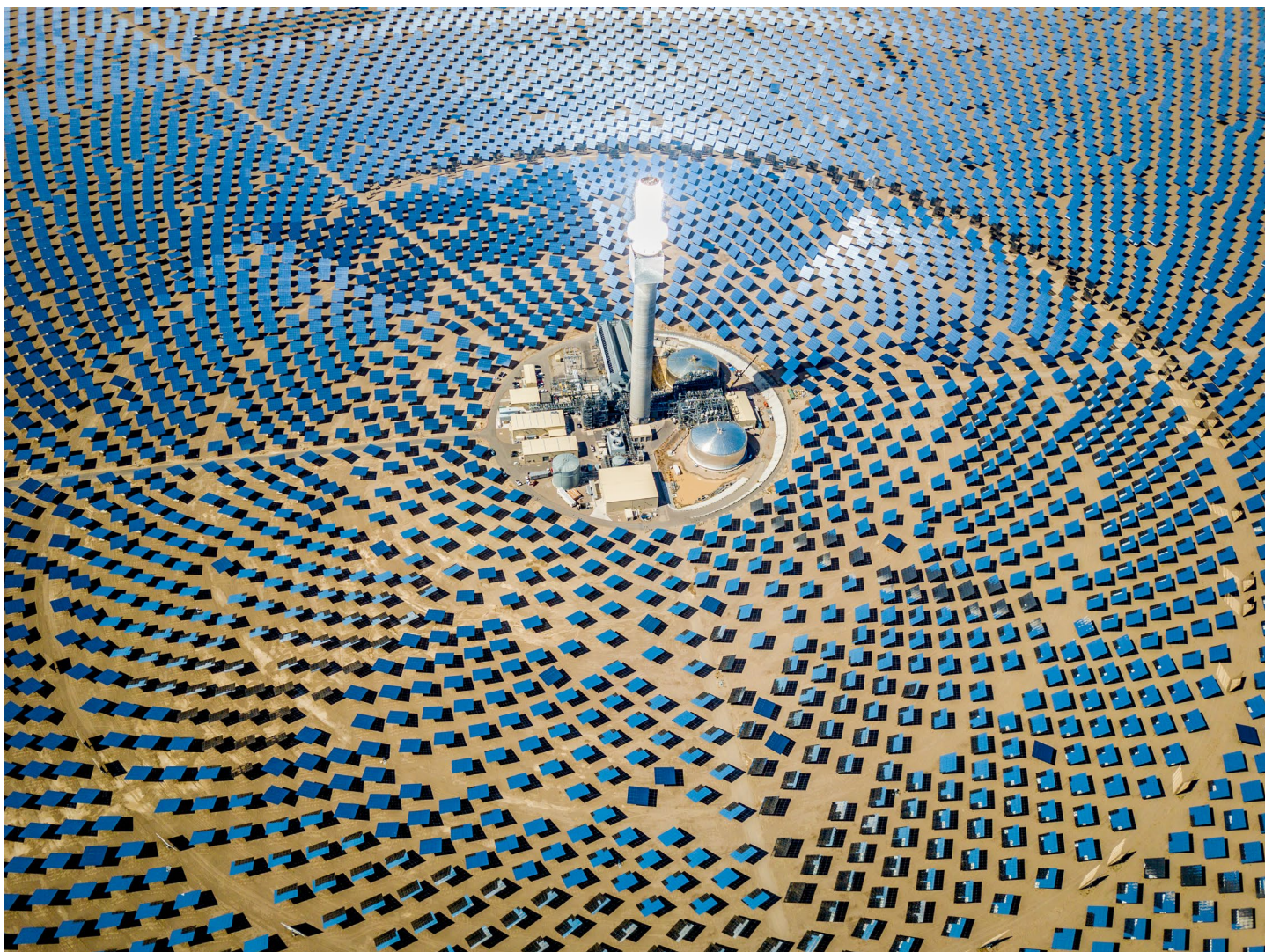

S&P Global
Ratings

COP24 Special Edition:

Shining A Light On Climate Finance

December 2018



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The Future Looks Green For CLOs

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Key Takeaways

- Green loans are evolving, with the Climate Bond Initiative forecasting nearly \$1 trillion in green bond issuance by 2020.
- Despite the uptick in green bond and loan issuance, the market still remains relatively small, especially compared to the universe of assets comprising CLO 2.0 transactions.
- In our view, a green CLO market has large growth potential, boosted by regulatory initiatives and emerging interest from both issuers and investors in 2018.
- We built a hypothetical rating scenario for a green CLO to compare and contrast the underlying portfolio and structure with a typical European CLO 2.0 transaction.
- Our hypothetical green CLO analysis showed that green loans may have different fundamental characteristics to corporate loans, such as lower asset yields, higher credit quality, and higher recovery rates assumptions.

The global collateralized loan obligation (CLO) market has experienced a rebirth (2010 in the U.S. and 2013 in Europe). New issuance continues to increase due to investor familiarity with the product, as well as low historical default rates (see tables 1 and 2 and "[2017 Annual Global Leveraged Loan CLO Default Study And Rating Transitions](#)," published on Oct. 9, 2018). While a market for green assets, such as green loans and bonds has been established for a while, although still of a relative size, a sustainable securitization market is still in its infancy. Considering the challenge in financing the amounts, S&P Global Ratings expects green CLOs to play a role in increasing the private sector presence in the sustainable finance market.

Following the Paris Agreement that came into force in November 2016, 184 parties have ratified the action plan to limit global warming. For this purpose, developed nations have pledged to provide \$100 billion (about €87 billion) annually until 2025. As part of this deal the EU has committed to decrease carbon emissions by 40% by 2030. In March 2018 the European Commission (EC) proposed the creation of environmental, social, and corporate governance 'taxonomy', regulating sustainable finance product disclosures, as well as introducing the 'green supporting factor' in the EU prudential rules for banks and insurance companies.

Although green CLOs have yet to fully emerge, in this report, we consider the growth potential and attractiveness of this product, as well as some challenges we currently see to the market's development. We also present a hypothetical rating scenario to compare and contrast the credit quality of green CLOs with a typical European CLO 2.0 (post-crisis issued) transaction.

Table 1

U.S. CLO Default History (S&P Global Ratings' Portfolio)

Original rating	CLO 1.0 (1996 – 2009)		CLO 2.0 (2010 – Q2 2018)	
	Tranches rated	Tranches defaulted	Tranches rated	Tranches defaulted
AAA	1,540	0	1,572	0
AA	616	1	1,220	0
A	790	5	1,033	0
BBB	783	9	873	0
BB	565	20	782	0
B	28	3	246	0
Total	4,322	38	5,726	0

Table 2

European CLO Default History (S&P Global Ratings' Portfolio)

Original rating	CLO 1.0 (1997 – 2009)		CLO 2.0 (2010 – Q2 2018)	
	Tranches rated	Tranches defaulted	Tranches rated	Tranches defaulted
AAA	472	0	223	0
AA	225	0	235	0
A	239	0	159	0
BBB	291	3	149	0
BB	205	15	137	0
B	11	1	120	0
Total	1,443	19	1,023	0

What Is Green And How Do We Define It?

There is currently no specific market definition for green bonds or loans or regulatory reporting requirement. Issuers can define what they think constitutes the notion of a green bond or loan. However, in 2014 the International Capital Market Association (ICMA) with support from 13 investment banks, developed Green Bond Principles (GBP) to facilitate guidance and transparency on the market. Later, in 2018 ICMA introduced Green Loan Principles. Both of these principles focus on the usage of proceeds, the project evaluation and selection process, and proceeds and reporting management process.

April 2017 saw the launch of our Green Evaluation that provides a relative green impact score on instruments targeted at financing environmentally beneficial projects (see "[Green Evaluation Analytical Approach](#)," published on April 26, 2017). It is not a credit rating, but rather a point-in-time assessment of the relative environmental impact of a financing transaction or portfolio. To date, we have completed 26 public Green Evaluations on individual transactions ranging from green bonds and green loans to asset-backed securities, project, and portfolio financings.

A Green Evaluation for a CLO would consider the weighted-average score of the individual green assets in the collateral pool based on the allocation of proceeds to environmentally beneficial assets such as renewable energy or efficiency projects. We would also take into account the transactions' transparency and governance scores. These scores assess the reporting and disclosure of proceeds allocation, as well as the issuer's commitment to regular monitoring of

environmental benefits. It is worth noting that the Green Evaluation of a green CLO would be separate to any credit rating provided and would provide an opinion of relative environmental contribution rather than creditworthiness.

How Does Green Relate To CLOs?

The starting point of our CLO rating process is the analysis of the underlying pool of assets. CLOs are backed by leveraged loans, typically from more than 100 distinct obligors. To meet a transaction's eligibility criteria, most of the loans must have a rating or a credit estimate assigned by S&P Global Ratings. This allows us to use the ratings on the underlying obligors as a proxy to quantify the credit quality of every asset in the portfolio.

Indeed, the credit fundamentals of a corporate will influence the overall credit quality of any CLO structure, whether the pool is comprised of green or non-green assets. We consider green factors in the context of our corporate credit analysis in several ways and typically reflect them in the industry risk and competitive position of an entity's business risk profile assessment, and in our assessment of an entity's management and governance.

According to a study by S&P Global Ratings, our industry specific criteria (or key credit factors [KCFs]) contain numerous environmental and climate risk-related references (see "[How Environmental And Climate Risks And Opportunities Factor Into Global Corporate Ratings - An Update](#)," published on Nov. 9, 2017). The KCFs provide complementary details, such as how industry-specific risk factors are assessed, for the application of the corporate ratings criteria in a specific sector. The study found that there were numerous instances where environmental and climate factors have affected corporate ratings. A review of all 9,000 corporate credit ratings between July 2015 and August 2017 found that climate and environmental factors were referenced in 717 instances in our credit analysis, or in nearly 10% of all credit rating actions, and there were 106 actions that listed an environmental or climate factor as the key rating driver.

The study also found that rating actions taken were relatively balanced with 44% in the positive direction and 56% in the negative direction. This is a change from our prior two-year lookback study published in 2015 where 79% of actions were in the negative direction out of 56 cases referring environmental or climate factors as having a material impact on credit quality (see "[How Environmental And Climate Risks Factor Into Global Corporate Ratings](#)," published on Oct. 21, 2015). This suggests that some companies have been able to effectively mitigate their environmental and climate risk or benefit from various transition opportunities or changes in environmental policy. As market, political, and regulatory drivers continue to support green and climate initiatives, corporate credit quality will increasingly reflect how entities are mitigating the risks and exploiting opportunities for their advantage.

In the corporate CLO space, we have yet to see green loan buckets as part of portfolio profile tests. However, some recent transactions' eligibility criteria have started introducing industry limitations, which restrict the manager from buying assets from certain industries, such as thermal coal mining, weapons, hazardous chemicals, pesticides and wastes, and tobacco. These documentation limitations would not affect our ratings analysis, but rather restrict the manager in its asset selection.

One area where we have seen increasing interest is in the area of green project finance CLOs. Initially, the issuance of green bonds was a way for projects to raise finance with the goal to cut/reduce emissions. In addition to the typical corporate debt issuance, debt instruments were

issued using project financing, with green projects covering a wide universe, from renewables, energy efficiency, low carbon, to water efficiency.

How Would We Rate Green CLOs?

One of the main criteria that we use to assign CLO ratings is "[Global Methodologies And Assumptions For Corporate Cash Flow and Synthetic CDOs](#)," published on Aug. 8, 2016 (see chart 1 for the main steps we follow in our CLO ratings process). We would perform the same credit and cash flow analysis and apply the same sensitivity tests as for any other CLO 2.0 transaction.

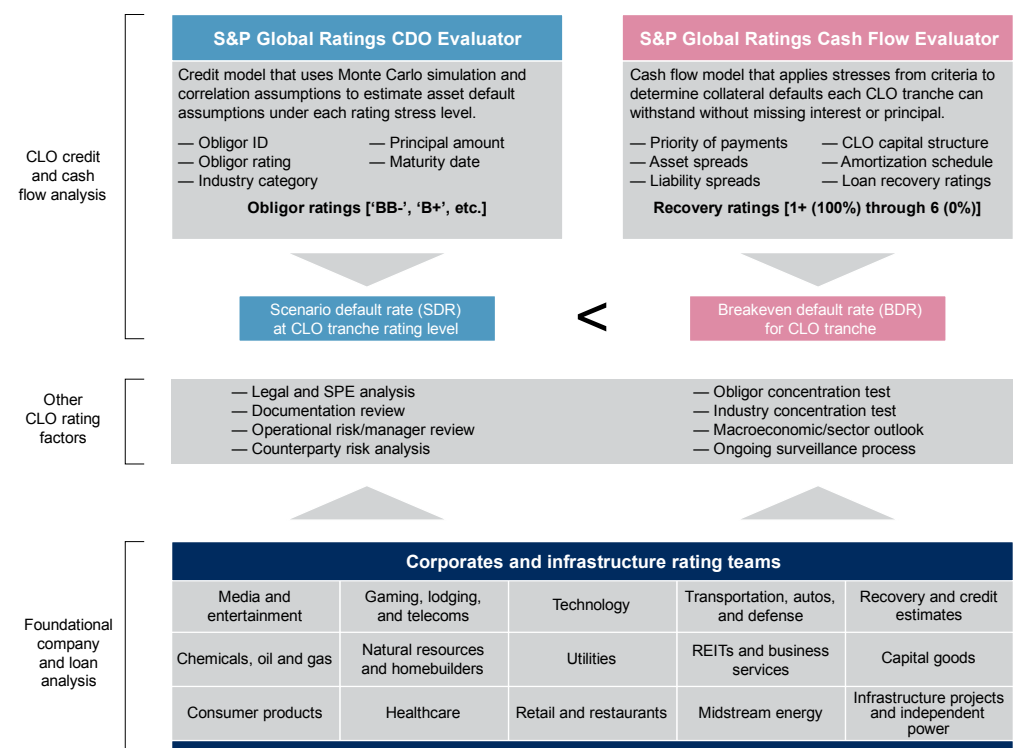
We expect to see the mix of corporate and project finance assets in the underlying portfolio of green CLOs and we would therefore use both our cash flow corporate and project finance CLO criteria for our credit and cash flow analysis.

Our criteria for rating CLOs of project finance adopt the similar methodologies, assumptions, and modeling parameters currently used to rate cash flow CLOs, with some differences due to the characteristics of project finance debt (see "[CDOs Of Project Finance Debt: Global Methodology And Assumptions](#)," published on March 19, 2014). Some of the assumptions we would use for rating CLOs of project finance are the following:

- There are specific project finance asset type classifications.
- We would apply a 12-month recovery delay for project finance loans. Corporate loans have immediate recovery assumptions under our criteria.
- Project finance debt typically has an amortization schedule based on the project's useful life, whereas corporate debt usually has bullet maturities (lump sums paid on a fixed legal maturity date). Consequently, the criteria use the following maturity assumptions, based on the debt's documented principal payment schedule: weighted-average maturity (WAM) if available or asset's legal final maturity date. For cash flow CLOs with a reinvestment period, we determine an expected portfolio amortization profile, considering the closing assets' WAM, the reinvestment period's remaining length, and the portfolio's maximum weighted-average life, as detailed under the CLO's transaction documents.

Chart 1

S&P Global Ratings' CLO Rating Process



How Might A Hypothetical Green CLO Look Like?

In preparation for rating CLOs with green loans as the underlying assets, we researched the loan structure and behavior of the instrument to build a hypothetical green CLO portfolio and structure. Based on our analysis, we concluded that green loans may have different fundamental characteristics to corporate loans. As a result, there are differences in the inputs we used to perform an analysis of a CLO transaction with sustainable loans as the underlying assets compared to transactions backed by corporate loans (see table 3). The main differences are the generally higher average rating and recovery assumptions, especially for project finance loans. These assumptions and results are hypothetical and will largely depend on the selection of loans by the portfolio manager, investor appetite for green CLOs, and regulatory environment.

We created a generic hypothetical transaction based on a highly simplified portfolio and capital structure described in the parameters outlined in table 3.

Table 3

Collateral Characteristics And Structures For Hypothetical Green CLO And CLO 2.0

	Hypothetical Green CLO	CLO 2.0
Average credit quality	BBB-	B
Weighted-average life	12.5 years	8 years
Weighted-average spread	2.20%	3.60%-3.80%
WARR (AAA-level)	50%	36%
Security type	Senior secured	Mostly senior secured
Industry type	Independent power and renewable electricity producers, Various. Top 3: media, software, chemicals building products (green), road and rail	
Portfolio size	€400 million/90 obligors	€400 million/120 obligors

Table 4 outlines the assumptions we used for the structure that we based on the following:

- We expect the pricing to be wider for green CLOs because it is a new product, which would include new loans to be securitized in the market, and the development of expertise by portfolio managers to manage the green debt.
- The equity returns under our hypothetical structure and portfolio are high single digit, compared to double digit for European CLO 2.0 transactions. This difference results from the lower asset yield, due to higher quality of the underlying assets and wider pricing on the tranches. We expect to see a new investor base emerge for green CLOs on the back of long-term and stable returns.
- A more supportive framework for green finance--for example the introduction of the green supporting factor in the prudential regulation for banks and insurance companies--may also result in a substantial increase in the investor base for green CLOs due to the capital relief provided for these investments.
- Lower credit enhancement for green CLOs results from better credit quality of the underlying assets than corporate credits and expected higher recovery rates.

Table 4

Outputs From Hypothetical Green CLO And CLO 2.0 Comparison

Class	Size (mil. €)	Spread over three-month EURIBOR	Rating	Credit enhancement green CLO*	Credit enhancement CLO 2.0*
A	280	1.20	AAA	30%	38%-40%
B	64	2.50	A	14%	20%
C	16	4.00	BBB-	10%	15.5%
Subordinated notes	40				

*Credit enhancement = (portfolio size minus rated tranche amount including pari passu/senior tranche amount, if any) divided by portfolio size. EURIBOR--Euro Interbank Offered Rate

We do, however, see some potential challenges for green CLOs. The idea behind every CLO is to generate enough interest from the underlying assets in the portfolio to pay for the tranching liabilities. In a few instances where we have received requests to analyze the green CLOs, we have seen that the proposed portfolio and structure were struggling to generate enough spread to pay for the CLO's liabilities. Where green bonds or loans were originated in the emerging market countries, the ratings on the CLO may also be capped by the application of our ratings above the sovereign criteria (See [“Ratings Above The Sovereign - Structured Finance:](#)

Methodology And Assumptions,”). This is in addition to the limited amount of assets in the portfolio that may qualify for a green CLO today.

Another challenge is for the green assets to show a better performance than the non-green assets. While there is some evidence of those green loans experiencing a lower default rate than non-green, it is difficult to conclude that this is due to the green nature of the assets. The small sample used in our analysis and relatively short history of the green finance market leads us to await further confirmation of the benefit to the credit performance of green CLOs.

Is The Future Green For CLOs?

Despite the uptick in global green bond and loan issuance, the market still remains relatively small, especially compared to the universe of assets comprising 2.0 CLO transactions. We see this lack of collateral currently as the main drawback to the development of a green CLO market. However, we expect the European regulatory and accounting initiative toward preferential treatment of green CLOs to have a positive impact on the market.

Although it's still early days, we expect to see continuous development and evolution of green CLOs, for example, the potential inclusion of green bond/loan buckets in CLO 2.0 transactions. Coupled with the highest post-crisis new issuance in the CLO market in 2018, robust performance in the last two decades, and the Climate Bond Initiative's forecast of nearly \$1 trillion in green bond issuance by 2020, we believe that 2019 and beyond looks big for investor and issuer activism in green CLOs.

Greener Pastures: China Cuts A Path To Becoming A Green Superpower

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Key Takeaways

- China is placing pollution control and an environmentally-conscious society at the forefront of its development agenda and turning to the green finance market to fund its sustainable growth.
- Through a supportive policy framework for green finance and strategic investment in renewable energy, battery storage, and electric vehicles, China is advancing next generation technologies that will help bolster its economic expansion.
- The country is promoting a green image for its ambitious Belt & Road Initiative in order to court the participation of international private capital, which is crucial for success.
- We see a number of ongoing challenges related to its green investments, such as a looming trade war with the U.S. and opposition by some nations to its Belt & Road Initiative, among others, but in our view, China will benefit considerably in the execution of its green strategy.

The response to climate change is driving a global transformation that has the potential to reshape geopolitics as countries around the world reorient their economies toward low-carbon and sustainable development. At the forefront of this shift is China, which is positioning itself as a leader on climate action as the U.S. federal government retreats, and is turning to the green finance market to fund its environment-friendly industries, achieve sustainable growth, and advance social well-being.

China has become a major player in the global green finance market, promoting environmentally-friendly policies and investing strategically in clean technologies. The country is also not only attempting to improve trade links through the ambitious Belt & Road Initiative, but also creating new green infrastructure investment opportunities in its development, and using the green finance market to court favor and expand its influence.

In our view, however, China still has a long way to go to transform its massive economy from being a major polluter to a green power. These challenges are compounded by the widespread air, water, and soil pollution that the country continues to face, and given its position as the largest emitter of greenhouse gases globally, the biggest coal consumer, and second-largest user of oil. That said, we expect China to reap considerable benefits from its emphasis on green development, both at home and abroad, and its role in the green finance market and the global stage is likely to become more prominent as it executes its green strategy.

"Beautiful China": More Than Political Rhetoric

Chinese leaders have ramped up their emphasis on environmental issues as national priorities, elevating pollution control to make it one of the top three major battles that the nation must fight, alongside financial risks and poverty.

Along those lines, China has been making a major pivot toward a low-carbon and environmentally friendly development model encapsulated in legislative efforts, Five-Year plans, and in blueprints at the provincial and local levels. To tackle pollution, China has escalated its efforts to create a comprehensive suite of laws and strict standards to remedy air and water pollution, along with new legislation on soil pollution prevention and control. Its climate agenda, outlined in its most recent Five-Year plan, includes ambitious targets to reduce absolute and relative carbon intensity and a peak in its carbon dioxide emissions by 2030. The country has also introduced what is likely to be one of the largest carbon emissions trading schemes and is targeting 675 gigawatts (GW) of renewable capacity installed by 2020.

The Chinese government has recognized that green finance is a powerful instrument to fund the country's next stage of development through its top-down government guided approach. President Xi Jinping has expressed China's commitment to build an ecological civilization and explicitly called on green finance to buttress its green agenda. The central bank, the People's Bank of China (PBoC) has also articulated this sentiment in its Guidelines for Establishing the Green Financial System, in which it outlines its support for a number of forms of green financing. Various financial regulatory authorities have further encouraged this trend by providing guidance and improving transparency to market participants on green bond issuance and climate financing. China also launched a green finance reform in June 2017 and green finance innovation pilot zones in five provinces that each have specific initiatives or targets for promoting green financing. In our view, these are important signals from the top-down decision-making bodies that will support further growth of the Chinese green finance market.

A Bank-Dominated Green Finance System

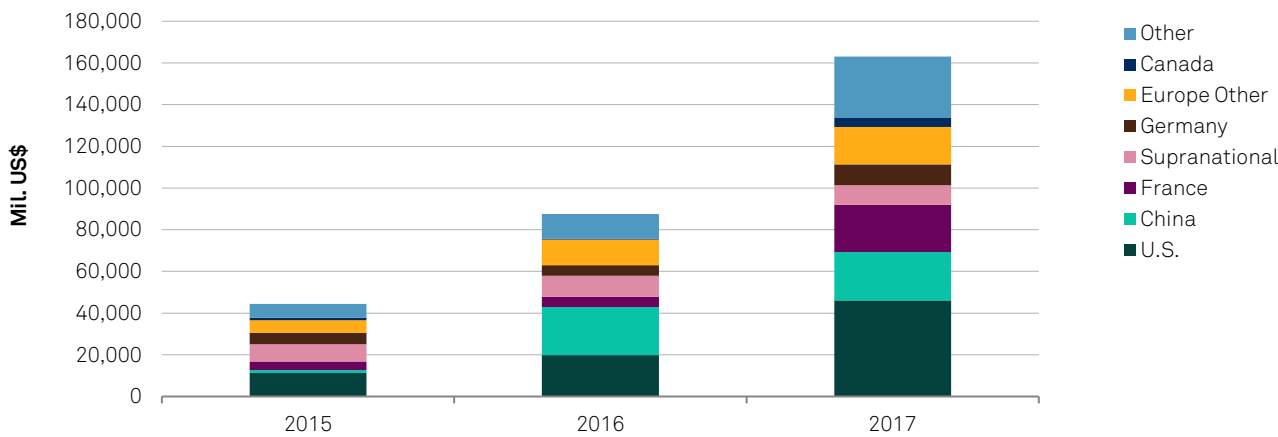
We expect banks will continue to play an overwhelming role in China's green finance system under the helm of the PBoC. Apart from bank loans, green finance in China also comprises bonds, equities, insurance, and funds. By the end of 2017, the total balance of green loans extended by 21 major Chinese banks was over Chinese renminbi (RMB) 8 trillion (nearly 10% of total loan book), representing more than 90% of total green financing in the country.

The PBoC spearheads the setting of standards and regulations for green finance in China, and represents the country's top-down approach to promoting green bonds, especially in the early stages of development. In December 2015, the PBoC published the Chinese Green Financial Bond Guidelines and Catalogue to guide the issuance of green bonds by Chinese banks. Shortly after, the National Development and Reform Commission also issued Guidelines for the Issue of Green Bonds by corporates. Both guidelines stimulated the take-off of China's green bond market in 2016 and made the nation the largest issuer that year.

Supportive government policies have further enabled China to reach nearly the top of the league table in 2017 as the second-largest issuer of green bonds, representing 15% of new issuance globally with about \$23 billion of internationally aligned new issuance (US\$37.1 billion total issuance). This put China behind the U.S., which issued \$42.4 billion, closely followed by France, with \$22 billion. China has already issued \$13 billion in the first half of 2018, a 14% increase year on year (data from the Climate Bonds Initiative).

Chart 1

Internationally Aligned Green Bond Issuance Growth



The policies on green finance have evolved to focus on better coordination across different ministries and cascading of policy support from the central to local governments. In August 2016, seven government agencies, including the PBoC and the Ministry of Finance, jointly issued the Guidelines for Establishing the Green Financial System, marking a new stage of green finance in China. Additionally, the PBoC stepped up support in 2017 by including banks' green credit performance in the central bank's macro-prudential assessment and helping ease capital requirements to a certain extent. In 2018, the PBoC further boosted support by expanding medium-term lending facilities to include banks' qualified green credit into collateral for monetary policy operations, aiming to lower the cost of green financing.

Banks also dominate China's nascent green bond market. Of note, issuance by small and midsize commercial banks is gaining momentum and growing much faster than major banks. Beyond banks, in 2017, a more diverse set of issuers started to appear, with more corporate issuers tapping the green bond market than the prior year. Similar to other financing arenas, state-owned issuers are far more active than privately owned entities in printing green bonds in China to finance investments in renewables, green buildings, and transportation.

Chart 2

China 2016 GB Issuance By Source

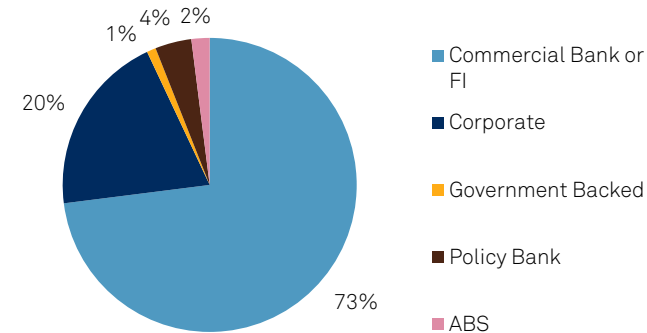
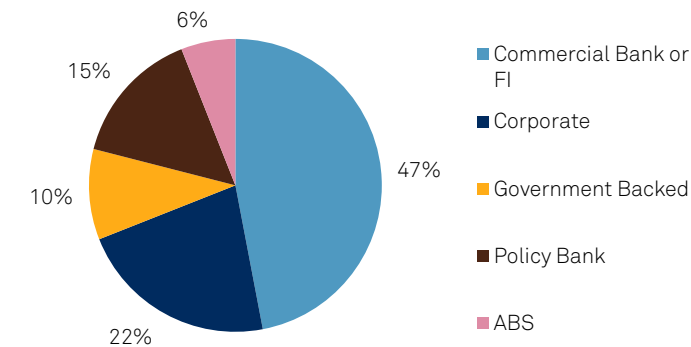


Chart 3

China 2017 GB Issuance By Source



We expect that financial innovation will also underscore the breadth and depth of development in the green finance market. For example, State Power Investment Corp, one of five major state-owned power generation groups and also the world largest solar developer, is launching a

RMB4.5 billion green asset-backed securities (ABS) program by securitizing the government subsidy receivables of its solar projects. Green ABS is likely to provide an effective solution for Chinese renewables developers, which are struggling with operating cash flow deficits and liquidity strains because of their mounting subsidy receivables. Moreover, the ramp-up in green lending by banks enables green asset securitization to follow, which in turn frees capital for further green lending. We expect to see more frequent green ABS transactions and even local government bonds emerging and growing at a faster rate in future.

Despite significant progress, achieving China's climate and sustainable development goals will require significant additional financing. The country is estimated to require at least RMB3 trillion-RMB4 trillion (\$480 billion-\$640 billion) each year in green investments from 2015 to 2020 to meet its ambitious energy and climate goals alone, according to research by the Ministry of Ecology and Environment and the China Council for International Cooperation on Environment and Development. The Chinese government expects that 85% of this investment will need to come from private sources, both domestic and foreign.

Compared with Europe and the U.S., China is still incubating a growing investor base and better awareness of sustainable finance among the financial community. This, compounded by higher administrative costs for green bond issuance and surveillance, is starting to hinder ongoing growth of the Chinese green bond market as both the demand and the supply of green finance are reaching bottlenecks. In light of these factors, some local governments, such as Jiangsu province, are putting forward measures to incentivize bond issuers through efforts including subsidies or interest rate discounts, in order to lower the overall issuance costs. However, the fiscal strength of local governments is key to sustaining the monetary benefits to issuers. As many Chinese local governments are already financially constrained, other more pressing policy goals may prevail when they allocate limited resources.

We believe more incentives are needed to boost the appeal of green finance products to investors. In the domestic market, as banks are the primary issuers of green loans and are also the major investors in green bonds, some argue that an appropriate risk weighting for bank holdings of green finance assets would likely boost demand from banks. Expanding the investor base, especially through the opening of China's bond market to more international investors under the Bond Connect scheme since 2017, would also help foster responsible investment in China and increase the demand for green bonds over the longer term, particularly when consistency and transparency are also tackled effectively.

Consistency Is Key

Harmonization of green definitions is the first and most important step to attract international capital to China's green bond market. Many of the self-labeled green bonds are issued under the Chinese green bond definitions, which are considered more flexible than the more established international guidelines. Current Chinese definitions include: efficiency improvements to coal facilities, nuclear power, and a higher limit (up to 50%) of the allocation to refinance or provide general working capital. In 2017, only around 62% of Chinese self-labeled green bonds aligned with international definitions. Therefore, to attract foreign investors such as through the Bond Connect scheme, the government is looking to improve the cooperation and consistency between Chinese green issuance standards and regional and national green bond markets across the globe.

More efforts are under way to address the consistency issue between China and the international market. In March 2017, the Chinese Green Finance Committee and the European Investment Bank launched a joint initiative to establish a joint framework to gradually align the

Chinese and European classifications of "green" in order to support greater issuance and investor demand for Chinese green bonds. In our view, the amount of internationally aligned issuance is likely to grow as the country embraces global standards and best practice, which will strengthen China's ability to attract foreign investors.

Bracing For The Clean Technology Superpower

A key part of China's green strategy centers on leading the renewable energy and clean technology revolution. In particular, its investments in renewables, batteries, and electric vehicles could push the country to the forefront of the energy transition, supporting its economic expansion and aspirations of global leadership. In 2017, clean energy represented the largest allocation of Chinese green bond proceeds, with \$6.8 billion in issuance, followed by low carbon transport, which combined accounted for 52% of total issuance (according to Climate Bonds Initiative data). The country's green bond volume continued along this trend in the first half of 2018; clean energy (\$3.4 billion) and low carbon transport (\$2.8 billion) together represented 66% of the \$13 billion in total issuance. According to the International Energy Agency, China plans to invest more than \$6 trillion in low-carbon power generation and other clean technologies by 2040, far exceeding the levels of investment committed by other countries in the EU or the U.S.

Chart 4

China 2017 GB Issuance By Asset Type

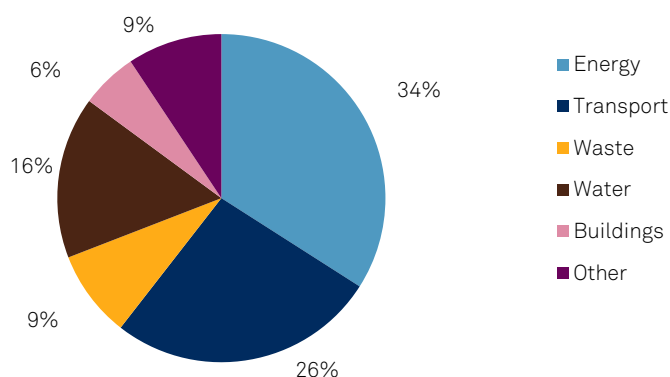
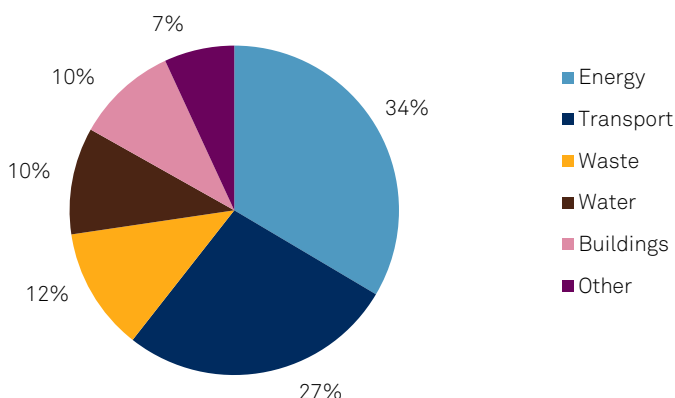


Chart 5

China H1 2018 GB Issuance By Asset Type



China already dominates in the manufacture of solar panel technology. In 2017, solar modules produced in China represented about 71% of global production (including foreign companies manufacturing in China) and its ability to drive down the cost of solar technology has helped the technology penetrate global markets. Now, the country is pursuing battery storage, a technology that promises to unlock the intermittency challenges of renewable energy, and is positioning itself as a leader in the global battery market. China accounted for 60% of the 131 gigawatt hours (GWh) of total global lithium ion battery manufacturing in 2017. Bloomberg New Energy Finance expects this to triple by 2021, with China maintaining nearly 73% of total capacity.

Fueled by supportive government policy, especially the subsidy scheme, China has become the largest electric car market in the world. Globally, electric passenger vehicle sales grew by 54% in 2017 to 1.1 million, and China accounted for over half of those sales. The country accounted for 26 million of 27 million in electric vehicles sales, including two- or three-wheeled e-bikes.

This new energy vehicle (NEV) expansion is further supported by China's efforts to develop charging station infrastructure; it has three times as many outlets as the U.S. China is also on track to meeting its target of having 5 million NEVs (mostly electric cars) on the road by 2020 and for the share of NEV sales to represent 40%-50% of total vehicle sales by 2030.

China is also leveraging the green bond market to invest in overseas renewable energy projects, enabling the country to attract a base of foreign investors and increase its influence abroad. In 2017, \$6.6 billion (RMB44.1 billion) of offshore green bonds were issued, representing about 18% of China's total green bond issuance. For example, in June 2017, China Three Gorges (CTG) issued €650 million green bonds to finance its acquisition of European wind power projects in Portugal and Germany. This transaction achieved an S&P Global Ratings Green Evaluation score of E1, the highest ranking, reflecting the relatively high environmental impact offered by the financing of wind farms that offset the moderate aggregate carbon intensity of local grids. In the first half of 2018, over 40% of Chinese green bonds were issued overseas by leading corporates and large commercial banks. In addition to CTG, we have published our Green Evaluation of two bonds to finance green buildings in China:

- Modern Land (China) Co. Ltd., a US\$350 million green bond; and
- Landsea Green Group Co. Ltd., a US\$150 million green bond.

By taking a lead in clean technologies, China is not only improving its domestic generating capacity and its energy security amid trade conflicts, but also positioning itself to become an exporter of clean energy technologies, which helps support its continued economic expansion and bolsters its geopolitical influence. These efforts also facilitate the decarbonization of its economy in line with the Paris Agreement in the process, strengthening China's commitment in the climate fight.

Private Capital Critical For Belt & Road

In our view, attracting private capital will be crucial to execute the China-led Belt and Road Initiative (BRI). However, China still needs to convince investors of the underlying credit quality of the infrastructure projects, let alone its green credentials. The BRI is an extensive infrastructure and economic development plan across around 70 countries and territories spanning Asia, Africa, and Europe along the Silk Road Economic Belt and 21st century Maritime Silk Road. We understand investment to support the BRI could reach a massive US\$6 trillion by 2030. Seed capital will come from two China-backed financing schemes, the sovereign Silk Road Fund and, to a lesser extent, the Asian Infrastructure Investment Bank (AIIB), as well as the Chinese Finance Ministry, the China Development Bank, and the state banking sector. But the huge funding needs for the BRI cannot be met without the participation of international capital. China is clearly aware that more international capital to finance the BRI projects is of both political and economic success to this initiative.

In May 2017, four Chinese ministries jointly published their plan to promote the Green BRI stating that the initiative becoming more green is crucial to its success. By applying a green agenda to the BRI, in our view, China is elevating the value of the initiative and helping to court international participation. The massive undertaking offers a supply of green infrastructure investment opportunities that could meet the increasing demand by global investors for sustainable finance. But we foresee significant hurdles in getting this initiative off the ground. Fundamentally, the appeal of those projects to global capital is still subject to the standard determinants of infrastructure finance, along with the adherence to international practices in assessing the social and environmental impacts, as well as governance and transparency.

Lately, the BRI also encountered some setbacks in the developing markets associated with the debt sustainability of those large infrastructure projects. Specifically, the political backlash in countries such as Sri Lanka, Pakistan, and Malaysia, will lead to some BRI projects being canceled or delayed under the concern of debt sustainability. This has placed the ambitious initiative at risk despite the promoted green image.

Challenges Ahead

Despite China gradually shifting its economy to meet its climate goals and invest in clean technology, a number of obstacles remain for the country to truly transform into a green superpower. Chiefly, China continues to rely heavily on fossil fuels; coal remains the largest source of energy, representing over 60% of its energy mix although China aims to reduce the share of coal in its primary energy mix down to 40% by 2050. Shifting its massive electricity system will be costly and despite the growing penetration of renewables and natural gas, both transmission and gas infrastructure is still under development.

Outside China, Chinese policy banks and state-owned commercial banks continue to invest in certain coal projects in developing markets. This not only runs counter to its own domestic climate policies but also undermines China's desired image as a climate leader. Moreover, other Chinese foreign investments, such as those in agriculture and mining, have reportedly failed to meet the same environmental standards that the country imposes domestically, suggesting that China may be exporting its environmental footprint. This inconsistency could also undermine China's credibility as a green leader as host countries begin to pay more attention to the environmental and social impacts of these investments.

Other forces also weigh on China's green economic strategy, including the escalating trade war with the U.S., which is likely to put pressure on the Chinese economy in the face of its growth plans. Attracting foreign investors will also require improvements in transparency in the Chinese finance market, although the government has pushed reform and transparency. Additionally, China's desire to attract foreign investment, particularly through the global sustainable finance markets, will require a greater focus on environmental, social, and governance issues (ESG), an investment ethos that has been embraced by foreign investors, particularly in Europe. Environmental performance information, in particular, remains insufficient and will require greater environmental risk information statistics and data disclosures to meet the demands of green bond investors. Indeed, attracting international investors will require Chinese firms to improve their treatment and disclosure of the broader set of ESG risks and opportunities and to remain accountable to the environmental and social commitments made.

As the second-largest economy in the world and the largest emitter of carbon, China has a major role to play in global efforts to address climate change. Recognizing the great opportunity presented by the U.S. federal government's retreat from its national climate commitments, China is leveraging the green finance market to invest in the clean technologies of the future in an effort to expand its economy and in turn improve its influence abroad.

Can U.S. Utilities Weather The Storm?

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Key Takeaways

- Climate change is challenging the utility industry's traditional risk management assumptions.
- Many of the most costly natural disasters have occurred over the past decade.
- While there are solutions to address climate change risks, each comes with their own possible risks to the utility industry, including financial, operational, and regulatory.
- S&P Global Ratings expects the utility industry in the U.S. and Canada to manage climate change risks through a combination of insuring a higher percentage of utility assets, system hardening, and improving regulatory mechanisms for cost recovery following a destructive weather event.

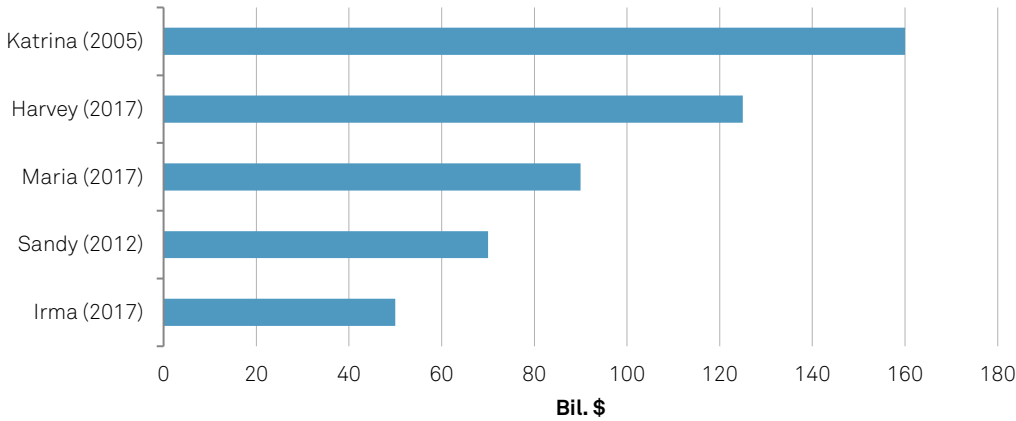
Effective enterprise risk management is a key factor for successful management teams. This complex endeavor requires sophisticated leaders with the skills to identify risks before they occur and take effective measures to diminish the impact of their destructive outcomes when they do. As our climate continues to change, effective management of weather-related risks is becoming more complex and ever more important, especially as it relates to the credit quality of regulated utilities in North America. Adverse weather events are forcing utilities to look at ways to protect their assets from natural disasters and maintain their investment-grade credit quality.

The Risks And Costs Of Natural Disasters Are Intensifying

During the past year, the utility industry has unfortunately witnessed the manifestation of climate change risks firsthand. In 2017, the unyielding impacts of wildfires destroyed parts of California, hurricanes ripped through the eastern part of the U.S., and Hurricane Maria devastated Puerto Rico. There was little let up from these severe natural disasters and unpredictable weather patterns in 2018 that included Hurricanes Florence and Michael. Not only does the frequency of these disasters appear to be increasing, but their costs are rising. The natural disasters that have occurred over the past decade have wiped out billions of dollars of assets over a relatively short period. Without the appropriate regulatory compact and other risk mitigation, the financial aftermath of these events could be devastating to any individual utility, adding another layer of unpredictability that utilities must effectively manage.

Chart 1

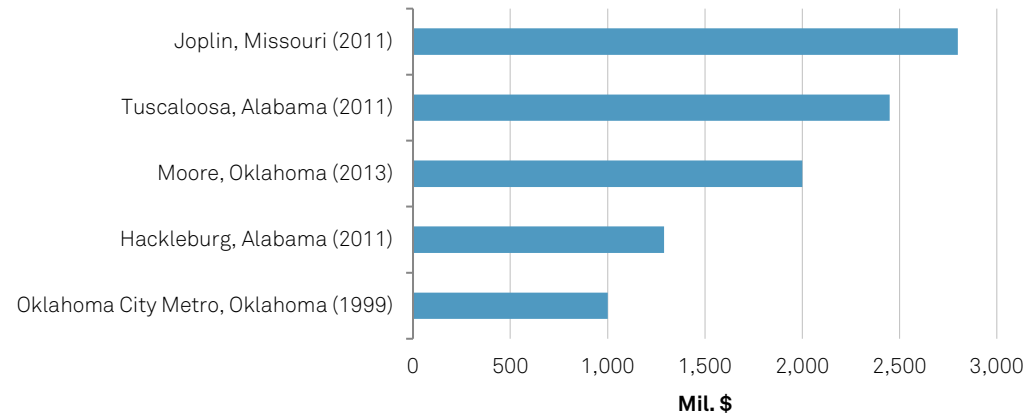
Hurricane Damage



Source: National Hurricane Center (adjusted for inflation); S&P Global Ratings.

Chart 2

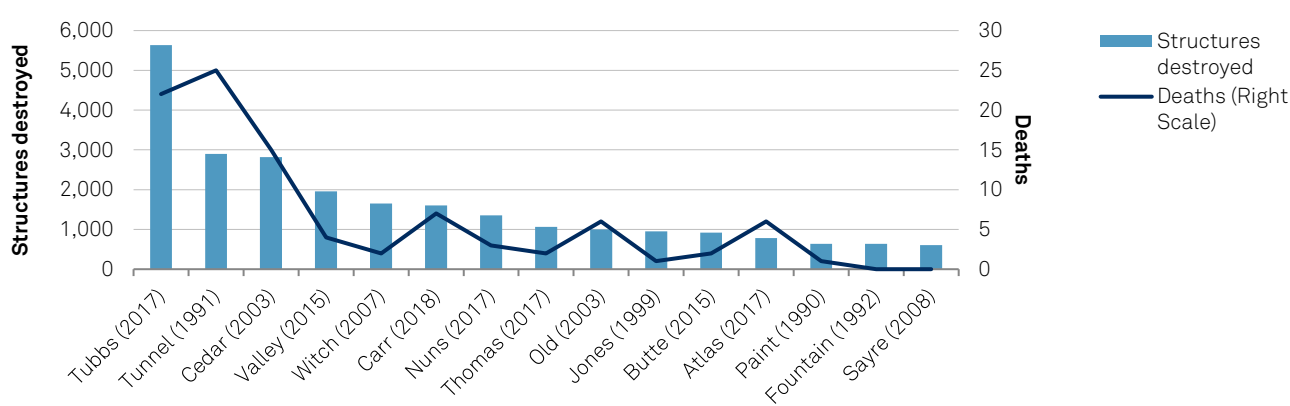
Tornado Damage



Source: National Hurricane Center; S&P Global Ratings.

Chart 3

Top 15 Most Destructive California Wildfires



Sources: California Dept. of Forestry and Fire Prevention; S&P Global Ratings.

Climate Change May Also Affect Operations

Climate-change related risks not only affects a utility's financial stability but also potentially alters its operational effectiveness. Utilities have a long record of providing a reliable service at a reasonable cost. While reliability has always been the primary concern for the industry, climate change may be reshaping its priorities. For example, because of the California wildfires and the billions of dollars in property damages, utilities are now taking steps to reduce wildfire-related risks and even openly debating the possibility of de-energizing power lines in advance of a fire. In such cases, utilities would proactively turn off electricity to customers, decreasing reliability in an effort to potentially mitigate wildfire risks and related property damages. This demonstrates a major strategy shift for the utility industry, reflective of climate change's challenges.

Financial Solutions To Climate Change Bring Their Own Risks

While regulators generally allow utilities to recover prudently incurred costs from ratepayers, utilities are always cognizant of the effect rising costs have on customers' bills. As these bills increase, customers find it incrementally more difficult to pay, which often hampers a utility's ability to effectively manage regulatory risk. This predicament is a drawback in many of the financial solutions used to reduce weather-related risks, and if not well managed, may lead to unintended consequences. Utilities will have to proactively implement solutions that reduce the financial risks of climate change, which often entails reducing operating costs to negate a sudden rise in customer bills. This strategy, while easier said than done, enables utilities to effectively manage regulatory risk, prevent out-of-the-blue rises in customers' bills, and continue to mitigate unknown risks associated with climate change.

Possible Avenues For Managing Climate Change

We think the industry is adopting a multifaceted approach to climate change risk reduction. Each strategy is not foolproof and has its own risks that could lead to unintended consequences. We also believe that companies may move with varying degrees of urgency, resulting in some companies being more prepared for weather-related calamities than others. We generally expect that the industry will focus its strategies on insurance, infrastructure investments, and managing regulatory risk.

Insurance

When purchasing insurance to protect their assets, utilities must balance the level of insurance against the cost to the ratepayer. The higher level of insurance purchased, the more protected the utility may be from climate change and related natural disasters. Yet that increased cost would eventually be reflected on customers' bills. While the industry has always had to balance these conflicting risks, the pendulum may be swinging toward retaining a higher level of insurance because of more frequent and destructive weather-related events. The "one-in-100-year" storm or wildfire has become a more commonplace occurrence and insurance decisions simply based on past performance may not be indicative of today's environment.

A key risk to this strategy is that a higher level of insurance protection generally lends to higher costs, which would increase customers' bills. Another consideration is that when a natural disaster strikes, insurance premiums materially increase and generally become less available. Thus, when a utility is most desperate to protect its assets, the insurance product becomes most prohibitive or even unavailable. We have seen this recently in California, where some

utilities' insurance premiums have exponentially increased and others are limited by the amount of insurance coverage that they can purchase. To offset some of these risks, utilities are assessing other financial products, including catastrophic bonds and weather derivative bonds. These innovative solutions, although generally expensive, may reduce a utility's exposure to climate change risks.

Similar to wildfires, more and more utilities are susceptible to hurricanes. Recent hurricanes wreaked havoc on customers and utilities in the Carolinas, Georgia, and Florida, and other East Coast states remain exposed to rising hurricane risks. As climate change continues to take hold, these states may need to address similar risks, including limits of the insurance protection that can be purchased and the possibility of exponentially higher insurance premiums.

Infrastructure investments

A possible long-term strategy to reducing some of these risks includes technology investments and system hardening. In California, [San Diego Gas & Electric Co.](#) has installed multiple weather stations and cameras around its service territory for early detection of wildfires. This technology has already identified wildfires in their early stages, possibly saving billions in property damages. In Florida, for example, utilities have been hardening, or strengthening, their electricity system for years. This was one of the key reasons that following Hurricane Irma in 2017, Florida utilities were able to restore service in days rather than the months of restoration efforts necessary in Puerto Rico.

A risk to this strategy is that system hardening increases the customer bill and utilities would need to identify other cost savings to avoid significant rise in customers' bills. Furthermore, system hardening generally requires some degree of consumer education because there is generally some disconnect to the ratepayer between its costs and benefits. A customer's benefit from system hardening is generally not self-evident and could take years to be realized, while the higher costs are immediately seen on the bill. Lastly, system hardening is a long-term strategy that could require much customer patience, which is usually in short supply. As system hardening is implemented, the customer is paying more but a catastrophic event may strike a part of the service territory that has not yet been upgraded. In this instance, the customer would only see higher bills and no benefit from the partially hardened system. Both San Diego Gas & Electric Co. and the Florida utilities had the benefit of implementing their enhanced technologies and system hardening for over a decade prior to the recent weather-related events. Other utilities that are just starting this process may not be as lucky.

Managing regulatory risk

Effectively managing regulatory risk is another key avenue for utilities to reduce climate change-related risks. Many utility management teams have successfully collaborated with their legislators and commissioners to implement various storm recovery mechanisms that can be used in the event of weather damage in the jurisdiction. These mechanisms include securitization, storm recovery riders, and reserve accounts. Other jurisdictions have made use of a general disaster fund that can be used to pay for costs incurred as a result of severe weather.

Many states have a strong record of implementing riders and recovering costs in a timely fashion to protect credit quality. In Florida, the susceptibility to multiple hurricanes in the same hurricane season can place abnormal strains on liquidity and financial performance. Proactively, Florida utilities and policymakers developed strategies over time to manage these unique risks and to protect the utilities' credit quality. More specifically, these utilities can

petition for the recovery of storm costs without being subject to an earnings test and the state has allowed for the securitization of these costs, mitigating the rate impact of such costs on the customer. These credit-supportive measures in Florida have reduced credit risk by shielding fixed income investors from the financial risk of unpredictable weather conditions. We've also seen utilities work with regulators to reduce risk by lowering the threshold when recovery mechanisms can take effect. For example, Eversource Energy's utilities continue to work with their regulators to reduce the minimum threshold when storm costs can be deferred. These situations contrast to the regulatory difficulties that we have more recently seen in California stemming from the wildfires. Since the 2017 California wildfires, we have lowered our ratings on PG&E Corp. two notches and now maintain a negative ratings outlook for all of the large investor-owned California utilities.

The risk to this strategy is that any regulatory mechanism used to recover costs from the customer leads to a higher bill. While Florida's utilities recently demonstrated effective management of regulatory risk by offsetting the higher cost from Hurricane Irma with tax reform, we view this creative approach as a one-off that cannot be consistently duplicated. Another risk to this strategy is that effective management of regulatory risk is not something that can just be turned on when there is a natural disaster, but often requires many small steps and years of negotiating to arrive at the desired result. Many utilities have done an outstanding job of effectively managing regulatory risk but those that are lagging will likely need years to catch-up.

Table 1

Storm Recovery Mechanisms Utilized

	Storm cost		
	Rider recovery	Reserve account	Securitization
Alabama	X	X	
Arkansas		X	X
California		X	
Connecticut	X		
Florida	X	X	X
Kentucky	X		
Louisiana		X	X
New Orleans	X	X	X
Maine	X		
Mississippi	X	X	X
Missouri	X		
New Hampshire	X	X	
North Carolina		X	
Ohio	X		
Oklahoma	X		
Oregon		X	
Pennsylvania	X		
Rhode Island		X	
Tennessee	X		
Texas	X	X	X

Sources: Company filings, S&P Global Market Intelligence, S&P Global Ratings.

Changing Strategies For A Changing Climate

As a whole, we expect utility industry leaders will take prudent steps to identify climate-related risks in advance of their occurrence and take effective measures to reduce these risks. For climate change, the industry will use various financial, operational, and regulatory means to reduce risk, yet, each strategy is not without its own risks and possible unintended consequences. We also believe that companies will move with various levels of urgency to address these concerns which will continue to have implications for our business risk assessments. While we will continue to monitor climate change developments and company-specific actions to reduce risk, we expect that the industry as a whole will remain vigilant to these rising risks and find an equilibrium that protects credit quality.

Untapped Potential: How The Green Economy Is Broadening

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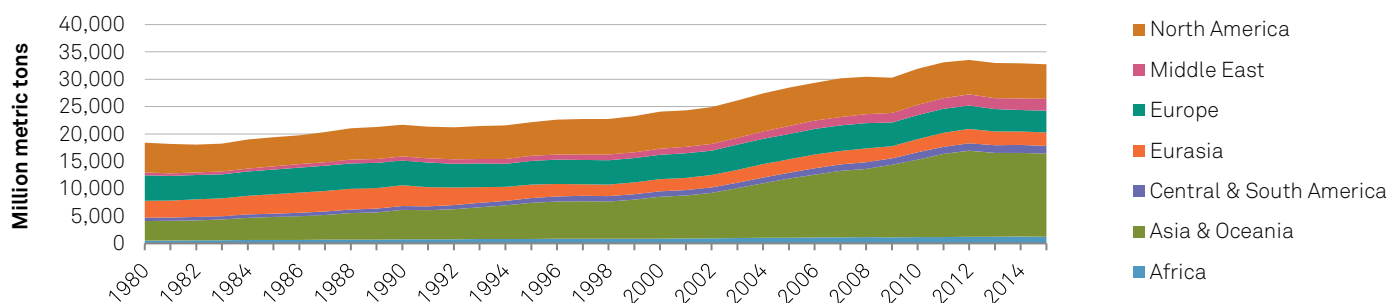
In April 2017, S&P Global Ratings launched its Green Evaluation tool, and since then we've used it to evaluate a variety of asset classes, issuers, industries, and financing types. As the labelled green bond universe has grown, so too has our capacity to evaluate the environmental impact of these debt issues. Moreover, we've begun to see a broader swath of inhabitants in the green bond market, and more participants in general that are contributing toward the ambitious goal of decarbonizing the global economy and mitigating environmental, social, and governance (ESG) risks, which are a facet of our credit ratings analysis.

Overview

- The green bond market continues to expand, reaching over \$160 billion for 2017 and may surpass \$200 billion in 2018 with a broader swath of sustainable assets that reflect the overall greening of the global economy.
- Although some industries cannot pivot away from their carbon intensive legacies, some agriculture, mining, and manufacturing companies are becoming greener—though not always by design
- We expect a stronger and broader green bond market in coming years with new asset classes, as new industries decarbonize and existing ones look to reposition themselves and show off their green credentials.
- While developed nations have been cutting carbon emissions, the global picture is a bit murkier, and a broader definition of what being green means could support more decarbonization everywhere.

Chart 1

Global CO2 Emissions, By Region



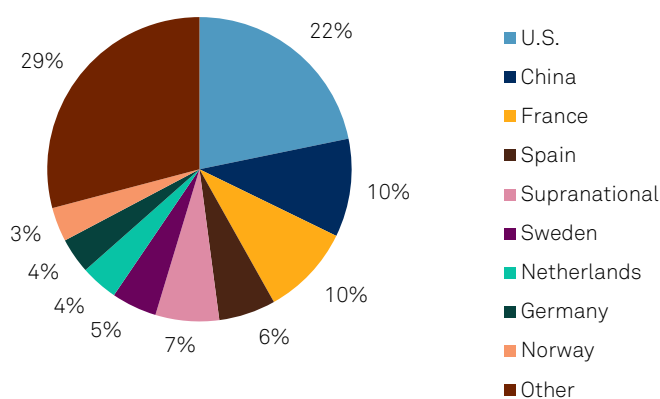
Source: International Energy Agency

The Financial Transition

While the market may have historically had a narrow definition of what asset types and financing structures would constitute a green financing, the scope of green products has grown immensely. Our green evaluation tool is also agnostic to the nature of the financing vehicle. Indeed, while investment grade corporate bonds have historically made up the lion's share of green financing, the market appears to have come to the understanding that other securities also need a means for establishing their relative greenness. Even sovereigns have become a major component of the green financing universe, with more than \$14 billion issued in the first half of 2018. Securitizations continue to grow in frequency and scale as well.

Chart 2

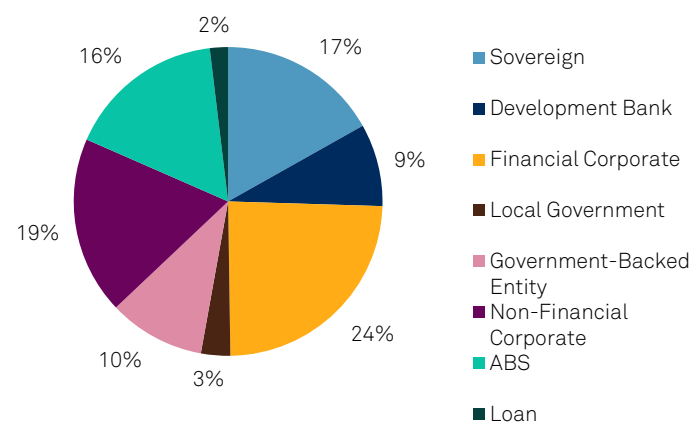
2018 Green Bond Issuances, By Country



Source: S&P Global Ratings. Through July 12, 2018.

Chart 3

2018 Green Bond Issuance, By Instrument



Source: California Statewide Communities Development Authority. As of July 12, 2018.

In addition, while the immediate pricing impact of green bond issuance may be modest and hard to discern, that could partially reflect low interest rates and the comparatively higher credit quality of green bond issuance. More than 90% of labelled green bonds have been rated investment grade. While higher interest rates may have negative impacts on overall bond issuance, it may also allow for somewhat more pricing separation. Currently, there is some anecdotal evidence of greater liquidity in issuances that are labelled green, with greater levels of over subscription that could ultimately manifest in better pricing.

The Next Generation

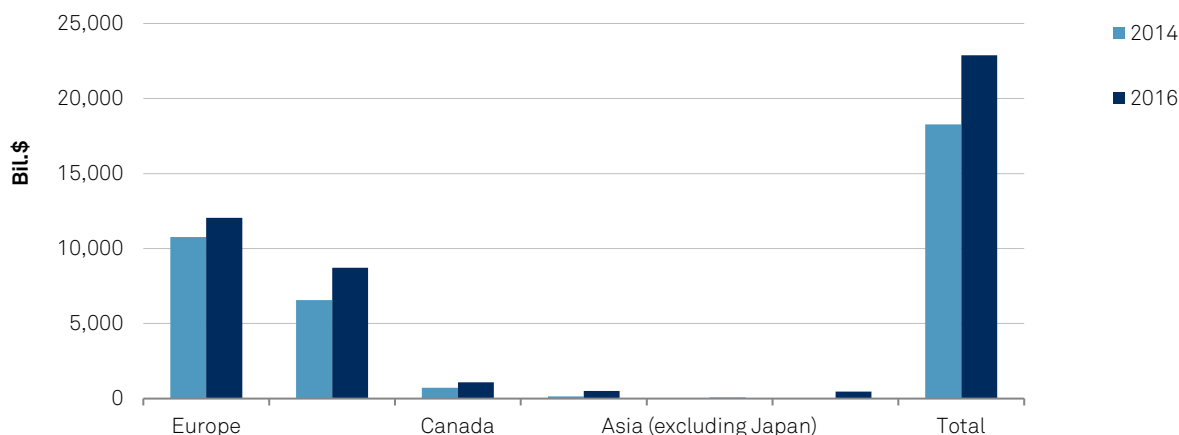
While the initial focus of the Paris Agreement targets was largely related to power generation and consumption, the scope of activities that can contribute to decarbonization is more far reaching—and the market seems to be taking notice. Even if some Nationally Defined Contributions (NDCs) under the Paris Agreements can be entirely met by installing renewables and retiring coal assets, countries are noticing that it's possible to also decarbonize other historically polluting sectors.

Even though not all polluting activities and businesses are within the scope of global carbon regulation, we've continued to see a trend of greening across the economy, even in businesses not historically perceived as environmentally sound. There are a number of potential reasons for this mass greening:

- More discerning investors: Our discussions with key investors during our time analyzing environmental finance have yielded numerous insights. Chief among them may be that these investors are facing increasingly strict mandates on what they are allowed to invest in. Investors with long holding periods, especially, are sensitive to all types of industries due to their stakeholders' concerns. Moreover, investors also have to account for longer term risks more critically because although some environmental and social risks may now appear remote, they can become far more important over the long term.
- Potential for future regulation: Industries that aren't now subject to heavy environmental regulation may not necessarily be spared in the future. California is a good example of this. The Golden State has long been known for its regulation of carbon emissions in the power sector, via a carbon trading regime and lofty renewable portfolio standards. But more recently, its program has expanded to encompass transportation fuels and industrial emissions.
- Compelling economics: Gas and electric utilities might be the most obvious places where addressing environmental concerns is a big economic factor, but there aren't the only ones. We see that this will increasingly be true in other industries. Materials costs for manufacturers, for instance, represent a significant proportion of their variable operating costs, and greater efficiency, which is becoming less expensive to achieve through smarter technology, means cost savings.
- More savvy consumers: Investors are not the only ones who are growing more conscious of environmental risk. Consumers are as well, for reasons both economic and conscientious. While this doesn't necessarily affect every industry, it generally does affect those with heavy consumer sales. In such industries, which run the gamut from regulated utilities to retail, a more modest environmental footprint is not merely insulation against regulation, it's a distinguishing factor among competing brands that will only become more entrenched as generations change and environmentally and socially conscious millennials increase in number.

Chart 4

Assets Managed Under ESG Strategies See Strong Growth Across Regions



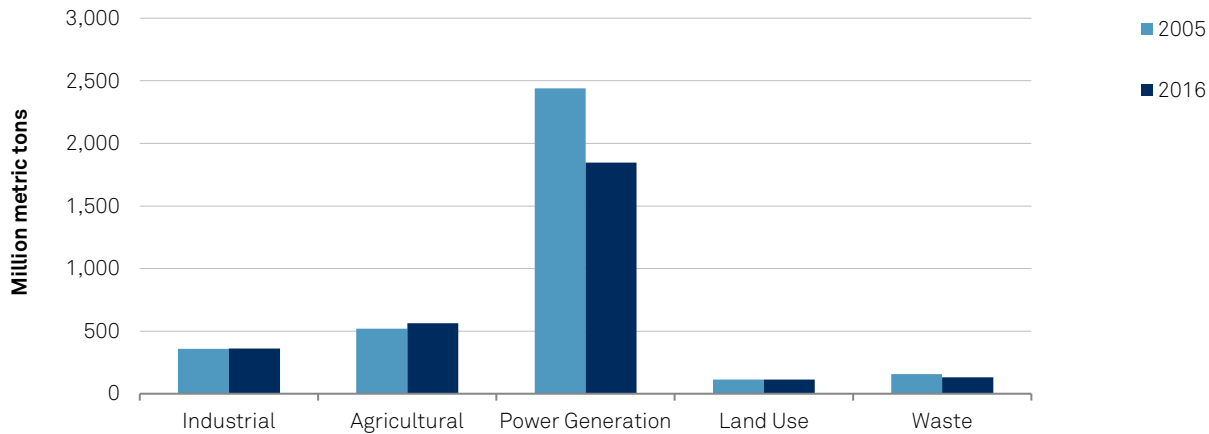
Source: S&P Global Ratings.

So which industries are most affected by this broadening of the green spectrum? A few major ones come to mind, and we anticipate that we could see an uptick in issuances not just of conventional green bonds, but more diverse financial instruments as well, as companies with a long history of pollution seek to do an about face and repackage themselves as participants in a greening economy. As shown below, while the power sector, at least in the United States, has had sharp declines in carbon intensity, other sectors lag. However, we believe that there could be parity in the future.

There are legal and regulatory movements to this end as well. The state of California, for instance, along with its much-heralded mandate to have 100% renewable energy by 2045, has also announced a goal of having a carbon-neutral economy by the same time, indicating that it will likely have requirements for cutting emissions in other sectors, including transport and agriculture.

Chart 5

U.S. Carbon Emissions Declines, 2005-2016



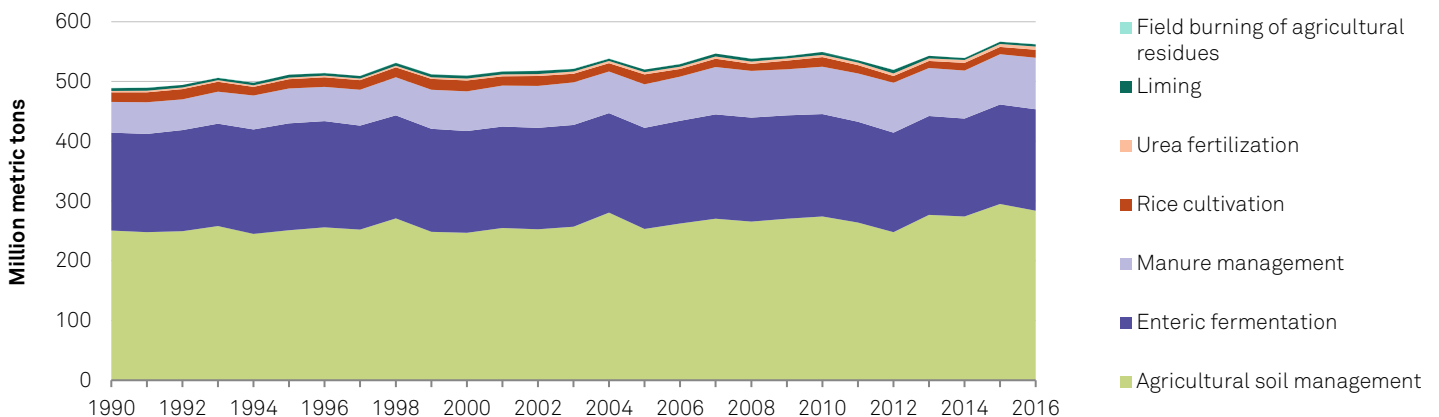
Source: U.S. EPA.

Agriculture And Land Use

The worldwide agriculture industry encompasses many activities, and to some degree, each of them is environmentally intensive. In the U.S., the agricultural sector (excluding land use) has carbon emissions totaling about 30% of the power sector's. Yet while the power sector's emissions have continued to decline, the same pattern hasn't been present in agriculture.

Chart 6

U.S. Agricultural Sector Carbon Emissions



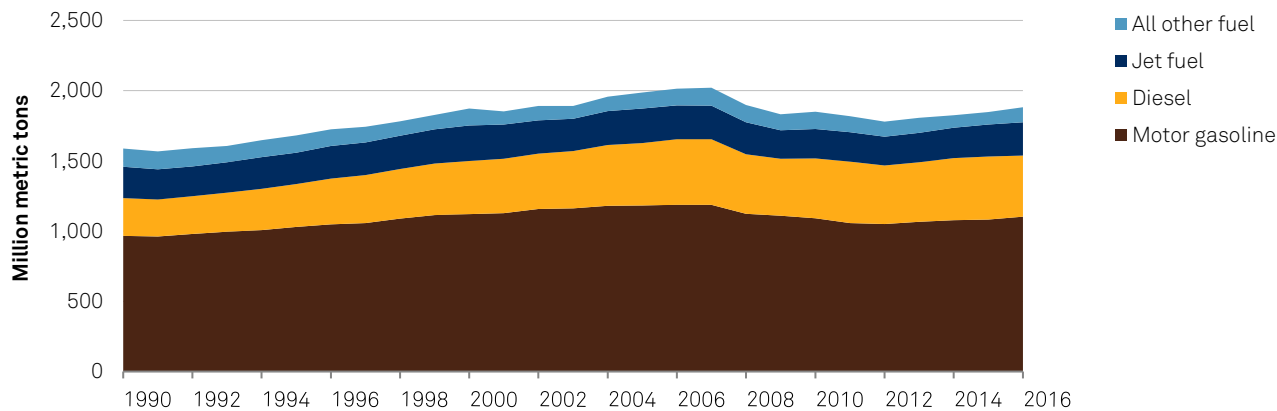
Source: U.S. EPA.

We anticipate that the use of advanced biofuels to transport agricultural goods is likely to be one way that the agriculture sectors will become notably greener, especially in Scandinavia,

Canada, and the Western United States. Given the relatively early stages of development for renewable diesel, biodiesel, and cellulosic ethanol, however, we believe that regulation will have to continue to propel their development. But regulations have had a definite impact in California, Norway, and certain Canadian provinces are raising blending mandates, and we see substantial potential for further reducing carbon output in the transportation sector. .

Chart 7

U.S. Transportation Sector CO2 Emissions

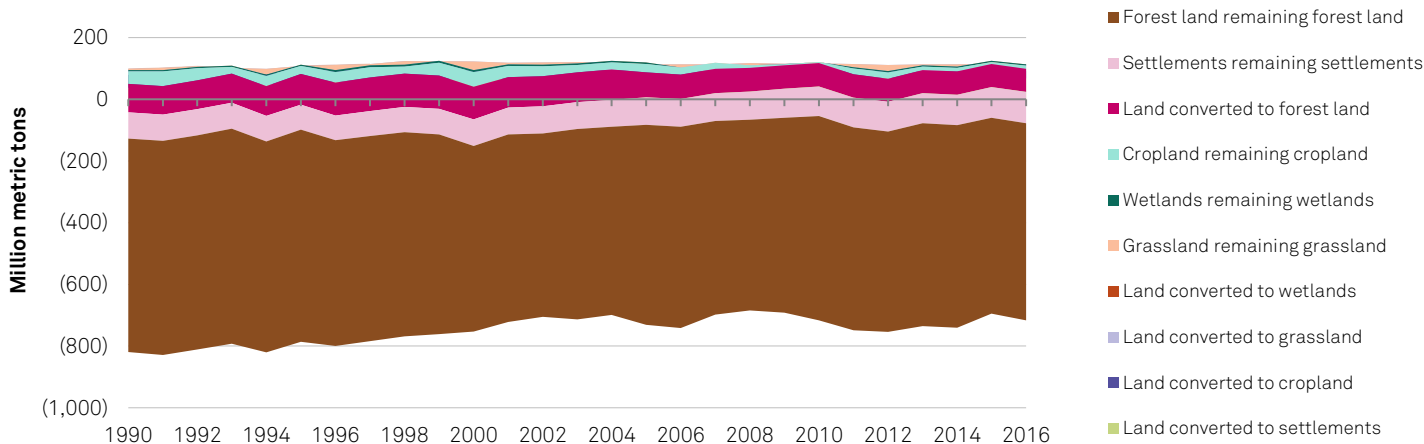


Source: EIA.

While these changes are happening mainly in jurisdictions with environmentally conscious citizens, their impact may reach further. Ethanol, for instance, is a more conventional biofuel that has come under siege in certain areas because of it could potentially disrupt food supplies. Although this is the subject of significant lobbying (and no real political consensus) in the U.S. , in China, the government has changed tack and sought alternative blending fuels such as methanol, which are produced by coal or natural gas byproducts, and are not as sustainable.

Chart 8

U.S. Land Use Sector Net Carbon Emissions



Source: U.S. EPA.

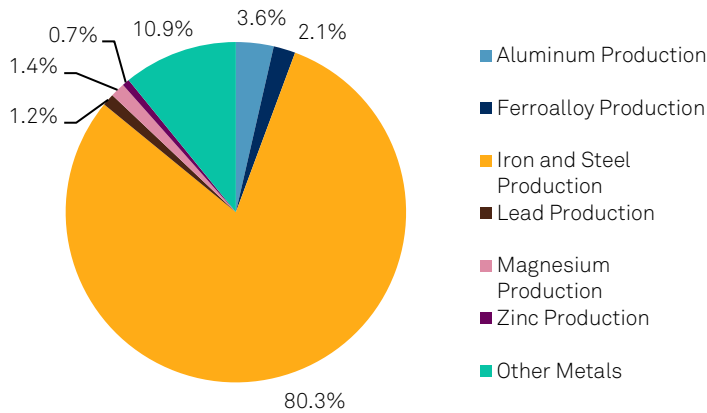
A more intriguing—and possibly less controversial—way that farmers and ranchers can become environmentally involved is changing the way they use land. The avoidance of

widespread deforestation, as well as the conversion of farm land back to forest land, when feasible, has been shown to have a beneficial impact on carbon emissions.

Metals and Mining

Chart 9

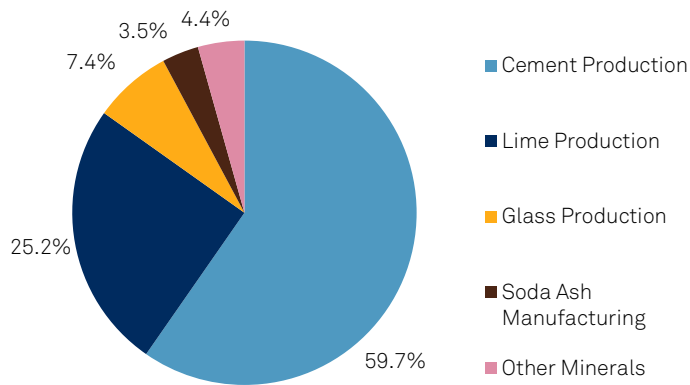
U.S. Metals Sector Carbon Emissions, 2016



Source: U.S. EPA, GHGRP (Greenhouse Gas Reporting Program).

Chart 10

U.S. Minerals Sector Carbon Emissions, 2016

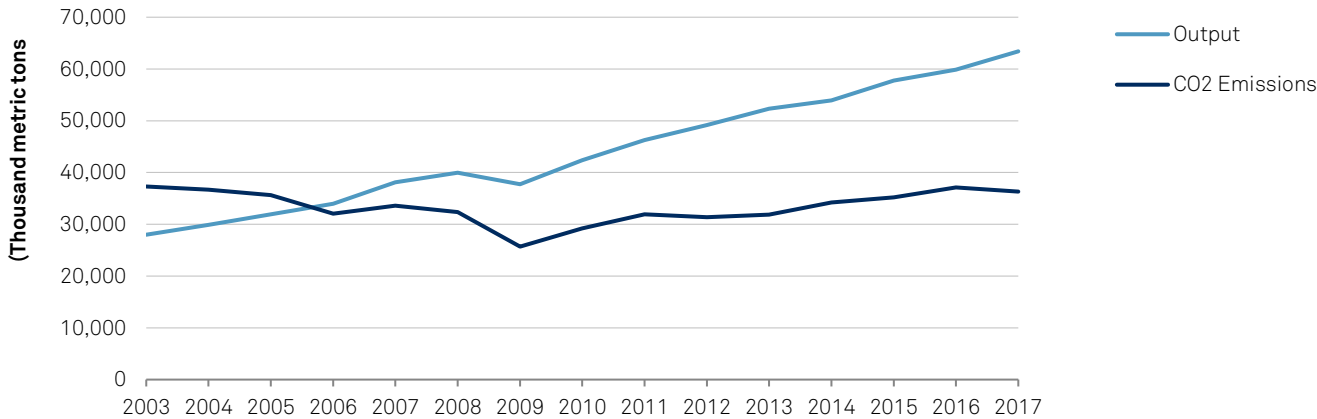


Source: EPA GHGRP (Greenhouse Gas Reporting Program).

In the U.S., we have seen a continued drop in emissions from metals production in the past decade, even as the number of total facilities producing metal has remained about the same. (Production, however, has not quite recovered to pre-recession levels.) Globally, though, improving industrial processes seem to have helped reduce carbon emissions. While aluminum output worldwide has more than doubled since 2003, CO2 emissions are beneath 2003 levels. While the immediate goal of efficiency improvements may be to obtain more competitive pricing (especially as most production has moved offshore), the ancillary benefit is that these processes have contributed substantially to diminished emissions and the use of less aluminum ore.

Chart 11

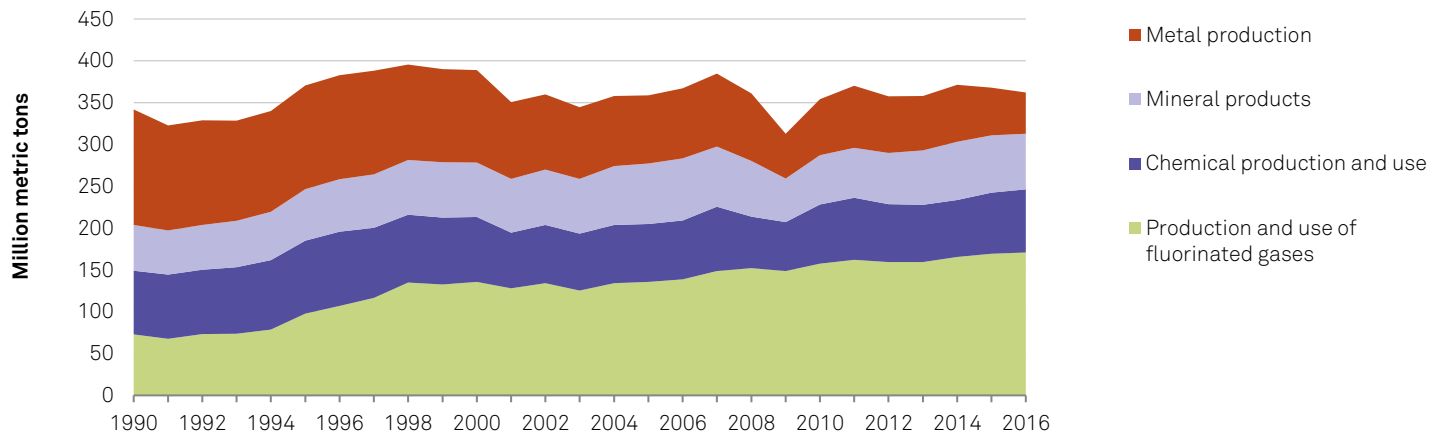
Global Aluminum Output And Carbon Emissions



Source: International Aluminum Institute.

Chart 12

U.S. Industrial Sector Carbon Emissions



Source: EPA.

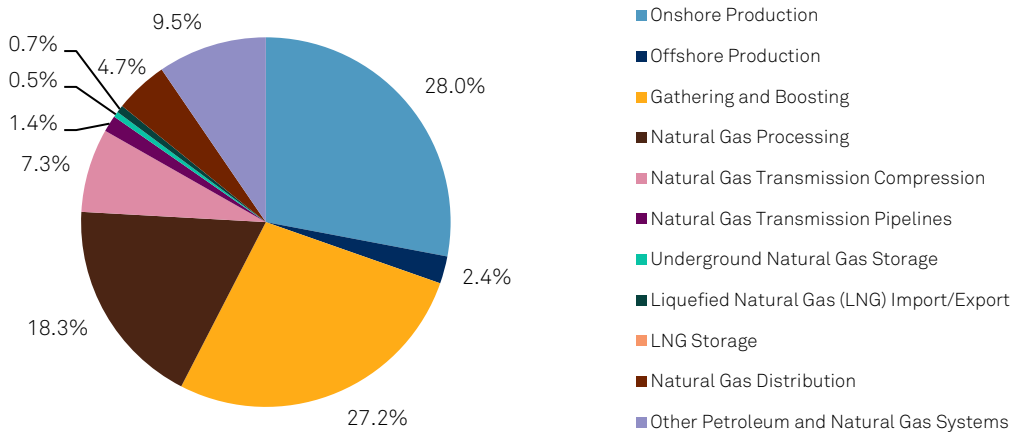
Petrochemical

The petrochemicals industry has had a checkered history on pollution, but numerous chemical companies are starting to respond to their own concerns about the role of fossil fuels in a greening economy. As with the electric utilities, emissions from the petrochemical sector fell in the wake of the recession. Unlike the power sector, however, that dip reversed itself as the economy began to pick up again.

The petrochemical sector has a large role to play in helping decarbonize, and numerous major companies have begun adapting. Large developing economies like China and India are bound to have substantial needs for liquefied natural gas as they seek to decarbonize their economies to meet the Paris Agreement targets and reduce their reliance on coal and oil, especially as they continue to see power demand growth due to energy intensive manufacturing industries.

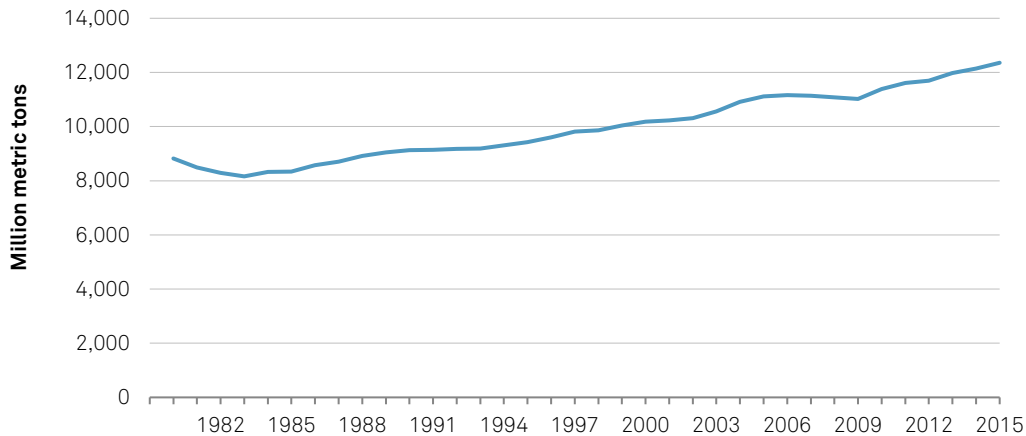
Chart 13

U.S. Petroleum Sector Carbon Emissions, 2016



Source: EPA GHGRP.

Chart 14

U.S. CO2 Emissions From Petroleum

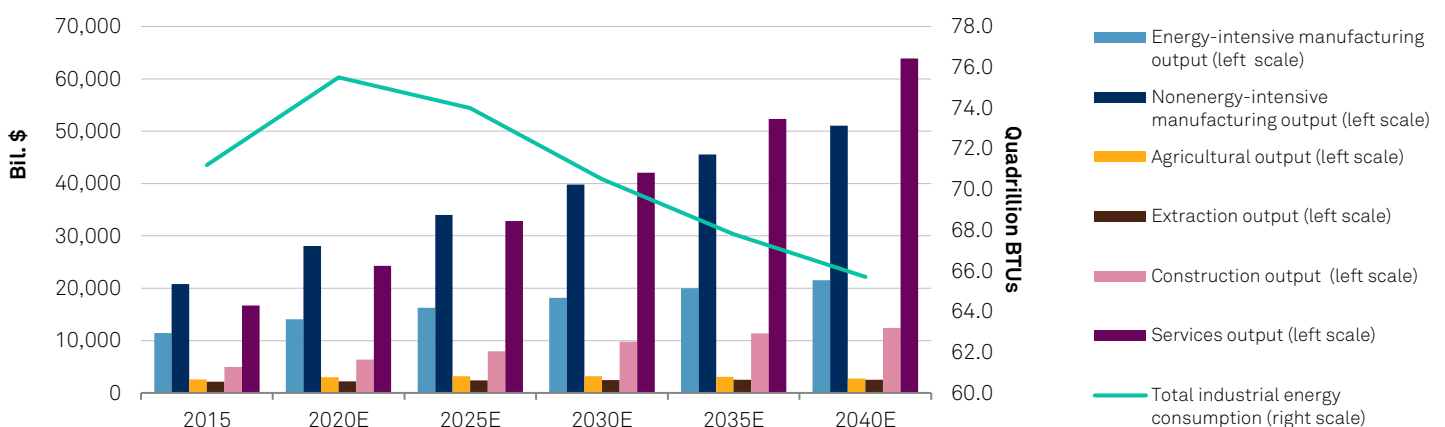
Source: EIA.

Industrials

We expect to see significant carbon savings in the manufacturing industry globally. This is certainly true in countries like the U.S., whose economies are increasingly service-oriented rather than focused on industry, and therefore less dependent on energy consumption for growth. But it's also likely to be true in economies where manufacturing is going to have a continued footprint between now and when Paris Agreement targets come into effect during the 2020s.

For instance, even though we expect China's energy-intensive manufacturing output to grow 50% by 2040, the EIA anticipates industrial energy consumption will actually decline by almost 10% over the same period as production becomes more efficient. This, in our view, undercuts the theory that the Paris Agreement targets will go unmet because of economic growth in emerging markets. Many emerging economies see their Paris Agreement goals take effect in 2030. Subsequently, we anticipate a worldwide decline in the energy intensity of manufacturing.

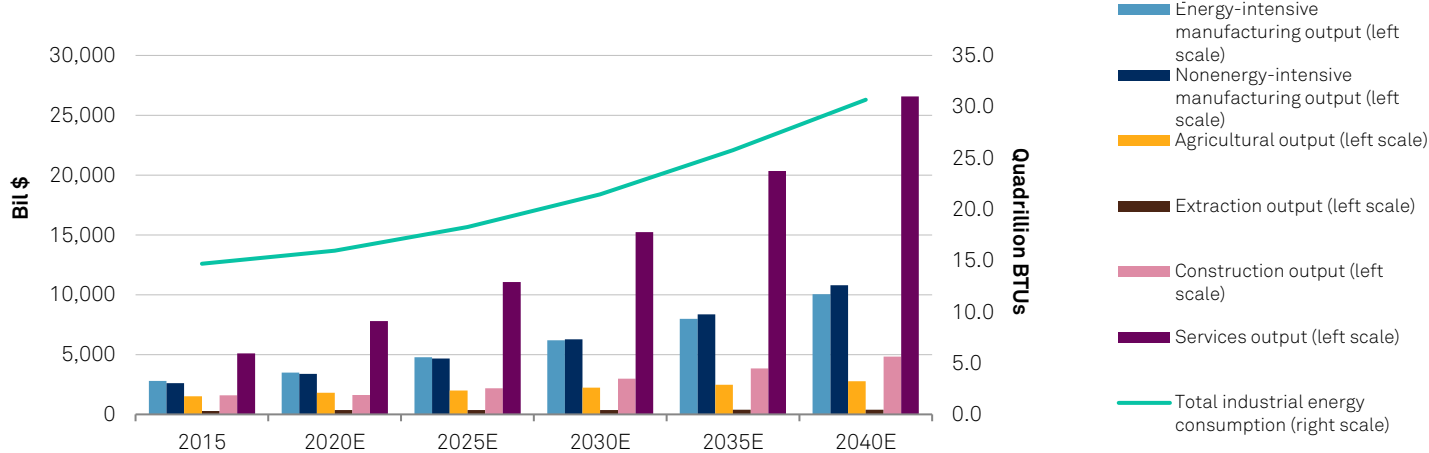
Chart 15

Forecast Total Industrial Energy Consumption And Economic Output, China

E--Estimate. Source: IEA.

Chart 16

Forecast Total Industrial Energy Consumption And Economic Output, India

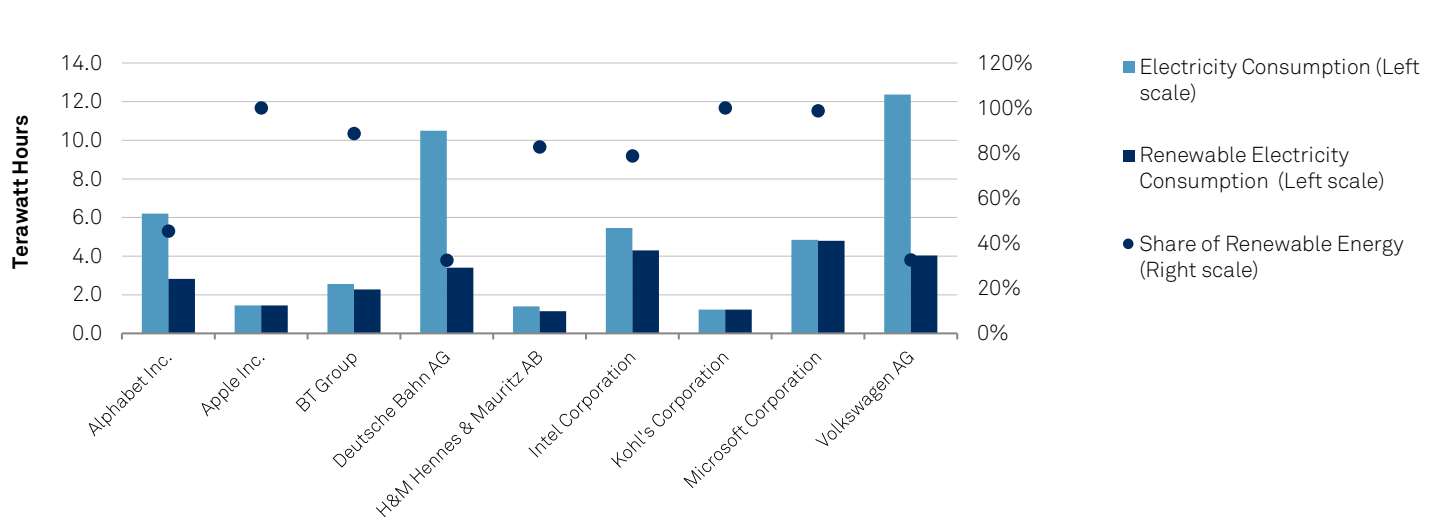


E--Estimate. Source: IEA.

Even manufacturers who can effectively trim energy use through more efficient production still have to power their operations. In the U.S. we see industrial issuers developing renewables either in-house or indirectly, via a corporate power purchase agreement (PPA). The appeal of this approach has grown substantially with the diminished costs of installed solar power. The ability to create certainty in power cost, which, for energy intensive manufacturers, can be a major cost, helps boost operating efficiency and competitiveness. **Microsoft Corp.**, for example, requires nearly five terawatt hours of power per year. The company has now set a target for 100% renewable energy. **Intel Corp.**, which requires nearly as much power, also has an ambitious renewable target. We expect that financings used to support renewable transactions for industrial issuers could be a major source of green bond issuance in years to come, as these issuers seek to show the market both cost competitiveness and environmental stewardship. Although this has been largely an American market for many years, the geographic reach of this financing approach has broadened substantially, with significant growth in Europe during 2017.

Chart 17

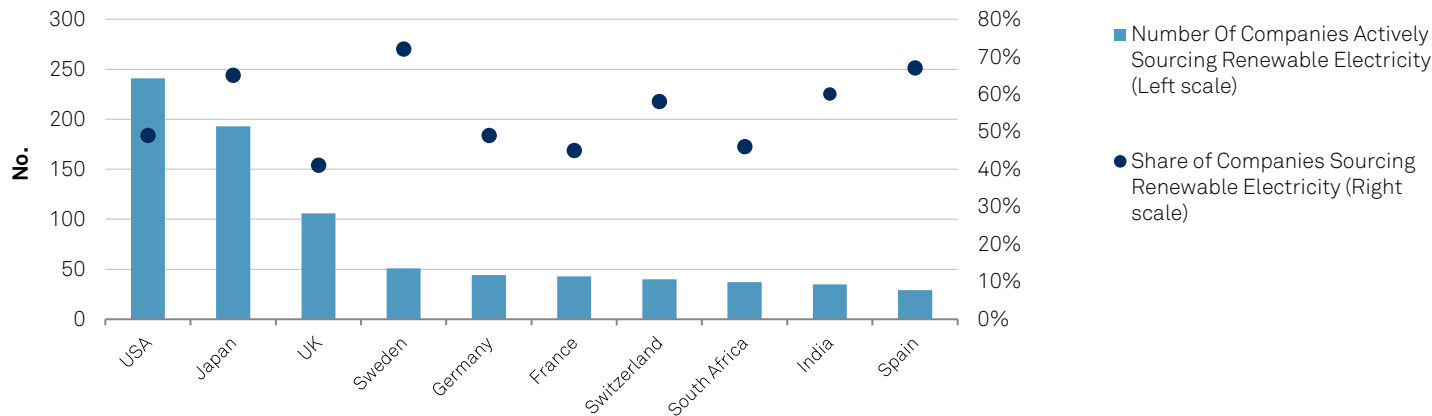
Selected Company Renewable Power Use



Source: IRENA.

Chart 18

Corporate Renewable Use, By Country

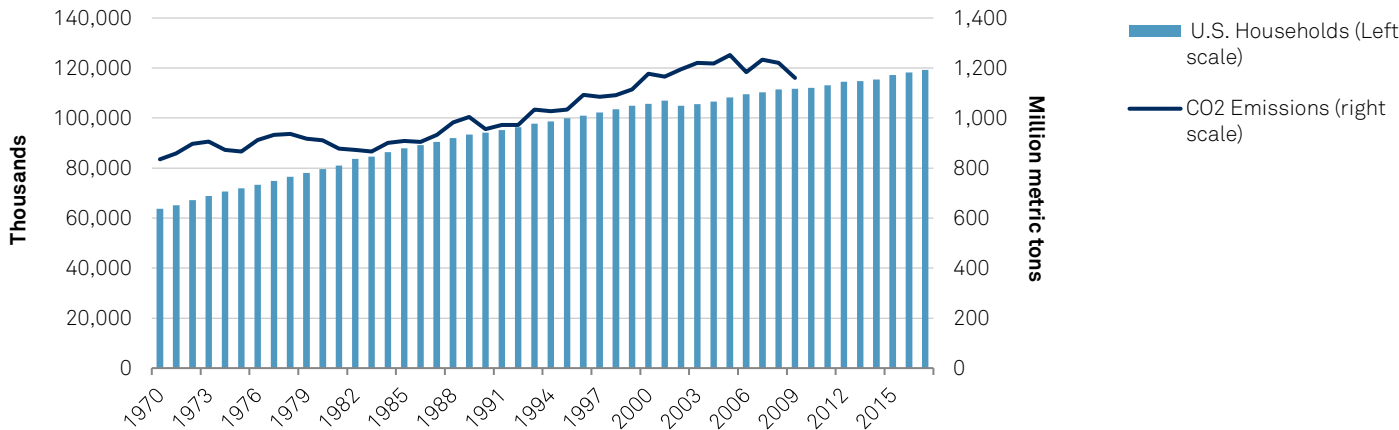


Source: IRENA.

Households

Chart 19

Historical Household CO2 Emissions



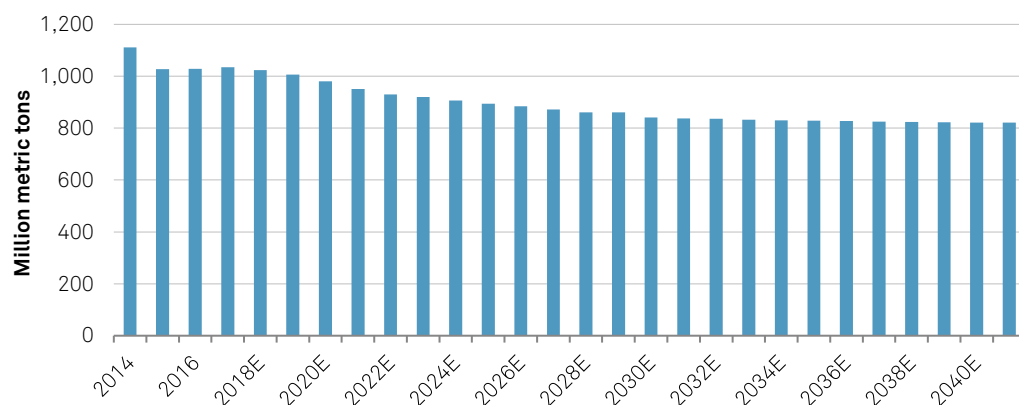
Source: Fed of St. Louis, EIA.

Much like the broader electric power sector, residential CO2 emissions in the United States more than tripled between 1950 and 2009 according to the Energy Information Administration, matching economic growth. But while the electric power sector has been able to mobilize and create a lower carbon footprint in the years since, household energy usage has been somewhat stickier, resulting in flatter emissions. However, we expect that in coming years, household carbon emissions will fall because of more energy efficient devices. This is in keeping with our belief that consumers are becoming more aware of their energy use and, by extension, their carbon footprints. While there’s historically been a tight correlation between the growth in demand for household products and economic growth, with little regard for the level of carbon emissions that accompanied the growth, this bond too appears to be breaking, much like the tie between economic growth and power demand growth.

Technology is enabling lower in-home carbon emissions. The proliferation of smart meters (about 60 million in the United States by the end of 2017) has allowed for more precise and immediate tracking of consumers' energy use. The ability for energy users to more granularly allocate their energy costs across various appliances provides the ability to analyze patterns, and, as needed replace aging appliances with newer, more efficient ones.

Chart 20

U.S. Residential CO2 Emissions



E--Estimate. Source: U.S. EPA.

Credit Impacts

So what, if anything, does all this mean for issuer credit quality? It's difficult to generalize. Each industry may be subject to the same corporate ratings criteria, but those criteria are interpreted through different key credit factors. Moreover, data describing the impact of ESG risks are scarce and not highly harmonized for the moment. But there are a few common channels through which credit quality could be impacted.

Financial Risk Profile

The process of companies becoming less carbon intensive is likely to be propelled by improved technology that leads to greater efficiency. This is, of course, going to be an expensive proposition. While this is bound to improve cash flow and de-risk balance sheets over time, the degree to which this influences credit metrics depends on several factors.

First, we consider the extent to which decarbonizing investments are financed, as a relatively heavier proportion of debt can weigh on ratios. In addition, we consider whether there is a lag between the incurrence of debt and any related efficiency improvements. As we rely on weighted average metrics, years of underperformance can adversely affect ratings, even if a company's new debt is intended to increase its long-term cost and environmental viability. But more positively, we consider how sustainability may impact borrowing costs. Investment grade category, and especially during a protracted low interest rate environment, issuers have gotten very comfortable issuing longer term debt. To the extent that longer term investors are considering either the physical effects of climate change or the possible impact of rules that seek to mitigate it, those risks accumulate and become more substantial over a longer holding period.

Competitive Position

A reduced emission footprint can be a competitive differentiator. In the European Union, for example, where carbon pricing is the norm for power generators, a low-carbon fleet is better positioned to compete in a price-taking industry. But in other industries that are less commoditized, and where a company's green reputation is important to consumers, the use of environmentally sound production methods could be an important differentiating factor. We believe that this competitive advantage is likely to grow over time: A 2017 Morgan Stanley report emphasizes that 85% of millennials (a growing consumer demographic) are concerned about sustainability.

Industry Risk

Certain industries are bound to be more susceptible than others as the economy transitions to lower carbon emissions. As more industries face explicit regulation (such as the efforts to curb carbon emissions in the transportation sector) or increasing public scrutiny (such as the environmental impact of agriculture practices), the inherent exposure to environmental factors could lead certain industries to take on more risk—with credit implications for participants in those industries.

Comparable Ratings Analysis

Our ratings methodology permits us some latitude to incorporate risk factors not already explicitly considered, and to adjust ratings by a notch in either direction based on favorable or unfavorable comparisons with peer companies. To the extent that we rate two otherwise similar companies from a common industry with comparable credit metrics, we could differentiate between the two companies on the basis of 'green' factors. One company, for example, may be more risky if it operates in an industry with a high level of environmental exposure and has not proactively mitigated this risk.

Environmental, Social, and Governance Factors in Credit Ratings

While some of these risks may seem to fit only obliquely into our ratings framework, it's worth pointing out that this is a unique challenge of assessing ESG risk. The management teams that have been proactive in attempting to mitigate longer term, material environmental risk could be doing so at the expense of current financial metrics. This, of course, is not a weakness from a credit strength, but reflects positively on management.

This is likely especially true in industries that historically have not been thought of as elements of a global decarbonization strategy.

Moreover, more non-energy companies are seeing environmental stewardship as a differentiating factor in the marketplace, as well as a way to cut costs. As companies are being asked to disclose their environmental bona fides more publicly, environmental attributes are now being more heavily scrutinized by investors and a younger generation of consumers. As these companies continue to reposition themselves to accommodate a new class of investors and consumers, we'll be keeping a close eye on how they fund their inevitable new developments.

The Credit Impact Of Water Risk

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Overview

- Climate change and the depletion of groundwater reserves are increasing water-related risks, including freshwater scarcity, flooding, and droughts.
- The credit impact of these risks is largely negative, but they can fuel growth in certain industries.
- Water factors have played a significant role in our rating analysis. They were the main driver of 28 rating actions over July 2015-August 2017, and were mentioned in 169 rating action articles in the same period.
- In the immediate future, we do not expect the weather events affecting cotton production in the U.S. and India to have as major an impact as in 2011, when record prices led to multiple rating actions.

Water-related risks are on the rise. Climate change is making weather patterns more erratic, and industrial and agricultural development are causing demand for water to outstrip supply. In a now frequently cited statistic, the World Bank's 2009 Water Resources Group report said that the global water deficit was set to reach 40% by 2030. That report also presented case studies on four regions--China, India, South Africa, and Sao Paulo--that have since experienced water crises.

This report examines the credit implications of water risk and the impact it has on our credit ratings. It looks at the effect of water risk on ratings between July 2015 and August 2017, and how we incorporated water-related factors into recent rating actions. This article is a continuation of a series of publications on how we incorporate environmental, social, and governance (ESG) factors into our ratings. Earlier publications include "[How Does S&P Global Ratings Incorporate Environmental, Social, And Governance Risks Into Its Ratings Analysis](#)," published Nov. 21, 2017, "[How Environmental And Climate Risks And Opportunities Factor Into Global Corporate Ratings - An Update](#)," published Nov. 9, 2017, and "[How Social Risks And Opportunities Factor Into Global Corporate Ratings](#)," published April 11, 2018.

What Is Water Risk?

Water risk is a broad environmental factor, encompassing water stress (the ratio of demand to annual renewable supply), risks associated with water quality that create scarcity, weather events, and other risks. Climate change will have a detrimental impact on both the provision and quality of freshwater resources around the world. Associated impacts from climate change and the depletion of groundwater is leading to coastal flooding, subsidence, and saltwater intrusion (where seawater gets into freshwater acquirers). Other types of water risk include weather events such as excessive precipitation leading to flooding.

Environmental risks are not always negative for credit. For example, China’s focus on environmental protection and increasing demand for natural gas instead of coal led us to revise outlooks to positive for China Resources Gas Group Ltd. in June 2017 and China Three Gorges in November 2015. The energy transition to low-carbon technologies has also led to positive outlooks and upgrades in the energy and automotive sectors. As markets and issuers absorb the impacts of droughts, floods, and declining water quality, there are opportunities as well as challenges.

How Water Risk Affects Credit Ratings

The impact of water risk on credit ratings can be both direct and indirect, such as through volatile agriculture commodity prices creating supply chain risk. To examine the broad extent of its impact on credit ratings, we reviewed our research updates--which we publish in the event of rating, outlook, or CreditWatch actions--over a two-year period, from July 2015 to August 2017.

We focused on two main categories of water-related risks: event-driven and continuous factors. Examples of event-driven factors are droughts, heavy rain, and floods, which have one-off impacts. Continuous factors relate to issuers that are dependent on water and weather as a resource or service, which means that water represents an inherent risk or opportunity (see table 1). We excluded weather factors that were unrelated to water (such as heatwaves, or wind). However, we took into account cases in which weather in general could influence creditworthiness, as this could include precipitation.

Table 1

Categories Of Water Factors

Event-driven factors	Continuous factors
Insufficient water or precipitation	Inherent weather risk
Water pollution or leakage	Inherent water risk
Poor water quality	Issuers that offer water solutions
Weather delaying planting season	
Favorable hydrology conditions	
Favorable weather conditions	
Change to water tariffs	

Water was a common environmental factor in rating actions

We published nearly 9,000 corporate research updates from July 2015 to August 2017. Of the research updates published over this period, environmental and climate factors were relevant in 717 cases. Of these, water factors were an important consideration in 197 cases, which is 27% of the total (see table 2). We found 28 rating actions in which water factors were a key reason we raised or lowered ratings, revised outlooks, or placed ratings on CreditWatch. Water factors were mentioned an additional 169 times, meaning they played a part, but not a predominant one, in the rating, outlook, or CreditWatch action. Water factors were as frequently identified as material to issuer credit ratings as social factors.

Table 2

References To ESG Factors In Research Updates

	ESG factor			Water as a proportion of E&C (%)
	Environmental and climate (E&C)	Social	Water	
Number of references	717	346	197	27
Number of references material to ratings	106	42	28	26
Material references as a proportion of the total (%)	15	12	14	

ESG--Environmental, social, and governance.

For some cases, water risk was mentioned but may not have been material for the rating change. For example, we cited poor water quality affecting fishing volumes in the upgrade of ASG Parent LLC on June 21, 2017, but the upgrade was driven by improved operating performance and cash flow generation that led to a reduction in leverage. In other cases, water was material to the rating. For example, a severe drought in 2017 affected Brazilian sugarcane processor Jalles Machado, reducing the amount of cane available to process and leaving facilities idle for a period. As a result, we revised the outlook to stable from positive.

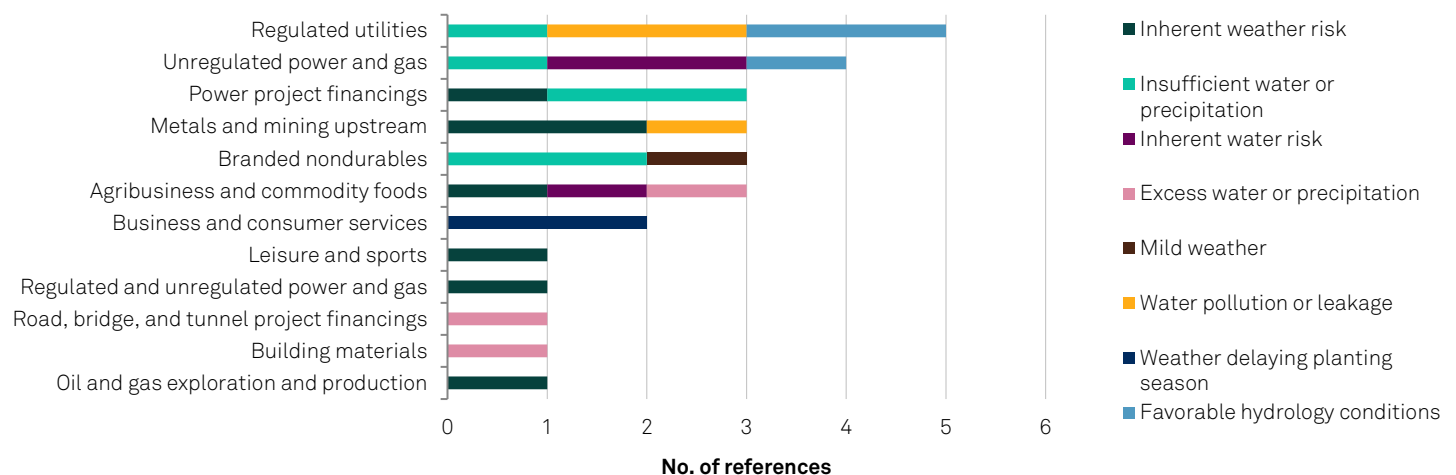
Water risk most frequently affected industries that are water-intensive or where weather influences consumers

Water-intensive industries (utilities and power, metals and mining, agriculture) and industries where weather influences consumer behavior (branded nondurables, leisure and sports, business and consumer services, retail and restaurant) were most exposed to water factors. Unsurprisingly, electric and water utilities featured frequently. Notably, the São Paulo drought resulted in negative rating actions for water and waste utility SABESP and electric utility Companhia Energética de São Paulo (CESP), which operates hydropower plants. We took positive rating actions after hydrological conditions became more favorable.

Chart 1

Water Factors By Sector

Most frequently cited category where water factors were a key driver in a rating change



Source: S&P Global Ratings.

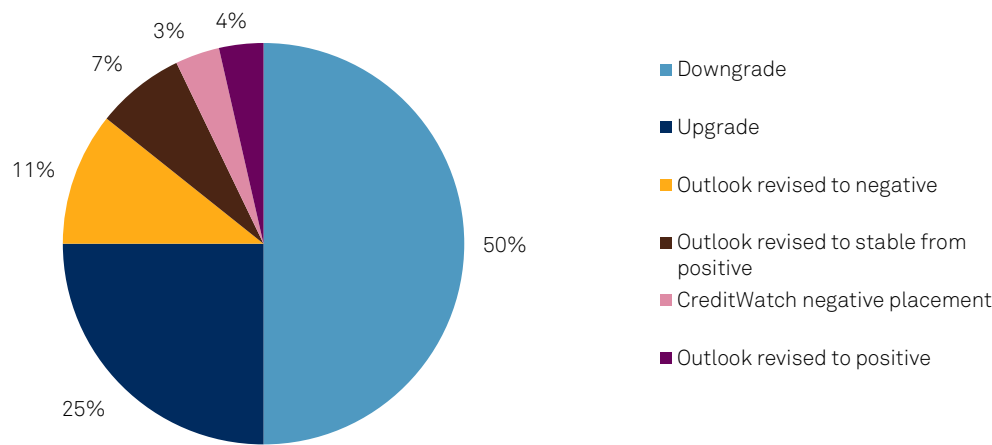
Water factors were mostly negative

Approximately 70% of ratings actions in which water risks were a key factor were negative, with half being downgrades (see chart 2). By comparison, three-quarters of rating actions with social factors and half of environmental and climate-related rating actions were negative.

Issuers that offer water solutions, such as water treatment technologies, have positive influences on credit. For example, our affirmation of the ratings on SPCM S.A. (the parent company of the French chemicals company SNF), cites its exposure to municipal and industrial water treatment end-markets as supportive of its resilience to GDP cyclicalilty. Its business also benefits from the increasing scarcity of clean water and natural resources.

Chart 2

Rating Actions Related To Water Factors



Source: S&P Global Ratings.

Table 3

Water-Related Rating Actions Breakdown

Positive rating actions		Negative rating actions		Neutral rating actions	
Upgrade	24	Downgrade	33	Ratings affirmed	87
Outlook revised to positive	6	Outlook revised to negative	8	New ratings assigned	28
Outlook revised to stable from negative	6	Outlook revised to stable from positive	3	CreditWatch developing placement	0
CreditWatch positive placement	1	CreditWatch negative placement	1		

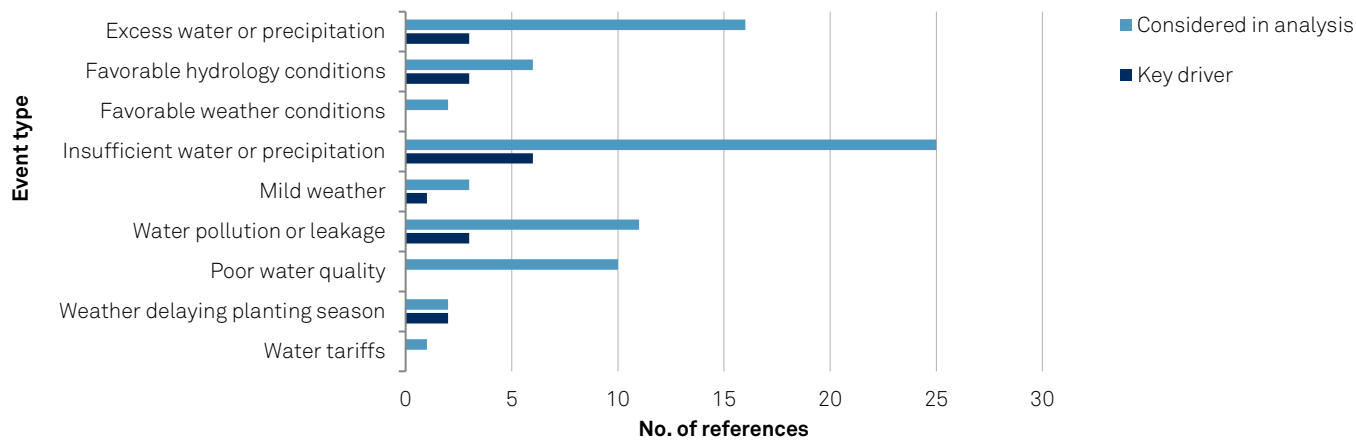
Events had a greater credit impact than continuous risks and opportunities

While continuous factors were present in more credit analyses (61% of cases), event-driven factors were more likely to cause a rating action. There was a rating change in 24% of the cases with event-driven factors, and within that figure only 17% were positive. As climate change continues to fuel volatility in other weather systems and the hydrological cycle, we could see more rating actions caused by water-related events. Where continuous factors were a key driver in a rating change, the result was split evenly between positive and negative actions.

Chart 3

Water Factors Driving Ratings

Most frequently cited event-driven factors considered or a key driver in a rating update



Source: S&P Global Ratings.

Table 4

Categories Of Water Factors Referenced In Research Updates

Category	Number of references	Number of material references
Inherent weather risk	89	7
Insufficient water or precipitation	25	3
Inherent water risk	25	6
Excess water or precipitation	16	3
Water pollution or leakage	11	3
Poor water quality	10	0
Issuers that offer water solutions	7	0
Unspecified weather	6	3
Favorable hydrology conditions	3	1
Mild weather	2	2
Favorable weather conditions	2	0
Water tariffs	1	0
Total	197	28

Is Water Risk Still In Fashion?

In addition to the above review, we looked at how water risk passes down the supply chain from cotton agriculture to the apparel sector. The example demonstrates how ESG factors are interwoven with broader credit considerations.

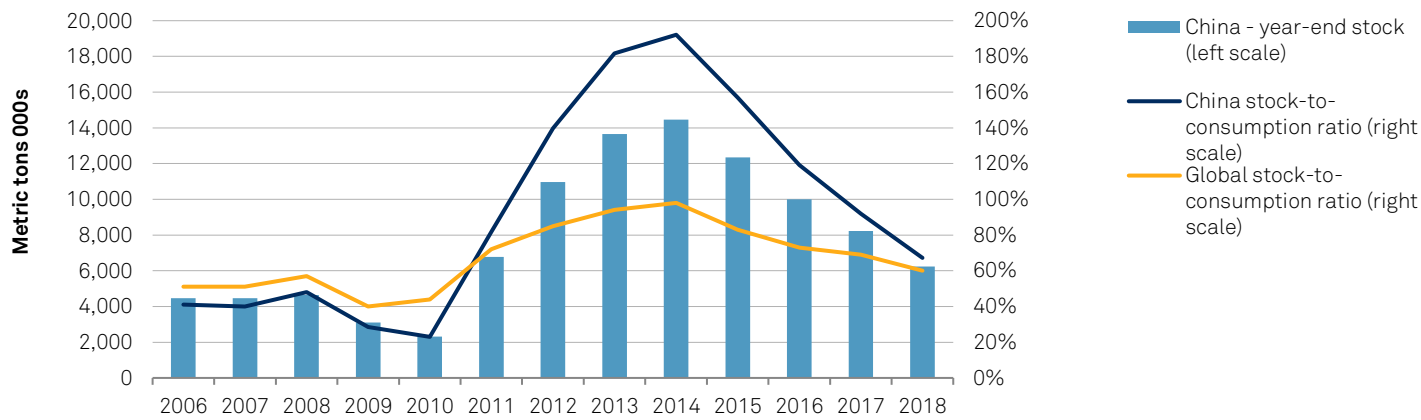
In 2011, floods affected cotton production in some key regions, and as a result of this and other factors, cotton prices started to rise--reaching heights not seen since the American Civil War. The effect of this rise rippled through the supply chain to apparel and textile producers. In 2018, a severe drought is affecting cotton production in the U.S., and there are droughts and floods in India. Will history repeat itself?

In the supply chain of apparel retail, water is used to grow cotton, and bleach, dye, print on, and finish the fabrics. The cotton crop needs lots of water to be able to produce high-quality fibers needed for the production of cloth and yarn. It needs more water than other fiber-producing crops like sisal, flax, and jute. Different cotton-growing regions require different amounts of water due to changes in evaporation rates. For example, Egypt and Syria have high evaporation rates and high water requirements, whereas the U.S. and Brazil have lower evaporation rates and so cotton can be grown with less water. Too much water is also a concern for farmers, as floods can wipe out whole fields.

Chart 4

Cotton Stocks And Consumption

Cotton stocks in China and annual stocks to consumption ratio for cotton in China and globally



Source: USDA, 2018. Production, Supply, and Distribution Online Database.

In 2010, severe floods affected China’s cotton-growing provinces Henan and Hubei. To compensate, China, the largest global consumer of cotton, began to increase its demand for imports. Supplies had been low over several proceeding years and the ratio of cotton stocks to consumption fell to its lowest level in 15-years. Then in early 2011, floods in Pakistan destroyed 16% of the nation’s crops. Prices began to rise as India put a ban on exports, and the price of cotton hit more than \$2 per pound for the first time in almost 150 years. Many analysts at the time noted that mills were panicking, which further fueled the price increase.

We cited the record cotton prices in our rationales for a number of rating actions during this period (see chart 5). There were mostly negative actions in the aftermath of the rise in cotton prices, but outlooks shifted to positive in late 2012. Burkina Faso’s economy was reliant on cotton exports and the period of high cotton prices strengthened its credit metrics, although it did not lead to a rating change.

Chart 5

Impact Of Rise In Cotton Prices On Apparel Retail's Supply Chain

Rating actions taking into account cotton prices	
Cotton agriculture	Burkina Faso ratings affirmed on Dec. 14, 2011, incorporating the boosting of export values by cotton prices.
Cotton spinning	
Textile manufacturing	Texhong Textile downgraded on March 22, 2012. Volatility in cotton prices was cited as a rationale for a weak business risk profile.
Apparel manufacturing	Renfro Corp. outlook revised to positive on Oct. 25, 2012, citing lower cotton prices following 2011 record high.
Apparel retail	Missouri TopCo (Matalan) downgraded on Nov. 1, 2011, and Gymboree Corp. downgraded on June 17, 2011. Cotton prices factored into both actions.

Source: S&P Global Ratings.

In 2018, we have seen drought affecting the south of the U.S. and drought and floods affecting Gujurat in India, both large cotton-producing regions. India is expected to see a 30% reduction in exports, according to Reuters. The impact of these environmental events on prices and credit is complex to assess. Many factors influence prices, including environmental, political, economic, and market factors. Their interaction is what drives the price, and so even if environmental conditions reduce the production of a commodity, prices may rise or fall, depending on other conditions.

The political and economic landscape today is different than in 2011. Although India is exporting less cotton, the government has not put a temporary ban on exports, as they did in 2011. Turkey has reduced its imports of cotton from the U.S. amidst currency depreciation and trade tensions. China has raised tariffs on U.S. cotton imports in response to tariffs the U.S. placed on importing Chinese goods. Further to this, China has been stockpiling cotton in the last few years, and although it has declined from its 2014 high, the U.S. Department of Agriculture projects China's year-end stocks for 2018 to be 2.7x the year-end stocks for 2010 (see chart 4). The state of annual stocks-to-consumption ratios (total annual stock of cotton to total annual consumption) globally and in China in particular typically drive global cotton prices.

Although the water risk has returned, contemporary import and export conditions mean that it is unlikely that we will see a rise in cotton prices like the one in 2011. Nevertheless, we will continue to monitor the impact of ESG factors (alongside all other relevant factors) on an entity's credit profile.

Examples Of Water-Related Rating Actions

Here are some additional concrete examples of how water factors can lead to a rating change.

K+S

- German Potash Producer K+S Downgraded To 'BB+/B' On Expectation Of Prolonged Weak Performance; Outlook Negative, Oct. 21, 2016

We lowered our rating on K+S due to water scarcity.

Low rainfall in June 2016 caused sales volumes to decrease by 400,000 metric tons year-on-year. The company's Werra plant needs to be able to discharge saline wastewater into the Werra river as part of its operations, and years of drought, can cause operating constraints on the facility that impact credit metrics. This operating constraint occurred under weak market conditions, with low potash prices (\$30-\$40 below our projections) and low sales volumes from a new site in North America.

Thames Water

- **Ratings On Thames Water Utilities' Class A And B Debt Lowered To 'BBB+' And 'BBB-' On Weaker Ratios; Outlook Stable**, July 24, 2017

Our downgrade of Thames Water was the result of poor water management compared with peers related to leakage from below-ground water assets that resulted in financial penalties.

The company lagged peers' operating performance in terms of customer service and below-ground water assets, resulting in regulatory penalties and fines at a time when the Thames Water financing group had no financial headroom for the rating with respect to its funds from operations FFO to debt ratio. Despite improvements to operating performance in several areas, the company remained affected by the performance of its below-ground water assets, which led to the company failing its leakage target for 2017 and to a number of consumer interruptions.

Hrvatska Elektroprivreda (HEP)

- **Croatian Utility Hrvatska Elektroprivreda Upgraded To 'BB' On Improved Liquidity; Outlook Negative**, Oct. 28, 2016

The upgrade reflected favorable hydrological conditions and commodity prices over the prior two years.

This allowed HEP, an owner and operator of hydropower facilities, to strengthen its liquidity, building a large cash balance of Croatian kuna (HRK) 2.8 billion. The upgrade followed several years of drought. We anticipate volatility in its cash flow and reflected this in the credit rating.

Can Multilateral Lending Institutions Support Rising Demand In The Green And Social Bond Markets?

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Overview

- ESG investing started gaining traction following the 2006 U.N. Principles for Responsible Investment initiative, designed to encourage investors to integrate environmental, social, and governance (ESG) issues into investment decision-making and ownership practices.
- Green bonds, and more recently new categories of social and sustainability bonds, offer issuers a way to capitalize on the growth in ESG-related trends.
- MLIs were early pioneers in the green bond market, and we expect they will continue to be an attractive asset class for ESG investors given their crucial role in the development and issuance of specialized green and social bonds, as well as their ESG-compatibility based on their unique public policy mandates.
- However, only a handful of MLIs dominate the green and social bond sectors, and differences in mandates, governance, and project and sector risks can lead to variability in their environmental, social, and governance performance.
- S&P Global Ratings already incorporates ESG factors into its credit rating analysis of MLIs. Particularly, we consider the impact of ESG factors on the business profile assessment, though they could also improve funding costs and access, which could support the financial profile.

Green bond issuance began just over 10 years ago, and the market has expanded significantly since. These bonds, and more recently new categories of social and sustainability bonds, offer issuers a way to capitalize on the growth in environmental, social, and governance (ESG)-related trends, in return adding value to their portfolios while maximizing sustainable environmental and social impact.

Multilateral lending institutions (MLIs) were the early pioneers of green bond issuance, with the [European Investment Bank](#) debuting the world's first green bond on July 4, 2007 (Climate Awareness Bond) for €600 million, followed by the World Bank in December 2008. Interest and demand for such bonds has been picking up rapidly across all sectors, and global green bond issuance is expected to surpass \$200 billion in 2018.

In our view, MLIs will continue to play an active role, having introduced several offshoots of the green bond, such as the forest bond and water bond, and spearheading the new class of social

and sustainability issuances. Since ESG investing extends to socially responsible investing that evaluates companies in terms of their environmental, social, and governance risks and opportunities, we believe that MLIs have an edge given their unique mandates. As a result, we believe MLIs are well-positioned to continue growing issuance volumes, even though their share of total issuances is declining as other sectors increase their activity. And while only a handful of MLIs dominate this space, smaller MLIs are likely to enter the market, especially given possible gains from increased investor diversification and pricing benefits.

We capture ESG factors in our credit rating analysis of MLIs. ESG factors mainly affect aspects of our business profile assessment--namely MLIs' policy importance and governance/management expertise. In instances where ESG factors provide a monetary benefit for an MLI, we'd consider that in our financial profile assessment.

Despite significant growth over the past several years, ESG investing and, specifically, the green and social bond markets are still in their early days. Investors therefore can struggle with comparability of data, as well as reporting formats and contents. MLIs themselves play an important role in tackling some of these issues by promoting best practices in green frameworks and impact reporting. Furthermore, while MLIs are naturally ESG compatible, key differences exist based on nuances in their mandates, the robustness and sophistication of policies and procedures, as well as potential controversies in key financing projects, which could compound reputational risks.

How Do ESG Factors Affect MLI Ratings?

We incorporate ESG into various aspects of our credit rating analysis for MLIs (see chart 1).

Addressing environmental and social issues is an intrinsic part of MLIs' business models and typically shapes our perception of their unique role. The ability to successfully address these issues also provides a benchmark for us to assess their public policy mandate. For instance, if we perceive that an MLI has been exposed to considerable ESG-related controversies, such as infrastructure projects that create environmental damage or dislocate local communities, this could call into question our view of the MLI's track record in fulfilling its public policy mandate. We would also expect that this would translate into institutional weakening that could, over time, affect the MLI's relationship with shareholders and weaken potential extraordinary shareholder support.

Other factors, particularly our assessment of governance and management expertise, may enhance or detract from an MLI's ESG strength. Generally, a diverse governance structure, with borrowing and nonborrowing members, may offer more checks and balances as well as provide greater scrutiny of project approvals in terms of ESG benefits and risks. Alternately, a highly concentrated governance structure could overlook or downplay ESG factors when it comes to disbursing, particularly when borrowers are in need of quicker and cheaper access to funds. In our view, robust risk-management frameworks and policies may mitigate some of the agency problems common in certain governance structures.

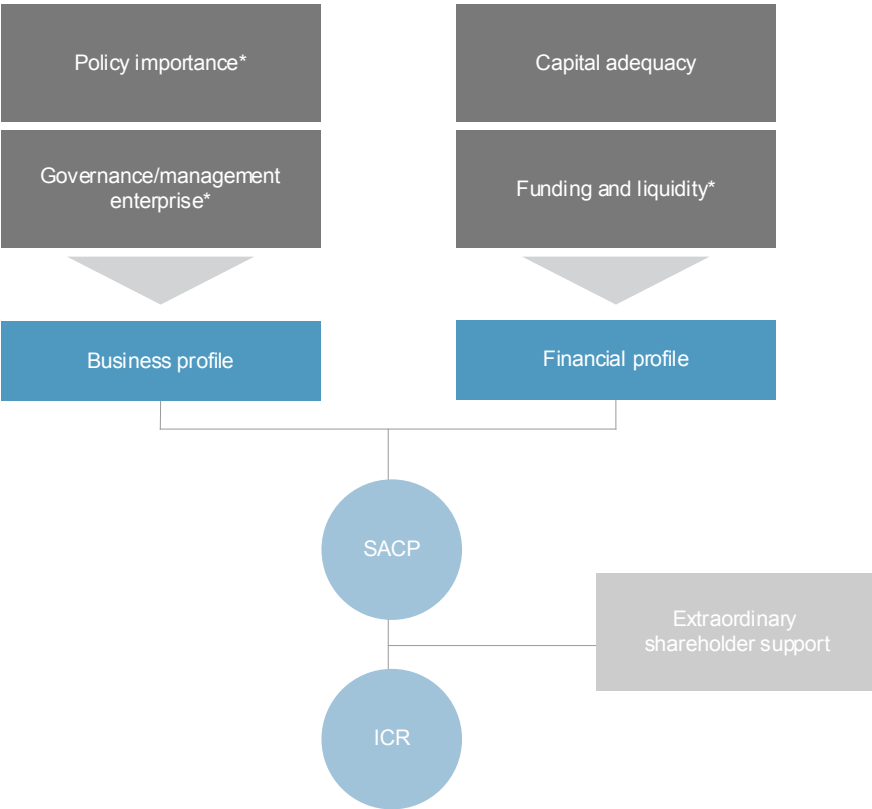
In terms of financial impact, it is difficult to isolate the funding benefit in terms of pricing and investor diversification due to an MLI's ESG focus. Besides, MLIs already, on average, have very good access to funding given their robust activity in debt markets and high ratings, so the marginal benefit to the rating would tend to be limited.

ESG factors can affect our views of MLIs' public policy mandates and governance and management expertise.

However, we have seen anecdotal evidence that suggests that green and social bonds, in particular, may be priced slightly better and attract a more diverse group of investors. This suggests that smaller MLIs that are not as active in debt markets or lower-rated MLIs have the most to gain from issuing more of these investment themed bonds, in terms of funding improvements, as well as earnings impact.

Chart 1

ESG In Multilateral Lending Institutions And Supranational Institutions Rating Criteria



*Factors most likely to include consideration of environmental, social, and governance risks. Source: S&P Global Ratings.

Rating Actions Based On ESG Factors

The MLI asset class is generally very stable and highly rated with limited data points that illustrate the preponderance of ESG risks or opportunities on rating actions. Notwithstanding, in the recent past we have seen that governance factors can have a direct impact on ratings.

Central American Bank for Economic Integration (CABEI)

- Date of the rating action: July 13, 2018
- Action: Upgraded to A+/Positive/A-1 from A/Positive/A-1
- Factors: Governance

We raised our rating on CABEL to 'A+' and maintained our positive outlook. The upgrade incorporates key developments following the 2015 amendments to CABEL's constitutive agreement to improve the bank's governance structure, increase its membership base, and unlock additional financing through diversification and capital injections.

International Investment Bank (IIB)

- Date of the rating action: April 12, 2018
- Action: Upgraded to BBB+/Stable/A-2 from BBB/Stable/ A-2
- Factors: Governance

We raised our rating on IIB to 'BBB+' to reflect the low level of nonperforming loans (loans overdue by 90 days or more) over the past five years since the bank's relaunch in 2012, low credit costs, and the sustained improvement of the quality of the treasury portfolio. This was largely driven by IIB's ongoing work to improve its governance standards, processes, and systems, which began delivering tangible improvements.

The Rise Of ESG

ESG investing started gaining traction following the 2006 U.N. Principles for Responsible Investment (PRI) initiative, which established six core principles designed to encourage investors to integrate environmental, social, and governance issues into investment decision-making and ownership practices.

Since then, various studies have come out examining the relationship between ESG factors and financial performance. We have also examined ESG factors on ratings (see "[ESG Risks In Corporate Credit Ratings--An Overview](#)," Nov. 16, 2015) and found that ESG risks and opportunities can affect the capacity and willingness of an entity to meet its financial commitments in many ways.

As more studies confirm the business case for ESG investing, client demand has increased substantially. For instance, the number of investment institutions publicly committing to adopt and implement the PRI principles has grown tremendously, with assets under management increasing to approximately \$80 trillion currently from \$2 trillion in 2006.

The U.N.'s 2030 Sustainable Development Goals (SDGs) agenda, formalized in 2015, bolstered the importance of ESG investing by providing a global framework for financing sustainable development. The SDGs emphasized the need for private-sector involvement to address large estimated funding gaps, thus encouraging more investors to evaluate ESG investing in the context of the SDGs, with clearer guidelines laid out in assessing impacts and risks.

We've also seen other initiatives and pledges that seek to align with ESG investing and the SDGs. For instance, the Climate Bond Initiative, which builds upon the 2015 Paris Accord to reduce nation emissions, recently introduced a target of \$1 trillion in green finance by 2020. This has increased the appetite for specialized bonds that directly fund projects that meet certain requirements, such as green bonds.

For more information, refer to "[The Rise Of ESG In Fixed Income](#)," published on Sept. 10, 2018.

The Evolution Of Green Bonds

Green bond issuances have grown exponentially over the past 11 years. Following the first green bond in 2007 and through 2009, the European Investment Bank (EIB) and the World Bank were

the only green bond issuers--their total yearly issuance did not exceed \$1 billion. Other larger regional MLIs, such as the **European Bank for Reconstruction and Development** (EBRD), the **International Finance Corp.** (IFC), the **Asian Development Bank** (ADB), the **African Development Bank** (AfDB), and, to a lesser extent, a few Norwegian financial institutions, started issuing green bonds in 2010.

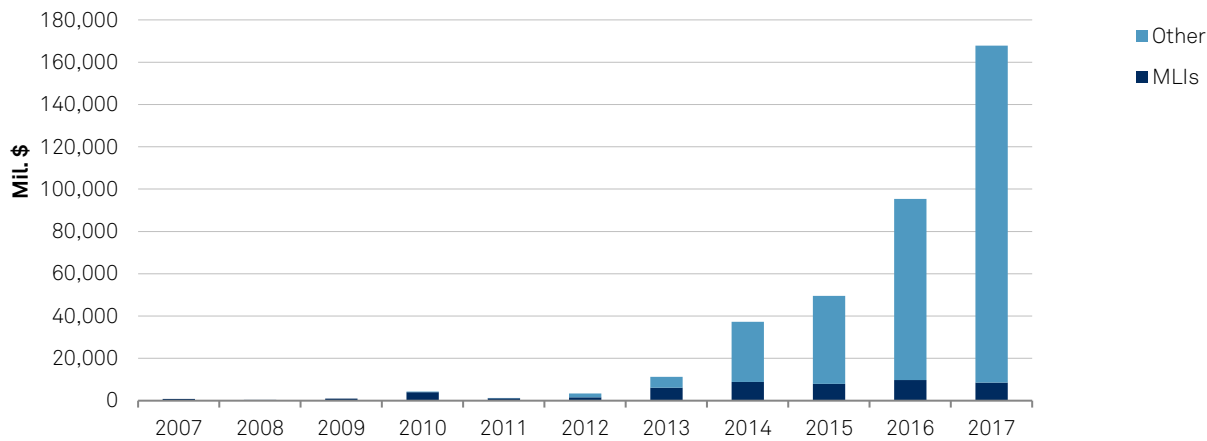
But it wasn't until 2014 that green bond issuances really started to take off, with total issuances increasing approximately three-fold to \$36.5 billion versus the prior year. The largest jump came from non-MLI issuers, including banks, corporate entities, and local governments. This was largely supported by the creation of the Green Bond Principles, created in January 2014 by four banks and with the support of the multilateral community, to set forth best practices in the green bond markets with a focus on disclosure and transparency.

By 2017, global green bond issuance reached a record US\$167 billion. Of this amount, approximately 5% was issued by supranational institutions (US\$8.6 billion), including a US\$4.6 billion issuance by the EIB, the third-largest cumulative green bond placement in 2017.

Green bond issuance reached a record US\$167 billion globally in 2017--supranational institutions account for 5%.

Chart 2

MLI Green Bond Issuances As A Share Of Total Global Green Bond Issuances

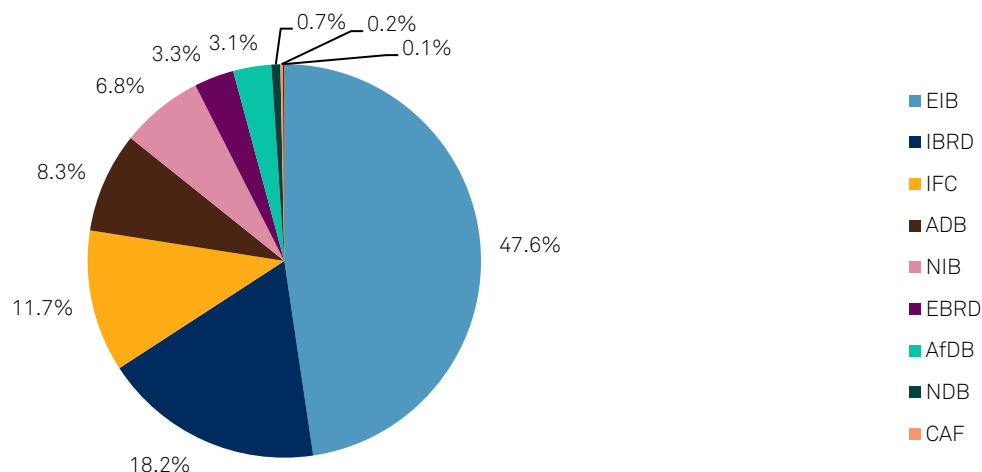


Sources: Climate Bond Initiative Database (August 2018), MLI websites, annual reports, and financial statements.

In fact, total yearly green bond issuances from the MLI sector have remained relatively stable over the past few years, as well as concentrated across a handful of MLIs. Eleven of the 33 MLIs we rate have issued some sort of bond labeled as green, and it is our understanding that two plan to do so. However, the EIB, IBRD, IFC, and ADB alone account for 86% of these issuances as of August 2018. EIB remains the world's largest issuer in the green bond market, with over US\$28 billion issued--more than 2.5x the amount of any other MLI (see chart 3).

Chart 3

Green Bond Issuances By Institution (Year To Date*)



*Through August 2018. Sources: Climate Bond Initiative Database (August 2018), MLI websites, annual reports, and financial statements.

MLIs have issued green bonds to fund investments in a broad variety of categories, including solar, wind, hydro, energy efficiency, renewable energy, climate change, sustainable transportation, green buildings, and biogas. Investment in renewable energy continues to be the most common use of proceeds for green bonds, although allocation to sustainable buildings, energy efficiency, and low carbon transport has grown rapidly in recent years. We believe MLIs play a role in indirectly funding a very large share of green projects for public and private borrowers--by raising green bonds in the market and on-lending to those borrowers (see "[Green Bonds Are Increasingly Expanding France's Public Sector Investor Base](#)," published Sept. 26, 2017).

MLIs have also led efforts to expand this market by introducing other types of environmental bonds. Environmental bonds are bond issuances whose funds raised are dedicated to specific clean environmental and climate purposes--the green bond is the most common. Examples of this include ASDB's issuance of more than US\$1.5 billion in water bonds to finance water-related projects in Asia. And in 2016, IFC issued the first forest bond specifically designated to reduce emissions from deforestation and ecosystem degradation. We understand that the [Caribbean Development Bank](#) (CDB) has shown interest in issuing a blue bond, which would be the first MLI bond specifically for ocean-based activities such as fisheries management.

We expect that as MLIs are called to step up lending and leverage their balance sheets from billions to trillions in support of the SDGs 2030 agenda, with strong emphasis on green infrastructure, we will likely see MLI environmental bond issuances grow. New MLIs continue to enter the space, with landmark green bond issuances in their member countries. For example, New Development Bank (NDB) tapped the market for the first time in 2016, issuing the first green bond by an international financial institution in the China interbank bond market.

Furthermore, within the context of MLIs' renewed role to mobilize private-sector lending, we expect new innovative environmental bond structures to come to the market. One such example is IDB Invest, which in March 2018 issued a \$135.8 million B-bond to refinance the debt of a wind farm in Uruguay, directly linking institutional investors with a specific green project to complement IDB Invest funding. (This is not included in the previous charts because it was not

recorded on the balance sheet.) The B-bond demonstrates one of the many ways multilaterals are addressing the green infrastructure financing gap in emerging economies.

Social And Sustainability Bonds Are Gaining Traction

Albeit younger than their green counterpart, social bonds--whose primary objective is to address social issues for a target population--and sustainability bonds--designed to finance a combination of environmental and social bond projects--have been gaining traction in recent years. MLIs' unique mandates allow them to prototype, raise awareness for development priorities, and support the growth in the environmental, social, and sustainable bond markets (see chart 5).

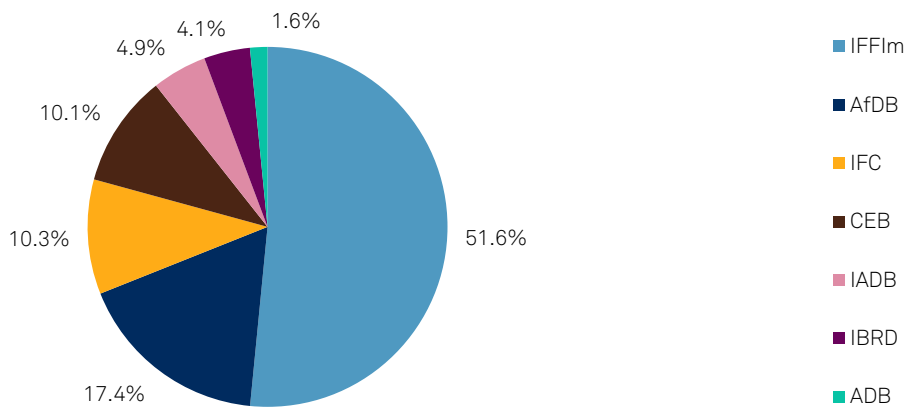
Social bond annual issuances, excluding vaccine bonds, grew to US\$8.8 billion in 2017, according to the International Capital Markets Association (ICMA), a 400% increase from the previous year. Since the first social bond issued in 2014, these have become increasingly diversified as more private-sector issuers enter the market. In 2017, 15% of social bond issuances were by the private sector, 60% by the public sector, and the remaining by MLIs. A total of eight MLIs we rate have issued some type of social bond as of August 2018.

Like environmental bonds, MLIs have played an active role expanding social bond categories. Four MLIs have issued social development/inclusion bonds for poverty reduction, job creation, gender equality, education, and youth-related projects. Other categories include EYE bonds (education, youth, and employment) issued by the [Inter-American Development Bank](#) (IADB), as well as banking on women bonds to support women-owned small and medium enterprises in emerging markets and inclusive business bonds to support private enterprises that incorporate low-income people into their business models and supply chains--both issued by the IFC. The ADB issued its first health and gender equality bonds in 2017.

The [International Finance Facility for Immunisation](#) (IFFIm) and IBRD have also debuted a new category of vaccine/pandemic bonds. IBRD launched a pandemic bond in 2017, the first catastrophe bond of its type aimed at fighting major health crises and epidemics. In addition, with over US\$6 billion issued as of year-end 2017, IFFIm is the largest social bond issuer in the MLI sector given its unique structure designed to frontload scheduled donor contributions provided in grant form to GAVI, the Vaccine Alliance, through the issuance of vaccine bonds.

Social bonds-- aimed at addressing social issues for a target population-- increased 400% from 2016 to 2017, and MLIs are helping fuel the growth.

Chart 4
Total Social Bond Issuances By MLIs Year To Date*

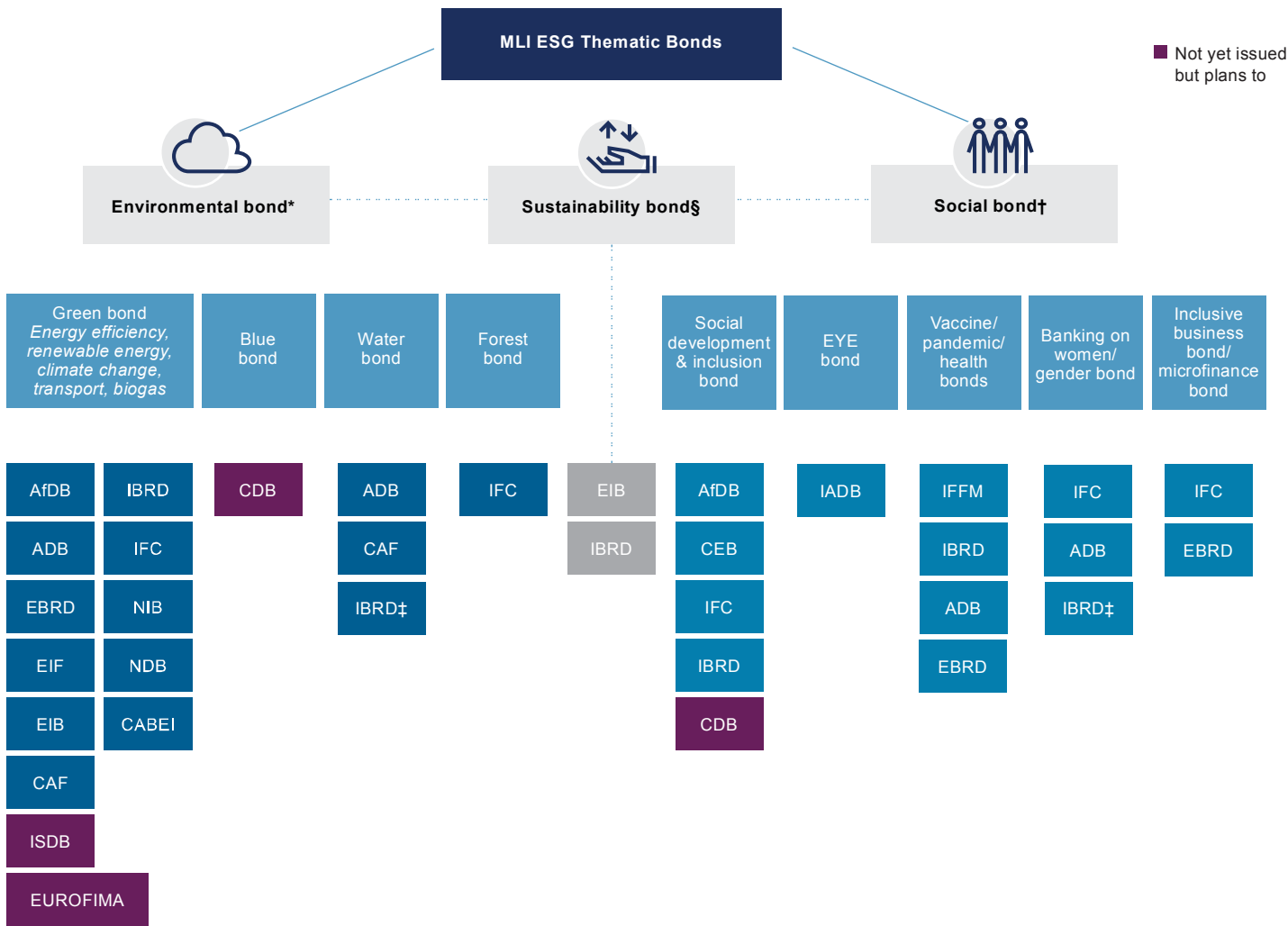


*Through August 2018. Source: MLI websites, annual reports and financial statements, and CBI Database Green Exclusion (August 2018).

IBRD in 2016 introduced a third category known as sustainability bonds. These bonds provide funding for a variety of green and social projects, such as climate change, gender, and health. Over the past few months, IBRD launched two new sustainability bonds: one to raise awareness for water and ocean resources and another linked to the new Global Sustainability Signatories Index. EIB issued its first sustainability bond in September 2018 for €500 million, focusing on activities in the water sector, health, and education. Issuance of sustainability bonds, which are still fairly new, totaled approximately \$9 billion in 2017.

Chart 5

Multilateral Lending Institution ESG Thematic Bond Map



*Environmental bond: Bonds that fund projects which have environmental and/or climate benefits.
†Social bonds: Aim to help address or mitigate a specific social issue and/or seek to achieve positive social outcomes, especially, but not exclusively, for a target population(s). (ICMA)
§Sustainability bonds: Hybrid between a green and social bond (ICMA).
‡IBRD makes a commitment to finance projects engaging in these themes.Source: S&P Global Ratings.
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Not Every MLI Green And Social Bond Is The Same

Progress has been made over the past few years to encourage green bond issuers to adopt similar standards when it comes to proceed allocation and reporting. A harmonized framework--known as the Green Bond Principles (GBP)--was established by a consortium of investment banks with the guidance of various MLIs and other stakeholders, focusing on use of proceeds, the process for project evaluation and selection, management of proceeds, and reporting.

We believe that the GBP are an important starting point for this market. Of the MLIs we rate that have green bond issuances, nine actively reference reporting in line with the harmonized framework, six of which helped to establish the framework. In fact, as green bond issuance grows, issuers across asset classes have started complying with the GBP. According to ICMA, an estimated 86% of the green bonds issued in 2017 were aligned with the GBP standards.

However, since the GBP are voluntary guidelines and principles based, they do not necessarily guarantee compliance or measure the greenness of these bonds. As such, the GBP recommend external reviews, such as second-party opinions, certifications, and scoring or rating issuances based on established methodologies.

S&P Global Ratings' green evaluation approach builds on the GBP and provides a relative green impact score based on three factors--transparency, governance, and mitigation/adaptation (see "[Green Evaluation Analytical Approach](#)," April 26, 2017). We believe that the MLIs we rate would tend to score highly on the governance and transparency assessments--given that most of them typically adhere to GBP and the Climate Bond Initiative standards as well as rely on robust internal frameworks, such as AFDB's climate finance tracking methodology and the World Bank's green bond selection criteria.

MLIs' strong focus on renewable energy generation and energy efficiency--sectors that are highly ranked under our green evaluations given their contribution to systemic decarbonization--would likely translate to higher assessments according to our green evaluation approach. To illustrate, in 2017, 54% of IFC's green bond commitments were in renewable energy, while 37% were in energy efficiency and 8% in climate. Similarly, 61% of EIB's 2017 green bond proceeds were allocated to renewable energy and the remainder to energy efficiency.

The social bond market, on the other hand, is still in a nascent stage. A Social Bond Principles (SBP) framework was established in June 2018 by the World Bank and IFC, among other commercial banks. Reporting on social bonds remains largely fragmented--many MLIs report issuances under their own social bond frameworks. As social bond issuance picks up, we anticipate investor expectations for transparency will grow and social bond impact reporting will become important to developing a harmonized social bond market.

How S&P Global's Proposed ESG Evaluation Could Address MLIs' Specificities

According to our "[S&P Global Ratings' Proposal For Environmental, Social, And Governance \(ESG\) Evaluations](#)," published Sept. 24, 2018, entities in different countries may be exposed to different institutional strengths and vulnerabilities to external shocks. This means that an MLI, such as the EIB, which lends primarily to European countries, will have different risks to consider than an MLI with most of its exposure to high-risk countries. Following a similar approach for MLIs would likely imply factoring in the MLI's governance structure, policies, and procedures, and the quality of its disclosures to evaluate how ESG risks are potentially counterbalanced. Finally, and perhaps equally importantly, an MLI's portfolio of exposures

(committed or disbursed loans) can also provide significant and valuable information on the level of environmental and social risks and opportunities it faces.

While MLIs are particularly active in the green, social, and sustainability bond sectors, not all of their issuances are labeled and earmarked to specific projects. In fact, of the MLIs active in the green bond market, only 2% of their total 2017 issuances were labeled green.

Nonetheless, given MLIs' unique mandates, we believe that their profiles often have pronounced ESG characteristics. For instance, the World Bank has a mandate to end extreme poverty and promote shared prosperity. Other MLIs focused on infrastructure investment, such as the AfDB, the [Asian Infrastructure Investment Bank \(AIIB\)](#), the EIB, and the [New Development Bank \(NDB\)](#), emphasize green and sustainable financing. More generally, we expect MLIs to play a large role, alongside the private sector, in helping countries achieve their Sustainable Development Goals (SDGs) (see "[It's Time For A Change: MLIs And Mobilization Of The Private Sector](#)," Sept. 21, 2018).

Yet, environmental or socially oriented mandates and strategies do not necessarily mean that all MLIs are facing the same ESG risks and opportunities.

Even with robust policies and procedures as well as disclosure practices in place, MLIs are not immune to project controversies, which, if frequent, could have reputational consequences that can weigh on their ESG evaluations. For instance, while MLIs are more likely to finance green projects associated with renewable energy, this does not preclude them from financing brown projects such as those linked to oil and gas. A larger share of brown project financing could weigh on an MLI's ESG evaluation, but, more importantly, if this goes against an MLI's perceived mandate or values, the effects could be even larger.

S&P Global Ratings' Proposal For Environmental, Social, And Governance (ESG) Evaluations

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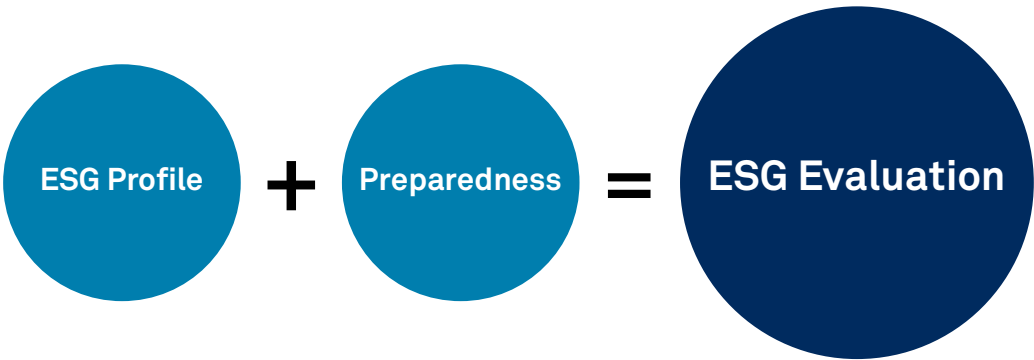
Overview

S&P Global Ratings is in the final stages of testing its new Environmental, Social, and Governance (ESG) Evaluation analytic approach. Our proposed analysis for an ESG Evaluation is both quantitative and qualitative. We aim to provide deep insight into an entity's ESG exposure and its capability to manage this exposure by:

- Leveraging our global analytical teams' knowledge and understanding of sectors and regions to develop our ESG Risk Atlas;
- Incorporating the results of an entity-specific ESG diagnostic questionnaire to capture relevant data;
- Leveraging our existing understanding of an entity's business and peers; and
- Engaging in a substantive dialogue with management, including members of the board as appropriate.

Chart 1

ESG Evaluation



Our ESG Evaluation combines our opinion of an entity's relative exposure to observable ESG-related risks and opportunities (the ESG "Profile"), with our qualitative opinion of the entity's long-term preparedness for ESG related opportunities and disruptions (ESG "Preparedness"). In our analysis, we take a broad view of Governance to include potentially material risks or opportunities that the entity faces.

The final outcome will be a qualitative opinion from S&P Global Ratings' analysts based on their sector and country knowledge and analysis, with entity-level analytical adjustments, and will be informed by interactive discussions with senior management, including members of the board.

The Evaluation will utilize data that entities supply directly through a new ESG Diagnostic questionnaire and incorporate environmental and other data from S&P Global Trucost and other S&P Global divisions.

The proposed ESG Evaluation is not a credit rating, a measure of credit risk, or a component of our credit rating methodology. However, the information we gather for an ESG Evaluation can inform our credit analysis of rated entities.

The ESG Evaluation will be a stand-alone, on-request service and separate from our credit ratings.

Summary of Analytic Approach

Our ESG Evaluation is a cross-sector, relative analysis of an entity's capacity to operate successfully in the future and is grounded in how ESG factors could affect stakeholders and potentially lead to a material direct or indirect financial impact on the entity. ESG factors typically assess the impact of the entity on the natural and social environment and the quality of its governance. Our definition of stakeholders for a particular entity goes beyond shareholders to include other groups as appropriate such as employees, the local community, government, regulators, customers, lenders, borrowers, policyholders, voters, members and suppliers.

Under our proposed approach, we first establish an ESG Profile for a given entity, which assesses the exposure of an entity's operations to observable ESG risks and opportunities, taking account of the governance structure in mitigating risks and capitalizing on opportunities.

Second, we assess the entity's long-term Preparedness, namely its capacity to anticipate and adapt to a variety of long-term plausible disruptions. Such disruptions are not limited to environmental and social scenarios, but could also include technological or political changes where relevant. This is because, in our opinion, high-quality corporate governance includes the full spectrum of potential risks and opportunities an entity faces.

Our final ESG Evaluation score will combine an entity's ESG Profile with our long-term Preparedness assessment, thereby indicating our view of how effectively the entity is set up to manage its ESG exposure and opportunities. The ESG Evaluation thus provides an opinion on an entity's relative exposure to observable ESG-related risks and opportunities, and our qualitative opinion of the entity's long-term Preparedness for opportunities and disruptions. Importantly, ESG Evaluations are not to be confused with credit ratings, which are separate opinions on creditworthiness (see box titled "How ESG Factors Affect The ESG Evaluation And Credit Quality" on the following page). However, the information we gather for an ESG Evaluation may inform our credit analysis of rated entities.

We are testing a ranking system which will equate the highest numeric position with the lowest exposure to ESG risks. An entity with a higher ESG Evaluation score would generally be seen to have:

- Mature, effective, and well integrated ESG policies and processes at all management levels.
- Best-practice strategic and operational execution.
- Integration of ESG risks with enterprise risk management.

- Well-mitigated (or non-material) environmental and social risks.
- A best-practice, forward-looking, and strategic governance framework and policy implementation.
- Agility and Preparedness to adapt to potential disruptions and opportunities.

How ESG Factors Affect The ESG Evaluation And Credit Quality

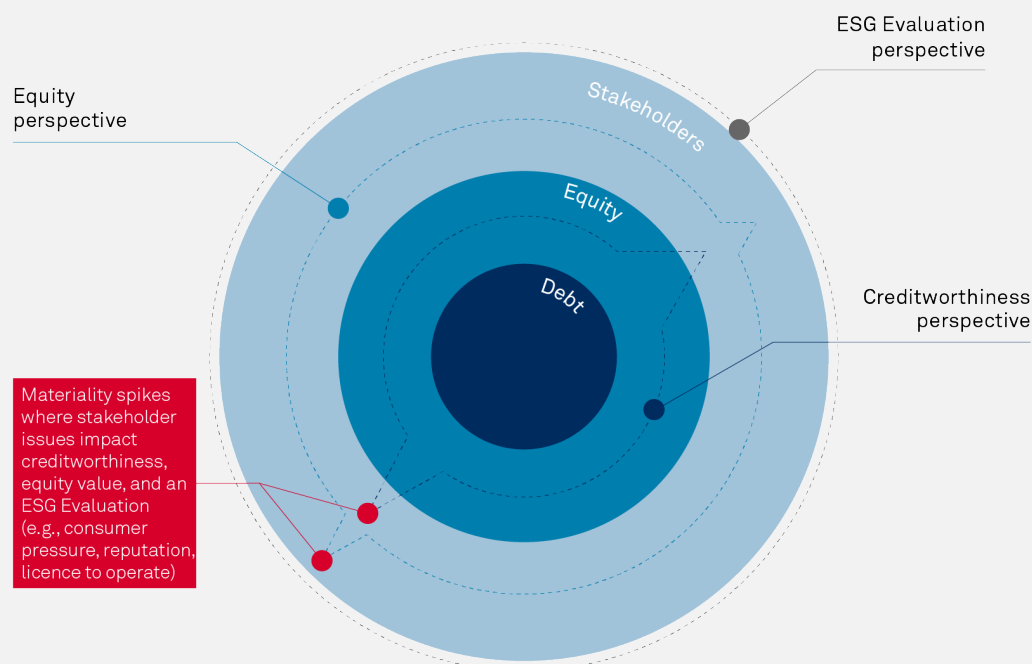
Our ESG Evaluation analysis will consider the entity's capacity to operate successfully in the future and is grounded in the materiality of how ESG factors could affect stakeholders and potentially lead to a financial impact on the entity. Our credit rating is a forward-looking opinion about an entity's overall creditworthiness, which focuses on the entity's capacity and willingness to meet its financial commitments as they come due. We already incorporate an analysis of ESG factors into our credit ratings when these factors are sufficiently material and visible--see box titled "ESG In Credit Ratings" on page 4.

We expect that the ESG Evaluation analysis will provide additional or complementary insights to the treatment of ESG factors when we apply our credit rating methodologies. For example, the percentage of water an entity recycles, or the degree of supply-chain audits for compliance with human rights conventions, may not be meaningful for our assessment of creditworthiness, but could affect the stakeholders of a company, financial institution, or government entity. Ultimately, the effect on stakeholders could translate into a future financial impact on the entity, which is a particular focus for the ESG Evaluation, but may be too uncertain or not material enough to incorporate in our credit rating analysis.

Our analysis of corporate governance is a core feature in the application of our credit rating methodology. It is also a critical and fundamental element of the ESG Evaluation. Application of the proposed ESG Evaluation analytical approach will provide our assessment of an entity's near-term governance structure in the ESG Profile, and the influence of governance on the entity's longer-term strategy, planning, and resulting culture in Preparedness.

Chart 2

ESG Evaluation Perspective, Creditworthiness Perspective and Equity Perspective



ESG In Credit Ratings

For more information on how we integrate ESG risks into our credit rating analysis, see “Corporate Methodology,” published Nov. 19, 2013, and related articles. Our Key Credit Factor articles address sector-specific ESG factors that can affect our credit analysis. We address governance in “Management and Governance Credit Factors for Corporate Entities and Insurers,” published Nov. 13, 2012. Related articles also include our analysis of which ESG risks have most affected credit ratings and rating actions in the past several years, such as “ESG Risks In Corporate Credit Ratings--An Overview,” published Nov. 16, 2015. (See the section titled “Related Research--ESG In Credit Ratings” on page 9.) Going forward, we plan to enhance the transparency of how and when ESG factors are material to our credit rating opinion.

ESG Diagnostic

Entities that request an ESG Evaluation will be asked to complete our detailed ESG diagnostic questionnaire, which will provide us with a comprehensive understanding of their current ESG exposure, policies, practices, metrics, disclosure practices, and how they have handled past ESG-related controversies.

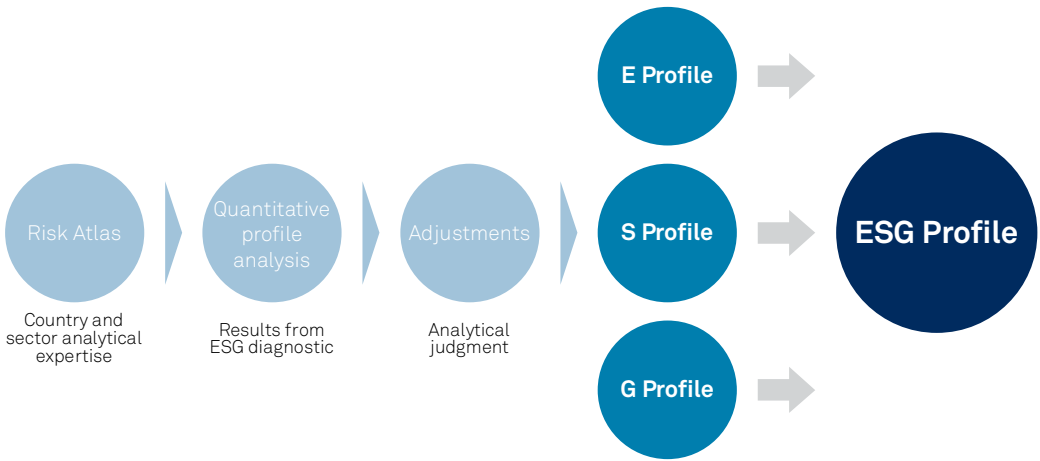
This data may be information that is publicly available, or information that entities disclose to us on a confidential basis. Our research has shown that available public ESG data is of uneven quality, and often inconsistent, and we believe that the diagnostic questionnaire, combined with our discussion of the responses with management, will equip us to assess the materiality of ESG factors more effectively and develop a more informed opinion.

ESG Profile

We expect to rank an entity’s ESG Profile based on our view of the degree to which the entity has greater or lesser overall exposure to ESG-related risks and opportunities. This ranking takes into account our view of the near- to medium-term effectiveness of the entity’s current strategic and governance framework and trends in its operational performance.

Chart 3

ESG Profile Components



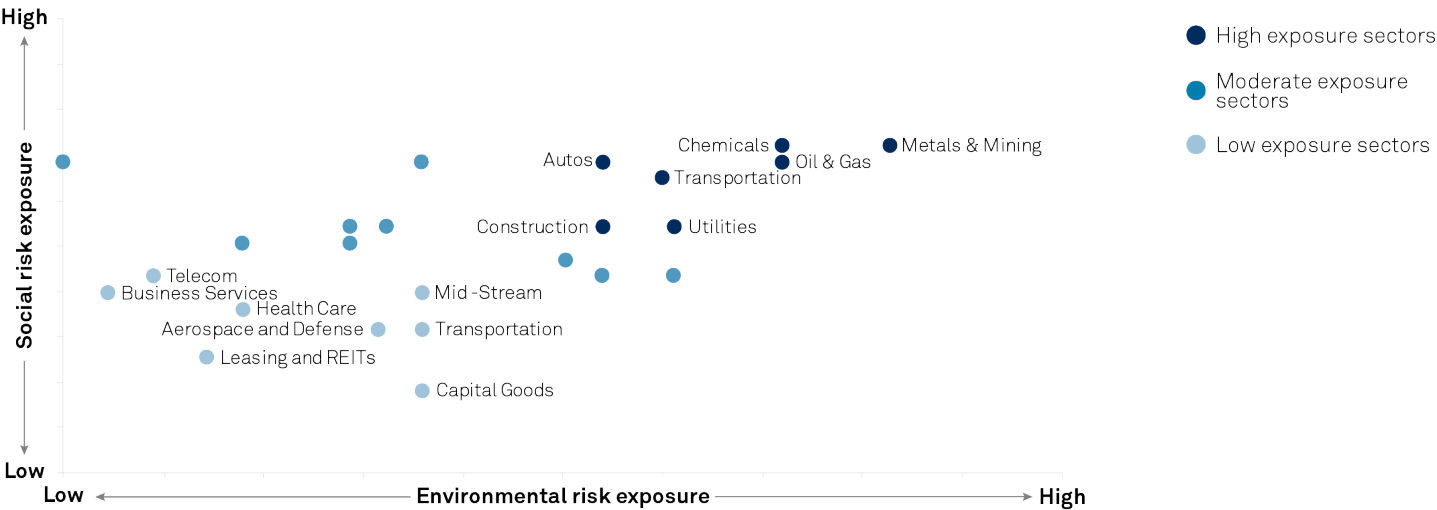
ESG Risk Atlas By Country And Sector

Our ESG Profile analysis starts with a global assessment of ESG-related exposure by sector and region, which we call the ESG Risk Atlas. There is a sector Risk Atlas and a country Risk Atlas.

The sector-level analysis draws on the vast knowledge and experience of our analytic community and public data to develop a global matrix of ESG exposures by sector. We expect to refresh our sector Risk Atlas on a regular basis, and in time, we may provide more sector differentiation if meaningful. Chart 4 below indicates our current assessment of the relative social and environmental risk exposure for selected sectors.

Chart 4

Indicative Sector Risk Atlas

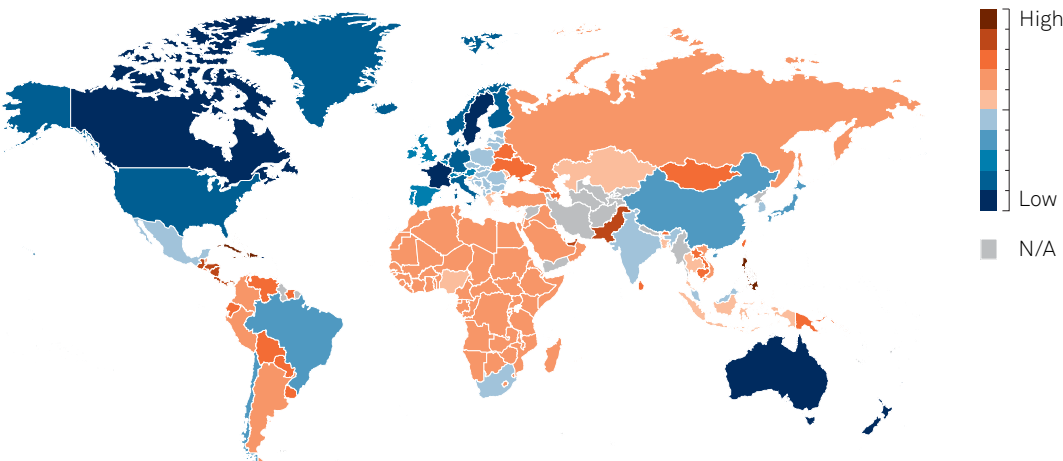


Our country Risk Atlas combines our sovereign analytical team's assessment of a country's institutional strength and capability with external assessments, including:

- The ESG regulations database from the UN's principles for responsible investment; and
- The UN's global assessment report--published data on the relative severity of the average annual loss to a nation's capital stock from natural disasters.

Chart 5

Country Risk Atlas



Quantitative Profile Analysis














The output from the ESG diagnostic builds on the sector and country analysis to inform our quantitative analysis for separate environmental, social, and governance profiles to reflect:

- Our assessment of the entity’s relative progress on relevant metrics;
- Our assessment of the coverage and quality of the entity’s policies and procedures;
- Our assessment of the overall quality of the entity’s disclosures;
- Our assessment of the transparency of the entity’s financial and nonfinancial reporting; and
- Our controversy and event analysis, which examines ESG-related controversies and business disruptions and provides an assessment of the entity’s exposure to ESG-related controversies and events.

Within each of these factors, we have selected multiple key performance indicators (KPIs) relevant for each profile, as summarized in table 1. KPIs for the environmental profile include greenhouse gas emissions; water usage, scarcity, and decontamination; waste, pollution, and toxicity; and land use and biodiversity. Our proposed approach and analysis of environmental exposures and performance leverages data and insights provided by S&P Global Trucost.

Table 1

ESG Factors

Environmental	Social	Governance
 Biodiversity	 Customers	 Reporting
 Carbon	 Human capital	 Structure
 Waste	 Human rights	 Transparency
 Water	 Safety	 Values
	 Social cohesion	

KPIs for social risk and opportunities generally factor in data about the satisfaction and data privacy of customers, human capital management, human rights, safety management, and

social cohesion. Our environmental and social analysis includes an assessment of how the entity manages ESG-related exposure in its supply chain. In our governance assessment, we have identified the key features of a best-practice governance framework; the composition of the governing body, usually the board; the policy framework; level of transparency; and reporting. We plan to assess how many of these features are present to evaluate the entity's governance structure.

Analytical Adjustment

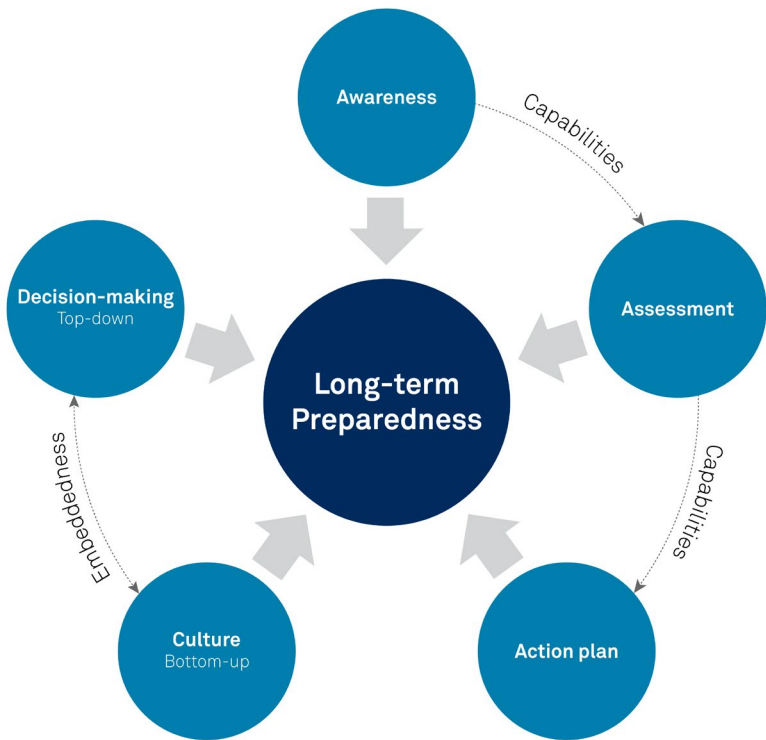
While it is likely that an entity's response to the diagnostic questionnaire will be based on past ESG performance indicators and data, our forward-looking sector- and country-based analysis will also inform the ESG Profile. Furthermore, we believe that the coverage and quality of an entity's policies, procedure, and targets are good forward-looking indicators of ESG exposure. After discussions with management, analysts will review the diagnostic results and make adjustments to each profile where appropriate. These adjustments allow us to provide a more forward-looking opinion and to reflect any entity-specific features (for instance subsector characteristics) that would not be otherwise addressed.

Long-Term Preparedness

Our long-term Preparedness evaluation will reflect our qualitative view of an entity's capacity to anticipate and adapt to a variety of long-term plausible disruptions and hence support the long-term sustainability of the entity. Such disruptions are not limited to environmental and social scenarios, but could also include technological, political, or other scenarios where relevant.

Chart 6

Long-Term Preparedness



This is because, in our opinion, high-quality corporate governance includes the full spectrum of potential risks and opportunities an entity faces.

First, we expect to assess senior management’s and the board’s capabilities with respect to their awareness and assessment of long-term risks and opportunities, associated long-term planning, and risk management processes. We also consider the extent to which the entity’s board and management have embedded environmental, social, and other long-term strategic considerations and potential future scenarios into both their decision-making and the entity’s culture.

Our qualitative long-term Preparedness assessment will be informed by discussions with senior management and the board and will include a deeper dive into the effectiveness of the governance framework, as well as the extent to which ESG factors have been integrated into management’s decision-making processes. Our assessment will be carried out by our analysts together with members of our sustainable finance team, drawing on our experience in identifying key potential risks, opportunities, and considerations for entities in a particular region and sector.

Alignment With Disclosure Recommendations From The Task Force On Climate-Related Financial Disclosures

At an entity’s request, we expect to indicate in our reports the extent to which the entity has aligned its financial disclosures with the 11 recommendations by the Financial Stability Board’s Taskforce on Climate-related Financial Disclosures (TCFD). As part of our ESG Evaluation and at an entity’s request, we will comment on the proportion of metrics and targets that the entity discloses relative to the TCFD’s suggested disclosure list.

We expect the outcome of our alignment assessment to be “fully aligned”, “partially aligned”, or “not aligned”. An assessment of fully aligned would reflect our belief that the entity has made all 11 of the TCFD’s recommended disclosures and will continue to report them. An assessment of not aligned indicates that the entity has not made any of the TCFD’s recommended disclosures in either its financial filings or other public reports. Where we believe the entity has partially aligned its disclosures with the TCFD’s recommendations, we will indicate which recommendations it has implemented and the source of our information (see the example in the table below). Therefore, we weight the TCFD’s recommended disclosures, metrics, and targets equally to arrive at the final TCFD alignment score.

The degree of alignment with the TCFD’s recommendations could also inform the ESG Evaluation.

Table 2
TCFD Sample Alignment Assessment

Governance	Strategy	Risk management	Metrics and targets
The board’s oversight of climate-related risks and opportunities	Climate-related risks and opportunities identified over the short, medium, and long term	Processes for identifying and assessing climate-related risks	Disclose metrics used to assess climate-related risks and opportunities in line with its strategy and risk management process
Not aligned	Fully aligned	Fully aligned	Fully aligned
Management’s role in addressing and managing climate-related risks and opportunities	Impact of climate-related risks and opportunities on the organization’s businesses, strategy and financial planning	Process for managing climate-related risks	Disclose Scope 1, Scope 2 and, if appropriate, Scope 2 greenhouse gas emissions and the related risks
Fully aligned	Fully aligned	Fully aligned	Fully aligned
	Resilience of the organization’s strategy, taking into consideration different climate-related scenarios, including a 2 degree or lower scenario	How are processes for identifying, assessing and managing climate-related risks integrated into the organization’s overall risk management	Targets used to manage climate-related risks and opportunities, and performance against targets
	Fully aligned	Fully aligned	Fully aligned

Despite Risks And Costs, The Next Generation Of Biofuels Could Support A Global Decarbonization Effort

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With the exit of Scott Pruitt from the Environmental Protection Agency (EPA), an already tense debate over the future of U.S. biofuels policy has become even more contentious. Ethanol, still the nation’s predominant biofuel, continues to carry political cachet even as market conditions fluctuate, and remains at the middle of a debate between the conflicting interests of agriculture and petrochemicals, both of which continue to wield significant lobbying power.

Despite ambitious mandates in place for the past decade, advanced biofuels have failed to proliferate in the U.S. because of insufficient infrastructure, high costs, and technological limitations. Despite advanced biofuels’ weak showing in the U.S., there are signs of progress that may lead to a significant expansion of the market in the next several years.

Key Takeaways

- While next generation biofuels, such as biodiesel, renewable diesel, and cellulosic ethanol, are currently cost prohibitive, certain markets have strengthened subsidies and incentives that could result in the economic viability of increased production and more widespread use.
- Major technological risks remain, complicating the construction process and potentially affecting credit quality.
- We continue to anticipate that nations will look to decarbonize their economies in part by using biofuels to power their transportation fleets in pursuit of Paris Agreement targets.
- Challenges abound for conventional corn-based ethanol, which is subject to considerable market volatility based on a number of factors.

Table 1

Environmental Protection Agency Policy Timeline

2005	Energy Policy Act enacted (including the Renewable Fuel Standard).
2007	Renewable Fuel Standard expanded along with enactment of Energy Independence and Security Act. Blending of renewables required to reach 36 billion gallons by 2022 and small refineries are exempt from RFS until 2011 so as to not impose financial hardship.
2011	Congress instructs the DOE to conduct a study to determine how and which refineries would be unfairly affected. Sinclair Oil in Wyoming gets another two-year extension to 2013 due to economic hardship.
2013	Congress creates a petition process for refineries to petition for an exemption for economic hardship.

2015	EPA denies waiver to Sinclair Oil.
2016	EPA grants 19 out of 20 waivers (total exempted RIN 790 million).
2017	Sinclair Oil takes appeals the EPA decision, which is overturned, allowing a review of the waiver.
April 2018	EPA grants waiver to energy giant Andeavor.
May 2018	EPA grants a waiver to Sinclair Oil and Holly Frontier Corp. Renewable Fuels Association and National Corn Growers Association file lawsuit against the EPA for awarding waivers to large refineries.
June 2018	12 Democratic members of the House Energy and Commerce Committee and the House committee on Agriculture ask the EPA to give more details about RFS standards and lack of implementation.
July 2018	EPA realases data for 2016 and 2017 RFS waivers and grants 19 out of 20 waivers granted in 2016. It also grants 29 out of 33 waivers granted in 2017, with 4 under review.

Sources: Alternative Fuels Data Center, Biodiesel Magazine, Wall Street Journal, New York Post, Biomass Magazine.

Market Overview

Ethanol

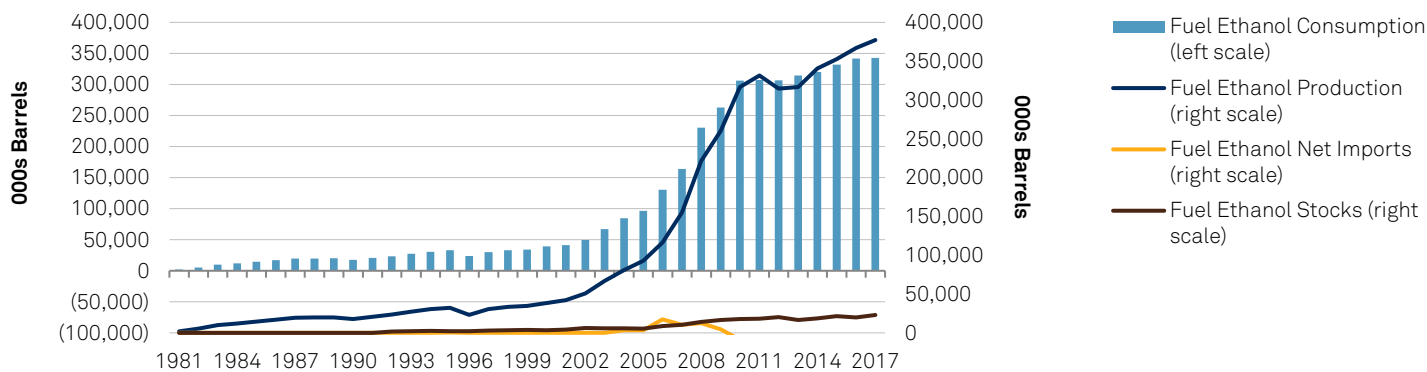
The Renewable Fuel Standard (RFS) mandates that refiners blend a certain amount of ethanol into the gasoline supply on an annual basis as a means to achieving federal decarbonization goals. While the domestic political will to continue to support a growing RFS may be highly variable, the demand for ethanol will continue to be driven by a bevy of other factors, including oil prices and estimates on miles driven. With increased oil prices alongside historically low corn prices, the latter part of 2018 promises to be somewhat stronger for ethanol producers. But the reality that any of these factors could change unpredictably is what amplifies the market risk of ethanol, and subjects ethanol producer cash flows to significant volatility--diminishing their credit quality under our criteria. Recently, an increased number of waivers granted to refiners that would otherwise be subject to blending requirements adds more uncertainty to the ethanol market.

As part of RFS regulation, each refinery assigns renewable identification numbers (RINs) to biofuel batches in quantities dependent on its overall output. It can get a RIN barrel either by blending a gallon of ethanol into its own fuel or from purchasing one from another producer. The price of a RIN drives ethanol demand. When a RIN price is high, refiners would rather buy and blend ethanol. When the price is low, refiners stock up on RINS by purchasing in the open market.

In 2018, the price of RINS has dropped dramatically, to about \$0.15 from about \$0.80 following government scrutiny of the RFS and a significant uptick in EPA waivers that allow small refineries to ignore their mandated RIN quotas. Given the current political climate and macroeconomic conditions, we don't expect ethanol demand to increase meaningfully over the next few years. Green Plains Inc., one of the larger North American ethanol producers, recently announced its intention to increase its focus on foreign markets and to sell ethanol plants that aren't ideally located for exports. Agribusiness giant Cargill has announced similar plans. Longer-term uncertainty and general weakness in U.S. demand likely partially drove some of these decisions, though we note that even when domestic demand falls as a result of either diminished market conditions or regulatory uncertainty, a robust export market remains.

Chart 1

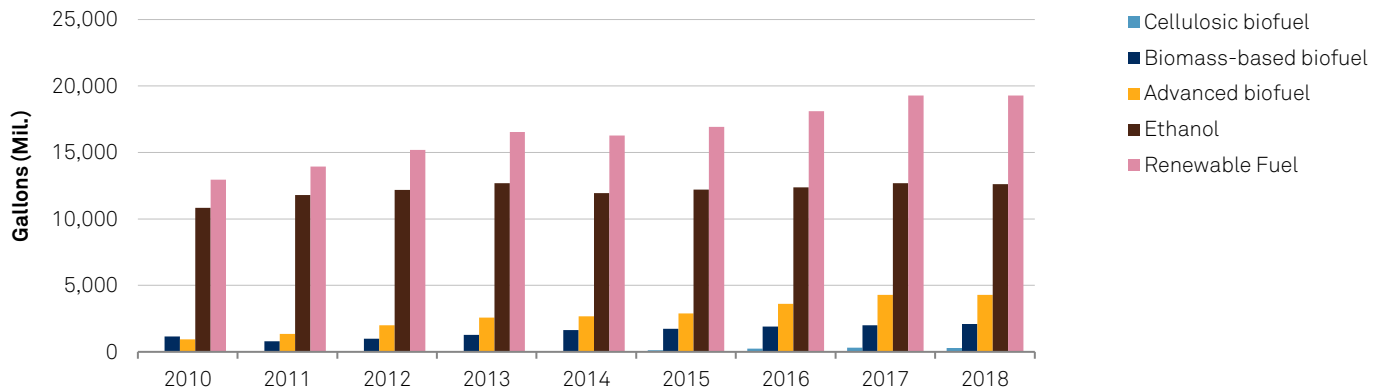
U.S Ethanol Production And Consumption



Source: U.S. Energy Information Administration.

Chart 2

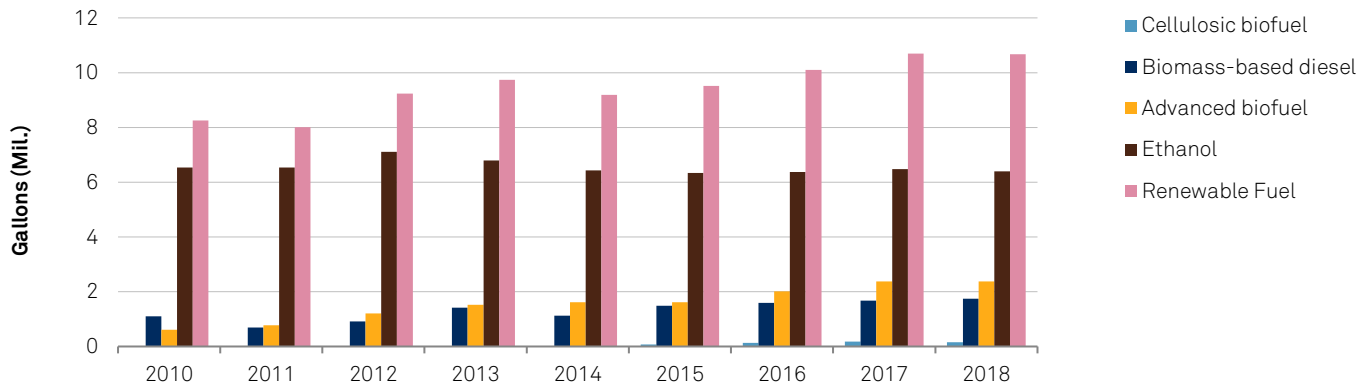
Renewable Fuel Standard Requirements By Fuel Type



Source: Environmental Protection Agency.

Chart 3

Renewable Fuels' Share Of Overall U.S. Fuel Consumption

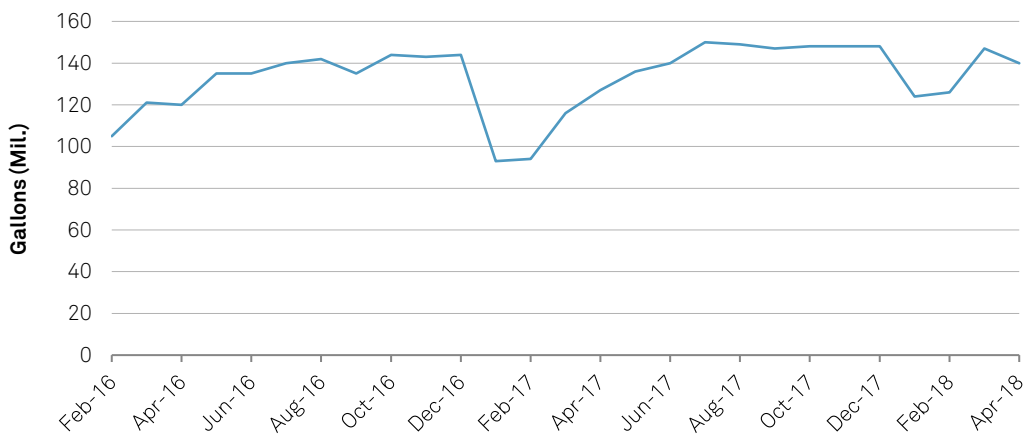


Source: Environmental Protection Agency.

Alternative fuels

Despite the fact that the RFS targets still remain unmet for all categories of advanced biofuels, growth in the market has been relatively low during recent years. As we discuss in Credit Implications below, the economics of biodiesel, renewable diesel, and cellulosic ethanol projects mean they may not be financeable without an additional stimulus beyond the RFS. In some states, supplemental tax credits or subsidies are available, but these too are often subject to regulatory uncertainty, especially true in states where there is a lack of political support for biofuels.

Chart 4
Monthly U.S. Biodiesel Production



U.S. Energy Information Agency.

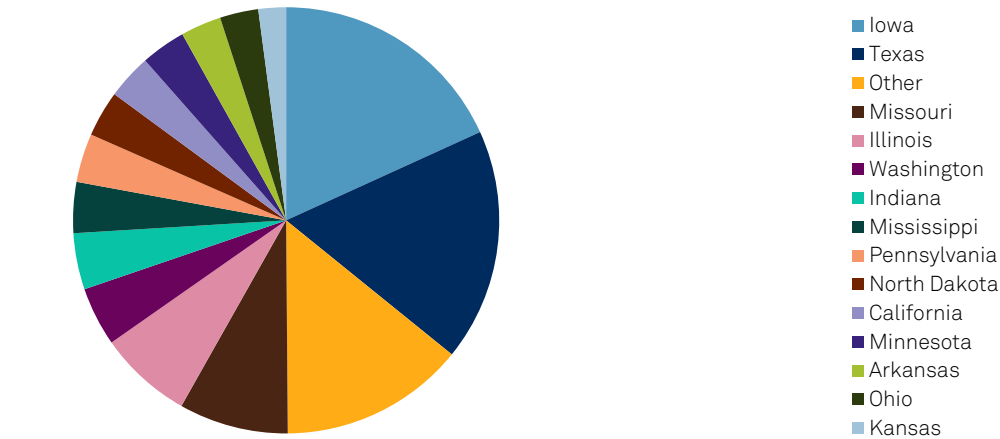
Table 2
Renewable Fuel Categories Summary

RIN Code	Biofuel Type	Examples	Required Greenhouse Gas Reduction (%)	EV
D3	Cellulosic biofuels	Cellulosic ethanol (including nonstarch parts of the corn plant such as the stalk and cob), cellulosic naphtha plus biogas into compressed natural gas and liquefied natural gas.	60	1.5
D4	Advanced biofuels: biomass-based diesel	Biodiesel, renewable diesel	50	1.7
D5	Advanced biofuels: unspecified	Any biofuel that is not ethanol made from corn starch such as sugarcane ethanol, renewable heating oil	50	1.0
D6	Renewable fuel	Corn ethanol, grandfathered from RFS1	20	1.0
D7	Cellulosic diesel	Cellulosic diesel Cellulosic jet	60	1.7

RIN--Renewable identification number. Source: Environmental Protection Agency.

Chart 5

Annual U.S. Biodiesel Production Capacity (Mil. Gallons)



Source: U.S. Energy Information Administration.

Carbon Goals: An Environmental Role for Biofuels

While doubts linger over the role of ethanol as a decarbonizing agent, there are comparatively fewer misgivings about the role of advanced biofuels, which are being promoted as a means for the greening of the transport sector throughout the world. While uncertainty swirls around the place of next-generation biofuels in the federal RFS, other government entities have provided incentives that look likely to bolster the market. Considering that biodiesel still makes up less than 4% of the total blending pool in the U.S., there is considerable room for growth of the industry through fuel switching to meet state mandates.

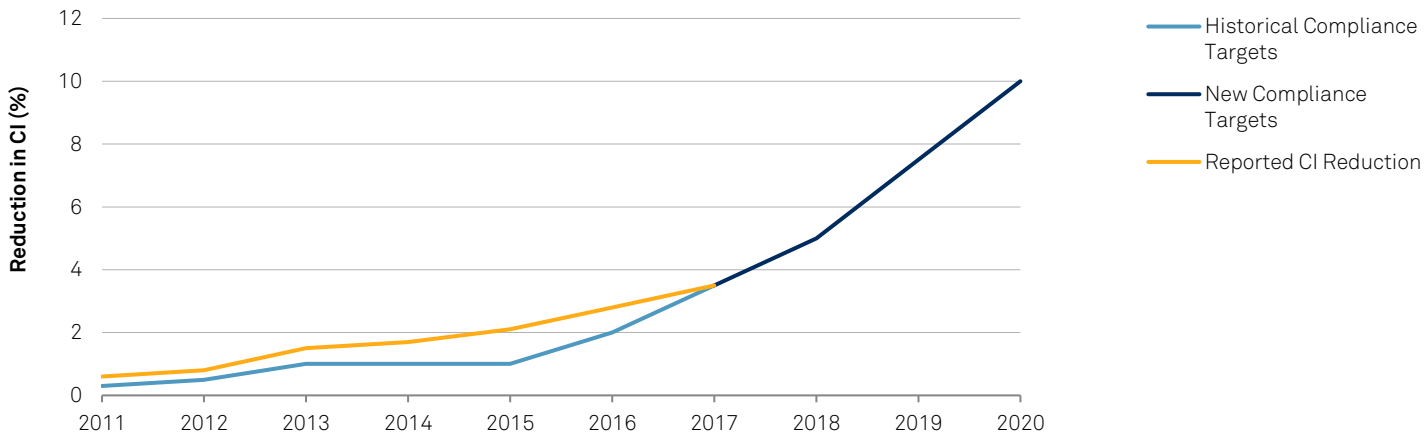
California’s low-carbon fuel standard

The Golden State has positioned itself as a leader in renewable energy and recently expanded its clean economy dominance into the transport sector through its Low Carbon Fuel Standard (LCFS). The LCFS acknowledges that while ethanol may be the most common fuel additive, other fuels are more effective in decarbonizing, and the standard ascribes credits accordingly. The standard is an ambitious one, requiring a 10% reduction in carbon intensity between 2010 and 2020, with that figure possibly increasing to a whopping 20% by 2030, though the goal won’t be finalized until the fall of 2018. As California was already subject to the federal RFS, this has inevitably necessitated fuel switching, which will lead to the development of a market for advanced biofuels. The bundled price of the credits stems from their relative carbon intensity. Additionally, the LCFS includes the life cycle carbon “cost” of fuels, including carbon emitted during extraction, which is often overlooked in carbon reduction calculations.

Considering that biodiesel still makes up less than 4% of the total blending pool, there is considerable room for growth of the industry through fuel switching to meet state mandates.

Chart 6

Performance Of The Low Carbon Fuel Standard In California, 2011-2017

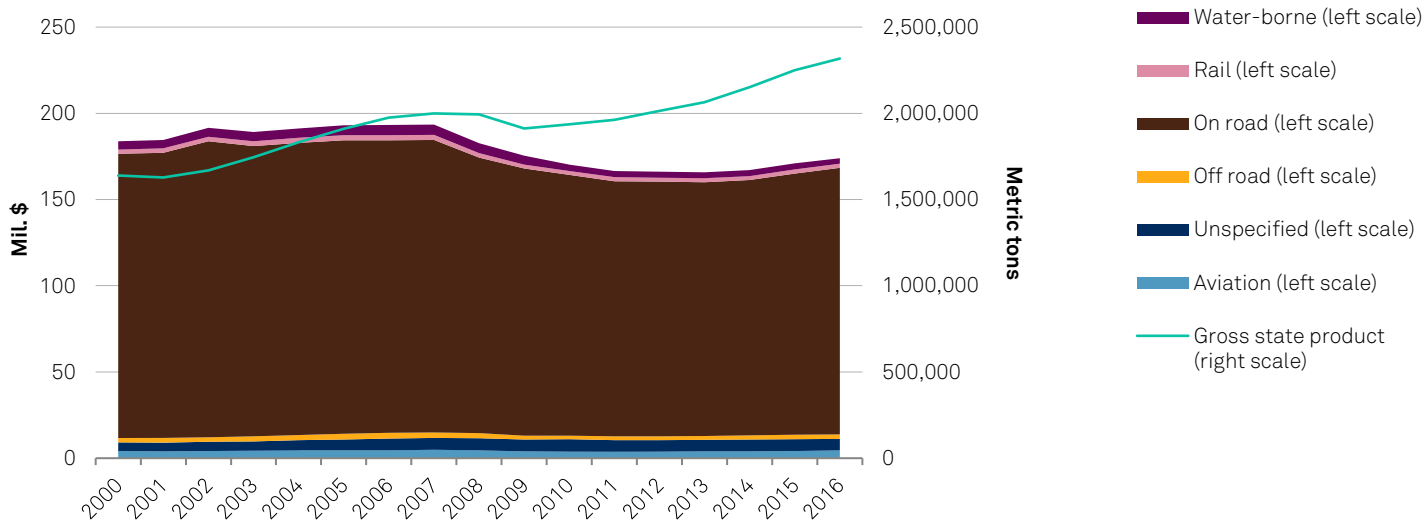


Source: California Air Resources Board. CI--Carbon intensity. Carbon intensities based on composite of gasoline and diesel fuels.

Aside from the obvious climate change benefits that the California rule seeks to achieve, there may be an ancillary economic benefit: A greater percentage of fuel will be produced in California. With Washington debating whether environmental progress jeopardizes economic growth, California appears to be demonstrating that it does not. As California’s economy has grown sharply in recent years, based in part on its leadership in climate initiatives, its transportation sector carbon emissions (and carbon emissions at large) have continued to diminish, a trend we expect to continue.

Chart 7

Transport Sector Carbon Emissions And Economic Growth In California



Source: California Air Resources Board, Bureau of Economic Analysis.

California’s northern neighbor, Oregon, has implemented a comparable LCFS. However, because its transportation fuel consumption is currently less than 10% of California’s, the rule will have a much lesser impact there.

Iowa: the biodiesel state

In 1983, Iowa became the first state to enact a renewable portfolio standard with the Alternative Energy Production law, which mandated that the two utilities in the state own or contract a defined amount of renewable energy capacity. Today, Iowa continues its legacy as a renewable energy leader as the top biodiesel and ethanol producer in the U.S. Iowa produced about 305 million gallons of biodiesel in 2016, and 443 million gallons in 2017, making up just over 18% of the total U.S. production capacity for that year, the largest percentage of any state. Fuel production tax credits, retailer tax credits for E85, retailer blending credits, infrastructure grants, and other programs provide incentives for biodiesel production in Iowa. The state's renewable fuel incentives far exceed those of states that produce less renewable fuel. Robust incentive programs may contribute to increased production capacity, and production itself may be dependent on such incentives.

The price of ethanol in Iowa rises and falls along with the price of corn. Government incentives for blending promote the production and use of biofuels, but they also support the corn industry.

Iowa is one of the largest corn producers in the U.S. According to the Iowa Corn Growers Association, the state grew about 2.7 billion bushels between 2016 and 2017 (about 150 billion pounds). Biodiesel clearly supports Iowa's agricultural industry. The Iowa Biodiesel Board estimates the biodiesel industry adds about \$480 million to Iowa GDP per year. Biodiesel in Iowa is not only environmentally sustainable initiative, but also drives economic growth. The dependence of the biodiesel industry on agricultural production and on state subsidies implies that if incentives were to end or if corn production were to decrease, biodiesel production could slow.

Changes ahead for Canadian provinces

The Canadian biofuels sector is rapidly expanding and is a major engine of growth for the Canadian national economy. Biofuels are boosting the agricultural sector and contributing to environmentally sustainable economic growth. A significant portion of the credit for the success of the Canadian biofuels industry to date belongs to national and provincial government leaders who have embraced the domestic biofuels industry after realizing its economic and environmental value. Federal regulations require 5% renewable fuel in gasoline and 2% renewable fuel in diesel.

Canadian ethanol production totaled about 1.7 billion liters in 2016 with an estimated market value of \$1.1 billion. It took \$800 million worth of feedstock to support this production, providing Canadian farmers with a large and consistent revenue stream. Ethanol production also resulted in \$260 million worth of distillers grains (a byproduct) in 2016.

In November 2016, the Canadian government announced plans for a national clean fuel standard that aims to eliminate 30 megatons of greenhouse gas (GHG) emissions per year by 2030. Likely to be fully implemented by 2021, the plan intends to achieve overall GHG target of 30% emission reduction below 2005 levels by 2030. The regulations will require the use of a broad range of low-carbon fuels, energy sources, and technologies, such as electricity, hydrogen, and renewable fuels, including renewable natural gas. This target could create an opportunity for advanced biofuels to take an increased role in the Canadian transportation fuel market.

The Canadian provinces have their own policies. British Columbia has a low carbon fuel standard (LCFS) similar to California's. It requires a 10% reduction in fuel carbon intensity in

2020 and 15% by 2030 relative to a 2010 baseline. In addition, British Columbia's regulation requires minimum renewable fuel content of 5% renewable for gasoline and 4% for diesel.

Ontario, Canada's largest province, has announced that it will increase ethanol content in gasoline to 10% from 5% by 2020, which is expected to increase the amount of Ontario corn going toward ethanol production. Ontario also encourages cellulosic ethanol blending by providing a regulatory incentive (in that 1 liter cellulosic ethanol is equivalent to 2.5 liters of ethanol produced from other feedstocks for compliance purposes).

Ontario's Greener Diesel Regulation requires both a minimum volume of bio-based diesel blended into petroleum diesel as well as minimum reductions in lifecycle GHG intensity. The regulation requires bio-based diesel to comprise at least 4% of total diesel and have at least a 70% reduction in lifecycle GHG intensity. As per the regulations, fuel suppliers could lower their minimum volume requirements if the fuels they supply have a lower GHG intensity than the standard.

The combination of an already strong domestic biofuels industry and aggressive emissions targets has Canada's biofuels industry primed for growth, with next generation biofuels entering the discussion in the effort to reduce GHG emissions.

A greener transport sector in Scandinavia

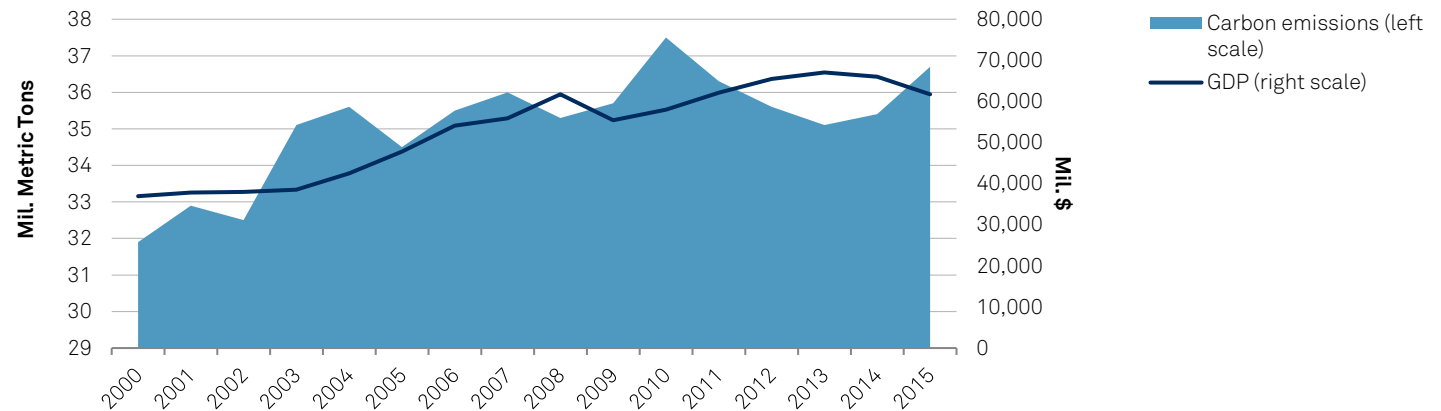
Norway is a secondary, but burgeoning, market for U.S. biofuels. that meets virtually all of its power needs through renewable energy (mostly hydroelectric power). With a mostly static population and an increasingly service-based economy, Norway does not anticipate tremendous power sector demand growth, and has less room for decarbonization through its power sector. However, it does consume and export oil and gas for its transport sector. As it seeks to become a leader in the global decarbonization mission alongside other major European economies (with an EU-wide goal of reducing CO2 emissions 40% from 1990 levels by 2030), the country has recently tightened its standards for renewable fuels to improve the sustainability of its transport sector.

The country reached its 20% biofuels mandate, originally slated for 2020, by the end of 2017, resulting in carbon emissions declining by 3.6% from the prior year. The 20%-by-2020 mandate also contains a provision requiring that 40% of that figure be advanced biofuels; given the weaker economics of domestically producing corn for ethanol purposes, the contribution from other, more advanced biofuels figures to grow in coming years. In part as a result of this significant achievement, the country also put in place a mandate to begin blending at least 1% sustainable aviation fuel by 2019; this fuel is a potential byproduct in certain chemical processes that produce other renewable fuels in coming U.S. projects.

The advances by Norway in using biofuels to decarbonize its economy may be precedent setting, much like California's. By 2017, approximately 80% of Norway's economy-wide emissions were subject to some manner of carbon tax or allowance pricing. We have seen similar progress in neighboring Sweden, with biodiesel (much of it from vegetable oil derivatives) accounting for more than a quarter of all diesel fuel consumed and biofuels more generally supplying almost 21% of total fuel consumed in vehicles for 2017.

Chart 8

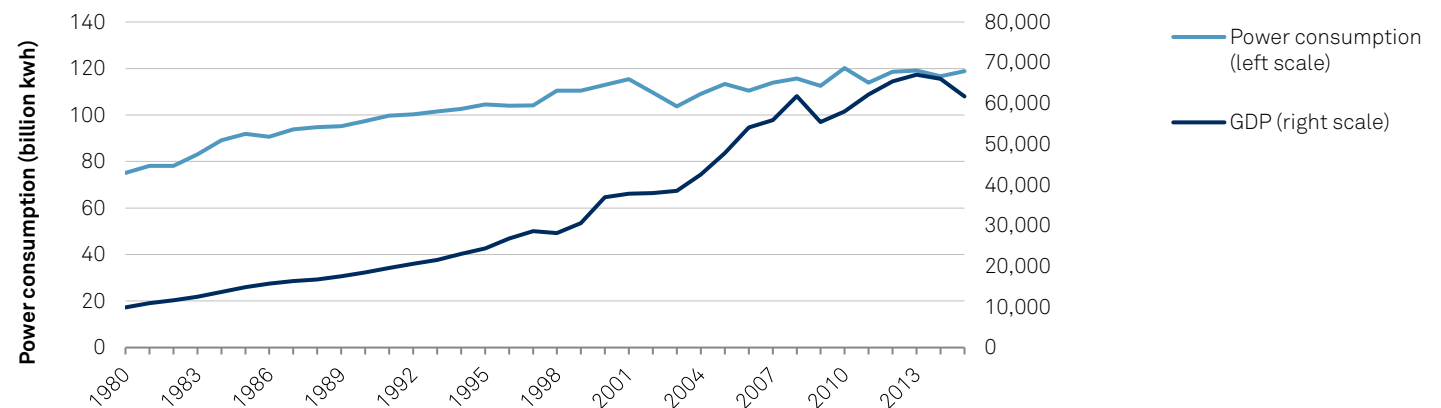
Norway CO2 Emissions Vs. GDP growth



Source: OECD.

Chart 9

Norwegian Power Consumption



The Formidable Opposition: Trump's EPA And Big Oil

In early 2018, Rep. Peter Welch and Sen. Tom Udall introduced The GREENER Fuels Act, which would phase out the corn ethanol mandate, cap ethanol blending at 9.7 percent, create a fee of 10 cents per RIN to support an environmental initiative, and alter the cellulosic mandate. While the bill has stalled amid high-level governmental discussions between interested parties, it's one signal that regulatory issues in the U.S. remain in the spotlight, and continue to pose risks to the agriculture industry. Given ethanol's place as the homegrown and incumbent blending fuel in the U.S., we expect continued challenges to the status quo, which has long been thought to be supportive of ethanol.

While politicians and industry participants alike debate how to move forward on ethanol, the EPA has used its significant power to grant small refinery waivers from RIN standards. In 2015, the EPA, under the Obama Administration, denied a request for a RIN waiver to Sinclair Oil. In 2017, a federal court overturned this decision, ruling that the EPA had

previously taken too narrow a stance on what is considered "financial hardship." In May 2018, Sinclair Oil became part of a group of refineries previously believed too large for RIN waivers that has since received them. Exemptions for larger refineries from biofuel blending requirements could pressure overall biofuel demand in the U.S. Yet it remains unclear whether large refineries will continue to receive waivers or if the EPA will change policy to make it more or less inclusive. Thus the true demand effect of the RIN waiver program on biofuels remains uncertain.

Credit Implications

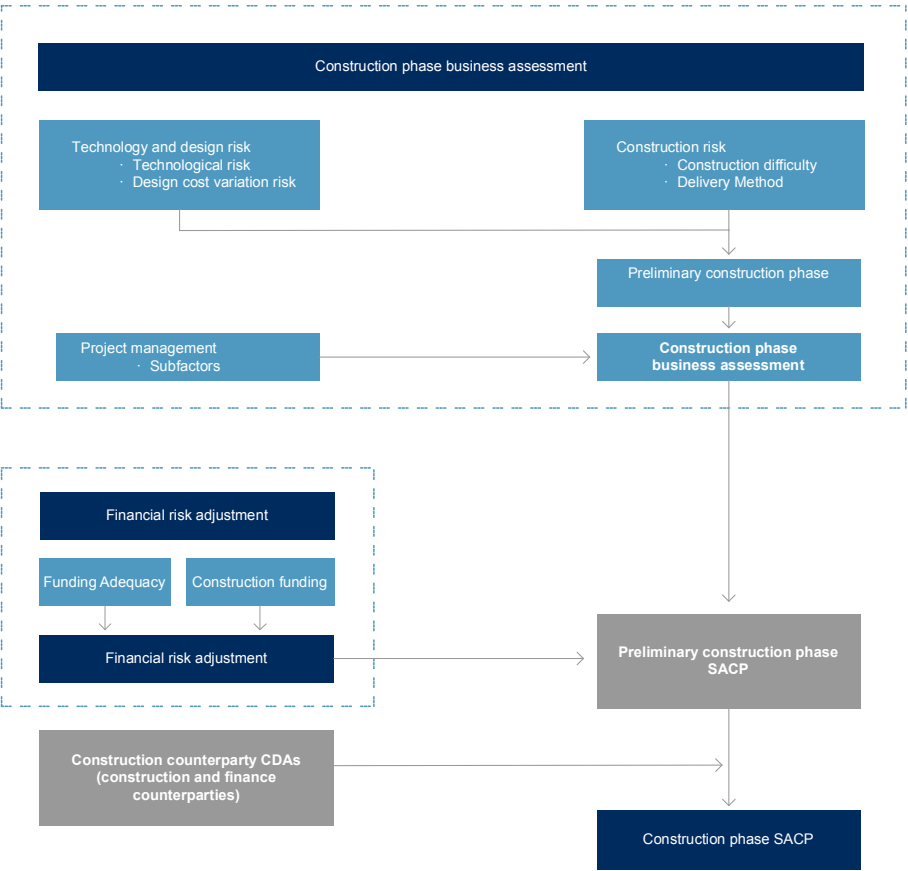
While the advanced biofuels market may have substantial promise, especially with the potential value of these fuels as decarbonizing agents becomes clearer, there are meaningful risks that could weaken issuers' credit quality.

Construction risk

Under our project finance criteria, a weak construction profile can undermine the credit quality of a project regardless of its merits after construction. For biofuels projects, especially newer ones, there are a number of potentially major construction risks.

Chart 10

Factors And Methodology For Determining The Construction Phase SACP



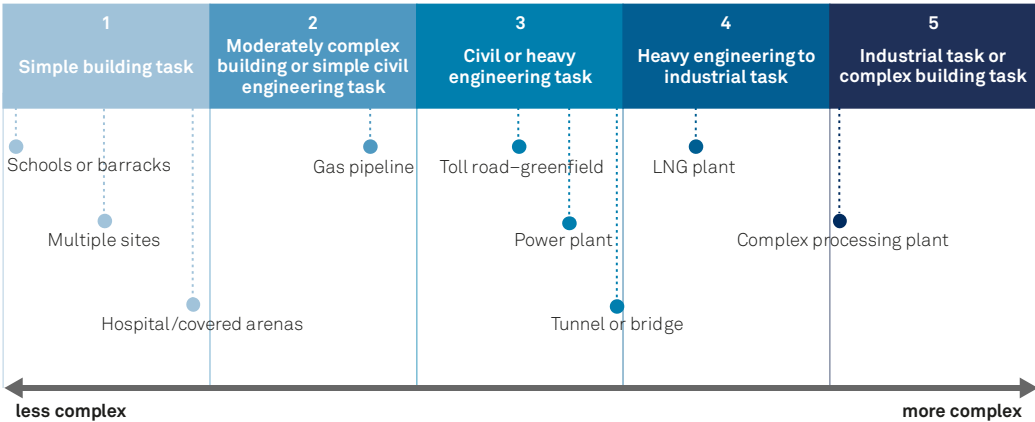
See S&P Global Ratings' "Project Finance Construction Methodology," published Nov. 15, 2013. SACP--Stand-alone credit profile. CDA--Counterparty dependency assessment.

First, we assess technological risk. Given that this is a relatively new asset class, particularly in North America, there is often uncertainty about the best location to build a biorefinery. Advanced biofuels generally involve relatively newer technologies to chemically convert materials from one state to another. Because the technologies are often proved only on a pilot scale but not at commercial scale, or only for use in other applications, we typically assess such projects "proven but not in this application or arrangement".

We would generally score the construction difficulty of a biofuel project "civil or heavy engineering task." However, depending upon construction schedules or activities, the assessment could be a notch lower or higher.

Chart 11

Diagram Of Construction Difficulty



See S&P Global Ratings' "Project Finance Construction Methodology," published Nov. 15, 2013.

Next, we assess the risk transfer capabilities of an engineering, procurement, and construction (EPC) contract. Typically, in large, complex construction, especially those for newer technologies, we would anticipate a comparatively higher degree of cost overruns or time delays due to a shorter track record. An effective contract could align incentives, shifting that risk from the project (and the lenders) to the construction counterparty. Even a comparatively risky project could fare well under our criteria with provisions that pass through most cost overruns and compensate with substantial liquidated damages. However, newer technologies seldom feature these favorable contracts, as both sponsor and contractor often have difficulty calculating the possible overruns they might face during the construction phase. Consequently, in many cases, we cap our assessment of these projects at a low rating.

Finally, we evaluate the liquidity of the transaction during the construction phase and whether it is sufficient to buoy a project should it face adversity. The difficulty with newer technologies and incomplete risk transfer provisions in EPC contracts is that the degree of cost overrun may be subject to significant uncertainty. This is especially true in the earlier phases of construction, in which timelines may be less certain and forecasting labor and parts needs may be less precise. Abundant liquidity to cover any foreseeable cost overruns can limit downward notching of the construction phase score. However, if reserves and contingencies are not immediately cash funded, the credit quality of the provider of funds and the conditions for drawing them also factor into our assessment.

Counterparty risk

Depending on the structure of the transaction, a biofuels project, especially one for advanced biofuels, may have material exposure to a number of counterparties that, because of their specialized skills, could be more difficult to replace than in a more conventional transaction, such as one for a combined cycle gas turbine.

First, a construction counterparty is critical for any in-construction transaction, but especially one that has a less established track record and one in which effective risk transfer to a high credit quality contractor can be a strong risk mitigant.

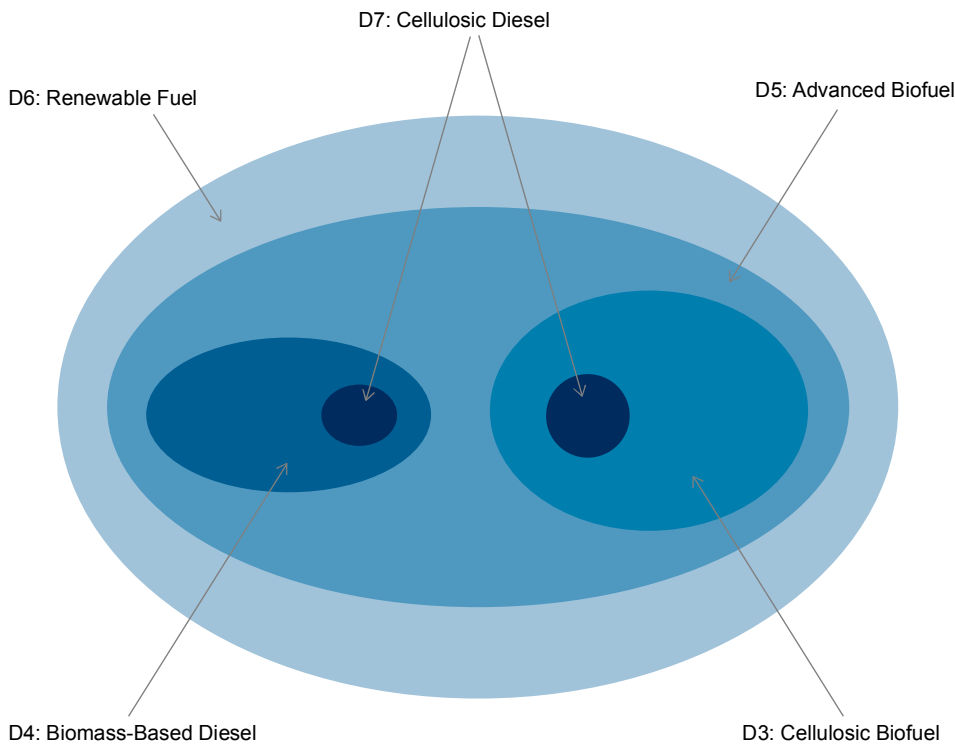
We also consider the credit quality of the project’s operator. While in many projects an operations counterparty could be very replaceable because the skill set is more readily available, the pool of potential replacement providers could be smaller for a newer technology such as next generation biofuels.

Market risk

Biofuel producers face a range of market risks, the most significant of which are the volatility of renewable fuel prices and regulation that drives credit pricing; these risks can be accentuated, with greater impact on cash flow, by a lower correlation between feedstock costs and revenues.

Chart 12

Classification Of RINS Under EPA Renewable Fuel Standards



RINS--Renewable identification numbers. Source: S&P Global Ratings.

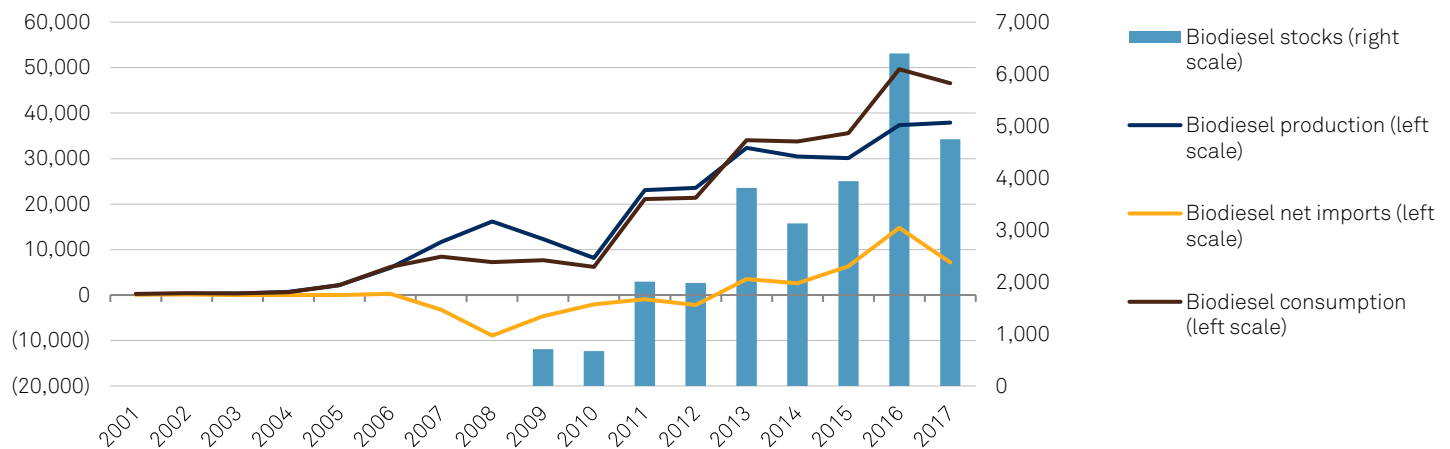
As mentioned above, renewable fuels, including advanced varieties, are subject to high price volatility that sometimes slightly correlates to input costs. Additionally, pricing is tied to regulation; even conservatively, we anticipate the renewable diesel market will grow by about

3.5x in the next five years because of an accommodating regulatory structure in California. The market for next-generation biofuels largely depends on regulation in certain supportive jurisdictions in California, some Canadian provinces, and in Europe (especially Scandinavia).

However, what compounds this risk is that aside from pure market supply and demand dynamics that factor into any commodity analysis, the biofuel revenue streams are often diversified into a variety of credits, the value of each of which regulation will largely determine. Regulation often reflects merely the impermanent political preference of the day, even in states and countries that value renewable fuels. Additionally, the more complex the biofuel, the more likely it is that it satisfies more than one potential RINS requirement. These fuels are more resilient to weakness from oversupply in one market due to their presence in multiple markets. And, to a degree, the operational flexibility of certain fuels benefits them as well. With renewable diesel, for instance, there is no known blending limit. As a result, the likelihood of the market hitting a pricing wall is therefore lower.

Chart 13

Biodiesel And Renewable Fuels



Source: EIA.

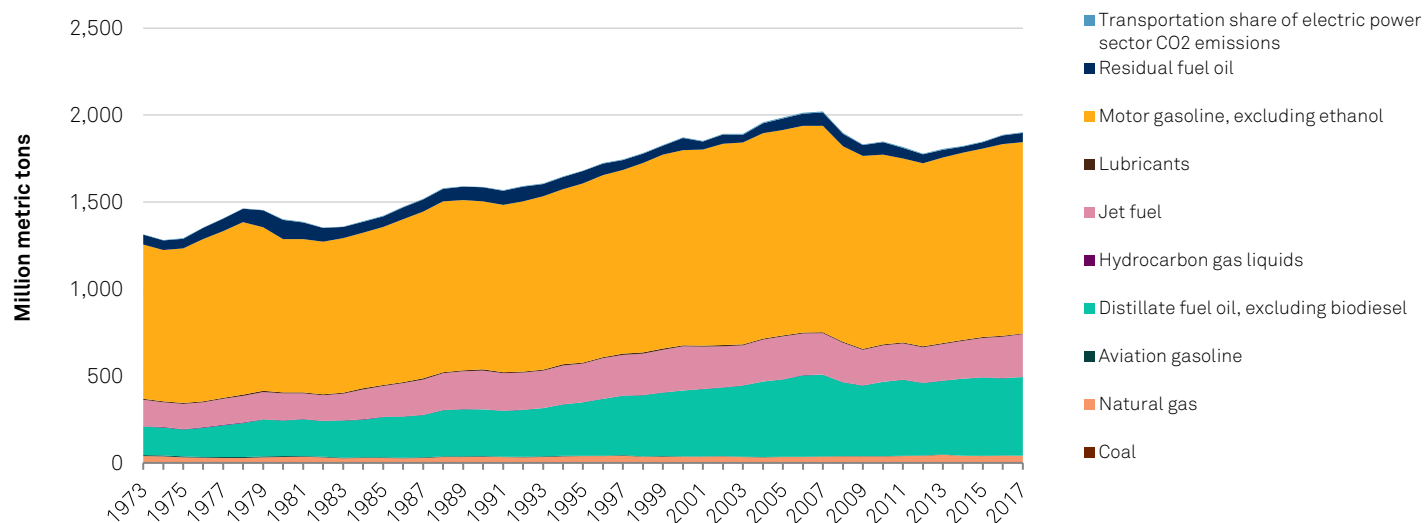
The primary market exposures for next-generation biofuels are feedstock costs and biofuels and related credit prices. Conventional biofuels such as corn ethanol face exposure to the same market forces as corn itself—prices subject to unpredictable weather and consumption patterns that have an enormous effect on the profitability and feasibility of ethanol both as a biofuel and as a blending ingredient for gasoline refiners.

As mentioned earlier, the market for LCFS credits continues to depend heavily on state level legislation and regulation. Supply of and demand for these credits depends on the magnitude of California’s carbon reduction targets. Current regulation requires a 10% reduction of fossil fuel emissions through 2030. The advanced amendment to this program, which is already well on its way to getting ratified, stipulates a gradual increase in emissions reductions from a 6% reduction in 2019 to the final reduction target of 20% in 2030.

If California succeeds in meeting its emissions reduction targets, other states will likely follow its lead and implement carbon emission reduction programs in the transportation sector. This will lead to potentially exponential growth of the biofuels industry and increased investment in next-generation biofuels technology as companies scramble to do their part to reduce emissions.

Chart 14

Transportation Carbon Emissions



Source: EIA.

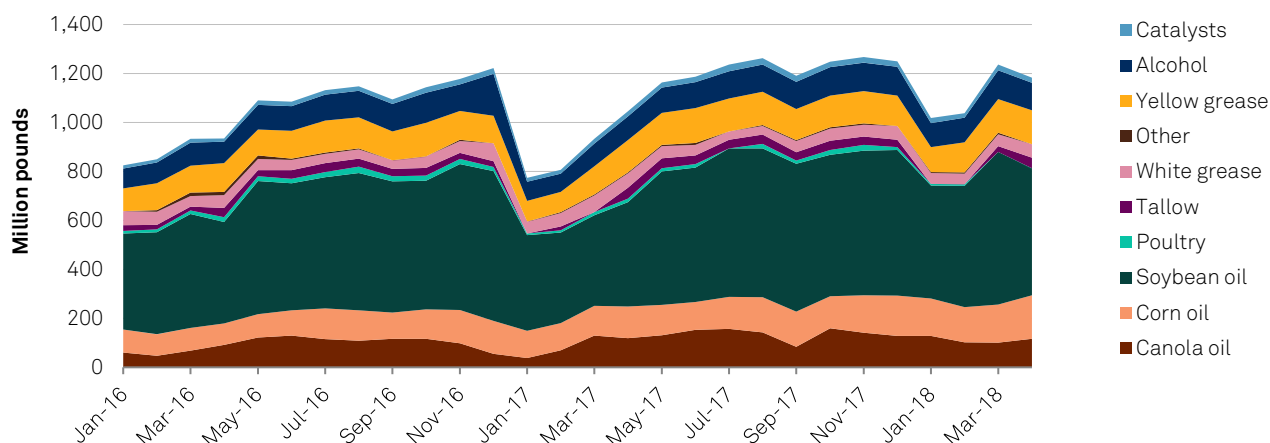
Biofuels refiners face significant market risk as they are very vulnerable to margin fluctuations and their ability to hedge in a sustainable manner. **Green Plains Inc.**, for instance, is an ethanol refiner that we currently rate 'B'. Although it has diversified its businesses in years past, its cash flows continue to highly correlate with its crush spread. The decline of crush spreads below \$0.10 during some points over the past several years has pressured Green Plains' standing at the current rating. As a result, the company has endeavored to diversify its businesses by purchasing cattle feedlots and expanding other parts of the business. The company also plans to invest in protein processing technology to lock in its margins.

Resource risk

The use of unconventional feedstocks to produce biofuels may provide an opportunity to increase profits by way of cheaper costs. However, over time, as more biorefineries open for business, unconventional feedstocks could face supply pressure. Currently, the alternative fuels market in the U.S. is relatively small. The myriad feedstocks used to develop these fuels are abundant, in part because they are often waste products with no consistent independent end use market. But if one fuel class proliferates because it can demonstrate economic and environmental merits independent of the RFS, development of that fuel is likely to grow faster than the feedstock market that supplies it. Because farm waste and used kitchen oils have a limited track record as resources, their ability to satisfy the demands of the market is more difficult to predict. Given the risks inherent in building a plant around a single feedstock, one potential way to mitigate resource risk is to build in dual fuel capabilities.

Chart 15

Monthly Biodiesel Inputs



Source: EIA.

Operating risk

While the primary risk for a biofuels facility stems from the market, there are also operating risks that could affect the credit quality of the project. The comparative novelty of the asset type may heighten these risks. Specifically, availability (the proportion of time that the plant is operating) and predictability of operating costs are critical in assessing the business risk profile. Additionally, under our project finance criteria, we develop a combined downside case that includes market, operating, and financial stresses. If a technology's track record is brief, we are inclined to apply a more strenuous scenario to reflect the greater uncertainty than with more conventional and tested assets. This can lead to a weaker downside case and a quicker default. In the absence of more substantial liquidity, a weak downside case can cause us to cap the rating.

In scoring, we factor in the type of technology. Because corn ethanol facilities are relatively straightforward and better understood, we give them an asset class score of '4'. In contrast, advanced biorefineries are akin to complex oil refineries, which we assess at '6'.

With all of these factors clouding the picture for biofuels, we remain focused on a number of critical rating factors. More advanced biofuels are still subject to significant construction and operating risks, which curbs our assumptions about liquidity and raises our expectation for operating costs. However, as capacity increases, we will look to determine how closely actual operating performance aligns with independent engineer forecasts. We also continue to monitor regulatory developments around the world to determine whether and to what extent countries' and states' decarbonization efforts will stimulate nascent biofuels markets. And we will continue to watch the political scenario unfold in Washington, D.C. regarding ethanol to determine whether opposite sides can reach a consensus on RFS that can provide great market certainty.

Refinancing Risks Are Rising As Asia Burns Through Its Carbon Budgets

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Key Takeaways

- Some coal producers in Asia could face heightened refinancing risks, particularly in view of US\$5.6 billion in debt maturing through 2021.
- Rising interest rates and less-supportive lending policies may require some companies to fund themselves with internal cash flows, which thanks to rising coal prices remain strong.
- Companies may face the risk of stranded assets (coal that may never be taken out of the ground) due to rising carbon emission limits.
- Banks and investors are increasingly focusing on alternatives to coal, due to concerns that carbon assets will not be monetized to repay debt.

Southeast Asia faces a difficult dynamic. Increased access to electricity would improve living standards for hundreds of millions of people, but traditional power sources (such as fossil fuels) would be environmentally detrimental. While growing energy demand is sustaining demand for coal, the focus on lower-emission energy sources is also rising. S&P Global Ratings believes that these trends could raise the long-term credit risks for levered coal producers seeking to refinance as lenders increasingly incorporate environmental risks into investment decisions.

Climate-change risks are long term, but the impact on coal companies could be around the corner. Coal producers have used the recent strength in coal prices and financial markets to extend their debt maturity profiles. However, rising interest rates and less-supportive lending policies may require these companies to fund themselves with internal cash flows. Coal prices hit a six-year high in July 2018, so cash flows have been strong. However, while some companies have used the favorable environment to repay debt, others have increased spending on capacity expansion. This could lead levered coal producers into difficult credit conditions when large maturities come due beginning in 2021 (see chart 2). Coal producers may find that refinancing is significantly more difficult than it has been in recent years.

The potential environmental impact of climate change could lead to new challenges for companies and their investors. The scenarios for carbon emissions and the Paris Agreement limits imply that the majority of global coal reserves can never be burned and may increasingly become stranded (meaning they may never be taken out of the ground). This could lead to material write-offs and more financing challenges. This is likely one of the driving factors

leading banks and investors to focus more on alternatives to coal, due to concerns that carbon assets will not be monetized to repay debt.

Just How Serious Are The Consequences Of Asia Exceeding Carbon Budgets?

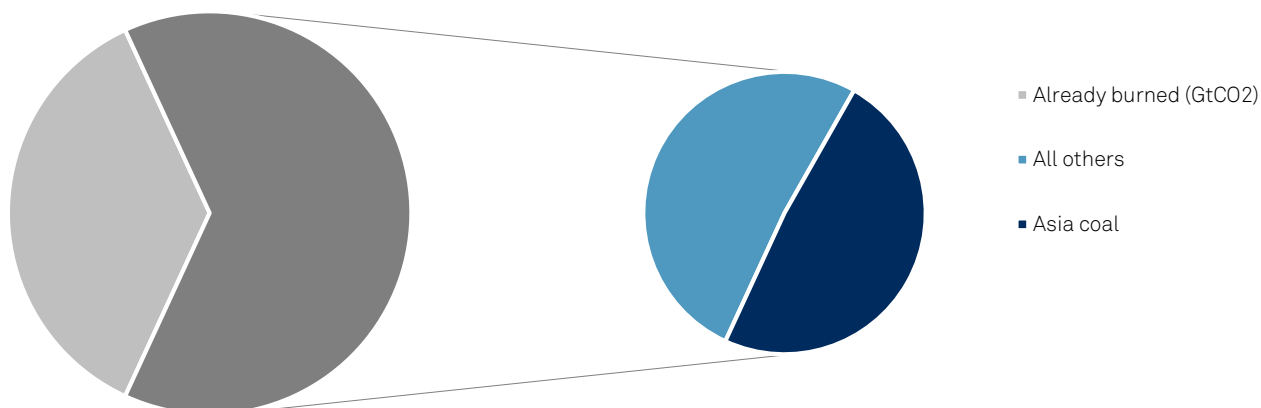
The World Resources Institute estimates that emissions must peak by 2020 and decline to well-below 2010 levels before 2050 to meet the targets set forth in the Paris Agreement. However, this could be difficult, given the multiple construction projects planned to meet rising energy demands. China, India, Indonesia, and Vietnam are slated to build three-quarters of the new coal-fired power plants over the next few years.

The UN Environment Program estimated in 2017 that existing and planned coal power plants in Asia will release 275 giga tons of carbon dioxide (GtCO₂). The Potsdam Institute for Climate Impact Research, a German government-funded research institute, calculates that to have an 80% chance of keeping global warming below 2°C, the global carbon budget for 2000-2050 is 886 GtCO₂. However, the Carbon Tracker Initiative estimated that 321 GtCO₂ was already emitted by 2011, leaving 565 GtCO₂ as the remaining budget for the period to 2050 (see chart 1). This means Asian coal would use about half of the remaining budget, leaving little for oil and gas fueled power, industrial use, transportation, construction, and agriculture, let alone emissions in the rest of the world.

Chart 1

Asia Is Expected To Use Much Of The World's Long-Term Carbon Budget

Coal power in Asia could use around half of 2050 climate-impact emission targets



GtCO₂--Giga tons of carbon dioxide. Source: Potsdam Institute of Climate Impact Research and UN Environment Programme.

Exceeding this budget could have a material, long-term impact across the region. This could result in coastal flooding, food shortages, air pollution, loss of biodiversity, and disease. The Global Climate Risk Index identifies six of the world's 10 countries most affected by climate change are located in Asia, with four in Southeast Asia. Also, S&P Global Ratings estimates that Cambodia, Vietnam, and Bangladesh are the most vulnerable countries to climate change. Nineteen of the top 25 cities affected by a one meter rise in sea level are located in Asia, while worsening monsoons and typhoons could also lead to some of the worst flood damage in the world.

The Asian Development Bank (ADB) estimates 410 million Asians are at risk of coastal flooding by 2025, and tens of millions of people could be displaced. Food shortages could increase as crop yields drop, with the ADB estimating each 10% increase in food prices would push 64 million people into poverty. Nearly all coral reefs would be bleached, and health concerns would increase due to air pollution. Insect borne malaria and dengue would increase. Harvard University estimates air pollution would already cause 3.3 million deaths globally, led by China, India, Pakistan, and Bangladesh. These consequences could lead to increasingly adverse regulations for greenhouse gas emitters, including coal producers

It's Complicated, But Alternatives Solutions Are Developing

The positive benefits and negative consequences of coal use are colliding. The International Energy Agency estimated that 65 million people in Southeast Asia don't have access to electricity, and another 200-300 million in India. Access to electricity has a multiplier effect by improving education, productivity, poverty, health, and food security. Coal is generally cheaper in Southeast Asia, with research consultancy Wood Mackenzie estimating the cost at around US\$60 per megawatt hour compared with over US\$200 for roof-top solar plus storage. Additionally, coal is abundant, especially in Indonesia, at a time where varied fuel sources will be needed to meet growing demand.

Realistic and affordable alternatives to fossil fuels are emerging for companies, consumers, and policymakers. And there are several ways that Southeast Asia can achieve the sustainable development goals of both affordable and clean energy as well as the climate action goals outlined in the Paris Agreement. Renewable technology is increasingly cost competitive with coal--especially older, less-efficient coal technologies.

Additionally, many remote island areas don't have easy access to coal generation. Rural areas with low population density can see grid connection costs exceed US\$300 per megawatt hour, so localized solar may be a cost-effective option compared with coal in these areas.

Battery and storage costs remain a challenge, but a focus on technology development and improvements could significantly change the overall dynamic. Wind, geothermal, and hydropower, and bioenergy technologies are also becoming increasingly cost competitive. New carbon capture and sequester (CCS) technologies are expensive but also could help.

Bank Policies And Investor Focus Are Shifting

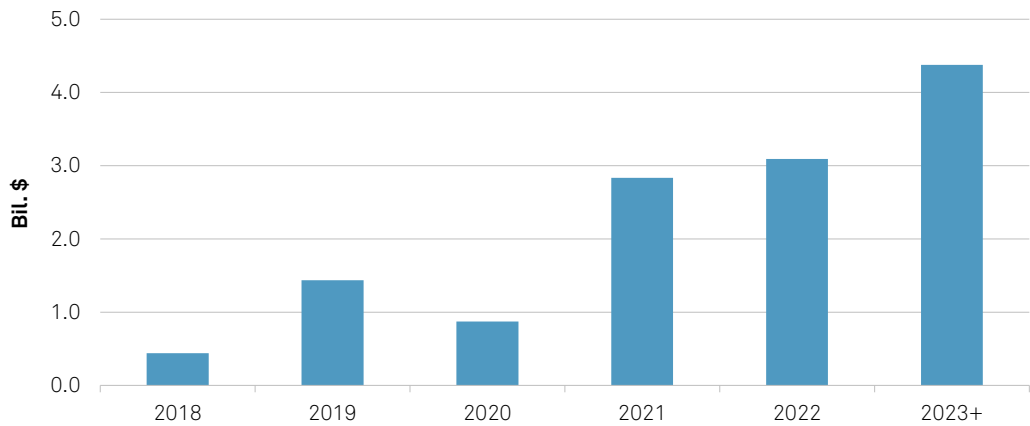
A number of large banks, both global and regional have instated policies to end financing to new thermal coal mines. Others have created policies to stop financing less-efficient subcritical power plants, low grade coal mines, or coal-related projects in developed markets. At the same time, international organizations like the G20's Task Force on Climate Related Disclosures are recommending that banks further assess and disclose climate-related risks and opportunities.

Investors and lenders are experiencing a similar shift in focus towards less carbon-intensive investments. The California Public Employee's Retirement System (CalPERS), Manulife, and Australia Super, were among investors that designed the "Climate Action 100+" initiative to engage with greenhouse gas-emitting companies. Some 289 investors have signed the initiative, and collectively manage around US\$30 trillion. Additionally, the World Bank and ADB are spending about 30% of their funding on climate change projects.

Given such developments, Southeast Asian coal producers could face colder markets when they seek to refinance in the future.

Chart 2

Maturity Profile Of Southeast Asia's 25 Largest Coal Companies



Source: S&P Ratings and Market Intelligence Data.

Navigating The Risks Will Be Tricky

The risks of increasingly challenging refinancing, adverse regulations, and lender risk aversion to stranded assets will like play out over the next two to three years. They will also provide more of a challenge to levered companies than to coal producers that have used favorable recent conditions to reduce their debt levels. Over the longer term, these less-levered companies should also be better positioned to adapt to changing market conditions, diversify their operations, or invest in developing new technologies. Still, a growing focus on sustainable energy will be a key credit risk that all coal companies in the region will have to navigate.

What's Behind The Rise In Green Covered Bond Issuance?

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The issuance of "green" covered bonds--backed by assets that are considered to have a positive environmental impact--grew strongly in the first half of 2018. As market activity increases, investors are inquiring more about green covered bonds and the nature and challenges of green finance. In this credit FAQ, we address questions we frequently receive on this topic, including what is driving green covered bond issuance, how our credit analysis could reflect green factors, and how we assess the environmental quality of financings through our Green Evaluation.

Table 1

Recent Green Covered Bond Issuance

Issuance date	Issuer	Maturity (years)	Size (bil.)
June 2018	DNB	7	€1.5
June 2018	LBBW	5	€0.5
May 2018	Landshypotek	5	SEK5.25
January 2018	Sparbol	7	€1.0
November 2017	Deutsche Hypo	6	€0.5
June 2017	Berlin Hyp	6	€0.5

SEK--Swedish krona.

Despite the recent rise in issuance, there is still plenty of scope for growth. The volume of green covered bonds only represents a fraction of the broader covered bonds market. S&P Global Ratings expects that the proportion of green covered bonds could rise significantly as regulators push for greener finance and banks focus increasingly on underwriting the financing of green assets (see "[A Look At Banks' Green Bond Issuance Through The Lens Of Our Green Evaluation Tool](#)," published March 2, 2018).

In our view, the emergence of green covered bonds highlights the growing prominence of green finance in the traditional area of covered bonds and offers an alternative mechanism for banks to contribute to financing global climate commitments.

Frequently Asked Questions

What is driving green covered bond issuance?

The increased interest in green lending in recent years, and the subsequent rise in green funding by banks, reflects three main factors:

- New political initiatives, particularly in Europe, aiming to address climate change by incentivizing green mortgage lending. Public sector covered bonds offer more potential to fund the public sector's green energy transition, as well.
- Issuer demand, driven by the reputational benefits associated with green issuance, greater sophistication in identifying the green attributes of loans, and potential access to a new and more diversified set of investors.
- Investors' green investment mandates and greater awareness and understanding of the environmental benefits of the assets backing the covered bonds.

How will these driving forces affect the issuance of green covered bonds?

Projects driven by political initiatives, such as the Energy Efficient Mortgages Initiative (EeMAP), all but guarantee increased growth in green covered bonds. EeMAP is a mortgage-financing mechanism that promotes the green tagging of mortgages, incentivizes building owners to improve their building efficiency or acquire new green properties at preferential interest rates, and collects data through a systematic framework.

Identifying the green credentials of existing assets and efforts to expand covered bond funding to new green asset classes will likely reshape the focus of loan underwriting. It will put more emphasis on green attributes and create further requirements for program documentation and public disclosure, while allowing issuers to attract new investors.

In turn, new investors may increase total demand or generate more-stable demand, influencing bond pricing and liquidity in green covered bond series. Given the relatively small number of green covered bonds issued to date, we expect the demand for green covered bonds to continue to outstrip supply in the near term.

What is a green asset?

Green cover pools have largely comprised green mortgages. These types of green properties, whether new or refurbished, residential or commercial, offer significant potential to improve energy efficiency since the building sector accounts for over 30% of all global energy-related CO2 emissions (Source: UN Environment, "Global Status Report 2017").

However, the concept of a green asset extends beyond green mortgages. While there is no common definition of what constitutes a green asset, projects involving assets for generating renewable energy (solar, wind, hydro, landfill gas, geothermal, and biomass), sustainable transport methods (rail infrastructure and electric vehicles), buildings with green certifications, and water conservation equipment are generally considered green. Other assets such as efficiency improvements to fossil fuel-based power plants and nuclear plants in some cases qualify as green, but this categorization is sometimes disputed.

How many traditional covered bond mortgage assets are green?

The prime focus for green cover pools has been on green mortgages. It is hard to say what proportion of traditional covered bond mortgage assets are green, as issuers have previously had difficulty identifying the green loans they have already underwritten--both commercial and residential. The current set of green covered bonds use different eligibility criteria for green buildings, which range from financing or refinancing new energy-efficient buildings to refurbishing existing commercial or residential properties.

To identify green loans, banks use certain recognized building certifications, including Energy Performance Certificates (EPC), building codes, analysis from independent consultants, and standards such as the Building Research Establishment Environmental Assessment Method (BREEM) or Leadership in Energy and Environmental Design (LEED). However, identification is made difficult by certification definitions and methodologies varying across countries, resulting in a lack of comparability. Additionally, exacerbating these issues are challenges accessing the energy performance of buildings and EPCs due to privacy concerns and data access constraints in certain countries, which further limit banks' abilities to differentiate their green mortgage lending.

The Energy Efficient Data Portal (EeDaPP), under the EeMAP initiative, is aiming to address this by developing a standardized European framework to capture technical and financial data related to mortgages on energy-efficient properties and to utilize this data to assess the correlation between energy efficiency and financial risk.

Could other covered bonds types play a role in green finance?

Covered bonds backed by public sector debt may offer an attractive source of green finance, particularly if political will supports the public sector (municipalities and regions) to playing larger role in encouraging green investment. Issuers of public sector covered bonds could use their loyal investor base to offer attractive funding for future public sector green projects such as renewable energy-generating installations on public sector facilities or funding for other green infrastructure.

What challenges do traditional covered bond structures pose for green issuance, and how are these being addressed?

Traditional cover pools consist of a mix of green and brown assets of different maturities. The dynamic nature of cover pools makes the documentation of the use of proceeds a key focus for green covered bond investors to ensure the assets backing the green covered bond remains green. Green covered bonds are associated with a sub-pool of the cover pool that is made entirely of green assets and relies on these assets for the green ranking. To our knowledge, there is currently no cover pool consisting entirely of green assets. Credit ratings consider all assets in the issuer's cover pool, and assign the same rating to all covered bonds issued from a cover pool program. While green covered bonds encourage green investments and specific issuances are backed by sub-pools that are entirely green, cover bond programs may be relying on brown assets for the necessary credit enhancement for the assigned credit rating.

In an effort to expand the covered bond setup for alternative green assets, legislative reviews are underway to broaden covered bond issuance beyond the existing framework--which focuses mainly on mortgages and public sector lending--to new asset classes, such as renewable energy. A notable example is the Luxembourg covered bond law to finance renewable energy infrastructure loans.

Do S&P Global Ratings' credit ratings reflect green factors?

Our ratings criteria (see "[Methodology And Assumptions: Assessing Pools Of European Residential Loans](#)," published Aug. 4, 2017) make no direct references to green factors for the assessment of credit risk, and a green borrower profile is unlikely to mitigate credit fundamentals such as unemployment, divorce rates, and death. In addition, the limited availability of historical performance data has provided no evidence of lower risk and therefore has not allowed us to make a green adjustment to other credit factors in our criteria.

Our residential and commercial credit criteria do specify factors that may already indirectly consider the impact of green borrowers and collateral on overall credit performance. One such factor is property valuations, which drive loan-to-value adjustments in our criteria. If green attributes lead to higher valuations, the result is credit-positive. In our opinion, valuations should only reflect green attributes if they offer a permanent improvement to the value of the property.

For residential borrowers, affordability at origination (a key indicator of propensity to default), the type of loan amortization, and general underwriting standards are examples of other credit factors that our criteria already consider and which may reflect a green impact or incentives for residential borrowers to take out a green mortgage.

How does S&P Global Ratings rank green quality?

We rank green quality using our Green Evaluation tool, which we developed to help investors understand the environmental contribution of financings (see "[Green Evaluation Analytical Approach](#)," published April 26, 2017). The Green Evaluation is separate to a credit rating. It is an asset-level credential that assesses the relative environmental impact of a financing on a global basis. The assessment takes into account the net environmental benefits associated with the technology utilized over its full lifecycle relative to a local baseline and adjusted based on the sector's overall contribution to avoiding and coping with climate change, combined with our review of governance and transparency protocols.

The overall score provides a benchmark of green quality that investors and issuers can use to understand not just whether a transaction is green or not, but how green it is relative to other financings globally. The final score is expressed on a scale of 1 to 100 and further broken into quartiles, where E1 (100-75) reflects the greatest positive environmental impact.

How does S&P Global Ratings' Green Evaluation apply to a green covered bond?

The Green Evaluation is applicable to any green financial instrument, including green covered bonds. When assessing a green covered bond pool, our Green Evaluation considers the net environmental attributes associated with the underlying assets that generate the cash flow in the cover pool based on the total collateral value. Our assessment can cover the entire pool or a portion of it. The green assessment is independent of the rating assessment and does not affect key credit rating measures such as the target credit enhancement for a given rating. For green buildings, which have served as the chief asset for green cover pools, we differentiate the assets on the basis of whether they are new buildings or a refurbishments. Moreover, our analysis considers the type of building--residential or commercial--and the building's location to estimate the net benefits associated with each of the underlying assets.

The Green Evaluation is a point-in-time assessment and captures the environmental impact at the time the evaluation is complete. For cover pools, which are dynamic in nature, we consider the transaction's eligibility criteria to confirm that the proceeds will be reinvested in green assets and look for annual reporting that tracks proceeds allocation and the environmental impact of the pool. For an example of how we've applied our Green Evaluation to a securitization, see "[Green Evaluation: Ygrene Energy Fund Inc.'s GoodGreen Series 2018-1 Notes](#)," published April 10, 2018.

Should there be guidelines or minimum requirements for covered bonds to be considered green?

We believe that transparency, governance, and credibility are critical elements in assigning environmental value to green investments. There is an ongoing and widespread debate concerning what qualifies as green for the purposes of a green bond, including green covered bonds, and whether there is a need for a set of standards to improve the integrity of the green bond market. Currently, there are a number of taxonomies globally that vary in terms of which assets they classify as green. This lack of standardization has prompted efforts to develop a common taxonomy for green finance, such as the European Union Action Plan for Sustainable Finance. However, investors' individual philosophies and investment goals complicate this effort.

Rather than define what green means, our Green Evaluation captures the fact that country-specific standards may differ from industry-accepted taxonomies and that investor preferences may also vary. In our assessment, we refer to the issuer's own definition of what constitutes a green use of proceeds, so long as we believe the project (or a discrete component of it) falls within the scope of our published approach. Importantly, we do not exclude technologies, but we differentiate between technologies that provide long-term systemic green solutions versus a reduction in environmental impact.

How is the green covered bond market overcoming the risk of "greenwashing"?

The green covered bond market is relatively new, fast-growing, and innovative. In such a burgeoning marketplace, there is a concern that green covered bonds might fall prey to greenwashing--in other words, that proceeds from green covered bonds will be misallocated to non-green projects.

The Green Bond Principles (GBPs) have become the established process guidelines that the majority of self-labeled green bond issuers use and that green investors around the world refer to (see "[Green Evaluations And Transaction Alignment With The Green Bond Principles](#)," published on April 6, 2018). The GBPs encourage issuers to obtain an external review to confirm that the bonds align with the principles. S&P Global Ratings can provide such a second-party opinion, when requested, through our Green Evaluation.

We believe that an independent, second-party opinion reflecting alignment with the GBPs, including a detailed review of the transaction documentation, should help alleviate fears of greenwashing.

Do green covered bonds offer a pricing advantage?

Across the green bond market, there have been a number of studies that point to a slight pricing advantage for issuers of green bonds, particularly in the corporate sector. To understand whether the value of “green” has had an effect on covered bond pricing, we compared the features and performance of green and non-green covered bonds issued by the same entity. We plotted the green covered bonds relative to each issuer’s interpolated yield curve based on mid yield to maturity at issuance. We chose issuers with a sufficient sample size to plot a curve, Deutsche Hypothekbank and Berlin Hyp, and we selected comparable bonds on the basis of similar credit characteristics.

We found that, for both banks, the green covered bonds priced inside the issuer's interpolated yield curve. In the case of Deutsche Hypo this was by around 30 basis points (see charts below). The “greenium” (green premium paid by investors) detected is likely due to the mismatch in the demand-supply dynamics of the overall green bond market at present and to the large green covered bond issue size. In the case of Berlin Hyp, its first green covered bond priced around 30 basis points tighter than its interpolated yield curve. We do however note that the second green bond issued by Berlin Hyp priced only 0.2 basis points lower than a comparable non-green bond issued around the same time, suggesting that a second green issuance may not maintain a pricing differential or that prevailing market characteristics at issuance could have a greater impact on pricing than the green features of the covered bond, among other factors. In the corporate sector, the pricing advantage for green bonds relative to non-green bonds is around 2-3 basis points on average.

We note that this analysis is limited by the fact that only Berlin Hyp has completed two green covered bond issuances. Indeed, the lack of data points and relevant comparable non-green bonds across green covered bond issuers makes interpretation challenging. Overall, we caution that these findings are based on a small sample size, which precludes us from being able to draw a firm conclusion over whether a "greenium" exists. It nonetheless provides additional case studies for green covered bond issuers.

Chart 1

Deutsche Hypo: Green Versus Non-Green Covered Bonds

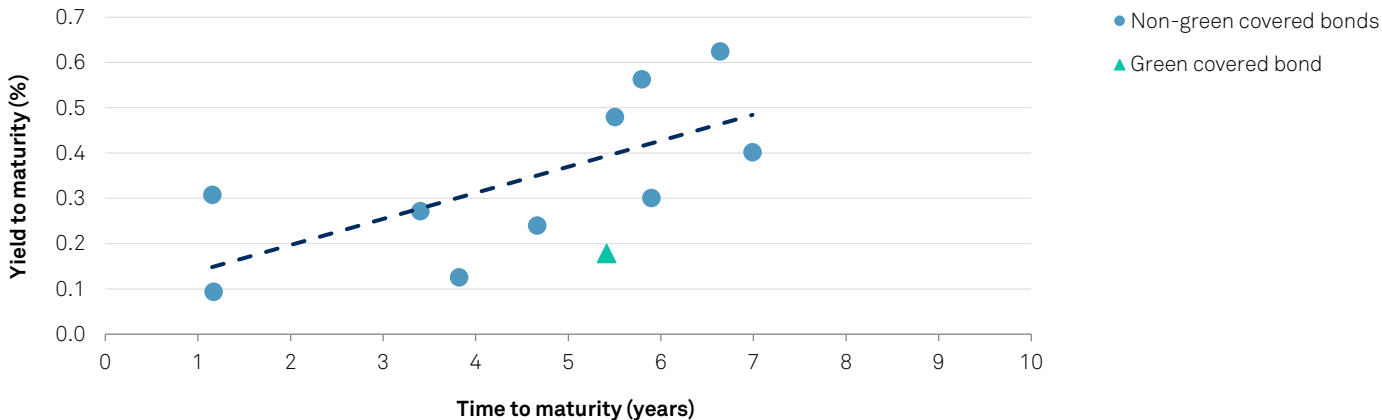
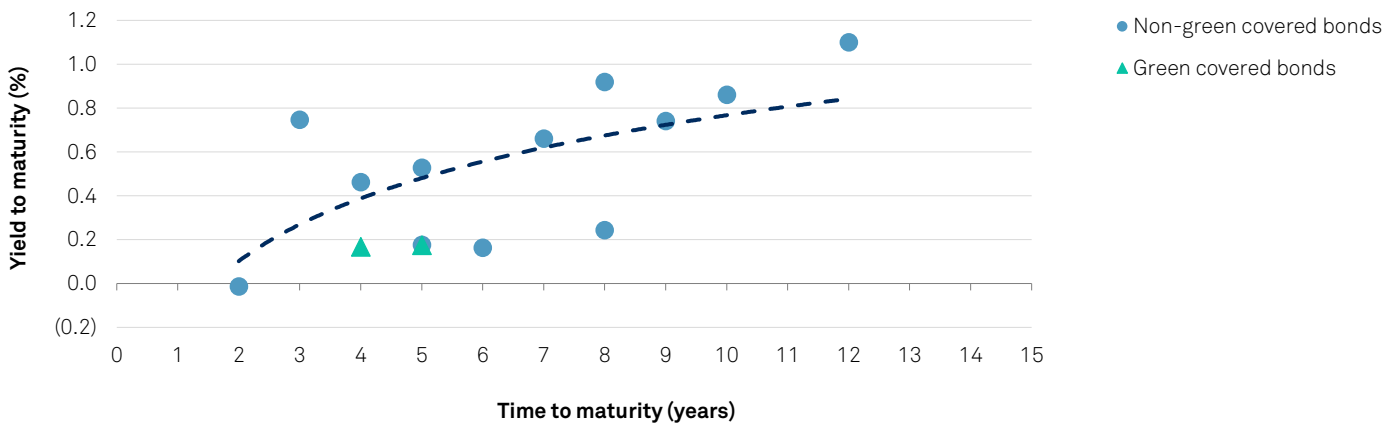


Chart 2

Berlin Hyp: Green Versus Non-Green Covered Bonds



How does S&P Global Ratings see the future for the green covered bond market?

The green covered bond market remains relatively small, but the growth potential is significant, in our opinion. We expect that green covered bond issuance will rise thanks to continued efforts to improve the identification of the green assets in bank lending, legislative initiatives to improve transparency and disclosure around green lending, and the expansion of the covered bond model to new asset classes. Some market participants believe that investor demand for green issuance could help compensate for some of the effect of the slow but sure exit of the European Central Bank from the covered bonds market.

As the market becomes more sophisticated, we anticipate that investors will increasingly look to assess green covered bond issuances not only for credit risk, but also for their relative environmental contribution.

What The Evolution Of Smart Cities Will Mean For The Environment, The Grid, And The Rest Of Us

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The smart city is coming. The vision is a city where innovation and advances in sustainable power generation, energy efficiency, non-polluting vehicles, and changes in local and regional electricity grids combine for an environmentally friendly metropolis. And in the smart city, these developments will be tied together by embedded and interconnected digital technology that makes for a cleaner, more efficient, and greener future.

What happens, however, when policymakers consider these new disruptive technologies as a whole? Will their development be driven by politics or by economics? Will consumers see adequate and clean power supplies at sustainable prices? And will the collective benefits compound linearly, or exponentially, or not at all?

Key Takeaways

- Smart cities depend on significant policy planning and data and technology management to attain cleaner air, energy-efficient construction and transportation, and better consumer control over power use.
- Small independent power grids formed under the option of community choice aggregation are poised to further disrupt power markets and have already created financial challenges for some power producers.
- The financial consequences of the transition toward smart cities will vary by issuer type, but we see positive environmental effects, as some of the technologies can be assessed through our Green Evaluation tool.
- A more data-intensive grid comes with serious risks, including cybersecurity vulnerabilities posed by the large number of devices that have to be connected to the Internet.

Smart cities lie at the convergence of politics, technology, service delivery and energy. While the potential benefit to consumers from disruption will vary, the effects could be much greater for some of the major players in the energy grid as it decentralizes. Our Green Evaluation tool has helped shed light on how various decarbonizing technologies, whether renewable energy, electric vehicles, energy efficiency, or battery storage, can affect individual financings from an environmental standpoint; additionally, the ability to manage these risks can influence credit ratings, as evidenced by a lookback study performed by S&P that concluded a significant number of ratings actions had been driven by ESG shortcomings.

In this article, however, we take a broader look at how incumbent members of the energy system, mostly corporate and project financed, are going to fare under these new business models from a credit, business, and environmental standpoint. We will look at how credit metrics could change directionally and how fast they could change, especially among different types of power producers. And we will see how environmental ambitions are playing into decisions on energy production and usage.

The Corporate Credit Impact Of Smart Cities

The comprehensive nature of smart city planning suggests that over the long term the credit quality of many types of issuers, including utilities, independent power producers, and technology firms, could be significantly affected. But the magnitude of these credit implications for corporate issuers, regardless of industry, hinges on several critical and, as yet, unanswered questions:

- How quickly will smart cities proliferate? Our ratings forecasts typically reach out around three or four years for investment grade issuers, so we'd need to understand when key credit metrics (for corporates, the funds from operations-to-debt or debt-to-EBITDA ratios) would begin slipping (or improving, depending on the issuer). Industry risk remains the foundation of our corporate methodology, so understanding which industries will experience the most disruption is critical.
- Will the changes be driven more by policies or economics? Secular economic changes may be more enduring, while policy decisions can be more easily reversed based on the changing popularity of the policy or policymaker. Both policy and economic factors could influence "competitive advantage", a key part of our corporate ratings methodology.
- What level of capital spending is required to capture the benefits of the smart city transformation, and how will it be financed? Increases in debt intended to capture the upside from this transition could lead to weaker ratings if there is a large gap between the spending and the related benefits. That would cause higher leverage. Substantial capital spending can also impact operating efficiency, making the rated entity's cash flows more volatile as revenues become less predictable.
- Are management teams reactive, or proactive? That is, will they be capturing the benefits of this shift or responding to them from a defensive position? Management and governance continues to be a critical modifier to our corporate ratings methodology.

As the green bond market continues to develop in U.S., where its growth has historically been slow, corporate entities looking to fund smart city developments could look to this market to fund their efforts. Given the enormity of the task at hand, the name of the game in smart city development is coordination and planning how to efficiently allocate scarce funds to attain maximum benefits. This comports with standard green bond principles, which require transparent allocation of issuance funds, as well as detailed reporting of the environmental impacts, which we believe can be achieved by leveraging the immense amount of data that advanced technology can now generate.

Under our green evaluation analytical approach, we have already captured a variety of the asset classes (renewable energy, energy efficiency, and transportation) that are critical for smart city growth. Moreover, we continue to expect that while numerous asset classes are growing within the green bond space, utilities could tap this market, especially if interest rates begin to rise as expected. That would be consistent with utility mandates toward energy efficiency in 47 states and renewable portfolio standards in 29; clearly, these are asset types that fall within the

purview of the labelled green bond universe. Our green evaluations can be used to assess some of the positive environmental effects of the transition toward smart cities.

We will continue to evaluate the financial consequences of the transition toward smart cities, which we believe could vary based on how they are implemented and the projects' efficacy.

The Politics of Smart Cities

The election of President Trump, a champion of coal who has also signaled a withdrawal from the Paris Agreement and seeks to end the Clean Power Plan, initially alarmed U.S. environmentalists. However, so far, the feared outcomes have not materialized. U.S. government statistics show that coal plants in the U.S. continue to close at an astounding rate, leading to an expected loss of 14 gigawatts (GW) of coal-fueled power in 2018, or approximately 7% of coal's 2017 total. Meanwhile, renewable generation continues to proliferate, with an additional 10 GW of solar power alone in 2017--up nearly 25% from the year before. In addition, because of more deliberate energy conservation and efficiency power demand growth, once closely tied to GDP growth, declined by about 80 terawatt hours (TWh), or around 1%, in 2017 from a year earlier (though some of this could also be attributed to weather). There are two broad reasons for these advances in green power despite the opposition of the Administration: The economics of many of the components to make smart cities, both energy and data related, have become more favorable, while some localities, particularly those in states with environmental goals, have instituted smart city policies on their own, without looking to the federal government for support or leadership.

One key component of the smart city concept is to transform the way people consume energy, with progressive coastal cities in the U.S. leading the early charge; San Francisco and Boston, for instance, have received strong marks for greening their footprints early in the process, especially in the realm of energy efficiency. Even when smart cities come together in a more piecemeal fashion, they feature a high level of integration among various energy assets. For example, if the goal is to cut the carbon footprint, it makes little sense to give consumers an incentive to buy electric cars (such as a free charging station) if the marginal fuel used to produce electric power in the region is a severe pollutant like coal.

Improved data collection makes the interconnectedness of operations possible. Market forecasts suggest a sharp increase in the internet of things (IoT, or the interconnection via the internet of computing devices embedded in everyday objects) to about \$457 billion in annual spending by 2022, according to recent Forbes magazine estimates. Of this total, we expect about 26% to be invested in smart cities by a variety of parties, including utilities and municipalities. We expect another 25% to come from the sale of devices for the smart homes, vehicles, and utilities that we expect to be critical in building a smarter American city and making Americans shrewder consumers of resources--a critical step in transforming the U.S. grid. The increase in data and interconnectedness through the IoT brings the possibility of great efficiencies, but also entails risks that will have to be considered regarding data safety and a different kind of resilience and protection from hackers.

Although the partisan chasm is wide and deep in Washington, rebuilding crumbling U.S. infrastructure seems to be an issue that may bridge the divide while also helping to accelerate the development of smart cities. By virtually all accounts, America's infrastructure on the eve of the 2020s will have degraded to such a degree that it threatens to disrupt economic growth if not addressed. In our opinion, smart city solutions provide a more efficient, sustainable, and enduring approach to overhauling infrastructure. By any estimate, the infrastructure financing needs will be enormous. We anticipate, however, that smart city development, with its stated

goal of a sharp reduction in natural resource utilization, can help reduce those infrastructure costs--a critically important consideration as the proportion of the citizenry living in urban areas continues to increase, both in the U.S. and globally.

In the U.S., we believe that the sophistication of cities, and the penetration of smart city technology, is going to occur largely at the confluence of economics and policy, and policy, especially, would seem to be a requisite for getting smart cities off the ground, while economics will provide the underlying longer term benefits. The opportunities for cost and carbon savings are most pronounced in highly populated areas that can benefit from distributed generation, reduced transmission building, electric vehicle penetration, and more advanced heating tactics. In some densely populated areas of the U.S., for example, energy consumption per capita is already remarkably low, thanks in part to more public transit and less vehicular traffic.

Green Policies

Given the large-scale planning responsibilities that municipal governments and authorities will need to undertake to implement smart cities tactics, we are more likely to see smart city policies implemented in jurisdictions that have already instituted environmentally conscious policies, and are instituting their own carbon regulations in lieu of a firm federal policy. These jurisdictions are considering everything from mandating the installation of solar panels on new homes, as California has recently done for post 2020 constructions, to favoring the use of electric or natural-gas fueled buses.

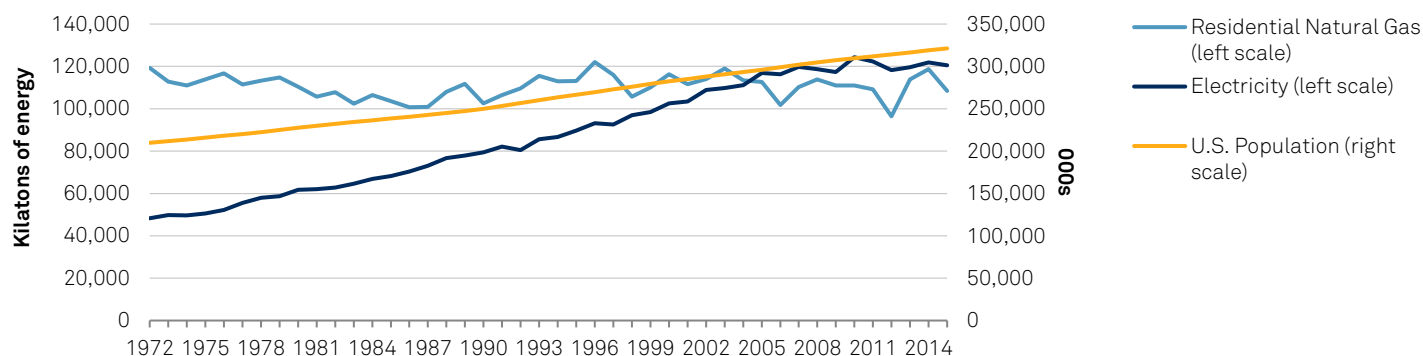
Energy efficient buildings

One of the tactics used by state and local governments to reduce carbon footprints is to improve the efficiency of buildings. As a result of this commitment to energy efficiency, between 1972 and 2015, despite a soaring population, residential natural gas usage remained essentially flat. Moreover, during the latter part of the period, electricity usage also flattened. The International Energy Agency continues to see declines in energy intensity as critical to sustained carbonization, with global energy intensity dropping by about 1.7% in 2017.

While many of these governments have taken advantage of the opportunities to improve their building efficiencies, the potential for advanced building codes that result in less energy use remains substantial. For example, some jurisdictions also offer energy reduction loans and energy efficiency audits. Participation in these programs, estimated at only 4% by the National Renewable Energy Laboratory, has fallen far short of their potential, highlighting the potential for continued improvement in this area.

Chart 1

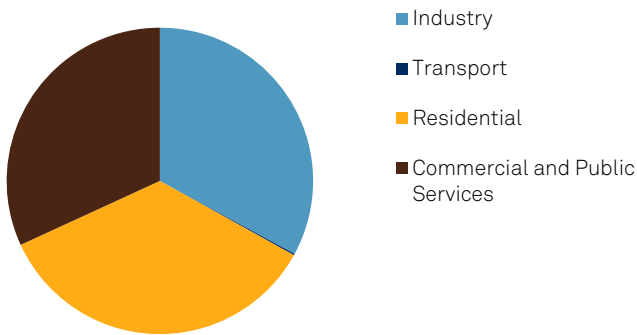
Residential Energy Usage



Source: Federal Reserve Bank of St. Louis, International Energy Agency.

Chart 2A

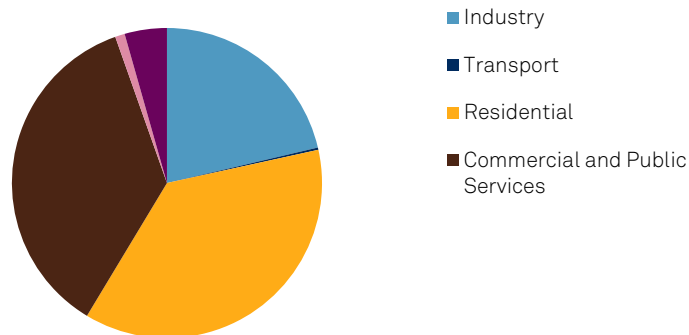
Energy Consumption 1990



Source: Energy Information Administration. Note: Transport represents less than 1% of energy use.

Chart 2B

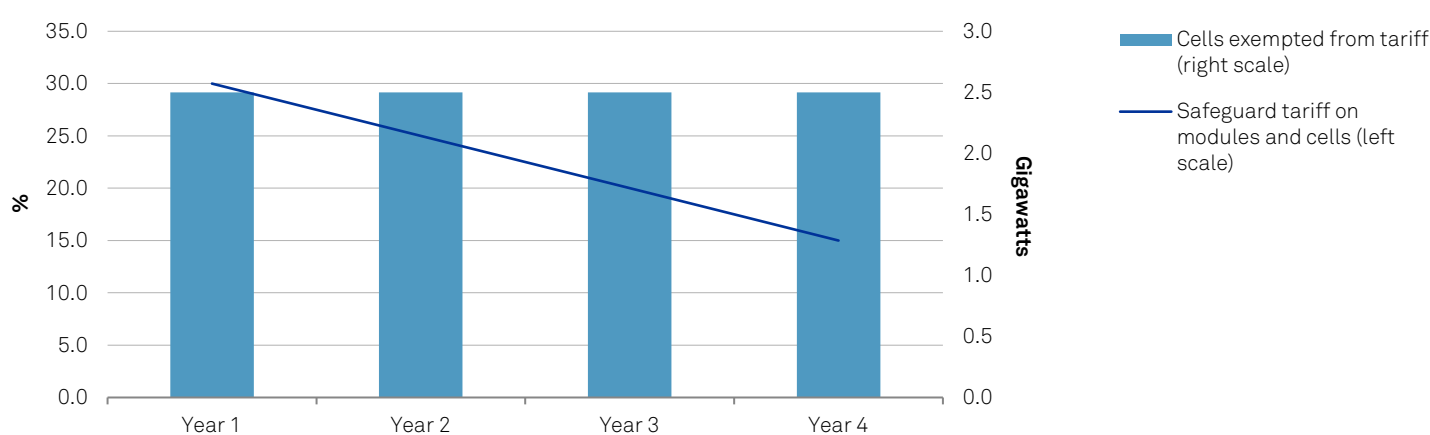
Energy Consumption 2015



Source: Energy Information Administration. Note: Transport represents less than 1% of energy use.

Chart 2C

Solar Tariffs



Renewable energy and distributed generation

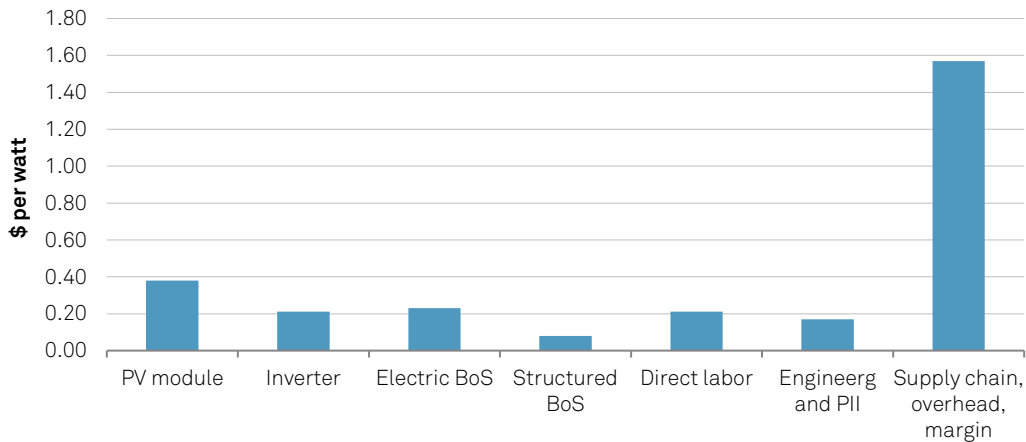
If using less energy to produce the same output is one-half of reducing carbon emissions, the more obvious other half is creating power with less carbon to start. One of the more promising avenues for greening city infrastructure is the greater proliferation of rooftop solar panels. At present, we estimate that only about 1% of nationwide rooftop solar potential is being realized. This figure seems slated to grow, however. The cost of solar panels continues to decline, having already dropped by over 50% during the past eight years (see Chart 5).

We believe state and municipal support of distributed renewable assets will be key to encouraging continued solar panel installation. At the national level, the continuation of the individual investment tax credit (ITC) through at least 2023 (the required installation date to collect ITC under current law), is also likely to propel rooftop solar installations during the next few years. Despite the headwinds from Washington on climate policy, tax benefits for solar installations seem to have attained a political consensus. Recent tariffs on solar panels could reduce further cost reductions through 2021 even as installed costs fall. We believe, however,

that the estimated increase of \$1-\$2 per megawatt hour may not significantly change the longer term trajectory of distributed generation, especially as state level policies continue to strengthen.

Chart 3

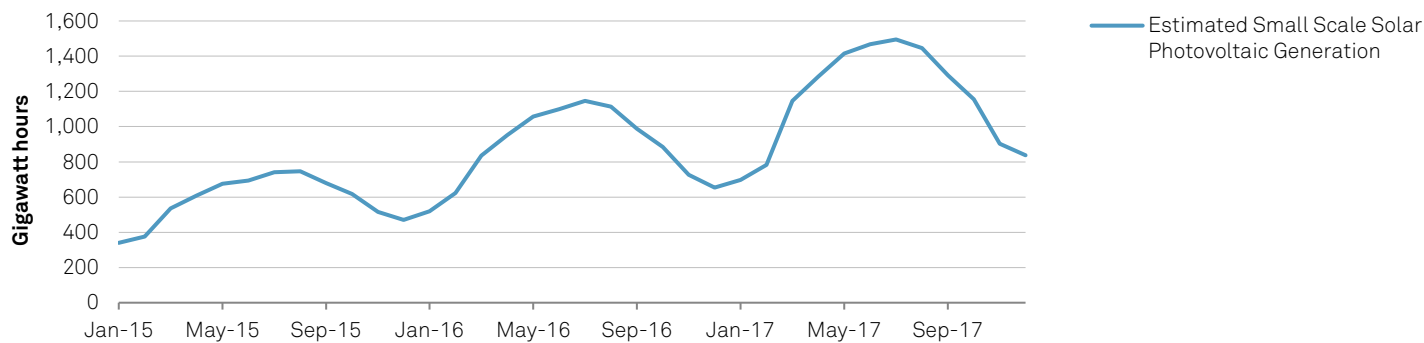
Residential Photovoltaic Solar System Costs



Source: National Renewable Energy Laboratory.

Chart 4

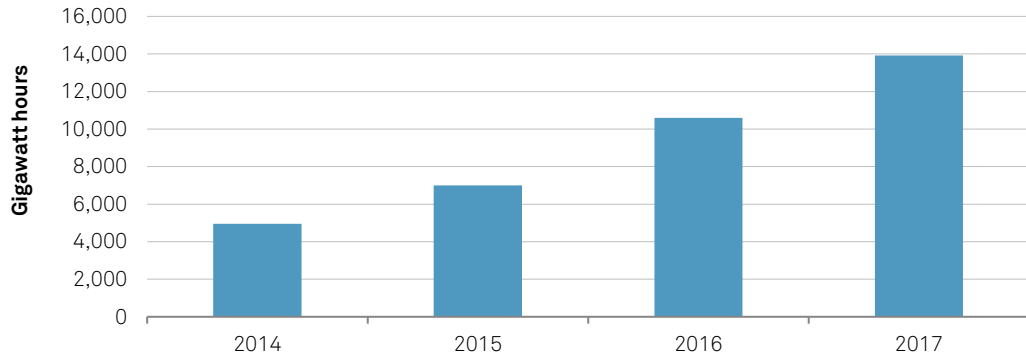
Residential Solar Output



Source: Energy Information Administration.

Chart 5

Estimated Small Scale Solar Photovoltaic Generation



Source: Energy Information Administration.

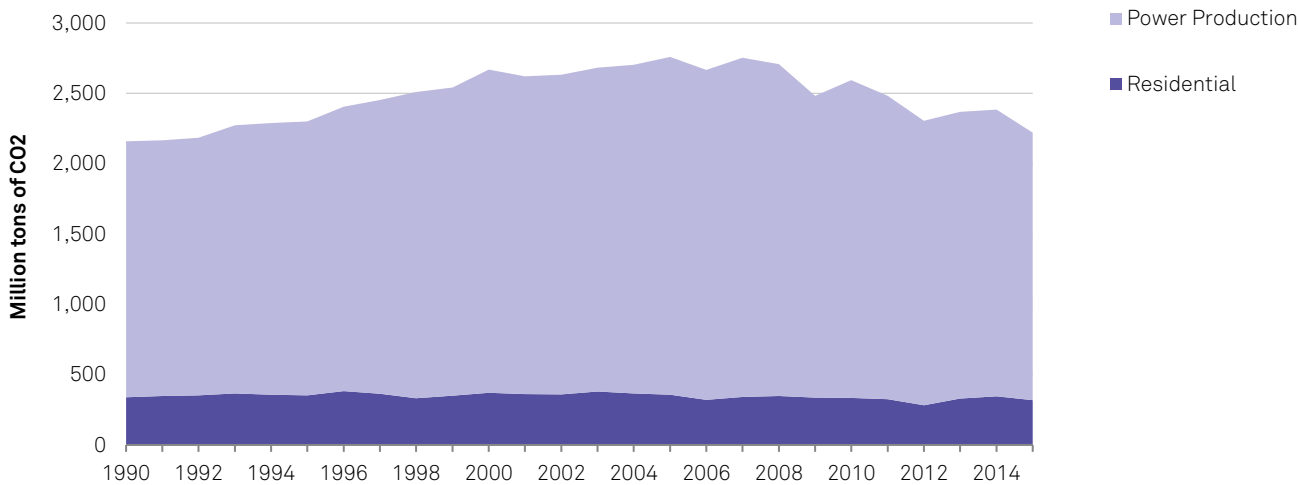
In addition, we could see environmental benefits over the next decade from building fewer transmission lines as residential battery storage improves and battery costs fall. As with much U.S. infrastructure, the transmission system in some regions is outdated and its eventual replacement will be expensive. This cost could be partially obviated in some areas by the greater use of renewable energy. The Edison Electric Institute (EEI), a trade organization for U.S. investor-owned utilities, estimates that about \$39.5 billion of transmission investment will be required in just 2018 and 2019. To put this into perspective, California, home to the country's greatest share of distributed generation (nearly six GW of behind the meter capacity as of early 2018) recently cancelled 20 transmission projects and revised 21 others, leading to an estimated \$2.6 billion in ratepayer avoided costs.

As we have noted before, while this initially appears to remove the utility from the generation framework to a degree, we have heard increasing discussions on the viability of Virtual Power Plants (supported by greater peer-to-peer communication), which can capture distribution level solar and batteries to replace aging generation and transmission systems for electricity and natural gas. The scale of these operations, however, is still very small in the U.S.

Of course, while the concept of distributed generation is very promising from a decarbonization perspective, it also introduces the potential for cost shifting. That is, indirectly, homeowners who have solar panels can be subsidized by their fellow ratepayers that do not, while the myriad fixed costs for transmission, reliability, and resilience that have historically been managed by both investor-owned utilities and municipal entities will ultimately be borne by a smaller contingent, one that might also be less able to bear significant cost increases. Efforts to revisit net metering rules could change the trajectory of installed residential solar.

Chart 6

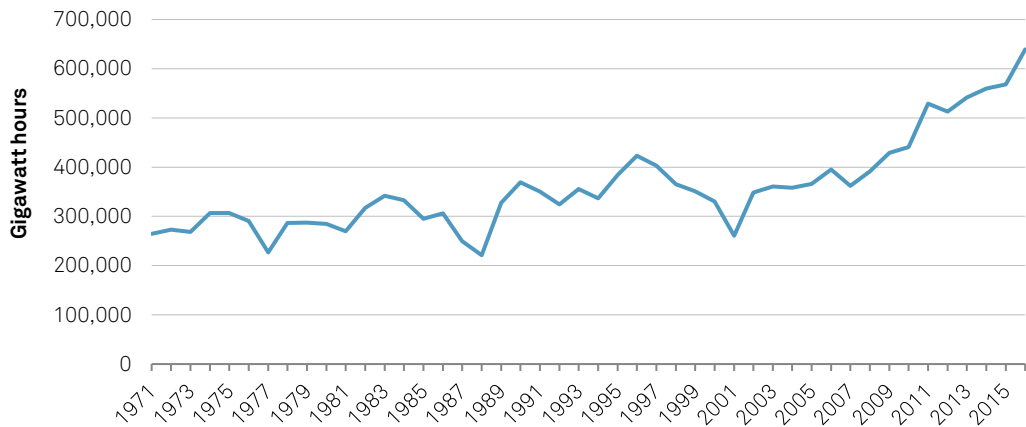
CO2 Emissions From Residential Users And Power Producers



Source: U.S. Environmental Protection Agency.

Chart 7

Residential Renewable Energy Output



Source: Source: Energy Information Administration.

Transportation

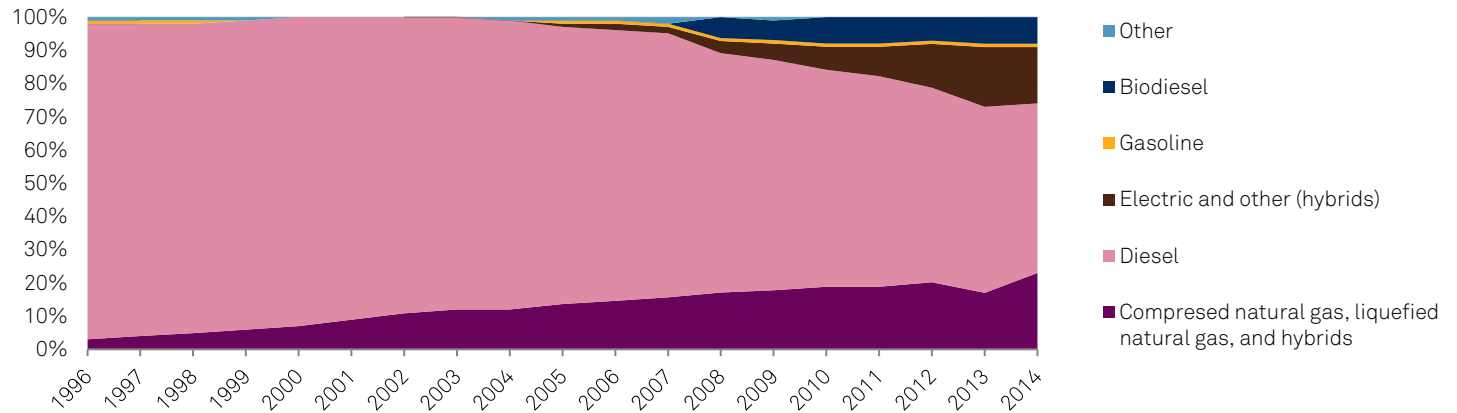
Many public transit providers have overhauled their fleet mix to reduce their carbon footprints, most notably with alternative fuel, electric buses, and other vehicles. High carbon diesel engines constituted as much as 95% of the American bus fleet as recently as 1997. That figure, however, has declined by nearly 50% in the past two decades as these alternative vehicles have fallen in price and policymakers have boosted their use to cut greenhouse gas emissions with the support of the Federal Transit Administration.

We anticipate that transit providers will increasingly look to hybrid and electric vehicles to reduce local carbon emissions, even in light of the revision to emissions standards proposed by U.S. Environmental Protection Agency head Scott Pruitt. This is a dynamic similar to how many utilities will look at ways to reduce greenhouse gases from the grid to reduce their carbon footprint even in the absence of a Clean Power Plan. The carbon savings from these transportation initiatives could be substantial even in a moderate abatement scenario where green mass transit resulted in 15% fewer private vehicle passenger miles. Moreover, the disruption in public transit vehicle fleets is likely taking its cue in part from the private sector, where long-haul trucking is facing mass conversions based on demand from large players like Walmart Inc., J.B. Hunt Transport Services Inc., and Meijer Inc. We also foresee significant increases in the number of individual electric vehicles during the next few years, although this is historically tied to the price of gasoline, which cities, no matter how smart, have limited ability to control.

Chart 8

U.S. Bus Power Sources, 1996-2014

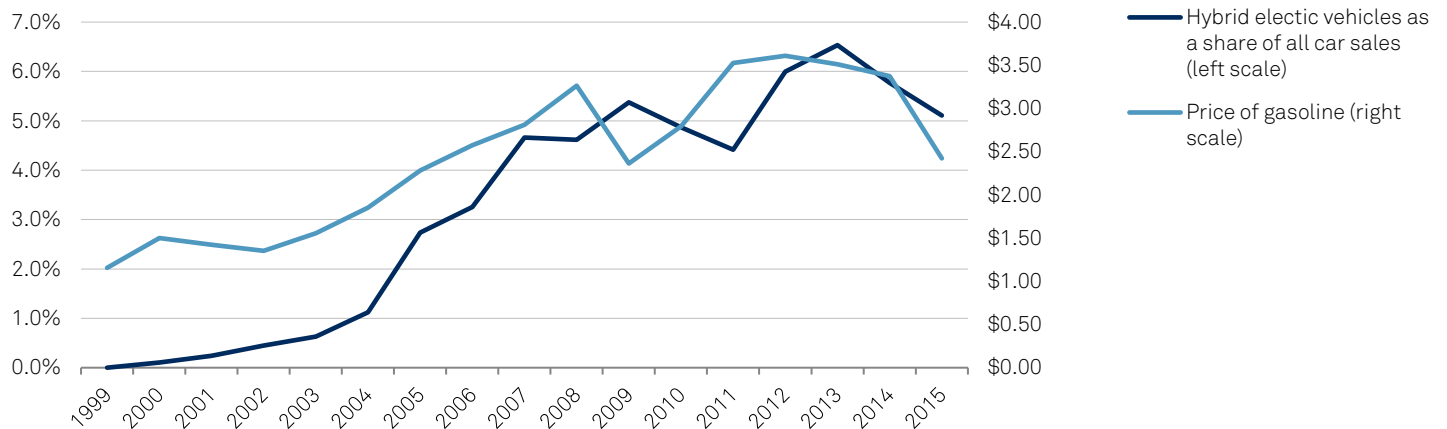
Share of total power sources



One increasingly vital piece of necessary infrastructure to support more electric and hybrid vehicles is the presence of sufficient charging infrastructure to effectively share the cost of ownership of an electric or hybrid vehicle. We see much of the development for this lying at the state and local levels, though this too is subject to budgetary constraints; additionally, local utilities, both public and investor owned, will be responsible for creating the appropriate incentives. Currently, according to World Economic Forum statistics, there are only eight charging stations for every 100 electric vehicles in the U.S., which is far fewer than in China, for example, where there are 23 stations per 100 vehicles. EEI estimates a need for about five million more charging station by 2025 to support the expected growth in electric vehicles. We also expect that state and local government legislation will be critical to bolstering the more nascent autonomous vehicle market. To some degree, state level policies have filled in the gaps. In 2017, the Regional Electric Vehicles Plan (REV) signaled the intention of nine western states to developed collective infrastructure to permit seamless access to major transportation corridors for electric vehicles; this followed the 2013 ZEV task force, including a different set of states that have committed to having the infrastructure to accommodate 3.3 million vehicles by 2025.

Chart 9

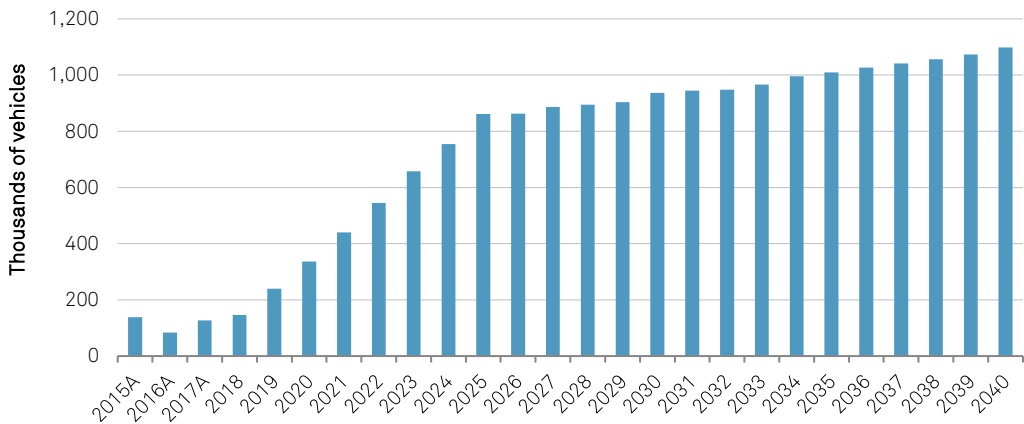
Sales Of Electric Vehicles And The Price Of Gas



Source: Bureau of Transportation Statistics, Energy Information Administration.

Chart 10

Projected Annual Electric Car Sales



Source: Energy Information Administration. A--Actual

Community Choice Aggregation And Smart Cities

Community Choice Aggregation (CCA) is a legal entity that can go outside the authority of the local utility and make their own selections on how to procure power. They could develop into extensions of smart cities, as there are few rules about how they must be formed, and no need for a CCA’s boundaries to be coterminous with a city or county. Only seven states permit the formation of CCAs: California, Illinois, Massachusetts, New Jersey, New York, Rhode Island, and Ohio.

Whereas smart cities have largely focused on creating individual incentives to increase distributed generation buildout, CCAs effectively allow one or more local jurisdictions to undertake utility scale projects with hundreds of thousands of consumers in the same aggregation. These projects can be greener and more cost efficient than existing utilities, and their size can help them manage the risk of opt-out, which can be heightened if the CCAs can’t ensure cost competitiveness. This is already an issue and could become more significant if a state’s renewable portfolio standards increase (as we expect they will).

CCAs now represent only a small portion of the grid. They could become more disruptive, however, in a state like California, where 13 already exist, including in large and affluent Marin and Sonoma counties. California’s CCAs have become larger in an effort to pool resources and combat climate change. In 2016, the state avoided 940 million tons of greenhouse gas emissions through its CCAs according to the CCA disclosures. The Sonoma and Marin county entities were formed even with the risk of opt-outs and despite the presence of substantial exit fees. A primary objective of such alliances is to further boost the use of renewable energy says the California Community Choice Association.

In both the aforementioned cases, those CCAs have renewable targets that outstrip even California’s lofty statewide goal of 50%. The reliability of this method would be bolstered by a continued decline in battery storage costs during the next few years, which threatens to be a major disruptor.

However, this could create a longer term policy challenge. If CCAs proliferate amid an effort to reduce carbon emissions, utilities could face the prospect of more stranded assets spread

across a smaller number of ratepayers and fewer megawatt hours. Therefore, utilities must be forward looking and potentially plan for defections from the grid. Nevertheless, this must still be put in the context of the prevailing market. In Illinois, formerly the hub for aggregation, a decline in wholesale market prices during and after the recession stalled the growth of CCAs.

Increasingly, we are fielding inquiries from banks on how we would rate CCAs as offtakers. While we do not have a methodology for rating such entities, it will become an important question. Under our project finance criteria, offtaker credit quality is a critical piece of the ratings puzzle.

The Electric Grid And Smart Cities

Clearly, the evolution of cities creates a possibility of changing power demand patterns, which could influence power pricing and capacity pricing. To be sure, revisions to our assumptions of demand growth have already adversely affected both capacity and energy pricing outcomes in the U.S., independent of the machinations of cities in changing their own resource consumption. Over time, we expect this shifting framework to have a disruptive impact on the U.S. generating grid as more cities with more sophisticated energy management tactics are likely to diminish demand and flatten demand curves, potentially eroding profitability for merchant generators.

It's a dynamic that accentuates trends already underway, including the delinking of economic growth and power demand, more renewable power (both distributed and utility scale) during peak demand periods, and persistently low gas prices. The latter, however, is not likely to be aided by greater energy efficiency in home heating, a tenet of smart cities. In California, where this pattern is already borne out through policies and shifting economics, the prospects for merchant generators have weakened substantially.

Although the U.S. is reducing its carbon footprint, some parts of the developed world are not, according to the International Energy Agency. This adds an extra level of urgency if green cities are to become a green world. After flatlining for three consecutive years, global greenhouse gas emissions rose by about 1.4% in 2017 while they fell by 0.5% in the U.S., aided by less energy use and more solar power. However, given the likely closure of some large zero-emission U.S. nuclear power plants in response to market pressures, the decline in greenhouse gas emissions could be halted without a more sustainable policy. In addition, progress toward smarter cities could be slowed without better assurances surrounding data security. This will continue to be an issue, even as investors increase their focus on environmental, social, and governance factors in making their investment decisions. How quickly and how well these issues are resolved will go a long way toward determining the future of the grid, the environment, and clean cities in the U.S.

A Look At Banks' Green Bond Issuance Through The Lens Of Our Green Evaluation Tool

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Even though green bonds represent a tiny proportion of bank borrowings, S&P Global Ratings expects that share to rise, supported by the fact that banks have a significant role to play in the transition to a low-carbon economy as key providers of funding. Banks have already boosted issuance of green bonds in the past few years, to \$27 billion in 2017 from \$1.5 billion in 2014 based on data from Climate Bond Initiative (CBI) that we adjusted to include green bonds invested in large-scale hydro or clean coal projects (see chart 1 below). Over the same period banks' share of green bond issuance rose to 16% from 4% and the number of banks having made their debut in the market increased to 72 from just five. Here, we present our findings of a review of almost all of the green bonds issued by the top 200 banks that we rate.

Key Takeaways

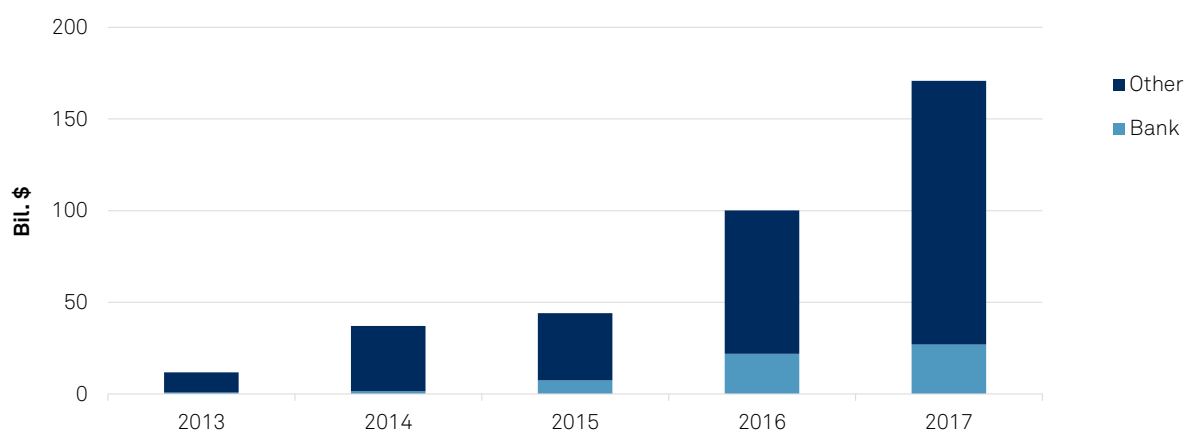
- S&P Global Ratings undertook a review of almost all of the green bonds issued by the world's top 200 banks.
- We found that issuance is growing fast but significantly below the amounts the OECD projects are needed to meet the Paris agreement targets.
- Renewable energy and green buildings represent the biggest share of banks' asset allocation for green bonds.
- Banks' green bonds are likely to receive an evaluation in the top two quartiles under our Green Evaluation because they invest predominantly in renewable energy and green buildings.

According to the OECD's report "Mobilising Bond Markets for a Low-Carbon Transition By 2035," annual green investment required for the 2-degree scenario will exceed \$4.3 trillion. In the EU, U.S., China and Japan, which represent the best established bond markets, the equivalent amount is \$2.2 trillion, with about one-third of that projected to be financed through loans. The amount of green bonds that banks are currently issuing is small compared to the OECD's estimates of required annual green investment. Green bonds can provide the means for banks to finance green investments. At the same time, we believe banks use their status as issuers of green bonds to other ends as well, particularly to demonstrate to stakeholders their own contribution to the transition to the low-carbon economy (see "[Climate Change-Related Legal And Regulatory Threats Should Spur Financial Service Providers To Action](#)," published on May 4, 2016).

The amount of green bond issuance represents a very small proportion, around 0.5%, of banks' total current borrowings, and a nominal amount of total bond issuance, about 1% in 2017. By comparison, green bond issuance by corporates was 2% of the total bond issuance in 2017. What's more, green bonds have not yet become a regular channel for raising capital for many banks, with 65% having issued only one so far. Yet, green bond issuance is not confined to the big banks; a little more than one-half of banks having issued green bonds are not in the top 200. At the same time, the large majority of the top 200 banks, about four-fifths, haven't issued any green bonds yet. Banks around the world may face peer and investor pressure to ramp up their efforts in the green bond market. (For a list of banks in the top 200 that have issued green bonds, see the appendix below. And for a list of the top 200 banks see "[Ratings Component Scores For The Top 200 Banks Globally--September 2017](#)," published on Sept. 29, 2017.)

Chart 1

Green Bond Issuance

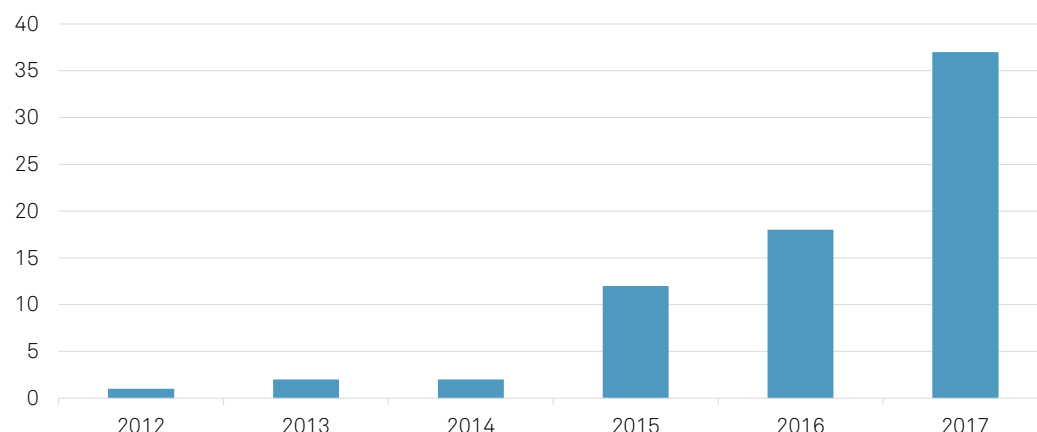


Source: Climate Bonds Initiative.

We expect all banks to continue to grow their share of green bond issuance in the near future. We think the EU's [Energy efficient Mortgages Action Plan](#) and opportunities offered by green securitization could provide further impetus to market growth. (We outline our views about the growth prospects of the wider green bond market in a recently published article, "[Green Bond Issuance Is Expected To Shoot Up Further](#)," published on Jan. 29, 2018, on RatingsDirect).

Chart 2

Number Of Banks Issuing Their First Green Bond



Source: Climate Bonds Initiative.

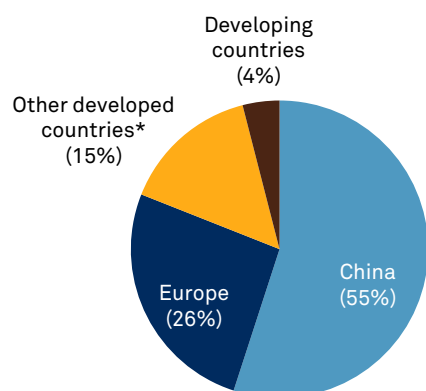
China's Big Contribution

Chinese banks have contributed significantly to the increase in green bond issuance following the government's decision to build a green financial system in China and the subsequent publication of green bond guidelines by the People's Bank of China (PBoC) in 2015. Chinese banks represent more than 50% of total green bond issuance by banks and around 40% of the number of green bond issuing banks.

Outside China, Europe is the most active region, representing around one-quarter of total issuance and the number of bank issuers. The geographic spread is very wide with bonds also being issued by banks in emerging markets such as Morocco, Colombia, India, and South Africa.

Chart 3

Breakdown Of Bank Green Bond Issuance By Region



*North America, Australia, Japan. Source: Climate Bonds Initiative.

What Is A Green Investment?

Many banks are still in the process of defining what green assets are. Admittedly, we recognize that just identifying green investments within a bank's portfolio is challenging, as highlighted in the The UN Environment Inquiry's report "Green Tagging: Mobilising Bank Finance for Energy

Efficiency in Real Estate.” Often, the disclosed amount of these green investments reflects the size of only the green portfolio backing the green bonds, which may not represent a bank's total green lending. There are many initiatives to define what green investments are. The reality is that there are shades of green depending on the investment's contribution to the transition to low-carbon economy. (This is the rationale for the approach we adopted in our Green Evaluation, see box). If banks understate their green portfolios, they face increased risk of unfavorable comparisons to their carbon-intensive portfolios, which some nongovernmental organizations are monitoring and reporting. As such, this could raise reputational risks.

Bank issuers rely on standards to define what green investments are, particularly the Green Bond Principles (GBP), which are the most widely used. A notable exception are green bond guidelines in China, which all Chinese onshore green bonds follow. The key differences between those two frameworks are the scope of projects allowed to be financed by proceeds of green bonds. The range of projects allowed under People's Bank of China (PBoC), which applies to banks, is wider and includes projects not explicitly included under GBP, such as fossil fuel power station upgrades and clean coal. In addition, GBP is a principles-based voluntary framework, which allows some flexibility, while PBoC rules are mandatory and embedded in regulation. There are no critical differences between both regimes in the requirements for the management and reporting of proceeds, so Chinese banks can follow international standards for their offshore issuance by restricting the scope of projects financed.

Strong Governance And Reporting Practices

One factor that defines the level of greenness of banks' green bond issuance is their green bond frameworks. Banks typically set up such a framework to define how assets financed through green bonds are selected and how proceeds are managed. The framework also covers reporting on the use of proceeds and any external reviews performed to demonstrate compliance with the relevant green bond guidelines. The framework spells out the process a bank follows when it identifies a suitable green portfolio of existing or new green assets. The proceeds of green bonds are then used to finance or refinance the green portfolio. Often, most of the assets backed by green bonds are existing financing. In that sense, such green bonds do not generate new green assets. However, we believe the green bond market will stimulate banks' future green financings as it would allow banks to issue green bonds once they have generated sufficient volume of new green assets through their lending activities.

What we also see is that banks' green portfolios are dynamic, increasing or decreasing with new issuance, redemption, and reclassification of green assets or lending. Most green frameworks allow for the possibility of the amount of the green portfolio to drop below the green bond proceeds temporarily, with the balance invested in money market instruments or other green bonds. However, in practice, the green bonds portfolio typically exceeds green bond issuance for most banks by a substantial margin. For example, the current green portfolios of some banks exceed the green bond proceeds by more than 50%. We consider the risk of green bond funds being used other than for green projects is small and, if it happens, is likely to be only temporary.

Most banks operating under GBP have in place strong governance and reporting of green bond proceeds. They publish detailed green bond frameworks as well as regular green bond reporting, which normally includes allocation of proceeds, typically on an annual basis. Most of them also perform impact reporting at a portfolio level, that is, expected or achieved mitigation effects such as carbon dioxide-equivalent emissions reduction and green energy capacity, for example. The vast majority of the green bonds we analyzed were subject to external review.

Investment Dominates In Renewable Energy And Green Buildings

Some banks have frameworks that allow them to invest in the whole range of projects allowed under GBP, while some only focus on specific sectors, typically renewable energy or green buildings, or both. In practice, even those banks whose frameworks cover a wider range of projects predominantly invest in renewable energy and green buildings. For around two-thirds of the banks we reviewed outside China, those two sectors represent more than 90% of the allocation. In contrast, in China, pollution prevention and clean transportation represent the largest share.

We see slight differences among banks' definitions of green assets, for example what constitutes green buildings. Banks use different minimum acceptable levels of building environmental certification (for example, Leadership in Energy and Environmental Design or LEED and Building Research Establishment Environmental Assessment Method or BREEAM). Another notable difference is large hydropower projects, which some banks exclude from their green portfolios. There, we see differences about what size constitutes a large hydropower project.

The majority of green assets of banks operating in developed countries are located in their own region. This may have implications for reaching global climate change goals, as according to the Paris agreement developed countries are to contribute to the green transition in emerging markets. We observe that the contribution of banks in developed countries to that transition is currently limited. For some developed banks, this may be a reflection of their more limited market presence in emerging markets. For others, the key reason may be the typically higher credit risk of investments in emerging markets.

S&P Global Ratings' Green Evaluation Tool

S&P Global Ratings has developed its Green Evaluation to help investors understand the positive environmental contribution of financings, including green bonds. A Green Evaluation is a point-in-time assessment of the relative environmental impact of a technology to be financed compared to similar technologies globally. This assessment is based on the quality of governance and transparency of a transaction as well as a quantification of the life-cycle environmental impacts associated with it. For mitigation projects, we estimate whether we expect a project, over its life (including construction, operations, and decommissioning phases), to create a net positive or negative environmental impact based on relevant environmental key performance indicators (eKPIs). We call this a net benefit ranking. We then overlay a hierarchy, which places the net benefit ranking of the specific technology within the broader context of the sector--for instance, solar power within the green energy sector.

Based on these three pillars--governance, transparency and environmental impact--the transaction receives a score between 0 to 100, reflecting its contribution to climate-related policies. The score is expressed as a quartile between E1 and E4, E4 representing projects with the lowest environmental contribution. Our Green Evaluation also applies to financings of adaptation projects that aim to strengthen the resilience of infrastructure and communities against the risk of extreme weather or changing weather patterns caused by climate change. The score of adaptation projects is expressed as a quartile between R1 and R4, with R4 representing projects with the lowest resilience benefit/cost ratio.

Why Our Mitigation Scores Could Be High For Banks' Green Bonds

The mitigation score is the key part of our Green Evaluation because it determines 60% of the score and fixes a ceiling on the overall assessment. Because the banks we reviewed invest predominantly in renewable energy and green buildings, the mitigation score is likely to be above 50. This reflects the positive impact of our carbon hierarchy, which typically increases the scores of renewable energy above 75 and the scores of green buildings above 50. Such scores are prerequisite for E1-E2 assessments. On the other hand, a material level of investments in clean coal, allowed under the Chinese green bond framework, could lower the mitigation score to a level that pushes the overall assessment down to E3 or lower (around 10% of green bonds issued by Chinese banks invest in clean coal according to CBI data). That's because such investments are in the lowest level in our hierarchy. (For a review of the green contribution of 282 green bonds issued between January 2012 and July 2017 across all issuers, see [“How Do Labeled Green Bonds Measure Up?”](#) published on Nov. 8, 2017.)

A key element factored in our mitigation score is the carbon intensity of the country grid where the project is located. The higher the carbon intensity the better the score, reflecting the higher environmental benefits of decarbonizing carbon-intensive economies. For bonds with significant investments in green buildings, which sit lower in our hierarchy, the carbon intensity of the country could make the difference between E1 and E2 overall assessments. However, for renewable energy projects, the mitigation score tends to be higher across all geographies as we rank these projects at the highest level of our hierarchy. This reflects the sector's relatively high contribution to avoiding and coping with climate change across all geographies.

Our evaluation is point in time and based on the current allocation of the bank's green portfolio. We use banks' current green portfolio as a proxy for the future allocation of green proceeds as we have observed that, even though banks' green portfolios are dynamic, the allocation by sector and geography remains relatively stable in practice. Therefore, if we are asked to reassess a green bond in the future, it is likely to observe a similar mitigation score assuming that consistent levels of reporting, governance, and disclosure are maintained.

The governance and transparency scores determine 15% and 25% of the Green Evaluation score, respectively. Generally, bank frameworks following the GBP address the key aspects of our governance and transparency assessments:

- There is a clear process and criteria for selecting eligible projects to be financed through the green bonds.
- The proceeds are tracked in a separate account.
- It is a standard practice for banks to ensure that the projects they finance comply with environmental regulations. Even then, some consider compliance with different industry environmental, social, and governance (ESG) standards such as the Equator principles.
- Banks produce regular reporting on proceeds allocation, at least on an annual basis, but some even more often. They typically disclose a breakdown of investments by type of project and geography at an aggregate level due to the confidentiality of the projects they invest in.

A differentiating factor across both governance and transparency is the level of detail in reporting on environmental impact (impact reporting). Those reports are useful for investors to understand the environmental benefits achieved, such as carbon savings. However, the differences in the methodologies adopted to estimate those environmental benefits as well as the lack of detailed disclosure about those methodologies limit the comparability of the results. In addition, there is often no external verification of impact reporting. This may reduce the

credibility of that information to investors, who may question its reliability given the complexity and recent developments of impact reporting methodologies.

We estimate that differences in the quality of the impact reporting could reduce an overall Green Evaluation by up to around 10. While this impact is relatively small, for the overall green evaluation it may still be a differentiating factor for banks with a material level of assets outside the renewable energy sector.

Overall, banks' green bonds that are aligned with the GBP and whose proceeds are predominantly allocated to renewable energy assets are, under our analytical approach, more likely to receive an evaluation in the upper quartile. For others with a material level of investments in other sectors high in the hierarchy (such as green buildings), the differentiation between the top and second quartile will likely depend on the carbon intensity of the grid where the green assets are located and features of their impact reporting (for example, level of detail and external verification). The Green Evaluation score of Chinese green bonds could be lower if a material level of the proceeds is allocated to efficient coal technologies. This could be somewhat offset by the high carbon intensity of the grid in China.

Appendix: Banks In Our Rated Top 200 That Have Issued Green Bonds

Table 1

Banks In Our Rated Top 200 That Have Issued Green Bonds

ABN AMRO Bank N.V.
Agricultural Bank of China Ltd.
Australia and New Zealand Banking Group Ltd.
Axis Bank Ltd.
Bancolombia, S. A. y Companias Subordinadas
Bank of America Corp.
Bank of China Ltd.
Bank of Communications Co. Ltd.
Barclays PLC
BNP Paribas
BPCE
Commonwealth Bank of Australia
Cooperatieve Rabobank U.A.
Credit Agricole S.A.
CTBC Bank Co. Ltd.
DBS Bank Ltd.
DNB Bank ASA
E.SUN Commercial Bank Ltd.
HSBC Holdings PLC
Industrial and Commercial Bank of China Ltd.
ING Bank N.V.
Intesa Sanpaolo SpA
Mitsubishi UFJ Financial Group Inc.
Mizuho Financial Group Inc.

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Morgan Stanley
National Australia Bank Ltd.
Nedbank Ltd.
Nordea Bank AB
Skandinaviska Enskilda Banken AB
Societe Generale
Sumitomo Mitsui Financial Group Inc.
Swedbank AB
Toronto-Dominion Bank
Westpac Banking Corp.

Related Criteria

- [Sovereign Rating Methodology](#), Dec. 18, 2017
- [Methodology And Assumptions: Assessing Pools Of European Residential Loans](#), Aug. 4, 2017
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- [Key Credit Factors For The Leisure And Sports Industry](#), March 5, 2014
- [Corporate Methodology](#), Nov. 19, 2013
- [Country Risk Assessment Methodology And Assumptions](#), Nov. 19, 2013
- [Key Credit Factors For The Regulated Utilities Industry](#), Nov. 19, 2013
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- [Industry Top Trends 2019: North America Regulated Utilities](#), Nov. 8, 2018
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- [2017 Annual Global Leveraged Loan CLO Default Study And Rating Transitions](#), Oct. 9, 2018
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Only a rating committee may determine a rating action and this report does not constitute a rating action.

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