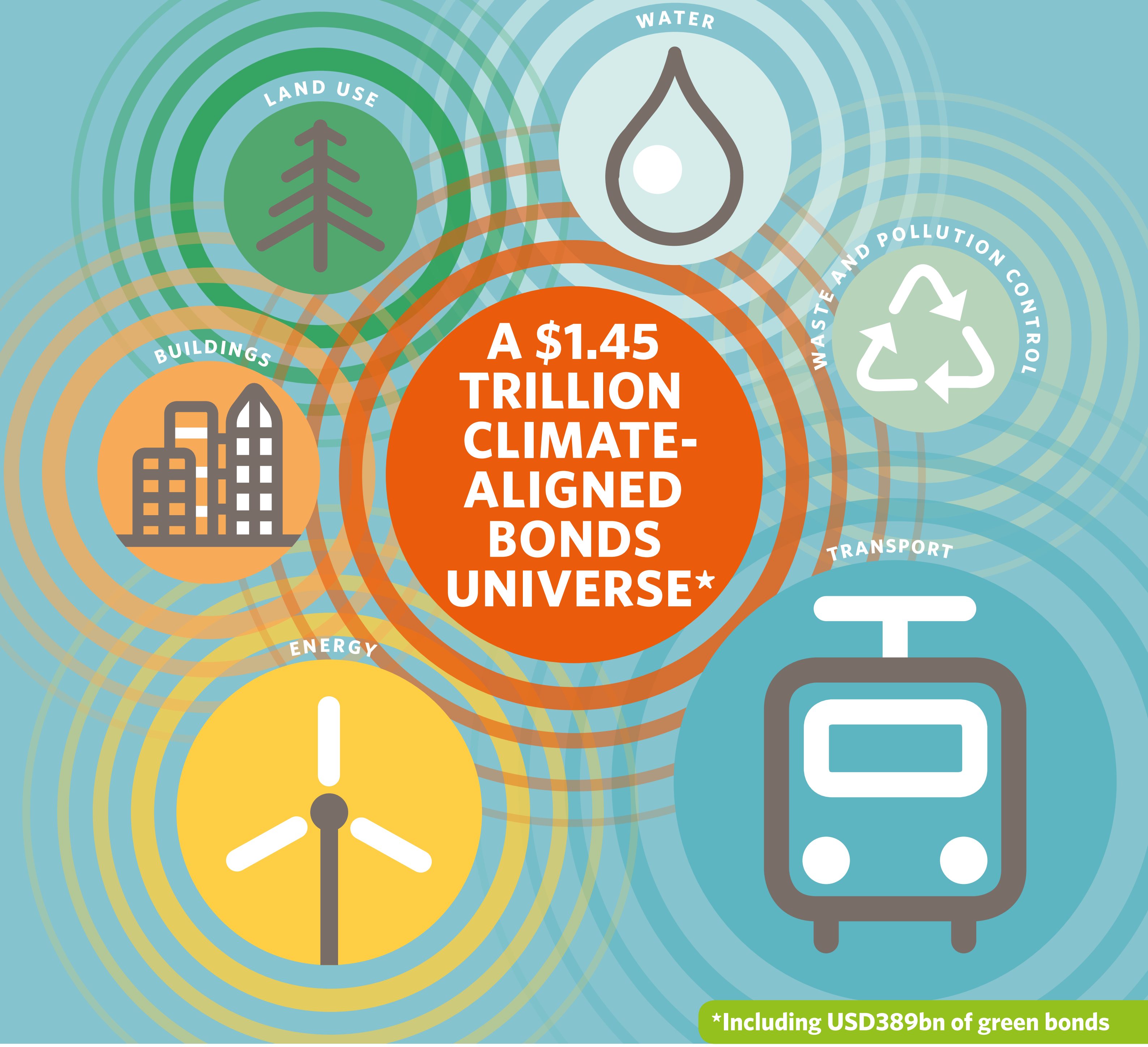
BONDS AND CLIMATE CHANGE

THE STATE OF THE MARKET

2018



*Including USD389bn of green bonds

Prepared by Climate Bonds Initiative.

Commissioned by HSBC.

Report Guide

About this report

The first part of this report presents the findings of Climate Bonds Initiative's research of climate-aligned issuers, conducted between April and June 2018. It identifies issuers who generate at least 75% of their revenues from 'green' business: low-carbon transport, clean energy, sustainable water and wastewater management, low-carbon buildings and built environment, sustainable forestry and agriculture, as well as waste management and recycling.

The second part of the report looks at the diversity of bond structures used in the green bond market. Features on different bond and securitisation types provide commentary on issuers and future prospects.

It also includes an update on green bond policy covering 2017 and 2018, as well as a summary of the green bond pricing research conducted by Climate Bonds Initiative.

Research methodology

This report identifies and analyses a universe of climate-aligned bonds, defined as:

- **bonds from issuers that derive > 95% of revenues from 'green' business lines (fully-aligned)**
- **bonds from issuers that derive 75-95% of revenue from 'green' business lines (strongly-aligned)**
- **labelled green bonds**

To identify aligned issuers and bonds, the following process was undertaken:

1. Issuer-level research

Companies were first identified by industry sub-sector and key words, or through previous climate-aligned issuer lists.

Issuers were considered for inclusion if they derived at least 75% of revenue from 'green' business lines in at least one of 6 climate themes: clean energy, low-carbon transport, water management, low-carbon buildings, waste management and sustainable land use.

Information on issuer revenues and debt outstanding was obtained from Bloomberg, Thomson Reuters EIKON and company websites (particularly annual accounts), and cross checked against other sources, including FTSE Russell Green Revenues.

Notes: Where deemed appropriate, special purpose vehicles and subsidiaries were aggregated under corporate groupings. Both publicly listed and private issuers were considered for inclusion.

2. Issuer screening

In the second phase, issuers were excluded if:

- they had no debt outstanding, according to Bloomberg and/or Thomson Reuters EIKON,
- had been acquired or
- there was insufficient revenue information to determine the share of 'green' revenues.

3. Bond research and data processing

In phase 3, we collated and analysed all bonds outstanding from issuers that passed the screens in phase 1 and phase 2. We further screened bond issuance data by:

- **Issue date:** bonds were only included if they were issued after 1 January 2005 and before the end of Q2 2018.
- **Maturity:** bonds were removed if they had matured, been called or otherwise repaid, or had a 2018 maturity date.

Other data notes:

All 2018 figures are for H1 2018.

For fully-aligned issuers, the full volume of outstanding bonds is climate-aligned.

For strongly-aligned issuers, we used a pro rata amount outstanding per bond that corresponds to the percentage of 'green' revenues. For example, if 80% of revenue is climate-aligned, for each bond we used 80% of the amount outstanding for all charts and figures. Consequently, this report refers to and analyses 'aligned outstanding' bonds rather than to total amount outstanding.

If an issuer is fully- or strongly-aligned and has *also* issued a labelled green bond, then to avoid double counting:

- their green bonds are attributed in full to green bond figures, and
- all remaining outstanding bonds are attributed to either fully-aligned figures (in full) or strongly-aligned figures (on a pro rata basis) as per the issuer's alignment.

Note that many green bond issuers have less than 75% of revenue derived from green business lines and are therefore neither fully nor strongly-aligned. Unlabelled bonds from these issuers are hence excluded from aligned outstanding volumes.

Issuer screening is *based on* the Climate Bonds Taxonomy (see p30) and the Climate Bonds Standard and Criteria but the screening process does not apply the full Climate Bonds Sector Criteria due to insufficient granularity of information available. Therefore, it is possible that some climate-aligned bonds would not meet the full Climate Bonds Standard.

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PART 1: CLIMATE-ALIGNED BONDS

PART 2: GREEN BOND FOCUS

Climate Bonds Initiative

The Climate Bonds Initiative is an international investor-focused not-for-profit organisation working to mobilise the USD100tn bond market for climate change solutions.

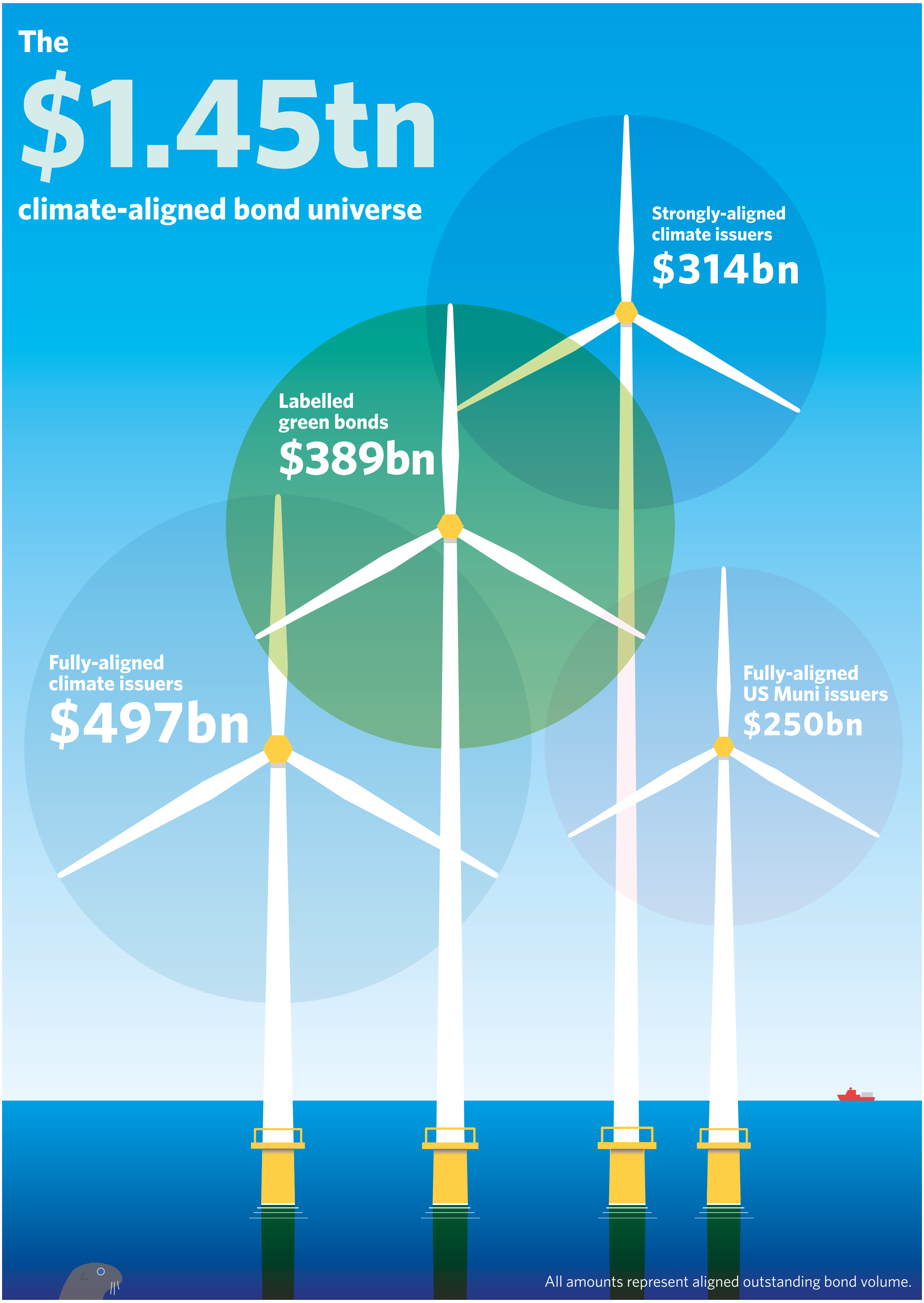
The mission focus is to help drive down the cost of capital for large-scale climate and infrastructure projects and to support governments seeking increased capital markets investment to meet climate goals.

The Climate Bonds Initiative carries out market analysis, policy research, market development; advises governments and regulators; and administers a global green bond certification scheme.

Climate Bonds Partners range from investors representing USD14tn of assets under management and the world's leading investment banks to governments like Switzerland and France.

The Climate Bonds Initiative is the lead partner in the Green Infrastructure Investment Coalition. Sean Kidney, Climate Bonds Initiative's CEO, is a member of the European Commission's Technical Expert Group (TEG) on Sustainable Finance (see p28).

The climate-aligned bond universe



Climate-aligned bond universe: 869 issuers with USD1.2tn outstanding (excluding US Muni fully-aligned issuers)

- **Fully-aligned: 342 issuers with USD497bn outstanding**
- **Strongly-aligned: 82 issuers with USD314bn aligned outstanding**
- **Green bonds: 498 issuers, of which 52 fully- or strongly-aligned, with USD389bn outstanding**

The Climate Bonds Initiative has been researching investment opportunities in bonds financing climate-aligned assets since 2012. The climate and investment backdrop has changed dramatically over the past 6 years. The labelled green bond market has taken off and with it, the focus of this research has expanded.

Previous reports identified issuers whose revenues are derived almost entirely from 'green' business activities (>95%). Outstanding bonds of these issuers, sometimes referred to as 'pure-plays', plus labelled green bonds were collectively defined as 'climate-aligned bonds'.

What's new in 2018?

This year we have expanded the scope to include issuers who are strongly climate-aligned, i.e. ones that derive at least 75% of their revenues from 'green' business lines. This is to capture companies transitioning to 'green' and to take into account the fact that as 'pure-play' issuers grow, their revenue streams tend to diversify. This approach seeks to highlight as many issuers raising funds for green assets and projects as possible including labelled green bonds and unlabelled bonds from climate-aligned issuers.

Sustainable Development Goals (SDGs) have been included for the first time in this report. We identified six SDGs where increased green investment provide direct benefits: SDG 6, 7, 9, 11, 13 and 15. However, climate mitigation measures, adaptation and the development of climate-resilient infrastructure and buildings underpin the achievement of all 17 SDGs. To highlight the links, sector headings use related SDG icons.

More in depth green bond coverage has been provided on green bond structures, policy updates and public sector developments, as well as green bond pricing. This can be found on pages 22-30.

The 2018 research identified 869 issuers: 342 fully-aligned, 82 strongly-aligned and 498 green bond issuers.

Quick guide to terminology used in this report

Green bonds: Bonds issued in order to raise finance for climate change solutions and labelled as green by the issuer. They can be issued by governments, banks, municipalities or corporations and can be applied to any debt format, including private placement, securitisation, covered bond and sukuk.

Green bonds are only included in this report and the Climate Bonds database if at least 95% of proceeds are dedicated to green assets aligned with the Climate Bonds Taxonomy and if sufficient information on the financed projects is available.

Fully-aligned climate issuers: Bond issuers that derive >95% of revenues from climate-aligned assets and green business lines. These are also referred to as 'fully-aligned' issuers.

Fully-aligned US Muni issuers: Municipal bond issuers from the United States, in particular dedicated authorities, agencies, departments and similar divisions with more than 95% of their revenue derived from climate-aligned water, transport, waste, land use and renewable energy operations. Climate Bonds conducted a separate scoping exercise. Outstanding bonds from these issuers are not included in the report analysis except in the overall climate-aligned universe figure of USD1.45tn. Labelled green bonds from these issuers (USD14bn) have been taken out of the USD264bn outstanding to avoid double counting. The USD250bn fully-aligned amount outstanding of US climate-aligned municipal bonds has been provided as an indication of the market size.

Strongly-aligned climate issuers: Bond issuers where 75%-95% of revenues are derived from climate-aligned assets and green business lines. For bonds from strongly-aligned issuers, we analysed a pro rata amount corresponding to green revenue rather than the full outstanding value.

Climate-aligned bond universe: the term is used to describe the full universe of aligned outstanding bonds - i.e. from fully-aligned issuers, strongly-aligned issuers and green bond issuers.

The term **aligned outstanding bonds** underscores the fact that this report does not analyse the full outstanding volume of bonds from strongly-aligned issuers (see definition of strongly-aligned climate issuers). For simplicity, 'aligned outstanding' bonds is always implied throughout the report although the term is not always used in full.

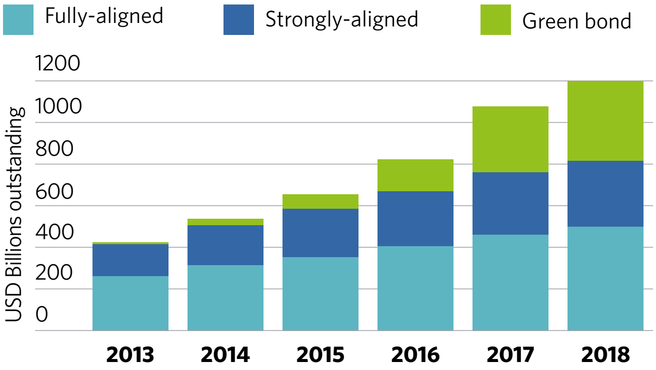
Certified Climate Bonds: Issuers can certify bonds or loans under the Climate Bonds Standard. Certification confirms that the bond is aligned to the Paris Agreement and to keeping global warming under 2°C. Many of the bonds in this report may be eligible for Certification but have not yet been certified unless otherwise stated.

Climate Bonds Taxonomy: The Climate Bonds Initiative uses the Climate Bonds Taxonomy to define 'green' assets and projects. The Taxonomy features eight broad categories: energy, transport, water, buildings, land use & marine resources, industry, waste and ICT. The Taxonomy is used as a framework for selecting issuers for this report.

A summary can be found on page 30.

GENERAL OVERVIEW OF THE CLIMATE-ALIGNED UNIVERSE

A climate-aligned bond universe of USD1.45tn



This year's research has identified USD1.2tn of aligned outstanding bonds from fully- and strongly-aligned issuers and green bonds (excluding bonds from US Muni fully-aligned issuers).

342 fully-aligned issuers with USD497bn of outstanding bond volume and 2,105 outstanding bonds, issued from 2005 to end Q2 2018. Fully-aligned issuers account for 41% of the climate-aligned bond universe.

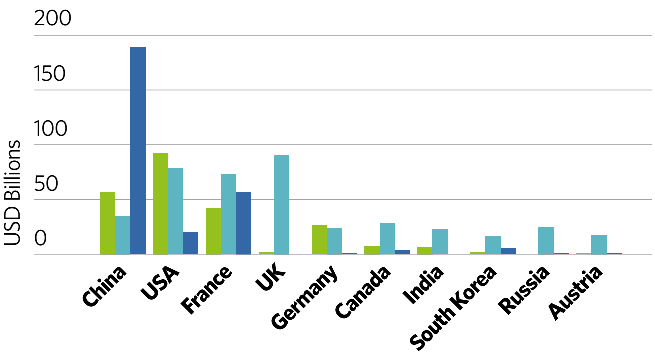
82 strongly-aligned issuers with USD314bn of outstanding bond volume accounting for 26% of the climate-aligned bond universe. The outstanding debt of these issuers is scaled down in proportion to the share of green revenues, e.g. if 80% revenues are 'green', then 80% of its outstanding debt is used.

498 green bond issuers with USD389bn of outstanding bond volume accounting for 32%. As a result of record-breaking green bond issuance in 2017, there is a USD72bn increase in green bonds outstanding from 2017.

52 issuers of labelled green bonds are also fully- or strongly-aligned issuers. The remaining 446 green bond issuers have less than 75% of revenue derived from 'green' business lines and are therefore not considered as fully or strongly-aligned issuers.

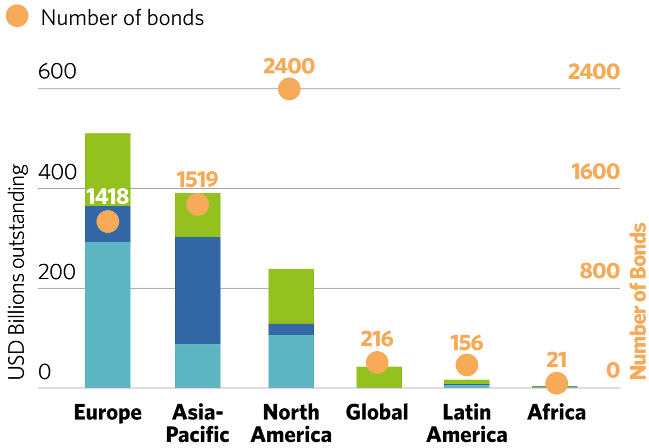
Separate research was conducted on fully-aligned US Muni agencies where USD250bn of unlabelled bonds was identified (see p7). This USD250bn is only included in the overall climate-aligned figure of USD1.45tn but not in the rest of the report analysis. Labelled green bonds from US Munis are included in green bond figures.

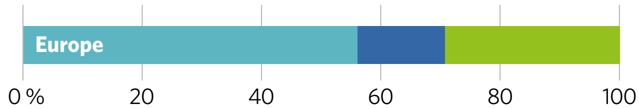
China tops country rankings



China tops the country rankings of climate-aligned bonds, primarily due to high volumes in the strongly-aligned category. The UK has the highest volume of outstanding bonds from fully-aligned issuers, followed by the USA and France. India, South Korea, Russia and Austria make the overall Top 10 thanks to fully-aligned issuers.

Europe has the highest volume of outstanding climate-aligned bonds

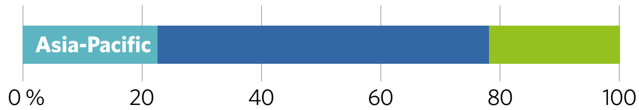




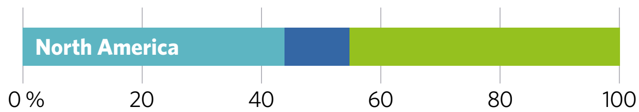
Europe's USD509bn climate-aligned bond market is composed of USD291bn in bonds issued by fully-aligned issuers, USD145bn of labelled green bonds and USD73bn of bonds issued by strongly-aligned issuers.

France, the UK and Germany are the top 3 countries with USD175bn, USD96bn and USD52bn of aligned outstanding bonds. The figures aggregate green bonds and bonds from fully- and strongly-aligned issuers.

- France has the largest volume of labelled green bonds (USD44bn) and bonds from strongly-aligned issuers (USD58bn).
- The UK is the top market globally for issuance from fully-aligned issuers with 253 fully-aligned issuers from various sectors contributing USD91bn to the climate-aligned bond universe.



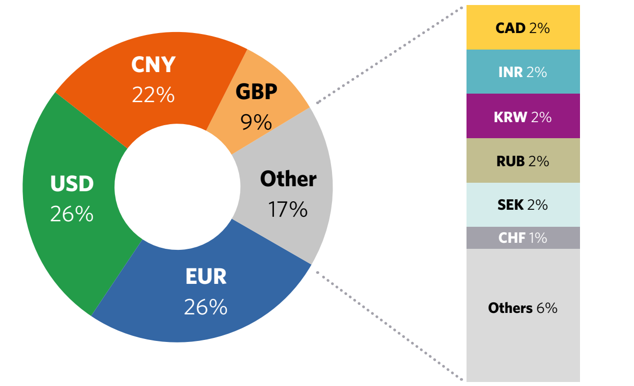
Issuance from strongly-aligned issuers dominates the Asia-Pacific region. Chinese volumes are by far the largest in the region both for issuance from strongly-aligned issuers (USD189bn) and green bonds (USD55bn) and represent 20 times and 8 times, respectively, of the relevant second largest market. India, South Korea, Japan and Australia are the next largest markets. USD14bn comes from ASEAN countries.



North America ranks third overall, but the volume of bonds from fully-aligned issuers is 19% more than Asia-Pacific's and the total number of outstanding climate-aligned bonds reached 2,400.

Fannie Mae's green MBS and US municipal green bond issuance have been driving the region's growth. At USD193bn, the US climate-aligned bond universe is over 4.5 times larger than Canada's. Canada's contribution to overall volumes is primarily from the fully-aligned issuer category, whereas US issuance includes a significant amount of green bonds.

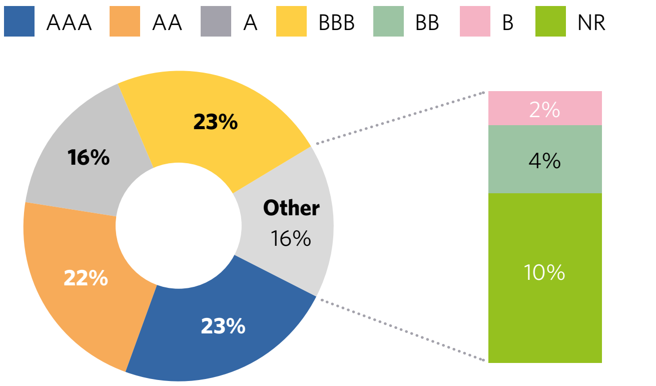
EUR, USD and CNY remain the major currencies

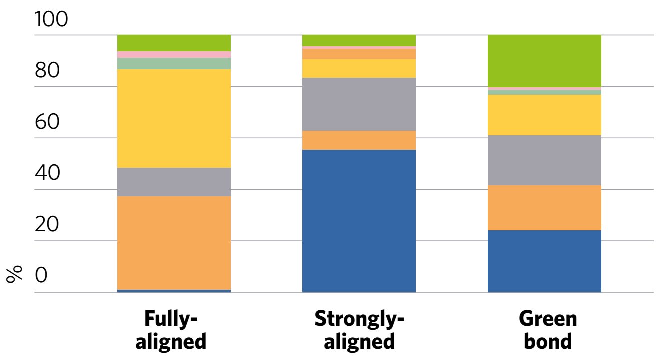


EUR denominated bonds account for 26% of the overall universe with USD316bn outstanding and are closely followed by USD denominated bonds (USD314bn). However, the largest amount of labelled green bonds outstanding is denominated in USD.

The share of CNY-denominated bonds has fallen to 22% of the climate-aligned universe, down from 32% in the 2017 report because the universe is larger and includes more green bonds. JPY is still under-represented compared to its presence in the overall global bond market.

Investment grade bonds account for 84% of the outstanding climate-aligned universe



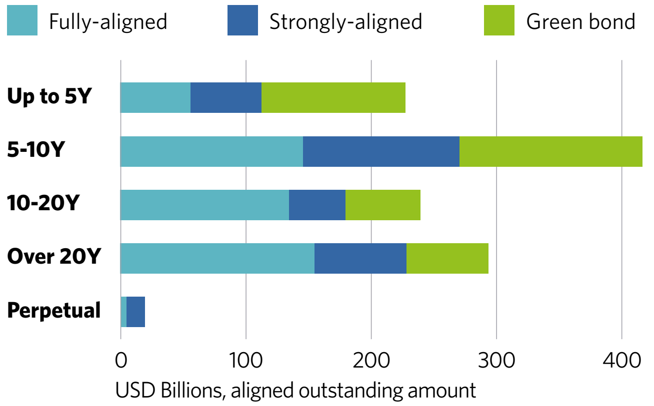


Almost a quarter of the universe is AAA-rated by international and/or local credit rating agencies and 84% of the USD1.2tn universe is investment grade. Non-investment grade bonds make up only 5% (the pie chart figures are rounded). The remaining 10% is not rated.

Labelled green bonds have the most evenly distributed ratings. Strongly-aligned issuers make up the largest proportion of the AAA rating band (63%) while bonds from fully-aligned issuers dominate the AA rating (67%).

China Railway (strongly-aligned) is the largest issuer in the universe and has a AAA rating from local rating agencies.

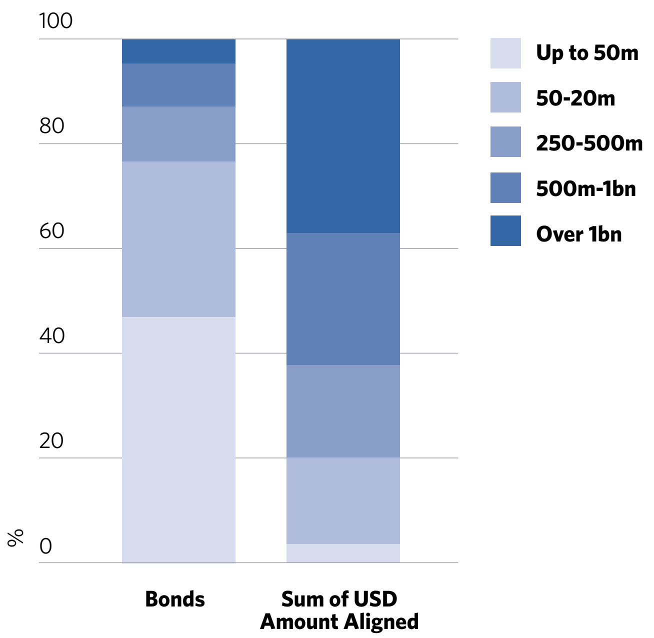
5 to 10 year tenors are most common



Most labelled green bonds have tenors under 10 years. Over half the outstanding bonds with a tenor under 5 years are labelled green bonds. This proportion drops as the bond tenor increases: labelled green bonds make up 22% of bonds with a tenor exceeding 20 years.

Outstanding bonds from fully-aligned issuers tend to be longer-dated. They account for 53% of aligned outstanding bonds with tenors exceeding 20 years. This is consistent with previous findings that fully-aligned issuers, such as rail entities usually have longer construction and operation periods and often issue long-term debt.

Large issues contribute over 60% of volume



Some 700 bonds have aligned outstanding amounts of USD500m or more (60% of the aligned universe). The remaining outstanding volume is made up of approximately 5,000 bonds. This reflects the large number of private and smaller issuers identified.

A big contributor to volumes is China Railway, the largest single issuer with USD172bn of aligned outstanding volume (see the Transport section). The second largest issuer is Electricite de France SA with USD53.6bn aligned outstanding in the strongly-aligned category and USD5.3bn of green bonds (see the Clean Energy section).

As a cross check for publicly-listed companies, we used data from the FTSE Russell Green Revenues Model. USD61bn of climate-aligned outstanding bond volume for fully-aligned issuers, and USD23bn for strongly-aligned issuers, relates to companies on this list.

Climate-aligned bonds are an indicator of labelled green bond growth potential

The universe of bonds from fully-aligned and strongly-aligned issuers highlighted throughout this report indicates that there is huge potential for the growth of the green bond market.

In the first year of publishing this report, there was no overlap between labelled green bond issuance and fully-aligned issuers. This is changing as more issuers with green business lines are discovering the value in the green bond label.

Below are various examples of how fully- and strongly-aligned issuers have capitalised on their green bond issuance.

Fully-aligned issuers who have issued green bonds (42 issuers, representing USD16.5bn outstanding)

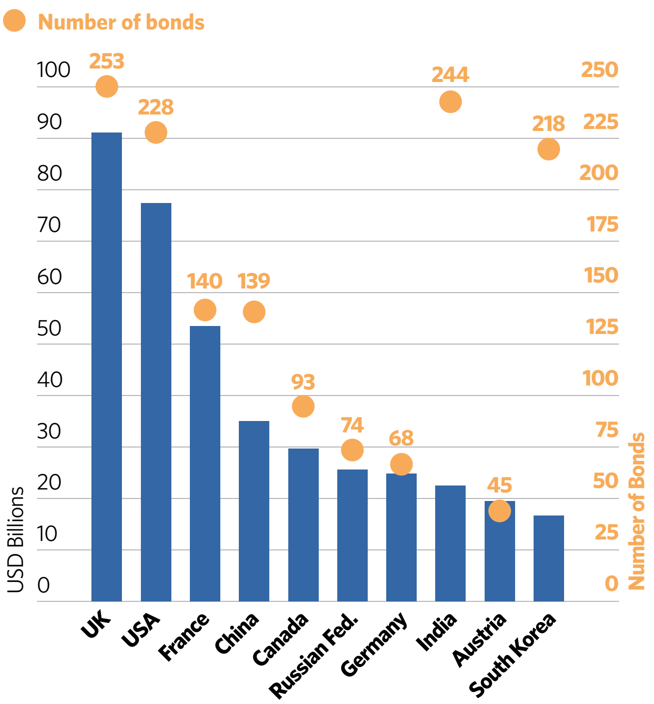
- An interesting feature of CGN Wind Energy's green bonds (CNY1bn issued in September 2017 and June 2018) is that these have been their first perpetual bonds ever issued.
- Landsvirkjun's debut green bond was their first deal issued on the US private placement market.
- Nordex's EUR550m green bond deal issued in 2016 was their very first Schuldschein.
- Indian Railway Finance Corp's green bond is one of the rare deals issued in USD currency by the issuer (most bonds were issued in rupees). We observed the same for Korea Water Resources Corp: their USD denominated green bond is one of the few deals in this currency (the majority of bonds is in KRW).

Strongly-aligned issuers who have issued green bonds (10 issuers, representing USD8.3bn outstanding)

- Verbund AG, a repeat Austrian issuer, placed a EUR100m digital green Schuldschein in April 2018. It was the first issuance of this type to be fully executed digitally using blockchain technology.

Opportunities for fully-aligned entities to issue green bonds exist all across the world

Top 10 fully-aligned issuer countries



The green label is an important tool to finance green assets and projects

While the unlabelled climate-aligned figures are for the global growth of climate finance, the green bond label is and will remain an essential tool within the fixed income space for both investors and issuers.

For issuers, it can provide much-needed finance for low-carbon assets while also signalling sustainability aspirations and enabling access to a wider investor base.

For investors, the label enables easy identification of green fixed income products as well as enhanced transparency of the projects being financed and their impact.

A different kind of fully-aligned issuer: US municipal agencies

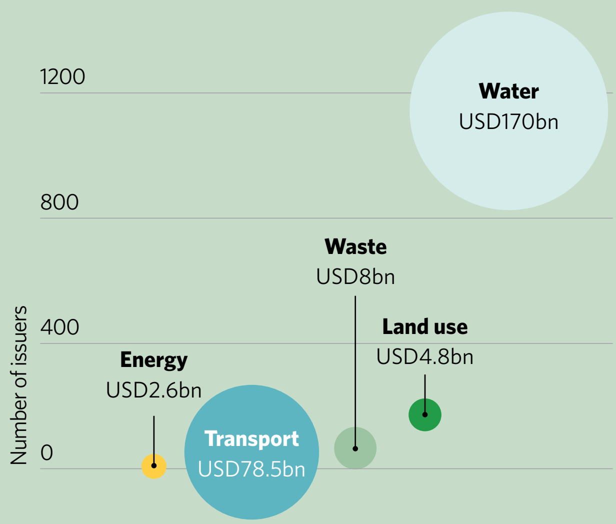
The climate-aligned research conducted for this report screened public and private entities across the globe. We did not, however, include US municipal agencies in the analysis of fully- or strongly-aligned issuers as their issuance volume can skew figures significantly.

In July 2018, Climate Bonds Initiative conducted a scoping exercise and identified USD250bn of outstanding bonds from specialised US municipal issuers, which are climate-aligned, but not labelled 'green', and USD14bn of green bonds issued by 23 of the agencies.

We honed in on specialised agencies with more than 95% of their revenue derived from climate-aligned sectors (fully-aligned issuers) and identified 1,436 issuers. At USD170bn, water accounts for 64% of the identified bond universe and includes 1,141 issuers. Transport comes in second with USD78.5bn outstanding (30%), with the remaining 6% (USD18.5bn) split between waste, energy and land use. More information on this study can be found at https://www.climatebonds.net/resources/reports.

Refinancing needs from fully-aligned US Municipal issuers offer an opportunity to label bonds and consolidate US municipals' position in the green bond market.

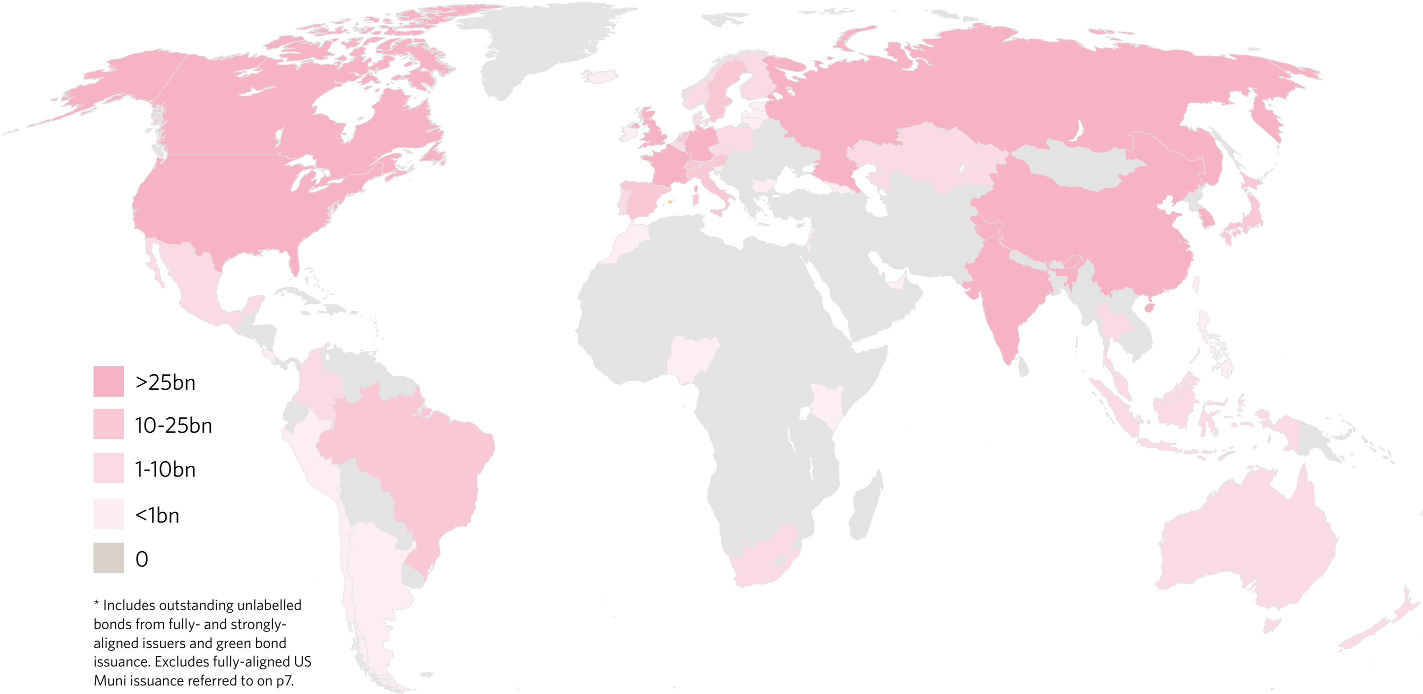
Water is the largest climate-aligned theme for fully-aligned US municipal issuers



The chart above includes USD14bn of outstanding labelled green bonds issued by fully-aligned US Muni issuers.

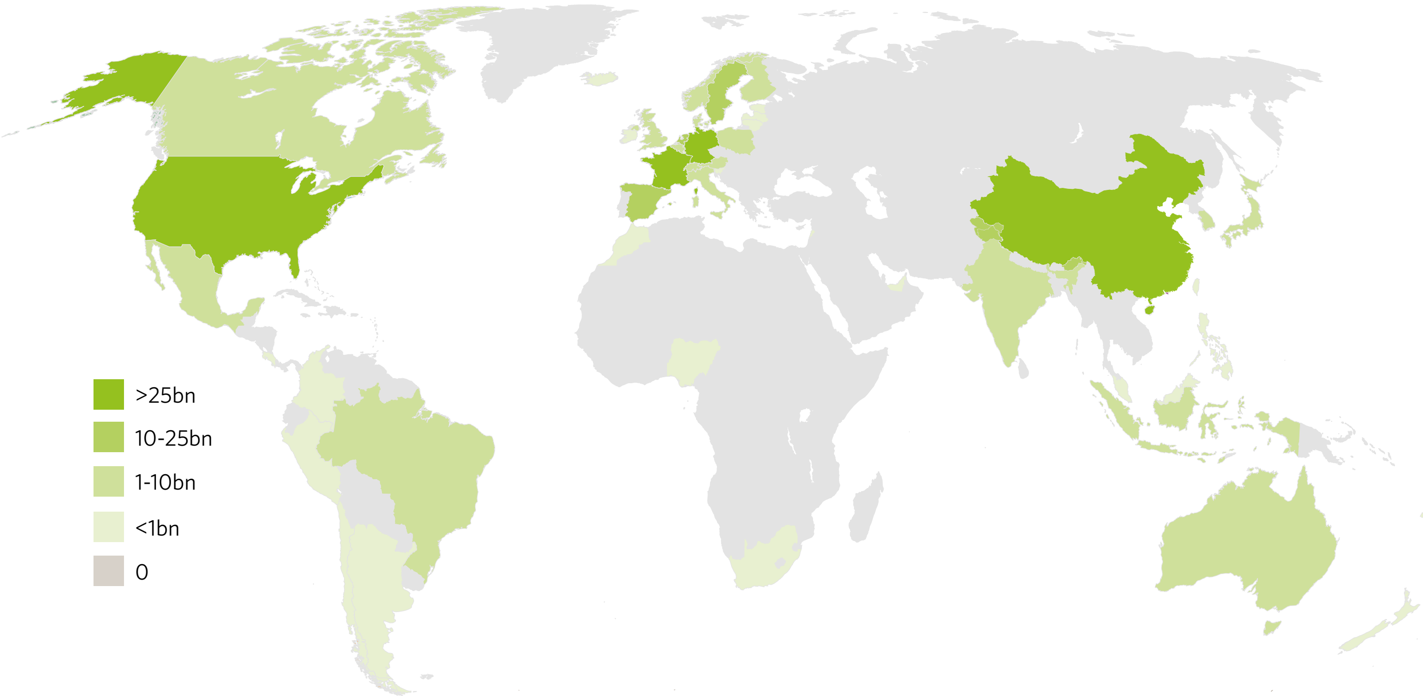
Climate-aligned issuance across the world

Climate-aligned issuance*



* Includes outstanding unlabelled bonds from fully- and strongly-aligned issuers and green bond issuance. Excludes fully-aligned US Muni issuance referred to on p7.

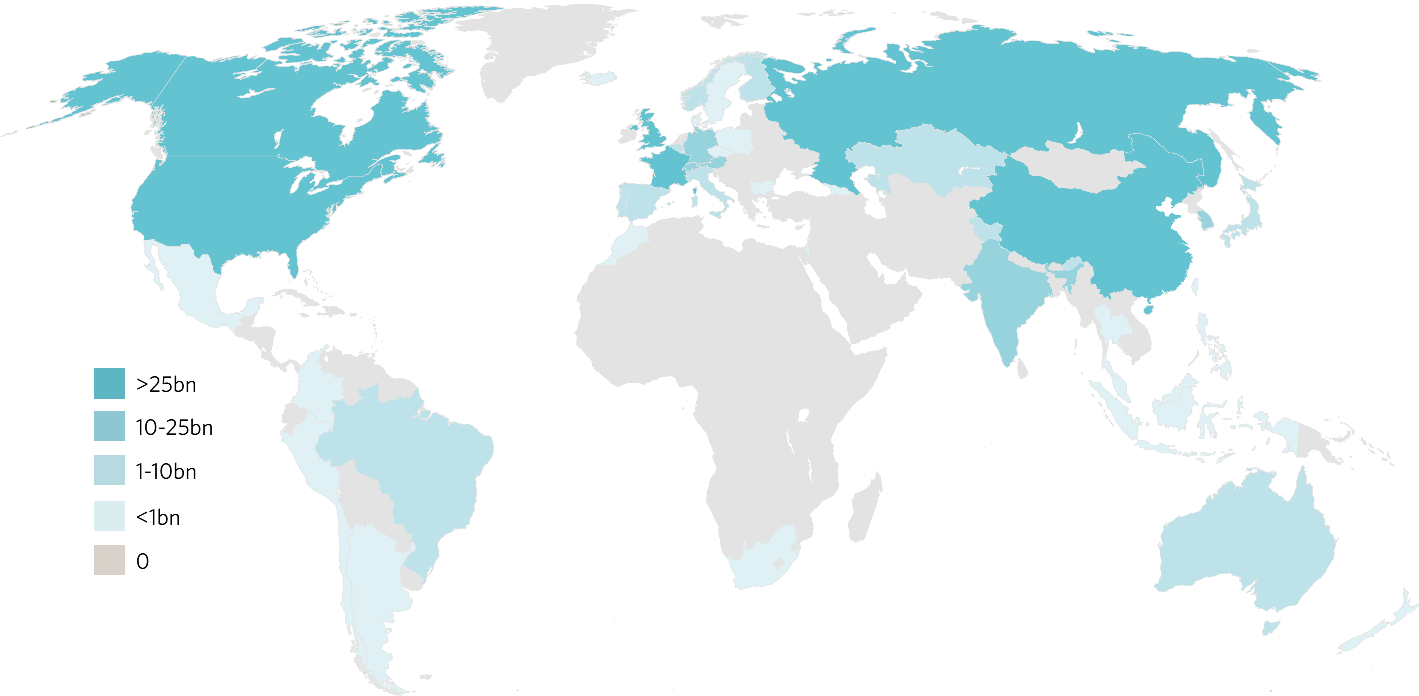
Green bond issuance



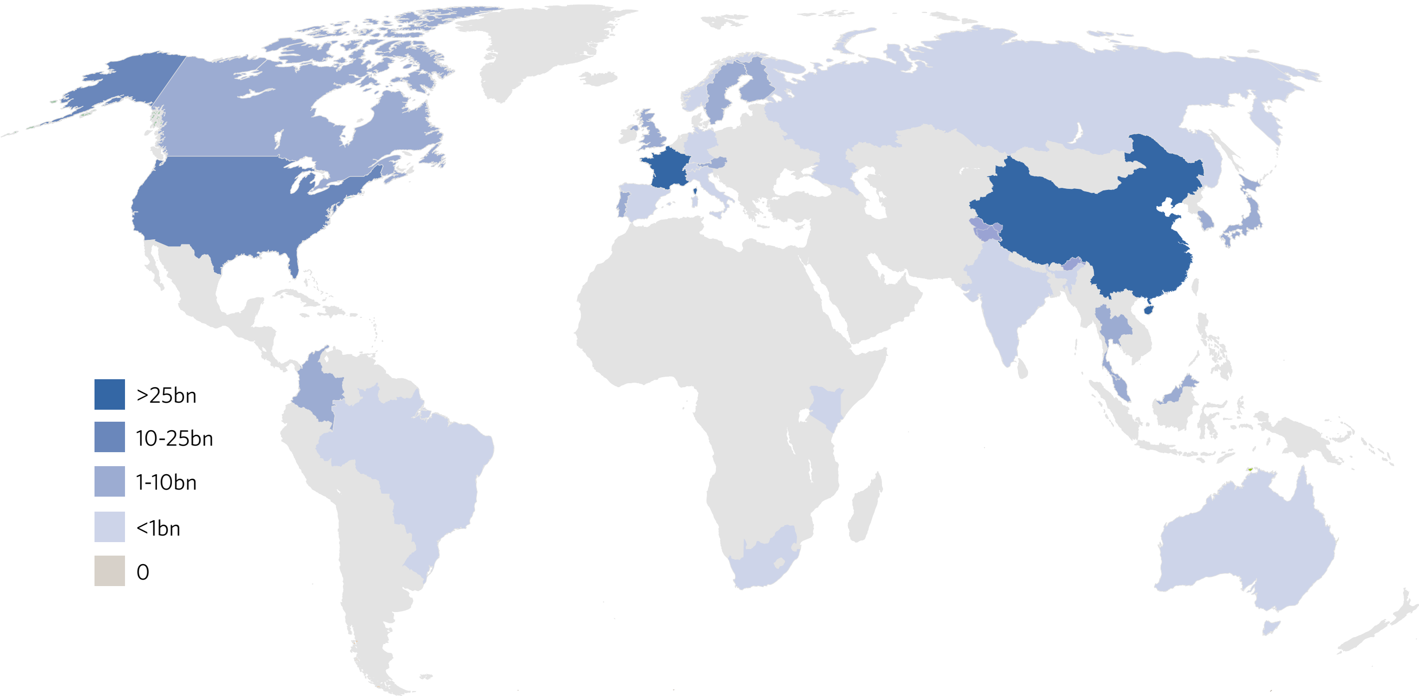
Region	Outstanding aligned (USD)	Number of bonds	Number of issuers
Africa	1,646m	21	12
Asia-Pacific	338,073m	1,519	312
Europe	509,444m	1,418	309
Global	43,050m	216	10
Latin America	15,891m	156	50
North America	241,308m	2400	229

Region	Outstanding aligned (USD)	Number of bonds	Number of issuers
Africa	1,298m	8	8
Asia-Pacific	84,455m	251	162
Europe	145,343m	397	153
Global	43,050m	216	10
Latin America	6,171m	23	20
North America	108,134m	1999	145

Fully climate-aligned issuance



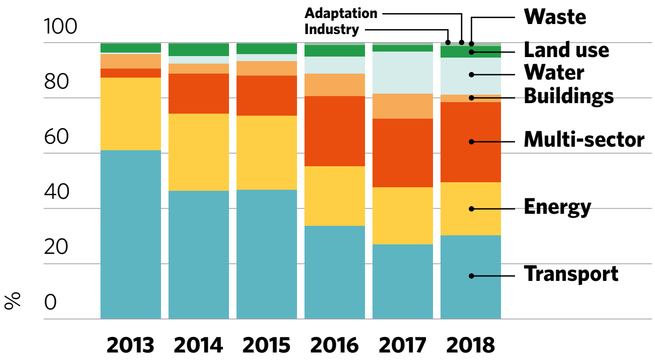
Strongly climate-aligned issuance



Region	Outstanding aligned (USD)	Number of bonds	Number of issuers
Africa	279m	7	2
Asia-Pacific	89,638m	763	110
Europe	291,192m	895	134
Global	0m	0	0
Latin America	8,270m	116	28
North America	107,194m	324	68

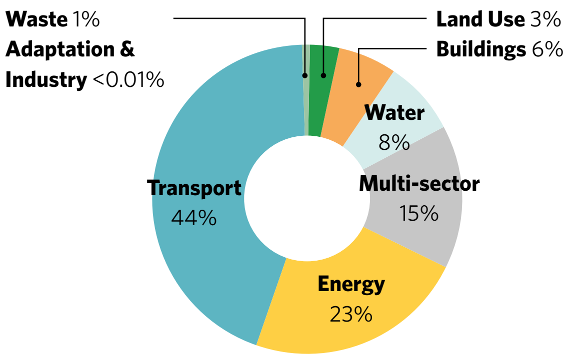
Region	Outstanding aligned (USD)	Number of bonds	Number of issuers
Africa	69m	6	2
Asia-Pacific	213,990m	505	40
Europe	72,908m	126	22
Global	0m	0	0
Latin America	1,451m	17	2
North America	25,980m	77	16

Transport retains top spot for allocations, but its share in the climate-aligned universe is falling



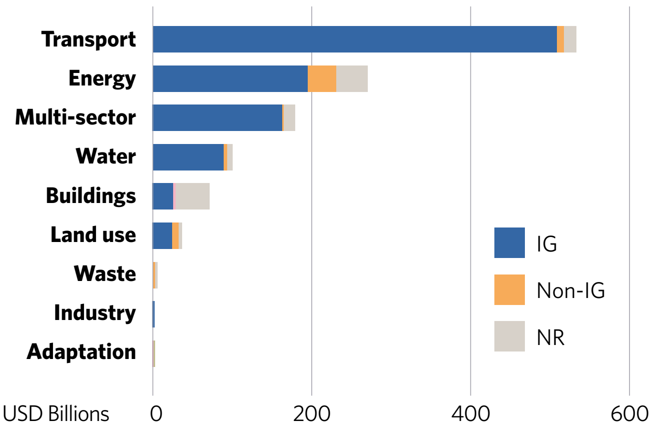
At USD532bn outstanding, transport is the largest theme in the climate-aligned universe. Its annual outstanding share in the universe has decreased from 61% in 2013 to 30% in H1 2018. In part, this reflects market trends such as increased multi-sector and buildings-related green bond issuance. In part, it also reflects our expanded screening methodology which has picked up more issuers from other sectors.

Transport tops the climate-aligned universe



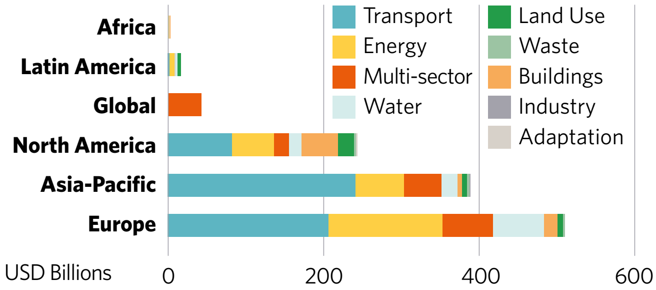
The multi-sector theme comprises primarily green bonds. Out of the USD179bn outstanding aligned amount, energy has the largest allocation at 34%, followed by buildings (21%), transport (17%) and water (11%).

Over 40% of investment grade bonds come from the transport sector



Energy and multi-sector issuers combined account for 30% of investment grade deals. We note that it is possible that some of the debt identified as unrated is rated by local agencies but this is not reflected on Bloomberg and Thomson Reuters EIKON or the debt is privately rated.

Asia-Pacific has largest volume of transport issuance



In Asia-Pacific, climate-aligned bonds from the transport theme total USD241bn outstanding. Chinese bonds account for the bulk of the amount, but transport is also a large theme in Europe (USD207bn), with France and the UK in the lead for issuance.

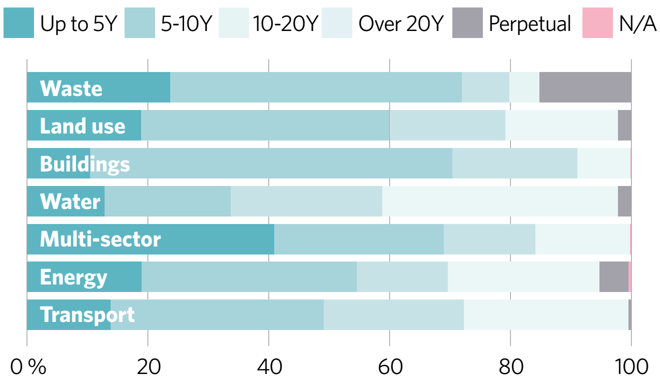
At USD147bn, energy ranks second in terms of European deals and outstanding bonds from France represent the highest volume, well ahead of other European nations.

Largest number of issuers is in Energy

Energy has the highest number of climate-aligned issuers of all sectors analysed (292) while the Buildings sector has the largest number of bonds outstanding at 1,843.

Theme	Amount (USDbn)	Share	Bond issuers	Bonds
Energy	271	23%	292	1,139
Multi-sector	179	15%	177	600
Transport	532	44%	131	1,361
Buildings	72	6%	102	1,843
Water	101	8%	89	564
Land use	37	3%	50	166
Waste	7	1%	26	55
Other	0.04	<1%	2	2
Total	**1,199**	**100%**	**869**	**5,730**

Water and transport bonds tend to be longer dated



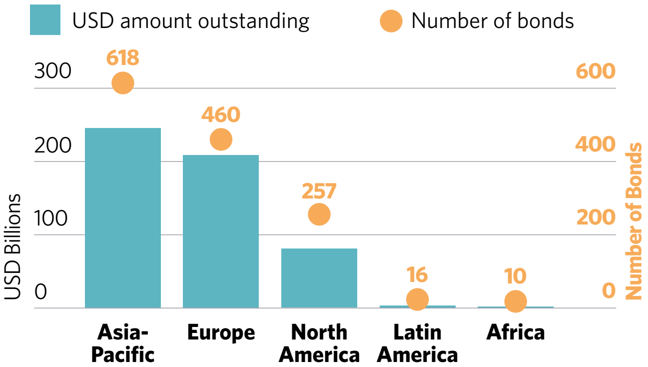
Outstanding water and transport bonds tend to be long-dated (10Y or longer tenors), while multi-sector issuers, which include primarily banks and government, tend to issue shorter deals (up to 5 years). Energy has the highest outstanding amount of perpetual bonds.

Low-carbon transport

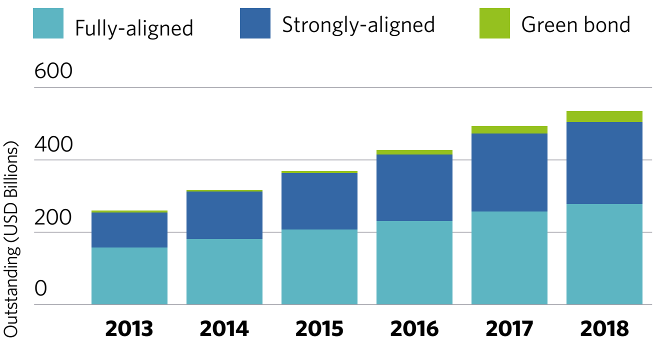
Transport remains the largest climate sector

With USD532bn outstanding, transport makes up 44% of the overall climate-aligned universe. As the second largest contributor to global GHG emissions, the transport sector contributes 30% of man-made CO_2 emissions in developed countries and about 23% of total man-made emissions worldwide.[1] There is widespread agreement that we need to reduce CO_2 emissions from transport by at least 50% by 2050 at the latest. Effective measures include the transition to low emission transport and EV technology innovation. Asia-Pacific is the biggest region for climate-aligned bonds issuance in the transport sector, followed by Europe.

Asia-Pacific tops the list by volume and bonds



Fully-aligned transport companies make up 52% of outstanding volumes

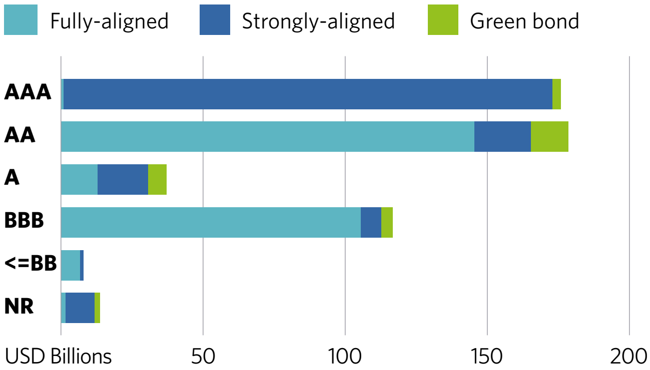


Although transport remains the largest sector, its proportion of aligned outstanding bonds is now much lower than for 2013 due to the increasingly diversified issuance from other sectors. As of the end of June 2018, fully-aligned low-carbon transport companies contribute USD278bn, accounting for 52% of the sector, while strongly-aligned issuers make up 43% and labelled green bonds account for 5% of outstanding climate-aligned bonds.

China Railway is the largest climate-aligned issuer

China Railway Corporation retains the top spot on the list with a total of USD172bn outstanding. This year, the company was reclassified as a strongly-aligned issuer as 'non-green' revenues generated from real estate and highway infrastructure are slightly in excess of 5%. In China, a clear national target has been set to extend the country's high-speed railway network to 30,000km by 2020.[2] As the developer and operator of China's massive high-speed railway networks, China Railway is expected to retain its leading position.

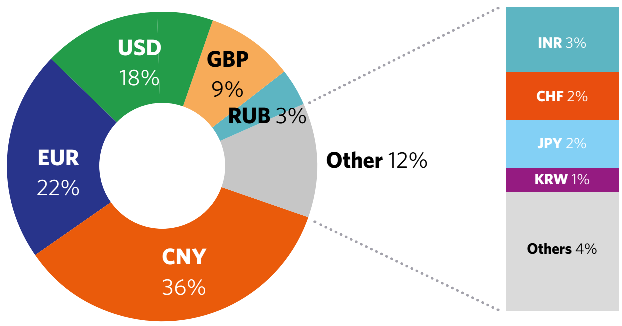
96% of outstanding bonds are investment grade



Almost three-quarters of aligned outstanding bonds are rated A or above and 96% are investment grade. This is primarily due to the fact that transport sector issuers are typically government agencies or companies backed by government. Examples include Canada National Railway, Japan Central Railway, China Railway and UK's Network Rail.

AAA-rated bonds are dominated by strongly-aligned issuers while fully-aligned issuers make up 82% of the AA-rated band.

CNY and EUR deals account for almost 60% of outstanding debt

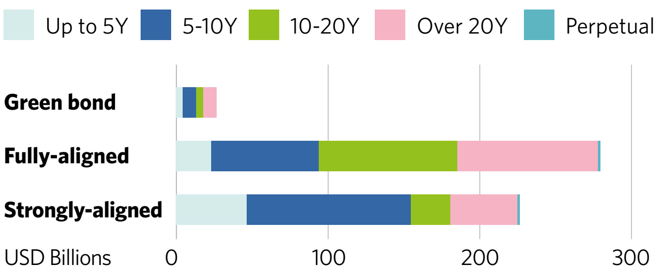


Transport sector issuance is denominated in 25 currencies with CNY making up the largest proportion as a result of China Railway being the largest climate-aligned bond issuer.

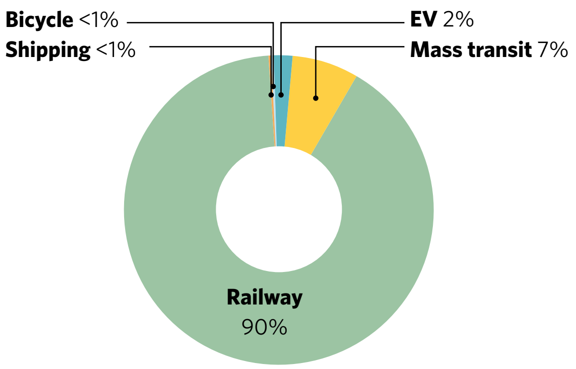
Transport issuers favour long tenors

A key feature of the sector is that bonds tend to have longer tenors. This reflects the underlying nature of transport projects, which typically have long construction and operation periods. The long tenors facilitate liability matching for institutional investors.

Fully-aligned low-carbon transport companies have the largest proportion of outstanding climate-aligned long-term bonds. Two-thirds have a tenor of 10 years or more. This compares to 51% for labelled green bonds and 32% for strongly-aligned bonds. The average tenor of outstanding bonds in the transport sector is 12 years.



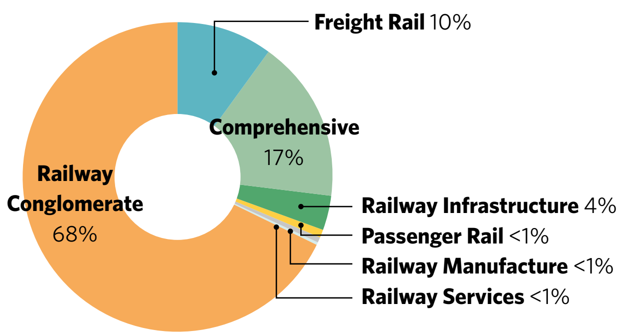
Rail dominates the Transport sector



Railway companies make up 90% of the Transport sector. They are usually large state-backed entities with a long history of issuing debt. The size of financing tends to be larger due to the massive scale of investment needed in railway infrastructure.

Railway

(USD481bn outstanding aligned, 80 issuers, 1130 deals)



Although railway construction and operation unavoidably have a carbon footprint, the climate impact is considerably less than other transport modes such as road and air. According to the International Energy Agency and the International Union of Railways, rail energy consumption per passenger/km and per freight tonne/km decreased by 27.8% and 18.1% from 2005 to 2015, contributing to CO_2 emission reduction by 21.7% and 19.0% respectively during the same period.[1]

Therefore, railway is considered to be one of the most important low-carbon transport modes because of its relatively energy efficient features. A variety of railway assets, including tracks, rolling stock, signals, controls and communications facilities as well as dedicated tunnels, bridges, and viaducts, have been recognised as eligible assets for climate-aligned bonds from railway companies.

A total amount of USD481bn bonds outstanding from railway issuers has been identified as climate-aligned.

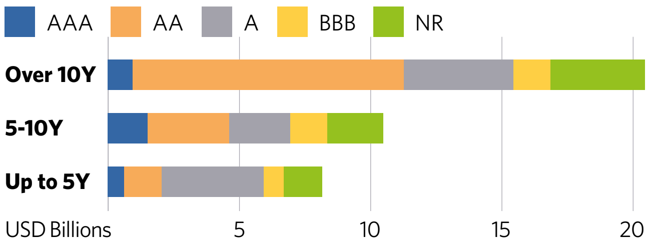
The largest theme in this sub-sector is railway conglomerates (68%), whose business activities range from railway infrastructure construction to rail operations and other services. This includes companies such as China Railway and Network Rail.

Railway operating companies make up 28% of the Railway sub-sector. This includes comprehensive railway operators such as Central Japan Railway which provide both passenger and freight transport services. Dedicated passenger rail service providers include Kowloon-Canton Railway and Keisei Electric Railway. An example of freight rail operators is Union Pacific Railroad.

Bonds outstanding from issuers operating as rolling stock manufactures, railway infrastructure constructors and signalling and other services providers account for 4%.

Mass transit

(USD39.1bn outstanding aligned, 37 issuers, 171 deals)



This sub-sector includes coach, bus, BRT, metro, and light rail operators who provide urban or intercity passenger transport services. With USD39bn outstanding, Mass Transit represents 7% of the Transport sector. Like railway issuers, it is common for mass transit operators to issue long term-debt with a high rating. 52% of the outstanding climate-aligned bonds have a tenor of more than 10 years, and 75% carry a rating of A or above.

Metro and light rail is the largest theme, making up three-quarters of this sub-sector, followed by bus and light rail companies. Fully- and strongly-aligned issuers primarily comprise metro operators, such as Guangzhou Metro, Transport for London, Tokyo Metro, Hong Kong MTR, Prasarana Malaysia, etc.

Metro companies often hold assets such as shops or property around stations. Some metro companies don't meet our green revenue threshold for full alignment due to the large proportion of revenue coming from property assets or other non-relevant business lines, so their bonds are not included in this research. However, we are supportive of the land value capture model and metro operators are encouraged to apply it to finance metro projects. We have seen labelled green bonds issuance from both Hong Kong MTR and Nanjing Metro, using land sale or lease to support metro network expansion.

EV and hybrid vehicles

(USD11.7bn outstanding aligned, 10 issuers, 57 deals)

This sub-sector is primarily composed of climate-aligned bonds from fully-aligned EV manufactures (e.g. Tesla) and labelled green bonds. These account for 42% and 46% respectively.

Auto manufacturers featured for the first time in our green bond list in 2014: Toyota's Auto ABS raised funding for Toyota to provide vehicle leases and loans on electric and hybrid vehicles. Auto financing companies such as Volvofinans Bank and Hyundai Capital Services, and conventional car manufactures including BAIC Motors and Geely are among the labelled green bonds issuers. Chinese company TGOOD, the biggest E-Vehicle charging solution provider worldwide, brought to market the only (to date) green bond that solely finances an EV charging station network.

FDG Electric Vehicles, who recently received an order of 500 EV trucks from a US fleet leasing company,[2] joined Tesla as the second pureplay EV manufacturer recorded in our database.

Other

(USD101m outstanding aligned, 3 issuers, 3 deals)

A few climate-aligned bonds have been issued from other sub-sectors, including bicycle manufacturing and shipping. Nippon Yusen Kaisha's labelled green bond is the first shipping bond in our database. Although it finances LNG-powered assets, we included it as the GHG emissions targets are clear and the assets financed by NYK's bond are currently the lowest emission asset option for long-haul shipping.

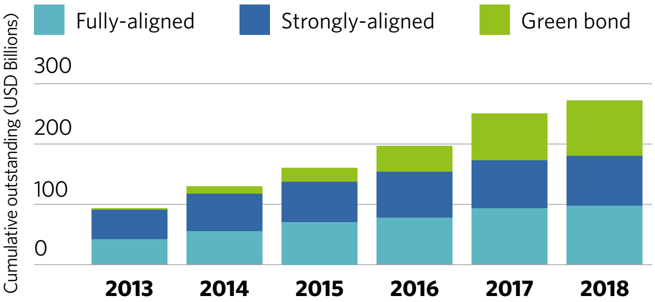
Clean energy

7 AFFORDABLE AND CLEAN ENERGY 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 11 SUSTAINABLE CITIES AND COMMUNITIES 12 RESPONSIBLE CONSUMPTION AND PRODUCTION 13 CLIMATE ACTION

Energy is the second largest theme of the climate-aligned universe

The energy sector is the second largest climate theme after transport and accounts for 23% of climate-aligned outstanding bonds, or USD271bn. In order to meet the goals of the Paris Agreement as well as support the SDGs, and in particular goals 7, 8, 9 and 13, renewable energy investment must scale-up quickly.

Green bonds for energy make up a third of cumulative aligned outstanding volumes



Labelled green bonds with energy allocations represent a third of the outstanding sector amount (USD90bn). A further 37% are contributed by unlabelled climate-aligned bonds issued from fully-aligned entities (USD99bn). The rest (USD82bn), are from strongly-aligned issuers. Over the years, the proportion of outstanding green bonds has increased in the energy theme.

Green bonds issued by strongly-aligned entities represent 3% of the total debt outstanding of these entities. By contrast, green bonds from fully-aligned issuers represent 18% of their outstanding debt. There is sizeable potential for climate-aligned issuers to make the green credentials of their debt more visible to investors and for investors to contribute to growing the green bond market.

35 countries are represented by energy companies with 75% or more of 'green' revenues. The top 5 are France (USD54bn outstanding), China (USD27bn), Canada (USD19bn), USA (USD15bn) and Norway (USD12bn). There would be an opportunity for entities in the Russian Federation, Kazakhstan, Portugal, Thailand, Israel, Kenya and Bulgaria to become the first national green bond issuers in these markets.

The split by emerging versus developed markets is somewhat different to green bonds. The share of emerging markets for fully climate-aligned issuance is 46% of the outstanding bonds, whereas it is 17% for green bonds. This again, suggests that there is potential both for investors and issuers to leverage green finance within emerging market nations.

Europe accounts for over 54% of Energy bonds

Region	Amount (USDbn)	Issuers	Deals	% IG rated	Hard CCY
Europe	147	102	401	73%	99%
Asia-Pacific	62	104	473	73%	24%
N America	54	64	194	77%	99%
Latin America	7	20	66	31%	25%
Africa	0.3	3	3	0%	51%
Supranational	0.2	2	2	100%	99%
Total	**271**	**298**	**1,139**	**-**	**-**

A market for all shapes and sizes

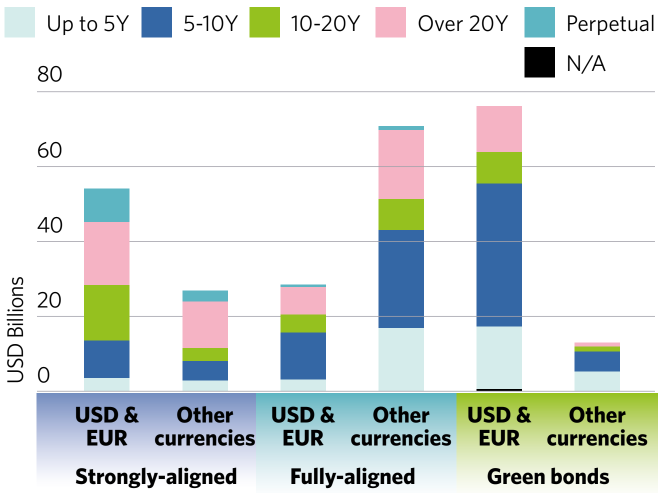
The fully-aligned universe features a wider range of currencies and a greater exposure to emerging markets than the green bond market. By contrast to Energy green bonds where 89% of outstanding debt is in hard currency, it is 51% for bonds from fully-aligned issuers. Currencies such as RUB, THB and ILS are solely available from climate-aligned bonds.

65% of outstanding bonds from fully-aligned issuers are investment grade. Within these, more than three-quarters of the outstanding volume is in currencies other than USD or EUR. Investors will find more EUR and USD denominated investment grade bonds from green and strongly-aligned bond issuers.

The most prolific fully-aligned issuers are from India, China and South Korea. Fully-aligned bond issuers offer a greater exposure to emerging markets: 60% of their outstanding bond number compared to 27% for strongly-aligned issuers and 28% for green bonds.

USD22bn of bonds outstanding from fully-aligned issuers will mature by 2020, and an additional USD40bn by 2025. This could be an opportune time to refinance with labelled green bonds.

Fully- and strongly-aligned issuers show different bond characteristics



Strongly-aligned issuers give investors the opportunity to access longer-dated bonds and a higher proportion of investment grade deals. Power companies such as EDF, Vattenfall and Fortum Oy are part of the largest size bucket.

Bonds issued by strongly-aligned entities offer a greater choice of longer-dated bonds compared to green and fully-aligned climate bonds. 33% have tenor of 20 years or more, including from EDF, Vattenfall, Toronto Hydro and Fortum Oy.

5 to 10 years is the largest bracket for green bonds in the energy space (48% of outstanding bonds) as well as for bonds from fully-aligned issuers (38% of outstanding bonds).

Strongly-aligned issuers tend, on average, to issue more investment grade bonds compared to green bond and fully-aligned issuers. 73% of the number of their bonds are investment grade, which compares to 42% for green bonds and 47% for fully-aligned issuers.

By 2025, USD36bn of bonds from strongly-aligned entities will reach their maturity. 79% of the amount is currently investment grade and denominated in hard currency.

Energy sub-sector characteristics

A large part of the outstanding aligned bonds finances a mix of at least two clean energy sources. Hydro comes second and accounts for 20% of outstanding bonds. Solar is in third position at 6%, followed by nuclear 3% and wind 3%. The remaining 2% is contributed by geothermal, bioenergy and battery/energy storage companies.

More analysis on each energy sub-sector can be found below.

Renewable energy (mix)

USD180bn outstanding aligned,
142 issuers, 542 deals

The top 3 fully-aligned issuers are Orsted (Denmark) with USD7.3bn, including USD1.5bn of green bonds, Korea Hydro & Nuclear Power (USD7bn, including a USD600m green bond), and Statkraft (Norway, USD3.9bn). Emerging markets account for half the outstanding bonds in the sub-sector and include Kazakhstan, Philippines, Malaysia and Thailand, for example.

For strongly-aligned issuers, French utility EDF (USD59bn aligned share of outstanding bonds, which includes USD5.3bn worth of green bonds), NextEra Energy (USA, USD7bn) and Vattenfall (Sweden, USD4.7bn) are in the top 3. Only EDF is a green bond issuer, and its green bonds represent 8% of its outstanding debt. Developed markets account for the bulk of the outstanding debt, but there are emerging market issuers from China, Brazil and Kenya, too.

Solar

USD14.8bn outstanding aligned,
51 issuers, 150 deals

32 fully-aligned climate bond issuers account for most of the debt outstanding in the solar sub-sector. The top 3 are US companies Solar Star Funding (USD2.5bn), Topaz Solar Farms (USD958m) and SunPower (USD825m). Emerging markets account for 32% of the outstanding debt, with China leading. Thailand and Taiwan are respectively in the second and third position.

US issuers are also very active in the green bond space. Tesla Energy (previously SolarCity) is the largest issuer, followed by Solar Mosaic and Vivint Solar.

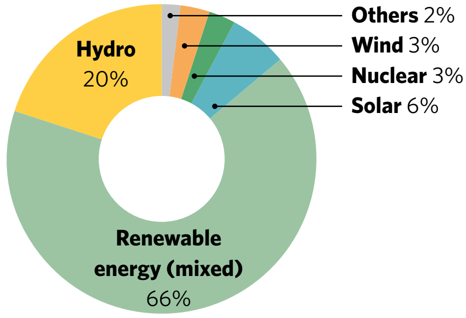
Wind

USD8.9bn outstanding aligned,
36 issuers, 71 deals

The top 3 out of the 22 fully-aligned issuers are Chinese company CGN Wind Energy (USD1.2bn, including USD469m of green bonds), Iberwind (Portugal, USD857m) and Continental Wind (USA, USD494m). Nearly half the outstanding amount from the sub-sector comes from emerging markets issuers from China, India, Peru, Mexico and South Korea.

Fully-aligned entities have already issued a sizeable amount of green bonds, e.g. CGN Wind Energy, Nordex (Germany), Envision Energy Overseas Capital (China), Energia Eolica (Peru), CPL Wind Farms (India), Arise (Sweden), CECEP Wind Power Corporation (China) and Hero Wind Energy (India). Most of the debt outstanding of companies cited here comes from green bonds.

Two-thirds of outstanding climate-aligned bonds finance diversified clean energy sources



Hydro

USD54bn outstanding aligned,
36 issuers, 291 deals

The top 3 fully-aligned issuers are Hydro-Québec (Canada, USD13.8bn), China Three Gorges (USD10.3bn, including USD295m of green bonds) and NHPC (India, USD6.1bn). Hydro-Québec and NHPC have yet to issue a green bond. Examples of fully-aligned issuers which have already entered the green bond market to finance hydro projects include Norway's BKK and Iceland's Landsvirkjun power company. Emerging markets account for half of the outstanding debt from hydro companies. China, India and the Russian Federation are in the top 3.

The top 2 strongly-aligned entities are Toronto Hydro (Canada, USD1.7bn) and Emgesa (Colombia, USD1.2bn). They have yet to issue a green bond. In terms of emerging markets, issuers from Colombia and India have a good potential.

Nuclear

USD9.2bn outstanding aligned,
7 issuers, 42 deals

Teollisuuden Voima Oy (Finland) has the largest amount of debt outstanding amongst fully-aligned issuers (USD3.3bn), followed by Kernkraftwerk Leibstadt (Switzerland, USD524m) and The Japan Atomic Power Company (USD464m). China National Nuclear Corporation (USD2.7bn aligned share) and China General Nuclear Power Corporation (USD1.3bn aligned share) are the only two strongly-aligned issuers in our list.

Geothermal

USD1.9bn outstanding aligned,
7 issuers, 14 deals

No strongly-aligned issuers have any outstanding debt in this sub-sector. Four fully-aligned issuers account for 18% of the outstanding amount; the largest being the Ormat Technologies (USA).

Contact Energy (New Zealand), Star Energy Geothermal Wayang Windu (Indonesia) and AP Renewables (Philippines) have already issued green bonds for geothermal energy.

Emerging markets represent 45% of the outstanding amount for the sub-sector. Indonesia is leading the category, followed by the Philippines, Brazil and Iceland.

Bioenergy

USD1.2bn outstanding aligned, 13 issuers, 20 deals

Only companies focusing on sustainable bioenergy production were selected. Fully-aligned issuers account for 93% of the outstanding debt from the bioenergy sub-sector. The top 2 issuers included are the American Darling Ingredients (USD500m) and the Thai company Energy Absolute (USD229m). Thailand and Bulgaria are the two emerging markets in the category.

Battery and energy storage

USD1bn outstanding aligned, 6 issuers, 9 deals

Fully-aligned entities account for 91% of the outstanding debt from the sub-sector. Most issuers are from emerging markets and in particular, China.

In the green bond space, Guoxuan High-Tech issued a CNY500m green bond in April 2018 to set up a lithium battery project by their new energy subsidiary.

Controversies in hydro and nuclear power

Bonds from fully- and strongly-aligned issuers in the energy theme represent a wider range of energy generation types than is currently eligible under the Climate Bonds Standard and Certification Scheme – in particular, nuclear and hydro power. Both of these electricity generation types have the potential to provide large-scale and low-carbon power that could meet baseload power demands. However, both power types can be controversial and require stringent criteria and standards in place in order for them to be included. In the absence of such criteria, they have been integrated into this report but may be excluded in the future as criteria are developed.

While hydro issuers in this study have not undergone a controversy screening process (the main challenge being to assess all of the issuers' projects one by one), the following criteria have been put in place for green bonds related to hydropower: run-of-river, existing reservoirs or new reservoirs with high density (preferably for >5W/sqm or higher) are eligible. These projects are included unless they are controversial due to loss of habitat/biodiversity and/or displacement of people or with weak social/environmental impact assessment (if publicly available).

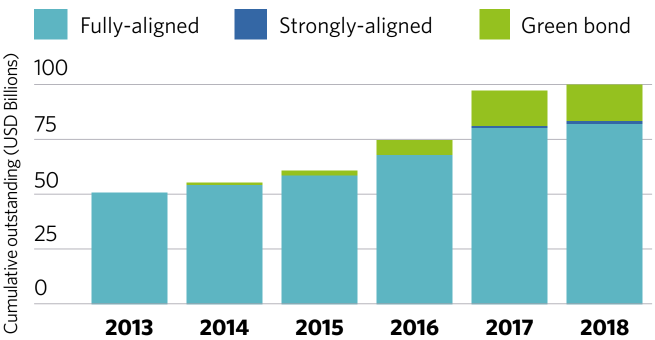
To date, no green bonds financing nuclear power have been included in the Climate Bonds labelled green bond database. When screening nuclear issuers for the purpose of this study, preference was given to entities engaging in the operation and/or decommissioning of nuclear power plants. Mining activities were not considered as climate-aligned and are excluded under the Climate Bonds Taxonomy.

Water management

Water is the fourth largest climate-aligned sector

The Water sector accounts for 8% of the total aligned universe, or USD101bn. Within the sector, labelled green bonds with proceeds allocated only to water represent 17% of the theme (USD17bn). 81% are unlabelled bonds issued from fully-aligned issuers (USD81bn) and 2% from strongly-aligned issuers (USD1.7bn).

Green bonds represent 17% of outstanding issuance in the water theme



The market is still heavily focused on developed markets. Issuers from the UK, France and USA represent 77% of the sector's aligned outstanding volume. Corporate issuers are more active in the English and French markets. In the US, most of the outstanding issuance comes from local government. Climate Bonds' briefing on US municipalities[3] identified Water as the largest sector, with more than 1,140 fully-aligned issuers and USD170bn of bonds outstanding (not included in this report's analysis).

It is crucial that there is a growth of bonds financing water infrastructure across a diverse range of geographies. Water stress is substantially impacting emerging markets,[4] aggravated by the lack of investment in resilient infrastructure. Global Water Intelligence has estimated that USD450bn of annual investment[5] is required to achieve the SDGs on water and sanitation by 2030.

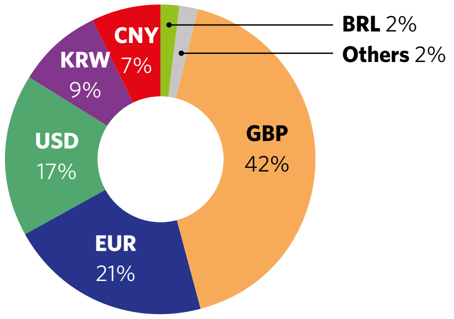
Europe accounts for 63% of water-themed bonds

Region	Amount (USDbn)	Issuers	Deals	% IG rated	Hard CCY
Europe	63.4	23	231	94%	99%
Asia-Pacific	19.7	21	190	80%	15%
North America	15	30	87	99%	99%
Latin America	2.3	10	54	<1%	15%
Africa	0.1	1	2	-	100%
Total	**100.5**	**85**	**564**	**-**	**-**

Bonds in the water sector tend to be longer dated. The largest tenor bracket is over 20 years and represents 39% of aligned outstanding issuance. A quarter of outstanding issuance falls in the 10-20Y range and a fifth in the 5-10Y category.

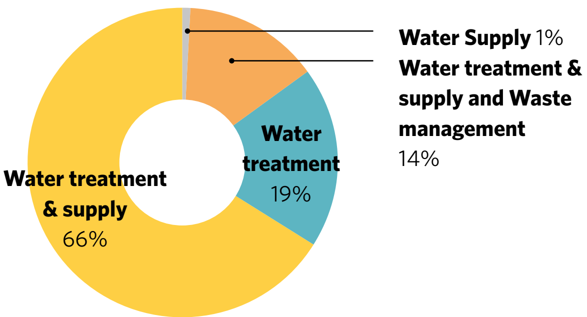
By 2025, USD41bn of water bonds will have matured, including USD34bn from fully-aligned issuers. Refinancing under a green label would improve visibility and possibly disclosure.

GBP issuance dominates water theme



42% of outstanding bonds in the sector are GBP-denominated, largely made up of bonds from fully-aligned issuers (50% of bonds from fully-aligned issuers are in GBP). CNY is the dominant currency for strongly-aligned bonds, whilst USD accounts for most of the green bonds outstanding (60%).

Water bonds are overwhelmingly investment-grade rated: 90% overall, 91% for fully-aligned issuers, 81% for strongly-aligned bonds and 84% for green bonds. From the identified universe, only fully-aligned issuers have issued sub-investment grade bonds and these represent 6% of their outstanding bonds.



A sub-sector analysis shows that 80% of aligned outstanding bonds were raised for a mix of services. Green bonds have been issued to finance all of the sub-sectors.

The water sector accounts for the highest share of adaptation and resilience integration[8] in the green bond market. Netherland's NWB Bank highlights how municipal banks can issue green bonds to provide loans to local water authorities to fund water projects that integrate adaptation components.

One of the latest developments in the sector comes from Kenya Pooled Water Fund which is planning a 1.5bn Kenyan Shilling bond (USD14.8m)[9] this year to fund water utilities. This is a welcome initiative as public entities remain the dominant players in this field.

Water treatment and supply

(USD66bn outstanding aligned, 54 issuers, 291 deals)

384 fully-aligned issuers account for most of the outstanding amount under the Water sector (87%, USD58bn). The top 3 by outstanding debt are Thames Water (UK, USD12bn), Veolia Environnement (France, USD10.2bn) and Water Capital (USA, USD4.5bn).

17 out of the 38 fully-aligned entities in this sub-sector are UK based. English water utilities are privately held and often raise debt through an offshore dedicated finance subsidiary.

The top 3 green bond issuers are Ibank (USA, USD1.3bn), Beijing Enterprises Water Group (China, USD1.1bn) and San Francisco Public Utilities Commission (USA, USD1bn). All others are US based.

Water supply

(USD1.5bn outstanding aligned, 7 issuers, 20 deals)

The largest outstanding amount of bonds comes from English company Affinity Water Programme Finance (USD1bn), followed by Thai TTW PCL (USD204m) and state-owned Umgeni Water Services (USD140m), the largest supplier of bulk potable water in the Province of KwaZulu-Natal, South Africa.

Water treatment

(USD19.1bn outstanding aligned, 16 issuers, 215 deals)

Fully-aligned issuers in the sub-sector account for 60% of debt outstanding. The largest is Korea Water Resources with USD10.2bn outstanding, including USD300m green bonds. Bazalgette Finance (UK), the financing vehicle for the Thames Tideway supersewer, comes second with USD1.9bn outstanding, including USD1bn of green bonds.

86% of bonds outstanding by number originate from emerging markets. South Korea and China account for the most deals.

Large green bond issuers include China Development Bank and US municipal New Jersey Infrastructure Bank.

Water treatment & supply and waste management

(USD13.7bn outstanding aligned, 12 issuers, 38 deals)

French utility Suez is the sole fully-aligned issuer identified in the sub-sector, with USD10.7bn worth of bonds outstanding. Its activities are split between water treatment and waste management.

No strongly-aligned issuers have been identified in the sub-sector.

In terms of green bond issuers, US local governments account for nearly all of the green bonds outstanding in the sub-sector.

Controversies

Water is a fundamental human right. Yet, freshwater represents only 0.5% of total potable water available.[6] Access to and consumption of water is highly unequal across the globe, putting an additional strain on vulnerable nations already greatly exposed to climate change.

While our screening process did not account for controversies, we acknowledge that certain activities by issuers have been under criticism. Financial sanctions have been applied to an increasing number of firms found to be breaching laws by committing environmental offences.[7] Other issuers have been reported to be involved in anti-competitive behaviour, which artificially inflates market prices.

The contractual relationships between water providers and municipalities have also been under increasing scrutiny. The concern is that they are not fostering the right incentives for water providers to keep investing in infrastructure, which in turn results in a substantial number of leakages and water loss.

Lastly, some controversies revolve around tax havens and the fact that several water utilities have a separate financial entity registered in more tax lenient countries.

Low-carbon buildings

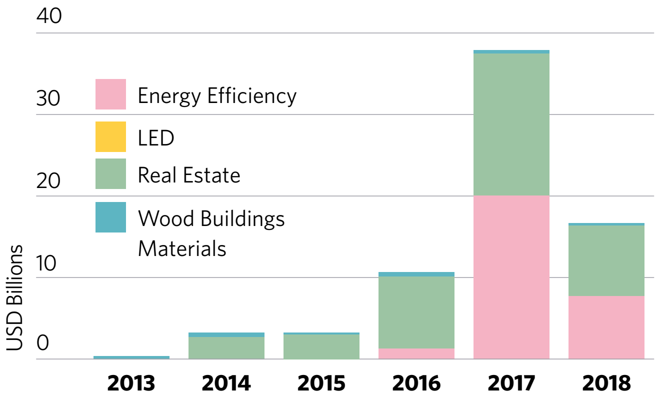
Green bonds dominate climate-aligned issuance

The decarbonisation of the buildings sector is paramount as it accounts for more than 6% of total global GHG emissions, according to the IPCC's *"Summary for Policymakers"* 2014.[10] The projected world population growth, combined with increased energy access across the globe will drastically increase the overall energy demand in the sector and its related carbon emissions.

Directing significant proportions of investments towards energy efficient buildings, equipment and materials provides substantial opportunities to offset future energy demands and CO_2 emissions.

In 2017, 59% of all energy efficiency investments went towards the building sector, according to the IEA's *World Energy Investment 2018 report.*[11] Yet the buildings sector constitutes a 6% share of the climate-aligned bond universe. The USD72.1bn outstanding is allocated to funding certified buildings (57%), energy efficiency upgrades (40%), FSC, MTCC and PEFC certified wood building materials (2%) and LED manufacturers (1%).

Green bonds for certified buildings and energy efficiency improvements dominate issuance



There are many manufacturers that produce energy efficient equipment and systems, but we have not been able to identify climate-aligned issuers among them due to the lack of revenue splits in corporate accounts that would help us identify 'green' revenues. Daikin Industries, for instance, produces HVAC equipment for green buildings but its revenue streams cover other products too.

Green bonds represent 97% of outstanding climate-aligned debt. Strongly-aligned issuers represent a negligible amount, with fully-aligned issuers accounting for almost all the remaining 3%. Over USD41bn worth of green bonds has been used to finance certified properties and USD29bn for energy efficiency improvements.

Fannie Mae dominates the sector with USD37.7bn of outstanding green agency MBS allocated to loans for energy and water efficiency improvements and mortgages on certified multifamily properties. Fannie Mae's green MBS represent over half the total climate-aligned debt in the sector. The remaining outstanding debt has been issued from a wide range of financial and non-financial institutions. The next largest issuers are BerlinHyp, Obvion and the Development Bank of Japan.

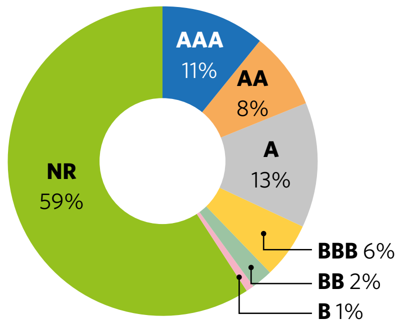
The US is the top country of risk at USD46.6bn of issuance. In Europe, France, Germany, Sweden, Norway and the Netherlands account for the largest volume of outstanding climate-aligned debt. As of the end of June 2018, Sweden has issued the largest number of green bonds: 44, far exceeding the European average.

Excluding green bond issuers, the largest issuer is Canadian producer of FSC and PEFC certified wood building materials Norbord Inc. It is a fully-aligned issuer with USD555m outstanding. Overall, we identified 7 other issuers in this sub-sector with a total of USD1.6bn of outstanding bonds: Boise Cascade and Louisiana-Pacific Corp. (USA), West Fraser Timber (Canada), Kanger International (China), Masisa (Chile), Dongwha Enterprise (South Korea) and Wood One (Japan). Most deals are private placements.

We also identified 4 LED manufacturers, all fully-aligned, with a total of USD493m of bonds outstanding.

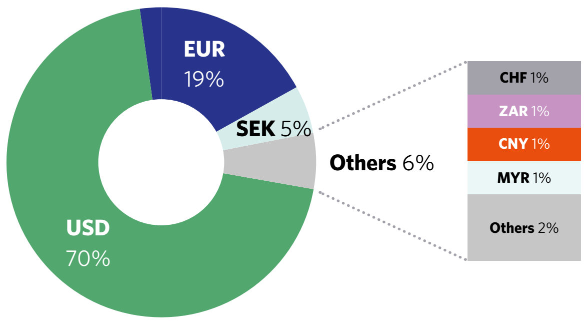
Almost 40% of outstanding climate-aligned debt is rated investment grade. If Fannie Mae issuance – generally regarded as low-risk due to its quasi-governmental status – is included, the figure increases to 90%. Non-investment grade issuers almost entirely comprise of fully- and strongly-aligned issuers, whereas green bond issuers are primarily investment grade.

38% of outstanding bonds are investment grade



US dollars dominate green bond issuance mainly due to Fannie Mae volumes. If issuance from Fannie Mae is excluded, EUR is the largest currency (USD13.7bn), followed by USD (USD12.7bn) and Swedish Krona (USD3.5bn).

70% of outstanding bonds are USD-denominated



The most popular issuance tenor across the building sector is between 5 and 10 years with 60% of climate-aligned outstanding debt falling in this tenor range.

Buildings sector allocations have been increasing, but there is still room for growth. Energy efficiency has become increasingly important to governments and policy makers who are aware of the benefits associated with implementing large-scale energy efficiency programmes across countries such as improved energy security and lower final energy demand.

Most of these programmes require public investment to support subsidies and/or incentive schemes as well as R&D to improve the products' energy performance. Green bonds represent an effective financial tool to raise such capital. Securitisation has proven to be effective in refinancing small energy efficiency loans.

Property companies are hard to classify

Many property companies, REITs, house builders and funds own certified green buildings, develop energy efficient buildings and/or have invested in energy efficiency upgrades. However, this information is rarely clearly delineated in corporate reporting. Consequently, our multi-faceted screening methodology did not pick up any fully- or strongly-aligned issuers.

Instead, we considered other metrics to identify best performers. For example, Klepierre, CapitaLand and Gecina provide more comprehensive environmental reports, which include key performance indicators such as GHG emissions and energy efficiency improvement measures introduced in new building projects. This approach represents an initial step towards improved best practice reporting, including increased disclosure on GHG emissions reductions and on certified buildings – number, share of total stock, certification programmes and level achieved.

In its recently published 2018 CSR report,[12] French property company Klepierre, for instance, reports that in 2017 75% of its assets were certified buildings and it is targeting 100% green building certification by 2022. We hope we will be able to include Klepierre in the climate-aligned bond universe in the future, along with an increasing number of property companies if they start reporting more extensively on building certifications and energy performance improvements, and the associated revenues.

We do not feel there is a single metric that captures the multi-faceted nature of what would define a 'green' property company. Instead, we considered a variety of metrics to form a broad view.

In addition to annual accounts and other corporate reports, we considered the following external resources:

- **CDP's A list**,[13] which scores companies according to their extent of environmental data disclosure;
- **GRESB** public disclosure list[14] which awards property companies based on ESG performance (gold winners only);
- **EPRA BPR Awards**[15] which scores property companies according to their successful adoption of EPRA BPR Guidelines (gold winners only);
- **Sustainalytics[16] and Robeco SAM[17] ratings**, which rate companies according to their ESG performance (more information on their methodologies is available on their websites);
- **Bloomberg's green building flag;**
- Disclosure on certified green buildings;
- Green bond issuance.

Each resource ranks or includes the relevant property company in their list according to different metrics, which are ultimately complementary and underpin corporate engagement in environmental performance measurement and disclosure. The table below provides a sample list of property companies which tick the most boxes using these reference points.

The combination of climate-related disclosure and revenue splits which identify 'green' revenue could help us identify companies which could be included in the climate-aligned bond universe.

Property Company or REIT	CDP A list 2017	GRESB Gold winner	EPRA Gold winner	Sustainalytics score	Robeco SAM score	Bloomberg green building tag	Green building certification	Green bond issuer
Klepierre	X	X	X	92.8	100	X	X	
Gecina SA		X	X	98.9	98	X	X	
CapitaLand Ltd				90.1	96	X	X	
British Land PLC		X	X	97.2	90	X	X	
Hammerson PLC		X	X	91.7	85	X	X	
Unibail-Rodamco		X	X	99.4	72	X		X
Sekisui House				66. 7	100	X	X	
Icade		X	X	96.7	58	X	X	X
Ventas Inc				63.5	76	X	X	
Stockland	X			-	91	X	X	X

Sustainable land use

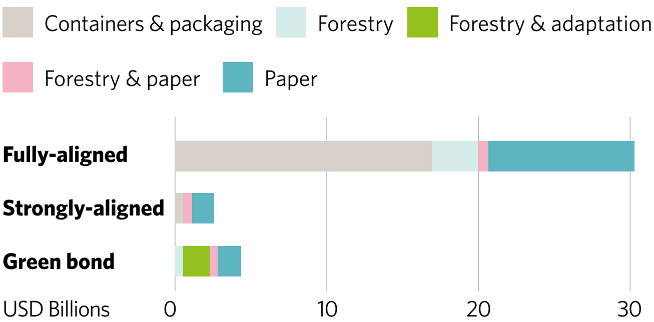
Small sector with big opportunities for switching from vanilla to green issuance

Agriculture and forestry play a crucial role in achieving global decarbonisation targets. In 2014, the IPCC estimated[18] that these two sectors account for approximately a quarter of anthropogenic emissions. The implementation of sustainable agricultural practices is necessary for the industry to successfully reduce emissions, adapt to changes in weather patterns, and withstand the pressures placed on food security by population growth. Simultaneously, limiting deforestation and forest degradation is imperative to ensure that forests act as a net carbon sink rather than a GHG emitter.

Despite the need for more finance flows directed towards addressing climate impacts on these sectors, **this theme remains small. It accounts for USD37.3bn or just over 3% of the climate-aligned bond universe.**

Identified land use companies have been divided into five sub-sectors according to their main areas of operation (with no overlap): Containers & Packaging, Forestry, Forestry & Adaptation, Forestry & Paper, and Paper. No 'green' agriculture issuers were identified.

Containers & packaging issuers dominate volumes



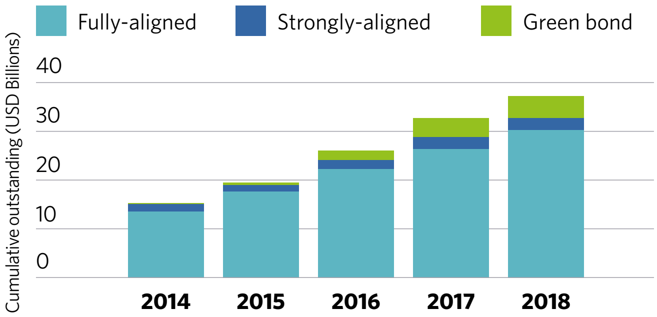
Fully-aligned companies account for over 82% of aligned outstanding bonds (USD30.4bn), with over half the volume coming from containers & packaging companies (and 47% for the sustainable land use sector overall).

Paper producers are the next largest segment. International Paper Corporation (USA) is by far the largest issuer in the sub-sector and sector. At USD9.7bn, it represents 26% of volume. The company benefits from FSC forest management, FSC Chain of Custody and PEFC Chain of Custody certifications[19] across its global operations.

The paper sub-sector represents 32% of fully-aligned figures and has already seen green bond issuance. In September 2017, Brazilian paper company Klabin came to market with a USD500m green bond[20] to finance FSC certified forest plantations, native forest restoration and biodiversity conservation, as well as renewable energy, clean transport, waste management, water management and adaptation projects. In March 2018, Stora Enso (Finland) published a Green Bond Framework[21] which includes projects related to FSC and PEFC certified forests among its eligible categories, signalling its intention to enter the market.

10% of fully-aligned issuance comes from forestry companies such as Weyerhaeuser Company (USA), included for its PEFC Chain of Custody certified[22] forests and manufacturing facilities.

Fully-aligned companies dominate issuance at 82%



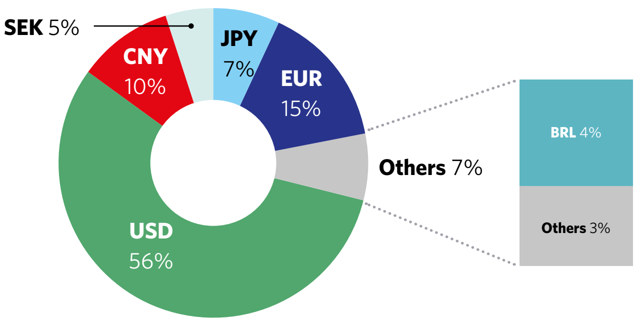
Strongly-aligned issuance makes up 7% at USD2.6bn, with approximately three-fifths of deals coming from paper companies including Mercer International (Canada) and Nippon Paper Industries (Japan). Japanese containers & packaging company Oji Holdings represents 22% of strongly-aligned volumes.

Swedish state-owned company Sveaskog, from the forestry & paper sub-sector, is both a strongly-aligned and repeat green bond issuer with a total of SEK2bn (USD242m) raised to finance FSC certified forestry land holdings.

USD4.3bn of labelled green bonds have been issued to finance land use related projects within this theme overall. Svenska Cellulosa Aktiebolaget (SCA) was the first green bond issuer to allocate part of the deal's proceeds to sustainable forestry projects in April 2014. Nine more issuers have come to market since. The Agricultural Development Bank of China is the largest issuer accounting for over a third of green bonds, with proceeds allocated to sustainable land use, forestry and adaptation.

In Q2 2018, Landshypotek Bank issued the first green covered bond secured on FSC and/or PEFC certified forestry assets. As the green covered bond market expands, other issuers could follow their example and use the dual-recourse debt structure to finance similar projects in the forestry and sustainable agriculture space.

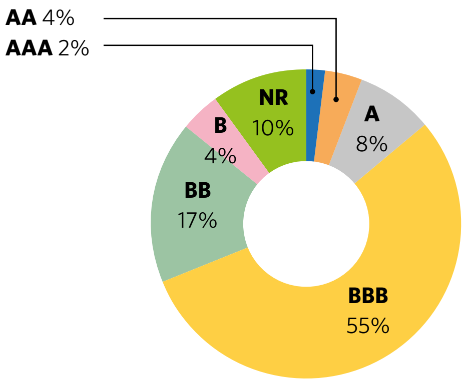
Over half of the outstanding bonds are USD-denominated



88% of outstanding aligned bonds are denominated in hard currency, with USD deals representing the largest share at 56%. This reflects the geographical distribution of issuers: half the deals were originated in the US, 82% of which issued in local currency. Most companies from Argentina, Brazil, Indonesia and South Korea have issued both in USD and local currencies; likely to attract more international investors.

EUR is the second most popular currency at 15%, with the bulk of deals coming from European entities and 22% from UK packaging and paper company Mondi Finance. CNY-denominated deals were issued exclusively by domestic companies, with ADBC and Shandong Chenming Paper Holdings accounting for 40% each.

69% of outstanding bonds are investment grade



BBB is the largest ratings band at 55%, with deals from large fully-aligned companies including International Paper Co, WestRock and Mondi Finance. 21% of issuance is rated BB+ or below, while 10% of deals are not rated.

Breaking down rating by developed and emerging markets shows that almost three-quarters of DM deals are investment grade compared to around half for EM issuance. 29% of EM deals are not rated – almost five times higher than DM – which could be due to deals being rated by local agencies which have not been captured in our database.

Greening the agriculture sector

The challenges facing today's agricultural industry will have wide ranging and cross-sectoral impacts, including exacerbating pressures on global food systems and landscapes, increasing health burdens such as hunger and malnutrition and rising the risk of conflicts.

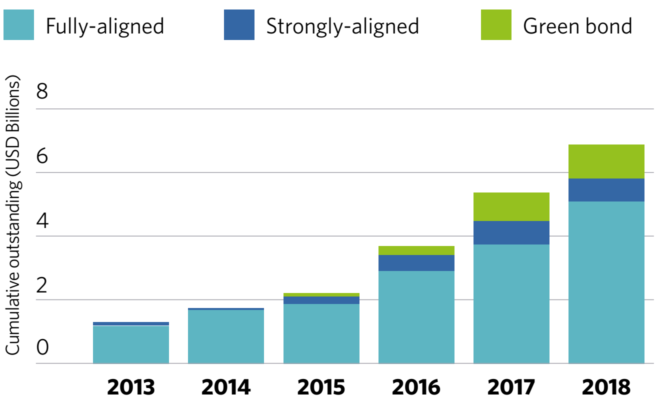
Therefore, the transition to a climate resilient and sustainable agricultural sector will require a holistic approach in order to be successful. The emergence of technological innovations present new avenues for achieving emission reductions while also tackling issues such as improving the food and nutrition systems. Examples of these technologies include:

- **Hydroponic and vertical farming** provide the opportunity to optimise land use and reduce stress on resources.
- **Yield enhancing technologies** can increase crop productivity and resistance to extreme changes in weather while also reducing water usage, and thus ensuring steadier revenue streams for farmers.
- Augmenting crop nutrient levels through **fortification/ biofortification processes** can contribute to tackling hunger and malnutrition.

The availability of such innovations presents significant investment opportunities to help create an efficient and low-carbon agriculture system.

Waste management

Waste management accounts for USD6.9bn of outstanding climate-aligned bonds

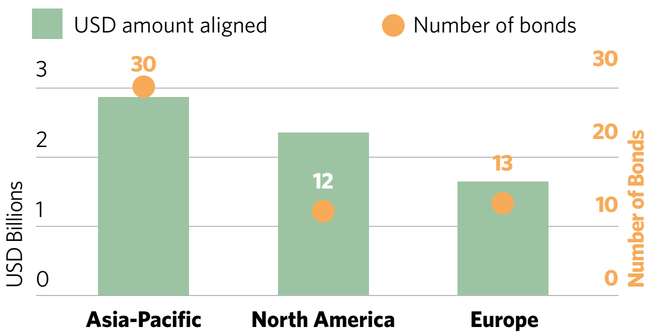


We have identified USD6.9bn of outstanding climate-aligned bonds in the waste management sector. According to UNEP, methane emission from waste management activities, including waste collection, transfer and treatment, contribute to global warming and climate change significantly. In addition to the potential climate impact, some types of industrial waste could also be hazardous to the environment.

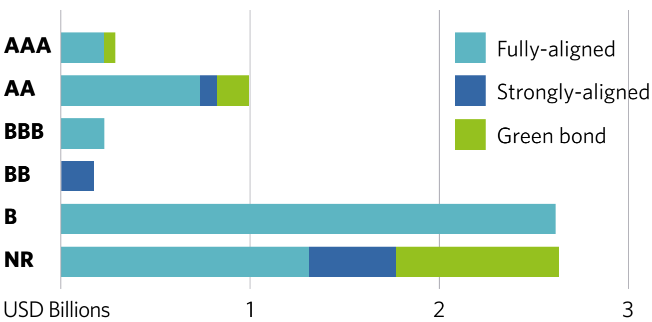
The size of this sector is relatively small, with three quarters of aligned outstanding bonds coming from fully-aligned companies, 10% from strongly-aligned and 16% from labelled green bonds.

The first labelled green bond in this sector was brought to market by UK waste management company Shanks Group in 2015. The group has since merged into Renewi and is a repeat issuer.

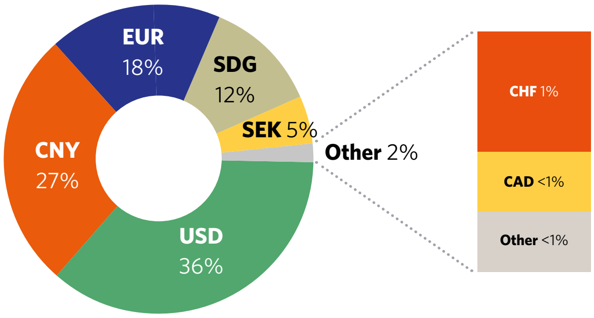
Asia-Pacific is the largest region by both volume outstanding and number of bonds issued.



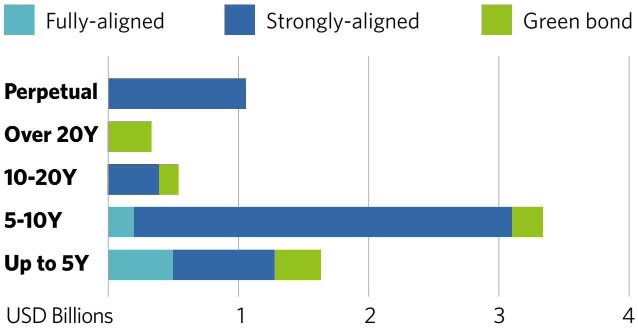
Investment grade bonds only make up 22% of the sector. 38% of outstanding bonds in this sector are not rated, and USD860m of that is labelled green bonds. This is partly due to municipality issuers, such as City and County of Honolulu, California Pollution Control Finance Authority and King County not seeking a rating for their green bonds.



36% of outstanding climate-aligned issuance is USD-denominated. The next most common currencies are CNY (27%) and EUR (18%). While CNY denominated bonds had the highest proportion of AA and AAA ratings (83%), it is worth noting that all Chinese issuers only used local rating agencies.



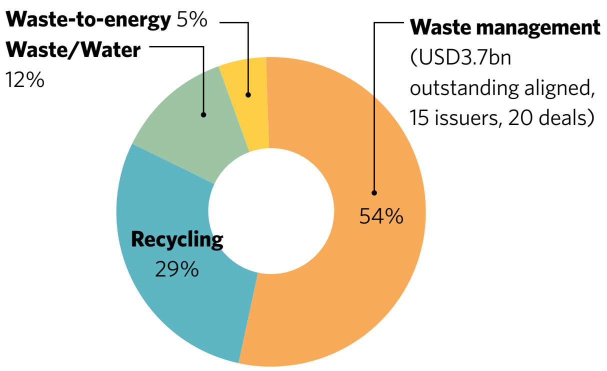
Short-term and medium-term bonds dominate the sector



Around half of the outstanding bonds have a tenor of 5-10 years. Long-term debt makes up 13% of the sector's outstanding bonds.

Labelled green bonds have the most diversified tenors. Bonds with more than 20 years tenor comprise solely green bonds issued by US municipalities. For example, South Carolina Jobs-Economic Development Authority and Ramsey County are on the list of long-term green Muni bond issuers. Green bonds have been widely used by US municipal government to fund large-scale, long-term waste infrastructure projects.

Waste is divided into four sub-sectors with Waste management being the largest

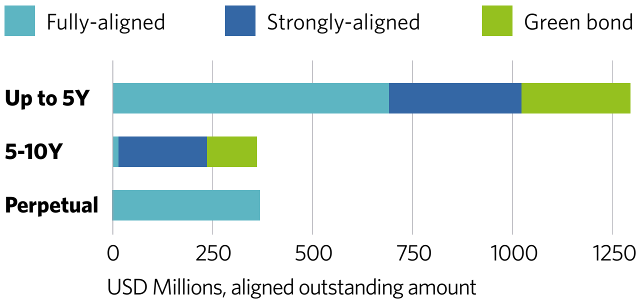


Waste management includes various activities ranging from recycling to monitoring of all forms of waste matters. Renewi (UK), Paprec (France) and Waste Italia are examples of comprehensive waste management corporate issuers.

Hazardous waste management companies, such as pharmaceutical waste manager Stericycle and dedicated nuclear waste solution provider Studsvik, are also included in our research.

Recycling

(USD2bn outstanding aligned, 7 issuers, 26 deals)



Recycling is a component of Waste Management, but it's treated as a separate sub-sector in this research because of its focus on waste prevention and minimisation before going to final treatment.

Recycling has been shown to result in the highest climate benefit compared to other waste management approaches in both OECD and developing countries.[23] Seven issuers from France, China and Sweden have been identified and their aligned outstanding debt adds up to USD2bn. All the issuers are from the private sector and 64% of their outstanding bonds have a tenor less than 5 years.

Issuers in this sub-sector include companies which recycle all types of materials, including metals, paper and plastic, and specialised ones. For instance, Stena Metall has dedicated operations to certain recyclable materials, China Hao Ran Recycling recycles paper and Huayou Cobalt recycles only cobalt.

This research has also identified a fully-aligned French issuer, Aurea SA, dedicated to the circular economy. By looking at alternatives for re-use, remanufacturing, repair and recycle, the circular economy is expected to further reduce waste disposal and close the loop of a product's life cycle.

Waste & water

(USD808m outstanding aligned, 2 issuers, 5 deals)

Hyflux Ltd and Taiwan Environmental Scientific Co. have been identified as climate-aligned issuers operating across the waste and water sectors. Due to the complexity, in practice, a company may provide services in both waste and water sectors. Taking Taiwan Environmental Scientific as an example, 93% of the company's revenue comes from pollution remediation, where both soil and water treatment are included.

Waste-to-energy

(USD368m outstanding aligned, 2 issuers, 4 deals)

Two waste-to-energy issuers were identified with outstanding issuance amounting to USD368m between them. Generating energy from waste can have a positive climate impact by replacing energy derived from fossil fuels, coupled with the fact that emissions arising from the use of waste as a source of energy are generally lower than those produced from fossil fuels, according to UNEP.[24]

In addition to fully- and strongly-aligned issuers in the sector, there is green bond issuance from US Munis in waste management.

Green bonds - diversity of bond structures

Green bonds have been issued using diverse structures and diversity is increasing

Most green bonds issued to date have been senior unsecured corporate or SSA[25] bonds with a specified use of proceeds: to fund assets and projects with a climate benefit. Over the years, however, issuers have applied the green bond label to a variety of structures. In some cases it has been applied to bond structures they have traditionally used to raise debt. Sometimes, they have used new approaches to achieve funding goals and appeal to a specific type of investor.

The introduction of solar ABS and PACE ABS as new funding instruments designed specifically to refinance large pools of small green loans and leases initiated a green securitisation market, which has gained prominence with Fannie Mae Green MBS.

Private placements have accompanied public bond issuance since 2010. Schuldschein, sukuk, covered bonds, hybrids and MTN programmes all play a role in growing the green bond market.

Green bond issuers use diverse structures*

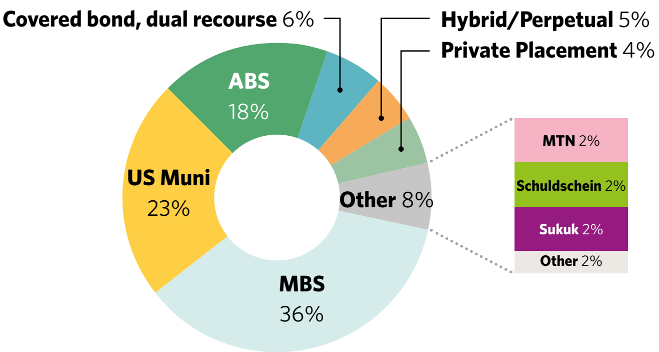


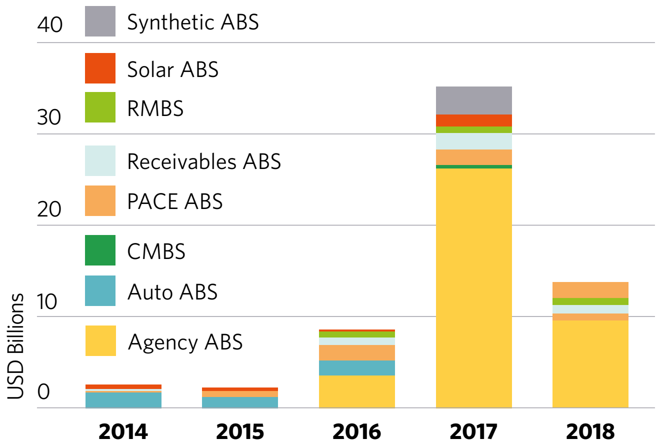
*Chart total represents 27% of the green bond market. It excludes senior unsecured and senior secured bonds (unless part of an MTN programme)

Securitisation enables companies and lenders to sell off existing financial assets to free up capacity for more business. It is the process through which an issuer creates financial instruments – asset backed securities or ABS – backed by financial assets such as mortgages or lease receivables. The ABS bonds are sold to investors who receive a return drawn from the cash flows of the underlying assets.

By aggregating the funding into a common structure, securitisations enable institutional investors to finance small-scale assets and small- and medium-size businesses.

A securitisation can be defined as 'green' when the underlying cash flows relate to low-carbon assets or where the proceeds from the deal are earmarked to invest in low-carbon assets such as mortgages on certified buildings, loans or leases on electric vehicles, on solar and wind assets or equipment (e.g. EV charging stations), loans for energy efficiency improvements and loans to climate-aligned SMEs.

Green securitisations are diverse too



Synthetic ABS is the largest ABS issue to date

What is it? In a synthetic ABS, the issuing bank retains ownership of the loans it wants to use as collateral for the deal but transfers the associated credit risk to an investor via the ABS structure. The bank continues to provide specialised loan servicing, but by selling the risk, it frees up regulatory capital. This allows the bank to originate new loans. In a green synthetic, proceeds are earmarked for new green lending.

Who's issuing? Credit Agricole CIB's USD3bn synthetic ABS from 2017 is the only one so far. It was privately placed with US-based Mariner Investment Group and was secured on a variety of loans, including project finance on renewable energy.

Future prospects: Synthetics can be very useful to lenders and the market as the freed-up capital can be used to create a multiplier effect in lending and scale up green funds available to small- and medium-sized businesses and projects. As the first deal shows, this can be done in scale.

The structure can also be used by financial institutions to help them transition to increased volumes of green lending. The loans included in Credit Agricole's ABS pool were a mixture of "brown" and green loans. Thus, 'brown' assets are helping the bank secure funding for green assets.

MTN issuance by property and UK water companies

What is it? Medium term note (MTN) programmes create a debt issuance framework which gives the issuer the flexibility to come to market repeatedly to raise funding. The eligibility criteria are fixed, but bond terms are set for each bond issue.

Who's issuing? Swedish property company Fabege AB put in place the first Green MTN in 2016 and has raised the equivalent of USD555m in multiple bonds issues. It is also a JV partner with 4 other property companies in SFF, a financing vehicle with an MTN programme, which caters to both vanilla and green bonds.

In the UK, MTN programmes are being used by Anglian Water and Bazalgette Finance to finance water and wastewater assets. They have raised funds through a variety of debt instruments, including public and private green bonds, retail bonds and loans.

In 2018, Malaysian property company Segi Astana issued the first ASEAN Green MTN, which complies with the ASEAN Green Bond Standards. French state-owned company Société du Grand Paris has set up a Green Euro MTN programme of up to EUR5bn to raise financing for investment in the Grand Paris Express metro system.

Future prospects: MTN structures can be deployed by repeat green bond issuers around the world to facilitate access to the market and lower issue costs.

Green sukuk was pioneered in Malaysia but Indonesia issued the first sovereign green sukuk

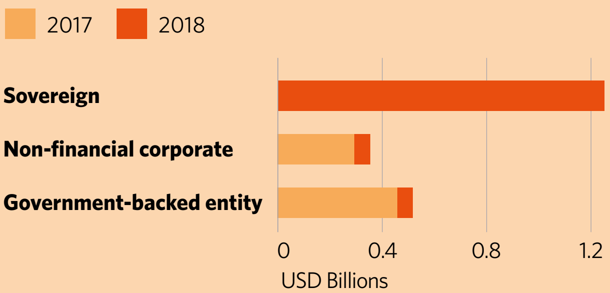
What is it? A sukuk is an Islamic financial instrument, that complies with Sharia law. The issuer sells an investor group certificates, uses the proceeds to purchase an asset, of which the investor group has partial ownership, and distributes part of the asset revenues as profit to the investors. The assets need to comply with Islamic ethical values, which include green assets and projects.

Who's issuing? The first green sukuk was originated in 2017 in the private sector to finance Malaysian solar projects with a deal each from Tadau Energy and Quantum Solar Park. State-backed investment company Permodalan Nasional Berhad has issued the largest Malaysian sukuk (MYR1.9bn/USD461m).

To date there have been five green sukuk from Malaysian issuers and one from Indonesia – a USD1.25bn sovereign green sukuk.

Future prospects: Malaysia and Indonesia have large sukuk markets, but Middle Eastern issuers could also decide to label Islamic finance debt structures to finance green assets. This represents a significant growth opportunity for property finance, solar and desalination plants, water conservation and resilience investment.

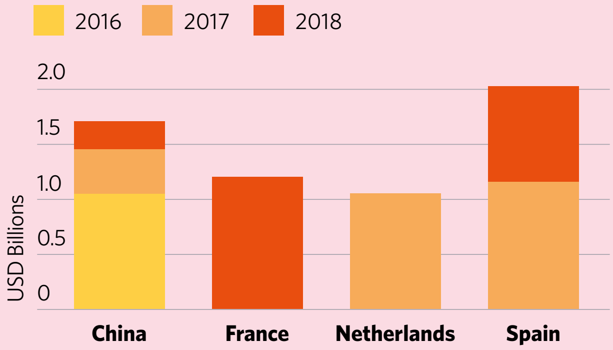
Multiple Malaysian green sukuk issuers but Indonesian sovereign dominates volume



Green perpetuals were pioneered in China

What is it? Perpetuals are bonds without a maturity date, i.e. they remain outstanding in perpetuity. However, issuers set call dates when they can redeem the bonds and these are typically 5-7 years after bond issuance. Perpetuals are one form of hybrid securities, as they exhibit certain features of equities given the absence of a maturity date, but at the same time, they pay a coupon and the call date sets an expectation of redemption, similar to bonds.

Repeat issuance of perpetuals and hybrids from Spain and China



Who's issuing? The first green perpetuals were issued by Xinjiang Goldwind, a Chinese wind turbine manufacturer, in 2016. The 6 Chinese issuers to date have raised the equivalent of USD1.7bn in 9 deals, primarily to finance investment in water and wastewater management and adaptation (USD976m) as well as renewable energy assets and related equipment (USD654m).

Energy companies Iberdrola (Spain), Engie (France) and TenneT Holdings (Netherlands) account for the remaining issuance. Typically sized at EUR1bn, European deals raise funds at scale.

Future prospects: Perpetuals are a flexible financing instrument which give the issuer control over the bond repayment date and can be used for capital management purposes. Their popularity among large European issuers appears to be on the rise.

Schuldschein are not just a German phenomenon

What is it? Schuldschein or SSD, also referred to as certificate of indebtedness, are privately placed, unlisted, bilateral loan notes. The debt is legally constituted by the underlying loan agreement, so the instrument is treated as a loan by investors. Historically German public authorities have been the largest issuers. Green Schuldschein have been issued by corporate borrowers.

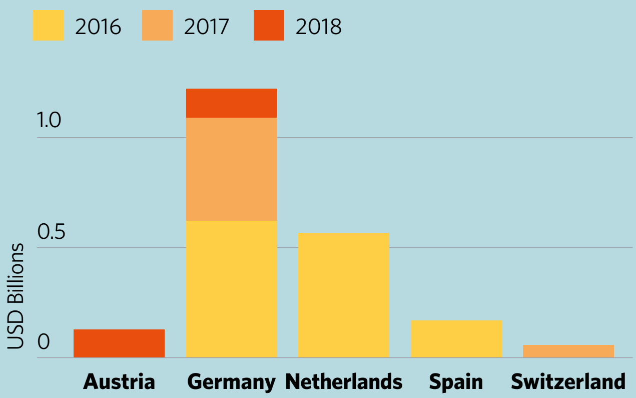
Who's issuing? Germany tops the rankings with deals from Nordex (wind turbine manufacturer), MANN+HUMMEL (filtration products) and Volkswagen Immobilien (property company).

MANN+HUMMEL's Green SSD Framework is one of the few that identifies environmental performance improvement of production facilities and processes as a key investment category in connection with investment in renewables, energy and water efficiency, as well as pollution prevention and control initiatives.

The Volkswagen Immobilien deal raised funding in 5 tranches of different maturity, exemplifying SSD flexibility as an instrument.

Energy sector companies TenneT Holdings (Netherlands), Acciona (Spain), Verbund (Austria) and Repower (Switzerland) have contributed USD911m to green Schuldschein issuance to date.

Schuldschein used across Europe



Future prospects: Verbund AG's EUR100m deal from April 2018 was a digital Schuldschein, executed over a fully integrated, digital issuing platform. The use of blockchain technology in the execution of deals could be the next chapter, but more broadly the structure is expected to retain its appeal among corporate and financial sector issuers given the well-established debt format and its flexibility.

Private placement

What is it? In private placements, the bond issuer places the bond directly with the investor. Certain terms such as the tenor or currency may be chosen to match investor preferences. Private placement (PP) bonds are typically not listed.

While most debt details – particularly pricing – are confidential, green bond issuers are expected to disclose information on the assets/projects to be financed. As with other green bond issuers, best practice is to develop a green bond framework in compliance with the Green Bond Principles and obtain an external review.

Who's issuing? 2017 volumes reached a record high of USD2.6bn, or over half of total PP issuance to date. The spike is largely due to higher issuance from non-financial corporates including rail company Alpha Trains (Luxembourg) and renewable energy companies Neoen (France), Acciona (Spain), Tenaska (USA) and GCL New Energy Investment (China).

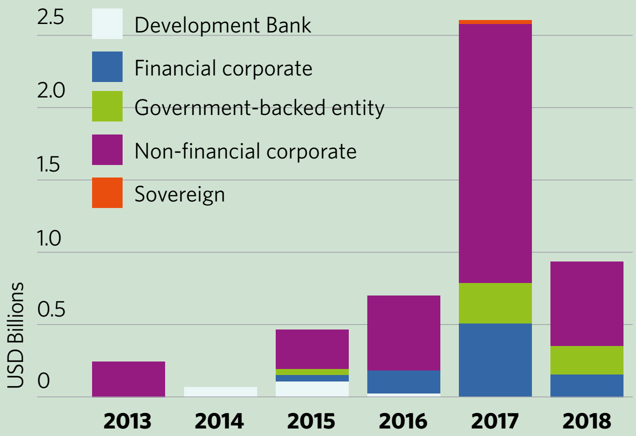
US REIT Hannon Armstrong Sustainable Infrastructure and Argo Infrastructure Partners (Cross-Sound Cable) have raised private bond funding for renewable energy infrastructure, while property companies WDP (Belgium) and Fonciere INEA (France) as well as Monash University (Australia) have raised funds for buildings.

Private placements also feature public sector issuance, including Fiji's sovereign green bond and some of the World Bank's green bonds issued between 2010 and 2016. Government-backed entities that have accessed the private placement market include the Indian Renewable Energy Development Agency (IREDA), water authority Aquafin (Belgium), power company Landsvirkjun (Iceland) and local government funding agency MuniFin (Finland).

Private placement investment can play an important role in supporting the introduction of green bonds in emerging markets. For instance, the first green bond from Lebanon, issued by Fransabank SAL in April 2018, was fully subscribed by the IFC and the EBRD. The IFC has invested in green bonds placed by further emerging market banks, e.g. Bank Zachodni WBK (Poland), Davivienda (Colombia), YES BANK (India).

Green bond private placements from emerging market issuers total USD1.4bn compared to USD3.4bn from developed market issuers, with the remaining USD233m attributable to the World Bank and Asian Development Bank.

US private placements and supranationals investing in EM green bonds support growth



Developed markets issuers such as Australian bank Westpac and New Zealand's Contact Energy have used US private placements to tap US institutional investors who can invest in size and can take long-term positions. Conversely, Canadian Solar used private placement to raise JPY funding for a Japanese solar power plant.

Five issuers have achieved Certification under the Climate Bonds Standard for 8 private placement deals, which account for USD1.3bn, or 28% of total green bond private placements to date. Certification under sector-specific criteria involves independent third party verification that the underlying assets are on a trajectory towards decarbonisation by 2050, and this is reconfirmed annually as part of ongoing impact reporting.

Future prospects: Private placements have been part of the green bond market since 2010, and are likely to be small but complementary to public placement bonds, given rising issuance from emerging markets financial institutions and private sector corporates.

Note: Bonds which do not disclose sufficient information to confirm an asset's green credentials are not included in the Climate Bonds green bond list. While private placements are confidential, greater climate-related disclosure on underlying assets would help improve market credibility and deal visibility.

US Munis

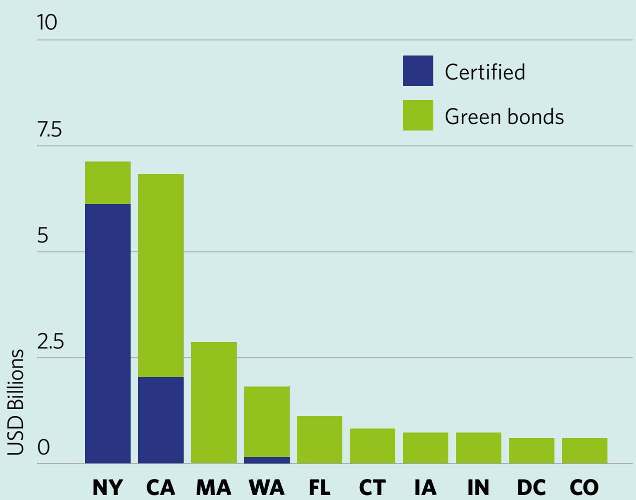
What is it? US Municipal bonds benefit from favourable tax treatment to facilitate access to private funding for public sector spending, including infrastructure investments. They feature long tenors and are often sold as a pension investment.

Who's issuing? Municipal entities from 29 US states have issued green US Munis, contributing USD26.6bn in issuance. New York State tops the rankings with USD7.2bn from 27 deals, followed by California (USD6.9bn, 38 deals). NY Metropolitan Transit Authority is the largest issuer at USD5.5bn, and its deals are Certified under the Low-Carbon Transport Criteria of the Climate Bonds Standard.

Future prospects: Issuance is expected to pick up again as the effect of recent tax changes is incorporated in deal structures.

For more on US Munis, see our US Muni briefing from July 2018.[26]

Top 10 US states for green bond issuance



PACE ABS

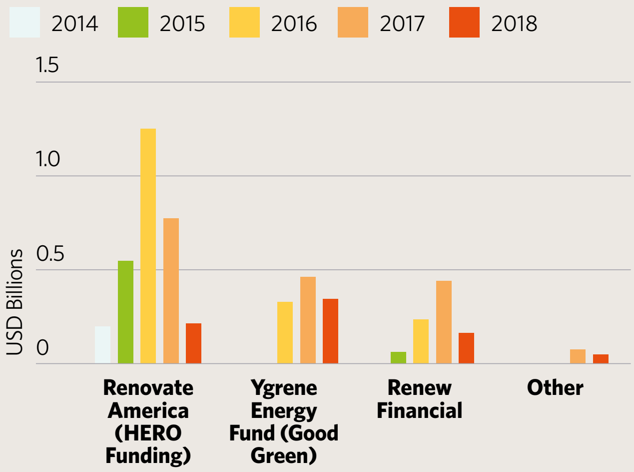
What is it? The US Property Assessed Clean Energy (PACE) model is an innovative mechanism for financing energy efficiency and renewable energy improvements. PACE loans fund the upfront cost of energy improvements on residential and commercial properties, and are paid back over time by property owners through property tax bills. Sponsoring states implement legislation to collect loan repayments through property tax bills and redistribute them to lending agencies. The funding and credit risk are passed onto ABS investors through the securitisation of the loans. Each ABS frees up lending capacity for new loans.

Who's issuing? Four PACE financing providers from California have issued green ABS backed by residential PACE loans. The largest issuer is Renovate America under its HERO funding programme. The most recent issuer is PACE Funding Group.

Greenworks Lending, based in North Carolina, became the first commercial property PACE (or C-PACE) issuer in 2017.

Future prospects: So far there has been limited issuance outside California and most loans are taken out by homeowners. Improved access to C-PACE loans from smaller landlords could help significantly in upgrading existing building stock.

PACE ABS reached USD5.1bn in H1 2018



Similar legislation for local governments to incentivise energy efficiency improvements can be implemented elsewhere. The Climate Bonds Initiative is part of the EuroPACE Project consortium – an H2020 project seeking to implement PACE financing in Europe through a city-wide pilot in Spain.

Solar ABS

What is it? Solar ABS are securitisations secured on cash flows from solar assets. Most deals are backed by lease payments and power purchase agreements. Some are backed by loans extended to fund the acquisition and installation of solar panels. A variation on solar ABS is Hannon Armstrong's ABS secured on ground lease receivables from solar and wind farms – see Other Receivables ABS below for details.

Who's issuing? In total USD4.4bn solar backed ABS have been issued through H1 2018 and 92% by volume, from US issuers. 2018 is shaping up as a record year for solar ABS with the market entry of Vivint Solar. In total, its public and private deals contributed USD932m to issuance figures.

SolarCity (now Tesla Energy) issued the first one in 2013: a USD54m deal backed by cash flows from power purchase agreements for the electricity generated by a bundle of residential rooftop PV installations of around 5,000 customers. In total, the company has placed 9 solar ABS deals.

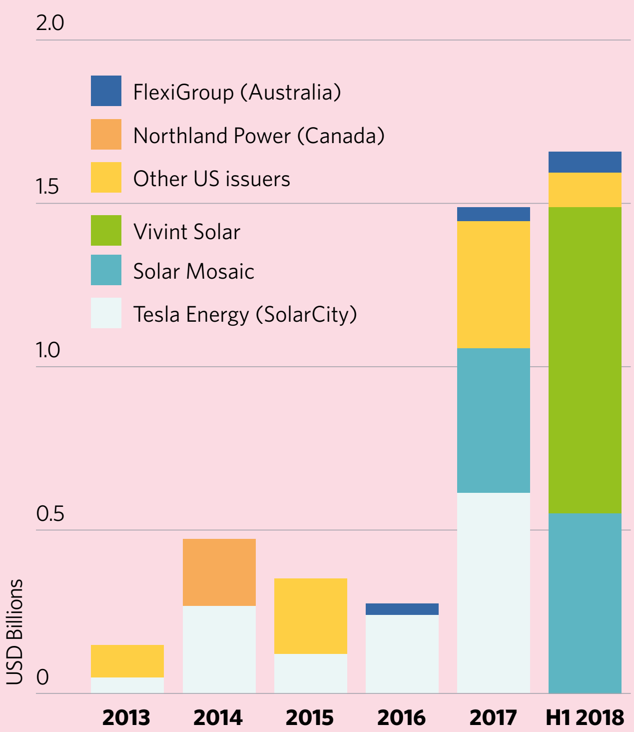
In Canada, Northland Power's 2014 ABS is backed by revenue from the 20-year feed-in tariff contract between the company's solar projects and the Ontario grid.

FlexiGroup issued the first Australian deal with a green ABS tranche in 2016 to refinance a pool of loans extended to customers for residential rooftop solar. The tranche priced 5bps lower than the pari passu non-green tranche issued as part of the same ABS. FlexiGroup's 2018 deal included a subordinated green tranche as well as a AAA-rated one, indicating yield appetite on the demand side.

Future prospects: Solar ABS has been used primarily to refinance residential rooftop solar, but commercial solar has significant scaling potential. Wind and Hydro ABS can also work.

Changes in or uncertainty about the availability of subsidies and the level of feed-in tariffs can impede issuance.

Solar ABS issuance is on the rise



In Europe, the uptake of renewable energy ABS has been hindered by the lack of standardised documentation, uncertainty around feed-in tariffs and insufficient volume of green assets from individual banks or leasing companies. Financial warehousing which aggregates loans and/or leases from multiple sponsors would help scale up the market.

Emerging markets such as India are also considering ABS for solar loans to finance ambitious targets for renewable energy capacity development within the lending capacities of banks.

Mortgage-backed securities

Type	Issuer Name	Note	2016	2017	H1 2018	Total
Agency MBS	**Fannie Mae (Green MBS)**	Whole deal	3,538m	26,354m	9,583m	39,475m
CMBS	**Harvest Capital**	Whole deal		124m		124m
	Natixis (CSAIL Commercial Mortgage Trust)	Tranches		72m		72m
RMBS	**NAB (National RMBS Trust)**	Tranche			233m	233m
	Obvion (Green Storm)	Whole deal	595m	667m	685m	1,948m
Grand Total			**4,133m**	**27,217m**	**10,501m**	**41,852m**

Agency MBS

What is it? US government agencies Fannie Mae and Freddie Mac purchase a significant volume of mortgage pools from originating lenders and refinance them in the MBS market. Fannie Mae's Multifamily Green Initiative Program now targets mortgages to certified low-carbon buildings and financing for energy and water efficiency improvements of at least 25%. Freddie Mac has a similar program.

Who's issuing? Fannie Mae issued USD26.4bn of labelled Green MBS in 2017, significantly above the USD3.5bn issuance volume achieved in 2016. It is the largest green bond issuer for 2017.

Future prospects: The Green Initiative sends a strong signal to lenders, incentivising best practice such as certification for buildings and lending for energy efficiency. Freddie Mac may also start labelling the MBS it issues which are secured solely on loan pools purchased under its Green Advantage program.

With time, more stringent prerequisites to enter the program can help ensure the building stock is aligned with a 2°C world.

RMBS

What is it? Residential mortgage-backed securities are ABS deals secured on large pools of residential mortgages.

Who's issuing? Dutch lender Obvion issued the first green RMBS in 2016. Together with its Green Storm 2017-1, the mortgage lender has now placed USD1.3bn of green RMBS. In 2018, National Australia Bank issued an AUD2bn RMBS with an AUD300m green tranche. All three green issues have been Certified against the Climate Bonds Standard for Low-Carbon Buildings (Residential).

Future prospects: A common barrier to scaling up green RMBS is the lack of data or access to energy performance data. In some countries such as the UK, pressure from lending institutions to make data available has resulted in new green bond transactions.

The Energy efficient Mortgages Action Plan (EeMAP) – an H2020 project led by the European Mortgage Federation – is seeking to create a standardised and cheaper energy efficient mortgage. A successful pilot could facilitate RMBS.

CMBS

What is it? Commercial mortgage-backed securities are ABS deals secured on commercial mortgages. Commercial asset classes include offices, shopping centres, multi-family housing, logistics, hotels, etc.

Who's issuing? CSAIL, a joint platform of the US operations of Credit Suisse and Natixis, issued the first CMBS deal with green subordinated notes. They are secured on a LEED Platinum certified office building on Wall Street in New York City.

But it is China that recorded the first green CMBS – a three-tranche deal secured on a LEED Gold certified office building owned by China Energy Conservation and Environmental Protection Group (CECEP).

Future prospects: There is significant potential in the US for green CMBS due to the common use of CMBS to finance property. This is less likely in Europe due to unfavourable capital treatment. The availability of competitively priced alternative funding, e.g. covered bonds, can also limit green CMBS issuance.

Covered bonds provide a funding option for banks and real asset security to bond investors

What is it? Covered bonds are highly-regulated securities with superior credit ratings. They achieve lower funding cost than unsecured debt thanks to a dual recourse structure where bond investors have a general claim against the issuer, as well as a claim over a dedicated 'cover' pool of assets. Cover pool composition is regularly monitored.

Who's issuing? Green covered bonds under German Pfandbrief legislation were first issued by BerlinHyp in two EUR500m deals in 2015 and 2016. Deutsche Hypo followed with a EUR500m deal in 2017. LBBW placed its first green covered bond (EUR500m) in 2018.

In early 2018, SpareBank 1 Boligkreditt (Norway), the covered bond vehicle of an association of savings banks, issued a EUR1bn green covered bond with a residential mortgage cover pool.

In contrast to German deals, the eligibility criteria were not focused on building certification and energy certificates, but on recent building codes. This proxy has helped identify the most energy efficient residential properties in Norway.

The approach was also adopted by DNB Boligkreditt (Norway) for its EUR1.5bn covered bond. Both deals are Certified under Residential Buildings Criteria of the Climate Bonds Standard.

In May 2018 Landshypotek Bank (Sweden) issued the first forestry covered bond. The cover pool eligibility criteria feature PEFC and FSC certification for large holdings and green forest management plans for small holdings.

Future prospects: Luxembourg has issued legislation on dual recourse bonds for renewable energy. Extending the structure to other low-carbon assets can encourage more green issuance.

The dual recourse structure can also be employed outside covered bond regulations, as was the case with Bank of China's USD500m dual recourse bond from late 2016.

Other receivables ABS

What is it? Any stream of receivables or revenues can be used to secure an ABS deal as long as the revenue is predictable enough to be modelled and valued. Diversification is a key benefit for investors as it reduces the risk of losses from any one project or borrower. This makes pools of lease payments, small loans, bills and fee collections ideally suited. The structure can be employed both by financial institutions and corporates.

Who's issuing? Green ABS may be relatively new with a limited number of deals so far, but the diverse range of financial assets and structures used bodes well for the growth of this type of debt instrument. Issuance to date exceeds USD8bn (excluding, MBS, solar, PACE and the synthetic ABS). Notably, about a fifth of transport issuance was raised to finance Chinese public transport investment, and China leads in public sector issuance.

Agribusiness credit rights: CRA ABS

Brazil's innovative securitisation instrument has helped farmers and cooperatives secure financing for the production, sale, processing or industrialisation of agricultural products.

Credit rights deals have been successful thanks to the competitive loan pricing they offer farmers, the asset-liability match and the tax exemptions for both investors and issuers.

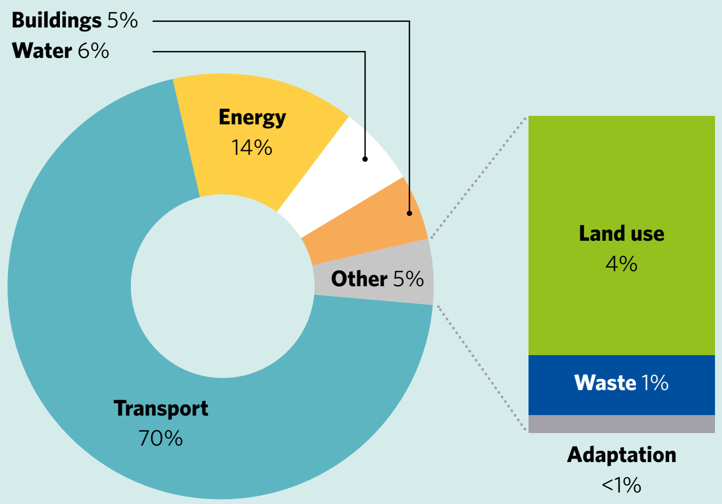
In 2016, Suzano Papel issued the first – and so far only – green CRA ABS of BRL1bn (USD295m). Brazilian peer and fellow green bond issuer, Fibria, has also issued CRA deals but not labelled green. Tagging issuance as green can help attract SRI investors.

Auto ABS

Toyota Finance has issued USD4.6bn in three green ABS secured against the cash flows from existing car leases and with the proceeds destined to finance new leases and loans exclusively on hybrid and electric vehicles. Using existing 'brown' assets to free up capital for more 'green' ones is a key component of financing the low-carbon transition.

An improvement on the structure would be to issue an Auto ABS secured solely on low- to zero-emission vehicles and use the proceeds to originate even more green assets in the form of vehicle loans and leases.

22 other receivables ABS fund a mix of low-carbon sectors



Bill receivables ABS

In 2014 the State of Hawaii issued GEMS 2014-1, an ABS deal secured on the green infrastructure fee collected by three state utility companies via electricity bills.

The bond raised funds for the Hawaii Green Infrastructure Loan Program, so it can provide loans to finance the installation of renewable energy power systems and for energy efficiency projects.

Ground lease ABS

Hannon Armstrong's first green ABS from 2013 is secured on ground lease receivables from 78 solar and wind farms.

Leasing land to renewable energy operators carries lower risk than owning and operating the solar and wind farms.

Pooling the leases creates diversity of income streams, a prized feature of securitisations, which further lowers deal risk.

Receivables ABS – China

Chinese issuers have issued 11 ABS deals totalling USD2.4bn and secured on receivables from wind turbines and other renewable energy equipment leasing, public transport, water and waste management: by far the most diverse sector range among countries with green ABS issuance.

One of the more intriguing examples is provided by Beijing Enterprises Water Group. The company operates 19 water treatment plants under takeover-operate-transfer (TOT) or build-operate-transfer (BOT) contract with 16 municipalities.

Its green ABS is backed by water treatment service fee receivables. The proceeds are allocated to another 9 water infrastructure projects that fall into Pollution Prevention, Resource Recycling and Adaptation categories under PBoC's green bond catalogue.

Another example comes from TGOOD. Its four-tranche ABS is secured on receivables from switchgear and electrical substation equipment with the proceeds earmarked for the installation of EV charging stations across China.

Green bond policy update

The role of green bond policy

Public sector action is central to enabling and scaling up green bond issuance and investment at the scale and speed required, to reach USD1tn of annual issuance by 2020.

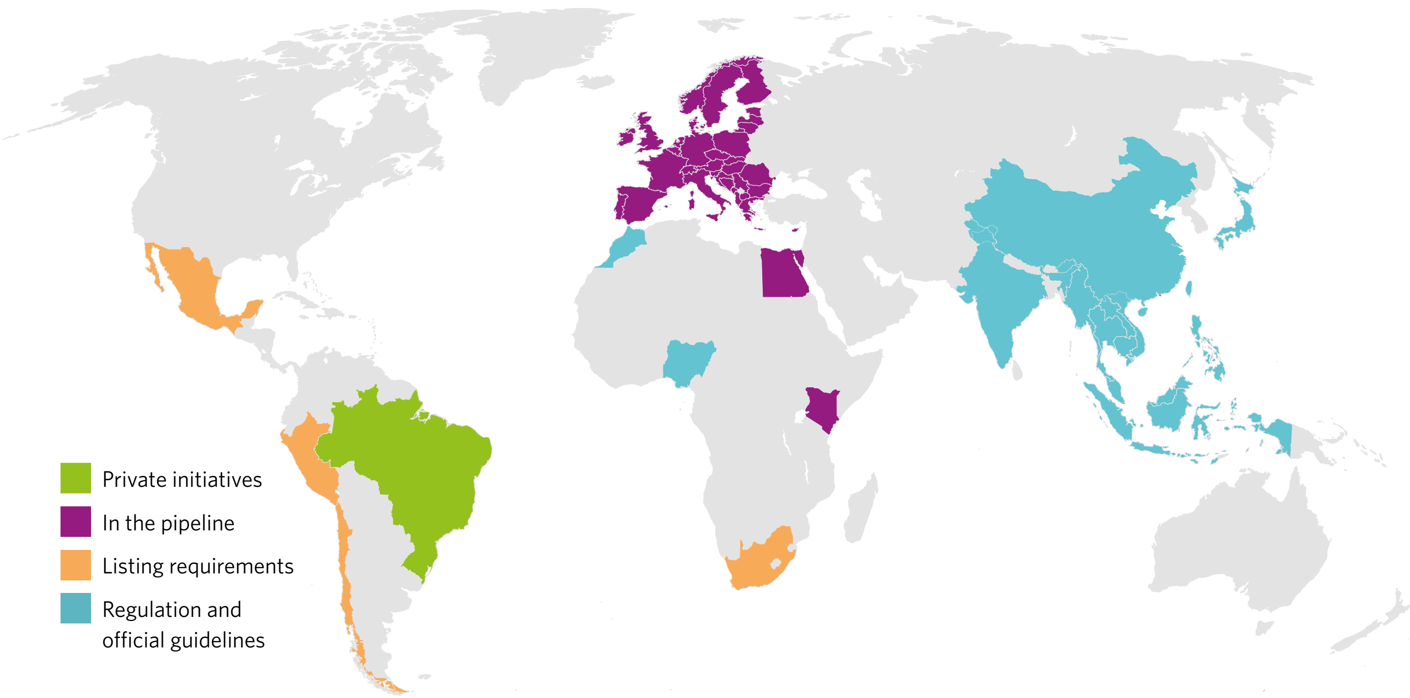
Public sector issuance from development banks in particular was instrumental to kickstarting the green bond market. Public sector issuance, excluding supranationals, now accounts for 26% of the market. Over the past few years policymakers and regulators have been stepping up their involvement by designing clear guidance, providing incentives and setting disclosure requirements.

Enabling private capital to flow towards low-carbon infrastructure and assets is the main goal of green bond policy.

Governments have used several tools in the past to successfully steer private capital towards policy priority areas; these can now be applied to channel capital to climate investments through green bonds.

Policymakers are involved both in creating the pipeline of low-carbon projects and in supporting the development of green finance tools to finance it.

Availability of national and regional green bond guidance



The role of central banks and financial regulators in addressing climate-related financial disclosures

Addressing climate-related risks is rising on the agenda of capital markets regulators and central bankers as they step up efforts to facilitate an orderly transition to a low-carbon economy, while trying to maintain the stability of financial markets.

Several central banks have started exploring stress-tests of climate-related risks, green bond investments, integrating climate risks in macroprudential frameworks and allowing green bonds in collateral frameworks.

The Network for Greening the Financial System was established in December 2017 as a forum for regulators and supervisors to find solutions to address climate-related financial risks. The network has decided on three work-streams: supervision, macro-financial and mainstreaming green finance.

The EU taxonomy on sustainable finance and green bond label

In March 2018, the European Commission announced a comprehensive Action Plan on sustainable finance. Following the Action Plan, the EC presented three legislative proposals aimed at establishing an EU taxonomy for sustainable finance, improving ESG disclosure, and creating low-carbon benchmarks.

A Technical Expert Group (TEG) on sustainable finance was established in June 2018 to progress on the details of the legislative proposals and action plan. The TEG is divided into 4 subgroups tasked with developing an EU taxonomy on sustainable finance, an EU green bond label, low-carbon indices and metrics for climate-related disclosure.

Sean Kidney, Climate Bonds Initiative's CEO, is a member of TEG's taxonomy subgroup, which will deliver the climate mitigation component of the taxonomy in Q1 2019, and climate adaptation and broader environmental assets in Q2 2019. On the back of the taxonomy, the EU green bonds label is planned to be developed by Q3 2019.

Green bond policy update

Top 3 public sector developments

Sovereign issuance is growing

Green sovereign bonds are increasingly seen as a key tool for governments to raise capital to implement infrastructure plans to meet the Paris agreement targets and the Sustainable Development Goals.

Besides raising capital, a sovereign green bond can diversify the investor base, signal policy certainty and coherence, scale up the domestic market and support the emergence of a green financial hub.

USD21bn of sovereign green bonds have been issued to date:

- **Fiji** issued the first emerging market at FJD100m (USD50m)
- **Nigeria** came to market with a NGN 10bn (USD30m) bond – the first African sovereign green bond
- **Indonesia** issued the first sovereign green sukuk worth USD1.25bn
- **Belgium** and **Lithuania** issued sovereign green bonds for EUR4.5bn and EUR20m
- **Poland** issued a second sovereign green bond of EUR1bn in February 2018
- **France** has tapped its green OAT 4 times, reaching EUR10.8bn outstanding as of H1 2018, and has since placed an additional EUR4bn
- **Hong Kong** has announced a sovereign green bond programme up to HKD100bn (USD12.7bn)
- **Ireland** has recently published a green bond framework, signalling its intention to come to market

Read more on sovereign green bonds in the Sovereign Green Bond briefing.

Harmonisation of definitions and standards

The development of clear guidelines and standards for what is green are a key step to establish the foundation for a green bond market.

Green bond guidelines and regulations are now in place in several countries across the globe. Latest developments include:

- **ASEAN** Green Bond Standard: developed by the Capital Markets Forum, the standard explicitly excludes fossil fuel investments
- **Indonesia:** OJK has issued green bond requirements; all ASEAN countries are expected to translate the regional guidelines into regulation.
- Stock exchanges in Santiago, **Chile** and Lima, **Peru** have issued green bond guidance for their listed companies. Santiago's newly established segment is for both green and social bonds.

Following the Green Bond Principles, ICMA has coordinated the development of Social Bond Principles (SBPs) and guidance on Sustainability Bonds. SDG bonds have also emerged.

The development of green, social and sustainable markets is expected to converge as disclosure and reporting frameworks remain consistent. Eligible assets overlap, especially those that deliver climate resilience and social goals.

Targeted incentives for green bond issuers

New forms of financial support and incentives, introduced in 2017 and H1 2018, can lower the initial hurdle for new issuers entering the market by covering or offsetting the additional costs of an environmentally robust issuance.

- **Singapore**: The central bank, Monetary Authority of Singapore, announced a green bond grant scheme that will absorb the full cost of external reviews.
- **Malaysia**: Tax deduction on issuance costs for issuers and tax exemptions for investors are in place until 2020 for socially responsible sukuk and green sukuk. A MYR6m Green SRI Sukuk Grant Scheme has also been set up to cover the costs of external reviews.
- **China**: PBoC will include green bonds as eligible collateral for its Medium-term Lending Facility. Green credit is now part of banks' Macro-Prudential Assessment: the higher the volume of green assets held (loans, bonds, etc.), the higher a bank's MPA score.
- **Hong Kong**: The government announced a HKD2.5m (USD0.3m) three-year pilot bond grant scheme that will subsidise the cost of getting green bond certification through the scheme operated by the Hong Kong Quality Assurance Agency.
- **Japan**: To facilitate green bond issuance, the Ministry of Environment has introduced subsidies of up to JPY50m per issue to help cover the costs of third-party outsourcing (e.g. external reviews, green bond structuring and consulting).

Climate Bond Initiative's role in driving green bond policy

- **Policy intelligence**: Monitoring and regularly reporting on green bond policy developments across the globe.
- **Policy advisory**: Working with governments and regulators to develop roadmaps for green bond market growth, draft green bond regulation and explore incentives.
- **Policy education and engagement**: Promoting green bond policy actions through public engagements, peer-to-peer exchanges and training programmes.

Spotlight on green bond pricing research

With the support of IFC, Obvion, Pax, and Rabobank, Climate Bonds Initiative has spent 2 years exploring how green bonds behave in the primary market. The work has concentrated on labelled green bonds issued in EUR or USD, with a minimum size of USD300m (increased to USD500m from January 2018).

From January 2016 to June 2018, analysis included 152 bonds with a combined value of USD126bn. We compiled data on the salient features of the primary pricing market such as order book size, spread compression during the book building process, whether there is a greenium, distribution of the bonds by type of buyer, and spread performance in the immediate secondary market. Where possible, we compared this data with equivalent vanilla bonds, sharing similar characteristics, and issued within the same quarter as the paired green bond.

Findings on pricing

On average, green bonds tend to achieve larger book cover and spread compression during pricing when compared to vanilla equivalents. In the immediate secondary market, half of green bonds tighten by a larger percentage than vanilla equivalents, after both 7 and 28 days. When matched with a corresponding index, 70% of green bonds tightened by a larger percentage after 7 days. After 28 days, that figure was 61%. Generous book cover may mean access to a broader investor base for issuers, and good performance in the secondary market is attractive to investors.

Many issuers of green bonds remark that they receive better or preferential pricing for their green bonds. What does this mean? It is normal for new bonds to price outside their own yield curves, i.e. with a slightly lower price than existing debt. This cost is borne by the issuer to attract investment and is known as a new issue premium. Occasionally, bonds may price inside their own yield curves, i.e. with a slightly higher price than existing debt. In this case, the investor will receive a slightly lower yield compared to existing debt, and this is known as a new issue discount, new issue concession, or, when applicable to green bonds, Climate Bonds Initiative has termed it a 'greenium'.

A new issue premium is a normal feature of the bond market, and the absence of a new issue premium is regarded favourably by issuers because it can lower their funding costs. We have monitored yields on pricing date for green bonds in our sample, with a minimum of four comparable vanilla bonds. 60 green bonds had enough data for this, 31 of which exhibited a new issue premium, albeit often reported to be smaller than expected. The remaining 29 green bonds priced either on the curve, or exhibited a greenium. While buyers of green bonds cannot expect to receive a new issue premium, a greenium cannot be guaranteed.

Findings on investors

We have tried to determine who is buying green bonds, by approaching issuers directly. Since there is no standard definition of a 'green bond investor' we have asked issuers to use their discretion.

We have gathered data for 57 bonds, and the range is from 20% to 85%. The average distribution to green investors is 51%. For green bonds with a country of risk designated as an Emerging Market that figure is 31%, while for Developed Markets, the average is 55%.

The takeaway of this analysis is that green bonds are being supported by those declaring themselves as green investors, and those that are not. Green bonds apparently appeal to a wide range of investors which will be critical in enabling the market to scale up.

For more information, please see Climate Bonds Initiative's pricing research at https://www.climatebonds.net/resources/reports

Climate Bonds Taxonomy

The Climate Bonds Taxonomy was used to categorise issuers by sector. The underlying research focused on 6 of the sectors: energy, transport, water, buildings, land use and waste. More information is available at https://standard.climatebonds.net/taxonomy.

Climate Bond Certified

ENERGY	TRANSPORT	WATER	BUILDINGS	LAND USE & MARINE RESOURCES	INDUSTRY	WASTE	ICT
Solar	Private transport	Water monitoring	Residential	Agriculture	Cement production	Preparation	Broadband networks
Wind	Public passenger transport	Water storage	Commercial	Commercial Forestry	Steel, iron & aluminium production	Reuse	Telecommuting software and service
Geothermal	Freight rail	Water treatment	Products & systems for efficiency	Ecosystem conservation & restoration	Glass production	Recycling	Data hubs
Bioenergy	Aviation	Water distribution	Urban development	Fisheries & aquaculture	Chemical production	Biological treatment	Power management
Hydropower	Water-borne	Flood defence		Supply chain management	Fuel production	Waste to energy	
Marine Renewables		Nature-based solutions				Landfill	
Transmission & distribution						Radioactive waste management	
Storage							

Certification Criteria approved

Criteria under development

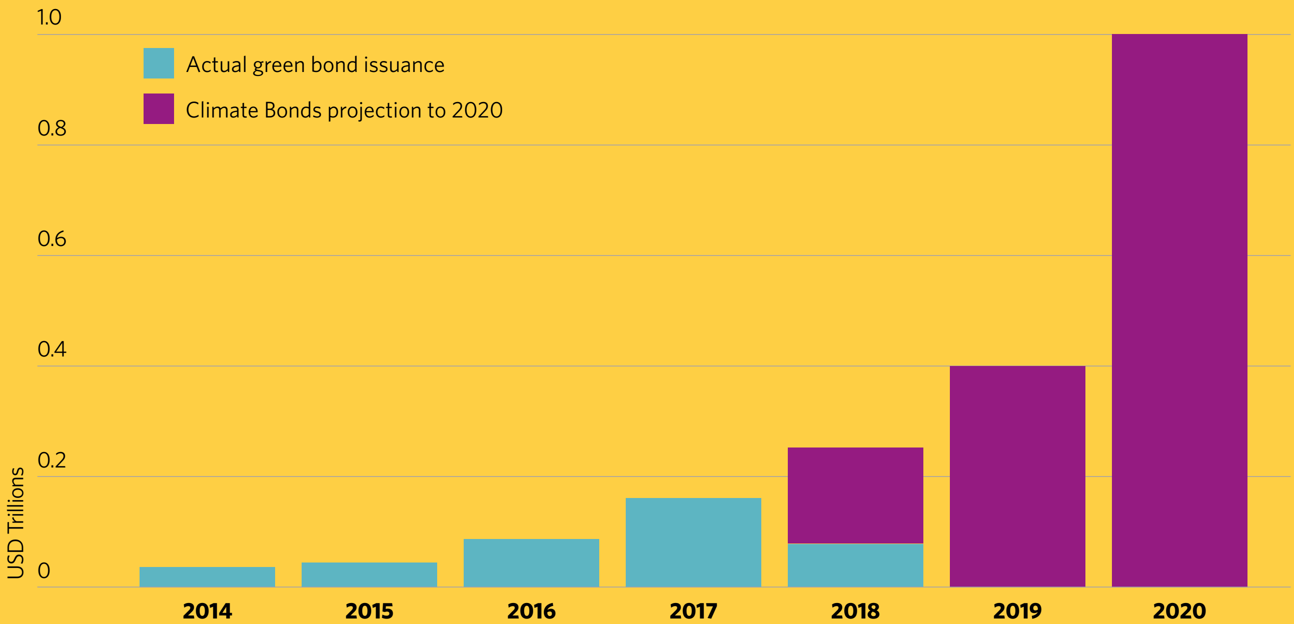
Due to commence

Are we nearly there yet? Towards USD1 trillion a year of green bond issuance by 2020

We estimate that the global green bond market would significantly boost progress on Nationally Determinted Contributions (NDCs) in connection with the Paris Agreement and the implementation of country climate plans if it reaches USD1tn per annum by 2020.

This report identifies USD1.45tn of climate-aligned bond issuance currently outstanding which have been issued since 2005. Meanwhile the labelled green bond market reached USD162bn of issuance in 2017.

The growth is encouraging but there is still a long way to go with global GHG emissions on track to far exceed 2 degrees of warming. Over the coming decade, much stronger action from government and the private sector is needed to ensure there is a pipeline of low-carbon projects sufficient to meet the Paris Agreement targets.



Endnotes

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25. SSA stands for "sovereign, subsovereign and agency"and covers a variety of government-related entities.
26. https://www.climatebonds.net/files/files/US%20Muni%20climate-aligned%20bonds%2011-07-2018.pdf

This report was prepared by the Climate Bonds Initiative.

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Source data from Thomson Reuters EIKON, Bloomberg, FTSE Russell Green Revenues, climatebonds.net and other parties. All figures are rounded.

This report identifies a universe of USD1.45tn climate-aligned bonds:

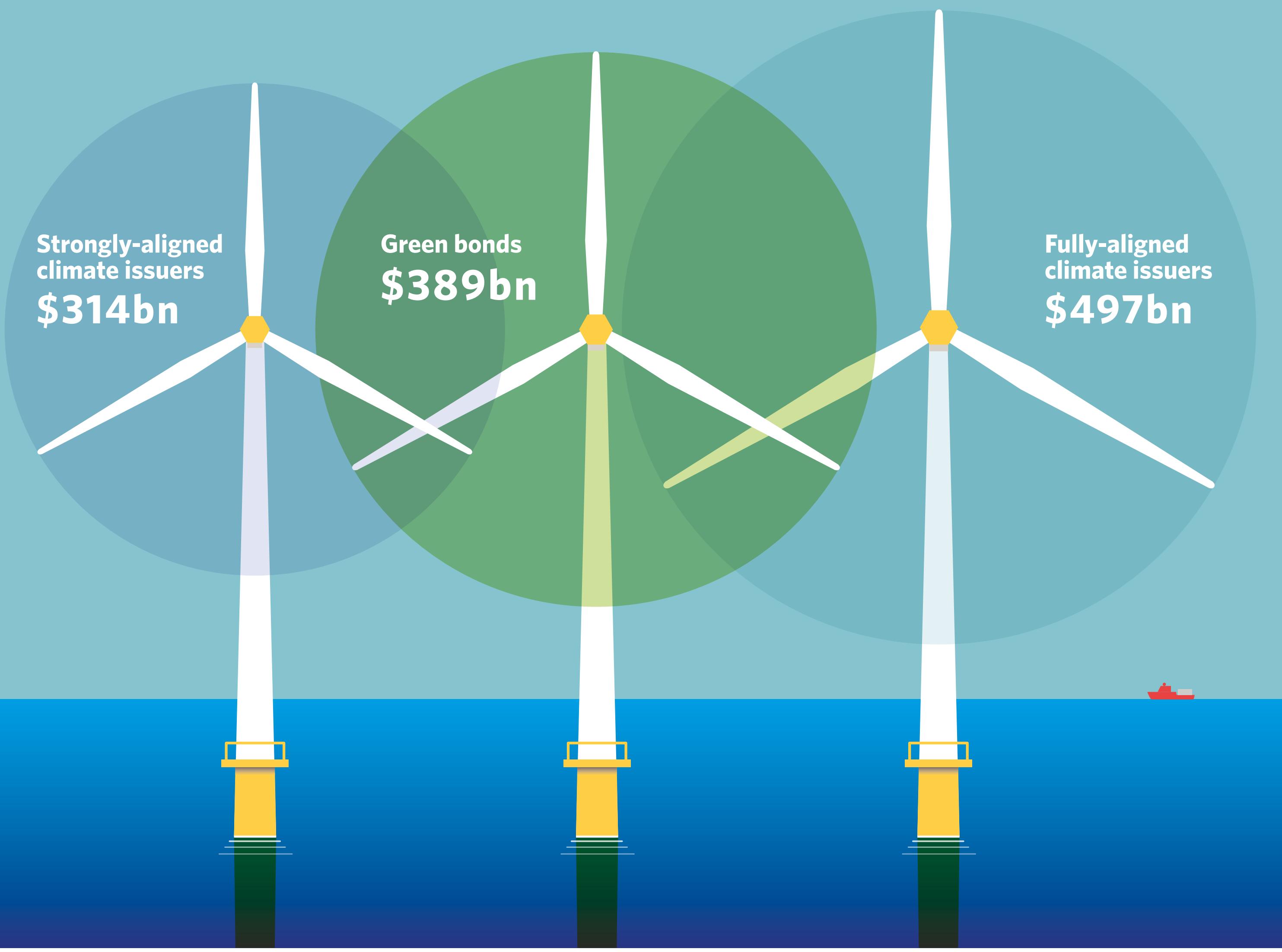
- 389bn in green bonds
- 497bn in bonds from fully-aligned issuers
- 314bn in issuance from strongly-aligned issuers
- 250bn in issuance from fully-aligned US Muni issuers

What does it mean?

- Global growth of green finance is encouraging
- There is a large universe of unlabelled bonds financing green infrastructure
- There is huge potential for a larger and even more diverse green bond market

There is still a long way to go

- Global emissions remain on track to exceed 2 degrees of warming
- USD90tn of investment in climate projects is needed by 2030
- Global green finance needs to reach USD1tn by end 2020 and grow each year of the new decade



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