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ARCHIVE | Analytical Supplement:

Second Party Opinions And Transaction Evaluations

Dec. 7, 2022

This article was retired on Jul. 27, 2023. Please see "Analytical Approach: Second Party Opinions: Use Of Proceeds."

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Overview And Scope

1. This article is an analytical supplement document and intended to be read in conjunction with the analytical approach for "Second Party Opinions And Transaction Evaluations", formerly known as "Sustainable Financing Opinions" or "Sustainable Finance External Reviews and Opinions".
2. This article provides additional information about how we produce opinions on sustainable financing frameworks and transactions, including key assumptions, interpretations, and data requirements. It aims to provide greater transparency about the analytical process.

Second Party Opinions

3. The list of third-party principles and standards (collectively "the Principles") that are in scope for SPOs on the date of this article are:

   - ICMA's Green Bond Principles (GBP)
   - ICMA's Social Bond Principles (SBP)
   - ICMA's Sustainability Bond Guidelines (SBG)
   - ICMA's Sustainability-Linked Bond Principles (SLBP)
   - The Loan Market Association's (LMA), Asia Pacific Loan Market Association's (APLMA) and Loan Syndications and Trading Association's (LSTA) Green Loan Principles (GLP)
   - LMA/APLMA/LSTA's Social Loan Principles (SLP)
   - LMA/APLMA/LSTA's Sustainability-Linked Loan Principles (SLLP)
   - ASEAN Capital Markets Forum's Green Bond Standards (AGBS)

4. These Principles map to the analytical components of our SPO reports (see table 1). The number '1' indicates that the analytical component is relevant for the Principle, whereas '0' indicates that the analytical component is not relevant and would not be included in the analysis. An analysis of sustainability strategy will be relevant for the Principles and standards that we expect to add to the scope in due course, or are yet to be released.

Table 1

Principles And Analytical Components Matrix

Analytical Component	GBP	SBP	SBG	GLP	SLP	AGBS	SLLP	SLBP
Sustainability strategy	0	0	0	0	0	0	0	0
Use of proceeds	1	1	1	1	1	1	0	0
Process for project selection and evaluation	1	1	1	1	1	1	0	0
Management of proceeds	1	1	1	1	1	1	0	0
Selection of Key Performance Indicators (KPIs)	0	0	0	0	0	0	1	1
Calibration of Sustainability Performance Targets (SPTs)	0	0	0	0	0	0	1	1
Instrument characteristics	0	0	0	0	0	0	1	1
Reporting	1	1	1	1	1	1	1	1
Post issuance review	0	0	0	0	0	0	1	1

5. The key analytical question being addressed in each analytical component is listed in table 2.

Table 2

The Key Question Per Analytical Component

Analytical Component	Key Question

Sustainability strategy	How clear is the issuer's sustainability strategy and how do the instrument's ESG objectives link to it?
Use of proceeds	In the documentation, how clear is the issuer's commitment to using the funds raised for sustainability projects?
Process for project selection and evaluation	In the documentation, how clear is the issuer's process for selecting eligible projects?
Management of proceeds	In the documentation, how strongly does the issuer commit to maintain the investment of proceeds from the funding in eligible sustainability projects over the lifetime of the funding?
Selection of Key Performance Indicators (KPIs)	How relevant and well defined is the KPI in terms of tracking the issuer's meaningful sustainability efforts? (we ask this of all individual KPIs)
Calibration of Sustainability Performance Targets (SPTs)	How ambitious are the performance targets for each KPI?
Instrument characteristics	How clear is the link between observed KPI performance, as measured against targets, and the financing structures of the instrument?
Reporting	How robust is the issuer's disclosure practice on sustainability performance, and/or on how funds are used over the lifetime of the funding?
Post-issuance review	How does the issuer intend to update investors on the progress of sustainable debt post-issuance/closing in terms of funding allocations or performance against targets?

6. We seek evidence, in each of these analytical components, that the relevant Principles' requirements and suggestions are being addressed.
7. SPOs also include a mapping to the SDGs. This is based on the information articulated solely within the issuer's framework.

SPOs on Transactions

8. When providing SPOs on specific transactions, we will expect to see greater detail on the commitments made in the documentation, and we will therefore apply a more specific assessment to some of the analytical components.
9. Under the Reporting analytical component for a green transaction, for example, we seek to identify the types of metrics reported as 'satisfactory', 'strong', or 'advanced' in terms of details provided and precision used to report on the environmental impacts of funded projects.

Table 3

Reporting On Environmental Impacts Of Funded Projects

	Resilience
Satisfactory	Disclose total benefits/costs
Strong	Provides a breakdown of key elements of benefits/costs (e.g. physical damage, economic disruption, environmental benefit/damage, social benefit/damage
Advanced	Provides value of the benefits across alternative project scenarios, e.g. climate change projections and exposure growth

10. Metrics are specific to each type of environmental project. Table 4 indicates how we may differentiate between satisfactory, strong, or advanced based on the types of metrics disclosed.

Table 4

Disclosure Levels For Environmental Projects

	Green energy	Green transport	Energy efficiency	Green buildings	Fossil fuels	Nuclear	Water	Waste management	Reducing waste	Forest	Agriculture livestock	Agriculture land
Satisfactory	Country of project Installed capacity	Country of project Est. annual ridership or vehicle carbon intensity (gCO2e per km)	Country of project Est. or targeted energy savings (kWh)	Country of project Total energy use (kWh) Asset type	Country of project Installed capacity	Country of project Installed capacity	Country of project	Country of project Amt. of waste diverted from local waste treatment pathway	Country of project Crop type	Country of project Total land area under project	Country of project Total land area under project	Country of project Total land area under project
Strong	Est. annual output or capacity factor	Est. impact on modal split	Est. or targeted savings of the unit/s (% of total yearly consumption)	Est. or targeted savings compared to standard buildings Est. avoided impacts	Est. annual output or capacity factor Est. or targeted savings compared to the existing plant (%)	Est. annual output or capacity factor	Conservation projects: Exp. water savings from installation of new technology (%) Reuse and transmission projects: Exp. water supply from installation of new infrastructure (m3 per year) Wastewater treatment projects: Exp. water treatment from installation of new infrastructure (m3 per year)	Annual energy generation from nonrecyclable waste in energy/emission-efficient waste to energy facilities in MWh/GWh (electricity) and GJ/TJ (other energy) Energy recovered from waste (minus any support fuel) in MWh/GWh/KJ of net energy generated p.a. Amt. of fertilizer obtained Amt. of hazardous waste post-incineration sent to landfill	Waste that is prevented before and after the project in % of total waste and/or in absolute amount in tons p.a. (from the handbook) Impact reporting	Additional forested or protected areas (ha) Sustainable land use projects: Total sustainable wood/timber production volume (tons) (Technologies 3 and 4)	Ratio of crop type in feed Ratio of livestock by animal Density of livestock	Proportion of land fully regenerated Quantity of fertilizers and/or pesticides used per ha by type Quantity of irrigated water per ha Land use split prior to biofuel deployment (e.g. agriculture, forest) Yield per ha per crop type
Advanced	Est. avoided carbon emissions	Est. avoided carbon emissions	Est. avoided carbon emissions	Est. avoided carbon emissions	Est. avoided carbon emissions	Est. avoided carbon emissions	Net carbon emissions (tCO2e) Emissions from technology or infrastructure manufacture minus carbon emissions avoided from reduced water intake, treatment, and distribution	Hazardous waste projects: Est. avoided land pollution for hazardous waste management Other project types: Est. avoided carbon emissions from waste management before and after the project in tCO2–e p.a. (from the handbook Impact Reporting)	Est. avoided carbon emissions from waste management before and after the project in tCO2e per year (from the handbook)	Est. avoided carbon emissions	Est. avoided carbon emissions	Est. avoided carbon emissions Increasing carbon stock (tC/ha) per year

11. To meet the disclosure requirements for satisfactory, strong, or advanced, all projects within a sector must meet the full requirements for the relevant indicator type. For example, if two projects in green energy are satisfactory and two projects are strong, we would select satisfactory.

12. Impact indicators are also additive. For example, if a project has disclosures for the advanced and basic indicators, but does not have disclosures for the comprehensive indicators, we would assess it as basic.

13. In the context of performing an SPO on a specific transaction, we refer to the issuer's definition of what constitutes a beneficial use of proceeds, as long as we believe the project (or a discrete component thereof) falls within the scope of our published approach. For our transparency and governance scoring, we consider (among other things) the strategies, criteria, policies, and financing covenants that show that the proceeds have been, or will be, applied to eligible projects (as defined by the issuer).

    If an issuer communicates its intention to allocate all proceeds to beneficial projects, but some of the projects do not fall within the scope of our analytical approach for calculating a Transaction Evaluation, we can still provide an SPO on a green transaction. The transaction could still be eligible for an SPO if its entire governance and reporting commitments meet our conditions for alignment. Our Transaction Evaluations identify the proportion of the financing that we were able to evaluate using our methodology. Our reports also clearly state the proportion of funds the issuer has allocated or intends to allocate to beneficial projects. Say, for example, an issuer intends to allocate proceeds from a $150 million bond as follows: $100 million to a wind energy project (covered by our analytical approach) and $50 million to a sustainable fishing project (not covered by our analytical approach). In our report, we would note that the Transaction Evaluation on sustainable debt applies to 66% of the $150 million transaction, and all proceeds are funding beneficial projects (therefore meeting our first condition for alignment).

14. Our SPOs for Green Transactions do not meet the Climate Bonds Initiative (CBI) certification standard. There are several reasons for this:

    - Some green projects might be considered green under the GBP but are excluded from CBI certification standards, such as nuclear and fossil fuel projects.
    - Green SPOs and Transaction Evaluations are not certifications.
    - CBI certification requires reporting until all proceeds of the transaction are disbursed. Our SPOs and Transaction Evaluations are point-in-time analyses on actual or expected allocation of proceeds.

Transaction Evaluations on sustainable financing

15. Currently we can provide Transaction Evaluations on green or resilience transactions. Transaction Evaluations are intended to be consistent across project types and location. While green taxonomies vary globally, our approach considers various commonly used and established taxonomies. We have also developed our environmental contribution hierarchies to be consistent with international conventions and treaties, where applicable. Our carbon and land use hierarchies are based on systemic decarbonization, which is broadly aligned with the objectives of the 2015 UN Framework Convention on Climate Change (UNFCCC) Paris Agreement.

16. If requested by the issuer, we can include an SPO in our Green Transactions, which are point-in-time evaluations and become public only at the issuer's request.

Environmental Benefit Score

17. To determine the environmental benefit score, we calculate a weighted average of the benefit ranking based on project type and location, and the hierarchy score based on where the project fits within our environmental contribution hierarchy.

The difference between economic and lifecycle projects

18. An important factor when disclosing project benefits is the period the disclosure covers. For environmental projects, we view a quantitative and transparent evaluation of the environmental impact of the project over its full lifecycle more favorably than just the economic life of the asset. We can better understand the lifecycle (whole of life) impact on an annual basis if there are annualized impact indicators.

Mapping project types to contribution hierarchies and KPIs

19. We analyze the environmental benefit of financed projects according to the relevant benefits ranking and hierarchy score. Similar project types will use similar KPIs to derive the benefits ranking, and map to a single contribution hierarchy for environmental benefits analysis. Table 5 summarizes this mapping; KPI definitions are in table 7 and more details about the contribution hierarchies are available in tables 8-12.

Table 5

Environmental Project Types

Category	Project type	Environmental contribution hierarchy	Relevant KPIs
Transport	All	Carbon	Carbon intensity
Facilities	Green building	Carbon	Carbon intensity, water use
	Energy efficiency	Carbon	Carbon intensity
	Water efficiency	Water	Carbon intensity, water use
Utilities	Energy: renewables	Carbon	Carbon intensity, waste generation, water use
	Energy: nuclear	Carbon	Carbon intensity, waste generation, water use
	Energy: fossil fuels	Carbon	Carbon intensity, waste generation, water use, SOx emissions*
	Water	Water	Carbon intensity, water use
	Wastewater/sewage	Water	Carbon intensity, water use
	Waste management	Waste	Carbon intensity, water use, eutrophication§
Natural resource use	Agriculture: alternative farming†	Land use	Carbon intensity, water use, eutrophication, land pollutants
	Agriculture: improvements in conventional farming	Land use	Carbon intensity, water use, eutrophication
	Agriculture: crop-based products	Land use	Carbon intensity
	Agriculture: land restoration	Land use	Carbon intensity
	Forestry	Land use	Carbon intensity
	Water efficiency: agriculture	Water	Carbon intensity, water use
	Water efficiency: industrial	Water	Carbon intensity, water
	Energy efficiency: industrial	Carbon	Carbon intensity.

*For flue-gas desulfurization only. §For food loss reduction only. †Depending on the project's benefit, two or three or four possible eKPIs are considered. SOx--Sulfur dioxides.

Calculating the benefit ranking: KPIs and process

20. We rank a project's benefit, taking into consideration the project type and location.

21. We calculate the net benefit using conservative assumptions: without disclosure, we assume a similar project type and country mix with the lowest benefit. If the specific location is not known, we use the appropriate regional or global factors. If the details of the projects to be funded have not been disclosed, we assume a worst-case allocation scenario.

Calculating the environmental benefits

22. The benefit ranking is designed to compare the relative environmental benefit of the projects being financed. Our analysis compares the environmental benefits to a baseline scenario. For example, the baseline scenario for an energy project would be the business-as-usual emissions rate for the grid system in the region where the project is based. Our benefits calculation assumes that the project is completed and operational, and operates within average industry expectations for the technology.

23. For project types that rely on a certain level of environmental performance improvement from a baseline to receive a green label, such as green buildings, we typically use external certification to decide on the project eligibility for the net benefit calculation. To date, for green buildings we view the levels for each standard outlined in table 6 as the minimum threshold for eligible green projects. As more standards emerge for green buildings or other technologies, we expect to apply a similar approach.

Table 6

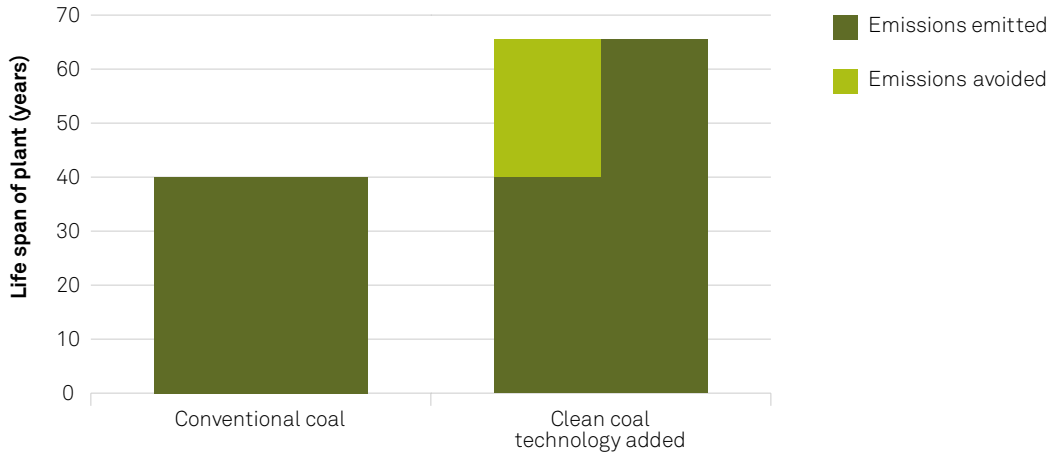
Green Building Certifications

Certificate	Recommended level
LEED	Gold or Platinum
BREEAM	Very Good or Outstanding
EDGE	Advanced or Zero Carbon
BOMA BEST	Gold or Platinum
Green Star	5-6 stars
Green Globes	Level 4
Energy Star	Minimum score of 85
CASBEE	A or S
EPC	A or B
National Green Building Standard	Gold or Emerald

24. Our analysis looks at all the significant stages of a project lifecycle, including the supply chain, construction, operations, and end of life. Some projects, such as clean coal, could score very well in terms of absolute quantities of carbon saved. However, in this scenario, the project would also 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 below).

Chart 1

Emissions Released Over Project Life Span



25. We do not model an expected growth or decline in energy demand or water availability. We work on the assumption that new generation assets will replace existing generation assets.

Environmental key performance indicators

26. Each eKPI for a given project has a weighting, informed by data from S&P Global Trucost 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.

27. The data definitions for the eKPIs are in table 7.

Table 7

eKPI Definitions

eKPI name	Definition
Carbon intensity: energy	Carbon dioxide emissions factor (tCO2/MWh), which is the carbon intensity per unit of electricity generation in the grid system, according to the 2015 UNFCCC Paris Agreement.
Carbon intensity: buildings	Carbon dioxide emissions factor (tCO2/m2) associated with energy use, and heat and cooling as well as construction of buildings.
Carbon intensity: transport	Carbon dioxide emissions factor (tCO2/passenger km) associated with the construction of transportation modes, as well as fuel combustion or electricity used in electric transport (e.g. light rail).
Carbon intensity: waste management	Carbon dioxide emissions factor (tCO2/ton) associated with treatment or decomposition of waste.
Carbon intensity: agriculture and forestry	Carbon dioxide emissions factor (tCO2/ha) associated with land use change and gases emitted during agricultural practices (e.g. N2O emissions from farms), including the production and application of inputs (e.g. energy, fertilizer, pesticides).
Waste generation	Total tons of mixed waste produced
Water use	Consumptive water that is not returned to the same basin from which it has been extracted (cubic meters).
SOx emissions§	Air pollution from fossil fuel combustion (kgSOx).
Eutrophication	Nutrient emissions to soil and water (kgN-eq/ha)† that contributes to eutrophic pollution events in water ecosystems (e.g. hypoxia).
Land pollutants	From pesticide and fertilizer production and use in agriculture, (kgDCBe/ha)‡.

*CO2 is carbon dioxide equivalent. §SOx is sulfur oxide. †N-eq is nitrogen equivalent. ‡DBCe is 1,4-dichlorobenzene equivalent
Note: Benefit rankings reflect the projected change in eKPI values compared to a baseline scenario.

Applying the environmental contribution hierarchies

28. The following sections (up until the Resilience Benefits Score section) outline projects associated with each tier of the contribution hierarchy, as well as the concepts of systemic change that drive the definitions of the different tiers. This indicates the project's relative contribution to improving the natural environment, including natural capital, or the mitigation of negative factors such as pollution and climate change over the project's lifecycle.

Table 8

Environmental Contribution Hierarchy Scores And Weighting

Tier	Rationale	Carbon	Land use	Waste	Water	Hierarchy score	Hierarchy weight
1	Projects that preserve or restore the natural environment.		Maintenance of natural state of ecosystems			100	85
2	Projects that bring systemic changes/solutions to their industry and directly or indirectly increase the availability of fresh water. Low human-intervention projects create potential for carbon sequestration.	Systemic decarbonization	Low human intervention	Waste reduction	System enhancements	100	75
3	Sector-specific solutions, which are already compliant with a decarbonized, or green, economy.	Significant decarbonization through low-carbon solutions	Alternative farming practices	Waste management with material reuse		90	70
4	Projects which improve the efficiency of conventional technologies.	Decarbonization by alleviating emissions of carbon-intensive industries	Improvements in conventional agriculture and forestry	Waste management for energy recovery		80	65
5	Projects to improve the delivery of existing freshwater supplies.				Marginal system enhancements	75	70

6	Projects to increase the availability of fresh water but have a significant negative environmental impact				System enhancements with significant negative impacts	62.5	70
7	Measures that reduce the demand on potable water supplies				Demand-side improvements	50	65
8	Projects with significant environmental hazards not captured in the net benefit ranking.	Decarbonization technologies with significant environmental hazards	Intensive land use	Waste management and incineration with no energy recovery		50	60
9	Fossil-fueled activities get the lowest score because of their long-term negative environmental impacts.	Improvement of fossil-fueled activities' environmental efficiency				0	60

Carbon hierarchy

29. We apply the carbon hierarchy to projects related to energy utilities, facilities, transportation, and industrial efficiencies. When considering carbon projects, systemic change refers to decarbonizing essential systems: it is substituting the use of fossil fuels with renewable energy sources.

30. We have developed our environmental contribution hierarchies to be consistent with international conventions and treaties, where applicable. The carbon and land use hierarchies are based on systemic decarbonization, which is broadly aligned with the objectives of the 2015 UNFCCC Paris Agreement.

Table 9

Carbon Hierarchy And Projects

Hierarchy tier	Project
Tier 2: 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 3: significant decarbonization of key sectors through low-carbon solutions	Green transport without fossil fuel combustion
	Green buildings--new build
Tier 4: 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 8: decarbonization technologies with significant environmental hazards	Nuclear power
	Green energy: large hydro in tropical areas
Tier 9: 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

31. **Systemic decarbonization:** Projects contributing to systemic decarbonization are on the top rung of the carbon hierarchy. These include renewable energy projects and demand management.

32. **Significant decarbonization of key sectors through low-carbon solutions:** This tier includes sector-specific solutions that already comply with a decarbonized, or green, economy. For example, 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 will likely be significant.

33. **Decarbonization by alleviating emissions in carbon-intensive industries:** This tier includes industrial efficiencies and energy-efficiency projects, with significant potential environmental benefits from lowering the impact of carbon-intensive activities. These projects optimize the environmental impact of existing technologies rather than promoting new low-carbon solutions.

34. **Decarbonization technologies with significant environmental hazards:** The projects that fall into this tier advance decarbonization but cause significant negative environmental impacts in the process. For instance, this includes the construction of nuclear power plants that require uranium mining and the disposal of radioactive waste.

35. **Improvement of fossil-fuel-based activities' environmental efficiency:** Projects that achieve immediate, and often significant, environmental benefits, but at the same time prolong the use of fossil fuels, are ranked lowest in the hierarchy. This is because these projects lock in emissions for the long term (see "The effect of natural gas supply on US energy and CO2 emissions," Christine Shearer et al., Environmental Research Letters, 9 094008, Sept. 24, 2014).

Land use hierarchy

36. For agriculture and forestry projects, we apply our land use hierarchy. For the land use hierarchy, systemic change involves restoring and regenerating degraded land and protecting biodiversity.

Table 10

Land Use Hierarchy And Projects

Hierarchy tier	Project
Tier 1: projects that preserve or restore the natural environment	Land restoration to natural state
	Forest protection and restoration
Tier 2: low human intervention	Low and no tillage
	Forestry expansion for non-timber forest products
	Forestry protection
Tier 3: alternative farming practices	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 8: intensive land use	Plantation forestry
	Crop-based products (biofuels)
	Land restoration to agriculture

37. **Projects that preserve or restore the natural environment, or restore and rehabilitate land to its pristine, natural state:** Projects that fall in this tier 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 to its natural state, these projects enable permanent habitats in which ecosystems can thrive over the long run, thereby bringing more environmental benefits than other projects in the scope of our green evaluation, in our view.

38. **Projects with low human intervention:** Projects that fall into this tier are those that prevent or reduce land degradation caused by 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 maintains forestland used for human purposes such that biodiversity, productivity, and regeneration capacity is maintained.

39. **Alternative farming practices:** Such methods improve soil quality and crop resilience over the long term. Projects that fall into this tier change agricultural practices to significantly lessen environmental damage over the long term by avoiding intensive chemicals and pesticides, or reducing water demand, or both.

40. **Improvements in conventional agriculture and forestry:** These usually lead to better yields and relieve pressure on land elsewhere. Projects that fall into this tier are conventional farming practices that achieve higher yields without significant land disturbance. Their main environmental benefit is to reduce the need for converting additional land for agricultural purposes. We also include sustainable forest management for timber production, which improves land use compared to conventional timber production.

41. **Intensive land use:** This can include significant land use that nonetheless causes less environmental damage than some other land uses. Projects that fall into this tier are those that deliver some environmental benefits while still requiring intensive land use. Although a very carbon-intensive baseline can render the net environmental benefit of biofuels significantly positive, these projects require further land conversion for human use and so increase water demand and degrade soil quality. Similarly, restoration of degraded lands for agricultural use may improve the condition of the land in the short term but will likely impact biodiversity, conservation, and erosion protection.

Waste hierarchy

42. We apply our waste hierarchy to projects related to the management of solid waste. 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.

Table 11

Waste Hierarchy And Projects

Hierarchy tier	Project
Tier 2: waste reduction	Reduction in food loss
Tier 3: waste management with material reuse	Aerobic composting with fertilizer reuse
Tier 4: waste management for energy recovery	Anaerobic digestion
	Gasification/pyrolysis with waste feedback
	Waste to energy
Tier 8: waste management and incineration with no energy recovery	Hazardous waste management

43. **Waste reduction** includes reduced quantity of waste produced, and pollution prevention. Projects that fall into this tier are preventative measures that help 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 waste and pollution.

44. **Waste management with material reuse** includes the recovery of resources from waste, which is then largely reused. Projects that fall into this tier involve the reuse of waste products for use in other products. By reusing waste, these technologies support the transition to a circular economy.

45. **Waste management for energy recovery** includes the recovery of resources from waste for use as energy. Projects that fall into this tier 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 greenhouse gas emissions and land pollutants. That said, we believe these technologies contribute less 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.

46. **Waste management and incineration with no energy recovery:** Projects that fall into this tier help improve the environmental impact of waste management, 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.

Water hierarchy

47. For projects related to water and wastewater/sewage utilities, as well as conservation projects for facilities and agriculture, we apply our water hierarchy. 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).

Table 12

Water Hierarchy And Projects

Hierarchy tier	Project
Tier 2: 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 5: marginal system enhancements	Reducing water losses in the water distribution network
Tier 6: system enhancements with significant negative impacts	Water desalination to supply potable municipal water
Tier 7: demand-side improvements	Conservation measure in residential buildings
	Conservation measure in commercial buildings
	Conservation measure in industrial buildings
	Smart metering in residential buildings

48. **System enhancements** directly or indirectly increase the availability of fresh water. Projects that fall into this tier are those that directly or indirectly increase the availability of fresh water. These are projects that do not have a significant negative impact on water availability, and deliver fresh water via the construction of new infrastructure.

49. **Marginal system enhancements** improve the delivery of existing freshwater supplies. The projects that fall into this tier are those that directly or indirectly improve the delivery of fresh water through existing infrastructure, including 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.

50. **System enhancements with significant negative impact:** The projects that fall into this tier increase the availability of fresh water by building new infrastructure but cause a significant negative environmental impact in the process. For instance, seawater desalination plants produce brine, a waste product which must then be managed.

51. **Demand-side improvements** include measures that reduce the demand on potable water supplies. Projects that fall into this tier are intended to reduce the demand on potable water supplies. These projects install technologies that help reduce the demand for freshwater sources in residential, commercial, or industrial settings.

Resilience Benefits Score

Selecting the resilience level based on resilience benefit ratio change

52. We select the resilience level based on the issuer of finance's cost-benefit analysis.

53. The rationale underpinning our calibration of the scale is further described in Appendix 2 of "Evaluating The Environmental Impact Of Projects Aimed At Adapting To Climate Change," published Nov. 10, 2016. In calibrating our resilience scale, we considered two studies: Mechler's 2016 review of the literature on the benefit of such projects ("Reviewing estimates of the economic efficiency of disaster risk management: opportunities and limitations of using risk-based cost-benefit analysis") and the ECONADAPT project report "Assessing the economic case for adaptation to extreme events at different scales".

Table 13

Resilience Benefit Scale

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

54. The lowest resilience level is level 5. This indicates a resilience 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 the Mechler and ECONADAPT 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 4x because to do so could reward smaller projects that address highly vulnerable infrastructure, more than addressing vulnerabilities that carry lower resilience benefits on a bigger scale.

Processes and considerations for determining the resilience benefit ratio range

55. 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 reductions in humanitarian and

ecological damage, both directly and indirectly. Although it is often difficult to put a financial value on these benefits, experts in the field have developed methodologies to capture such value. To the extent that these humanitarian and ecological factors are reflected in the benefit analysis an entity performs, we include them in our resilience analysis.

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

57. We consider the magnitude of the benefit as quantified by the issuer of finance, 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 effects;
    - Climate change projections and their impact on the resilience project; and
    - Quantification of humanitarian and ecological benefits.

58. We consider damage 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 (2012) summarizes scientific understanding of the expected impact of climate change on the characteristics of extreme weather events. We calculate the added resilience a project offers (the resilience benefit) by estimating the reduction in expected damage to the environment due to the project being funded by the financial transaction over the targeted period.

59. Resilience projects chiefly provide benefits if there is an extreme event. Such benefits are uncertain and require probabilistic representation. Therefore, third-party 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 analysis 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, we would likely, with some exceptions, assess the resilience at the lowest level (5).

60. Calculating the benefit of resilience 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 are likely to be more limited.

61. 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 scenarios).

Considerations for applying the quantification approach adjustment

62. In our qualitative assessment, we consider the following aspects of an entity's quantification approach to assess whether, in our opinion, it is 'robust', 'adequate' or 'less than adequate':

    - Scope of the model: Allows for all material benefits and negative impacts of the resilience 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: Considers 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.

63. Our qualitative assessment is adequate when, even though not all the above factors are captured extensively and robustly, no key factor is missed and there are no reasons to believe the benefit is overstated. We would normally assess the typical quantification approach as adequate and our resilience benefit ratio scale would incorporate the associated degree of modeling uncertainty. 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.

64. When we consider the quantification approach to be 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). This could 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 increased understanding as to how climate change is likely to affect the relevant area.

65. 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 could be a considerable risk that the resilience benefit is overstated.

Considerations for applying the developing countries adjustment

66. If no probabilistic benefit analysis has been performed, we could assess a project 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.

67. If we believe social benefits have not been adequately captured in the entity's resilience analysis, we may modify the assessment, adjusting it upward by one level. 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/vulnerability to climate risk. In our view, improved resilience in such countries is likely to have significant social benefits. These potential benefits include fewer casualties, fewer displaced people, and fewer disrupted livelihoods following extreme weather events.

Examples of applying the adjustments

68. If the initial resilience level is 1, a positive adjustment for adequacy of quantification approach has no effect on the resilience level. Similarly, if the resilience level in the first stage is 5, a negative adjustment for adequacy of quantification approach will also have no effect on the resilience level. Furthermore, a negative adjustment for the quantification approach does not neutralize a potential positive adjustment for developing countries. Hence, a positive adjustment for a project in a developing country could result in a resilience level of 4.

69. If we determine the initial resilience level is 2, 3, or 4, and then factor in a negative adjustment for adequacy of quantification approach, we could adjust the resilience level downward to 3, 4, or 5, respectively. Our positive developing country assessment on that same project could then move the resilience level back to 2, 3, or 4, respectively.

APPENDIX

Glossary

Baseline: The reference scenario used to calculate the net impact of the project--for example, the tons of carbon emissions 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.

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.

Grid emissions factor: This refers to a carbon dioxide emissions factor (tCO2/MWh), which is the carbon intensity per unit of electricity generation in the grid system, according to the 2015 UNFCCC Paris Agreement.

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 CO2 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 (m3) per person (source: UN). We use the World Resource Institute's Baseline Water Stress indicator that measures the ratio of demand for water resources to annual renewable supply as the data definition capped to 100%.

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