

INNOVATE»COLLABORATE»SUSTAIN

SUSTAINABILITY @MSE 2022



Ministry of Sustainability
and the Environment
— SINGAPORE —

MSE | BUILDING A
5 | GREEN & RESILIENT
SINGAPORE



National
Environment
Agency

PUB

Singapore
Food
Agency

FOREWORD



In 2021, the world continued to grapple with critical challenges of climate change and the COVID-19 pandemic.

Amid the pandemic, the Ministry of Sustainability and the Environment (MSE) and our statutory boards – National Environment Agency (NEA), PUB and Singapore Food Agency (SFA) – worked unrelentingly to deliver our essential services without disruption.

But even as the coronavirus continues to roil the world, there has been no respite from the climate crisis, which is the generation-defining and existential threat for the global community. Recent studies suggest a limited window for action against irreversible global warming, an issue that was addressed during COP26 in November 2021.

As a low-lying city-state disproportionately vulnerable to climate change, Singapore has always been active in engaging the global community on climate action. Singapore contributed to the COP26 proceedings in Glasgow, with our Minister for Sustainability and the Environment successfully co-facilitating negotiations on Article 6 on carbon markets. Singapore also contributes to other international platforms, such as G20 discussions on topics such as climate and food resilience, and at the UN Environment Assembly.

Domestically, we have forged ahead with a whole-of-nation sustainability and climate action movement. The Singapore Green Plan 2030 was launched in early 2021, setting out concrete sectoral plans and targets over the next decade to strengthen our ongoing efforts to achieve the UN Sustainable Development Goals and our net zero aspiration.

Our Green Plan conversations have started a national dialogue on sustainability, engaging all Singaporeans to co-create a green future. This effort involves all of us, from citizens adopting climate-friendly behaviour to industries driving sustainability innovation, and the Public Service building an ecosystem for sustainability.

The Public Service has committed to the GreenGov.SG movement, setting ambitious targets such as peaking public sector's carbon emissions by 2025. In the MSE family, we ensure that sustainability remains the cornerstone of our operations, processes and, most importantly, culture. Achieving our national net-zero ambitions would involve leveraging science and technology and R&D efforts.

This year, MSE celebrates its 50th anniversary. We have come a long way since the Ministry of Environment was established in 1972. This publication is timely. It lays out efforts undertaken by the MSE family, progress we have made over the last five decades, and the bold steps we are taking to build a more sustainable and climate resilient Singapore.



Albert Chua
Permanent Secretary
Ministry of Sustainability and
the Environment

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TRENDS, CHALLENGES & OPPORTUNITIES



Our operating environment is increasingly complex

We live in a world that is increasingly interconnected across all aspects – economic, in terms of trade; political, with evolving multilateral relations; and social, where civic awareness has extended beyond domestic spheres to the international arena. The transboundary nature of environmental issues has become more pronounced, as exemplified by the effects of global warming (climate change), forest fires (air pollution) and marine litter (marine pollution).

This has not only accelerated the pace of change, but also amplified the complexity of issues, bringing with it both challenges and opportunities. Broadly, these key trends can be categorised into:

Unprecedented changes in the physical environment

With climate change, countries are experiencing more frequent and intense weather events. Rising global temperatures exacerbate the urban heat island effect and result in sea levels rising – affecting cities and threatening coastal and low-lying areas, such as

Singapore. By 2100, the mean sea level around Singapore might have risen by up to one metre relative to the period between 1980 and 2009, and we would expect to see more incidences of flooding from frequent and severe storms.

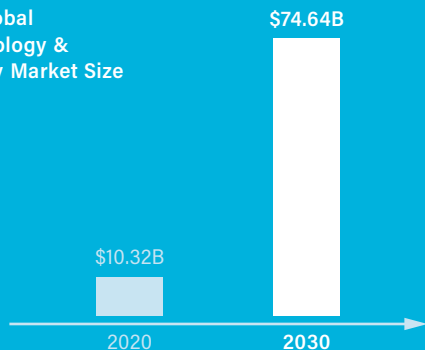
These shifts in the physical environment would have significant implications on access to necessities, such as food and water supplies. Compounding the challenge is the need to live with endemic COVID-19 and future disease outbreaks, which will further strain global resources and supply chains.

With no hinterland and limited natural resources, Singapore faces stark trade-offs to balance resilience, growth and sustainability. We will need to manage shorter-term costs associated with investing in sustainability to stave off the long-term costs of delaying climate action.

Accelerating pace of technological advancements

There has been a growing global emphasis on developing the science and technology in the areas of renewable energy, electrification of vehicles, and low carbon solutions such as hydrogen and carbon capture, storage and utilisation. The global

Projected Global Green Technology & Sustainability Market Size

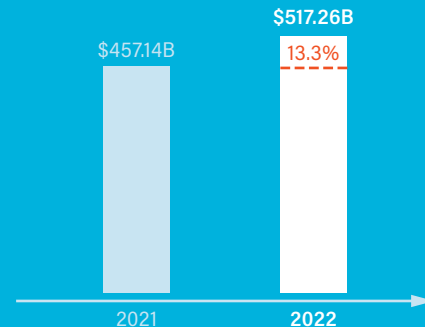


green technology and sustainability market size was valued at US\$10.32 billion in 2020 and is projected to reach US\$74.64 billion by 2030.¹

More sustainability pathways and solutions are being created with the costs of technology being lowered. This has led to technology applications expanding across a wider range of industries and enterprises, setting the stage for increased adoption of green technology.

Singapore, as a living lab for urban solutions and sustainability, is well-positioned to attract investments in science and technology to develop solutions in energy transition and decarbonisation, healthy cities and the circular economy.

Revenue from Global Waste Recycling & Circular Economy Market



Emergence of Green Growth Opportunities

To tackle climate change, the world must make a transition to a resource- and carbon-constrained future and embrace the Circular Economy. This emphasis on sustainable growth has resulted in the formation of new markets and services, such as carbon abatement. The value of global carbon markets reached US\$277 billion in 2020, a 16% increase from 2019.² This growth trajectory is likely to continue following tightening emissions caps worldwide.

Beyond carbon trading, companies and start-ups in the circular economy space are also flourishing, with the global waste recycling and circular economy market estimated to grow 13.3% in 2021.³

The spotlight on green growth has also led to capital flows to the

¹ Report on Green technology and sustainability market by technology: Global opportunity analysis and industry forecast 2021 – 2030, from Allied Market Research

² Refinitiv Carbon Research

³ Global Waste Recycling and Circular Economy Market Report 2021, from Research and Markets.

TRENDS, CHALLENGES & OPPORTUNITIES

development and adoption of sustainable solutions, as well as markets to support the green economy.

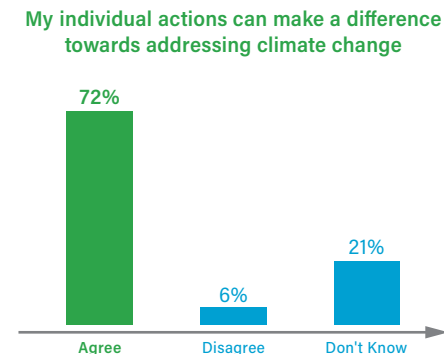
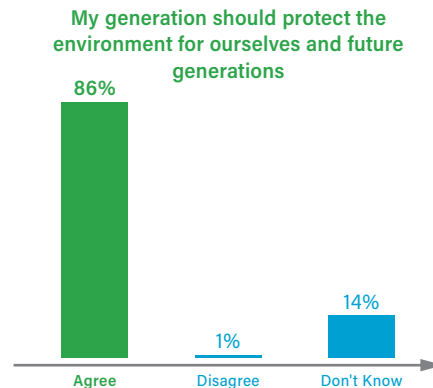
Singapore can seize these opportunities to become a hub for green financing and carbon services.

Increasing awareness and activism on sustainability and climate change

With the adoption of the 2030 Agenda for Sustainable Development and the Paris Agreement in 2015, sustainability awareness and calls for climate action have grown. Governments are now expected to prioritise sustainability in the national agenda, and ensure that policies facilitate sustainable corporate decisions.

In Singapore, citizens are more vocal and active in contributing to sustainability while organisations have become proactive in showing their sustainability commitment and strategies. Local communities are mobilising to implement green initiatives and contribute to climate action. A 2021 survey on environmental perception of youths, conducted by MSE and the Ministry of Education (MOE), found that a large majority agreed that they should protect the environment and individual actions can make a difference to address climate change.

This presents a window of opportunity to engage the youths, inculcating sustainability and climate action values in them to move from awareness to action. This way, we can nurture a new generation of citizens who are prepared to take responsibility and action.



2021 survey by MSE and MOE on environmental perception of youths

SUSTAINABILITY VISION



A sustainable, resource-efficient and climate-resilient Singapore

To ensure that Singapore continues to survive and succeed, we developed the framework of three “Resiliences” to align our efforts towards building a sustainable, resource-efficient and climate-resilient Singapore.

We aim to achieve the three Resiliences with five strategic priorities, which guide the various policies, operations and initiatives undertaken at our Ministry and the statutory boards – NEA, PUB and SFA.

3 RESILIENCES

Climate Resilience

Protecting Singapore from the effects of climate change such as rising sea levels and urban heat island effect, while taking steps to reduce carbon emissions.

Resource Resilience

Ensuring a safe and secure supply of critical resources, and maximising efficient use of scarce resources.

Economic Resilience

Ensuring that our future economy remains competitive amid carbon and resource constraints, by finding new green growth areas for Singapore and rallying businesses towards sustainable economic growth.

5 PRIORITIES



Move towards Zero Waste Nation & Circular Economy

- Fostering a circular economy and closing the loop for food, packaging and e-waste
- Encouraging sustainable consumption and zero waste mindset
- Ensuring an efficient & effective waste management system



Build a Smart, Resilient & Sustainable Water Supply System

- Securing Singapore's water supply
- Closing the water loop through water reclamation
- Building resilience against climate change flood risk



Strengthen our Climate Change Resilience & Transition to a Low Carbon Future

- Reducing carbon footprint comprehensively
- Protecting Singapore's coastlines against rising sea levels
- Mitigating Urban Heat Island effect



Achieve Food Safety & Security Sustainably

- Securing Singapore's food supply and strengthening food supply chain resilience
- Achieving 30-by-30 goal for local food production
- Enhancing regulatory oversight for food safety



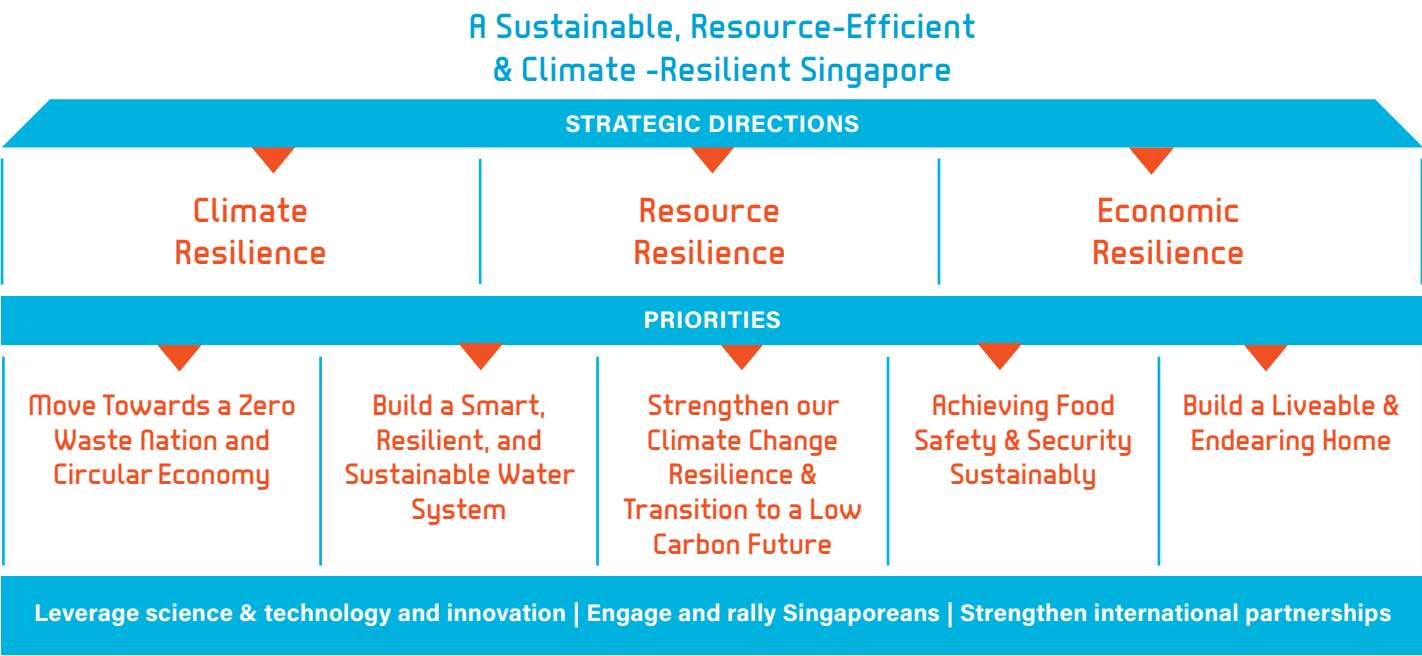
Build a Liveable & Endearing Home

- Ensuring high public cleanliness and hygiene standards
- Ensuring clean air for Singapore
- Creating vibrant and thriving hawker centres and culture
- Promoting environmental sustainability

SUSTAINABILITY VISION

Our sustainability vision, strategic directions and priorities are encapsulated in the diagram below – a unified narrative of all the work at MSE. We leverage science and technology as well as

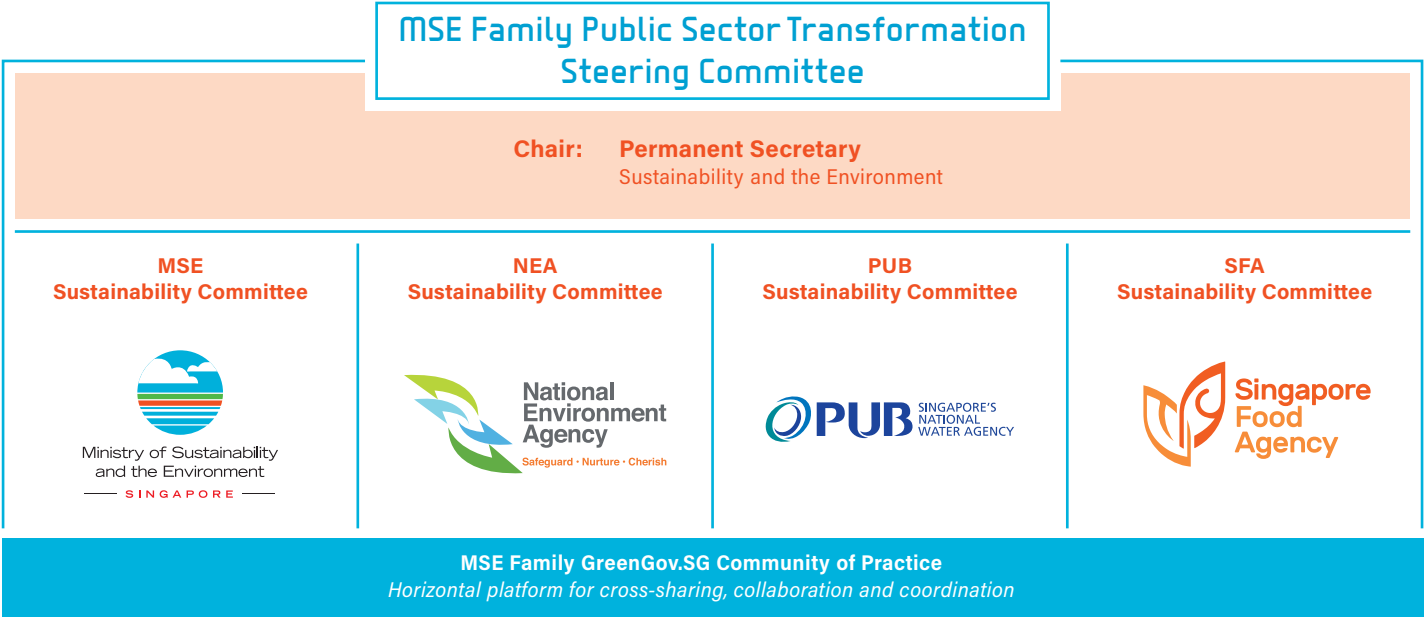
innovation, along with partnerships with communities locally and internationally, to achieve our sustainability vision.



Ensuring oversight and guidance with a governance structure

To drive the sustainability agenda across the MSE family, we have in place a robust governance structure. This provides clear direction and oversight of our initiatives towards achieving our sustainability vision.

At the MSE family level, sustainability initiatives are coordinated by the MSE Family Public Sector Transformation Steering Committee, chaired by our Permanent Secretary. This exemplifies our commitment to integrate sustainability as a key pillar of the transformation efforts in the MSE family.

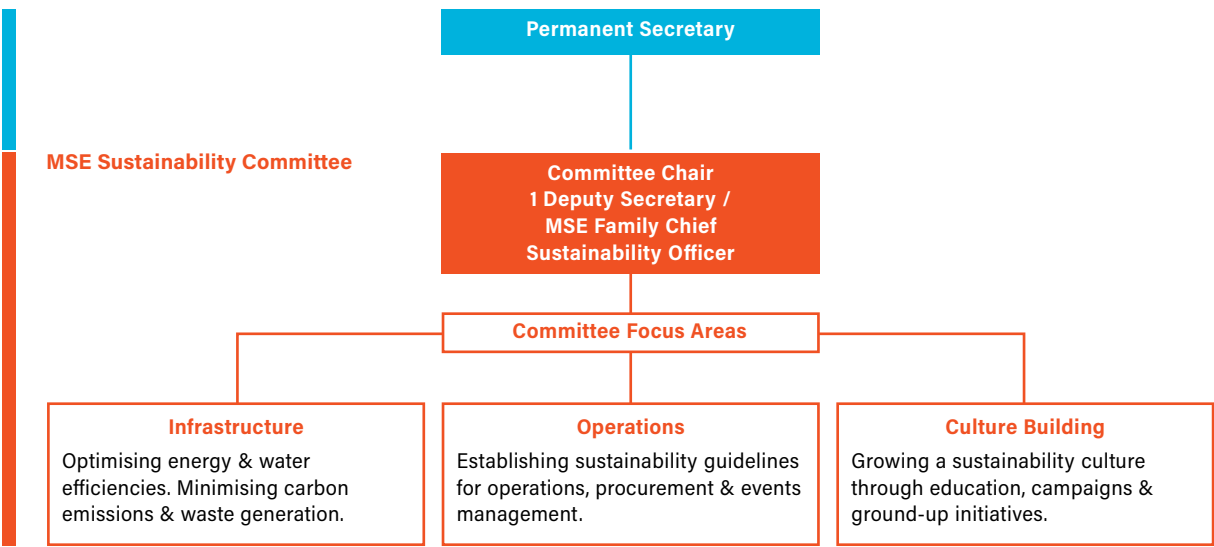


Supporting the MSE family's sustainability efforts is our GreenGov.SG Community of Practice. This is a platform for our sustainability champions to share information and best practices, exchange ideas and collaborate on initiatives and campaigns, fostering a green mindset across all our agencies.

Within MSE, the sustainability committee is chaired by 1 Deputy Secretary who is also the Chief Sustainability Officer for MSE family, and comprises directors overseeing sustainability strategies and initiatives in infrastructure, operations and culture. This committee reports to our Permanent Secretary, who together with senior management, oversees sustainability efforts in MSE.

Oversight & Guidance

Planning, Execution & Reporting



Strengthening our food security by growing our own

By 2030, we will produce more eggs, fish and vegetables locally to buffer against climate risks and supply disruptions.

Let's build a City of Green Possibilities together.

greenplan.gov.sg



THE MSE FAMILY APPROACH



A fine balance between growth and sustainability

Since independence, Singapore has always pursued sustainable development by balancing economic development with environment protection and social inclusion. This approach continues to drive and shape sustainability policies and initiatives.

In 2021, we launched the Singapore Green Plan 2030, an ambitious long-term plan that builds on ongoing efforts to secure a green, liveable and sustainable home for generations to come. This was despite the COVID-19 pandemic and the challenges it posed.

Now, with a focus on achieving the three Resiliences and guided by the five strategic priorities, the MSE family has redoubled efforts in pursuing an inclusive and sustainable growth. Our approach can be broken down into the following key strategies:

[Campaign image for the Singapore Green Plan](#)



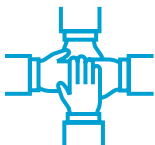
Sustainability and climate action beyond our shores

Contributing to global climate action through international collaboration.



Sustainable infrastructure & operations

Maximising efficiency and minimising the carbon footprint of our infrastructure and operations at MSE family agencies is central towards achieving our net zero ambitions.



Innovating with industry

Partnerships with industry, academia and economic stakeholders are crucial in developing and multiplying the impact of sustainability solutions.



Partnering the community

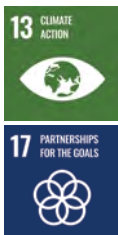
Community partnerships unlock the expertise and resources inherent in society and galvanise collective action to solve climate change problems.



Building a sustainable organisation

Sustainability starts at home. In the MSE family, sustainability is exemplified in our practices and processes, and forms the culture binding the MSE family together.

SUSTAINABILITY & CLIMATE ACTION BEYOND OUR SHORES



Playing an active international role in sustainability and climate action

Many environmental challenges are global in nature and do not stop at international borders, requiring global cooperation to ensure a sustainable future for all. Adopted in 2015, the UN 2030 Agenda for Sustainable Development (2030 Agenda) and its Sustainable Development Goals (SDG) provide an important framework for the global community to take action on sustainable development, to protect and safeguard the global environment for generations to come.

Climate change is a global crisis that requires a strong global response. This is why small states like Singapore are passionate supporters of multilateral systems and processes. Singapore is committed to doing our part in climate action and sustainable development, and a strong supporter of the SDGs.



FROM LEFT TO RIGHT:
President for COP26
Alok Sharma, Singapore's
Minister Grace Fu, and
Norway's Climate and
Environment Minister Espen
Barth Eide at 2021 UN
Climate Change Conference
(COP26) in Glasgow,
Scotland

A small country with limited land and no natural resources, Singapore understands the challenges of sustainable development and our limitations when it comes to resolving the climate crisis.

Singapore is a strong advocate of the multilateral, rules-based system as embodied by the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. We have been actively working at the international, regional, and bilateral levels to support efforts to in addressing climate change:

We ratified the Paris Agreement in September 2016 – one of the first 55 Parties to do so, thereby contributing to its early entry into force on 4 November 2016.



Senior Minister of State Amy Khor at G20 Environment Ministerial Meeting and G20 Climate and Energy Joint Ministerial Meeting in Naples, Italy

In March 2020, we submitted our enhanced Nationally Determined Contribution (NDC) and Long-Term Low-Emissions Development Strategy (LEDS) under the Paris Agreement, notwithstanding the challenging circumstances posed by COVID-19 pandemic. In essence, Singapore has pledged to peak emissions at 65 MtCO₂e around 2030. Thereafter, we aspire halve our emissions from its peak to 33 MtCO₂e by 2050, with a view to achieve net zero emissions as soon as viable.

During Budget 2022, the Government announced that Singapore will raise our ambition to achieve net-zero emissions by or around mid-century, in line with the COP-26 Glasgow Climate Pact.

Singapore has provided technical assistance and capacity-building support to fellow developing countries since 1992, under the auspices of the Singapore Cooperation Programme (SCP) – our flagship technical assistance programme. In 2018, we launched a dedicated Climate Action Package (CAP) under SCP, which focuses

on climate-related areas such as climate science, climate adaptation and mitigation strategies, disaster risk reduction, green finance, and implementation of the Paris Agreement.

We have worked with bilateral partners to jointly organise capacity-building initiatives for countries in the region. For example, MSE collaborated with Norway to conduct two runs of the Singapore-Norway Third Country Training Programme on “Waste Management and Reduction of Marine Litter” under the auspices of the SCP. MSE, the National Climate Change Secretariat and National University Singapore’ Centre for International Law have also partnered New Zealand to organise a CAP workshop on ‘Decoding the Paris Rulebook in Southeast Asia: Implementation and its Challenges’. The workshop provides a platform for knowledge sharing and best practices on steps that countries in the region need to take to fulfil their Paris Agreement obligations.

Participants of the CAP “Decoding the Paris Rulebook in Southeast Asia: Implementation and its Challenges” workshop



Building a network with like-minded countries

MSE believes in partnering like-minded countries to collaborate in areas of mutual interest while contributing to the larger global good. MSE has over 10 formal ministry-level cooperation agreements with countries spread across the globe.

This includes a long-standing Memorandum of Understanding (MOU) with China's Ministry of Ecology and Environment on environmental cooperation where both countries have mutually agreed to expand cooperation to include matters pertaining to green and low carbon development. We also recently signed an MOU with Indonesia's Ministry of National Development on green and circular economy development cooperation.

Our MOU with Denmark's Ministry of Environment and Food facilitates an exchange of best practices in areas such as climate adaptation and circular economy solutions, water technologies and management, energy efficiency and waste management policies. Another partner is the Netherlands, whom we have collaborated with in areas such as circular economy, climate science and coastal protection under our MOU with their Ministry of Infrastructure and Water Management. We also have a long-standing partnership with the United States, whom we meet regularly to discuss common interests in topics such as recycling and the circular economy under the Memorandum of Intent on Cooperation in Environmental Matters.



Participants of the Singapore-Norway Regional Training Programme on Sustainable Waste Management and Marine Litter Reduction

PHOTO CREDIT: MINISTRY OF FOREIGN AFFAIRS



Cover of Singapore's Zero Waste Masterplan

Sharing Singapore's sustainability experiences

One way that Singapore contributes to the global sustainability agenda is by sharing the knowledge and experience we have gained through our sustainable development efforts, such as through showcases at the UN. They explain Singapore's continual efforts to enhance our sustainability and prepare ourselves for future challenges.

In 2018, PUB held an exhibition on Singapore's Water Story at the United Nations Headquarters, which featured how we overcame our water constraints, and our approach to closing the water loop.

The following year, NEA's exhibition on Singapore's Zero Waste Masterplan provided insights into how we closed the waste loop. It showcased our efforts to encourage sustainable consumption and production, and waste and resource management.

More recently, in 2021, an exhibition, helmed by PUB, was set up in conjunction with the UN World Water Day, featuring Singapore's innovations in developing weather-resilient water sources. These include NEWater and desalination, as well as Tuas Nexus where we have developed the technology to maximise resource and energy recovery in the water reclamation process.

SUSTAINABLE INFRASTRUCTURE & OPERATIONS



MSE family's operations touch on many vital aspects of life in Singapore – food safety, sustainable water supply, clean and healthy living environment, just to name a few.

These are not only crucial to the well-being of Singaporeans but are existential issues for the country.

Through decades of hard work, careful planning and investment, we have built a range of robust systems that ensure our operations are carried out smoothly and sustainably. Today, Singapore is a world leader in water reuse and management, and home to highly efficient waste collection and management infrastructure.

The extensive systems that keep Singapore running

Some of our systems and infrastructure are tucked away in corners of the island.

In the westernmost region of Singapore, our Tuas South waste-to-energy incineration plant operates all year round to process the nation's waste. Incineration reduces waste volume by up to 90%, not just saving landfill space but producing electricity for the national grid at the same time. Minimising impact on the environment are the 150-metre tall chimneys. These chimneys come with flue gas cleaning systems such as lime dosing and catalytic



Tuas South Incineration Plant, where waste is reduced by up to 90% in volume

PHOTO CREDIT: NEA



Deep Tunnel Sewerage System, Singapore's superhighway for used water

PHOTO CREDIT: PUB

bag filters that remove pollutants before the flue gas is released into the atmosphere.

Across the island, stretching for kilometres at depths of up to 55 metres underground, is our Deep Tunnel Sewerage System. This is Singapore's superhighway for used water management, which enables us to capture and reuse every drop of water endlessly. The system is designed to last 100 years, be resilient to the corrosive sewerage environment, and serve generations of Singaporeans.

Other aspects of our infrastructure and operations are highly visible and ubiquitous, and have become a familiar part of everyday life. For instance, sustainability has been progressively embedded into our community spaces like hawker centres and markets, serving as tangible demonstrations of sustainability in the community.

Supporting the journey towards a low-carbon future

As Singapore's economy and urban landscape further evolves, operating our national infrastructure will become more resource- and carbon-intensive. Increased economic and social activity brings about higher utilisation of resources and essential services. Since the early days of independence, we have sought to ensure that economic growth does not affect our living environment. But this trade-off has become starker over the years as we face the intensifying threat of climate change.

We must therefore press ahead to minimise our carbon and resource footprint even as we upgrade and expand our operations. This requires us to think creatively and find new ways to integrate sustainability considerations and green our infrastructure and operations.

» Ingraining sustainability in everyday lives

Our markets and hawker centres are vital community assets, and centres of economic and social activities. In contrast, away from the hustle and bustle of everyday life are columbaria that provide tranquil spaces for bereaved families.

As different as they are, these amenities are similarly crucial to our society.

We are making strides in ensuring our infrastructure and operations

High ceiling at Bukit Panjang Hawker Centre facilitate natural ventilation

PHOTO CREDIT: NEA



are green and sustainable. Between 2017 and 2021, 19 premises achieved or improved their Green Mark ratings. Notable examples include Tiong Bahru Market and Choa Chu Kang Columbarium, which attained Green Mark Platinum in 2020. They achieved high scores for good natural ventilation, energy-efficient lighting installation, use of environmentally friendly products and generation of on-site solar energy.

Solar Panels on Bukit Panjang Hawker Centre harness sunlight to generate electricity

PHOTO CREDIT: NEA



Green Mark Certification at premises overseen by the MSE family

Premises	GM Rating	Date Attained	Premises	GM Rating	Date Attained
Choa Chu Kang Columbarium	Platinum (Positive Energy)	2020	Geylang Serai Market	Gold	2020
Tiong Bahru Market	Platinum (Super Low Energy)	2020	Centre for Climate Research Singapore	Gold	2020
Bukit Panjang Hawker Centre & Market	Platinum	2020	WaterHub (Office building and Singapore Water Academy)	Gold	2019
Tuas Water Reclamation Plant	Platinum	2020	Marsiling Mall	Gold	2018
Senja Hawker Centre	Platinum	2020	Yishun Park Hawker Centre	Gold	2017
Environment Building	Platinum	2018	Lower Seletar Waterworks (Membrane Filtration Building)	Gold	2017
Singapore Water Exchange	Platinum	2018	Jurong West Hawker Centre	Gold	2017
Taman Jurong Market & Food Centre	Gold ^{PLUS}	2020			
Golden Mile Food Centre	Gold ^{PLUS}	2020			
Woodleigh Village Hawker Centre	Gold ^{PLUS}	2019			
Pasir Ris Central Hawker Centre	Gold ^{PLUS}	2017			
NEA @ 2 Bukit Merah Central	Gold	2020			

» Powering our operations with clean energy

Over the years, we are harnessing resources available to us, such as sunlight. The Whole-of-Government SolarNova programme accelerates the deployment of solar photovoltaic systems in Singapore, to aggregate demand, achieve economies of scale and drive the growth of Singapore's solar industry. Six NEA-managed premises are currently installed with solar panels under the programme, including five hawker centres and the Mandai Crematorium and Columbarium.

The solar energy generated in these six premises alone are enough to power 3,556 four-room flats for a month.

Solar energy generated by NEA-managed premises

NEA-managed premises	Solar Energy generated in 2021 (KWh)
Mandai Crematorium and Columbarium	596,814
Dunman Food Centre	42,382
Bukit Panjang Food Centre	90,257
Serangoon Garden Market	157,997
Zion Riverside Food Centre	29,467
Pasir Ris Hawker Centre	149,952

Our reservoirs are more than just critical water catchment areas. They now double up as solar farms. In July 2021, PUB and Sembcorp launched the Sembcorp Tengeh floating solar farm, which at about the size of 45 football fields, is one of the world's largest inland floating solar farms. The clean energy generated is sufficient to power PUB's five local water treatment plants – equivalent to powering about 16,000 four-room Housing Development Board (HDB) flats – making Singapore one of the few countries in the world to have a fully green waterworks system. By using our space creatively in land-scarce Singapore, we will continue to shift our operations towards a more sustainable paradigm.

Sembcorp Tengeh floating solar farm – one of the world's largest of its kind

PHOTO CREDIT: SEMBCORP



» Greening our newest desalination plant



LEFT: Green spaces integrated into the infrastructure design of the Keppel Marina East Desalination Plant

RIGHT: The plant uses ultrafiltration (pictured) and reverse osmosis systems
PHOTO CREDIT: KEPPEL CORPORATION

With its innovative dual-mode capability, the Keppel Marina East Desalination Plant – Singapore's fourth desalination plant – can treat either seawater or freshwater drawn from the Marina Reservoir. It offers greater operational flexibility and strengthens Singapore's water supply resilience in the face of climate change.

In addition, with the direct coupling of ultrafiltration and reverse osmosis systems, water filtered from the upstream ultrafiltration process is fed directly into the downstream reverse osmosis process, removing the need for intermediate break tanks and pumping stages. Together, they save both cost and space, while improving energy efficiency by up to 15%.

Officially opened on 4 February 2021, it is also the first desalination plant that incorporates environmentally friendly landscaping elements. Its lush 20,000m³ Green Roof is linked via the Park Connector from East Coast Park and Gardens by the Bay. By integrating green spaces into our infrastructure design, we make our facilities accessible for the public to appreciate and enjoy.

Tapping technologies and innovative solutions to strengthen operations

Maintaining high standards of daily operations is a fundamental priority for the MSE family, from water treatment, waste collection and disposal, to ensuring food safety standards. But we always strive to do better. New technologies and solutions create opportunities for us to transform our operations and upgrade our systems, such that they become greener and more resilient. Therefore, we keep pace with global technology developments and look out for solutions that could unlock new possibilities for Singapore in closing resource loops and shrinking our resource footprint.

We adopt a systematic and pragmatic approach to identify and evaluate technologies for adoption based on their maturity and context. These technologies are adapted to our local context to tackle the pressing issues that Singapore faces.

» Smart Water Meters for more informed water demand management

Smart water meters provide consumers with on-demand and convenient access to their detailed water consumption information. From the MySmartWaterMeter portal, users can login to their account to view daily, even hourly breakdowns of their water usage data and be automatically alerted to suspected leaks in their premises. This will empower consumers to better manage their water usage and see tangible results of their water saving efforts.

In January 2022, PUB started installing smart water meters in Tampines Central and will progressively install the rest of the 300,000 smart water meters in Tampines, Hougang, Jurong West, Bukit Batok, Tuas and new estates of Tampines North and Tengah under the first phase of the programme.

Pilot trials by PUB in 2016 and 2018 with 800 households reported an average water saving of 5% from early leak detection and adoption of water-saving habits.

» Tuas Nexus – Turning waste into resources and energy



An artist's impression of the completed Tuas Nexus facility

PHOTO CREDIT: PUB

Set to be completed in phases from 2025 onwards, Tuas Nexus will be the world's first integrated waste and water treatment facility to be conceptualised and planned from the ground up. This mega facility integrates operations of PUB's Tuas Water Reclamation Plant (TWRP) and NEA's Integrated Waste Management Facility (IWMF) to treat used water and solid waste within a single facility.

The integrated facility will harness the synergies of the water-energy-waste nexus, by turning by-products of one process into resources for another. For example, IWMF's Food Waste Treatment Facility will convert food waste into food waste slurry, which will be co-digested with used water sludge at TWRP. This will increase biogas production, which will in turn increase electricity generation

at IWMF. Furthermore, dewatered sludge from TWRP will be incinerated at the IWMF. This enables energy recovery and reduces carbon footprint by eliminating the need for trucking the dewatered sludge to another location for treatment.

With these features and capabilities, Tuas Nexus will be self-sufficient in its energy needs, with excess electricity to be exported to the national grid. This is expected to yield carbon savings of more than 200,000 tonnes of CO² annually, equivalent to taking 42,500 cars off the road. Land use will also be optimised. Compared to building two standalone facilities, the integrated facility will allow land savings of up to 2.6 hectares, about the size of four football fields.

» Pushing the frontiers of sustainability through Science & Technology

Science and technology has enabled Singapore to turn critical constraints into strategic capabilities – transforming our water-stressed city into a global leader in water management, supporting the conversion of waste into valuable products and making a circular economy possible. Our investments in this area will continue to be a key pillar of our sustainability strategy.

A prominent example would be how PUB is leveraging technology to reduce energy consumption for desalination. Desalination is one of Singapore's four national taps, essential for a resilient and sustainable water supply. However, the process is energy-intensive,

PUB's Carbon Zero Grand Challenge seeks to incentivise innovative solutions that can help PUB achieve net-zero emissions by mid-century

PHOTO CREDIT: PUB



currently requiring 3.5 kWh/m³ of energy to make seawater drinkable.

To reduce the energy consumption of the process, PUB has partnered Nanyang Technological University (NTU) and water solutions company Aquaporin Asia to develop a biomimetic membrane that can treat seawater much more efficiently. This method mimicks the biological processes used by mangrove plants and euryhaline fish to extract freshwater at low energy.

Another initiative involves the harnessing of blue energy from the salinity difference between desalination waste streams and NEWater. This technology, which will be piloted at Changi Water Reclamation Plant, can potentially decrease energy consumption by 0.5 kWh/m³.

Moving ahead, PUB will be working with the Separation Technologies Applied Research and Translation Centre to develop a Desalination Integrated Validation Plant, to incorporate these and many promising technologies into our desalination process.

Through these initiatives, PUB targets to reduce the energy consumption of its desalination process by more than one-third to 2 kWh/m³ by 2025 – potentially making it the most energy-efficient desalination method globally.

Looking even further ahead, PUB launched the Carbon Zero Grand Challenge in Oct 2021 to seek carbon capture, utilisation and storage (CCUS) solutions to achieve net-zero emissions by 2050. Hosted on global crowdsourcing platform HeroX, PUB is soliciting the best ideas and solutions from around the world. A total of S\$6.5 million has been set aside to be awarded to innovative solutions that can be integrated with PUB's operations and reach commercial scale within a decade or sooner.

In the area of resource circularity and sustainability research, NEA is studying how to produce NEWSand, an environmentally-safe product derived from waste treatment residues. If successfully scaled up, NEWSand can be a sustainable source of construction materials. As this diverts incineration bottom ash (IBA) away from the landfill, we will also be able to extend the lifespan of Semakau Landfill.

One form of NEWSand involves treating IBA using methods such as washing and chemical stabilisation following the removal of metals. Studies are underway to explore its potential applications such as in non-structural concrete and as road base/sub-base material.

Another form of NEWSand involves the use of slagging gasification. This technology, which has been piloted at NTU's Waste-to-Energy Research Facility, directly converts municipal solid waste into slag, a glass-like material that is environmentally safe for various applications. NEA has successfully used this form of NEWSand in

the construction of the concrete plaza in front of the Environment Building, among other demonstrations.

Meanwhile NEA has also been partnering institutes of higher learning, research institutes and the private sector to improve on the treatment methods for IBA as well as develop new uses for IBA. For example, Republic Polytechnic working with EnGro on developing cost-effective techniques to treat and convert incineration ash into construction aggregates.

TOP: NEWSand, an upcycled material which can prolong the lifespan of Semakau Landfill beyond 2035

BOTTOM: A bench at Environment Building Eco Garden, constructed with NEWSand



INNOVATING WITH INDUSTRY



The pursuit of sustainability is complex and multi-faceted, and goes beyond public policies and initiatives. It requires innovative green partnerships, a cornerstone of our sustainability agenda.

At MSE, we work closely with the industry, research institutions and IHLs to co-create sustainability solutions across a wide range of sectors, including environmental services, water, agri-food, carbon services and clean energy sectors. These partnerships bring together diverse expertise in the ecosystem, allowing for the development of technologies and solutions tailored to different industry needs.

Such collaborations multiply the impact of sustainability initiatives, offering solutions to a much wider audience – not only to Singapore companies but also those in the region and beyond.

Co-creating innovative sustainability solutions

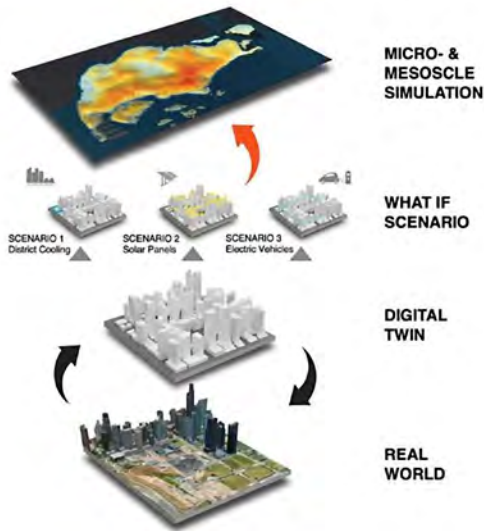
'Cooling Singapore 2.0' Research Project

The impact of global warming is compounded in Singapore by a phenomenon known as the Urban Heat Island (UHI) effect. The effect arises from the higher amount of heat trapped in urban built-up areas, resulting in higher ambient temperature compared to rural or more forested areas.

To address this, MSE and the Urban Redevelopment Authority are collaborating with a multi-disciplinary consortium on the Cooling Singapore 2.0 research project. Funded by the National Research Foundation, this project involves developing a Digital Urban Climate Twin (DUCT) to simulate Singapore's urban climate.

It brings together a wide range of partners from public and private sectors, with the Singapore-ETH Centre and Singapore Management University co-leading the consortium. Various public agencies have contributed with their respective climate models, namely the Centre for Climate Research Singapore's urban-scale model and HDB and Agency for Science, Technology and Research's Integrated Environment Modeller, which simulates climate within local districts.

The DUCT simulation would guide urban planning – in siting greenery and open spaces, for instance – and interventions to mitigate the UHI effect. Ultimately, this allows policymakers to make more informed decisions to mitigate UHI effects in Singapore.



The Cooling Singapore 2.0 research project aims to uncover new insights into how UHI impacts Singapore

Anchoring chemical recycling in Singapore

Plastic waste is one of Singapore's largest waste streams, with 868,000 tonnes generated in 2020. With limited landfill capacity and more countries banning the import of plastic, it is imperative that we shift towards closing our plastic waste loop locally, where plastic is reused and recycled as far as possible.

To this end, NEA and Shell are exploring chemical recycling solutions to convert contaminated plastics into higher-value products such as pyrolysis oil, which can be used as feedstock for Singapore's petrochemical sector.

There are multiple benefits from this initiative – plastic waste is diverted from incineration plants thereby reducing carbon emissions; new jobs and capabilities are created to support a circular economy; and petrochemical companies will transform their operations to be more sustainable. Embracing a circular approach in closing the waste loop is key to achieving Singapore's vision to be Zero Waste Nation.

NTU Singapore-CEA Alliance for Research in Circular Economy (SCARCE)

By using fruit peel waste to extract and reuse precious metals, researchers from NTU have found a way to give old lithium-ion batteries a new lease of life. This is one of the innovations born from a collaboration between NTU and the French Alternative Energies and Atomic Energy Commission (CEA) to develop green

technologies.

The collaboration, known as SCARCE, marks CEA's first research centre outside of France. SCARCE was awarded \$12.5 million funding under NEA's "Closing the Waste Loop" Funding Initiative. The collaboration focuses on recycling lithium-ion batteries and

silicon solar panels, as well as recovering valuable metals from printed circuit boards – a timely initiative given the growing amount of e-waste.

SCARCE has since licensed a venture capital company to scale up the translation and adoption of the fruit peel solution for commercialisation in North America and Canada.

Building an eco-system for innovation and collaboration

Beyond direct collaborations, MSE takes active steps to create opportunities and platforms to engender dialogue and information exchange among different stakeholders. These include PUB's Singapore International Water Week (SIWW) and NEA's CleanEnviro Summit Singapore (CESG), where stakeholders from various industries and sectors get to interact, build networks and explore collaboration opportunities. MSE family agencies have also introduced various grants and incentives to facilitate and support companies looking to pursue more sustainable business models and processes.



One of the innovations developed under SCARCE is a way to upcycle spent lithium batteries using fruit waste

PHOTO CREDIT: NATIONAL RESEARCH FOUNDATION



Singapore International Water Week

Bringing together thought leaders and stakeholders from the global water industry, SIWW has, since its inception in 2008, grown to be a highly anticipated event. SIWW 2021 took place as a fully virtual event, attracting close to 5,000 industry leaders, experts and practitioners from 91 countries despite the COVID-19 pandemic.

SIWW is now recognised as a platform to share best practices and solutions, showcase the latest technologies and for its participants to harness business opportunities. In 2018, S\$23 billion worth of projects, investments and MOUs were announced during the event. For example, Gradiant Corp's announced their new R&D centre in Singapore for industrial desalination and water reuse in 2018.

SIWW also facilitates collaboration among international partners. At SIWW 2021, Tajikistan and Singapore convened the "Regional Preparatory Meeting for the Mid-Term Review of the Water Action Decade". The event brought together representatives from Asia-Pacific countries to discuss efforts towards achieving the UN SDG 6 to provide clean water and sanitation for all.



CleanEnviro Summit Singapore

A kitchen sink that helps you turn food waste into fertiliser, technology systems that clean and monitor at the same time and a 3D model of Singapore that serves as a "cockpit" to simulate the impact of various climate scenarios such as flash floods. These are some of the innovations that have been showcased at CESG over the years.

Every two years, NEA organises the global networking platform for thought leaders, senior government officials, regulators and industry captains to connect, discover and discuss practical and scalable solutions for environmental challenges. In 2021, NEA organised the CESG Catalyst 2021 in partnership with Temasek's Ecosperity Week 2021 with the theme "Enhancing Sustainable Development in a Pandemic World". The event brought together more than 200 thought leaders, industry experts and senior government officials. Discussions revolved around strategic blueprints for developing climate-resilient cities capable of handling public health threats such as COVID-19.

» Grants and Incentives

Co-funding productive & sustainable urban farming practices

To help farmers better harness technology in local food production, the SFA launched a S\$60 million Agri- Food Cluster Transformation (ACT) Fund in 2021. The ACT Fund promotes the transformation and growth of the agri-food sector by supporting the adoption of high-tech farming systems. These systems increase productivity and use environmentally sustainable farming methods, contributing to Singapore's food security and our "30 by 30" goal by boosting local produce.

Blue Ocean Aquaculture Technology (BOAT) Pte Ltd, a modern fish farm, leveraged the ACT Fund to implement smart automated systems for the transfer of fishes from tank to tank, self-cleaning culture tanks, and dissolved oxygen producing and monitoring systems. These systems were developed at SFA's Marine Aquaculture Centre (MAC). MAC has successfully transformed hatchery production from outdoor pond systems – which are land intensive and are vulnerable to weather conditions - to recirculating indoor aquaculture systems. These systems require a smaller land footprint and allow farmers to better monitor and control breeding conditions and chances of disease. Waste discharges are also minimised through water re-use and feed optimisation.

Through these initiatives, BOAT Pte Ltd has achieved annual

manpower savings equivalent to 18,340 man-hours and water savings of 17,000m3.

Similarly, local poultry farm Seng Choon Farm Pte Ltd tapped the funding to upgrade its feed mill. The farm automated its micro ingredients and liquid dosing systems for feed mixing and introduced specially designed silos to decrease manual handling of materials. These improvements enabled the farm to increase its egg production while achieving annual manpower savings of 18,561 man-hours.

Minister of State Desmond Tan at a local farmer's market where freshly harvested seafood and vegetables from Nippon Koi Farm's miniature aquaponics system are sold



Helping companies improve water efficiency

With the aim of encouraging firms to seek efficient and innovative ways to manage their water demand, the Water Efficiency Fund (WEF) was first introduced in 2007. The scheme was later enhanced in 2020 to include activities such as water efficiency assessments and pilot studies. To date, PUB has facilitated more than 360 projects, with over \$30 million funding awarded.

Commercial laundry operator Iwash Laundry is among the companies that have tapped the WEF, using it to build its first water recycling system. This allows Iwash to recycle almost half of the used water from its tunnel washer and washer extractors for laundry operations, enhancing sustainability in its operations while saving 15% in monthly water bills.

Energy efficiency funding for manufacturing SMEs

The industrial sector is the largest energy-consuming sector in Singapore, accounting for around two-thirds of the country's end-use energy. To support energy efficiency efforts at industrial facilities, the Energy Efficiency Fund (E2F) was launched in 2017. From 1 April 2022, the E2F grant support cap will increase from 50% to 70%, to provide greater support for the adoption of energy-efficient technologies by SMEs in the manufacturing sector.

E2F mainly supports enterprises in three ways: (i) projects to integrate energy and water efficiency design into new facilities; and (ii) initiatives to improve energy efficiency in existing facilities,

Minister Grace Fu at Blue Ocean
Aquaculture Techonology Farm

PHOTO CREDIT: SFA



through audits to identify areas for improvement and adoption of equipment with better efficiency and (iii) installing energy management information systems to monitor and analyse their real-time energy usage.

Since the launch of the E2F in 2017, MSE has committed over \$5 million and supported 80 projects. One example of a beneficiary is Kawarin Enterprise Pte Ltd, a local steel manufacturing company. By upgrading their old air compressors to more energy-efficient ones, they enjoyed annual cost savings of more than \$30,000, and abated about 48 tonnes of carbon annually.

Growing innovation with industry partners

The MSE family, together with other Government agencies, will continue to grow a vibrant ecosystem for industry collaboration.

In Research, Innovation and Enterprise (RIE) 2020, the Government had committed a budget of S\$1 billion under the Urban Solutions and Sustainability (USS) domain, which is testament to the importance Singapore places on investment in research and innovation to overcome our natural constraints. Going into RIE 2025, MSE will expand its efforts under the USS domain to address growing sustainability and infrastructure needs. Focus areas include research on resource circularity, water sustainability, sustainable urban food production, and capabilities in climate science and adaptation. Under RIE 2025, the government has allocated \$220 million for R&D in resource circularity and water technologies and \$23 million to urban food sustainability projects.

The MSE Family will continue to tap the best talent and technologies as pioneers and front-runners in sustainable development. With an eye to the future, the MSE Family is determined to push the frontiers of resource efficiency, with Singapore as a living lab where new solutions are developed and test-bedded, for ourselves and for the world.

PARTNERING THE COMMUNITY



Catalysing a green society through strong community partnerships

Climate change is a global reality requiring coordinated action across national and sectoral borders. But equally important are collaborations in local communities to address the diverse environmental concerns on the ground.

Community partnerships unlock the expertise and resources inherent in society and galvanise collective action to solve climate change problems.

We work with the community to take action through a comprehensive suite of campaigns and initiatives. This includes the \$50 million SG Eco Fund, launched in November 2020, which supports ground-up community projects that advance environmental sustainability. Since its launch, 105 individuals and organisations have been awarded a total of S\$6.6 million to support their ground-up sustainability initiatives.

Our goal is to build a well-informed and engaged community, contributing to Singapore's sustainability.

Signing of SG Eco Fund Trust Deed

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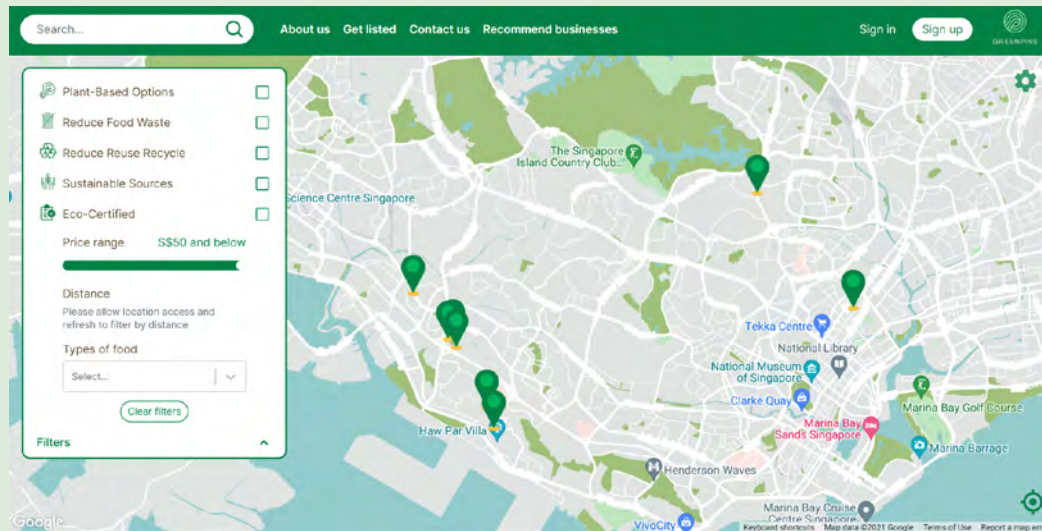
Professor Lily Kong, Mr Chaly Mah,
Permanent Secretary Albert Chua, Minister
Grace Fu, Mdm Zuraidah Abdullah



» Green Pins – a foodie's guide to sustainable eateries

A web-app that enables users to locate and support food and beverage (F&B) establishments that champion sustainability, Green Pins was developed with the support of the SG Eco Fund by trio Stanley Tan, Lecarl Lim and Jeongjun Yun, to create a community

of eco-conscious food lovers. Their goal is to empower consumers to consume responsibly and incentivise more F&B businesses to join the sustainability movement.



LEFT: A screenshot from the Green Pins web-app that allows users to locate sustainable eateries

BOTTOM: Lecarl Lim, one of the three co-founders of Green Pins

PHOTO CREDIT: GREEN PINS



» F.Ar.M – promoting sustainable lifestyles through agriculture

Social enterprise Family believes that a sustainable future starts with education. Tapping on the SG Eco Fund, it transforms unutilised grass plots into community urban farms to teach residents about sustainable agriculture and composting. At Kebun Baru Community Club, it has set up 100 raised beds, 200 composting bins, a solar-powered irrigation system and a germinator that is equipped with a rainwater harvesting system.

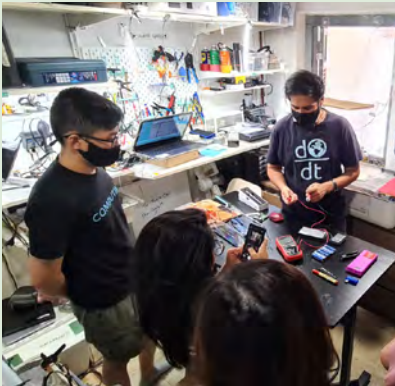
Promoting sustainable urban farms at unutilised spaces such as roof tops and grass plots

PHOTO CREDIT: FARMILY



» ReMakeIT – Cultivating a repair-first mindset

As electronic devices are now so readily available, faulty ones are thrown away without a second thought. But charity Engineering Good is trying to change this habit by equipping people with the skills to fix laptop problems through ReMakeIT workshops. The refurbished laptops are then donated to Family Service Centres and MOE beneficiaries to provide digital access for vulnerable families. Workshop participants also learn how to upcycle spare parts from old laptops, using them to create new products such as bluetooth speakers and powerbanks.



Workshop participants learning how to repair laptop spare parts

PHOTO CREDIT: REMAKEIT

National Dialogue

MSE is working hard to create opportunities for everyone to participate and contribute to our national sustainability agenda and has initiated several high-profile conversations on sustainability.

Green Plan Conversations

MSE held the inaugural Green Plan Conversation shortly after the Singapore Green Plan 2030 was launched in February 2021. The Inaugural Green Plan Conversation brought together over 100 individuals, who shared their thoughts on how we should chart Singapore's sustainability journey. Participants were members of



Participants of the inaugural Green Plan Conversation, where they discussed how Singapore should chart its sustainability journey

the public, and representatives from the 3P (People, Private, and Public) sectors including students, teachers, non-governmental organisations and business representatives.

Diverse ideas for sustainability were surfaced, while priorities and trade-offs were discussed, acknowledging that hard decisions will have to be made. Most importantly, the roles that each 3P partner can play were raised, driving home the importance of having everyone on board the sustainability journey. The Green Plan is a living plan and the Government will be holding more conversations for us to collectively advance our national sustainability agenda

Climate Action Week

We need the whole nation to understand, mitigate, and adapt to climate change. To galvanise stakeholders to take collective action for climate change, MSE hosts the annual platform Climate Action Week. The 2021 edition, which saw a record number of 130 activities including webinars, workshops, exhibitions and competitions involving over 60 partners, was held from 12-18 July with the Partners for the Environment Forum.

» Partners for the Environment Forum @ Climate Action Week 2021

Since 2013, Partners for the Environment Forum has been a vital platform for MSE and our partners to discuss environmental sustainability issues and co-create solutions. In line with this focus, the theme for 2021's Forum was "City of Green Possibilities", with partners sharing how they can contribute to the Green Plan. Participants echoed Minister Grace Fu's call for the 3P stakeholders to work together to make sustainability efforts relevant and realistic.

Minister Grace Fu (Left) and Ms Melissa Low, a research fellow from the Energy Studies Institute, speaking during the Partners for the Environment Forum 2021



Growing partnerships through campaigns, community projects and community infrastructure

To motivate the community to take simple steps towards a sustainable lifestyle, the MSE family runs various campaigns to raise awareness, and encourage the community to lead sustainable lifestyles by reducing food waste and cutting down on disposables.

» Say YES to Waste Less Campaign

One of the best ways to manage food waste is to avoid overbuying. Launched in 2019, NEA's Say YES to Waste Less Campaign has drawn the participation of 169 partners over 3,000 premises to reduce food waste through pre-planning capacity and using blemished or surplus food. These partners cover a range of sectors, comprising corporates, social enterprises, interest groups, non-governmental organisations, and Community Development Councils.

Consumers were also urged to play their part by ordering just what they can consume, and encouraged to bring their own reusable containers. Such green actions would be rewarded with free drink topping, discounts or loyalty points.



Resident with one of the Say YES to Waste Less partners

PHOTO CREDIT: NEA

» Transparent Recycling Bins

In an effort to facilitate better recycling behaviours among the community, MSE is piloting a transparent recycling bin that displays information on recyclable items. The initiative was launched in November 2021 at selected HDB blocks within Hong Kah North and East Coast constituencies.

The transparent bin was the brainchild of participants at the #RecycleRight Citizen's Workgroup, convened as part of the

#SGTogether movement, which saw more than 40 citizens working together to improve household recycling. The idea behind the design was to make the contents of communal recycling bins visible, with the intent to reduce contamination and raise awareness on the treatment of non-recyclable items.

LEFT: Senior Minister of State Amy Khor at the launch of transparent recycling bins aimed at reducing contamination

RIGHT: A co-mingle transparent bin prototype



» Sustainability @ Tampines Park

By donating food waste from their homes, Tampines residents earn “green currency”, which they can then use to purchase vegetable and fish. The food waste is then fed to black soldier fly (BSF) larvae, which produce fertiliser for a vertical vegetable farm and nearby community gardens, and serve as feed for tilapias.

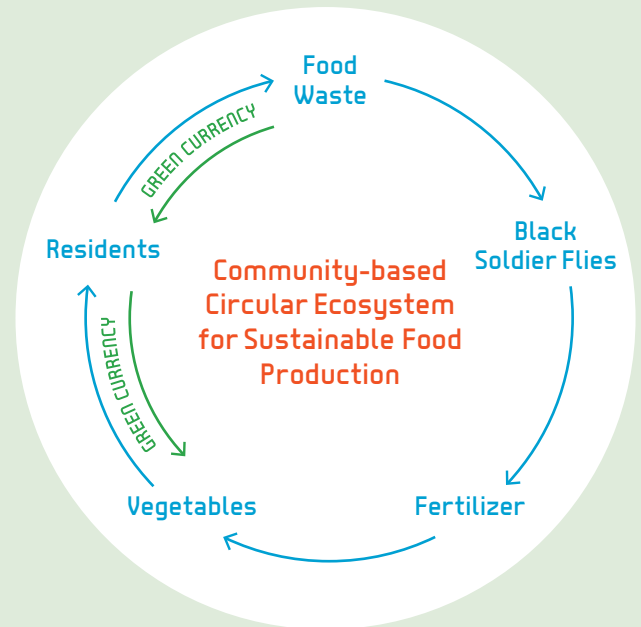
This is the concept behind Sustainability @ Tampines Park – Singapore's first community-based circular ecosystem for sustainable food production. The pilot project aims to reduce food waste and strengthen the community's food resilience.

The reception has been encouraging. To date, an average of 83kg of food waste is received every week from 46 households in Tampines, and 70 individuals have signed up as volunteers at the BSF facility where they help with tasks such as the collection and processing of food waste.

From Dec 2020 to Aug 2021, the vertical farm completed four production cycles and distributed approximately 200kg of vegetables to residents per crop cycle.

Other than supporting SFA's “Grow Local” strategy to strengthen Singapore's food resilience, this project also offers local farms the opportunity to test innovative technologies. Having urban farms in the heartlands also reduces trucking of produce from farms to

consumers, thus reducing carbon footprint while allowing residents to enjoy fresh produce. This would also allow the local community to better appreciate the farm-to-fork process and support local produce.



PARTNERING THE COMMUNITY

FROM TOP LEFT CLOCKWISE:

A Tampines resident contributing a container of food waste to the BSF facility

Leafy vegetables grown using a hydroponics system at the pilot vertical farm

Volunteers helping out at the BSF facility.

Minister of State Desmond Tan and Tampines GRC MPs feeding BSF larvae to tilapia fish

PHOTO CREDIT: SFA



» Enabling e-waste disposal

With increasing demand for electrical and electronic products, electronic waste (e-waste) has become a growing – and potentially hazardous – waste stream without proper disposal. The Extended Producer Responsibility (EPR) scheme for e-waste management was implemented in 2021 to address this by extending producers' responsibility to ensure proper treatment of their products at end-of-life.

To make recycling of e-waste more accessible, more than 500 e-waste collection bins have been deployed at convenient locations

including shopping malls, community centres and supermarkets. In-store collection by large retailers and doorstep collection of bulky e-waste have also been made available.

ALBA E-waste Smart Recycling Pte Ltd, the Producer Responsibility Scheme operator, collects all regulated consumer e-waste materials and sends them to licensed e-waste recyclers for proper handling, treatment and recycling.



Consumers get their e-waste recycled by depositing them at these ALBA bins

An early start on sustainability

Engaging people from an early age helps to mould a new generation of citizens who are prepared to take responsibility and action. The MSE family regularly works with schools and youths to co-create sustainability solutions, such as through NEA's Environmental Education Advisors. These advisors are educators that champion environmental programmes in schools to educate students on environmental issues. They also provide

valuable feedback to NEA, which is used to refine environmental programmes for students.

In 2021, MSE and MOE collaborated on a survey to understand the environmental perceptions of our students. Insights from the survey could inform the design of MOE's Eco Stewardship Program and other behavioural nudges to encourage our students to move from awareness to action and then activism in promoting sustainable behaviour among their family and friends.

» Co-creating Sustainability Solutions with Youths

In 2020, MSE, NEA and Chua Chu Kang Town Council collaborated with Temasek Polytechnic (TP) to design and implement an e-waste recycling campaign.

TP's final-year psychology students designed a range of collaterals to encourage households to use proper e-waste recycling channels. To evaluate the effectiveness of the different interventions, the students organised an e-waste collection drive at Chua Chu Kang.

Over 60 households participated, and more than 600 e-waste items were collected during the campaign. Insights from this initiative have enabled MSE and NEA to design e-waste collection points to improve e-waste recycling rates.

A poster created by the students to encourage households to use proper e-waste recycling channels



» Inculcating water-saving habits in students

Every March, over 60 schools pledge to hold "Water Wednesdays" where activities are organised on each Wednesday of the month to encourage students to conserve water. This is one of the ways PUB actively engages schools in educating students on water causes.

In collaboration with MOE, PUB also contributes water-related topics to the school curriculum to deepen students' knowledge of Singapore's Water Story, as well as organises interactive activities such as workshops for making mini-water gardens and tours to NEWater facilities.

Through the agency's active involvement in reaching out to students, youths are able to better appreciate water as a resource to be conserved and, more importantly, inculcate good water-saving habits from an early age.



Students picking up litter during a waterway clean-up activity organised as part of "Water Wednesday"

BUILDING A SUSTAINABLE ORGANISATION



Sustainability is at the heart of all that we do.

"Building sustainability" is not just a job description for MSE officers; it is a core value that guides our daily work life. In the MSE family, sustainability is exemplified through our everyday practices and processes, and forms the culture that binds us.

A Typical Day in the Office

Imagine waking up to a brand-new Monday and setting off to work. You get onto your bicycle – a carbon-free and healthy mode of transport – and arrive at the Environment (ENV) Building, home to MSE officers and packed with sustainability features and which is also Green Mark Platinum certified.

Walking across the NEWSand Plaza, you wave to your colleague, who has just come up from the basement carpark where he's charging his electric car at the EV charging station⁴. He shows you some pre-loved toys that he is donating for the upcoming "social



ENV Building's main plaza was re-graded using NEWSand, part of a waste-to-resource pilot project

recycling" collection drive, a regular initiative organised by MSE's Staff Wellbeing Committee. You make a mental note to finish up your spring cleaning by next week as you have some items which are good for reuse.

⁴ EV charging stations will be installed in the ENV Building car park in mid to end 2022.

After a productive morning, the office lights dim at 12:30 pm – an energy saving feature which also signals lunch time.

You finish your lunch at the ENV Building cafeteria and dispose of your leftover food into food waste bins, knowing that they will be fed into a bio-digester, converting them into fertiliser. A post-lunch coffee goes into your Bring Your Own (BYO) thermos to tide you through the afternoon.

You head to the toilets, which have showers fitted with water-saving features such as sensor taps and dual flushing system, to freshen up.

Your colleague pops by your desk to check if you would be attending the department lunch next week. She is collating attendance and reminding everyone to bring their own cutlery as MSE practises zero waste and bring-your-own for catered events.

As you head off at the end of the day, you place your non-recyclables into the Big Belly bin – a smart, solar-powered, sensor-equipped waste compactor – before getting on your trusty bicycle for a ride home.

This is the MSE way of life, where sustainability is not a job but a passion.

Did you know?



MSE officer emptying food scraps into food waste bins, these leftovers are fed into our bio-digester

Every day, MSE saves up to 100kg of organic waste from being incinerated and dumped at Semakau Landfill. This is done through the food waste bio-digester, which has been in use in the Environment Building cafeteria since July 2017.

We collect all our diners' leftovers and food waste from food preparation (such as chicken bones, eggshells and vegetable stems), which are fed to our bio-digester. After weeks of decomposition with the aid of facultative bacteria, close to 100% of the organic waste converts into liquid nutrients. These nutrients are used as fertiliser for the plants around our building, turning food waste into a useful resource.

Rainwater is also harvested for landscape watering and horticulture waste is composted as fertiliser, closing our horticulture waste loop at the ENV building.

Culture as the foundation of our sustainability journey

In the MSE family, our officers embrace a sustainability mindset as we go about our daily work. Our policies and guidelines remind officers to minimise our resource and carbon footprint, including procurement practices and event organisation:

- Green procurement policies, where we procure materials (including carpets, partitions, furniture and fittings) which have been certified by the Singapore Green Building Council. We use environmentally friendly materials, such as products that have Singapore Green Labels or meet ENERGY STAR requirements. MSE also selects paints with low volatile organic compounds and paper with recycled content.
- Event guidelines, which require venues to be Green Mark-certified and close to public transport nodes. Event materials are kept to an absolute minimum through e-communication, paperless registration and electronic backdrops. MSE also takes a zero-waste and bring-your-own-cutlery approach for catered events.

Sustainability goes beyond following guidelines – going green is a lifestyle for our officers. We continue to build on the strong sustainability culture through activities such as periodic “Social Recycling” collection drives to promote reuse of pre-loved items near festive periods, calls to action and sustainability campaigns.

Every year, MSE also recognises officers who are green champions

through the “I Love Green” annual awards, given to individuals and teams committed to adopting a sustainable lifestyle. Our officers are recognised for their efforts in protecting the environment by volunteering with the community on green initiatives.



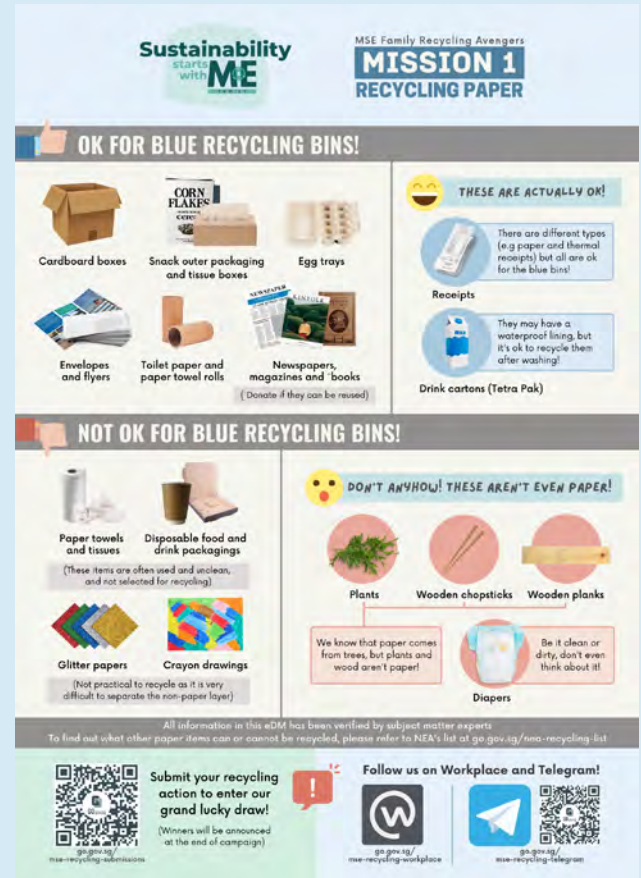
» Sustainability Starts with M(s)E!

In 2021, the MSE Family organised a three-month recycling campaign, "Sustainability starts with M(s)E", with the goal of equipping officers with the knowledge to recycle right, and to build their confidence to be recycling ambassadors.

The campaign was managed by a group of enthusiastic officers who responded promptly to a call for volunteers – a testament to the passion for sustainability within the MSE family. They were aptly named the "Recycling Avengers".

Gamifying the recycling experience

Structured as a series of "missions", the campaign kicked off with a contest to create a recycling corner at home. The aim was to get participants to create a simple infrastructure at home that would not only make recycling convenient, but also act as a visual reminder to recycle. Subsequent missions required participants to perform recycling actions covering different material types (i.e. paper, plastic, glass, metal), equipped with knowledge and tips shared by the Avengers.



A poster on how to recycle right, created for the "Sustainability starts with M(s)E" campaign

Over three months, more than 500 MSE family officers took part in the campaign through a range of activities including recycling action, quizzes, contests and surveys. The 14 teams which took part in the finale, the "Recycling Together" hackathon, submitted numerous ideas on how to bolster recycling at the workplace. The campaign also used Telegram to share useful bite-sized information about recycling and hold quizzes to reinforce recycling facts.

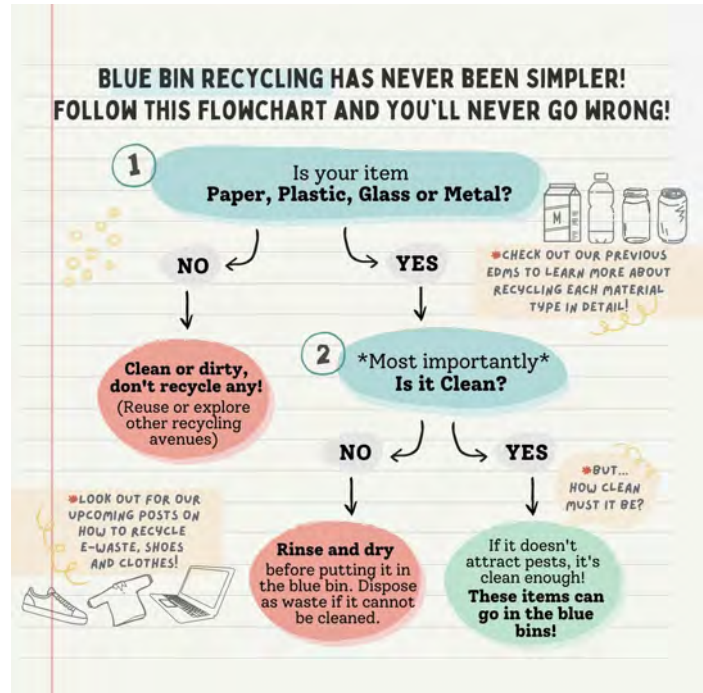
Outcome and achievements

The campaign created rich information resources to generate awareness of what to recycle, how to recycle and what the recycled materials are turned into. It succeeded in what it set out to do – and more.

Officers gave feedback that the campaign has improved their recycling knowledge, encouraging them to recycle more. A post-campaign survey showed that 78% of respondents expressed confidence in recycling, an increase of 28% compared to pre-campaign. Many also introduced a recycling corner at home. The rich content developed for the campaign has been adapted for other communication projects outside MSE.

This campaign brought a great sense of achievement to those involved, and it has inspired them to grow the sustainability culture in the MSE family.

Recycling tips sent regularly over Telegram



CONCLUSION



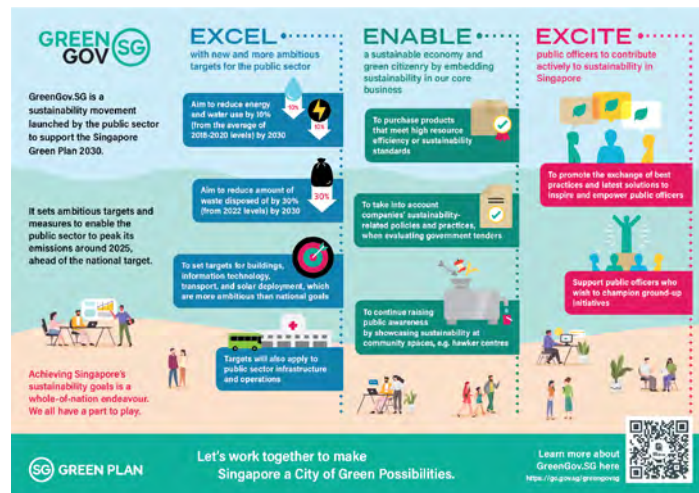
Sustainability is a marathon that we cannot run alone. We must be in it for the long haul, working together as responsible stewards for our children and generations to come.

The pandemic has placed us at a critical crossroads. It has threatened to reverse decades of developmental gains. But there are opportunities together with the challenges, and we can shape the recovery to emerge greener and stronger. We will leverage the reset to forge new pathways towards more resilient and sustainable growth.

While we have made progress, we are only at the beginning of the journey. The Public Service has embarked on the next bound of sustainability through the GreenGov.SG initiative, with expanded responsibilities and more ambitious targets. For the MSE family, we must and will sustain our momentum, championing sustainability in all that we do.














An infographic highlighting targets set for GreenGov.SG



ANNEX

MSE family's sustainability efforts contribute to the following Sustainable Development Goals (SDGs):

Key Strategies	GreenGov.SG pillar	SDGs contributed to	Examples of Initiatives
Sustainability & climate action beyond our shores	-	 	<ul style="list-style-type: none"> Enhanced Nationally Determined Contribution and Low-Emissions Development under the Paris Agreement Climate Action Package under Singapore Cooperation Programme Singapore-Norway Third Country Training Programme UN World Water Day exhibition
Sustainable infrastructure & operations	Excel	     	<ul style="list-style-type: none"> Deep Tunnel Sewerage System SolarNova Programme and Floating Solar farms Keppel Marina Bay desalination plant Smart Water Meters Tuas Nexus

Innovating with the industry	Enable		<ul style="list-style-type: none"> • 'Cooling Singapore 2.0' Research Project • NTU Singapore-CEA Alliance for Research in Circular Economy • Anchoring chemical recycling in Singapore • Singapore International Water Week • CleanEnviro Summit Singapore • Agri- Food Cluster Transformation, Water Efficiency Fund, Energy Efficiency Fund
Partnering the community	Enable		<ul style="list-style-type: none"> • SG Eco Fund • Green Plan Conversations • Climate Action Week • Say YES to Waste Less campaign • #RecycleRight Citizen's Workgroup • Sustainability @ Tampines Park pilot • Enabling e-waste disposal • Co-creating sustainability solutions with youths
Building a sustainable organisation	Excite		<ul style="list-style-type: none"> • Growing a culture of green champions • Green practices in procurement, daily operation • Organising green events