Sustainable Finance External Reviews And Opinions

Primary Credit Analysts: Corinne B Bendersky, London, + 44 20 7176 0216; corinne.bendersky@spglobal.com
Beth Burks, London, (44) 20-7176-9829; Beth.Burks@spglobal.com
Noemie De La Gorce, London, + 44 20 7176 9836; Noemie.delagorce@spglobal.com
Secondary Contacts: Michael Wilkins, London, (44) 20-7176-3528; mike.wilkins@spglobal.com
Michael T Ferguson, CFA, CPA, New York, (1) 212-438-7670; michael.ferguson@spglobal.com
Kurt E Forsgren, Boston, (1) 617-530-8308; kurt.forsgren@spglobal.com
Olivier J Karusisi, Paris, (33) 1-4420-7530; olivier.karusisi@spglobal.com
Anna Liubachyna, London; anna.liubachyna@spglobal.com

OVERVIEW

1. S&P Global Ratings' Sustainable Finance External Reviews and Opinions can provide Green Transaction Evaluations as well as Transaction Alignment Opinions and Framework Alignment Opinions that consider established market principles.
2. We consider whether a financing framework is aligned with International Capital Market Assn.'s (ICMA) Green Bond Principles (GBP) and/or the Loan Market Assn.'s (LMA) Green Loan Principles (GLP), or aligned with ICMA's Social Bond Principles (SBP), or with a combination of the GBP and SBP, collectively known as ICMA's Sustainability Bond Guidelines (SBG). These opinions relate to a framework's governance and transparency. At the transaction level, we also consider whether the transaction is aligned with the GBP and/or GLP and determine a Green Transaction Evaluation

Key Publication Information

- This revised approach is effective Oct. 16, 2020.
- It is related to "Sustainable Finance External Reviews And Opinions Q&A: Transaction And Framework Alignment Opinions With The Green Bond, Green Loan, And Social Bond Principles," published Oct. 16, 2020.
- We previously revised this article on June 5, 2020. See the Revisions And Updates section at the end of this article for details.

3. Sustainable Finance External Reviews and Opinions are not credit ratings, and they do not consider credit quality, and nor do they factor into our credit ratings. The transaction-level evaluations provide a relative ranking of financings globally. A Green Transaction Evaluation is based on three scores--transparency, governance, and mitigation (environmental impact) or adaptation (resilience level). We evaluate a financing against each category and then combine the resulting scores into a final Green Transaction Evaluation.
4. In a Green Transaction Evaluation, we first consider the financing's governance and transparency from a green perspective. We then combine this assessment with an estimate of the asset's expected lifetime environmental impact in its region, relative to maintaining the status quo. The analytical approach can evaluate both mitigation and adaptation projects.
5. The transparency score focuses on the quality of disclosure, reporting, and management of bond (or other financial instrument) proceeds.
6. The governance score assesses what steps have been taken to measure and manage the environmental impact of the proceeds of the financing, including certification, impact assessment, risk monitoring, and risk management.
7. Mitigation projects aim to bring environmental benefits and target areas such as natural resources depletion, loss of biodiversity, pollution control, and climate change. Adaptation projects aim to reduce exposure to and manage the impact of natural catastrophes by, for example, making communities and critical infrastructure more resilient to the risk of extreme weather events due to climate change.
8. The mitigation score reflects the environmental impact of the use of proceeds over the life of the assets. It considers variables such as sector, technology, location of the assets, and funding allocation. It considers a variety of environmental key performance indicators (eKPIs), such as carbon, water, pollution, and waste.
   - The environmental impact calculation is done on a net benefit basis, meaning we consider each project's negative and positive environmental impact relative to the regional baseline (for example, the net benefit of a new renewable energy project compared with production from the conventional grid) for relevant eKPIs.
   - The net benefit for each eKPI is compared against a range of modelled net benefit outcomes derived from relevant regional data to determine a ranking.
   - The resulting ranking is a weighted average across the eKPIs applicable to that sector and is referred to as a net benefit ranking against the best-in-class technology within that sector or technology peer group.
   - For financings that involve multiple technologies, we calculate the net benefit rankings based on funds allocated to each project to derive the net benefit ranking for the sector. If a financing covers multiple projects in different sectors, we repeat this process for each sector.
   - We then determine each sector's overall environmental impact based on where it fits within either our carbon, water, waste, or land use hierarchy. This indicates the sector's relative contribution to avoiding and coping with climate change.
   - To derive the mitigation score for the project financing or portfolio of projects, we then calculate each sector's environmental impact based on funds allocated to that sector.

9. The adaptation score reflects the estimated reduction in the cost of expected damages that projects achieve. To determine the resilience benefit that may be achieved through the use of proceeds, we analyze the benefit studies prepared for the project.
10. The last step is to combine the scores from transparency, governance, and either mitigation or adaptation to derive the final Green Transaction Evaluation on a scale of 0-100. Our transparency and governance assessment does not enhance our final Green Transaction Evaluation--rather, its impact is neutral or negative. Poor transparency and governance may have a negative impact on the outcome, but good transparency and governance does not enhance a financing's overall environmental impact, in our view.

SCOPE

11. Sustainable Finance External Reviews and Opinions are point-in-time assessments. They consider a variety of projects or initiatives a given instrument (debt or equity) finances. These projects include bond-financed projects, in line with the various green bond project taxonomies available, as well as conventionally financed projects outside of current green taxonomies that may have beneficial environmental or social implications.
12. Sustainable Finance External Reviews and Opinions apply to a wide variety of financial frameworks and instruments, including those issued by corporate entities, project and structured finance vehicles, financial institutions, multilateral development banks, sovereigns, and municipalities. The evaluation is also applicable to financings by corporations whose businesses are solely focused on environmentally beneficial activities (such as wind turbine manufacturers), issuing general use-of-proceeds bonds. In addition, a Green Transaction Evaluation can apply to portfolios of assets, including those held by financial or other institutions.
13. For transactions, our approach is relevant for pre- and post-closing of a financing and pre- or post-construction of an asset.
14. If proceeds are used for refinancing, the evaluation is based on disclosed information regarding which investments or project portfolios are being refinanced and considers an assumed asset life from the point of refinancing as if undertaking a new evaluation. In cases where this information is not disclosed, the evaluation is based on the company's existing asset profile.
15. If the financing is issued by a financial institution, such as a bank, raising funds to on-lend, where specific projects have not yet been identified, the evaluation considers the underlying portfolio of assets financed by previous green issues. If all instruments finance the same portfolio of green assets without specific earmarking of assets, we assign all those instruments the same Green Transaction Evaluation.

Mitigation

16. Mitigation projects aim to provide increased mitigation of the effects of climate change. Green mitigation sectors that are currently in scope for Green Transaction Evaluations include:
    - Green energy,

- Green transport,
- Green buildings,
- Energy efficiency,
- Fossil fuel power plants (decreased carbon or sulfur oxide emissions),
- Nuclear power,
- Water,
- Waste management, and
- Agriculture and forestry.

Net benefit ranking.

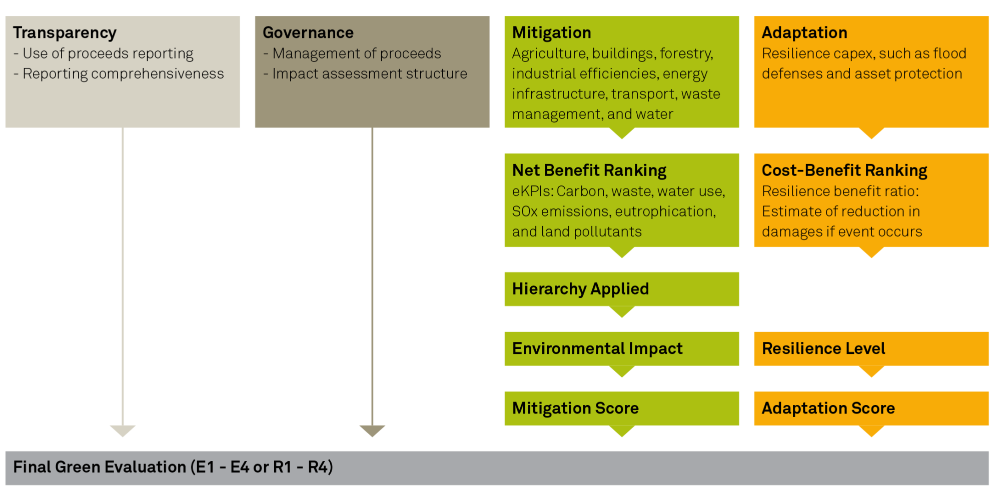
17. The net benefit ranking calculation takes into account the full supply chain and operational phases over a project's lifetime. We consider the most material and quantifiable environmental eKPIs for each sector (see table 1). These include carbon emissions, water use, waste, land pollutants, eutrophication, and air pollution from sulfur oxides. Our selection of the eKPIs is based on the availability of robust quantitative data within each sector.

Adaptation

18. Adaptation projects aim to strengthen the resilience of buildings, critical infrastructure, and communities against the risk of extreme weather or longer-term shifts and variability in weather patterns caused by climate change. Strengthening flood defenses in coastal areas--to protect against the impact of storm surge due to rising sea levels, widely regarded as one consequence of climate change--is one example of an adaptation project.
19. For a Green Transaction Evaluation we analyze four categories: transparency, governance, mitigation (environmental impact), and adaptation (resilience level) (see chart 1 below).

Chart 1

Green Evaluation Analytical Approach



eKPIs--Environmental key performance indicators.

20. For mitigation projects, we estimate whether a project, over its life (including construction, operations, and decommissioning phases), is expected to create a net positive or negative

environmental impact based on relevant eKPIs. We call this a net benefit ranking. We then overlay a hierarchy, which places the net benefit ranking of the specific technology within the broader context of the sector (for instance, solar power within the green energy sector). The outcome is referred to as the environmental impact. If applicable, we combine each sector's environmental impact to derive the mitigation score. We then combine the mitigation score with the transparency and governance scores to produce a Green Transaction Evaluation, which is mapped to an E score.

21. For adaptation projects, we determine the resilience level by assessing the increase in resilience a project will likely provide. We map the resilience level to an adaptation score. We then combine that score with the transparency and governance scores to determine a Green Transaction Evaluation, which is mapped to an R score.

Framework Alignment Opinions

22. We assess the following four components of a framework to consider its alignment with the GBP, GLP, SBP, or SBG (collectively the "Principles"):
    - Use of proceeds: documentation states that all net proceeds of any instrument issued under the framework will be allocated to eligible green or social projects;
    - Process for project evaluation and selection: documentation contains clear criteria in selecting projects for funding;
    - Management of proceeds: it is clear how the issuer manages and tracks proceeds; and
    - Reporting: there is commitment to regular reporting on the use of proceeds and associated environmental or social outcomes.

Green Transaction Evaluation

A. Transparency

23. In assessing transparency, we look at the quality of reporting on the financing instruments. High-quality reporting enables investors and other stakeholders to understand and evaluate the governance of a transaction, as well as determine whether the promised environmental targets and performance are being achieved. Although not always available, independent certification of the environmental performance can further bolster stakeholders' confidence in the environmental effectiveness of the transaction, in our view.
24. Our evaluation of a transaction's transparency includes a qualitative review of:
    - Use of proceeds reporting;
    - Impact reporting and disclosure; and
    - External verification of impact data.
25. We review public documentation of the financing transaction and, if available, actual reporting and disclosure. Our qualitative analysis of actual (or promised future) reporting is based on questions we pose to the party seeking the green financing. (In this article, "entity" refers to the party seeking green financing.)

26. We evaluate each factor within transparency and apply weightings to determine the overall transparency score on a scale of 0-100.

Use of proceeds reporting

27. A single financing can fund multiple projects, all of which may have a beneficial environmental impact, but to varying degrees. Disclosure of the allocation of funds may be more or less detailed and can hamper an investor's ability to ascertain the overall environmental benefit. Alternatively, only a portion of the proceeds may be directed toward a project with a beneficial environmental impact. Our Green Transaction Evaluation analytical approach can accommodate either scenario. Allocating only a portion of proceeds to environmentally beneficial projects does not affect our Green Transaction Evaluation, which is based on the projects funded and applies only to that portion of the proceeds.
28. We identify the proportion of proceeds to be allocated to environmentally beneficial projects in our report.
29. In situations where the details of the projects to be funded have not been disclosed, we assume a worst-case allocation scenario.
30. We can provide our point-in-time Green Transaction Evaluation at any stage in the financing or project life. Our evaluation is based on the assumption that the project is completed and operational--if the evaluation is completed at a time when construction is anticipated to go ahead as planned--and operates within average industry expectations for the technology.

Total signed amount of financings and the amount of allocated proceeds:

31. Our appraisal of disclosure of the amount of signed and allocated proceeds is twofold. First, we evaluate the total amount (signed for financing and the amount of proceeds allocated to the specific financing), if published, then we review the level of granularity of the reporting on allocation.

Level of disclosure about proceeds allocated to projects:

32. Here we assess the depth of disclosure about proceeds allocated to eligible financings. This indicates to investors and stakeholders whether (and to what extent) an entity is following its objectives indicated at issuance. The disclosure (if any) can be project level or aggregate level by sectors. For financings being assessed pre-issuance, we look for documented intention to report.

Frequency of reporting, or commitment to report, on the use of proceeds:

33. A commitment to report more frequently (as well as a commitment to publish the reports) leads to a higher level of transparency than publishing less frequently and gives the investor more frequent data points. Funds allocation reporting frequency can vary from annual reporting, to less frequent, to no reporting commitment at all.

Disclosure about including and removing projects and financings from a portfolio:

34. A defined process for including and removing projects in a report is important for portfolios with financings that may be added or subtracted from the portfolio from time to time. In addition, by removing from the portfolio a project that does not meet an entity's environmental targets, the entity further demonstrates its commitment to its own green principles.

Project selection protocol:

35. Here we assess whether an entity has disclosed the rules and principles governing its future allocation of funds. In other words, our evaluation will examine if the principles for selecting which projects to fund are clear and transparent. This is equally applicable for single-project financings.

Reporting and disclosure about environmental impact

Commitment to reporting about environmental impact:

36. A commitment to disclosing the environmental impact of funded projects enhances transparency and informs environmentally conscious investors. Environmental impact reporting frequency can vary from annual reporting, to less frequent, to no reporting commitment at all.

Disclosure of environmental impact:

37. The existence of (or commitment to) at least annual quantification and disclosure of eligible projects' expected or actual environmental impact is assessed separately. The disclosure (if any) can be quantitative or qualitative, and it may be at a project or aggregate portfolio level. We do not include the disclosure of specific annual quantitative environmental impact results in our net benefit ranking.

Depth of disclosure of impact indicators:

38. We evaluate the existence and quality of environmental impact indicators in line with the characteristics of different technologies. Basic indicators include location, capacity (power generation) or energy savings (energy efficiency investments), vehicle carbon intensity (green transport), description of asset types (green buildings), waste diverted from landfill (waste management), and project land area (agriculture and forestry). Comprehensive indicators include additional disclosure related to estimated outputs such as capacity factors (power generation), impact on modal split (green transport), targeted or estimated savings (energy efficiency), estimated savings compared with baseline scenarios (green buildings), energy generated from waste (waste management), and sustainable wood production (agriculture and forestry). Advanced indicators have an additional layer of disclosure, such as estimated avoided carbon.

Disclosure of lifecycle impact and a project's economic life

39. An important factor when disclosing a project's impact is the time period the disclosure covers. We can better understand the lifecycle (whole of life) impact on an annual basis if there are annualized impact indicators. The disclosures (if any) can cover the full lifetimes for all of the projects financed, the lifetimes for some of the projects financed, the economic life for all of the projects, and the economic life for some of the projects.

Methodology for environmental impact calculation:

40. Disclosure of an entity's methodology for calculating the actual or expected environmental impact is viewed positively. It allows for a more thorough investigation by environmentally conscious investors and facilitates stakeholder discussions. For example, understanding an

entity's baseline assumptions and scope when calculating avoided emissions provides added transparency for investors. When provided, the disclosure may or may not cover all projects; the former is preferable.

External verification of impact data

Quality of assurance:

41. Certification that an entity's environmental impact assessment complies with an established assurance standard improves the transparency of the transaction, in our view. A third-party appraisal of an issuer's data quality that lacks compliance with an assurance standard is not viewed as positively. Without any external verification of environmental impact data, an investor is less assured of the entity's claims regarding the environmental impact of the transaction and associated project or projects.

Treatment of general use of proceeds transactions by pure-play entities

42. "Pure-play" companies that focus solely on environmentally beneficial activities, such as solar panel or wind turbine manufacturers, often issue general use-of-proceeds bonds. We assume these issuances are fully committed to eligible green projects.

Portfolios

43. For portfolios of multiple financings, we would expect to review the criteria for selecting or deselecting assets within the portfolio.

B. Governance

44. In our governance assessment, we look at the procedures in place to manage proceeds allocation and to evaluate environmental impact over the life of the assets.
45. We consider whether there are well-defined procedures in place for:
    - Selecting projects eligible to be financed,
    - Preventing proceeds of the bond from being used for other purposes than the intended green financings,
    - Appraising and managing environmental impacts, and
    - Complying with environmental regulations.
46. We evaluate each factor within governance and apply fixed weightings to determine the overall governance scores on a scale of 0-100.

Management of proceeds

Selection rules of eligible investments or financings:

47. The existence of a well-defined selection protocol is important for ensuring that proceeds are allocated to projects with environmental benefits. We view favorably transactions with well-defined environmental objectives and explicit selection principles to achieve those objectives.

Proportion of total issued amount committed to green financings:

48. The higher the commitment to green financings, the higher the score on these factors because we view it is an indicator of the extent to which the proceeds are committed to being used or already are being used to finance environmentally beneficial projects.

Tracking, non-contamination, and allocation of proceeds:

49. These three factors cover the oversight and internal control of proceeds. When analyzing issue-related governance processes, we consider whether a subaccount separation of proceeds is, or is intended to be put, in place (allowing for transparent tracking of the use of proceeds). We also assess any protocols in place to prevent proceeds from being used for purposes other than the stated financing objectives in the documentation.

Verification of proceeds allocation or future commitment to verify proceeds allocation:

50. A third-party review provides additional assurance to investors that proceeds are being allocated as expected. We therefore view the quality of governance as higher when an external independent reviewer reviews proceeds allocation. The provision of regular evaluations in line with an assurance standard is also viewed positively.

Evaluation of environmental impact

Measuring the positive and negative environmental impact:

51. We look at whether a qualitative or quantitative environmental impact evaluation of the funded projects is available to investors. We view a quantitative and transparent evaluation of the environmental impact of the project over its full life cycle more favorably than just the economic life of the asset.

Compliance with regulations:

52. For projects with intended environmental benefits, we expect an entity to evidence compliance with relevant environmental regulations. If an entity doesn't provide this evidence, generally we score governance lower.

Certificates against industry standards

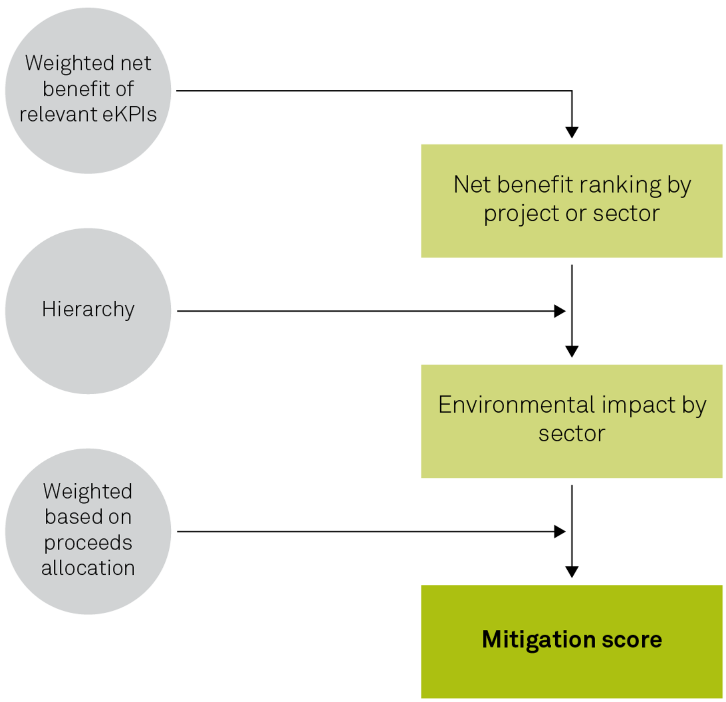
53. This factor currently covers green building certificates, such as BREEAM or LEED, and differentiates between their various levels as an assurance that issuers have considered industry standards or exceeded industry standards when financing such projects.
54. If requested, we can provide an opinion on whether the transaction is aligned with the GBP and/or GLP.

C. Mitigation

55. Our assessment of mitigation reflects the environmental impact of a financing's proceeds over the life of the assets that it finances. It considers a variety of eKPIs, such as carbon, water, waste, land pollution, eutrophication, and air pollution from sulfur oxides. We use those to determine a project's net benefit ranking. We then assess where each project fits within either our carbon, water, waste, or land use hierarchy (which indicates the sector's relative contribution to avoiding and coping with climate change) to determine the environmental

impact. Finally, we calculate the environmental impact of each sector a project covers based on funds allocated to that sector to derive the mitigation score (see chart 2).

Chart 2
Determining The Mitigation Score



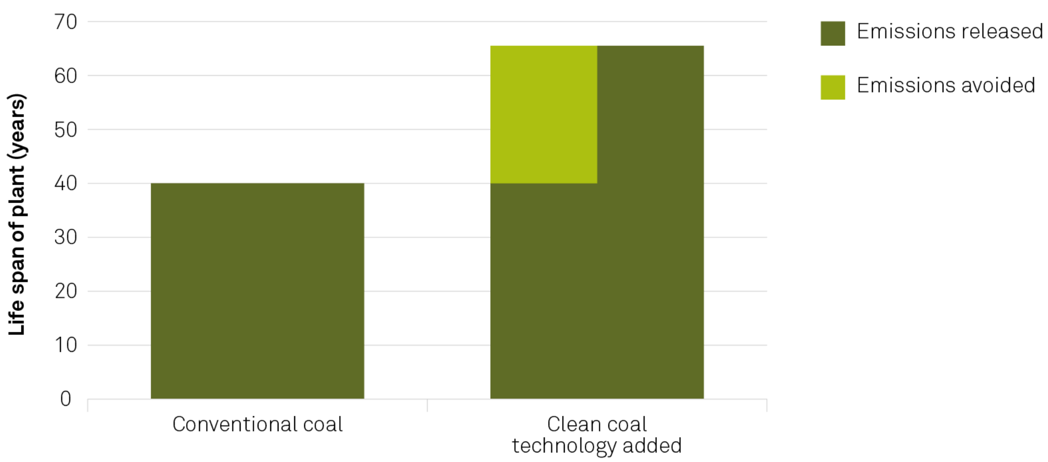
eKPIs--Environmental key performance indicators.

Net Benefit Ranking

56. In assessing a project from a mitigation perspective, we use a net benefit approach. We estimate a project's positive and negative impact compared with a baseline scenario to determine its net environmental impact overall compared with other technologies in the same sector. We call this a net benefit ranking. We consider the material stages of a project lifecycle, from the supply chain (including construction), through operations, to end of life. The operational phase is the assumed lifetime of the project or asset, minus an assumed one-year construction phase, and is the point at which we would consider the environmental impact of the project relative to its baseline.
57. For example, for a renewable wind energy project, we would consider the environmental impact of constructing, operating, and decommissioning a windfarm against the benefits of using the windfarm to produce energy instead of the conventional grid in that country over the lifetime of the windfarm.

58. We estimate the positive and negative impact over the life of a project for each of the material eKPIs in its sector. For a renewable energy project, we estimate the net benefit to the environment over its lifetime after considering the carbon emissions, waste creation, and water usage (eKPIs for green energy) associated with the supply chain, operation, and decommissioning.
59. Our analytical approach compares emissions savings to a baseline scenario. For an energy project, for example, the baseline scenario would be the business-as-usual emissions rate for the grid system in the region where the project is based. Therefore, some projects, such as clean coal projects (which make the burning of coal more efficient and reduce emissions per megawatt-hour of energy produced), could score very well in terms of absolute quantities of carbon saved. However, in this scenario, the project would also invest in a fossil fuel energy source and effectively extend the lifespan of the plant, thereby locking fossil fuel energy into the grid. As a result, total emissions from the asset over its lifetime would increase (see chart 3).

Chart 3
Emissions Released Over Project Life Span



Data requirements

60. The net benefit ranking is designed to compare the relative green impact of the projects being financed. We take into consideration the sector, the technology, and the location of each asset. (If the specific country, U.S. state, or Canadian province is not known, we use regional or global factors as appropriate.) We calculate the net benefit using conservative assumptions, meaning that, in the absence of disclosure, we assume the technology within the sector and country mix with the lowest net benefit. If the subsector type is known (for example, green power generation or green power technology), then the calculation can be refined further, with the most granular level of detail at the individual project level (for example, wind power generation or smart grid). This concept is illustrated below for the category of green energy.

Green Energy Technologies Considered Under The Green Evaluation

- Photovoltaic solar power generation
- Concentrated photovoltaic solar power generation
- Solar thermal
- Small hydropower generation (<30 megawatts)
- Large hydropower generation (>30 megawatts)
- Onshore wind power generation
- Offshore wind power generation
- Wave and tidal power generation
- Landfill gas power generation
- Geothermal power generation
- Biomass power generation
- Biomass cogeneration
- Fuel cells

Table 1
eKPIs Considered In Determining Net Benefit Ranking

Technology	Carbon	Waste	Water use	SOx emissions	Eutrophication	Land pollutants
Renewable energy	✓	✓	✓			
Green buildings	✓		✓			
Green transport	✓					
Energy efficiency	✓					
Water	✓		✓			
Fossil fuel power plants	✓	✓	✓	✓*		
Nuclear	✓	✓	✓			
Waste management	✓		✓§		✓§	✓
Forestry protection	✓					
Forestry expansion	✓					
Alternative farming†	✓		✓		✓	✓
Improvements in alternative farming	✓		✓		✓	✓
Improvements in conventional farming	✓		✓		✓	
Crop-based products	✓					
Land restoration	✓					

*For flue-gas desulfurization only. §For food loss reduction only. †Depending on the technology's benefit, two or three of four possible eKPIs are considered. SOx--Sulfur oxides. eKPIs--Environmental key performance indicators.

Green energy.

62.A key environmental impact of renewable energy generation is that it supplies the grid with low-carbon electricity, which reduces the local or national carbon intensity of electricity. Indeed, we assume that the electricity a renewable energy power plant produces would have been produced by the existing power plants connected to the same grid in the event that this project had not existed. As a result, the amount of carbon dioxide avoided by a particular renewable energy power plant is dependent on the collective carbon content of all the energy connected to this grid, netted by the carbon costs of installing these assets. Adding renewable energy in a carbon-intensive electric system, heavily reliant on fossil fuels, will avoid more emissions as it replaces comparatively carbon-intensive electricity.

Buildings.

63. Green building projects aim to reduce the environmental impact of buildings over their lifespan. Buildings accounted for one-third of global carbon emissions and half of global electricity consumption in 2012. Between 2000 and 2012, the sector's final energy consumption increased by an average annual 1.5%, well beyond the 0.7% that would limit the global temperature rise to no more than 2 degrees Celsius above preindustrial levels, according to the International Energy Agency (IEA). Green buildings target a variety of environmental impacts. However, the focus remains primarily on two main eKPIs: energy efficiency and water saving. Globally accepted green building certifications include BREEAM, LEED, Energy Star, Green Star, and many others, according to the Whole Building Design Guide.

64. The two key types of commercial and residential green building projects are:
   - Construction of new buildings, and
   - Retrofit of existing buildings.

65. Within both subcategories are many asset types, including residential, retail, industrial, and health care. Examples of energy-saving initiatives in both new buildings and refurbishments include:
   - Energy-efficient heating, ventilation, and air conditioning systems;
   - Double glazing of glass windows and walls to improve thermal insulation;
   - High-efficiency pool equipment;
   - Smart meters;
   - High-efficiency water heating; and
   - Roof and wall insulation.

Green transport.

66. A key environmental impact of low-carbon transportation sources is meeting transportation demand without emitting the carbon dioxide associated with fossil fuel combustion. That's because transport accounts for a large share of human-generated carbon dioxide emissions and requires significant evolution to meet climate goals. For instance, the IEA estimates that the electric vehicle market has to increase by 80% per year by 2025 to be on track with the 2-degree scenario. As a result, providing low-carbon transport solutions, such as electric private or public transport, is a key aspect of the energy transition and can achieve significant environmental benefits.

67. Project subcategories are:
   - Urban rail system,
   - Electric vehicles,
   - Fuel-efficient vehicles, and
   - National rail and freight systems.

Energy efficiency.

68.The key environmental impact of energy-efficiency projects is their ability to provide the same service while reducing energy demand. Energy efficiency is integral to achieving a low-carbon transition in traditional sectors, such as buildings, transportation, and industry. The scope of the savings and the techniques required depend on the sector they are applied to and location. Energy efficiency should be distinguished from energy conservation, which is a broader term that includes foregoing a service, such as turning down the thermostat in the winter to save energy.

69.Many of these technologies are assessed in other sectors (green buildings, green energy, and green transport), leaving two main categories of projects to consider within energy efficiency: energy-efficient products (such as those with an Energy Star certification) and industrial efficiencies.

Water.

70.While other sectors, such as green energy, green transport, and green buildings are targeted at decarbonization of the economy, water-related mitigation projects focus on using water resources and networks more efficiently and improving the quality of water treatment for various end uses and the environment. Projects focusing on water are increasingly important as climate change warms the atmosphere, altering the hydrologic cycle and changing the amount, timing, form, and intensity of precipitation (see "Climate Change and Watersheds: Exploring the Links," Environmental Protection Agency Science Matters Newsletter, published August 2013). These projects aim to address problems of water scarcity and pollution, often at local and watershed levels. Therefore, the key environmental impact can be more efficient water use or distribution, increased levels of water recycling, and improved water treatment compared with the baseline scenario. Importantly, the majority of projects in this sector take into account regional scarcity factors.

71.We recognize that water projects improve the resilience to drought risk and, therefore, also have an adaptation element. We reflect that by incorporating water scarcity in the net benefit calculation. However, we consider projects whose main objective is to reduce water consumption or improve water quality as mitigation. At the same time, water projects whose primary motivation is to increase communities' resilience to drought will likely be considered as adaptation, provided that the resilience benefit is quantified (see section D).

72.The water sector in scope encompasses a broad range of water-focused projects, such as water demand reduction, water treatment, water treatment to increase supply, and wastewater treatment with or without energy recovery. The specific types of projects in scope are listed below.

73.Water demand reduction projects are:

- Conservation measures in residential buildings,
- Conservation measures in commercial buildings,
- Conservation measures in industrial equipment,
- Improved irrigation,
- Smart metering in residential buildings, and

- Reducing water losses in the water distribution network.

74. Water treatment to increase supply covers:
    - Water desalination to supply potable municipal water,
    - Recycling wastewater to supply potable municipal water,
    - Recycling wastewater to supply non-potable water for agricultural uses, and
    - Recycling wastewater to supply non-potable water for other industries.
75. Wastewater projects are:
    - Biofiltration wastewater treatment with no energy recovery,
    - Biofiltration wastewater treatment with energy recovery,
    - Wastewater treatment with no energy recovery, and
    - Wastewater treatment with energy recovery.

Fossil fuel power plants.

76. The fossil fuel power plants sector considers a variety of carbon reduction initiatives in the conventional energy sector, including "clean coal" and coal-to-gas conversion projects. The global average efficiency of coal-fired power plants currently in operation is roughly 33%, significantly lower than the 45% efficiency possible with modern, ultra-supercritical coal-fired power plants, according to IEA analysis. These figures highlight scope for improving carbon efficiency within existing and planned conventional power generation capacity. The key environmental impact that these projects target is reducing greenhouse gas (GHG) emissions through the decreased carbon intensity of conventional energy production.
77. Project subcategories are:
    - Coal plant efficiency upgrades,
    - Flue gas desulfurization,
    - Fossil fuel-based cogeneration,
    - Oil refinery efficiency,
    - Reduced flaring,
    - New clean coal plants, and
    - Coal-to-gas conversions.

Nuclear.

78. The key environmental benefit of nuclear power generation is extremely low GHG emissions. Low-carbon power generation technologies, such as renewable power generation and nuclear, continue to play an important role in the decarbonization of the power sector, according to the IEA. However, the high carbon-intensity of uranium mining required to power nuclear technology reduces its net contribution to decarbonization, compared with renewable energy generation, when taking supply chain emissions into account (see "Sustainability of uranium mining and milling: toward quantifying resources and eco-efficiency," G.M. Mudd and M. Diesendorf, Environmental Science and Technology, 42:2624-2630, published 2008).

Waste management.

79. The key environmental benefits of waste management are reducing waste, reusing waste materials, avoiding GHG emissions, and minimizing land pollutants. Waste management

practices vary in their intended environmental benefits. Certain technologies, such as anaerobic digestion, involve the recovery of gas generated by waste and converting it to energy, thereby reducing GHG emissions from landfills. Some waste management activities aim to reduce the quantity of waste sent to the local waste pathway. Others improve systems that avoid or reduce land pollution impacts.

80. Project subcategories are:
   - Food loss reduction,
   - Hazardous waste incineration,
   - Waste composting,
   - Waste to energy,
   - Aerobic digestion,
   - Anaerobic digestion, and
   - Gasification pyrolysis.

Agriculture and forestry.

81. A key environmental benefit of agriculture and forestry is more sustainable land use, which can support biodiversity, the sequestration of GHG emissions, the reduction of water use and pollutants, and soil enhancements. Land and forests play an important role in the climate system, acting as both a source and sink of GHGs, and in facilitating the exchange of energy, water, and aerosols between the land surface and the atmosphere. Agriculture and forestry projects aim to manage land more sustainably by preventing or reducing land degradation or both, maintaining land productivity, enhancing soil culture and biodiversity, and supporting mitigation and adaptation of climate change.
82. Project subcategories are:
   - Forestry protection,
   - Forestry expansion,
   - Alternative farming,
   - Improvements in conventional farming,
   - Crop-based products, and
   - Land restoration.
83. Forestry protection projects are:
   - Forest restoration and protection, and
   - Forestry protection.
84. Forestry expansion projects are:
   - Forestry expansion for nontimber products,
   - Plantation forestry, and
   - Sustainable forest management for timber production.
85. Alternative farming projects are:
   - Low and no tillage,
   - Organic farming,
   - Sustainable fertilizer,
   - Drought-resistant crops, and

- Rotational grazing.

86. Improvements in conventional farming projects are:
    - Rice intensification systems, and
    - Precision agriculture and livestock systems.
87. Crop-based product projects are:
    - Biofuels.
88. Land restoration projects are:
    - Land restoration to natural state, and
    - Land restoration to agriculture.

Weighting eKPIs and determining the ranking

89. In order to convert our estimate of the absolute net benefit impact in terms of each relevant eKPI, such as cubic meters of water, kilograms of land pollution, metric tons of sulfur oxides, metric tons of nitrogen (for eutrophication), metric tons of waste, and metric tons of carbon, into a relative ranking, the net benefit is compared against net benefit results for each eKPI and for each technology within a technology's peer group.
90. The comparison uses percentiles to assign a score. For example, if the carbon net benefit result of a project financing fits between the 20th and 30th percentiles of the representative range of carbon outputs, the instrument scores 30 out of 100. This net benefit ranking is a best-in-class approach because it compares a particular financing's environmental impact against results achieved for each eKPI within the sector.
91. To derive the representative range, net benefit calculations use all the available project types in the peer group and a group of relevant countries. For example, within the renewable energy sector, we refer to the 61 countries responsible for 95% of power generation capacity, according to the Shift Project, the U.S. Energy Information Administration, and IEA statistics. The carbon net benefit for every type of renewable energy power generation technology considered in the peer group (such as wind, solar, and geothermal) is calculated to produce the representative range.
92. Each eKPI for a given sector has a weighting, informed by using Environmental Valuations to understand the most material environmental impact of a particular activity. For example, carbon may be weighted at 70%, water at 20%, and waste at 10% for a particular sector. The net benefit ranking is a weighted average of the individual eKPI percentile scores for each project. If there are multiple projects within a sector being funded by the same transaction, we weight each project (based on funding allocation) to achieve a sector-level net benefit ranking. For sectors that cross our hierarchy categories (for example, water and carbon), we provide a subsector total by hierarchy level.

Sector Hierarchy And Environmental Impact

93. After determining the sector (and subsector, if applicable) net benefit rankings, we apply our carbon, water, waste, or land use hierarchy. This places the final mitigation score within the broader context of different sectors. In effect, this limits the mitigation score that projects or portfolios with potentially uncaptured negative effects are able to achieve (see chart 2). The

carbon hierarchy differentiates between long-term green solutions and environmental impact reduction. For example, after applying the hierarchy, a clean coal project would not be able to achieve as high a score as a renewable energy project. Importantly, the hierarchy does not exclude any project type from the evaluation. The water hierarchy differentiates between system enhancements and demand-side improvements. The waste hierarchy differentiates between reductions in waste and pollution and waste management improvements. The land use hierarchy differentiates between maintenance of the natural state of ecosystems and intensive land use.

94. The water, carbon, waste, and land use hierarchy scores range from 0 (for example, extending the use of fossil fuel) to 100 (for example, renewables contributing to systemic change) and carry weights of 60%-75% (see table 2). Higher hierarchy scores carry a heavier weight because we believe those projects are contributing the most environmental benefit. To determine the environmental impact score, we combine the weighted hierarchy score with the weighted net benefit ranking of each project or sector. The net benefit rankings are weighted 25%-40%.

Table 2

Carbon, Water, Waste, And Land Use: Hierarchy Scores And Weighting

Sector	Tier	Description	Hierarchy score (0-100)	Weighting of hierarchy score (%)	Weighting of net benefit ranking (%)
Carbon					
	1	Systemic decarbonization	100	75	25
	2	Significant decarbonization through low-carbon solutions	90	70	30
	3	Decarbonization by alleviating emissions of carbon-intensive industries	80	65	35
	4	Decarbonization technologies with significant environmental hazards	50	60	40
	5	Improvement of fossil-fueled activities' environmental efficiency	0	60	40
Water					
	1	System enhancements	100	75	25
	2	Marginal system enhancements	75	70	30

	3	System enhancements with significant negative impacts	62.5	70	30
	4	Demand-side improvements	50	65	35
Waste					
	1	Waste reduction	100	75	25
	2	Waste management with material reuse	90	70	30
	3	Waste management for energy recovery	80	65	35
	4	Waste management improvements	50	60	40
Land use					
	1	Maintenance of natural state	100	85	15
	2	Low human intervention	100	75	25
	3	Alternative farming	90	70	30
	4	Improvements in conventional agriculture and forestry	80	65	35
	5	Intensive land use	50	60	40

Source: S&P Global Ratings.

Carbon hierarchy

95. The carbon hierarchy (see table 3) is based on an assessment of a technology's overall contribution to decarbonization of the economy. We apply the land use hierarchy to projects in the agriculture and forestry sectors, the waste hierarchy to projects in waste management, and the water hierarchy to projects in the water sector (see paragraphs 101-117). We apply the carbon hierarchy to projects in energy, buildings, transportation, fossil fuels, and industrial efficiency sectors.
96. Projects contributing to systemic decarbonization are on the top rung of the carbon hierarchy. These include green energy projects and demand management.
97. The second level in the carbon hierarchy includes sector-specific solutions that are already compliant with a decarbonized, or green, economy. These include fully electric transport solutions or net-zero buildings (with zero net energy consumption). For instance, electric vehicles may achieve limited environmental benefits because of the carbon content of their

electricity use, but as systemic change to the electricity grid takes place, the long-term benefits are likely to be significant.

98. Industrial efficiencies and energy efficiency projects with significant potential for environmental benefit (lowering the impact of carbon-intensive activities) come third in our hierarchy. These project types--for example, a hybrid vehicle--optimize the environmental impact of existing technologies rather than promoting new low-carbon solutions.
99. Projects that achieve immediate, and often meaningful, environmental benefits, but at the same time prolong the use of fossil fuels, are ranked lowest. This is because these projects lock in emissions for the long term (see "The effect of natural gas supply on US energy and CO_2 emissions," Christine Shearer et al., Environmental Research Letters, 9 094008, Sept. 24, 2014).

Table 3
Carbon, Water, Waste, And Land Use Hierarchies

Sector	Technology
Carbon	
Tier 1: Systemic decarbonization	Green energy: Wind power
	Green energy: Solar power
	Green energy: Small hydro
	Green energy: Large hydro (excluding tropical areas)
	Energy efficiency: Energy management and control
Tier 2: Significant decarbonization of key sectors through low-carbon solutions	Green transport without fossil fuel combustion
	Green buildings —new build
Tier 3: Decarbonization by alleviating emissions in carbon-intensive industries	Energy efficient projects (industrial efficiencies and energy star products)
	Green transport with fossil fuel combustion
	Green buildings refurbishment
Tier 4: Decarbonization technologies with significant environmental hazards	Nuclear power
	Green energy: Large hydro in tropical areas
Tier 5: Improvement of fossil fuel-based activities' environmental efficiency	Fossil fuel power plants: Coal to natural gas
	Fossil fuel power plants: Cleaner fuel production
	Fossil fuel power plants: Cleaner use of coal
Water	
Tier 1: System enhancements	Recycling wastewater to supply potable municipal water
	Recycling wastewater to supply non-potable water for agricultural uses
	Recycling wastewater to supply non-potable water for other industries

	Wastewater treatment with no energy recovery
	Wastewater treatment with energy recovery
Tier 2: Marginal system enhancements	Reducing water losses in the water distribution network
Tier 3: System enhancements with significant negative impacts	Water desalination to supply potable municipal water
Tier 4: Demand-side improvements	Conservation measure in residential buildings
	Conservation measure in commercial buildings
	Conservation measure in industrial buildings
	Smart metering in residential buildings
Waste	
Tier 1: Waste reduction	Reduction in food loss
Tier 2: Waste management with material reuse	Aerobic composting with fertilizer reuse
Tier 3: Waste management for energy recovery	Anaerobic digestion
	Gasification/pyrolysis with waste feedback
	Waste to energy
Tier 4: Waste management improvements	Hazardous waste management
Land	
Tier 1: Maintenance of natural state	Land restoration to natural state
	Forest protection and restoration
Tier 2: Low human intervention	Low tillage
	Forestry expansion for non-timber forest products
	Forestry protection
Tier 3: Alternative farming	Sustainable fertilizers
	Organic farming
	Drought-resistant crops
	Rotational grazing
Tier 4: Improvements in conventional agriculture and forestry	System of rice intensification
	Precision agriculture and livestock
	Sustainable forest management for timber production
Tier 5: Intensive land use	Plantation forestry
	Crop-based products (biofuels)
	Land restoration to agriculture

Source: S&P Global Ratings.

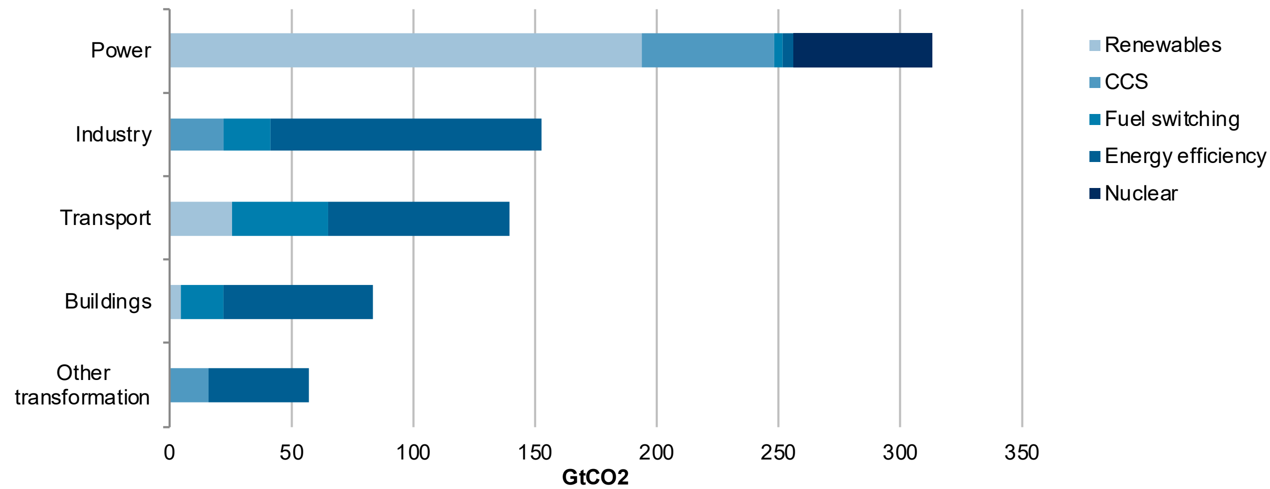
100. The principles applied to establish this hierarchy are:

- Systemic solutions prevail over sector-specific solutions: Decarbonizing electricity affects not only the power sector, but also the entire carbon intensity of economies as electricity feeds through all other economic sectors (Scope 2 emissions as defined under the Greenhouse Gas Protocol). Because of this, solutions affecting this central aspect of energy transition have a wider reach than sector-specific solutions as they allow systemic change. For instance, the deployment of electric vehicles is highly dependent on an optimal energy demand management (smart grid solutions).

- Compare low-carbon solutions with technologies that provide marginal improvement: The hierarchy distinguishes between low-carbon solutions (such as electric vehicles), which are already compliant with a low-carbon economy, and "intermediary" technologies that aim to achieve environmental savings through a marginal improvement of carbon-intensive processes (such as hybrid vehicles). Although the latter might achieve significant savings by improving a very intensive baseline, it does not directly contribute to the deployment of low-carbon solutions.
- Isolate sectors with a particularly negative environmental impact: Large hydropower projects in tropical areas (of more than 30 megawatts) produce low-carbon energy. However, we differentiate these projects from other renewable electricity generation given the significant methane emissions from rotting vegetation in large reservoirs in tropical areas (see "Do Hydroelectric Dams Mitigate Global Warming? The Case of Brazil's CuruA-una Dam," P. M. Fearnside, Mitigation and Adaptation Strategies for Global Change, Volume 10, Issue 4, pages 675-691, published October 2005). The significant carbon-intensity of uranium mining (see G.M. Mudd and M. Diesendorf) and uncertainty about hazardous nuclear waste management lead us to rank nuclear energy near the bottom of our green hierarchy, despite its low-carbon intensity during operations.
- Consider a broad green universe: Country-specific standards may differ from industry-accepted taxonomies, such as the Green Bond Principles or Climate Bonds Initiative. The inclusion of the clean use of coal or clean fossil fuel production in the Chinese Green Bonds standards underlines the lack of consensus about how green these activities are and that the fossil fuel sector is still developing.
- Place projects that help to extend fossil fuels' lifespan at the bottom of the scale: Although a very carbon-intensive baseline can make the net environmental benefit of fossil-fuel plants retrofit from coal to gas transition or to clean coal significantly positive, these projects increase further fossil fuel usage and create "locked-in emissions" (see Christine Shearer et al., Sept. 24, 2014).
- Apply a carbon dioxide reduction potential approach: The IEA has estimated the potential carbon emissions reduction achievable per sector in a low-carbon scenario, compared with business as usual.

Chart 4

Cumulative CO2 Reductions By Sector And Technology In The Two-Degree Scenario To 2050



Note: A portfolio of low-carbon technologies is needed to reach the two-degree scenario; some solutions will be broadly applicable, while others will need to target specific sectors. CCS--Carbon capture and storage.
Source: International Energy Agency (2015), Energy Technology Perspectives 2015, OECD/IEA, Paris.

Water hierarchy

101. For the water projects listed in paragraphs 73-75, we apply our water hierarchy--and not the carbon hierarchy. We have divided our water hierarchy into four tiers, based on the project's type of impact:

- System enhancements,
- Marginal system enhancements,
- System enhancements with significant negative impact, and
- Demand-side improvements.

System enhancements:

102. Directly or indirectly increase the availability of fresh water. Projects that fall into the top tier of the water hierarchy are those that directly or indirectly increase the availability of fresh water. These are projects that do not have a significant negative water impact and deliver fresh water through the construction of new infrastructure. For instance, a wastewater recycling plant that delivers water to agriculture will fall into this tier of the hierarchy.

Marginal system enhancements:

103. Improve the delivery of existing freshwater supplies. The projects that fall into the second tier of the hierarchy are those that directly or indirectly improve the delivery of fresh water through existing infrastructure. This second tier is for projects that upgrade existing water infrastructure, rather than build new infrastructure, and do not have any significant negative

water impact. An example would be upgrading the water distribution network by reducing leakage from pipes.

System enhancements with significant negative impact:

104. Increase the availability of fresh water but have a significant negative environmental impact. The projects that fall into the fourth tier increase the availability of fresh water by building new infrastructure but cause a significant negative water impact in the process. For instance, this includes the construction of seawater desalination plants that dispose of waste saline solution, a byproduct of the desalination process, back into seawater.

Demand-side improvements:

105. Measures that reduce the demand on potable water supplies. Projects that fall into the fourth tier of the hierarchy are those that reduce the demand on potable water supplies. These projects install technologies that aid in reducing the demand on freshwater sources in residential, commercial, or industrial settings. For instance, they can include the installation of smart meters in residential buildings or the installation of more efficient kitchen appliances in commercial buildings.

106. While the principles behind the carbon, water, waste, and land use hierarchies are similar, the definitions of systemic changes differ slightly for the different hierarchies. This is because, when considering carbon projects, systemic change refers to decarbonizing power supply networks. It is substituting the use of fossil fuels with renewable energy sources, such as wind and solar. For water supply networks, systemic change involves substituting ground water withdrawals with infinitely (locally) recycled surface water, where water is not treated as a once-used commodity (similar to using carbon one time by burning it to generate energy). For the agriculture and forestry hierarchy, systemic change involves restoring and regenerating degraded land and protecting biodiversity. For the waste hierarchy, systemic change involves reducing the quantity of raw materials required to produce goods and services and minimizing the polluting impacts of waste.

Waste Hierarchy

107. For waste projects (see paragraphs 79-80), we apply our waste hierarchy (not the carbon, water, or land use hierarchy). We divide the waste hierarchy into four tiers based on the project's type of impact:

- Waste reduction,
- Waste management with material reuse,
- Waste management for energy recovery, and
- Waste management improvements.

Waste reduction: Reduce quantity of waste produced and prevent pollution.

108. Projects that fall into the first tier of the waste hierarchy are preventative measures, which avoid or eliminate the amount of waste and pollution produced and thereby divert waste volumes from the local waste treatment pathway. These projects offer production efficiencies that reduce the amount of waste and pollution produced.

Waste management with material reuse: Recovery of resources from waste with materials reuse.

109. Projects that fall into the second tier of the waste hierarchy involve the reuse of waste products for use in other products. By reusing the waste as a material resource, these technologies support the transition to a circular economy.

Waste management for energy recovery: Recovery of resources from waste for energy.

110. Projects that fall into the fourth tier of the waste hierarchy involve the reuse of waste products for energy generation. Technologies such as waste-to-energy plants incinerate waste intended for landfill and capture waste gas for power generation. By reusing the recovered gas, these technologies contribute to reduced GHG emissions and land pollutants. On the other hand, we believe those technologies have a lower contribution to a circular economy than technologies that fall in the waste management with material reuse category because the waste used for energy recovery reaches the end of its utility in the economy.

Waste management improvements: Improved waste management with no reuse.

111. Projects that fall into the fourth tier of the waste hierarchy provide improvements in the environmental impact of the waste management system with no reuse of materials or energy recovery. Technologies such as hazardous waste incineration eliminate the toxic constituents in the waste stream and reduce the volume of hazardous waste to manage.

Agriculture and forestry hierarchy

112. For the agriculture and forestry projects listed in paragraphs 81-88, we apply our land use hierarchy--and not the carbon, waste, or water hierarchy. We have divided our land use hierarchy into five tiers, based on the impact the project has on land use and quality, with higher scores reserved for projects that maintain land in its natural state or minimize human impacts on ecosystems:

- Maintenance of natural state,
- Low human intervention,
- Alternative farming,
- Improvements in conventional agriculture and forestry, and
- Intensive land use.

Maintenance of natural state: Restore and rehabilitate land to its pristine, natural state.

113. Projects that fall in the top tier of the land use hierarchy are those that return degraded land to its natural state and thereby enhance above- and below-ground biodiversity, improve soil quality, support climate change adaptation and mitigation, and optimize water cycling and storage. By returning the environment in its natural state, those projects enable permanent habitats for ecosystems to thrive over the long run, thereby bringing more environmental benefits than other projects in the scope of our green transaction evaluation, in our view.

Low human intervention: Minimal disturbance of land for human use.

114. Projects that fall into the second tier of the land use hierarchy are those that prevent or reduce the impact on land degradation from human land use. Technologies such as low or no agricultural tillage are intended to achieve sustainable food production with minimal impact

on the soil and the atmosphere, while also supporting soil and water conservation. Similarly, forestry protection projects maintain forestland used for human purposes at a rate that maintains their biodiversity, productivity, and regeneration capacity.

Alternative farming: Farming practices that improve land resilience over the long term.

115. Projects that fall into the third tier of the land use hierarchy change agricultural practices to significantly lessen their environmental impact over the long term by avoiding the use of intensive chemicals and pesticides, reducing water demand, or both. For instance, organic farming reduces the use of pesticides and fertilizers, thereby supporting improved soil quality, carbon sequestration, and biodiversity.

Improvements in conventional agriculture and forestry: Improve yields from conventional agricultural production that relieves pressure on land elsewhere.

116. Projects that fall into the fourth tier of the land use hierarchy are conventional farming practices that achieve higher agricultural yields without significant land disturbance. The main environmental benefit of those projects is to reduce the need for converting additional land for agricultural purposes. For instance, rice intensification supports an increase in the productivity of irrigated rice by changing the management of plants, soil, water, and nutrients. We also include sustainable forest management for timber production, which improve land use compare to conventional timber production.

Intensive land use: Significant land use with somewhat lower environmental impact.

117. Projects that fall into the fifth tier of the land use hierarchy are those that deliver some environmental benefits while requiring intensive use of land. Although a very carbon-intensive baseline can make the net environmental benefit of biofuels significantly positive, these projects require further land conversion for human use, resulting in increased water demand and degraded soil quality. Similarly, restoration of degraded lands for agricultural use may improve the condition of the land in the short term but is likely to result in some impact on biodiversity, conservation, and erosion protection.

Example of applying the hierarchy

118. Table 4 shows a simplified example of a best-in-class fossil fuel project and a worst-in-class green energy project before and after application of the hierarchy.

Table 4

Example: Best-In-Class Fossil Fuel Versus Worst-In-Class Green Energy Project

Sector	Net benefit ranking (0-100)	Weight (%)	Hierarchy score (0-100)	Weight (%)	Environmental impact (0-100)
Best clean coal project	100	40	0	60	40
Worst green energy project	0	25	100	75	75

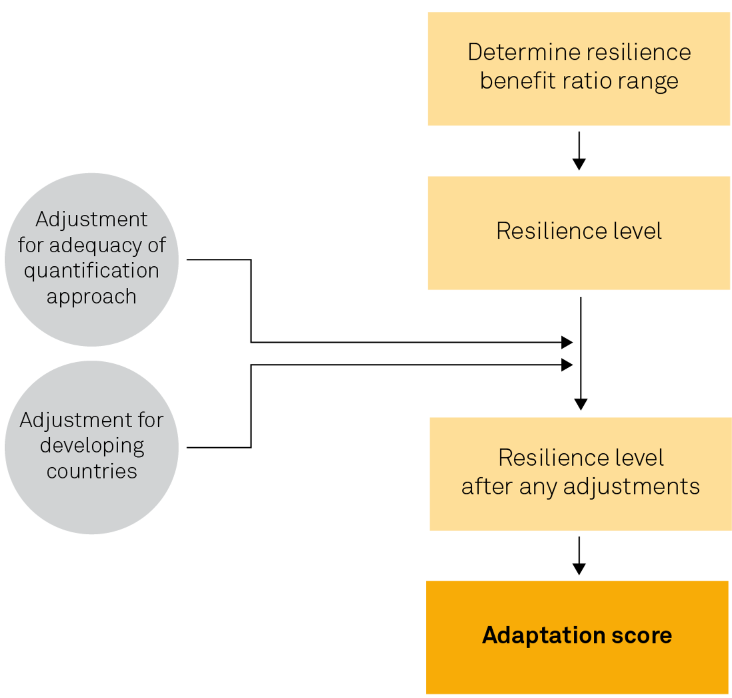
Source: S&P Global Ratings.

D. Adaptation

119. We base our evaluation of an adaptation project on the increase in resilience the project is likely to provide for the covered geographical area or asset base. This results in the adaptation score (see chart 5).

- First, we quantitatively evaluate the benefit of the added resilience, relative to the amount of the financing's proceeds, on a five-point scale. The benefit is the forecast reduction in the cost of expected damages caused by extreme weather events. It is based on an entity's analysis, to which we may apply quantitative adjustments.
- Second, we modify the evaluation score produced in the first step, based on our qualitative view of the adequacy of an entity's quantification approach, to determine the resilience benefit.
- Third, we may apply additional adjustments in certain cases--for example, for projects that are in developing countries where the resilience benefit may be understated because the likely significant social benefits are difficult to quantify.

Chart 5
Determining The Adaptation Score



120. We assess the environmental benefit on a five-point scale based on the resilience benefit ratio (see table 5). We define this as the ratio of the resilience benefit and the financing derived

from the bond's proceeds. The rationale underpinning the calibration of the scale is further described in appendix 2 of "Evaluating The Environmental Impact Of Projects Aimed At Adapting To Climate Change," published on Nov. 10, 2016.

Table 5

Resilience Benefit Scale

Resilience level	Range of resilience benefit ratio
1	>=4
2	>=3 and <4
3	>=2 and <3
4	>=1 and <2
5	<1

Source: S&P Global Ratings.

121. After considering any adjustments made in stages 2 and 3, the resilience level is mapped to an adaptation score (see table 6).

Table 6

Deriving The Adaptation Score

Resilience level*	Adaptation score
1	100
2	75
3	50
4	35
5	0

*Including any adjustments. Source: S&P Global Ratings.

Determining the resilience benefit ratio range

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

123. To determine the resilience benefit, we review the analysis an entity has already performed, in which it has quantified the benefit expected as a result of the capital expenditure. Typically, this analysis is part of the design process and is used to assess a project's viability. In our view, resilience benefits go beyond financial benefits and include reduction in humanitarian and ecological damage, both directly and indirectly. Although it is

often difficult to put a financial value on those benefits, experts in the adaptation field have developed methodologies to capture these elements. To the extent that these factors are reflected in the benefit analysis an entity performs, we include them in our adaptation analysis.

124. Adaptation projects chiefly provide benefits in the case of extreme events, which are uncertain and require probabilistic representation. Therefore, methodologies used for funding purposes normally require that the benefit assessment is done on a probabilistic basis. In practice, these assessments incorporate the benefit over a variety of modeled events covering different severities of impact and probabilities of occurrence. The evaluation is also often performed over different long-term climate scenarios, incorporating projections of how climate change might develop and exposure to the resulting risks might grow. If the benefit analysis is not performed on a probabilistic basis, it is likely, with some exceptions, that we will assess the resilience level at the lowest level (5, or adaptation score of 0 out of 100).

125. Methodologies and assumptions used for different projects and in different countries vary, and those differences affect the quantification of the benefit. Differences in the methods and key assumptions used are often justified by the specific nature of the projects. Also, those differences reflect the uncertainty regarding how policies for reducing carbon dioxide emissions affect future carbon dioxide levels and the lack of scientific agreement about the impact of those climate change scenarios on extreme weather events. For example, some entities may calculate a greater benefit because their models assume that climate change may have a more severe impact on extreme weather events.

126. We consider the magnitude of the benefit as quantified by the entity seeking financing, regardless of how sophisticated the analyses are. However, we require that the key elements of the benefit assessments be performed by an independent third party. These elements are:

- Probabilistic simulation approach to generate a sample of weather events and their financial impact,
- Climate change projections and their impact on the adaptation project, and
- Quantification of humanitarian and ecological benefits.

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

128. In determining any quantitative adjustments, we may use sensitivity analysis to assess the impact that any changes in key assumptions could have on the size of the benefit. We may use this to adjust the resilience benefit if we consider some of the tested alternative assumptions

to be more appropriate than the central assumptions (for example, discount rates or climate change scenario).

129. In calibrating our adaptation scale, we considered two studies: Mechler's review of the literature on the benefit of adaptation projects ("Reviewing estimates of the economic efficiency of disaster risk management: opportunities and limitations of using risk-based cost-benefit analysis") and ECONADAPT project report "Assessing the economic case for adaptation to extreme events at different scales".

130. The lowest resilience level (5) indicates an adaptation project that would provide a lower benefit than the financing amount. To achieve the highest resilience level (1), the resilience benefit ratio must be at least 4x, which is approximately the average and median figures reported in those studies. Our rationale is that this represents a significant resilience benefit relative to the cost of constructing the project. Furthermore, we do not consider it appropriate to differentiate above the 4x level because to do so could reward projects that address highly vulnerable infrastructure, but on a smaller scale, instead of addressing vulnerabilities on a bigger scale, which carry lower resilience benefits.

131. Our calibration assumes that the entire cost of the adaptation project is met through the financing raised by the green financing. If the adaptation project is partially funded from other sources, we prorate the resilience benefit.

Adjustment for adequacy of quantification approach

132. In the second stage in determining our resilience assessment, we may apply a qualitative adjustment to the initial assessment, based on whether we view the quantification of the resilience benefit as robust, adequate, or less than adequate. This adjustment reflects the risk of overstatement and understatement of the benefit relative to the initial assessment in stage one. Also, this adjustment could be used to reflect a smaller modeling uncertainty than in typical quantification approaches, which underlie the calibration of our resilience benefit scale.

133. In our qualitative assessment, we consider the following aspects of an entity's quantification approach:

- Scope of the model: Allows for all material benefits and negative impacts of the adaptation project.
- Modeling approach: Uses a probabilistic simulation approach to generate a sample of weather events representing the frequency, severity, and location of plausible events.
- Key financial modeling assumptions: Takes into account an assumed modeling period, as well as maintenance and financial assumptions (especially the discount rate), that are well justified and appropriate.
- Calibration data: Uses a long event history for calibration purposes.
- Key modeling assumptions: Bases vulnerability assumptions on a robust calibration.
- Exposure data: Sufficiently details exposure data to allow modeling of key damage drivers.
- Exposure growth assumptions: Allows for growth in exposure over the projection period, based on robust growth assumptions.

- Allowance for climate change and variability: Allows for projected climate change caused by global warming and climate variability in its modeling assumptions.
- Modeling uncertainty and sensitivity analysis: Considers the sensitivities of the benefit to alternative projections of climate change and exposure growth rates. Assesses the sensitivities of the key parameters of the modeled weather events and vulnerability assumptions.

134. Our qualitative assessment is adequate when, even though not all of the above factors are captured extensively and robustly, no key factor is missed and there are no reasons to believe the benefit is overstated. The typical quantification approach is normally assessed as adequate and our resilience benefit ratio scale incorporates the level of modeling uncertainty associated with that. For example, we consider that the methodologies used to gain public-sector funding in developed countries or financing from international development banks are a good benchmark for our adequate assessment. We therefore make no adjustment when we assess the quantification analysis as adequate.

135. When we consider the quantification approach robust--implying that it incorporates less modeling uncertainty than typical quantification approaches--we would reduce the assessment by one (for example, to resilience level 2 from resilience level 3). We expect this may be the case for projects that are designed to allow for the uncertainties of estimating the impact of climate change. Such projects are typically flexible, allowing adjustments to their structure over time (for example, the height of flood defenses) to reflect improvements in the understanding of how climate change is likely to affect the covered area. We would apply this positive adjustment if the quantification strongly reflects the modeling factors listed in paragraph 133.

136. We may assess the quantification as less than adequate when some of the listed modeling factors are not captured appropriately or not reflected at all. If the quantification approach is less than adequate, we would increase the assessment by one because there may be a considerable risk that the resilience benefit is overstated.

Adjustment for developing countries

137. In the third stage, we apply additional adjustments for projects in developing countries. If no probabilistic benefit analysis has been performed, we could assess it at resilience level 4 if the entity can provide another type of analysis (such as a scenario-based analysis) that demonstrates the benefit is likely to exceed the financing.

138. We anticipate using The Notre Dame Global Adaptation Index (ND-GAIN; http://index.gain.org/; see "Climate Change Is A Global Mega-Trend For Sovereign Risk") to identify countries that have high exposure to climate risk and high vulnerability. In our view, improved resilience in such countries is likely to have significant social benefits. Those potential benefits include fewer casualties, fewer displaced people, and fewer disrupted livelihoods following extreme weather events. If we believe these social benefits have not been adequately captured in the resilience analysis, we may modify the assessment, adjusting it upward by one level.

Examples of applying adjustments

139. Here are examples of how we could adjust the resilience level in the second and third stages of our adaptation assessment. If the resilience level in the first stage is 1, a positive adjustment in the second or third stage has no effect. Similarly, if the resilience level in the first stage is 5, a negative adjustment in the second stage has no effect. Furthermore, it does not neutralize a potential positive adjustment in the third stage. Hence, a positive adjustment in the third stage, for a project in a developing country, could result in a resilience level of 4.

140. On the other hand, if, in the first stage, we determine the resilience level is 2, 3, or 4, and we then factor in a negative adjustment in the second stage, the resilience level could be adjusted downward to 3, 4, or 5, respectively. A positive developing country assessment (in the third stage) on that same project could then move the resilience level back to 2, 3, or 4, respectively.

E. Determining The Final E And R Scores

141. For mitigation projects, our transparency, governance, and mitigation scores together determine a Green Transaction Evaluation, which we map to a scale of E1 to E4, based on quartiles, to get the E score. For adaptation projects, our transparency, governance, and adaptation scores together determine a Green Transaction Evaluation, which we map to a scale of R1 to R4, again based on quartiles, to get the R score (see table 7).

Table 7

Composition Of The E And R Scale

Green Evaluation	E score	R score
75-100	E1	R1
50-74	E2	R2
25-49	E3	R3
0-24	E4	R4

***Including any adjustments.** Source: S&P Global Ratings.

142. The overall Green Transaction Evaluation, on a scale of 0-100, consists of a weighted average of mitigation or adaptation, governance, and transparency. The weights are 60% for mitigation or adaptation, 25% for governance, and 15% for transparency. If both mitigation and adaptation are relevant, the overall Green Transaction Evaluation will consist of two separate assessments--one for the mitigation part and another for the adaptation part, both on a scale of 0-100.

143. We believe efficient governance processes have to be in place for the proceeds to achieve their environmental impact. Governance factors relating to proceeds management increase the likelihood that proceeds are used for climate change mitigation and adaptation, and, as such, we deem them relatively more important than environmental reporting and disclosure. We therefore weight the governance score more heavily than transparency.

144. At the same time, we believe that transparency and governance do not enhance the overall environmental impact, assuming the assets function as expected. As such, in deriving the final Green Transaction Evaluation, we cap both transparency and governance at the level of the mitigation or adaptation score. If transparency or governance is as good as or better than the mitigation or adaptation score, the effect is neutral on our final Green Transaction Evaluation. However, if transparency or governance is lower than mitigation or adaptation, the final Green Transaction Evaluation will be negatively affected.

145. The calculation to derive the Green Transaction Evaluation is x*G(capped)+y*T(capped)+z*M (see table 8).

Table 8

Carbon, Water, Waste, And Land Use Hierarchies

	Score (0-100)	Capped scores	Weight (0-100%)
Governance	G	if G > M then G(capped) = M	x
Transparency	T	if T > M then T(capped) = M	y
Mitigation or adaptation	M or A	M = M, A = A	z
Final E score	x * G(capped) + y * T(capped) + z * M		
Final R score	x * G(capped) + y * T(capped) + z * A		

Source: S&P Global Ratings.

146. Tables 9-11 provide examples. The capped and weighted scores are combined to derive the Green Transaction Evaluation on a scale of 0-100 (see table 8, left-hand column).

Table 9

Strong Transparency And Governance Have A Neutral Impact On Strong Mitigation Or Adaptation Score

	Score (0-100)	Capped scores	Weight (0-100%)	Weighted subscores
Governance	95	90	25	22.5
Transparency	95	90	15	13.5
Mitigation or adaptation	90	N/A	60	54
Green evaluation				90

Source: S&P Global Ratings.

Table 10

Strong Transparency And Governance Provide No Uplift To Weak Mitigation Or Adaptation Score

	Score (0-100)	Capped scores	Weight (0-100%)	Subscore (0-100)
Governance	95	10	25	2.5
Transparency	95	10	15	1.5

Mitigation or adaptation	10	N/A	60	6
Green evaluation				10

Source: S&P Global Ratings.

Table 11

Weak Transparency And Governance Have A Negative Impact On Mitigation Or Adaptation Score

	Score (0-100)	Capped scores	Weight (0-100%)	Subscore (0-100)
Governance	40	40	25	10
Transparency	40	40	15	6
Mitigation or adaptation	80	N/A	60	48
Green evaluation				64

N/A/--Not applicable. Source: S&P Global Ratings.

147. When less than 100% of the proceeds are allocated to green projects, we evaluate the proportion of proceeds that is allocated to environmentally beneficial projects. In such cases, we make clear the portion of the proceeds that has been evaluated by putting a percentage after the score (e.g., E2 (50%)). For example, if an instrument was evaluated as E2 with an underlying evaluation of 74 and the entire use of proceeds fell within the scope of our approach, the resulting Green Transaction Evaluation would be E2 (100%). Similarly, if only 50% of proceeds were earmarked for in-scope projects, the resulting score would be E2 (50%). The portion of proceeds would not affect the underlying Green Transaction Evaluation of 74 on our scale of 0-100.

REVISIONS AND UPDATES

On Oct. 16, 2020, we changed the name of this article to "Sustainable Finance External Reviews & Opinions" from "Green Evaluation Analytical Approach" to provide transparency on the range of offerings S&P Global ratings provides. We also added S&P Global Ratings' new second-party opinion on a Social and/or Sustainability Framework's alignment with ICMA's SBP and/or the GBPs, respectively (collectively the SBG).

On June 5, 2020, we republished this article to incorporate S&P Global Ratings' new second-party opinion on a Green Financing Framework's alignment with the Green Bond Principles and the Green Loan Principles.

On April 16, 2020, we republished this article to correct the labeling of the third and fourth tiers of the land use hierarchy in tables 2 and 3, and in table 2 some of the hierarchy weights, hierarchy scores, and net benefit scores. We also corrected the position of alternative farming technologies in our land use hierarchy in paragraphs 115-117, as well as chart and table references.

We previously republished this article on Dec. 4, 2019, to incorporate the agriculture and forestry and waste management sectors and the analysis of several new technologies within the existing green energy, water, and fossil fuel power plant sectors.

The Dec. 4, 2019, version supersedes "Green Evaluation Analytical Approach," published on April 26, 2017.

We made the following changes to the version published on April 26, 2017:

- We have incorporated two additional sectors, agriculture and forestry and waste management, and added several new technologies within the existing green energy, water, and fossil fuel power plant sectors.
- The green energy technology sector now includes biomass cogeneration and fuel cells.
- The water technology sector now includes improved irrigation, biofiltration wastewater treatment with energy recovery, and biofiltration wastewater treatment with no energy recovery.
- The fossil fuel power plants sector now includes flue gas desulfurization, cogeneration, oil refinery efficiency, and reduced-flaring technologies.
- We've incorporated three new environmental key performance indicators, including land pollution, eutrophication, and air emissions from sulfur oxides, which are used in the net benefit ranking for agriculture and forestry and waste management technologies.
- Hierarchies for agriculture and forestry and waste management projects were developed for technologies in these sectors.

GLOSSARY

Baseline

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

Construction/Implementation impacts

These are the impacts associated with the initial phase of a project, before it starts achieving environmental benefits. For physical infrastructure, the impact associated with the construction phase is accounted for as construction emissions. For projects focused on technology implementation, the implementation impact accounts for the impact associated with the deployment of the technology.

Green Bond Principles or Green Loan Principles

These are voluntary guidelines developed by the International Capital Markets Association and Loan Market Association that clarify the approach for issuance of a green bond or raising a green loan, respectively.

Grid emissions factor

This refers to a carbon dioxide emissions factor (tCO_2/MWh), which is the carbon intensity per unit of electricity generation in the grid system, according to the UN Framework Convention on Climate Change.

Economic life

This is the timespan during which the project makes an economic contribution before being decommissioned.

Eutrophication

This is caused when agricultural fertilizers, manure, organic waste, and other matter leach into bodies of water and disrupt aquatic ecosystems.

Environmental valuation

This refers to the analysis of methods for obtaining empirical estimates of environmental values, such as the benefits of improved river water quality or the cost of losing an area of wilderness to development.

Modal shift

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

Modal split

The distribution of transportation means used by passengers, depending on the city or city type. Depending on geographies, the prevalence of private cars as a means of transportation will vary, which affects the CO_2 savings that can be attributed to a given public transport infrastructure. Indeed, the more carbon-intensive the initial modal split is, the more a modal shift to a low-carbon public transport will avoid emissions.

Smart grid

Electricity network that uses digital and other advanced technologies to minimize costs and environmental impact while maximizing system reliability, resilience, and stability, according to the IEA.

2-degree scenario

Holding the increase in the global average temperature to well below 2 degrees above pre-industrial levels. This is the main objective of the Paris Agreement.

Water scarcity

A region is considered to be experiencing water scarcity when annual water supplies drop below 1,000 cubic meters (m^3) per person (source: UN).

Related Research

S&P Global Ratings research

- Sustainable Finance External Reviews And Opinions Q&A: Transaction And Framework Alignment Opinions With The Green Bond, Green Loan, And Social Bond Principles, Oct. 16, 2020
- Led By Green Bonds, The Sustainable Debt Market Looks To Surge Ahead, Feb. 13, 2020
- Could Agriculture And Forestry Be The New Frontier For Green Bonds? Dec. 4, 2019
- Infrastructure Seeks A Circular Solution To Sustainability, Dec. 4, 2019
- Sink Or Swim: The Importance Of Adaptation Projects Rises With Climate Risks, Dec. 3, 2019
- Evaluating The Environmental Impact Of Projects Aimed At Adapting To Climate Change, Nov. 10, 2016

Other research

- Sustainability of uranium mining and milling: toward quantifying resources and eco-efficiency, G.M. Mudd and M. Diesendorf, Environmental Science and Technology, 42: 2624-2630, 2008
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This report does not constitute a rating action.

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Oct. 16, 2020