As global political and business leaders gather in Paris for the U.N.'s 21st Conference of Parties (COP21) to discuss progress on the U.N. Framework Convention on Climate Change, Standard & Poor's Ratings Services analysts and economists take a look at what’s at stake for governments and business—with additional contributions from other McGraw Hill Financial (MHFI) units, including S&P Dow Jones Indices and Platts. After 20 previous conferences, the need to address the issues raised by climate change has become more urgent, and the ante has been raised this year for the stakeholders, as, for the first time, the Conference aims to keep global temperatures from rising more than 2 degree Celsius through legally binding and universal agreements.

When it comes to achieving the 2° goal, no one formula works for everyone, and each country and economic bloc has developed a plan that fits its economy, energy portfolio, and future growth. Some schemes are more ambitious than others, and some are more aspirational than realistic, but it is plain that participants are taking the goal seriously and recognize the threats that global climate change poses. However, not all agree that the pledges should be legally binding, nor are these actions likely to be successful in halting global warming, and many political and financing issues remain to be resolved.

In our lead article, credit analyst Michael Wilkins asserts, “If governments are to send strong signals in support of long-term strategies and priorities to support movement toward low carbon and resilience, then financing will be a key issue that must be unblocked for there to be agreement in Paris.” However, if governments cooperate and establish carbon markets and standards, the financing may then follow. "Paris may well usher in the necessary policy and regulatory infrastructure for action. While COP21 may not achieve a 2° outcome, the necessary impetus to get there is gaining momentum. That should be considered a success, of sorts.”

McGraw Hill Financial President and CEO Doug Peterson comments in this edition on the increasingly important role of environmental, social, and governance (ESG) analysis to responsible investing. "Investors are taking a broader view, aiming to account for the full spectrum of ESG-related risks and opportunities to align capital allocation to the longer-term interests of their clients and beneficiaries. Investors also have become more aware of the credit risks posed by companies failing to address in a timely and sufficient manner ESG impacts that result from their activities," Mr. Peterson observes. And MHFI is responding strongly: "Our brands are uniquely positioned to add transparency and clarity to responsible investing. For example, Standard & Poor’s examines ESG risks as part of its credit analysis.”

In order to meet COP21 goals, global energy portfolios must be reshuffled and transitioned to less polluting sources. One of the biggest changes must come from moving away from coal. Here, we present four segments on what carbon constraints mean for coal’s future. “Despite being the most polluting source of power generation, accounting for 41% of global carbon emissions, coal remains a cornerstone of the global economy,” says credit analyst Elad Jelasko. "New initiatives, such as those made recently by China, the EU, and the U.S. may flatten the growth in coal demand over the coming years. However, whether this will lead to a decline of coal use over time is more uncertain.”

Also in this issue, we examine what climate change means for sovereign and corporate ratings, the credit risks of energy efficiency projects, the necessity of protecting U.S. coastal infrastructure from rising sea levels, and the steps being taken by insurers to account for climate risk and where they still may find themselves vulnerable. “The effect of a sudden climate change shock, however, could test the industry. Estimating how climate change will play out is inherently uncertain, so the picture may change dramatically over time,” cautions credit analyst Milan Petkov.

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Climate Change: Building A Framework For The Future

Michael Wilkins

Many remain skeptical about whether the forthcoming forum of talks in Paris will be successful. So what would constitute a success and what would failure look like?

From Washington To Paris: The EPA In A Global Context

Michael T. Ferguson

Not all nations have yet submitted plans for carbon reduction, but this is already taking the shape of a large, collective effort. Even if they fall short of the goal, they will change in the way the world generates and uses power.

The Heat Is On: Climate Change And Sovereign Ratings

Marko Mrsnik

What are the potential consequences of climate change for sovereign creditworthiness? Assessing economic impacts and individual sovereign rating factors is the key.

Reversing Global Warming Requires Nothing Less Than A Global Effort

Satyam Panday

While global warming will ultimately affect everyone, it appears that the largest economic blocs on the planet may be the ones that point the way to ensure that climate change does not seriously erode global economic prosperity.

Insurers Anticipate A Smooth Road Ahead On Climate Change, But Their View May Be Restricted

Mirslav Petkov

Insurers consider climate change as a top emerging risk, but not to their daily activities; given their ability to reprice risk. Still, climate change may present a wider range of threats.

How Environmental And Climate Risks Factor Into Global Corporate Ratings

Michael Wilkins

How does Standard & Poor’s incorporate environmental and climate risks into its corporate credit ratings? And what impact have these risks already had?

ESG Risks In Corporate Credit Ratings: An Overview

Laurence P. Hazell

In our corporate ratings framework we differentiate between the incidence of environmental and social (the “E” and “S”) impacts associated with all entrepreneurial activities, and their management and oversight (the “G” in ESG).

How Standard & Poor’s Views The Credit Risk Of Energy Efficiency Projects

Michael Wilkins

The International Energy Agency predicts energy efficiency investments will grow substantially as interest in low-carbon investment opportunities increases.

Climate Resilience Can Protect Ratings From Sea-Level Rise And Threats To U.S. Coastal Infrastructure

Geoffrey E. Buswick

Depending on the level and pace of the rising seas, seaside infrastructure—in addition to millions of homes—could see billions of dollars in losses over the next few decades if nothing is done.

How Natural Disasters Would Affect Ratings

Doug Peterson

McKenzie SGF Financial President Doug Peterson on environmental, social, and governance risks.

Investors Eye Tools To Address Mounting Carbon Risk

Frank Watson, Platts

For investors looking to protect their assets, the important question is becoming whether the transition to a low-carbon economy will be orderly or disruptive.

The Future Of Coal Series

Eldad Jelasko

A look at coal’s present importance to the global energy markets, and the future of the industry and its major producers.

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The aim of the 21st Conference of the Parties is to reach a global agreement that will combat climate change effectively and boost the transition toward a resilient and low-carbon global economy. A successful agreement would limit greenhouse gas emissions, forestalling a rise in the average global temperature by no more than 2° Celsius. National and international regulations arising from such an agreement would have major repercussions for carbon-intensive sectors, in particular power generation and coal mining. Financing the transition will need to rely on private investment aimed at low-carbon technologies such as renewables and energy efficiency as well as carbon-pricing mechanisms to provide the necessary incentives.

» With the Group of Seven nations pledging earlier this year to decarbonize their economies by 2100, expectations are high that the U.N. Climate Change Conference in Paris from Nov. 30, to Dec. 11, 2015, will produce a global treaty. Yet our memories are littered with failed climate change negotiations of the past, and many remain skeptical whether the forthcoming fortnight of talks in the French capital will be any different. So what would constitute a success and what would failure look like? And what should the world of business and finance expect from an agreement in Paris, at the 21st Conference of the Parties (COP21) to the U.N. Framework Convention on Climate Change? (Watch the related CreditMatters TV segment titled “Financing To Be Key Issue For Climate Change Agreement,” dated Nov. 13, 2015.)
Some have argued that success at COP21 won’t be and shouldn’t be a legally binding treaty to curb global emissions. Instead, they argue, success would be a flexible, high-level political framework that allows for bottom-up national pledges (the so-called intended nationally determined contributions or INDCs). Countries would then translate their pledges into national policies to decarbonize their global economies by 2100 (source: Carbon Tracker Initiative (CTI), “What will success for Paris, COP21 look like?”). Many countries have made commitments to date, creating optimism about the chances for an agreement. However, as many commentators have noted, the sum of these commitments doesn’t bring down carbon emissions enough to limit the average global temperature rise to 2° Celsius, relative to pre-industrial levels. As a mechanism to address this, the proposed agreement contemplates periodic revisions to the national commitments, say every five years, akin to those in recent EU environment and energy legislation. The rationale behind this mechanism is that in the meantime, developments in science, technology, and funding will allow for more ambitious commitments in the future.

**Global Warming By Numbers**

As of Oct. 30, 2015, a month before the start of the Paris talks, more than 150 countries, led by China, the U.S., and the EU, had released their INDCs accounting for 90% of global energy-related emissions. The U.N. estimates these pledges, which are to be set in stone by world leaders attending the climate change summit, could limit the average global temperature rise to around 2.7° by 2100. While the scientific consensus argues this is by no means enough, such a reduction nonetheless is a lot lower than the estimated 4, 5, or more degrees of warming that many previously projected (source: “Synthesis report on the aggregate effect of the intended nationally determined contributions,” Framework Convention on Climate Change (UNFCCC), Oct. 30, 2015).

Global temperatures have already risen by nearly 1° since the industrial revolution amid increasing greenhouse gas (GHG) emissions that mostly come from burning fossil fuels such as coal, oil, and gas. The U.N. has been holding climate negotiations for more than 20 years to try to curb a steady rise in emissions that reached the equivalent of 49 billion tons of carbon dioxide (CO2) in 2010. The pledges so far imply emissions rising to 56.7 gigatons of CO2-equivalent by 2030. That’s nearly 4 gigatons less than without the INDCs, but still about 15 gigatons more than what the latest scientific report from the U.N.’s Intergovernmental Panel on Climate Change suggests is needed to have a reasonable chance of avoiding 2° of warming (see chart 1). To be sure, INDCs are a measurable improvement and may help global emissions peak sometime after 2030. However, reaching the 2° goal requires emissions to peak earlier than that.

Another way to portray emissions growth is the amount of energy consumed per unit of GDP, or emissions intensity, which has been reducing by about 1.3% a year over the past 15 years. It is argued that the rapid decoupling of emissions from economic growth is essential to avoid the worst impacts of climate change. The Paris pledges should further this reduction to about an annual 3%, whereas a carbon-neutral pathway by the end of the century would necessitate an annual 6% to 7% reduction (source: PricewaterhouseCoopers, “Low Carbon Economy Index 2015: Conscious uncoupling?”; see chart 2).

**The Drive Toward Decarbonization: The Implications**

If we look at the 2020 emissions reductions pledges that China, the U.S., and the EU have made so far, China’s don’t go beyond the business as usual projections that the International Energy Agency (IEA) has made (what it calls its “Central Scenario”). Although the EU doesn’t need to take additional action to reach its 2020 target, the projections do show a significant gap against its 2030 target. The EU nevertheless plans to adopt more policies to comply with its Energy Efficiency Directive, implement structural reforms to the cap-and-trade program to revive the CO2 market price, and decide on a post-2020 CO2 target for carmakers. Europe’s finance ministers have recently endorsed the EU’s stance on climate finance ahead of COP21, reiterating the region’s ambition to push for a strong signal to the private sector to decarbonize investment as part of a COP21 agreement. The U.S. has set the most ambitious 2020 target of the four main global emitters—which include China, the EU-28, and India. However, the U.S. has not yet implemented policies to reach that target, including the Clean Power Plan that was finalized just last month as well as methane reduction targets. Beyond 2020, regulations issued by the government’s Environmental Protection Agency (EPA) may not be enough, and the strong Republican majority currently in Congress makes any bold move on carbon-cutting policies very unlikely.

What’s the possibility that some governments will up the ante? Some parties have said that they would set tougher targets, with the EU moving to -30% by 2020, instead of -20%, if COP21 reaches a binding and ambitious agreement. However, we believe that this is highly unlikely, considering that current 2020 targets are far below the levels needed to meet the 2° objective.

Energy production and use account for two-thirds of the world’s GHG emissions, according to the IEA, meaning that the pledges made at COP21 must bring deep cuts in these areas while sustaining growth of the world economy (source: the IEA, “World Energy Outlook Special Report,” 2015). The use of low-carbon energy sources is already expanding rapidly, and signs point to a gradual decoupling of energy-related emissions and GDP growth. The IEA predicts the share of global low-carbon power generation will grow to almost 45% in 2030, resulting in a flattening out of power emissions—despite an increase in electricity demand by more than 40%.

What’s becoming clearer is that many INDCs target fossil fuel producers—especially coal companies. Coal-fired power generation is coming under increasing scrutiny, as countries try to decarbonize, with many INDCs putting regulation of coal front and center—like China’s. The country’s stall in coal consumption is the main reason their emissions growth slowed in 2014, although recent reports suggest that coal-related carbon emission reductions may have been somewhat exaggerated. Nonetheless, the economic slowdown in China and the country’s explicit policies to restrict coal use mean that the massive growth in coal demand that had been assumed until recently as last year has all but evaporated from outlooks. As a result, China’s emissions may reach its highest point well before their goal of 2030, which would help global emissions peak sooner rather than later. Although it is far too early to tell, some even hope that China’s coal use may have already peaked, despite annual GDP growth of more than 7%. Although economic and emissions data must be treated with caution in China, it does appear that in 2014 at least, the country was able to decouple emissions from growth. The IEA has recently laid out a Bridge Scenario for a peak in global energy-related emissions by 2020 that could provide the best chance to keep global warming below 2°. It relies solely on proven technologies and policies, without changing the economic and development prospects of any region. The catch is that immediately it does not require 1) increase energy efficiency; 2) reduce the least-efficient coal-fired power plants and ban new construction; 3) increase renewable investment; 4) phase out fossil fuel subsidies, and 5) reduce methane emissions. For such a scenario to work, coal use would peak before 2020 and then decline, with oil demand rising to 2020 and then plateauing. Importantly, China would decouple its GDP from emissions growth by around 2020, much earlier than expected. Others, like the U.S., would significantly accelerate the decoupling of economic growth and emissions under this scenario.

**Financing The Transition**

In its latest World Energy Outlook released this week, the IEA estimates investment of $13.5 trillion in low-carbon technologies and efficiency is required to 2030 just to meet the COP21 pledges to keep below 2° of warming. A key question to be hammered out in Paris is the amount of financing that developed-country parties to the negotiations may be willing to provide to developing-country parties, and under what kind of terms. While no amounts have been floated in the run-up to COP21, the figure of US$100 billion a year from 2020 was proposed at COP15 in Copenhagen in 2009. While some commentators argue that this figure may be insufficient to cap the rise in the average global temperature to 2°, it is promoted as essential in helping bridge the gap. As a way to decarbonize the global economy, the negotiators will also consider how big a role energy efficiency programs can play, how to lower the cost of capital for renewables and infrastructure (such as transport), and how to develop effective carbon-pricing mechanisms.

Several countries state in their INDCs that their level of commitment is conditional upon having access to additional national carbon market, under negotiation for the immediate post-Paris
A growing number of jurisdictions are implementing domestic climate policies and, more specifically, are pricing GHG emissions. Efficiencies in emission reduction activities to be identified beyond borders and can attract investment where emissions reductions occur at the lowest cost. This could accelerate clean energy investment at the scale needed to meet the world’s ambitious decarbonization goals.

Paris may well usher in the necessary policy and regulatory infrastructure for action. While COP21 may not achieve a 2° outcome, the necessary impetus to get there is gaining momentum. That should be considered a success, of sorts.

**The UNFCCC And The Kyoto Protocol**

Established in 1992, the UNFCCC provided a platform for sovereign states to consider how they could limit average global temperature increases. This was followed by the Kyoto Protocol, a separate international agreement adopted 18 years ago, which attempted to bind developed countries to emission reduction targets. The Protocol, which covered around 10% of global emissions, was neither universal in application nor ratified by the U.S. The Protocol’s first commitment period started in 2008 and ended in 2012. The second commitment period began on Jan. 1, 2013, and will end in 2020.

**PART 1 CONSTRAINTS CAST A SHADOW**

This is the first of four vignettes adapted from a longer article, “Carbon Constraints Cast a Shadow Over the Future of the Coal Industry” (published Aug. 27, 2015, on RatingsDirect).

Delegates to the U.N. Framework Convention on Climate Change (COP21) in Paris are aiming to formulate a global agreement to replace the Kyoto Protocol adopted in 1997 and enacted in 2005. The ultimate objective will be to set a viable roadmap to limit global warming to an average of no more than 2°C relative to pre-industrial levels. Yet, to date, few countries have submitted pledges to cut carbon dioxide (CO2) emissions, apart from the EU, Russia, China, and others that collectively represent about one-third of global greenhouse gas (GHG) emissions. The Paris summit is taking place against the backdrop of flat CO2 emissions in 2014. This, coupled with the shale gas boom in the U.S., high investments in renewable energy sources, and the relatively sluggish global economic recovery effectively give countries another year’s breathing space to refine their emission reduction plans. The global emissions trend of last year was not homogenous: Emissions continued to climb in China, while in Europe economic weakness dampened industrial production with a knock-on effect on emissions. Positive developments in 2014 included the fact that 50% of the additional energy capacity worldwide came from renewable sources, and the first commercial coal-fired power plant with a carbon capture and storage system was commissioned by SaskPower in Canada. Even so, Standard & Poor’s Ratings Services expects CO2 emissions to increase in coming years, as a result of an increasing world population and economic growth in emerging countries. The question is at what pace emissions will rise.

The lower-than-expected demand for energy, coupled with increased coal production, has continued to put pressure on coal prices. In the past 12 months, thermal coal prices have dropped by 30%, to $50 per ton, completing a collapse by more than 50% that began in early 2012 when prices reached $105 per ton. At the same time, coal-fired power plants around the world are coming under close scrutiny as populations look to more environmentally friendly energy solutions.

Despite being the most polluting source of power generation, accounting for 45% of global carbon emissions, coal remains a cornerstone of the global economy, delivering 30% of energy and 40% of power generation worldwide. However, the pledges announced by the EU and the U.S., as well as the new Chinese energy policy, are likely to slow the pace of coal demand growth over the medium term. Longer term, a significant decline in coal production and consumption worldwide is becoming a much more realistic concept, in our view: as governments globally seek to reduce their CO2 emissions, it looks increasingly likely that “King Coal” will lose its crown. However, the pace and scale of change within the coal industry is far from clear, and investors could potentially remain in the dark for some time (as indicated by the widely diverging coal demand scenarios set out by the International Energy Agency).

In this multi-dimensional environment, changes in the demand for coal could have a relatively wide array of wide-ranging consequences. Coal is a regional commodity, mainly due to the cost of transportation; and we believe that changes in the energy mix of most countries will take time to play out. We believe the main risk will be the speed of change: as we’ve observed in the U.S., the dramatic fall in gas prices over the past three years has put many coal producers under pressure, and now bankruptcy. The changes in the coal industry over the medium and long term could also result in stranded assets (coal reserves with no economic return). In our view, those potential impairments are less likely to affect ratings, compared with the equity value of companies, under current prices. This is because we give limited weight to coal reserves that cannot be tapped over the next five to seven years.

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**World Carbon Dioxide Emissions By Fuel Type In 2014**

GLOBAL EMISSIONS REDUCTION TARGETS

- **Canada**: 30% below 2005 by 2030
- **U.S.**: 26-28% below 2005 by 2025
- **Mexico**: 22% below BAU by 2030
- **EU**: 40% below 1990 by 2030
- **Japan**: 26% below 2013 by 2030
- **Russia**: 25-30% below 1990 by 2030
- **South Korea**: 37% below BAU by 2030
- **China**: 60-65% emissions intensity 60-65% below BAU by 2030

Below is a map displaying the announced carbon reduction goals by country and region. The figures represent the planned contribution of each, compared with a baseline and goal year.

Sources: Bloomberg New Energy Finance, UNFCCC, World Bank, IMF.
In just under a month’s time, world leaders will descend on Paris for the U.N. Climate Change Summit; the goal of these talks will be to put in place mechanisms to curb global temperature increase to 2°C. Yet not all nations have yet submitted plans for carbon reduction, but, this is already taking the shape of a large, collective effort. Even if these carbon reduction commitments fall short of achieving the desired 2°C goal, the goals introduced by these participating nations will precipitate a major change in the way the world generates and uses power. In previous carbon reduction efforts, there had been some developing nations that resisted, but now it appears that the world’s large carbon emitters are virtually all in agreement. Tomorrow’s goal will look much different than today’s. The following is excerpted from the article, “New National Commitments To Lower Carbon Emissions Will Alter Global Power Generation,” published Nov. 16, 2015, on RatingsDirect.

FROM WASHINGTON TO PARIS: THE EPA IN A GLOBAL CONTEXT

Japanese carbon reduction goal of 18% from 1990 levels (or 26% from 2013 levels) by 2030 remains comparatively low by developed-nation standards. But even this goal remains in question, as Japan seeks to re-structure its generating portfolio in light of a devastating nuclear incident in 2011 and with limited access to lower-carbon natural gas (in the form of liquid natural gas imports), relying on demand reduction may be a viable strategy. This has, in fact, curbed emissions during the past two decades. Japan may be an outlier in that it is still pursuing the development of coal generation as a baseload fuel source, but it also seeks to get more than 24% of its power from renewables over the same time frame.

Germany

Like several other large developing nations, Germany has been addressing climate change, despite its considerable coal-fired generation. In 2014, it generated 26% of renewable energy sources, and we expect the penetration of renewables to deepen in coming years as Germany phases out its large nuclear fleet. Germany seeks to reduce carbon emissions by 40% from 1990 levels by 2020 and by 80% by 2050, with targets of 30% of energy from renewables by 2020; it is already well on pace to meet this goal. While it’s not yet clear how Germany intends to replace base load generation from coal and nuclear, we expect to see considerable investments in assets that would mitigate the reliability challenges of the country’s vast (and growing) renewable fleet. Importantly, Germany has also asserted itself as a leader not just in clean energy supply, but in demand reduction as well.

Among large and developed economies, Germany is the first of the parties to the convention to demonstrate serious resolve in achieving this goal—that it has begun exploring options for a cap-and-trade program modeled on Quebec’s alliance with California.

In a nation with the sheer size of the U.S., attaining a dramatic carbon reduction requires significant initiative. The Environmental Protection Agency (EPA) has announced the final Clean Power Plan (CPP), which will help push toward the reduction goal. But does this plan alone fulfill the U.S.’s objectives? Unlike some of the other plans for carbon reduction, the CPP is to be implemented at a state level, so the federal government, by design, will have less control over the compliance mechanisms. Because climate change is more politicized and contentious in the U.S. than in other developed nations, legal battles could lengthen this process. Still, the U.S. may actually have more tools at its disposal for carbon reduction, despite its more checkered history.

Mexico has asserted itself as the first developing nation to establish an Intended Nationally Determined Contribution. As the 13th-leading emitter of carbon in the world, it now seeks to reduce carbon emissions by 50% by 2050. However, it may be the first of the parties to the convention to demonstrate serious resolve in achieving this goal—that it has begun exploring options for a cap-and-trade program modeled on Quebec’s alliance with California.

Numerically, Brazil has offered a sharper reduction goal than most other parties to the upcoming conference, promising a 37% reduction by 2025. The reason is especially telling for Brazil’s commitment: since most emerging economies are delaying their goals somewhat to accommodate economic growth. It would then shoot to attain 66% of its second-lowest carbon output per capita among large economies. Crucial to Brazil’s commitment is its wealth of renewable resources; it will shoot to attain 66% of its energy from hydropower and 23% from other renewable sources. Of course, its ability to do this in an economically efficient fashion depends on the expected continued reduction in installed renewable prices.

Mexico

For its part, we note that the U.K.’s participation in the wider 2030 climate goal will require carbon reduction in excess of 50% from 2005 levels by 2030. Clearly, the EU has emerged as a global leader in progressive energy policies, with policy proposals on renewables, carbon reduction, biofuel usage, and coal curtailment. The effort has been a largely cohesive one, and, indeed, in shooting for a 2050 goal, the results are to be assessed collectively. Carbon emissions have already been reduced by about 19% from 1990 levels within the eurozone. Of course, much of the infrastructure needed to incentivize this innovation to meet these goals already exists, but challenges still abound. The commitment to carbon reduction comes amid efforts to reduce nuclear generation in certain parts of the continent. With limited natural gas resources, the EU must lean more heavily on renewables and demand reduction to curb carbon to meet its goals.

For a country that has long relied on coal for a baseload fuel source, but it also seeks to get more than 24% of its power from renewables over the same time frame.

Australia

Somewhat more controversial have been Australia’s efforts. The federal government recently promised carbon cuts of around 26% to 28% by 2030. While this is, on paper, an ambitious goal, the reality projects to be somewhat different. Rather than a sharp decrease as promised, carbon emissions from Australia will likely rise by 27% with a continuation of current policies. Recently, the nation’s Renewable Energy Target was scaled back by about 20%. With 73% of energy currently generated by coal, there is substantial work to do. This isn’t surprising, given Australia’s prominence in world coal production. Still, with modest economic growth projections for the next decade, demand reduction may one part of a viable strategy, one that would allow alleys of power price increases.

China

China’s ability to reduce carbon emissions during the next few years will be limited. On paper, it is due to its expected economic growth and dependence on coal-fired generation, but it seems that the country has taken inspiration from the U.S. CPP. China’s president, Xi Jinping, presented the Green Dispatch system, which will give preference to lower-carbon sources in electricity markets. Indeed, its proposed carbon trading system, due to be implemented in 2017, is considerably more comprehensive than the EPA’s CPP envisions, cutting across a variety of industrial sectors, and the actual reduction goals are comparable. Like the CPP, it delegates some of the compliance burden to the provinces for the actual reduction goals are comparable. Like the CPP, it delegates some of the compliance burden to the provinces for the actual reduction goals are comparable. Like the CPP, it delegates some of the compliance burden to the provinces for the actual reduction goals are comparable. Like the CPP, it delegates some of the compliance burden to the provinces for the actual reduction goals are comparable. Like the CPP, it delegates some of the compliance burden to the provinces for the actual reduction goals are comparable. Like the CPP, it delegates some of the compliance burden to the provinces for

China among other things, we note that the U.K.’s participation in the wider 2030 climate goal will require carbon reduction in excess of 50% from 2005 levels by 2030. Clearly, the EU has emerged as a global leader in progressive energy policies, with policy proposals on renewables, carbon reduction, biofuel usage, and coal curtailment. The effort has been a largely cohesive one, and, indeed, in shooting for a 2050 goal, the results are to be assessed collectively. Carbon emissions have already been reduced by about 19% from 1990 levels within the eurozone. Of course, much of the infrastructure needed to incentivize this innovation to meet these goals already exists, but challenges still abound. The commitment to carbon reduction comes amid efforts to reduce nuclear generation in certain parts of the continent. With limited natural gas resources, the EU must lean more heavily on renewables and demand reduction to curb carbon to meet its goals.

U.K.

Canada

Canada has announced a goal for carbon reduction that is similar in magnitude to that proffered by the CPP, shooting for a 30% nationwide reduction off of 2005 levels by 2030. Like the U.S., Canada has also been slow to adopt environmentally progressive policies, and, indeed, while American carbon emissions have already dropped by about 13% since 2005, Canada’s have fallen less than 2% during the same period, albeit with more significant economic growth. Much like the CPP, Canada’s plan relies very heavily on work already done at the provincial level; Ontario, specifically, has pointed to a 37% reduction over the same time frame. Still, questions abound.

Japan

The Japanese government recently announced a more ambitious goal of 26% to 28% by 2030. While this is, on paper, an ambitious goal, the reality projects to be somewhat different. Rather than a sharp decrease as promised, carbon emissions from Australia will likely rise by 27% with a continuation of current policies. Recently, the nation’s Renewable Energy Target was scaled back by about 20%. With 73% of energy currently generated by coal, there is substantial work to do. This isn’t surprising, given Australia’s prominence in world coal production. Still, with modest economic growth projections for the next decade, demand reduction may one part of a viable strategy, one that would allow alleys of power price increases. Still, while most emerging economies are delaying their goals somewhat to accommodate economic growth. It would then shoot to attain 66% of its second-lowest carbon output per capita among large economies. Crucial to Brazil’s commitment is its wealth of renewable resources; it will shoot to attain 66% of its energy from hydropower and 23% from other renewable sources. Of course, its ability to do this in an economically efficient fashion

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McGraw Hill Financial
President Doug Peterson
On Environmental, Social, And Governance Risks

RISKS ARISING FROM CLIMATE CHANGE HAVE INCREASINGLY DRAWN THE ATTENTION OF GOVERNMENTS, PUBLIC AND PRIVATE INSTITUTIONS, BUSINESSES, AND FINANCIAL MARKETS. HERE, PRESIDENT AND CEO OF MCGRAW HILL FINANCIAL (MHFI) DOUG PETERSON DISCUSSES HOW STANDARD & POOR’S RATINGS SERVICES AND OTHER MHFI BUSINESSES HAVE SHARPENED THEIR FOCUS ON ENVIRONMENTAL, SOCIAL, AND GOVERNANCE (ESG) RISKS. (FOR STANDARD & POOR’S RATINGS SERVICES’ VIEWS, PLEASE SEE THE ARTICLE IN THIS ISSUE, “ESG RISKS IN CORPORATE CREDIT RATINGS—AN OVERVIEW.”)

What is ESG, and why is it important to capital market participants?
There is a growing realization in the financial community that independent and comprehensive analysis of environmental, social, and governance issues is fundamental to assessing the value and performance of an investment over the medium and longer term. These issues are increasingly important to any market participant focused on responsible investing. Many investors now consider a wide array of ESG factors in their decisions about asset allocation, stock selection, portfolio construction, shareholder engagement, and voting (see table).

Investors are taking a broader view, aiming to account for the full spectrum of ESG-related risks and opportunities to align capital allocation to the longer-term interests of their clients and beneficiaries. Investors also have become more aware of the credit risks posed by companies failing to address in a timely and sufficient manner ESG impacts that result from their activities.

What capabilities does MHFI have to help market participants assess ESG risks?
McGraw Hill Financial strives to provide global market participants with essential information that can help them make more informed decisions. Our brands are uniquely positioned to add transparency and clarity to responsible investing.

For example, Standard & Poor’s Ratings Services already examines environmental, social, and governance risks as part of its corporate credit analysis. It assesses rating impacts of matters such as climate events, pollution, resource depletion, employee and customer and community relations, and adherence to legal and regulatory requirements. In many cases, environment- and climate-related factors have either contributed to a rating change by S&P or were a significant factor in its rating analysis (see table). As the severity and frequency of environmental and climate risks continue to rise, we expect the amount of ESG-related corporate rating actions to accelerate in coming years.

S&P Dow Jones Indices, meanwhile, publishes 45 ESG indices based on a wide array of broad-market, blue-chip, specialty, screened, and diversification strategies. Platts is a leading provider of global information on energy, petrochemicals, metals, and agriculture, as well as specialized products for the carbon, biofuel, and renewable energy markets. And S&P Capital IQ and SNL deliver quantitative models and scoring templates in the renewable energy finance space.

Are there new products in MHFI’s pipeline that focus on ESG?
We constantly develop new products and services that capitalize on our capabilities and brands to give our customers greater access to the data, research, and analytics they need. Environmental, social, and governance risk factors are not exceptions. Our product teams are currently working on several solutions that will allow asset owners and managers to benchmark and perform more granular analyses of specific types of risk, such as ESG and others factors. We are looking to make these new tools, as well as richer underlying data and research, available to the market.

ONE IN EVERY $6*
under professional management in the U.S. is now aligned with sustainable, responsible, and socially impactful investing strategies.


↑330%
Assets incorporating ESG criteria have rapidly increased to $4.3 trillion in 2014, from $1 trillion in 2012, with over 900 distinct ESG funds in existence.

≈300 CASES
in 2013 and 2014, in which environment- and climate-related factors contributed to a rating change or were a significant factor in Standard & Poor’s Ratings Services rating analysis.

56 OF THE CASES resulted in a rating action, CreditWatch placement, or outlook revision; 44 of which (or close to 80%) were negative in direction.
THE HEAT IS ON: CLIMATE CHANGE AND SOVEREIGN RATINGS

Overview

- Based on a sample of 38 sovereigns and 44 natural catastrophe events, our simulations show that climate change impact, triggered by tropical cyclones and floods that can be expected once in every 250 years, would exacerbate the current negative sovereign rating impact of a natural catastrophe on average by about 20%.
- The calculated impact is, however, only partial because it doesn’t reflect all the risks that come with climate change and stops in 2050. The actual ratings impact of climate change could, therefore, be larger still.
- While the climate change risks to sovereign ratings of advanced economies appear on average negligible, the ratings of many emerging sovereigns (specifically in the Caribbean or Southeast Asia) would likely come under additional significant pressure.
- We find that catastrophe insurance can partly mitigate the rating impact of climate change disasters. This advice is, however, by no means always effective; however, depends to a large degree on the strength of the fundamentals that factor into the rating, especially when the damage is large.

See the full version of this article, published Nov. 25, 2015, on RatingsDirect.

» Record-beating warm weather worldwide so far in 2015 could make it the hottest year on record. This is fitting climatic context ahead of the 2015 U.N. Climate Change Conference taking place in Paris over next two weeks. Earth is warmer now than it has been for over 90% of its 4.6 billion-year history, and there’s no sign of any slowdown (McGuire, 2014). The British Met Office estimates that global temperatures between January and September of this year were just over 1° Celsius above the 1850-1900 average—halfway to the 2° Celsius increase from that time that many governments have committed to as a benchmark limit to avoid catastrophic levels of warming. (Watch the related CreditMatters TV segment titled “The Rating Impact Of Natural Catastrophes Due To Climate Change,” dated Nov. 26, 2015.)
That raises a very relevant question from Standard & Poor’s Ratings Services’ view. As the planet as a whole gets hotter, what are the potential consequences of climate change on particular nations’ sovereign creditworthiness? It’s a fairly complicated exercise, and to make our first-ever informed estimates requires us to assess climate change’s impact on economic and individual sovereign ratings factors (see the Climate Change infographic on p. 28 of this issue).

Extreme weather conditions that likely lead to a radical rise in the number of meteorological disasters, and their magnitude, are increasingly becoming part of everyday lives. According to the World Meteorological Organization, more than 370,000 people died in extreme weather incidents between 2001 and 2010—a 20% rise over the previous decade. Our planet is expected to become even more lethal, e.g., given the future trends in coastal urbanization, with rising sea temperatures and levels resulting in more frequent and more devastating storms, particularly in the tropical regions. In fact, extreme precipitation events have increased significantly at high and middle latitudes in the second half of the 20th century, and tropical cyclones worldwide are becoming stronger, with a 25% increase with sustained wind speeds exceeding 175 km per hour (McGuire, 2015). For small island nations, such as Maldives in the Indian Ocean and the Marshall islands in the Pacific, a one-meter rise in sea level would flood up to 75% of their dry land, making the islands uninhabitable. Other major concentrations of population at risk from such events are those living by river deltas, including in Bangladesh and Thailand.

Public awareness of these risks is growing. Indeed, the Global Risks 2015 report by the World Economic Forum (World Economic Forum, 2015) shows that survey respondents mostly consider environmental risks will grow faster over the next decade than any other risk category. Another recent global survey, with respondents from 40 countries, confirms this. Its respondents cited risk from such events are those living by river deltas, including in Bangladesh and Thailand.

Climate Change And Our Sovereign Ratings Methodology

Standard & Poor’s sovereign credit rating methodology doesn’t specifically refer to risk of climate change impact. However, it makes reference to natural perils as an “event risk” and a situation where a sovereign would be subject to “constant exposure to natural disasters or adverse weather conditions.” While not explicit, the latter is very much in line with the description of potential consequences of climate change (see “Sovereign Rating Methodology,” published Dec. 23, 2014, on RatingsDirect). In general, however, the most likely effect of climate change via natural catastrophes on sovereign ratings would be indirect rather than direct, through a weakening of the fundamental factors that determine a sovereign’s rating, such as our economic, external, fiscal, monetary, and institutional assessments. Similar to the ratings implications of aging societies (see “Global Aging 2013: Rising To The Challenge,” published March 20, 2013), our criteria implicitly capture the effect of climate change and natural disasters on the sovereigns we rate.

Quantifying The Impact Of Climate Change

This is our initial attempt to quantify the severity of the economic and ratings impact of climate change, and we’re focusing on two perils: tropical cyclones (and their associated storm surges) and floods. Of course, climate change can exacerbate other, non-meteorological natural hazards. Due to limited data availability, we had to omit drought and some other hazards related to climate change, but we recognize that they, too, can affect lives and economic activity, especially in low-income developing sovereigns with important agricultural sectors. Our results presented here should therefore be understood as merely a partial analysis of how climate change would affect sovereign ratings.

To quantify climate change impact for each country, we start by simulating direct damage to property and infrastructure resulting from a disaster whose severity would be expected to occur once every 250 years. It’s important to note that our analysis isn’t aimed at quantifying the impact of climate change in totality. We’re just looking at the implications climate change will have on a once-in-every-250-year catastrophe event. We’re not including all other gradual and accumulating impacts. As a starting point, we use estimates of property damage-to-value that could result from natural disasters under climatic conditions prevailing today (for a more detailed discussion of our assumptions, see “Storm Alert: Natural Disasters Can Damage Sovereign Creditworthiness: Methodological Supplement,” published on Sept. 24, 2015). We then reassessed this impact by modifying the models hazard component to reflect climate change, which will lead to higher potential damages (see Appendix). The result: Once-in-250-years disasters become more damaging as climate change increases.

What is now considered a once-in-250-years event could become, say, a once-in-50-years event.

The mainstream in climate science takes the view that global warming will make meteorological natural catastrophes more frequent and more severe than at present. That assumption also underlies our analysis here. It also means given the forecasts for increased frequency of extreme events, what is now considered a once-in-250-years event could become, say, a once-in-50-years event. Depending on emissions scenarios, warming might not be stopped by 2050 and could go on beyond 2100. In the very long term, therefore, our estimates may well underestimate climate change risks to sovereign creditworthiness (see Appendix). It’s important to reiterate that our simulation’s aim isn’t to incorporate all climate change effects for an individual sovereign. Instead, the key is to analyze how the impact of climate change through 2050 affects the severity of a 250-year event (tropical cyclone or flood) and its implication on the sovereign’s economy and creditworthiness. The direct damage data we used were compiled and provided by reinsurance company Swiss Re. The data estimation is based on the open-source climada model (Bresch, 2015) and further

 proprietary information provided by Swiss Re (see Appendix). The data set contains 30 estimates of 250-year tropical cyclone events and 14 estimates for 250-year flood events.

Compared to our recent report on natural catastrophes, here we’re extending our analysis to Africa (previously not covered) and notably the Caribbean region (increasing the number of sovereigns analyzed). It’s worth recalling that the direct damage data include only the estimated value of the physical destruction of private and public property, including infrastructure. It doesn’t include the knock-on effects on economic growth because of the concomitant impact on productive capacity or disrupted supply chains. We model these secondary impacts separately. A comprehensive assessment should include a projection of economic development in the future. This can encompass more densely populated cities, newly constructed infrastructure and enlarged industrial and settlement areas, which may increase the future potential damage following a natural disaster.

The economic and sovereign rating impact is expressed in relative GDP terms. Under the reasonable assumptions that absolute property damage (in constant-dollar terms) grows proportionally with absolute property values (equally measured) and that property values move proportionately with real GDP, we quantify the impact of climate change by solely increasing the damage-to-value ratio of a natural catastrophe. The sample analyzed is limited by data availability. Many of the 130 sovereigns we currently rate aren’t in the sample because data were unavailable or we considered damage estimates to be too low to have any ratings impact. Our simulations take into account existing insurance coverage for the sovereigns concerned, as made available by Swiss Re. The impact of climate change could, therefore, still be ratings-relevant for sovereigns left out of this report. We recognize that alternative reasonable specifications and modeling could lead to equally valid but differing damage estimates. Nevertheless, and in full recognition
of those caveats, we consider the Swiss Re data set to be the most comprehensive and cross-country comparable available to us. We simulated the macroeconomic impact and sovereign rating outcomes as described in our September 2015 “Storm Alert” report and methodological supplement. For the purpose of this analysis we assume that, all things being equal, the ratings distribution will remain broadly unchanged in 2050. In fact, sovereign default probabilities have on average empirically not changed significantly over a time period of 35 years, like we’re covering here. Indeed, our historical ratings transition data suggest that the relative rank ordering is likely to remain broadly unchanged in the future (see “2014 Annual Sovereign Default Study And Rating Transitions,” published on May 18, 2015).

Finally, it’s also worth recalling that the hypothetical rating changes this simplified model generates are not to be misunderstood as Standard & Poor’s definitive view on likely future ratings trajectories.

**What The Simulations Show**

In the following sections, we analyze the results of our simulations of the impact of climate change on sovereigns. As in our September 2015 “Storm Alert” report, the benchmark is an event that occurs once every 250 years on average. But here we’re including the corresponding damage assumptions from climate change. Differences between individual perils are recognized in the direct damage estimates, which is the main factor behind the macroeconomic and ratings impact. The simulations of economic, external, and budgetary variables are uniformly applied across the sample and do not discriminate among the two perils, tropical cyclones and floods.

Overall, in 44 natural catastrophes in 38 countries, climate change increases the expected once-in-250-years damage-to-value ratio significantly, on average by about 25%. The negative rating impact of the catastrophes due to climate change increases accordingly on average by about 25% compared to a scenario not including climate change. However, important differences exist among the sovereigns covered in this report. The impact of climate change is far more important for emerging and developing sovereigns than the advanced economies. In terms of average impact, our simulations show that tropical cyclones are more damaging than floods. Most notable climate change risk increases include tropical cyclones in the Bahamas, Barbados, Dominican Republic, Jamaica, and Vietnam, and floods in Thailand. Regarding Thailand, the impact is particularly severe: It doubles the potential flood damage compared to a status-quo scenario without climate change. Nevertheless, we expect advanced sovereigns to also see significantly raised potential direct damage from climate change. For example, that from tropical cyclones in the U.S., New Zealand, or Japan would be higher by 45%, 50%, and 64%, respectively, compared to the no-climate-change scenario.

In our view, some countries will be able to adapt to the challenges associated with climate change. But the speed of change could be so rapid as to make this all but impossible for the most vulnerable nations in Asia, Africa, the Caribbean, and elsewhere in the developing world.

**Climate Change Could Lead To More Destructive Floods And Tropical Cyclones**

The Swiss Re direct damage data assessing the impact of climate change on tropical cyclones and floods indicate a particularly large increase in potential direct economic damage (of more than 1 percentage point increase in value compared to the no-climate-change scenario) for the Caribbean sovereigns like Bahamas, Barbados, Bermuda, Dominican Republic, Jamaica, Vietnam, and all tropical sovereigns (see chart 1) and Thailand (floods; see chart 2 for detailed data on damage caused as well as key results of our economic simulations). In some other sovereigns that are geographically exposed to tropical cyclones, for example Bangladesh and Fiji, the increase in direct damage is not so significant. But this needs to be viewed in the context that a natural catastrophe would already be extremely devastating under current climatic conditions (8.6% and 11.7% of value in Bangladesh and Fiji, respectively). Climate change would only be aggravating an already very vulnerable position.

Conversely, the impact of climate change is likely to reduce potential direct damage from floods in Poland and the Czech Republic, although even so marginally. This is due to the likely decline in floods usually caused by the combination of heavy rains and snow melting. With warmer temperatures, snowfall will be lower and so will be meltwater.

**Economic impact**

For each of the sovereigns analyzed, our damage estimates represent an immediate severe negative economic shock, and our simulations of macroeconomic impact show worsening GDP per capita losses (in cumulative U.S. dollars) due to climate change. In the most affected sovereigns, the per-capita income losses range from about 1.6% (Bermuda) to 8.5% (Thailand), compared to a simulation with no climate change.

**Fiscal impact:** As a result of the economic shock, we would expect government finances to deteriorate due to the necessary public spending on reconstruction following the disaster, as well as the negative cyclical effect of the resulting economic downturn. Climate change alone would increase government debt in the affected sovereigns by between slightly more than 4% of GDP in Vietnam and 42% of GDP in the Bahamas, compared to a no-climate-change scenario.

**External impact:** Adding the adverse impact of climate change to the devastation of a tropical cyclone or flood would likely further depress exports and increase imports, such as food, medical supplies, and reconstruction-related materials. As a result, the external position of the affected sovereigns would worsen compared with a no-climate-change scenario. We expect the projected weakening of current account balances, in particular the decline in current account receipts, to contribute to a significant
The additional amount of insurance that would offset climate change impacts will, of course, not only depend on the additional direct damage likely to be caused, but also on the specific economic and fiscal circumstances of the economy in question. These factors determine the country's vulnerability to credit downgrades. In Thailand, for example, when accounting for climate change, a 250-year event will wreak double the damage of the same event when assuming no climate change. But it will take an additional 74% insurance coverage, more than seven times the actual coverage ratio, to offset the impact due to climate change (see chart 6). This is because insurance cannot fully mitigate the higher fiscal costs of larger damage and the larger initial economic disruption. Therefore, to cut the rating impact from 3.4 notches (with climate change) to 1.6 notches (without climate change and with actual insurance coverage levels) with a much larger damage, insurance needs to help accelerate the restoration of damaged productive assets of the private sector. This boosts economic growth and raises the tax base. As a result, higher insurance coverage will also mitigate the example climate change impact due to natural catastrophes. This holds true if we account for changes in magnitude of disasters due to climate change, as we do in this report.

That said, we’re shifting the angle at which we look at insurance. We use insurance coverage as a measure to quantify the cost of the ratings impact due to climate change. More precisely, we ask: What incremental insurance coverage would an economy need to fully offset the ratings impact due to climate change? To answer this question, we compute the additional insurance coverage ratio that would result in the same rating impact under a 250-year event under climate change would yield as under a 250-year event without climate change (taking as given actual insurance coverage ratios). We caution that insurance can’t offset all of the economic and ratings impact of a natural disaster. Even with insurance coverage at 100%, it will take time to rebuild infrastructure and other capital. During that time, government spending is likely to be at least as high as in the absence of a natural disaster while tax receipts will fall comparatively short, leading to a deterioration of the fiscal position. In our exercise, our measure of additional insurance coverage also aims to account for this loss in terms of the ratings impact.
up to 60% of the damage can be cost-effectively averted (ECA, 2009; swissre.com/eca). Consider the Netherlands, with about a quarter of its surface below sea level, countless man-made canals, and large areas of reclaimed land. This makes the country highly exposed to both saltwater and freshwater floods, which materialized in a devastating storm surge in 1953, the country’s worst natural disaster so far. Since then, however, successive Dutch governments have been building protection measures, allocating large amounts of their annual budget to keep up safety levels. As a result, a network of dike rings and river embankments is designed to withstand up to once-in-10,000-year events, which makes additional insurance coverage less necessary. This also explains the surprising absence of flood insurance in the Netherlands. Therefore, the extent to which insurance coverage can be effective depends to a large degree on the strength of the fundamentals supporting the rating, especially when the damage caused by the disaster is large.

High Stakes At The 2015 U.N. Climate Change Conference

Our simulations indicate that climate change-related natural hazards can harm sovereign ratings. In terms of average impact of climate change by peril, our simulations show that tropical cyclones and associated storm surges will be more damaging than floods as the Earth’s temperature rises. Geographically, ratings of sovereigns in the Caribbean and Southeast Asia appear to be most at risk. The additional climate change damage caused in richer countries is on average more moderate. Their higher level of preparedness, including insurance coverage, further reduces the economic and rating impacts for that prosperous group. Finally, our results confirm that a larger insurance coverage against natural hazards is on average associated with more likely mitigation of adverse economic implications of any climate change impact. The extent to which this can be effective, however, depends to a large degree on the strength of the fundamentals that support the rating, especially when the damage caused by the disaster is large.

Climate change is projected to have different impacts on precipitation patterns in different parts of the world.

Appendix: Climate Change Impact Scenarios

Storms and floods are major natural hazards. Over the past decade they have been responsible for three-quarters of global insured losses and over half the fatalities and economic losses from all natural catastrophes. Most climate models suggest that the proportion of rainfall classified as heavy will continue to increase, raising the frequency and magnitude of flooding events. Over the past three decades, the number and intensity of hurricanes have increased in the North Atlantic and Western Pacific Oceans, thanks to rising sea surface temperatures (Main, 2014).

Tropical cyclones

Tropical cyclones form in six basins worldwide, the East Pacific, North Atlantic, South Indian Ocean, North Indian Ocean, West Pacific, and South Pacific. An increase of maximum wind speed in the basins between 1% and 5% and stable cyclone frequencies is used, based on the IPCC Fifth Assessment Report (2014), Emanuel (2013), and Knutson et al. (2010). Model simulations show robust results for increased precipitation associated with cyclones. As the water vapor content of the tropical atmosphere increases, the rainfall rates in tropical cyclones increase as well. The storm surge associated with tropical cyclones increases due to sea level rises in the different basins. For the purpose of the simulation, sea level rise data from the IPCC AR5 based on the high greenhouse gas emission scenario Representative Concentration Pathway 8.5 are used. In an extreme climate change scenario, storm surge increases due to rising sea levels until 2050 range between +2.5 m and +40 cm for the different basins.

Floods

Climate change is projected to have different impacts on precipitation patterns in different parts of the world. Where climate change leads to higher precipitation events, river inundation zones will extend. In some regions, severe flood events can occur more often, for example, an event that on average occurs every 100 years could occur every 50 years in the future. As warmer air can take up more moisture, and therefore more water is available for precipitation and subsequent flooding, the global water cycle intensifies. An opposing phenomenon may lead to fewer peak flood events. With warmer temperatures, snowfall will be lower and so will be meltwater.

In an extensive research study conducted by the University of Tokyo, Hirabayashi et al. (2013), calculated the changing return period of a 100-year flood event on a global scale. This change of return period was applied for all evaluated countries, downscaled to a time horizon until 2050 and modified by a country-based natural hazard management resilience factor that is published and evaluated by the insurance company FM Global on a yearly basis. The FM Global resilience index reflects the capability of a country to prevent and manage natural disasters. In simple words, it refers to “preparedness.” While economically well-developed countries like Germany, the Netherlands, and the Czech Republic already have strong natural hazard prevention measures in place, countries like Honduras or Venezuela do not appear that well prepared. Estimating climate change’s effect on precipitation in Europe, Rajczak et al. (2013) find two different patterns. While Southern Europe will see less precipitation, the north will have a substantial increase, defining a zone that moves south/northwards with seasonal patterns. This pattern includes countries like Austria, Czech Republic, France, Germany, Hungary, Netherlands, and Poland. Even while mean rainfall decreases for Southern Europe, strong events—like a five-year return period precipitation event leading to inundation—will in general increase across most of Europe.

Overall, most countries will see a moderate increase in climate change-related flood risk. However, countries like Mozambique and Thailand will see a strong increase in flood damage. On the other hand, Eastern European countries like Poland and Czech Republic will even see a small decrease in flood-related damages (only considering climate change and not taking economic growth into account). It should be mentioned, that economic growth will have a strong influence on future flood damages, too.

*Flood: Note: The perils for all countries are tropical cyclones, except for Hungary and Thailand where the peril is flood.

© Standard & Poor’s 2015.
Our analysis shows that the climate change impact, triggered by tropical cyclones and floods that can be expected once in every 250 years, would exacerbate a negative rating impact of a natural catastrophe on average by about 20%. While the risks to sovereign ratings of advanced economies appear, on average, manageable, the ratings of many emerging sovereigns in the Caribbean or Southeast Asia would likely come under additional significant pressure due to the climate change impact.
REVERSING GLOBAL WARMING REQUIRES NOTHING LESS THAN A GLOBAL EFFORT

SATYAM PANDAY

Overview

- Some economic forecasts predict that if climate change causes the Earth’s temperature to rise by another 4°C Celsius by 2100, global economic output is projected to be 4% to 9% lower relative to an economy with no warming effect.
- Global warming is the result of emissions of carbon dioxide and other greenhouse gases (GHGs), primarily from transportation, power generation, and industrial sources.
- Developing nations are struggling to balance the need for economic growth with the need for environmental protection.
- While Europe and the U.S. already have some plans to combat global warming, China recently announced a cap-and-trade system and new goals for cutting GHGs.
- With the world’s three leading economic regions ready to combat global warming, more of the developing world may be ready to join the fight.

Although the existence of climate change is all but a settled matter—few scientists dispute anymore that the Earth is heating up—far less consensus exists on how to ameliorate the damaging effects. Evidence continues to mount that glaciers and ice caps are melting, sea levels are on the rise, and hurricanes, tornadoes, blizzards, floods, and droughts are happening with more intensity, more frequency, or both.

As the Earth continues to warm and climate change accelerates, the global economy is likely to take a hit. And while global warming will ultimately affect everyone, it appears that the largest economic blocs on the planet, the U.S., Europe, and China, may be the ones that point the way to ensure that climate change doesn’t seriously erode the potential for global economic prosperity.

Standard & Poor’s Economics is among those believing the economic consensus that the economic costs of marginal warming will be small—up to a 2°C Celsius rise in the Earth’s overall temperature—but that damages will begin to climb at an accelerated pace past that threshold, becoming substantial if the temperature rises 4°C Celsius or more. Those temperature changes may sound insignificant, but prominent studies predict that by the time the 4°C of warming is reached in 2100, absent any mitigating action, global losses could range from 4% to 9% of economic output relative to an economy without global warming. No one can predict future temperatures with absolute certainty, but the reports produced for the World Bank by the Potsdam Institute for Climate Impact Research estimate a 40% chance of a 4°C temperature rise by 2100 if emissions follow a moderate, “business-as-usual” path, i.e., as if the world’s governments don’t implement their pledges to reduce emissions.

Two Degrees Of Separation?

So, how does the world turn down the thermostat? The U.N. will once again seek answers in December.

So, how does the world turn down the thermostat? The U.N. will once again seek answers in December at the 2015 Paris Climate Conference (COP21), which its French hosts call, “A Conference of the Parties with higher stakes than ever before.” The UN COP21 aims for more effective national targets to keep global temperature increases to less than 2°C Celsius over pre-industrial age temperatures, which should avoid the worst effects of climate change.

Chart 1: Long-Term Global Nominal GDP Growth Projections

(Trillion $)

Source: OECD. © Standard & Poor’s 2015

Overview

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So, how does the world turn down the thermostat? The U.N. will once again seek answers in December.
But it won’t be easy because it requires collective, global action. The difficulty comes from the fact that costs to mitigate global warming need to be borne today, while the benefits won’t be apparent until the future. In addition, while most parties can see the dangers in unabated global warming, their long-term and short-term goals may be different. That’s especially true in the difference between the advanced economies, which have more money to spend and have been the source of most emissions of greenhouse gases (GHGs) until now, and some developing nations, which are striving to achieve strong near-term economic growth without adding to the atmospheric damage generated by intense urbanization and industrialization.

According to the Organization for Economic Co-operation and Development’s (OECD) long-term projections, global GDP is expected to almost treble by 2060, with almost two-thirds of global growth (at current prices) set to come from non-OECD countries (see chart 1). Given their energy-intensive stage of development, the non-OECD countries will require disproportionate amounts of energy to achieve that growth. But just as equity demands that developed countries act first in reducing GHG emissions, the physical workings of our planet demand that developing countries also limit and, in time, reduce their emissions. This will require high levels of trust and co-operation among the nations attending the Paris summit, if they are to come up with the action necessary to put the world on a trajectory below 2°C global warming.

A Hotter Earth And A Cooler Economy

To keep the Earth from reaching those critical extra degrees in overall heat—one of the prime goals of COP21—scientists know what’s needed to cut emissions of GHGs, such as carbon dioxide (CO2), methane, nitrous oxide, and fluorinated gases that trap the sun’s heat and promote global warming. In large part, GHGs such as CO2 result from burning fossil fuels. The less wood, coal, oil, and natural gas that’s used, the better it will be for the planet. Economies have several ways to use less fossil fuel, but all of them exert a cost somewhere along the line. Whether it is individual consumers, sovereign governments, or businesses, someone has to pay for phasing out fossil fuels while developing and installing replacement power sources. Power, and, more importantly—the sectors that use the most fossil fuels (see chart 2). Conversely, some or all of those same parties might also gain direct and indirect economic benefits in terms of new construction and new industries, the reduced likelihood of serious problems and collapsing food production, lower health care costs, and less property damage from natural disasters.

Determining the costs of action versus inaction to avoid even a 2°C Celsius increase is an inexact science. First, although consensus exists that temperatures will rise, there is still uncertainty on how much temperatures will rise under current conditions, and what the damage function looks like, which is uncertain regarding the timing of cascading effects. And just as important, all potential costs of global warming must be discounted over future years—and economists can disagree widely on what the discount rate will be. Many argue that traditional methods using the cost of capital may not be appropriate to discount the welfare of future generations and therefore a lower discount rate should be used to calculate the present value of future climate damages.

In a report, Climbing the Costs of Climate Change, economists estimated future damages using different discount rates. They also estimated the costs of action to mitigate GHG emissions through a combination of increased energy efficiency and reduced fossil fuel use for power production and transportation. They found the $190.2 trillion expenditure through 2060 on mitigating actions for energy (capital expenditure through 2060) and $33 trillion for transportation. They found the $190.2 trillion expenditure through 2060 on mitigating actions for energy (capital costs and fuel) are nearly the same as the expenditure of conducting business as usual, at $192 trillion. In other words, costs are incurred mostly on development of renewables and energy efficiency, resulting in lower use of fossil fuels, which in turn lowers the total cost in later years.

But the real difference lies in the estimated cumulative losses. The central estimate of cumulative losses from inaction from 2015 to 2060 is as high as $44 trillion (assuming a 2.5°C Celsius rise by 2060) with a 0% discount rate (see table 1). A low discount rate encourages early action precisely because future damages count for so much. Using a higher discount rate—that values costs in the future less than costs incurred presently—shows somewhat lower losses (see table 1). In fact, when viewed through a typical discount rate schedule of 5% to 7%, global losses amount to 6% to 13% of current GDP.

And this is in line with most studies that estimate impact on global GDP growth. Climate scientists use so-called “Integrated Assessment Models” to estimate how inaction affects global GDP. The inaction estimates range from 0.7% to 2.5% of GDP loss for a temperature of 2.5°C Celsius, expected to be reached in 2100.

Solving the climate problem is going to require that the world’s economic leaders encourage early action. This requires stepping beyond the emissions targets that are the focus of the U.N. Climate Change Conference in Paris, and into the realm that what the world’s major economies do to fight it will be critical. Because the amount of CO2 and other GHGs that a nation generates are generally a function of industrial activity, transportation, and power generation (see chart 2)—all linked to GDP—advanced economies and fast-growing developing ones will have a big part to play. That said, in a sign that potentially marks delinking between CO2 and GDP, CO2 emissions were flat according to the International Energy Agency, despite the global

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<th>Table 1: Potential Costs Of Climate Change Damage</th>
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<td><strong>Discount rate</strong></td>
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Notes: (1) Global GDP currently amounts to about $80 trillion in nominal terms. (2) A typical discount rate is 6.5%, which assumes a combined real risk-free rate of 15% and an equity risk premium of 5.5% to give a cost of capital of 6.5%. Source: Cirefi Research.

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<th>Table 2: The Damage To Global GDP From Global Warming By 2100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature rise (degree Celsius)</td>
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<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>1°</td>
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<td>2°</td>
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<tr>
<td>3°</td>
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<tr>
<td>4°</td>
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<tr>
<td>5°</td>
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</tbody>
</table>


Reversing Global Warming Requires Nothing Less Than A Global Effort

The U.S. EPA’s Clean Power Plan (CPP) is an executive rather than a legislative action, as it can be reversed by a subsequent presidential administration. We also expect the CPP will face many administrative and legal challenges, especially from states that produce coal or get much of their electricity from coal-fired plants. However, the CPP is flexible. Instead of a strict federal mandate about how to cut CO2, it establishes goals and then allows states latitude about how to achieve them. States can use direct carbon taxes, a cap-and-trade system, the production of renewable energy, or other methods that meet specified statewide goals. While slowing climate change, the CPP’s economic benefits by 2030, says the Obama Administration, would also be substantial:

• By 2030, when the CPP is fully in place, carbon pollution from the power sector will be 32% below 2005 levels;

• The CPP’s public health and climate benefits will total an estimated $34.4 billion to $54.4 billion per year in 2030, versus a cost of $18.4 billion;

• Just from soot and smog reduction, U.S. families will see up to $4 in health benefits for every dollar invested through the CPP; and

• The lower exposure to particle pollution and ozone in 2030 will avoid a projected 1,500 to 3,600 premature deaths, 90,000 asthma attacks in children, and 300,000 missed school and work days.

The assumptions, discount rates, and specific factors behind any cost estimates for fighting global warming can and will be debated, even as politicians gear up to begin fighting on behalf of the stakeholders they believe have much to gain or lose under the CPP. It will unquestionably cost something to keep America’s air clean and prevent it from heating up. How large that cost turns out to be and who will ultimately bear it remains open to debate.

The U.S. is also attacking climate change in the transportation sector, with calls for higher fuel efficiency for autos. Although the Corporate Average Fuel Economy standards were first instituted in 1975 as a way to reduce oil imports in the wake of the 1973/1974 Arab oil embargo, they’re now also widely seen as a way to help cut GHG emissions. The EPA and the National Highway Traffic Safety Administration are preparing to increase Automotive Fuel Efficiency in new cars, light-duty trucks, and medium-duty passenger vehicles, starting in 2017. The final standards are projected to result in an average fleetwide trend in model-year 2025 of 54.5 miles per gallon if they’re achieved exclusively through fuel economy improvements. Light-duty vehicles currently account for nearly 60% of U.S. transportation-related petroleum use and GHG emissions.
have more than 34 then sell or buy allowances from other manufacturers. Producers can sell or buy allowances to and from other producers, transportation companies, or governments gradually tighten limits on emissions by issuing or selling allowances in the power sector 32% below 2005 levels by 2030. The U.S. is also proposing to further reduce GHG by boosting fuel efficiency in light cars and trucks starting with 2017 models. The transportation and power generation sectors each account for a little less than one-third of all GHG emissions in the U.S. (see chart 3).

And China Makes Three

While Europe and the U.S. have been ramping up efforts to combat climate change, progress has been somewhat slower in China, now the world’s second-largest economy, and largest on the basis of purchasing power parity. The Chinese government is acutely aware of the potential damages to the nation from global warming, even as its economy boomed. Much of the population is in coastal areas that could be hurt by rising sea levels, while disappearing glaciers that feed many rivers could hurt agricultural production if those rivers eventually lack the necessary water for regular irrigation. And beyond that, of course, is the cost to day-to-day life in China’s big cities from the nation’s infamous smog, a direct result of GHG emissions from factories and cars.

Aging China’s rapid economic growth has already become the largest generator of CO2 from power plants in the world, with a 27% share of that global pie. (The U.S. produced 14% and the EU 9%). On a per capita basis, however, China doesn’t even come close to being the leading CO2 generator. While Chinese per capita emissions and total emissions (see chart 4) have more than doubled since 1995, consumption-based per capita emissions—the emissions embodied in the final goods and services consumed regardless of country of production—in the US are still about four times larger. Much of China’s power still comes from coal (and in the developing world in general, 70% of power is now coal-generated). China has rapidly urbanized, and with people flocking to its cities from rural areas, the need for power is likely to increase.

Therefore, China’s pronouncements in November 2014 that it will set limits on CO2 emissions are, in our view, something of a landmark in the fight against global warming. China announced goals to achieve 20% of its power by 2030 from zero-emission sources, such as nuclear, wind, hydroelectric, and solar. The nation also said it would reduce CO2 emissions to peak by 2030, making best efforts to reach a peak earlier than that. Its aim is to reduce carbon emissions per unit of GDP by 60% to 65% by then. And to help it do so, China is also committed to a major reforestation project. Nearly a year later in October, 2015, Chinese President Xi Jinping further strengthened the country’s efforts to combat global warming when he said China would begin a national emissions trading system in 2017—a cap-and-trade mechanism—to lower GHGs. The system would cover power plants and several major industrial sectors, including steel, chemicals, and paper manufacturing. That initiative was announced at the U.S. White House with President Obama. No one can say with certainty how effective China’s new environmental policies will be—especially after early November 2015, when it revealed that it had been burning much more coal than it previously acknowledged.

Nevertheless, China has agreed to cooperate with the U.S. on a number of initiatives to increase energy efficiency and reduce global warming, including work on carbon capture and sequestration projects that could cut greenhouse emissions at coal-burning plants, a joint clean energy research and development center, enhanced bilateral cooperation on the phase-out of hydrofluorocarbons (GHGs used in refrigeration and air conditioning), and the promotion of trade in green infrastructure, power, and construction goods.

Protecting The Commons

We expect a new seriousness about combating climate change is likely to emerge at COP21 now that the three largest economies in the world, the U.S., the EU, and China, have laid out detailed plans for GHG reduction. A strong Chinese commitment could signal to other nations that they can undertake the expense of ameliorating climate change without putting themselves at a disadvantage vis-à-vis their economic competitors on the world stage.

In 1832, William Forster Lloyd, an economist at Oxford, first enunciated the theory known as the Tragedy of the Commons: When stakeholders take free and full advantage of a common good, that good eventually becomes so depleted as to be economically useless to everyone. Civilization is in a similar position today with the atmosphere. For most of human history it has been seen as an endless commodity that all can use as they wish, without consequence. But it’s clear now that without significant investment and cooperation on the part of humanity the economic utility of this common good will begin to be depleted in a matter of decades and that living with the damage will surely prove to be far more expensive than preventing it.
However, in Standard & Poor's Ratings Services' view, climate change may present a wider range of threats for insurers. Insurers' capital positions could be affected by lower investment income and higher capital requirements, and by the anticipated increase in weather-related claims. Taking into account those effects that we currently consider to be quantifiable, our analysis indicates that insurers' capital management will be sufficient to manage the additional strain of a reduction of about 0.5% in capital adequacy per year, possibly at the expense of dividends being 5% to 10% lower. The effect of a sudden climate change shock, however, could test the industry. Estimating how climate change will play out is inherently uncertain, so the picture may change dramatically over time. We cannot rule out the possibility that climate change could have a significant effect on insurers' capital positions in the future. For example, if market values are adjusted to incorporate the expected lower returns under climate change, it could reduce insurers' capital adequacy by up to 10%.

Our analysis used a recent study by the Mercer Group, a consultancy, which indicates that climate change has implications for investment returns, and thus for earnings. In addition, we used an analysis by Risk Management Solutions Inc. (RMS), a catastrophe risk modeling company. RMS has reviewed likely changes to common peril, and considers that there is strong evidence that climate change will worsen the effect of tropical storms. This could increase capital requirements.

Much of the uncertainty regarding the magnitude of climate change comes from the lack of clarity regarding the level of future carbon dioxide emissions. At a U.N. conference on climate change in Paris in December 2015, the governments of more than 190 nations will discuss a possible new global agreement on climate change, aimed at reducing global carbon dioxide emissions. This will be an important step toward reaching an intergovernmental agreement on limiting future carbon dioxide emissions and so reducing the threat of dangerous climate change.

Climate Change’s Potential Effect On Insurers’ Capital Adequacy

Our analysis assumes that insurers do not anticipate the immediate impact when setting pricing levels and managing capital levels, but only react to it as its impact emerges. On this basis, we have estimated the potential consequences of climate change on insurers’ capital adequacy over 2016-2050.

Prospective capital adequacy is a key element in our rating analysis of insurers (see “Insurers: Rating Methodology,” published on May 7, 2013). To determine an insurer’s capital adequacy, we compare its available capital over the rating horizon to the required capital, which we determine by running our capital model at various rating levels (see “Refined Methodology And Assumptions For Analyzing Insurer Capital Adequacy Using The Risk-Based Insurance Capital Model,” published on June 7, 2010). Of course, this assessment incorporates our view of the insurer’s prospective earnings and its capital management (for example, its dividend policy).
In our view, climate change could affect insurers’ prospective capital adequacy through reducing earnings and by increasing the level of required capital, if its impact is not anticipated. Earnings will be affected, not only by the potential for higher weather-related claims, but also through lower investment returns. We have also allowed for a possible increase in required capital as a result of increased volatility in weather-related claims.

Our analysis estimates how insurers’ expected capital adequacy could be affected, on average, as a result of climate change. In practice, the future will not follow the “average” path and major weather events could have a significant effect on insurers’ capital position. Although such events could happen with or without the impact of climate change, it could be argued that climate change may increase their likelihood. We do not consider that any such extreme event would be solely attributable to climate change. Reinsurers are particularly exposed to such major catastrophes and we have previously investigated the potential capital and rating impact on reinsurers as a consequence (see “Discipline Is Necessary As Reinsurers Adjust Their Exposure To Catastrophe Risk,” published on Sept. 2, 2015).

Our analysis focuses on quantifiable risks. Our analysis estimates how insurers’ expected capital adequacy could be affected, on average, as a result of climate change. In practice, the future will not follow the “average” path and major weather events could have a significant effect on insurers’ capital position. Although such events could happen with or without the impact of climate change, it could be argued that climate change may increase their likelihood. We do not consider that any such extreme event would be solely attributable to climate change. Reinsurers are particularly exposed to such major catastrophes and we have previously investigated the potential capital and rating impact on reinsurers as a consequence (see “Discipline Is Necessary As Reinsurers Adjust Their Exposure To Catastrophe Risk,” published on Sept. 2, 2015).

Our analysis focuses on what can reasonably be quantified despite the challenges involved in estimating the impact of climate change. We incorporate the views of experts in this area, in particular, the work done for the Mercer study on the impact of climate change on investment returns (see “Investing In A Time of Climate Change - 2015 Study,” published on the Mercer Group’s Web site) and RMS’ estimates of how climate change may affect extreme weather events.

One of the aims of the Mercer study was to assess the impact climate change could have on the risk/return profile of an investment portfolio and when the impact may occur (see Appendix 1 for further details). From Mercer’s report, we have used projections of the size of the annual change in the expected investment return for different asset classes that can be attributed to climate change across different scenarios, each reflecting a different future emission level. These projections assume that the impact of climate change on returns will be fairly gradual and most of the changes identified result in net reductions in investment return. We used the projections at asset class level for the following classes: equities, investment-grade bonds, and speculative-grade bonds.

RMS studied the impact of climate change on extreme weather in 2050, both at the expected and extreme levels (that is, at a 250-year return period, see Appendix 2 for more details). We used RMS’ results to estimate the likely hit on earnings and the impact on capital; the one-in-250-year figure drives our catastrophe figure. We applied linear interpolation between 2015 and 2050 to estimate the annual impact over the projection period.

In our analysis, we assume that insurers’ current one-in-250 estimates accurately reflect the current effect of climate change on the probability of extreme weather events. However, any models estimating the magnitude of extreme weather events carry considerable modeling uncertainty.

In the scenario we created for “Climate Change Could Sting Reinsurers That Underestimate Its Impact,” published on Sept. 3, 2014, we extrapolated from recent catastrophe experience to explore whether reinsurers have underestimated their current catastrophe risk charges.

Our Case-Base Scenario Suggests That Insurers Can Manage The Effect Of Climate Change

Our analysis shows that if the impact of climate change is gradual, it will erode insurers’ capital adequacy by about 0.5% per year. (For example, if an insurer’s capital adequacy shows expected surplus of 5% above the AA+ required capital calculated by our capital model, after allowing for the impact of climate change, the surplus could reduce to 4.5%.) Over the projection period (2016–2050) the cumulative effect could be material, but set alongside the insurance sector’s capital position—stemming from changes to the economic, competitive, regulatory environment—the outcome is not as significant.

Insurers’ capital management tools should be effective in handling the slow and gradual strain of climate change. However, managing the repercussions of climate change may require insurers to balance maintaining capital adequacy against meeting the profit expectations of their shareholders. We anticipate that insurers could reduce their dividends moderately, slow growth rates, or increase their use of risk mitigation techniques such as reinsurance. Taking these actions may have consequences for insurers’ risk/return profile, reducing their expected shareholders’ total return and dividend income by about 5% to 10%.

Different insurance subsidiaries will have different experiences. To explore the effect on different types of insurance companies, we analyzed four sample companies—one offering insurance and reinsurance and operating in the London market (the reinsurer), a multiline insurer, a life insurer, and a non-life insurer. We created profiles by aggregating data from some of the biggest rated insurers within each category.

The investment impact appears to be more material than the weather-related impact across all four types of insurers. As a consequence, the estimated climate change impact on the life and multiline insurers, which are more exposed to investment risk, is slightly higher than that on the other two (an average annual capital impact of 0.5%, versus 0.3% to 0.4%). Even for the non-life insurer and the reinsurer, the investment impact is bigger than the weather-related, representing 70% of the total impact and 69% respectively.

Climate Change Projections Carry Significant Uncertainty

We recognize that the projections we used to estimate the impact of climate change over such a long period carry a high level of inherent uncertainty. In particular, it can arise from:

1. The uncertainties regarding the degree of political consensus that may be achieved globally regarding the appropriate way to deal with carbon dioxide emissions and the effectiveness of any agreed policies;
2. The range of mitigation actions that society might adopt to deal with the new policies, regulations, and challenges presented by climate change, and
3. The precise impact of climate change on extreme weather.

Therefore, our analysis offers only an indication of the possible consequences, based on our current understanding and incorporating some of the latest research. We are aware that several other parties have tried to quantify the impact of climate change, and that their projections may differ from those we have used. These differences illustrate the uncertainty in any estimates of the impact of climate change.

As policy becomes clearer and advances in science and climate modeling improve our understanding of how climate change affects weather events, we may adjust our conclusions substantially. For example, if an agreement is reached in Paris that could reduce policy uncertainty.

Abrupt Changes Could Hurt The Industry

Although we expect the industry to be able to absorb gradual adjustments, climate change may also lead to abrupt shifts, which could have a more severe effect on the industry’s capital. For example, the financial markets may recognize that under climate change, returns will be lower than previously expected and may react by correcting market values to maintain the yield levels. If this were to occur now, it could cause a drop of up to 10% in the available capital for the insurance profiles we considered in our analysis. The life and multiline insurers would be most affected. We anticipate that insurers may find it difficult to quickly restore their capital positions after a capital drop of this magnitude.

Other shocks are more difficult to quantify. Climate change may trigger a cascade of shocks: an example is described in the food shock scenario published by Lloyd’s (see “Food System Shock: The Insurance Impacts Of Acute Drought To Global Food Supply,” published on Lloyd’s Web site) Lloyd’s commissioned the development of a scenario describing an acute, but plausible, disruption to global food production due to sudden systemic shocks. Examples include catastrophic weather events or plant pandemics, many of which would be exacerbated by climate change.

Climate change may also lead to a sudden increase in the risk and volatility of weather losses if certain tipping points are reached, for example, the melting of the Greenland ice sheet. It is very difficult to estimate the likelihood and results of reaching such tipping points. However, following such an event, an insurer’s required capital may rise. Additional risk to the insurer’s capital position may arise if, due to political or consumer pressure, it cannot pass on the full increase in the risk to insured parties quickly.

Not All Effects Can Be Quantified

The U.K.’s Prudential Regulation Authority has released a report on how climate change may affect insurers (see “The Impact Of Climate Change On The UK Insurance Sector,” published on the Risk of England Web site), which highlighted that insurers may see increased liability risks. Claimants who have suffered loss from climate-related risks could seek legal redress because, in their view, the accused did not take the necessary precautions to prevent climate change from affecting them, and so is liable for their loss.

It is hard to predict whether claimants will win and the size of any awards that might result—it would depend on future court decisions.

RISK MANAGEMENT SOLUTIONS’ ESTIMATED INCREASE IN INSURED LOSSES IN 2050 DUE TO CLIMATE CHANGE

<table>
<thead>
<tr>
<th>Change in AAL</th>
<th>Change in 1-in-250-year loss</th>
<th>Change in AAL</th>
<th>Change in 1-in-250-year loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America Hurricane</td>
<td>4</td>
<td>2</td>
<td>54</td>
</tr>
<tr>
<td>Japan and China Typhoon</td>
<td>10</td>
<td>9</td>
<td>45</td>
</tr>
<tr>
<td>Australia Cyclone</td>
<td>0</td>
<td>0</td>
<td>45</td>
</tr>
</tbody>
</table>

Main background change is sea-level rise. §Including changes in event frequency and intensity changes. AAL—Annual average loss. Source: Risk Management Solutions Inc.
decisions. Because of this uncertainty, we have not attempted to quantify the impact of potential climate change-related liability claims. Climate change may also affect people’s health. For example, hotter and more humid conditions may help tropical diseases to spread to new areas. This could have a widespread impact on health, which could cause major losses for life and health insurers. Again, we have not allowed for this type of effect because it is too difficult to project losses in such a case.

Could there be positive effects?

Although we have focused chiefly on the negative potential of climate change, there could also be benefits for the insurance industry. For example, the climate change debate may improve risk awareness, which could lead to governments, corporations, and individuals taking better risk mitigation measures. This, for example, could reduce weather-related losses at insured properties. Increased risk awareness may also increase demand for insurance, even in less developed insurance markets. As a result, insurers’ geographical diversification would widen. Better diversification could lead to more stable insurance portfolios that required lower levels of capital.

Climate Change Is On Insurers’ Radar

Climate change brings uncertainty to the insurance industry and could have diverse consequences. The insurance industry is fully aware of the potential risks and actively monitors these areas. We expect insurers to reflect these risks in their pricing, investment, and capital management. As long as the industry is not complacent, we anticipate that insurers should be able to manage the quantifiable effects on their capital, possibly at the expense of lower dividends.

The biggest danger stems from unexpected, abrupt changes. We recognize that making decisions regarding risk-mitigation actions is difficult when the potential impact of climate change is inherently uncertain. We consider that the industry has processes in place to implement the necessary mitigation actions, provided that it is affected gradually and with sufficient warning. That said, we see a small risk that climate change may hit without giving any clear signals to guide decision makers.

Appendix 1: Mercer Group Study

Mercer and its partners undertook a study of the potential consequences of climate change for expected returns in different industry sectors and asset classes, and for total portfolio returns over the period 2015 and 2050. The study was based on four scenarios, each reflecting a different level of action taken to mitigate climate change. Different methods of reducing carbon dioxide emissions will vary in cost and effectiveness. They will, in turn, have varying effects in the period 2015 and 2050. The study was based on four scenarios, any clear signals to guide decision makers.

Appendix 2: Risk Management Solutions Inc. Study

We consider the following weather-driven natural catastrophes peril to be the most material for the insurance industry:

- U.S.: hurricane, severe convective storms, winter storms, and flood;
- Caribbean: hurricane;
- Europe: wind storms and flood; and
- Australia, China, and Japan: cyclone/tornado.

RMS’s study considered the impact of climate change on these perils (see table). It considers that there is conclusive evidence that changes in sea levels will worsen the impact of tropical storms (that is, hurricanes, cyclones, and typhoons), which may also be affected by changes in frequency and intensity. It based its projections for U.S. hurricane losses on a detailed modeling study conducted as part of the Risky Business project (see “Risky Business: The Economic Risks Of Climate Change To The United States,” published on the Risky Business Web site). The research uses a standard risk-assessment approach to determine the range of potential consequences for each region of the U.S.—as well as for selected sectors of the economy—if we continue on our current path. It is focused on the clearest and most economically significant of these risks.

RMS then used the relative change between the U.S. and other tropical cyclone-exposed regions to estimate the impact of climate change on Caribbean hurricane, Japan, and China typhoon and Australia tropical cyclones. All projections are based on current exposure, including insurance penetration and defences for flood and storm surge.

When RMS’ model experts reviewed latest academic research on the other perils listed above, they found no conclusive evidence that climate change would be an accelerating factor. In particular, they stated that the current evidence suggests that most increases in flood losses by mid-century will stem from increases in exposure inside the flood plain, rather than from physical changes in the nature of flooding in response to a changing climate.

The authors would like to acknowledge the contributions of Alex Bernhardt, Mercer, and Dr Paul Wilson at Risk Management Solutions Inc. to this article.

• T: Progress in developing Technology to support the low-carbon economy;
• R: Changes in Resource availability due to long-term shifts in temperature or precipitation;
• I: Physical Impact from changes in the frequency/severity of extreme weather, and;
• P: Policies and regulations meant to reduce the risk of further man-made climate change, under these four scenarios.

We assessed how Mercer’s scenarios would affect insurers’ investment portfolios. Given that most insurers have a well-diversified investment portfolio, we consider that variations across the four scenarios are not significant in the context of our analysis.

Coalli would provide 30% of the world’s primary energy, 40% of global electricity, and 68% of steel. The main advantages of coal are its availability, its ready thermal conversion for power generation, and construction costs per megawatt (MW). On the flip side, coal leaves a big carbon footprint compared with other energy sources.

According to BP’s Statistical Review of World Energy, global coal reserves are about 890 billion metric tons. The IPCC is enough to last more than 100 years at current production levels. However, if we analyze the quality of the reserves, we find that 50% to 60% consists of low-quality, sub-bituminous and lignite coal, mainly located in Russia, the U.S., China, Germany, and Indonesia. In a carbon-constrained environment, most of these assets will become stranded assets.

Given the medium-term uncertainties in the coal industry, miners are unlikely to initiate big export-oriented projects. This is especially true of diversified miners, which can invest in more attractive segments. Given the very challenging market environment, we believe most small miners will try to weather the unfavorable market conditions without any financial flexibility to take on new ventures. As for all cyclical industries, assuming very limited capacity coming to the market, we cannot dismiss a rebound in prices at some point, especially with improving demand, operational disruptions, and supply cuts (particularly in the U.S.).

How Policies To Halt Climate Change Could Affect The Demand For Coal

Energy-related CO2 emissions have increased in emerging countries as they have experienced rapid growth. Climatologists are concerned about the impact of this increase on global warming and climate change. It is very difficult to predict the turning point and how much CO2 emissions can continue to rise before we see irreversible effects on sea levels, or changes in rainfall, drought, flood, and other extreme weather conditions (see Dealing With Disaster: How Companies Are Starting To Assess Their Climate Event Risks). International institutions, including the World Bank and NASA in the U.S., have assessed that these scenarios could more than double if the world’s temperature rose by 2 to 3°C Celsius. Drawing a line between the environmental regulations in place and the impact on climate change, some scientists predict that the world’s temperature could increase by more than 6°C Celsius toward the end of the century. The International Energy Agency (IEA) has assembled several scenarios to under the actions needed to meet the 2°C target by 2035. Under the 450 ppm parts per million scenario, governments will need to introduce energy efficiency policies; limit the use of inefficient coal power plants; use carbon capture and storage technology and more. Under this scenario the global consumption should come down by 3.5% per annum till 2035.

In our opinion, this scenario appears challenging, not only because government would need to enter into a coal diet mode, but also because the demand for electricity continues to increase (an annual increase of 3.4% in the demand for coal in the last five years), as well as the need to replace existing coal-fired power plants. (see ‘Assuming very limited capacity: Of Europe’s Renewable Energy Frameworks’). As can be seen from the divergence of the IEA’s scenarios, the demand for coal in the future and its price will rely on numerous factors and their timing, including: (1) a move by China to shale gas; (2) introduction of new regulations; (3) technological breakthroughs; and (4) global economic growth.

We believe new initiatives, such as those made recently by China, the EU, and the U.S. may flatten the growth in coal demand over the coming years. However, whether this will lead to a decline of coal use over time is more uncertain. In our view, any decline in coal would depend on the availability of viable alternatives, such as large-scale gas developments in China or renewables.

PART 2
THE SIGNIFICANCE OF COAL
How Environmental And Climate Risks Factor into Global Corporate Ratings

MICHAEL WILKINS

» With climate change and severe weather events garnering rising numbers of headlines, lenders and institutional investors have become more interested in how Standard & Poor’s Ratings Services incorporates environmental and climate (E&C) risks into its corporate credit ratings, and the impact these risks have had on our ratings of late. To provide some clarity, we conducted a lookback review of all of our global corporate rating actions and published surveillance reports since Nov. 19, 2013 (the launch date of our updated corporate ratings methodology, which provides increased transparency into our ratings process) to discern the impact of extreme weather events and E&C risks. (Watch the related CMTV segment “How Environmental And Climate Risks Impact Global Corporate Ratings.”)

Overview

- To provide some clarity into how Standard & Poor’s incorporates environmental and climate (E&C) risks into its corporate credit ratings, and the impact these risks have had on our ratings, we conducted a lookback review of corporate rating actions and surveillance reports over the past two years. Our research identified 299 cases in which these factors either contributed to a rating revision or were a significant factor in our rating analysis.
- Fifty-six of these cases resulted in a rating action, CreditWatch placement, or outlook revision, 44 of which (close to 80%) were negative in direction.
- The subsectors with the greatest exposure to E&C risk thus far have been the oil refining and marketing, regulated utilities, and unregulated power and gas subsectors, and the greater focus on E&C risk in our criteria for these segments reflects this.
- As the severity and frequency of E&C risks continue to rise, we expect the number of E&C-related corporate rating actions to accelerate in coming years.

With climate change and severe weather events garnering rising numbers of headlines, lenders and institutional investors have become more interested in how Standard & Poor’s Ratings Services incorporates environmental and climate (E&C) risks into its corporate credit ratings, and the impact these risks have had on our ratings of late. To provide some clarity, we conducted a lookback review of all of our global corporate rating actions and published surveillance reports since Nov. 19, 2013 (the launch date of our updated corporate ratings methodology, which provides increased transparency into our ratings process) to discern the impact of extreme weather events and E&C risks. (Watch the related CMTV segment “How Environmental And Climate Risks Impact Global Corporate Ratings.”)
E&C—Environmental and climate.

In some instances, a company's exposure to environmental regulations (such as emissions controls) and how the company complies with them has been a key consideration in our business risk profile assessments. Our October 2014 downgrade of GenOn Energy to ‘B’ from ‘B’, for instance, resulted in large part from increasingly stringent environmental regulations on nitrogen oxide (NOx) emissions in Maryland, which could force the retirement of power plants over the next few years. Such closures would significantly hinder the company’s ability to service its lease obligations. However, E&C risk considerations can also benefit corporate entities that diversify away from certain regulated business segments or which create a niche for successfully serving regulated areas in ways that other companies don’t (see sidebar on Tenneco).

North America has seen the greatest number of cases in which E&C risk has either affected ratings or contributed significantly to the credit analysis (48%), followed by Europe (10%) and Asia-Pacific (8%) (see chart 2). Among other factors, this largely reflects the increasing number of environmental regulations introduced in the U.S., as well as the concentration of corporate ratings there.

Table 1: E&C Risk Impact On Credit Analysis And Ratings

<table>
<thead>
<tr>
<th>E&amp;C Risk Impact On Credit Analysis And Ratings</th>
<th></th>
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<tbody>
<tr>
<td>Outlook revised to negative</td>
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<td>Downgrade</td>
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<td>CreditWatch Negative placement</td>
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<td>Upgrade</td>
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</tr>
<tr>
<td>Outlook revised to stable from negative</td>
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<tr>
<td>Outlook revised to positive</td>
<td>1</td>
</tr>
<tr>
<td>Contributed to general analysis</td>
<td>243</td>
</tr>
</tbody>
</table>

E&C-Risk in our management and governance criteria

Our assessment of M&G acts as a modifier in our corporate rating methodology and therefore can directly influence an issuer’s credit rating. The modifier is an aggregation of our analysis of eight management and seven governance subfactors.

We incorporate our view of how a company’s management deals with environmental and social risks into the “comprehensiveness of risk management standards and tolerances” subfactor, which is part of our general risk management analysis. That is because we believe that material unmanaged environmental and social risks can hurt a company’s creditworthiness over the rating horizon.

During our review, we identified that analysts had taken either a positive or negative view of environmental or social risk management for 117 corporate issuers, although the resulting impact on the overall M&G modifier has resulted in just one rating action to date (the downgrade of Volkswagen AG).

Accounting for extreme weather and natural catastrophes

Our corporate criteria consider the impact of unfavorable weather on the rating profile in many industries. The impact of weather includes extreme weather events, such as storms and floods, and seasonal weather, including cold spells and heat waves.

Although unfavorable weather can result in property losses and production and market disruptions for companies, such events have not been frequent contributors to rating actions over the past decade (see “Climate Change Will Likely Test The Resilience Of Corporates’ Creditworthiness To Natural Catastrophes,” published April 15, 2015). Overall, we have found that companies’ liquidity management,
insurance protection, natural disaster risk management, and post-event recovery measures have been adequate to mitigate the effect of natural catastrophes on their rating profiles during the period. Looking ahead, however, the picture is less certain. Climate change may increase the frequency and severity of weather events. And indeed, scientific evidence, as summarized in the 2014 Intergovernmental Panel on Climate Change (IPCC) report, points in that direction.

Our criteria consider the impact of unfavorable weather through direct property and production losses, as well as supply chain and market disruptions.

**Direct impact.** Extreme weather events can directly damage a company’s production facilities, leading to disruptions in its operations. This is of particular concern for companies with limited geographical diversification, which are less able to offset the impact of a weather event by ramping up production elsewhere, and thus could face major production disruptions or shutdowns and significant financial damage.

**Supply chain disruptions.** Natural catastrophes can cause major supply chain disruptions, as we saw in 2011 following the Tohoku earthquake and tsunami in Japan and floods in Thailand. Again, suppliers’ level of geographical diversification is an important factor in determining the extent of the impact. In the future, the increasing integration of the world economy through complex global supply chains may exacerbate the impact of natural catastrophes. While insurance can provide some protection against weather-related losses, companies may find it harder to insure against these risks following a major event. For instance, following the large insurance losses from contingent business interruption resulting from the Japan earthquake and the Thai floods in 2011, insurers tightened up their policy conditions, increased rates, and, in some cases, reduced the insurance coverage for certain companies.

**Market impact.** Market conditions in certain industries may deteriorate following severe weather. For instance, supply and demand disruptions could lead to abrupt price movements and volatility. A major event affecting an important link in the economy, such as power and energy distribution, is likely to have a widespread and long-lasting impact on supply and demand and lead to price volatility.

In particular, a number of our industry-specific criteria consider exposure to volatility in raw materials prices. Natural catastrophes can have a considerable impact on the cost of raw materials, particularly when they hurt harvests or damage production facilities (e.g., when hurricanes force the shutdown of oil refineries). For some segments, such as oil refining and marketing and the midstream energy industry, the adequacy and cost of insurance can be important risk factors. Therefore, a major market and price disruption in the insurance industry could have an effect on a company’s cost of insurance. Because the cost and availability of insurance depends on the expected impact of extreme weather events, the potential negative impact of climate change on the impact of extreme events may increase the cost of insurance or restrict its availability.

**E&C Risks Vary By Sector**

Government regulations regarding emissions and environmental remediation can present material barriers to entry in a given industry, which can help incumbents that have already invested in meeting these standards. For example, in the oil refining and marketing industry, the government regulates refinery emissions (into the air and water) and environmental remediation of spills. However, restrictions on refinery emissions, along with standards for gasoline and diesel fuel and blending mandates to produce cleaner-burning fossil fuels, can also add significant costs and investment requirements to refiners, thereby constraining refining margins.

Environmental standards play an important role in assessing an affected company’s operating efficiency. For example, in the regulated utilities industry, we analyze how successfully a utility’s management achieves compliance with environmental standards while preserving cash flow stability. We also consider how management of these factors reduces the prospect of penalties for noncompliance. Increased political and social emphasis on demand management and energy efficiency effectively represent, in economic terms, substitution risk (the risk that cleaner resources will take share from existing “dirty” technologies) that could affect demand, rather than complete displacement. In the unregulated power and gas industry, we observe a modest trend in more affluent markets for a small but increasingly material number of residential consumers and small and midsize enterprises to migrate to on- and off-grid energy supplements (i.e., distributed or self-generation). Government mandates can accelerate this trend (and are already doing so in many areas, especially the U.S.), and subsidies to promote certain environmental policies can bolster demand for specific asset types (including gas-fired resources, renewables such as wind and solar, and distributed generation through rooftop solar panels, for example) while harming others (like traditional coal-fired generation).

E&C issues can also influence a company’s competitive advantage in various ways. Take the unregulated power and gas industry, for example, where the markets in which a given company operates have a profound impact on risk. Specifically, we assess how public policies (including energy and environmental policies) affect an unregulated power and gas company’s operating stability. The relative supportiveness and effectiveness of public policies and the likelihood of weather volatility influence our view of a market’s attractiveness. For instance, many European markets have already been liberalized (with the breakup of monopolies and an opening to competition and cross-border trading) and are influenced not only by national energy policies (such as the hard turn by Germany away from nuclear energy), but also by EU-wide initiatives. The EU’s “20-20-20” targets (for a 20% reduction in greenhouse gas emissions compared with 1990 levels, an increase in energy consumption produced from renewable resources to 20%, and a 20% improvement in energy efficiency by 2020), for instance, have dramatically reduced profitability for Europe’s traditional power and gas companies.

**E&Cs Will Likely Grow**

Corporate exposure to E&C and extreme weather risk has generally been relatively modest to date, but is increasing. We believe the future could usher in significantly more devastating...
Corporate exposure to E&C and extreme weather risk has generally been relatively modest to date but is increasing.

Those related to companies and business lines that would only face disruptions to their business due weather volatility.

The assessment of impact reflects whether environmental and climate risks have had a direct effect on a company’s operations and profitability or an indirect effect through its upstream or downstream activities.

After assessing the relevance and impact of the 94 references in our KFCs, we ranked nearly two-thirds in the “high” relevance and “direct” impact categories (62 and 60 of the references, respectively), with the greatest numbers of “high” relevance and “direct” impact references related to the regulated utilities, oil refining and marketing, and unregulated power and gas industries.

We incorporate E&C risks primarily into our assessments of companies’ business risk profiles, and they have the biggest influence on the industry risk and competitive factors portions of this analysis (see charts 4 and 5).

The authors would like to acknowledge the contribution of Adele Bertolino of Bocconi University, Milan, to this research.

With Trevor D’Olier Lees in New York and Miroslav Petkov in London

Chart 5: Mapping Of E&C Risk Factors To Corporate Ratings Methodology

Scope of the criteria

- Financial risk (33%)
- Country risk (11%)
- Industry risk (64%)
- Competitive position (35%)

Reference per KEF risk factor (%)

Reference per business risk determinant (%)
ESG Risks In Corporate Credit Ratings: An Overview

Among the many categories of risk Standard & Poor’s Ratings Services examines within its ratings framework are environmental, social, and governance (ESG) risks. Since all rated entities operate in the natural and social worlds, we regard these risks as ubiquitous across the ratings spectrum.

Our Management And Governance Credit Factors For Corporate Entities And Insurers, (M&G; published Nov. 13, 2012) includes our assessment of management and directors’ oversight of environmental and social factors at the companies they lead. This includes the impact of—and their contribution to—matters like climate change, pollution, and resource depletion, their effectiveness in terms of maintaining employee and community relations, and their adherence to legal and regulatory requirements. In our ratings methodology, we allow for positive, neutral, and negative evaluations of management’s capabilities in those areas.

However, regarding governance, our M&G criteria only permit neutral or negative evaluations. Fouling or “bad governance”—however that might be defined—does not in and of itself constitute credit enhancement in our view. For investors, ESG risk and measures are now a key factor for their investment decisions (see note 1).

In our corporate ratings framework we differentiate between the incidence of environmental and social impacts associated with all entrepreneurial activities, and their management and oversight—the “G” in ESG.

Objective

Examine the material ESG factors that impact corporate and insurer credit ratings.

ESG Framework

The Corporate Criteria Framework and Key Credit Factors

Introduction

Our Corporate Criteria Framework and Key Credit Factors (KCF) is a set of industry-specific criteria, which we call Key Credit Factors (KCF) that focus on particular industry risks, for example, the impact of carbon reduction programs on the the power and natural gas industries. These criteria either reinforce or complement and modify our general criteria framework.

To illustrate, the Liquidity modifier element of Supply Chain Risk (SCR) is a KCF that focuses almost exclusively on the risk-related impacts of a retailer’s supply chain. Similarly, the Competitor Financial Health (CFH) KCF provides an assessment of a rated entity’s competitors’ financial performance.

Corporate Criteria Framework

The Corporate Criteria Framework (CCF) consists of three analytical layers:

1. Corporate Industry Country Risk Assessment (CICRA)—the vertical bar between country and industry risk in the chart.

2. Corporate Industry Sector Risk Assessment (CISRA)—the horizontal bar between country and industry risk in the chart. It includes industry sector-specific factors, for example, the regulatory environment and the role of government in the industry.

3. Corporate Criteria Framework—our general rating criteria for all corporate and insurer entities.

Overview

- Examining environmental, social, and governance risks is an essential element of our credit analysis.
- We assess rating impacts of matters like climate change, pollution, resource depletion, employee and customer and community relations, and adherence to legal and regulatory requirements.
- Our analysis identifies downside risk to credit ratings and any favorable mitigating conditions that lend support to a credit rating, or provide evidence for a higher one.
- Credit ratings are time-dependent: credit is present value given in exchange for the promise of future repayment. For example, rating sea levels are a long-term, macroeconomic credit risk, but one that is unlikely to be a significant ratings factor in the next five years (see note 2).

Although this ratings framework clearly illustrates that we consider business and financial risk profile elements separately, they combine with one another to produce a current credit rating and outlook for a corporate enterprise. Similarly, we evaluate ESG risks within different parts of our analytical framework, but these ESG risks are united in the overall rating analysis to provide a view of a rated issuer’s ESG profile from a credit rating perspective.

Consequently, we do not provide stand-alone ESG assessments. For credit ratings, these risks are best understood in the context of all the components that together constitute the issuer credit rating. This framework and associated KCFs allow Standard & Poor’s to factor ESG considerations as essential elements of our ratings analysis, when we assess them as material to the rating or the outlook on a corporate issuer. But where, in our opinion, they are not material to the credit rating, they can still be disclosed to market participants, so that investors, issuers, and others can make their own decisions about their relevance in terms of investment priorities, entrepreneurial activities, counterparty assessments, purchase and sales activities, and so forth (see note 3).

Introduction To The Corporate Criteria Framework

Country Risk

Country risk includes economic, institutional, financial system, payment culture, and role-of-law considerations in the country or countries where the rated entity operates. Collectively, we use this country-level “governance profile” to illuminate the constituent elements of a country risk profile for the industry, which we call the Corporate Industry Country Risk Assessment (CICRA)—the vertical bar between country and industry risk in the chart.

This will include any specific social and political conditions that either support or impair a corporate entity’s credit quality. From a ratings perspective, relevant social and political considerations include matters as diverse as the use of child labor to produce clothing, forms of political repression fomenting unrest that drain a country’s skill base, and its knock-on effects for domestic corporations (see note 4).

One way these issues surface at the entities we rate is in terms of supply-chain risk, e.g., in the retail sector. Although the broadening of supply chain sourcing can benefit developing countries and the markets they serve, there are risks such as:

- Weaker monitoring, law enforcement, and regulation that create labor issues;
- A potential for manufacturing defects; or
- Concerns about workplace safety.

Reputational risk for the manufacturer, suppliers, and retailers can become acute, particularly where the emergence of facts connected with those issues contradict a retailer’s corporate social responsibility statements.

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- Weaker monitoring, law enforcement, and regulation that create labor issues;
- A potential for manufacturing defects; or
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Reputational risk for the manufacturer, suppliers, and retailers can become acute, particularly where the emergence of facts connected with those issues contradict a retailer’s corporate social responsibility statements.
From a credit rating perspective, the failure to adequately monitor suppliers and intermediaries would also weigh on our assessment of a retailer's management and governance. That alone, depending on the rating level, could lead to a lower credit rating or outlook change, depending on the specific circumstances and our assessment of the degree of harm caused. An expose of poor working conditions by investigative journalism and a company's prompt remediation of them would likely have a different rating outcome than, say, the occurrence of a factory fire due to negligence and neglect, where loss of life occurs.

Industry risk

Industry risk includes specific growth trends, salient elements of the sector’s market structure and competition, and the industry cycles that can markedly affect a rated issuer's ability to service its debt (see note 5).

More specifically, general conditions can affect an industry and its operating environment (whether these changes are deemed to be natural or man-made). Where such changes have a general impact—given that every rated entity is affected similarly (of course, broader downgrades or upgrades may result for the industry sector over time). The China Fishery case illustrates how environmental factors (see note 6) can markedly affect a rated issuer's ability to service its debt.

In our June 12, 2015, ratings rationale on China Fishery we discussed the cancellation of the second Peruvian fishing season due to environmental issues (i.e., El Nino) and the impact that would have on cash flow generation. Our “weak” management and governance assessment (resulting in a one-notch rating downgrade) reflected our view that the company stretches its capabilities to achieve its growth aspirations and rapidly shifts its strategic focus across geographic regions, requiring a level of management expertise that is not always evidenced in corporate actions. We note that China Fishery has initiated communication with major lending banks for temporary support for its short-term liquidity needs, but as of Oct. 19, 2015, the timing and amount of that support were uncertain (see “China Fishery Group Ltd. Rating Lowered to CCC+: On Vulnerable Liquidity Position, Placed On Credit Watch Negative,” published Oct 19, 2015, on RatingsDirect).

We acknowledge the support may be there, given the company’s long-term banking relationships, and that operations could recover if weather conditions change.

Competitive position

Competitive position includes a number of factors that can markedly affect a rated issuer's credit strength, including inherent competitive advantages, e.g., with the ability to easily source key raw materials, the scale of operations, their scope and diversity, the issuer's operating efficiency compared with peers, and how much profit can be extracted from the company's operations.

However, the path to competitive advantage is strewn with danger, and if mismanaged, its pursuit can have a negative ratings impact. On Sept. 18, 2015, we revised the outlook on Sysco Corp. to negative from stable after it announced it would likely issue $2 billion in new debt in the first quarter of fiscal 2016. The proceeds would fund a $1.5 billion accelerated share repurchase and repay $500 million in commercial paper borrowings.

While this marketer and distributor of food and related products to the food-service industry has several competitive strengths, including greater route density than most competitors and a more profitable private-label and street business, it is in an intensely competitive and low-value-added sector. Our ratings on Sysco incorporate the company’s industry-leading operating efficiencies, good customer and geographic diversification, and its status as the sector’s largest player. The industry’s relatively low customer-switching costs were highlighted by lost business at US Foods Inc. following its planned merger into Sysco, which regulators ultimately blocked for antitrust reasons.

But, in attempting to further consolidate its leadership status, Sysco, in our opinion, made several strategic mistakes, including the $600 million spent on the failed acquisition of US Foods and the investment of more than $1.5 billion in a business transformation program that has fallen short of desired results. The company’s “satisfactory” management and governance assessment remains unchanged for now, but the July 1, 2015, research update “Sysco Corp. Downgraded to A-/A-2” indicated that any further missteps in terms of management execution or board oversight could lead to a reassessment and a lower rating. This is because at the company’s rating level, a “fair” overall management and governance score would have a rating impact (see table).

In Sysco’s case the culmination of the company’s “satisfactory” management and governance score really speaks to middle management’s execution capabilities. These strengths maintain our M&G criteria assessment, despite those identified missteps. It is also worth noting (given some who view activist investor engagement as simply an “easy” credit negative) that Nelson Peltz’s Trian Partners gained two board seats in August, after it purchased a 7% ownership stake. However, that investment and presence on the board did not itself trigger a reassessment (positive or negative) of Sysco’s management and governance profile (see note 6).

Not all of the elements that constitute the Business Risk Profile will be equally pertinent from an ESG perspective. ESG considerations will more rarely apply when considering an entity’s scale, scope, and diversity, or industry-specific growth trends. However, it is important to bear in mind that matters of “scale and scope” or “growth trends” still might—where, for example, they are helped or harmed by labor shortages or barriers to entry imposed by high costs or legal and regulatory hurdles.

Management and governance

Management and governance, a modifier in our ratings framework (see chart), has proven on several occasions to be a leading indicator of changes to creditworthiness. This part of our ratings analysis encompasses the breadth range of oversight and direction conducted by an enterprise’s owners, board representatives, executives, and functional managers. Their strategic competence, operational effectiveness, and ability to manage risks shape an enterprise’s competitiveness in the marketplace and credit profile.

If an enterprise can manage important strategic and operating risks, then its management plays a positive role in determining its operational success. Alternatively, weak management with a flawed operating strategy or one that cannot execute its business plan effectively is...
likely to substantially weaken an enterprise’s credit profile. So, as noted earlier, by this juncture in our analytical framework, this modifier speaks to the management of risks, not their prevalence or occurrence in a country, industry, or competitive landscape.

Managing environmental and social risk is included in the enterprise risk management (ERM) subfactor for corporate ratings. ERM is a core consideration for all of our ratings practices, as evidenced by the different articulation it receives for corporate, insurance, and more recently, nonbank financial institution credit ratings.

There are four overall scoring outcomes for our assessments of management and governance: “strong,” “satisfactory,” “fair,” and “weak” (see table). These originate from the six-point scale that we use for determining the Business Risk Profile in Corporate Ratings consisting of the middle four of the six available ratings (i.e., except for “excellent” and “vulnerable”).

For corporate ratings, a “strong” score requires five or more positive assessments among the eight management subfactors, with three “positive” for a “satisfactory” score. Critically, the achievement of either of these scores requires that none of the management subfactors, or any of the governance subfactors, receives a negative assessment.

A “weak” score would result from five or more of the management subfactors receiving a negative assessment, or in the analyst’s judgment and confirmed by a rating committee, where any one or more identified deficiencies in the management and governance subfactors are so severe, that singular or in combination, they warrant a “weak” overall score.

“Weak” scores have a constraining effect on investment-grade ratings in the single ‘A’ rating category and above, and result from a number of other combinations of scores that can be summarized as having either insufficient positive management subscores or the presence of any management or governance negative assessment.

Conversely, “strong” M&G scores can positively affect single and double ‘B’ ratings, and these scores could include situations where a company effectively manages its environmental and social impacts.

In sum, our management assessments drive the M&G score, while our governance assessments constrain the overall score.

An illustration of the misalignment of environmental risk, which includes additional management and governance deficiencies, is the case of Volkswagen AG. The company’s acknowledgement that it deliberately falsified emissions testing led to a revision of our overall M&G assessment to “fair” from “satisfactory.” This had an immediate ratings impact (see table), and the company remains on CreditWatch with negative implications, including the potential for a further downward revision of our M&G assessment and attendant consequences for the rating (see note 7).

More recently we lowered our management and governance assessment to “weak” from “fair” (which in turn lowered the rating) on Valmont Pharmaceuticals International Inc. to “B+” from “BB-” (with a negative outlook), rating weakened management credibility, a significantly tarnished corporate reputation, and exacerbation of legal and regulatory headwinds for Valmont, following the serving of fines with its affiliate, specialty pharmacy Philidor RX Services, for a relative to its competition, (8)

**Notes:**


2. “Urenco-Rivals Can Protect Ratings From Geopolitical Risks And Threats. To U.S. Coastal Infrastructure.”

3. “Your Environmental And Climate Risks Factor Into Global Corporate Ratings.”


**In view of our recognition that ESG is very much a work in progress for all of us, we’ll conclude by answering some questions that millennial members of the NYU Stern School of Business Net Impact Club posed to Standard & Poor’s at their lunchtime speaker event on Oct. 22, 2015.**

**Could a company’s commitment to ESG issues and concerns hurt credit ratings?**

Yes. A company may decide to try a new production method to lower or eliminate climate-changing or toxic emissions. This may be either voluntary or in response to regulatory requirements or a legal challenge. The initiative in most cases will be costly—new plant and working methods—with corresponding effects, like workforce retraining, updating safety standards, and pricing challenges, particularly if the product is in a competitive market.

If the transition is costly enough, the company’s credit measures can worsen to a point where we could lower the rating. So, a negative rating action could occur unless we determined that the capital and operating spending had remained within the expected range for the existing rating.

However, Standard & Poor’s analysts would also be considering the potential advantages of the company being an “early adopter” and the marketing opportunities for the product that may be realized if the company can position itself, for example, as a “clean” supplier. As you would expect, the skills of management in terms of how they used equity and debt to achieve the transformation would be key elements in terms of making our credit assessment.

**ESG risks for different companies are diverse. How do you ensure that you apply effectively comparable standards of assessment?**

A key challenge for a credit rating agency is that it has to strive to provide equivalent assessments of credit risk, irrespective of geography, jurisdiction, or sector. We have considerable experience in navigating these differences, as set out in our ratings framework. The work we have done on our M&G assessments has augmented our skills and abilities in assessing ESG risk. These kinds of considerations are at the heart of the credit rating exercise.

Currently, what are the most common reasons for rating changes due to ESG risks?**

A company’s exposure to ESG risks is the most common factor cited for rating changes. This reflects the introduction of our M&G credit factors criteria in 2012 and prior work we had done in 2010, but looking forward, we expect environmental and social factors to receive greater prominence.

**Could any emerging ESG risks lead to ratings being changed in the future?**

Yes. An environment that so many now inhabit in addition to the natural environment is the cyber-environment. While different in so many important respects from the issues regarding the natural environment, we are beginning to make inroads to the assessment credit impacts from cyber-crime and cyber-breaches and earlier this year published our initial thinking on this fast-evolving and increasingly significant area of potential credit risk (see note 8).

**Do you have to believe that climate change is true to be able to analyze it from a credit rating perspective?**

No. This question reflects a debate, a particularly lively one in the U.S., about whether climate change is actually occurring and, if it is, what it is man-made. From a credit rating perspective, how we assess climate change impacts on rated entities does not require any kind of prior commitment to the truth or falsity of climate change—or its causes. But questions about belief and the nature of truth are extremely important to the truth or falsity of climate change—or its causes. And we are reviewing the preparedness of rated entities over that longer term horizon because time is an essential factor in credit analysis—credit’s value is given in the present in exchange for the promise of future repayment.

**Notes:**


**ESG Risks In Corporate Credit Ratings: An Overview**

**Some Questions and Answers**

**Why aren’t matters like rising sea levels and other long- and longer-term phenomena factored into Standard & Poor’s ratings today?**

At the most fundamental level, this is a question about the confidence and the one can have about assumptions going years out into the future. That individual issue ratings can change over their life from issuance to maturity reflects not only changing fundamentals of the rated issuer but our evolving views of that issuer’s future fundamentals. In our experience a foreseeable horizon is less than two years for a speculative-grade credit (rated ‘BB-’ and below) and no more than five years for an investment-grade credit (‘BBB-‘ and above), reflecting the fact that investment- and speculative-grade credits are differentially vulnerable to the many factors in the business, financial, natural, and social environments.

Complicating the time horizon question is that any two investors buying the same security at the same time may experience vastly different holding period expectations. Those buying a bond to trade it during the coming year have a different horizon than the so-called “buy-and-hold” institutional investor, and even the latter often dispose of bonds before maturity for a variety of reasons.

We do believe (see the last question, but note that this belief is not a prerequisite for our analytical conclusion) that rising sea levels is a long-term, macro credit risk, but one, nevertheless unlikely to be a significant ratings factor in the next five years. But we are reviewing the preparedness of rated entities over that longer time horizon precisely because time is an essential factor in credit analysis—credit’s value is given in the present in exchange for the promise of future repayment.

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**Notes:**

7. “Cyber Risk And Corporate Credit: ‘UBS. Financial Services Credit Ratings Are Resilient To Cyber Risk—For Now.’”


What different approaches are investors taking today regarding decarbonization?

There are three main types—carbon-efficient, fossil-free and green investing—and for that reason, we’ve developed indices in each of these areas:

- **S&P Carbon Efficient Indices.** These underweight or exclude the worst carbon emitters on the basis of their carbon footprint. Even though the carbon footprint of constituent companies is much smaller, the indices closely track their benchmarks.

- **S&P Fossil Fuel Free Indices.** To appeal to investors who want to exclude exposure to fossil fuels or divest from them, these indices exclude all companies that own fossil fuel reserves.

- **S&P thematic green indices.** These focus on green opportunities rather than risks. One example is the S&P Global Clean Energy Index. In the fixed-income area, last year, we launched the S&P Green Bond Index (for labeled bonds) and S&P Green Project Bond Index (for any bonds that are essentially green). They include those bonds issued to finance projects in the green segments, such as renewable energy.

How does S&P define “carbon efficiency” for the purposes of its carbon-efficient indices?

Carbon efficiency is measured by a company’s carbon footprint, which is the size of a company’s greenhouse gas emissions divided by revenue. We take this data from Trucost, which is the world’s leading environmental economics company.

Last question, what’s next for S&P’s family of green indices, and why are they important to the future of climate finance?

We are looking at the possibility of distinguishing among different shades of green. We don’t want to be too categorical, and aim to allow different sub-indices address different levels of greenness. We are also thinking about a family of sub-indices that will take credit ratings into account, to make a link between greenness and credit standing. What’s more, we are considering a wider scope of carbon-related and climate-related projects, not only in renewable energy or climate adaptation, but also in green transportation, agriculture, and forestry, among others. By doing this, we are aiming to create a green growth story for investors, who can determine for themselves whether greenness comes at the expense of profitability. And if the story is impressive, then it may help mobilize the investment that’s needed for green infrastructure projects, and for making industry more eco- and climate-friendly.

(This article was based on Standard & Poor’s CreditMatters TV segment, “How Green Indices Can Help Decarbonize Portfolios,” published on Nov 19, 2015.)
How Standard & Poor’s Views The Credit Risk Of Energy Efficiency Projects

MICHAEL WILKINS

A total of $90 billion was invested in energy efficiency in the buildings sector alone in 2014, and the International Energy Agency predicts this will grow substantially over the next decade, especially as policymakers target these kinds of projects as a cost-effective way to reach climate change goals. Investors are becoming increasingly interested in low-carbon investment opportunities—such as energy efficiency projects—which for their part are looking to attract financing.

Interest in energy efficiency has also led to growth in bonds raised by corporates active in the sector, such as Schneider Electric, which on Oct. 13, 2015, issued its inaugural €200 million ($215 million) green bond to finance R&D programs dedicated to technologies enabling its customers to reduce carbon emissions.

Renewable energy projects such as onshore wind and solar have reached a maturity level over the past 15 years where investors are now easily able to determine their ability to make timely and full repayments on debt. However, energy efficiency projects like those in the building sector are less established, and still raise questions for investors about how they will be repaid and the credit risk they face.

Barriers to investment in energy efficiency include the diverse kinds of projects, their long payback periods and small transaction size, as well as an absence of a visible cash flow stream for debt repayment. By way of illustrating diversity, it helps to know that projects in this area work in one of three main ways:

• Reduced energy consumption (through the use of more efficient appliances or LED lighting, for example);

• Energy conservation; in monitoring and thereby optimizing consumption (via “smart” technologies);

• Use of a project’s own energy resources (localized renewables).

For debt servicing, energy efficiency projects rely on measured cost savings for repayments, often backed by project counterparties. What’s also adding to investor uncertainty has been the historical lack of a standardized system for measuring energy savings, though we are now seeing some progress in this area.

Here, Standard & Poor’s Ratings Services explores how energy efficiency projects are structured today, and discusses how our project finance ratings methodology views their credit risks.

The Politics And The Costs

Governments around the world are targeting energy efficiency as a cost-effective means to improve energy security and to combat climate change. The EU’s Energy Efficiency Directive of 2012 aims...
Many government entities and companies understand the concept of energy efficiency, in that investment in energy-saving buildings, plants, and other forms of infrastructure save on energy costs over the long term. Indeed, companies face more pressure and incentives to reduce energy consumption and cut costs, coming from several sources, for example, corporate responsibility initiatives, volatile oil prices, and slow business growth in some markets. The biggest remaining hurdle is that the upfront costs for energy efficiency measures often appear too high, considering factors such as energy saving lighting with movement sensors can have a payback period of less than three years, whereas heating, ventilating, and air conditioning equipment can have a payback period of 10 years or more. To overcome this problem, companies need to examine all their energy consumption and the technologies involved. Energy-saving lighting is an example of a technology that can in some cases be significant in the short term, with cost savings and investments only materializing over the long term. The payback period for energy efficiency projects varies greatly based on the client's energy consumption and the technologies involved. Energy efficiency measures can be self-funded by companies and individuals. Power and gas utilities are increasingly looking to expand these energy services through bundled offers, first for heavy users and municipalities, and then for residential consumers. Emerging financing vehicles in the area of energy efficiency project finance include Energy Performance Contracts (EPCs) and mechanisms known as bill financing, where debt repayments are attached to utility or property tax bills. An EPC involves a company or individual entering into a contract with an Energy Service Company (ESCO) and often a debt provider (see chart 2). The ESCO carries out an energy audit to identify and subsequently implement energy efficiency measures. ESCO fees and loan repayments are frequently linked to the resulting measured reduction in energy consumption. The ESCO/EPC model emerged in the U.S. in the 1970s within the municipal, universities, schools, and hospitals (MUSH) public sector, with many projects funded by municipal bonds offering a cheap, long-term source of finance. Since the 1970s, the U.S. MUSH market has grown steadily, though moves into the commercial market have been sluggish. Companies in the U.S. and EU with ESCOs include Amareesco, Johnson Controls, Schneider Electric Buildings, and Siemens Building Technologies. The U.S. ESCO/EPC model has been promoted around the world with relatively limited success, with some take-up in China in recent years. There are two main contract models used in an EPC, the shared-savings model and the guaranteed savings model. Under a shared-savings contract, the energy cost savings delivered by a project are split between the client and the ESCO for a pre-determined period of time at an agreed percentage. Under a guaranteed savings contract, the ESCO guarantees a certain level of energy savings and in this way shields the client from any performance risk. The value of energy saved is guaranteed to meet debt service obligations, down to a floor price. The shared-savings model involves the ESCO carrying out the financing, whereas the guaranteed model involves the client sourcing funding from a third party and retaining the debt on its balance sheet (see chart 3). In the world of project finance, we believe the shared-savings model would most closely resemble a non recourse structure. That’s because the ESCO would act as the “project company,” raising the capital financing directly through a special-purpose vehicle (SPV) and repaying the project debt through service payments received from the energy user (the party benefiting from the project), subject to performance standards. Lenders therefore would take ESCO performance risk, and the ESCO would take energy user counterparty risk. However, project lenders are also exposed to this counterparty risk if the project company is dependent on it. The guaranteed savings model is not non recourse project finance since the lender provides the loan directly to the energy user (rather than the ESCO) and directly takes off-taker counterparty risk. The energy user will still take the ESCO’s performance risk, even though it is “guaranteed,” rather than the project lender.
there have been financing challenges for those on-bill projects where payments for energy savings were subordinated to other payments.

New models are emerging. This year has seen the first securitization of residual energy efficiency loans, as one way to circumvent one of the barriers to project finance in this area: small transaction size (see box on Landmark Energy).

### Assessing Credit Risk

One issue that energy efficiency projects face is the credit risk of those involved in their construction, operation, and finance. Financial institutions typically lend to borrowers with collateral that they can repossess in case of default. Standard & Poor’s project finance ratings are designed to capture this type of credit risk—as well as operational, construction, and market risks—under our criteria.

Construction risks

The project might include construction risk related to the adaptation or construction of mechanical, electrical, lighting, and water systems. We would expect to classify such works as relatively simple building tasks, with limited exposure to technology, under our criteria. One key credit factor would be the record track of the technology, equipment, material, or technical solution as well as how the solution and its design address the site-specific challenges.

In most cases, when assessing the technology risk and the underlying energy efficiency project, we would expect to assign an assessment of “commercially proven.” That’s because we would expect most projects to use off-the-shelf technology.

In addition, since the project management and logistics skills are required to complete construction on schedule, on budget, and to performance requirements. As we have seen in other project finance sectors, we anticipate that projects in this sector might use fixed-price contracts, such as engineering, procurement, and construction (EPC) contracts, to mitigate construction cost and delay risk, allowing the project to retain management of specific tasks, including the procurement and installation of specialized equipment, though the latter risk may be retained in the EPC contract.

Counterparty risk

The reliance on third parties under a contractual structure to make payments or perform under a wide range of agreements—such as revenues, construction, equipment supply, operations, and maintenance—is a common feature in project finance debt issues. That’s why it’s important to assess counterparty risk. Standard & Poor’s focus centers on where a material risk is transferred to the counterparty, for which we provide an estimate of the exposure to the project should the counterparty become insolvent, assessing whether the latter is replaceable or not. If they are replaceable, subject to the amount of available liquidity, a project can have a higher rating than the creditworthiness of the construction and equipment suppliers (see “Project Finance Construction and Operations Counterparty Methodology”, published Dec. 20, 2011).

Under the shared-savings type of energy efficiency project, even though the ESCO assumes both performance and the underlying customer credit risk, if the energy user were to stop paying, the revenue stream from the project would stop, putting the ESCO at risk. This risk is akin to an off-taker utility that purchases power from an independent power producer. Under this scenario, we would therefore consider the energy user or “customer” as the revenue counterparty, whose credit quality may constrain the project’s rating.

### Market Risk

Market risk only applies when a project’s cash flow available for debt service (CPADS) has the potential to decline by more than 5% from our base case to our downside case. In such cases, we then assess the project’s market exposure (an assessment of its CPADS volatility due to market forces) and its competitive position. Our view of market risk reflects the extent to which a project is exposed to market changes, for example, if the pricing of the power generated is linked to commodity market pricing. Under the shared-savings model, performance is related to the cost of energy saved, as the ESCO bills upon actual results. The cost of energy saved will be split for a predetermined length of time at an arranged percentage, depending on the cost of the project, the length of the contract, and the risks that the ESCO and energy user assume.

We understand some energy efficiency projects, to cope with the risk of energy price fluctuations, have contractually agreed to...
New models are emerging. This year has seen the first securitization of residential energy efficiency loans.

Energy efficiency projects with a portfolio of independent assets with geographic diversification could benefit from a “positive” performance redundancy score in our OPBA. We have applied this assessment to renewable transactions such as Continental Wind LLC (BBB-/Stable), as it benefits from independent assets providing meaningful diversity and low correlation risk. In addition to renewable energy projects, another relevant peer would be the U.S. utility services project DTE Energy Center LLC (DTEEC; A-/Stable). We assess DTEEC’s OPBA as “1” on a 12-point scale on which “1” is the strongest, reflecting its asset diversity (there are 65 systems at eight plants), low technology risk, and stable operating performance of the underlying utility assets. We would expect energy efficiency projects to display similar operating characteristics as well as potential linkages to the revenue counterparty which, as for DTEEC, could ultimately act as a constraint on the project rating.  


Landmark Energy Efficiency Loan Asset-Backed Security Transaction

In June 2015, Renew Financial and Citi announced a $12.6 million securitization transaction comprising a portfolio of homeowner energy efficiency loans from the Warehouse for Energy Efficiency Loans (WHEEL). The entire issuance was purchased by Calvert Investment Management. This asset-backed security transaction, covering energy efficiency loans, creates a new asset class for investors and opens a pathway for capital markets to access energy efficiency returns. WHEEL is a public-private partnership where energy efficiency loans are collected by Renew Financial, using a combination of public funds from state treasuries and private funding from Citi, until the size of the aggregated loan meets requirements for transaction markets. WHEEL includes Pennsylvania, Kentucky, and the Greater Cincinnati Energy Alliance, and more states are expected to join allowing for potentially larger transaction sizes in future. Citi and Renew expect to bring additional transactions to market in the coming years.

PART 3

CHINA’S ENERGY MIX

This is the third of four vignettes adapted from a longer article, “Carbon Constraints Cast A Shadow Over The Future Of The Coal Industry” (published Aug. 27, 2015, on RatingsDirect).

After eight years of escalating demand at a rate of 75% per year, China’s demand for coal increased by only 3.5% in 2014, according to the Coal Industry Association. Even so, China remains the world’s largest coal consumer, accounting for about 45% of global coal consumption.

Besides raising the country’s output of CO2 emissions, this rapid expansion has brought heavy air pollution in industrial provinces and issues regarding the availability of clean water. To counter these adverse effects, the Chinese government has introduced several policies to deal with the environmental issues, without risking growth. The new policy allows the country to increase the demand for coal by 10% before hitting the ceiling. On a positive note, in our view, the shift in the Chinese economy is likely to flatten the demand in the coming years.

We don’t believe the program will trigger a fundamental change in China’s energy profile over the short term, and more steps are needed between 2020 and 2030 to meet the IEA’s 450 parts per million scenario, especially if it uses its entire capacity under the new regulations. In addition, self-imposing targets may change as seen by a few examples in the past. We believe that gas in China could become one of the silver bullets to reduce the demand for coal over time, and as a result also a threat for the domestic coal industry.

The weak seaborne price has forced domestic producers (responsible for 90% of the domestic consumption) to cut prices, leading to material losses across the coal industry year to date. This could have some implications on growth capabilities of domestic coal industry.

**Gas Rivals Coal In The U.S. Energy Mix**

The structural change in the U.S. coal market is probably a more drastic scenario compared with the gradual change we anticipate the global coal industry will be going through from 2020. The discovery of large deposits of natural gas in early 2010 triggered a collapse of 75% in natural gas prices till 2012, before recovering somewhat to current price. As a lower-cost and lower-carbon energy source, natural gas has created incentives for utility companies in the U.S. to abandon the use of coal. Since 2010, the demand for coal in the U.S. has dropped by 125 million tons (Mt) (or roughly 15% of annual production in the U.S.). In addition, in early August the U.S. Environmental Protection Agency (EPA) issued its final Clean Power Plan rules for reducing the carbon emissions of power plants (see “The U.S. EPA Finally Its Clean Power Plan, But Questions Still Remains,” published Aug. 6, 2015). Under its latest proposals, the EPA has moderately increased the emissions reduction target to 32% by 2030. We understand that the new regulations are likely to result in the retirement of more than 60 gigawatts of coal-fired capacity over the coming years, equal to 80 Mt to 90 Mt. The main mines at risk are in Central Appalachia.

The coal-mining industry in the U.S. is no stranger to regulation. However, these latest proposals arrive as the industry is struggling, and the specter of bankruptcy is moving beyond the smaller miners to threaten the giants in the concentrated industry. Since the beginning of the year five U.S. coal miners bankrupted and one entered into chapter 11. The future of U.S. coal mining companies will rely on domestic natural gas prices, as well as their ability to export coal, and the momentum toward more gas-fired generation is only likely to accelerate following the EPA’s latest pronouncements to curb emissions. In 2014, U.S. coal miners exported about 110 Mt of thermal coal, compared with 45 Mt in 2006. While previously U.S. coal miners aimed to expand their export capabilities to more than 200 Mt over the coming years, the EIA anticipates that coal exports from the U.S. will decrease slightly to 80 Mt in 2016.

**U.S. Coal Production And Export**

Rising Seas Could Mean Heavy Losses

Between 1960 and 2013 relative sea-level change (the height of the ocean at particular locations, rather than globally) rose eight inches or more along parts of the Atlantic and Gulf coasts, according to the National Oceanic and Atmospheric Administration. Considering the global trend of ocean levels, which showed little change in the two millennia before the industrial era, rising an average 0.06 inch annually between 1880 and 2012—and double that rate since 1993, the rising seas need to be contemplated when designing coastal infrastructure.

Population growth and development that encroaches on shorelines and low-lying areas could greatly elevate losses if coastal protections aren’t added (see table). For example, the World Bank estimates that average annual losses (AAL) (from a moderate 20-centimeter (7.8-inch) rise in sea level between 2005 and 2050 in Florida’s Tampa Bay-St. Petersburg area) would boost AAL there to $3 billion from $763 million. Under the same conditions, AAL in Miami would rise to $7.3 billion from $2.1 billion, in Virginia Beach, Va., to $1.5 billion from $278 million, and in Houston to $6.1 billion from $118 million. Storms such as Hurricane Katrina and Superstorm Sandy underscore these exposures and have eclipsed AAL projections.

Depending on the level and pace of the rising seas, coast-hugging highways, seawalls, harbors, nearby water, sewage, and power facilities, and other seaside infrastructure—in addition to millions of homes—could see billions of dollars in losses over the next few decades if nothing is done. Damage to these facilities also could seriously erode local tax bases, adding another level of risk to coastal areas.

Standard & Poor’s Ratings Services considers the dangers from rising sea levels to be a long-term, macro-credit risk that is unlikely to be a significant ratings factor in the next five years. But in our view, the failure of states and localities to start planning for the logistical, structural, and financial risks of more water in the wrong places could leave them struggling to protect existing investments in seaside infrastructure.

Localities Are Responding

After Superstorm Sandy and Hurricane Katrina, we have observed that localities have begun strengthening their flood-protection measures to avert a repeat of the catastrophic damage they suffered. One response has been to build new flood protection to greater strength, as measured by the event’s severity. The floodgates, berms, or whatever protection is being built may be strengthened to protect against an event expected to happen once in every 200 years, instead of once in a century. Such strengthening can be done in interior flood areas as well as coastal ones. After Sandy left millions of metropolitan New York City area residents without power when the storm surge knocked out substation and wind blew down transmission lines, some of the affected utilities, including the investor-owned utility Consolidated Edison Inc. and the public power entity Long Island Power Authority, embarked on a program of storm hardening. It partly entailed raising some key structures above expected storm surge levels. Recouping those costs can be difficult even after federal aid, so they may ask to raise rates, a politically unpopular measure. How much utility customers pay for these improvements will differ in each service area, and Standard & Poor’s considers the ratemaking process and its outcome a ratings factor for these issuers. But the larger point remains that protection against rising water levels has become a more important consideration for coastal utilities in light of storm surges and eventually rising sea levels.

Will Transportation Facilities Go Under?

Coastal transportation facilities, including toll roads, bridges, and rail lines, could become exposed to rising sea levels. Issuers for these facilities can obtain disaster aid for immediate catastrophes, but some have already begun planning for longer-term possibilities.

Overview

- Coastal infrastructure and municipalities face increasing exposure to rising sea levels.
- Constraining barriers to avert flooding might avert billions of dollars of losses.
- The exact credit impact of the threat and preventative measures is unknown at this time.
- Entities taking steps now to protect credit quality might long-term will not necessarily incur damage to current credit ratings.

For years, policymakers have argued whether climate change is a naturally occurring phenomenon, a result of human activity, or some combination of the two. Regardless of cause, few disagree anymore with the scientific consensus that global warming is leading to higher sea levels—a reflection of melting glaciers in Arctic regions, as well as the greater volume of warmer water globally.

Climate Resilience Can Protect Ratings From Sea-Level Rise And Threats To U.S. Coastal Infrastructure

GEORGE A. BUSCH
When Superstorm Sandy’s waters receded, New York’s Metropolitan Transportation Authority (MTA), which operates the subways, found severe damage in some of its systems. But its credit rating remained intact because MTA management put in place three liquidity facilities after the storm that provided the authority with $950 million of interim financing capacity. The MTA decided to supplement its property insurance coverage with a capital markets-based alternative. $290 million in fully collateralized coverage for losses from storm surges that occur until July 30, 2016. And its 2015-2016 capital budget included $5.8 billion toward hardening the system against future storms and catastrophes. Management’s existing contingency plans, plus its quick response to the damage, were enough to maintain credit stability. The other big transportation agency in the region is the Port Authority of New York and New Jersey, responsible for the area’s harbors, airports, some of its bridges and tunnels, and the PATH commuter rail line that runs between New York and New Jersey. It also maintained credit stability and embarked on a 10-year capital plan (2014-2023) that includes $1 billion for repair, mitigation, and resiliency projects. Issuers willing to invest in projects that look toward the possibility of higher sea levels are taking actions that may prevent long-term operational and financial difficulties. Any such long-term projects, of course, run the risk that issuers will encounter difficulty in raising taxes or user fees sufficient to support them. Moreover, barring immediate emergences, it could prove difficult to get local policymakers and the public to agree to begin large-scale and expensive planning for events that might not prove to be a chronic crisis until after their lifetimes. The credit standing for transportation infrastructure has generally fared well following severe weather events because any disruptions to operations have been short in duration, typically lasting days or up to a couple of weeks, without major dislocations to key drivers of demand. However, in rare cases, credit quality can be adversely affected. For example, the failure of United Airlines to complete its general airport revenue bond revolt to ‘BB’ from ‘A’ in 2005 because of a dramatic drop in passenger traffic, high uncertainty regarding what the key drivers of air travel demand will be in a service area depopulated due to Hurricane Katrina, and the airport’s inability to operate on a fully residual basis following the disaster. The airport, however, since then has regained much of its credit standing, presently rated ‘A’. With the global long-term forecast of rising sea levels, the frequency of severe events could threaten credit quality where preparations are short-sighted.

The Danger To Water Facilities

Sewerage and water facilities in areas where sea levels are likely to rise present special difficulties. In some U.S. coastal areas, such as Florida and California, where waters are a big source of fresh water; rising sea levels could eventually contaminate and renders other ground water supplies—the aquifers—with salt, making them unusable without expensive desalination equipment. That problem can be especially serious in areas like Florida, where aquifers consist of a particularly porous, crumbly or sponge-like material that allows water in and to rise present special difficulties. In some U.S. coastal areas, such as Florida and California, where waters are a big source of fresh water; rising sea levels could eventually contaminate and renders other ground water supplies—the aquifers—with salt, making them unusable without expensive desalination equipment. That problem can be especially serious in areas like Florida, where aquifers consist of a particularly porous, crumbly or sponge-like material that allows water in and plum.

Coastal areas have always been favored as transport and shipping centers, and as large population centers. Rising sea levels would not be attracting so much attention if most of the population lived far inland. But population growth and business development near the coastline has raised the question of whether there might be a point of concern. As the world’s existing stock of coal-fired power plants operates at an average efficiency of 33% (the average efficiency rate in the EU is 38%), this is far lower than plants that rely on other fossil fuels, and significantly lower than the 45% efficiency possible with modern, ultra-supercritical coal-fired power plants. If existing coal-fired plants were upgraded to an average 42% efficiency, the International Energy Agency, annual CO2 emissions could be reduced by more than 2 billion tons (the latest available data put total CO2 emissions at 31.7 billion tons in 2012). In addition, increased efficiency results in lower operating costs, improved air quality, and reduced water consumption. Based on several studies undertaken by utility companies, improved technology could push the efficiency of a coal-fired power plant to around 50% by mid-2020. To make deeper cuts in CO2 emissions, carbon capture and storage (CCS) units would ultimately be required. Currently, there are several CCS pilot plants operating worldwide. However, the technology is still premature with limited capabilities to deal with existing power plants.

Evolution Of Rated U.S. Coal Miners’ Debt And Maturities 2013-2019

<table>
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<th>Debt repayment</th>
<th>Reported debt (Bil. $)</th>
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<tr>
<td>2015</td>
<td>4.2</td>
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F-Forecast. Sources: Company data, Standard & Poor’s calculations.

Almost in every case, we find that the combination of larger capacity plants, higher efficiency, and better environmental performance is associated with lower CO2 emissions, reduced water consumption, and better air quality. But the biggest gains are likely to come in the near term, with the planned and in-progress conversions to more efficient technologies. The danger to water facilities could become a point of concern for seaborne players. Governmental and regulatory agencies will have to focus their attention on energy efficiency alongside renewables projects.
How Carbon Risks Are Reduced Is An Important Factor

Although not all parties agree with all of the IPCC’s statements, few governments now reject the climate science as a whole, and these sobering findings will place an increasing focus on curbing carbon emissions. Companies exposed to the related carbon risk are already taking steps to ensure that climate policy actions will not compromise their future profitability. And for investors looking to protect their assets, the important question is becoming whether the transition to a low-carbon economy will be orderly or disruptive.

Importantly, the IPCC also warned that “delays in additional mitigation or constraints on technological options increase the longer-term mitigation costs to hold climate change risks at a given level.” In other words, the longer the world waits to curb emissions, the higher the eventual cost will be.

Since the private sector hasn’t taken adequate action to cut emissions to rates that will hold global warming at levels scientists consider safe, the push for governments to act has intensified. With a U.N.-brokered global climate deal in the offing this December at the United Nations Climate Change Conference (or COP21) in Paris, climate policy options are coming into sharper relief. The underlying economics governing fossil fuel markets would themselves eventually force a transition to clean energy. Since fossil fuel resources are finite, supply will eventually decline, sending prices higher, while at the same time, the cost of renewable energy is falling as production is scaled up. However, this will almost certainly not happen within a timeframe that avoids the dangerous effects of climate change. That means governments will play a critical role in shaping the frameworks that guide industry onto a cleaner track. The choice for policymakers is stark: either put a price on carbon, or use direct regulation to curb emissions. Policymakers have generally done one of four things: nothing; regulate emissions directly; put a tax on carbon; or use carbon markets.

Interest has been building among policymakers, economists, and industry groups alike in using carbon pricing—charging those who emit carbon dioxide (CO2) for their emissions—to enable an orderly and affordable transition to a cleaner, lower-carbon economy, allowing for more efficient use of fossil fuels during the process.

International climate talks in Copenhagen in 2009 failed, in that countries were not ready to take on binding emissions reduction targets under a second commitment period under the Kyoto Protocol for 2013-2020, covering about 14% of global greenhouse gas emissions. The focus in Copenhagen was to agree to a renewal of the Kyoto Protocol for the period after 2012, i.e., a second commitment period. It failed because of a deep divide between rich and poor countries over who was to blame for global warming and who should act and when. It didn’t impose emissions cuts on fast developing economies like China, and many industrialized countries could not accept this. So, although it failed to bring more countries on board Kyoto, it did succeed for the first time in uniting the U.S., China, and other big developing economies to go beyond Kyoto to find a more inclusive global deal in which all countries would take action. So in
this regard, Copenhagen helped lay the ground for a deal in Paris. The Kyoto Protocol was clearly only a first step toward a much more comprehensive global agreement. The potential new global deal to be agreed upon at the December COP21 talks is widely expected to include actions by more than 150 countries that account for about 90% of global greenhouse gas emissions. The new global deal looks set to include voluntary action instead of top-down legally binding targets, giving governments the flexibility to increase their climate ambition by tailoring actions to their individual circumstances and capabilities. Each country’s action plan (intended nationally determined contribution, or INDC) is submitted voluntarily, but they are expected to become legally binding under the main agreement in Paris. There is no punitive enforcement mechanism at this stage, but it is expected that all the INDCs will be subject to international scrutiny and countries are expected not to backslide on their minimum commitments. On the contrary, many countries are expected to build on their original INDCs by showing further ambition, circumstances allowing.

The Problem

According to the IPCC, under a business-as-usual scenario, ongoing unabated combustion of fossil fuels will ultimately cause the build-up of atmospheric greenhouse gases to reach levels that could destabilize the global climate system. This could include:

- Significant sea level rise, causing widespread coastal flooding;
- More severe and frequent storms, causing deaths, flooding of populated areas and farmland, and damage to property and economic activity; and
- Drought, causing disruptions in fresh water availability and crop failures.

Taken together, these factors increase the risk of famine, civil unrest, increased global conflict, failure of already fragile states, and mass migrations. For these reasons, and based on the available science, climate change is increasingly likely to become a national security issue for governments as time passes.

Moreover, Bank of England Governor Mark Carney warned in November 2015 that climate change, if left unaddressed, could destabilize the global financial system. This could stem from a combination of direct physical impacts that affect populations and disrupt trade or by a sudden reassessment of the value of fossil fuel assets in light of global action to keep global warming within safe limits.

For investors looking to protect their assets, the important question is becoming whether the transition to a low-carbon economy will be orderly or disruptive.

More than 190 countries have agreed to limit global warming to no more than 2°C Celsius above preindustrial levels. This target is not arbitrary: Scientists believe a 2-degree rise is the level of warming beyond which changes to the climate are likely to become dangerous and potentially irreversible.

This temperature target means limiting the atmospheric concentration of carbon dioxide to no more than 450 parts per million (ppm), according to the U.N. In preindustrial times, the atmospheric CO2 concentration stood at roughly 280 ppm, according to the IPCC. The CO2 level had risen to about 399 ppm in 2015, based on data from the U.S. National Oceanic and Atmospheric Administration.

This discussion has raised the concept of a global carbon budget, or the volume of emissions that can be added to the existing atmospheric build-up before exceeding the 2-degree threshold. The reason this matters for the energy markets is clear: Much of the world’s proven fossil fuel reserves will have to remain dormant or be separated from their carbon content in order to stay within the global cap, a point that the World Bank, the International Monetary Fund, the Bank of England, and others now acknowledge.

If the global warming science is even approximately correct, this suggests that the industrialized world’s economic model—which is based largely on unabated emissions from fossil fuel combustion—is flawed and will have to be altered or replaced. The question for investors is over what time period this process will unfold, and whether the transition to a low-carbon economy will be managed and orderly, or sudden and disruptive.

Various financial, economic, and physical risks loom as the concentration of CO2 increases from year to year. Aside from the direct risks, including harm to people and property and disruptions in trade arising from storms, floods, and droughts, climate change also raises litigation risk for carbon-intensive companies and resulting financial risks for those that invest in them. Individuals or civil society groups may seek compensation through the courts for climate change-related damage from those they hold accountable.

We can expect lawsuits against companies—or governments—accused of not taking reasonable action to reduce greenhouse gas emissions or, potentially, those accused of deliberately misleading the public about climate dangers.

Well-designed policy measures could help mitigate many of these risks both by curbing greenhouse gas emissions and demonstrating that governments and companies are taking appropriate action in response to the climate science.

The Solutions

Fossil fuels are not, in themselves, the problem: greenhouse gas emissions are. And there is no inherent reason why the two cannot be separated. The ability to strip out greenhouse gas emissions from combustion energy may provide a long-term lifeline to coal, oil, and natural gas. However, the cost of removing carbon from traditional fuels may undermine their underlying economics, just as renewable energy is nearing grid parity with fossil fuel power generation.

The economics have not stacked up well for carbon capture and storage thus far, and one risk for the fossil fuel industry is that if further delays occur in developing capture/storage technologies, the traditional energy markets could be undercut by cost-competitive wind and solar power generation and new technological solutions. High-efficiency renewable energy coupled with commercially viable energy storage is just one example.

Attempts at a managed transition to clean energy are already underway in some areas, with help in many cases from government subsidies, but the falling cost of renewable energy and an eventual rise in the cost of fossil fuels will eventually drive the transition to a low-carbon economy, irrespective of current tax or related policy choices. However, without a strong global climate deal thus far, this effort has been disorderly and fragmented as governments try to balance the need to curb emissions while supporting economic growth and protecting their industrial competitiveness.

As the urgency to act increases, these two inescapable fundamentals—that global greenhouse gas emissions must be reduced to keep temperatures at safe levels, and that basic economics dictate that this must be done in the cheapest way possible—have generated interest in market-based approaches and spurred the effort to put a price on carbon emissions. Together, these objectives suggest that carbon markets—under which entities may trade allotments of CO2 emissions within a broad cap on total emissions—will continue to expand, and with political opposition continuing in some jurisdictions.

Civil society and investors are exploring options for curbing emissions through policy mandates using powers provided under existing legislation, others are implementing carbon markets on a piecemeal basis, with Europe, China, the U.S., and other nations continuing to move forward with market-based approaches to controlling greenhouse gas emissions under unilateral or multilateral agreements.

For investors eyeing tools to address mounting carbon risks, a range of approaches to curb emissions is therefore already in play. While some approaches look promising, it is clear that increasing scrutiny of carbon emissions is already in place. The World Bank has offered some compelling testimony of the move toward carbon pricing. A September 2015 World Bank report noted “clear evidence of growing momentum to put a price on carbon,” stating that the number of carbon-pricing instruments already in place or scheduled for implementation has almost doubled since January 2012, to 38 from 20. The EU has used a carbon market approach for the past 10 years, whereby a cap is set on industry’s CO2 emissions and allowances to emit CO2 are distributed between companies, up to the level of the cap. The cap ensures that emissions are reduced, while the trading of allowances allows the price to fall naturally to its lowest possible level, so long as the cap is being met, reducing the overall cost to the economy. By contrast, other countries are using a tax on CO2, including the U.K., Japan, Mexico, Switzerland, Sweden, Denmark, Finland, Norway, France, Portugal, Poland, South Africa, and Chile. The bank also noted a threefold increase in the share of emissions covered by carbon pricing over the past decade, stating that roughly 40 national jurisdictions and more than 20 cities, states, and regions—accounting for nearly one-quarter of global greenhouse gas emissions—are putting a price on carbon.

“Together, carbon pricing instruments cover about half of the emissions in these jurisdictions, which translates to about 7.5 gigatons of carbon dioxide equivalent, or about 12% of global emissions,” the bank said.

The World Bank estimates that the global value of the regional, national, and subnational carbon pricing instruments in 2015 is estimated at just under $50 billion. The bank values these instruments by using the annual revenue from carbon taxes, or in the case of carbon markets, the value of all allowances in a given year, multiplied by the average traded price.

Europe’s flagship climate policy tool, the EU Emissions Trading System, has successfully priced CO2 emissions since 2005, and although the system has faced various criticisms (including an overallocation of carbon allowances, lower-than-expected carbon prices, and a lack of coordination between different markets), it has succeeded in driving investments into renewable energy and helping to reduce greenhouse gas emissions across the EU. This success has led to calls for the creation of a global carbon market, which could provide a more effective and efficient way to reduce global greenhouse gas emissions and limit the impact of climate change.

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Fossil fuels are not, in themselves, the problem: greenhouse gas emissions are.
California started an internal carbon market in 2012, and has a goal of reducing greenhouse gas emissions by 40% by 2030.

The UN’s December climate summit will likely lead to a new global climate protection agreement. In the short term, this may not materially affect the underlying economics of fuels for power generation, for example. But in the long run, the Paris summit could be a decisive turning point toward globally coordinated action to reduce greenhouse gas emissions.

In light of such an agreement, fossil fuels will be part of the energy and industrial sectors for many decades to come even as renewable energy gains market share. With the right, timely policy signals, the markets can cope with risk and deal with the transition in an orderly fashion, making the nature of this change more of an evolution than a revolution. But if action is too slow, it would raise the risk that new technology emerges with a sudden and disruptive impact on the energy- and emissions-intensive industrials sectors.

For both industry and the financial sector, what matters perhaps more than anything else is that transparency about carbon risk is increasing. This means investors will have better access to tools that enable them to make sound investment decisions and protect their profitability while the transition to a low-carbon economy moves forward.

We have determined, based solely on the developments described herein, that no rating actions are currently warranted. Only a rating committee may determine a rating action and, as these developments were not viewed as material to the ratings, neither our nor this report were reviewed by a rating committee.

Better Tools Will Cut Risk

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