

**ADDENDUM TO SINGAPORE'S
LONG-TERM LOW-EMISSIONS
DEVELOPMENT STRATEGY**



Preface

The 26th Conference of the Parties (COP-26) to the United Nations Framework Convention on Climate Change (UNFCCC) held in Glasgow in 2021 laid a firm foundation for accelerated climate action. As part of the Glasgow Climate Pact, Parties were requested to revisit and strengthen the 2030 targets in their Nationally Determined Contributions (NDCs) as necessary to align with the Paris Agreement temperature goal, and urged to communicate long-term low-emissions development strategies (LEDS) toward just transitions to net zero emissions by or around mid-century, taking into

account different national circumstances.

Singapore has reviewed our climate targets, policies and strategies, and has updated them in this addendum, which builds on our LEDS submitted in 2020, *Charting Singapore's Low Carbon and Resilient Future*. This document has been prepared by agencies in the Singapore Government under the Inter-Ministerial Committee on Climate Change (IMCCC), taking into account views from academia, industry and members of the public that were gathered through stakeholder engagements.

National Circumstances

Climate change is one of the greatest existential threats of our time. The Intergovernmental Panel on Climate Change (IPCC)'s Sixth Assessment Report concluded that the impacts of climate change are more apparent, and will affect us more severely, than previously thought. The world must rally to make deep cuts in emissions if we are to limit global warming to 1.5°C.

As a small, low-lying island city-state in the tropics, Singapore is especially vulnerable to the adverse effects of climate change, notably the heightened risks of extreme weather events, urban heat stress, and rising sea levels. As Singapore has to import most of our resources, we will be affected by rising

global pressures on food, energy and raw materials. Although Singapore only accounts for around 0.1% of global emissions, we have been an early and committed contributor to global efforts to address the climate crisis. In the early 2000s, we switched from fuel oil to natural gas, the cleanest form of fossil fuel, to decarbonise our electricity generation. We also pursued energy efficiency improvements and other environmental protection measures across all sectors of our economy.

To meet our climate commitments, Singapore will continue to find innovative ways to reduce emissions whilst remaining competitive in the face of our geographical constraints. Singapore is small, low-lying, highly urbanised, and has limited access to alternative energies like wind or hydro-electric power. Despite these constraints, we have accelerated our deployment of solar power to the best of our ability, and forged international and regional partnerships to explore clean energy imports and work on needle-moving low-carbon technology and solutions. Our

comprehensive suite of policies and actions to achieve our climate goals are outlined in the Singapore Green Plan 2030.

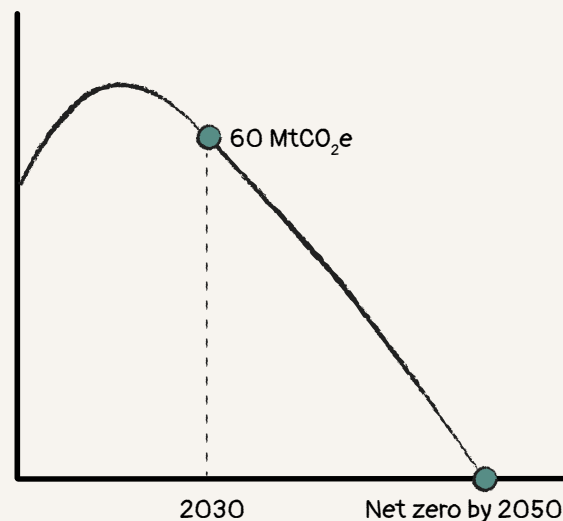
Singapore's Climate Commitments

The early and collective efforts of businesses, individuals and the Government have borne fruit. Singapore met our commitment to reduce emissions to 16% below business-as-usual (BAU) levels by 2020, made in 2009 ahead of the Copenhagen Summit, achieving a 32% reduction below BAU levels. In March 2020, we also submitted our first update to our 2030 NDC and our LEDS under the Paris Agreement. At that time, our LEDS pledged to halve emissions from our 2030 peak to 33 MtCO₂e by 2050, with a view to achieving net zero emissions as soon as viable in the second half of the century.

Since then, accelerating global momentum on climate action has given us the confidence to further enhance our LEDS pledge. Countries and corporations worldwide have significantly increased their investments and research in decarbonisation technologies, and there have been positive developments in international cooperation in areas such as global carbon markets and regional power grids. In the light of these global developments and progress made on the domestic front, Singapore announced that we will further update our 2030 NDC and enhance our long-term emissions trajectory:

*Second update to 2030 NDC:
To reduce emissions to around
60 MtCO₂e in 2030 after
peaking emissions earlier.*

*Updated LEDS: To achieve
net zero emissions by 2050.*



Illustrative diagram of Singapore's net zero emissions trajectory.

Given Singapore's national circumstances — we are a resource-constrained and alternative energy-disadvantaged city-state — these are ambitious targets. We are committed to doing our part as a responsible member of the international community. Our ability to fulfil our pledges, like all Parties, will depend on the continued international commitment by Parties to the Paris Agreement and their climate pledges. The targets will also be contingent on the maturity of decarbonisation technologies and effective international cooperation.

To achieve net zero by 2050, Singapore is accelerating the low-carbon transition for industry, economy and society through four key thrusts:

- Catalysing business transformation;
- Investing in low-carbon technologies;
- Pursuing effective international cooperation; and
- Adopting low-carbon practices.

They are supported by the carbon tax, as a key enabler of this transition.

Charting Singapore

Achieve net zero emissions by 2050

Long-Term Low-Emissions Development Strategy (LEDS)



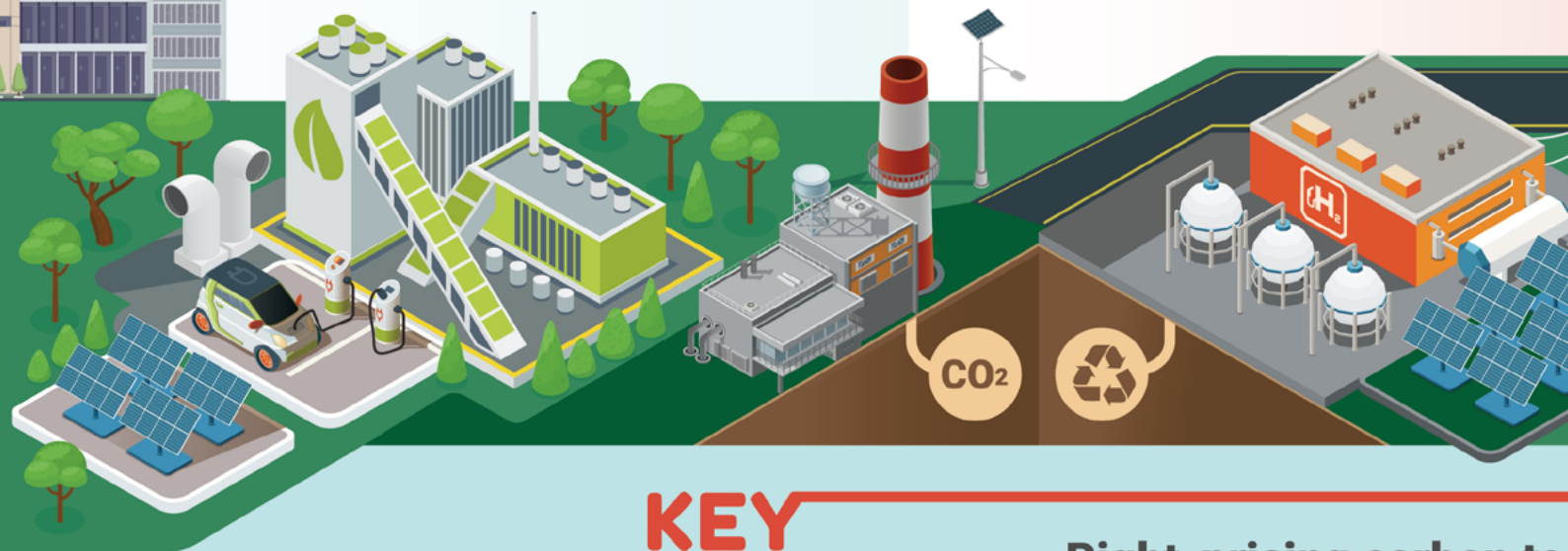
Accelerating Low-Carbon Transition

Catalyse business transformation

- Sustainable energy and chemicals hub in conjunction with industry
- Grants for energy efficiency and emissions reduction

Invest in low-carbon technologies

- Carbon Capture Utilisation and Storage
- Low-carbon hydrogen
- Solar and energy storage systems



KEY ENABLER

Right-pricing carbon to decisions and consumer

**EVERYONE CAN
PLAY A PART**

Public sector

Achieve net zero emissions across public sector around 2045 as part of GreenGov.SG



Singapore's Net Zero Future

**Reduce 2030 emissions to 60 MtCO₂e
after peaking emissions earlier**

2030 Nationally Determined Contribution (NDC)



Focus in Industry, Economy and Society

Pursue effective international cooperation

- International carbon markets with high quality carbon credits
- Regional power grids for green energy

Adopt low-carbon practices

- Green commutes via public transport, Walk-Cycle-Ride & cleaner energy vehicles



**Shape business
and consumer behaviour**

**Carbon tax
S\$50-80/tCO₂e
by 2030**

Private sector

Develop and adopt low-carbon solutions, and pursue green growth opportunities



Individuals

Contribute to climate friendly initiatives



Charting Singapore's Net Zero Future

The following sections outline the current plans and policies that Singapore has put in place to chart our way to net zero. We will continue to update our measures and strategies over time.

CATALYSING BUSINESS TRANSFORMATION

To support businesses in their decarbonisation journeys, the Government has introduced a suite of measures to help companies improve energy efficiency, reduce emissions, and seize opportunities in the green economy. The Resource Efficiency Grant for Energy and the Energy Efficiency Fund support businesses in improving the energy efficiency of their industrial facilities, so as to reduce emissions, lower operational costs, and increase business competitiveness. We are also supporting local enterprises, particularly Small and Medium Enterprises (SMEs), in building long-term capabilities in sustainability and capturing green growth opportunities through the Enterprise Sustainability Programme.

The Sustainable Jurong Island report articulates our aspirations to transform Jurong Island into a Sustainable Energy & Chemicals (E&C) Park that operates sustainably and exports sustainable chemicals globally. By 2050, we plan for Jurong Island to increase the output of sustainable products by four times from 2019 levels, and achieve at least 6 MtCO₂e of carbon abatement per annum from low-carbon solutions.

To help companies build up their competitive advantage in the green transition, the Government will closely partner with them to develop, pilot, and eventually adopt emerging low-carbon technologies to drive decarbonisation in our industries.

INVESTING IN LOW-CARBON TECHNOLOGIES

Singapore is studying emerging low-carbon technologies like hydrogen, carbon capture utilisation and storage (CCUS), and advanced geothermal systems. These can enable decarbonisation at scale for hard-to-abate sectors. Under the Low-Carbon Energy Research (LCER) Funding Initiative, we have awarded S\$55 million to support 12 research, development and demonstration projects on low-carbon hydrogen and CCUS. We are setting aside another S\$129 million for the next phase of the programme.

Low-carbon hydrogen has emerged as a key potential decarbonisation pathway for Singapore, given its possible applications as an alternative fuel and industrial feedstock. Although many hydrogen technologies are still nascent, Singapore is taking steps to prepare for hydrogen deployment. Our National Hydrogen Strategy is organised around five key thrusts:

- Experimenting with the use of advanced hydrogen technologies at the cusp of commercial readiness through pathfinder projects;
- Investing in research and development (R&D) to unlock key technological bottlenecks;
- Pursuing international collaboration to enable supply chains for low-carbon hydrogen;
- Undertaking long-term land and infrastructure planning; and
- Supporting workforce training and development of our broader hydrogen economy, so that Singaporeans will be in good stead to capture new opportunities in the global hydrogen economy.

The power sector accounts for almost 40% of our emissions today. We are pressing ahead with ambitious solar deployment plans to achieve our target of at least 2 gigawatt (GW)-peak by 2030, which will generate enough

energy to meet around 3% of Singapore's total electricity demand in that year.

Although solar power is Singapore's most viable renewable energy alternative, its scale-up is fundamentally limited by our land constraints. Nevertheless, the Government will continue to review our longer-term strategies for maximising solar power, and actively invest in R&D and test-bedding to increase efficiency and optimise space utilisation, including through the deployment of floating solar farms and vertical panel installations.

To enhance the resilience of our energy supply and power grid, the Energy Market Authority (EMA) appointed Sembcorp to build, own and operate Energy Storage Systems (ESS) with 200 megawatt-hours (MWh) of energy storage capacity and 200 megawatts (MW) of discharge capacity. Once it is operational, it will be the largest ESS deployment in Southeast Asia, and one of the fastest of its size to be deployed.

We are also exploring possible CCUS deployment pathways. Carbon dioxide captured from industrial facilities in Singapore could be sequestered in suitable sub-surface geological formations, utilised as feedstock for synthetic fuels or as building materials through mineralisation. Singapore will continue to monitor technological and market developments, and scale up deployment as pathways become techno-economically viable.

PURSUING EFFECTIVE INTERNATIONAL COOPERATION

Given our national circumstances, Singapore is highly dependent on effective international cooperation for the success of our decarbonisation measures. While we continue to prioritise domestic efforts to reduce emissions, we will need to pursue collaboration with international partners to access regional

and global mitigation opportunities to meet our ambitious climate goals.

This is why Singapore actively fosters effective international cooperation on climate action. Singapore has played an active role in supporting the multilateral framework of cooperation on climate change under the UNFCCC, including co-facilitating the negotiations at COP-26 that finalised the Article 6 rulebook of the Paris Agreement. Singapore also collaborates actively with international partners, such as the UNFCCC, the UN Development Programme (UNDP), the UN Environment Programme (UNEP), ASEAN and city-networks such as the C40, on the sharing of best practices and experiences on climate change and green growth issues.

Singapore is an advocate of close bilateral, regional and plurilateral cooperation, and has signed agreements with various partners to strengthen collaboration on carbon markets, green finance and low-carbon technologies. On carbon markets, for example, Singapore has signed Memoranda of Understanding (MOUs) with countries such as Indonesia, Colombia, Vietnam, Brunei and Morocco on carbon credits collaboration aligned to Article 6 of the Paris Agreement.

On the energy front, enhancing regional energy connectivity, including through the ASEAN Power Grid, is one initiative that can enhance economic development, energy security and sustainability in the region. As a pathfinder to the ASEAN Power Grid, Singapore has begun importing hydroelectric power from Laos, using existing interconnections via Thailand and Malaysia, as part of the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMP-PIP). Our aim is to import up to 4 GW of low-carbon electricity from beyond our shores by 2035, which is expected to make up around 30% of Singapore's total supply. In addition to working with our regional neighbours on the LTMP-PIP, Singapore has signed MOUs with

countries like Australia, Cambodia, Chile, Lao PDR, New Zealand, Indonesia, and Japan, to collaborate on areas including regional power grids and low-carbon solutions.

In October 2022, Singapore signed our first Green Economy Agreement — and the world's first green agreement of its kind — with Australia to further accelerate both countries' transitions towards a green and sustainable future. In support of broader global climate action, Singapore has also committed to initiatives such as the Powering Past Coal Alliance, Global Methane Pledge, and Greening Government Initiative.

ADOPTING LOW-CARBON PRACTICES

Transport Sector

Singapore has one of the most comprehensive and innovative systems in the world for managing vehicle ownership and usage. Since 2018, we have kept our private vehicle population growth at zero. The Government aims to phase out internal combustion engine vehicles and have all vehicles running on cleaner energy by 2040. To encourage the adoption of electric vehicles (EVs), we have various incentives to lower the upfront and running costs of an EV. We are also expanding our public EV charging infrastructure, with a target of 60,000 charging points nationwide by 2030.

At the same time, we are continuing to invest significantly in our public transport and active mobility infrastructure to encourage Walk-Cycle-Ride (WCR) modes of travel. Our target is for 9 in 10 peak period journeys to be WCR journeys by 2040, with 9 in 10 of these WCR journeys to be completed in less than 45 minutes.

Building Sector

Singapore is accelerating our transition towards a low-carbon built environment. Under the Singapore Green Building Masterplan, we have set three ambitious targets:

- 80% of buildings by gross floor area (GFA) to be green by 2030;
- 80% of new developments (by GFA) to be Super Low Energy (SLE) buildings¹ from 2030 onwards; and
- 80% improvement in energy efficiency (compared to 2005 levels) for best-in-class green buildings by 2030.

Our key strategies include raising the sustainability standards of existing buildings, driving the adoption of SLE standards for new buildings, and pushing the boundaries of energy efficiency through research and innovation.

Singapore is also implementing district-level sustainability measures and solutions in areas such as Jurong Lake District (JLD), a new growth area in western Singapore that aspires to become a world-class sustainability district. JLD aims to achieve net zero emissions for new developments around 2045. To meet this target, all new developments in JLD will be required to meet SLE standards, with some achieving Zero Energy standards as technology improves, and will be required to use the district cooling system, which improves energy efficiency. We will also maximise solar energy deployment on buildings. To support green mobility, 85% of all trips are targeted to be through WCR modes of travel by 2035. 40% of land in JLD will also be set aside for green spaces and water bodies that will cool the district and serve as recreational spaces.

¹ SLE buildings refer to buildings that have achieved at least a 60% improvement in energy efficiency compared to 2005 levels.

Household Sector

Singapore has taken steps to reduce energy consumption of the household sector, which accounts for about 16% of our total electricity consumption. The Minimum Energy Performance Standards — which have been progressively tightened over the years — raise the energy efficiency of household appliances such as refrigerators, air-conditioners, and clothes dryers. To help consumers make more informed purchasing decisions, the Government has also progressively expanded the Mandatory Energy Labelling Scheme to cover an increasing variety of appliances.

Singapore will continue to provide support to households impacted by the low-carbon transition, through initiatives such as the Climate Friendly Households Programme to defray the costs of switching to more resource-efficient and climate-friendly appliances.

Water and Waste Sector

Singapore is embracing a shift towards a circular economy to reduce emissions, maximise resource efficiency and resilience, and conserve landfill space. In our Zero Waste Masterplan, the Government has set a target to reduce by 2030 the amount of waste sent to the landfill each day by 30%. We have also introduced the Extended Producer Responsibility (EPR) framework for e-waste management, and plan to introduce a beverage container return scheme by mid-2024, as the first phase of an EPR approach for managing packaging waste.

We also aim to maximise energy efficiency in our water and waste treatment operations. One key initiative in development is the co-location of a used water treatment plant and an integrated waste management facility, collectively known as Tuas Nexus. It will harness synergies from the waste and water treatment processes to generate enough electricity to sustain its own operations, with any excess electricity channelled to the

national grid. Tuas Nexus is expected to be completed in phases from 2026 onwards.

RIGHT-PRICING CARBON

Singapore implemented a carbon tax in 2019, becoming the first country in Southeast Asia to do so. The tax is applied across all sectors, and puts a price tag on the externality of carbon. This encourages companies and individuals to internalise this cost when making decisions, and at the same time gives them the flexibility to take action where it makes the most economic sense. The tax covers about 80% of our carbon emissions. Revenue from the carbon tax will be used to support decarbonisation efforts and cushion the impact on businesses and households, facilitating our transition to a low-carbon economy.

Singapore announced our plans to progressively raise the carbon tax to around S\$50/tCO₂e to S\$80/tCO₂e (~US\$36.90/tCO₂e to US\$59.00/tCO₂e) by 2030. This move reflects our commitment to step up the pace of transformation so that we can achieve net zero emissions by 2050. The announcement of the revised carbon tax trajectory provides businesses with the lead time to plan for the transition. More broadly, it ensures that new investments, economic activity, and corporate and individual behaviour will be aligned with a low-carbon future.

Singapore supports global carbon pricing. Every tonne of carbon dioxide emitted imposes the same social cost on the environment, regardless of its location of origin. An effective global carbon pricing mechanism will enable countries to internalise the negative externalities of carbon emissions without compromising their international competitiveness.

PUBLIC SECTOR TAKING THE LEAD

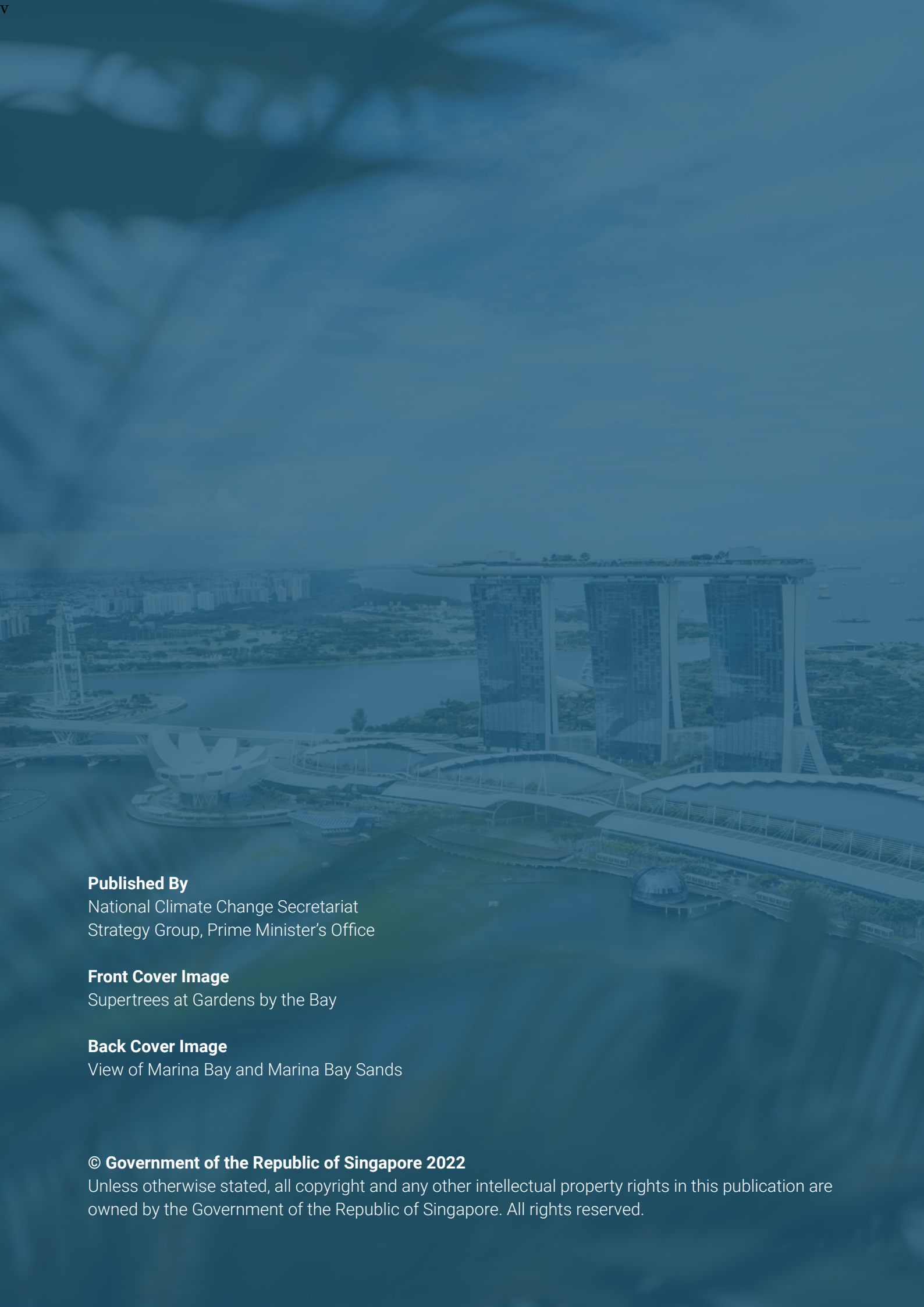
Under the GreenGov.SG initiative, Singapore's public sector will strive to attain ambitious sustainability targets in carbon abatement and resource efficiency. Our aim is to peak public sector emissions around 2025 and achieve net zero emissions around 2045, ahead of the national target. To achieve this, the Government intends to raise the energy efficiency of public sector premises, deploy solar power on-site where feasible, and eventually power public sector assets with clean energy sources. All public sector cars will also run on cleaner energy by 2035.

As a major consumer of goods and services, the Government is working sustainability considerations into government procurement decisions and tender evaluations to influence our suppliers to make more sustainable businesses choices. We are also raising public awareness on climate change and sustainability through our school curriculum and community programmes. Our goal is to inspire and enable action beyond the public sector, by individuals and industry alike.

Everyone and Every Nation Must Play Their Part

Despite Singapore's geographical constraints and lack of alternative energy options, we have set an ambitious target to reach net zero by 2050. Achieving this goal will require significant transformations in all aspects of daily life, economy and society. Our government agencies, businesses, individuals and the community must work together and play their part. We have a responsibility to future generations to ensure that Singapore remains a vibrant and liveable city in the decades to come.

Singapore brings this spirit of cooperation and sense of responsibility to the world stage. No country can solve the challenges of climate change alone. Our ability to fulfil our pledges, like all Parties, will depend on the continued international commitment by Parties to the Paris Agreement and their climate pledges. International collaboration and courageous global action will be needed if we are to limit temperature rise to 1.5°C above pre-industrial levels, and avoid the catastrophic consequences of a warming world. Singapore will continue to work at the international, regional and bilateral levels to support collective global efforts to decisively address the challenges of climate change. ■



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Front Cover Image

Supertrees at Gardens by the Bay

Back Cover Image

View of Marina Bay and Marina Bay Sands

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