

A RAIA profile on: **Singaporean Minister for Sustainability and the Environment**

Grace Fu Hai Yien

Fourth part of a six part series on climate leaders ahead of the 2025 United Nations Climate Change Conference

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Introduction

*It is is a different world and a different Singapore today [...] but the threats remain and the challenge to national survival is grave.*¹

Although found in the foreword of Lee Kuan Yew's memoirs, that sentence could have been picked up by James Fu², press secretary of the founding father of Singapore³, from 1972 to 1993⁴. The belief that the city-state was facing an existential threat at any time has been ingrained in the citizens' minds and continues to be a recurring theme in the Singaporean narrative. In the aftermath of the independence, the city-state felt threatened by Sukarno's Indonesia and Abul Rahman's Malaysia. But towards the end of the century, another existential threat emerged, both to humankind and Singapore: climate change.

As of today, the main decision-maker in Singapore to tackle climate change is none other than Grace Fu, James' daughter, and the Minister for Sustainability and the Environment since 2020⁵. Fu's ascent to leadership was unsurprising due to her upbringing alongside the generation of Singapore's founding fathers, while attending prestigious academic institutions. Her father's experience, having been both a Coldstore's operation detainee⁶ and press secretary illustrates the People's Action Party (PAP) unique illiberal ruling. This inevitably crafted her thorough understanding of Singaporean politics.

Before joining politics, Grace Fu began her career in the private sector working for the Overseas Union Bank⁷, a regional Singaporean bank, after graduating from the National University of Singapore (NUS) in 1985⁸ with a Bachelor of

¹ Lee Kuan Yew, *The Singapore Story : Memoirs of Lee Kuan Yew Vol. 1* (Times Editions 2000).

² 'Photo of Press Secretary James Fu Taken at Malacanang Palace ...' (Nas.gov.sg2025)
<<https://www.nas.gov.sg/archivesonline/photographs/record-details/df0f97f9-1161-11e3-83d5-0050568939ad>> accessed 31 July 2025.

³ Cherian George, *Freedom from the Press: Journalism and State Power in Singapore* (National University of Singapore Press 2012).

⁴ Elgin Toh, 'First among Equals: Mr Lee Kuan Yew Led a Tiny Island Nation from Third World to First' *The Straits Times* (Singapore, 24 March 2015)
<<https://www.straitstimes.com/singapore/first-among-equals-mr-lee-kuan-yew-led-a-tiny-island-nation-from-third-world-to-first>>.

⁵ Tee Zhuo and Ng Huiwen, 'New Cabinet Appointments: Changes at a Glance' (*The Straits Times* 25 July 2020)
<<https://www.straitstimes.com/politics/new-cabinet-appointments-changes-at-a-glance>>
accessed 31 July 2025.

⁶ Cherian George, *Freedom from the Press: Journalism and State Power in Singapore* (National University of Singapore Press 2012) 131

⁷ Ms Grace FU Hai Yien' (*Prime Minister's Office Singapore* 2015)
<<https://www.pmo.gov.sg/The-Cabinet/Ms-Grace-FU-Hai-Yien>>.

⁸ 'People's Action Party Constituency Portal - People's Action Party' (*Archive.org* 2025)
<<https://web.archive.org/web/20120109030341/http://ge.pap.org.sg/candidate/gracefu>>
accessed 31 July 2025.

Accountancy⁹. She then pursued a Master of Business Administration at NUS, graduating in 1991. Fu's business experience is critical to her leadership strategy as she knows the economic implications of climate change and is able to decipher policies analytically. Until 1995, Fu worked for the Haw Par Group, before joining the Port of Singapore Authority (PSA). The PSA, at the heart of Singapore's economy, represents the world's largest transshipment hub¹⁰, contributing indirectly to 7% of Singapore's GDP and employing over 170,000 people.¹¹ In 2003, she was appointed as CEO of South-East Asia and Japan, running the largest container port operations in the world at the time¹². Coming from this professional-driven background provided her with before-hand experience on the dependencies between the city-state's growth and the risks and opportunities of its economic model. .

Grace Fu joined politics in 2006¹³, when Lee Hsien Loong, Prime Minister at the time and Lee Kuan Yew's eldest son, convinced her to join the government. Fu was elected Member of Parliament (MP) in the Jurong district. She then held different ministerial positions at the Ministries of National Development, Education, and the Environment. In 2012, she became Second Minister for Foreign Affairs until 2015. Before being appointed as Minister for Sustainability in 2020, she also held the position of Leader of the House and became the first woman to hold a Ministry, as Minister for Culture, standing as a trailblazer for generations of Singaporean women. In January 2024, she was appointed Minister-in-charge of Trade relations¹⁴ and was reelected member of Parliament in 2025¹⁵, marking almost twenty years since she entered politics.

The rise of sea levels, combined with more extreme and frequent climatic events like heatwaves and rainfalls, endanger the city-state. For the past five years, climate mitigation has been Fu's central concern. Global warming threatens the

⁹ PARL | MP' (*Parliament.gov.sg*2020)

<<https://www.parliament.gov.sg/mps/list-of-current-mps/mp/details/grace-fu-hai-yien>> accessed 31 July 2025.

¹⁰ PSA, 'PSA Singapore Hits Record-Breaking Annual Throughput of More than 40 Million TEUs - PSA Singapore' (*PSA Singapore*27 December 2024)

<<https://www.singaporepsa.com/2024/12/27/psa-singapore-hits-record-breaking-annual-throughput-of-more-than-40-million-teus/>>.

¹¹ Christl Li, 'Connecting to the World: Singapore as a Hub Port' (*Csc.gov.sg*2018)

<<https://knowledge.csc.gov.sg/ethos-issue-19/connecting-to-the-world-singapore-as-a-hub-port/>>.

¹² Bloomberg News, 'Port Operator Buys a Stake in Big Rival' *The New York Times* (22 April 2006)

<<https://www.nytimes.com/2006/04/22/business/worldbusiness/port-operator-buys-a-stake-in-big-rival.html>>.

¹³ 'Ms Grace FU Hai Yien' (*People's Action Party*) <[Ms Grace FU Hai Yien](#)> accessed 25 June 2025

¹⁴ 'Changes to Cabinet and Other Appointments (Jan 2024)' (*Prime Minister's Office Singapore*2024)

<<https://www.pmo.gov.sg/Newsroom/Changes-to-Cabinet-and-Other-Appointments-Jan-2024>> accessed 31 July 2025.

¹⁵Michelle Ng, 'GE2025: PAP Scores Big Wins in Newly Formed Jurong East-Bukit Batok GRC, Jurong Central SMC' (*The Straits Times*3 May 2025)

<<https://www.straitstimes.com/singapore/politics/ge2025-pap-wins-jurong-east-bukit-batok-grc-jurong-central-smc>> accessed 31 July 2025.

survival of the Little Red Dot (Singapore's nickname), hindering the records-high growth rates of the past decades.

Singapore being a resilient country and quick to respond to existential threats created the Green Plan 2030. The objective is to adapt the country's growth model to strengthen its climate security and economic resiliency, through different policies: taxing carbon emissions, enhancing local food production, and adapting vulnerable infrastructure. Grace Fu's action is anchored in a security-oriented framework. The climate crisis could cause Singapore's downfall, if the city-state fails to provide the prosperity it has given its citizens over the past five decades.

Grace Fu's Stake

Singapore and Climate Change

Carrying on the legacy of leaders in Singapore, Grace Fu's stake is the survival of one of the most sophisticated societies in the world against an existential threat: climate change. The belief that the survival of the island is at stake is a recurring theme in the Singaporean narrative that has historically helped the city-state to adapt to challenges and innovate.

Singapore gained independence from the federation of Malaysia when it was expelled on 9 August 1965. Surrounded by Indonesia in the South and by Malaysia in the North, the island possessed scarce resources, no hinterland, covering 720 square kilometers and inhabited by 2 million people.¹⁶ Just emerging as a sovereign state, the island's strategic position seemed fragile in the minds of the Singaporean leaders. Lee Kuan Yew states '*We were a Chinese island in a Malay sea. How could we survive [...]?*'¹⁷

Singapore's small population, featuring a Chinese majority, alongside Malay and Indians¹⁸ minorities, contrasted with Malaysia's¹⁹ and Indonesia's large populations²⁰ of muslim-Malays. Before independence, tensions had arisen between different ethnicities and sparked racial riots²¹ in July and September 1964. On top of that, Sukarno had declared Konfrontasi against the Malaysian

¹⁶ The World Bank, 'Population, Total - Singapore | Data' (Worldbank.org2021)
<<https://data.worldbank.org/indicator/SP.POP.TOTL?locations=SG>>.

¹⁷ Lee Kuan Yew, *The Singapore Story : Memoirs of Lee Kuan Yew Vol. 2* (Times Editions 2000).

¹⁸ Ezra F Vogel, *The Four Little Dragons : The Spread of Industrialization in East Asia* (Harvard University Press 1991).

¹⁹ The World Bank, 'Population, Total - Malaysia | Data' (data.worldbank.org2022)
<<https://data.worldbank.org/indicator/SP.POP.TOTL?locations=MY>>.

²⁰ World Bank Group, 'Population, Total - Indonesia | Data' (worldbank.org2022)
<<https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ID>>.

²¹ SG101, 'Racial Riots (1964 and 1969)' (Sg101.gov.sg2023)
<<https://www.sg101.gov.sg/social-national-identity/examples/racialriots/>>.

federation, opposing its merger, conducting military actions on its territory²². Yew's quote alluded to these difficulties as the existential threat driving policy alignment and development.

Eventually, economic disagreements between the Singaporean People's Action Party (PAP), and the United Malays National Organisation (UMNO) led to its break-away, leaving Singapore with reasonable grounds to feel threatened by its neighbours. The imminent menace to the island's sovereignty pushed Singapore to embark on an unprecedented economic growth, while facing regional competition. Due to the inability to form a single-market with Malaysia²³, Singapore couldn't develop import-substitution industrialization²⁴ and opted for a subtle combination of state capitalism and foreign investment.

Singapore was then later described as a corporate state, acting as an entrepreneur, entering the market to create employment and generate profit by establishing statutory boards²⁵ and wholly or partially state-owned companies. Government-linked enterprises (GLE) were highly profitable, and the state didn't hesitate to close down loss-making firms. This economic environment built confidence²⁶ to attract foreign direct investments (FDIs) from transnational corporations²⁷ that specialised in petrochemicals, computer products, telecommunications services, among others. The government invested in infrastructures, providing well-planned industrial estates, equity participation in industries, fiscal incentives, and export promotion, which promoted political and economic stability, fostering the investor's confidence in the system. As a result, the Singaporean GDP per capita skyrocketed, alongside growth rates, with an average of 9.76% per year between 1965 and 1985²⁸. Singapore achieved an economic miracle, similar to those of Taiwan, Hong Kong or South Korea, later referred to as the Asian dragons²⁹.

In the 21st century, climate change represents a different existential threat to Singapore³⁰. The city-state is vulnerable to **sea-level rise**, the increased

²² 'CO15062 | KONFRONTASI: Why Singapore Was in Forefront of Indonesian Attacks'

(@RSIS_NTU2017)

<<https://rsis.edu.sg/rsis-publication/rsis/co15062-konfrontasi-why-singapore-was-in-forefront-of-indonesian-attacks/>> accessed 31 July 2025.

²³ Lee Kuan Yew, *The Singapore Story : Memoirs of Lee Kuan Yew Vol. 2* (Times Editions 2000). 66

²⁴ M Szanyi, *Seeking the Best Master : State Ownership in the Varieties of Capitalism* (Central European University Press 2019) 279.

²⁵ M Szanyi, *Seeking the Best Master : State Ownership in the Varieties of Capitalism* (Central European University Press 2019) 280.

²⁶ Lee Kuan Yew, *The Singapore Story : Memoirs of Lee Kuan Yew Vol. 2* (Times Editions 2000). 68

²⁷ Lee Kuan Yew, *The Singapore Story : Memoirs of Lee Kuan Yew Vol. 2* (Times Editions 2000). 57

²⁸ World Bank, 'GDP Growth (Annual %) - Singapore | Data' (Worldbank.org2022)

<<https://data.worldbank.org/indicator/NY.GDPMKTP.KD.ZG?locations=SG>>.

²⁹ Ezra F Vogel, *The Four Little Dragons : The Spread of Industrialization in East Asia* (Harvard University Press 1991).

³⁰ 'PMO | PM Lee Hsien Loong at the UN Climate Ambition Summit' (Prime Minister's Office Singapore13 December 2020)

occurrence and the intensity of **climatic events**, while possessing **scarce resources** and being dependent on trade. Before the year 2100, Singapore could witness a rise in sea levels by 0.23m to 1.15m depending on the lack of changes made to their carbon emissions. In an increase of +2°C globally scenario, Singapore's **sea levels** could rise up to 2m by 2150³¹. This threatens its small, urbanized and densely populated territory (7,851 people per square kilometer³² for 6 million of inhabitants³³), as 30% of the country is located less than 5 meters above the sea level in its 300 km coastline.

On top of that, scientific reports³⁴ predict that climate change will increase the 'frequency and the intensity'³⁵ of **extreme weather events**. These include heatwaves, rainfalls but also droughts, pollution and wildfires. Heatwaves and rainfalls directly threaten the population, with the recurring threat of flooding, increase in humidity levels foster favorable conditions for the spread of diseases like dengue and zika, while wildfires in neighbouring countries would degrade air quality in Singapore and droughts could also hinder its ability to supply drinkable water.

Lastly, Singapore lacks **natural resources**, increasing its dependency on global trade. The island doesn't possess any fossil fuels, or geostrategic metals and minerals such as lithium. Moreover, its ability to produce halieutic or agricultural resources is limited, as its Exclusive Economic Zone (EEZ) covers between 1,000 to 1,500 square kilometres, and the island only dedicates 1% of its soil to agricultural use, thus limiting food production. Thus, Singapore depends on imports for everything, notably food and energy³⁶. An exposure that coupled with extreme weather events worsens the city-state's vulnerability to trade disruptions.

Grace Fu and Climate Leadership

With all of these challenges in mind, Singapore knows how to adapt, and has created an opportunity out of this threat. Led by Grace Fu, the government launched the Singapore Green Plan 2030 in February 2021, in a joint effort

<<https://www.pmo.gov.sg/Newsroom/PM-Lee-Hsien-Loong-at-the-UN-Climate-Ambition-Summit>>.

³¹ National Environment Agency, 'Singapore's Third National Climate Change Study – Climate Change Projections to 2100: Report for Stakeholders' (Centre for Climate Research Singapore, 2024) <[Climate Change Study](#)> 'accessed 22 June 2025'

³² The World Bank, 'Population Density (People per Sq. Km of Land Area) - Singapore | Data' (Worldbank.org2019) <<https://data.worldbank.org/indicator/EN.POP.DNST?locations=SG>>.

³³ The World Bank, 'Population, Total - Singapore | Data' (Worldbank.org2021) <<https://data.worldbank.org/indicator/SP.POP.TOTL?locations=SG>>.

³⁴ Intergovernmental Panel on Climate Change, 'Climate Change 2021: The Physical Science Basis. Summary for Policymakers. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change' (IPCC 2021) Section B, (2) 15 <[Summary for Policymakers](#)> accessed 25 June 2025

³⁵ The World Bank, 'Population, Total - Singapore | Data' (Worldbank.org2021) <<https://data.worldbank.org/indicator/SP.POP.TOTL?locations=SG>>.

³⁶ 'Singapore - Countries & Regions' (IEA2025) <<https://www.iea.org/countries/singapore>>.

alongside other ministries. It consists of five key pillars to achieve Singapore's sustainable goals³⁷: city in nature, energy reset, green economy, resilient future, and sustainable living. The 'City in nature' pillar aims at adapting Singapore's urbanism to future climatic conditions, while 'Energy reset' emphasizes renewable energy and sustainable transport. The 'Green Economy' pillar attempts to seize opportunities arising from the climate transition, while the 'Resilient Future' tackles vulnerabilities such as food insecurity and flood threats. Finally, the 'Sustainable Living' pillar targets waste reduction and objectives related to educating young generations.

For Grace Fu, this plan is not solely the roadmap to Singapore's sustainability, but it reflects Fu's personal stakes. More specifically, her values, identity, history, and career, are closely linked to the success of the Green Plan. An inability to meet and implement its core policies like decarbonising the economy, improving their food security, and resilient infrastructures; would not only signal a problem in meeting its climate commitments, but also would symbolise a personal and political setback in Fu's career and reputation as a climate leader.

In a city state aware of its vulnerability to current crises based on geography, economy, and the environment, the Green Plan is the country's most ambitious policy framework yet to secure Singapore's long term future. Grace Fu is directly linked with the framework's success as she strongly advocates for it³⁸. If the plan were to be unsuccessful, Singapore would face irreversible environmental damage along with a heightened amount of scrutiny for Fu as one of the only women in Singapore's upper political ranks³⁹. Research shows that women in leadership positions often have higher value on long term social welfare, inclusive governance, and sustainability⁴⁰. All of these aspects are reflected in Fu's policy framing that calls towards collective responsibility and intergenerational justice.

For instance, in the Sustainable Living pillar of the Green Plan, an Eco Stewardship Programme aims to nurture Singaporeans to be 'stewards of the environment' by strengthening school curriculums about sustainability and reduce two-thirds of net carbon emissions from schools by 2030⁴¹. This example reinforces the commitment by Grace Fu to create an inclusive and value driven environmental society. Her leadership style reflects the gender pressures she has

³⁷Singapore Green Plan, 'Singapore Green Plan 2030' (SG Green Plan2025) <<https://www.greenplan.gov.sg/>>.

³⁸ 'Green Citizenry' (Greenplan.gov.sg2024) <<https://www.greenplan.gov.sg/green-citizenry/>>.

³⁹ 'Gender Parity in Singapore's Parliament | My Site' (My Site2022) <<https://www.nuspsoc.org/genderparityinsingaporeparliament>>.

⁴⁰ Charlie King, 'The Importance of Women in Sustainability' (Sustainabilitymag.com4 April 2025) <<https://sustainabilitymag.com/articles/the-importance-of-women-in-sustainability>>.

⁴¹ SG Green Plan, 'Sustainable Living' (www.greenplan.gov.sg2025) <<https://www.greenplan.gov.sg/key-focus-areas/sustainable-living/>>.

faced by framing the Green Plan as a societal transformation that requires collaboration to be made by everyone in the country.

In addition, her ideological stake in the Green Plan is not only framed by her gendered experience, but also influenced by her early career in the private sector. In the past Grace Fu had a senior role at PSA International as previously mentioned⁴². This role provided Fu with firsthand knowledge and experience on Singapore's dependency on global trade and international supply chains. In PSA Fu worked in a logistics and data driven environment where optimization, cost management, and competitiveness were key. This past experience can be directly seen in her new political position and how she approaches policy.

The Green Plan is presented as a necessity of survival and creating independence within the country, such as domestic food resilience, energy efficiency, and creating a circular economy. In the Resilient Future pillar of the plan it commits to increasing local food production and creating new investments in water recycling (NEWater) and desalination to address water insecurity concerns driven by disputes with Malaysia over the Johor River⁴³. Moreover, Fu's private sector background drives her mixed approach in technocracy and anthropocentric where the Green Plan explores distinct solutions like carbon capture and smart urban cooling as potential adaptation strategies⁴⁴.

Fu's mixed approach is reinforced by her educational background making her trained to see issues through key performance indicators. This is manifested in the Green Plan as it places emphasis on measurable and time constrained goals. These examples demonstrate how the plan is designed to be monitored, benchmarked, enforced, and adapted based on the data collected. The analytical approach creates a clear straightforward plan that combines ethics and policy implementation to achieve the plan's goals. Rather than just making the framework focus on civic moral duty, the plan can be turned into numbers to connect with all stakeholders through sustainability in the growth sector, creation of green jobs, and early decarbonization against long term costs. In the Green Economy Pillar of the plan Fu is able to create incentives over ideology and bring logic to her beliefs and actions.

Thus, the Green Plan 2030 crafted by Fu can be considered to be her contribution to Singapore's legacy, reflecting the pragmatism and ambition that drove

⁴² 'Ms Grace FU Hai Yien' (*Prime Minister's Office Singapore*2015)
<<https://www.pmo.gov.sg/The-Cabinet/Ms-Grace-FU-Hai-Yien>>.

⁴³ Victoria Milko and David Goldman, 'In Water-Stressed Singapore, a Search for New Solutions to Keep the Taps Flowing' (*AP News*25 February 2024)
<<https://apnews.com/article/singapore-water-security-climate-technology-malaysia-2f4a23baccdc22f46128728171ec5cff>>.

⁴⁴ SG Green Plan, 'Energy Reset' (www.greenplan.gov.sg8 March 2025)
<<https://www.greenplan.gov.sg/key-focus-areas/energy-reset/>>.

Singapore's success since 1965 except in this case the challenge is not regional hostility, but environmental barriers.

Grace Fu's Defining Moment

Grace Fu's defining moment as Singapore's leader in climate change came on March 4th 2021 when she delivered the speech "The Singapore Green Plan - A Pledge to Our Children and Future Generations"⁴⁵, marking the public launch of Singapore's most ambitious climate policy framework to date. It was not just the unveiling of a plan, it was the moment Singaporeans began to understand what kind of leader Grace Fu intended to be. One who would transition from a technocrat to a moral and intergenerational voice of urgency. "Climate Change is one of the gravest threats facing mankind and Singapore,"⁴⁶ she began; immediately raising attention to the issue being beyond the political sphere or economics but an existential risk that demanded systematic change.

By framing the climate crisis in this way, Fu was able to create a sense of urgency and a new narrative for environmental governance in Singapore. A narrative that combined personal conviction, national interests, and a moral responsibility. The speech arguably represents a strategic pivot in Singapore's approach to sustainability as it was the first time a minister had framed the issue not merely in terms of pragmatic policy, but as a duty to future generations. In doing so, Fu moved away from Singapore's historically technocratic framing of environmental issues and created emotive, civic, and ethical dimensions of climate responsibility.

In her speech, the language she repeatedly used in the speech unified citizens to highlight the shared responsibility. The repetition of "we", "our," "together" is a rhetorical strategy to emphasize that climate resilience is not only the responsibility of the government, but a collective project that involves all Singaporeans. This approach juxtaposed against Singapore's traditional policy approach that tends to be top down, where the government acts while citizens comply; a social contract between government and citizens⁴⁷. When Fu states "this is a solemn pledge to our children and future generations,"⁴⁸ she humanised

⁴⁵ 'Speech by Minister Grace Fu: The Singapore Green Plan - a Pledge to Our Children and Future Generations' (Ministry of Sustainability and the Environment 2021)
<<https://www.mse.gov.sg/latest-news/joint-segment-mse>>.

⁴⁶ 'Speech by Minister Grace Fu: The Singapore Green Plan - a Pledge to Our Children and Future Generations' (Ministry of Sustainability and the Environment 2021)
<<https://www.mse.gov.sg/latest-news/joint-segment-mse>>.

⁴⁷ Darwin Gosal, 'Keeping the Game Alive: Singapore's Social Contract in a Changing World' (Medium 29 April 2025)
<<https://medium.com/@darwingosal/keeping-the-game-alive-singapores-social-contract-in-a-changing-world-71c0e55a068f>>.

⁴⁸ Ibid (45)

the mission with the intent of calling on listeners not just as citizens, but as parents, and children evoking emotion from the audience.

The speech also signalled a critical shift in Singapore's climate governance, a growing recognition that technology driven adaptation solutions alone were insufficient to address the scale and urgency of the climate crisis. In the past Singapore relied on adaptation strategies like coastal protection, desalinations, and advanced water recycling systems as a solution against environmental challenges. For decades, the government's technocratic confidence in engineering solutions appeared to help the island from climate harm. However, Fu's speech departed from this idea of overreliance as it no longer guarantees the long term survival for the nation. She also acknowledged that Singapore contributes "only around 0.1% of global emissions," but then made a bold rhetorical turn: "if we can succeed in our plans, we will show the world how a small country with severe constraints is nevertheless able to take bold action."⁴⁹ This remark reasserted the country's soft power and credibility on the global stage, suggesting that moral leadership does not have to be related to economic or geographic size.

Fu also addressed the immediate, tangible risks Singapore is facing. She included the fact that the country is low lying and vulnerable to sea level rise and food insecurity, since over 90% of the nation's food is imported. She framed these problems as currently ongoing and critical. She painted a picture where if the country failed to act they would end up in the ocean or that the crisis could affect their water and food supply. This made the threats real and personal to her audience. True security means the country must step away from passive adaptation to active mitigation strategies and that is what Fu is proposing.

In many parts of the world, climate change is still viewed as a far away problem that someone else will handle. Fu challenged this mentality. She insisted that these threats were "not tomorrow's problems, but today's,"⁵⁰ she sought to close the psychological distance between the public and the climate crisis.

Fu went further, stressing the importance of embedding sustainability into "our DNA"⁵¹. This phrase captured her vision of climate action being more than just policy; instead it must be part of an individual's everyday lives. The public attitudes, consumption habits, and collective consciousness must change. Sustainability must become a daily way of life. She exemplified this by launching GreenGov.SG which expands its reach to open food courts with various independent food stalls known as hawker centers, hospitals, and waste to energy plants. These changes presented how the government is serious about making

⁴⁹ Ibid (45)

⁵⁰ Ibid (45)

⁵¹ Ibid (45)

climate action part of daily life from what people eat to how their waste is managed.

Since this speech took place in 2021, Grace Fu has continued to make true on her words and represented Singapore on numerous occasions; from the United Nations, COP, to ASEAN forums while advocating for regional cooperation and stressed the importance of collective action across Southeast Asia, where water scarcity and biodiversity loss threaten regional stability.

Fu distinguished herself as a climate leader in this case by offering a new perspective on climate change based on commitment and responsibility to future generations. She does not just outline the bleak outcomes of climate change, but offers possibilities for change. She offers a blueprint for small states navigating similar challenges. She managed to articulate a vision with her speech and ultimately made it her defining moment in climate leadership.

Grace Fu's Solutions

This section examines three policies that reflect Grace Fu's strategic vision and influence: Singapore's carbon tax framework, the national food security program, and the resilient infrastructure initiatives.

Taxing Carbon Emissions

Singapore intends to reach net-zero emissions as soon as viable in the second half of the century⁵². To achieve this objective, Singapore adopted a carbon tax on 1 January 2019, launching the first carbon pricing initiative in South-East Asia⁵³. The idea of a carbon tax was first introduced by Finland in 1990. The purpose of carbon pricing is to assign financial costs to emissions in hopes of reducing the negative externality and decrease contribution to climate change. This policy has now become very popular when it comes to climate policy with 23 European Nations having implemented carbon taxes with varying rates based on the social cost of carbon⁵⁴.

The tax in Singapore was designed to accelerate the transition toward a low carbon economy and evaluate signals to reduce reliance on carbon intensive goods and services; incentivizing renewable energy and clean technologies instead. Initially, before Grace Fu became the minister for environment and

⁵² National Climate Change Secretariat Strategy Group, Prime Minister's Office, 'Charting Singapore's Low-Carbon and Climate Resilient Future' (*National Climate Change Secretariat Strategy Group*, Prime Minister's Office 2020) <[Charting Singapore's Low-Carbon and Climate Resilient Future](#)> accessed 15 July 2025.

⁵³ Adrian Murdoch, 'What Singapore Is Prioritising for Climate Mitigation - Capital Monitor' (*Capital Monitor* 21 July 2022) <<https://www.capitalmonitor.ai/analysis/singapore-prioritising-climate-mitigation/>>.

⁵⁴ Harsh Vaibhav, 'The History and Legacy of Carbon Pricing | Earth.Org' (*Earth.Org* 4 March 2025) <<https://earth.org/the-history-and-legacy-of-carbon-pricing-around-the-world/>>.

sustainability the tax started at S\$5 per tonne of CO₂-equivalent (tCO₂e) from 2019 to 2023. The tax was relatively low compared to the \$75 recommended by the IMF to incentivise achieving net zero by 2050⁵⁵, but this was done to provide industries time to adapt⁵⁶.

On November 8th 2022, Fu proposed raising the tax for greenhouse gas emissions progressively in phases. She shared that the tax will rise to S\$25 per tonne in 2024 and to S\$45 per tonne in 2026 with a continued increase over the following years expected to reach between S\$50 and S\$80/tCO₂e (see Figure 1).⁵⁷ In addition to the tax, companies are able to use carbon credits to offset up to 5% of their taxable emissions from 2024. The amount of allowances for each firm is dependent on their performance on internationally recognised efficiency benchmarks and the facility's decarbonisation plants.

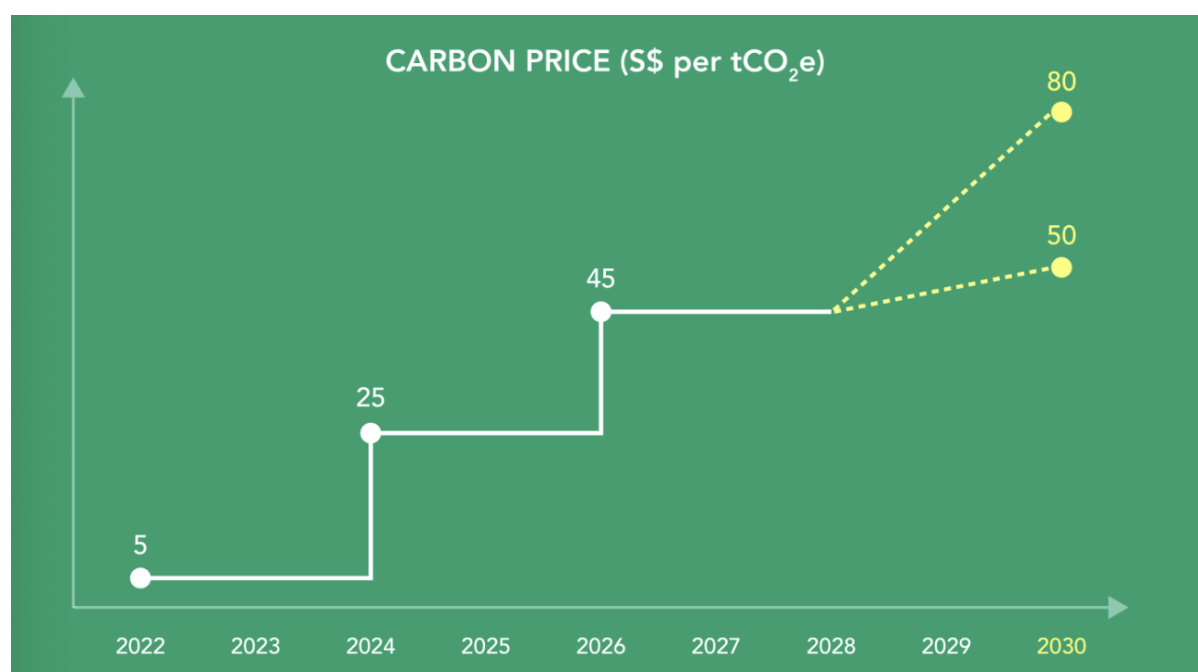


Figure 1⁵⁸

This policy supports Fu's goals as it drives decarbonisation across Singapore and works towards reducing the country's vulnerability to climate change in terms of helping to stabilize climate patterns, protecting biodiversity, and improving air quality. In Parliament she emphasised that the higher the carbon tax the more

⁵⁵ Ibid (54)

⁵⁶ Roohi Ghelani, 'The Singapore Carbon Tax: Where to Next? | Anthesis Australia' (www.anthesisgroup.com18 February 2024)

<<https://www.anthesisgroup.com/au/insights/the-singapore-carbon-tax/>>.

⁵⁷ 'Carbon Pricing (Amendment) Bill 2nd Reading Closing Speech - Grace Fu' (Ministry of Sustainability and the Environment2022)

<<https://www.mse.gov.sg/latest-news/the-closing-speech-by-minister-grace-fu-carbon-pricing-amendment-2nd-reading>>.

⁵⁸ NCCS, 'Carbon Tax' (www.nccs.gov.sg2023)

<<https://www.nccs.gov.sg/singapores-climate-action/mitigation-efforts/carbontax/>>.

incentive for clean energy and carbon efficiency. To support this the revenue generated from the tax will be reinvested into decarbonisation initiatives such as supporting businesses' shift to low carbon solutions.

According to Fu's parliamentary replies, the government does not expect any net revenue gain this decade; instead it will all be redirected into building capacity for carbon capture, clean energy, and support firms in intensive sectors. Importantly, this mitigates Singapore's exposure to extreme climate risks like urban flooding, rising sea levels, and heat stress. Reducing the carbon emissions ultimately is not just about sustainability for Singapore, but due to their small size and low lying position it is about long term survival.

Fu sees this policy as an opportunity given Singapore's small size. The country can catalyse new technology much faster than larger nations through technology, policy, and finance and the carbon tax only pushes companies to do this⁵⁹. Given Singapore's near total dependency on imported fossil fuels, the increase in renewable energy use addresses this vulnerability to global trade.

For instance, geopolitical disruptions in the Suez Canal⁶⁰ or food and energy export bans from suppliers exposes Singapore to supply chain risk⁶¹. Reducing this carbon dependence and diversifying its energy mix, it's more sustainable and strategic. Grace Fu's strong support for the carbon tax demonstrates this argument by looking at her career. Fu spent a lot of her career working in the private sector, specifically one of the largest shipping ports. She has firsthand knowledge about the vulnerabilities in the supply chain and knows the consequences of climate change. She is aware of how the supply chain can be disrupted. With this knowledge Fu knows Singapore needs to reduce their dependency and therefore has framed climate action as not only a scientific need, but as a moral obligation to Singaporeans as it affects their survival.

Enhancing Nutritional Sovereignty

Singapore banks on three strategies to tackle trade disruptions vulnerability: diversifying its food imports, stockpiling reserves and boosting local production⁶². The 30-by-30 initiative forms part of the 'Resilient Future pillar' of the Green Plan 2030. The objective is to *'build up [the] agri-food industry's capability and capacity*

⁵⁹ Ibid (53)

⁶⁰ 'News in Focus' (Nexus) <[News in Focus](#)> accessed 24 July 2025.

⁶¹ 'Malaysia Bans Chicken Exports from June 1: How Singapore Consumers, Businesses Are Coping | the Straits Times' (www.straitstimes.com 1 June 2022) <<https://www.straitstimes.com/singapore/malaysia-bans-chicken-exports-from-june-1-how-singapore-consumers-businesses-are-coping>>.

⁶² Audrey Tan, 'High-Tech Farming "Toolbox" Can Help Singapore Weather Future Food Supply Challenges: Chan Chun Sing' (*The Straits Times* 16 March 2021) <<https://www.straitstimes.com/singapore/environment/toolbox-of-made-in-singapore-high-tech-farming-solutions-can-help-country>> accessed 31 July 2025.

to produce 30% of our nutritional needs locally and sustainably by 2030'. It constitutes a crucial policy to safeguard Singapore from supply fluctuations due to trade disruptions. In the recent years, different phenomena, such as global pandemics (Covid-19⁶³), disease outbreaks, geopolitical conflicts, or trade restrictions such as Trump's tariffs have severely affected the Singaporean supply chain. In particular, the Russian invasion of Ukraine led to supply shortages and rising prices, that forced Malaysia to ban exports of chicken to Singapore⁶⁴, threatening food security. More recently, the discovery of African Swine Fever (ASF) cases, a highly-contagious disease, among pigs⁶⁵, shrunk imports from Indonesia, which accounted for 15% of Singapore's total pork supply.

Moreover, out of its 720 square kilometers of land, Singapore only dedicates 1% for agriculture use⁶⁶, facing trade-offs between competing land use needs. It is essential to promote an efficient use of land. Singapore targets to achieve this objective through three different measures.

First, the development of high-tech agricultural facilities, with innovative methods of production and new technologies, constitute a core feature of the initiative. Cutting-edge technologies include smart sensors to monitor temperatures, CO₂ or humidity levels; LEDs growth lights for an optimized light exposition, combined with AI and IoT systems. Automation is also implemented with innovations such as robotic arms or rotating systems. New methods of production include hydroponics, aquaponics or aeroponics as well as indoor, vertical or terrace farming. Farming on rooftops and terraces offer many advantages. The use of natural light reduces energy costs, while growing vegetables inside greenhouses prevents pests proliferation and avoids using chemicals or pesticides. Combined with closed-water systems, it drastically reduces water consumption.

Then, investing in capital represents a key enabler of the project. R&D projects, alongside educational programs are conducted to train the current agri-food workforce, but also future generations. The challenge posed by the growth of the industry requires these new and higher value jobs to acquire multidisciplinary

⁶³ World Bank, 'GDP Growth (Annual %) - Singapore | Data' (*Worldbank.org*2022) <<https://data.worldbank.org/indicator/NY.GDPMKTP.KD.ZG?locations=SG>>.

⁶⁴ Zakir Hussain, 'SG Extra Podcast: What Malaysia's Chicken Export Ban Means for Singapore's Food Resilience' (*The Straits Times*31 May 2022) <<https://www.straitstimes.com/singapore/sg-extra-podcast-what-malaysias-chicken-export-ban-means-for-singapores-food-resilience>> accessed 31 July 2025.

⁶⁵ Ang Qing, 'Singapore Stops Import of Live Pigs from Indonesian Island after African Swine Fever Detected in Shipment | the Straits Times' (*www.straitstimes.com*20 April 2023) <<https://www.straitstimes.com/singapore/import-of-live-pigs-from-indonesian-island-into-s-por-e-stopped-after-african-swine-fever-detected>>.

⁶⁶ 'Master Plan Exercise to Transform Lim Chu Kang into a High Tech Agri Food Cluster' (*Ourfoodfuture.gov.sg*2020) <<https://www.ourfoodfuture.gov.sg/speeches-and-media-releases/lckmasterplan/>>.

expertises in science, engineering, and info-communications⁶⁷. World-class universities such as the National University of Singapore (NUS)⁶⁸ or the Nanyang Technological University (NTU)⁶⁹ offer both undergraduate and graduate programs in bioengineering or environmental engineering, among others.⁷⁰ The Singaporean Food Agency also launched in April 2021 a \$60 million Agri-Cluster Transformation (ACT) Fund⁷¹ to which farmers have until 31 December 2025 to submit their applications, directly targeting the agricultural workforce.

Last, the emergence of direct and indirect outlets for locally-produced foods marks a key step in the development of a market for sustainable food. It is essential to help tech farms be economically viable, as the agri-tech sector faces higher costs compared to regional competitors. Agricultural start-ups can supply Singaporeans without intermediaries, through retail platforms or in supermarkets. The tech farms' profitability is also sustained by incentives from government agencies to encourage Singaporeans to buy and consume local, such as labels and recognition programs in supermarkets or restaurants.

Adapting the Climate-Vulnerable Infrastructure

The climate resilient infrastructure policy aims to make vulnerable infrastructures, both public (streets, roads, drainage systems) and private (office buildings) resilient. This refers to the ability to reduce the magnitude and duration of disruptive events.⁷² Infrastructure should be able to anticipate, absorb, adapt to, and recover from harmful occurrences⁷³. Singapore banks on two strategies to enhance infrastructure resiliency: prevent both inland and coastal floods and mitigate the Urban Heat Island (UHI) effect.

The first objective of the policy is to protect Singaporeans from floods, both coming from the coastline and/or due to heavy rainfalls. Singapore is extremely vulnerable to sea level rise and could witness a sea level rise of up to 2 meters by 2150. The second objective, is to tackle inland flooding as the mean annual rainfall in South-East Asia is expected to increase by 2.6 to 13.4%⁷⁴. To mitigate

⁶⁷ Ministry of Sustainability and the Environment, 'Food' (*Ministry of Sustainability and the Environment* 23 December 2024) <<https://www.mse.gov.sg/policies/food>>.

⁶⁸ 'NUS - National University of Singapore' (www.nus.edu.sg) <<https://www.nus.edu.sg/>>.

⁶⁹ Nanyang Technological University' <Nanyang Technological University> <<https://www.mse.gov.sg/policies/food/>> accessed 11 July 2025.

⁷⁰ SG Green Plan, 'Sustainable Living' (www.greenplan.gov.sg 2025) <<https://www.greenplan.gov.sg/key-focus-areas/sustainable-living/>>.

⁷¹ Singapore Food Agency, 'Agri-Food Cluster Transformation (ACT) Fund' (*Default* 13 December 2023) <<https://www.sfa.gov.sg/recognition-programmes-grants/grants/agri-food-cluster-transformation-act-fund>>.

⁷² 'MND | Resilient Infrastructure' (www.mnd.gov.sg) <<https://www.mnd.gov.sg/urbansustainability/resource/resilient-infrastructure>>.

⁷³ Ibid (72)

⁷⁴ Ibid (31)

these possible consequences government authorities have decided to pursue various solutions.

The first solution is implementing Nature Based Solutions (NBSs), such as sea walls, earthen bunds, revetments, or mangroves. NBSs refers to actions that address societal challenges through the protection, sustainable management, and restoration of ecosystems. Then, the government has introduced a holistic 'Source Pathway Receptor' which aims to adapt the drainage system, focusing on integrating the drains, canals, areas that generate stormwater runoff, and regions where flooding may occur (Figure 2). Within this receptor they also explored a multi layered reservoir system consisting of underground caverns, detention tanks, and stormwater tunnels designed to store and release excess rainwater⁷⁵. These enhanced structures act as buffers during intense rainfalls and reduce the risk of flash flooding in low lying areas, while offering benefits, such as freeing up surface area for future urban development, creating opportunities to reuse water, and potentially integrating energy generation systems⁷⁶.

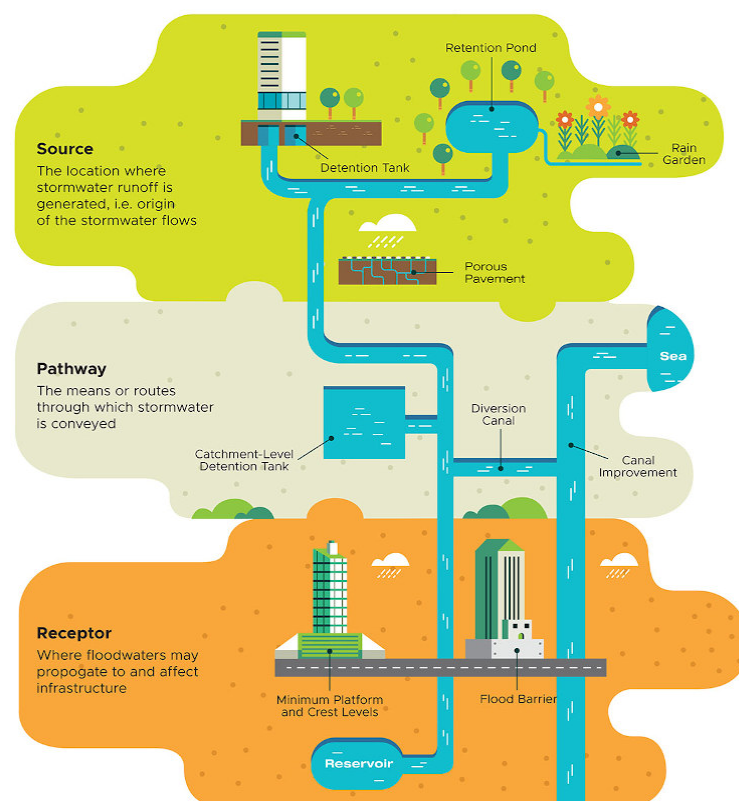


Figure 2⁷⁷

⁷⁵ 'Drainage and Flood Prevention' (www.nccs.gov.sg)
<<https://www.nccs.gov.sg/singapores-climate-action/drainage-and-flood-prevention/>>.

⁷⁶ 'More Climate-Resilient Infrastructure' (www.ura.gov.sg)
<<https://www.ura.gov.sg/Corporate/Planning/Long-Term-Plan-Review/Space-for-Our-Dreams-Exhibition/Sustain/Climate-Resilient-Infrastructure>>.

⁷⁷ National Climate Change Secretariat, 2025

The third objective of this policy is mitigating against the Urban Heat Island (UHI) effect. This phenomenon occurs when 'air temperatures are higher in a city than in its surrounding countryside'⁷⁸. One of the causing factors⁷⁹ of the UHI effect is the lack of vegetation that has been replaced by buildings with lower albedos, and creates higher heat absorption rates. As climate change progresses, temperatures are predicted to rise by 0.6°C–5.0°C by 2100⁸⁰. Consequently, mitigating against the UHI effect is a priority as it affects the standards of living for Singaporeans⁸¹.

To combat against the UHI effect the government has chosen to adopt NBSs. The Green Plan 2030 includes several targets that promotes NBSs, such as developing 130ha new parks and enhancing 170ha of existing ones⁸² or planting 1 million more trees before 2030⁸³. Similarly the government will also improve the existing infrastructure to combat the problem through greening. This means increasing vegetation and natural elements in urban areas to lower temperatures and mitigate heat retention caused by concrete and asphalt. The SkyRise Greenery⁸⁴ initiative aims to green facades, terraces and rooftops. The adoption of more reflective materials on cool roofs and surfaces help reflect the sun's energy and decrease the air temperatures⁸⁵.

Technology also plays a crucial role in studying the effects of urban heat. In 2021, Singapore launched the Cooling Singapore 2.0 Project, of which a core component is the Digital Urban Climate Twin (DUCT). It consists of an hypothetical alternative that can stress Singapore's response to future climate change threats. DUCT is a virtual model of Singapore that studies future climatic scenarios to adapt the infrastructure and mitigate urban heat's consequences. This innovation strengthens previous mitigation measures, involving technology for modeling purposes.

⁷⁸ T. R. Oke, 'The Energetic Basis of the Urban Heat Island' (1982) 108 Quarterly Journal of the Royal Meteorological Society 1, 2 <[Article](#)> accessed 15 July 2025.

⁷⁹ A Synnefa and others, 'On the Use of Cool Materials as a Heat Island Mitigation Strategy' (2008) 47 Journal of Applied Meteorology and Climatology 2846 <[Article](#)> accessed 15 July 2025.

⁸⁰ Ibid (31)

⁸¹ James Balzer, 'Singapore as a Global Leader in Urban Heat Governance - What Can the World Learn? | Illuminem' (*Illuminem.com* 13 March 2024) <<https://illuminem.com/illuminemvoices/singapore-as-a-global-leader-in-urban-heat-governance-what-can-the-world-learn>>.

⁸² Singapore Green Plan 2030, 'Our Targets' (*www.greenplan.gov.sg* 2024) <<https://www.greenplan.gov.sg/targets/>>.

⁸³ Ibid (82)

⁸⁴ Skyrise Greenery, 'What Is Skyrise Greenery?' (*Nparks.gov.sg* 2023) <<https://skyrisegreenery.nparks.gov.sg/whatis/>>.

⁸⁵ Adam Vaughan, 'White Roofs Could Have Cut Heat Deaths by a Third' (*The Times.com* October 2024) <<https://www.thetimes.com/uk/environment/article/white-roofs-could-have-cut-heat-deaths-by-a-third-h33w9df6m>>.

Grace Fu's Impact

Taxing Carbon Emissions

As the carbon tax in Singapore has already been in place for several years, it now approximately covers 71-80% of the nation's total emissions accompanied by the fuel excise duties⁸⁶. The carbon tax serves as the backbone of Singapore's climate mitigation strategy. The tax is currently applied to major facilities in the manufacturing, power, waste and water sectors. It has incentivised companies to pursue energy efficiency, invest in low carbon technologies, reduce greenhouse gas footprint, and begin planning for long term emissions reductions. Major emitters such as refineries and power plants have reported operational changes to cut crude refining by half and opt for carbon capture and storage⁸⁷. The increased carbon tax in 2024 also sent a stronger price signal to polluters raising S\$642 million, partly offset by rebates to energy heavy industries⁸⁸.

However, the full potential of the tax has been constrained by several structural weaknesses and policy decisions. Critics have pointed to the initially modest rate of S\$5 per tonne between 2019-2023 as being too low to make any meaningful change and framed it as a missed opportunity for early action⁸⁹. While the government defended this initial rate as necessary to begin a shift others argue that it diminished Singapore's credibility as a climate leader. Despite this, the policy has created a foundation for a deeper shift in Singapore's policies sending a clear message that renewable and clean energy is the new direction for the city state.

Furthermore, the tax has had a significant impact on Grace Fu's credibility as a climate leader. By leading the expansion of Singapore's carbon pricing she has demonstrated policy leadership that aligns with sustainability while understanding the economic side, an approach that is consistent with her background from corporate leadership to public service. Nevertheless, it is not to say that the policy has not faced scrutiny. Stakeholders in the industry argue that the tax increases production costs and could lead to carbon leakages.

In 2022 after Fu's speech Carbon Pricing (Amendment) Bill 2nd Reading Closing Speech it created a debate between herself and Jamus Lim, a member of the Singapore parliament for the Workers' Party on how to best increase the tax

⁸⁶ National Climate Change Secretariat, 2023

⁸⁷ 'Singapore Refiners Weigh Carbon Tax Pressure' (*Argus Media*, 4 March 2022) <[Singapore Refiners Weigh Carbon Tax Pressure](#)> accessed 3 July 2025.

⁸⁸ Trixie Yap and Chen Aizhu, 'EXCLUSIVE Singapore Offers Carbon Tax Rebates for Refiners near Term, Sources Say' (*Reuters* 13 June 2024) <<https://www.reuters.com/sustainability/climate-energy/singapore-offers-carbon-tax-rebates-refiners-near-term-sources-say-2024-06-13/>>.

⁸⁹ Jing Ling Tan, 'The Goldilocks Dilemma of Singapore's Carbon Tax' (*Eco-Business* 26 April 2018) <<https://www.eco-business.com/opinion/the-goldilocks-dilemma-of-singapores-carbon-tax/>>.

overtime. The pair argued on what is the right way to make the tax more progressive⁹⁰. To resolve this issue the government introduced transitory rebates of up to 76%, effectively reducing the S\$25/tCO₂e rate to as low as S\$6–10/tCO₂e for some firms. These rebates created controversy as it has decreased the predicted revenue generated by more than 30%. This underperformance in the policy complicates Fu's leadership as it undermines the effectiveness of the policy. Additionally, the scope of the tax is limited to only direct emissions leaving out crucial aspects including emissions from purchased electricity and the ones embedded in global supply chains. This is very important in Singapore as it's a global hub involving a lot of trading and underrepresents the nation's real carbon footprint.

Although, Singapore's carbon tax significantly impacts the domestic emissions of the country its total greenhouse gas emissions only affects about 0.1% of global emissions due to the country's small size⁹¹. Nonetheless, the impact of the policy can be much greater. As the first Southeast Asian country to implement a carbon tax, Singapore has positioned itself as a climate leader and Fu's advocating for a progressive tax signals to neighboring countries that sustainability and economic growth can coexist. However, this potential influence is threatened by the country's reliance on carbon credits. For instance many stem from REDD+ projects where there are inflated baselines and weak verification systems which can create uncertainty on the actual emissions. In fact, reports have revealed that 94% of rainforest credits certified by Verra were "worthless".

Grace Fu has defended Singapore's Memoranda of Understanding on international carbon credits, arguing that such partnerships are essential for meeting the net zero goals in a carbon constrained economy. She has insisted that the country is committed to adopting stricter verification standards, promising alignment with Article 6 of the Paris Agreement which requires transparency. Fu has also stated that Singapore will only recognize credits that meet high environmental integrity⁹²; emphasising the importance of credible offsets to ensure genuine emissions reductions while maintaining public trust in the carbon pricing framework.

⁹⁰ Khalis Rifhan, 'Jamus Lim and Grace Fu Engage in Heated Debate over Carbon Pricing Bill in Parliament - Singapore News' (*The Independent Singapore News* 9 November 2022) <<https://theindependent.sg/carbon-pricing-amendment-bill-pritam-singh-steps-in-during-heated-exchange-between-jamus-lim-and-grace-fu/>>.

⁹¹ Yuanzhe Li and others, 'Carbon Taxation in Singapore's Semiconductor Sector: A Mini-Review on GHG Emission Metrics and Reporting' (2023) 2 Carbon Research.

⁹² 'Oral Reply to Parliamentary Question on Carbon Credits by Ms Grace Fu, Minister for Sustainability and the Environment' (*Ministry of Sustainability and the Environment* 2023) <<https://www.mse.gov.sg/latest-news/oral-reply-to-pq-on-carbon-credits>>.

Enhancing Nutritional Sovereignty

This section outlines the efforts undertaken to implement the 30-by-30 initiative, developing high-tech agricultural facilities, investing in capital and providing outlets for the agri-tech industry.

To begin with, Singapore focused its efforts on the development of high-tech facilities. The The Lim Chu Kang (LCK) Master Plan was launched in October 2020, in an area in the North-West of the island, spanning around 390 ha of land⁹³ to 'raise food production in a sustainable and resource-efficient way'⁹⁴. After the consultation process in 2021 and up to mid 2023, the area was conceived as planned. It contains an innovative stacked farm concept which will optimise land use, a district cooling facility to provide cooling needs for farms and reduce energy consumption; and a centralised waste treatment facility to process farm waste collected from the district and reduce the negative impact on the environment.

Moreover, Singapore also focused on investing in capital. The Singapore Food Story R&D Programme was launched in 2019⁹⁵, to foster the collaboration of the research ecosystem. The programme developed fish feed, to increase the growth rate, and vaccines to improve the disease resistance of the Asian Sea Bass. It also created a genome-edited leafy vegetable suite for urban farming⁹⁶.

Furthermore, the Aquaculture Plan⁹⁷ was launched in November 2024⁹⁸ to counter the several challenges faced by this industry, such as limited sea space, suboptimal water quality and a limited domestic market with strong import competition. The objective is to transform the industry into a more productive and sustainable sector, through the careful consideration of competing sea uses and ecological sensitivities when selecting sites, the development of resilient infrastructures and regulations.

Finally, Singapore provided the agri-tech industry with outlets, implementing green labels and recognition programs. The SFA introduced in February 2022 the label SG Fresh Produce⁹⁹ (SGFP) found on locally and/or sustainably produced food in supermarkets. The SFA also launched in 2023 the Farm-to-Table Recognition Programme (FTTRP) that recognises food businesses in the HoReCa

⁹³ Ibid (66)

⁹⁴ Ibid (66)

⁹⁵ 'Towards a Resilient Future' (Singapore Food Agency) 3 <[Towards a Resilient Future](#)> accessed 16 July 2025.

⁹⁶ Ibid (96)

⁹⁷ Singapore Food Agency, 'The Singapore Aquaculture Plan' (www.ourfoodfuture.gov.sg) <<https://www.ourfoodfuture.gov.sg/uplifting-aquaculture-industry/sg-aquaculture-plan/>>.

⁹⁸ Ibid (97)

⁹⁹ 'SG Fresh Produce (SGFP) Logos' (Default 13 December 2023)

<<https://www.sfa.gov.sg/farming/sg-fresh-produce-logos/sg-fresh-produce-logos>>.

(hotels, restaurants and caterers) sector that support local produce¹⁰⁰, procuring at least 15% of local produce in different food categories. These incentives bear fruits, as Singaporean supermarkets, such as FairPrice¹⁰¹, Ryan's Grocery, HAO Megamart, Redmart¹⁰², Cold Storage, Prime and Sheng Siong¹⁰³ increase their supply from local producers.

The 30-by-30 initiative fostered innovation in the agri-tech industry¹⁰⁴. In 2019, 220 farms produced 14 percent of leafy vegetables Singapore consumes, 26 percent of eggs and 10 percent of fish.¹⁰⁵ Since then, a number of start-ups, such as Artisan Green, Green Harvest, Kin Yan Agrotech, Universal Aquaculture, Ubertas Agritech, or Sky Greens partnered with government agencies to enhance sustainable farming, through the high-tech farming toolbox initiative¹⁰⁶, with the objective to develop production capabilities.

The 30-by-30 initiative tackles climate change from a global perspective. Aiming to produce 30% of Singapore's food supply on the island itself reduces the portion of imports in Singapore's food supplies, decreasing greenhouse gases emissions, both in transport and storage. Nevertheless, it also faced two challenges.

First, the agri-tech sector faces higher costs compared to regional competitors due to land scarcity, high-tech infrastructures, utilities costs and labor protection standards. Subsidies could provide the tech-driven farms with the competitive advantage needed to outperform neighbouring countries.

Secondly, the hawker culture, deeply rooted in the citizens' behaviors and in the island's culture, also threatens the outlets of the 30-by-30 policy that could hinder the demand for sustainable food. As the 30-by-30 by policy aims to create outlets for organic food, it induces rising prices for consumers. Higher costs for the agri-tech sector, even if subsidised, inevitably translate into higher prices for purchasers, who may prefer hawker centers instead, a cheaper and more traditional alternative.

¹⁰⁰ 'Farm-To-Table Recognition Programme (FTTRP)' (*Default*13 December 2023) <<https://www.sfa.gov.sg/recognition-programmes-grants/recognition-programmes/farm-to-table-recognition-programme>>.

¹⁰¹ Tan Hsueh Yun, 'Tech Farming Bears Fruit in Singapore' (*The Straits Times*13 November 2021) <<https://www.straitstimes.com/life/food/harnessing-technology-to-grow-food-in-singapore>> accessed 31 July 2025.

¹⁰² Ibid (101)

¹⁰³ Ibid (101)

¹⁰⁴ Ibid (101)

¹⁰⁵ Tan Hsueh Yun, 'Tech Farming Bears Fruit in Singapore' (*The Straits Times*13 November 2021) <<https://www.straitstimes.com/life/food/harnessing-technology-to-grow-food-in-singapore>> accessed 31 July 2025.

¹⁰⁶ Audrey Tan, 'High-Tech Farming "Toolbox" Can Help Singapore Weather Future Food Supply Challenges: Chan Chun Sing' (*The Straits Times*16 March 2021) <<https://www.straitstimes.com/singapore/environment/toolbox-of-made-in-singapore-high-tech-farming-solutions-can-help-country>> accessed 31 July 2025.

Thus, the objective of the 30-by-30 initiative is to develop the capabilities of the farming industry, in the short- to medium-term; and if unavoidable, to scale them up to face difficult circumstances that could arise in the long-term. The purpose is to prevent future generations of Singaporeans from suffering from food insecurity.

Adapting the Climate-Vulnerable Infrastructure

The impact of Fu's policies on climate-vulnerable infrastructure are clear. The Public Utilities Board (PUB), Singapore's national water agency pushed for both coastal and inland flood adaptation. The PUB sustained R&D programs, pilot projects, feasibility studies, such as the Coastal Inland Flood Model to guide infrastructure decisions¹⁰⁷. As of 2024, 300 improvement projects to enhance drainage capacity in flood-prone areas were underway. In 2025, an additional S\$5 billion was injected¹⁰⁸ in the Coastal and Flood Protection Fund on top of the S\$5 billion original budget. The fund was established in 2020 to finance projects like sea walls and tidal gates, in vulnerable areas like the City East Coast¹⁰⁹.

Grace Fu further implemented urban heat adaptation plans while taking inspiration from previous efforts like Cool Singapore 1.0 and 1.5¹¹⁰ programmes. Her biggest efforts were combining new technologies and urban heat adaptation, with the Digital Urban Climate Twin of the Cooling Singapore 2.0 program and the HDB Smart Hub program. For instance, the recently-awarded Pan Pacific Orchard¹¹¹, which opened in 2023, illustrates Fu's achievements and Singapore's efforts, in mitigating urban heat, combining greenery with urban geometry solutions.

Nevertheless, the resilient infrastructure policy faces challenges and creates controversy. The construction industry struggles with ethical concerns. Non-resident foreign low-skilled workers¹¹² make up majority of the construction

¹⁰⁷ Philipp Li-Fan Lui, 'Integrated Coastal-Inland Flood Model for Climate Change' (*National University of Singapore*) <[Integrated Coastal-Inland Flood Model for Climate Change](#)> accessed 3 July 2025.

¹⁰⁸ Chin Hui Shan, 'Budget 2025: Additional \$5 Billion Injected into Coastal and Flood Protection Fund' (*The Straits Times* 18 February 2025) <<https://www.straitstimes.com/singapore/budget-2025-additional-5-billion-injected-into-coastal-and-flood-protection-fund>>.

¹⁰⁹ 'GreenGov.SG Report FY2023' (*Ministry of Sustainability and the Environment* 2023) <<https://www.mse.gov.sg/latest-news/press-release-greengovsg-report-fy2023>>.

¹¹⁰ Lea Ruefenacht and Juan Angel Acero, 'Strategies for Cooling Singapore: A Catalogue of 80+ Measures to Mitigate Urban Heat Island and Improve Outdoor Thermal Comfort' [2017] www.research-collection.ethz.ch <<https://www.research-collection.ethz.ch/handle/20.500.11850/258216>>.

¹¹¹ Sherlyn Sim, 'Singapore's Pan Pacific Orchard Hotel Crowned World's Best New Skyscraper' (*The Straits Times* 6 October 2024) <<https://www.straitstimes.com/singapore/singapore-s-pan-pacific-orchard-hotel-crowned-world-s-best-new-skyscraper>>.

¹¹² Brenda Yeoh, 'Rapid Growth in Singapore's Immigrant Population Brings Policy Challenges' (*migrationpolicy.org* 3 April 2012)

workforce, are exploited, forced labor and domestic abuse¹¹³. In 2025, a sinkhole appeared in Tanjong Katong and endangered drivers¹¹⁴. Migrant workers were the first to rescue harmed citizens after the incident. While Grace Fu publicly thanked them for their courage, criticism sparked over their labor conditions.

Back in 2021, Grace Fu advised Singaporean citizens to check weather reports more frequently in order for them to be informed of possible flash floods. These remarks angered Singaporeans, claiming that the government failed to acknowledge systematic failures in drainage infrastructure, while placing the burden on citizens. Critics further argued that floods disproportionately affect lower income groups with fewer relocation opportunities¹¹⁵, as government officials failed to prioritise low-income residential zones, instead favouring commercial areas like the East Coast Park or Marina Bay¹¹⁶.

The climate-resilient infrastructure policy is crucial for Grace Fu to demonstrate actionable progress towards her climate leadership goals. By supporting major public investments in flood resilience and mitigating urban heat, she signals both ambition and accountability in reaching Singapore's climate goals. These efforts reinforce Fu's position as a leader of long term national wellbeing, someone proactively redesigning the urban environment to align with the ecological limits of the country.

More importantly, Fu's personal stake in the success of Singapore's resilient infrastructure policies can be linked to her broader ambition of securing Singapore's reputation as a climate resilient and innovative economy. The integration of new tech tools like the HDB Smart Hub, which centralises data on energy and water usage helps Singapore to efficiently monitor and optimise their sustainability. NBSs help manage floods and appeal to private and international investors due to their cost effectiveness, offer environmental and economic value. For instance, the Bishan Ang Mo Kio Park in Singapore was formerly a concrete canal that was naturalised into a river with vegetated riverbanks. This was able to

<https://www.migrationpolicy.org/article/rapid-growth-singapores-immigrant-population-brings-policy-challenges/>.

¹¹³ U.S. Department of State, 'Singapore - United States Department of State' (*United States Department of State* 20 March 2023)

<https://www.state.gov/reports/2022-country-reports-on-human-rights-practices/singapore/>.

¹¹⁴ Esther Loi, 'Grace Fu Apologises for Tanjong Katong Sinkhole, Says Road May Stay Closed for a Few More Days' (*The Straits Times* 29 July 2025)

<https://www.straitstimes.com/singapore/grace-fu-apologises-for-tanjong-katong-sinkhole-says-road-may-stay-closed-for-a-few-more-days> accessed 31 July 2025.

¹¹⁵ Kathleen, 'Netizens Chide Minister Grace Fu's Remarks about Adapting to Intense Weather; Demand Govt Fix Drainage Issues' (*The Online Citizen* 2 September 2021)

<https://www.theonlinecitizen.com/2021/09/02/netizens-chide-minister-grace-fus-remarks-about-adapting-to-intense-weather-demand-govt-fix-drainage-issues/>.

¹¹⁶ Koh Wan Ting, 'In Focus: With "No Place to Retreat To", Singapore Advances to Protect Its Coastlines' (*CNA* 2 December 2023)

<https://www.channelnewsasia.com/singapore/rising-sea-levels-low-lying-vulnerable-coastal-protection-long-island-3955651>.

increase surrounding property values while becoming a recreational hub¹¹⁷. The Digital Urban Climate Twin for cooling reflect Singapore's climate planning¹¹⁸. These different techniques support Fu's vision of Singapore as an urban hub in climate policy and strengthen long term trust.

As of 2025, Singapore improved climate-vulnerable infrastructure. New drainage systems and real-time weather monitoring systems have decreased the frequency and severity of the flash floods. New infrastructure enhancements delivered against intense storms, protecting lives and minimizing damages. Urban adaptation mitigated the UHI and drove down temperatures, while NBSs improved biodiversity, and enhanced public spaces. Thus, Singapore now stands as a global leader in urban adaptation, in the prevention of floods and in the mitigation of urban heat. Both low-lying archipelagos and very densely populated areas, facing similar dilemmas¹¹⁹, can learn from Singapore's green and climate-resilient urbanism.

Conclusion

In conclusion, Grace Fu has been a strong advocate and leader for Singapore when it comes to tackling the global crisis. The minister has made the current environmental challenges and her support clear to Singaporeans and the global stage. It has allowed observers to determine the kind of leader she is; especially in 2021 during her speech "A Pledge to Our Children and Future Generations". This was a defining moment in her career because she was able to show Singapore how critical the current situation is and how everyone must do their part to protect the nation's survival. In this speech she was able to present the Green Plan, and within this framework, the policies that the country must integrate into its economy for mitigation against the effects of climate change.

Arguably the three most important policies are the carbon tax, enhancing nutritional sovereignty, and adapting the urban infrastructure to flooding, sea level rise, and greening buildings. These three policies are at the heart of the Green Plan 2030 connecting to the most important concerns the country is facing regarding its vulnerabilities. The policies so far have been effective to an extent. They help mitigate the challenges, but they do lack transparency and have been slow to implement, hindering the effectiveness that they could have on the country to make the most progress. With this in mind Grace Fu has helped

¹¹⁷American Society of Landscape Architects, 'Bishan-Ang Mo Kio Park | 2016 ASLA Professional Awards' (Asla.org2016) <<https://www.asla.org/2016awards/169669.html>>.

¹¹⁸ 'MND | Resilient Infrastructure' (www.mnd.gov.sg) <<https://www.mnd.gov.sg/urbansustainability/resource/resilient-infrastructure>>.

¹¹⁹ World Bank Group, 'Building Resilience, Uplifting Communities in South Asia' (World Bank24 June 2025) <<https://www.worldbank.org/en/results/2025/06/23/building-resilience-uplifting-communities-in-south-asia>>.

Singapore make strides towards meeting its goals and raising awareness by helping to implement the policies, advocate for the Green Plan, and speak out about the issues that matter during conferences.

Therefore, as a climate leader Grace Fu has been successful. She has been able to make great progress towards the climate crisis. She creates a new path for Singapore by not solely relying on technocracy, but by leading with a mixed approach that integrates systems thinking, especially in a country historically slow to change and heavily rooted in technocratic governance.

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