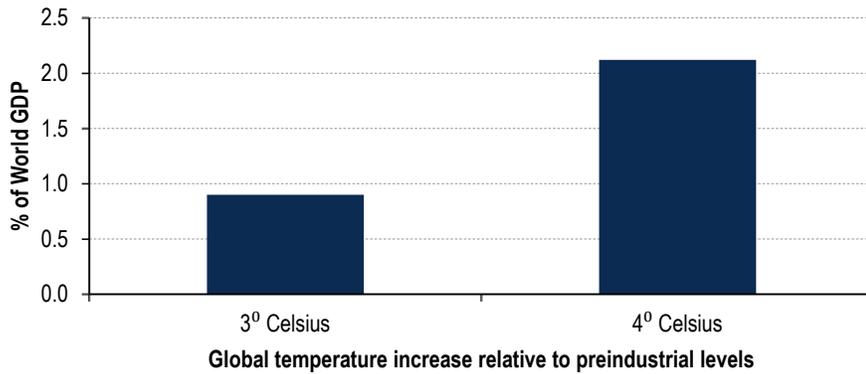
	Losses 2010, bn PPP corrected USD	Losses 2010, % of GDP	Net Losses, % of GDP 2010	Net Losses, % of GDP 2030
Climate	696	0.9%	0.8%	2.1%
Carbon	542	0.7%	0.7%	1.2%
World	1238	1.7%	1.6%	2.1%

Source: DARA and Climate Vulnerable Forum

**White House: potential US\$150bn loss/year for US economy**

For every decade the US waits to enact climate policy, the net cost for mitigating climate change rises by 40%, with this figure increasing over time, according to a White House report based on research by Nordhaus 2013. The report estimates that damages from a global warming scenario of 3°C, instead of 2°C, would reduce GDP by 0.9% worldwide, which, for the US, would mean about US\$150bn lost each year.

**Chart 26: Economic damage from temperature increase beyond 2°C (% of world GDP)**

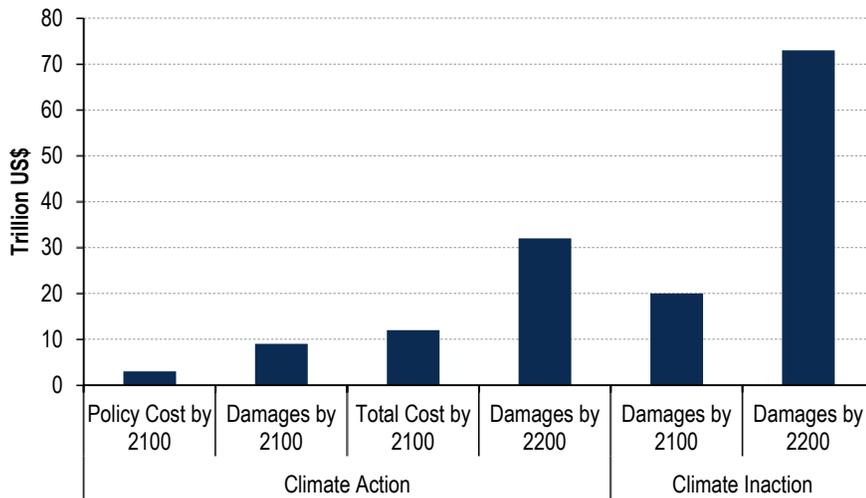


Source: White House based on Nordhaus 2013

**Costs of inaction are far greater: doing nothing could be catastrophic**

There is an argument that mitigating climate change would hurt the economy, but the opposite is true, in our view. Those who argue that reducing emissions will be too expensive ignore the long-term costs of climate change – economic studies have consistently shown that mitigation is several times less costly than trying to adapt to climate change.

**Chart 27: Comparing the cost of Climate Action vs Climate Inaction**

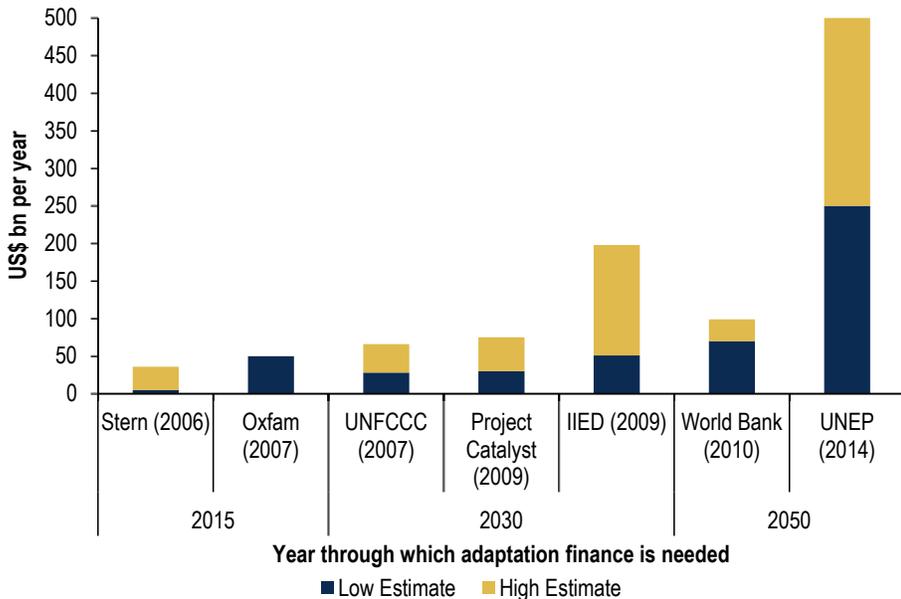


Source: Watkiss et al 2005

### Adaptation costs: worst-case scenario of US\$500bn/year

Over the past decade, numerous studies have estimated adaptation costs based on climate change knowledge at the time. However, there has been a continuous upward revision of these estimates as climate change action is delayed, exacerbating the uncertainty of the future cost of handling the issue. The UNFCCC projected in 2007 that adaptation costs for developing countries would start at US\$28bn annually by 2030E. The IPCC estimated, based on World Bank 2010 data, the cost of climate change adaptation for EMs to be around US\$70-100bn per year by 2050E.

**Chart 28: Estimated annual adaptation finance needs for developing countries through the years**



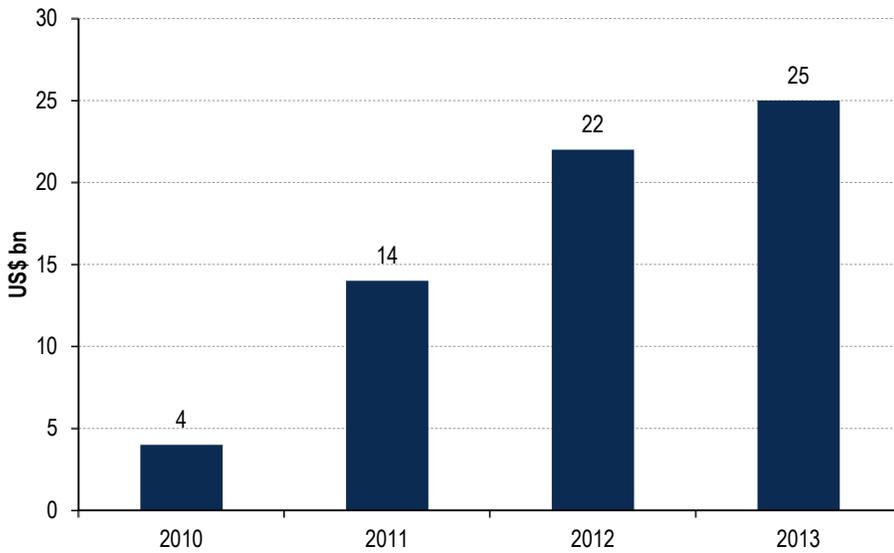
Source: WRI

However, recent analysis by UNEP suggests that the IPCC figure might “significantly underestimate” the cost of the challenge ahead for EMs. Its *Adaptation Gap* report flagged that costs could climb to US\$500bn per year in a worst-case scenario by 2050E, even based on the assumption that emissions are cut to keep temperature rises below 2°C above pre-industrial levels. UNEP found that this was driven primarily by Africa. It is estimated that adaptation costs for Africa alone could reach approximately US\$350bn annually by 2070E, in a business-as-usual scenario compared with US\$200bn per year if the 2°C target were met.

### Mitigation finance dominates: DMs could be doing more to help EM adaptation

A key stakeholder argument is that, since they have cumulatively emitted the most GHGs over time, DMs should contribute more to cost mitigation, whether that be funding or technological transfer, and help EMs to deal with climate change. In an effort to tackle this problem, DMs have pledged US\$100bn by 2020E to the Green Climate Fund (GCF) – the UNFCCC framework to help developing countries combat climate change. However, year to date, the UN’s data shows they have only donated cUS\$10bn so far, meaning the figure is well short of the target with just five years to go.

**Chart 29: Global public adaptation finance commitments, 2010-2013 (US\$ bn)**

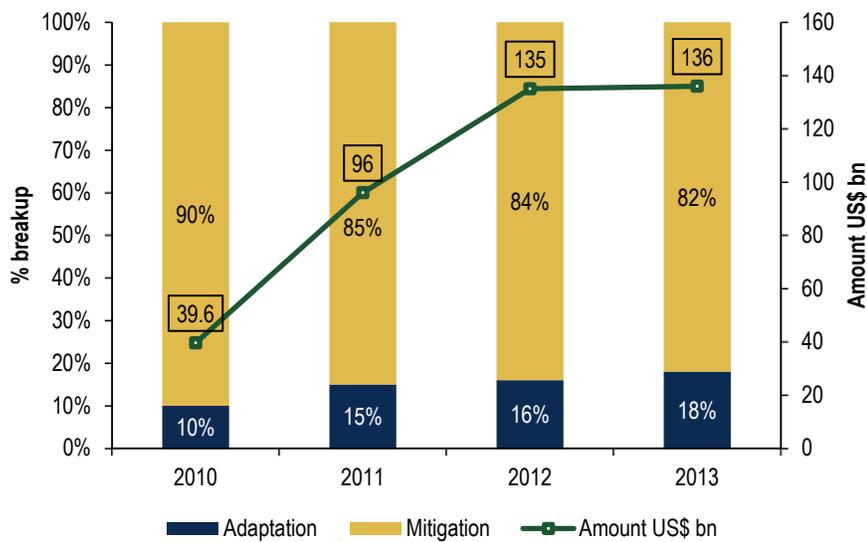


Source: WRI, CPI

**A long way to go**

In 2010, public finance committed to address climate change adaptation amounted to US\$4bn. By 2013, this figure had increased to US\$25bn, 90% of which was invested in non-OECD countries including Chile and Mexico (source: WRI, CPI). However, the share of adaptation finance pales in comparison with the funding channelled towards mitigation. The US\$25bn for adaptation was only 18% of total public climate finance vs 82% for mitigation, or US\$112bn. Even more significantly, mitigation receives almost 2x as much finance from the private sector as from the public sector – about US\$191bn vs US\$111bn. The share of adaptation (long-term solution) vs mitigation (short-term solution) finance needs to increase rapidly, in our view, to deal with the growing changes in our climate.

**Chart 30: Mitigation and adaptation finance commitments from public sources, 2010-2013**



Source: WRI, CPI

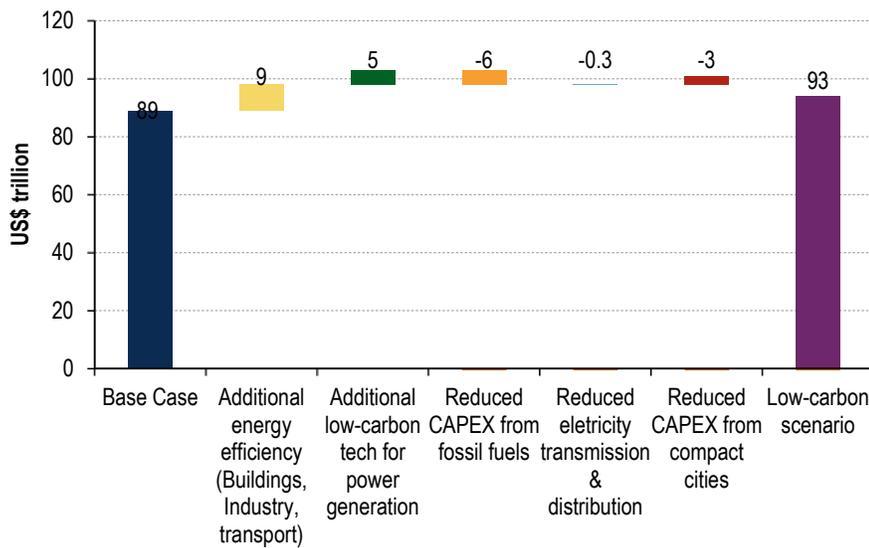
# US\$650-860bn/year gap: the need for additional investment vehicles

## 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. 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 31: 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

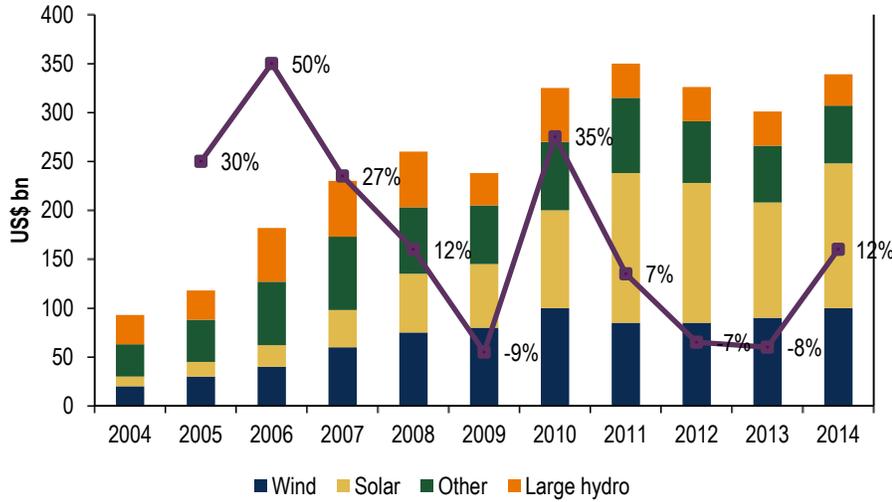
## Cleantech investments making progress: \$13.5tn to 2030E

Despite positive progress, efforts are not yet enough to move the world onto a pathway consistent with the 2 °C climate goal. The IEA estimate that the full implementation of the INDC pledges made for COP21 by more than 150 countries by mid-October 2015 would require cumulative investments of US\$13.5 trillion in low carbon technologies and energy efficiency until 2030E. Hence this implies in reality we need more than this figure to ensure we don't overshoot 2C warming by the end of this century.

### Cleantech investment: +3.5x in 10 years

New investment in clean energy has increased by 3.5x in the past decade and has ranged from US\$300-350bn over the past 5 years. Between 2013-14 there was a 12% YoY increase in new cleantech investments, marking a return to levels close to the peak last seen in 2011 (source: Bloomberg New Energy Finance).

**Chart 32: New investment in clean energy 2004-14 (US\$bn)**

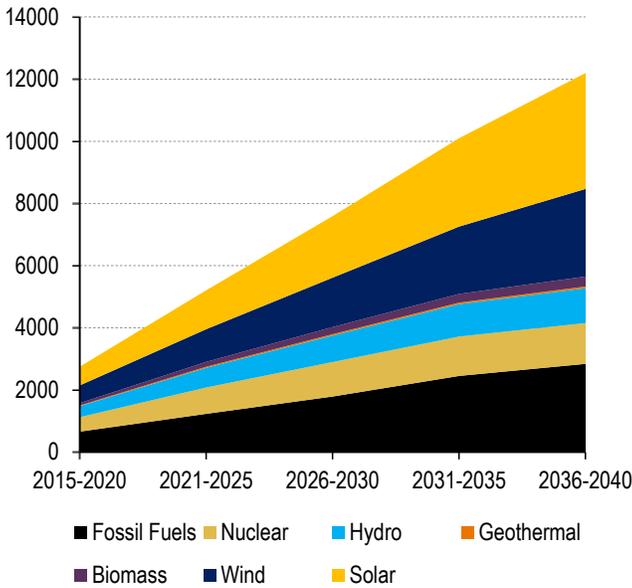


Source: Bloomberg New Energy Finance

**US\$8 trillion in renewables investments to 2040E**

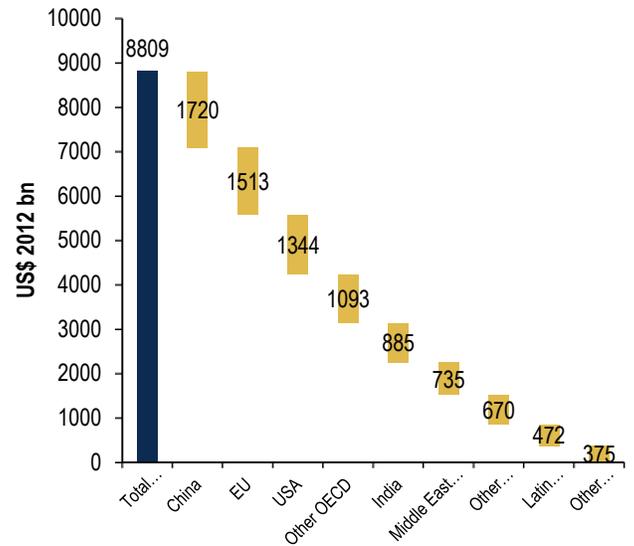
BNEF estimates that there will be US\$12.2tn in cumulative investments towards power alone to 2040E with renewables taking the lion’s share at 65%, which is roughly US\$8tn. Out of this figure: solar is expected to account for US\$3.7tn, wind at US\$2.4tn and fossil fuels at US\$2.6tn. APAC is expected to account for over 50% of the US\$12.2tn invested to 2040E with almost US\$2tn alone going into solar (source: BNEF).

**Chart 33: Global investments in power generation, 2015-40E**



Source: Bloomberg New Energy Finance

**Chart 34: Sustainable energy investment requirements in the “450 scenario” 2014-35**



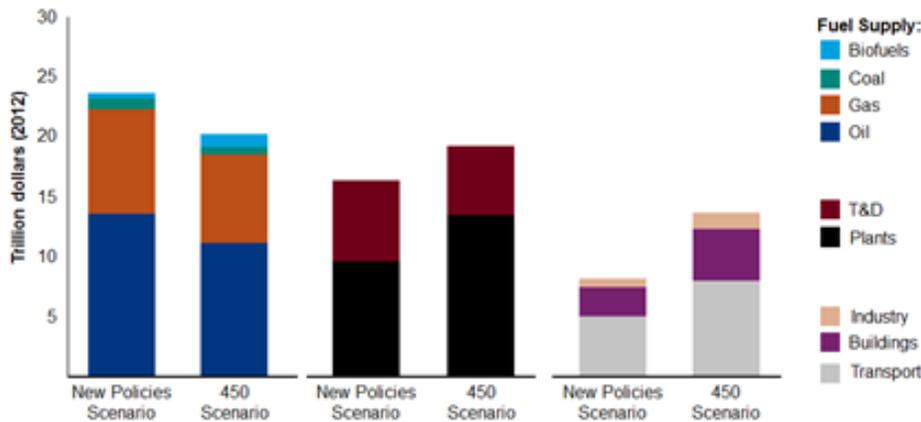
Source: OECD

**Up to US\$14tn investments needed for energy efficiency to 2035E**

Global investments in energy efficiency have ranged from US\$130bn-300bn/pa in recent years. By 2035E, we are anticipating US\$8-14tn in investments – or US\$550bn+ in annual spending – both to meet growth in demand and make the transition to a lower-carbon economy (source: IEA). We believe that there is significant “low hanging fruit” potential 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). Investing in efficiency will also reduce mid- to long-term exposure to the risk of stranded assets vis-à-vis fossil fuels.

**Exhibit 16: World cumulative investment in energy supply & energy efficiency, 2014-2035E**



Source: IEA. New Policies Scenario: energy demand and supply projections reflect policies and measures adopted as of early 2014 and takes a cautious view on non-implemented measures. 450 Scenario: more capital investment in energy to reduce CO2 emissions to meet the 2° C target.

## US\$650-860bn/year investment gap remains

Despite high growth in spending, we are still not doing enough. We require over US\$1tn in annual investment in energy access, renewable energy, and energy efficiency globally. Actual spending only amounted to around US\$400bn in 2012, which implies a gap of US\$650-860bn per year by 2030E (Source: SE4All). Renewables and energy efficiency make up the great majority of current investment, but are also the areas where we require the highest additional growth.

**Table 6: Annual global investment—actual and required (\$ billion)**

Annual investment	Universal access to modern energy services	Universal access to modern energy services	Doubling the global rate of improvement in energy efficiency	Doubling the share of renewable energy in the global mix <sup>a</sup>	
Source	Electrification	Cooking	Energy efficiency	Renewable energy	Total
Actual for 2012 <sup>b</sup>	9	0.1	130	258	397
Required to 2030 <sup>c</sup>	45	4.4	560	442–650	1,051–1259
Gap	36	4.3	430	184–392	654–862

Source: World Bank; IEA

a. This is the range for significantly increasing the share of renewable energy in total final energy consumption.

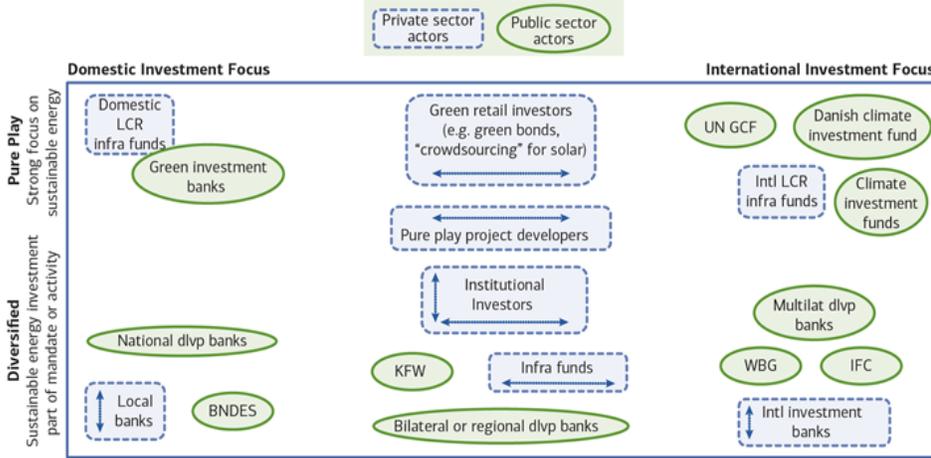
b. The total assumes 2010 investment in access figures for 2012.

c. Estimates are derived from various sources: Energy access, electrification: SE4All Finance Committee Report, World Bank (2014); Energy access, cooking: Energy for All Scenario, WEO (IEA, 2012); Energy efficiency: 450 scenario, WEO (IEA, 2014); Renewable energy lower bound: WEO 450 (IEA, 2014), corresponds to a 29.4 percent renewable energy share in total final energy consumption by 2030; Renewable energy upper bound: REmap 2030 (IRENA, 2014), corresponds to a 36 percent renewable energy share in total final energy consumption by 2030.

## Public sector were footing the bill

Historically, the leading providers of capital have been governments, commercial banks, and national and multilateral development banks.

**Exhibit 17: 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\$650-860bn of additional annual investment required, raising the need for new sources of capital.

**Table 7: 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) Structured Note	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
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 provide US\$120bn/yr of additionality**

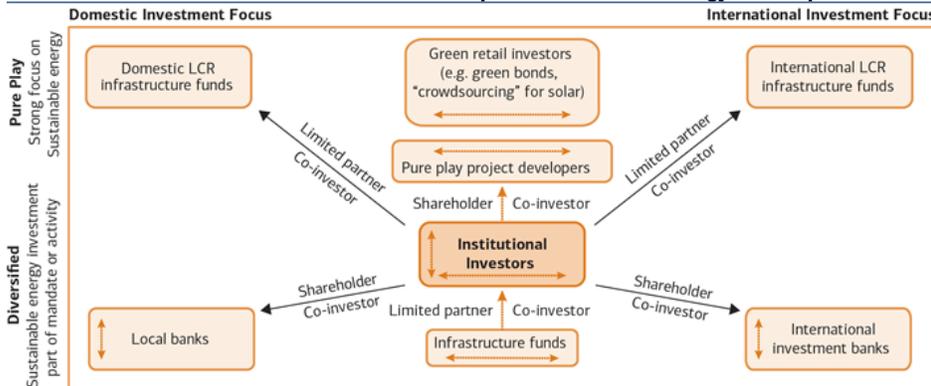
The UN advisory group SE4All believe that instruments like green bonds could account for around US\$120bn in incremental annual investment by 2020E. Other key tools include structures that help derisk projects, insurance products, and aggregation and pooling approaches to scale smaller projects (Source: SE4All). Much of this can already be bundled with green bonds, or can be offered as stand-alone measures.

**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:

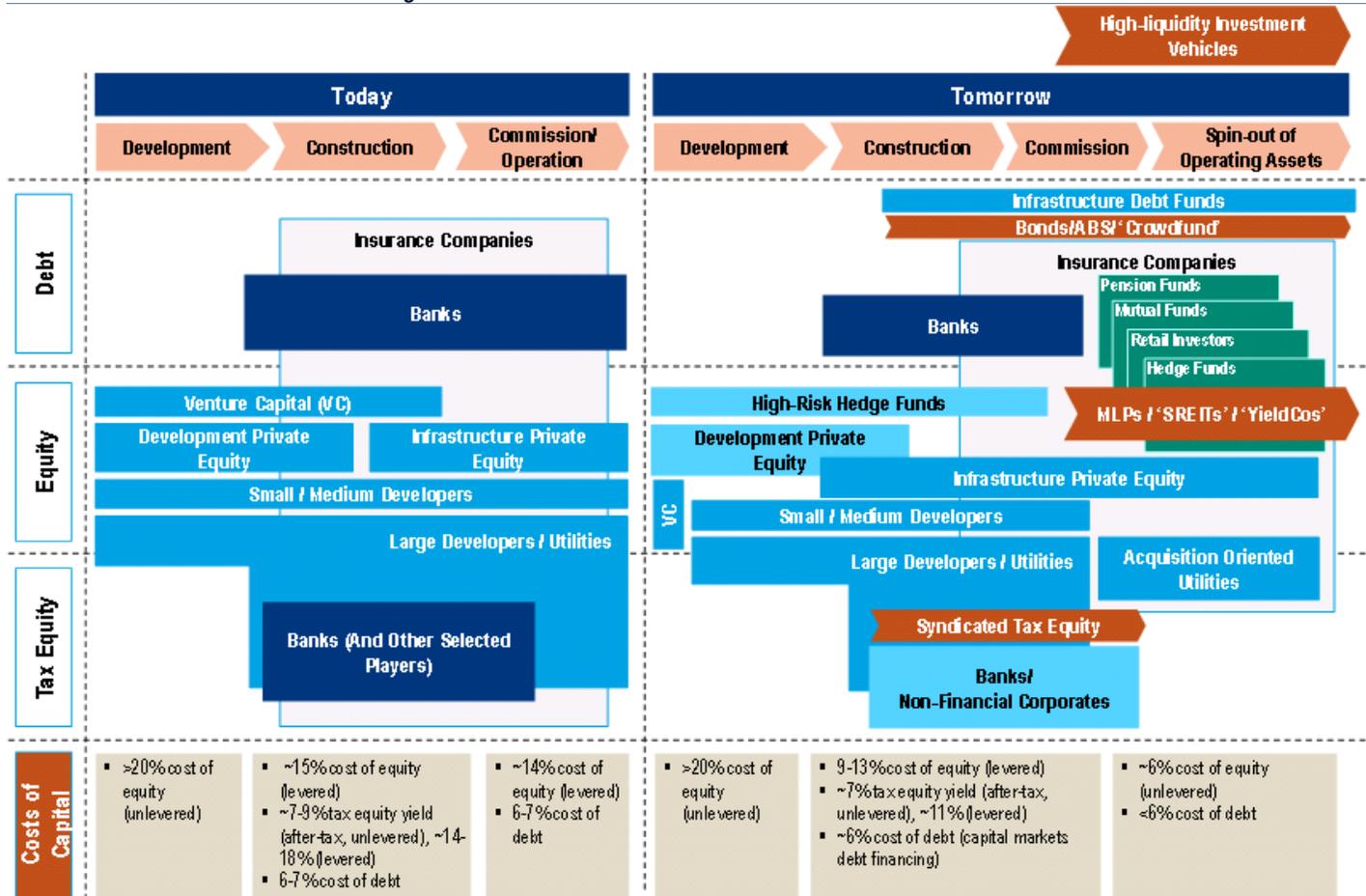
- Preconditions for institutional investment and favourable framework conditions for long-term investment financing.
- Stable, transparent, integrated “investment-grade” policy environment addressing key barriers by institutional investors
- Improve risk-return profiles of sustainable energy projects 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 18: Institutional investor interactions with private sustainable energy finance providers**



Source: OECD

Chart 35: Potential Evolution of US Solar Financing

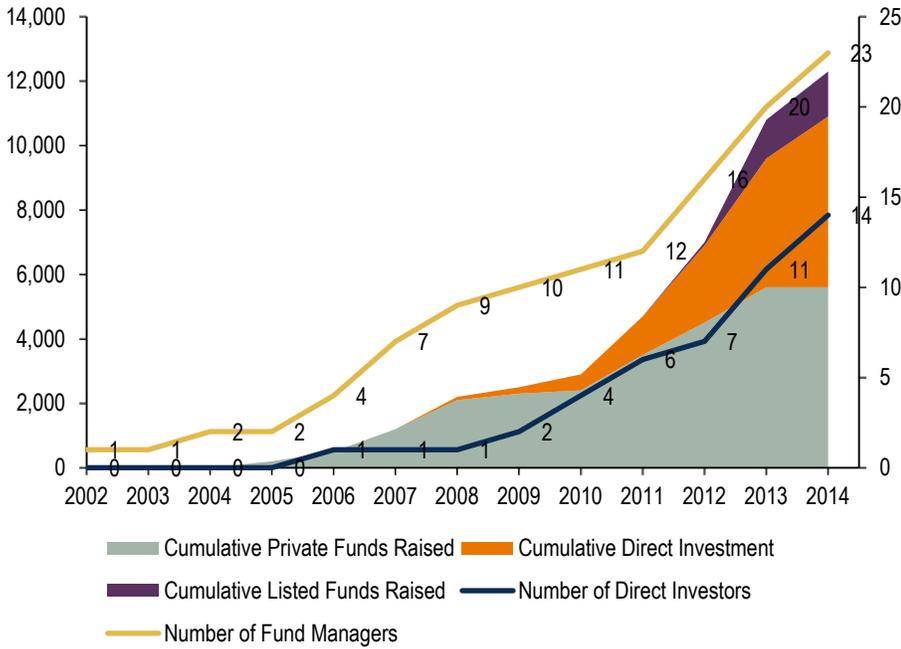


Source: CERES

### Asset finance has provided the biggest proportion of clean energy funding

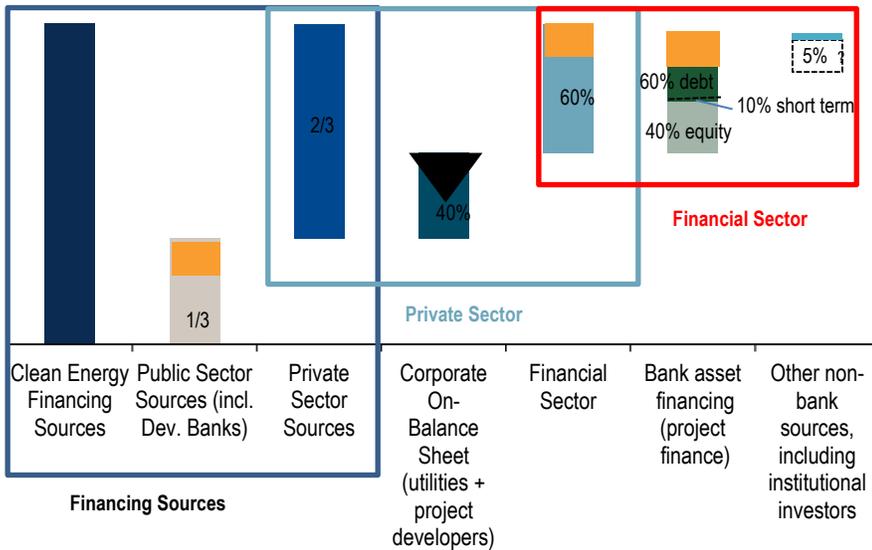
Global expenditure on environmental solutions can be broken down into two main categories of investment – direct in infrastructure projects and indirect through debt and equity of companies. Asset finance often entails the direct financing of projects such as the construction of renewable power plants, 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.

**Chart 36: Evolution of EU renewable power sector investment by institutional investors (2002-14)**



Source: Murley (2014); OECD

**Chart 37: Landscape of investment financing sources for sustainable energy and dynamics across the OECD 2008-14 (illustrative example, varies by country)**



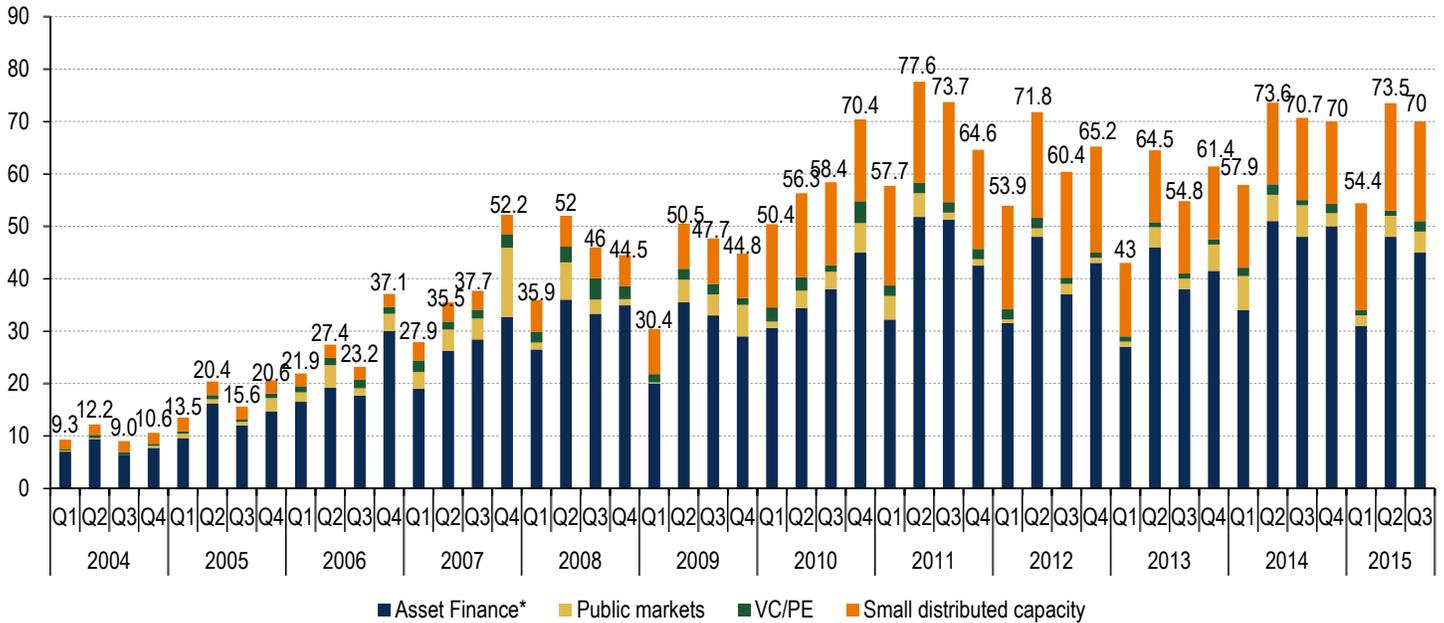
Source: OECD

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).

**Chart 38: New investment in clean energy by asset class in US\$ bn (Q1 2004-Q3 2015)**

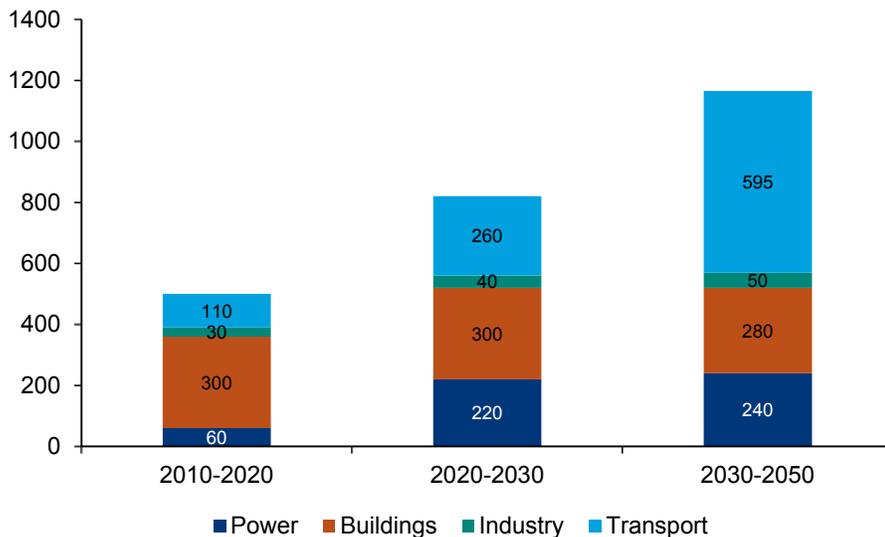


Source: Bloomberg New Energy Finance  
 Note: \*Asset finance adjusted for reinvested equity  
 Total values include estimates for undisclosed deals. Excludes corporate and government R&D, and spending for digital energy and energy storage projects (reported in annual statistics only)

**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 39: Additional annual investment in clean energy in IEA 2 degree scenario relative to 6 degree scenario, 2010-2050 (\$bn)**

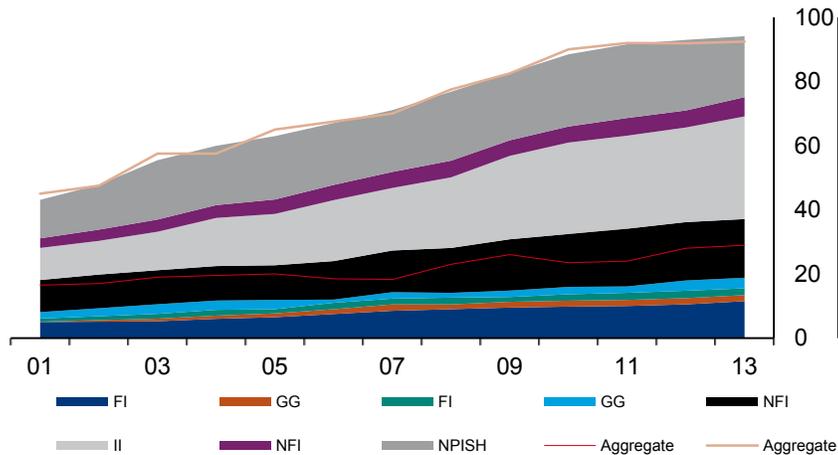


Source: IEA, Ceres

## 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 40: 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

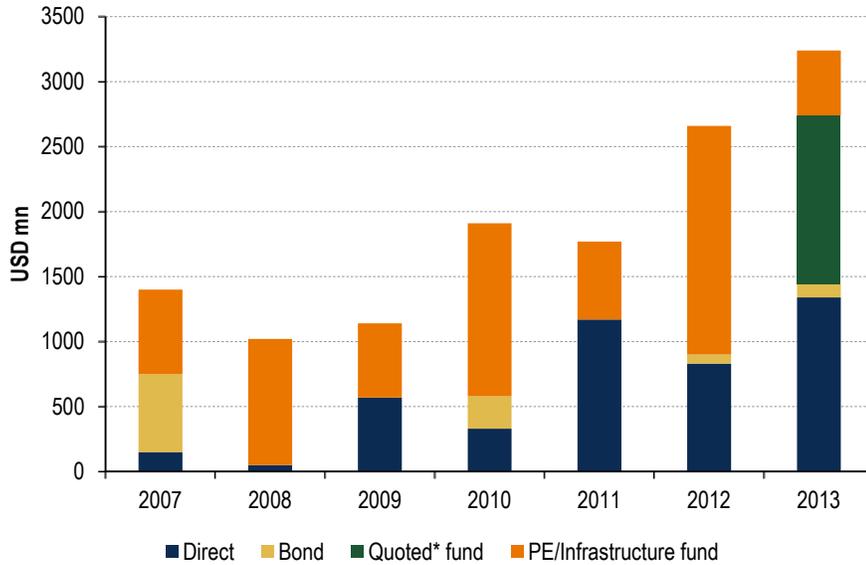
## Large and stable source of funding needed

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\$650-860bn/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 41: Institutional investor commitment to European sustainable energy projects**



Source: Bloomberg New Energy Finance; OECD

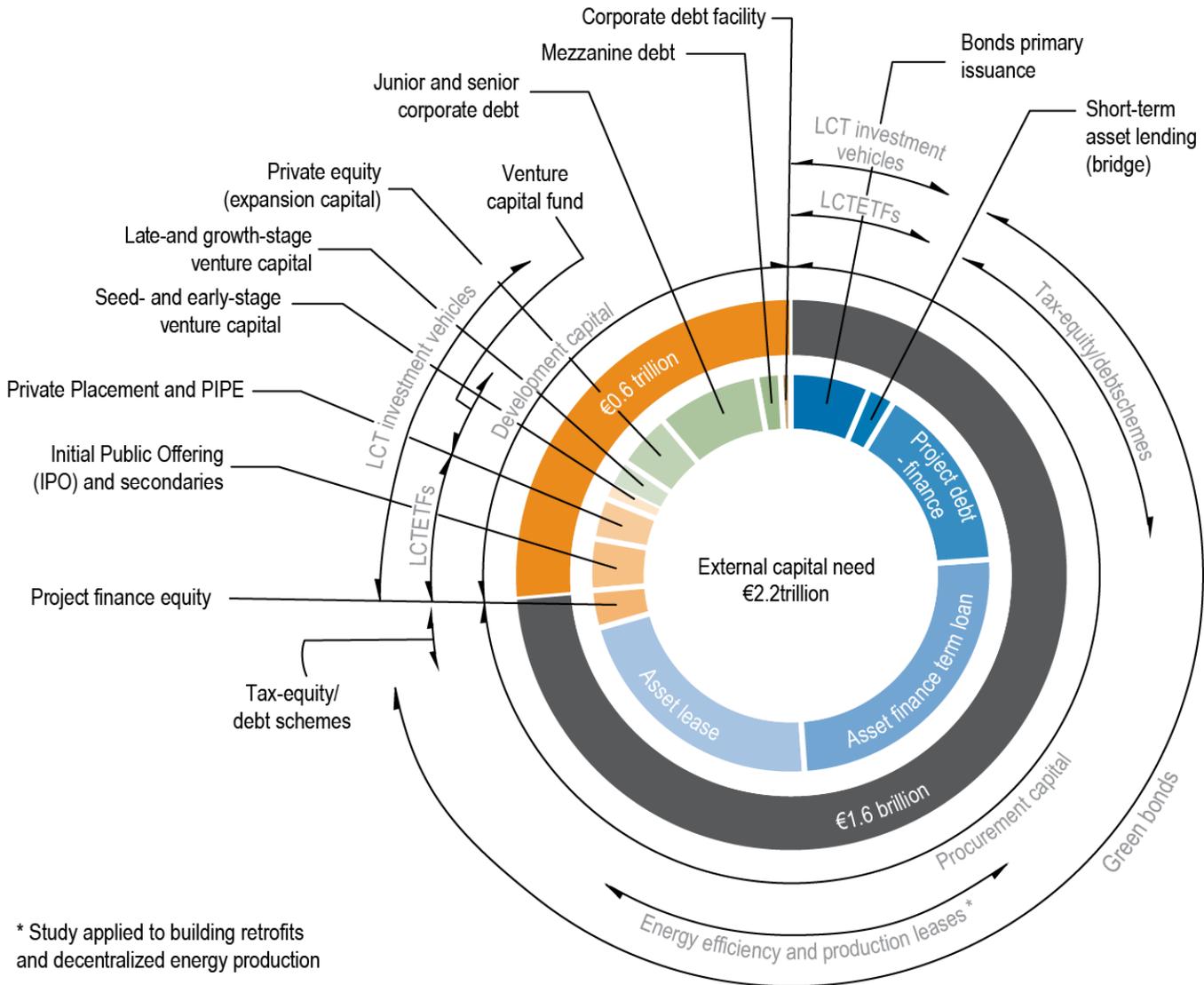
### Derisking balance sheets

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.

### Green Bonds could meet 84% of capital needs

With the securitisation of long-term loans, leases and assets, Green Bonds have the potential to represent 84% of all private capital required for an energy-resilient world (source: Accenture). Accenture conducted a study on the low-carbon technology capital needs in EU25 and found that the region would need €2.9tn of LCT investment in the next 10 years. They divided capital sources into two categories: internal – financing provided by the entity itself; and external – private funding provided by investors and sponsors. They found that €2.2tn of the total investment required would need to be external capital, which encompasses project finance debt, asset finance loans, asset leases, and bonds. The study divides capital needs into development capital – funding for companies that are core in the LCT value chain, and procurement capital – purchase and installation of LCT assets. Accenture estimated that 84% of external procurement capital could all be securitised into Green Bonds to meet LCT needs. This is an ambitious target and requires growth and maturing of the Green Bond market. Increasing liquidity and market standardisation will be key enablers of this.

**Chart 42: Application of Financing Schemes to the Development and Procurement Capital Needs Identified**



Source: Accenture Carbon Capital

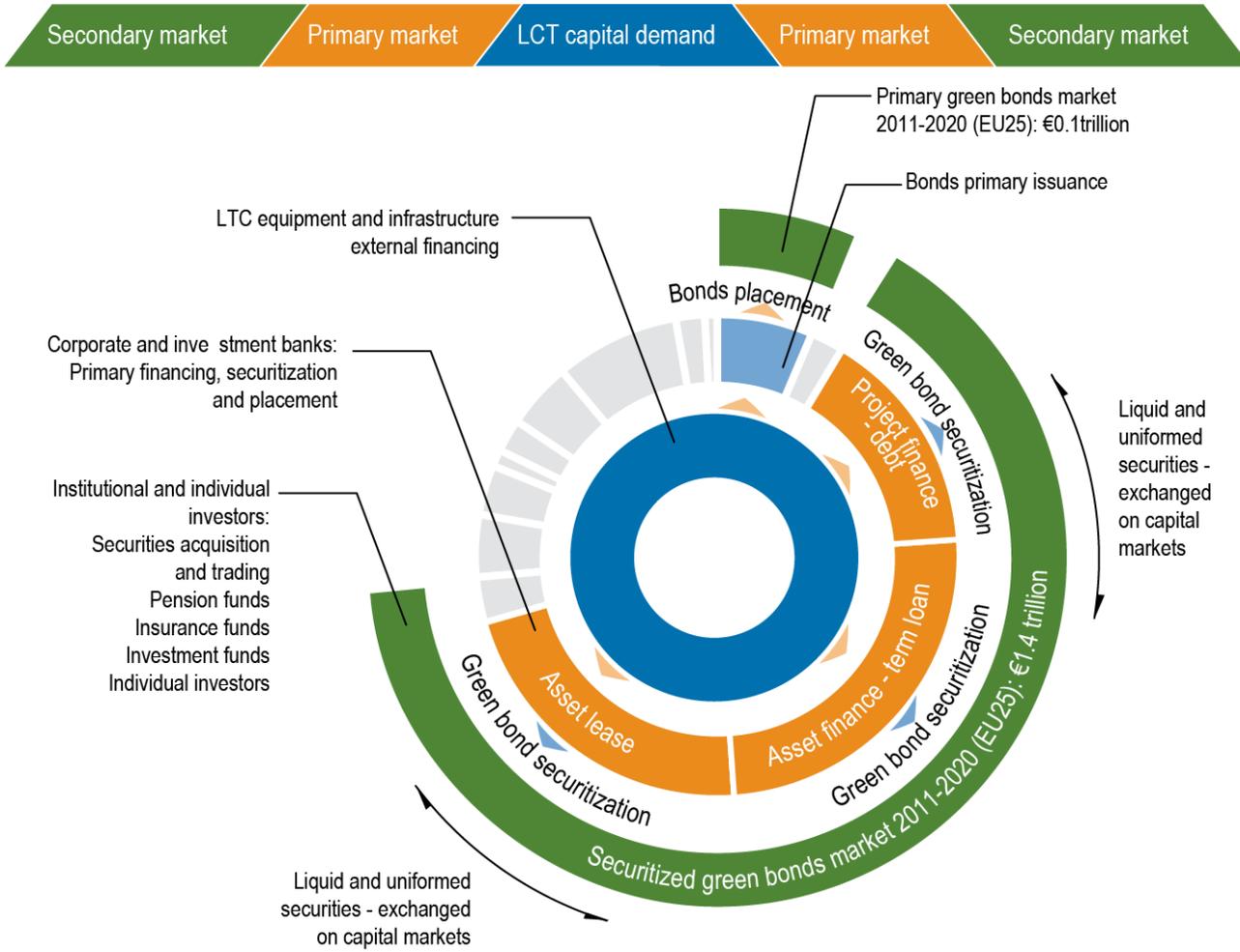
### Expanded issuance needed

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 43: 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 8: 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?	<p>A set of principles that outlines good practice for the process of issuing a green bond, including:</p> <p><b>Use of proceeds:</b> 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.</p> <p><b>Project evaluation and selection:</b> what process will be used to apply ‘green’ criteria to select specific projects or activities.</p> <p><b>Management of proceeds:</b> what processes and controls are in place to ensure funds are used only for the specified ‘green’ projects.</p> <p><b>Reporting:</b> how projects will be evaluated and progress reported against both environmental and financing criteria.</p>	<p>A standard that issuers can have their green bond certified to.</p> <p>The standards define what is considered ‘green’ and the technology specifications for certain types of climate-related projects.</p> <p>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.</p>	<p>A growing number of green bond indices launched by investment banks or credit rating agencies including:</p> <ul style="list-style-type: none"> <li>•Barclays/MSCI</li> <li>•Standard &amp; Poor’s/Dow Jones</li> <li>•Bank of America Merrill Lynch</li> </ul> <p>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.</p> <p>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.</p>
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 November 2015, the number of supporters has grown to 103, including 26 investors, 22 issuers, and 55 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 Securitised 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

Green Bonds are characterised by the use of the proceeds of the bond. Issuers of Green Use of Proceeds Bonds and Green Use of Proceeds Revenue Bonds must declare the eligible Green Project categories in the Use of Proceeds section of the legal documentation of the security. All designated Green Project categories should provide clear environmental benefits that can be described, quantified and/or assessed if feasible.

#### GBP recognises several broad categories eligible for Green Projects

- Renewable energy
- Energy efficiency (including efficient buildings)
- Sustainable waste management
- Sustainable land use (including sustainable forestry and agriculture)
- Biodiversity conservation
- Clean transportation
- Clean water and/or drinking water

### Part 2: Process for Project Evaluation and Selection

Issuers of the Green Bond should outline the decision-making process whereby they determine the eligibility of investments using Green Bond proceeds. There should be a well-defined process for determining how investments fit within eligible Green Project categories. When feasible, issuers should establish the impact objectives of the Green Projects and assess subsequent results.

Independent of GBP, third party agencies and International Finance Institutions have processes to assess environmental criteria of projects to which they allocate funds. GBP recommends that all issuers engage in similar reviews of all projects. Investors are increasingly considering issuers' overall environmental, social, and governance framework.

### Part 3: Management of Proceeds

Net proceeds of Green Bonds should be ring-fenced – moved to a sub-portfolio or tracked by the issuer and attested to by a formal process that links to the issuer's lending and investment operations for projects. The balance of the tracked proceeds should be reduced by amounts matching investments made. Issuers should make known to investors the intended types of eligible instruments for any remaining proceeds.

Third party auditors can enhance the environmental integrity of Green Bonds by verifying the issuer’s internal tracking method for the flow of funds from the Green Bond proceeds.

**Part 4: Reporting**

Issuers should report at least annually, if not semi-annually, on the investments made from the Green Bond proceeds, detailing the specific project and dollars invested in the project. Issuers should use quantitative and/or qualitative performance indicators that measure the impact of specific investments. There has been much progress in the standardisation of impact measurement systems. Issuers should familiarise themselves with them and assess the environmental impact of their Green Bond proceeds.

**GBP 2.0**

In March 27 2015, the International Market Association (ICMA) provided the first update to the Green Bond Principles (GBP) since it was first introduced in January 2014. GBP is a voluntary set of guidelines developed by an executive committee consisting of issuers, underwriters, and investors, which first provided a way to help standardise the Green Bonds market. The second edition of GBP updated and built out the broad categories of eligible Green projects. Water as a Green category was expanded to specify sustainable water management. Climate change adaption was also an added as an accepted category.

**Table 9: GBP broad categories for potential eligible Green Projects for Use of Proceeds**

Old	New
Renewable energy	Renewable energy
Energy efficiency (including efficient buildings)	Energy efficiency (including efficient buildings)
Sustainable waste management	Sustainable waste management
Sustainable land use (including sustainable forestry and agriculture)	Sustainable land use (including sustainable forestry and agriculture)
Biodiversity conservation	Biodiversity conservation
Clean transportation	Clean transportation
Clean water and/or drinking water	Sustainable water management (including clean and/or drinking water)
	Climate change adaptation.

Source: International Capital Market Association

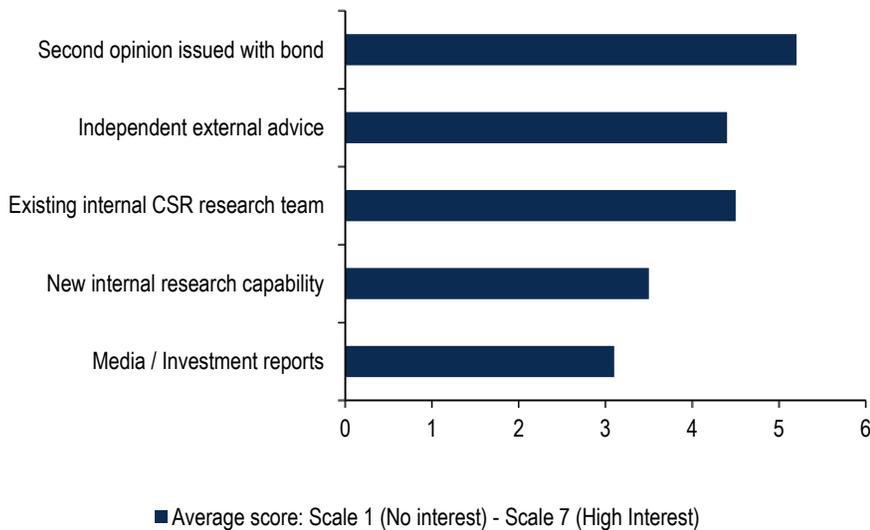
**Assurance, an increased focus**

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 2<sup>nd</sup> party reviews, audits, and 3<sup>rd</sup> 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”.

- **Second party reviews and consultation:** an issuer can seek advice from consultants and/or institutions (“second party”) with recognized expertise in environmental sustainability to review or to help in the establishment of its process for project evaluation and selection including project categories eligible for Green Bond financing. The reviews and reports of the second party are private, and may be made publicly available only at the discretion of the issuer.
- **Audits:** Issuers are encouraged to have independently verified or audited certain aspects of their Green Bond process, such as the internal tracking method and the allocation of funds from proceeds. The verification can be provided by qualified third parties, or by internal and/or external auditors. These independent reports and audits may be put in the public domain at the discretion of the issuer.

- **Third-party certifications:** Second-party standards intended for use by qualified third parties to certify Green Bonds are in use or in development. The GBP are supportive of the development of and use of such standards for the certification of Green Bonds as they are defined above. (source: ICMA)

**Chart 44: Ranking of tools' usefulness when analyzing green bonds' credentials**



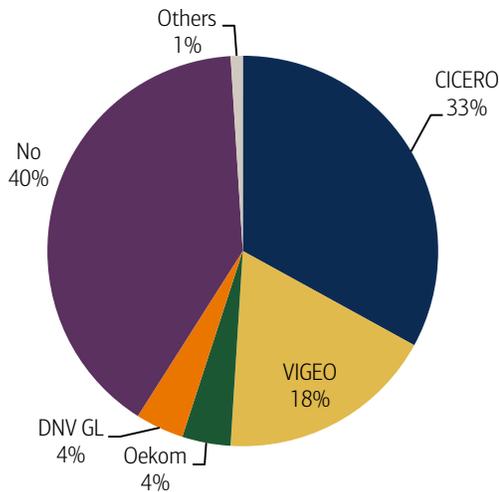
Source: Euromoney

### 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 45: Significant providers of second party reviews**



Source: CBI HSBC

**New entrants emerge, but Cicero and Vigeo are primary sources of 2<sup>nd</sup> opinion**

Currently, around 60% use a 2<sup>nd</sup> 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 2<sup>nd</sup> party opinion to verify the green credentials of the bond.

**Table 10: 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.

**Climate Bonds Certification Scheme, third-party verifier**

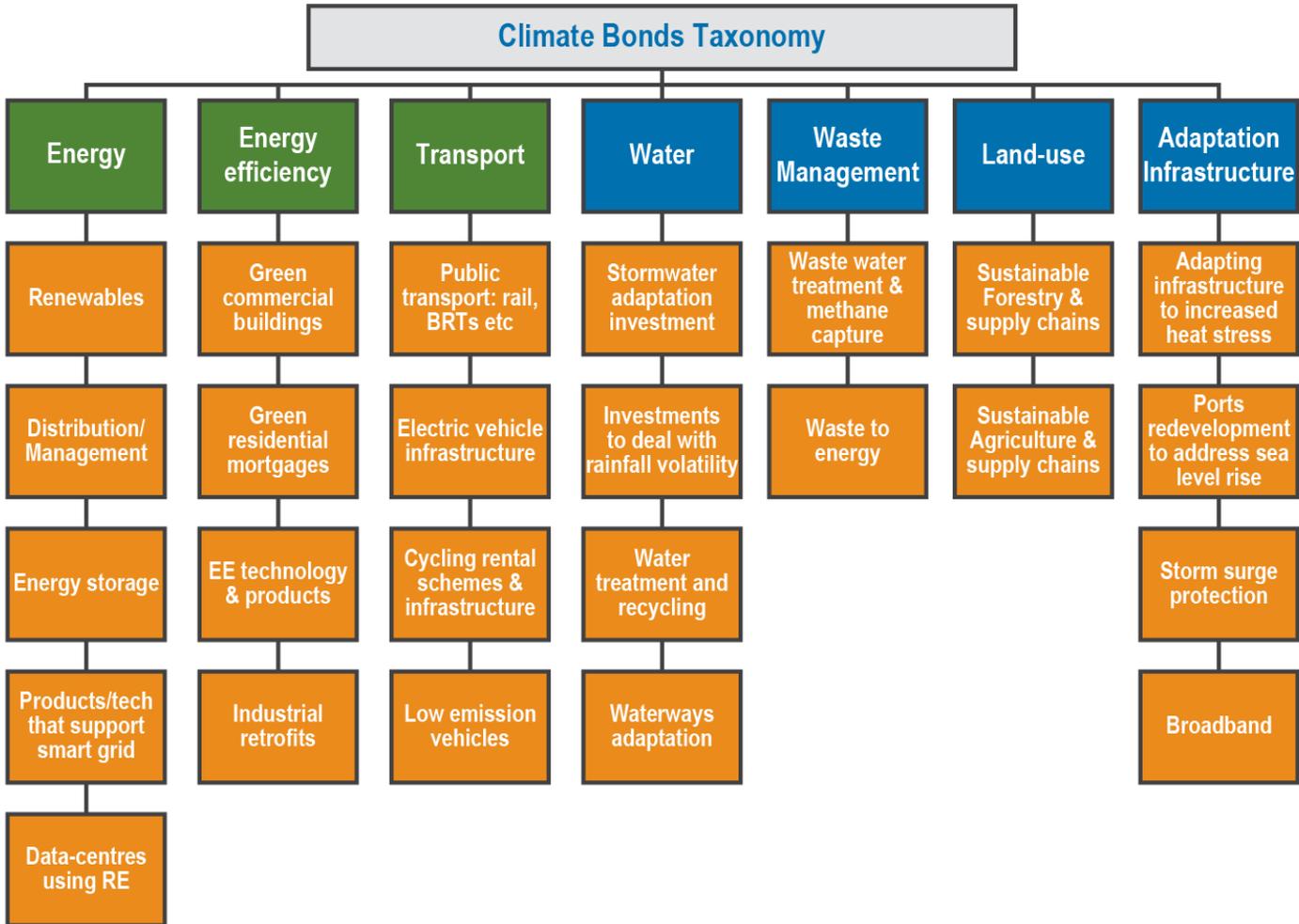
The Climate Bonds Initiative (CBI) – a non-profit company focused on mobilising the bond market for climate change solutions – has been studying the development of the climate-change-themed bond market. It has established a Climate Bonds Taxonomy, along with a Climate Bond Standard and Certification 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 19: Climate Bonds Taxonomy**

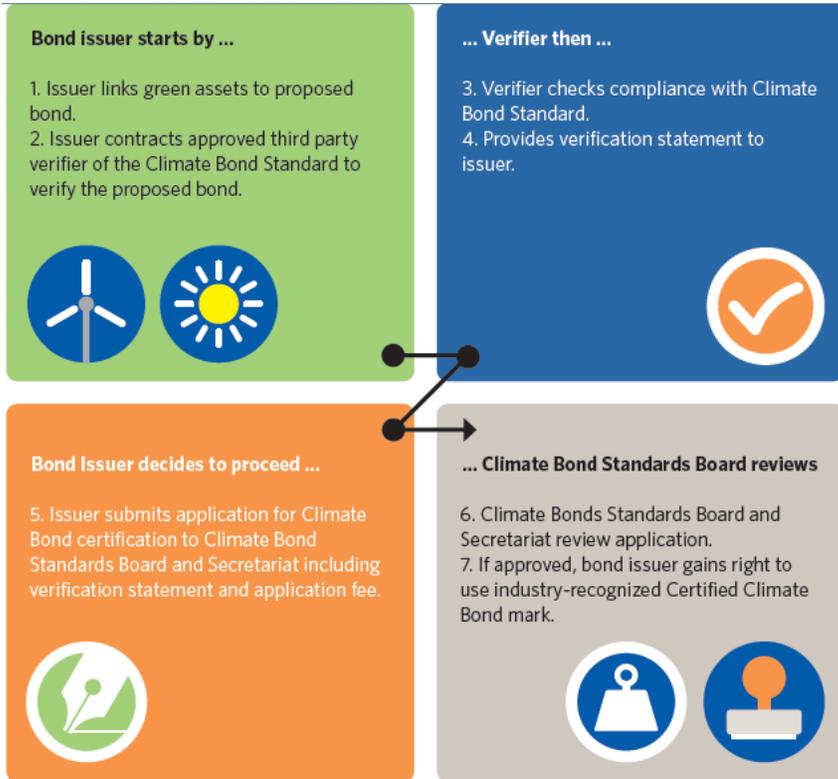


Source: Climate Bonds Initiative

**CBI certification process**

In the certification process, the issuer proposes a set of green assets or projects for which the proceeds will be used, and a verifier such as DNV or Bureau Veritas will check the proposal against the Climate Bond Standards and give their recommendation. The issuer then submits a formal application to the Climate Bond Standards Board for review and to receive certification.

Chart 46: Process for Climate Bonds certification



Source: Climate Bonds Initiative

## New guidelines to increase transparency and standardisation

After the windfall year of issuance in 2014 of US\$37bn, there has been a lot of focus on transparency of accuracy within the Green Bond market, as well as measurement of impact. 1H15 was a busy period for the evolution of guidelines for Green Bonds, including the much anticipated update to the original Green Bond Principles.

- February 2015, the Investor Network on Climate Risk (INCR), developed from the sustainability advocacy group Ceres, signed a new set of guidelines for Green Bond issuers. The guidelines were meant to complement the Green Bond Principles (GBP) which were the first guidelines for Green Bonds introduced in 2014.
- March 2015, a group of supranationals developed a framework for impact reporting
- June 2015, Climate Bonds Initiative introduces Green Property Standards
- June 2015, Global Real Estate Sustainability Benchmark (GRESB) introduces Green Bond guidelines for the real estate sector.

## Standards for Real Estate Green Bonds

The market saw tremendous growth within Green properties during 2015. Pure-play real estate companies have issued nearly US\$5bn Green Bonds to date, excluding those by non-property companies for the same purposes. In June, Climate Bonds Initiative (CBI) and Global Real Estate Sustainability Benchmark (GRESB) introduced the first detailed frameworks to provide guidance to issuers and investors.

### GRESB Green Bond Guidelines for the Real Estate Sector

GRESB, an industry-driven organization focused on sustainability for global real estate sector for institutional investors, published guidelines specific for the property portfolios in accordance to 2015 GBP. The guidelines connect each of the eight eligible

Green Project categories in GBP, with a framework of green building rating systems that are common in the real estate sector. (source: GRESB)

**Table 11: Eligible Green Project Criteria**

2015 GBP Categories	Asset Attributes / Actions	Building Rating System Credit Categories	Environmental Impacts
Renewable Energy	<p><b>Onsite renewable energy generation powering the building and/or distributed to the grid</b></p> <ul style="list-style-type: none"> <li>-- Solar / Wind / Geothermal / Fuel Cell / Other</li> </ul> <p><b>Offsite renewable energy purchase</b></p>	<p><b>BREEAM</b> Energy, Pollution</p> <p><b>Green Star</b> Energy, Innovation</p> <p><b>LEED</b> Energy &amp; Atmosphere</p>	<p>Carbon emissions</p> <p>Ozone depletion</p> <p>Mineral extraction</p> <p>Infrastructure needs</p>
Energy Efficiency	<p><b>Buildings that demonstrate energy efficiency metrics at above market performance</b></p> <ul style="list-style-type: none"> <li>-- Building Energy Ratings <ul style="list-style-type: none"> <li>--- Energy Performance Certificate [EU]</li> <li>--- ENERGY STAR [United States]</li> <li>--- NABERS [Australia / New Zealand]</li> </ul> </li> <li>-- Net Zero Energy buildings</li> </ul> <p><b>Peak load demand reduction</b></p> <ul style="list-style-type: none"> <li>-- Thermal energy storage</li> <li>-- Demand response systems</li> </ul> <p><b>Building energy retrofits</b></p> <ul style="list-style-type: none"> <li>-- Equipment upgrades – lighting / HVAC</li> <li>-- Deep retrofits – systems / envelope</li> </ul>	<p><b>BREEAM</b> Energy, Pollution</p> <p><b>Green Star</b> Energy, Management</p> <p><b>LEED</b> Energy &amp; Atmosphere, Innovation</p>	<p>Carbon emissions</p> <p>Ozone depletion</p> <p>Mineral extraction</p> <p>Air quality</p> <p>Human health</p> <p>Infrastructure needs</p>
Sustainable Waste Management	<p><b>Buildings that demonstrate waste management metrics above prevailing building codes and/or standard market practices</b></p> <ul style="list-style-type: none"> <li>-- Waste recycling rates <ul style="list-style-type: none"> <li>– Construction / demolition</li> <li>– Building operations</li> </ul> </li> <li>-- Ozone depletion</li> <li>-- Construction activity</li> <li>-- Stormwater quantity / quality</li> </ul>	<p><b>BREEAM</b> Waste</p> <p><b>Green Star</b> Management, Materials</p> <p><b>LEED</b> Sustainable Sites, Materials &amp; Resources, Energy &amp; Atmosphere</p>	<p>Resource depletion</p> <p>Soil contaminants</p> <p>Chemical hazards</p> <p>Pollution prevention</p>
Sustainable Land Use	<p><b>Real estate investments that demonstrate sustainable land use attributes regarded as conservation and/or preservation</b></p> <ul style="list-style-type: none"> <li>-- Smart growth development</li> <li>-- Wetlands preservation</li> <li>-- Historic rehabilitation</li> <li>-- Certified forests</li> <li>-- Organic farmlands</li> </ul>	<p><b>BREEAM</b> Land Use &amp; Ecology</p> <p><b>Green Star</b> Land Use &amp; Ecology</p> <p><b>LEED</b> Sustainable Sites, Materials &amp; Resources</p>	<p>Floodplains</p> <p>Wetlands</p> <p>Prime farmland</p> <p>Forest resources</p> <p>Natural resources</p> <p>Historic sites</p>
Biodiversity Conservation	<p><b>Real estate investments that demonstrate attributes regarded as preserving habitat biodiversity and/or cultural resources</b></p> <ul style="list-style-type: none"> <li>-- Conservation easements</li> <li>-- Land banks</li> <li>-- Carbon sequestration</li> <li>-- Ecosystem services</li> <li>-- Ecological connectivity</li> </ul>	<p><b>BREEAM</b> Land Use &amp; Ecology</p> <p><b>Green Star</b> Land Use &amp; Ecology</p> <p><b>LEED</b> Sustainable Sites</p>	<p>Species habitat</p> <p>Migratory paths</p> <p>Land conservation</p> <p>Cultural resources</p>
Clean Transportation	<p><b>Support multiple types of transit modes</b></p> <ul style="list-style-type: none"> <li>-- Siting near multiple mass transit options</li> <li>-- Carpool programs/dedicated bike facilities</li> </ul> <p><b>Incorporate clean transportation infrastructure</b></p> <ul style="list-style-type: none"> <li>-- Electric vehicle charging stations</li> <li>-- Fuel cell vehicle charging stations</li> <li>-- Liquid / gas / battery facilities</li> </ul>	<p><b>BREEAM</b> Transport</p> <p><b>Green Star</b> Transport</p> <p><b>LEED</b> Sustainable Sites</p>	<p>Carbon emissions</p> <p>Ozone depletion</p> <p>Mineral extraction</p> <p>Air quality</p> <p>Infrastructure needs</p>
Sustainable Water Management	<p><b>Minimize potable water consumption / disposal</b></p> <ul style="list-style-type: none"> <li>-- Capture / recycle stormwater</li> <li>-- Implement vegetated / green roofing</li> <li>-- No potable water in landscaping</li> <li>-- Water metering / monitoring systems</li> <li>-- Sustainable Drainage Systems (SUDS)</li> </ul>	<p><b>BREEAM</b> Water</p> <p><b>Green Star</b> Water, Emissions</p> <p><b>LEED</b> Sustainable Sites, Water Efficiency</p>	<p>Water conservation</p> <p>Water quality</p> <p>Species habitat</p> <p>Human health</p> <p>Infrastructure needs</p>
Climate Change Adaptation	<p>Asset Resiliency</p>	<p>All Building Rating Systems</p>	<p>Infrastructure needs</p> <p>Human health</p>

Source: GRESB

## GRESB metrics based on real estate industry standards

For project evaluation, buildings can be certified by third parties under green building certification systems and ratings that are already widely recognized in the real estate sector. They include BREEAM (EU), CASBEE (Japan), DGNB (Germany), Green Star (Australia), and LEED, and others. Energy ratings for buildings are available that specifically focus on energy efficiency of building operations. Ratings and labelling programs include ENERGY STAR (United States), the European Union Energy Performance Certificate, NABERS (Australia), and others. (Source: GRESB)

**Table 12: The leading green building rating systems worldwide have issued over 82,000 ratings related to green building projects:**

Rating System	Certified Projects
BREEAM	24,000
DGNB	1,165
ENERGY STAR	26,800
Green Star	865
HK-BEAM	665
LEED	26,550
NABERS	2,035
Total	82,080

Source: GRESB

**Table 13: Primary Indicators**

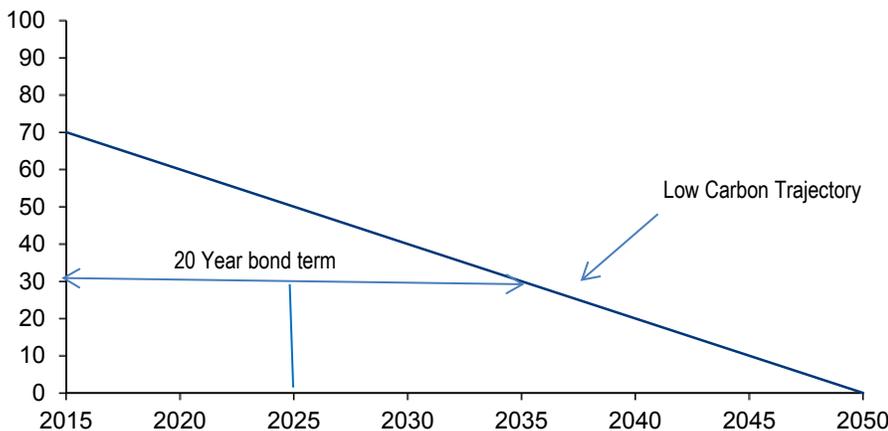
Scope	Type	Metrics
Asset	Green Building Certifications	Rating system • Specific rating system version • Certification date • Score and certification level • Specific scorecard - credits and metrics achieved
Asset	Energy Ratings	Rating system • Annual score • Certification date
Asset	Non-Building Certifications (as applicable)	Rating system • Asset-specific applicability • Certification date • Score and certification level • Specific scorecard - credits and metrics achieved

Source: GRESB

## CBI focuses on low-carbon building standards

While GRESB's metric uses pre-existing green building standards, CBI has developed a separate framework based on minimum level of carbon performance of the building. For instance, Sydney has an emissions baseline equivalent to 70kgCO<sub>2</sub>/m<sup>2</sup> in 2015. A 20-year bond in 2015 would have a Climate Bonds carbon hurdle of 50kgCO<sub>2</sub>/m<sup>2</sup>. Property portfolios can either meet the carbon hurdle at the time of bond issuance or during the lifetime of the bond. (source: CBI)

**Chart 47: Mechanics of CBI carbon hurdle**



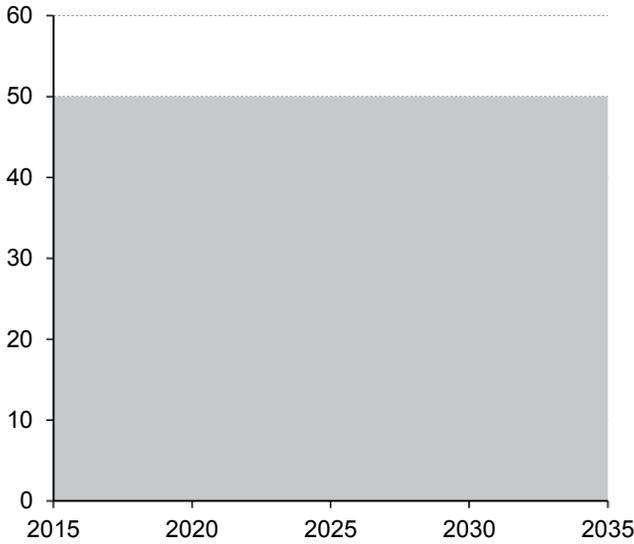
Source: CBI

- Commercial buildings** – For commercial buildings located in cities with an emissions baseline\* established at the city level, buildings qualify under the Climate Bond Standard if: Their emissions performance meets the Climate Bonds hurdle derived from the emissions baseline, and they maintain that performance over the life of the bond. Alternatively, their carbon performance is improved over the term

of the bond, to achieve a level of carbon performance equivalent to maintaining the Climate Bonds hurdle for the life of the bond. Monitoring and verification is required annually for both pathways.

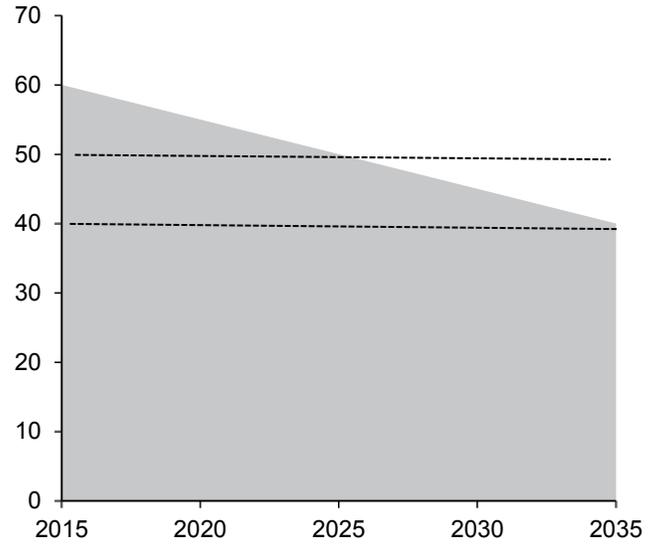
- **Residential buildings** – building has achieved compliance with a building code that is deemed equivalent to moving the building into the top 15% of the market in terms of emissions performance. No ongoing monitoring and verification beyond that required by the building standard used is required, due to the practical limitations.

**Chart 48: Maintain performance 50kgCO<sub>2</sub>/ m<sup>2</sup>**



Source: CBI  
Shaded area is Emissions during bond term

**Chart 49: Achieve equivalent performance**



Source: CBI  
Shaded area is Emissions during bond term

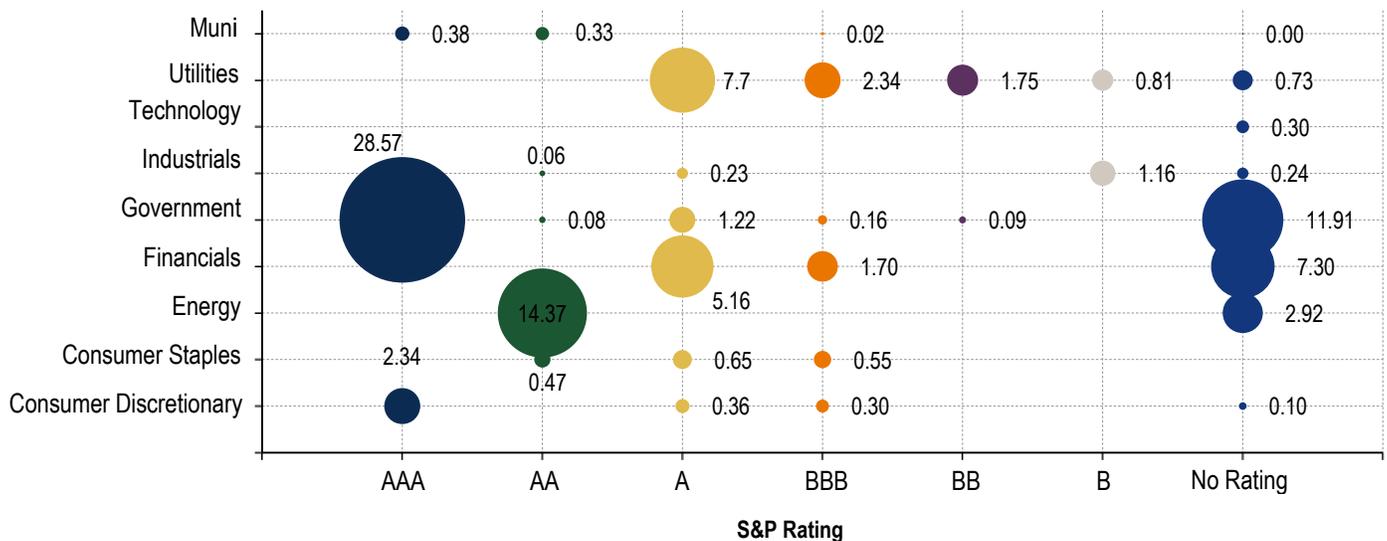
# Current state of the market: 2015 another record year

2015 was the 4<sup>th</sup> consecutive record year for issuance of Green Bonds, with US\$42.3bn of issuance through November 27 2015. This has surpassed 2014, which was already a pivotal year, tripling the market versus 2013. The Green Bond market now stands at US\$96.2bn, which is twice the size versus a year ago. The universe is now comprised of 600+ bonds, from 24 countries, in 23 currencies. Issuers span from multilateral banks and supranationals, to banks, property companies, car makers, food producers, conglomerates, to traditional cleantech companies.

Traditionally, Green Bonds issuers have included supranationals and multilateral banks such as the World Bank and European Investment Bank, commercial banks, local and national governments, and corporations. The Green Bonds come in many forms, including “vanilla” bonds, in which the issuer is responsible for distributing the pool of proceeds; project bonds, in which investors are investing in specific projects; and asset backed with interest and principal tied to the cash flow of an underlying asset.

In the past year, we’ve seen tremendous developments from regions like Asia, as well as continued innovation in Green ABS, Masala Green Bonds, and credit enhancements from multilateral development banks. However, further growth would need to be aided by increased standardization, development of second and third party assurance, political support, and overall further maturation and diversification of the Green Bond market.

**Chart 50: Green Bond Universe by sector and rating, outstanding issues (through November 27 2015)**



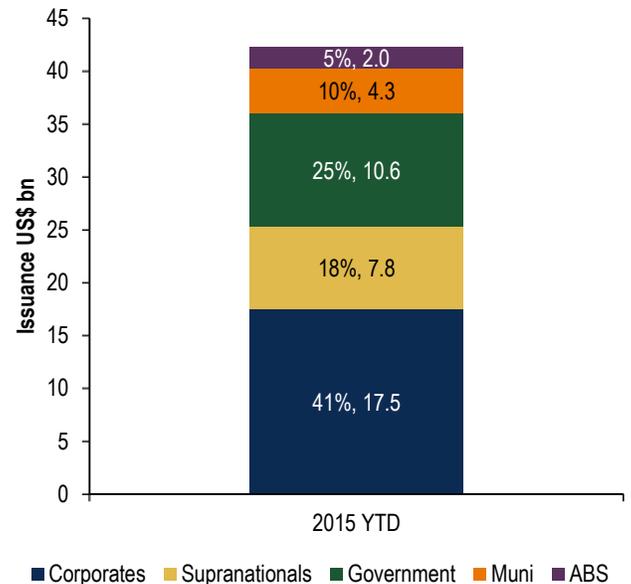
Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings

**Table 14: Top 20 issuers 2015 YTD (through November 27 2015)**

European Investment Bank	4,494
KFW	3,892
International Bank for Reconstruction & Development	1,340
ING	1,333
Electricite de France SA	1,250
TerraForm Power Operating LLC	1,250
Toyota Auto Receivables 2015-B Owner Trust	1,250
Nederlandse Waterschapsbank NV	1,131
TenneT Holding BV	1,124
Southern Power Co	1,000
Agricultural Bank of China Ltd	995
Central Puget Sound Regional Transit Authority	943
TerraForm Global Operating LLC	810
Nordic Investment Bank	688
International Finance Corp	657
Transport for London	607
Bank of America Corp	600
ABN AMRO Bank NV	564
Berlin Hyp AG	560
BRF S.A.	545
All other issues in 2015	17,286
Total (US\$m)	42,318

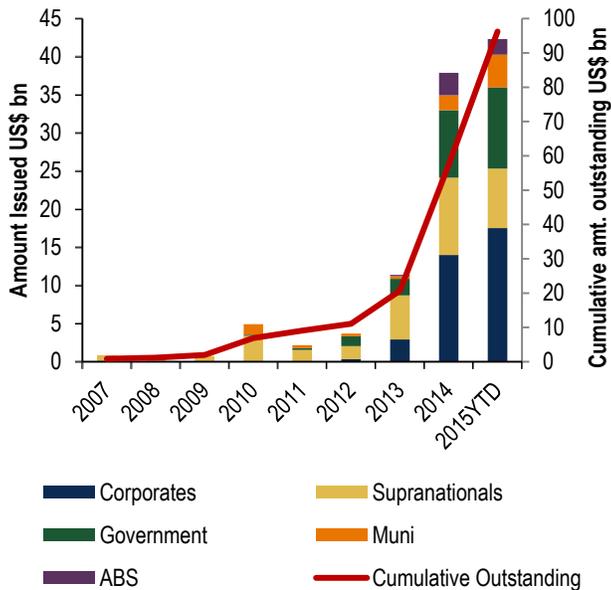
Source: Bloomberg

**Chart 51: Issuance by issuer type, 2015 YTD (through November 27)**



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

**Chart 52: Corporates leading growth in "Use of Proceeds" green bonds YTD (through November 27 2015)**



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

## Increasing diversification, corporates, SSAs, Munis

2015 was another record year for Green Bond issuance, with around US\$42.3bn through November 27 2015. Issuances by a mix of actors such as Agricultural Bank of China, Southern Power, Digital Realty, EDF, KFW, and the European Investment Bank, indicate that the market continues to grow and diversify.

**Table 15: Top 20 new issuers in 2015 (through November 27 2015)**

Issuer	US\$ mn
ING	1,333
TerraForm Power Operating LLC	1,250
Toyota Auto Receivables 2015-B Owner Trust	1,250
TenneT Holding BV	1,124
Southern Power Co	1,000
Agricultural Bank of China Ltd	995
Central Puget Sound Regional Transit Authority	943
TerraForm Global Operating LLC	810
Transport for London	607
ABN AMRO Bank NV	564
Berlin Hyp AG	560
BRF S.A.	545
HSBC France SA	531
Societe Generale SA	531
Vestas Wind Systems A/S	527
Paprec Holding	523
Digital Realty Trust LP	500
Export-Import Bank of India	500
Morgan Stanley	500
Nacional Financiera SNC	500
Other	7,751
<b>Total</b>	<b>22,843</b>

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

## Supranational/multilaterals: first movers

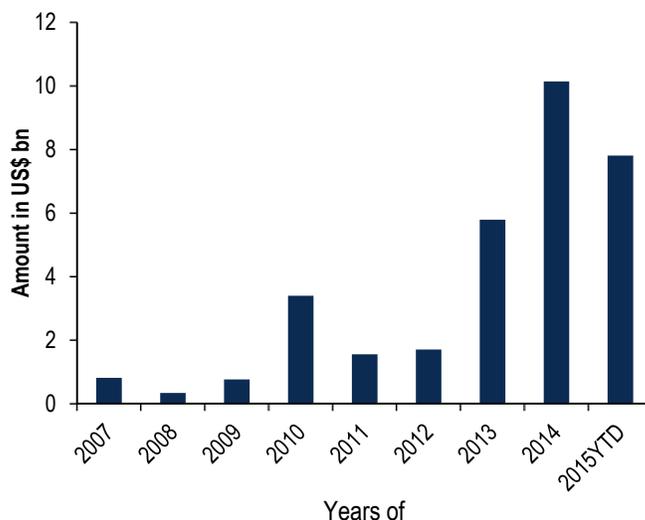
In terms of issuers, supranationals, sub-sovereigns, and agencies (SSAs) historically have been the largest group of Green Bond issuers, and were also the first movers. Bonds are not tied to specific projects, but are pooled, with the issuers committing to match the proceeds with low-carbon lending. To date, the largest issuers in the Green Bond market remain multilateral banks such as the World Bank and European Investment bank. However, they are taking on a smaller share of the Green Bond market, with around \$7.8bn issuance YTD.

**Table 16: Top 20 issuers to date (through November 27 2015)**

Issuer	US\$ mn
European Investment Bank	14,292
International Bank for Reconstruction & Development	8,479
KfW	7,412
International Finance Corp	4,015
GDF Suez	3,427
Electricite de France SA	3,150
Nordic Investment Bank	1,872
Region of Ile de France	1,837
Nederlandse Waterschapsbank NV	1,812
Toyota Auto Receivables 2014-A Owner Trust	1,750
Asian Development Bank	1,721
Unibail-Rodamco SE	1,556
NRW Bank	1,503
Kommunalbanken AS	1,366
ING	1,333
Agence Francaise de Developpement	1,295
African Development Bank	1,256
TerraForm Power Operating LLC	1,250
Toyota Auto Receivables 2015-B Owner Trust	1,250
Nederlandse Financierings Maatschappij voor Ontwikkelingslanden	1,210
Other	42,563
<b>Total</b>	<b>104,350</b>

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

**Chart 53: Supranational Green Bonds (through November 27 2015)**



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.

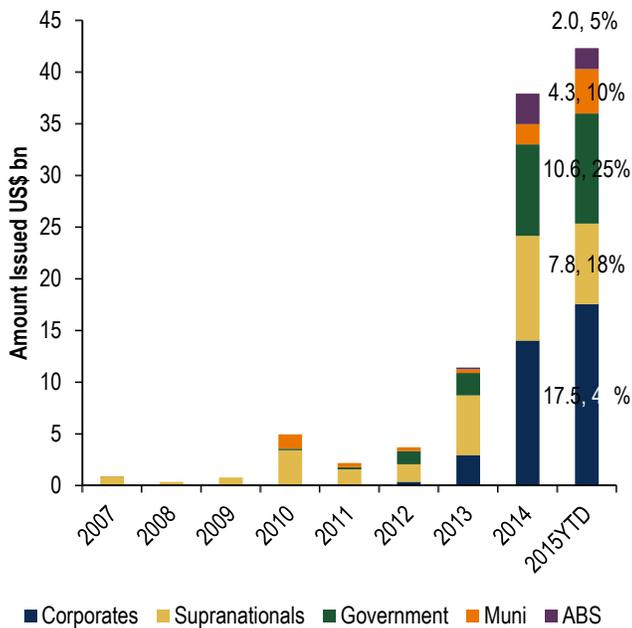
#### IFC investment in Yes Bank Green Bonds

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.

### Corporates continue to dominate

While SSAs had been the largest issuers of Green Bonds, corporates are now the single largest issuer, with nearly US\$17.5bn of issuance through November 27 2015. The largest issuers in 2015 span a wide range of sectors, and include ING, EDF, TerraForm Power, Toyota, and TenneT Holdings.

**Chart 54: Green bond issuance by type, 2007-2015 YTD (US\$bn)**

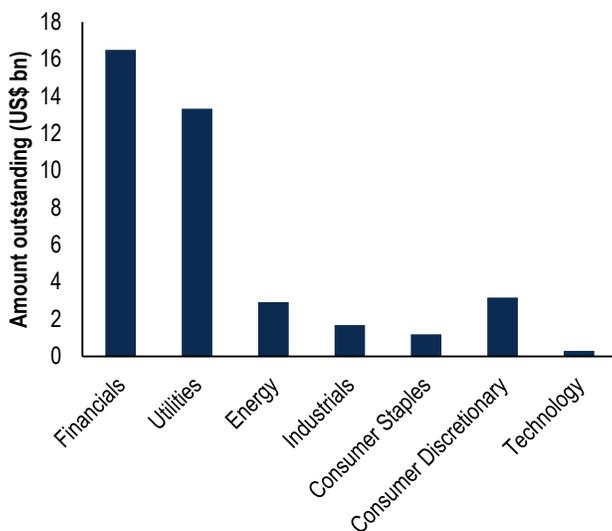


Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.

**Financials are the #1 corporate issuer**

While environmentally focused companies such as power generation and energy utilities previously made up the great majority of corporate issuance, companies in the financial services sectors have overtaken them this quarter as the largest issuer within corporates. Historically, power producers had been the first movers in Green Bonds as they have a large amount of renewables and cleantech assets within their portfolio that easily qualify as green projects. However, 2015 thus far has been a busy year during which non-traditional cleantech companies moved to become largest corporate issuer.

**Chart 55: Distribution of Green Bonds by sector (through November 27 2015)**



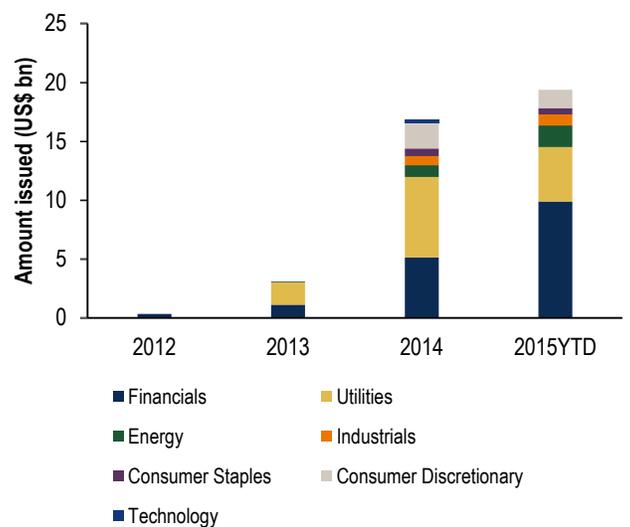
Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.  
\* Financials includes Real Estate

**Table 17: Corporate issuers of 2015 YTD (through November 27)**

Corporates	2015 US\$ mn
ING	1,333
Electricite de France SA	1,250
TerraForm Power Operating LLC	1,250
Toyota Auto Receivables 2015-B Owner Trust	1,250
TenneT Holding BV	1,124
Agricultural Bank of China Ltd	995
TerraForm Global Operating LLC	810
Bank of America Corp	600
ABN AMRO Bank NV	564
Berlin Hyp AG	560
BRF S.A.	545
HSBC France SA	531
Societe Generale SA	531
Unibail-Rodamco SE	531
Vestas Wind Systems A/S	527
Paprec Holding	523
Digital Realty Trust LP	500
Export-Import Bank of India	500
Morgan Stanley	500
Sumitomo Mitsui Banking Corp	500
Others	4,448
Total	19,372

Source: Bloomberg.

**Chart 56: Corporate bonds by sector (through November 27 2015)**



Source: BofA Merrill Lynch Global Research. Compiled from Bloomberg, CBI, company filings.  
\* Financials includes Real Estate

**Table 18: Current outstanding amount issued by Financial Services (US\$ bn), through November 27 2015**

Issuer	Amt. Issued US\$ mn	# of Bonds	Currency
ING	1,333	2	USD, EUR
Bank of America Corp	1,100	2	USD
Credit Agricole Corporate & Investment Bank SA	1,081	38	Multiple
Agricultural Bank of China Ltd	995	3	USD, CNY
ABN AMRO Bank NV	564	1	EUR
Berlin Hyp AG	560	1	EUR
HSBC France SA	531	1	EUR
Societe Generale SA	531	1	EUR
Morgan Stanley	500	1	USD
Export-Import Bank of India	500	1	USD
Sumitomo Mitsui Banking Corp	500	1	USD
Australia & New Zealand Banking Group Ltd	463	1	AUD
Toronto-Dominion Bank/The	453	1	CAD
Xing Yuan Loan Asset Backed Trust	450	1	CNY
IDBI Bank Ltd/DIFC Dubai	350	1	USD
Nedbank	338	1	ZAR
Hannon Armstrong	268	3	USD
National Australia Bank Ltd	247	1	AUD
Rodamco Sverige AB	225	2	SEK
THP Partnership	217	1	CAD
Yes Bank Ltd	210	2	INR
500 Georgia Office Partnership	173	1	CAD
DNB Bank ASA	133	1	NOK
Renew Financial	13	1	USD
<b>Total</b>	<b>11,734</b>	<b>69</b>	

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

### Banks issuing Green Bonds for climate commitments

The market has witnessed several major issues from banks, investment banks, real estate companies, and other financial services institutions. US-based Morgan Stanley's US\$500mn paper went towards wind farms in Texas and installing energy efficient lighting in its New York headquarters. Australia & New Zealand (ANZ) banking group issued a Green Bond in which 40% will go towards property, with the remaining 60% for wind and solar energy loans.

**Table 19: Banks YTD issuance (through November 27 2015)**

Issuer	Amt. Issued US\$ mn
ING	1,333
Agricultural Bank of China Ltd	995
Bank of America Corp	600
ABN AMRO Bank NV	564
Berlin Hyp AG	560
HSBC France SA	531
Societe Generale SA	531
Morgan Stanley	500
Export-Import Bank of India	500
Sumitomo Mitsui Banking Corp	500
Australia & New Zealand Banking Group Ltd	463
IDBI Bank Ltd/DIFC Dubai	350
Yes Bank Ltd	210
DNB Bank ASA	133
Credit Agricole Corporate & Investment Bank SA	71
<b>Total</b>	<b>7,840</b>

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

## 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. In June, Unibail-Rodamco issued a €500mn 10-year paper that was 6x oversubscribed, on the heels of its inaugural €750mn Green Bond issuance last year. Unibail concurrently issued a non-Green €500mn 15-year bond, which drew a €2bn book versus €3bn for the Green 10-year counterpart. Swedish real estate company Vasakronan is the one of the most prolific, issuing its 7<sup>th</sup> Green Bond, a SEK120mn 3-yr note earlier this year.

**Table 20: Current outstanding amount issued by Real Estate (through November 27 2015)**

Issuer	Amt. Issued US\$ mn	# of Bonds
Unibail-Rodamco SE	1,556	2
Vasakronan AB	730	11
Digital Realty Trust LP	500	1
Vornado Realty LP	450	1
Stockland Trust Management Ltd	375	1
Regency Centers LP	250	1
Cambridgeshire Housing Capital Plc	228	1
Rikshem AB	160	5
Fastighets AB Forvaltaren	79	2
Stangastaden AB	59	1
Uppsala AB	59	1
Wallenstam AB	59	1
Vardar AS	41	1

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

\* Financials includes Real Estate

## The first mortgage Green Bond by Berlin Hyp

In April 2015, Berlin Hyp issued a €500mn seven-year 0.125% Aaa/AA+ rated mortgage backed Green Bond. This was also the first Green Pfandbrief, which is a German form of covered bond, with recourse to a pool of assets as well as to the bank. In this case, the pool of assets are mortgages for green buildings, and proceeds will be used to finance new green buildings. The bond was 4x over-subscribed. German investors accounted for 71% of the order book, with Scandinavia, Austria and Switzerland accounting for the remainder. Just under half (48%) were allocated to Socially Responsible Investors (SRI). Berlin Hyp has earmarked €650mn of green buildings in its portfolio to go towards the €500mn bond, but has plans to acquire additional acquisitions when existing assets mature or default (source: Berlin Hyp).

## Pureplay companies getting increasingly involved

There has been much discussion on whether cleantech companies would issue Green Bonds because the core of their businesses are naturally green. Earlier in the year, cleantech and environmental companies such as Vestas, Paprec, Shanks, and United Photovoltaics all chose to issue Green Bonds. The first Chinese corporate Green Bond by Xinjiang Goldwind, China's 2<sup>nd</sup> largest wind turbine maker, also made headlines with its inaugural US\$300mn which was 5x oversubscribed.

**Table 21: Pure-play issuance in 2015 YTD (through November 27) in US\$ mn**

Issuer	Amt. Issued
TerraForm Power Operating LLC	1,250
TenneT Holding BV	1,124
TerraForm Global Operating LLC	810
Vestas Wind Systems A/S	527
Paprec Holding	523
Rapid Holding GmbH	446
SolarCity Corp	357
Goldwind New Energy	300
Shanks Group PLC	112
CLP Wind Farms India Pvt Ltd	90

**Table 21: Pure-play issuance in 2015 YTD (through November 27) in US\$ mn**

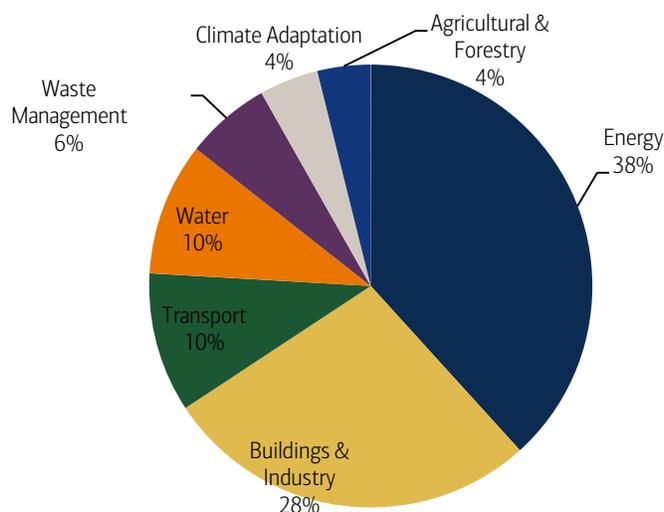
Issuer	Amt. Issued
LM Group Holding A/S	58
Scatec Solar ASA	58
Neija Energija AS	56
Neoen	44
AKUO Energy	38
Aligera	12

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

## Renewables and buildings are largest use of proceeds

The majority of Green Bonds are multi-purpose, which means that as long as the projects meet the guidelines as specified under the Green Bond Principles they are valid. According to the Climate Bond Initiative estimates, around 38% are financing for renewables energy, and 28% for buildings and industry, including low carbon buildings. This compares to 70% of proceeds going towards transport for climate bonds, indicating a large area for future growth.

**Chart 57: Green bonds use of proceeds**



Source: CBI HSBC

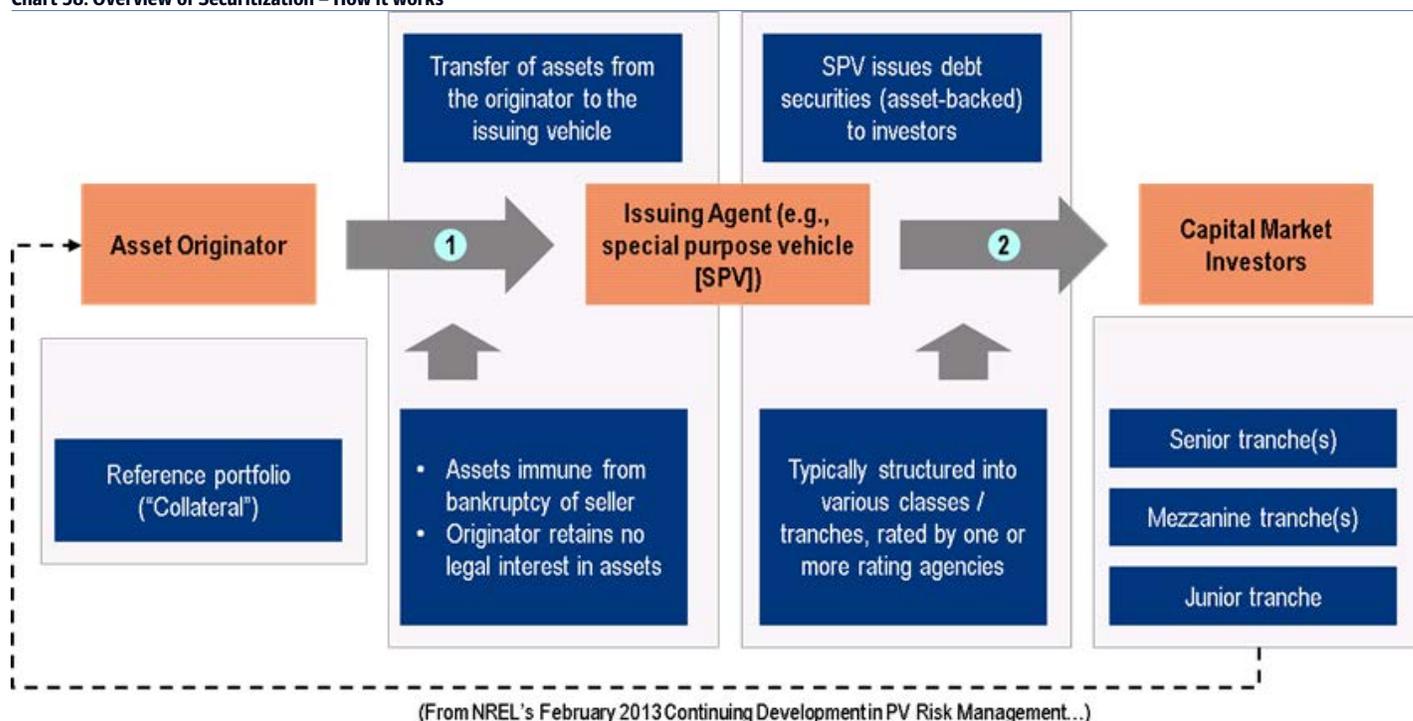
## Asset backed Green Bonds: a new area

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.

### 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 58: Overview of Securitization – How it works



Source: CERES, US National Renewable Energy Laboratory

### Green ABS continues

Green asset-backed (ABS) bonds had been a huge area of interest as it is a key tool that could link additional private capital with environmental needs. This quarter, Toyota issued its 2<sup>nd</sup> green ABS following its inaugural one in 2014. The US\$1.25bn note was also the 3<sup>rd</sup> largest Green Bond issued this year so far. Proceeds are to be used to fund finance and lease contracts for Toyota and Lexus cars that meet certain environmental standards, including eight models that currently qualify. The specifications include:

- Gas-electric hybrid or alternative fuel powertrain
- Minimum EPA estimated MPG (or MPG equivalent for alternative fuel vehicles) of 35 city / 35 highway
- California Low-Emission Vehicle II (LEV II) certification of super ultra-low emission vehicles (SULEVs) or higher, which would include partial zero emissions vehicles (PZEVs) and zero emissions vehicles (ZEVs)

Table 22: ABS Green bonds issued (through November 27 2015)

Issuer	US\$ mn
<b>2015</b>	
Toyota Auto Receivables 2015-B Owner Trust	1,250
HERO Funding Trust 2015-3	202
Hannon Armstrong	168
SolarCity Corp	124
Hindustan Powerprojects Pvt Ltd	59
Renew Financial	13
<b>2014</b>	
Toyota Auto Receivables 2014-A Owner Trust	1,750
Xing Yuan Loan Asset Backed Trust*	450
SolarCity Corp	272
State of Hawaii Department of Business Economic Development & Tourism	150
Western Riverside Council of Governments	129
Western Riverside Council of Governments	233
Goldman Sachs Japan Co., Ltd	63

**Table 22: ABS Green bonds issued (through November 27 2015)**

Issuer	US\$ mn
Connecticut Clean Energy and Finance Authority	33
Fannie Mae Green MBS	20
<b>2013</b>	
Hannon Armstrong	100
SolarCity Corp	54
Goldman Sachs Japan Co., Ltd	20
Total	<b>5,088</b>

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

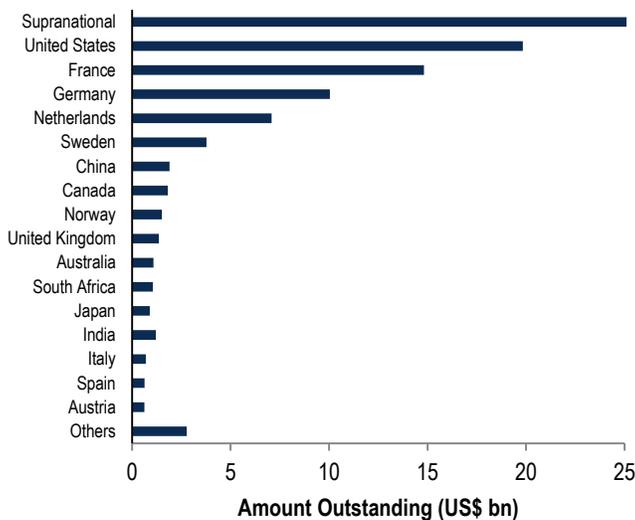
**Green muni ABS introduced late 2014**

The Hawaii State Department of Business, Economic Development and Tourism (DBEDT) issued a US\$150mn AAA-rated green ABS. The note was backed by a Green Infrastructure Fee, which is applied to electricity bills of Hawaiian state utilities. Proceeds are to go towards loans for customers to fund installations of solar panels, storage, inverters, and monitoring devices.

**Europe and US remain largest issuers, but declining**

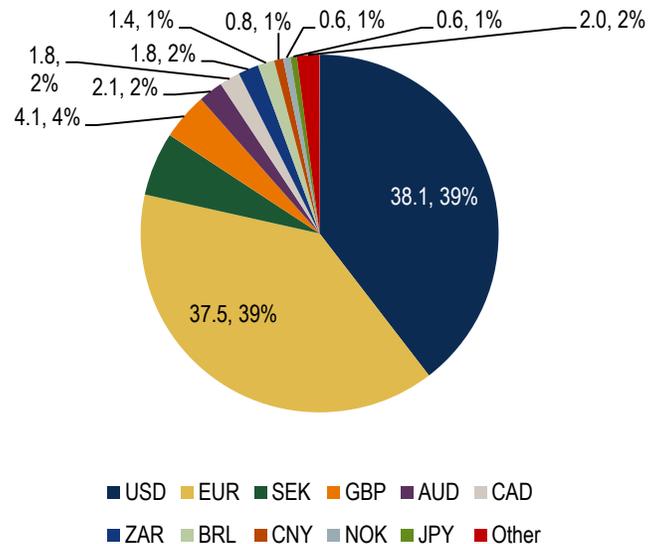
As a region, Europe remains the most developed Green Bond market and has some of the largest issuers. France, Germany, Netherlands, Norway, and Sweden comprise around 36% of the total outstanding market. EUR denominated Green Bonds make up around 42%, down from roughly half the market earlier in 2014. Increase in issuance from the US has driven a rise in USD denominated bonds, which now comprises 38%, tying with EUR.

**Chart 59: Distribution of Green Bonds by country (through November 27 2015)**



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

**Chart 60: Distribution of Green Bonds by Currency (outstanding through November 27 2015)**

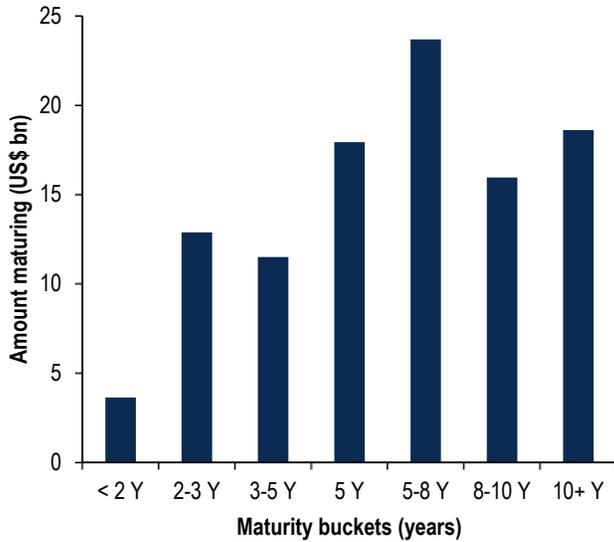


Source: BofA Merrill Lynch Global Research.. Compiled from Bloomberg, CBI, company filings.

**Maturity of issuance getting longer**

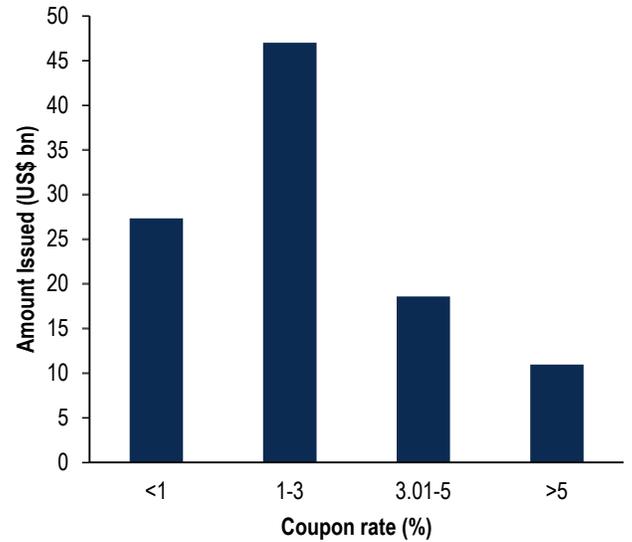
Historically, most Green Bonds span between two and ten years, with the five to eight-year maturity the most popular bucket (source: Bloomberg). However, investors are warming up to the idea of longer-duration projects and the 10-year+ bucket has been growing as a proportion of the market. This is encouraging because many environmental projects have a longer time horizon, and locking in long term financing would alleviate certain funding concerns.

**Chart 61: Maturity distribution of Green Bonds (through November 27 2015)**



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

**Chart 62: Coupon distribution of Green Bonds (through November 27 2015)**

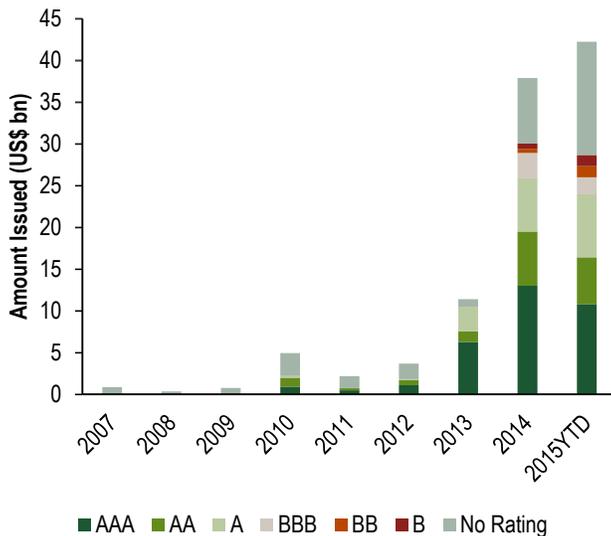


Source: BofA Merrill Lynch Global Research.. Compiled from Bloomberg, CBI, company filings.

## Growth of speculative grade continues

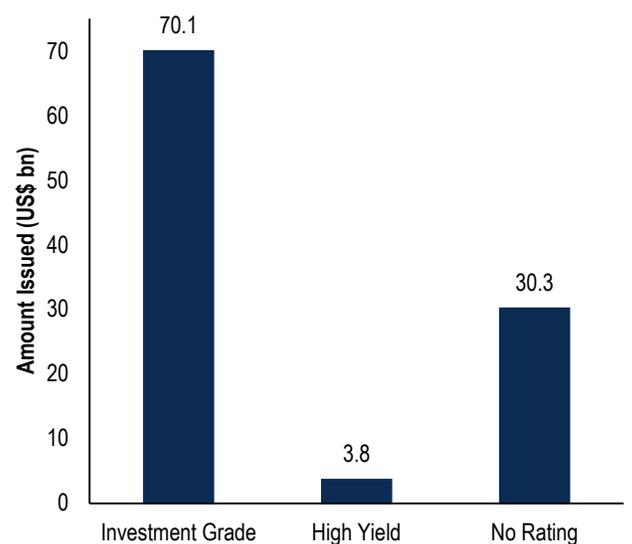
While historically Green Bonds have been predominantly investment grade (the BofAML Green Bond Index had an average rating of AAA prior to March 2014), 2014 saw the emergence of high yield issues with NRG Yield. Earlier this year, issuers like Paprec, TerraForm Global, TerraForm Power, and Virginia College Building Authority entered the market.

**Chart 63: S&P ratings distribution of Green Bonds (through November 27 2015)**



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

**Chart 64: High Yield vs Investment Grade Issues (through November 27 2015)**



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

## HY holders more traditional vs SRI

While holders of Green Bonds issued by traditional SSAs have been predominantly the SRI and ESG investor base, there may be evidence that speculative grade Green Bonds remain popular with traditional HY investors. For instance, Global Capital reported in

March that Paprec's book was comprised of traditional high yield investors. The paper interviewed someone familiar with the matter, who stated that "the green category is very important for issuers, yet so far has limited impact on the investor base in high yield."

**Table 23: Total amount issued by high yield issuers through (November 27 2015)**

Issuer	AMT Issued USD mn	Issue Date	Maturity	S&P Rating
TerraForm Global Operating LLC	810	05-Aug-15	05-Aug-22	B+
TerraForm Power Operating LLC	800	28-Jan-15	01-Feb-23	BB-
Abengoa Greenfield SA	635	30-Sep-14	01-Oct-19	B
Paprec Holding	524	27-Mar-15	01-Apr-2022/23	(P)B+/(P)B-
NRG Yield Operating LLC	500	05-Aug-14	15-Aug-24	BB+
TerraForm Power Operating LLC	300	17-Jul-15	15-Jun-25	BB-
TerraForm Power Operating LLC	150	08-Jun-15	01-Feb-23	BB-
Virginia College Building Authority	67	15-Jul-15	01-Jul-19	BB+
Chicago Board of Education	20	29-Apr-15	01-Dec-32	BB
City of York PA	2.2	28-Dec-11	15-Nov-27	BB+
<b>Total</b>	<b>3,808</b>			

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

\* Paprec holding has two bonds with amounts (322+202)=524

\* Abengoa has two bonds with amounts issued (335+300) = 635

## The Green muni opportunity

Municipalities have tremendous environmental infrastructure needs, where the US alone needs US\$3.6tn of investments through 2020E in things including transportation systems, waterways, and the power sector. At the same time, cities are also particularly vulnerable to the impacts of climate change. In just the last three years, US metropolitan areas have suffered more than US\$188bn in damages and lost more than 1000 lives on the back the extreme weather. Investment in low-carbon and environmental solutions is one of the best ways to combat this. (Source: Green City Bonds Coalition)

**Table 24: Types of Green Muni Bonds**

TYPE	PROCEEDS RAISED BY BOND SALE	DEBT RECOURSE	EXAMPLE
General Obligation Bond	Earmarked for green projects	Full recourse to the issuer; therefore, same credit rating applies as to the issuer's other bonds.	State of California issued \$300 million in Aa3/A green bonds with final maturities in 2037. The September 2014 issuance was backed by the State's General Fund, 90 percent of which is derived from personal income tax, sales and use tax, and corporation tax). Proceeds went to fund a variety of projects across several categories, including air pollution, clean water and drinking water, and flood prevention.
Revenue Bond	Earmarked for green projects	Revenue streams from the issuer, such as taxes or user fees, provide repayment for the bond.	Iowa Finance Authority issued \$321.5 million of State Revolving Fund revenue bonds in February 2015, with 1- to 2-year tenors, 1 to 5 percent coupon, rated AAA. The green bonds were backed by water-related fees and taxes. Proceeds were earmarked for water and wastewater projects.
Project Bond	Ring-fenced for the specific underlying green project(s)	Recourse is only to the project's assets and revenue.	No issuance seen in the market yet
Securitized Bond	Either (1) earmarked for green project or (2) go directly into the underlying green projects.	Recourse is to a group of financial assets that have been grouped together as collateral.	Hawaii State Government issued \$150 million, AAA-rated of green asset backed securities in November 2014. The securities were issued in two tranches: \$50 million, 8-year, 1.467 percent coupon and \$100 million, 17-year, 3.242 percent coupon. The bonds were backed by a Green Infrastructure Fee applied to the bills of the State Utility's electricity customers. Proceeds went to loans to install distributed solar panels, connectors, and storage.

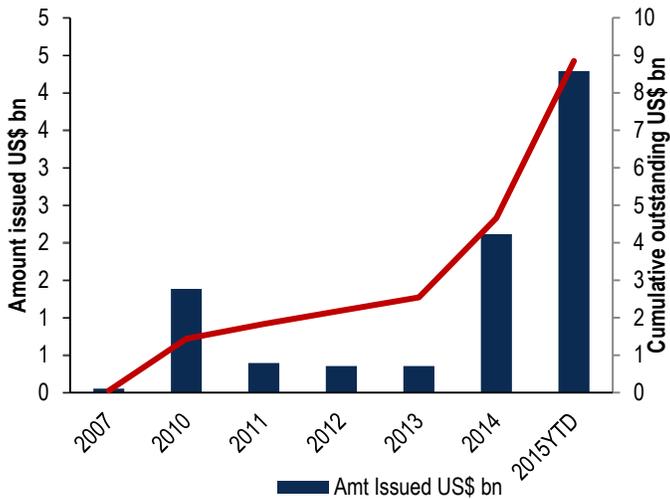
Source: Green City Bonds Coalition

## US\$3.7tn in US muni opportunity

According to a report released by the Green City Bonds Coalition, the US municipal bond already stands at US\$3.7tn, with individual investors and mutual funds accounting for more than 70% of the market. This is because individuals tend to have significant tax liability, making tax-exempt muni bonds particularly attractive. While the inaugural US\$100mn US Green Muni Bond was issued in 2013, the market ballooned to US\$2.6bn by 2014, and we have already surpassed that this year with US\$3.5bn issued through August 2015. We have been seeing growth of Green Bonds outside the Qualified Energy Conservation Bonds (QECB) and Clean Renewable Energy Bonds (CREB) programs already. Similar to non-muni Green Bonds, demand has been particularly high. We see

room for additional growth of Green Bonds within the US\$3.7tn muni market, as well as expanding issuance that would not have occurred previously.

**Chart 65: US Muni issuance (through November 27 2015)**



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

**Table 25: Top 10 Green US Muni Bonds 2015 YTD (through November 27 2015)**

Governments	2015 YTD Amt Issued US\$ mn
Central Puget Sound Regional Transit Authority	943
New York State Environmental Facilities Corp	479
Iowa Finance Authority	322
City of Los Angeles CA Wastewater System Revenue	290
State of Connecticut Clean Water Fund - State Revolving Fund	250
Indiana Finance Authority	240
Massachusetts Clean Water Trust/The	228
Metropolitan Water Reclamation District of Greater Chicago	225
Arizona State University	183
Massachusetts Development Finance Agency	158
Others	973
<b>Total</b>	<b>4,290</b>

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

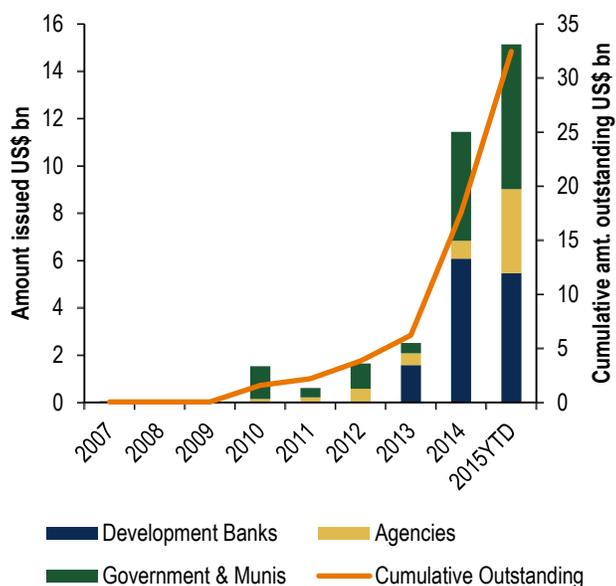
**Largest Green muni bond from Seattle Transit**

In August 2015, the Central Puget Sound Regional Transit authority issued a AAA-rated US\$942mn note, which was the largest US Muni Green Bond to date. The sale includes fixed-rate bonds paying 3.88% interest and around US\$150mn in floating rate bonds. The proceeds will go towards building more than 30 miles of light rail extensions through 2023E, and will go towards refinancing existing bonds to achieve over \$30mn in cost savings. The rail projects are forms of low-carbon mass transit located in and around the Seattle, Tacoma and Puget Sound area, primarily focusing on commuter rail links to the city and airport.

**European munis continue, Gothenburg repeat issuer**

In addition to United States, we are seeing continued participation from sovereigns and municipalities in Europe and elsewhere. Earlier this year, Transport for London, a public-private partnership that manages London’s public transport network, issued a £400mn 10-year AAA 2.125% Green Bond, which is the 2<sup>nd</sup> largest government issue this year. The City of Gothenburg, who has been active in Green Bonds since 2013, issued a SEK1bn 6-year 1.455% note. Proceeds will be used to fund green projects including an electric vehicle scheme, energy-from-waste project, sustainable housing, and water project. Majority of the bonds were placed with pension funds (61%), asset managers (17%) and Banks (16%).

**Chart 66: Governments, Quasi-Government, and Multilateral Bank issuance YTD (through November 27 2015)**



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

**Table 26: Top 20 Green Government & Muni Bonds issued 2015 YTD (through November 27)**

Governments	2015 YTD US\$ mn
Central Puget Sound Regional Transit Authority	943
Transport for London	607
Region of Ile de France	541
New York State Environmental Facilities Corp	479
City of Paris France	322
Iowa Finance Authority	322
City of Los Angeles CA Wastewater System Revenue	290
State of Connecticut Clean Water Fund - State Revolving Fund	250
Indiana Finance Authority	240
Massachusetts Clean Water Trust/The	228
Metropolitan Water Reclamation District of Greater Chicago	225
Stockholms Lans Landsting	213
Arizona State University	183
Massachusetts Development Finance Agency	158
City of Gothenburg Sweden	127
District of Columbia Water & Sewer Authority	100
University of Virginia	98
Grant County Public Utility District No 2	90
East Bay Othercipal Utility District Water System Revenue	74
Virginia College Building Authority	67
Others	573
<b>Total</b>	<b>6,127</b>

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

## Colleges, universities issuing Green Bonds

While colleges and universities have been active in issuance for several years, we saw four new issues this year thus far from University of Virginia, Arizona State University, Indiana University, and Chicago Board of Education. Much of this has been driven by the growing trend of using proceeds to fund low-carbon buildings around campus. For instance, Arizona State University and University of Virginia issued a US\$182mn and US\$98mn Green Bond each going towards LEED Gold certified energy efficient buildings.

**Table 27: Bonds issued by Educational Institutes (through November 27 2015)**

Issuer	Issue Date	All Amt. Issued US\$ mn	Details
Massachusetts Institute of Technology	29-Sep-14	370	In 2008 and 2009 Massachusetts Institute of Technology (MIT) issued bonds that were used, in part, to fund the building of green property. MIT refinanced these bonds by issuing a new bond to pay off the existing debt. In doing so, MIT earmarked the part of the debt (\$370m) which was used for green property and repackaged the amount into a green bond. (Source: CBI)
Arizona State University	07-Apr-15	183	Proceeds from the green bond will be used to refinance LEED Gold certified buildings (link is external) for the university. The properties being refinanced are the Law and Society Building Project (\$114m), Academic complex (5 campus buildings) and the University Police Department building. (Source: Arizona State University, CBI)
University of Virginia	08-Apr-15	98	To finance and refinance certain projects that the University has identified as promoting environmental sustainability purposes, including the construction, furnishing and equipping of certain buildings certified as LEED® Gold or LEED® Silver (the "Green Projects"). (Source: University of Virginia)
Massachusetts State College Building Authority	17-Dec-14	91	Enable investors to invest directly in bonds that finance environmentally sustainable projects. The Hammond Campus Center, the new residence hall at Framingham, the Design + Media Center at MassArt and the Westfield science building are designed to meet, at a minimum, the requirements of the U. S. Green Building Council for Leadership in Energy and Environmental Design (LEED) certification at the Silver level, and the parking structure at Salem State University is designed to meet, at a minimum, the requirements of the Green Parking Council for Green Garage Certification at the Bronze level. (Source: Bloomberg)
Virginia College Building Authority	15-Jul-15	67	-
Indiana University	14-Jan-15	59	To invest in projects identified as promoting environmental sustainability on University campuses. (Source: Indiana University)
Mount Diablo Unified School District/CA	30-Sep-10	58	-

**Table 27: Bonds issued by Educational Institutes (through November 27 2015)**

Issuer	Issue Date	All Amt. Issued US\$ mn	Details
Board of Governors of Colorado State University System	07-Aug-15	42	Will be used to finance green buildings.
University of Cincinnati	19-Dec-14	30	The proceeds will be used to finance a portion of Scito Hall Renovation Project, a project that will promote environmental sustainability. This will make it the 1st public university in the United States to bring a green bond to market (Source: University of Cincinnati)
University of Louisville	29-Dec-10	21	-
Vermont Educational & Health Buildings Financing Agency	10-Nov-15	18	Will finance construction of a new hall of residence for students, which is being designed to use less energy. (Source: assetservicetimes.com)
Tulare City School District	02-Oct-14	14	-
University of Kentucky	19-Nov-10	13	-
Yuba Community College District	21-Jun-11	13	-
Sonoma Valley Unified School District	22-Dec-10	11	-
Lincoln Unified School District	31-Aug-12	7	-
Castro Valley Unified School District	08-Sep-11	6	-
Southern Illinois University	19-Dec-12	5	-
California Community College Financing Authority	23-Aug-11	5	-
Kane County School District No 129 West Aurora	04-Nov-15	5	-
Western Technical College District	09-Oct-12	5	-
Alma Center School District	08-Sep-11	5	-
Yellowstone County School District No 2 Billings	26-Jul-12	5	-
University of Nebraska Facilities Corp	15-Apr-14	4	-
Glendale Unified School District/CA	16-Aug-11	4	Proceeds will be used for capital expenditure of one or more qualified renewable energy projects (Source: Bloomberg)
Rapid City Area School District No 51-4/SD	01-Nov-11	4	-
Yellowstone County High School District No 2 Billings	26-Jul-12	4	-
Mandan Public School District No 1	04-May-11	4	-
University of Colorado	28-Oct-10	4	-
Boardman Local School District	10-Aug-11	3	-
Shenandoah School Building Corp	13-Dec-12	3	-
Ely Independent School District No 696	15-Jun-11	3	-
Mount Horeb Area School District/WI	09-May-11	3	-
Jefferson School District/WI	12-Apr-11	2	-
North Newton School Building Corp/IN	18-Oct-11	2	-
Tippecanoe Valley 2011 School Building Corp	02-Jun-11	2	-
Hartford Joint School District No 1	03-May-11	2	-
Beloit School District	17-Sep-12	2	Will be used for constructing additions to and repair, remodelling and improvement projects at District elementary school buildings and sites to add new and better classroom space, increase security and improve efficiency. (Source: Bloomberg)
Racine Unified School District	10-Jun-13	2	-
West Sonoma County Union High School District	09-Jun-11	2	-
Anderson Valley Unified School District	13-Oct-10	2	To acquire, construct, and improve classrooms and facilities, including repairing, upgrading, and modernizing Anderson Valley Elementary, improving student access to modern technology at Anderson Valley Junior Senior High, improving energy efficiency, installing solar panels to reduce energy costs. (Source: Bloomberg)
Mitchell School District No 17-2	01-Dec-10	2	-
Santee School District	16-Jun-10	2	-
Menasha Joint School District	01-Jul-11	2	-
Western State College	29-Jun-10	2	-
Calistoga Joint Unified School District	25-May-11	2	New clean renewable energy bonds for purposes of the American Recovery and Reinvestment Act of 2009. (Source: Bloomberg)
Tri-Valley School District	30-Dec-13	2	-
Peoria Tazewell Etc Counties Community College District No 514	13-Mar-14	1	-
Twin Hills Union School District	17-Mar-11	1	-
McHenry & Kane Counties Community Consolidated School District No 158 Huntley	30-Sep-11	1	-
Osseo-Fairchild School District/WI	05-Dec-11	1	-
Big Pine Unified School District	07-Sep-10	1	Making renewable energy improvements and improving efficiency of classrooms and facilities. (Source: Bloomberg)

**Table 27: Bonds issued by Educational Institutes (through November 27 2015)**

Issuer	Issue Date	All Amt. Issued US\$ mn	Details
Champaign County Community Unit School District No 116 Urbana	14-Dec-10	1	Proceeds of the Bonds will be used to (i) improve the sites of, build and equip additions to and alter, repair and equip school buildings and facilities, purchasing equipment and renovating various District facilities for the purpose of increasing energy efficiency, expanding and renovating the Martin Luther King, Jr. Elementary School Building and the auditorium in the Urbana High School Building, installing an air conditioning system in the Urbana High School Building and renovating and improving the commons areas and athletic fields and related facilities at the Urbana Middle School and Urbana High School Buildings and (ii) pay for certain costs associated with the issuance of the Bonds. (Source: Bloomberg)
Champaign County Township High School District No 193	20-Dec-10	0	Qualified Energy conservation Bonds (Source: Bloomberg)

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

### Green Bonds pipeline appears robust

There are numerous Green Bonds on the horizon, as reported, that are both diverse in region and by issuer.

**Table 28: Examples of Green Bonds in pipeline**

Country	Issuer	Amount	Details	Source
Norway	Nordic Investment Bank (NIB)	€700mn	Retail green bonds to be issued annually in the future	Environmental Finance
United States	State of Connecticut	US\$65mn	NA	Climate Bonds
United States	Rhode Island Infrastructure Bank	US\$18.3 mn	Proceeds will be used to finance construction and improvement of its wastewater and drinking water infrastructure.	Environmental Finance
United Kingdom	Barclays	NA	NA	Environmental Finance
India	NTPC	NA	NA	The Financial Express

Source: Company Filing, Press sources

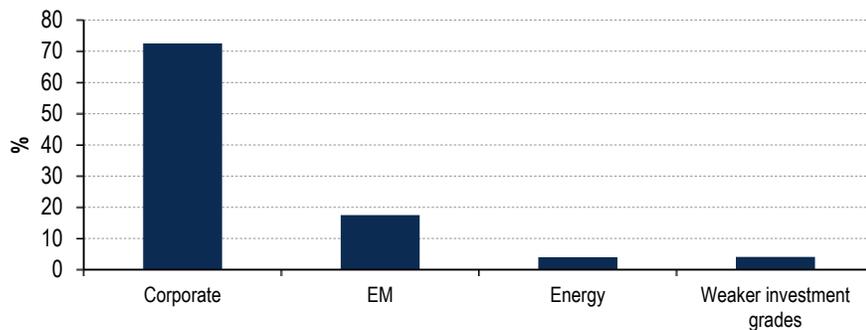
# US\$60bn issuance in 2016E, driven by corporates and Asia

While Green Bond issuance YTD has already surpassed 2014's record breaking year, the pace of growth fell short of expectations which were in the range of US\$80-100bn for 2015. We see US\$50-60bn in issuance in 2016E, which implies a CAGR of 10-30%. This is expected to be driven by increased issuance by 1) corporations in both the investment grade and high yield; 2) emerging markets, primarily China and India; 3) increased standardization in both guidelines and impact reporting.

## Corporate issuance still highest focus

2014 and 2015 have been pivotal years for standard setting and increasing the diversity of the Green Bonds universe, including corporates, EMs, HY, green ABS, projects bonds, and other innovative solutions. However, the #1 space where investors would like to see growth remains corporate Green Bonds (Source: Euromoney). This is likely because corporate Green Bonds offer natural diversity in industry sectors, credit quality, and geographical reach, which maintaining similar characteristics to traditional corporate bonds that investors are familiar with.

**Chart 67: In which sector would you like to see more green bonds issued?**

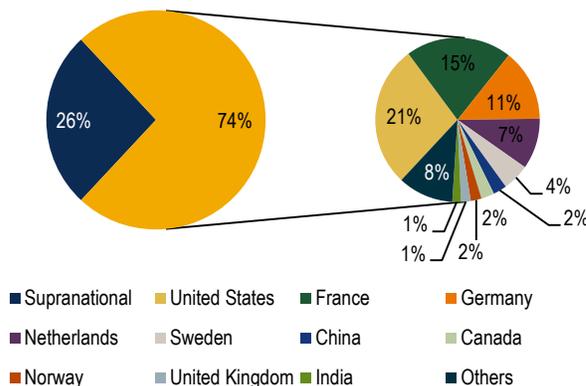


Source: Euromoney

## Asia expected to drive future growth

Geographical diversification will also be key. While issuers from the US and Europe currently account for around 60% of the outstanding market, Green Bonds are gaining traction in the rest of the emerging and development world as well. Moody's believes that while the market in US and Europe will become increasingly sophisticated, emerging markets such as China and India are likely to drive growth of issuance as they move towards more eco-friendly economies.

**Chart 68: Distribution of outstanding Green Bonds by country (through November 27 2015)**



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

**Table 29: All bonds issued in Asian currencies (through November 27 2015)**

Issuer	US\$ mn
<b>CNY</b>	
Xing Yuan Loan Asset Backed Trust*	450
CGN Wind Energy Ltd	160
Agricultural Bank of China Ltd	95
International Finance Corp	80
<b>IDR</b>	
European Bank for Reconstruction & Development	60
Credit Agricole Corporate & Investment Bank SA	9
<b>INR</b>	
Yes Bank Ltd	210
CLP Wind Farms India Pvt Ltd	90
Credit Agricole Corporate & Investment Bank SA	72
Hindustan Powerprojects Pvt Ltd	59
International Finance Corp	49
European Bank for Reconstruction & Development	40
International Bank for Reconstruction & Development	26
Kommunalbanken AS	5
<b>JPY</b>	
Credit Agricole Corporate & Investment Bank SA	500
European Investment Bank	49
International Bank for Reconstruction & Development	1
<b>MYR</b>	
International Bank for Reconstruction & Development	11

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

\*Based on green loans from Industrial Bank

**Table 30: All bonds issued by Asian countries (through November 27 2015)**

Issuer	Amt. Issued US\$ mn	Country
Asian Development Bank	1,721	NA
Agricultural Bank of China Ltd	995	China
Sumitomo Mitsui Banking Corp	500	Japan
Export-Import Bank of India	500	India
Export-Import Bank of Korea	500	South Korea
Xing Yuan Loan Asset Backed Trust**	450	China
IDBI Bank Ltd/DIFC Dubai	350	India
Development Bank of Japan Inc	316	Japan
Goldwind New Energy	300	China
ASE*	300	Taiwan
Yes Bank Ltd	210	India
CGN Wind Energy Ltd	160	China
CLP Wind Farms India Pvt Ltd	90	India
Goldman Sachs Japan Co., Ltd	83	Japan
Hindustan Powerprojects Pvt Ltd	59	India

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

\*Issued through Cayman Islands subsidiary Anstock II Ltd.

\*\*Based on green loans from Industrial Bank

## China needs RMB2.9tn in annual investments

We “resolutely declare war on pollution as we declared war against poverty” – China’s premier Li Keqiang

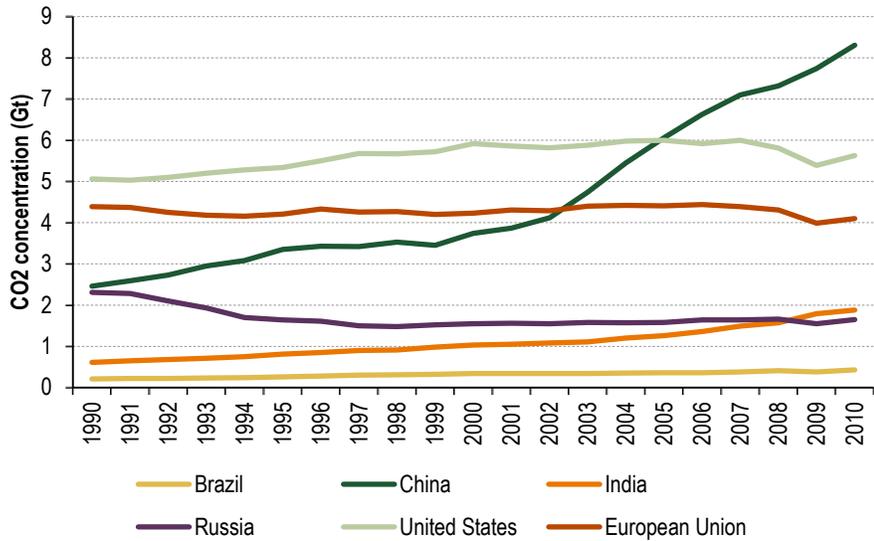
Given the energy needs, China shows some of the greatest potential for increased Green Bond issuance. The country is the largest emitter of greenhouse gases, and the cost of pollution is around 3-6% of GDP (source: World Bank). Only three out of 74 cities meet air quality minimum standard in 2014, 60% of underground water is polluted, and 19% of arable land is badly polluted. According to the 13<sup>th</sup> Five-Year Plan, the country needs RMB2.9tn annually from 2015 to 2020, or 3% of GDP. This is equivalent to 14% of the fiscal revenue for the period, which far exceeds the public budget. Hence, and estimated two thirds of this, or RMB2tn, will need to come from capital markets, both domestic and international (source: DRC, IISD).

### China: #1 CO2 emitter and coal user

[Thematic Investing: A Call to Action – Climate Change Solutions Primer 27 November 2015](#)

2000-10 was marked by the interrelationship between China’s exponential use of coal and the resultant carbon released in the atmosphere. While CO2 emissions growth remained relatively flat in the US, EU and other BRIC countries, China’s emissions more than doubled on a gigaton basis.

**Chart 69: CO2 emissions (Gt) by 1990–2014**

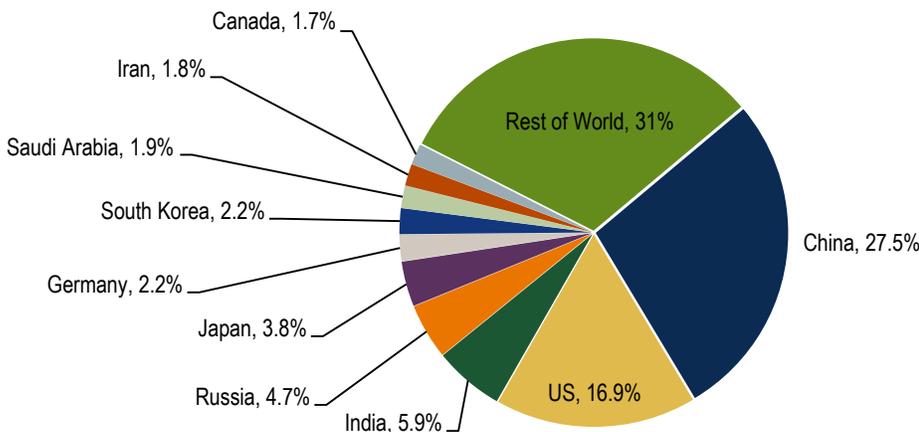


Source: IEA

**27.5% of global CO2 emissions**

China overtook the US as the world’s #1 emitter of CO2 in 2005-06, and has retained pole position ever since, continuing to grow its global share of CO2 emissions (source: IEA). In 2014, China accounted for 27.5% of the global total of carbon emissions, followed by the US at 16.9% and India at 5.9% (source: BP).

**Chart 70: Global carbon emissions - 2014 (mn ton of CO2)**



Source: BP statistic review

**“Under The Dome”: an (in)convenient truth for China**

[China: An Equity Strategist’s Diary: Under the Dome, a convenient truth?](#)  
03 March 2015

Earlier in 2015, *Under the Dome*, a 104-minute documentary on air pollution produced by Chai Jing, a former CCTV investigative journalist, went viral after its release, accumulating 200 million views in just three days before being taken offline by state authorities. David Cui, our Head of China Equity Strategy, believes in the long run the documentary may prove to be as consequential as *Silent Spring* and *An Inconvenient Truth*. It is becoming increasingly apparent that the Chinese public are fed up with

pollution in general, with the average haze days in a year skyrocketing over the past decade (see chart below).

**Chart 71: Average haze days in a year (nationwide)**



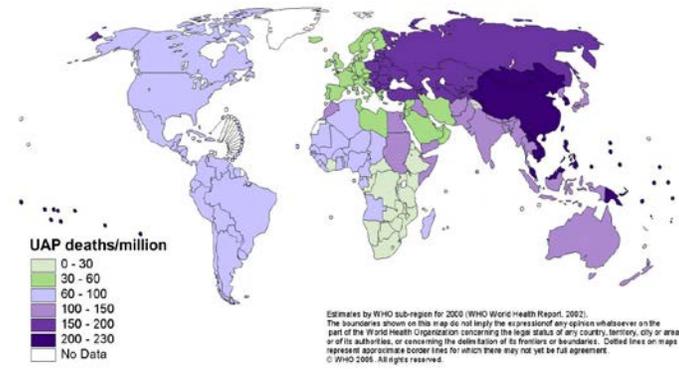
Source: "Characteristics of Climate Change with Respect to Fog Days and Haze Days in China in the Past 40 Years (May 2013)" by Climatic and Environmental Research, China Meteorological Administration

### **"Airpocalypse" is #1 factor driving the wealthy Chinese exodus**

Environmental issues have become the leading source of social unrest in China, especially for middle class and wealthy individuals. In our view, the trend of public unrest caused by air pollution will continue to escalate unless serious efforts are made to curb coal-energy production.

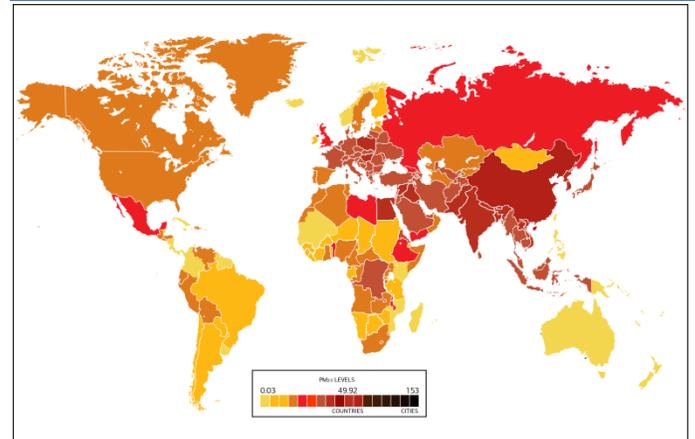
- **The health and economic costs of air and water pollution in China amount to about 5.8% of Chinese GDP** (source: World Bank). Separately, the Chinese Academy of Environmental Planning estimates that environmental degradation and pollution alone costs the national economy US\$9.3tn, or 3.5% of China's GDP, each year.
- **Sixty-four percent of wealthy Chinese – defined as those with assets of more than \$1.6mn – are either emigrating or planning to leave**, citing the worsening environment and air pollution as the #1 reason (source: Hurun Report).
- **Levels of PM2.5 (tiny airborne particulate linked to cancer and heart disease) soared** in 2015 in Shenyang, Liaoning province in northern China, reaching 56x the levels (1,157mg) considered minimally safe by the WHO (25mg) based on data released by the city's environment protection bureau.

**Exhibit 20: Deaths from air pollution**



Source: WHO

**Exhibit 21: Air pollution index by country**

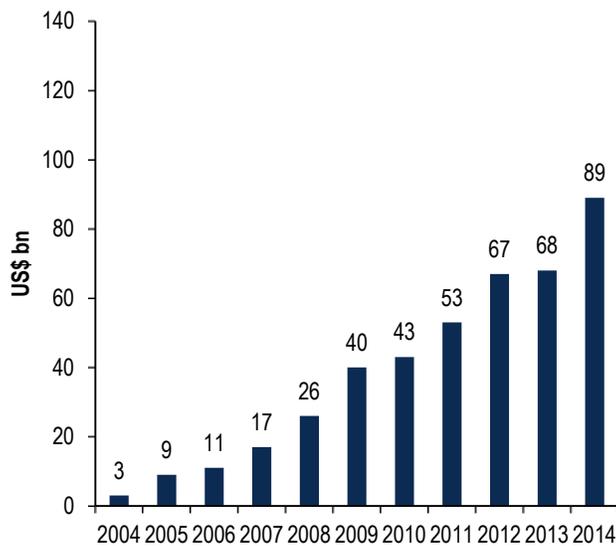


Source: Yale University

**China accounts for 1 out of 3 dollars spent on renewables**

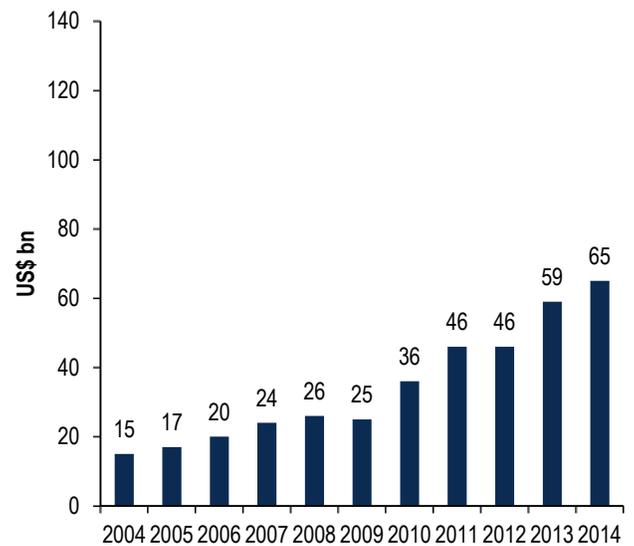
On the positive side, China has been the largest renewables investor, with US\$89.5bn in investment in 2014, accounting for 1 out of 3 dollars spent on clean energy in the world. Overall, Asia is the largest investor in clean energy, with US\$113-161bn invested in the past three years, followed by the Americas at US\$75-109bn and EMEA at US\$65-74bn (source: BNEF).

**Chart 72: Clean energy investment in China 2004-14 (US\$bn)**



Source: Bloomberg New Energy Finance

**Chart 73: Clean energy investment in Asia ex-China 2004-14 (US\$bn)**

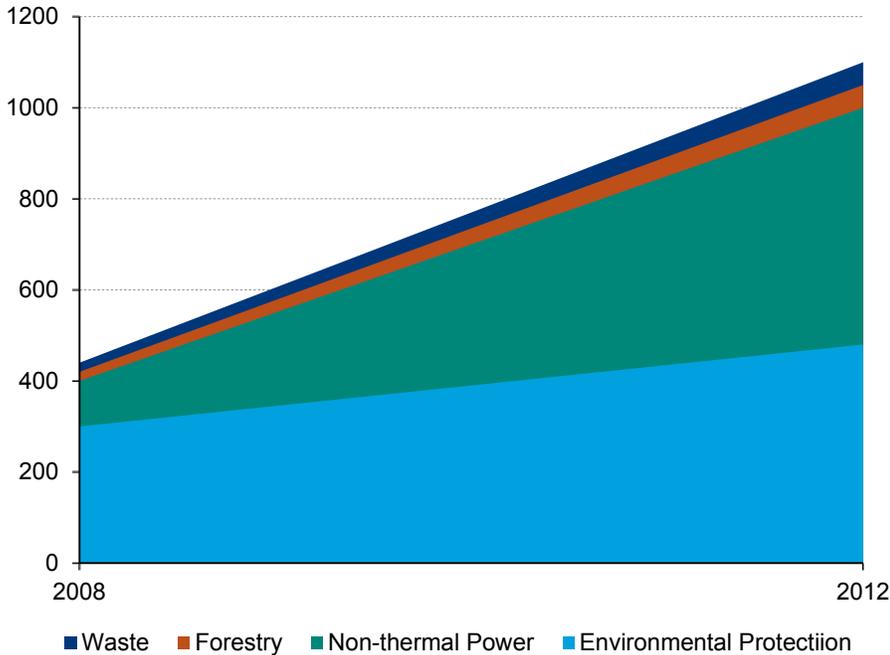


Source: Bloomberg New Energy Finance

**Current mechanisms already market-based**

The DRC estimates that green investments in China were RMB1.26tn (US\$200bn) in 2012, or around 2.43% of the GDP and 70% of this had been through market-based channels, predominantly bank loans. To date, green project lending from 21 major Chinese banks including CITIC and Industrial & Commercial Bank of China has already exceeded RMB6tn through the end of 2014, representing 10% of all lending activity (Source: China Banking Association). While some of the risk would be priced in, many of the banks making loans are state owned enterprises (SOEs), some with implicit backing from the government. Additional growth from the private sphere would be needed to aid additional green growth.

**Chart 74: Market based green finance 2008 & 2012**



Source: DRC, IISD

### **Green framework developed, Green Bonds are a tool**

Earlier in 2015, China's Development Research Center of the State Council (DRC), and Canada's International Institute for Sustainable Development (IISD) published an outline for greening China's financial system. The overarching recommendation was for government's promotion of green credit, green securities, and green insurance. Green Bonds specifically have been highlighted as a potential solution to link capital markets with the need for environmental investments. (Source: DRC, IISD)

### **CBI and IISD recommendations for framework**

Separately, CBI and IISD released a list of Green Bond recommendations to help develop a potential framework for the market:

- China Banking Regulatory Commission should develop China-specific definitions for Green Bonds
- A multi-sector "Green Bond Market Development Committee" should be set up to address paper from DRC, IISD, and PBoC.
- Partial credit guarantees to help green municipal revenue bonds and green public-private partnership project bonds.
- Tax credits for interest earned on Green Bonds
- Green Bonds quota for foreign investors (source: CBI).

### **Final framework to be introduced**

The proposed framework is currently being circulated amongst the Ministry of Finance, National Development and Reform Committee (NDRC) and National Association of Financial Market Institutional Investors (NAFMII), as well as Chinese banks and academics. A final version of the regulation has been slated for the end of the year (Source: Global Capital Asia).

### **First Chinese corporate Green Bond issued by Goldwind**

In July, Xinjiang Goldwind Science and Technology, the 2<sup>nd</sup> largest wind turbine manufacturer in China, became the first Chinese corporate to issue a Green Bond. The

US\$300mn 3-year 2.5% note had credit enhancement from the Bank of China's Macau branch, which brought it up to an A1/A/A credit rating. Agricultural Bank of China (ABC) followed in October with a RMB600mn deal. While the domestic Chinese market is likely to be governed by its own Green Bond framework, the company attained a 2<sup>nd</sup> review from DNV GL. While most Green Bond have proceeds earmarked for specific projects, Xinjiang Goldwind did not, given it is a pure-play wind turbine maker, similar to Vestas' note earlier this year.

#### 5-8x oversubscribed, primarily Asian investors

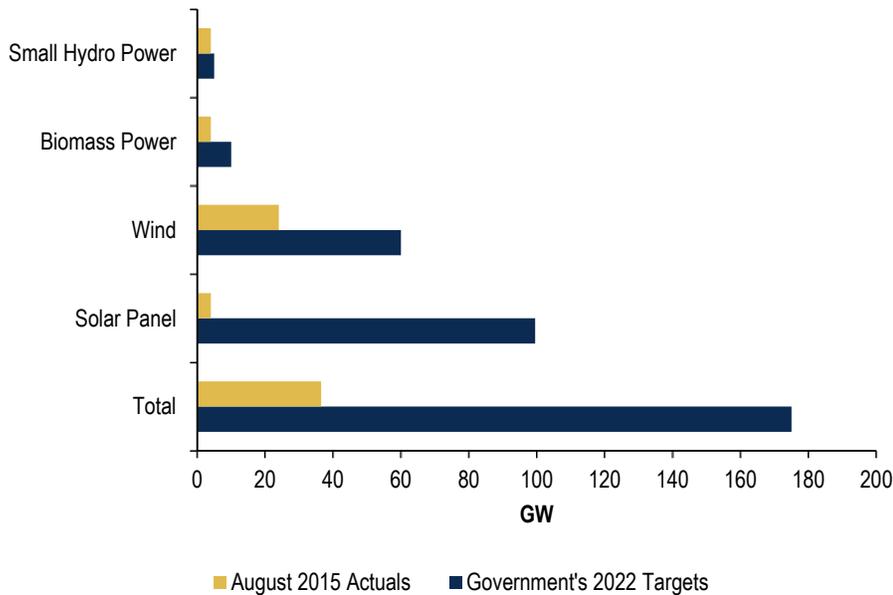
The inaugural Chinese corporate Green Bond by Goldwind saw tremendous investor demand, with the order book peaking at US\$1.5bn, 5x oversubscribed although the total issue was capped at US\$300mn due to the credit enhancement from Bank of China. Similarly, ABC's deal was 8x oversubscribed, receiving RMB4.9bn of orders, 94% originating from Asian investors.

### India: 3<sup>rd</sup> largest GHG emitter, needs US\$200bn for renewables alone

Renewable energy and sustainability has been a key focus area for the newly elected 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 – 100GW of solar power and 60,000MW of wind power by 2022. 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 75: 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

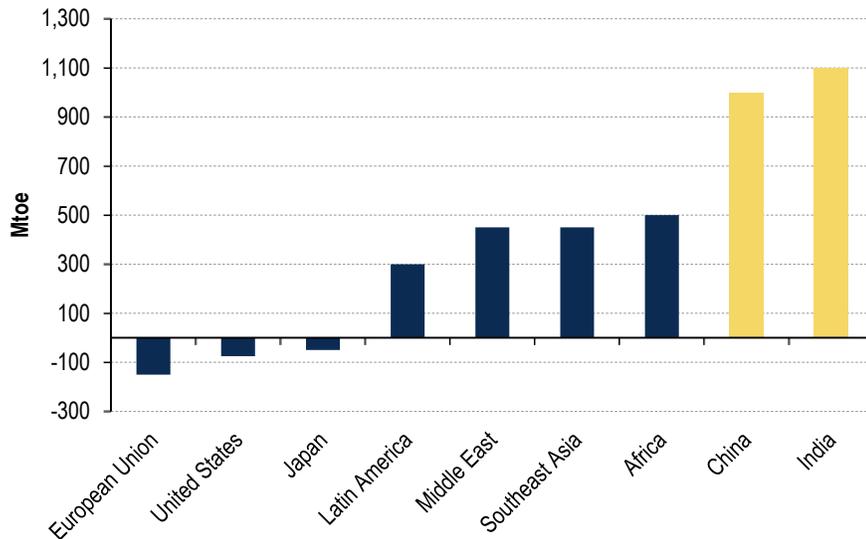
#### Rising energy demand

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 76: Change in energy demand in selected regions, 2014-2040**



Source: IEA 2015

## US\$2.5tn needed through 2030E for low carbon

Leading into COP21, the country 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.

## India issued first Green Bonds this year

Yes Bank became the first company in India to issue a Green Bond when it sold Rs10bn (US\$161mn) 10-year Green Bond with a 8.85% coupon and AA+ local rating in February (source: IFR, CBI). Export-Import Bank of India followed in March with its US\$500mn 2.75% note issuance. In the last quarter, IDBI Bank and CLP Wind Farms entered the market with their respective issuances. Several SSAs have also already issued in Rupees in recent years. As the Green Bond and overall Indian corporate debt market matures, renewables sector could see price benefits (source: IFR).

**Table 31: Indian bonds issued through November 27 2015**

Issuer	Issue Amt US\$ mn	Currency of issue
Export-Import Bank of India	500	USD
IDBI Bank Ltd/DIFC Dubai	350	USD
Yes Bank Ltd	210	INR
CLP Wind Farms India Pvt Ltd	90	INR
Credit Agricole Corporate & Investment Bank SA	72	INR
Hindustan Powerprojects Pvt Ltd	59	INR
International Finance Corp	49	INR
European Bank for Reconstruction & Development	40	INR
International Bank for Reconstruction & Development	26	INR
Kommunalbanken AS	5	INR

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

## USAID to help deploy Green Bonds

In June 2015, the US Agency for International Development (USAID) signed a memorandum of understanding (MOU) to provide IIFCL Asset Management (IAMCL) to provide technical assistance for increasing environmental investments in the country by US\$655mn. As part of the agreement, USAID will help IAMCL in developing new financing mechanisms including the creation of Green Bonds and infrastructure debt fund-mutual fund worth US\$655mn.

## Innovation with Green Masala bond

Even within the Green Bonds market, we are seeing further innovation. In August, IFC raising 3.15bn rupees, issuing the first Green Bond in the offshore rupee market, or a Masala bond, which was listed on the London Stock Exchange's Main Market. The proceeds were in turn fully invested in Green Bonds issued by India's Yes Bank, whose proceeds had gone towards energy efficiency and renewable energy projects across India. The Yes Bank green bond was sold in a private placement, with IFC as the sole investor. Not only was this the first green Masala bond, but it was also the first time the IFC had made an investment in an emerging market Green Bond. The IFC bond was part of a US\$3bn offshore rupee bond program, under which IFC has issued over US\$1.66bn in bonds in a range of tenors.

## EMs outside of Asia getting increasingly involved

Outside of Asia, countries like South Africa, Brazil, Mexico, Peru, Latvia, and Estonia have all begun issuing Green Bonds. The issuers also span a diverse spectrum ranging from Brazilian food processor BRF, to Mexico's state-owned development bank Nacional Financiera SNC, to the City of Johannesburg.

**Table 32: All bonds issued by Emerging Markets ex-Asia (through November 27 2015)**

Issuer	Amt. Issued US\$ mn	Country	Issue Date	Maturity	Currency
Industrial Development Corp of South Africa Ltd	577	South Africa	19-Oct-12	19-Oct-17	ZAR
BRF S.A.	545	Brazil	29-May-15	03-Jun-22	EUR
Nacional Financiera SNC	500	Mexico	05-Nov-15	05-Nov-20	USD
Nedbank	338	South Africa	01-Aug-12	01-Aug-17	ZAR
Energia Eolica SA	204	Peru	18-Dec-14	30-Aug-34	USD
City of Johannesburg South Africa	137	South Africa	09-Jun-14	09-Jun-24	ZAR
Latvenergo AS	85	Latvia	10-Jun-15	10-Jun-22	EUR
Nelja Energia AS	66	Estonia	02-Jun-15	02-Jun-21	EUR

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

\*Issued through Cayman Islands subsidiary Anstock II Ltd.

Credit rating refers to S&P rating

## Islamic finance, green "sukuk" opportunities

Green sukuk are another potential area to expand issuance. Sukuk differ from traditional bonds in that there is sharing of risk and profit between the lender and the borrower. In 2014, Malaysia's Khazanah (sovereign wealth fund) raised US\$27mn from issuing the country's first SRI "sukuk" - Sharia-compliant bonds to fund socially responsible projects. (Source: RAM Ratings). The Saudi Arabia-based Islamic Development Bank has also indicated that it may issue green sukuk bonds that are compliant with religious law.

Separately, the UAE are also considering issuing their first green "sukuk" in 2015, according to press sources (Reuters, ArabianBusiness). The World Bank and Dubai Supreme Council of Energy (DSCE), which oversees energy planning, have been holding discussions to build a framework for this. If issued, these would be the world's very first Sharia-compliant bonds financing green energy projects. Although still a nascent segment, the emergence of green bonds in Islamic finance is likely to create profitable future opportunities for investors, in our view.

## Focus on impact reporting

As the Green Bond market matures, investors have been looking for increased transparency regarding where the proceeds are going, and what exact environmental benefits are being achieved. The Green Bond Principles already recommend annual updates regarding projects and beneficial impact, while 2<sup>nd</sup> party reviews and opinions have been an additional way to assure green-ness of the bonds.

### SSAs at forefront of impact reporting

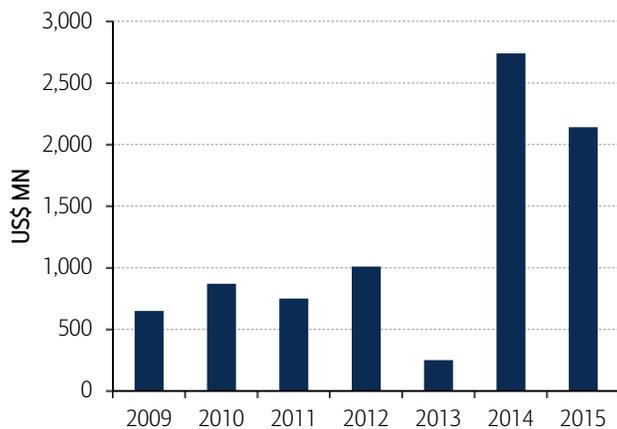
In March of this year, several multilateral development banks, which are the largest single issuer of Green Bonds, issued a working paper called “Working towards a harmonised framework for impact reporting.” Written by the African Development Bank (AfDB), European Investment Bank (EIB), International Finance Corporation (IFC), and the World Bank (IBRD), the white paper aims at creating standardized guidelines to measure and report impact. Issuers are recommended to use a limited number of core predictors including:

- Annual energy savings (EE)
- Annual Greenhouse Gas (GHG) emissions reduced or avoided (EE and RE)
- Annual renewable energy produced (RE)
- Capacity of renewable energy plant(s) constructed or rehabilitated (RE).

### World Bank releases impact report

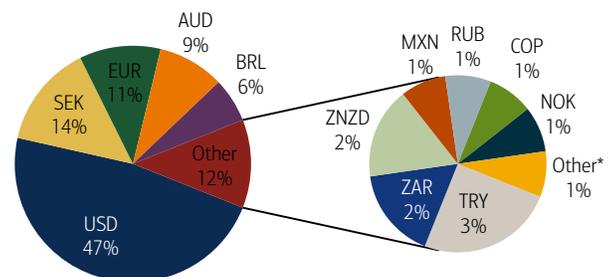
The World Bank, which is one of the largest issuers to date with more than 100 Green Bonds in 18 currencies, adding up to US\$8.4bn, released its latest impact report on the use of proceeds. The report gives details on 77 projects funded by Green Bonds, along with amount allocated, with expected or achieved outcomes. The projects span from renewable energy and energy efficiency, to urban transit financing, to waterways.

**Chart 77: World Bank Bond Issuance by Fiscal year**



Source: World Bank

**Chart 78: World Bank Bond Issuance by Country**



Source: World Bank

\* HUF, PLN, MYR, CAD, INR and JPY

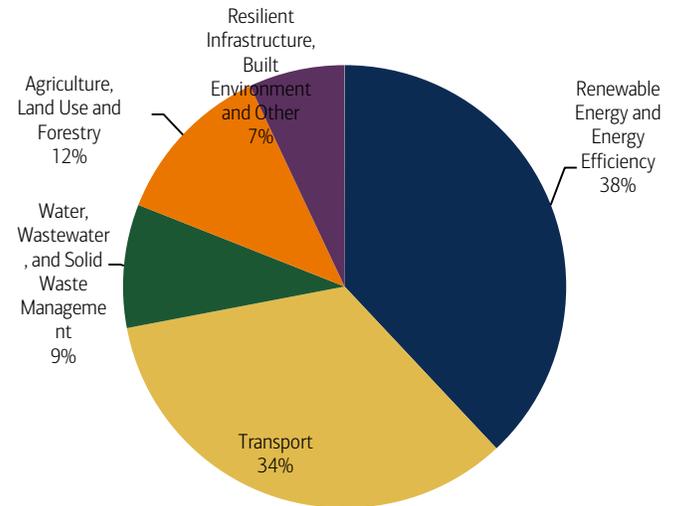
The World Bank has 80 Green Bond eligible projects with US\$14bn in commitments, with disbursements commenced for 77 of the projects in 24 countries. US\$5.3bn in Green Bond proceeds are supporting the financing of the disbursements. This leaves the pipeline of undisbursed commitments to eligible projects to be US\$8.3bn.

**Table 33: Commitments by Sector**

Amounts in Eq. US\$ billion (may not add up due to rounding)	Committed		Total	Allocated & Outstanding
	Mitigation	Adaptation		
Renewable Energy and Energy Efficiency	5.2	0	5.2	2.7
Transport	4.6	0	4.6	1.1
Water, Wastewater, and Solid Waste Management	0.2	1.1	1.3	0.6
Agriculture, Land Use and Forestry	0.4	1.1	1.6	0.4
Resilient Infrastructure, Built Environment and Other	0.3	0.7	1	0.7
<b>Total</b>	<b>10.7</b>	<b>3</b>	<b>13.7</b>	<b>5.4</b>
	78%	22%	100%	

Source: World Bank

**Chart 79: Commitments by Sector**



Source: World Bank

The world measures and reports beneficial environmental impact on each of the 77 projects, with examples summary impact including:

- US\$1.5bn commitments to nine renewable energy projects is expected to result in 2,284 MW of renewable energy capacity<sup>1</sup> – equivalent to the total installed capacity of Panama in 2010.
- US\$3.5bn committed to improve public transportation in 30 cities in emerging countries. In China, seven of these projects totaling US\$1.1 billion increase ridership by 680,000 passengers per day.

**Table 34: Sample list of World Bank Green Bond by Renewable Energy and Energy Efficiency Projects**

Project name (number   year/s loans approved) and description	A/M	Project life	Annual energy savings MWh	Annual energy produced MWh	Target Results		Other results	Committed US\$ mil	IBRD share	Allocated US\$ mil
					Renewable capacity added MW	Annual GHG emissions avoided tons of CO2 eq.				
Belarus - Biomass District Heating (P146194   FY14): increase energy efficiency in district heating systems and replace natural gas with wood biomass as a renewable energy source.	M	20	236,000	1,660,000	106	420,000	Cumulative over 5 years: 1,180,000 MWh energy savings from efficiency investments. 2,100,000 tons of CO2 eq. emissions reduced.	90	100%	3.6
China - Beijing Rooftop Solar Photovoltaic Scale-Up (Sunshine Schools) Project (P125022   FY13): promote renewable energy in 1000 schools and other educational institutions.	M	20	na	100,000	100	89,590	10 to 15 % of the schools annual power use provided by renewable sources. 650,000 students in 1,000 schools benefit.	120	50%	7.6
China - Eco-Farming Project (P096556   FY09): promote sustainable farming systems and reduce greenhouse gas emissions (from methane and burning coal and firewood) benefiting rural communities with biogas systems.	M	20	na	-	-	900,000	400,000 - 500,000 rural households benefit with cleaner biogas-based cooking and heating systems.	119.8	27%	119.8
China - Energy Efficiency Financing (P084874   FY08, FY12): promote energy conservation in China's industrial sector supporting intermediary loans for energy efficiency projects in medium and large-sized manufacturing companies.	M	20	21,807,900	na	na	6,490,000	2,666,000 tons of coal eq. (tce) annual energy savings (assuming 150 subprojects)	300	45%	253.8

**Table 34: Sample list of World Bank Green Bond by Renewable Energy and Energy Efficiency Projects**

Project name (number   year/s loans approved) and description	A/M	Project life	Target Results				Other results	Committed US\$ mil	IBRD share	Allocated US\$ mil
			Annual energy savings MWh	Annual energy produced MWh	Renewable capacity added MW	Annual GHG emissions avoided tons of CO2 eq.				
India - Power System Development Project IV (P101653   FY09): expand transmission infrastructure resulting in decreased CO2 emissions through efficiency gains and transferring surplus hydro energy to power deficit regions.	M	20	8,699,000	na	na	~	Reduced transmission losses equivalent to between 526-993 MW. 107,000 circuit kilometers of increased transmission capacity. 68,000 GWh power exchange growth between regions.	400	16%	400
India - Rampur Hydropower Project (P095114   FY08): scale-up access to renewable energy through construction of a run-of-the-river hydroelectric scheme.	M	30	na	1,770,000	412	1,407,700	-	400	60%	400

Source: World Bank

**Table 35: Sample list of World Bank Green Bond by Other Resilient Infrastructure projects**

Project name (number   year/s loans approved) and description	A/M	Other results	Committed US\$ mil	IBRD share	Allocated US\$ mil
India - Eastern Dedicated Freight Corridor - II (P131765   FY14): increase the capacity and quality of freight rail service.	M	1,133 kms of new freight-only rail. Axle-load limit raised from 23 to 25 tons increasing speeds. 12.8 million tons of CO2 eq. emissions reduced over a 30 year period.	1100	67%	0.3
Brazil - Greening Rio de Janeiro Urban Rail Transit – Additional Financing (P111996   FY12): provide a more efficient and cleaner suburban rail transportation system.	M	60 new trains and upgraded infrastructure to shorten travel times. Bicycle and parking facilities in select stations. 70,200 additional passengers served per day. 34,000 tons of CO2 eq. reduced annually by project end.	600	73%	205.4
Morocco - Solid Waste Sector DPL (P104937   FY09): enhance the governance of the solid waste sector.	M	Regulatory reforms leading to solid waste management programs in 11 municipalities. 735,000 tons of CO2 eq. emissions reduced annually (methane gas capture). 30% of waste disposed in sanitary landfills and 21 dumpsites closed or rehabilitated.	111.8	100%	111.8
Philippines - Rural Development (P132317   FY15): improve the resilience of small-scale farmers and fishermen to climate change by helping them recover and increase income-generating activities and strengthening the conservation of coastal and marine resources.	M	Increase incomes of about 1.9 million farmers and fishermen and the value of their products.	501.3	75%	45.1
Mexico - Climate Change Development Policy Loan (P110849   FY08): mainstream climate change considerations into public policy.	Both	Climate-informed public policies, including: 642,000 hectares reforested. 6,000,000 tons of CO2 eq. emissions reduced annually due to reforestation. Domestic carbon pricing strategy developed. City and state climate action plans developed.	501.3	100%	501.3

Source: World Bank

## US\$50-60bn issuance likely in 2016

Our base case scenario is for US\$50-60bn in Green Bond issuance in 2016, which implies a CAGR of 10-30%. This would be in line with growth in 2015, which is admittedly conservative. Part of this is driven by macro headwinds for the broader fixed income market, which has suffered on the back of QE. In 2015, annualized return for global bonds is -3.7%; 30-year US treasury is -4% YTD; equities have become a yield proxy as there are now US\$17tn of bonds yielding <1%; flows to fixed income funds are now in negative territory for the year. Globally we are now at the lowest interest rates in 5000 years, and this trend is likely to persist through 2016 as the ECB are likely to continue easing.

## [Global Credit Strategy Year Ahead: 2016: It's complicated 23 November 2015](#)

### **Bull case scenario for US\$80-90bn**

In a bull case scenario, we could see US\$80-90bn issuance, which would imply a doubling versus 2015. For this, China and India would adopt more favourable regulatory measures for green financing, which may include a more clearly defined framework, tax incentives, guarantees or credit backstops. This would catalyse issuance in the region, which is still in its nascent stages. Corporates, which are already a powerful force in Green Bonds, will need to ramp up issuance. For some, they may have held back issuance on the back of incremental cost or meeting more stringent standards on reporting.

### **Bear case scenario for flat at US\$45bn**

In a bear case scenario, growth would be flat at around US\$45bn. This assumes that growth drivers fail to materialize. We do not see significant downside from here given the growth in investor appetite and existing regulatory tailwinds.

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

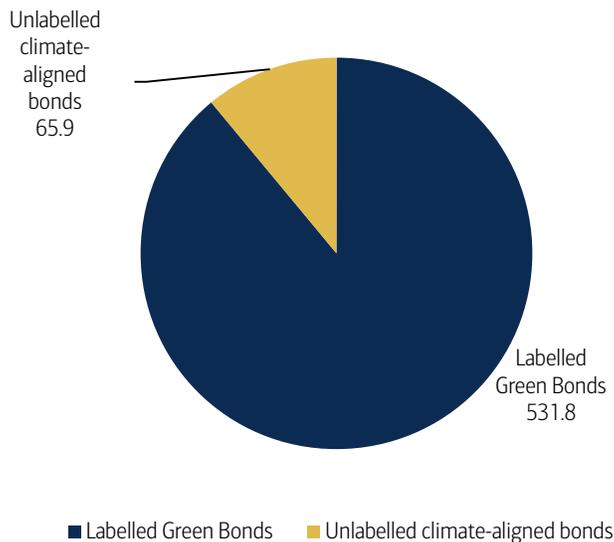
## Climate themed bonds balloon to US\$600bn

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 \$597.7bn as of June 10 2015, representing a 20% increase the previous year. Climate-themed bonds include around 1,400 companies with over 95% of their revenues coming from climate-aligned assets. The universe is comprised of 2,769 bonds from 407 issuers, spanning six climate themes: Transport, Energy, Buildings and Industry, Agriculture and Forestry, Waste and Pollution, and Water.

### Green Bonds have been major driver of growth

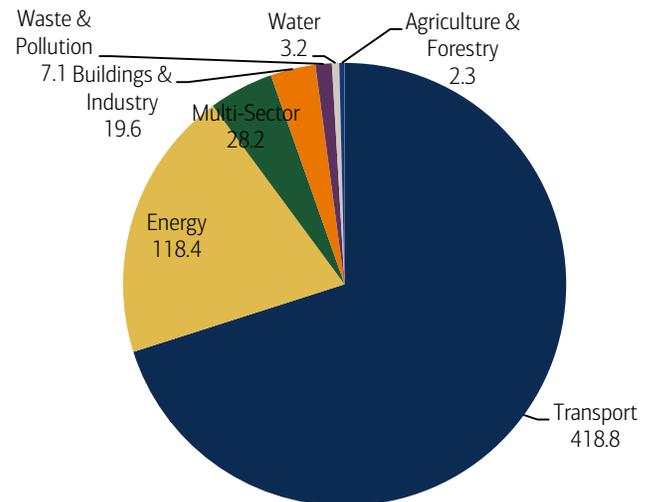
The US\$95bn growth in the climate-aligned bond universe has been driven by the growth of Green Bonds, which grew by an additional US\$30.6bn during the same period, or making up 32% of the growth. At the time of publication, Green Bonds made up US\$65.9bn of the climate-aligned bonds universe, or only 11%.

**Chart 80: Climate-aligned bond universe \$ bn (through June 10 2015)**



Source: CBI HSBC

**Chart 81: Transport continues to be the dominant theme (US\$ bn, through June 10 2015)**

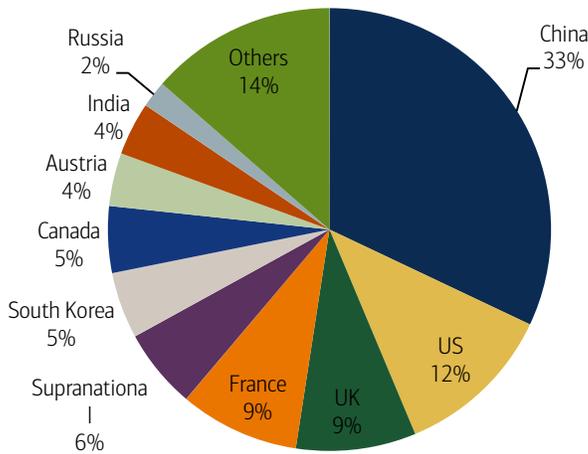


Source: CBI HSBC

### Transports and China make up majority of climate bonds

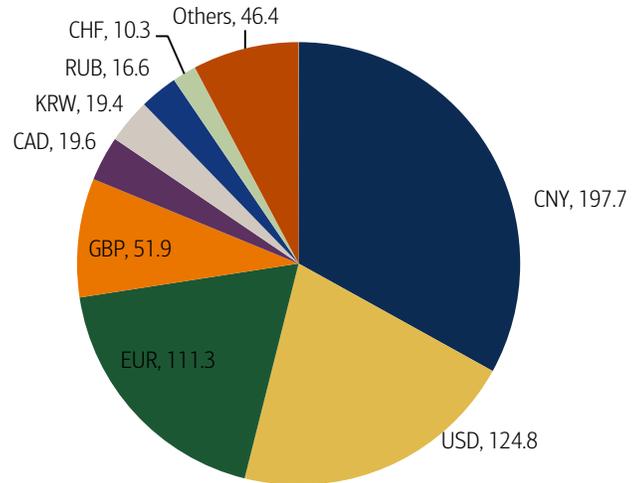
Within the universe, Transport continues to make up the largest proportion of the universe at US\$418.8bn, 95% of which are rail companies that tend to be backed by state entities. Energy is the 2<sup>nd</sup> largest at US\$118.4bn, including renewable energy such as hydropower, wind, solar, bioenergy, geothermal and nuclear. China (33%) and Chinese Yuan (US\$197.7bn worth) denominated bonds also have a much heavier weighting versus the Green Bonds universe. This is due to the high volume of rail and hydro bonds originating from China.

**Chart 82: Top 10 countries for climate aligned bonds**



Source: CBI HSBC

**Chart 83: Currency breakdown US\$ bn**

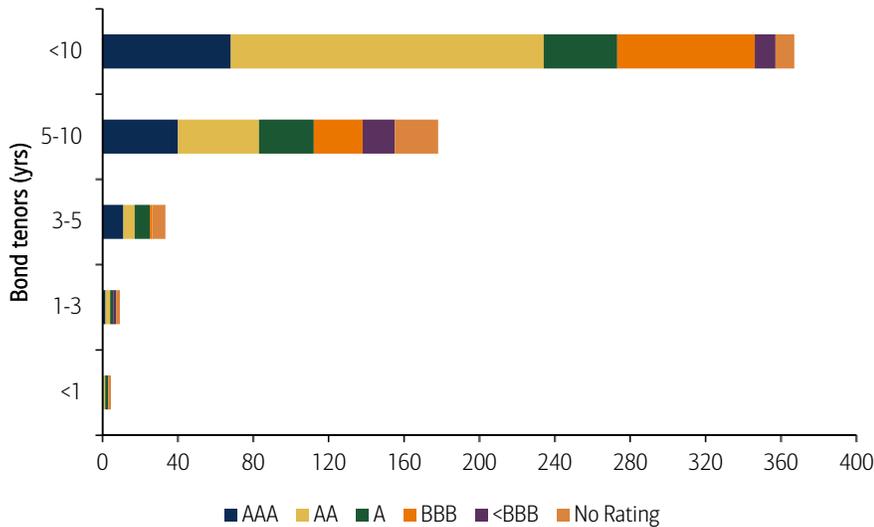


Source: CBI HSBC

**Majority are investment grade, and long-dated**

Similar to previous years, the great majority of the bonds are investment grade, at US\$523.5bn, or 88% of total. At the same time, most climate bonds fall in the 10Y+ category, which reflects the long-term nature of certain infrastructure projects such as rail. This is significantly higher than for Green Bonds, which are still predominantly in renewable energy and energy efficient buildings that tend to have a shorter time horizon.

**Chart 84: Bond tenors of Climate-aligned bonds**



Source: CBI HSBC

**Green mortgages, high-efficiency homes**

Another nascent market is green mortgage-backed securities that allow individuals to invest in energy efficiency improvements for their homes. Thus, a prospective homebuyer would take out a regular mortgage, but with additional capital required for

energy efficiency improvements to be done on the home. This would result in energy savings over the life of the loan that exceed the cost of the green component of the loan itself.

#### **Enhanced collateral and faster payback possible**

Energy efficiency can enhance a home's value and lower energy costs can make it easier for homeowners to repay the mortgage (source: HUD). Greater disclosure of energy efficiency could increase the value of the home, the underlying collateral for the mortgage loan. Moreover, homeowners spending less on energy consumption are left with more income to pay off their loans. This positive knock-on effect could potentially be accounted for in the risk when underwriting a mortgages leading to an enhanced credit rating and a lower rate for the home buyer.

#### **YieldCos: cheaper capital with green assets**

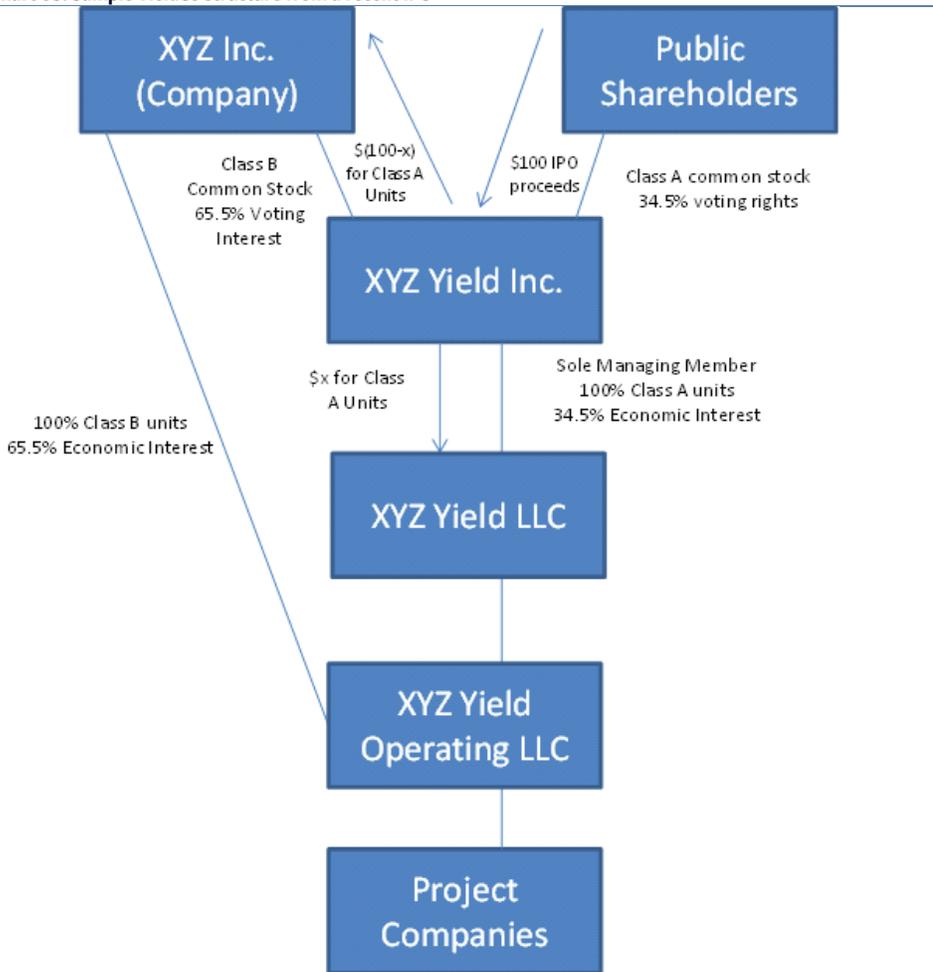
On the equity side of the renewable energy capital space, YieldCos have been another transformational development, gaining traction in the past 12 months as a cheaper way of financing. YieldCos are financial roll-ups of long-term contracted power-generating assets that are primarily renewable. The parent 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: Illuminating key characteristics as valuation yields set to compress 29 October 2015](#)

#### **YieldCos are heavily contracted dividend growth vehicles**

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 85: 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.

### YieldCos claim temporary tax protection via depreciation

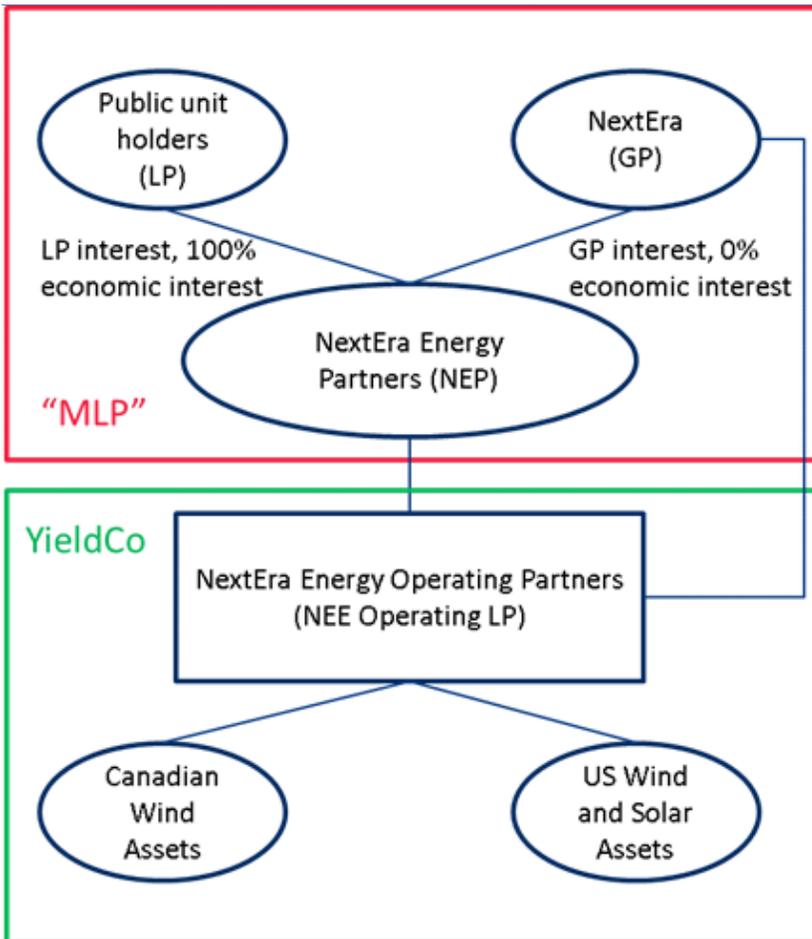
YieldCos are not legislatively tax protected at the corporate level like MLPs. But, YieldCos often have 10+-year tax shields as a result of accelerated depreciation for tax purposes through the Modified Accelerated Cost Recover System (MACRS). Accelerated depreciation tax treatment is not exclusive to 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.

## 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).

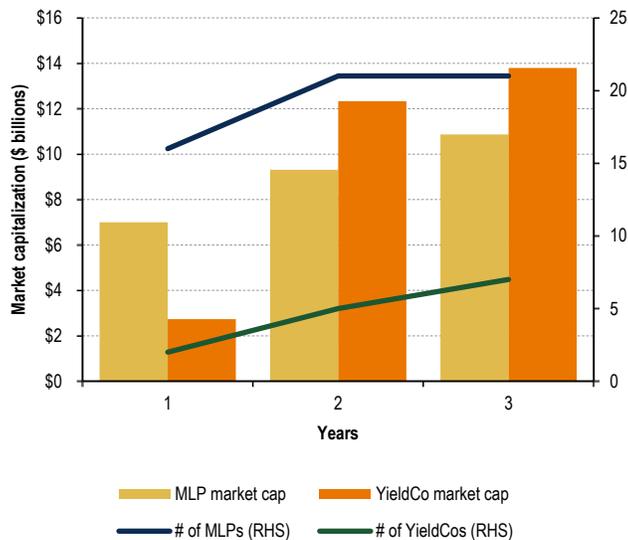
Chart 86: NextEra YieldCo vs MLP



Source: BofA Merrill Lynch Global Research

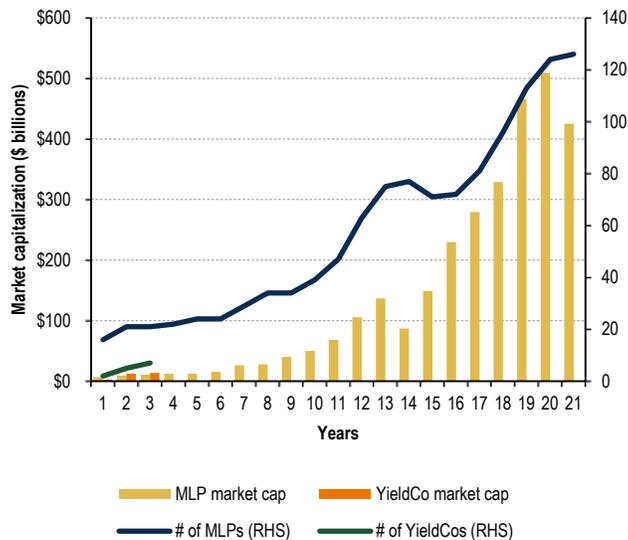
In our view, commonalities between YieldCos and MLPs are strong enough to highlight the growth potential YieldCos may have as an equity class. The sector's market capitalization has demonstrated strong growth in its early years similar to that of MLPs. As noted, we believe the market for underlying assets 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 87: 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 88: 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 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.

### YieldCos not subject to the political risk surrounding MLPs

There has long been discussion in Washington DC that the tax protected status of MLPs could be rescinded due to loss in tax revenues. Because YieldCos do not benefit from any special tax designation, there is little risk of political withdrawal, in our view. Should MLPs lose their tax benefited status (a position we believe is unlikely), YieldCos could benefit from the substitution effect.

### 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.

### **Not all Yieldcos are the same**

YieldCos are differentiated based on asset type and geography, contract duration, payout ratio, portfolio size, ROFO opportunity, and longer-term growth visibility. There are several YieldCos in the power space. Selected names include: NRG Yield (NYLD), NextEra Energy Partners (NEP), Abengoa Yield (ABY), Pattern Energy Group (PEGI), 8Point3 Energy Partners (CAFD), Terraform Power (TERP), and Terraform Global (GLBL). NRG Yield and NEE Partners come from the electric utilities sector. Abengoa and Pattern come from engineering and construction firms that focus on power and contracted infrastructure. 8Point3 and the Terraform family's sponsor are solar and wind developers. YieldCos are differentiated based on asset type and geography, contract duration, payout ratio, portfolio size, ROFO opportunity, and longer-term growth visibility.

### **Credit-neutral to parent**

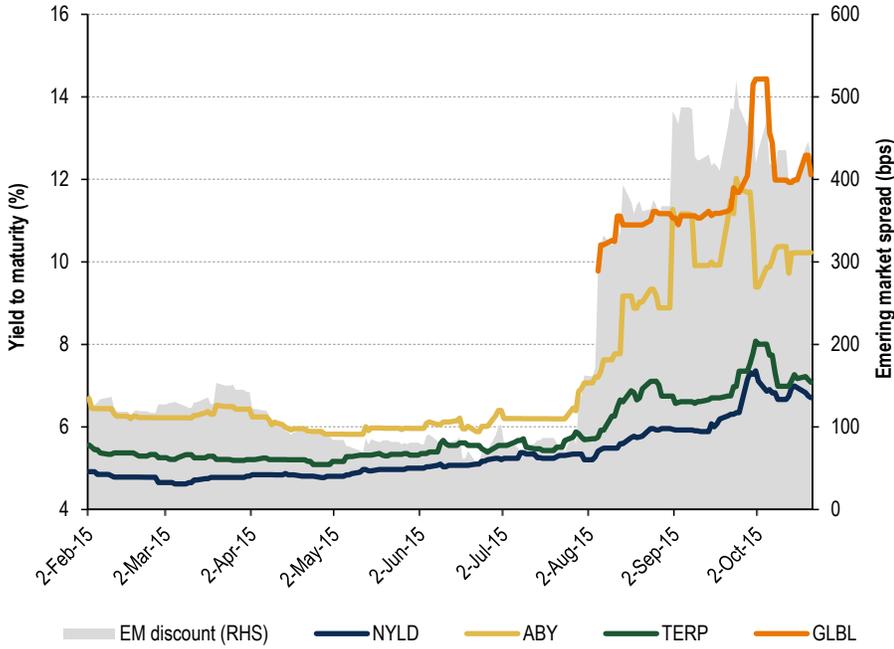
The impact of YieldCos to the parent issuer is dependent on the deployment of the proceeds. While raising low-cost capital is positive for a company's credit quality, YieldCos permanently transfer a portion of the parent's most reliable cash-flow-producing assets and therefore no longer fully support the parent's credit profile. This effectively results in the structural subordination of the debt of the parent company to the debt of the new subsidiary. If a significant proportion of the IPO proceeds are used for debt reduction or credit-accretive capital investments, the impact would be credit neutral. Ratings agencies have put companies under negative outlook for creating yield-oriented structures and other activities that cause structural subordination of corporate level, but this is predicated on the overall financial policy of the issuer (source: Moody's).

## **YieldCos are issuing Green Bonds: increasing use of corporate-level debt to finance dividend growth**

Use of corporate leverage is a new and growing phenomenon in the sector. The two principal ways in which recourse debt is deployed are acquisition financing, and project debt or tax equity refinancing. We have observed both uses, although companies have demonstrated a preference for the former. The primary advantage in both cases is the ability to generate higher levels of near-term CAFD since corporate debt is typically non-amortizing. Downsides are the need to refinance recourse leverage at term, and the treatment of its non-amortizing principal balance in determining equity value.

In July 2014, NRG Yield became the first YieldCo to issue a Green Bond when it placed US\$500mn of 5.375% notes due 2024. Terraform Power and Terraform Global, YieldCos of SunEdison, followed suit in 2015.

**Chart 89: Yield to maturity on publicly traded YieldCo corporate bonds**

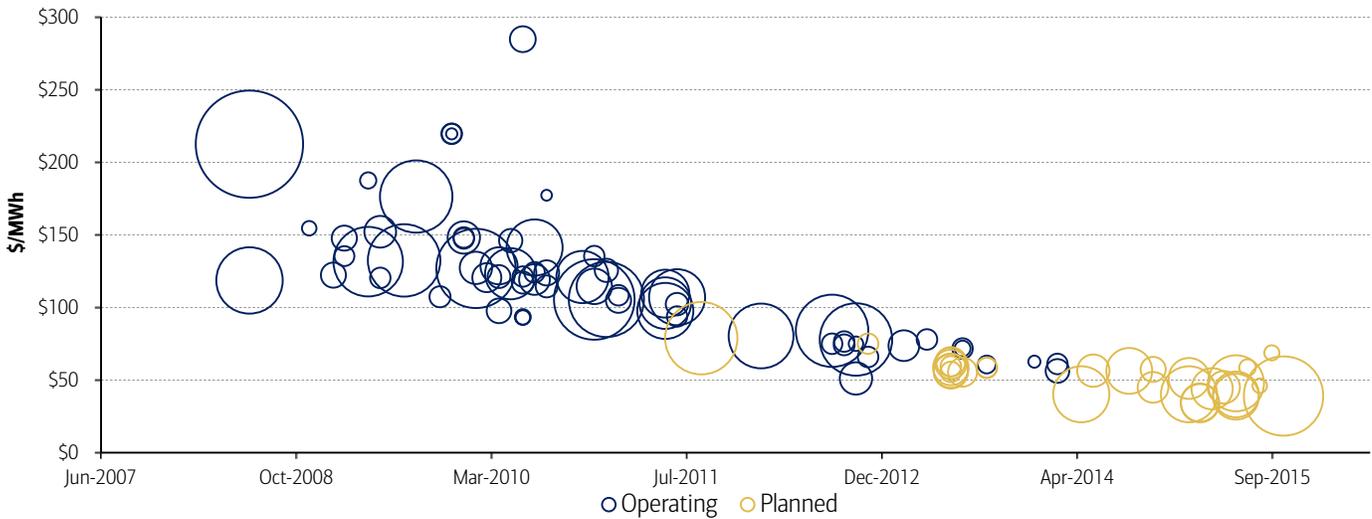


Source: BofA Merrill Lynch Global Research, Bloomberg

**YieldCo influence on a changing renewables landscape**

Key factors in the evolution of YieldCo-eligible assets include the availability of low-cost capital, falling equipment and installations costs, low natural gas prices, and dwindling subsidies. For utility-scale assets, the tension between lower offtake pricing versus falling development costs will determine the impact on future returns. Cost of capital is a key consideration on both sides of the coin. Developers acknowledge that the availability of cheap capital through the YieldCo model has put downward pressure on offtake pricing for new projects. At the same, it has helped lower the overall cost of development as a mitigant against return deterioration.

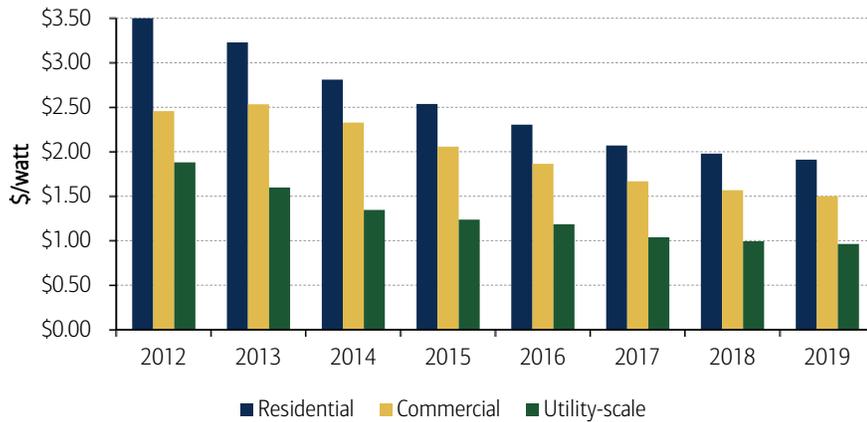
**Chart 90: Low gas, cheap capital through the YieldCo model, and declining input costs have driven utility-scale solar PPA prices lower**



Source: Berkeley Labs

Deciphering the relative impact of low gas, cheap capital, and falling cost on utility-scale solar PPAs in particular is difficult. Ultimately, the outcome is more competitively priced and long-term contracted power versus fossil fuel alternatives. Eventually, this may serve to increase the addressable market for YieldCo-eligible assets. Cost declines must keep pace with offtake price declines in order to support returns that sustain business models across the value chain. Post contract value assumptions are also important factors in this discussion.

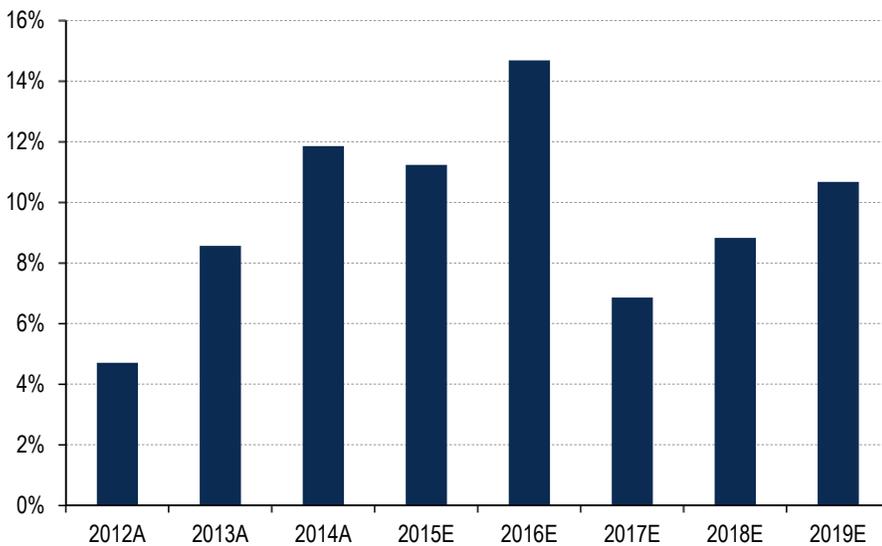
**Chart 91: Solar installation costs by segment are expected to continue falling**



Source: BofA Merrill Lynch Global Research estimates, HIS/SolarBuzz

Another key factor influencing future returns is the pending stepdown in the 30% Investment Tax Credit (ITC) to 10% at the end of 2016, as well as the eventual sunset of the wind production tax credit (PTC). The implication is that developers will have a void in the capital stack to fill with either some variety of project debt or greater use of traditional equity or corporate leverage. The resulting impact on returns can be phrased either as an increase in levelized electricity price needed to generate the same level of return, or a decline in returns at the same level of offtake price.

**Chart 92: Historical and projected unlevered return estimates for rooftop solar assets**



Source: BofA Merrill Lynch Global Research estimates, company reports

Lawrence Berkeley National Labs estimates that a 30% ITC is worth \$20-30/MWh relative to 2015 US utility-scale solar PPA prices. In other words, in order to earn a comparable return on an asset in a 10% ITC environment versus today's 30% ITC environment, offtake pricing needs to be \$60/MWh versus the \$40/MWh level for PPAs

struck in CY2015. Our own analysis focuses on IRR compression that results from continued declines in offtake pricing as the capital stack changes by virtue of the tax credit stepping down. In the rooftop segment, we anticipate project IRRs will compress to 2013 levels in the year after the expected reduction, but recover quickly thereafter. We note there is optimism around a potential extension as well.

## Potential to expand GBP to social and sustainability bonds

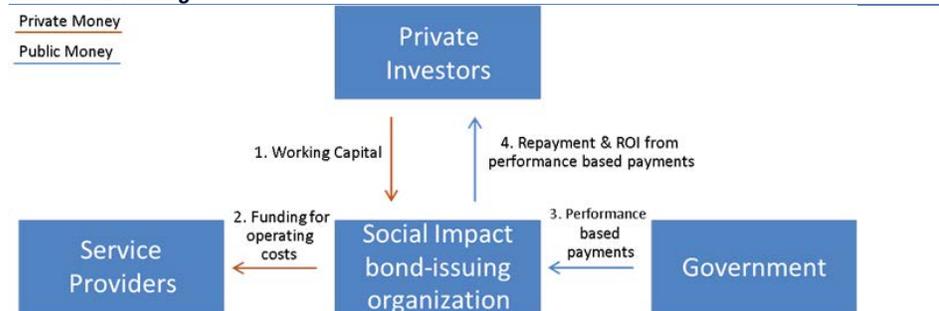
Much of the standardization in the past few years has been for environmental solutions such as Green Bonds and climate-themed bonds. In July, Credit Agricole, HSBC, and Rabobank published Social Bond and Sustainability Bond Appendix (SSBA), which is an official proposed amendment the Green Bond Principle to widen its scope. While some of the outcome can be more subjective than climate uses, there seems to be significant interest already. For instance, in January 2015, Instituto de Crédito Oficial sold a €1bn social bond aimed at generating economic growth in Spain.

## 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 93: 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).

# Who invests in Green Bonds

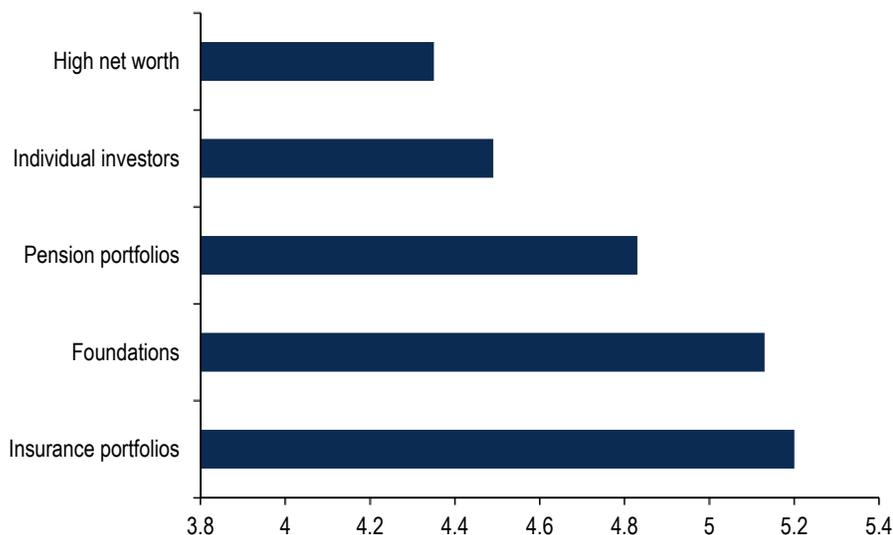
## Breaking down the Green Bond interest

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 94: 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).

**Notable divestments pledges so far in 2015**

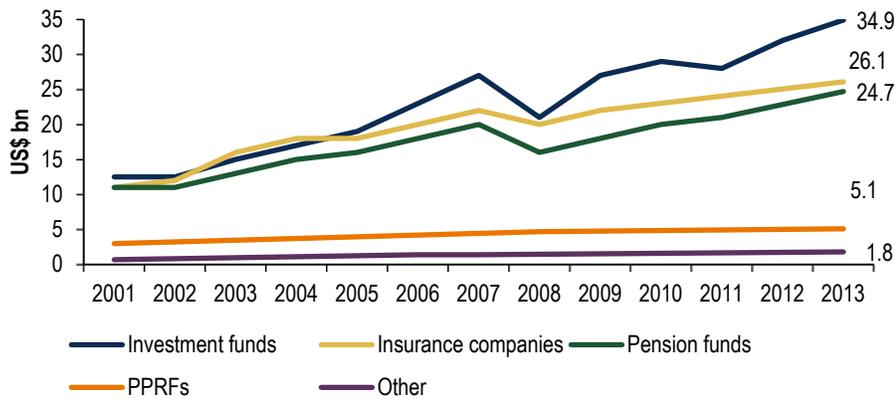
AXA – \$1tn AuM, €500mn divestment from coal by year-end  
 Allianz – \$2tn AuM, divestment from companies w/30% exposure to coal  
 AP2 Pension Fund of Sweden - \$34bn AuM  
 Government Pension Fund of Norway - \$900bn AuM  
 Nordea - \$230bn AuM, €100mn divestment from 40 coal companies  
 Rockefeller Brothers Fund - \$860mn  
 University of California - \$98bn endowment  
 University of Oxford - \$2.6bn endowment  
 CalPERS & CalSTRS - \$476bn combined AuM (source: Arabella Advisor, press reports)

- 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 95: 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 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 November 2015, PRI has accumulated 1,380 signatories with US\$59tn 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.

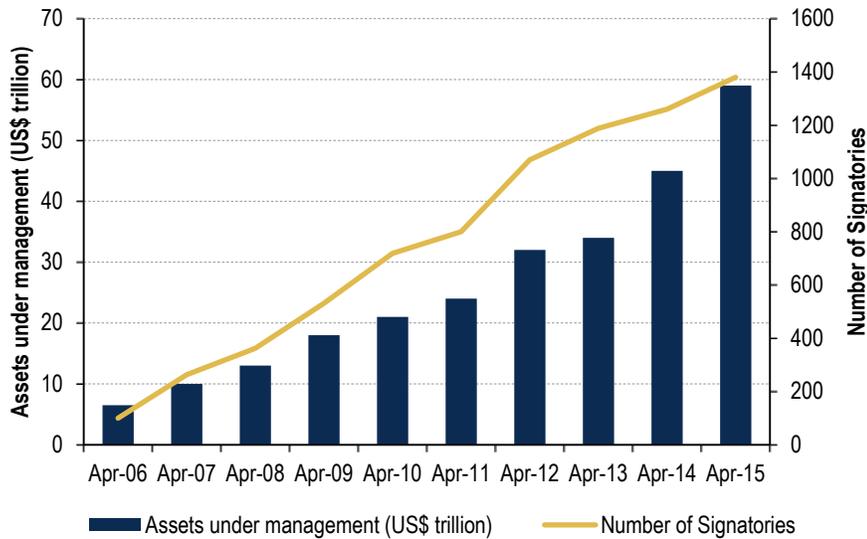
### Exhibit 22: UN PRI Progress



Source: UN PRI

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 96: Growth of the PRI Initiative**



Source: UNPRI

**Growth of Green Bond-specific funds**

There have been a many public pledges over the past 12 months from underwriters, issuers, and investors to grow the Green Bond market. Several investors have made explicit commitments to buy Green Bonds directly. During 2015, we have also seen significant 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 36: Green Bond Funds**

BBG Ticker	Name	Description
LUXIOEI LX Equity	SEB Green Bond Fund	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.
CGAFX US Equity	Calvert Green Bond Fund	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.
NRDSDV FP Equity	Natixis Asset Management Mirov	Mirova Green Bond - Global is an open-end fund registered in France. The Fund's objective is to outperform "green bonds". The Fund will invest 70-100% of its assets in debt instruments favoring energy and ecological transition and labeled green bonds by Mirova.
DBSSDBF SP Equity	Nikko AM Shenton World Bank Gr	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.
AVASDBS SP Equity	Aviva Nikko AM Shenton World B	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.
NKWGRAU LX Equity	Nikko AM World Bank Green Fund	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".
SSGBIEH LX Equity	State Street Global Advisors S	State Street Global Green Bond Index Fund is an open-end fund incorporated in Luxembourg. The Fund's objective is to seek to track as closely as possible the performance of the Barclays MSCI Green Bond Index. The Fund invests in the Green bonds which are fixed income securities and may include government and government related bonds
MIIX US Equity	Praxis Intermediate Income Fund	Praxis Intermediate Income Fund is an open-end fund incorporated in the USA. The Fund's objective is current income. To a lesser extent, it seeks capital appreciation. The Fund invests primarily in fixed-income securities of all types, consistent with the Fund's social responsibility criteria, including corporate bonds and notes, and U.S. Government agency obligations.
PRFIX US Equity	Parnassus Fixed Income Fund	Parnassus Fixed Income Fund is an open-end fund incorporated in the USA. It is a fundamental, U.S., intermediate, government/credit fixed-income strategy that invests principally in investment-grade debt securities including U.S. government obligations, corporate bonds and convertible bonds.
SPPGOBL SS Equity	SPP	SPP Gron Obligationfond is an open-end fund domiciled in Sweden. The Fund's objective is to reach a value growth over time. The Fund invests in bonds, which have clear effect on the environment and society. The fund invests primarily in fixed income securities denominated in GBP.
NA	Blackrock	ZIB 2US\$bn mandate to Blackrock

**Table 36: Green Bond Funds**

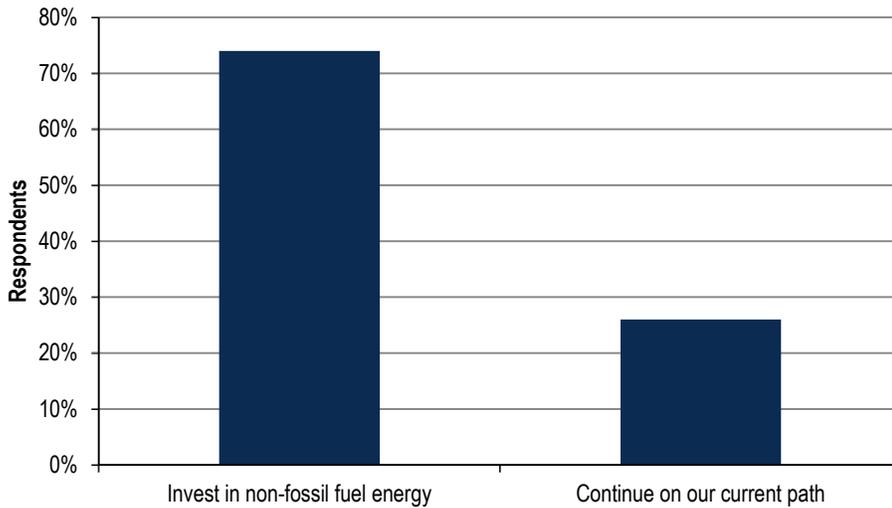
BBG Ticker	Name	Description
NEXTX US Equity	Shelton Capital Management	Shelton Green Alpha Fund is an open-end fund incorporated in the USA. The Fund's objective is to achieve a high level of long-term capital appreciation. The Fund invests at least 80% of its assets in U.S. stocks and ADRs in a proprietary universe of companies working to address important global green issues.
AXAPBID LX Equity	AXA World Fund Planet Bonds	AXA World Funds - Planet Bonds is an open-end fund incorporated in Luxembourg. The Fund's objective is to achieve a mix of income and capital growth. The Fund invests in a portfolio of transferable debt securities denominated in any freely convertible currencies issued by investment grade governments and institutions.

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).

**Chart 97: Millennials believe we must seize the energy opportunity**

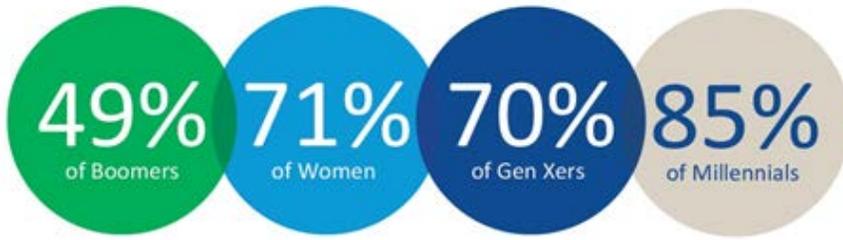


Source: American Progress

### Impact investing: key investment criteria

By age demographic, Millennials hold the strongest views vis-à-vis impact investing. Investors think environmental, social and political issues are an important part of their investment decisions – including 49% of Baby Boomers, 70% of Gen Xers, 71% of Women and 85% of Millennials.

**Exhibit 23: Percentage of investors that consider environmental, social and political issues an important part of their investment decisions**

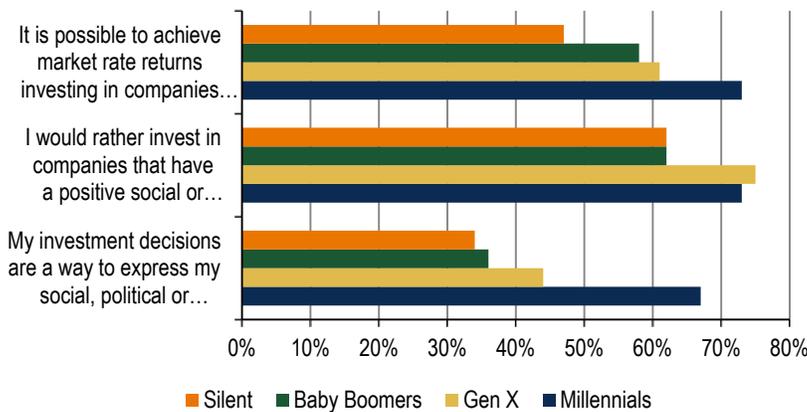


Source: US Trust

- 67% of Millennials said their investment decisions were a way to “express their social, political or environmental values”.
- 73% believe it is possible to achieve market rate returns on companies based on their “social or environmental impact” (source: US Trust).

Hence, in our view, this generation could be a key driver of impact investing. It also shows how Millennials are more aware of long-term thematic issues around the world and seek to “make the world a better place”, in our opinion.

**Chart 98: Investor attitudes to social impact investing**



Source: US Trust

**Individual retail investor base is growing**

Indeed we are seeing read-through of Green Bonds interest from individual retail investors. For instance, in August 2014, the World Bank issued a Step-Up Callable Green Bond sold exclusively to wealth management clients. This was the first time a US wealth management firm offered World Bank Green Bonds to US individual investors. It gave retail investors the opportunity to invest in environmentally friendly solutions through a high grade fixed income instrument. The AAA-rated bonds will pay a 2.32% coupon per year for the first five years and will mature on 27 August 2024, unless called earlier by the World Bank. The types of eligible projects include alternative energy installations, funding for new technologies that reduce greenhouse gas emissions, reforestation, watershed management and flood protection (source: MLWM).

**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).

# 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, potentially US\$35bn, could be new annual investment in renewable energy and energy efficiency catalysed by Green Bonds by 2020 (source: SE4ALL).

## Corporates want diversification in investor base

A common reason for corporate issuers to green-label their bonds is to diversify their investor base and attract more sustainability oriented investors. A growing number of investors want to align their investing policy with overall Corporate Social Responsibility policies. The UN's Principles for Responsible Investment now has 1,380 signatories, comprising investors with US\$59tn assets under management that incorporate ESG issues as part of their investment (source: UN PRI). ESG/SRI funds commonly have longer holding periods and less churn in their portfolios given their aim to create long-term value that benefits the environment (source: Mercer IRR Institute).

## High demand, oversubscription

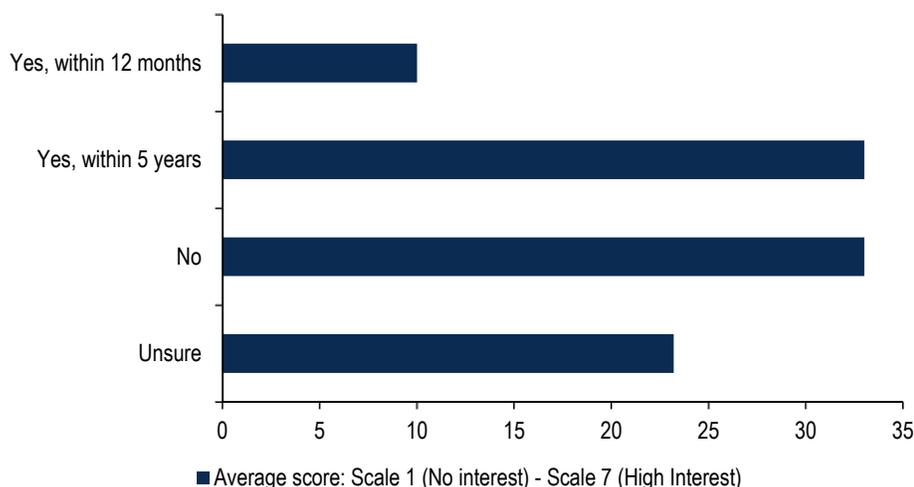
Green Bonds have experienced high demand from potential investors, most issuances have been oversubscribed.

- Agricultural Bank of China's (ABC) 2-year bond was 8x oversubscribed
- Yes Bank of India's inaugural bond was 2x oversubscribed
- Unibail-Rodamco SE's US\$1bn 10-year bond was 3.4x oversubscribed
- Iberdrola's US\$1bn 8.5-year bond 4x oversubscribed, despite only offering a 2.5% coupon, the lowest offered by a Spanish utility to date
- GDF Suez's US\$3.4bn dual-tranched Green Bond was 3x oversubscribed

## Potential for lower yields in the future

However, there is not necessarily a pricing advantage expected in the market according to a Euromoney survey of 40 large fixed income investors in 2015. Pricing of Green vs. non-Green bonds has been very similar, although we may see divergence within the next 5 years.

**Chart 99: Expectation of green bond pricing through secondary curve on a consistent basis**

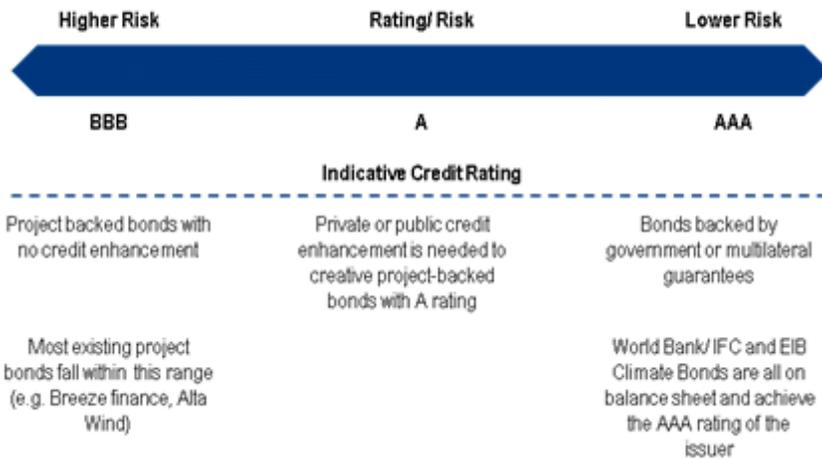


Source: Euromoney

## 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.

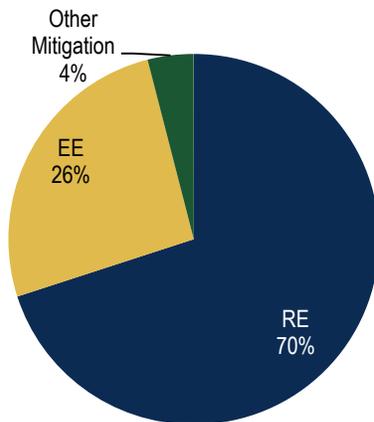
Chart 100: The spectrum of climate bonds



Source: Accenture Carbon Capital

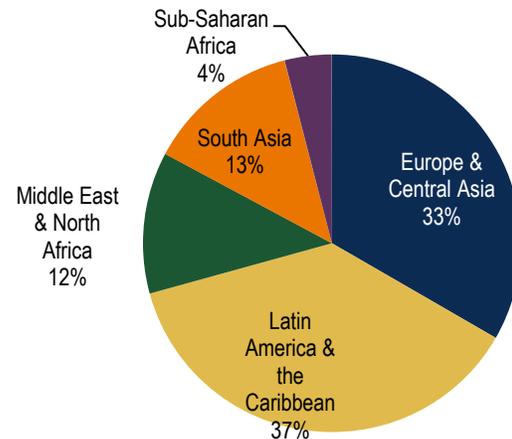
SSAs invest a significant proportion of their capital in emerging markets, and much of it is to fund smaller projects. The IFC, for example, allocated 66% of its FY15 commitments in emerging markets including Latin America, Africa, and South Asia (source: IFC).

Chart 101: IFC FY15 Commitments by Sector



Source: IFC

Chart 102: 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).

### 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 37: Progress on SE4All objectives**

Proxy indicator	OBJECTIVE 1 Universal access to modern energy services		OBJECTIVE 2 Doubling global rate of improvement of energy efficiency	OBJECTIVE 3 Doubling share of renewable energy in global energy mix
	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 38: Risks and barriers are heightened for institutional investment in emerging markets and developing countries**

<b>Market risks</b>	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
<b>Political risks</b>	Retroactive policy change risk	Change in regulatory or 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
<b>Technology risks</b>	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).

# Green Bond Index

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Section pertaining to BofAML Green Bond Index is written by Phil Galdi, Bond Index Research Analyst

[Bond Index Introductory Guide: Introducing the Green Bond Index 30 October 2014](#)

## Introduction of Green Bond indices

2014 was the year when benchmark indices came into fruition. Bank of America Merrill Lynch launched its Green Bond Index (ticker GREN) in October 2014. It currently has a market cap of around US\$45bn or around half of the total green bonds market. Bonds were filtered out of the index due to lack of ratings or failure to meet the minimum size requirements.

Several other Green Bond indices had also been launched, including S&P Green Bond Index, S&P Green Project Bond Index, and Barclays MSCI Green Bond Index and Solactive AG Green Bond Index. 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).

## Evolution of the index

The pace of net additions to the Green Bond Index over the last months was roughly on par with the March-May period (\$5.0bn vs \$5.4bn) as the index added 14 new issues, up from nine in the prior period. The Index closed August with a market cap just over \$45bn – up 12% versus three months ago and 52% YOY. The 12-month growth rate has steadily declined from its peak last October but remains in line with levels back in mid-2014. Most of the decline is attributed to the sharp slowdown in 1Q but lately the three month growth rate has remained above the \$5bn mark.

The Green Bond Index growth rate remains strong, but is still below peak levels.

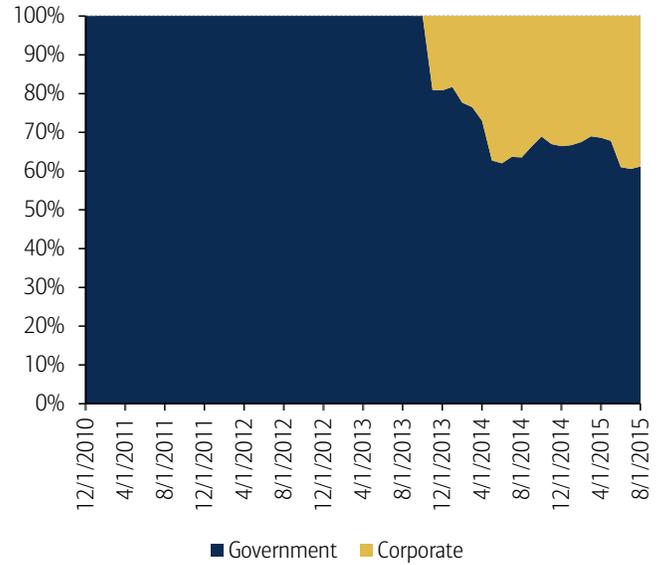
Corporate issuers continue to expand their presence in the green use of proceeds market. Of the 14 issues to enter the index over the last three months, ten were corporates that accounted for over two-thirds of the incoming face value. That boosted the corporate allocation to 39%, just eclipsing its prior high back in June 2014. It is also noteworthy that 12 of the 14 new additions were from ten issuers who made their debut in the index, including: ANZ, BRFSBZ (2 bonds), DLR, FVHSAM, GWNDLN, MS, SEK, STOCKL, TENN (2 bonds).

**Chart 103: Face value of net additions (USD MM)**



Source: BofA Merrill Lynch Bond Indices

**Chart 104: Index distribution between corporate and government issuers**

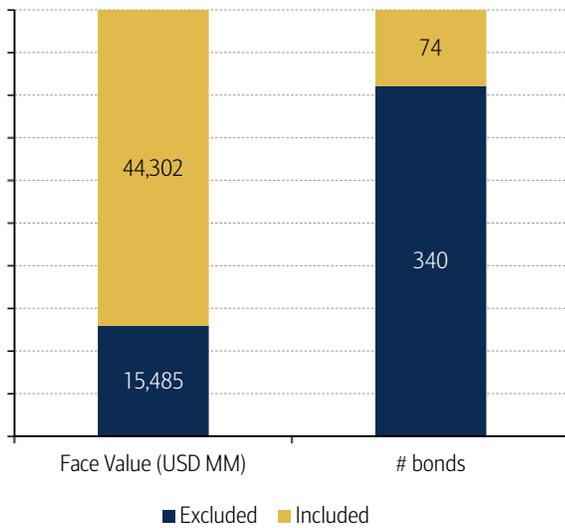


Source: BofA Merrill Lynch Bond Indices

2015 continues to see a proliferation of very small deals coming to market.

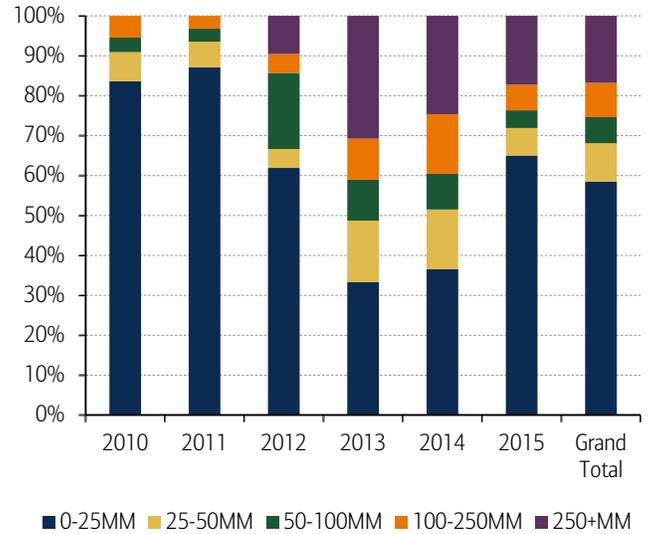
Looking beyond the scope of index-qualifying issues, the overall corporate and government green use of proceeds market saw a similar expansion over the last three months with the total face value of securities up \$7.8bn to \$59.8bn, leaving the index share of the overall market unchanged at 74%. Of the 93 bonds issued over the last three months only 14 entered the index. Most of those that did not enter the index failed to meet the minimum size requirements, including 60 bonds with a face value of only \$25mn or less. So far in 2015 the \$0-25mn bucket accounts for 65% of new issuance. That is down a little from three months ago (67%) but well above the average share across all years (49%). In addition to the recent issuance that did not meet the index minimum size requirements, there were three issues that did not join the index due to lack of ratings and another three that have below investment grade ratings.

**Chart 105: Green Bond Index coverage of the green use of proceeds universe (Aug 31, 2015)**



Source: BofA Merrill Lynch Bond Indices

**Chart 106: Distribution of green issuance by issue size**



Source: BofA Merrill Lynch Bond Indices

## Green Bond Index performance

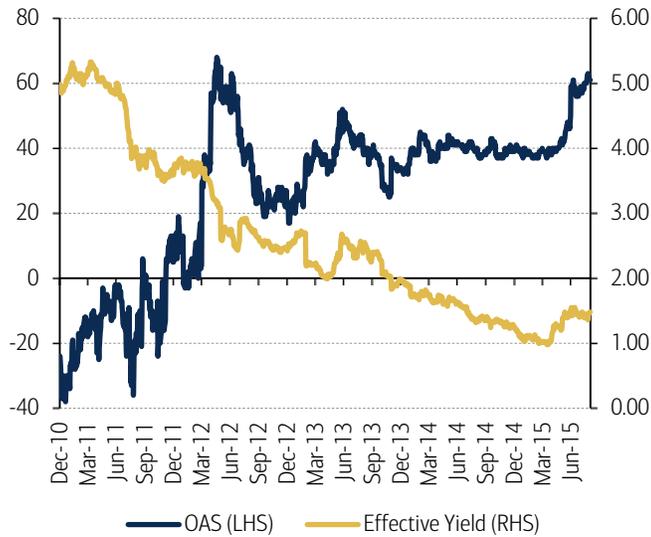
The Green Bond Index did not escape the recent bond market downturn as it slipped to a breakeven return for the year.

The global bond markets have run into hard times of late and the Green Bond Index did not escape the downturn. The Index lost 0.77% (in local currency terms) over the last three months, which essentially wiped out all of its gains over the first five months of the year leaving the index with a 0.03% YTD total return. The sell-off increased the index yield a little more than a quarter percent versus the end of May to 1.48%, returning it to levels of about a year ago. About two-thirds of March-May yield increase was attributed to underlying benchmark yield curves, but for the last three months spread widening was the primary cause (+18bp) of the 0.27% yield increase. That does not sound like much but it represents a 42% increase in the credit risk premium (61bp spread currently vs 43bp at the end of May).

All of the spread-widening in the last three months took place in the corporate sector of the index.

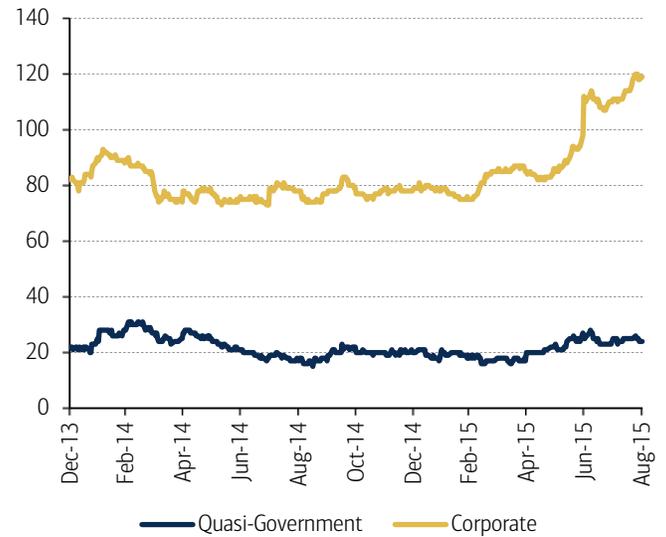
All of the spread widening took place in the corporate sector. Quasi-governments spreads were virtually unchanged versus three months ago (24bp vs 23bp), while Corporates jumped from 86bp to 119bp, touching a new record high during the last week of August. With the Corporate allocation also on the rise (up 6.6% over the last three months), that has exacerbated the negative impact on the index return. The larger Global Single-A Corporate Index, inclusive of non-green bonds, is a good comparison point for the green corporate segment as it has a very similar duration (6.17yrs currently vs 6.22yrs for green corporates) and average rating (both A2). The Global Single-A Index only widened 20bp over the last three months (versus 33bp for the Green Index). But those changes are inclusive of the impact of rebalancing changes. If the rebalancing impact is stripped out, then the Green and Global Single-A Indices widened by an identical 19bp.

**Chart 107: Green Bond Index yield and spread through Aug 31, 2015**



Source: BofA Merrill Lynch Bond Indices

**Chart 108: Green Bond Index spread by sector through Aug 31, 2015**

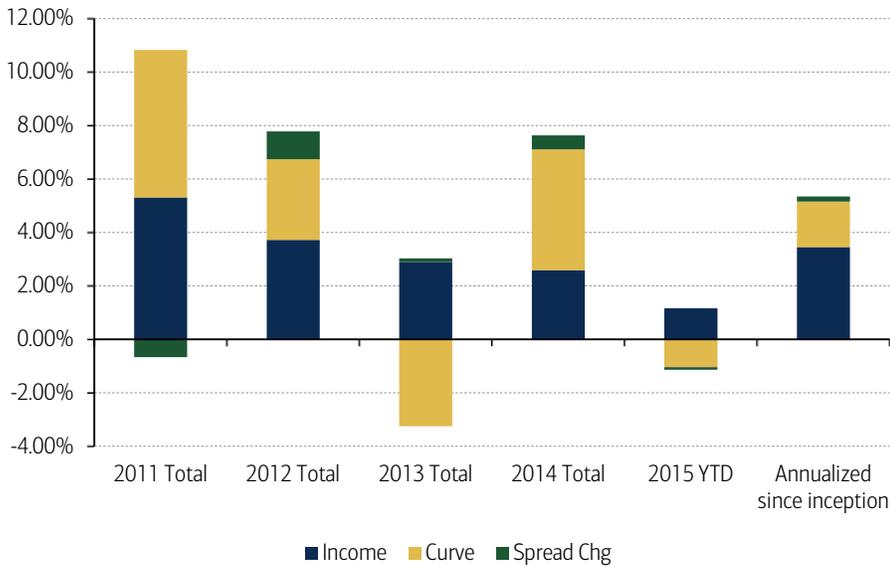


Source: BofA Merrill Lynch Bond Indices

Spread movement played an important role in index performance over the last three months but for the year it remains a negligible return factor

Spread movement played an important role in index performance over the last three months but for the year it remains a negligible return factor, costing the index just 0.10% or a little over a basis point a month. As has been the case in four of the last five years, almost all of this year's performance is attributed to interest income and yield curve movement. 2012 was the only exception to that rule, and even then spread gains totaling a little over 1% amounted to less than a third of the contributions of the income and curve factors. While spread performance has been a minimal factor all along, the curve factor has been anything but. In absolute terms the curve factor has been as large as, or larger than, the income factor every year. The problem is that curve movement is just as prone to wiping out the index income (2013, 2015) as it is to making a positive contribution. And with the index duration extending about a year and a half over the last two years, the curve is like to remain an important factor going forward.

**Chart 109: Green Bond Index return factors**



Source: BofA Merrill Lynch Bond Indices

Compared to other flagship global indices, the Green Index has the highest Sharpe ratio but ranks next to last in terms of Information ratio .

The Green Bond Index cumulative annualized return since inception (5.35%) is down half a percent versus the end of May but it remains ahead of other flagship investment grade indices. For the current year it ranks right in between the global high grade corporate and quasi-government indices, both in terms of total return and excess return. Adjusted for risk, the Green Index Sharpe ratio continues to rank first though its lead over second place Global Quasi-Governments declined from 0.06 at the end of May to 0.04 at the end of August. And it now ranks next to last in the Information ratio rankings ahead of only Global IG Corporates.

**Table 39: Green Bond Index total return (in local currency terms) vs other global IG indices**

	2011	2012	2013	2014	2015 YTD	Cumulative annualized
Green Bond Index (GREN)	10.16	7.78	-0.22	7.62	0.03	5.35
Global IG Govt (WOG1)	6.09	4.36	-0.36	8.37	0.41	3.99
Global Broad Mkt (GBMI)	5.90	5.70	-0.31	7.81	0.37	4.12
Global IG Corp (GOBC)	5.16	10.79	0.05	7.80	-0.44	4.92
Global IG Quasi-Govt (GOBQ)	6.17	5.89	-0.65	7.47	0.75	4.16

Source: BofA Merrill Lynch Bond Indices

**Table 40: Comparative YTD return attributions 2015**

Index	Interest income	Yield curve	Spread Change	Total Return	Excess Return
Green Bond Index (GREN)	1.16%	-1.04%	-0.10%	0.03%	-0.41%
Global IG Govt (WOG1)	0.99%	-2.09%	1.52%	0.41%	0.12%
Global Broad Mkt (GBMI)	1.41%	-1.56%	0.49%	0.36%	-0.18%
Global IG Corp (GOBC)	2.00%	-1.39%	-1.05%	-0.44%	-1.10%
Global IG Quasi-Govt (GOBQ)	1.25%	-0.54%	0.04%	0.75%	-0.07%

Source: BofA Merrill Lynch Bond Indices

**Table 41: Comparative Sharpe and Information Ratios (Jan-2011 – Aug 2015)**

	<b>Avg monthly total return</b>	<b>Total return volatility</b>	<b>Sharpe Ratio</b>	<b>Rank</b>	<b>Avg monthly excess return</b>	<b>Excess return volatility</b>	<b>Information Ratio</b>	<b>Rank</b>
Green Bond Index (GREN)	0.44	0.83	0.53	1	0.04	0.25	0.15	5
Global IG Govt (WOG1)	0.33	0.82	0.40	4	0.04	0.22	0.17	4
Global Broad Mkt (GBMI)	0.34	0.75	0.45	3	0.06	0.31	0.19	2
Global IG Corp (GOBC)	0.41	1.03	0.39	5	0.11	0.90	0.13	6
Global IG Quasi-Govt (GOBQ)	0.34	0.70	0.49	2	0.07	0.31	0.22	1
Global HY Corp (HW00)	0.57	1.79	0.32	6	0.35	1.99	0.17	3

Source: BofA Merrill Lynch Bond Indices

# Disclosures

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