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Second Party Opinion

Land Transport Authority of Singapore Green Bond Framework

July 26, 2024

Location: Singapore **Sector:** Transport Infrastructure

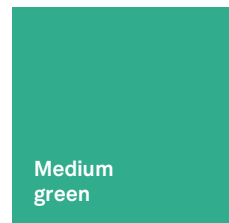
Alignment With Principles Aligned = ✓ Conceptually aligned = ○ Not aligned = ✗

- ✓ Green Bond Principles, ICMA, 2021 (with June 2022 Appendix 1)
- ✓ Asean Capital Markets Forum Green Bond Standards

See [Alignment Assessment](#) for more detail.

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Activities that represent significant steps towards a low-carbon climate resilient future but will require further improvements to be long-term low-carbon climate resilient solutions.

Our [Shades of Green Analytical Approach](#) >

Strengths

Land Transport Authority of Singapore (LTA, the Authority) plays an important role in the country's transition to clean transportation and net-zero by 2050. Financed projects will support decarbonization of the transport sector by upgrading electric vehicle (EV) charging infrastructure, which will also drive EV adoption.

Weaknesses

No weaknesses to report.

Areas to watch

While LTA has a net-zero objective, it has not yet set short-term organizational targets. The Authority has prioritized sectoral abatement targets for the wider land transport sector, and is aligned with the national target of achieving net-zero emissions by 2050, and the Government of Singapore's aim of a 10% reduction in the Energy Utilization Index (EUI) by 2030. However, the Authority has yet to set clear carbon reduction targets for scope 1 and 2 emissions, and report on its scope 3 emissions. It has started to consider lifecycle or embodied emissions in a number of projects, with no specific emission ceilings yet.

Eligible Green Projects Assessment Summary

Eligible projects under an issuer's green finance framework are assessed based on their environmental benefits and risks, using Shades of Green methodology.

Clean Transportation

 Dark green

Electrified railway infrastructure

Electric Bus infrastructure

Electric vehicle (EV) charging infrastructure

Personal mobility and cycling infrastructure and solutions

Other relevant infrastructure or assets that help to increase accessibility and connectivity of public transport networks


Research and development (R&D) for zero-emission transportation technologies, capped at 10% on a portfolio basis

Renewable Energy

 Dark green

Renewable energy systems, including solar (photovoltaic) at Mass Rapid Transit (MRT) stations, on bus station roofs, and in other related facilities and infrastructure

Energy Efficiency

 Medium green

Energy efficient infrastructure and other related assets

Energy storage


R&D for new energy efficiency technologies, capped at 10% on a portfolio basis

Green Buildings

 Light green

Buildings that meet regional, national, or internationally recognised standards or certifications such as Building and Construction Authority (BCA) Green Mark certification of Gold^{Plus} or above, or other equivalent and recognised green building standards or certifications.

Climate Change Adaptation

 Medium green

Design, construction, maintenance, and upgrades of infrastructure for adapting to extreme weather events

See [Analysis Of Eligible Projects](#) for more detail.

Issuer Sustainability Context

This section provides an analysis of the issuer's sustainability management and the embeddedness of the financing framework within its overall strategy.

Company Description

Founded in 1995, LTA is a Statutory Board under the Ministry of Transport in Singapore. The Authority primarily focuses on planning, designing, building, and maintaining Singapore's land transport infrastructure and systems. It also manages the implementation of road infrastructure projects and maintains road structures and facilities; conducts project safety reviews; implements policies related to vehicle ownership and usage control; enforces vehicle safety; and regulates public transport services, and operates the electronic road pricing system, the electronic parking system, the transit fare system, and transit ticketing services in Singapore.

In fiscal year 2023 (ended March 31, 2023), LTA Group's revenue stood at S\$2.1 billion (US\$1.6 billion) and its total assets were S\$81 billion (US\$61 billion), with over 6,000 employees and 34,000 contractors.

Material Sustainability Factors

Climate transition risks

Transportation is the fastest-growing source of emissions worldwide, and transportation users like autos, airlines, and freight account for around a quarter of global greenhouse gas emissions, according to the International Energy Agency (IEA). The design and condition of infrastructure can affect greenhouse gas emissions (such as if rail lines are electrified or the availability of ship-to-shore power at ports). Existing transportation infrastructure might require investment to support wider decarbonization trends. Infrastructure development also produces significant emissions due to land use changes and reliance on carbon-intensive materials such as steel and cement. In Singapore, the transportation sector represents 13.5% of carbon dioxide emissions, with cars accounting for most of such emissions, according to the IEA.

Physical climate risks

Acute physical risks such as storms, wildfires, and floods can impair, disrupt, or even destroy assets, limiting the availability of essential infrastructure, including roads and mass transit systems. Over time, both acute and chronic risks--such as changing temperatures and precipitation patterns and rising sea levels--can shorten the useful lives of vehicles and infrastructure. Transportation issues can lead to major impacts for communities and regions, which can be much broader if key assets such as bridges, tunnels, or ports are unavailable for extended periods. The increasing frequency and severity of acute physical risks and the assets' long-term nature and fixed locations point to growing materiality. The impacts of physical climate risks can extend beyond the assets themselves and impair the infrastructure provider's region or service area, which could have more prolonged impacts on demand, potentially affecting stakeholders. According to the World Bank, the key risks in Singapore are rising sea levels, intense rainfall, and dry spells.

Pollution

Pollution can take the form of airborne emissions (such as nitrogen oxides and soot), ground pollution at facilities such as gas stations, and excessive noise. These have severe impacts, especially for people living near major sea or road transportation routes. For instance, air pollution from transportation, along with that from other sources, kills more than 3.5 million people across the world every year and causes health problems for many more, according to the OECD. There has been some progress in reducing pollution through regulation, engine improvements, safety procedures, and in some cases changes to equipment. In Singapore, the main sources of air pollution are heavy industries and motor vehicles. The country's air quality is benchmarked

against World Health Organization (WHO)'s air quality guidelines and its Pollutant Standards Index (PSI) was in the good and moderate range in 2022, according to National Environmental Agency (NEA).

Access and affordability

Transportation infrastructure enables travel for work, health care, education, and reliable movement of goods. Given the essential nature of transportation infrastructure, access and affordability of the services is highly material, as they could weigh on household purchasing power, affect access to means of livelihood or essential services, and limit economic activity. Projects that extend or improve service for select communities while potentially isolating others may prompt public opposition; these are regional issues but can have severe adverse effects on vulnerable populations. Tariff increases for toll roads, airports, or mass transit, are subject to strong regulatory oversight and if considered excessive, could lead to strong opposition from users or communities as well as regulatory or political actions reducing demand. This could also limit the infrastructure provider's ability to make ongoing investments to maintain reliable service. Most Singaporeans use public transport, and the Government of Singapore provides more than S\$2 billion in subsidies annually to maintain the affordability of bus and train services despite fare adjustment. The government has also provided further assistance to lower-income households by offering public transport vouchers, and to lower-wage workers and persons with disabilities with caps on fare increases in recent years.

Issuer And Context Analysis

All financing project categories aim to address some of LTA's material sustainability factors.

Investments in clean transportation, renewable energy, energy efficiency, green buildings, and climate change adaptation projects directly address climate transition risks. The climate change adaptation project category also addresses physical climate risks. On the other hand, the framework introduces some risks related to biodiversity and local neighborhoods. Biodiversity risks are limited as Singapore is largely urbanized and the expansion of the MRT network under financing will be mostly underground.

As the authority overseeing public transport, LTA has a role in Singapore's aim to transition to net zero by 2050.

The Authority has long-term targets of having a 100% cleaner energy public bus fleet by 2040 (using electric, hybrid, or other cleaner alternative fuels). Its short-term targets include replacing 360 existing diesel buses with electric ones starting from December 2024 and achieving 50% electric public bus fleet by 2030. The Authority has deployed 50 diesel hybrid buses on the roads since 2018 and another 60 electric buses since 2021. The Authority is also expanding its rail network to 360km by 2030s. The Authority aims to deploy 60,000 EV charging points across Singapore by 2030, comprising 40,000 in public car parks and 20,000 in private premises, in a bid to facilitate the adoption of EVs. Additionally, the Authority plans to stop registration of new diesel cars and taxis from 2025. Furthermore, new EV car registrations increased to 18.1% in 2023 (from 0.2% in 2020). This is an outcome of the implementation of EV adoption schemes including the EV Early Adoption Incentive, Enhanced Vehicular Emissions Scheme, Commercial Vehicle Emissions Scheme, and Enhanced Early Turnover Scheme. LTA has so far prioritized sectoral abatement targets for the wider land transport in Singapore. Meeting such targets could have a material impact on the country's net zero commitments. The sectoral abatement targets will be further shared in the first Singapore Biennial Transparency Report to be published in end-2024.

To reduce embodied emissions, LTA is reviewing the designs of new stations to reduce material usage. For instance, LTA aims to reduce conventional material usage by 10% and the quantity of ceiling panels by 25% for the construction of Cross Island Line Stages 2 and 3 (CRL2 and CRL3). LTA plans to install solar panels on the roofs of newly constructed or recently renovated land transportation infrastructure, including offices, facility buildings, and rail and bus depots to reduce carbon emissions and energy costs.

Furthermore, to promote adoption of active mobility, LTA will build approximately 150km of additional sheltered walkways by 2040 and 1,300km of cycling lanes by 2030 under the Island-wide Cycling Network Programme.

LTA's climate reporting is at an early stage. The Authority has a short record of reporting on emissions. Disclosures are limited to two years from fiscal year 2021. It currently does not report scope 3 emissions, which could be substantial. The wider Singapore Public Service is studying the feasibility of Scope 3 reporting, and the Authority will align with those requirements when ready.

The Authority has yet to set its scope 1 and 2 carbon reduction targets at the organizational level but has prioritized sectoral abatement targets for the wider land transport sector in Singapore. It shared that it has aligned itself with the national aim on achieving net zero emissions by 2050 and the government's target of achieving a 10% reduction in EU1 by 2030. It also plans to reduce emissions by electrifying its public bus fleet, optimizing operational electricity usage, and increasing the integration of renewable energy. The Authority's inaugural sustainability report, published in 2023, was with reference to Global Reporting Initiative Standards. The report had no third-party verification, which is not a requirement for the Statutory Boards of the Government of Singapore. In our view, more comprehensive reporting of greenhouse gas emissions would allow LTA to better monitor the impact of its operations and progress of its mitigating measures.

Physical climate risks are important for LTA due to the fixed nature of its assets. The Authority's extensive transportation network is particularly exposed to rising sea levels, intense rainfall, and dry spells. During the design of the MRT infrastructure, LTA considers climate scenarios analysis (Intergovernmental Panel on Climate Change's Representative Concentration Pathway (RCP) 4.5 and RCP 8.5 scenarios) based on the findings of the National Climate Change Study by the Center for Climate Research Singapore (CCRS), to consider the possible effects of climate related hazards to its assets. The Authority has also focused on building climate resilient infrastructure, notably flood mitigation systems, in recent years.

LTA incorporates biodiversity considerations in its infrastructural activities. Considering nature in infrastructure development and operations is critical, given Singapore's dense population and local land scarcity. Prior to the construction of new infrastructure, LTA conducts an environmental impact assessment for relevant areas. Some of its past environmental impact studies are available on its website. Such assessments will be conducted in collaboration with nature groups and technical agencies. Additionally, to minimize the negative impact of construction, the Authority has implemented strategic measures and an Environmental Management and Monitoring Plan to ensure the effectiveness of its mitigation efforts. Furthermore, to maintain ecological balance, LTA works with the National Parks Board to identify trees that can be transplanted.

LTA considers the social impacts of its projects during the planning and design stages and implements measures to mitigate negative externalities. As an infrastructure developer and enabler of key government policies, it focuses on implementing and enforcing safety regulations, performing inspections, and audits on public transport operators and business partners. It also fosters a collaborative safety culture through workshops and discussions with public transport operators. It has established safety engagement platforms with the National Transport Workers' Union and operators to encourage the sharing of safety practices. Furthermore, to ensure road safety, the Authority has established a Road Safety Governance Framework, which includes the Project Safety Review for road projects that are designed and constructed with safety considerations. Lastly, the Authority holds community meetings, public consultations, and feedback mechanisms to address citizens' concerns and make sure that community perspectives are considered during project planning and decision-making. In addition to regular inspections and annual internal audits at its construction sites, LTA also tracks and reports safety metrics such as accident frequency rates in its sustainability report.

Alignment Assessment

This section provides an analysis of the framework's alignment to Green Bond principles.

Alignment With Principles

Aligned = ✓ Conceptually aligned = ○ Not aligned = ✗

- ✓ Green Bond Principles, ICMA, 2021 (with June 2022 Appendix 1)
- ✓ Asean Capital Markets Forum Green Bond Standards

✓ Use of proceeds

All the framework's green project categories are shaded in green, and LTA commits to allocate the net proceeds issued under the framework exclusively to clean transportation, renewable energy, energy efficiency, green buildings, and climate change adaptation project categories. LTA will disclose the proportion of financing versus refinancing in its allocation reporting. The look-back period is 24 months, better than the market practice of 36 months. Please refer to the Analysis of Eligible Projects section for more information on our analysis of the environmental benefits of the expected use of proceeds.

✓ Process for project evaluation and selection

LTA has set up a Green Bond Committee chaired by the Chief Executive and comprising the Authority's Deputy Chief Executives, Chief Financial Officer, and Chief Sustainability Officer. The committee will be responsible for the screening of eligible green expenditures. It will meet annually or as needed to evaluate and approve the potential projects. LTA has internal processes such as its Safety, Health, and Environmental System, and Project Safety Review certification processes to identify and manage environmental and social risks related to eligible projects. The framework connects certain LTA's project categories to activities that meet the green criteria under the Singapore-Asia Taxonomy (SAT) Technical Screening Criteria, and commits to only funding these projects when they meet the green criteria under SAT. This adds objectivity to the projects screening process.

✓ Management of proceeds

LTA will track the net proceeds in a green bond register, and allocate the net proceeds based on a portfolio basis. The Authority is committed to reallocating proceeds as soon as reasonably practicable if invested projects cease to comply with the framework's eligibility criteria. Pending allocation, unallocated proceeds will be managed as part of LTA's cash management process, which includes short-term balances held by the Accountant-General's Department under the government's Centralized Liquidity Management Framework for Statutory Boards. The framework's exclusion criteria also apply to the management of unallocated proceeds.

✓ Reporting

LTA commits to annual allocation and impact reporting until full allocation (and in case of material developments) in its progress report. Allocation reporting will include the total amount of green bonds outstanding, and the breakdown of allocation of net proceeds by eligible category. LTA will also report on the associated estimated environmental benefits of the eligible projects. It intends to disclose on specific performance indicators of the eligible green expenditures, with information on social co-benefit where possible. Furthermore, the issuer will provide a methodological note on the assumptions used to calculate the key impact indicators. It is a positive that LTA commits to receiving limited assurance on the allocation and impact reporting until full allocation. The progress reports and external reviews will be available on its website throughout the tenure of the instruments.

Analysis Of Eligible Projects

This section provides details of our analysis of eligible projects, based on their environmental benefits and risks, using the Shades of Green methodology.

Over the three years following issuance of its inaugural green bond, LTA expects to entirely allocate the proceeds to finance EV charging infrastructure upgrades and related operating expenditure.

The issuer expects to allocate most proceeds to new projects, with a minority directed to project refinancing.

Overall Shades of Green assessment

Based on the project category shades of green detailed below, and consideration of environmental ambitions reflected in LTA's Green Bond Framework, we assess the framework shading to be Medium green.

Medium green

Activities that represent significant steps towards a low-carbon climate resilient future but will require further improvements to be long-term low-carbon climate resilient solutions.

Our [Shades of Green Analytical Approach](#) >

Green project categories

Clean Transportation

Assessment

 **Dark green**

Description

Land transport infrastructure and mobility solutions with zero direct tailpipe carbon dioxide emissions:

- Electrified railway infrastructure, including rolling stock and other related assets and expenditures.
- Electric Bus infrastructure, buses and other related assets and expenditures.
- EV charging infrastructure and solutions (e.g. charging points and swap stations, cabinets, etc.) and related assets including:
 - Electricity grid connection upgrades necessary to support the deployment and operation of infrastructure for charging EVs; and
 - All other solutions related to optimising and/or providing the necessary electrical capacity to support the deployment and operation of EV charging solutions.
- Personal mobility and cycling infrastructure and solutions (e.g. cycling tracks, pedestrian zones, parking provisions for active mobility modes, electrical charging and hydrogen refuelling installations for personal mobility devices)
- Other relevant infrastructure or assets that help to increase accessibility and connectivity of public transport networks, which support zero direct emission mobility solutions, to increase its usage and ultimately reduce reliance on private vehicle transportation and greenhouse gas emissions.
- R&D for zero emission transportation technologies, capped at 10% on a portfolio basis.

Analytical considerations

- Zero-direct-tailpipe emission public transport is essential for achieving net zero by 2050 given public transportation is less resource and emissions-intensive than private modes of transportation. Investments in electrification are crucial in decarbonizing the transportation sector. LTA expects to allocate most proceeds to EV charging infrastructure and solutions, and

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related assets. Such supporting infrastructure for EVs is well-aligned with a low-carbon climate-resilient future. Therefore, we assigned a Dark green shading for this project category.

- Charging stations will be connected to the national grid, which implies the actual emissions reduction the vehicles can provide is dependent on the country's electricity grid energy profile. Currently, Singapore's electricity generation mainly relies on imported natural gas (>95%), which is expected to continue being a major fuel in the future, according to the National Climate Change Secretariat Singapore. The country's grid has become more carbon emissions intensive in the past three years, with the average grid emission factor increasing from 0.407 kg carbon dioxide per kilowatt hour (CO₂/kWh) in 2020 to 0.409 kg CO₂/kWh in 2021, and 0.417 kg CO₂/kWh in 2022, due to increased diesel usage, according to the Energy Market Authority.
- For the electricity grid connection upgrades, LTA stated that the primary focus is on EV charging related projects, such as consumer switch rooms and substations upgrades in residential estates. For example, expenditure would be to ensure sufficient electrical supply for EV charging at Housing and Development Board residential carparks.
- Electric rail and buses support a low-carbon climate-resilient future, especially given that currently only 60 out of about 5,800 public buses are fully electric. LTA excludes the financing of any hybrid, biofuel, or fossil-fuel solutions. According to the Authority, switching transportation modes from internal combustion engines to MRT, electric buses, and EVs should reduce carbon footprints by up to 90%, 70%, and 50% respectively. LTA also intends to manage its indirect emissions and upstream environmental impacts by requesting train suppliers to provide an Environmental Product Declaration stating the materials used and their respective recovery and recyclability. Furthermore, LTA manages lifecycle emissions through the demonstration of sustainability and environmental commitment from its business partners. LTA also shared that it expects all rolling stock (i.e. MRT) and electric buses, both existing and newly purchased fleets, that are financed to have regenerative braking systems in present. Such systems enable the reuse of energy from braking and potential environmental benefits include more efficient use of energy and better durability of the vehicle components.
- Construction work is often emissions and resource intensive. According to LTA, eligible infrastructure under this category may include depots, stations, and workshops as long as they support transportation solutions with zero-direct-tailpipe emissions. LTA conducts environmental impact assessment for all eligible projects, in compliance with local requirements, and will implement mitigation measures to address potential environmental impacts from construction activities. Furthermore, LTA requires tenderers to include carbon disclosure, decarbonization of their operation processes, and relevant green accreditations in their tender specifications.
- Proceeds will also finance infrastructure that support personal mobility solutions, such as cycling tracks, pedestrian zones, and bicycle parking provisions that promote cycling and walking. These projects have low risk of emissions locked-in and are aligned with a low-carbon future. For hydrogen refueling installations for personal mobility devices, LTA has shared that it does not plan to deploy such technology at this juncture and will consider the types of hydrogen (e.g. green/ blue/ grey) that are eligible for potential financing in the future.
- LTA manages infrastructure projects' embodied emissions by reviewing the use of building materials at the design phase and mandating the use of low-carbon concrete (for example, targeting a minimum reduction of 20% in carbon emissions compared with conventional concrete for upcoming footpath renewal contracts, and concrete produced from recycled by-products from steel production for the construction of permanent reinforced concrete structures), as well as requiring contractors to submit embodied carbon reports accounting for materials used.
- Physical risk is relevant to this project category, in particular facilities and infrastructure due to their fixed nature. LTA stated that the design of its rail infrastructure considers the climate change scenarios from the CCRS's National Climate Change Study, including rising sea levels, rainfall, temperature, and wind. Eligible projects that are identified as "specified activities" under the national Sewerage and Drainage Act must comply with the drainage and flood protection requirements set out in the Public Utilities Board's Code of Practice on Surface Water Drainage.

Renewable Energy

Assessment

 Dark green

Description

Renewable energy systems, including solar (photovoltaic), at MRT stations, bus station roofs, and other related facilities and infrastructure.

Analytical considerations

- Renewable energy is key to the green transition to a low carbon energy future by enabling systemic decarbonization, which the Dark green shading reflects. According to LTA, this project category will be exclusively for financing solar systems. Financed projects will include the installation of solar panels on the roofs of rail and bus stations, as well as ancillary facilities and works necessary for the deployment, operation, and maintenance of the renewable energy system. LTA plans to achieve a solar energy deployment target of 16-megawatt peak (MWp) by 2025 and 25 MWp by 2030.
- There are lifecycle carbon emissions during solar panel materials sourcing, manufacturing, transportation, construction, and disposal. Currently, LTA does not specify a quantitative lifecycle emissions threshold for emissions in its supply chain. However, it will work with its business partners on carbon disclosure and decarbonization in their respective operations.
- Downstream end-of-life solar infrastructure can be associated with waste and local pollution risks. LTA will ensure that the contractor for replacing solar panels disposes materials in accordance with the NEA’s requirements, such as the Environmental Public Health (Toxic Industrial Waste) Regulations that details the handling, transportation, treatment, and disposal of toxic industrial waste in Singapore.
- Solar projects can also be exposed to physical climate risks. These risks are less material given the nature of the project, as these solar panels would be on the rooftop of the LTA’s facilities. Nevertheless, LTA references environmental impact assessment, and the climate change scenarios from the National Climate Change Study by the CCRS for identifying and managing projects’ potential physical climate risks.

Energy Efficiency

Assessment

 Medium green

Description

Energy efficient infrastructure and other related assets, such as energy-efficient lighting systems

Energy storage dedicated to integrating the deployment of low carbon energy sources, transmission & distribution systems comprised of energy-efficient equipment.

R&D for new energy efficiency technologies, capped at 10% on a portfolio basis

Analytical considerations

- Energy efficiency projects reduce the amount of energy use, and the associated emissions. The extent of climate benefits from energy efficient infrastructure is difficult to quantify. Improved efficiency could drive more energy usage and may slow or prevent the transition of some assets to a more sustainable energy source, introducing carbon lock-in risks. That said, LTA indicated that projects related to fossil fuels will not receive funding. With indicative specifications on energy performance required for eligible projects, there are limited insights on the projects’ energy saving potential, supporting a Light green assessment. The energy storage projects can help mitigate the issue of intermittence of renewable energy systems, which is considered a Dark green element, leading to an overall project category shade to be Medium green.
- LTA has a target to reduce the EUI of its premises by 10% by 2030. Specifically, LTA requires eligible energy efficiency projects involving the installation of equipment to meet minimum energy performance standards as per the two highest energy efficiency classes of NEA’s mandatory energy labelling scheme or other relevant international labelling schemes. However, the actual energy saving required to determine each project’s eligibility is unclear.
- Examples of “low carbon energy sources” are electricity generated from solar, wind, hydropower, geothermal energy. The construction, maintenance, operation, and decommissioning of energy storage equipment could be energy intensive. LTA has

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indicated that these projects must meet the green criteria under the Singapore-Asia Taxonomy, in which the lifecycle emissions for transmission and distribution projects must not exceed a ceiling of 100gCO₂e/kWh, in line with EU taxonomy.

- LTA adheres to the green procurement guidelines set forth by the Government of Singapore to purchase equipment meeting specified energy-saving requirements. However, limited considerations to the development and manufacturing processes along the supply chain restrict the visibility of the lifecycle benefits to these projects. Similarly, material sourcing for batteries used for energy storage may contain significant emissions and result in negative environmental impacts.
- Energy efficiency projects in physical assets present some physical climate risks. LTA stated that an environmental study will be conducted for infrastructure projects that present significant environmental impacts, which partially mitigates such risk.

Green Buildings

Assessment

 Light green

Description

Buildings that meet regional, national, or internationally recognized standards or certifications for environmental performance such as BCA Green Mark certification of Gold^{Plus} or above, or other equivalent and recognized green building standards or certifications (e.g. Leadership in Energy and Environmental Design (LEED) Gold and above).

Analytical considerations

- Green buildings support climate change mitigation by potentially alleviating greenhouse gas emissions. They also serve other benefits in water efficiency, as well as resource and waste management. However, construction activities introduce other issues like the energy usage and emissions associated with building materials. The Authority has policies addressing embodied emissions in its transport infrastructure construction and intends to progressively roll out similar policies in building projects. However, we do not view this as sufficiently addressing embodied emissions in building projects, limiting the assessment to Light green. Physical climate risks are material considerations for buildings, and new construction may raise biodiversity issues.
- LTA considers buildings in support of public-transit related operations, and buildings for its own use that have obtained international or national green certificates to be eligible. The Authority does not currently have plans to finance this project category, thus it has not provided an expected split between new buildings, existing buildings, or renovated buildings for upcoming financings.
- The requirements of eligible green building certifications could vary. LTA expects that eligible certified buildings will support and align with the Government of Singapore's 10% EUI reduction target and a 30% reduction target in Waste Disposal Index in buildings by 2030. The Authority will also require all new buildings and existing buildings undergoing major retrofits to meet Green Mark Platinum Super Low Energy Standards or equivalent. Such requirements are among top commitment within Green Mark certifications and could achieve at least 60% energy saving compared to building codes in 2005. Initiatives may include solar panels and energy efficient equipment installations. Certified buildings could create sustainability benefits. However, certifications do not necessarily require the highest energy efficient building, nor the use of buildings material with low embodied emissions, given their points-based system.
- LTA indicated that all eligible buildings are fully electrified and will not involve the use of fossil fuel-based equipment in heating or cooling.
- LTA currently does not have green building projects in the pipeline. Nonetheless, LTA has informed us that the Authority is likely to manage buildings' embodied emissions by reviewing the use of building material at the design phase and reducing the volume of architectural materials used, as well as requiring contractors of construction projects to submit embodied carbon reports accounting for materials used.
- Green buildings are exposed to physical climate risks, including rising sea levels, and increased frequency of flooding and rainfall in Singapore. LTA references the climate change scenarios from the National Climate Change Study by the CCRS for identifying and managing projects' potential physical climate risks.
- LTA indicated the environmental impact assessments will address biodiversity and land use risks through project-design stage risk identification and assessment. Results will be used to inform mitigation measures in relation to traffic, public health,

heritage, and the ecological environment. The process is governed by the Urban Redevelopment Authority. All development will require the government's approval, prior to any project commencements.

Climate Change Adaptation

Assessment

 **Medium green**













Description

Design, construction, maintenance, and upgrades of infrastructure for adapting to extreme weather events, such as climate change resilient infrastructure, flood prevention, flood protection, and other risk mitigation programmes.

Analytical considerations

- As a low-lying island country, Singapore is highly vulnerable to rising sea levels, and climate change adaptation solutions such as flood mitigation measures plays a vital role in protecting the infrastructure and resilience against physical climate risks. Some eligible projects will align with the national climate action plan on enhancing flood protection at underground MRT stations. However, construction of such infrastructure could result in high direct (construction machinery using fossil fuels) and indirect emissions (embodied emissions from building materials), for some of which LTA has yet to establish a clear reduction pathway, leading to a Medium green shading.
- Construction materials such as cement, steel, and glass are often energy-intensive to produce. As a result, the construction for adaptation measures can result in significant embodied emissions. LTA monitors such emissions by requiring the contractors to submit embodied carbon reports accounting for materials used during construction. The Authority also plans to use low-carbon concrete (made from recycled by-products from steel production) to partially replace conventional cement, which contributes to certain degree of emission reduction.
- Construction projects to support adaptation can also impact biodiversity. LTA identifies and manages these risks through environmental impact assessments, which applied to relevant eligible projects, and its Safety, Health, and Environment Management System.

S&P Global Ratings' Shades of Green

Assessments					
 Dark green	 Medium green	 Light green	 Yellow	 Orange	 Red
Description					
Activities that correspond to the long-term vision of an LCCR future.	Activities that represent significant steps toward an LCCR future but will require further improvements to be long-term LCCR solutions.	Activities representing transition steps in the near-term that avoid emissions lock-in but do not represent long-term LCCR solutions.	Activities that do not have a material impact on the transition to an LCCR future, or, Activities that have some potential inconsistency with the transition to an LCCR future, albeit tempered by existing transition measures.	Activities that are not currently consistent with the transition to an LCCR future. These include activities with moderate potential for emissions lock-in and risk of stranded assets.	Activities that are inconsistent with, and likely to impede, the transition required to achieve the long-term LCCR future. These activities have the highest emissions intensity, with the most potential for emissions lock-in and risk of stranded assets.
Example projects					
 Solar power plants	 Energy efficient buildings	 Hybrid road vehicles	 Health care services	 Conventional steel production	 New oil exploration

Note: For us to consider use of proceeds aligned with ICMA Principles for a green project, we require project categories directly funded by the financing to be assigned one of the three green Shades.

LCCR--Low-carbon climate resilient. An LCCR future is a future aligned with the Paris Agreement; where the global average temperature increase is held below 2 degrees Celsius (2 C), with efforts to limit it to 1.5 C, above pre-industrial levels, while building resilience to the adverse impact of climate change and achieving sustainable outcomes across both climate and non-climate environmental objectives. Long term and near term--For the purpose of this analysis, we consider the long term to be beyond the middle of the 21st century and the near term to be within the next decade. Emissions lock-in--Where an activity delays or prevents the transition to low-carbon alternatives by perpetuating assets or processes (often fossil fuel use and its corresponding greenhouse gas emissions) that are not aligned with, or cannot adapt to, an LCCR future. Stranded assets--Assets that have suffered from unanticipated or premature write-downs, devaluations, or conversion to liabilities (as defined by the University of Oxford).

Mapping To The U.N.'s Sustainable Development Goals

Where the Financing documentation references the Sustainable Development Goals (SDGs), we consider which SDGs it contributes to. We compare the activities funded by the Financing to the International Capital Markets Association (ICMA) SDG mapping and outline the intended linkages within our SPO analysis. Our assessment of SDG mapping does not impact our alignment opinion.

This framework intends to contribute to the following SDGs:

Use of proceeds

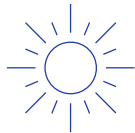
SDGs

Clean Transportation



11. Sustainable cities and communities

Renewable Energy



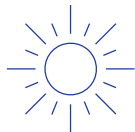
7. Affordable and clean energy* **13. Climate action**

Energy Efficiency



11. Sustainable cities and communities **12. Responsible consumption and production** **13. Climate action**

Green Buildings



7. Affordable and clean energy* **11. Sustainable cities and communities***

Climate Change Adaptation



13. Climate action*

*The eligible project categories link to these SDGs in the ICMA mapping.

Related Research

- [Analytical Approach: Second Party Opinions: Use of Proceeds](#), July 27, 2023
- [FAQ: Applying Our Integrated Analytical Approach for Use-of-Proceeds Second Party Opinions](#), July 27, 2023
- [Analytical Approach: Shades of Green Assessments](#), July 27, 2023
- [S&P Global Ratings ESG Materiality Maps](#), July 20, 2022

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