

# Green Finance: Scaling Up To Meet The Climate Challenge

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## Climate Finance A Year After Paris: Driving Politics Into Action

**Primary Credit Analysts:**

Michael Wilkins, London (44) 20-7176-3528; [mike.wilkins@spglobal.com](mailto:mike.wilkins@spglobal.com)

Jessica Williams, London (44) 20-7176-3884; [jessica.williams@spglobal.com](mailto:jessica.williams@spglobal.com)

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# Climate Finance A Year After Paris: Driving Politics Into Action

A lot has happened since Dec. 12, 2015, when the Paris Agreement was adopted by consensus of the 195 countries present at the United Nations Framework Convention on Climate Change 21st Conference of the Parties (COP21)--and more than what might have been expected. For starters, the agreement smoothly slid into force on Nov. 4, in record time for a document of this significance. This is a clear indication by governments to business and the financial markets that a low-carbon future is firmly on the agenda. Over the past year, the green bond market, a bellwether for climate finance, has grown at an impressive rate. Plus the Task Force on Climate-Related Financial Disclosures (TCFD), launched on Dec. 4, 2015, is on target to deliver its recommendations to the Financial Stability Board (FSB) on Nov. 17 and a 60-day public consultation will commence in early December. Furthermore, at this year's UN climate change summit (COP22) starting in Marrakech this week, we expect participants to flesh out a roadmap for further scaling up climate finance. However, in the area of green infrastructure investment in particular, S&P Global Ratings believes there's still much to be done to meet the Paris Agreement's targets.

## Overview

- Since its signing late last year, the Paris Agreement on climate change rapidly slid into force on Nov. 4, a clear indication to business and the financial markets that a low-carbon future is firmly on the agenda.
- The green bond market grew at an impressive rate in the past year, with 2016 issuance already up 50% on last year's total, though more could be done to expand the market.
- At the UN climate change summit in Marrakesh starting this week, in the area of climate finance, participants will turn to the practical tasks of developing voluntary, consistent disclosures of pledges and requirements; and finalizing a plan to mobilize the \$100 billion a year in flows to developing countries for climate change adaptation and mitigation.
- S&P Global Ratings believes that trends in green infrastructure investment show the need for a significant scaling up of both public- and private-sector capital flows to meet the 2-degree target.

The Paris Agreement reached at COP21 on Dec. 12, 2015, was a momentous signal to the world that the tides are changing on climate policy (see "Paris Agreement--A New Dawn For Tackling Climate Change, Or More Of The Same" published on RatingsDirect on Jan. 18, 2016). The common framework committed all countries to submit their "best effort" emissions reduction plans, which they are to revise upward every five years via a ramping-up mechanism. Parties have also agreed to report regularly on their emissions and implementation efforts, and undergo international review. The agreement set out a number of ambitious targets. Here, S&P Global Ratings outlines a few of those targets that, in our opinion, are potentially most relevant to the green finance sector:

- Carbon neutrality, which means that emissions from carbon sources must equal those absorbed by carbon sinks (such as forests that take up carbon dioxide) so that no net emissions will be added to the atmosphere, to be reached during the second half of this century.
- Mobilizing \$100 billion a year in climate change support by 2020 (both mitigation and adaptation) through to 2025,

after which a more ambitious target will be set.

- Making finance flows consistent with a pathway toward low greenhouse gas emissions and climate-resilient development
- Reaffirming the 2-degree Celsius goal while urging efforts to limit warming to 1.5 degrees, which sends a signal to heavy emitting industries that governments are serious about emissions reduction.

## **The Surging Green Bond Market**

Issuance to date for 2016 (as of Nov. 1) stands at \$64.3 billion, which is already 1.5 times total issuance in 2015 of \$42 billion. We are observing a diversification in the market as proceeds are used for increasingly different types of projects. The dominance of renewable energy is starting to decline, and we are seeing an increase in water, waste, and adaptation-focused bonds. This should help to spur the market further as new corporate and municipal issuers are drawn to the space.

Another notable milestone this year has been the announcement by a number of sovereigns that they will issue their first green bonds. It looks like France will be the first to issue in 2017, with a proposed initial €3 billion of green bond issuance for a total of €9 billion through 2019. France's could be the first of many sovereign green bonds to come to market as governments begin to source the financing required to enable them to meet their COP21 pledges, known as nationally determined contributions (NDCs).

As issuer and project types diversify in this market, there is a need for comparability and environmental analysis behind the "green" label. S&P Global Ratings is looking into this niche, with plans to potentially release a Green Bond Evaluation product that provides an independent view of transparency and governance surrounding the use of the bond's proceeds and also proposes to go further by evaluating the expected environmental impact of the bond. This analysis aims to offer the market a methodology for assessing the environmental impact of different bonds, for example, a water-focused green bond compared with an industrial efficiency focused green bond (see "Proposal For A Green Bond Evaluation Tool," published on Sept. 2, 2016).

Identifying other needs, Mark Carney, Governor of the Bank of England and FSB chairman, suggested in a speech on Sept. 22 in Berlin that the following measures could enable further growth in the green bond market:

- The development of a "term sheet" of internationally recognized standardized terms and conditions for a green bond;
- Creation of voluntary definitional frameworks, certification, and validation to give certainty to issuers and investors that the project being financed is green;
- Integration of environmental risk and green certification into credit ratings;
- Development of green bond indices to unlock the potential investment power of passively managed investments; and
- Assessment of the scope for standardization and harmonization of principles for green bond listings to promote efficient trading and adequate liquidity.

S&P Global Ratings already examines climate and environmental risk as part of its ratings process, which we explain in "How Environmental And Climate Risks Factor Into Global Corporate Ratings," published on Oct. 21, 2015, and we plan to expand our work in this area outside credit ratings to include green bond evaluations.

## **The TCFD: Tools For Green Investment**

The FSB task force's mission is to develop recommendations for voluntary, consistent climate-related financial risk disclosures that companies use to provide information to lenders, insurers, investors, and other stakeholders. Despite the voluntary nature of the group's recommendations, most large corporates in Group of Twenty countries, and potentially others, are expected to adopt the recommendations over time.

The recommendations are expected to standardize the plethora of current reporting systems making disclosures more comparable and therefore useful to investors. As well as providing metrics and targets for more conventional historical emissions performance, they are also expected to go further to examine future risks, by recommending tools such as scenario analysis. S&P Global Ratings believes that these recommendations will bring environmental performance into the mainstream as an investment and credit consideration.

## **Toward A Plan For Mobilizing Climate Finance**

In 2010, the UN formalized an agreement to increase climate finance flows to \$100 billion per year by 2020 from developed to developing countries for climate change adaptation and mitigation. COP 21 allowed for the continuation of the \$100 billion target figure to 2025, with agreement that the parties will seek a more ambitious funding level for the next time period—that is, after 2025. COP22 needs to yield a finalized plan for mobilizing this \$100 billion, which can come from public or private sources, in particular for striking a balance between adaptation and mitigation finance, as called for by the Paris Agreement.

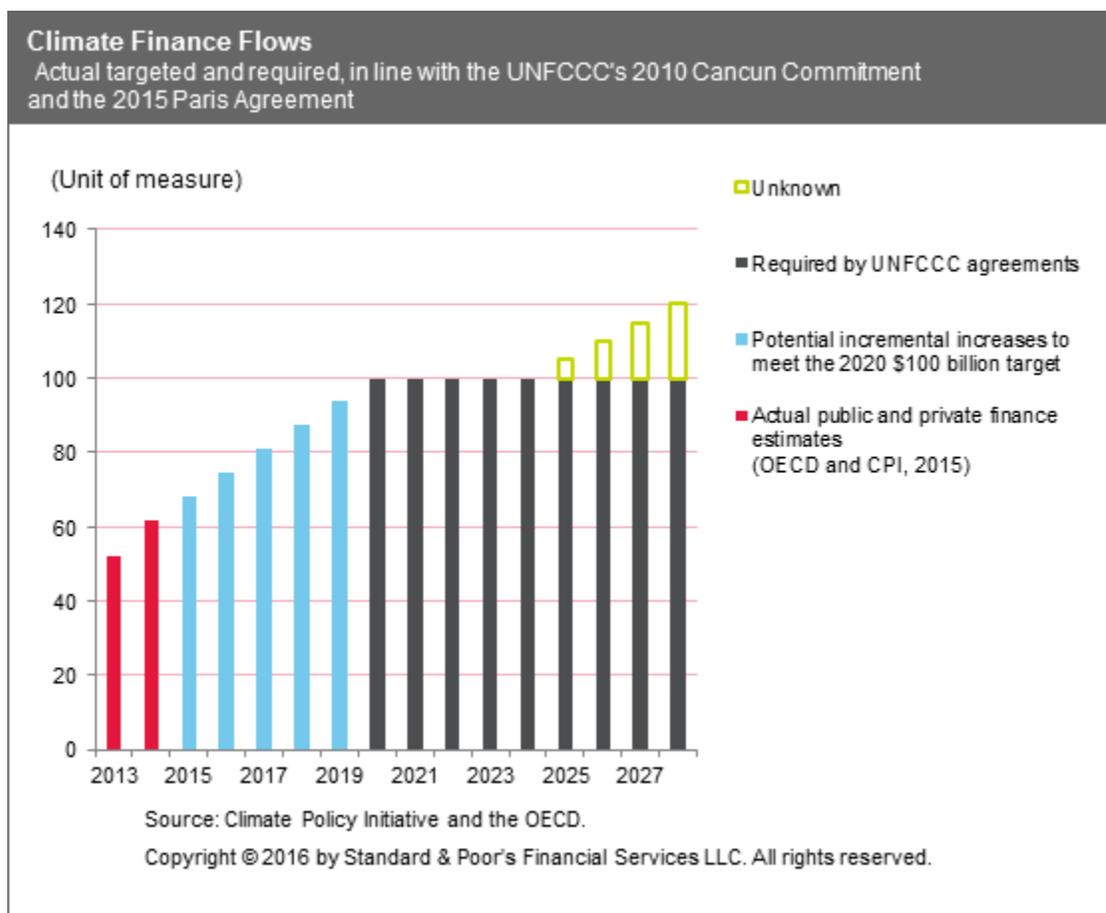
The Green Climate Fund (GCF) was developed as a financial mechanism for the \$100 billion target and currently has achieved pledges of \$10.3 billion. Of this, the fund aims to disburse \$2.5 billion this year, of which \$1.17 billion has been approved. However, the GCF has faced questions because it has been slow to get off the ground, and has received criticism regarding governance and transparency. There are additional concerns that the GCF could reroute financing that might otherwise have found its way to other more established climate funds.

The OECD released an initial "roadmap" for climate finance on Oct. 17, which provides clarity about the status of current funding and outlines a possible route to mobilizing the \$100 billion.

This exercise is made more complex because no single widely accepted definition of what constitutes "climate finance" exists. However, this is one point that COP22 is expected to review in order to keep a constructive discussion going.

COP22 also needs to work toward finalizing rules for reporting on climate finance initiatives, which would include disclosing both the finance provided, intended contributions, and finance required and received (in developing countries).

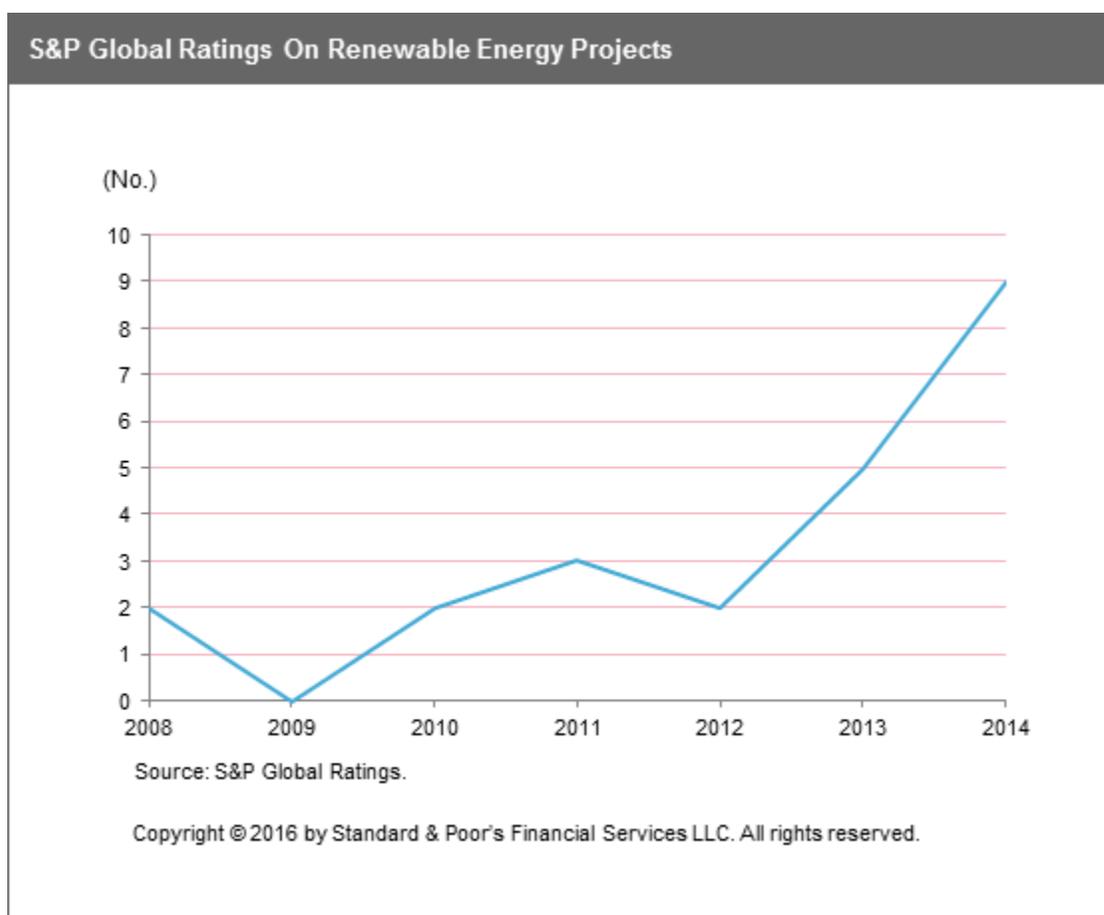
Chart 1



### Renewable energy investment

One aspect that is closely related to climate finance is investment in renewable energy, which is significant since the energy sector contributes most to global emissions. These figures look at global investment whereas the \$100 billion climate finance figures above focus on flows to developing countries (mostly from developed countries). Overall, global energy investment (both renewable and fossil fuel combined) fell in 2015 to \$1.8 trillion, according to the International Energy Agency (IEA), a decrease of 8% in real terms from 2014, mostly due to a reduction in upstream oil and gas investment. However, investment in the electricity sector actually rose considerably to \$690 billion, mostly because of renewables and network infrastructure. For the first time renewables (excluding large hydro) made up more than 50% (53.6%) of the gigawatt capacity of all technologies installed in 2015, which is a considerable milestone and most likely the sign of things to come. This fits with trends observed by S&P Global Rating's infrastructure practice which has seen renewable energy project ratings increase steadily over the six-year period to 2014 (see chart 2). The low-carbon generation capacity that came online in 2015 was more than growth in global power demand, which explains why the average carbon intensity of generation is falling: Renewable capacity is beginning to replace some fossil fuel capacity. The carbon intensity of generation fell to 420 kilograms of carbon dioxide per megawatt-hour last year according to the IEA, but this is still insufficient to meet the target of "well below 2 degrees" as set out in the Paris Agreement.

Chart 2



Energy efficiency investment also increased even though energy prices fell. S&P Global Ratings believes this could be a sign that emissions reductions policies are taking effect, and that wholesale price signals are starting to play less of a role in driving investment decisions. The IEA believes that as much as 95% of power generation investment relies on vertical integration, long-term contracts, and price regulation. New forms of investment under innovative, consumer-led spending business models such as corporate buying of renewable power and distributed renewable energy for households and businesses also contributed \$50 billion to investment figures in 2015.

Despite these positive figures in 2015, the picture in 2016 is looking less optimistic. Total investment in renewable energy is predicted to fall from 2015's record of \$348.5 billion, according to Bloomberg New Energy Finance (BNEF). Investment figures for the first three-quarters of the year were down approximately 20%, 20%, and 40% on their equivalent quarters in 2015. This is problematic as BNEF's 2 degree pathway indicates that investment figures need to stay broadly in line with the 2015 record. One reason behind this decrease is that technology costs are falling; the same capacity can now be bought for less. However, other factors are weighing in such as China's slowdown and the five-year extension of the U.S. Production Tax Credit for wind and the Investment Tax Credit for solar--meaning investors are not rushing to push deals through before the end of the initiative.

As well as acknowledging the renewed vigor required in renewable energy investment, S&P Global Ratings believes

that fossil fuel infrastructure presents a looming risk, as we outline below in the next section. This is particularly relevant in regions where investment in fossil fuel infrastructure remains strong, such as India.

## **Green Infrastructure Investment: Significant Scaling Up Required**

Instead of a gradual increase in investment in green infrastructure and decline in carbon-intensive infrastructure, much more may be needed. Research from Oxford University's Sustainable Finance Program shows that if current operational energy infrastructure and planned additional energy infrastructure investment is made and operated to the end of its normal economic life, we won't be able to build any more fossil fuel infrastructure after 2017 if we are to meet the 2-degree target.

Last month Lord Nicolas Stern and the Global Commission on the Economy and Climate estimated that \$80 trillion-\$90 trillion in infrastructure investments are required over next 15 years, which works out to between \$5.3 trillion and \$6 trillion on average per year. The key drivers of this requirement are:

- Higher growth rates and therefore increasing infrastructure demand in developing economies;
- Rapid urbanization, creating pressure on city expansion and development, which currently stands at about 50% of the population (about 7 billion) and is expected to rise to 70% by 2050 (more than 9 billion); and
- Aging infrastructure in advanced economies, which will need to be replaced or refurbished.

Global annual infrastructure investment stood at \$3.4 trillion in 2014, so this figure would need to increase by at least 56% to reach the lower end of the \$5.3 trillion needed on average per year. To put this in perspective, annual infrastructure investment has increased by \$1 trillion over the decade to 2014.

S&P Global Ratings believes this demonstrates the need for a significant scaling up of infrastructure investment, and underlines the growing concern about stranded assets (assets that have suffered from unanticipated or premature write-downs, devaluations or conversion to liabilities). According to Oxford University, if policymakers are serious about reaching the Paris Agreement's targets, all electricity infrastructure investment from next year onward will need to be green. Serious questions may be raised about the long-term viability of brown investment as regulation starts to tighten so that countries can reach their NDCs. New fossil fuel investment beyond that allowed in a 2-degree scenario would mean the early retirement of some fossil fuel capacity, meaning asset write-downs. The alternative option would be installation of carbon capture and storage technologies. However, these technologies are not yet widely commercially viable and can depend on access to a location having specific geological features.

S&P Global Ratings believes there is one big hurdle to investment in sustainable infrastructure: the initial increased upfront cost of most kinds of sustainable infrastructure, which the New Climate Economy estimates to be about \$4.1 trillion in addition to the \$80 trillion-\$90 trillion required over the next 15 years. However, over the lifetime of these assets, the costs are generally offset by energy and resource savings, or resilience to extreme weather.

## **From Politics To Action**

The world has made remarkable progress over the past 12 months that might have been almost unimaginable this time

last year. The Paris Agreement came into force on Nov. 4, reassuring business and the financial markets that potential political turbulence is unlikely to easily derail the global climate agenda. However, it is no time for complacency because as the numbers show, serious political and financial commitments are needed to meet COP21's goals and avoid the catastrophic impacts that climate change could bring. In our view, the ultimate success of the Paris Agreement hinges on the COP22 talks commencing over the next two weeks in Marrakech. It is time for governments and the private sector alike to start accelerating toward the green destination set in Paris.

## **Related Criteria And Research**

- Proposal For A Green Bond Evaluation Tool, Sept. 2, 2016
- Paris Agreement--A New Dawn For Tackling Climate Change, Or More Of The Same, Jan. 18, 2016
- Climate Change--Building A Framework For The Future, Nov. 13 2015
- How Environmental And Climate Risks Factor Into Global Corporate Ratings, Oct. 21, 2015
- Standard & Poor's Approach To Rating Renewable Energy Project Finance Transactions, April 20, 2015

## **Related External Research**

- World Energy Investment 2016, International Energy Agency, 2016
- Climate Finance in 2013-14 and the USD 100 billion goal, Climate Policy Initiative and the Organisation for Economic Co-operation and Development, October 2015
- The '2°C capital stock' for electricity generation: Committed cumulative carbon emissions from the electricity generation sector and the transition to a green economy, Institute for New Economic Thinking at the Oxford Martin School and the Smith School for Enterprise and the Environment, University of Oxford, March 2016
- The Role Of The Climate Investment Funds In Meeting Investment Needs, The Climate Policy Initiative, June 2016
- Better Growth, Better Climate, The New Climate Economy, 2014

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# Proposal For A Green Bond Evaluation Tool

**Primary Credit Analysts:**

Michael Wilkins, London (44) 20-7176-3528; mike.wilkins@spglobal.com  
Miroslav Petkov, London (44) 20-7176-7043; miroslav.petkov@spglobal.com  
Jessica Williams, London (44) 20-7176-3884; jessica.williams@spglobal.com

**Secondary Contacts:**

Kurt E Forsgren, Boston (1) 617-530-8308; kurt.forsgren@spglobal.com  
Michael T Ferguson, CFA, CPA, New York (1) 212-438-7670; michael.ferguson@spglobal.com  
Nicole D Martin, London (1) 416-507-2560; nicole.martin@spglobal.com

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# Proposal For A Green Bond Evaluation Tool

## Executive Summary

S&P Global Ratings is seeking feedback on a potential new Green Bond Evaluation product ("the Green Bond Evaluation" or "the Evaluation"), which we are proposing be based on a newly developed green bond evaluation framework and scoring methodology. The Green Bond Evaluation is not a credit rating.

Our proposed Green Bond Evaluation methodology looks beyond the governance and management of a bond by providing an analysis and estimate of the environmental impact of the projects or initiatives financed by the bond's proceeds over its lifetime relative to a local baseline. This would be in addition to assessing the governance and transparency surrounding the bond. When evaluating environmental impact, the methodology would consider both climate change mitigation and adaptation projects.

Mitigation projects focus on efforts to reduce or prevent the emission of greenhouse gases, ranging from upgrades to conventional generation projects to new renewable energy and energy efficiency initiatives. Adaptation projects aim to take practical steps toward reducing the exposure to and managing the impact of natural catastrophes, such as building the resilience of communities and critical infrastructure against an increased risk of extreme weather events due to climate change.

### Overview

- S&P Global Ratings is proposing a new product to analyze and estimate the environmental impact of bond projects or initiatives.
- The Green Bond Evaluation, which is not a credit rating, would consider both climate change mitigation and adaptation projects.
- The Evaluation would include a Transparency score, a Governance score, and a Mitigation score and/or Adaptation score, as relevant, to arrive at an overall final score.
- We are seeking feedback to our proposed Green Bond Evaluation product, framework, and methodology from investors, issuers, governments, multilaterals, and intermediaries.

The output of the Green Bond Evaluation would include at least three scores (a Transparency score, a Governance score and a Mitigation score and/or Adaptation score, as relevant,) and an overall final score as follows:

- The Transparency score would focus on the quality of disclosure, reporting, and management of bond proceeds.
- The Governance score would assess what steps have been taken to measure and manage the environmental impact of the use of proceeds of the bond including certification, impact assessment, risk monitoring, and risk management
- The Mitigation score would consider key environmental impacts of the use of bond proceeds, such as reductions in greenhouse gas emissions and water use. It is proposed to be based on a consideration of key variables (such as technology and location) that determine the level of environmental impact in each project. It would score the bond on a net benefit basis relative to the appropriate local baseline (for example, a new renewable energy project compared to the conventional grid). A broad range of project types could be considered within the Mitigation score

from prevalent green bond taxonomies (such as wind farms and energy efficiency projects) to other relevant projects that are a focus of various governments and multilaterals (such as gas-fired power plants, nuclear, and large hydropower plants, understanding that the perception of a green project may vary from region to region).

- The Adaptation score would reflect the estimated reductions in the costs of expected damages achieved by the initiatives financed. To determine the environmental resilience benefit that may be achieved through the use of bond proceeds, we would propose to analyze and assess the cost-benefit studies prepared for the project.

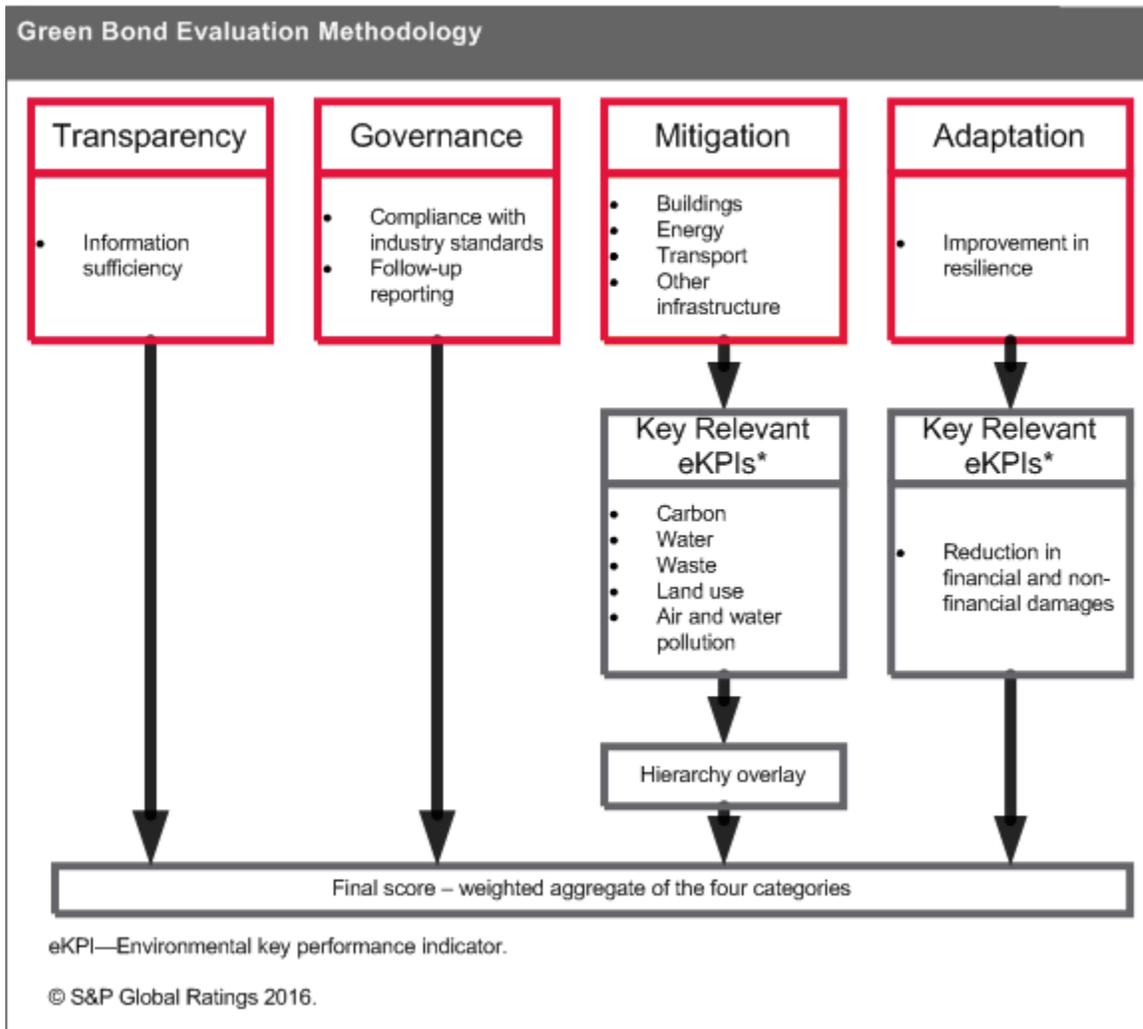
The proposed approach would evaluate a bond financing against each category, with the resulting scores weighted and amalgamated into an overall final Green Bond Evaluation.

The mitigation impact of an individual bond would also be assessed within a hierarchical sector overlay. The placement of the Mitigation score within the broader context of different sectors would indicate its relative contribution to the ongoing effort to avoid and cope with climate change.

This relative hierarchy would imply that projects that are financing climate change solutions, such as renewable energy, for example, would score more highly than projects looking to improve conditions within conventional technologies (such as coal-to-gas). The resulting Mitigation score would provide a flexible and user-friendly assessment of the relative importance of net benefit impact and broader technology-level considerations. For example, if a bond were financing coal-to-gas switching, the Mitigation score would reflect how the bond compared to best-in-class bonds within this project type, while also providing information on the difference between these and other project types, such as renewables.

We look forward to receiving your feedback to our proposed Green Bond Evaluation product, framework, and methodology and our specific questions below, and to discussing our approach on this important issue with investors, issuers, governments, multilaterals, and intermediaries. To access the survey feedback platform, please click on the following link or paste it into your browser: [www.spratings.com/greenbonds](http://www.spratings.com/greenbonds) .

Chart 1



## Introduction

### Progress

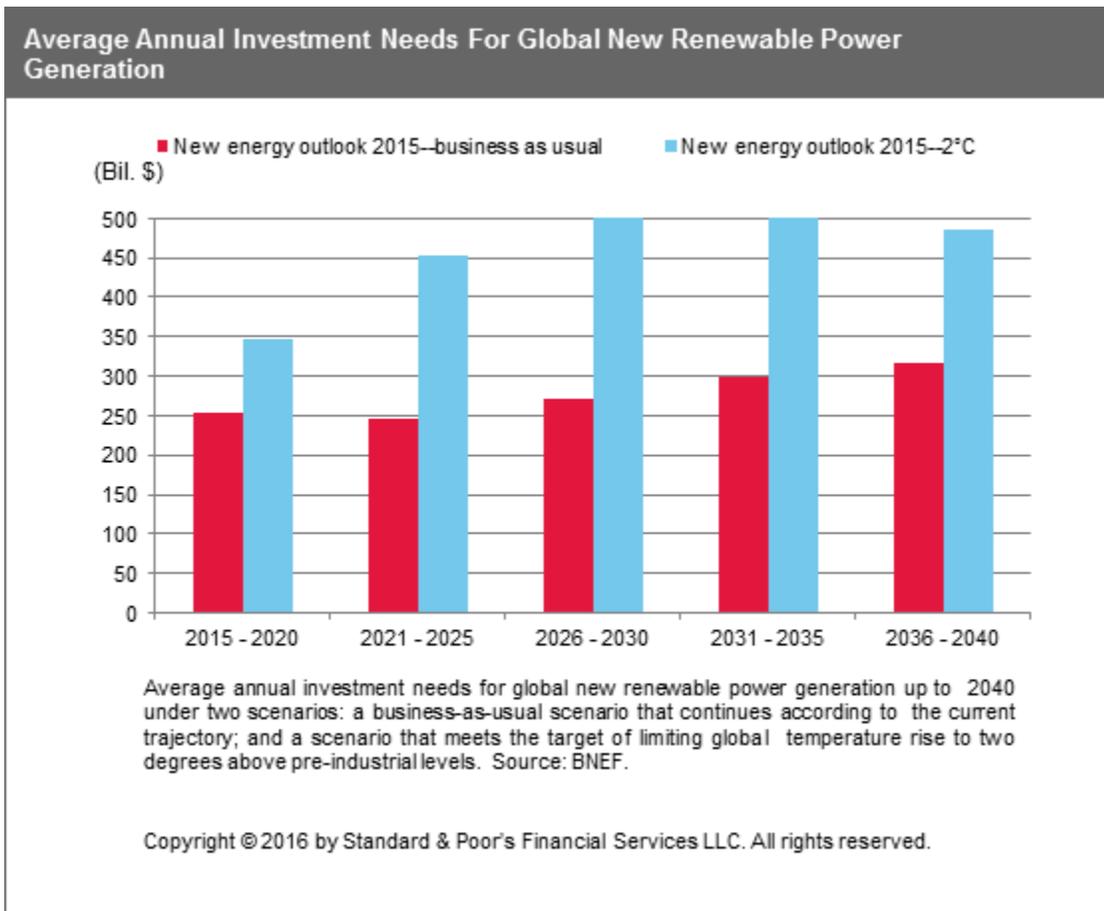
The green bond market is expanding. In response, in April 2016, S&P Dow Jones Indices, another division of S&P Global, published a consultation paper regarding the scoring of green bonds in order to create new green bond indices. As market interest for information relating to the green credentials of capital market instruments continues to grow, S&P Global Ratings believes that development of a Green Bond Evaluation product may further serve to meet informational needs of market participants. Today, S&P Global Ratings is asking for market feedback on the development of a tool to aid in the evaluation of green bond issuance.

### Context

Financing on a significant scale will be required to meet the Paris Agreement's target of limiting the rise in global temperature to no more than two degrees above pre-industrial levels. The International Energy Agency (IEA)

estimates this will cost around \$1 trillion per year globally until 2050, which is approximately 1.3% of the world's annual output of goods and services. Bloomberg New Energy Finance (BNEF) recently estimated that \$14.6 trillion would need to be invested into clean energy alone up until 2040; the corresponding average investment figures are outlined below in chart 2. Even without the Paris Agreement, BNEF estimate that a business-as-usual scenario would require expenditure of \$9.2 trillion per year to keep up with global energy demand. This is only a fraction of what could be required overall to limit global warming, as it doesn't capture the future investment needed in the areas of clean transport (such as electric vehicles), energy efficiency, adaptation measures (such as flood defenses), sustainable agriculture, or the many other areas that will require development in the face of climate change.

**Chart 2**



The sheer scale of the financing required has led to the development of a range of green finance instruments designed to increase investment flows into projects and technologies to prevent or mitigate climate change, to improve resilience, or help adapt to the impact of climate change. The potential benefits of these green finance mechanisms have received mainstream recognition, with the G20 finance ministers and central bank governors incorporating the topic, for the first time, into their meeting communiqué ahead of the G20 summit in Hangzhou in September 2016. Green bonds, which are issued to raise funds for new and existing projects with environmentally sustainable benefits, are the most prolific of the green finance instruments developed to date. Since the first green bond was issued by the

European Investment Bank in 2007, the market has grown to over \$45 billion issuance so far this year, with approximately \$150 billion in green bonds outstanding worldwide. At current growth rates, annual issuance in the green bond market is forecast to grow to over \$100 billion within a relative short timeframe.

### **Opportunity**

We believe that there may be a gap in the market for a green bond evaluation product that looks beyond the governance and management of a bond to measure what the green label means in terms of its qualitative environmental element, whether that is related to the mitigation of, or the adaptation to, climate change. This is borne out by reports such as HSBC's November 2015 green bond publication, which states: "We think that the market requires a single metric with which to gauge the environmental element of the green bond offering."

Currently, most second opinions cover important aspects of governance and transparency, but few provide comprehensive environmental impact evaluation. There are numerous taxonomies that list the categories of projects (defined as the assets or schemes financed by the bond) that are potentially eligible for green bond financing. However, these approaches face problems defining what is green, especially as climate change mitigation and adaptation technologies are expanding rapidly in many sectors. S&P Global Ratings is seeking to recognize the breadth of climate-related actions and initiatives that are qualitatively green by assessing the expected relative environmental impact of capital projects. As presently contemplated, our Evaluation would establish a method for assessing the potential environmental benefit of assets and initiatives funded by the proceeds of bond financings. We anticipate providing the proposed component scores that would support each overall Evaluation to provide users of the Evaluation with the opportunity to assess and weigh the relevance of the individual scores based on those factors users find most important in their assessment of green bond credentials. Over time, our intention is to develop the product so that it can assess the environmental impact of a broad range of projects or initiatives financed by a bond, whether it is labeled as a green bond financing project in line with the various green bond project taxonomies available or it is a conventional bond financing projects outside of current green project taxonomies that may nonetheless have environmental implications.

### **Question 1**

Should all relevant project types be part of the Evaluation, or should some be excluded? (If yes, please expand on which project types should be excluded).

The investor community has articulated its desire to compare green bonds based on their environmental impact in a way that is similar to how they can compare bonds based on their credit quality, and to then take this further so that they can assess the "greenness" of multiple projects or a portfolio.

S&P Global Ratings is developing an analytical tool it thinks may help to fill this need. The tool is in the form of a framework that would be capable of assessing the environmental impact of projects aimed both at mitigating and adapting to climate change, as required. The tool would also take account of the adequacy of such projects' governance relating to their environmental impact, management of proceeds, and transparency and disclosure in line with assessments currently provided by second opinions.

## Green Bond Evaluation Tool

### Scope

Our proposed approach would address both mitigation of and adaptation to climate change. As outlined above, Mitigation projects focus on reducing negative environmental impact, such as carbon emissions, in order to stop climate change. Adaptation projects look to create resilience to the impact of climate change that is likely to be unavoidable, such as resilient subway systems in New York to cope with the increasing frequency of storms such as Hurricane Sandy, or flood defenses in coastal areas to protect against rising sea levels.

*Scope of mitigation category.* Initially, we expect this category to evaluate green bonds that finance four types of green projects or technologies: green energy, green transport, energy efficiency, and green buildings. We anticipate releasing a prototype of this product in the coming months. These initial four project types cover around two-thirds of the green corporate bond market issuance to date (including issuance by financial institutions). Depending on the success of that release, we may expand the range of projects that the tool is able to assess, to include water projects, coal-to-gas switching, nuclear, and large hydropower projects with further extensions possible.

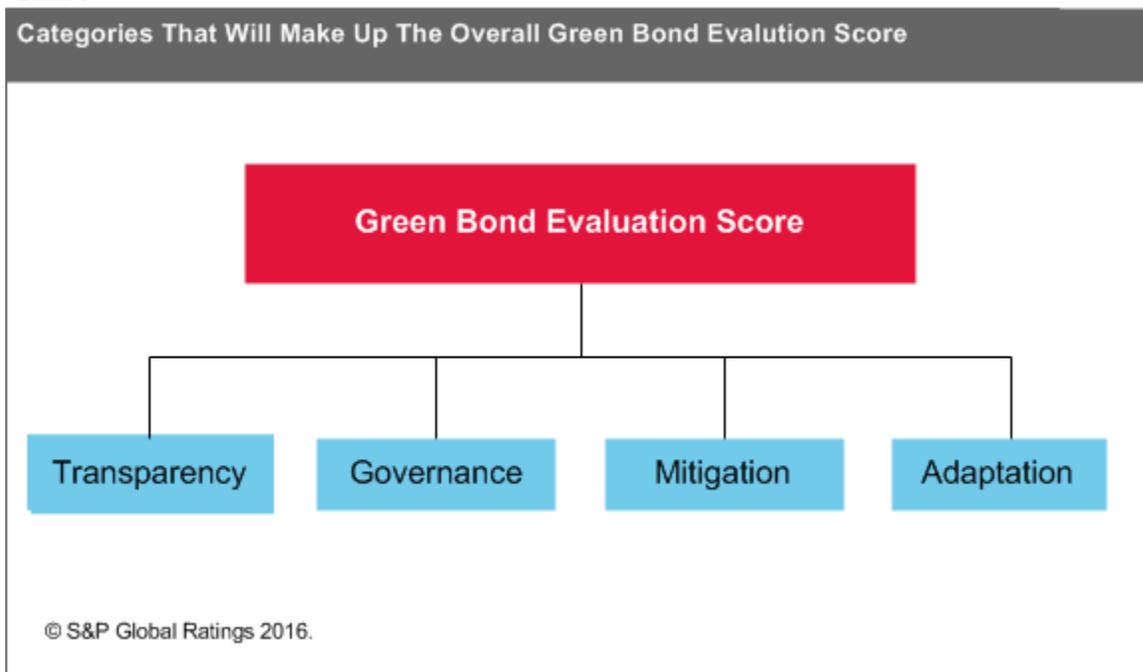
### Framework

The proposed Green Bond Evaluation framework will assess four categories: transparency, governance, mitigation, and adaptation, as outlined in chart 3.

#### Question 2

Do you agree that these are the best project types (green energy, green transport, energy efficiency, and green buildings) to focus on initially?

Chart 3



We expect that projects will be assessed in either the mitigation or adaptation category. However, in some cases, both adaptation and mitigation evaluations will be important. For example, within the green buildings sector the mitigation category would examine the environmental impact in terms of carbon, waste, and water savings in order to establish its relative greenness compared to its peers in the sector. At the same time, the adaptation category would assess the resilience of the building to climate change risks where relevant. The location of the project would likely inform the analysis by taking into account, for example, whether it is built in an area likely to suffer from increasingly severe weather such as storms and floods. In cases where both a Mitigation and an Adaptation score would be calculated, we anticipate amalgamating those scores into a single score along with governance and transparency scores, according to a category weighting. The categories shown in chart 3 are more fully explained in the section "Green Bond Evaluation Categories" below.

**Question 3**

Should the Evaluation cover Adaptation?

**Question 4**

Do you agree that Adaptation and Mitigation, if both are relevant, can be integrated into a single score, or should the two assessments remain separate?

## Scoring: A Potential Design

The overall Green Bond Evaluation is proposed to consist of a weighted average of the scores in each of the three categories of governance, transparency, and mitigation (or four categories, where adaptation is relevant as well as mitigation) shown below in table 1. Each category will score out of 100 and carry a particular weight. Final calculation:  $[V1W1 + X1W2 + Y1W3 + Z1W4]$

**Table 1**

Composition Of The Green Bond Score			
Category	Score (0-100)	Weight (0-100%)	Subscore (0-100)
Transparency	V1	W1	V1W1
Governance	X1	W2	X1W2
Mitigation	Y1	W3	Y1W3
Adaptation	Z1	W4	Z1W4
Final score			Sum

The weighted category scores will be combined to form the percentage score shown in the left-hand column below in table 2. These percentage scores will correspond to the grades in the right-hand column. E1 represents the highest score possible and E5 represents the lowest.

**Table 2**

Nomenclature Of The Final Green Bond Evaluation Score	
%	Grade
80-100	E1
60-80	E2
40-60	E3
20-40	E4
0-20	E5

### Question 5

What format of score would be the most useful for you in terms of tool output?

## Time Frame For Responses

This consultation period, beginning on Sept. 5, 2016, and ending on Oct. 17, 2016, was established to help contribute to our development of the product in time for a currently proposed scheduled prototype launch before year-end.

Schedule of request for comment:

- Sept. 3, 2016: White paper released

- Oct. 17, 2016: Deadline to submit comments via an online platform, which can be accessed by clicking on the following link or pasting it into your browser: [www.spratings.com/greenbonds](http://www.spratings.com/greenbonds) .
- Week commencing Oct. 24, 2016: Webinar to discuss feedback and further steps.

## Green Bond Evaluation Categories

### Transparency

This category would propose to look at the reporting and management of green bond proceeds.

**Reporting and disclosure.** We propose to assess the clarity of reporting on use of proceeds and environmental impact for all projects and all tranches, as well as the relative quality and depth of disclosure.

**Management of proceeds.** We propose to assess whether there is a method employed to ring-fence or track use of proceeds in support of the stated green project(s).

### Governance

This category would propose to assess certification, relevant planning and environmental procedures, risk monitoring, and risk management. While the same sub-factors would be considered across all projects and sectors, they would be tailored slightly through application of different sub-factor weighting, so as to suit the types of projects in question.

**Certification.** Is proposed to assess if the project is aligned with industry best practices, for example, BREEAM and LEED certificates for green buildings.

**Planning and environmental procedures.** Is proposed to consider whether planning procedures, such as an Environmental Impact Assessment (EIA), have been completed.

**Risk monitoring.** Is proposed to consider whether appropriate environmental key performance indicators (eKPIs) are in place to measure and manage environmental impact. eKPIs must be defined and quantitative, assessing, for example, a reduction in carbon emissions of X over Y years from Z% of total proceeds.

**Risk management.** Is proposed to consider whether systems are in place to manage environmental impact, such as an Environmental Management System (EMS), and whether this EMS is certified against a relevant industry standard, such as the International Standard for Environmental Management Systems ISO 14001.

### Mitigation

This category would propose to use a net benefit approach toward assessing mitigation. A net benefit approach looks at the positive and negative impact of a particular project over its lifetime compared to a baseline scenario to determine whether the project has created a net positive or negative environmental impact overall. This category would propose to consider material stages of a project lifecycle, from the supply chain (including construction) through operations, to end of life. The operational phase is as long as the lifetime of the project or asset, and is the point at which we would consider the impact of the project compared to the baseline.

For example, a net benefit of a renewable wind energy project would consider the environmental impact of constructing and decommissioning a windfarm against the benefits of utilizing the windfarm to produce energy instead of the conventional grid in that country over the lifetime of the windfarm.

In order to net the positive and negative impact of a project, it is proposed that absolute quantities of eKPIs would be

analyzed, for example, the carbon generated versus carbon saved (tonnes CO<sub>2</sub>e). In this way, net benefit assessments can conclude that a renewable energy project delivers a net benefit to the environment over its lifetime even after considering the emissions associated with the supply chain, operation, and decommissioning.

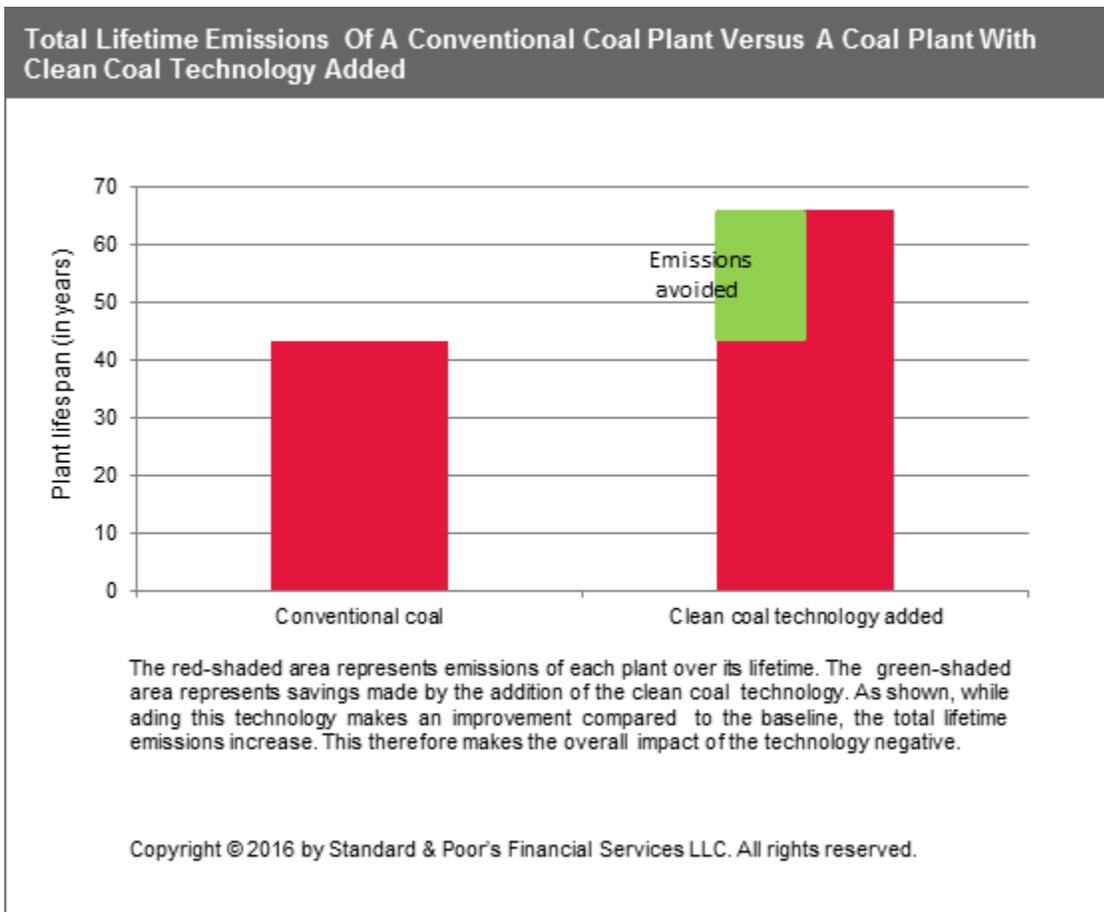
It is proposed that each eKPI would be considered separately and scored, with the final scores amalgamated into a Mitigation score using a weighting appropriate to the sector or project. For example, the eKPI most relevant to the energy efficiency sector would be carbon emissions.

#### **Question 6**

Do you agree that a net benefit approach is the most appropriate methodology?

The methodology would compare emissions savings to a baseline scenario, (for an energy project, for example, the baseline scenario would be the business-as-usual emissions rate for the grid system in the region where the project is based). Therefore, some projects, such as clean coal projects (which make the burning of coal more efficient and hence reduce emissions per MWh of energy produced), could score very well in terms of absolute quantities of carbon saved. However, in this scenario, the project would also invest in a fossil fuel energy source, and effectively extend the lifespan of the plant, therefore locking fossil fuel energy into the grid. As a result, the total emissions from the asset over its lifetime would increase. For further details, see chart 3 below.

**Chart 3**



**The need for a sector hierarchy in mitigation**

As contemplated, the net benefit methodology is proposed to assess the impact of a project over its lifetime against a baseline. As a result, a qualitative layer of analysis would be required to limit the overall Green Bond Evaluation score that projects with potentially uncaptured negative effects would be able to achieve (as illustrated in chart 3) and to differentiate between long-term green solutions and environmental impact reduction. The Green Bond Evaluation framework hence is proposing to apply, within the mitigation category, a sector level "hierarchy" as an overlay. The proposed net benefit analysis can be described as a "best in class" approach because the net benefit of a particular project is compared against a range of potential impacts within the sector in order to derive a score. For example, after applying the hierarchy, a "clean coal" project would not be able to achieve as high a score as a renewable energy project. Importantly, the hierarchy does not exclude any project type from the Evaluation.

**Question 7**

Do you agree that we should use a hierarchy of green technologies?

## Question 8

Should certain types of project scores be capped?

The proposed hierarchy (shown in table 3) is based on a value assessment of a technology's overall contribution to a green economy, ranging from providing systemic change on top, to extending fossil fuel use at the bottom. As a result, technologies such as clean coal, which have cumulatively negative overall effects over their lifespans, are capped at the lower end of the scale, as shown in table 3.

The upper end of the scale (dark green) comprises "systemic change" projects, allowing the generation of low-carbon electricity and demand management, as this transition then feeds all the other economic sectors to allow a wider decarbonization of the economy by reducing the need for new generation.

The second level is occupied by sector-specific solutions, which are already compliant with a decarbonized, or green, economy. This includes, for instance, fully electric transport solutions or net-zero buildings. Electric transport may achieve limited environmental benefits due to the carbon content of its electricity use, but as systemic change takes place, the long-term benefits are likely to be significant.

Industrial efficiencies and energy efficiency projects come third in the proposed hierarchy, as they have significant potential for environmental benefits by lowering the impact of intensive activities. These project types are optimizing environmental impact within key sectors rather than developing low-carbon solutions. The example of an electric vehicle and a hybrid vehicle illustrates the distinction between the second and third categories.

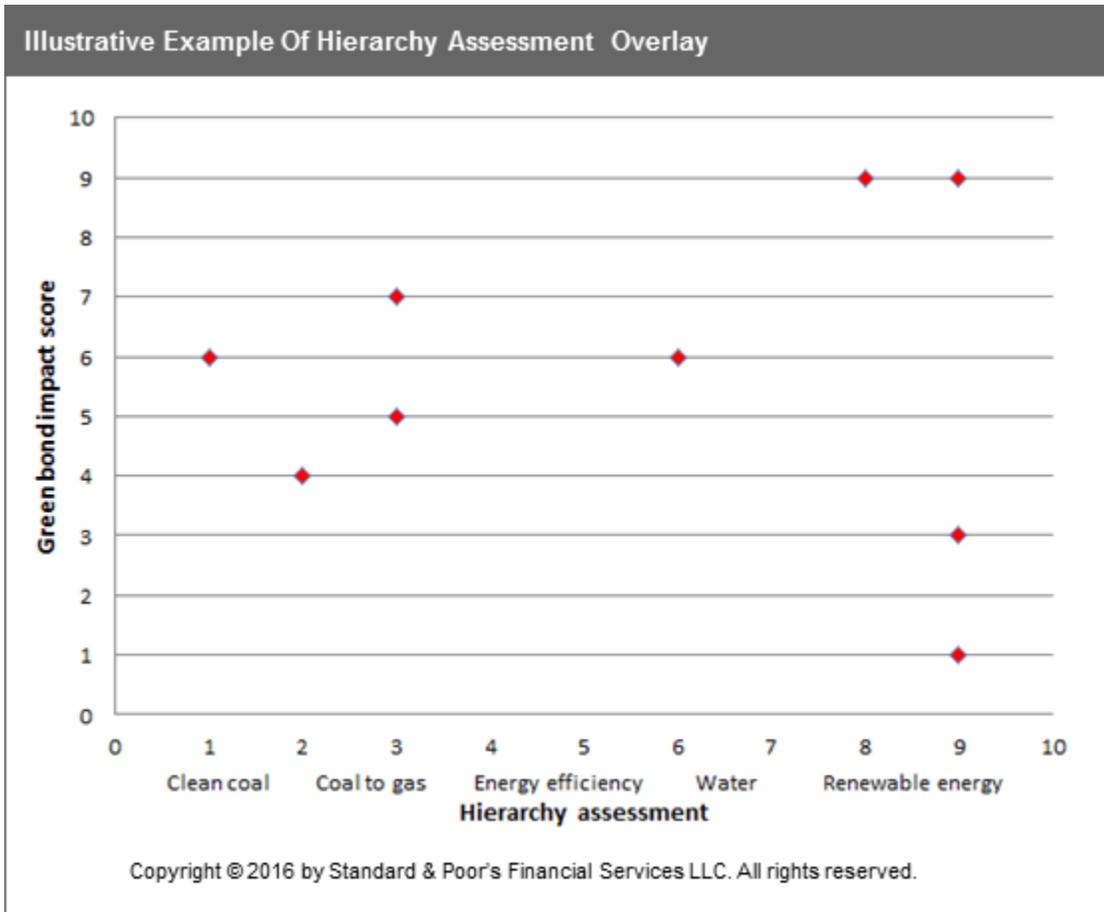
As discussed, any projects achieving environmental benefits by extending the use of fossil fuels would be proposed to be placed at the lower end of the scale. This is based on the principle that although important marginal impact mitigation can be achieved in the short term, these projects are essentially delaying the energy transition and "locking in" emissions in the long term (see Endnote 1).

Table 3

Tool Hierarchy Of Green Projects	
Role in green transition	Technology
Systemic decarbonization of economies	Wind power
	Solar power
	Small hydro
	Large hydro
	Energy management and control
Significant decarbonization of key sectors through low-carbon solutions	Green transport apart from hybrid/fuel efficient vehicles
	Green buildings new built best standards/net zero
Decarbonization by alleviating emissions in intensive industries	Industrial efficiencies
	Green transport (with fossil fuel combustion)
	Green buildings refurbishment/new built lower standard
	Energy-efficient products
Decarbonization technologies with significant environmental hazards	Nuclear, large hydro in tropical areas
Improvement of fossil fuel-based activities' environmental efficiency	Coal to natural gas
	Clean fuel production
	Clean use of coal

Our proposed approach is shown in chart 4 below. The vertical scale represents the net benefit score, which considers the mitigation impact of a particular project relative to its sector. The horizontal axis represents the hierarchy overlay, where the place of the sector in the hierarchy is indicated on the X-axis (renewable power is 10, coal is 1). Mitigation impact and hierarchy scores are multiplied together in order to ascertain a final green bond score out of 100, with 100 being the best score.

Chart 4



## High-Level Sector Methodology For Mitigation

### Renewable energy

**Context.** A key environmental impact of renewable energy generation is that it supplies the grid with low-carbon electricity, hence reducing the local/national carbon intensity of electricity. Indeed, it can be assumed that the electricity produced by a renewable energy power plant would have been produced by the existing power plants connected to the same grid in the event that this project had not existed. As a result, the amount of CO<sub>2</sub> avoided by a particular renewable energy power plant is dependent on the "carbon content" of the energy connected to this grid, "netted" by the carbon costs of installing these assets. Adding renewable energy in a carbon-intensive electric system, heavily reliant on fossil fuels, will avoid more emissions as it "replaces" a very carbon-intensive electricity.

#### *Project sub-categories:*

- Solar power plant
- Hydro power plant (small/large)
- Large hydro power plant
- Wind power plant (offshore/onshore)
- Energy from waste power plant
- Green energy grid connection

Table 4

Green Energy eKPIs Considered In Net Benefit					
Carbon	Waste	Water use	Water pollution	Air pollution	Land use
X	X*	X**			

\*For energy from waste power plants only.  
 \*\*Only the consumptive water associated with hydropower plants will be considered (i.e. water loss through evaporation, not the total withdrawal of water). <http://waterfootprint.org/media/downloads/Mekonnen-et-al-2015.pdf>

**Green buildings**

**Context.** Green buildings projects aim to reduce the environmental impact of buildings over their lifespan. Buildings accounted for one-third of global carbon emissions and half of global electricity consumption in 2012. Between 2000 and 2012, the sector has seen its final energy consumption increase by 1.5% per year on average, well beyond the 0.7% required to limit the global temperature rise to no more than two degrees (2).

Green buildings target a range of environmental impacts. However, the focus remains primarily on three main eKPIs: energy efficiency, water saving, and waste reduction. Globally accepted green building certifications include BREEAM, LEED, Energy Star, Green Star, alongside many others (3).

**Project sub-categories:** Two key types of green buildings projects can be distinguished (4):

- Construction of new buildings.
- Retrofit of existing buildings.

Within both sub-categories are multiple asset types, including residential, retail, industrial, health care, and many more. Examples of energy-saving initiatives both in new builds and refurbishments include:

- Energy-efficient heating, ventilation, air conditioning (HVAC) systems.
- Double glazing of glass windows/walls to improve thermal insulation.
- Building Energy Management Systems (EnMS) to reduce energy use.
- Installation of onsite energy sources.

Table 5

Green Buildings eKPIs Considered In Net Benefit					
Carbon	Waste	Water use	Water pollution	Air pollution	Land use
X	X	X			

## Green transport

**Context.** A key environmental impact of low-carbon transportation sources is to satisfy transportation demand without emitting the CO<sub>2</sub> associated with fossil fuel combustion. Transport accounts for a large share of human-generated CO<sub>2</sub> emissions and requires a significant evolution. For instance, the IEA estimates that the electric vehicles market has to increase at a rate of 80% per year by 2025 to be on track for a two-degree scenario. Hence, providing low-carbon transport solutions, such as electric private or public transport, is a key aspect of the energy transition and can achieve significant environmental benefits.

### Projects sub-categories:

- Urban rail system.
- Electric vehicles.
- Fuel-efficient vehicles.
- Bicycle transport.
- National rail and freight systems.

**Table 6**

Green Transport eKPIs Considered In Net Benefit					
Carbon	Waste	Water use	Water pollution	Air pollution	Land use
X	X			X	

## Energy efficiency

**Context.** The key environmental impact of energy-efficiency projects is the ability to provide the same service while reducing energy demand (5).

Energy-efficiency projects do not constitute a separate sector, but are an integral means to achieve low-carbon transition within a range of traditional sectors, such as buildings, transportation, and industry. The scope of the savings and the techniques required depend on the sector they are applied to and location (6).

**Project sub-categories:** Examples of existing projects financed by green bonds and classified under the theme of energy efficiency are given below:

**Table 7**

Existing Projects Financed By Green Bonds	
Energy efficiency projects	Issuers
<b>Buildings sector</b>	
Refurbishment of existing public buildings	EIB
LED lights retrofits	Bank of America
Thermal energy efficiency improvements of the building envelope (wall insulation, windows, roof and cellar insulation)	EIB, HERO
HVAC (High-efficiency heating, ventilation and air conditioning).	HERO
High-efficiency pool equipment	HERO

**Table 7**

Existing Projects Financed By Green Bonds (cont.)	
Energy efficiency projects	Issuers
High-efficiency water heating	HERO
Windows, doors, and skylights	HERO
Pump improvement or replacement	SCA
Compressors	SCA
Consumer energy efficiency loans to homeowners to make a range of improvements to their homes, such as HVAC equipment, water heaters, roofing, insulation, windows and energy efficient appliances	Citi
Energy sector	
Smart grid/ Smart metering/ Demand-side management (DSM)	Alliander, GDF Suez, Innovatec, Fortum Varme Holding SAM
Low-carbon district heating/ Cogeneration/ Heating networks efficiency improvements	EIB, Fortum Varme Holding SAM, GDF Suez, Fortum Varme Holding SAM, Alliander
Industry	
Fans	SCA
Heat recovery from steam and refrigeration systems in factories; Energy recovery measures at production site	Unilever, Fortum Varme Holding SAM
Energy efficiency in hydropower plants	Verbund
Various	
Equipment replacement with significant energy efficiency improvements e.g. Energy Star-certified products	EIB

In effect, many of these technologies are considered within other sectors (green buildings, green energy, and green transport), leaving two main categories of projects to be considered within energy efficiency: energy efficient products (such as those with an Energy Star certification) and industrial efficiencies.

**Table 8**

Energy Efficiency eKPIs Considered In Net Benefit					
Carbon	Waste	Water use	Water pollution	Air pollution	Land use
X					

### Adaptation

We propose this category, which is an assessment of the environmental benefit of an adaptation project, would be based on the increase in resilience of the covered geographical area or asset base. The main component of our resilience assessment is proposed to be the ratio of the resilience benefit relative to the financing derived from the bond's proceeds.

We propose to calculate the resilience benefit as the reduction of the expected financial, humanitarian, and ecological

damages caused by the natural catastrophe, and the changes in weather patterns projected under climate change the infrastructure is designed to protect against over the targeted period.

To determine the resilience benefit, we would propose to review the analysis already performed by the technical advisers to the project as a part of the design of the resilience infrastructure to assess the cost-benefit of the project.

In addition, we propose this category would incorporate our view of the adequacy of the third party data and assumptions used to determine the resilience benefit.

## **Glossary**

### **Water scarcity**

A region is considered to be experiencing water scarcity when annual water supplies drop below 1,000 cubic meters (m<sup>3</sup>) per person (Source: United Nations).

### **Grid emissions factor**

Measure of CO<sub>2</sub> emissions intensity per unit of electricity generation in the grid system. (tCO<sub>2</sub>/MWh) (Source: United Nations Framework Convention on Climate Change).

### **Baseline**

The reference scenario used to calculate the net impact of the project, for example, the tonnes of carbon avoided owing to a particular low-carbon solution. For instance, the baseline of a new power plant is the electricity currently input to the grid by the existing plants.

### **Construction/Implementation impact**

This refers to the impact associated with the initial phase of projects, before they start achieving environmental benefits. In the case of a physical infrastructure, the impact associated with the construction phase is accounted for as construction emissions. For projects focused on technology implementation, the implementation impact accounts for the impacts associated with the deployment of the technology.

### **Modal split**

The distribution of transportation means used by passengers, depending on city/city type. Depending on geographies, the prevalence of private cars as a means of transportation will vary, which affects the CO<sub>2</sub> savings that can be attributed to a given public transport infrastructure. Indeed, the more carbon-intensive the initial modal split is, the more a low-carbon public transport will avoid emissions by modal shift.

### **Modal shift**

The process by which a new supply of transportation displaces users from existing transportation means.

### **Smart grid**

Electricity network that uses digital and other advanced technologies to minimize costs and environmental impact while maximizing system reliability, resilience, and stability (Source: International Energy Agency).

## **Cogeneration**

Combined production instead of separate production of heat and electricity (Source: European Commission).

## **Endnotes**

1. <http://iopscience.iop.org/article/10.1088/1748-9326/9/9/094008>
2. IEA Energy Transition Perspectives 2015
3. Whole Building Design Guide <https://www.wbdg.org/resources/gbs.php>
4. Note the CBI Taxonomy splits developments into residential and commercial due to data availability reasons.
5. Energy efficiency should be distinguished from energy conservation, which is a broader term that can also include foregoing a service, such as turning down the thermostat in the winter to save energy.
6. Napp et al., 2012. What's energy efficiency and how much can it help cut emissions? (online) Available at: <https://www.theguardian.com/environment/2012/jun/08/energy-efficiency-carbon-savings>

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## Evaluating The Environmental Impact Of Projects Aimed At Adapting To Climate Change

**Primary Credit Analyst:**

Miroslav Petkov, London (44) 20-7176-7043; miroslav.petkov@spglobal.com

**Secondary Contacts:**

Michael Wilkins, London (44) 20-7176-3528; mike.wilkins@spglobal.com

Kurt E Forsgren, Boston (1) 617-530-8308; kurt.forsgren@spglobal.com

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# Evaluating The Environmental Impact Of Projects Aimed At Adapting To Climate Change

In a consultation paper published on Sept. 2, 2016, "Proposal For A Green Bond Evaluation Tool," S&P Global Ratings outlined its proposed framework for evaluating the green credentials of projects financed by green bonds. The evaluation is not a credit rating. When evaluating the environmental impact, we consider projects that aim to mitigate climate change separately from those that seek to adapt buildings and infrastructure to cope with the effects of climate change. Here, we expand on our proposed methodology for assessing the resilience benefit of green bonds which focus on adaptation.

Adaptation projects aim to take practical steps toward strengthening the resilience of buildings, critical infrastructure, and communities against an increased risk of extreme weather events or longer-term shifts and increased variability in weather patterns caused by climate change. (Extreme weather events are sometimes referred to as representing acute climate-related physical risk, while longer-term changes to weather patterns are chronic climate-related physical risks.) Events related to extreme weather cause substantial economic damages worldwide. Over the past 30 years, worldwide weather losses have averaged above \$80 billion annually (Source: Swiss Re sigma world insurance database)

Examples of adaptation projects include flood defenses in coastal areas to protect against the increasing impact of storm surge due to rising sea levels, widely regarded as one consequence of climate change. The cost of adapting to climate change in developing countries is forecast to reach \$140 billion-\$300 billion a year by 2030, and \$280 billion-\$500 billion a year by 2050, according to United Nations Environment Programme (UNEP) in "The Adaptation Finance Gap Report 2016."

## Overview

- The proposed framework is intended to enable investors to compare adaptation projects funded by green bonds based on the increase in resilience they offer.
- The resilience benefit is defined as the forecast reduction in expected damages from extreme weather events.
- The evaluation scale is based on the ratio of the resilience benefit to the financing amount.
- We may also apply qualitative adjustments to reflect the robustness of the quantification approach performed by the issuer.

## Framework For Assessing Adaptation Infrastructure Projects

Our evaluation of the environmental benefit of an adaptation project will be based on the increase in resilience of the covered geographical area or asset base.

- First, we quantitatively evaluate the benefit of the added resilience, relative to the amount of the bond's proceeds, on a five-point scale. The benefit is the forecast reduction in the expected damages caused by extreme weather events, based on the issuer's own analysis.

- Second, we modify the evaluation score determined in the first step, based on our qualitative view of the adequacy of the issuer's quantification approach for determining the resilience benefit.
- Third, we may apply additional adjustments in certain cases, for example, where projects are in developing countries for which the resilience benefit may be understated because the likely significant social benefits are difficult to quantify.

### **Determining the increase in resilience for adaptation infrastructure**

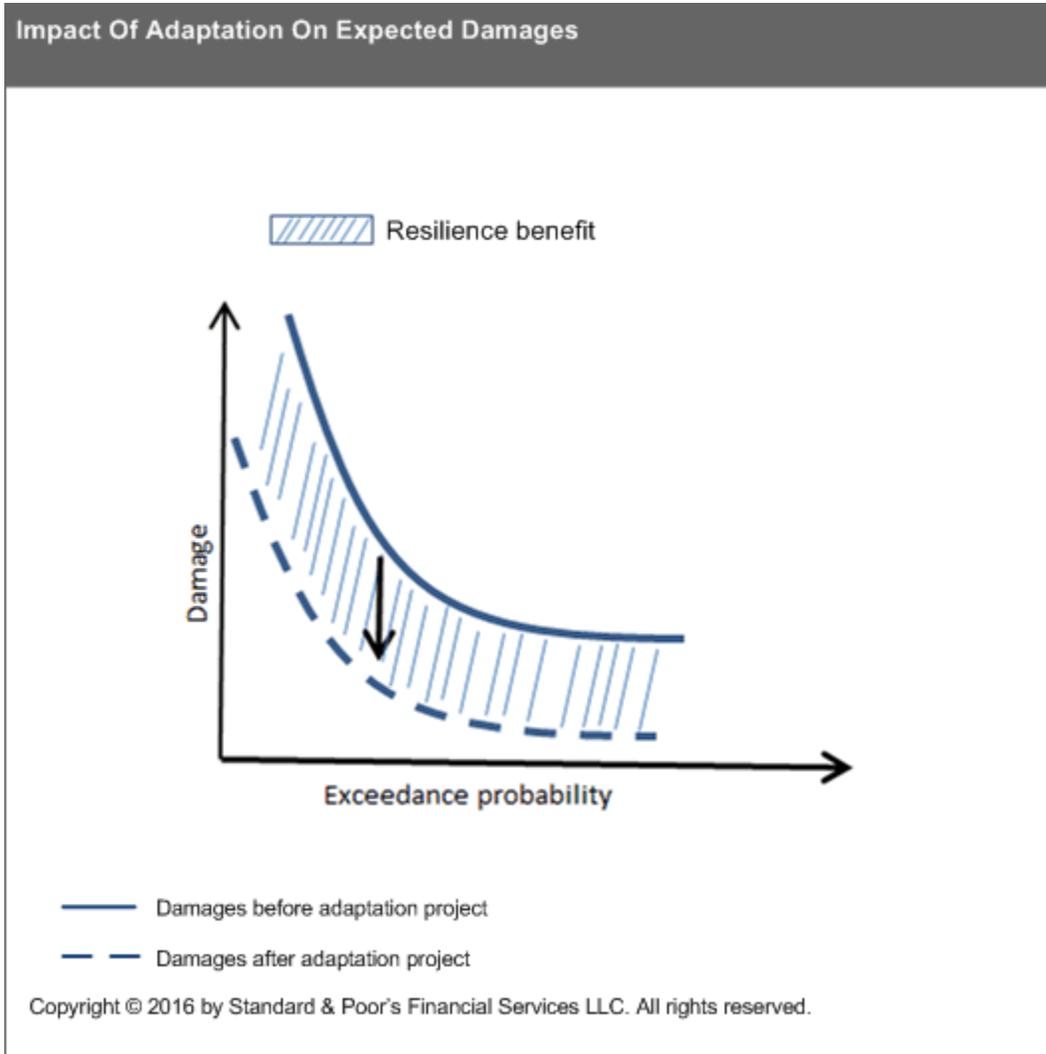
In our calculation, we consider damages caused by the extreme weather events or weather patterns. The publication "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation" by The Intergovernmental Panel on Climate Change (IPCC) is a summary of the current scientific understanding of the expected impact of climate change on extreme weather. We calculate the added resilience a project offers (the resilience benefit) by estimating the reduction in expected damages the infrastructure funded by the green bond is designed to achieve over the targeted period.

To determine the resilience benefit, we will review the analysis the issuer has already performed, in which it has quantified the benefit expected as a result of the capital expenditure. Typically, this analysis is part of the design process and is used to assess the project's viability. In our view, resilience could go beyond financial benefits and incorporate reducing the humanitarian and ecological damage, both direct and indirect. Although it is often difficult to put a financial value on those benefits, experts in the adaptation field have developed methodologies to capture these elements. To the extent that these factors are reflected in the benefit analysis performed by the issuer, we will include them in our evaluation.

Therefore, a green bond for which all types of benefits have been quantified may receive a higher resilience benefit evaluation than one for which only the direct financial benefits have been quantified, all else being equal. In our view, a more-detailed quantification should provide investors with greater insight into the resilience benefit of specific adaptation projects.

We understand that in many developed countries, such as the U.S. and the U.K., projects where the sponsors are seeking public sector funding must provide detailed analyses of the expected benefit. Similarly, such analyses are often required to gain financing from international development banks. We have reviewed some of the methodologies used by such projects and consider that the analyses provided offer us a useful basis for our determination of the resilience benefit of adaptation projects.

Adaptation projects chiefly provide benefits in the case of extreme events, which are uncertain and require probabilistic representation. Therefore, methodologies used for funding purposes normally require that the benefit assessment is done on a probabilistic basis. In practice, these assessments incorporate the benefit over a range of modeled events covering different severities of impact and probabilities of occurrence. The evaluation is also often performed over a range of different future scenarios, incorporating a range of projections of how climate change might develop and exposure to the resulting risks might grow.



In the chart above, the adaptation infrastructure reduces the exposure by shifting the loss curve downward. In other words, the losses arising from each of the modeled extreme events will be lower compared with the same situation without adaptation. The benefit is the reduction of the expected losses, which is represented by the area between the loss curves before and after adaptation.

**Our resilience evaluation scale**

We will assess the environmental benefit on a five-point scale based on the resilience benefit ratio (see table 1). We define this as the ratio of the resilience benefit and the financing derived from the bond's proceeds. In Appendix 2, we have described the rationale underpinning the calibration of the scale.

**Table 1**

Resilience Benefit Scale	
Resilience Level	Range Of Resilience Benefit Ratio
1	>4
2	3-4

**Table 1**

<b>Resilience Benefit Scale (cont.)</b>	
<b>Resilience Level</b>	<b>Range Of Resilience Benefit Ratio</b>
3	2-3
4	1-2
5	<1

As we gain more insights over time, we may refine the calibration of the different levels.

### Reflecting Differences In The Modeling Approaches

We recognize that methodologies and assumptions used for different projects and in different countries vary, and those differences will affect the quantification of the benefit. We appreciate that differences in the methods and key assumptions used are often justified by the specific nature of the projects. Also, those differences reflect the uncertainty regarding how policies for reducing carbon dioxide emissions will impact future carbon dioxide levels and the lack of scientific agreement on the impact of those climate change scenarios on extreme weather events. For example, some issuers may calculate a greater benefit because their model assumes that climate change will have a more-severe impact on extreme weather events. We will not initially specify what methods and assumptions we expect issuers to apply for our evaluation. When we observe agreement in the climate change assumptions used, we may provide additional guidance on the climate change scenarios we expect to see in the issuers' quantification of the benefit.

We will consider the magnitude of the benefit quantified by the issuer, irrespective of the level of sophistication of the analyses used. We recognize that calculating the benefit of adaptation projects often takes place amid considerable data, assumptions, and modeling challenges. These challenges may introduce a material level of modeling uncertainty, which could cause the overall level of the benefit to be overestimated. Therefore, where we consider that the analysis may have materially overstated the benefit, we may adjust it later. Similarly, where we consider that the benefit may have been understated, we may also adjust it. Upward adjustments require prudence, so will be more limited. Our approach for such adjustments will be informed by the experience we have gained from reviewing insurers' economic capital and natural catastrophe modeling, which we perform as a part of our rating analysis (see "A New Level Of Enterprise Risk Management Analysis: Methodology For Assessing Insurers' Economic Capital Models," published Jan. 24, 2011; "How We Capture Catastrophe Modeling Uncertainty In (Re)insurance Ratings," published April 27, 2016; and "Rating Natural Peril Catastrophe Bonds: Methodology And Assumptions," published Dec. 18, 2013).

We expect to apply quantitative adjustments after we provide guidance on the key assumptions we expect to see being used in the benefit analyses performed by the issuers. In determining any quantitative adjustments, we may utilize sensitivity analyses undertaken as a part of the benefit assessment to assess the impact on the size of the benefit of changes in key assumptions. We may use this to adjust the resilience benefit if we consider some of the tested alternative assumptions to be more appropriate than the central assumptions (for example, discount rates or climate change scenario).

### Modifying the initial resilience evaluation for adaptation infrastructure

The second stage in determining our resilience assessment is to incorporate our view of the adequacy of the quantification of the resilience benefit. We may apply a qualitative adjustment to the initial assessment, based on our view of whether the quantification of the resilience benefit was robust, adequate, or less than adequate.

The typical quantification approach is normally considered adequate and our resilience benefit ratio scale incorporates the level of modeling uncertainty associated with that. For example, we consider that the methodologies used to gain public sector funding in developed countries or financing from international development banks are a good benchmark for our adequate category. We therefore make no adjustment where we assess the quantification analysis as being adequate.

Where the quantification approach is considered to be robust--implying that it incorporates a smaller modeling uncertainty than typical quantification approaches--we intend to raise the initial assessment by one level (for example, to Resilience Level 2 from Resilience Level 3). We expect that this may be the case for projects where the design allows for uncertainties regarding the impact of climate change. Such projects are typically flexible, allowing adjustments to their structure over time (for example, the height of the flood defenses) to reflect improvements in the understanding of how climate change is likely to affect the covered area.

We would apply this positive modifier if the quantification appropriately reflects the following modeling factors:

- It allows for all material benefits and negative impacts of the adaptation project.
- It uses a probabilistic simulation approach to generate a sample of weather events representing the frequency, severity, and location of the range of plausible events.
- The models used are calibrated based on a long event history.
- Vulnerability assumptions are based on robust calibration.
- Exposure data is sufficiently detailed to allow modeling of key damage drivers.
- It allows for growth in exposure over the projection period, based on robust growth assumptions.
- The assumed modeling period, and maintenance and financial assumptions (especially the discount rate) are well-justified and appropriate.
- The model allows for projected climate change caused by global warming.
- It considers the sensitivities of the benefit to alternative projections of climate change and exposure growth rates.
- It assesses the sensitivities of the key parameters of the modeled weather events and vulnerability assumptions.

We may assess the quantification as less than adequate when some of the above-listed modeling factors are not sufficiently captured or not reflected at all. Where the quantification approach was less than adequate, we intend to reduce the initial assessment by one level as there may be a considerable risk that the resilience benefit is overstated.

As with the initial calibration, as we gain greater insight over time, we may provide a more-explicit description of what types of modeling we consider to be robust, adequate, or less than adequate.

### **Evaluating the impact of adaptation projects in developing countries**

If no probabilistic benefit analysis has been performed, but the issuer can provide another type of analysis, such as a scenario-based analysis, that demonstrates that the benefit is likely to exceed the financing, we will assess it at Resilience Level 4. It is more likely that we will apply this modifier to adaptation projects in developing countries.

Where a project will protect infrastructure in a developing country that has high exposure to climate risk and a high level of vulnerability, we may modify the assessment, increasing it by one level following a qualitative assessment of the overall benefit. In our view, a considerable improvement in resilience in a highly exposed area of such a country is likely to have significant social benefits, which may not be adequately captured in the benefit analysis. Fully capturing

the benefits of adaptation is more difficult where significant benefits may arise from fewer casualties, displaced people, and disrupted livelihoods following extreme weather events.

We anticipate using The Notre Dame Global Adaptation Index (ND-GAIN; <http://index.gain.org/>; see "Climate Change Is A Global Mega-Trend For Sovereign Risk") to identify countries that have high exposure to climate risk and a high level of vulnerability.

## **Integrating The Resilience Benefit Into The Green Bond Evaluation**

The resilience level is converted into a numerical resilience score as shown in table 2. To determine the overall green bond evaluation, the resilience score is combined with the governance and transparency assessments of the green bond as described in "Proposal For A Green Bond Evaluation Tool".

**Table 2**

<b>Resilience Level</b>	<b>Resilience Score</b>
1	1.00
2	0.75
3	0.50
4	0.25
5	0.00

## **Appendix 1: Case Studies**

### **Example 1: Application of the methodology for adaptation infrastructure**

Let's consider city A, which is located on the banks of a major river estuary. This city recognizes that because of climate change, its current flood defenses will not be adequate in the future. To address that the city is issuing \$1 billion in adaptation green bonds to finance the strengthening of its flood defenses. The city's cost-benefit analysis suggests that over the defenses' assumed effective operation period, they would result in a reduction of the expected financial, humanitarian, and ecological damages caused by floods equivalent to \$2.5 billion. The resilience benefit is therefore equal to 2.5x, which equates to an Resilience Level 3 on our evaluation scale. In most cases, we expect to assess the quantification approach as adequate and would not need to apply any other adjustments, so Resilience Level 3 is the most likely final assessment. Below, we outline examples of situations where we may apply adjustments:

#### **First scenario**

When we review the city's approach to quantifying the resilience benefit of the flood defenses, we assess its approach as robust under our framework. In particular, we see that:

- The assessment fully reflects the current exposure to flood risk and how it is likely to increase over the projection period.
- The modeling of the probability of flood risk is well-calibrated and the projections appropriately reflect the impact of climate change.
- It has considered the sensitivity of the key assumptions to the impact of climate change on the flood-risk projections

and the assumed vulnerabilities of the properties to flood damage.

This robust assessment of the quantification improves the overall evaluation by one notch to Resilience Level 2.

### **Second Scenario**

When we review the city's approach to quantifying the resilience benefit of the flood defenses, we assess it as less than adequate under our framework. In particular, we see that:

- It is largely based on the damage experienced after a recent major flood event, without making any allowance for the impact of climate change and exposure growth.
- The modeling assumed that the recent flood was a one-in-100 year event, and we do not consider this appropriate given the number of major floods experienced over the past 30 years.

This would lead us to conclude that the benefit of the flood defenses may have been considerably overstated and the quantification approach is less than adequate, causing us to decrease the overall evaluation by one notch to Resilience Level 4.

### **Third Scenario**

City A is in a country we consider to be highly vulnerable to floods--it is a developing country ranked in the last quartile on the Notre Dame Global Adaptation Index. If we find that the social benefits are materially understated, for example, no allowance is made for the lower economic and social costs due to the reduced risk of major epidemic triggered by floods, we may apply an additional adjustment to the assessment and modify it up by one notch, leading to a final assessment of Resilience Level 2.

## **Appendix 2: Calibration Of The Scale**

In calibrating our adaptation scale, we considered two studies:

- Mechler's review of the literature on the benefit of adaptation projects ("Reviewing estimates of the economic efficiency of disaster risk management: opportunities and limitations of using risk-based cost-benefit analysis"). His analysis indicates that based on 39 studies, the average benefit/cost ratio was 3.7x and the range of ratios in those studies was 0.1x–50x. We anticipate that most adaptation green bonds will be for flood-based adaptation projects. Mechler's review suggests that the average benefit/cost ratio for these projects is 4.6x, based on 21 studies with ratios of 0.1x–30x.
- ECONADAPT project report "Assessing the economic case for adaptation to extreme events at different scales". This report analyzed the benefit-to-cost ratios (BCR) for investments in flood defenses based on 110 observations on projects from 32 studies covering 16 European countries. The result showed average BCR of 5.9x and median BCR of 3x. We also took into account the distribution of the level of BCR, which is disclosed in the report. The data showed that variation in BCR under different analytical approaches was not large. That said, the report recognizes that the studies it analyzed often failed to capture nonfinancial benefits.

Although these reports aggregate the findings of various adaptation projects covering different countries, we recognize that the number of projects covered is not large enough for robust calibration.

The lowest level (5) indicates an adaptation project that would provide lower benefit than the financing amount. We set the highest level (1) to be higher than 4x, which is around the average/median figures reported in those studies.

Our rationale is that projects have already achieved this level and it represents a significant resilience benefit relative to the cost of constructing it. Also, we reflect the risk of "publication bias," as identified in the second report. This refers to the likelihood that successful investments and projects are more frequently reported in official documents, and therefore have a higher chance of being included in the studies covered by the report.

Furthermore, we do not consider it appropriate to differentiate above the 4x level because to do so could reward projects that address highly vulnerable infrastructure, but on a smaller scale, instead of addressing vulnerabilities on a bigger scale, which will carry lower resilience benefit.

For example, a project that reduces flood risk in an area with a high concentration of expensive real estate may achieve a high resilience benefit ratio. If the scope of the project were expanded to include a wider area that includes less-affluent areas, the resilience benefit ratio may reduce, but a wider community may benefit from it.

Our calibration implicitly assumes that the entire cost of the adaptation project will be met through the financing raised by the green bond. Where the adaptation project is partially funded from other sources, we will pro rata the resilience benefit.

## **Related Research**

### **Related research**

- Proposal For A Green Bond Evaluation Tool, Sept. 2, 2016

### **External Publications**

- Reviewing estimates of the economic efficiency of disaster risk management: opportunities and limitations of using risk-based cost-benefit analysis, by Mechler R., Nat Hazards (2016) 81: 2121
- Assessing the economic case for adaptation to extreme events at different scales, published by the ECONADAPT project

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## What's Next For U.S. Municipal Green Bonds?

**Primary Credit Analyst:**

Kurt E Forsgren, Boston (1) 617-530-8308; kurt.forsgren@spglobal.com

**Secondary Contact:**

Geoffrey E Buswick, Boston (1) 617-530-8311; geoffrey.buswick@spglobal.com

**Research Assistant:**

Joshua Hanson, Centennial

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# What's Next For U.S. Municipal Green Bonds?

The issuance of U.S. municipal green bonds – bonds backing projects with positive environmental effects -- is increasing, joining a trend in the broader market for similarly labeled debt instruments. S&P Global Ratings estimates the municipal market will see between \$6.3 billion and \$7.2 billion of green bonds in 2016 (see chart 1), a meaningful step up from \$4.1 billion in 2015 and \$2.4 billion in 2014. Our 2016 estimate is based on actual data through July from Climate Bonds Initiative (CBI) assuming issuance stays on pace and average par remains the same.

However, we believe the market for U.S. municipal green bonds could be significantly larger. A recent HSBC report conservatively identified \$30.3 billion of municipal bonds issued from 2014 to 2016 that met its green standard, only \$10.9 billion of which were actually labeled green by issuers. This suggests the potential for significant growth simply by a broader acceptance of this asset classification. The same HSBC report estimates that green labeled municipals represented about 8% of the total \$118 billion in labeled green bonds issued globally since 2007.

## Overview

- The U.S. municipal market could see \$6.3 billion-\$7.2 billion of green bonds issued this year, up from \$4.2 billion in 2015;
- In our view, the potential for broader participation by municipal market issuers into green bonds is high, and will be a function of costs relative to benefits, investor demand, and broader public support for infrastructure projects that promote sustainable long-term environmental objectives.
- Over time we expect to see metrics to evaluate the level of disclosure and environmental credentials of green bonds becoming more important to investors.

Issuance of green labeled transactions in the corporate debt market may reach \$15 billion this year while they are just beginning in the real estate sector (see "The Corporate Green Bond Market Fizzes As The Global Economy Decarbonizes," published April 15, 2016 on RatingsDirect, and "New Shoots Emerging In Green Bond Market For Real Estate," published Aug. 22, 2016). Globally, the market for green bonds is expected to expand significantly as signatories to the December 2016 Paris climate change agreement increase efforts to reduce carbon emissions (see "The Paris Agreement: A New Dawn for Tackling Climate Change, Or More Of The Same?," published Jan. 18, 2016).

## Where Is The Municipal Green Bond Market Headed?

Current low interest rates and other municipal market fundamentals obscure efforts to discern any preferential pricing for green bonds in the primary market. This would suggest that rather than a lower cost of capital, near-term growth of the market will come from a combination of reclassifying eligible (but unlabeled) bonds as green and continued recognition by issuers of the potential long-term social benefits derived from these investments. Successful marketing will also contribute to near-term growth as many municipal issuers seek to serve different segments of the investor base, including institutional investors with environmental mandates and focused investors with separately managed accounts serving high net worth clients.

Over the longer term, we believe the broad and deep \$3.7 trillion municipal market, which is on track to see issuance in 2016 in excess of \$400 billion, can meaningfully add to the global green bond market. But we have questions as well:

- Will the municipal sector embrace the global trend toward greater transparency and comparability in financing public infrastructure assets that meet broad environmental objectives and investor demand, particularly if it requires dedication to independent external review, ongoing reporting, and additional costs? and,
- If the U.S. municipal market for green bonds expands as expected, how will investors evaluate the qualitative environmental credentials of these projects relative to other green fixed-income investments?

## **U.S. Municipal Asset Categories**

Following the first self-labeled municipal green bond, issued by the Commonwealth of Massachusetts in June 2013, the market has seen growth both in issuance volume and the asset categories represented. Chart 2 illustrates that after the initial green bonds were issued primarily for water projects, the range of asset categories has expanded to include buildings, power, land conservation, and transportation. Water projects still represent about half of all par issued for green bonds as well as half of all issues. Transportation comprises 24% of the par but just 6% of the issues, reflecting the capital intensity of the sector and attributable almost exclusively to the nearly \$1.4 billion issued since 2013 by the New York Metropolitan Transportation Authority. The prevalence of energy efficient buildings in education and health care drives that category to 15% of par and 23% of all issues.

Chart 1

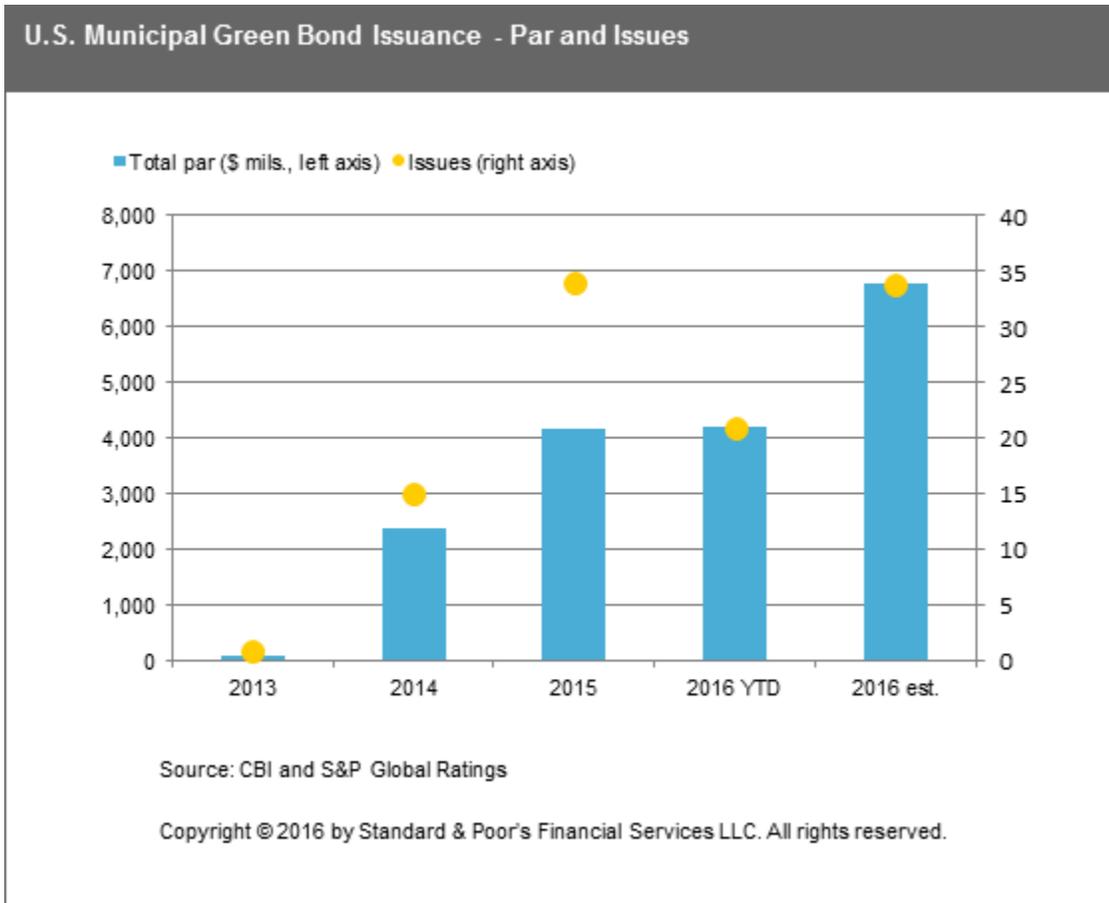


Chart 2A

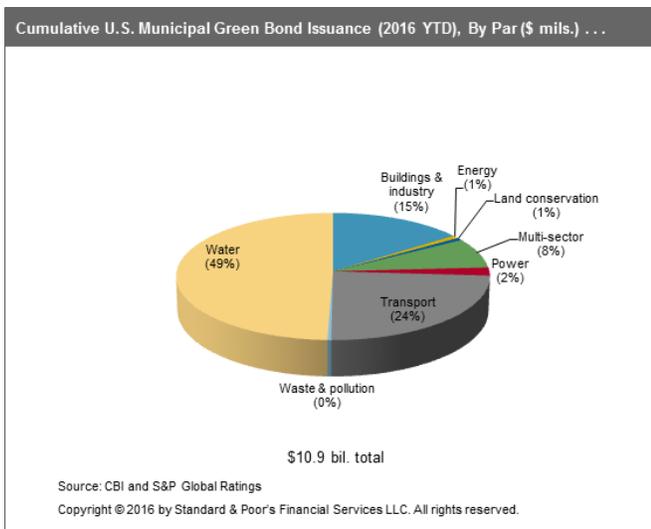


Chart 2B

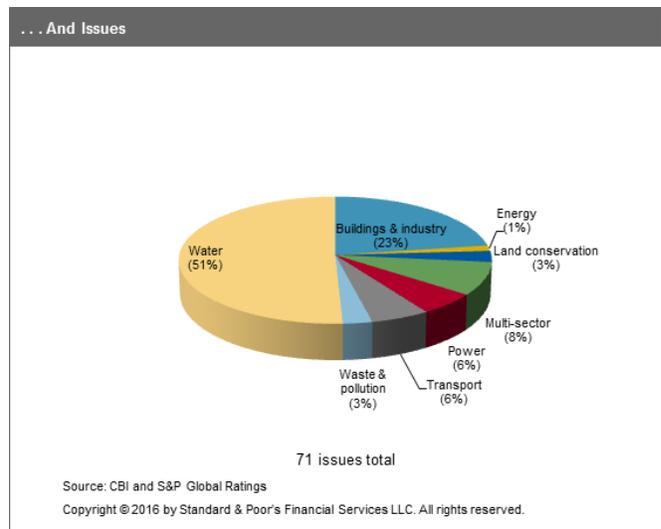
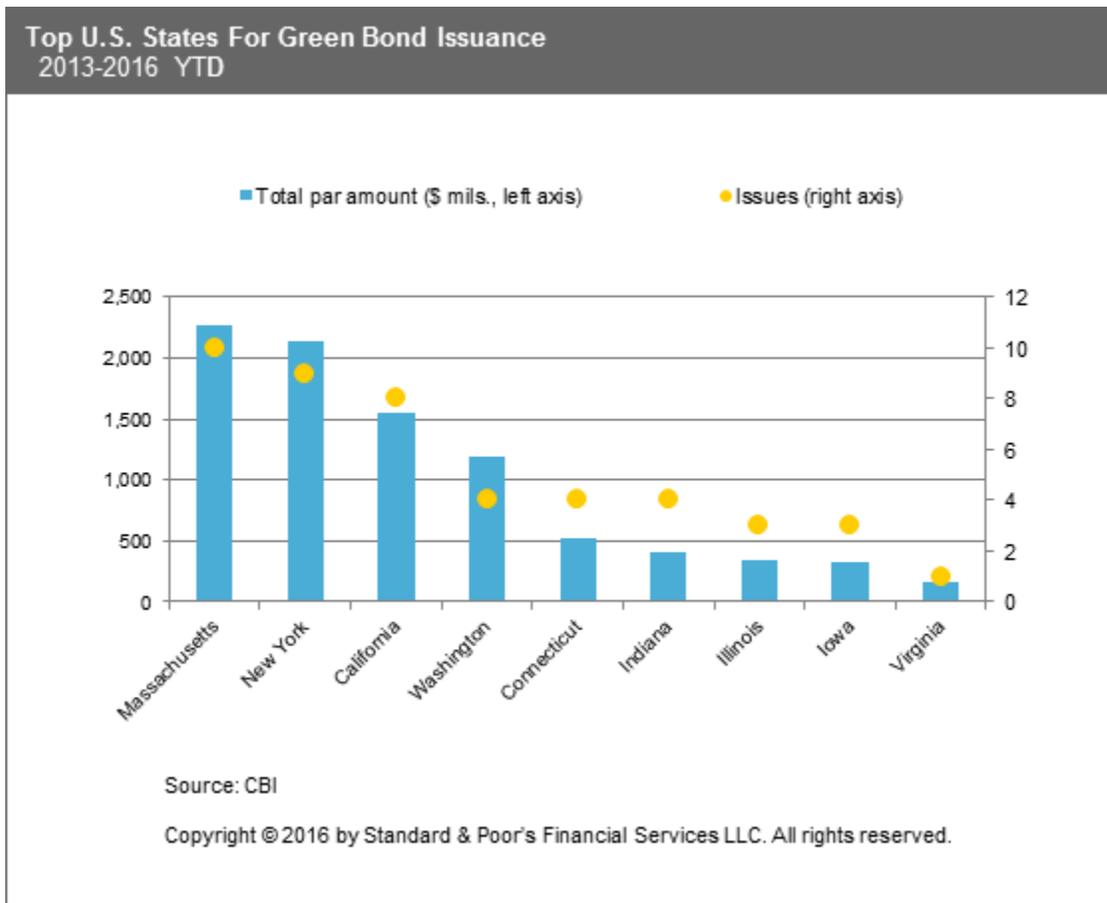


Chart 3



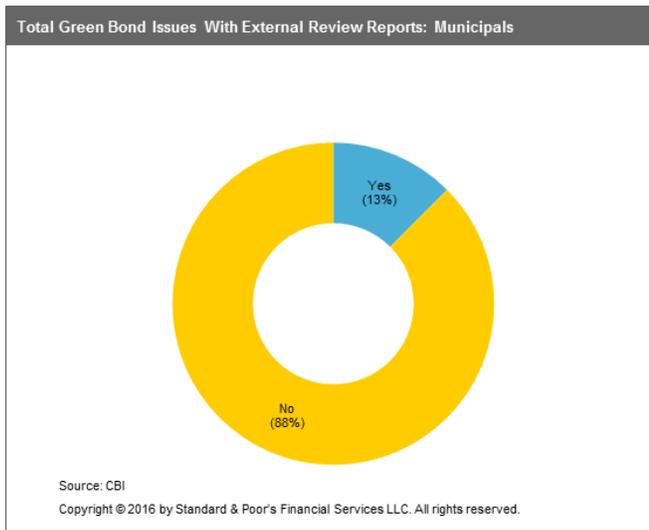
There has been significant progress in the development of common definitions to support the green market. Through its technical and industry working groups, CBI is developing taxonomy with supporting criteria to group like-asset classes under broad categories for the purpose of standardization and leveraging common data across related projects. One challenge is balancing the need for global consistency across and within asset categories while serving the often unique features of local infrastructure providers in different markets. For example, many U.S. municipal water utilities operate as combined enterprises with water, wastewater, and storm water assets as part of an integrated system. Other water and wastewater utilities operate as separate enterprises. CBI's current taxonomy has yet to fully develop wastewater as part of the water category, which could leave many municipal issuers that operate wastewater and particularly stormwater enterprises without a CBI-certified green bond option.

## Defining Green

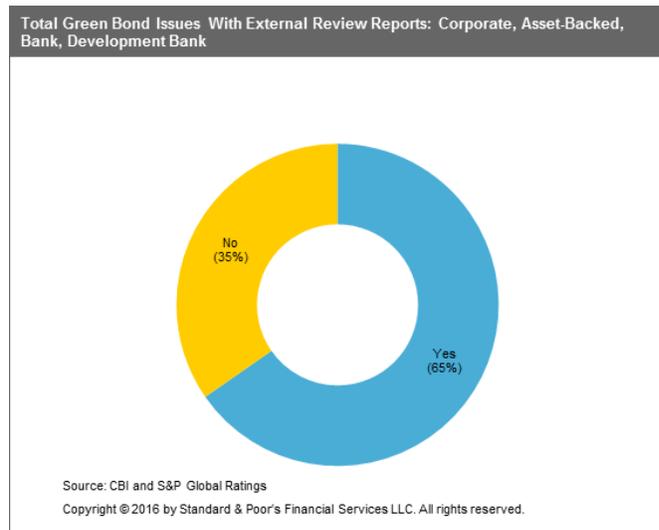
Though a global standard is evolving, "green bonds" is still a loose term, and in the municipal space, the presence of an independent second opinion or third-party external review report certifying a bond's green credentials is much less common than in the broader market (see chart 4). Indeed, while the growth in green bond issuance reflect investor demand, it highlights a significant challenge: what exactly does "green" mean and will the environmental objectives of

this developing market be eroded by "greenwashing" (labeling bonds with questionable or limited environmental benefits as green)? We believe that transparency for this developing market requires clear definitions and disclosure of how proceeds are used, how projects are managed, and a clear demonstration of the environmental benefits to be derived.

**Chart 4A**



**Chart 4B**



The International Capital Markets Association (ICMA), which defines green bonds very broadly, serves as the de facto market leader in establishing voluntary guidelines that encourage transparency and disclosure, known as the Green Bond Principles (GBPs). Initiated in 2014 by several banks and last updated in June 2016, the GBPs outline process guidelines for issuers and their agents that focus on transparency, accuracy of data and disclosure at issuance beyond, with the objective of providing standardization across the market and limiting "greenwashing" (see box, "Four Pillars of the Green Bond Principles").

The ICMA defines a green bond as any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance in part or in full new and/or existing eligible projects that provide clear environmental benefits -- assessed and quantified by the issuer where feasible. Examples of project categories or asset types that are recognized as Green Bond Principles-eligible includes those supporting:

- Renewable energy,
- Energy efficiency,
- Pollution prevention,
- Sustainable management of water and natural resources,
- Transportation, or
- Adaptation of infrastructure to the effects of climate change.

This broad spectrum of green categories suggests a need among investors for further refinement and independent evaluation of a project's environmental credentials.

## The Four Pillars of The Green Bond Principles

### Use of proceeds

Transaction documents should clearly describe that the environmental benefits of the asset being financed or re-financed are consistent with recognized green categories and include a quantifiable assessment by the issuer if feasible.

### Process for project evaluation and selection

Issuers should detail the criteria by which the projects fit within the GBP categories and the environmental sustainability objectives.

### Management of proceeds

Issuers should separately segregate and track bond proceeds through the use of sub-accounts or other means throughout the drawdown period.

### Reporting

After the drawdown of proceeds have been matched to eligible projects, issuers should provide and keep current ongoing disclosure regarding the qualitative and quantitative performance measures if possible, verifying the environmental impacted expected or experienced.

## U.S. Municipal Market Examples

While adherence to the GBPs provides uniformity to the process, confirmation that the assets financed are green is often left to an external reviewer, and it is here where we see a range of disclosure in the U.S. The vast majority of municipal issuers of green bonds have provided no third-party external review relative to other segments of the capital markets, though we have found several reports associated with 2016 issues (see table). More common are examples where issuers include the "green" label in their offering statements and disclose a range of descriptions regarding use of proceeds. For those U.S. municipal issuers that sought and included in their offering statements a report by an independent third party, the report typically offers an opinion confirming that the financing is achieving a specific industry-accepted level of energy conservation or that proceeds more broadly meet the ICMA's GBPs (see box, "Types Of External Reviews Of Green Bonds").

**Table 1**

### 2016 U.S. Municipal Labeled Green Bonds (through July)

Issuer	Series	State	Par (\$ mils.)	Rating	Sector	External review
Vermont Educational and Health Building Financing Agency	Series 2016B	VT	\$89.00	A-	Buildings & industry	Yes
American Municipal Power	Series 2016 A Meldahl Hydroelectric Project Revenue Bonds	OH	\$80.05	A	Power	Yes
Greater Chicago Metropolitan	2016 Series C, D, E, F GO Unlimited & Limited GO Tax Capital Improvement Bonds	IL	\$104.00	AA+	Water	--

**Table 1**

2016 U.S. Municipal Labeled Green Bonds (through July) (cont.)						
Issuer	Series	State	Par (\$ mils.)	Rating	Sector	External review
San Diego Water Authority	Series 2016A Water Revenue Refunding Bonds	CA	\$98.95	AAA	Water	--
Maryland Economic Development	Series 2016A, Series 2016B, Series2016C, Series2016D	MD	\$313.04	BBB+	Transport	--
Massachusetts Development Finance Agency	Series 2016-A and Series 2016-B Emanuel College Issue	MA	\$50.20	NR	Buildings & industry	--
Rhode Island Infrastructure bank	Series 2016B Water Pollution Control Revolving Fund Revenue Bonds	RI	\$18.79	AAA	Water	--
New York Metropolitan Trans Authority	Subseries 2016B-2 Dedicated Tax Refunding Bonds	NY	\$588.31	AA	Transport	Yes
New Jersey Environmental Infrastructure Trust	Series 2016A-1 Environmental Infrastructure Bonds	NJ	\$29.32	AAA	Water	--
San Francisco Public Utilities Commission	2016 Series A	CA	\$240.58	AA	Water	Yes
Massachusetts Water Authority	2016 Series C General Revenue Refunding Bonds	MA	\$681.62	AA+	Water	--
California Infrastructure and Economic Development Bank	Series 2016 Clean Water State Revolving Fund Revenue Bonds	CA	\$410.74	AAA	Water	--
Columbia University	Subseries 2016A-1	NY	\$50.00	AAA	Buildings & industry	--
City of Saint Paul	Series 2016B Sewer Revenue Bonds	MN	\$7.72	AAA	Water	--
Cleveland	Series 2016 Ohio River Pollution Revenue Bonds	OH	\$32.39	A+	Water	--
Indiana Finance Authority	Series 2016A, Series 2016B State Revolving Fund Program Bonds	IN	\$115.79	AAA	Water	--
Ramsey County	Series 2016A GO Sold Waste Facility Revenue Bonds	MN	\$17.90	AAA	Waste & Pollution	--
New York Metropolitan Trans Authority	Series 2016 A-1, A-2 Transportation Revenue Bonds	NY	\$782.52	AA-	Transport	Yes
Massachusetts State Clean Water	Series 19 State Revolving Fund Bonds	MA	\$207.81	AAA	Water	--
San Diego Unified School District	Series 2016 General Obligation Bonds (Dedicated Unlimited Ad Valorem)	CA	\$100.00	NR	Buildings & industry	--
University of Texas	Series 2016B Revenue Financing System Bonds	TX	\$206.04	AAA	Buildings & industry	--

Source: Climate Bonds Initiative and S&P Global. Water category includes clean water and wastewater projects.

In May 2016, the San Francisco Public Utilities Commission (SFPUC) issued \$308.4 million of wastewater revenue bonds, comprising \$240.6 million series A (designated as green bonds) and \$67.8 million of series B. The SFPUC provided data to CBI and received certification that the series A bonds qualified as green bonds. As part of the certification process, the SFPUC received a separate third-party external review report (although not included in the official statement) confirming compliance with the GBPs. The SFPUC indicates that it will "undertake reasonable efforts" to maintain that certification going forward and report information of the use of bond proceeds on their website.

Other third-party reports provide anticipated green credentials, but not at the time of issuance. In June 2016, the

Massachusetts Development Finance Agency's issued \$188.24 for Emmanuel College comprising \$137.9 million series 2016A bonds and \$50.27 million series 2016B taxable green bonds. The series 2016B taxable green bonds were issued to finance a 692 bed residence hall. No third-party external review report was provided, however the college will apply for and expects to receive a Leadership in Energy and Design (LEED) certification for the building, which is provided only upon completion and inspection several years after the bond sale. Bond proceeds will be tracked and disclosed, however the college will not be providing any further reporting to investors after the expected LEED certification.

Finally, the vast majority of green labeled municipal bond issues lack any independent third-party external reviews. Some, like the City of Saint Paul, Minn., which in April 2016 issued \$7.72 million of sewer green revenue bonds, simply state their intention to comply with the ICMA's GBPs. Less common are transactions like the San Diego Unified School District, which issued \$100 million in January 2016 for a variety of energy efficiency, renewable, water conservation and waste management projects. Instead of referencing the GBP standard, the district provided a significant level of disclosure regarding projects categories and alignment with a green standard developed as part of city-wide climate action plan.

Thus, it is clear in the developing U.S. municipal market for green bonds that we observe both good intentions and a wide variation in reporting, including independent third-party confirmation of environmental credentials. Over time, a key issue will be the pre- and post-sale level of commitment to timely and complete reporting by municipal issuers which operate in a segment of the capital markets where consistent disclosure has been a continuing concern voiced by investors. In our view, the heightened focus on disclosure in the green bond market is a positive that could carry over to more traditional financial disclosure and improve diligence in satisfying those ongoing requirements.

## **Types Of External Reviews Of Green Bonds**

### **Consultant review**

This type of review includes advice from institutions with recognized expertise in environmental sustainability or other aspects of the issuance of a green bond (previously called Second Party Reviews and Consultation).

### **Verification**

These are independent external reviews of a green bond, green bond framework, or underlying assets. In contrast to certification (below), verification (previously called audits) often focus on the bond's alignment with the internal standards or claims made by the issuer.

### **Certification**

This includes a review of an issuer's green bonds, the associated green bond framework, or use of proceeds certified by a third party against an external green assessment standard.

### **Rating**

This includes a review of an issuer's green bond or green bond framework by an independent third party, rating agency, or research provider, and differs from a company's broader environmental, social, and governance (ESG) rating because it would be limited to individual green bonds or the issuer's green bond framework.

## **Global Market Expectations For Independent Opinions**

While standards have developed, we believe that investors would benefit from a more comprehensive approach to understanding the actual, and comparative, environmental credentials of a potential green bond investment. Many current second-party opinions focus on a check-box review of the GBPs, producing a binary outcome, whereby a bond is either certified if it reaches this standard or failed if it falls short. We believe that as the market develops investors will look for a more relative assessment of green projects to see which of two certified bonds provides the greatest environmental benefit.

Toward this end, S&P Global Ratings has proposed a green bond evaluation framework and scoring methodology to provide greater transparency to investors and a clear understanding of the credibility and benefit of a green bond (see "Proposal for a Green Bond Evaluation Tool," published Sept. 2, 2016). Under the proposed framework distributed for market comment, the methodology would provide an analysis and estimate of the environmental impact of the projects or initiatives financed by the bond's proceeds over its lifetime relative to a local baseline. This would be in addition to assessing the governance and transparency surrounding the bond. When evaluating environmental impact, the methodology would consider both climate change mitigation projects (that focus on efforts to reduce or prevent the emission of greenhouse gases) and adaptation projects (that aim to take practical steps toward reducing the exposure to and managing the impacts of natural catastrophes, such as building the resilience of communities and critical infrastructure).

In our view, we believe that there may be a gap in the market for a green bond evaluation to measure what the green label means in terms of its qualitative environmental element, whether that is related to the mitigation of, or the adaptation to, climate change. There are numerous taxonomies that list the categories of projects (defined as the assets or approaches financed by the bond) that are potentially eligible for green bond financing. However, as noted, these approaches face problems defining what is green, especially as climate change mitigation and adaptation technologies are expanding rapidly in many sectors. The evaluation would also take account of the adequacy of such products' governance relating to their environmental impact, management of proceeds, and transparency and disclosure in line with assessments currently provided by second opinions.

Only a rating committee may determine a rating action and this report does not constitute a rating action.

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Guest Opinion:

## Aligning 2016 Green Finance Expectations With Green Bond Index Strategies

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## Guest Opinion:

# Aligning 2016 Green Finance Expectations With Green Bond Index Strategies

*(Editor's Note: The author of this article is Martina Macpherson, global head of sustainability indices at S&P Dow Jones Indices, which is an analytically and editorially independent division of S&P Global, as is S&P Global Ratings. The thoughts expressed in this Guest Opinion are those of the writers and do not necessarily reflect the views of S&P Global Ratings.)*

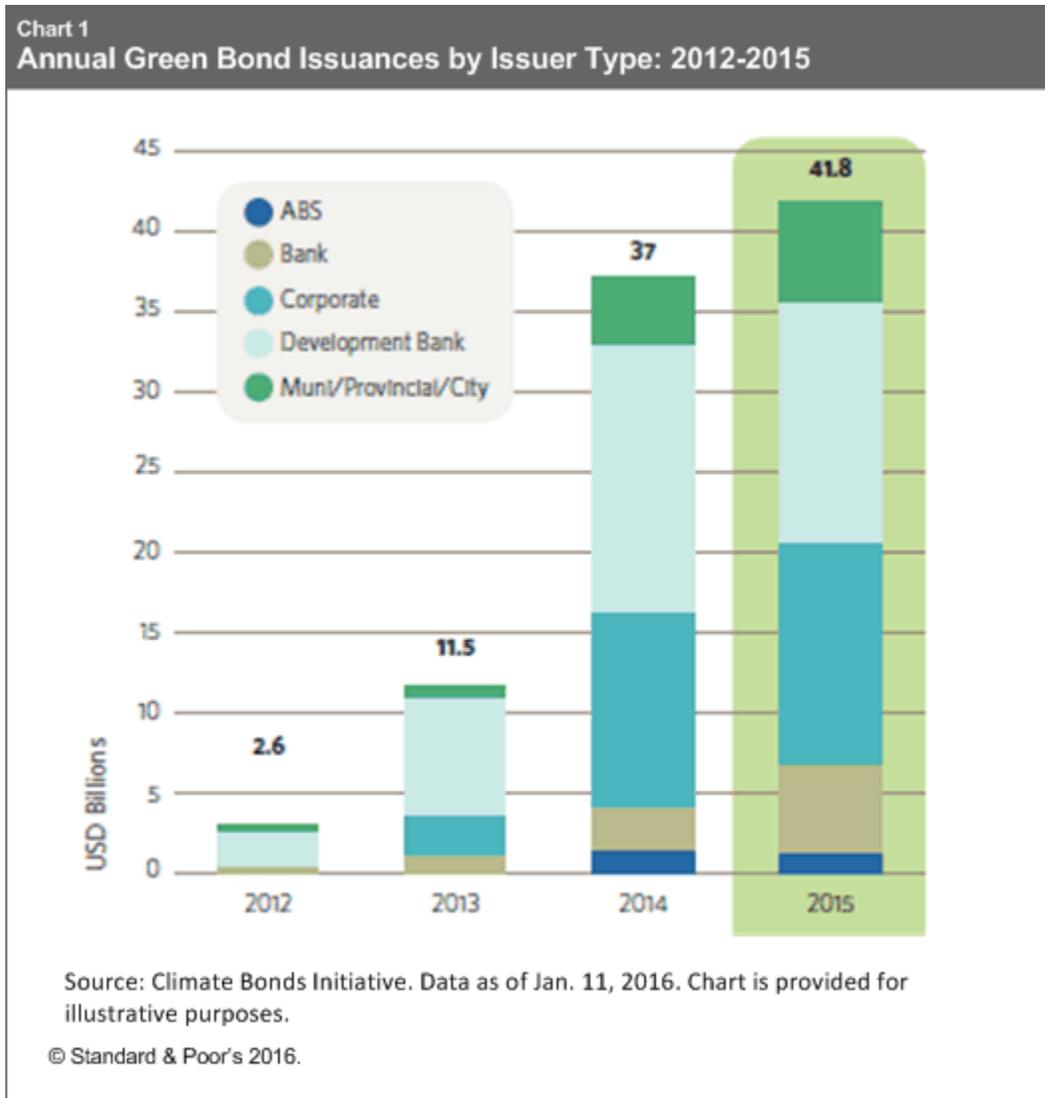
Living up to expectations, 2016 has become "the year of green finance" (see endnote 1), crowned by the adoption and ratification of the Paris Agreement that entered into force on Nov. 4, 2016 (2). On the heels of this historic agreement and the UN Development Programme's Sustainable Development Goals (3), the momentum for addressing global environmental issues has moved into the financial mainstream. Over the past 18 months, a number of industry- and policy-led initiatives have been launched that support the mainstreaming of private-sector capital to address sustainable investment, green finance challenges, and long-term value creation, to mention just a few: the G-20 Green Finance Study Group under the Chinese G-20 presidency (4), the Task Force on Climate-Related Financial Disclosures established by the Financial Stability Board (5), the EU Commission's Capital Markets Union program of 33 actions to mobilize capital (6), and the Sustainable Stock Exchange's Green Finance Working Group (7).

Even the International Monetary Fund, which long held the view that green finance was solely a private-sector matter, has shifted its position and now mandates disclosure of firms' carbon footprints and appropriate stress testing for climate risks to ensure financial stability during the transition to a low-carbon economy (8).

## The Market Opportunity For Green Bonds

Green finance initiatives around the world have led to increasing interest in green bonds, which are plain-vanilla fixed-income investments created to fund projects that have positive environmental or climate benefits. They can play an important role in engaging institutional market participants in the transition to low-carbon and climate-resilient development and growth (9) to meet the UN Framework Convention on Climate Change goal (2009) (10) of limiting global warming to 2-degrees Celsius above preindustrial temperatures. Indeed, the scaling up of green bond issuance for sustainable development has become a key area of focus (11).

Since the first green-labeled bonds were issued by the European Investment Bank in 2007 (12) and the World Bank in 2008 (13), demand for green bonds has increased significantly. The total amount of green-labeled bond issuances accumulated to USD41.8 billion at the end of 2015 (14), with this year breaking another record, with issuances totaling USD65.4 billion to date (15). That represents 1.5 times the amount raised during the entire previous year. Bank of America Merrill Lynch predicts that green bond issuances could even reach up to USD90 billion (16) by year-end 2016.



## Defining "Green": From Green Bond Principles And Taxonomies To Ratings

The potential for scaling up green finance, and green bonds, is substantial. However, the speed and scale at which the green bond market can further develop and mature relies on several variables, including policy and regulatory factors, market conditions, and financing trends (17). It faces a range of specific challenges and barriers such as underdeveloped domestic bond markets, issuer views about costs versus benefits, a mismatch between projects, bonds, and institutional investors, as well as a lack of commonly accepted green standards and definitions (18).

Since inception in 2014, the Green Bond Principles (GBP), a set of voluntary process and reporting guidelines for the use of proceeds of green bonds (19), have been at the center of the effort to promote voluntary principles for green finance. The principles aim to provide "more clarity of green finance definitions" to "facilitate cross-border investment in green bonds" and "improve the measurement of green finance activities and their impacts," as called for in the

September 2016 "G20 Communiqué on Green Finance." (20)

Over the years, multiple standards, taxonomies, and tools for verification have been developed in line with the Green Bond Principles, including Second Party Opinions, the CBI Standard, and the Chinese government-backed "Green Bond Guidelines" and the "Green Bond Endorsed Project Catalogue" (published by the People's Bank of China and the Green Finance Committee of China Society of Finance and Banking, 2015-2016) (21). Supported by the Sustainable Stock Exchanges Initiative, issuer and investor demand, the Luxembourg Stock Exchange (22) and the London Stock Exchange Group (23) launched green bond listing requirements and trading models. And just last week, ShareAction, 2 Degrees Investing Initiative, Client Earth, Carbon Tracker, Eurosif, and the World Wildlife Fund announced that they will urge the European Commission to support speedy development of standards for green bonds (24)--echoing Bank of England Governor Mark Carney's recent call (25)--as well as recommending policy makers should look at tax incentives to encourage market growth.

Still, the question about how to define, measure, and benchmark "green" remains unclear. The "greenwashing" of projects financed by labeled green bonds could undermine the short-term credibility of the market, and with it, its long-term growth. Defined "green" eligibility criteria, more disclosure and transparency, and an independent assurance for green bond issuances remain key areas of investor concern (26). There has been global investor commitment to address these, most notably via the "Paris Green Bond Statement" which was signed by 27 investors representing over USD11.2 trillion of total assets under management in December 2015 (27).

Industry developments have followed suit: In 2016, S&P Global Ratings have recently started to develop a tool to evaluate green bonds and a framework for assessing corporate issuers' exposure to environmental, social, and governance (ESG) risk. The proposed "Green Bond Evaluation" tool will score a given bond issue in at least three areas--transparency, governance, and mitigation/adaptation, as relevant--with these scores then amalgamated and weighted to produce a final score. The proposed methodology looks beyond the governance and management of a bond by providing an analysis and estimate of the environmental impact of the projects or initiatives financed by the bond's proceeds over its lifetime relative to a local baseline. This is in addition to assessing the governance and transparency surrounding the bond. When evaluating environmental impact, the methodology considers both climate change mitigation and adaptation projects.

## **The Investment Case For Green Bond Indices**

There has been growing engagement in the areas of sustainable development and green finance issues within the investment community. Signatories of the Principles for Responsible Investment (28) have grown every year since it was introduced in 2006, and now represent over USD60 trillion of assets under management. The Montreal Pledge (29), which commits investors to measure and disclose the carbon footprints of their portfolios, has been signed by more than 120 investors with over USD10 trillion in assets under management, and the Portfolio Decarbonisation Coalition (30), which commits institutional investors to reduce the carbon intensity of their portfolios, has grown substantially since it was launched in 2014. It now includes 25 investors overseeing the decarbonization of USD600 billion in commitments.

The rationale for investor engagement regarding sustainability issues goes beyond "doing well by doing good." It's driven by a growing consensus (31) that acting to build sustainability into capital markets will bring significant economic gains, while inaction could lead to economic losses. These losses for global assets from climate change are estimated at USD4.2 trillion in present value terms, with the potential to rise to USD7 trillion if global temperatures are allowed to increase by an average of 5 degrees C (32). And related industry studies estimate that cumulative lost GDP from climate change impacts could amount to more than USD44 trillion on an undiscounted basis (33).

However, despite the emphasis that investors have put on sustainable investment and green finance issues, the green bond market itself remains still relatively small, particularly when considering benchmark size deals for government and agency bonds. Hence, it's not a surprise that green bonds, despite their rapid growth from USD11 billion in December 2013 to USD65.4 billion year to date in November 2016, still constitute less than 1% of the overall global bond market (34).

So from theory into practice: how can the green bond market live up to investor expectations? Green bond indices can help, by aligning investors' sustainable investment and green finance goals with their long-term risk-return objectives. In the past 24 months, several green bond indices have been launched, including:

- The Solactive Green Bond Index (March 2014),
- The S&P Dow Jones Green Bond Index (July 2014),
- The Bank of America Merrill Lynch Green Bond Index (October 2014), and
- The Barclays MSCI Green Bond Index family (November 2014).

The launch of these green bond indices can be interpreted as a sign of the market's growing maturity. Still needed are investment tools like exchange-traded funds (ETFs), index funds, or investment funds benchmarked against green indices instead of conventional benchmarks.

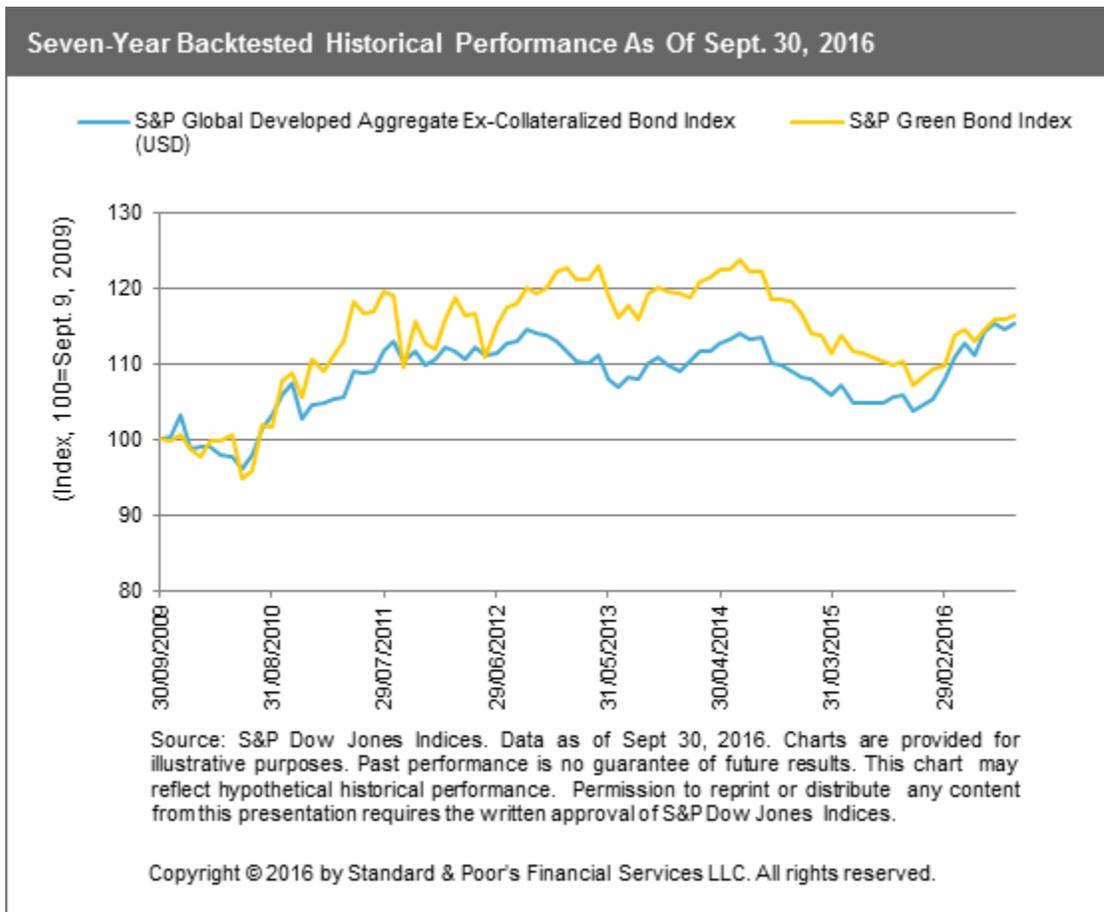
S&P Global Ratings and Trucost are also collaborating with S&P Dow Jones Indices on the development of a dedicated a Green Bond Evaluation Index, which can facilitate the expansion of green finance and foster sustainable development practices across divisions--a strategic goal for S&P Global in 2017.

## **The S&P Green Bond Index**

S&P Dow Jones Indices has focused its efforts on providing investors with access to the labeled green bonds market. The S&P Green Bond Index comprises a global universe of 1,320 bonds that are labeled "green" by their issuers, with an additional filter applied. There are currently no restrictions in relation to the size, type, currency, or jurisdiction of the issuer. The index is designed to provide transparency into the characteristics of the green bond market and independently track and report its performance. It is defined by a set of transparent eligibility criteria mandating multiple layers of "green" disclosure at issuer level (e.g. through websites, sustainability reports, public filings, and Second Party Opinions). In addition, bonds must be flagged as "green" by Climate Bonds Initiative (CBI) to be eligible for index inclusion (35). The vast majority of the constituents carry top investment-grade ratings.

Over a seven-year backtested time horizon, the S&P Green Bond Index achieved an annualized return of 2.18% versus its parent index, the S&P Global Aggregate Developed ex Collateralized Index, which achieved a return of 2.05%.

Chart 2



## Global Sustainable Development In The Making

Here is a brief overview of green bond developments in the past two years that stand out:

As one of the largest emerging-market countries with a high level of pollution, China has become a leading green bond market issuer in 2016, with issuance of more than USD15 billion in the first-half of 2016 alone (36). Ahead of COP21, China committed to reduce its greenhouse gas emissions per unit of GDP by 60%-65% of 2005 levels by 2030 and to a target of 20% of non-fossil fuel energy production. To achieve these targets, China requires annual investments in its economy of between around 2 trillion to 4 trillion yuan (USD315 billion to USD625 billion) and some of this has and will come from green bonds (37).

The diversification of issuer types was another key trend that continued throughout 2016 and will continue into 2017. And after issuances by supranationals, federal and local government agencies, commercial banks and corporations, municipalities and cities, the first green bond issued by a sovereign will be issued next year by the French government (38). The sovereign was the first country to introduce mandatory climate change-related reporting for institutional investors this year ("Energy Transition Law"), and Paris just issued a 15-point plan to become "the green financial

center of the world." (39) It seems like a logical step to use green bonds to fund some commitments on the international climate change and sustainable development agenda. Once governments receive clear guidance about how to predetermine and monitor the use of proceeds over the lifecycle of a green bond, more growth is expected from this issuer segment.

Last but not least, 2016 saw an increasing amount of social, ESG, and sustainability bonds that take a broader view of sustainable and societal development (40). The Green Bond Principles came out with a set of defined social metrics in June 2016 (41) and are paving the way for the diversification of issuance types.

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## Proposal For Environmental, Social, And Governance (ESG) Assessments

### **Analytical Contacts:**

Laurence P Hazell, New York (1) 212-438-1864; laurence.hazell@spglobal.com  
Laline S Carvalho, New York (1) 212-438-7178; laline.carvalho@spglobal.com  
Kurt E Forsgren, Boston (1) 617-530-8308; kurt.forsgren@spglobal.com

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# Proposal For Environmental, Social, And Governance (ESG) Assessments

## Executive Summary

S&P Global Ratings is seeking feedback on a potential new ESG evaluation framework and scoring methodology it is developing for corporate issuers (referred to herein as the "ESG assessment tool" or the "tool") to evaluate a company's impact on the natural and social environments it inhabits, the governance mechanisms it has in place to oversee those effects, and potential losses it may face as a result of its exposures to such environmental and social risks. These losses (or increased costs) could stem from a variety of sources including potential increased/changed regulations, litigation, manmade or natural catastrophe events, and resource scarcity/degradation, among others. We believe these potential impacts, in turn, could weaken a company's business risk and financial risk profiles over time, unless properly managed, including effective mitigation strategies. The ESG assessment tool is not a credit rating.

In May, S&P Global Ratings expressed support for initiatives being promulgated by the United Nations Principles for Responsible Investment (UN-PRI) that recognize the needs of investors for greater clarity on how ESG factors are considered in credit analysis. This reflects our commitment to transparency in the way in which we consider ESG factors when determining credit ratings, and support for industry efforts to encourage consistent public disclosure by issuers on ESG factors that may impact creditworthiness.

Our proposed ESG assessment tool is not part of our credit rating methodology. However, we do consider certain related factors, as set forth in "Management And Governance Credit Factors For Corporate Entities And Insurers" (M&G), published Nov. 13, 2012, which includes reference to the management of environmental and social risks and the oversight of these risks by a company's board of directors. The proposed ESG assessments would be offered separately from our credit ratings to provide greater transparency into ESG risk.

We propose ranking rated issuers on a five-point scale based on our view of the degree to which each issuer has greater or lesser exposure to ESG risk over the medium to long term. We define medium term as the next two to five years, and long term beyond five years. We expect to assign different weightings to the medium-term and long-term horizon, and propose greater weighting toward the medium term. This reflects our view that medium-term risk is more discernable, and that the impacts of these nearer-term risks are more assessable in terms of risk to creditworthiness.

We are considering basing our ESG assessments on four main pillars, or subfactors:

- Subfactor A: Environmental Risk Profile (E)
- Subfactor B: Social Risk Profile (S)
- Subfactor C: Management and Governance (G)
- Subfactor D: Environmental and Social Risk Management

The proposed framework would also consider incorporating a mitigation history modifier for subfactors A and B, so we could differentiate a company with a strong environmental and social mitigation history over a given time period (we are proposing the past 10 years, on a rolling forward basis) from one with weaker mitigation risk, as seen in the

number of E and S related adverse events during that period. This historical view would be balanced and weighted against the forward-looking perspective of our fourth pillar, the environmental and social risk management assessment.

We are proposing to give the four subfactors different weightings based on our view of their importance relative to the other subfactors. We are endeavoring to make these subfactor weightings the same for all issuers, so that the results of the ESG assessment tool can be comparable across different industries and peer groups.

We look forward to receiving your responses to our questions, and any additional observations, and discussing our approach with investors, issuers, governments, multilaterals and intermediaries.

To access the survey feedback platform, please click on the following link or paste it into your browser: [www.spratings.com/esg](http://www.spratings.com/esg) .

## 1. S&P Global Ratings' ESG Assessments

### 1.1 Proposed assessment scale

Our approach to ESG assessment proposes to consider ranking companies on a five-point scale based on our view of the degree to which they have greater or lesser exposure to ESG risks over the medium to long-term (see table 1). For the purposes of our assessment we intend to define medium-term as the next two to five years, and long-term as beyond five years.

Our ESG assessment tool proposal would compare rated issuers across a fixed set of pillars, with weightings for those pillars that can facilitate comparability across different industry sectors.

#### Question 1

Is our proposed range for defining ESG risks robust enough to capture outliers and differentiate between entities in the mid-range?

Table 1

ESG Assessment	Definition
★★★★★	Low exposure to ESG risks
★★★★	Modest exposure to ESG risks
★★★	Moderate exposure to ESG risks
★★	High exposure to ESG risks
★	Very high exposure to ESG risks

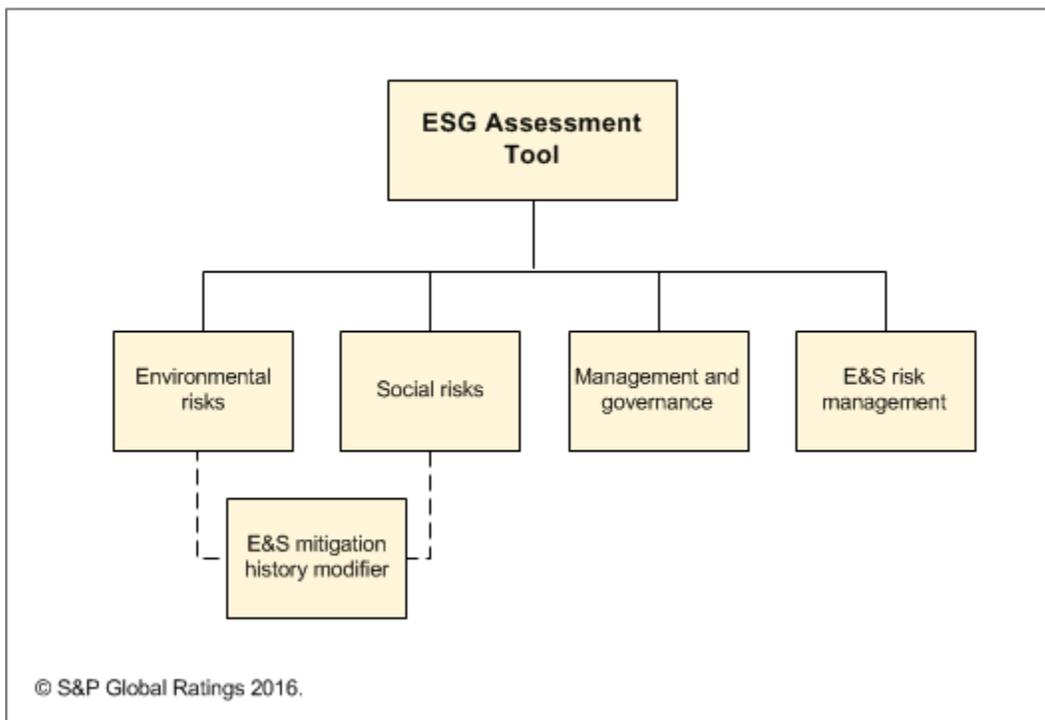
## 1.2 Methodology

We are considering basing our ESG assessment on four main pillars (see chart 1):

- Subfactor A: Environmental Risk Profile
- Subfactor B: Social Risk Profile
- Subfactor C: Management and Governance Assessment
- Subfactor D: Environmental and Social (E&S) Risk Management Assessment

This proposed analytical framework would also consider incorporating a mitigation history modifier for E&S Risk Profiles, such that a company with a strong E and S mitigation history over a proposed defined period of time (for example, the past 10 years) will be differentiated from a company with a weaker mitigation risk as seen in the number of E- and S-related adverse events during that period.

Chart 1



We are proposing to give the four subfactors different weightings based on our view of their importance relative to the others. We are proposing to make these subfactor weightings the same for all issuers, so that the results of the assessment tool can be comparable across different industries and peer groups.

The final score will translate into our ESG assessment scale by using the proposed Score Ranges guideline shown in table 4 below.

Table 2

ESG Assessment	Score Ranges
★★★★★	1.00-1.49
★★★★	1.50-2.49
★★★	2.50-3.49
★★	3.50-4.49
★	4.50-5.00

### Question 2

Is our proposed five-point scale and ranking system for ESG risk sufficiently granular for your purposes?

### 1.3 Time frame for request for comment

This consultation period, beginning on Sept. 5, 2016, and ending on Oct. 17, 2016, will help the development of our ESG scoring tool in time for its scheduled prototype launch before year-end.

Schedule of request for comment:

- Sept. 6, 2016: White paper released
- Oct. 17, 2016: Deadline to submit comments via an online platform that can be accessed here [hyperlink]
- Oct. 18, 2016: Webinar to discuss feedback and further steps. Follow this link to register [hyperlink]

## 2. Assessment Pillars For Environmental And Social Risk Profiles

### 2.1 Environmental risk profile

We are proposing to derive the environmental risk profile by analyzing a company's exposure to environmental risks through two separate metrics:

#### 2.1.1 Greenhouse gas (GHG) risk exposure assessment

This metric is still in development but aims at classifying issuers according to their greenhouse gas intensity. We propose that issuers would fall into one of five categories:

Table 3

#### GHG Risk Exposure Assessment

1 - Minimum GHG intensity
2 - Modest GHG intensity
3 - Moderate GHG intensity
4 - High GHG intensity
5 - Very high GHG intensity

We believe issuers with a higher GHG intensity would have a weaker environmental risk profile, while issuers with a lower GHG intensity would have a stronger environmental risk profile. This reflects our view that companies with a higher GHG footprint are more likely to face increasing challenges in coming years, as a significant number of world economies continue to move towards an energy (and technological) transition in line with lower targeted GHG emissions.

### 2.1.2 Environmental risk exposure assessment

We expect this subcategory to measure companies' degree of environmental risk exposures to a set of broad categories broken out as follows:

**Table 4**

Environmental Risk Exposure Type
1. Climate change impacts
2. Water use/scarcity/efficiency and decontamination
3. Waste pollution and toxicity
4. Energy/land use and biodiversity

### Question 3

Are there other environmental risks that should be considered beyond the four listed above (please see Appendix A)?

For each environmental risk exposure category, we would propose to assess companies as having one of three levels of exposure: 1) minimum, 2) moderate, and 3) significant. We would measure these levels of exposure separately over two time horizons: 1) medium term (the next two to five years); and 2) long-term (beyond five years).

We expect the result of this analysis to lead to an overall assessment of an issuer's medium- and long-term environmental risk exposures. We expect to assign different weightings to the overall environmental risk exposure assessment view over the medium- and long-term horizons, with greater weighting towards the medium term. This is because we believe we can better measure medium-term risks relative to long-term risks, where there is greater uncertainty related to the potential range and severity of outcomes.

**Table 5**

Environmental Risk Exposure Assessment
<b>a) Medium-term environmental risk exposure (defined as next two to five years; X% weighting)</b>
a1 - Minimum
a2 - Moderate
a3 - Significant
<b>b) Long-term environmental risk exposure (defined as beyond five-year horizon; Y% weighting)</b>
a4 - Minimum
a5 - Moderate
a6 - Significant

#### Question 4

Do you agree with our proposed approach of giving weight in our scoring of risks to the medium term?

#### Question 5

What time horizons would you find most helpful in understanding ESG risks?

### 2.1.3 Arriving at a final subscore for the environmental risk profile

After arriving at separate subscores for 1) GHG risk exposure assessment and 2) environmental risk exposure assessment, we expect to add their results on a weighted-average basis to arrive at the overall subscore for the environmental risk profile assessment, or subfactor A. We are proposing a 50-50 weighting for GHG risk exposure and environmental risk exposure, respectively, reflecting our view that both of these metrics constitute significant indicators of an issuer's overall environmental risk profile.

#### Question 6

Do you agree with our proposed 50-50 weighting between GHG exposure and other environmental risk factors?

**Table 6**

Subfactor A: Environmental Risk Profile	
Step 1	Determine GHG risk exposure assessment subscore
Step 2	Determine environmental risk exposure assessment subscore
Step 3	Add #1 and #2 on a weighted average basis (currently proposed 50/50 weighting)

### 2.2 Social risk profile

This metric would reflect our view of the degree of social risk that issuers may be exposed to over different time horizons, defined as medium-term (two to five years) and long-term horizons (beyond five years). Similar to our proposed approach on the environmental risk profile analysis, we expect to evaluate a broad spectrum of social risk exposures, in terms of impacts that companies can have on society and vice versa.

We are proposing to organize the breadth of social impacts into four specific areas covering (1) the company's management of human capital; (2) its community and societal impact, responsibilities, and relationships; (3) engagement with its customers, regulators, policymakers, and industry groups; and (4) maintenance of its social license to operate. We would analyze company, third-party, and other information for our analysis of the issuer's social risk profile along these parameters. We acknowledge the complexities of categorizing social phenomena for analytical purposes, and will be sensitive to overlaps and redundancies in scoring these four areas.

## Question 7

Are there areas outside of the four proposed social impacts that should inform our view of the social risk profile (please see Appendix B)?

Similar to the proposed approach in our environmental risk profile assessment, we expect to assign different weightings to the medium- and long-term horizon, with greater weighting towards the medium term. This reflects our view that, similar to environmental risks, medium-term social risks can be better measured than long-term social risks. This chart summarizes our current thinking:

**Table 7**

### Subfactor B: Social Risk Profile

**a) Medium-term social risk exposure (defined as next two to five years; M% weighting)**

b1 - Minimum

b2 - Moderate

b3 - Significant

**b) Long-term social risk exposure (defined as beyond five-year horizon; N% weighting)**

b4 - Minimum

b5 - Moderate

b6 - Significant

### 2.3 Environmental and social mitigation history modifier

In our view, a company's history of success (or failure) in mitigating its environmental and social risks is something that deserves inclusion in an ESG assessment. This reflects our view that given two issuers operating in similar industries and with similar product and geographic footprints, an issuer with a proven history of no significant E&S loss-related event(s) over a meaningful time period has a less risky environmental and social risk profile, and is better positioned to face these risks in future years, compared with a company that has experienced significant E&S-related losses.

We are proposing to analyze a company's mitigation history over 10-year horizon to recognize that losses incurred from environmental and social risk factors (such as an oil platform explosion, large toxic contamination, a material labor or human-rights infraction or litigation) can follow a low-frequency/high-severity pattern that should be analyzed over such long periods.

The mitigation history modifier will have three subcategories: 1) positive, 2) neutral, 3) negative. We expect the positive modifier to result in an improved score for the issuer's combined environmental and social risk profiles, while we expect the negative modifier to result in a worsened score. We will apply the modifier over the combined result for the environmental and social risk profiles as follows:

**Table 8**

<b>E&amp;S Mitigation History (Past 10 Years)</b>	
<b>Subscore</b>	<b>Proposed multiplication factor</b>
Positive	1.0 minus X1, where X1 range is 0.1-0.2
Neutral	No adjustment
Negative	1.0 plus X2, where X2 range is 0.1-0.2

In applying this modifier we would expect that the vast majority of issuers will be in the neutral category. We would expect to apply the positive score to companies that have a significant, differentiated, and successful history of environmental and social risks mitigation, in particular, relative to peers within the same industry. Conversely, we expect to apply the negative score to companies that have a significantly worse-than-peer history of adverse E&S-related losses.

### Question 8

Do you agree with incorporating an issuer's environmental and social mitigation history and resolution in our assessment tool?

## 3. Management And Governance (M&G) Assessment Pillar

For the purposes of the management and governance assessment subfactor we expect to apply the same analysis we use to evaluate a company's M&G when determining a credit rating in accordance with our November 2012 credit ratings criteria "Management And Governance Credit Factors For Corporate Entities And Insurers." The assessment of management and governance is one of many that we undertake when determining a credit rating.

Our scoring methodology for corporate entities uses the following subfactors:

#### Strategic Positioning

- Strategic planning process
- Consistency of strategy with organizational capabilities and marketplace conditions
- Ability to track, adjust, and control execution of strategy

#### Risk Management

- Comprehensiveness of risk management standards and tolerances
- Standards for operational performance

#### Organizational Effectiveness

- Management's operational effectiveness
- Management's expertise and experience
- Management depth and breadth

## Governance

- Board effectiveness
- Entrepreneurial or controlling ownership
- Management culture
- Regulatory, tax, or legal infractions
- Communication of messages
- Internal controls
- Financial reporting and transparency

Assessments of management and governance have four overall scoring outcomes: strong, satisfactory, fair, and weak. We allow for positive, neutral, and negative evaluations of management's capabilities for different subcategories. However, regarding governance, our M&G criteria only permit neutral or negative evaluations.

**Table 9**

Subfactor C: Management And Governance
1 - Strong
2 - Satisfactory
3 - Fair
4 - Weak

## 4. Environmental And Social Risk Management Pillar

Our environmental and social risk management assessment pillar would aim to be a prospective assessment that evaluates the degree to which an issuer is proactively managing its environmental and social risks, and the likelihood that current efforts will likely help reduce the occurrence of potential E&S-related losses outside management's tolerance levels (or expectations).

Companies, we propose, would be assessed as falling into one of four categories:

**Table 10**

Subfactor D: E&S Risk Management
1 - Strong
2 - Adequate
3 - Less than adequate
4 - Weak

We expect only a small proportion of the issuers we analyze to receive strong or adequate assessments for this subfactor, reflecting our view that to-date only a small proportion of issuers have developed--and are acting upon--a fully comprehensive risk management framework to specifically reduce environmental and social risks consistent, for example, with a 2-degree Celsius scenario. For this reason, we expect most issuers to (at least initially) fall in the less than adequate or weak categories.

We are also considering capping a company's environmental and social risk management subfactor at weak when its M&G assessment is weak. This is because we believe weak management teams are unlikely to be able to effectively

focus on, and fully dedicate needed resources to, longer-term risks such as environmental and social risks.

### Question 9

Do you agree with our proposed approach for capping a company's environmental and social risk management subfactor at weak when we assess their management and governance as weak?

## 5. Determining The Final ESG Assessment

We are proposing to derive our final ESG assessment by adding our resulting subscores for A) environmental risk profile, B) social risk profile, C) M&G assessment, and D) environmental and social risk management as follows:

**Table 11**

Category	Score (1-5)	Weight (0-100%)	Subscore (1-5)
Environmental risk profile	Subfactor A	W1	Subfactor A x W1 (see note)
Social risk profile	Subfactor B	W2	Subfactor B x W2 (see note)
Management and governance assessment	Subfactor C	W3	Subfactor C x W3
Environmental and social risk management	Subfactor D	W4	Subfactor D x W4
Final score			Sum

Note: After application of Environmental and Social Mitigation History Modifier

### Question 10

What relative weightings would you suggest for an overall ESG risk assessment?

The resulting score would then flow into the respective final assessment in our ESG scale as proposed below:

**Table 12**

ESG Score Ranges	ESG Assessment	Definition
1.00-1.49	★★★★★	Low exposure to ESG risks
1.50-2.49	★★★★	Modest exposure to ESG risks
2.50-3.49	★★★	Moderate exposure to ESG risks
3.50-4.49	★★	High exposure to ESG risks
4.50-5.00	★	Very high exposure to ESG risks

## **Appendix A: S&P Global Ratings' Environmental Risk Profile Assessment Factors**

In our analysis of a company's environmental risk profile we would propose to consider a number of environmental risk factors, that may include (but are not limited to) some or all of the following:

### Climate change

- Which company (and supply chain) activities make the greatest contribution to greenhouse gas emissions?
- Does the company (and suppliers) operate in regions susceptible to climate change effects? (flood, drought, hurricane, etc.)
- Are corporate operations geographically concentrated and/or reliant on a specific location(s)?
- Does the company have mitigation programs in place for climate change risk in terms of lessening its own climate footprint and/or impacts from climate change?
- Are there legal/regulatory impacts on the company and/or its suppliers with respect to climate change?

### Water use/scarcity/efficiency and decontamination

- What are the water usage requirements for the company (and supply chain) operations?
- Does the company or its suppliers operate in water-stressed (scarce) regions?
- Are mitigation programs in place for efficient water use, recycling and decontamination?
- Is the company using or developing water-efficient technology for its operations?
- Are there legal/regulatory impacts on the company and/or its suppliers with respect to water usage?

### Waste, pollution, and toxicity (WPT)

- Does the company (supply chain) produce waste and/or hazardous waste?
- Are WPT from operations quantified and measured?
- Has the company (supply chain) experienced any WPT incidents in the last 20 years?
- Is there a corporate WPT policy and risk management process in place?
- Are there legal/regulatory impacts on the company and/or its suppliers with respect to WPT?

### Energy, land, and biodiversity (ELB)

- What is the company's (and supply chain's) footprint for energy use (renewable/non-renewable)?
- What is the company's (and supply chain's) footprint for land use (and/or reclamation)?
- Do corporate/supply chain operations adversely impact biodiversity (e.g., marine habitat)?
- Is there a corporate ELB policy and risk management process in place?
- Are there legal/regulatory liabilities and responsibilities on the company and/or its supply chain with respect to ELB?

In our analysis we propose to also consider whether the company or its suppliers had incidents, controversies, or adverse legal/regulatory findings with respect to any environmental risks over the last 10+ years.

## **Appendix B: S&P Global Ratings' Social Risk Profile Assessment Factors**

In our analysis of a company's social risk profile we would propose to consider a number of social risk factors that may include (but are not limited to) some or all of the following:

Human capital management, occupational health and safety, and human rights

- Are there specific skills that are vital for the company's products and operations?
- What are the turnover rates among these identified skillsets?
- What are the key measures and metrics for employee attraction and retention?
- What steps does the company take in terms of occupational health, safety, and wellbeing, and the advancement, protection, and enforcement of human rights (including suppliers)?
- Is corporate labor representation significant and how are these labor relations managed?

Community/society relations

- Do company (and supplier) operations distress neighboring communities and what steps are taken to mitigate those impacts?
- Does the company's enterprise risk management program include environmental and social impacts on neighbors (e.g., emissions' impact on local air quality, noise from operations, pollution from production processes, etc.)?
- Do company (and supplier) operations and products create reputational issues for the company, and how are those issues managed and mitigated?
- Are operational and product innovations and developments considered from the perspective of their impact on local communities and wider society?
- Is the company a signatory to socially responsible third-party organizations that require regular reporting on the company's operations and products, and their impact on its neighbors and wider society?

Engagement with customers, regulators, policymakers, and industry groups

- Does the company regularly engage with its customers to inform itself of their needs, and of their satisfaction with its products and means of production?
- Does the company regularly engage with regulatory and other legal authorities to keep abreast of legal, regulatory, and compliance developments?
- Does the company interact with legislators and policymakers, and does it assess risks associated with those interactions?
- Does the company interact with industry groups/trade associations to ensure implementation of best practices across the organization?
- Is the company's board of directors regularly briefed on current and emerging liabilities and does the company use outside counsel/experts to survey and surface these risks?

Liabilities and maintaining the company's social license to operate

- Does the company disclose risk management programs and designate personnel to speedily respond to legal and reputational issues arising from its operations and products?
- Does the company disclose and utilize insurance or other third-party providers to minimize or mitigate its exposure to legal and reputational risk?
- Does the company articulate and regularly update its risk profile for investors and stakeholders?

- Are disciplinary policies and whistleblower programs in place to protect the corporation's reputation?
- In the last five years, has the company responded positively/negatively to investor and stakeholder concerns regarding lobbying and political engagement?

Similar to our analysis of environmental risks, in the social factor analysis we propose to consider whether the company or its suppliers had incidents or adverse legal/regulatory findings with respect to any social risks over the last 10+ years.

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## Policymakers Play A Role In Preparing Financial Systems For Climate Change Risk

**Primary Credit Analyst:**

Miroslav Petkov, London (44) 20-7176-7043; miroslav.petkov@spglobal.com

**Secondary Contacts:**

Alexandre Birry, London (44) 20-7176-7108; alexandre.birry@spglobal.com

Michael Wilkins, London (44) 20-7176-3528; mike.wilkins@spglobal.com

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# Policymakers Play A Role In Preparing Financial Systems For Climate Change Risk

In S&P Global Ratings' view, climate change is most likely to threaten financial services at the macroeconomic level. As we discussed in our article "Climate Change-Related Legal And Regulatory Threats Should Spur Financial Service Providers To Action," published on May 4, 2016, the macroeconomic impact could be triggered by regulatory or policy actions or an extreme weather event. We do not consider it possible to accurately assess the likelihood of such risks materializing, but governments and financial systems need to consider their exposure to these emerging risks.

A comparison of the relative exposure to climate change risk of the biggest financial markets--those in the Group of Twenty (G20) countries--can offer us a useful indicator of the relative exposure of financial systems and individual financial services providers to that risk.

## Key Factors

We have used external assessments to help us assess the relative exposure of the G20 financial markets to risks posed by climate change by looking at the following factors:

- How much the national economy relies on fossil fuels;
- The level of commitment to decarbonization revealed in government policy;
- How attractive are the options for low-carbon investments; and
- How vulnerable the country and its infrastructure are to climate risk.

A key factor in that assessment is the government climate policy. In our opinion, policymakers have a clear role to play in reducing the impact of climate change on their financial systems. They can offer the market a push to decarbonize by creating either a favorable environment for green investments or incentives to adopt low-carbon policies. We have observed that for all G20 countries, a clear climate change policy is a necessary prerequisite for a favorable environment for green investment.

## Macroeconomic Costs Are Likely To Be Far Higher Than Direct Costs

Climate change could affect the global economy, international political stability, and financial systems in many different ways. The effects could accumulate, triggering a sharp deterioration in the overall macroeconomic and financial environment. In such a case, the aggregated cost could be a multiple of the cost associated with the direct impact of climate change. Mark Carney stressed these risks in his speech "Resolving the climate paradox" in Berlin in September 2016.

In our view, there could be international pressure to decarbonize, which could trigger sudden policy changes. Such pressure could arise, for example, because of the Paris Climate Agreement, which came into force on Nov. 4, 2016, even though the momentum of the process may be affected by the outcome of the U.S. presidential election. For example, we could see macroeconomic effects if governments suddenly imposed stricter carbon dioxide emissions

limits, leading to a material reduction in the profitability of carbon-intensive sectors and a sharp drop in the value of assets in those sectors. In our view, such risks are highest in countries that have carbon-intensive economies, especially those that don't have a clear policy on transitioning toward a low-carbon alternative.

A very extreme flood or drought event could also cause significant financial losses and social unrest, leading to contagion in the financial sector as insurers suffer large claims bills and weaker economic prospects hit asset values. Even if the severity of the event were not linked to climate change, it could still trigger policy changes that would further affect financial services providers. We consider that such risks are highest in countries that are exposed to severe climate events and also have economies that are vulnerable to the physical impact of those events (see "Storm Alert: Natural Disasters Can Damage Sovereign Creditworthiness," published on Sept. 10, 2015, and "The Heat Is On: How Climate Change Can Impact Sovereign Ratings," published on Nov. 25, 2015).

## **Giving The Market A Nudge**

Creating a conducive environment for the investments needed to move to a low-carbon economy (for example, by investing in sufficient renewable energy capacity) can make a big difference to the speed of that shift. For financial service companies, it also makes it easier to replace their exposure to investments and loans to carbon-intensive industries with green alternatives and subsequently manage down the risk of financial and reputational risk arising from climate change. If the investment environment makes it unlikely that market forces alone will contribute significantly to encouraging a shift in the economy, we consider that government is more likely to use policy tools (such as carbon taxes) to achieve this end.

## **External Assessments Help Us Rank Financial Market Exposure**

We have used external assessments to help us assess the relative exposure for the G20 financial markets to climate change risks. We don't endorse these external reports entirely, as we recognize that making these assessments requires a significant level of judgement. Our combined ranking incorporates an assessment of:

- The economy's reliance on fossil fuels;
- The government's commitment to encouraging decarbonization through policy initiatives;
- The attractiveness of low-carbon investments; and
- The country's exposure to climate risk.

Ranking these factors provides us with useful insights into the relative exposure of different countries' financial systems to climate change risks.

To judge an economy's reliance on fossil fuels, we currently use Climate Transparency's assessments, published in its report "Brown to Green" in September 2016. We take an average of the first six columns of the table "G20 climate performance scorecard" on page 11 of the report. (For the calculation, we expressed the qualitative assessment in numerical terms, with 1 being the best). To judge a government's commitment to decarbonization, we take an average of the last two columns of the same table. To assess the attractiveness of low-carbon investments, we use Allianz Climate Solutions' investment attractiveness assessment, published in its Energy and Climate Monitor on May 2016.

Finally, to measure a country's exposure to climate risk, we use the University of Notre Dame Global Adaptation Index (ND-GAIN), which captures both climate risk and the level of vulnerabilities.

When we aggregate the individual assessments, we double the weights of the first two elements because we consider that they make a stronger contribution to the macroeconomic risk of climate change than the other two.

## Strongest To Weakest

**Table 1**

<b>G20 Financial Systems' Exposure To Climate Change Risk: Strongest To Weakest</b>						
	<b>Carbon Intensity</b>	<b>Climate Policy</b>	<b>Green Investment Attractiveness</b>	<b>Climate Risk Exposure</b>	<b>Overall Score</b>	
France	2.7	2.5		2.0	3.0	2.6
Germany	3.3	2.5		2.0	2.0	2.6
U.K.	3.3	2.5		2.0	2.0	2.6
US	3.8	2.5		3.0	2.0	2.9
Brazil	2.0	3.0		4.0	4.0	3.0
Italy	2.7	3.5		3.0	3.0	3.1
Mexico	2.8	2.5		4.0	4.0	3.1
Canada	3.2	4.0		3.0	2.0	3.2
India	3.2	2.5		3.0	5.0	3.2
Indonesia	2.7	3.5		4.0	4.0	3.4
China	4.2	2.5		3.0	4.0	3.4
Argentina	3.0	4.0		4.0	4.0	3.7
Korea	4.2	4.0		3.0	3.0	3.7
Japan	3.8	4.5		3.0	3.0	3.8
Australia	4.5	4.5		3.0	2.0	3.8
Russia	4.0	3.5		5.0	3.0	3.8
South Africa	4.3	3.5		4.0	4.0	3.9
Turkey	3.2	4.5		5.0	4.0	4.1
Saudi Arabia	4.0	4.5		5.0	4.0	4.3

The assessment doesn't include the EU, which is one of the G20, as it is a supranational body.

We consider that of the G20 financial systems, those of Russia, Saudi Arabia, South Africa, and Turkey have the highest exposure to the risk of macroeconomic shock caused by climate change. These economies are all highly carbon-intensive among the G20 countries and their governments do not have strong climate policies. Although, Australia, Japan, and Korea share these weaknesses, their overall risk is somewhat mitigated by their more-favorable green investment environments and because they have a lower risk of a climate event having a physical impact on them. The strength of China's climate policy has reduced its exposure compared with the above-mentioned countries.

The financial systems that have the lowest risks are those of the U.K., Germany, France, and the U.S. Among the G20 countries, these have favorable scores across almost all the elements we use in our ranking.

In our view, clear policy is critical to reducing the impact of climate change on financial services. We recognize that

climate policies are reflective of the political environment and election results could have significant influence on how policies develop over time. We do not anticipate that market forces will propel decarbonization on its own and we have not seen any G20 country that has created a favorable green investment environment without having a clear climate policy. We consider that the negative long-term effects on financial services as a whole could be profound if governments delay taking the necessary steps to address climate change further.

## **Related Research**

### **Related Research**

- Climate Change-Related Legal And Regulatory Threats Should Spur Financial Service Providers To Action, May 4, 2016
- The Heat Is On: How Climate Change Can Impact Sovereign Ratings, Nov. 25, 2015
- Insurers May Anticipate A Smooth Road Ahead On Climate Change, But Their View Could Be Restricted, Nov. 16, 2015
- Storm Alert: Natural Disasters Can Damage Sovereign Creditworthiness, Sept. 10, 2015

### **External Publications**

- Climate Transparency's report "Brown to Green", published on its website at <https://newclimate.org/2016/09/01/brown-to-green/>
- The Allianz Energy and Climate Monitor, published on May 2016 at [https://www.allianz.com/en/sustainability/articles/allianz\\_climate\\_energy\\_monitor/](https://www.allianz.com/en/sustainability/articles/allianz_climate_energy_monitor/)
- The University of Notre Dame Global Adaptation Index, published at <http://index.gain.org/>

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## The ICAO's Global Airline Emission Agreement Will Have Little Near-Term Credit Impact But Could Potentially Lead To Long-Term Costs

**Primary Credit Analyst:**

Philip A Baggaley, CFA, New York (1) 212-438-7683; philip.baggaley@spglobal.com

**Secondary Contacts:**

Michael Wilkins, London (44) 20-7176-3528; mike.wilkins@spglobal.com

Rachel J Gerrish, CA, London (44) 20-7176-6680; rachel.gerrish@spglobal.com

# The ICAO's Global Airline Emission Agreement Will Have Little Near-Term Credit Impact But Could Potentially Lead To Long-Term Costs

The historic Carbon Offset and Reduction Scheme for International Aviation (CORSIA) agreement announced by the International Civil Aviation Organization (ICAO, a United Nations body) on Oct. 6, 2016, should not have a material near-term credit effect on the airlines, aircraft manufacturers, or aircraft leasing companies that we rate. However, over the long-term (the next decade and beyond), this agreement could potentially lead to increased costs for airlines and their passengers.

## Overview

- The United Nations-sponsored ICAO agreement to limit aircraft emissions would only cover international routes, while separate technical standards for engine emissions would apply to all new aircraft delivered after Jan. 1, 2028.
- The regulations will be phased-in over a long period, and the oversight of domestic flights will be left to national authorities.
- We believe that these regulations will have a limited near-term effect on the airlines, aircraft manufacturers, and aircraft leasing companies that we rate.
- However, the airlines could eventually face significant added costs if technological breakthroughs in the use of cleaner alternative fuels do not materialize.

The CORSIA agreement covers only a particular subset of aviation environmental regulation. Specifically, it applies to international flights (not domestic) and is intended to supplement the ICAO's recommended technical standards for future aircraft deliveries and new designs. The reasoning behind the ICAO's approach is that a combination of technological advances, operational improvements (e.g., air traffic control), and the adoption of less polluting fuels will halt the growth of the global aviation industry's carbon dioxide emissions beyond 2020. The group sees the use of carbon offsets--credits that companies can buy to support projects that will reduce greenhouse gas emissions--as a way to supplement the use of alternative fuels and other technological breakthroughs that, on their own, would be insufficient to hold the industry's CO2 emissions at 2020 levels.

The impact that CORSIA and the recommended technical standards will have on global aviation is mitigated by a number of features in the agreements, including:

- The carbon offset program will be phased-in over time, with two voluntary phases (2021-2023 and 2024-2026) followed by mandatory participation (with some minor exceptions);
- The program applies only to international routes (which the ICAO estimates account for 1.2% of all global CO2 emissions; total aviation, including domestic flights, accounts for about 2%) between countries that have signed the agreement;
- Although most countries, including those that represent the largest air travel markets (such as the U.S., the European Union, and China), support the agreement, some others--notably Russia and India--have expressed their

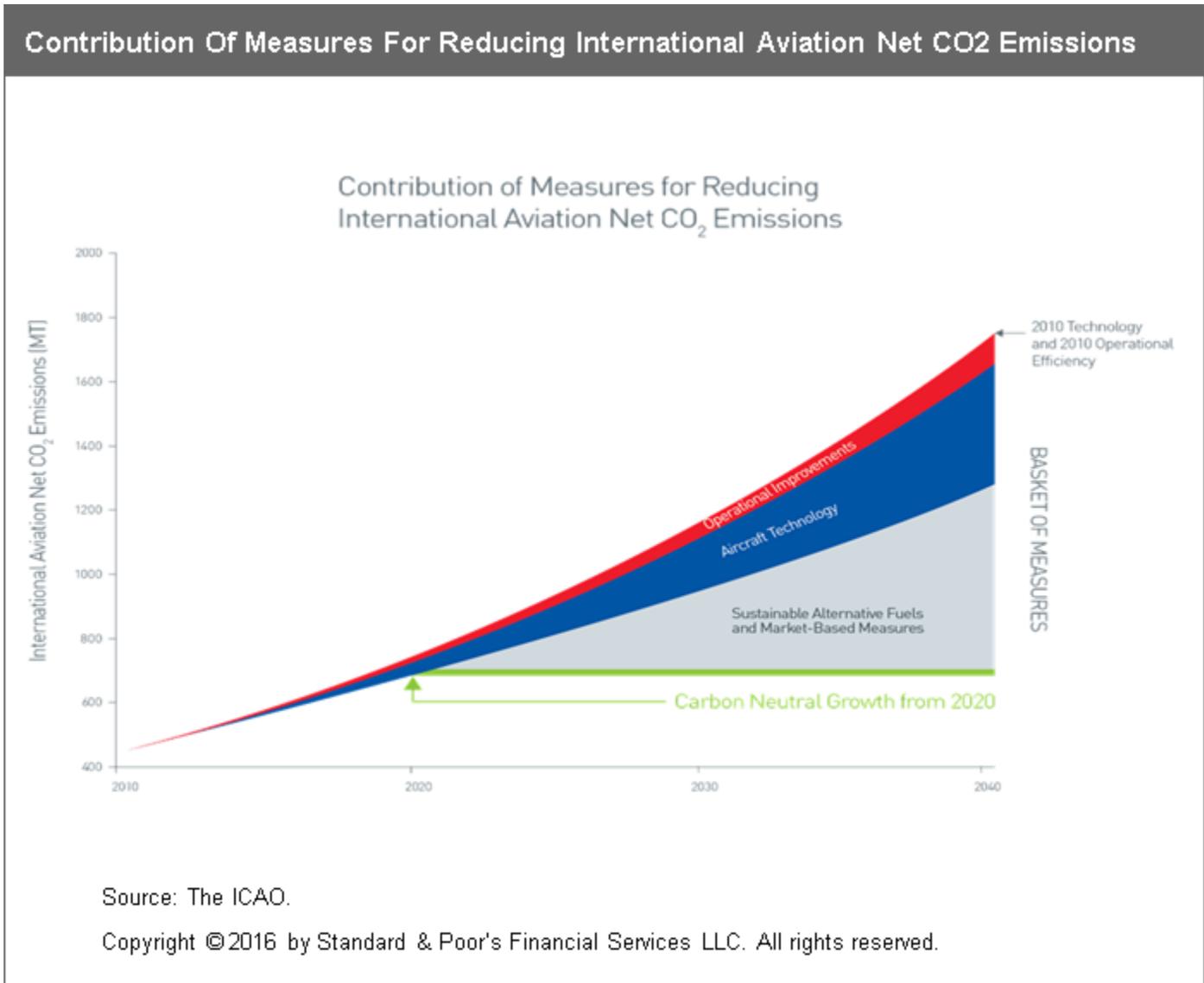
concerns and chosen not to join the agreement yet;

- The parallel track of increasing regulations on engine emissions (which covers more than CO<sub>2</sub>) will also be phased-in over a long period and apply only to newly delivered aircraft after Jan. 1, 2028, with separate requirements for new aircraft designs intended for entry into service after 2024; and
- The aircraft standards are set such that the new technology aircraft that are currently being delivered (e.g., the Boeing 787 and Airbus A320 neo and A350) or developed (e.g., the Boeing B777X) will meet the emissions targets.

On the other hand, the features of the agreement that imply potentially significant long-term effects include:

- The national regulators that oversee aviation or environmental standards, such as the U.S. Environmental Protection Agency, have already indicated that they intend to pursue rules that would impose a similar regime on domestic flights; and
- The carbon offset program implies potentially large costs if the expected breakthroughs in the use of alternative fuels or other advances do not materialize because of the agreement's open-ended commitment to cap CO<sub>2</sub> emissions at 2020 levels.

That open-ended potential is clear in the ICAO graph below, which shows their forecast of the contributions from various initiatives and regulations to emission control.



The red area of the graph, the smallest part, represents operational improvements, such as changes to air traffic control systems that allow aircraft to be routed more quickly and efficiently to their destinations. The blue area represents advances in aircraft technology that will lead to increased fuel savings, some of which are already occurring (the regulations, which will need to be implemented by various national aviation regulators such as the U.S. Federal Aviation Administration, in effect hedge against backsliding on trends that are already underway). The largest area, in gray, comprises the combination of alternative fuels and market-based measures, such as carbon offsets, that will be responsible for offsetting the majority of the growth in CO<sub>2</sub> emissions. The ICAO says that technological advancements are improving aircraft fuel efficiency by 1%-2% a year; however, global air traffic is increasing by about 5% annually, leaving a significant gap that needs to be addressed through the use of alternative fuels or measures like CORSIA.

The trend toward more stringent environmental standards will affect aviation players in different ways. For the airlines,

the increasingly stringent regulations will give further reason to pursue fleet modernization programs. Still, the schedule of implementation is sufficiently lengthy such that the regulations will not likely make a significant difference to the airlines' fleet procurement plans over the near-term. Furthermore, at least initially, the carbon offset quotas will be calculated entirely on the overall growth rate of CO2 emissions from all international flights, while the increased weighting for individual airlines' international emissions won't begin until further in the future. This could lead to some counterintuitive results because there is no requirement to retire older, less efficient planes (standards apply only to new deliveries) and an airline gets no credit, at least initially, for having a more environmentally friendly fleet.

The extent to which the airlines will be able to pass on the increased cost of carbon offsets to their passengers will depend on the same factors that influence their ability to pass on higher fuel prices: current economic conditions, the supply and demand balance of airline seats in a given market, and the intensity of competition among the airlines in each market. Still, even if the airlines can pass on these increased costs in the form of higher ticket prices, it will likely dampen the demand for flying and thereby slow traffic growth, at least somewhat.

For the aircraft manufacturers, this trend is mostly good news as the the regulations will push their airline customers to buy new, more efficient planes. In addition, the rules are written so that the manufacturers should be able to meet them without difficulty. Although the regulations will be phased-in over a long period, airlines have to make buying decisions for assets that could last 20-30 years. And, because rising costs of any kind trim the airlines' profitability, this leads to some concern that the increased costs associated with the CORSIA regulations will hurt their ability to pay for new planes over the long-term; though the costs from these regulations will at least be more predictable than the gyrations in oil prices.

Aircraft leasing companies will likewise have years to adapt to the new regulations, which will slowly encourage them to own newer technology planes over time. For the aircraft lessors that we rate, this is a trend that they have already been following, though some smaller unrated leasing companies have chosen to focus on less expensive--but potentially more volatile--older aircraft.

Thus, while we do not believe that these emerging aviation environmental regulations will affect the credit quality of the airlines, manufacturers, and aircraft lessors that we rate over the next several years, the potential impact will mount over time and could become significant during the next decade or beyond.

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Guest Opinion:

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## Guest Opinion:

# How Asset Level Data Can Improve The Assessment Of Environmental Risk In Credit Analysis

*(Editor's Note: The authors of this article are Director Ben Caldecott and Research Assistant Lucas Kruitwagen of the Sustainable Finance Programme at the University of Oxford. The thoughts expressed in this Guest Opinion are those of the writers and do not necessarily reflect the views of S&P Global Ratings.)*

The 21st Century will be increasingly defined by emerging and changing environmental risks and opportunities. Environmental risks are fundamental drivers of company and financial risk exposure for debt issuers. Asset level data build on disclosure regimes by providing physical and nonphysical asset level information tied to company ownership. The potential of asset level data to inform new analysis of environmental risk exposure is significant, including for the assessment of credit risk. These high-resolution data have the potential to improve the identification and analysis of environmental risk for analysts, investors, and other stakeholders.

Over the course of 2015 and 2016 the Bank of England (1), the Group of Twenty (G-20) Financial Stability Board (FSB) (2), and European Systemic Risk Board (3), among many other respected institutions, have all highlighted how a late and abrupt transition to a low-carbon economy could have implications for financial stability. They have emphasized the need to pre-emptively manage environmental risk in financial institutions, companies, and the financial system as a whole. Asset level data are needed to enable universal, detailed analysis of environmental risk exposure for issuers, guiding the efficient deployment of capital in the transition to a more sustainable economy.

## Implications For Analysis Of Credit Risk

There are downside risks and upside opportunities associated with a changing environment and society's response to those changes; investors and analysts, generally, are concerned with the risks. As a subset of ESG (environmental, social, and governance) risks, environmental risks are becoming increasingly important in credit research that considers medium- and long-term investment horizons, the time frame over which management teams must proactively manage these risks. (For example, see "What A Carbon-Constrained Future Could Mean For Oil Companies' Creditworthiness," published on March 1, 2013, on RatingsDirect, and "Carbon Constraints Cast A Shadow Over The Future Of The Coal Industry," published on Aug. 15, 2015.) The understanding of environmental risk has expanded beyond the traditional limit of exposure to physical environmental changes (see table 1). This expanded typology shows that environmental risk is a fundamental driver of both the business and financial risk of issuers.

**Table 1**

**Typology Of Environmental Risks And Opportunities**

Class	Description and examples
<b>Physical</b>	
Environmental challenges and change	Climate change, water stress, and biodiversity loss.
Changing resource landscapes	Price and availability of different resources, such as oil, gas, coal, and other minerals and metals. For example, the shale gas revolution and phosphate scarcity.
<b>Societal</b>	
New government regulations	Introduction of carbon pricing (via taxes and trading schemes), subsidy regimes (fossil fuels, renewables), air pollution regulation, disclosure requirements, the "carbon bubble" and international climate policy.
Technological change	Falling clean technology costs (solar PV, onshore wind), disruptive technologies, and genetically modified organisms or GMO.
Evolving social norms and consumer behaviour	Fossil fuel divestment campaigns, product labeling and certification schemes, consumer preferences.
Litigation and changing statutory interpretations	Court cases, compensation payments, and changes in the way existing laws are applied or interpreted.

Note: See Caldecott, B., Howarth, N. & McSharry, P., (2013). "Stranded Assets in Agriculture: Protecting Value from Environment-Related Risks," Smith School of Enterprise and the Environment, University of Oxford. Oxford, U.K.

Asset level data offer new opportunities for the analysis of environmental risk and its contribution to business and financial risk. At its core, asset level data enable granular analysis of environmental risk by measuring the exposure of assets directly, before then aggregating this information to the company level, revealing competitive differences among debt issuers.

The business risk profile of an issuer captures risk associated with its industry and country of operation and its competitive position relative to its peers. Environmental risk is causing entire industries to undergo transformation, for example by constraining demand for carbon-intensive products, or by reducing the pollution intensity of operations (see table 2 for highly exposed industries). Based on this, the competitive landscape will shift dramatically, potentially favoring entities that have lowered their risk exposure at the expense of those that haven't. Regulatory environments differ by country and can change rapidly as governments adopt new environmental policies; a highly predictable environmental regulatory framework is a credit strength. Firms that are better positioned to adapt to and benefit from these changing risks will enjoy a competitive advantage relative to their peers, reducing their baseline business risk. Additionally, operating efficiency is a significant driver of credit quality, and one that is increasingly impacted by environmental regulations. As an example, decreases in cash flow brought about by carbon pricing will disproportionately affect high-carbon and high fixed-cost generators such as coal assets, and increased spending on environmental retrofitting could lead to higher operating leverage. For companies with considerable fixed asset investments, like utilities, asset level data can allow investors to understand which assets might be a drag on cash flow in the future.

Environmental risks are drivers of financial risk for debt issuers. By fundamentally influencing demand and prices in markets, environmental risks can threaten the free cash flow of companies, reducing the ability of companies to service debt or make the necessary investments to manage or respond to environmental (and other) risks. Especially for

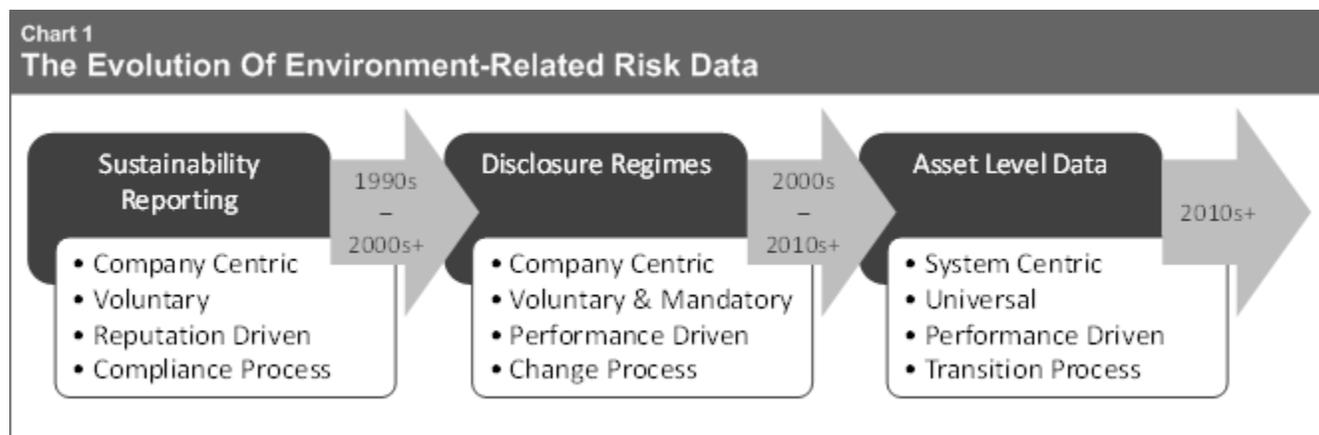
investment-grade issuers with (generally) a longer time horizon, the risks of cash flow attrition due to unmitigated environmental risks become more acute. Companies under cash flow stress for protracted periods may take on additional debt to maintain or adapt their strategies, increasing leverage and the risk of default, and even impairing recovery prospects should default occur. Environmental risks can also impair key ratios with additional balance sheet affects, for example by reducing asset values or increasing remediation liabilities.

Ratings on issuers can be constrained to the analysis of data for which agencies have universal coverage, obtained, for example, via mandatory disclosure regimes. In contrast, asset level data for listed and non-listed companies, even in jurisdictions without effective disclosure regimes, can be found in local or national registries and public records, existing proprietary and nonproprietary databases, and company reporting to financial markets and regulators. This can enable universal coverage without mandatory corporate disclosure, though it requires asset level data to be brought together and effectively matched. The existing data can also be augmented by new sources of asset level data, such as remote sensing and big data. The potential for these new sources to transform the availability of accurate and near real-time asset level data at low cost are significant.

Universal coverage unlocks the inclusion of more sophisticated forms of analysis. Coverage of multiple industries could also enable analysts to consider industry-level cross-effects, such as competition for a limited carbon budget between oil and gas and coal extractive companies. Finally, due to the continual, rather than periodic, availability of asset level data, changes in environmental risk exposure can be used to inform analysts closer to real time, rather than on annual reporting cycles.

## Current Approaches To Measuring Environmental Risk

Investors and other stakeholders currently obtain information regarding environmental risk through disclosure and reporting regimes. Disclosure regimes, both mandatory and voluntary, are making progress beyond dedicated sustainability reporting by demonstrating how improvements in environmental risk management are core to company performance. Reporting platforms like the CDP (5) and GRI (6) have made progress in attracting voluntary data disclosure from a large number of companies (for how the availability of environment-related risk data have evolved, see table 1).



Environmental disclosure provides a basis for dialogue between investors and disclosing companies, driving incremental progress on requested indicators. This reporting has made great progress in establishing the profile and understanding of environmental risks among debt issuers. This process is limited, however, by a narrow focus on certain metrics, such as corporate greenhouse gas emissions at the parent company level, omitting many important aspects of environmental risk (for example, exposure to water scarcity, ecosystem service dependence, and competition from emerging low-carbon technologies). Such reported data are also immediately out of date and annual reporting cycles are slow; voluntary reporting does not have universal coverage and is unlikely to ever secure such coverage; and reporting and verification of metric indicators like carbon intensity are burdensome and expensive.

Asset level data provide bottom-up and forward-looking outlooks of company performance, give transparent information about company assets, and can be made more efficient and timely than annual reporting cycles. The high-resolution data do not supplant disclosure regimes, but rather supplement reported data where additional resolution is necessary and useful. By connecting assets with company ownership information, asset level data build the critical link between the real and financial economies, allowing market stakeholders to assess exposure to and the potential impact of environmental risks.

## Potential Of Asset Level Data

Asset level data are the building blocks that can enable extensive analyses of many forms of environmental risk and opportunity. Asset level data do not preclude company-level analysis; Asset attributes can be aggregated by company to obtain company-level views of risk exposure. Asset level data are not needed for all industry sectors, just those highly exposed to environmental risk (see table 2). In many cases it is just data on physical assets that are required, however, nonphysical asset level data such as human capital, intellectual property, or reputational capital could become of interest in the future.

**Table 2**

Sectors Highly Exposed To Environmental Risk
Oil and gas
Coal
Metals and mining
Agriculture and forestry
Power
Automotive
Aviation
Marine
Cement and steel
Clean technology
Real estate

Credit risk analysis using asset level data could benefit in these ways:

- Bottom-Up: Asset level exposure is aggregated up to the company level rather than inferred from company-level reporting.

- **Fundamental:** Fundamental asset attributes (for example, location, technology, and age) inform analysis rather than disclosed metrics (for example, carbon intensity) enabling more sophisticated and flexible analysis.
- **Comparable:** Standardization can ensure accurate company comparisons and avoids embedded methodological assumptions.
- **Forward-looking:** Asset attributes (such as age) can enhance analysis of company future performance and enable validation of company projections.
- **Efficient:** It can significantly reduce reporting burdens and reduce time and money spent on assuring voluntary disclosures.
- **Timely:** Asset level data can be updated in real time as events occur (like mergers or asset commissioning) rather according to annual reporting cycles.
- **Transparent:** Asset attributes are transparent and are based on real observational data, giving stakeholders access to the same data as company executives.
- **Scalable:** The marginal costs of data acquisition and analysis decrease with scale of the dataset.
- **Science-driven:** Unlocks scientific approaches to analysis which are repeatable, testable, and methodological.
- **Unbiased:** Opinions of environmental factors informed by asset level data do not rely on the (non-expert) opinions of corporate boards.
- **Self-improving:** Science and technology-driven risk analysis and data acquisition improve continuously with new generations of technology and research. Costs also reduce over time.

Focusing on fundamental attributes (for example, boiler technology and capacity) rather than composite indicators (like tCO<sub>2</sub>/MWh) allows flexibility as the understanding of environment-related risk exposure improves. Even the simple disclosure of asset location attributes unlocks forms of spatial analysis, including the cross-referencing of geospatial and environmental change datasets (see the case study below). Table 3 provides examples of the asset types and attributes that may be useful for assessing environment-related risk exposure of power utility companies or real estate investment trusts. Box 1 describes sources of asset level data.

**Table 3**

<b>Asset Level Data Attribute Examples</b>		
	<b>Power utility</b>	<b>Real estate investment trust</b>
<b>Asset</b>	<b>Per power station</b>	<b>Per property</b>
<b>Nameplate</b>		
	Name	Name
	Location (lat/lon)	Location
	Ownership	Ownership
	Age	Age
<b>Activity</b>		
	Nominal capacity (GW)	Nominal capacity (units)
<b>Technology</b>		
	Power generation (MWh/Yr)	Tenancy (%)

## Sources Of Asset Level Data

A wide array of asset level data already exists. These data are categorized according to whether they are structured and unstructured. Structured data are organized (as in a database or spreadsheet), and are easily queried and manipulated. Unstructured data exist in small pieces across the Internet, or even in media or embedded in remote-sensing images.

Industry databases have been the traditional source of asset level data for the financial industry. This information is typically sold by private firms as part of their business model. These databases may or may not include information related specifically to physical assets such as location or technology employed. In addition to such industry databases, a variety of climate-relevant government data are available from national statistics authorities. For example, such information includes mandatory GHG reporting data (EU ETS, US EPA, etc.), some types of GHG inventories, and air and water pollution permits. While these data are generally backward-looking and can lack ownership information, they can also serve as an important complement to industry databases, connecting assets to emissions and filling in data gaps. In fact, many industry databases already draw from government statistics and corporate disclosure sources in compiling their commercial products.

NGO and academic datasets are developed by researchers in around the world – kept on hard drives and servers, or even paper publication archives. Although these publications are often publicly available, their disparate locations have prevented their use in credit analysis.

Corporate disclosure data at company level (both mandatory and voluntary, financial and nonfinancial) also have a role to play, offering aggregated totals of environmental indicators (for example, greenhouse gas or GHG emissions) and financial data. There is considerable variability in how thorough this reporting currently is and environmental indicators are often unverified. Investors and other stakeholders may call on companies to disclose certain types of asset level data relevant to the salient areas of environmental risk they identify. Disclosure of asset level data might be seen as a corporate analog to the disclosure of holdings data of financial institutions.

Unstructured data offer great promise for the future of data creation. New machine learning and artificial intelligence techniques can scan vast amounts of unstructured data to identify assets and their attributes, and associate them with their owner companies.

## The Necessary Task Of Building Asset Level Datasets

In the absence of perfect reporting, it is necessary to build asset level datasets to provide universal coverage and open up more sophisticated bottom-up approaches to measuring environmental risk. The good news is that much of the data required to undertake this already exist. It's just in disparate locations and needs to be brought together and can be augmented with remote sensing and big data datasets. This is an awkward task, but not a particularly expensive one. It also lends itself to being a coordinated public goods endeavor. Analysts would benefit from asset level data to better inform their opinions of credit risk, and would do well to encourage such efforts.

## Appendix: A Case Study Into Environment-Related Risks In The Global Thermal Coal Value Chain

This case study is taken from "Stranded Assets and Thermal Coal: An analysis of environment-related risks," a technical report by the Sustainable Finance Programme at the University of Oxford, supported by Norges Bank Investment Management (NBIM) (7).

In January 2016, the Sustainable Finance Programme published the results of a technical study of environment-related risks in the global thermal coal value chain. The study developed 36 hypotheses of environment-related risk exposure in the leading companies in the thermal coal value chain: The top 100 coal-fired utility companies by coal-fired power generation; the top 20 thermal coal-mining companies with more than 30% of total revenue derived from thermal coal mining; and the top 30 coal-processing technology companies by normalized syngas (synthesis gas) production (collectively the "top thermal coal companies").

Asset level datasets were developed for each company in the top thermal coal companies: coal-fired power stations for the utility companies, coal mines for the mining companies, and coal-processing facilities for coal-processing technology companies. This case study presents how asset level data enabled a higher-resolution opinion of environment-related risk exposure for Entergy Corp., which was chosen for this example due to their small number of plants with diverse environment-related risk exposure. Entergy, a U.S. company, is also subject to number of disclosure regulations, providing a global example of the best data availability. This case study shows how adding only two additional fields of asset level data enables a wide array of additional analysis of environment-related risk indicators. S&P Global Ratings rates Entergy Corp. 'BBB+' with a stable outlook. The investment-grade rating and stable outlook are in part due to Entergy's long-term management of regulatory risk, such as that imposed by changing environmental regulations. (See "Entergy Corp And Subsidiaries Issuer Credit Ratings Raised to 'BBB+'; Outlook Stable," Aug. 4, 2016.)

Entergy Corp is a U.S. utility company with operations in Arkansas, Louisiana, Mississippi, and Texas. Entergy has three coal-fired power stations: Independence, White Bluff, and Roy S. Nelson. Analysis may examine the coal-fired power stations of a utility company to identify the company's total exposure to environment-related risk, but can also allow investors to understand how changes to those specific assets could weigh on metrics and ratings over time.

Entergy regularly submits data to CDP, scoring in the 'A' performance band since 2013 (although declined to submit to CDP in 2016). Entergy's integrated reporting includes some asset level data, reported under the U.S. Environmental Protection Agency's Mandatory Reporting Rule. Table 4 shows the data available from Entergy's integrated reporting.

**Table 4**

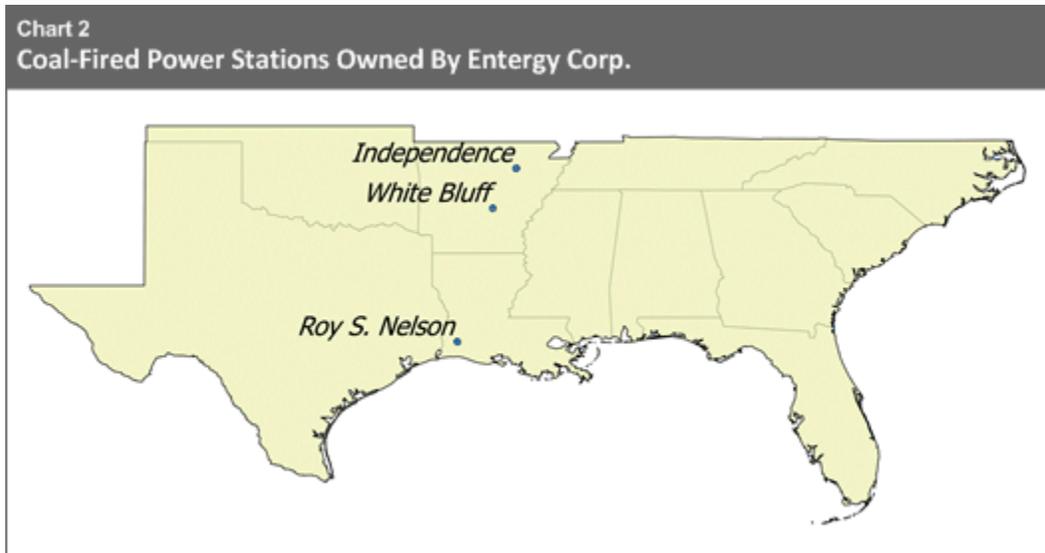
	<b>Independence PS</b>	<b>White Bluff PS</b>	<b>Roy S. Nelson PS</b>
Stock ticker	NYSE: ETR		
Equity ownership	0.48	0.57	0.81
Coal-fired capacity (MW)	1677	1660	476
CO2 emissions (kt)	10430	10805	2915

Additional asset level data can provide further insight into Entergy's environment-related risk exposure. In this case study, two additional pieces of asset level information, location and emissions, allow the creation of an abundance of new data fields for analysis. Five examples are given.

### Additional asset level data

#### 1. Power Station Location

The locations of Entergy's coal-fired power stations are obtained from Google Inc. (8) Chart 2 shows the locations of Entergy's coal-fired power stations in the southern U.S.



#### 2. Power Station Emissions Rate

The emissions rate (in kg CO<sub>2</sub>e/MWh) for Entergy's power stations are obtained from Carbon Monitoring for Action (CARMA) (9) , which maintains a database of global coal-fired power station emissions rates through 2012 (data available for Roy S. Nelson only until 2009).

### Additional analysis: examples

#### A. Annual Generation

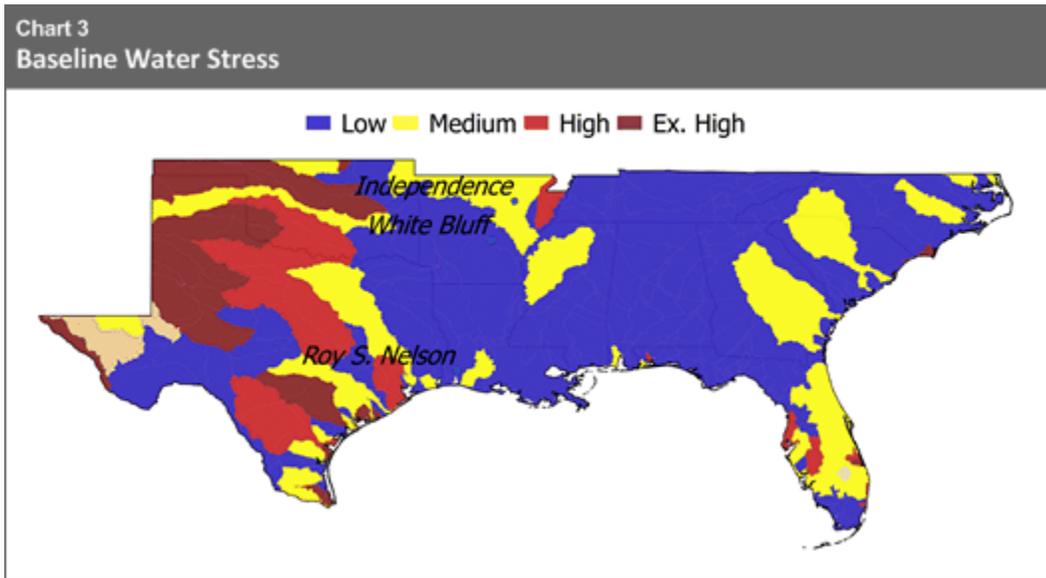
Using peer-reviewed estimation methodologies and CO<sub>2</sub> emissions reported by Entergy, total annual generation (in MWh) for the power station can be calculated. It may be useful for investors to know the total generation of a power station to assess its importance in the generating fleet of the utility company.

#### B. Utilization Rate

From annual generation (in MWh) and total capacity (in MW), the utilization rate of the power station is able to be calculated. The utilization rate is a measure of asset productivity, describing the total generation of a power station as a fraction of the maximum possible annual generation.

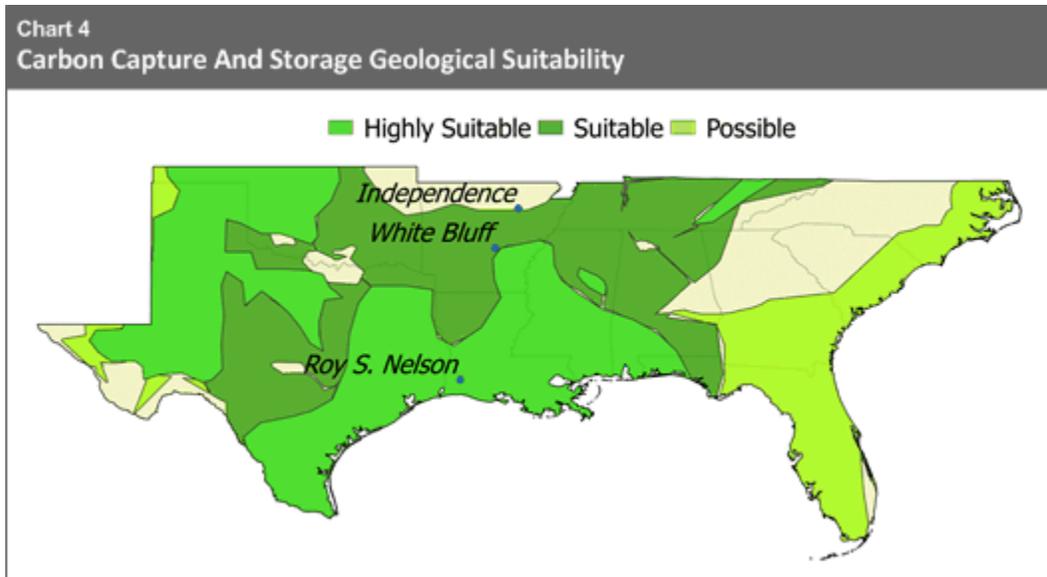
### C. Baseline Water Stress

Thermal power stations have large water footprints for cooling loads. Baseline water stress describes the amount of water demand in a water basin relative to the amount of renewable water resource available in that basin. Low water stress indicates an abundance of water. A geospatial dataset for baseline water stress was obtained from the World Resources Initiative's Aqueduct, see Figure 3.A. (10)



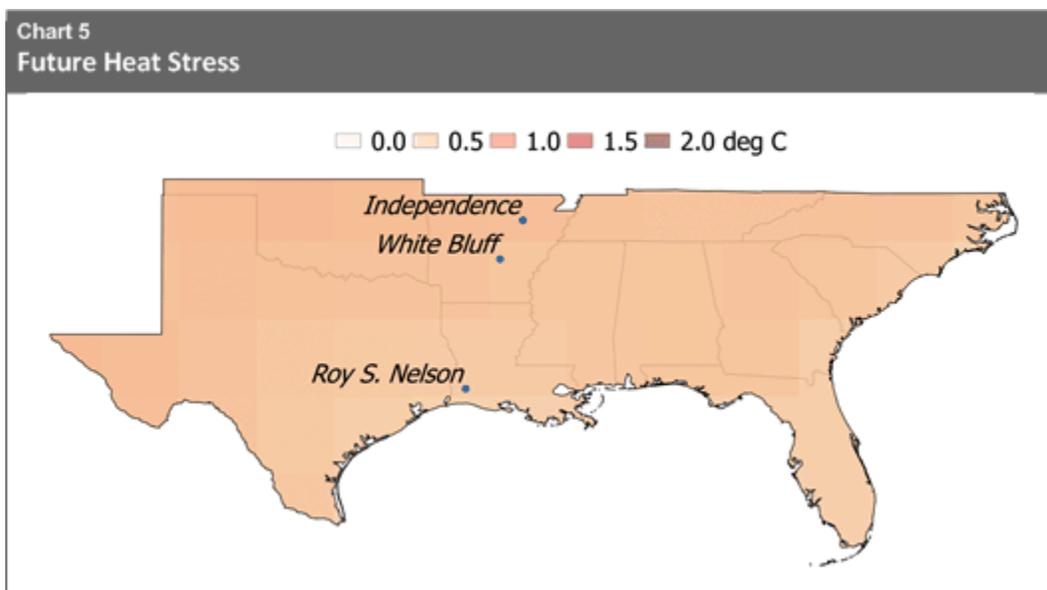
### D. CCS Geological Suitability

Carbon capture and storage (CCS) retrofits may become an option to extend the life of coal-fired power stations while reducing GHG. CCS is limited by (among other things) the local availability of suitable geological storage. A geospatial dataset for CCS geological suitability was obtained from the IEA Greenhouse Gas R&D Programme, see Figure 3.B. (11)



E. Future Heat Stress

Heat stress is the average temperature increase over pre-industrial levels. Heat stress can cause decreases in power station efficiency and extreme weather can threaten operations. A geospatial dataset for heat stress from 2016 to 2035 was obtained from the Intergovernmental Panel on Climate Change, see Figure 3.C. (12)



**Table 5**

Data Table: Disclosure Regimes Plus Additional Asset Level Data			
Power station	Independence	White Bluff	Roy S. Nelson
Stock ticker	NYSE:ETR		
Equity ownership (MW)	0.48	0.57	0.81

**Table 5**

<b>Data Table: Disclosure Regimes Plus Additional Asset Level Data (cont.)</b>			
<b>Power station</b>	<b>Independence</b>	<b>White Bluff</b>	<b>Roy S. Nelson</b>
Coal-fired capacity	1677	1660	476
CO2 emissions (kt)	10430	10805	2915
<b>Additional asset level data</b>			
Location (lat/long)	35.672/-91.408	34.419/-92.141	30.242/-93.251
CO2 emission rate (kg CO2e/MWh)	1060	1050	1080
<b>Additional analysis</b>			
Annual generation (GWh)	9840	10291	2699
Utilization rate	0.67	0.71	0.65
Baseline water stress	<Medium>	<Low>	<Low>
Carbon capture and storage geologic suitability	<Unknown>	<Suitable>	<Highly Suitable>
Future heat stress (oC)	0.82	0.74	0.66

Note: See Caldecott, B., Howarth, N. & McSharry, P., (2013). Stranded Assets in Agriculture: Protecting Value from Environment-Related Risks, Smith School of Enterprise and the Environment, University of Oxford. Oxford, UK.

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## Storage: The Final Piece In The Global Energy Transition Puzzle

**Primary Credit Analyst:**

Michael Wilkins, London (44) 20-7176-3528; mike.wilkins@spglobal.com

**Secondary Contacts:**

Luisina Berberian, London (44) 20-7176-3276; luisina.berberian@spglobal.com

Michael T Ferguson, CFA, CPA, New York (1) 212-438-7670; michael.ferguson@spglobal.com

Corinne B Bendersky, San Francisco (415) 371-5091; corinne.bendersky@spglobal.com

**Research Contributor:**

Jessica Williams, London (44) 20-7176-3884; jessica.williams@spglobal.com

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# Storage: The Final Piece In The Global Energy Transition Puzzle

Recent mergers and acquisitions (M&A) featuring substantial investments in energy storage companies indicate a structural shift in global energy systems. S&P Global Ratings believes this is a sign of things to come, as leading estimates predict that the world will need 150 gigawatts (GW) of battery storage if it is to double the share of renewable power generation by 2030.

Two notable M&A deals this year involve French companies. On May 9, energy giant Total S.A. announced that the board of Saft Groupe, producer of energy storage systems alongside other types of batteries, had approved its takeover bid of €950 million (about \$1.1 billion). This represents the biggest acquisition of an energy storage provider to date. One day later, Engie announced its purchase of an 80% stake in California-based battery storage firm, Green Charge Networks, for an undisclosed figure.

## Overview

- Considerable declines in power generation costs and the need for wider renewable options mean significant growth prospects for the rapidly evolving energy storage sector.
- Some governments have started producing policy to encourage the use of energy storage, while in other markets we see the private sector taking the lead in this regard.
- That said, financing of storage projects will likely be more complex than for traditional renewable energy, due to the multitude of revenue streams available and the risks involved.
- Nevertheless, as the technology approaches large-scale commercial viability, we believe storage will become a key tool in global efforts to decarbonize the power sector in the years to come.

A growing number of governments are starting to share the enthusiasm for storage. For example, in the U.K., the National Infrastructure Commission recently published a report in which it concludes that the country could save £8 billion per year through the incorporation of "smart power," which it defines as a mix of interconnection, energy storage, and demand flexibility. We believe the increasing attention to the sector stems partly from the continuously declining price of battery storage technology. As an illustration, the price of lithium ion technology used in battery packs for electric vehicles fell to \$350 per kilowatt hour (kWh) last year from \$1,000 per kWh in 2010.

There are theoretically many financing options for energy storage projects and the market is beginning to explore which ones to use at this stage of the sector's development. A lot can be learnt from financing models for solar, wind, and energy-efficiency projects, which share common barriers like high upfront costs and fairly long payback periods. However, unlike those technologies, energy storage has the potential for multiple-use applications, enabling various revenue streams and potentially shortening payback periods. This increased flexibility serves as both an opportunity for creative project development and a risk to realizing full revenue projections and hence returns.

## Storage Technology Still Has A Long Way To Go

Governments' increasing interest in storing energy is a natural progression as renewables gain ground in national energy systems. Storage is crucial to unlocking the full potential of renewable energy. Without it, renewables are unlikely to account for a majority share of a country's power generation mix, due to the unpredictability of sources, such as wind and solar. Managing the variability of supply from renewables increases the stress on energy grids and brings with it associated costs, for both operators and customers. Some nations are fast approaching or have surpassed the typical renewables usage level of 20%-30%, beyond which grids struggle to cope with the variability. They include Denmark, Portugal, and Nicaragua, where 39%, 27%, and 21% of electricity demand respectively was met by wind power in 2014.

The International Renewable Energy Agency (IRENA) estimates that the world needs 150 GW of battery storage to meet its desired target of 45% of power generated from renewable sources by 2030. To put this into perspective, one of the largest battery storage projects is a 40 megawatt (MW) system at the Tohoku Electric Power Company's Nishi-Sendai substation in Japan. 3,750 of these would be required to meet the 150 GW target. But, on a positive note, even larger projects are on the horizon. STEAG Energy Services has started a 90 MW storage program in Germany and Edison is setting up a 100 MW facility in Long Beach, California. Indeed, in the U.S., where carbon reduction efforts are less uniform, lower-cost storage is seen as a possible game changer under the authorities' Clean Power Plan, since it could obviate the need for gas-fired capacity to support intermittent renewable sources.

Today, well over 90% of global energy storage capacity consists of large-scale pumped hydro projects (see table 1), which have been a viable but geographically limited option for decades. New, disruptive technologies, such as battery storage, are emerging, and we see numerous other up-and-coming storage technologies with a lot of potential.

**Table 1**

Grid Connected Energy Storage Projects As Of May 31, 2016				
Technology type	Projects	Projects (% of total)	Power from rated entities (MW)	Power from rated entities (% of total)
Electro-chemical	923	59.4	2,679	1.4
Pumped hydro	350	22.5	179,427	95.3
Thermal energy	203	13.1	3,615	1.9
Electro-mechanical	69	4.4	2,611	1.4
Hydrogen	9	0.6	6	0
Total	1,554		188,338	

MW--Megawatts. Source: U.S. DOE Global Energy Storage Database.

The number of utility-scale energy storage projects has increased dramatically worldwide over the past few years (see chart 1). Much of this growth has been in the U.S., followed by the Asia-Pacific region, Europe, the Middle East, and Africa. Lithium ion battery technology accounted for 79% of the energy storage capacity announced in the first three quarters of 2015, according to the United Nations Environment Programme, showing a considerable lead over other technologies. This complements the growth of global renewable energy capacity (see chart 2) and the renewable energy targets of more than 140 countries (see table 4 in Appendix II).

Chart 1

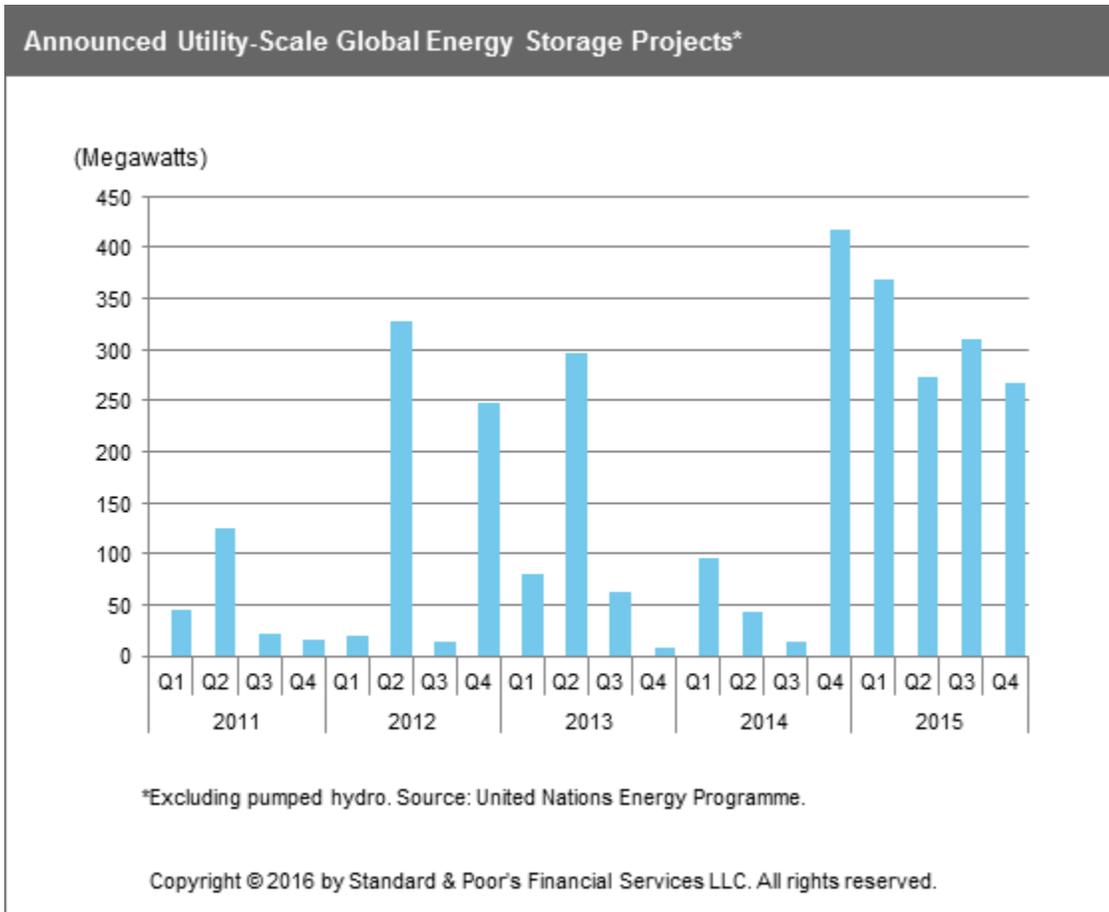
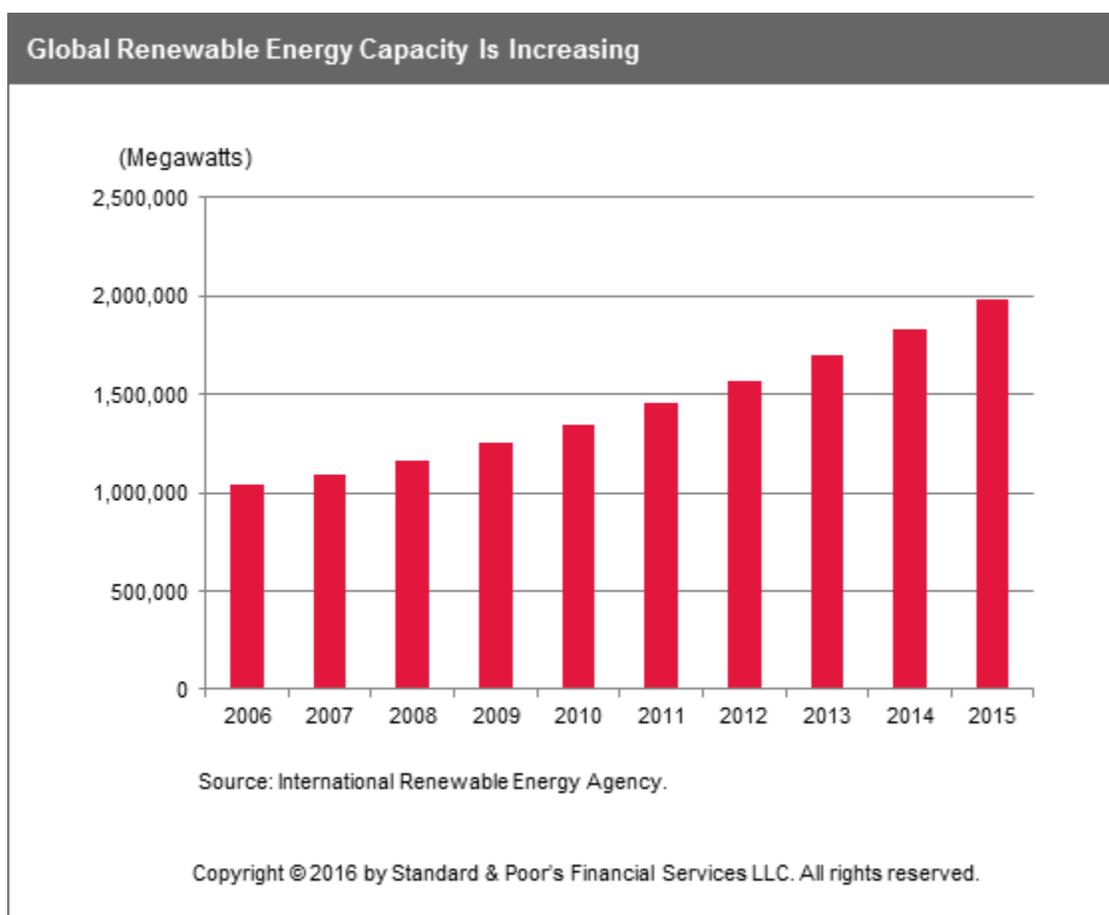


Chart 2



## Policy And Costs Must Be In Harmony

In our view, three major long-term benefits of energy storage are fueling national interest:

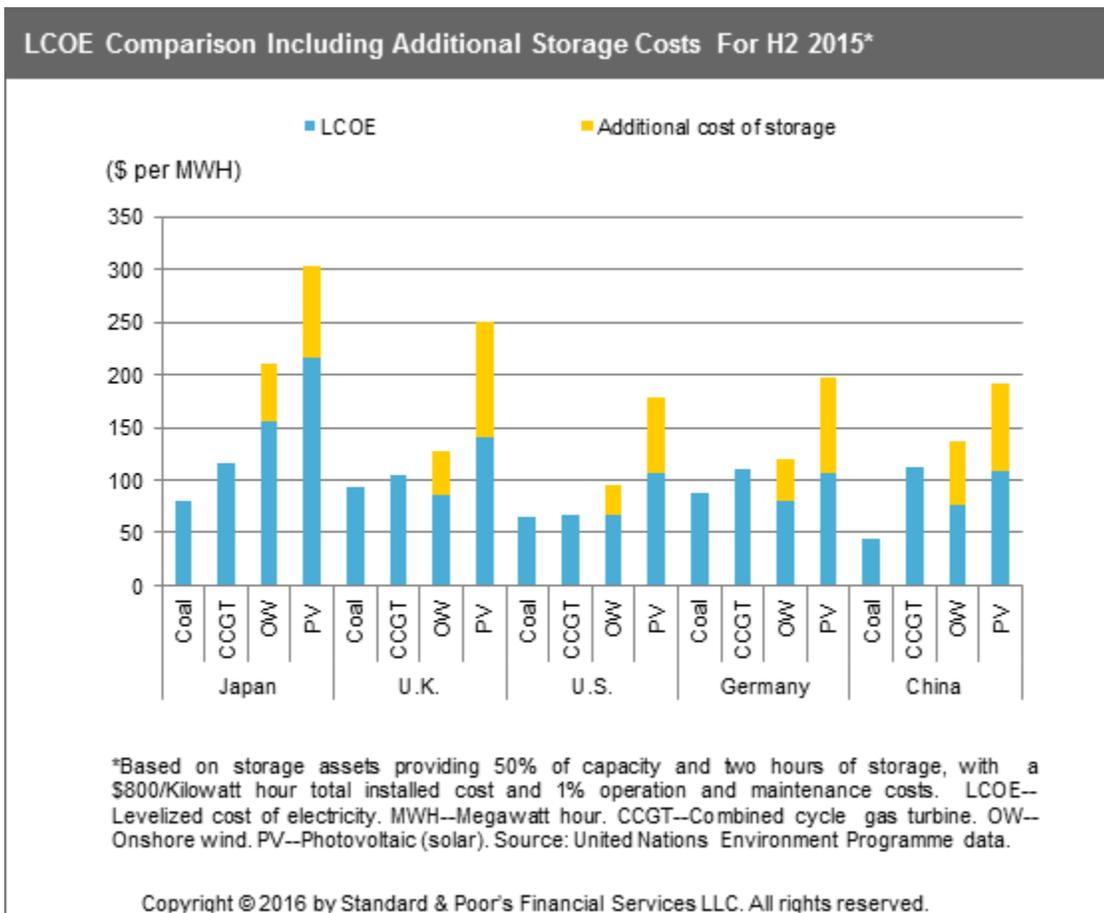
- Lower systemwide costs, thanks to increased use of low-carbon-generation assets;
- Greater energy security, which can help countries reduce reliance on imported fossil fuels; and
- Relief for aging electricity transmission and distribution (T&D) networks, including through reduced need for expensive grid reinforcements.

The number of policy initiatives designed to encourage the uptake of storage options is therefore rising. For instance, California and Ontario have mandated the consideration or installation of energy storage as part of systemwide solutions. In the case of California, legislation stipulates that investor-owned utilities must procure 1.3 GW of energy storage by 2020, which coincides with the state's initial target year for achieving 33% of power from renewables. Elsewhere, Puerto Rico was one of the first jurisdictions to require that renewable energy projects include storage as a means of short-term load balancing. The technical requirements were for wind and solar projects to provide frequency and ramping (output change) control for 30%-45% of nominal generation capacity. We believe this policy requirement for storage alongside renewable energy will slowly become the norm, because it ensures that new renewable energy

projects do not add to the strain on T&D networks through intermittency.

Yet policies like these could significantly increase the levelized cost of electricity (LCOE), which represents the per-kilowatt-hour cost of generation over a plant's lifetime (see chart 3). We believe higher costs could initially deter wider adoption of policies similar to Puerto Rico's until the LCOE of renewables and storage, combined, becomes cheaper than the fossil fuel equivalent; or some of the additional cost can be offset by other revenue streams. The industry is currently focusing on the second option, with a number of revenue stacks being investigated for individual projects. The cost of projects will vary, depending on how long batteries need to store power. A large percentage of energy stored for a longer period will mean higher costs than if a lower proportion is stored for a shorter time. However, storage costs will continue to decrease as the technology evolves.

**Chart 3**



The role of policy/regulatory frameworks is also important for the economics of storage systems. For example, tax structures, asset depreciation rates, and other subsidies/enablers can create or inhibit market opportunities and influence compensation for project developers. An example of a policy-enabled revenue stream is the capacity-payment type system for frequency regulation that the U.K. is considering. National Grid PLC has issued a tender for additional generating capacity to deliver enhanced frequency response (EFR; which refers to power that can be delivered within one second to stabilize the frequency of grid supply). The need for a short response time makes

battery storage an ideal candidate because large power stations, such as coal-fired plants, are incapable of firing up as quickly. That said, even those plants could benefit from EFR revenue if they invest in storage assets and stock up on energy while they're in operation, specifically for the purpose of EFR. We understand National Grid is seeking 200 MW of EFR capacity under four-year contracts, which could make U.K. storage an attractive investment. However, National Grid also states that any proposed solution must be able to self-fund its development and be fully operational by March 2018. This is a tight deadline for any battery storage projects that are not already well into the planning stage.

## **Will Greater Storage Depress Prices In U.S. Capacity Markets?**

In the U.S., further growth in energy storage technology could have implications for unregulated power markets, such as PJM, ISO New England (ISO-NE), or ERCOT (Electric Reliability Council of Texas). We liken storage technologies to demand-side management resources in that they provide a substitute for conventional generation capacity. Greater storage capacity means weaker net demand for generation capacity. Without a related curtailment of supply (which might come in the form of increasingly uneconomical and environmentally disadvantaged coal plants), we expect that capacity prices will drop. Additionally, to the extent that storage assets are subsidized through some form of tax credit, their owners gain a cost advantage and can put in lower supply bids, potentially dragging down the average capacity price.

However, the nature of a specific market largely determines the extent of storage's role in capacity auctions. For example, largely reliability-driven capacity markets like ISO-NE or PJM may not see a lot of storage participation. Such markets severely penalize suppliers that cannot provide the promised power in critical periods, so those with storage assets that are either technologically untested or subject to considerable variability may want to avoid this risk. By contrast, a market like ERCOT has no capacity construct, and MISO a comparatively weak one, in our view. In these markets, we might expect to see storage complement the seemingly exponential growth in renewable capacity, especially in the U.S. following the recent extension of the investment-tax and production-tax credits.

In less-reliability-focused markets, a greater proportion of energy storage participation can allow for use of various dispatchable renewables (which can transmit energy relatively quickly on request), such as geothermal, hydro, and concentrated solar power. This could trim peak power prices somewhat, to the detriment of base-load generation players that rely on outsized pricing during those periods.

## **Regulation Could Turn Energy Storage Into A Mixed Blessing For Utilities**

In deregulated energy markets, legislation prohibits utility companies from owning generation assets to keep markets fair and competitive. Such legislation is holding back the implementation of storage technologies because storage is widely defined as a generation asset. A key question is whether a utility company should be allowed to own a dispatchable resource that could come into direct competition with independently owned traditional energy assets. However, utility companies are best placed to deploy storage at locations and volumes optimal to the power system (that is, at congested points in the grid); therefore they can make the most efficient use of resources. In regulated

markets, this type of mismatch is less of a problem, due to the vertical alignment of energy systems.

The risk comes from the ability of customers, especially large commercial and industrial companies, to use storage assets to manage their expenses, thereby reducing utility companies' revenues. Such users, which typically pay time-of-use tariffs that include a premium for energy provided during peak demand periods, can use storage for arbitrage purposes. They can store energy during the night, when prices are considerably lower, to use the next day during peak times. Large end users can also be subject to a demand charge, which reflects the maximum power draw; such users could use stored energy to offset usage during peak periods, thereby reducing the demand charge.

Another more serious threat to utilities stems from distributed energy supply, whereby communities, individuals, or businesses source electricity from their own generation and storage assets that don't require connection to the grid. That said, the risk is less imminent because the costs of becoming fully self-sufficient, under most conditions, are still significant and largely uneconomic.

## **Storage Can Fit In With Various Business Models**

Numerous business models and revenue streams are available for financing energy storage projects. The way operators combine revenue streams to maximize the potential value of storage will be essential to the sector's development, especially as projects reach commercial viability.

Take for example large wind projects, which typically generate more energy at night when demand and therefore energy prices are low. Storage can play a role in such load levelling by storing low-cost electricity until demand and, therefore prices, increase during the day. The less obvious value of storage is for T&D systems. Transmission systems are generally underutilized and most efficient at night, so storing wind energy closer to the end users at that time increases the efficiency of T&D infrastructure and frees it up to deliver energy during peak demand times during the day. This means more energy can be transmitted through the same infrastructure.

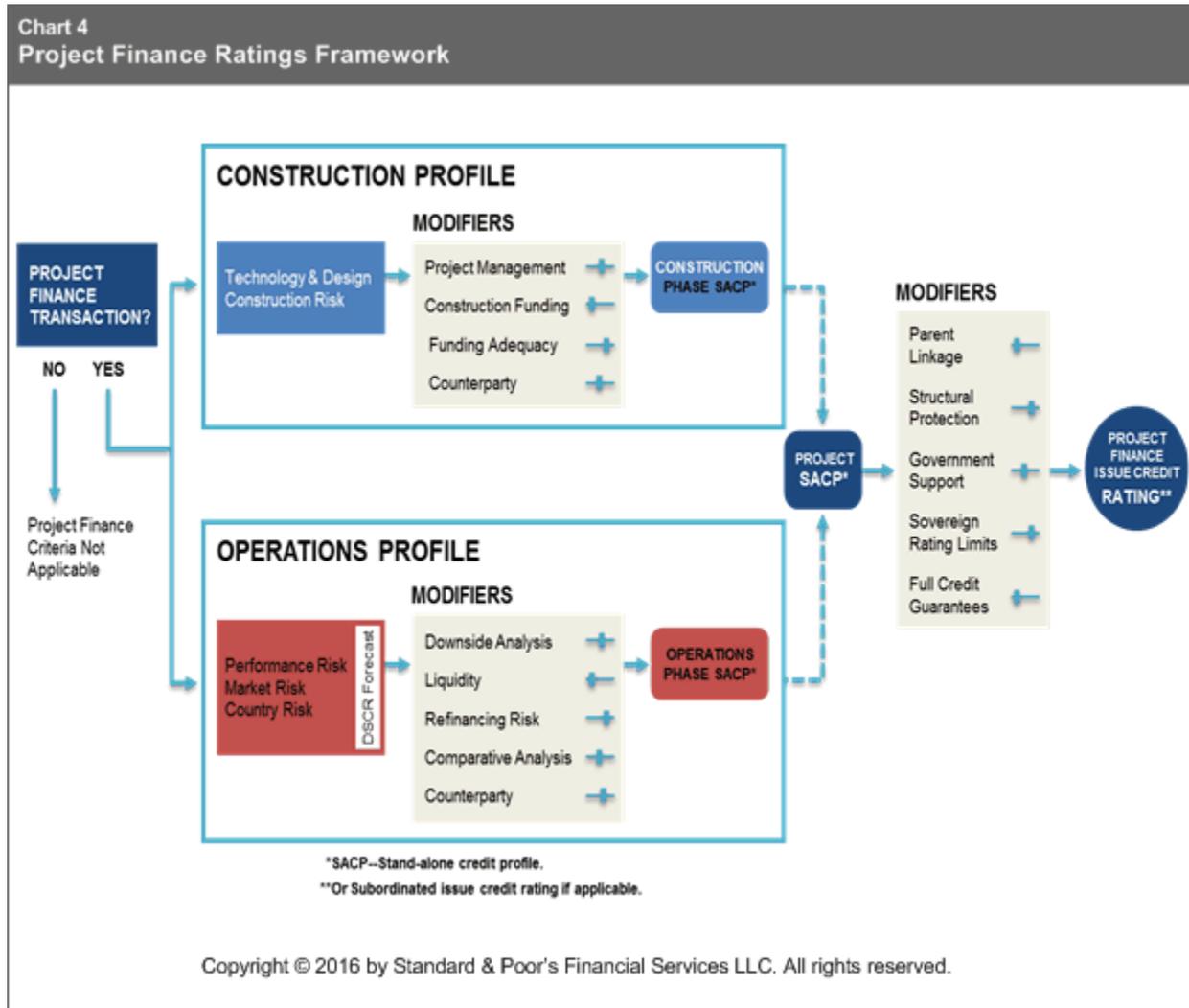
Stored power could be used for several purposes (see table 2 in Appendix II), depending on the requirements of the system and whether lucrative storage options are available. Some options, such as black-start services (restarting a power station without relying on external networks) are unlikely to serve as the primary funding source for an energy storage project. However, they could complement other revenue streams, which otherwise might not be compatible with each other; so careful planning is important. Generally, the more revenue streams that feed into an operator's cash flow, the more attractive storage projects or assets become.

We believe energy storage will become one of the most essential contributors to efforts to decarbonize the power sector. It is a rapidly evolving area that shows encouraging rates of price decline, which is bringing it toward large-scale commercial viability. Right now, the risks are abundant as the industry goes through the early stages of transition. But we expect these risks will reduce over the next few years as the technology becomes a mainstream participant in the power sector.

**Acknowledgements:** Many thanks to Asif Rafique of SUSI Partners for his contribution to this article.

## Appendix I: Assessing Credit Risk In Storage Projects

Six main factors contribute to our view of a project's credit risk profile (see "Project Finance Framework Methodology," published Sept. 16, 2014) planning, construction, operations, resources, counterparties, and the market (see chart 4).



### Planning risk

This is relatively low compared with that in low-carbon-generation assets because storage modules are typically smaller than wind turbines or solar farms, often able to fit into standard shipping containers, and will therefore not face similar opposition to their aesthetics. However, concerns over fires and safety might trigger some level of resistance. Storage projects are also generally based in industrial areas, which means they do not usually face major planning approval hurdles, unlike projects slated for densely populated areas.

## **Construction risk**

In general, we would expect to classify storage projects as simple building tasks. Construction risk is relatively low compared with that for other new technologies because batteries are modular units that require minimal construction on site. Risk emerges when interfacing such assets with other projects, such as solar or wind, because there is currently limited practical experience of this in the market.

One key credit factor that contributes to construction risk is technology. More specifically, we scrutinize the previous performance of the system, equipment, and material, as well as how the solution and its design address site-specific challenges. In most cases, when looking at a project's technology track record, we would expect to assess it as commercially proven because we would expect most projects to use off-the-shelf technology.

However, that type of technology might not yet be the norm for energy storage projects, given that it is relatively new and evolving rapidly. It's possible that supplier warranties could mitigate additional risk from the technology side, however. The type of long-term warranty packages required may well be offered by some of the large, well-established companies entering the battery storage space, such as Panasonic, Samsung NEC, and LG Chem.

## **Operations risk**

When we assess a project's operations phase stand-alone credit profile (SACP), we first determine its business risk profile, which we call the operations-phase business assessment (OPBA; see "Project Finance Operations Methodology," published Sept. 16, 2014). The OPBA can be thought of as a measure of how risky a project's operations are. It ranges from '1' to '12', with '12' representing the highest risk. To arrive at the OPBA value, we assess market and performance risks, both key factors. Two other important aspects of performance risk, from the energy storage perspective, are asset class operations stability and technology performance.

### **Asset class operations stability**

Our assessment of this factor indicates the risk that a project's cash flow will differ from expectations as a result of it being unable to provide services or products based on the type of activities it engages in. Energy storage is a sophisticated technology that requires complex electrical components and interlinkages between these components and sometimes other infrastructure outside the project. This means that we are initially likely to assign asset class operations stability a high score (indicating higher risk) until a track record of operational stability is established.

### **Technology performance**

Our assessment in this area focuses on the extent to which a project may face operating challenges, based on the technology deployed. Unless the technology has a proven track record, with large amounts of industry data demonstrating good operating performance at a similar scale and under similar operating conditions, we would likely assess technological performance as negative until more data are available to support a neutral view.

We then evaluate financial risk and other factors such as counterparty risk. In our financial analysis of the operations phase, the key assumptions for energy storage analysis are those regarding degradation rates and operations and maintenance (O&M) expenses, including reserves for equipment replacement or refurbishment. As large battery storage projects increase in number and mature, more data will be available to build our key assumptions in these areas. Until then, data from demonstration projects and independent engineer reports can contribute to our opinion on performance factors and life-cycle costs. Key factors for energy storage projects include: round-trip efficiency, energy

density, and capacity fade. An increase in data availability will also contribute to our assessment of other important aspects of the operations phase, such as performance risk. We will also factor contractual terms and project-specific risk attributes into our analysis, allowing us to gauge whether projects will maintain a high level of operating performance.

Utility companies will often be a natural off-taker of an energy storage project, either for ancillary services or load levelling, or in the future potentially as a simple power generation asset. Utilities will want a high degree of flexibility from storage projects to match the varying requirements of the energy system. This flexibility could cause issues because the benefits of revenue-generating services may need to offset degradation of the assets. With current technology, battery systems can run for a limited number of cycles. The number of cycles is maximized when capacity remains within set limits (such as 20%-80% of total capacity) instead of when the battery unit is fully charged or discharged. A balance will need to be found between flexibility for the off-taker and reduction of O&M costs for the owner.

### **Resource risk**

Battery storage projects, if used for generation purposes and supplied by a single wind or solar plant, will face resource risk, which is one of the biggest risks for renewable energy power operations, in our opinion. This is because, with rare exceptions, renewable power purchase or feed-in tariff agreements stipulate that suppliers are paid only for volumes they deliver. Our assessment of resource and raw-material risk in renewable projects aims to determine whether the resource or raw material will be available in the quantity and quality needed to meet production and performance expectations. Our resource and raw-material risk assessments range from minimal to high.

### **Counterparty risk**

Reliance on third parties to make payments or perform under a wide range of agreements--such as revenues, construction, equipment supply, and O&M--is a common feature in project finance. That's why it's important to assess counterparty risk. Where a material amount of risk is transferred to a counterparty, we provide an estimate of the exposure to the project should the counterparty become insolvent, and we assess whether the counterparty is replaceable. If that is the case, subject to the amount of available liquidity, a project can achieve a higher rating than the creditworthiness of the construction and equipment suppliers (see "Project Finance Construction And Operations Counterparty Methodology," published Dec. 20, 2011).

For energy storage projects, equipment counterparties in particular, and interconnection will be key issues. We have seen several bankruptcies by small battery manufacturers such as Extreme Power and A123 Systems, which highlight this risk. In our view, relatively few players in the battery storage industry are not easily interchangeable. Some larger players have entered the market, but many of the advancements seem to be coming from smaller players, which may expose projects to their credit risk.

### **Market risk**

This only applies when a project's cash flow available for debt service (CFADS) has the potential to decline by more than 5%, to our downside case from our base case. In such instances, we determine the project's market exposure by assessing its CFADS volatility due to market forces, as well as its competitive position, which for renewable projects comprises our analysis of regulation support and predictability, barriers to entry, delivery cost relative to peers', fuel

supply, and transmission access. Our view of market risk reflects the extent to which a project is exposed to market changes, for example, if the price of power generated is linked to commodity market prices.

If a project has a period of no market risk, followed by a period of market risk, we would typically assess these two periods independently and determine an SACP level for each. We would then use the lower of the two SACP assessments to determine the rating on the project's debt. In periods of contracted revenue, the SACP category is usually higher than when there is uncontracted revenue, but not always.

## Appendix II: Additional Data

**Table 2**

Business Models And Revenue Streams Compatible With Storage Projects		
Business models category	Revenue stream	Relevant counterparties
<b>Load levelling</b>		
Definition: Adjusting supply to demand at source or distribution points.	Power fleet optimization--This enables the most efficient use of power plants with the lowest operating costs.	Independent power producers (IPPs) and utilities
	Renewables integration--Reduces time to mobilize renewables to meet demand.	IPPs and utilities
	Peak shaving--Reduces overall energy bill through storing energy when cheap and using it when expensive.	IPPs and utilities
	Peak power plant replacement--Replacing expensive "peaker" plants with stored energy.	IPPs and utilities
	T&D deferral--Ability to delay maintenance/upgrade costs to the grid infrastructure, which can also help alleviate grid congestion. From our observations, this revenue stream is rarely used, so we treat these as potential benefits.	Transmission grid operators, distribution grid operators, and utilities
<b>Isolated area supply</b>		
	Remote generation--This combines energy storage and renewable energy to provide access to off-grid consumers in remote locations or to improve reliability of an isolated grid system.	Grid operators, commercial, industrial, or residential customers, governments/municipalities
<b>Ancillary services</b>		
Definition: Providers of ancillary services ensure the consistent quality of electricity supply, usually in the open market or through bilateral agreements with the grid operator.	Regulation of frequency/power quality--To avoid damaging equipment and to prevent grid instability, it is important to maintain a constant voltage and frequency. Frequency regulation usually involves ramping generation assets up or down, which has a time lag of minutes or seconds. Battery storage has the capacity to reduce the time lag to milliseconds. Frequency regulation has the highest value among ancillary services.	Grid operators and end customers
	Operating reserve--To allow for a quick response to unpredictable consumer demand or a generator failure. Traditional power systems typically have an operating reserve that is equal to the largest generator plus a fraction of the peak load. The operating reserve provided by battery storage provides additional capacity that can be brought online as required and does not increase the strain on generation assets. This brings the additional benefit of making more efficient use of generation assets.	Grid operators and utilities

Table 2

## Business Models And Revenue Streams Compatible With Storage Projects (cont.)

Business models category	Revenue stream	Relevant counterparties
	Black-start services--These provide non-grid energy to power stations and certain industrial equipment to restart after they are switched off. Storage suits this purpose well, but because the frequency of black starts is low, it would need to be in conjunction with other revenue streams.	Grid operators and commercial and industrial customers such as IPPs

T&amp;D--Transmission and distribution.

Table 3

## Energy Storage M&amp;A Over The Past Six Months

Announced date	Closed date	Target	Buyer/Investor	Size (mil. \$)
May 10, 2016	May 10, 2016	Green Charge Networks, LLC	Engie SA	N.A.
May 9, 2016	--	Saft Groupe S.A.	Total S.A.	1,372.4
April 18, 2016	--	e-Wolf GmbH	SOLARWATT GmbH	N.A.
March 23, 2016	--	Golden Power Group Holdings Limited (SEHK:8038)		1.9
March 7, 2016	--	Zhuhai Yinlong New Energy Ltd.	Gree Electric Appliances, Inc. of Zhuhai	N.A.
Feb. 26, 2016	--	Zhuhai Yinlong New Energy Ltd.	Jingning Shezu Autonomous County Fangde New Energy Investment Partnership	7.7
Jan. 27, 2016	--	Changsha Economic and Technological Development Zone Investment Holding Co., Ltd.		2.5
Jan. 20, 2016	--	Chongqing Wanli New Energy Co., Ltd., Non-Cash Assets and Liabilities	Shenzhen Nanfang Tongzheng Investment Co., Ltd.	106.4
Jan. 18, 2016	Jan. 18, 2016	MCM Energy Lab S.r.l.	Electro Power Systems S.A.	0.3
Jan. 8, 2016	--	Lithium Technology Corp., Substantially All Assets	Alveni Holdings B.V., Mas Arbos Invest B.V., VFR Holding B.V., Virium BV	2.5
Dec. 25, 2015	Dec. 25, 2015	Guangzhou Great Power Energy & Technology Co. Ltd.		N.A.
Dec. 23, 2015	--	Zhuhai Yinlong New Energy Ltd.	Beijing Bashi Media Co., Ltd.	30.9
Dec. 14, 2015	Dec. 29, 2015	Elvi Energy	Electro Power Systems S.A.	2.7
Dec. 14, 2015	Dec. 29, 2015	MCM Energy Lab S.r.l.	Electro Power Systems S.A.	N.A.
Dec. 11, 2015	--	Xiangyang Tuolong New Energy Co., Ltd.	Camel Group New Energy Battery Co., Ltd.	30.7

M&amp;A--Mergers and acquisitions. N.A.--Not available.

Table 4

## Examples Of Country Targets For Final Energy From Renewables

Country/region	Target share of generation (%)*	Target year
EU	20	2020
Albania	38	2020
Algeria	40	2030
Austria§	45	2020
Belarus	32	2020

**Table 4**

<b>Examples Of Country Targets For Final Energy From Renewables (cont.)</b>		
<b>Country/region</b>	<b>Target share of generation (%)*</b>	<b>Target year</b>
Belgium	13	2020
Bosnia and Herzegovina	40	2020
Botswana	1	2016
Bulgaria	16	2020
Burundi	2	2020
China	13	2017
Croatia	20	2020
Cyprus	13	2020
Czech Republic§	14	2020
Denmark	35	2020
Estonia	25	2020
Fiji	23	2020
Finland	25	2020
France	23	2020
Gabon	80	2020
Germany	60	2050
Greece	20	2020
Guatemala	80	2026
Hungary§	15	2020
Ireland	16	2020
Israel	50	2020
Italy	17	2020
Jamaica	15	2020
Kosovo	25	2020
Laos	30	2025
Latvia	40	2020
Lebanon	12	2020
Lithuania	23	2020
Luxembourg	11	2020
Macedonia	28	2020
Madagascar	54	2020
Malta	10	2020
Moldova	17	2020
Montenegro	33	2020
Nauru	50	2015
Netherlands§	16	2020
Norway	68	2020
Palestinian Territories	25	2020
Poland	16	2020
Portugal	31	2020
Romania	24	2020

**Table 4**

Examples Of Country Targets For Final Energy From Renewables (cont.)		
Country/region	Target share of generation (%)*	Target year
Serbia	27	2020
Slovakia	14	2020
Slovenia	25	2020
Spain§	21	2020
Sweden§	50	2020
Thailand	25	2021
Ukraine	11	2020
U.K.	15	2020

Note: Final energy is the useful, secondary energy available to the end user, for example heat (hot water) for a radiator or electricity from the socket at home. This table shows one type of renewable energy target. Other types such as: share of renewable electricity production, share of heating and cooling from modern renewable technologies, total capacity targets, and share of primary energy from renewable targets are also used at the national level (see Ren21, Renewables 2015 Global Status Report). \*Rounded to the nearest whole decimal for numbers over 10%, except where associated targets are expressed differently. §Some countries shown have other types of targets. Final energy targets for all EU-28 countries are set under EU Directive 2009/28/EC. The governments of Austria, the Czech Republic, Germany, Greece, Hungary, Spain, and Sweden have set higher targets, which are shown here. The government of the Netherlands has reduced its more ambitious target to the level set in the EU Directive. Source: Renewable Energy Policy Network for the 21st Century (Ren21 2015).

## Related Criteria And Research

### Related Criteria

- Project Finance Framework Methodology, Sept. 16, 2014
- Project Finance Operations Methodology, Sept. 16, 2014
- Key Credit Factors For Power Project Financings, Sept. 16, 2014
- Project Finance Construction Methodology, Nov. 15, 2013
- Project Finance Construction And Operations Counterparty Methodology, Dec. 20, 2011

### External Research

- UNEP and ors, Global Trends in Renewable Energy Investment 2016, March 2016:  
[http://fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2016lowres\\_0.pdf](http://fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2016lowres_0.pdf)
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[http://www.irena.org/DocumentDownloads/Publications/IRENA\\_REmap\\_Electricity\\_Storage\\_2015.pdf](http://www.irena.org/DocumentDownloads/Publications/IRENA_REmap_Electricity_Storage_2015.pdf)
- REN21, Renewables 2015 Global Status Reports, June 9, 2016

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### Additional Contact:

Infrastructure Finance Ratings Europe; [InfrastructureEurope@standardandpoors.com](mailto:InfrastructureEurope@standardandpoors.com)

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Guest Opinion:

## The Growing Impact Of Sustainability

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Q&A

## Guest Opinion:

# The Growing Impact Of Sustainability

*(Editor's Note: The authors are Theresa Baggs, editor-in-chief of Indexology Magazine, and Martina Macpherson, global head of sustainability indices at S&P Dow Jones Indices, which is an analytically and editorially independent division of S&P Global, as is S&P Global Ratings. The article was excerpted from "The Growing Impact Of Sustainability," which appeared in the September 2016 edition of Indexology, a biannual publication of S&P Dow Jones Indices. The thoughts expressed in this Guest Opinion are those of the writers and do not necessarily reflect the views of S&P Global Ratings.)*

Socially responsible investing has evolved from a niche asset class to a mainstream investment strategy in the past few years alone. But there are still question marks around whether sustainable investing is in fact sustainable. Theresa Baggs, editor-in-chief of Indexology Magazine, sat down with Martina Macpherson, global head of sustainability indices at S&P Dow Jones Indices (S&P DJI), to assess the staying power and universal impact of sustainability around the world.

## Q&A

**Baggs: Let's start with universal relevance. How would you finish this sentence: In terms of its global impact on financial markets, sustainability is...**

Macpherson: Globally imperative. While sustainable investing is not a new concept, it was overlooked in the financial markets up until a few years ago. Thanks to a few key catalysts, namely the United Nations-backed Principles for Responsible Investment (PRI) and environmental, social, and governance (ESG) research, and academic studies focusing on evidence around materiality, sustainability is in the day-to-day consciousness of investors in the financial markets. How mainstream is it? There are now more than USD60 trillion in assets under management (AUM) assigned to PRI via its 1,500 signatories worldwide, up from just USD4 trillion in 2006. (Source: Ban Ki-moon, UN Secretary-General, "Principles for Responsible Investment," 2006-2016.) Today the concept of sustainability is directly influencing companies, policy makers, and other market participants. However, I still see clear gaps in the investment value chain in relation to ESG terminology and metrics, integrated profitability/sustainability models at the corporate and investor level, and in relation to impact assessment considerations in line with global sustainable development goals.

**Baggs: Sustainable and impact investing are gaining traction in many markets. Why do you think that is, and what are the main drivers?**

Macpherson: That's a loaded question. Let's set the stage with a quote from Milton Friedman in an article published in New York Times Magazine in 1970: "The social responsibility of business is to increase its profits." Since that time, a new world has emerged, one driven by megatrends, mispriced opportunities, and systemic risks. ESG research and analysis is at the core of this development, and aims to identify hidden risks and opportunities linked to key issues like climate change and natural resource scarcity, population trends, rapid urbanization, shareholder expectations, board accountability, and diversity. Faced with pressure to accept the wider role of stakeholders and responsibilities, corporations now publish Corporate Social Responsibility (CSR) reports, or more casually sustainability reports. In fact, reporting social and environment performance is becoming more standardized and rigorous, much like reporting

financial accounts. Last but not least, regulation and legislation across regions are setting the mandate for more sustainability and ESG disclosure around the world.

Changes in investment trends and in the debate around "business with purpose" also signal a trend toward a more mixed economy where the dividing line between private and public activity and financial and nonfinancial gains is becoming more and more blurred. Millennials, the next generation of wealth, who are set to eventually inherit up to USD41 trillion from the baby boomer generation, play a key role in this as they appear to be more interested in and concerned with investment outcomes beyond financial results. This concept is at the heart of impact investing, a key area of growth among sustainable investment strategies.

**Baggs: What are the main components of sustainability, and how do you define them?**

Macpherson: According to extensive research, three components are key to sustainable investing and growth:

- Financial materiality;
- Long-term impact; and
- Universal ownership, stewardship, and fiduciary duty.

What does this mean? Over the last few years, many large asset owners have embraced the concept of stewardship and universal ownership. Through their long-term portfolio exposure to the whole economy, asset owners have realized that certain material issues, such as externalities generated by companies, can have a direct impact on the risk/return profile of their portfolios, and hence require specific investment actions. In line with their fiduciary duty, they are redefining their investment beliefs and integrating ESG into investment mandates and decision-making to achieve higher sustainable long-term returns.

**Baggs: It seems decarbonization is frequently discussed in this space. What's driving this?**

Macpherson: In the wake of and post the global financial crisis, investors and business leaders have been forced to rethink the fundamentals of mainstream asset pricing and business models. A common motivation for ESG screening, for engagement on key issues or for integrating sustainability factors into the investment process, is to identify and manage extra-financial factors that are believed to be important drivers of risk and return.

In the context of new asset price valuation models, decarbonization and climate-friendly investment strategies have become an area of focus within sustainable and mainstream investing. Climate change represents a key investment challenge, not just from a reputational and regulatory perspective but also from a business and portfolio risk management perspective. Many investors are trying to facilitate the transition to a low-carbon economy by taking either a solutions-led (e.g. project finance in renewables) or risk management-led approach (e.g. by reducing their exposure to carbon intensive companies). At S&P DJI, we provide both thematic indices that focus on renewable energy companies, and a broad range of carbon-efficient and fossil fuel-free sustainability indices.

**Baggs: Where do green bonds fit into the picture?**

Macpherson: On the heels of historic agreements like COP 21 in Paris last year, addressing global environmental issues has become a mainstream theme in the financial community. Multiple new green finance initiatives have been launched that support the streaming of private-sector capital to address environmental challenges, and S&P DJI actively participates in many of these. And here lies the answer to your question: these green finance initiatives around

the world are where green bonds have a key role to play. According to the Climate Bonds Initiative, the total amount of labeled green bond issuances accumulated to USD41.8 billion at the end of 2015 (Source: CBI, "2015 Year End Review," January 2016), and Bank of America anticipated in June that green bond issuances could reach up to USD90 billion by the end of this year (Source: Financial Times, "Green Bond Market Facing Growing Pains," June 2016). However, this exponential growth is also linked to new challenges, especially in the context of "green washing." Existing green labeling standards will need to evolve to bring consistency and rigor. For now, they remain in flux, as the market is reliant on voluntary standards. Here, green bond indices have an important role to play, as they can help increase transparency and drive harmonization of metrics and standards. And there are more opportunities ahead. We see a clear market trend for moving beyond green and incorporating social (impact) assessment metrics. An area to watch.

**Baggs: Sustainable investing has become popular around the world, but particularly in Europe. Why do you think that is, what are the drivers and challenges, and where do you think it's headed next?**

Macpherson: The uptick in Europe is continuing across countries. There are a few key reasons for this: first, asset owner demand and initiatives; second, increasing regulatory pressure; and third, close engagement between stakeholders in the broader investment value chain including investors, corporates, policy makers, academics, and the media.

In the U.S., fiduciary duty is key to the pendulum swing. Before 2015, many avoided sustainable options for fear of violating complicated federal regulations governing retirement plans. But a 2015 ruling by the U.S. pension regulator offers managers of pensions and 401(k) the opportunity to add ESG funds to their line-ups. The new policy opens the door for an increase in sustainable investment strategies across North America. ESG issues are already well-understood and developed in Canada; the introduction of a carbon tax, which comes into effect next year, is expected to lead to further adoption of climate-friendly strategies.

In Asia-Pacific, certain regions such as Japan and Australia show stronger interest in ESG thanks to asset owner demand, availability of ESG data, and regulatory pressures. And in Latin American, overall investor allocation to sustainable investment strategies has grown over 30% in the last couple of years, with Mexico and Brazil leading the ESG charge. (Source: EIRIS, "Evolving markets: what's driving ESG in emerging economies?" September 2012.) Stock exchanges such as MILA (Mercado Integrado Latinoamericano), one of S&P DJI's key partners, are playing a leading role in setting and driving the ESG agenda across the region. I think it's also important to note that beyond geographic diversification, there is also an increasing interest in sustainable investing across different segments, most notably among independent financial advisers and retail investors where financial and social outcomes are converging in the interest of generating and preserving natural and physical assets for the long term.

**Baggs: Where does sustainability fit into portfolio allocation?**

Macpherson: Nowadays, sustainability factors are commonly integrated across asset classes, and across active and passive investment strategies. Exchange-traded funds (ETFs) offer more sustainable and cost-effective options. Hence, passive investment in equities and fixed income has grown significantly in recent years. At S&P DJI, total net assets of index equity funds have increased from USD281 billion in 2002 to USD1,790 billion in 2015. Under the umbrella of sustainability, there are currently five ESG-based ETFs with BlackRock and State Street, which are indexed to S&P Dow Jones Indices.

Although the performance impact of individual sector and style effects typically varies over time, persistent exposure to industry and style factors can increase volatility and ultimately detract from risk-adjusted returns if not properly managed in the portfolio construction process.

Large factor exposures also tend to overwhelm the stock selection effect, masking the stock-specific characteristics of ESG-screened portfolios. By minimizing active factor exposures and removing significant market biases through an "optimization" process, RobecoSAM, one of S&P DJI's strategic research partners, has also found a positive stock-specific impact.

**Baggs: What are S&P DJI's plans to address growing sustainability demands?**

Macpherson: Integrated financial and extra-financial factors matter to S&P DJI. We have a proven track record in delivering sustainability indices since 1999 when we launched the first range of Dow Jones Sustainability Indices (DJSI)—one of the most well-known in the industry. Since 2010, S&P DJI has more than tripled its sustainability offering through indices ranging from classic beta to quant alpha overlay index strategies to meet clients' varying risk/return and ESG expectations.

Today, S&P DJI runs a well-diversified range of environmentally and socially responsible indices that are based on ESG data, scores, and screens from RobecoSAM, Trucost, Sustainalytics, and Climate Bonds Initiative.

Over the next few months, S&P DJI plans to build a range of indices that can meet the requirements set by the UN Sustainable Development Goals (SDG) that are also able to deliver on sustainability, risk/return, and impact. This involves expanding index capabilities around environmental impact, with a focus on water demand risk, long-term value creation, and building on green bond indices.

Source: Macpherson, Martina and Baggs, Theresa. "The Growing Impact of Sustainability." S&P Dow Jones Indices Indexology Magazine, pages 2-5, released October 2016.

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# Key Contacts

## S&P Global Ratings

### Michael Wilkins

Managing Director  
Environmental & Climate Risk Research  
Global Infrastructure Ratings  
T: +44 20 7176 3528  
E: mike.wilkins@spglobal.com

### Jessica Williams

Rating Analyst  
Environmental & Climate Risk Research  
Global Infrastructure Ratings  
T: +44 20 7176 3884  
E: jessica.williams@spglobal.com

### Miroslav Petkov

Director  
Environmental & Climate Risk Research  
Financial Services Ratings  
T: +44 20 7176 7043  
E: miroslav.petkov@spglobal.com

### Michael Ferguson

Director  
U.S. Energy Infrastructure  
Global Infrastructure Ratings  
T: +1 212 438 7670  
E: michael.ferguson@spglobal.com

### Kurt Forsgren

Managing Director  
Infrastructure Sector Lead  
International Public Finance  
T: +1 617-530-8308  
E: kurt.forsgren@spglobal.com

### Nicole Martin

Senior Director  
EMEA Utilities  
Global Infrastructure Ratings  
T: +1 416-507-2560  
E: nicole.martin@spglobal.com

### Laurence Hazell

Director  
Corporate Ratings  
T: +1 212 438 1864  
E: laurence.hazell@spglobal.com

### Laline Carvalho

Director  
Financial Services Ratings  
T: +1 212-438-7178  
E: laline.carvalho@spglobal.com

## S&P Dow Jones Indices

### Martina Macpherson

Senior Director  
Head of Sustainability Indices  
Product Management & Development  
T: +44 20 7176 8476  
E: martina.macpherson@spglobal.com

### Emily Ulrich

Senior Specialist  
Sustainability Indices  
Product Management & Development  
T: +1 212 438 0612  
E: emily.ulrich@spglobal.com

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