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Bank less

Spurring Businesses Towards Sustainability Transformation:

A playbook for small & medium
enterprises in Singapore

Knowledge Partner:

Deloitte.



Table of Contents

Introduction	3
Area of transformation 1: Transport decarbonisation and fleet electrification	4
Importance of electrifying your transport fleet:	4
What are the regulatory and business cases driving this?	
Key opportunity areas for transport decarbonisation & fleet electrification:	6
What are the technologies available in the market?	
What is the workflow for SMEs to begin this and what are the resources available to support implementation?	10
Area of transformation 2: Renewable Energy and Green Buildings	12
Importance of green buildings:	12
What are the regulatory and business cases driving this?	
Key opportunities areas for green buildings and renewable energy:	15
What are the technologies available in the market?	
What is the workflow for SMEs to begin this and what are the resources available to support implementation?	20
Area of transformation 3: Circularity and Resource Efficiency	23
Importance for SMEs to be part of the circular economy:	23
What are the regulatory and business cases driving this?	
Key opportunities for circular economy and resource efficiency:	26
What are the technologies available in the market?	
What is the workflow for SMEs to begin this and what are the resources available to support implementation?	33
Conclusion:	35
The Way Forward: How SMEs can be Supported in their Sustainability Journey	



Introduction

The impacts of climate change are already affecting economies worldwide and pose a major business risk for companies around the world¹. The urgency is evident by the Intergovernmental Panel on Climate Change (IPCC)'s latest warning that the world is likely to surpass its climate target of limiting global warming to 1.5°C as compared to preindustrial levels by the early 2030s². This has major implications for economies around the world, including Singapore – a low-lying island city state vulnerable to the impacts of climate change³. By the end of the century, Singapore's National Climate Change Secretariat (NCCS) predicts a 4.6°C increase in temperature and a 1-meter rise in sea levels, showcasing how no one will be insulated from the effects of global warming⁴.

Large corporations are increasingly taking the lead on climate action with significant efforts being put into embedding environmental, social and governance (ESG) into business strategy and practices. However, their efforts alone are not enough. Small and Medium-sized Enterprises (SMEs) are equally important for the world to move the needle on climate change. As SMEs comprise around 90% of the global economy⁵ and account for at least 50% of global greenhouse gas (GHG) emissions in the business sector⁶, it is important for them to incorporate sustainability into their business and capitalise on the emerging opportunities associated with the transition to a low-carbon economy. There is increased pressure and growing expectations by stakeholders such as investors, regulators and consumers who recognise the crucial role that corporates play in the global effort to limit global warming.

In Singapore, SMEs are well positioned to enhance climate resilience while reaping the benefits of improved sustainability performance. This segment will be a key driving force for ensuring a climate-resilient Singapore and supporting government initiatives such as the Singapore Green Plan 2030⁷.

This playbook identifies three crucial areas where SMEs in Singapore can reap benefits while making significant contributions to Singapore's -and the world's- climate targets:

- **Transport Decarbonisation and Fleet Electrification**
- **Renewable Energy and Green Buildings**
- **Circularity and Resource Efficiency**



These areas hold numerous opportunities for companies to introduce new practices and practical solutions to become greener and more sustainable in their day-to-day operations. As climate change increasingly influences consumer choices, investor preferences, and regulations, SMEs in Singapore can enhance their competitive advantage, mitigate risks, and reduce costs by taking the lead on climate action⁸. This playbook also outlines some of the challenges SMEs may face when embarking on their sustainability journey, such as inadequate financial or technical resources. However, as this playbook will demonstrate, SMEs that are committed to transformation can access and leverage a range of local resources and incentives such as government programmes and sustainable financing options.

¹ Deloitte (2019), <https://www2.deloitte.com/us/en/insights/topics/strategy/impact-and-opportunities-of-climate-change-on-business.html>

² Intergovernmental Panel on Climate Change (IPCC), https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf

³ Ministry of Sustainability and the Environment (MSE), <https://www.mse.gov.sg/resources/climate-action-plan.pdf>

⁴ National Climate Change Secretariat (NCCS), <https://www.nccs.gov.sg/singapores-climate-action/impact-of-climate-change-in-singapore/>

⁵ World Bank, <https://www.worldbank.org/en/topic/sme/finance>

⁶ Organization for Economic Cooperation and Development (OECD), <https://www.oecd.org/coronavirus/en/data-insights/sustainable-smes>

⁷ Deloitte (2023), <https://www.deloitte.com/global/en/about/press-room/new-deloitte-research-on-sustainability-investments.html>

⁸ Deloitte, <https://www2.deloitte.com/nl/nl/pages/sustainability/articles/putting-people-at-the-heart-of-your-sustainability-transformations.html>



Area of transformation 1: Transport decarbonisation and fleet electrification

Importance of electrifying your transport fleet: What are the regulatory and business cases driving this?

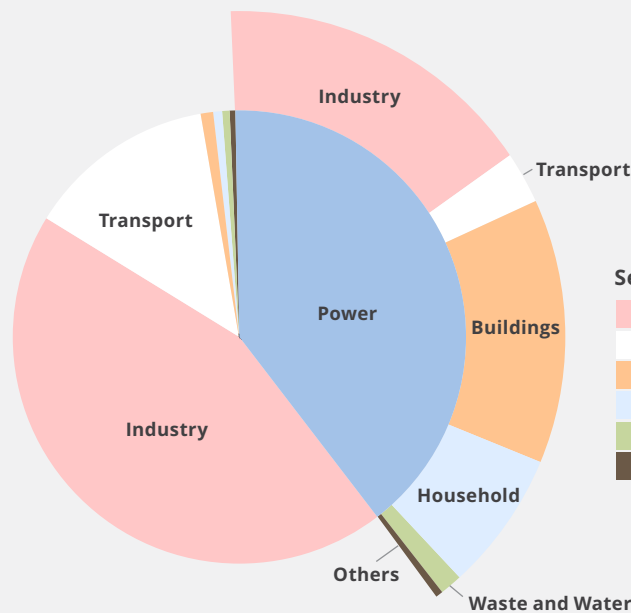
Transport is a key aspect of business operations, and many SMEs rely on transportation in their day-to-day operations. However, transportation accounts for around 20% of global GHG emissions and this proportion is expected to increase in coming decades⁹. In Singapore, transport accounts for roughly 14% of total emissions, making it the country's third largest source of carbon dioxide equivalent (CO₂e) emissions¹⁰. It is therefore of utmost importance that SMEs address their transport-related emissions.

Emission profile of Singapore (2020)

Emissions: 49.7 MtCO₂e

Primary Emissions

Power	39.8%
Industry	44.4%
Transport	13.7%
Buildings	0.8%
Household	0.5%
Waste and Water	0.6%
Others	0.2%



Source: National Climate Change Secretariat Singapore (2020)¹¹

The emissions profile above excludes estimated hydrofluorocarbons (HFCs) emissions of around 3.1 MtCO₂e, from the Refrigeration and Air-conditioning (RAC) sector in 2020. When more robust estimates are established, the national emissions profile will be updated in accordance with the United Nations Framework Convention on Climate Change (UNFCCC) and Intergovernmental Panel on Climate Change (IPCC) guidelines on continual improvement of national GHG inventories.

⁹ Statista (2023), <https://www.statista.com/topics/7476/transportation-emissions-worldwide/>

¹⁰ National Climate Change Secretariat (NCCS), <https://www.nccs.gov.sg/singapores-climate-action/singapores-climate-targets/singapore-emissions-profile/>

¹¹ National Climate Change Secretariat (NCCS) (2020), <https://www.nccs.gov.sg/singapores-climate-action/singapores-climate-targets/singapore-emissions-profile/>



To promote decarbonisation of transportation, there have been a range of innovations and initiatives around the world. Perhaps most notably is the emergence of electric vehicles (EVs), which has experienced rapid uptake in recent years, evident by the rise in global EV sales with over 2.3 million electric cars sold in the first quarter of 2023 - a 25% increase from 2022¹². Business purchases of new EVs make up a substantial portion of these sales, creating a strong opportunity for companies to reduce global fossil fuel dependence and emissions.

In Singapore, there has been a strong push for the decarbonisation of transportation, driven by the government's aim of reducing land transport emissions by 80% by or around 2050¹³. With the government's plans to raise the current carbon tax from S\$5 per ton of CO₂e, to S\$50-80 per ton of CO₂e by 2030, this will result in increased costs for high emitters¹⁴. The changing transportation landscape thus presents a strong opportunity for SMEs to incorporate greener transportation modes across their operations¹⁵.

As the shift from internal combustion engines (ICE) vehicles to EVs becomes increasingly mainstream, this will be accompanied by a corresponding demand for sustainable energy solutions to ensure that vehicles are powered by efficient and accessible charging infrastructure and battery systems. Governments and private companies across the world are investing in such infrastructure, including in Singapore, to accommodate the EV revolution. To meet the increasing demand in Singapore, the government is actively ramping up EV charging deployment across the island¹⁶. In September 2021, the Urban Redevelopment Authority (URA) and Land Transport Authority (LTA) awarded a pilot tender for more than 600 EV charging points across 200 public car parks. More tenders for charging point deployment at public carparks is expected to be issued in the near future, signaling greater accessibility and convenience for companies with EV fleets¹⁷.

In addition, the application of more sustainable materials, technology, advanced energy storage solutions, and innovations in battery chemistry is making EVs increasingly eco-friendly and efficient.

With emerging innovations in self-driving smart technologies such as automated guided vehicles (AGVs), there are also new and existing opportunities to further decarbonise Singapore's transport ecosystems¹⁸. Globally, these technologies became increasingly prominent in recent years, especially during the pandemic, as they facilitate contactless delivery and are designed to optimise navigation, thereby reducing fuel consumption and optimising efficiency¹⁹.

In the drive towards a net-zero future, transport decarbonisation and fleet electrification will be crucial and there are already exciting and viable opportunities for SMEs across various sectors to explore more energy efficient solutions to reduce operational costs and emissions.

¹² International Energy Agency (IEA), <https://www.iea.org/energy-system/transport/electric-vehicles>

¹³ Land Transport Authority (LTA), <https://www.lta.gov.sg/content/ltagov/en/newsroom/2022/3/news-releases/reducing-peak-land-transport-emissions-by-80-.html>

¹⁴ National Climate Change Secretariat (NCCS), <https://www.nccs.gov.sg/singapores-climate-action/mitigation-efforts/carbontax/#:~:text=The%20carbon%20tax%20level%20was,period%20for%20emitters%20to%20adjust.&text=To%20support%20our%20net%20zero,tCO2e%20by%202030>

¹⁵ Ministry of Transport (MOT), <https://www.mot.gov.sg/what-we-do/green-transport/electric-vehicles>

¹⁶ World Economic Forum (WEF), <https://www.weforum.org/agenda/2022/03/five-transit-policies-cities-should-prioritize-to-become-more-sustainable/>

¹⁷ Ministry of Transport (MOT), <https://www.mot.gov.sg/what-we-do/green-transport/electric-vehicles>

¹⁸ Deloitte, <https://www2.deloitte.com/us/en/pages/manufacturing/articles/autonomous-robots-supply-chain-innovation.html>

¹⁹ Ministry of Transport (MOT), <https://www.mot.gov.sg/what-we-do/green-transport/electric-vehicles>



Key opportunity areas for transport decarbonisation & fleet electrification: What are the technologies available in the market?

SMEs with vehicle fleets, such as those in the transportation services sector, courier and delivery services, as well as logistics sector, can contribute to Singapore’s decarbonisation goals by electrifying their fleets and moving towards greener transportation models. This can also go beyond the transportation itself by considering elements such as charging, maintenance, and recycling, to ensure that sustainability is integrated throughout the value chain and product life cycle.

Below, we share some examples of available technologies and solutions that SMEs across different sectors in Singapore can explore to enable transport decarbonisation and fleet electrification.



Electric Vehicles (EVs)					
Use Case/ Application	<p>When we talk about electric vehicles, cars and passenger vehicles typically comes to mind. However, this category extends to a range of other types of vehicles, equipment, and systems used in the movement of goods and services, such as e-vans, e-bikes, e-forklifts, and automated guided vehicles (AGVs). For SMEs in Singapore operating these types of vehicles, there is a range of private and public incentives available to support their transition to EVs. For example, the Singapore government introduced the <i>EV Early Adoption Incentive</i> and the <i>Vehicular Emission Scheme</i>, offering tax rebates up to 45% on the <i>Additional Registration Fee (ARF)</i> for purchases of new EVs²⁰. Through visible decarbonisation efforts such as utilising EVs, SMEs in Singapore can boost their appeal to investors and customers alike. By adopting EVs, companies may also unlock access to new financing opportunities such as the <i>DBS Equipment and Vehicle Loan</i>²¹. With preferential interest rates, such loans make it increasingly cost-effective and attractive for SMEs to make the transition to cleaner and more efficient vehicle fleets.</p>				
Cost Estimation	High	Medium	Low	Initial Investment	Maintenance/Operations
	●	●	●	●	●
Advantages	<ul style="list-style-type: none"> • Cost Savings: <ul style="list-style-type: none"> - With fewer moving parts, EVs may experience less wear and tear compared to ICE vehicles, enabling greater cost savings on maintenance in the long term. - Fleet electrification can also lead to substantial cost savings by eliminating dependency on gasoline and diesel. • Operational Efficiency: With built-in smart technologies, EVs can enable SMEs to monitor vehicle performance in real-time, optimise routes, and plan maintenance proactively. These capabilities contribute to improved operational efficiency and overall productivity to better streamline their operations²². 				
Limitations	<ul style="list-style-type: none"> • High Initial Investment: Replacing an ICE fleet with EVs would require a high initial investment. However, this can be offset through financial incentives and subsidies as mentioned in the Use Case-section above. • Access to Charging Infrastructure: While it is rapidly improving, there is still demand for additional EV-charging infrastructure in the market. To further their decarbonisation efforts, companies that have invested in fleet electrification can also consider smart and sustainable electric charging facilities within their premises. This can include microgrids²³ which are self-contained, on-site energy systems, to supply energy to EVs. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Electric Vehicles (E.g., Tesla, BYD, BMW, Volvo) • Regenerative Braking Systems • Advanced Driver Assistance Systems 				

²⁰ Ministry of Transport (MOT), <https://www.mot.gov.sg/what-we-do/green-transport/electric-vehicles>






²¹ DBS, <https://www.dbs.com.sg/sme/financing/fixed-asset/equipment-vehicle-loan>

²² European Business Review, <https://www.europeanbusinessreview.com/why-electric-vehicle-fleet-management-software-is-the-future/>

²³ Forbes (2023), <https://www.forbes.com/sites/forbestechcouncil/2023/06/01/creating-a-sustainable-ev-fast-charging-future/?sh=74366b387fc0>



Charging Infrastructure

Use Case/ Application	<p>For companies with large vehicle fleets such as transportation companies, logistics, courier and delivery services, transitioning to EVs would also require access to adequate charging infrastructure to ensure efficiency, reliability and to further support their overall decarbonisation effort. This may, for example, include private electric charging facilities within the company premises.</p>				
Cost Estimation	High	Medium	Low	Initial Investment	Maintenance/Operations
Advantages					
Limitations	<ul style="list-style-type: none"> • Efficiency and reliability: By investing in onsite EV charging infrastructure, companies can enhance efficiency and reliability by eliminating dependency on public charging stations. With onsite infrastructure, charging can be strategically planned during off-hours. Another advantage is the time saved for staff to locate and wait for public charging facilities. • Enhanced Brand Image: Onsite EV charging infrastructure showcases a company's proactiveness and dedication to transforming their operations and is a visible commitment to sustainability. Such innovations also complement Singapore's national ambition to decarbonise its transportation ecosystem and enhances the public image of the company, fostering positive relationships with its stakeholders, including investors, partners and customers. • Adaptation to Future Trends: With the growing trend towards EVs, having onsite infrastructure positions the company as forward-thinking and adaptable to emerging technologies and may strengthen resiliency and competitive position. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Direct current (DC) fast charging • Wireless charging • Solar powered charging • Smart charging 				





Smart Vehicle Management Technologies

<p>Use Case/ Application</p>	<p>The application of EVs introduces new concerns and considerations, such as battery life planning and preventative maintenance, requiring companies to be conscious of the overall operations and lifecycle of their EV fleets. SMEs can manage these concerns and even create opportunities by investing in cutting-edge monitoring software to optimise energy consumption and efficiency. For example, battery monitoring systems can help ensure safety and reliability while extending the lifespan of EVs by monitoring and managing battery voltage, current, ambient temperature etc.</p>				
<p>Cost Estimation</p>	<p>High</p>	<p>Medium</p>	<p>Low</p>	<p>Initial Investment</p>	<p>Maintenance/Operations</p>
<p>Advantages</p>	<p>●</p>	<p>●</p>	<p>●</p>	<p>●</p>	<p>●</p>
<p>Limitations</p>	<ul style="list-style-type: none"> • Resource efficiency and resilience: Smart monitoring systems and softwares can optimise energy consumption and efficiency to mitigate risk of disruptions while improving overall operational efficiency. • Partnerships: Innovative technologies may present opportunities for collaboration with other stakeholders committed to sustainability in the electric mobility ecosystem, thereby creating new avenues for growth. 				
<p>Examples of Market Technologies</p>	<ul style="list-style-type: none"> • Battery Management System (E.g Tesla Battery Management System, Nissan Leaf Battery Management System) • Geographic Information systems (for route-planning etc.) 				



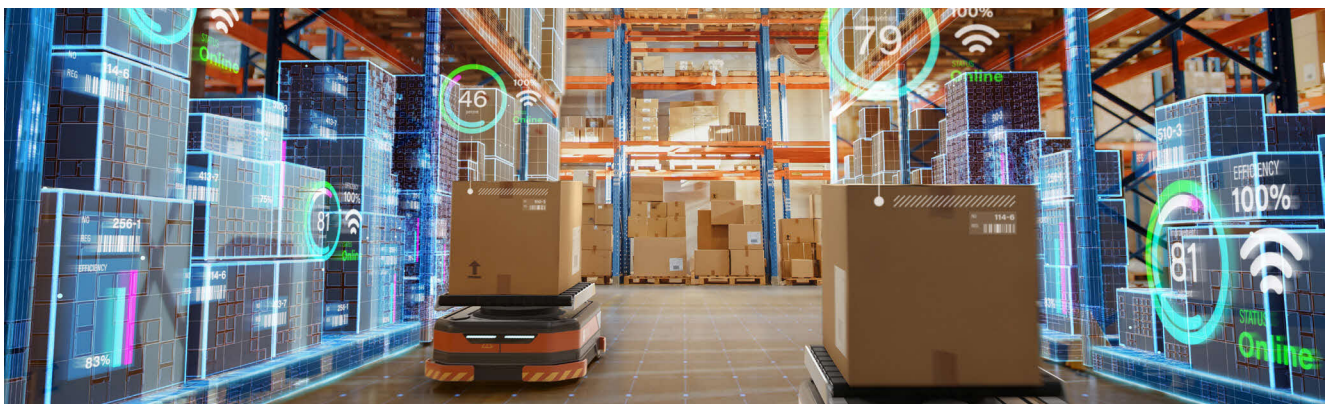
²⁴ Ministry of Transport (MOT), <https://www.mot.gov.sg/what-we-do/green-transport/electric-vehicles>



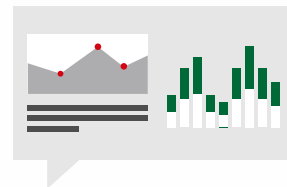


Smart Vehicle Management Technologies

Use Case/ Application	<p>With the impressive growth in sectors such as e-commerce and the sharing economy, there is increasing demand for enhancements in technologies such as e-robots and other automated guided vehicles (AGVs) to optimise delivery and enhance the efficiency of logistics. The adoption of technologies to enable automation, especially in industries with manufacturing and logistics facilities, is a key opportunity for companies to improve their efficiency, environmental performance, and competitive advantage.</p>				
Cost Estimation	High	Medium	Low	Initial Investment	Maintenance/Operations
	●	●	●	●	●
Advantages	<ul style="list-style-type: none"> • Optimise Transport and Logistics: Using automated electric robots for logistics in warehouses or even delivery reduces the need for larger machinery or trucks, allowing companies to operate more sustainably and efficiently. This can be achieved through technologies such as smart sensors and artificial intelligence (AI) features²⁵. • Return on Investments: The adoption of automated delivery systems may also improve margins by improving efficiency, order fulfillment rates, delivery speed, and ultimately, customer satisfaction. 				
Limitations	<ul style="list-style-type: none"> • High Investment and Maintenance Costs: Introducing AGV systems may require high initial costs in purchasing and installing the necessary infrastructure, as well as integrating the AGVs into existing systems. AGVs also require regular maintenance to ensure safe and proper functioning. • Emerging market: AGV's, especially for on-the-road delivery, is still an emerging concept and is accompanied with various risks and concerns relating to safety, regulations, reliability etc. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Centralised Control Software • Warehouse Management Systems Integration • Artificial Intelligence solutions 				



What is the workflow for SMEs to begin this and what are the resources available to support implementation?



Conduct a cost-benefit analysis of transitioning to EVs:

Start by evaluating the current fleet to identify vehicles that are in line for EV replacement. Engaging a consultant may be useful to identify the most suitable EVs and charging infrastructure. This is important for assessing the potential cost savings from transitioning to EVs and understanding the full environmental impact from manufacturing, usage, and disposal. Also consider factors such as expected usage (e.g., operating hours and distance per day) to select the most appropriate technologies.



Explore incentives available:

Before procuring the recommended technologies, companies can also explore government incentives and subsidies available to SMEs, such as the EV Early Adoption Incentive and the Enhanced Vehicular Emissions scheme, which may help reduce the initial investment needed²⁶. For EV procurement, sustainable financing options from banks should also be considered, such as the DBS Equipment and Vehicle Loan, which is applicable to electric and hybrid car and offers preferential interest rates²⁷.



Conduct pilot trials:

Companies should ensure the suitability of the technology by conducting tests on the technology's viability, reliability, and efficiency in their intended operations. This can be achieved through pilot trials to test the vehicles, equipment and charging infrastructure to assess its suitability and make any refinements before extending to a wider scale.



Educate employees on the benefits, operation and maintenance of EVs, charging infrastructure and batteries:

To ensure that those involved in the use of company vehicles experience a smooth transition in key aspects such as charging points availability and maintenance requirements, companies should provide guidance for employees to be fully equipped with an understanding of operating EVs and its charging infrastructure to better optimise its use.

²⁶ Ministry of Transport (MOT), <https://www.mot.gov.sg/what-we-do/green-transport/electric-vehicles>

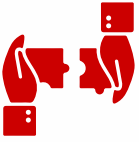
²⁷ DBS (2023), <https://www.dbs.com.sg/sme/financing/asset/equipment-vehicle-loan>





Develop a maintenance plan:

As EVs have different requirements from traditional vehicles, companies should develop a maintenance plan to ensure their EVs and supporting infrastructures are well maintained to extend its lifecycle and optimise usage.



Explore collaborative solutions:

This can include sharing EVs or coordinating transportation options to reduce costs. Companies with limited space can also consider collaborations with neighboring companies for larger initiatives such as on-site charging infrastructure.



Communicate with customers and other stakeholders:

Companies should engage and inform their customers and other stakeholders about the introduction of new transportation modes and delivery methods, to address any concerns and emphasise the benefits, such as improved environmental performance.



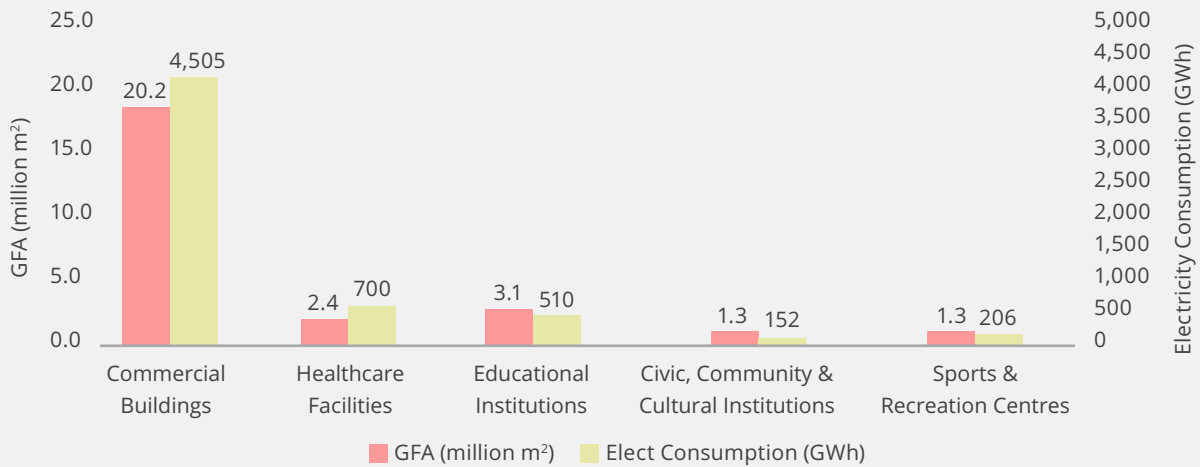


Area of transformation 2: Renewable Energy and Green Buildings

The importance of green buildings: What are the regulatory and business cases driving this?

There is significant potential for SMEs to create a positive impact within the very buildings they exist and operate. According to the International Energy Agency (IEA), buildings account for 30% of global energy usage and 26% of energy-related emissions²⁸. In Singapore, buildings account for 20% of emissions and consume more than one third of the nation’s electricity. Annual electricity consumption from commercial buildings in the city had the highest share of electricity consumption across all building types in 2020²⁹.

Gross Floor Area and Annual Electricity Consumption (GWh) by Building Types in Singapore (2020)



Source: Building and Construction Authority³⁰ (BCA)

To support Singapore’s goal of achieving net-zero emissions by 2050, ambitious emissions reduction targets across building types will be crucial. In Singapore, both new and existing buildings will need to be designed and improved to maximise efficiency and reduce energy consumption³¹. According to the Singapore Green Building Council (SGBC), a green building is distinguished by its resource-efficiency and environmental responsibility “throughout its lifecycle from planning to design, construction, operation, maintenance, renovation and demolition”³². Green buildings also consider the well-being and comfort of its occupants. This can, for example, be achieved through features to improve air quality and circulation, thermal comfort, as well as optimising lighting conditions to enhance productivity. Such features are especially important in the context of Singapore’s dense urban landscape and its hot and humid climate.

²⁸ International Energy Agency (IEA), <https://www.iea.org/energy-system/buildings>

²⁹ Ministry of Sustainability and the Environment (MSE) (2022), <https://www.mse.gov.sg/resource-room/category/2022-05-20-sgbc-gala-dinner/#:~:text=7%20The%20built%20environment%20sector,third%20of%20our%20nation%27s%20electricity>

³⁰ Building and Construction Authority (BCA), https://www1.bca.gov.sg/docs/default-source/docs-corp-buildsg/sustainability/bca-building-energy-benchmarking-report-%28bebr%29-2021.pdf?sfvrsn=1f6d0bdc_0

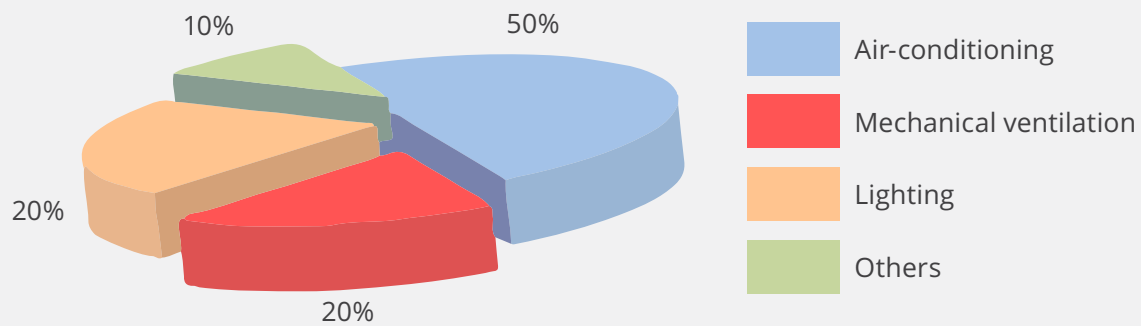
³¹ World Green Building Council (WGBC) (2019), <https://worldgbc.org/article/zero-carbon-buildings-for-all-initiative-launched-at-un-climate-action-summit/>

³² Singapore Green Building Council (SGBC), <https://www.sgbc.sg/resources/live-work-play-green/green-building>



In Singapore, air conditioning accounts for roughly half of energy consumption in buildings, followed by lighting, signaling the pressing need for companies to adopt innovative and sustainable solutions to reduce energy demand and enhance the overall sustainability of the built environment.

Breakdown of energy consumption within buildings in Singapore



Source: National Environment Agency (NEA)³³

Adaptive heating, ventilation and air conditioning (HVAC) capabilities, smart lighting, and other smart technologies that promote greater energy efficiency are important and viable solutions as companies work towards developing greener buildings. With the emergence of artificial intelligence (AI) and the Internet of Things (IoT), buildings can be managed more efficiently with the support of optimisation tools, data analytics, and predictive maintenance. For example, AI-enabled IoT sensors with wireless systems such as lighting sensors and thermometers can provide a steady stream of data to enable facilities managers to monitor, analyse, and optimise energy consumption.

Another increasingly popular solution to promote the development of green buildings and reduce overall energy consumption is the adoption of rooftop solar to generate renewable energy. To support local deployment of solar energy, the Singapore government has launched various initiatives and incentives such as tax rebates and solar deployment programmes, which extend to privately leased industrial properties, making commercial solar adoption more accessible for SMEs in the city³⁴. More tenders have been issued, complemented by greater support by the government to help companies adopt solar energy, with the aim of transforming industrial and commercial facilities to become greener³⁵.

³³ Singapore's Second National Communication: Under the United Nations Framework Convention on Climate Change (November 2010), NEA; <https://www.nccs.gov.sg/files/docs/default-source/default-document-library/air-con-system-efficiency-primer-a-summary.pdf>

³⁴ The Business Times, <https://www.businesstimes.com.sg/companies-markets/jtc-extends-solar-deployment-programme-privately-leased-industrial-buildings>

³⁵ The Business Times, <https://www.businesstimes.com.sg/companies-markets/jtc-launches-tender-raise-solar-capacity-jurong-island>



Another option to “green” buildings is the incorporation of natural elements such as rooftop gardens and green roofs. Vertical farms and gardens are also increasingly incorporated in buildings as part of wider efforts to promote sustainability within urban spaces. In fact, with Singapore’s push to become greener, the Singapore government has supported skysrise greening by providing incentives to stimulate the industry. Such features have become increasingly visible across buildings and rooftops in the city, transforming buildings into urban farms and edible gardens as part of the country’s aims to reduce emissions, green the city, and increase local food production³⁶.

The urgency for companies to consider the sustainability of the buildings in which they operate is driven by how minimum performance standards and building energy regulations are becoming more stringent, both globally and in Singapore³⁷. With a target of having “at least 80% of buildings (by floor area) in Singapore to be green by 2030”, Singapore’s Green Building Masterplan represents a key step in the expansion of sustainable buildings³⁸. Furthermore, under the Singapore Green Plan 2030, the government has aimed to bring Super Low Energy buildings into the mainstream with expectations that all new and existing buildings (upon major retrofit) are to achieve Green Mark Platinum Super Low Energy standards or equivalent³⁹.

As of March 2020, Singapore had greened more than 40% (approximately 12 million square metres) of the built environment⁴⁰. However, many buildings in Singapore remain energy-inefficient and contribute significantly to the city’s overall carbon emissions. As such, SME building owners and tenants have the opportunity to contribute to Singapore’s overall objectives while reaping the benefits of creating more resource efficient workspaces.



³⁶ NParks, https://www.nparks.gov.sg/-/media/cuge/ebook/citygreen/cg11/cg11_journey_of_skyrise_greenery_in_singapore.pdf?la=en&hash=042A58C41D18D536EED09391A94417944B49FA90

³⁷ Deloitte (2022), <https://www2.deloitte.com/lu/en/pages/real-estate/articles/value-green-buildings.html>

³⁸ Building and Construction Authority (BCA), <https://www1.bca.gov.sg/buildsg/sustainability/green-building-masterplans>

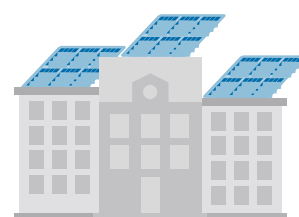
³⁹ Building and Construction Authority (BCA), <https://www1.bca.gov.sg/buildsg/sustainability/super-low-energy-programme>

⁴⁰ Singapore Green Building Council (SGBC) (2015), <https://www.sgbc.sg/about-green-building/sgbmp>

⁴¹ Deloitte, <https://www.deloitte.com/global/en/Industries/government-public/perspectives/urban-future-with-a-purpose/smart-and-sustainable-buildings-and-infrastructure.html>

Key opportunities areas for green buildings and renewable energy: What are the technologies available in the market?

Embracing sustainability efforts within the buildings they operate may bring a range of benefits for SMEs building owners and tenants in Singapore, such as hoteliers, manufacturers and corporate offices. SMEs can reduce operating costs and enhance their competitive advantage by integrating environmentally friendly elements that suit Singapore’s tropical climate and urban setting through features like smart technologies, climatic response design, building energy performance, and promoting resource stewardship, which are all key criterion in Singapore’s Green Mark Certification Scheme⁴². The following table outlines some initiatives and opportunities that SME building owners and tenants in Singapore can consider for greening their own buildings and workplaces:



Solar Rooftops, Building-integrated Photovoltaic Systems (PVs) and Energy Storage Systems

Use Case/ Application	For SMEs operating within commercial buildings, the adoption of solar panels on rooftops that are oftentimes underutilised can be advantageous, particularly in sectors such as manufacturing, professional services, and small-scale hotels. Energy storage systems can also be implemented in conjunction with solar panels to ensure a stable supply of energy and mitigate any risk of disruptions.				
Cost Estimation	High ●	Medium ●	Low ●	Initial Investment ●	Maintenance/Operations ●
Advantages	<ul style="list-style-type: none"> • Low Operating Costs: Once installed, solar panels have minimal operating costs. Maintenance will involve cleaning the panels and ensuring that they are in working condition on a periodic basis to ensure optimal performance. • Price Stability and Risk Mitigation: Opting for solar energy may help to avoid or mitigate the risk of price fluctuations in the grid energy supply. • Flexible Design: Solar energy systems can be tailored to meet specific energy needs, making them customizable and scalable. Additional solar panels can be added as energy demands increase, providing a adaptable energy solution. • Improved Reputation: Renewable energy usage demonstrates a business’ commitment to climate action, which may improve brand image and reputation. 				
Limitations	<ul style="list-style-type: none"> • High Initial Investment: The initial cost of purchasing and installing solar panels, along with associated equipment like inverters and batteries, may be high – especially for larger projects. • Space Requirements: Solar rooftops require a considerable amount of space. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Photovoltaic (PV) Solar Panels • Energy Storage Systems 				

⁴² Building and Construction Authority (BCA), <https://www1.bca.gov.sg/buildsg/sustainability/green-mark-certification-scheme>

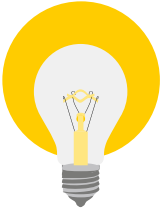




Rooftop Gardens, Green Roofs & Vertical Farming

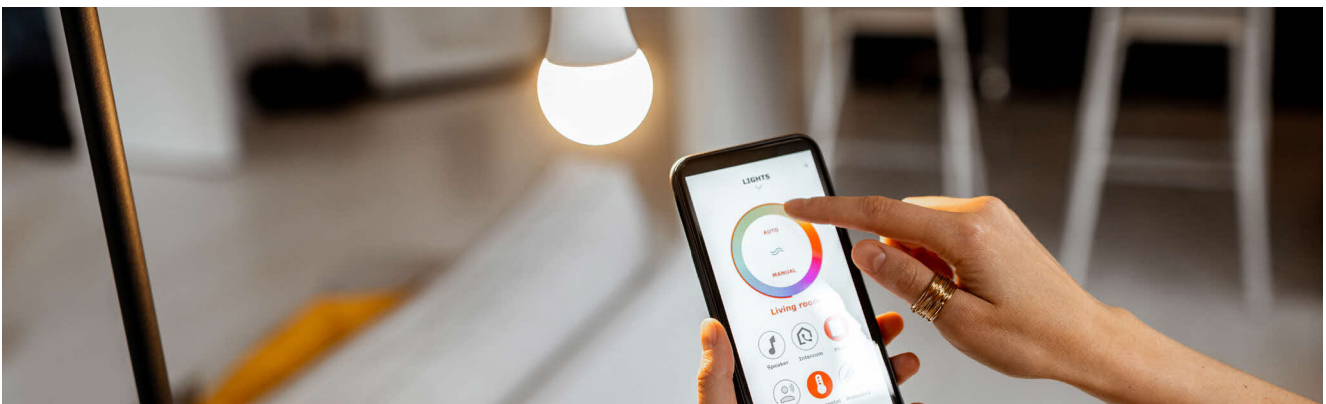
Use Case/ Application	SMEs across various sectors such as hotels and hospitality, food and beverage (F&B), real estate and property management, services and retail, can consider converting empty rooftops and other spaces into green areas such as rooftop gardens or urban farms as part of their overall sustainability efforts.				
Cost Estimation	High	Medium	Low	Initial Investment	Maintenance/Operations
	●	●	●	●	●
Advantages	<ul style="list-style-type: none"> • Lower Operating Costs: Green roofs and rooftop gardens can help to reduce energy costs by further insulating buildings and reducing the need for mechanical heating, ventilation, and air-conditioning (HVAC). • Aesthetic Enhancement and Biodiversity Support: Rooftop gardens enhance the visual appeal of buildings and may create habitats for birds and insects, contributing to the natural aesthetics and biodiversity of urban landscapes. • Carbon Sequestration: Green roofs sequester carbon, helping reduce greenhouse gas emissions. This contributes to climate change mitigation efforts while simultaneously improving overall air quality. 				
Limitations	<ul style="list-style-type: none"> • Maintenance: Rooftop gardens, green roofs, and vertical farms require regular maintenance, such as watering, weeding, and fertilising, which can be time-consuming and may require assistance from skilled personnel who can manage these systems. • Structural Load Capacity: The weight of soil, plants, and water can impose a significant load on a building's structure. Not all buildings are designed to support the additional weight of rooftop installation. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Rainwater Harvesting Rooftop Gardens • Pre-planted Green Roof Modules • Hydroponic/Aquaponic Vertical Farming Systems 				



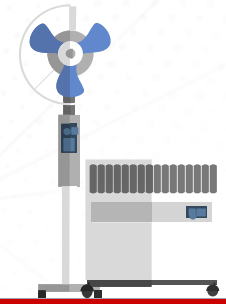


Smart Lighting

Use Case/ Application	<p>SMEs across the various sectors can use intelligent lighting systems to optimise lighting conditions in their premises, improving visibility, safety, and overall operational efficiency. These systems can automatically adjust lighting levels based on the specific tasks being performed and preference, contributing to a more comfortable and productive work environment while also reducing energy consumption and costs.</p>				
Cost Estimation	High ●	Medium ●	Low ●	Initial Investment ●	Maintenance/Operations ●
Advantages	<ul style="list-style-type: none"> • Lower Operating Costs: Smart lighting systems can bring about cost savings through monitoring and analytics, providing insights into energy usage patterns to help users identify opportunities for cost savings. Retrofitting buildings with energy efficient lighting has also been found to be a practical solution for reducing overall footprint, saving up to 40% of electricity compared to conventional lighting devices such as bulbs⁴³. • Improved Environmental Performance: The energy-efficient features of smart lighting are a cost-efficient method for directly reducing the electrical consumption and GHG emissions of a company. 				
Limitations	<ul style="list-style-type: none"> • Complexity: Installing and setting up a smart lighting system can be more complex than traditional lighting systems, requiring professional advice and support. • Security and Privacy: Smart Lighting monitoring software may process sensitive data related to energy usage, movement etc. Data security and privacy must therefore be considered. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Smart light switches • Smart bulbs and dimmers • Smart lighting sensors • Software and data analysis 				



⁴³ Transforma Insights, <https://transformainsights.com/blog/smart-buildings-reduce-global-energy#:~:text=35%2D40%25%20of%20electricity%20consumed,which%20contribute%20towards%20energy%20savings.>



Alternative Cooling

Use Case/ Application	<p>Adaptive cooling offers viable solutions for enhanced temperature control and improved operational efficiency. As SMEs across sectors in Singapore are reliant on cooling systems in their workplaces, this area presents a significant opportunity to adopt alternative cooling solutions to improve energy efficiency and reduce operational costs. For example, alternative cooling systems can enable companies to optimise temperature control in their workspaces and create more comfortable working conditions for employees while reducing energy usage in unoccupied workspaces.</p>				
Cost Estimation	High ●	Medium ●	Low ●	Initial Investment ●	Maintenance/Operations ●
Advantages	<ul style="list-style-type: none"> • Resource efficiency and cost: The adoption of more efficient and sustainable cooling technologies can lead to enhanced resource efficiency and a reduction in energy consumption and costs. Transitioning towards more efficient cooling technologies has the potential to reduce expenditure by as much as 40% for a small office space⁴⁴. • Improved Environmental Performance: Cooling technologies directly reduce the electrical consumption and environmental footprint of a company. • Improved Workplace Comfort: Smart cooling systems can contribute to a more comfortable work environment and healthier indoor air quality. 				
Limitations	<ul style="list-style-type: none"> • High Initial Investment: The initial investment needed for installing a new cooling system throughout a building or office may be high depending on project scope. • Compatibility: For building owners or tenants in older buildings, it may be challenging to achieve the successful integration of new cooling systems. However, there are companies which specialise in HVAC systems and installations that can support this effort. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • IoT-enabled thermostats • Passive cooling systems • Shading devices • Passive draught evaporative cooling (PDEC) • Smart blinds 				



⁴⁴ Singapore Institute of Technology (SIT), <https://www.singaporetech.edu.sg/news/cooler-greener-alternative-air-conditioning>



Internet of Things (IoT) Building Management System and Smart Retrofits

Use Case/ Application	<p>For SMEs with extensive operations in buildings, incorporating technologies and smart retrofits into existing building management systems offers several advantages to optimise operations and align with modern sustainability and efficiency standards. For example, those operating in office environments can tap into the advanced functionalities offered by IoT solutions to optimise workspace utilisation and promote climate control to improve employee comfort and reduce operational costs.</p>				
Cost Estimation	High ●	Medium ●	Low ●	Initial Investment ●	Maintenance/Operations ●
Advantages	<ul style="list-style-type: none"> • Operational and Resource Efficiency: IoT platforms generate valuable insights through data collection and analytics that can inform operational planning and decision-making. • Cost Savings and Improved Environmental Performance: IoT platforms can help reduce energy consumption and costs by optimising the operation of HVAC systems and other building systems such as lighting through the monitoring of temperature, humidity, and occupancy levels. • Improved Comfort and Productivity: SMEs operating in office environments can leverage the advanced functionalities from IoT to optimise their workspace through climate control and improve employee comfort and productivity. 				
Limitations	<ul style="list-style-type: none"> • High Investment: The upfront costs of installing IoT building management systems and smart retrofits can be high, as both the hardware and software may be costly to upgrade. IoT-based software also typically involves many interconnected devices and sensors, making it complex to install and calibrate. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Smart light switches • Smart bulbs and dimmers • Smart lighting sensors 				



What is the workflow for SMEs to begin this and what are the resources available to support implementation?



Conduct assessment of building(s) and office(s):

Assessing the current and future energy demand of relevant building(s) and office(s) is the first step to understand the feasibility of the various solutions discussed above. This can be done by reviewing past utility bills, conducting site inspections, and planning for future scenarios. For companies interested in utilising their rooftops for solar power generation or green roofs/gardens, it is advisable to engage a consultant to conduct appropriate assessments and advise on the most effective solutions. This may, for example, include an evaluation of the structural integrity and orientation of the rooftop to ensure it can support relevant infrastructure such as solar panels and batteries while accounting for factors like shading, available space, structural capacity, accessibility and condition.



Ensure that energy efficient features are incorporated in the building:

Embarking on step-by-step initiatives such as switching to LEDs or installing more energy efficient air conditioning systems are feasible ways in which companies can work towards developing green and more efficient buildings. LEDs can offer up to 60% reduction in energy consumption, as compared to traditional T8 fluorescent lights⁴⁵. Other examples include motion sensors and timers for lights to be automatically switched off when rooms are unoccupied to conserve energy, as well as smart lighting apps to remotely control and schedule lighting or HVAC systems, ensuring they are only active when needed. SMEs should assess the various products and solutions available in the market to identify low-hanging fruits that are most relevant to their company, improve environmental performance, and save costs.



Identify available and emerging green technologies:

Companies can explore a range of existing and emerging green technologies to meet their specific needs. For example, *the Super Low Energy Building Smart Hub*⁴⁶ provides a database for emerging smart technologies, which can be one starting point for SMEs to identify different types of green technologies that are suitable for their buildings, as well as to estimate the costs and maintenance requirements for each technology.

⁴⁵ Ministry of National Development (MND), <https://www.mnd.gov.sg/mso/newsroom/parliamentary-replies/view/smart-lighting-system>

⁴⁶ SLEB Smart Hub, <https://www.sleb.sg/Technologies/TechnologiesList?CategoryID=99>





Seek expertise and guidance on available solutions and technologies:

Design professionals, consultants, architects and engineers can be engaged to identify suitable solutions and technologies to optimise performance and maximise resource efficiency.



Explore available financing options and funding programmes:

Companies must account for various costs associated with the planning, installation, and ongoing maintenance of the different solutions and technologies. This can enable companies to determine the most cost-effective approach and leverage available programmes and financing options. For example, companies considering investing in smart technologies as part of their renovations can consider loans such as the *DBS Eco Renovate Loan* which offers preferential interest rates and longer repayment periods for businesses which incorporate environmentally friendly features in their renovations⁴⁷.



Explore national programmes:

Companies may also tap into a range of ongoing programmes such as the *Landscaping for Urban Spaces and High Rises (LUSH)* programme by the Urban Redevelopment Authority (URA)⁴⁸, the *Skyrise Greenery Incentive Scheme (SGIS)* by NParks⁴⁹, the *Green Mark Certification Scheme*⁵¹ and the *Green Mark Incentives Schemes*⁵⁰, which comprise incentives, guidance, and other support available to drive implementation and best practices in this area.



Ensure regulatory compliance:

As some projects and installations may involve regulatory compliance considerations and requirements, companies must understand and comply with local building codes, permits, and regulations.



Seek guidance on the design and engineering aspects:

Companies should assess the various types of solutions available in the market for commercial installation and its applicability and compatibility with their own buildings. Work with relevant contractors and consultants who can offer guidance and expertise in selecting the right technologies and solutions for a specific building or office.



⁴⁷ DBS, https://www.dbs.com.sg/sme/finance-better/eco-renovate-loan?pk_source=word-edit&pk_medium=referral&pk_campaign=affiliate

⁴⁸ Urban Redevelopment Authority (URA), <https://www.ura.gov.sg/Corporate/Guidelines/Development-Control/Non-Residential/SR/Greenery>

⁴⁹ NParks, <https://skyrisegreenery.nparks.gov.sg/>

⁵⁰ Building and Construction Authority (BCA), <https://www1.bca.gov.sg/buildsg/sustainability/green-mark-certification-scheme/>

⁵¹ Building and Construction Authority (BCA), <https://www1.bca.gov.sg/buildsg/sustainability/green-mark-incentive-schemes>





Start small and scale up:

Before expanding and implementing any technology full-scale, companies may begin with a pilot project in a specific area of their building to gain experience with the technology and assess its feasibility.



Engage staff:

To ensure that the technologies and installations are maintained and fully utilised, companies should engage its employees to raise awareness and provide guidance. For example, companies that have chosen to incorporate rooftop gardens or farms can engage their employees and create opportunities to reconnect with nature and cultivate a stronger sense of community and involvement.



Conduct regular maintenance and updates:

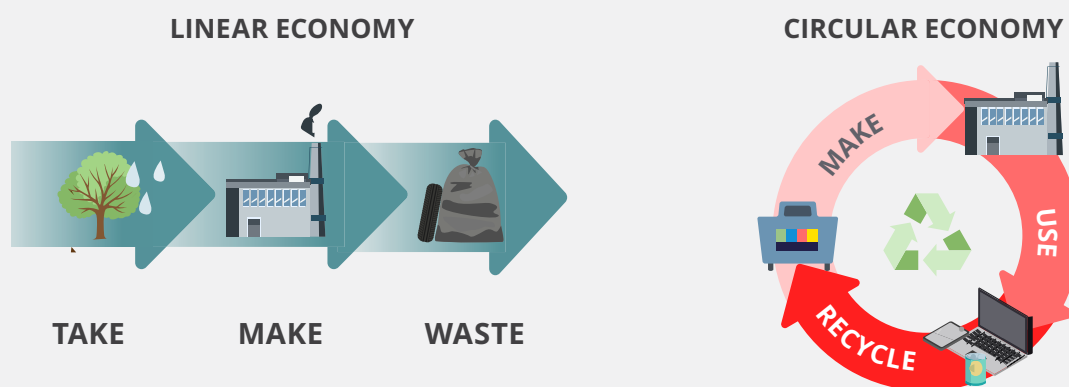
Once a technology has been installed into the premises, clear maintenance plans and requirements with defined responsibilities and accountability must be established to ensure that the technologies are regularly maintained and are up-to-date in order to maximise its potential.

Area of transformation 3: Circularity and Resource Efficiency

The Importance for SMEs to drive the circular economy: What are the regulatory and business cases driving this?

The path towards a circular economy offers opportunities for companies across all sectors. Globally, 11.2 billion tonnes of solid waste are generated annually, and if left unchecked, will continue to contribute to the further environmental degradation, depletion of natural resources, and the worsening effects of climate change⁵². As such, a shift towards a circular economy and improved resource efficiency is crucial for combatting climate change. Unlike the linear model of production (take-make-waste), a circular economy is restorative, aiming to reduce, reuse, and recycle materials across the value chain.

Transition from a linear to a circular economy



Source: Ministry of Sustainability and the Environment (MSE) Singapore⁵³

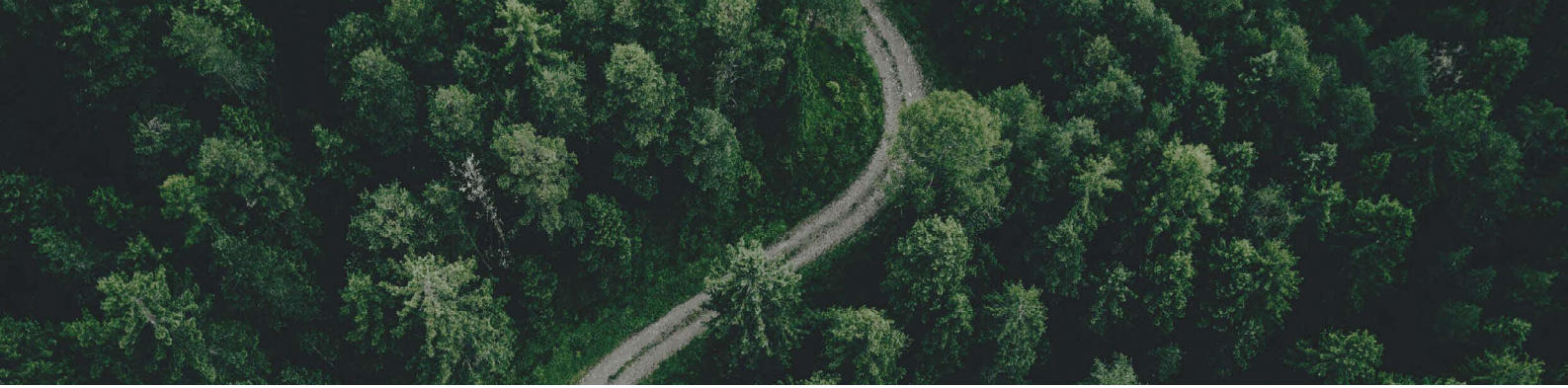
The development of a circular economy is also important in Singapore where waste is a growing problem. Singapore produced 7.39 million tonnes of waste in 2022 alone, with more than 5 million tonnes originating from non-domestic sectors⁵⁴. One example is e-waste, which is a growing global concern given the increasing usage and dependency on technology. This is also a major consideration in Singapore's waste management, considering how the city-state generates around 60,000 tonnes of e-waste annually. With rising incomes and the rapid replacement of technologies, e-waste continues to grow at an unsustainable rate. Plastic waste is also a major component of waste, yet is one of the least recycled types. Globally, only around 9% of plastic waste is recycled while only 4% is recycled in Singapore⁵⁵.

⁵² United Nations Environment Program (UNEP), <https://www.unep.org/explore-topics/resource-efficiency/what-we-do/cities/solid-waste-management>

⁵³ Towards Zero Waste SG, <https://www.towardszerowaste.gov.sg/circular-economy/>

⁵⁴ National Environment Agency (2023), <https://www.nea.gov.sg/media/news/news/index/waste-generation-and-recycling-rates-increased-in-2022-as-economic-activity-picked-up#:~:text=Waste%20Generation%20and%20Recycling%20Rates%20increased%20in%202022%20as%20Economic%20Activity%20Picked%20Up,-03%20May%202023&text=Singapore%2C%203%20May%202023%20%E2%80%933%20According,4.19%20million%20tonnes%20were%20recycled.>





Of a particular concern to Singapore is food waste, which is one of the biggest waste streams in the city and has increased by around 20% over the past decade⁵⁶. Coupled with Singapore's concerns over food security due to its reliance on imports, there is an urgency and opportunity to address and tackle food waste through innovative solutions.

As a small city state, Singapore aims to balance economic growth with environmental sustainability through more efficient resource planning and waste management. Under the Zero Waste Masterplan, Singapore has set a national recycling rate target of 70% by 2030, with an aim of reducing its daily rate of waste-to-landfill per capita by 30%⁵⁷. This will be critical in alleviating the pressure on Singapore's only landfill.

Over the past decade, national policies have been enacted to improve waste management in Singapore, with a focus on holding companies more accountable for their resource usage. For example, the Mandatory Packaging Reporting Framework is expected to be implemented in the city no later than 2025⁵⁸. Under this framework, companies will be required to disclose information on the packaging used for the Singapore market, distinguished by type of packaging materials (e.g., plastic, paper, metal, glass), packaging form (e.g., carrier bags, bottles) and their corresponding weights. Furthermore, recent legislation under the *Resource Sustainability Act*, which will take effect from 2024 onwards, will require food waste from large commercial and industrial premises to be treated⁵⁹.

With these ambitious waste reduction targets and policies set by the government, it makes practical business sense for all companies, including SMEs, to reduce their resource consumption and improve waste management practices across all waste streams to support national targets and better prepare for future rules and regulations.

To take action, SMEs in Singapore should ramp up their capabilities and initiatives relating to resource efficiency, circularity and waste management, to address these concerns and capitalise on new opportunities.

Innovative solutions to tackle the global waste-problem have rapidly emerged in recent years and technology has been a key part of the solution in enabling more effective waste management as well as reducing overall waste. For example, specialised waste facilities equipped with smart technologies such as robotics, AI, and computer vision systems, can efficiently recover valuable resources such as metals and components from waste, while sorting and diverting hazardous materials from landfills. This is only one example of how technological solutions can improve recycling accuracy and efficiency⁶⁰. To tackle the problem of improper

⁵⁵ Towards Zero Waste, <https://www.towardszerowaste.gov.sg/waste-streams/packaging-waste/#:~:text=Of%20the%201.6%20million%20tonnes,to%20further%20reduce%20packaging%20waste.>

⁵⁶ Towards Zero Waste, <https://www.towardszerowaste.gov.sg/foodwaste/>

⁵⁷ Zero Waste Masterplan, <https://www.towardszerowaste.gov.sg/files/zero-waste-masterplan.pdf>

⁵⁸ Ministry of Sustainability and the Environment (MSE), <https://www.mse.gov.sg/resource-room/category/2020-07-30-resource-sustainability-act/>

⁵⁹ Singapore Statutes Online (2019), <https://sso.agc.gov.sg/Acts-Supp/29-2019/Published/20191004?DocDate=20191004>

⁶⁰ Agency for Science, Technology and Research (A*Star), <https://www.a-star.edu.sg/News/astarNews/news/press-releases/fairprice-group-and-astar-launch-BINgo>



recycling practices, smart recycling technologies can be incorporated to better engage users in the recycling process and improve national recycling rates.

Technology has also been increasingly recognised as a needle-moving solution in reducing food waste by improving the quality of food and prolonging its shelf life. Examples of conventional and emerging technologies that can be considered across various sectors such as food manufacturing and F&B include pasteurisation, sterilisation cooling, freezing and nanotechnology to improve food production, transport and storage processes. Optimising temperature, humidity and air quality conditions increases shelf life and delays food spoilage to reduce overall waste⁶¹.

Smart technologies can also be used to promote the upcycling of food by converting food waste into other useful resources. For example, food waste digesters convert food waste into compost or biogas through anaerobic digestion, reducing landfill waste and generating renewable energy. Food waste can also be converted into other useful products such as fertilisers, compost, or even food packaging through onsite composting.

To minimise the use of plastics, degradable bioplastic innovations can be explored as alternatives to single-use plastics. Corn and bamboo are examples of biodegradable options that some companies are already using. Solutions like bioplastics are particularly relevant for sectors engaged in the manufacture of consumer goods as well as F&B.

Through enhanced resource efficiency initiatives, SMEs across different sectors in Singapore can support the development of a circular economy and minimise waste generation.



⁶¹ Singapore Food Agency (SFA), <https://www.sfa.gov.sg/food-for-thought/article/detail/using-nasa-technology-to-extend-shelf-life>.

Key opportunities for circular economy and resource efficiency: What are the technologies available in the market?

Moving towards a circular business model requires a transformation in the way a company produces, consumes and manages resources throughout its lifecycle. In particular, sectors such as manufacturing, retail, consumer goods, hospitality, and F&B, can make a significant impact. Below, we outline some areas that SMEs across these sectors can explore to improve resource efficiency and move towards a circular business model.

Key areas to focus for alignment with a circular business model

Resource Recovery



This approach reduces waste by redirecting resources into the lifecycle of another product and reduces disposal expenses for companies. This is especially beneficial for companies that produce significant quantities of by-products or have the capability to efficiently recover and recycle waste materials by channeling them into other productive uses.

Such a strategy can help SMEs reduce dependency on finite resources and minimise vulnerabilities related to resource scarcity or supply chain disruptions

Product Life Extension



This strategy centers on extending the lifespan of products through processes such as upgrading to better quality materials, maintenance works, repairs, remanufacturing, or remarketing. Prolonged product use may generate extra revenue for companies through increased sales and additional services associated with maintenance and repair.

This approach reduces the need for new replacements, thereby conserving resources, minimises procurement costs and helps avoid waste to landfill.

Resource Use Optimisation



This entails the use of platforms and technology that provide insights to track and optimise resource use by strengthening connections between different stakeholders, fostering greater collaboration and exchange of resources through the efficient exchange of information and insights.

This strategy is advantageous for SMEs operating in sectors where the resale of used items is prevalent, such as those in the electronics, fashion, accessories, and furniture.

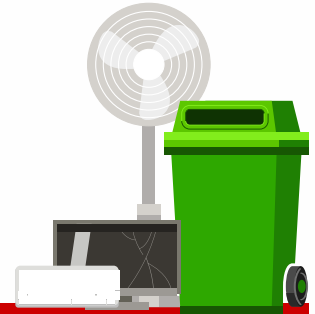


The following table outlines some initiatives that SMEs in Singapore may consider in strengthening their circular economy capabilities by enhancing waste management and resource efficiency practices:



Smart Recycling Bins and Sorting Technologies					
Use Case/ Application	<p>Smart recycling technologies such as smart bins and sorting facilities which leverage technologies such as machine learning and radio-frequency identification (RFID) can be applied across various sectors including manufacturing, logistics and delivery, retail, and F&B to ramp up waste management practices and enhance material recovery. For SMEs in the retail, logistics and delivery sectors, RFID technology can be used to tag and track recyclable materials, allowing for automated sorting and identification of items. Machine learning algorithms can also be adopted to help identify and separate different types of recyclables more accurately. These systems continuously learn and improve their accuracy over time, helping companies to optimise their recycling processes. In consumer facing sectors, smart recycling bins can also be equipped with smart capabilities such as reward systems to engage customers and incentivise recycling.</p>				
Cost Estimation	High	Medium	Low	Initial Investment	Maintenance/Operations
	●	●	●	●	●
Advantages	<ul style="list-style-type: none"> • Improved Waste Management and Efficiency: Smart Recycling Technologies can enable more efficient sorting, tracking, and accurate disposal of materials, providing valuable data and insights for optimising resource use and complying with evolving environmental regulations. • Enhanced Stakeholder Engagement: For consumer-facing sectors, smart recycling technologies provide an excellent opportunity to engage with employees, customers and other stakeholders to promote recycling and showcase corporate responsibility. 				
Limitations	<ul style="list-style-type: none"> • Improper Recycling Practices: Improper recycling where recyclables are contaminated by remnants of food and drinks or other items results in waste which cannot be recycled and ends up in landfills. • Data Privacy and Security Concerns: The adoption of smart recycling technologies may be hindered by concerns regarding data privacy. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Radiofrequency Identification (RFID) technology equipped smart bins • Sensor based and machine learning enabled sorting systems • Smart bins connected to mobile applications 				





E-waste Lifecycle Management

Use Case/ Application	SMEs can engage consumers to reduce e-waste by optimising their use of the product through repair and maintenance services as well as take-back or buy-back programs for old electronics such as mobile phones, computers, tablets and smart watches, promoting responsible disposal.				
Cost Estimation	High	Medium	Low	Initial Investment	Maintenance/Operations
	●	●	●	●	●
Advantages	<ul style="list-style-type: none"> • Reduce Cost: E-waste refurbishment can be more cost-effective than replacement with new units, which is particularly beneficial for businesses that wish to allocate resource efficiently. • Improved Reputation and Brand Loyalty: Offering repair and maintenance services showcases a commitment to sustainable and circularity practices, which may enhance brand reputation and image. Furthermore, such programs offer an opportunity to connect with customers and build brand loyalty. 				
Limitations	<ul style="list-style-type: none"> • Expertise and Safety: Repairing and maintaining e-waste can be challenging, particularly for complex devices such as computers and smartphones. Electronic devices often contain hazardous materials which may be challenging to manage and may require specialised equipment and skillsets to work with. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Repair program partnerships with manufacturers • Online take-back/buy-back platforms 				





Biodegradable Packaging

Use Case/ Application	<p>For companies that rely on packaging in their operations – for example producers of consumer goods, retail, textiles and apparel, food and beverage, and delivery services - biodegradable materials should be considered as an eco-friendly alternative to replace plastics and other non-renewable resources. Bio-based products from raw materials such as corn and bamboo are not only biodegradable but can be reused for other purposes to extend its lifecycle.</p>				
Cost Estimation	High ●	Medium ●	Low ●	Initial Investment ●	Maintenance/Operations ●
Advantages	<ul style="list-style-type: none"> • Innovation Opportunities: Shifting towards biodegradable packaging creates opportunities for innovation in both packaging design and waste management. • Improved Safety and Quality: Some eco-friendly materials may be safer options compared to conventional plastic packaging as they require less chemicals for production. Some packaging even possesses antibacterial properties which can extend the shelf life of fresh food, thus reducing food waste⁶². • Improved Reputation and Risk Mitigation: With increased awareness among consumers and restrictions imposed by regulators on single-use packaging, sustainable packaging options can enable companies to demonstrate their commitment to sustainability and attract increasingly eco-conscious consumers while staying ahead of the regulatory curve⁶³. 				
Limitations	<ul style="list-style-type: none"> • Cost Considerations: Biodegradable packaging may be more expensive to produce than conventional packaging options, impacting the overall cost of production. • End-of-Life Considerations: Certain bioplastics may not be suitable for existing recycling infrastructures, which may interfere with a company's waste management processes. It is thus important for companies to fully understand the impact of each bioplastic alternative throughout its lifecycle before making the transition. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Edible and degradable packaging, cutlery and utensils • Compostable bags • Polyhydroxyalkanoates (PHA)-based bioplastics 				



⁶² Nanyang Technological University (2022), https://www3.ntu.edu.sg/CorpComms2/documents/2022/01_jan/supermarketnews_220114_Packaging.pdf

⁶³ Deloitte, <https://www2.deloitte.com/uk/en/pages/consumer-business/articles/sustainable-consumer.html>





Food Waste Solutions – Upcycling and Preservation Technologies

Use Case/ Application	<p>SMEs operating in the F&B industry can adopt a more circular business model and reduce waste by upcycling their food waste into other useful products, as well as adopting technologies such as smart storage and preservation facilities, to preserve and extend the shelf life of their products. Advanced preservation techniques utilising nanotechnology, or inventory management systems with sensors and data analytics to monitor inventory levels and identification of contaminated food are just some options available for F&B operators and manufacturers to minimise waste and enhance the quality of their products.</p>				
Cost Estimation	High	Medium	Low	Initial Investment	Maintenance/Operations
Advantages	<ul style="list-style-type: none"> • Enhanced Resilience and Compliance: Companies who pursue opportunities in this area may not only achieve improved environmental performance but may also gain a competitive advantage in the market by building resilience. Practices such as upcycling food can enhance the resilience of businesses by reducing dependency on its supply chain - especially in light of fluctuating prices and availability of imported raw materials. By embracing these practices, companies can also stay ahead of emerging legislations, which will require some companies to segregate and treat their food waste on-site⁶⁴. • Waste Reduction: Implementing food waste solutions helps reduce the overall volume of waste generated, and thereby improving the waste management practice of businesses. • Improved Efficiency: Practices to reduce and minimise food waste can lead to better inventory management, reduced losses during transportation, and optimised production processes for businesses. 				
Limitations	<ul style="list-style-type: none"> • High initial Investment for Some Technologies: Certain advanced food waste solutions and technologies may require specialised knowledge, technology and equipment, which may be costly to implement and maintain. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Food traceability systems • Smart storage systems for food • Nanotechnology for food preservation • Vacuum packaging 				

⁶⁴ National Environment Agency (2020), <https://www.nea.gov.sg/media/news/news/index/businesses-required-to-segregate-food-waste-for-treatment-under-new-legislation>





Food Waste Solutions - Onsite Composting

Use Case/ Application	<p>Composting technologies can enable companies, especially those in sectors such as food manufacturing and F&B, to facilitate the upcycling process discussed above by converting organic waste into other useful products. For example, food digesters can be utilised to accelerate the natural decomposition of organic waste and repurpose food waste into useful products and biomaterials such as nutrient-rich compost⁶⁵.</p>				
Cost Estimation	High	Medium	Low	Initial Investment	Maintenance/Operations
Advantages	<ul style="list-style-type: none"> • Improved Efficiency: Waste digesters offer on-site waste management solutions for various types of SMEs, including commercial kitchens, restaurants, and food processing plants. By processing organic waste on-site, waste management can be improved while reducing overall environmental impact. 				
Limitations	<ul style="list-style-type: none"> • Environmental Concerns: While onsite composting technologies can reduce the volume of waste to landfills, they may still pose environmental challenges, including the potential release of pollutants such as dioxins and heavy metals during the composting process. Ensuring strict emission controls and proper waste segregation is of utmost importance to mitigate these environmental impacts. • High Maintenance Costs: Composting technologies require specialised skillsets and equipment to operate given its complexity and potential odour and hygiene issues. • Limited Waste Types that are Compostable: Composting is most effective for organic waste such as food scraps, yard trimmings, and certain paper products. Non-biodegradable materials, plastics, and even certain types of food waste may not be suitable for traditional composting methods, limiting the amount of waste that can be upcycled by certain sectors. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Automatic compost bins • Compost turners • Food waste digesters 				



⁶⁵ GovTech (2022), <https://www.tech.gov.sg/media/technews/innovative-solutions-to-fight-food-waste>





Sustainable Construction Materials

Use Case/ Application	<p>For SME building owners, as well as companies supplying construction materials and certain consumer products like furniture, there are opportunities to incorporate sustainable materials into the construction process by actively seeking suppliers and manufacturers that offer eco-friendly alternatives that use less resources and increase the reusability of materials, thus improving the circularity of their products. Examples include reclaimed or recycled metals from demolished buildings, sustainably sourced wood, and concrete alternatives such as hempcrete which is made from hemp fibres and have similar structural properties to conventional concrete⁶⁶. Using more sustainably sourced materials for construction and production reduces the overall demand for virgin aggregates, conserves natural resources, and decreases waste to landfills.</p>				
Cost Estimation	High ●	Medium ●	Low ●	Initial Investment ●	Maintenance/Operations ●
Advantages	<ul style="list-style-type: none"> • Reduced Environmental Footprint: Sustainable construction materials reduce the demand for other types of virgin aggregates, conserves natural resources, and decreases waste to landfills. • Reduced Maintenance and Operating Costs: Sustainable materials can be more durable than their traditional counterparts, extending the lifespan of a building or product and reducing the need for repairs and maintenance. 				
Limitations	<ul style="list-style-type: none"> • High Initial Investment: Some sustainable construction materials may come at a higher initial cost compared to traditional materials which may be a limiting factor for SMEs. However, this may be offset through financial incentives, grants and even loans tied to sustainability-linked projects such as the <i>DBS Eco Renovate Loan</i>. 				
Examples of Market Technologies	<ul style="list-style-type: none"> • Recycled concrete • Hempcrete • Reclaimed and sustainably sourced wood 				

⁶⁶ CIC Construction Group, <https://www.cicconstruction.com/blog/eco-friendly-sustainable-building-materials-for-greener-construction/>







What is the workflow for SMEs to begin this and what are the resources available to support implementation?



Conduct assessment of building(s) and office(s)

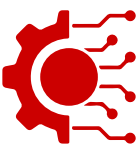
Companies may undergo an audit to identify the various types and quantities of waste generated and to better understand its recycling potential. Before embarking on any of the technologies or solutions discussed, companies should ask the following questions to identify low-hanging fruits and areas that may be most suitable for enhanced resource efficiency or circularity:

 Raw Materials	 Energy Consumption	 Waste	 Demand for Sustainable Products
<p>Are environmental issues affecting, or affected by our raw materials or production processes?</p> <p>Are there alternatives to substitute or reduce dependency on non-renewable resources in our operations or production?</p>	<p>What are the areas where we consume the most energy?</p> <p>Can we use energy more efficiently while still maintaining or increasing production?</p> <p>What are our peers doing to reduce energy consumption?</p> <p>Are there renewable energy options?</p>	<p>What does our waste footprint look like?</p> <p>How can we reduce waste created in our value chain (from raw materials to end-of-life)?</p> <p>How may new taxes or regulations impact our packaging or waste disposal in the foreseeable future?</p>	<p>What do our target customers wish to see from our business and products with regards to sustainability?</p> <p>How much are consumers willing to pay for “greener” products and services?</p> <p>Can we engage our customers and stakeholders to minimise waste and improve recycling?</p>



Start small and scale

Before embarking on elaborate solutions and programmes, companies should ensure that basic recycling practices are in place to raise awareness and promote onsite recycling for common materials such as paper, cardboard, plastic, and glass.

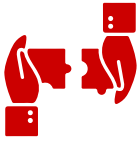


Explore technology options:

After identifying areas which can be tackled, companies can explore suitable technologies across the different areas involving recycling, waste management, alternative packaging and waste-to-energy conversion. For recycling options, technologies can include smart bins to monitor and optimise waste collection. Those operating in sectors like food manufacturing can explore smart storage systems to monitor and control storage conditions, such as temperature and humidity, to extend the shelf life of perishable food items and facilities in operations. In addition, they can ensure that their facilities are equipped with features like data analytics to enhance inventory management and reduce food



spoilage by predicting demand more accurately and minimising excess stock. In sectors where excessive waste is generated, they can consider waste-to-energy technologies like gasification that best suit their waste streams and energy needs.



Collaborate with suppliers, local vendors and partners:

Working closely with suppliers, vendors and partners is key in enabling companies to boost their capabilities in areas like resource recovery, recycling and waste management. For companies involved in food manufacturing and F&B operators, they can consider selling or distributing surplus food which can be distributed to the community or sold at a lower price, or consider working with partners that provide facilities to enhance the quality of their food through advanced technologies and innovative solutions. Companies which are keen on switching packaging of their products can identify reliable suppliers of bioplastic materials and biodegradable packaging that meet their specific requirements and quality standards. They can also work closely with research agencies such as the Agency for Science Technology and Research (A*Star)'s recently established *Institute of Sustainability for Chemicals, Energy and Environment (ISCE²)* to explore alternative types of packaging with properties such as increasing the shelf life of food⁶⁷.



Identify potential sources of funding and programmes to support implementation:

This can include a range of government grants, incentives, or partnerships, such as the *3R Fund* or *Closing the Resource Loop (CTRL) Funding Initiative* to support the initial investment in research and development (R&D) on sustainable resource recovery solutions as well as smart bins, and other advanced technologies incorporated in the management of different waste streams⁶⁸.



Educate stakeholders:

Effective waste management in companies can be achieved through strong education and guidance which strengthens awareness among stakeholders on the use of technologies that facilitate recycling, waste reduction and resource recovery. Informative workshops and training sessions are examples of how SMEs can raise awareness about the benefits and proper use of these technologies. They can also leverage digital platforms and marketing materials to share success stories and demonstrate the positive environmental impact of their waste management initiatives, fostering a sense of responsibility and engagement among their stakeholders. Additionally, SMEs can create open channels for communication and feedback to ensure that employees and customers feel empowered to actively participate and provide insights in the ongoing improvement of waste management practices.

⁶⁷ A*Star, <https://www.a-star.edu.sg/News/astarNews/news/press-releases/a-star-sets-up-new-research-institute-to-support-singapore-s-sustainability-goals>

⁶⁸ National Environment Agency (NEA), <https://www.nea.gov.sg/programmes-grants/grants-and-awards/index/filter/waste-management>



Conclusion

The Way Forward: How SMEs can be Supported in their Sustainability Journey

This playbook shows that SMEs are strategically positioned to experiment with cutting-edge solutions and innovations particularly in areas where it is exceptionally key for Singapore to improve and develop capabilities to reduce its impact on climate change. Investing in efforts to transition and capitalise on windows of opportunities in areas like transport decarbonisation and fleet electrification, renewable energy and green buildings and even circularity and resource efficiency offer numerous advantages for SMEs that undertake swift action across these areas.

That being said, SMEs face a host of challenges in getting started on their sustainability journey which include the lack of subject matter expertise, internal buy-in, initial investment costs, or resource constraints. Due to these challenges, some SMEs may consider sustainability and profitability as conflicting business goals, making them resistant to change. However, there are a multitude of opportunities and benefits available to companies which take concrete steps to improve their environmental performance.

As highlighted in this playbook, SMEs in Singapore are uniquely positioned to implement practical solutions across various areas of operations to improve their own business processes, reduce cost, and attract business - all while supporting Singapore's national environmental goals.

Investing in efforts to enhance environmental performance in areas such as transport decarbonisation, renewable energy, green buildings, circularity and resource efficiency offer numerous advantages and opportunities for SMEs in Singapore. There is also a range of opportunities and support available for SMEs in the city to embark on their sustainability journey - including financing, tax rebates, subsidies and more. In fact, SMEs which capitalise and embed sustainability across their business and operations are well positioned to benefit from the range of opportunities available for companies that actively demonstrate their commitment to sustainability objectives.

SMEs should start by assessing their current state of sustainability performance across the three areas discussed in this playbook. This will create a starting point for formulating subsequent strategies, plans, and roadmaps for implementing their own ESG-related initiatives.

SMEs are crucial in enabling Singapore's transition to a net zero economy and we encourage companies to take action today to create a better tomorrow.



Available solutions and resources for SMEs

The table below is a non-exhaustive list of various financing options, programs and networks that SMEs in Singapore can leverage to catalyse their own sustainability journeys.

Support Type	Applicable Sector(s)	Agency	Description	Relevant Link(s)
Various	All	DBS Bank	<p>DBS SME Banking Support A dedicated channel for SME Banking support in the form of varied networking events, marketplaces for green and digital solutions, financing through loan and grant programmes and avenues specific to navigating an SME sustainability journey with advisory, tracking and reporting tools.</p>	About the Support
Financing Option/Grant	Fleet Electrification and Transport Decarbonisation	Land Transport Authority	<p>Commercial Vehicles Emissions Scheme (CVES) Commercial vehicles are categorised into three bands resulting in a \$15,000 surcharge for the most pollutive vehicles to \$15,000 incentive for the least pollutive vehicles. This encourages buyers to choose commercial vehicle models that have lower emissions across the identified pollutant categories, with effect from 1 April 2021 to 31 March 2025.</p>	About the Support
			<p>Enhanced Early Turnover Scheme (ETS) From 1 April 2021, existing Euro 4 Cat C diesel vehicles will also be eligible for the ETS incentive. This seeks to increase the number of commercial vehicles eligible for the ETS incentive to encourage turnover to cleaner alternatives.</p>	About the Support
		DBS Bank	<p>Equipment and Vehicle Loan Companies can enjoy preferential rates for financing new EVs and charging equipment.</p>	About the Support



Support Type	Applicable Sector(s)	Agency	Description	Relevant Link(s)
Financing Option/Grant	Renewable Energy and Green Buildings	Building and Construction Authority (BCA)	Built Environment Transformation Gross Floor Area Incentive Scheme: Under the scheme, developers/building owners can enjoy up to 3% additional Gross Floor Area (GFA) allowed beyond the Master Plan Gross Plot Ratio (GPR) for delivering the stipulated Industry Transformation Map Outcome Requirements.	About the Support
		Economic Development Board (EDB)	Resource Efficiency Grant for Energy (REG(E)): Administered by EDB, this grant encourages improvement in energy efficiency of manufacturing facilities and data centres.	About the Support
			Investment Allowance for Emissions Reduction: The investment allowance is granted on capital expenditure incurred for energy-efficient or green data centre projects.	About the Support



Support Type	Applicable Sector(s)	Agency	Description	Relevant Link(s)
Financing Option/Grant	Circularity and Resource Efficiency	National Environment Agency (NEA)	<p>3R Fund The 3R Fund is a co-funding scheme aimed at encouraging organisations to reduce waste disposed of at NEA's incineration plants and disposal facilities through the implementation of waste minimisation and recycling projects. The 3R Fund will co-fund up to 80% of qualifying costs, subject to a cap of \$1 million per project or per applicant. The funding level will depend on the quantity and type of waste reduced or recycled. The grant will be calculated based on key outcomes such as the actual quantity of waste reduced or recycled.</p>	About the Support
Financing Option/Grant	All	Enterprise Singapore (ESG)	<p>Enterprise Development Grant (EDG): The Enterprise Development Grant (EDG) supports projects that help companies upgrade, innovate, grow and transform their business. EDG funds qualifying project costs, namely third-party consultancy fees, software and equipment, and internal manpower cost. From 1 April 2023, SMEs can receive up to 50% support for EDG (sustainability-related projects may be supported at up to 70% from 1 April 2023 to 31 March 2026)</p>	About the Support
			<p>The Sustainable Loan Grant Scheme (SLGS): The SLGS supports corporates of all sizes to obtain sustainable and transition financing by defraying the expenses of engaging independent service providers to validate the sustainability credentials of the loan. It offsets up to S\$125,000 of expenses incurred for external reviews of eligible green, social, sustainability, sustainability-linked as well as transition loans, and promotes the adoption of internationally recognised standards and taxonomies.</p>	About the Support Interested parties can write to fsdf@mas.gov.sg to obtain the application form or for more information.
			<p>Enterprise Financing Scheme – Green: Targeted at project developers, system integrators and technology solution enablers who develop enabling technologies and solutions to reduce waste, resource use or greenhouse gas emissions.</p>	About the Support





Support Type	Applicable Sector(s)	Agency	Description	Relevant Link(s)
Financing Option/Grant	All	DBS Bank	ESG Bonds: Depending on the business needs and sustainability strategy of the organisation, ESG bonds could be structured as green bonds, social bonds, sustainable bonds, sustainable-linked bonds, or transition bonds. to raise funding for a company's green and climate projects or social missions	About the Support
			Sustainability-linked Loans: Loans that are structured to enable customers to pay variable interest depending on their achievement of a set of pre-agreed ESG performance targets which are validated by an independent ESG rating agency or verification party.	About the Support
			Green and Sustainable Financing: Allows companies to meet their ESG goals and obtain financing support for their renewable or sustainability-linked projects from bidding till contract fulfilment.	About the Support
			Eco Renovate Loan To support companies in creating an environmentally friendly business environment, this loan provides simplified and easy access to financing of renovation works which incorporates sustainable materials, fixtures or equipment at preferential interest rates. Eligible activities include installation of solar panels and energy efficient LED lighting.	About the Support



Support Type	Applicable Sector(s)	Agency	Description	Relevant Link(s)
Financing Option/Grant	All	DBS Bank	Business for Impact Grant Award: The DBS Foundation Grant Award is a flagship programme to recognise, reward and support businesses for impact, both Social Enterprises and SMEs. It provides grant funding to SMEs to scale their business model and deepen their social and/or environmental impact.	About the Support
			Business for Impact Banking Package Tailor-made for enterprises with a strong commitment to social and environmental impact, this package offers preferential banking solutions to help these businesses prioritise their mission over financial costs. To be eligible for this package, a company must be classified as either a social enterprise or a small and medium enterprise actively driving social and environmental change.	About the Support
		National Environment Agency (NEA)	Energy Efficiency Fund: Companies that adopt energy-efficient technologies to build capabilities and decarbonise early can receive up to 70 % of qualifying costs.	About the Support
		Multi-Agency Initiative	Low-Carbon Energy Research Funding Initiative (LCER FI): An initiative to accelerate the development of viable low-carbon energy technologies in Singapore, the LCER FI was introduced in 2021. The first phase of the programme awarded S\$55 million to projects designed to improve the technoeconomic viability of low-carbon technologies such as carbon capture, utilisation, and storage (CCUS) and hydrogen.	About the Support



Support Type	Applicable Sector(s)	Agency	Description	Relevant Link(s)
Programmes	Green Buildings/ Real Estate	Building and Construction Authority	Green Buildings Innovation Cluster (GBIC) 2.0 Programme: An integrated research, development and demonstration (RD&D) programme that aims to accelerate the development and deployment of promising energy efficient technologies in buildings by collaborating with the local and international R&D community, and industry stakeholders to develop innovative solutions to improve building energy efficiency.	About the Support
		Research Centres for Clean Energy (ReCCE)	Funding Initiatives (RIE2025): The FI provides core fundings to the Solar Energy Research Institute of Singapore and Energy Research Institute @ NTU, which support the four supply switches for Power Sector Decarbonisation (viz. Solar, Regional Power Grids, Low-Carbon Alternatives, and Natural Gas).	About the Support
	All	DBS Bank	DBS SME Skills Booster Programme To help SMEs future-proof their workforce, DBS has partnered SkillsFuture Singapore (SSG) to launch the DBS SME Skills Booster Programme. Through the programme, SME employees can hone their skills in areas such as sustainability, digital and transformation, banking, and finance, and cyberwellness.	About the Support
			SME Kickstarter Decarbonisation Programme Organised by Schneider Electric, this first-of-its-kind programme provides training & mentorship to SMEs over 3 years. SMEs will receive support in developing their decarbonisation roadmaps, identifying energy saving opportunities and leveraging digital solutions to track their energy consumption and emissions.	About the Support
		Enterprise Singapore (ESG)	Enterprise Sustainability Programme (ESP): Aimed at supporting Singapore companies, especially SMEs, this is a programme dedicated to build and advance their capabilities of companies to capture new opportunities in sustainability. The ESP includes a series of courses designed to help companies better navigate their sustainability journey and supports various capability and product development projects.	About the Support



Support Type	Applicable Sector(s)	Agency	Description	Relevant Link(s)
Programmes	All	Nanyang Technological University	EcoLabs Centre of Innovation for Energy: Works with corporate partners and investors to provide member companies with up to 30 public and private sector test-bedding sites, ranging from high-tech lab facilities to specialised test centres, to pilot projects in a controlled environment. EcoLabs is a collaboration between NTU, ESG and the Sustainable Energy Association of Singapore. NTU professors from various faculties such as material sciences and electrical engineering will also provide mentorship for member companies.	About the Support
		National Environment Agency (NEA)	National Voluntary Partnership: Under the National Voluntary Partnership for E-Waste Recycling, industry partners assume a leading role in spearheading recycling programmes, with added support and recognition from NEA	About the Support
Network Access	Transportation	Land Transport Authority (LTA)	The Land Transport Innovation Portal (LTIP): LTIP serves as a comprehensive platform for ecosystem partners, fostering and enabling innovators to create groundbreaking solutions that align with the objectives outlined in the Land Transport Master Plan 2040 (LTMP 2040). Through this portal, companies can obtain a better view of the challenges, problem statements and areas of focus that LTA is keen in working with ecosystem partners to co-innovate and share potential solutions that meet LTA's needs and address problem statements	About the Support

[Contact us](#) if you'd like to find out more about our sustainability programmes and sustainable financing solutions.

