Guidebook for Sustainable Practices at LTA Sites

(Updated as at Sep 2022)

Land Transport Authority

We Keep Your World Moving

Published by the Land Transport Authority
Enquiries can be directed to LTA Construction Safety & Environmental Protection Division

Foreword

The effects of climate change require all stakeholders to take urgent collective action towards the decarbonisation of the built environment.

Transport sector accounts for over 16%* of Singapore's carbon emissions. To address this, there is a need to shift to more sustainable modes of transport and limit the carbon impact of our transportation infrastructure.

Therefore, it is important to adopt a holistic view towards reducing carbon emissions across the life cycle of such infrastructure. This means going beyond the use phase and placing greater emphasis upstream, in the design and construction phases, and downstream, in the management and maintenance phases. For instance, the use of green concrete can reduce up to 50% embodied carbon emissions from conventional concrete and the upcycling of waste materials also promotes environmental sustainability and resource circularity.

(continued)

**NCCS 2019 Emissions Profile* data

(continued)

Implementing sustainability plans, such as the BCA Green Mark for Transit Stations, provides a holistic framework from design, construction to operation and is key towards the outcome of our sustainable infrastructures.

I encourage all to incorporate sustainability in your practices towards a more sustainable, low-carbon future.

Ang Kian Seng
Group Director,
Environmental Sustainability Group
Building and Construction Authority

Preface

Singapore's goal towards net-zero carbon is well known and it has laid out the SG Green Plan 2030. LTA has also begun its journey towards a greener land transport system and operations. In alignment with this corporate direction, this guidebook is the first pictorial compilation of sustainable practices for the construction of Singapore's strategic infrastructure projects, some of which will be funded by the Green Singapore Government Securities (Infra-structure).

Management commitment is key to driving this green transition successfully. Leaders and line alike are expected to set the right targets and plans for all to follow. A strong green culture to choose sustainable solutions will make a significant difference in reducing the carbon footprint and waste generated in a project.

We at LTA hope this guidebook will provide that spark to ignite this culture for our contractors and suppliers. We look forward to collaborating with like-minded partners to drive sustainability efforts not only in our worksites but also in our

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procurement and supply chains. Through our collective efforts, we can pave the way for a more sustainable tomorrow.

The chapters in this guidebook have been divided into the office and site contexts, from design to construction phase, to guide contractors in designing and operating a more sustainable work site. The list of examples here is not exhaustive, and Contractors are encouraged to continually develop and share sustainable initiatives that can be implemented. Thus, we have intended for this guidebook to be a living document that will be updated periodically with newer and more sustainable practices in the coming years.

Lew Yii Der
Group Director,
Safety & Contracts
Land Transport Authority

Acknowledgement

The Land Transport Authority (LTA) would like to thank our staff for their invaluable contribution and support in producing this guidebook.

Special thanks to the Building and Construction Authority and the National Environment Agency for the support and advice.

Lastly, a big thank you to all our contractors for their efforts in promoting sustainability on our worksites.

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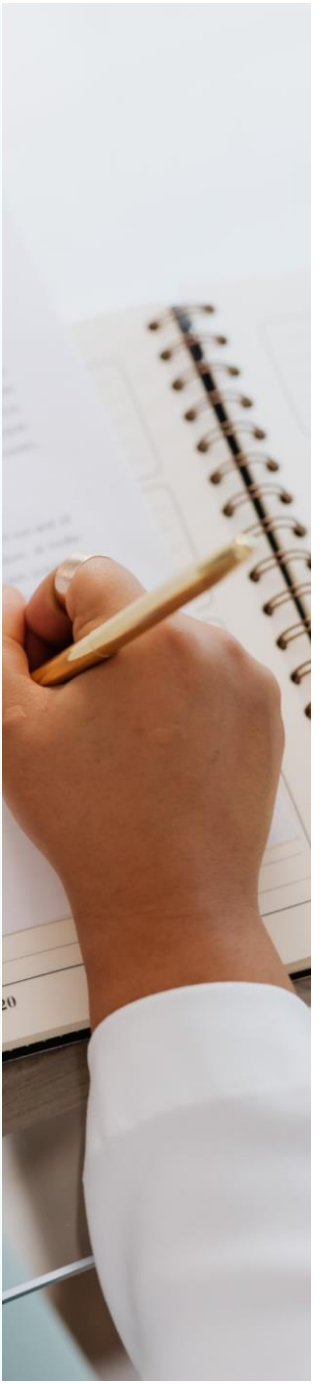
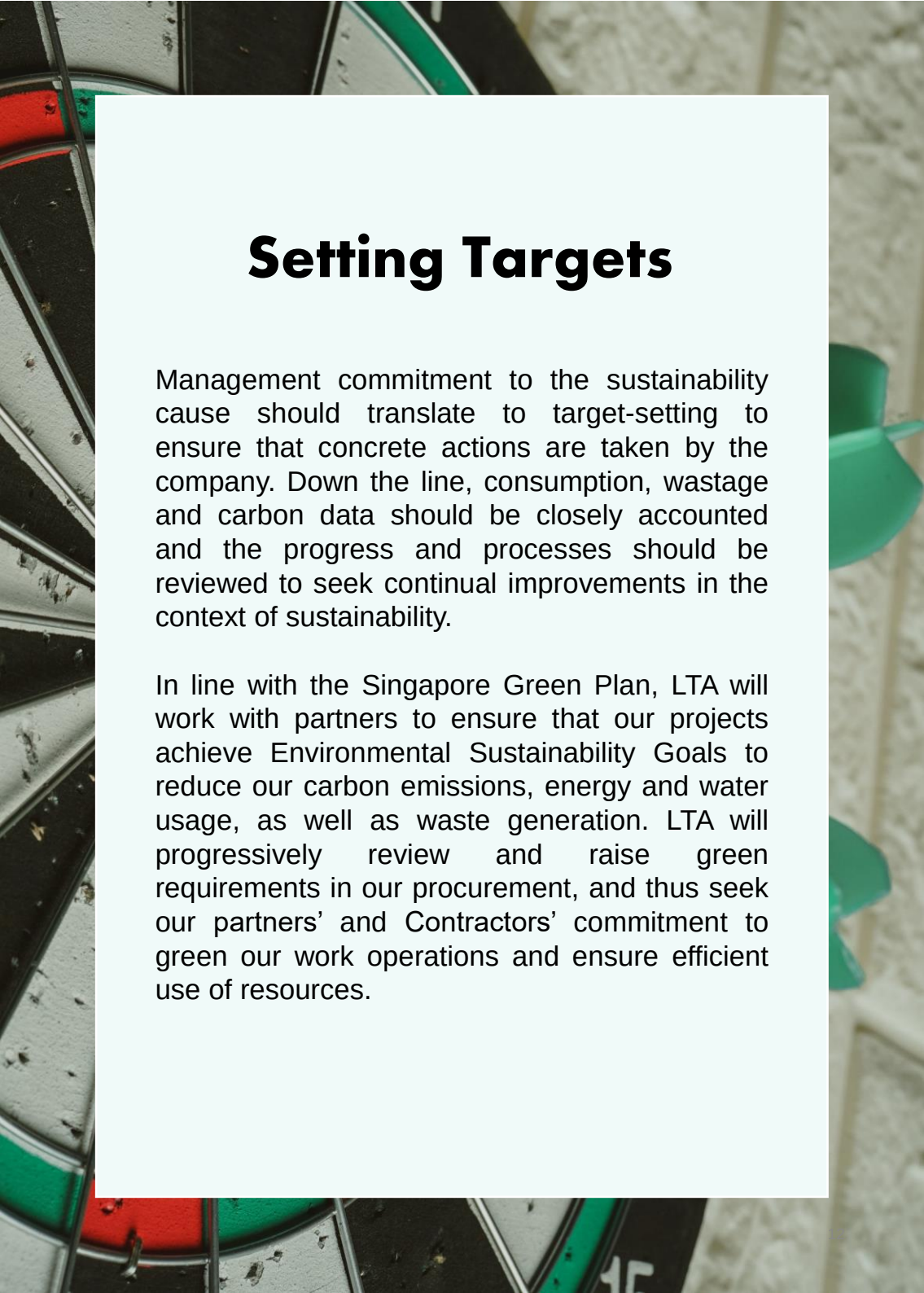
Section 1:
Culture & Training

Management Commitment

The commitment and involvement of top management is one of the key success factors for sustainable development. From changing mindsets and priorities, to providing sufficient resources, leaders can effect positive influences on their workforce and processes.

In the area of sustainability, managers need to adopt circular economy concepts into projects and enable responsible consumption and production.





Setting Targets

Management commitment to the sustainability cause should translate to target-setting to ensure that concrete actions are taken by the company. Down the line, consumption, wastage and carbon data should be closely accounted and the progress and processes should be reviewed to seek continual improvements in the context of sustainability.

In line with the Singapore Green Plan, LTA will work with partners to ensure that our projects achieve Environmental Sustainability Goals to reduce our carbon emissions, energy and water usage, as well as waste generation. LTA will progressively review and raise green requirements in our procurement, and thus seek our partners' and Contractors' commitment to green our work operations and ensure efficient use of resources.

Empowering & Training

On the path to becoming a sustainable business, the company management needs to provide resources and train up competent personnel to lead the rest of the workforce in making a change.

Proper training can help provide sufficient knowledge for staff to make informed decisions for the company.

Designating a Sustainability Team

A designated team should be tasked to examine the specific environmental issues faced at your workplace and work towards improving sustainability accordingly.

This team will need to be equipped with skills and ideas to make a change. Attending relevant courses and exchanging of ideas through networking events enables better decisions when designing sustainability efforts for your workplace.

Involving Everyone

Sustainability is everyone's responsibility, and employees on the ground are critical in identifying areas of work that can be improved.

Encourage staff to take ownership of sustainability over their domains. Having proper training and systems in place is also key to enabling everyone to make sustainability part of their job and developing a culture of sustainability in the company.

Promotional Campaigns

Organising campaigns is a great way to raise awareness and rally support for a cause.

Sustainability campaigns can be organised at organisational and project levels to increase understanding of our carbon footprint and inculcate green habits in our people. This chapter collates a non-exhaustive list of ideas and activities.

Campaign Ideas

Carpooling/ Car-lite challenge

Bring your own container

Meatless Mondays

Recycling drive

Upcycling

Plant a tree

Green idea contest

Lunch power-down

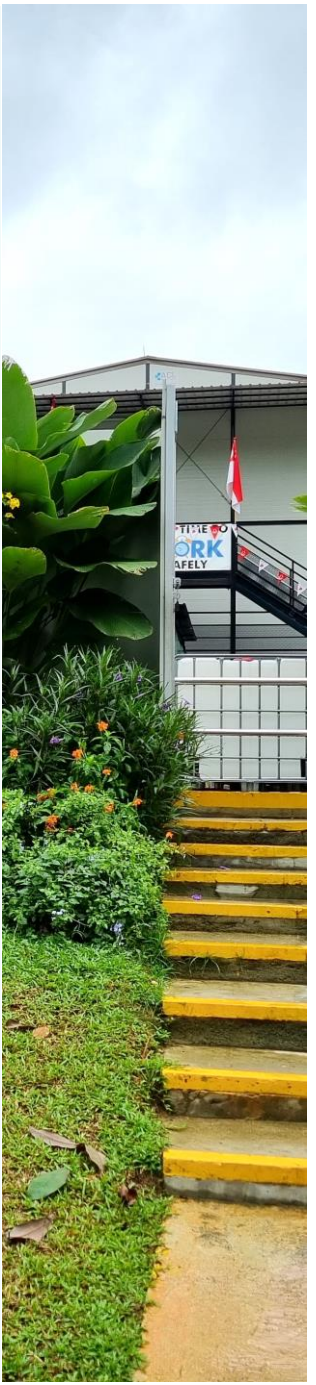
Mass housekeeping & waste- sorting

Section 2: Site Office

Setting up the Site Office

Before the site office is set up, green considerations regarding the design of the office, use of alternative renewable energy sources and procurement of equipment should be examined.

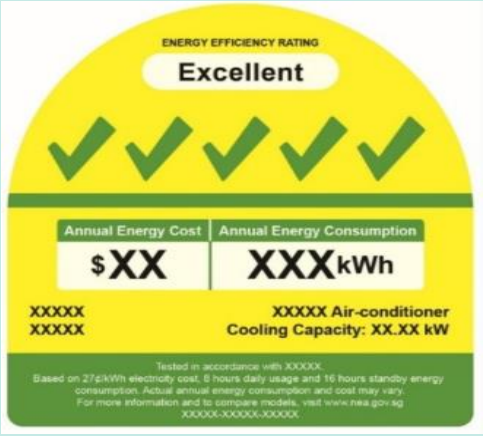
Similarly, during the procurement of office logistics, Contractors should opt for fit-out amenities and furniture that could be redeployed to other sites after the project is completed.

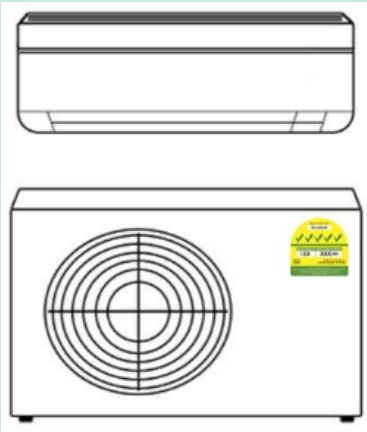


Energy Labels for Electrical Appliances

GS Appendix A/ PS Appendix B, Annex A-g

Clause 2.3: Electrical appliances such as refrigerators and air conditioners shall be procured from registered suppliers supplying registrable goods affixed with the Energy Label. The appliance shall have its energy efficient rating rated "Excellent".





This would equate to 5 ticks for appliances such as air conditioners, televisions and dryers, and 4 ticks for refrigerators (depending on specific capacities).

More info: https://www.nea.gov.sg/our-services/climate-change-energy-efficiency/energy-efficiency/for-household-sector/the-energy-label

Energy Efficient Lighting

GS Appendix A/ PS Appendix B, Annex A-g

Clause 2.6: Energy efficient lightings shall be used.

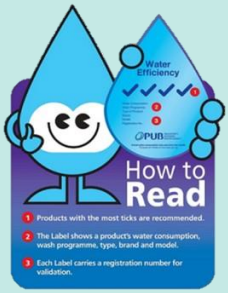
LED bulbs tend to be more energy efficient than Compact Fluorescent Lamps or incandescent bulbs, as most of the energy is released as light instead of heat.

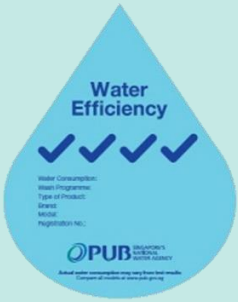
Lights in the toilets are to have motion sensor feature.

Water Efficient Products

GS Appendix A/ PS Appendix B, Annex A-g

Clause 2.7: The Contractor is required to install water efficient products based on the Mandatory Water Efficiency Labelling Scheme (Mandatory WELS) as well as from the Voluntary Water Efficiency Labelling Scheme (Voluntary WELS) implemented by PUB.



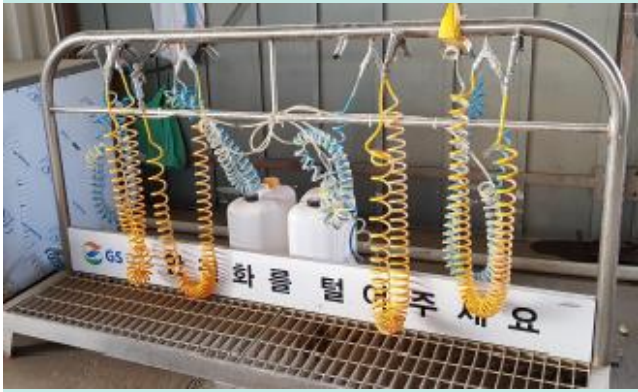


Clause 2.8: Water efficient products used in site office such as basin taps and mixers, low-capacity flushing cisterns, urinal flush valves and shower heads shall be rated with three ticks.

Water Efficient Products

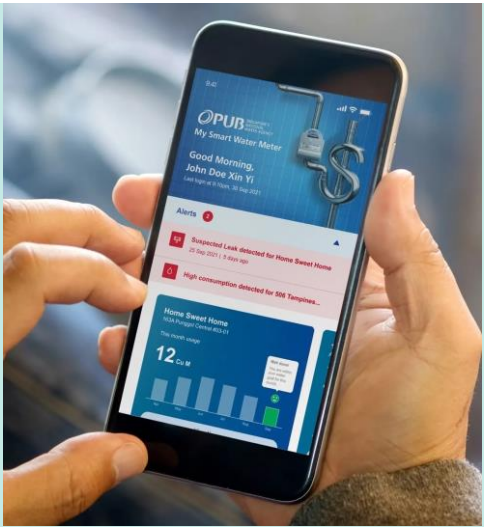
Installation of thimbles at tap head.

Use of high pressure jets for boot wash.



Installation of Meters

GS Appendix A/ PS Appendix B, Annex A-g



Clause 2.1: The Contractor shall reduce energy and water consumption of site offices by using energy-saving and water conservation appliances, adopting conservational practices and monitoring consumption through smart meters.

Clause 2.9: For contracts above S$20million, the Contractor shall install private water meters at various water usage areas to track and monitor water consumption on site and workers' dormitory (if any) in accordance with Public Utilities (Water Supply) Regulations.

Office Amenities

The design and choices of office amenities to be included will affect resource usage and staff habits downstream. Below are some examples for consideration.

Toilets in site office should be well-ventilated. Air conditioners should not be installed within the toilet to avoid unnecessary energy consumption.

More blinds and windows can be considered to allow for natural light and ventilation, reducing reliance on lamps and air conditioners.

Solar films are also useful in blocking heat out of the office.

Office Amenities

Planting vertical greenery and greenery on roofs prevents excessive heat from being absorbed by buildings and lowers the ambient temperature. This means that less energy is required as the air conditioners need not work as much to cool the offices.

Deploy solar panels at the site office, where possible, to tap on renewable energy.

Alternatively, if your site location lacks solar irradiation, tap on green electricity plans.

Office Amenities

Procure electric or hybrid vehicles instead of pollutive models. Install electric vehicles (EV) charging points at the site office to encourage the transition to EV.

Install bicycle parking racks and shower facilities to encourage staff and workers to cycle to work.

Office Amenities

Use piped-in water dispensers instead of refillable bottled water dispenser, where possible. This helps to reduce the carbon emissions arising from the transportation of bottled water.

Site Office Operations

After the site office is completed and staff move in to work, eco-friendly habits should be encouraged and inculcated amongst the workforce to conserve resources.

Air Conditioners

GS Appendix A/ PS Appendix B, Annex A-g

Clause 2.5: The Contractor shall ensure that air conditioners are serviced regularly at a frequency of at least once a year to ensure the efficient running of the air conditioner.

Air conditioning temperature is to be maintained at ≥ 25 degree Celsius.

Printing of Papers

GS Appendix A/ PS Appendix B, Annex A-g

Go paperless for meetings, and switch to electronic systems for records and documentation.

E.g., QR code for logging attendance, ePermit-To-Work, etc.

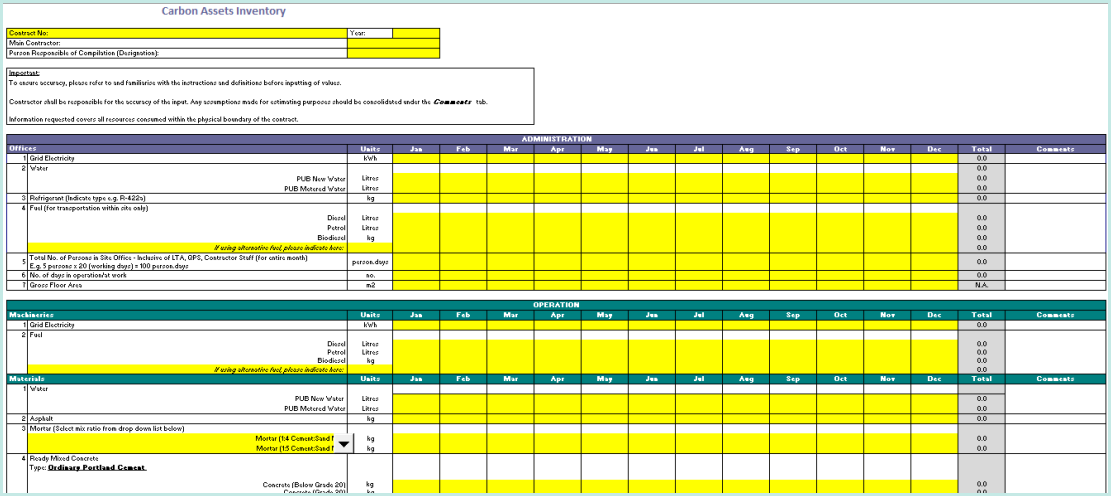
Clause 2.11: The Contractor shall as far as possible, where printing is necessary, print on both sides of the paper.

Clause 2.12: The Contractor shall procure site office items accredited with green label (e.g., SGLS+ for printing paper).

Carbon Accounting

GS Appendix A/ PS Appendix B, Attachment A-7

Clause 3.2: The Contractor shall also maintain and make available resource usage data of the project. The data shall be in accordance with the scope of assessment defined in Attachment A-7 or as specified by the Engineer.



Carbon Assets Inventory

Contract No:	Year:
Main Contractor:	
Person Responsible of Compilation (Designation):	

Important:
To ensure accuracy, please refer to and familiarize with the instructions and definitions before inputting of values.

Contractor shall be responsible for the accuracy of the input. Any assumptions made for estimating purposes should be consolidated under the ***Comments*** tab.

Information requested covers all resources consumed within the physical boundary of the contract.

ADMINISTRATION

Offices	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Comments
1 Grid Electricity	kWh													0.0	
2 Water														0.0	
PUB New Water	Litres													0.0	
PUB Metered Water	Litres													0.0	
3 Refrigerant (Indicate type e.g. R-422a)	kg													0.0	
4 Fuel (for transportation within site only)															
Diesel	Litres													0.0	
Petrol	Litres													0.0	
Biodiesel	kg													0.0	
If using alternative fuel, please indicate here.														0.0	
5 Total No. of Persons in Site Offices - Inclusive of LTA, GPS, Contractor Staff (For entire month) E.g. 5 persons x 20 (working days) = 100 person.days	person.days													0.0	
6 No. of days in operation/at work	no.													0.0	
7 Gross Floor Area	m2													N.A.	

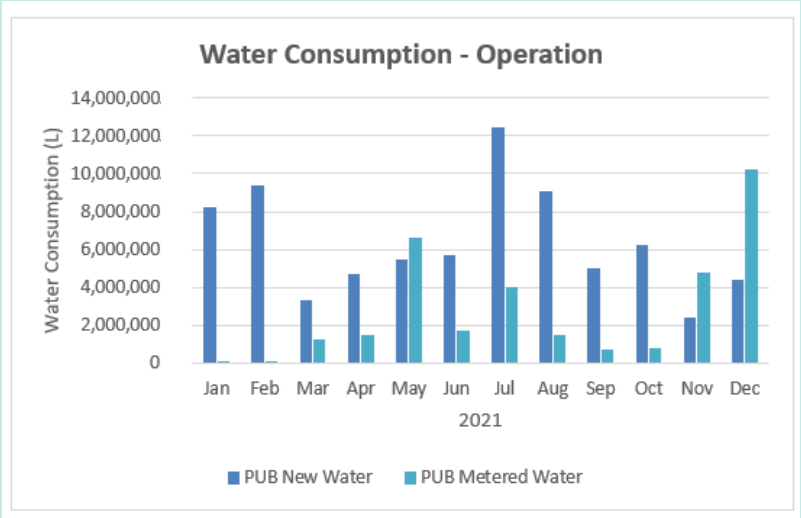
OPERATION

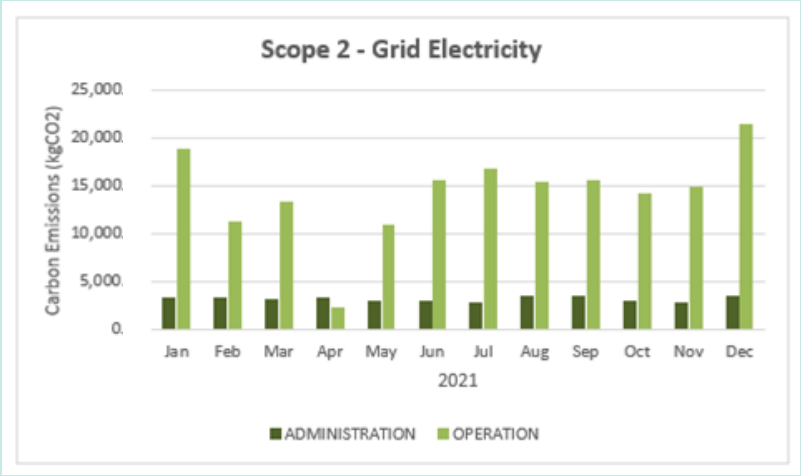
Machineries	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Comments
1 Grid Electricity	kWh													0.0	
2 Fuel															
Diesel	Litres													0.0	
Petrol	Litres													0.0	
Biodiesel	kg													0.0	
If using alternative fuel, please indicate here.														0.0	
Materials	**Units**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**	**Comments**
1 Water															
PUB New Water	Litres													0.0	
PUB Metered Water	Litres													0.0	
2 Asphalt	kg													0.0	
3 Mortar (Select mix ratio from drop down list below)															
Mortar (1:4 Cement:Sand)	kg													0.0	
Mortar (1:5 Cement:Sand)	kg													0.0	
4 Ready Mixed Concrete															
Type: **Ordinary Portland Cement**															
Concrete (Below Grade 20)	kg													0.0	

Contractor is required to **submit the Carbon Assets Inventory Form (Attachment A-7)** for LTA's data analysis.

Carbon Accounting

The form can also be used to track and reduce monthly resource consumption on site, where possible.





Reducing Waste in Office

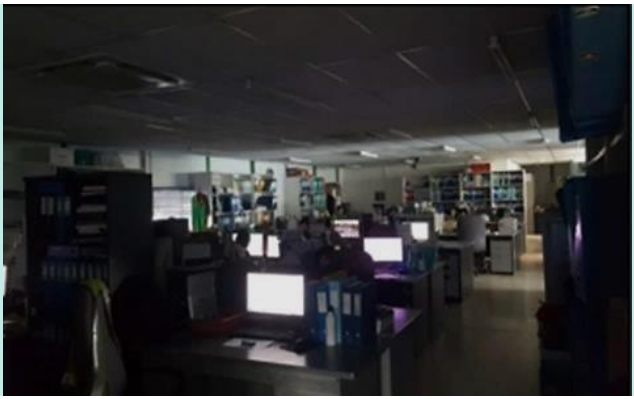
Eliminate single-use cups from the pantry and paper towels in the bathrooms and switch to reusable cups and electric hand dryers.

Having a single trash collection point (e.g., at the office pantry) encourages staff to think twice about generating waste.

Powering Down

Simple actions and good habits like switching off power plugs when not in use can help to reduce electricity consumption.

Switch off lights during lunch hour, and switch off power sources to computers/appliances at the end of the day to reduce standby power consumption.



Power down monitor brightness and activate energy-saving mode to reduce electricity consumption.

Recycling at Office

GS Appendix A/ PS Appendix B, Attachment A-10

Under the Waste Management Plan, there should be **initiatives to recycle/reduce e-waste and food waste (treatment to be considered before disposal).**

Set up a recycling point in the office to collect recyclables and e-waste.

Display visual instructtions on what can or cannot be recycled for easy reference.

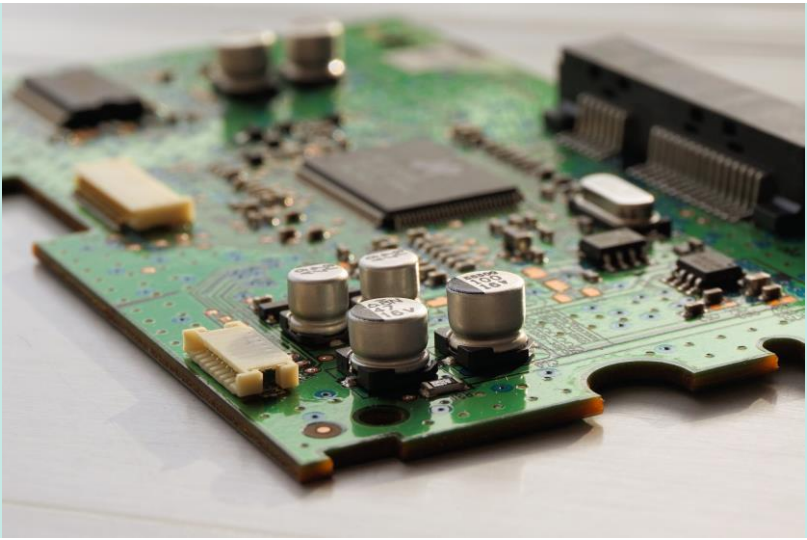
Recycling at Office

Drop the recyclables off at public recycling bins or engage a recycling service provider if a sufficient amount is collected.

For site offices with canteens, a food waste composter can digest segregated food scraps and food waste into fertiliser, recycling the waste generated.

Recycling at Office

Premises can liaise directly with NEA's appointed Producer Responsibility Scheme (PRS) Operator to arrange for the collection of regulated e-waste.

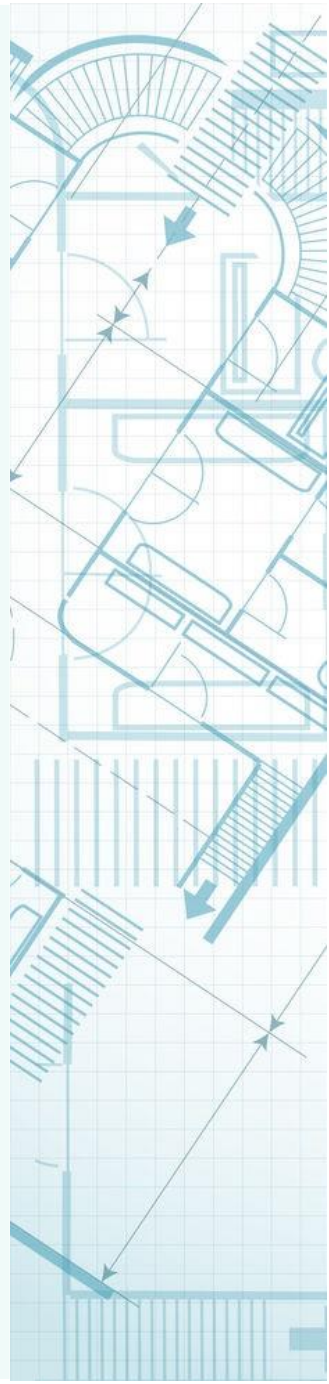


Examples of regulated e-waste are computers, laptops, desktop monitors, mobiles, tablets, printers, network switches, set-top boxes, light bulbs and tubes, household batteries, power banks, electric mobility devices, air-conditioners, refrigerators, washing machines and dryers.

Section 3: Construction Site

Planning & Procurement

Before the commencement of work, it is necessary to give careful consideration to protecting the environment, and to set the direction for sustainable work practices.



Green Building Materials

Green concrete reduces the embodied carbon by substituting cement with recycled materials or waste, such as recycled carbon dioxide and ground granulated blast furnace slag (GGBS), in its production process while maintaining its strength performance.

Where possible, designers and contractors should design and use green concrete for the works.

Green Building Materials

For interior works of site offices or permanent building structures, use green-labelled interior building products with low emissions of formaldehyde and Volatile Organic Compounds (e.g. low-VOC emitting paints that meet SS150), to promote better indoor air quality.

For more information on Sustainable Construction, please refer to BCA's resources: Sustainable Construction Publications | Building and Construction Authority (BCA)

Prefabrication & Precast Elements

Through the use of prefabrication and precast elements, such as precast staircases and precast walls, construction wastage and on-site can be reduced as compared to cast in-situ works.

Reusable Construction Materials

When considering the lifecycle assessment of temporary construction materials, it would be best to find reusable materials and methods where practicable.

Modular staircases

System formwork

Reusable Construction Materials

Reusable footpaths

Reusing of tunnel segments as temporary retaining walls

Connecting to the Grid

Where and when possible, opt to connect to the electrical power supply from the power grid. If there are plans for a substation, Contractors can consider building the substation earlier to connect to the grid.

Using electricity is more environmentally-friendly than relying on diesel-powered generators, with lower carbon footprint, less noise and reduced air pollutants produced.

Electric Construction Machinery

Use of electric or hybrid construction machinery can bring about several benefits such as reduction of on-site fuel consumption, minimal energy loss, and less air and noise pollution as compared to diesel-powered machines.

The electrification of machinery enables tapping onto green electricity and can further reduce carbon emission.

In situations where the use of electric construction equipment is not feasible, consider using diesel engines that meet EU Stage IIIA / US Tier III / JPN Tier III standards or better, to mitigate the emission of air pollutants (e.g. PM2.5) from construction equipment.

Energy-saving Devices

Smart or innovative devices that are available on the market can help to lower energy consumption.

Motion sensor lights along walkways and corridors.

LED lights can provide illumination at work areas at a lower energy consumption than fluorescent lamps.

Energy-saving Devices

With a separate power pack, the crane operator can switch on the independent AC system to keep the cabin cool instead of keeping the entire crane engine idling. This reduces fuel consumption and noise generated.

Solar-powered Devices

Source for devices that use alternative/renewable energy sources, such as solar energy.

Solar-powered devices such as CCTV, street lighting, and instrumentation data loggers.

Construction Phase

As work begins on site, many materials are continuously moved in and out of site.

Management plans and systems need to be in place to ensure sustainable work processes are implemented.

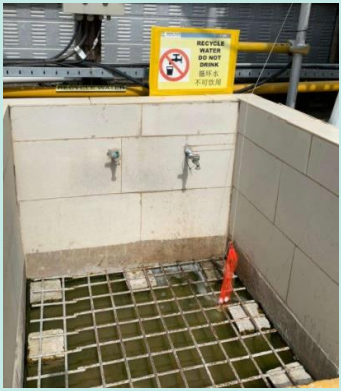
Recycling of ECM Water

GS Appendix A/ PS Appendix B, Annex A-g

Clause 2.10: The Contractor is to use recycled water obtained through ECM treatment plants for non-potable water usage, where possible.

Possible uses of recycled water:

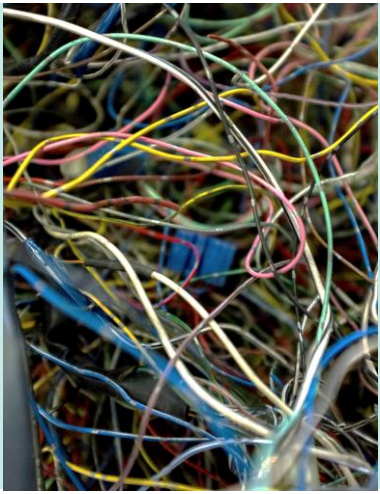
- Wash bay
- Boot wash
- Dust Control



Waste Management

GS Appendix A/ PS Appendix B, Annex A-g

Clause 8.3: The Contractor shall carry out effective on-site sorting of construction and demolition waste (to recover inert, reusable and / or recyclable portion shall be provided).
a) Metals shall be recovered for collection by recycling contractors.



Cables can be collected and sold to be recycled.

Waste Management

GS Appendix A/ PS Appendix B, Annex A-g

b) Cardboards and paper packaging shall be recovered, properly stockpiled in dry and covered conditions to avoid cross contamination by other construction and demolition materials.

c) Excavated materials shall be sorted to recover inert portions (e.g. soil and crushed rocks) for re-use on site or disposal to designated filling areas.

Demolished concrete used as recycled concrete aggregate.

Waste Management

Reduce the use of bottled water on site by encouraging staff and workers to bring their own water bottles instead. Water cooler facilities should be readily available at rest areas for refilling of water bottles.

Upcycling of Materials

With a little imagination, construction materials can be upcycled into many useful items for the site/office.

Examples are:

- Furniture
- Toolboxes
- Umbrella stand

Towards a Sustainable Future

The journey towards sustainability requires committed effort from both staff and management to shift mindsets and habits.

We hope that Contractors are inspired to leverage technology and create innovative solutions to build a greener land transport system together.

LTA will be progressively embedding sustainability into our procurement processes with the aim of cultivating an eco-system of green contractors and suppliers. Thus, Contractors are encouraged to demonstrate their sustainability commitment and to take an active role to incorporate sustainable measures from the early stage to the end of the project.

References

1. LTA Specifications:

- LTA General Specifications Appendix A (June 2022)

2. Online Resources:

- https://www.nccs.gov.sg/singapores-climate-action/singapore-emissions-profile/
- NEA | National Environment Agency
- https://www.pub.gov.sg/wels
- https://www.pub.gov.sg/smartwatermeter/
- https://www.lta.gov.sg/content/ltagov/en/industry_innovations/technologies/electric_vehicles.html
- https://sgls.sec.org.sg/
- https://www.nea.gov.sg/media/news/news/index/three-in-five-households-recycled-regularly-in-2021-singaporeans-are-encouraged-to-recycle-more-and-recycle-right
- https://www.volvoce.com/europe/en/products/electric-machines/ecr25-electric/
- https://www.wackerneuson.eu/en/products/zero-emission/
- Sustainable Construction Publications | Building and Construction Authority (BCA)