An Institute of

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

# “Getting to Zero” The Explainer

SUSTAINABILITY LEARNING LAB
National Institute of Education Singapore

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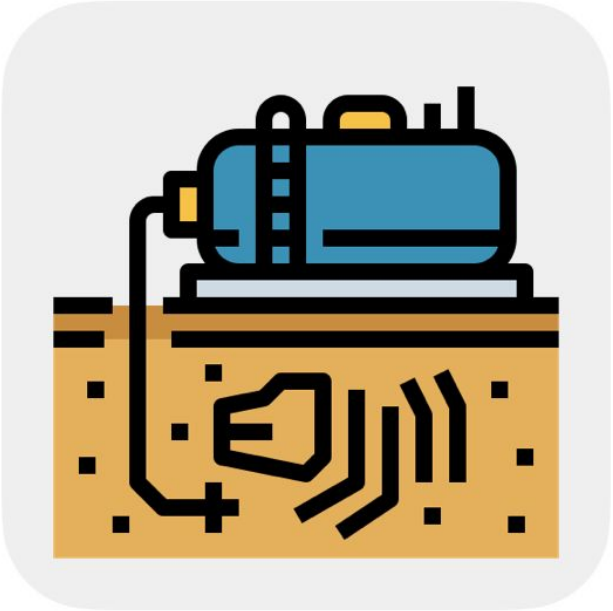
INSPIRING LEARNING
TRANSFORMING TEACHING
ADVANCING RESEARCH

# FOSSIL FUEL USAGE



Fossil fuel is burned to generate electricity. Singapore relies heavily on natural gas, a form of fossil fuel, to meet its energy needs.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# Fossil Fuel Usage

- **Today, about 95% of Singapore's electricity is generated using natural gas.**
- **Natural gas is the cleanest form of fossil fuel.**
  - When burned, natural gas emits up to 60% less carbon dioxide compared to other fossil fuels such as coal or oil.
- **Natural gas will continue to be a dominant fuel for Singapore in the near future.**

# COAL GASIFICATION PLANT

A coal gasification plant converts coal into hydrogen and carbon monoxide, gases used in the energy and chemicals sectors.


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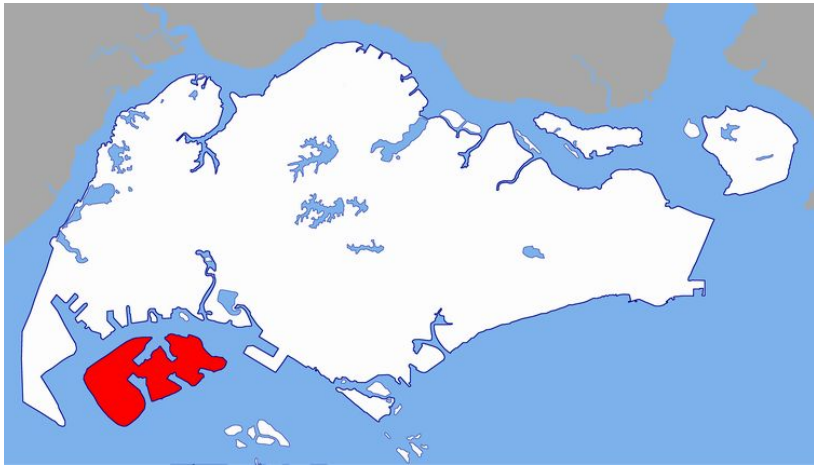
# Coal Gasification Plant

- **Hydrogen and carbon monoxide produced by a coal gasification plant are used in the energy and chemicals sectors.**
  - For example, the hydrogen produced can be used to make ammonia.
  - Hydrogen can also be used in fuel-cell vehicles.
- **A coal gasification plant will be developed on Jurong Island.**



*Jurong Island (shaded in red), is located about 5 km off the southwest coast of Singapore.*

*Jurong Island is the heart of Singapore's chemical and energy industry.*

# Coal Gasification Plant

- **NOTE:** While the hydrogen produced does not create greenhouse gas emissions, the use of coal (one of the most pollutive forms of fossil fuels) in producing the hydrogen means that it is scarcely better than burning fossil fuels outright.

# DEFORESTATION

When trees are cut down and/or burned, carbon dioxide is released into the atmosphere. Deforestation also removes the ability of trees to absorb existing carbon dioxide.

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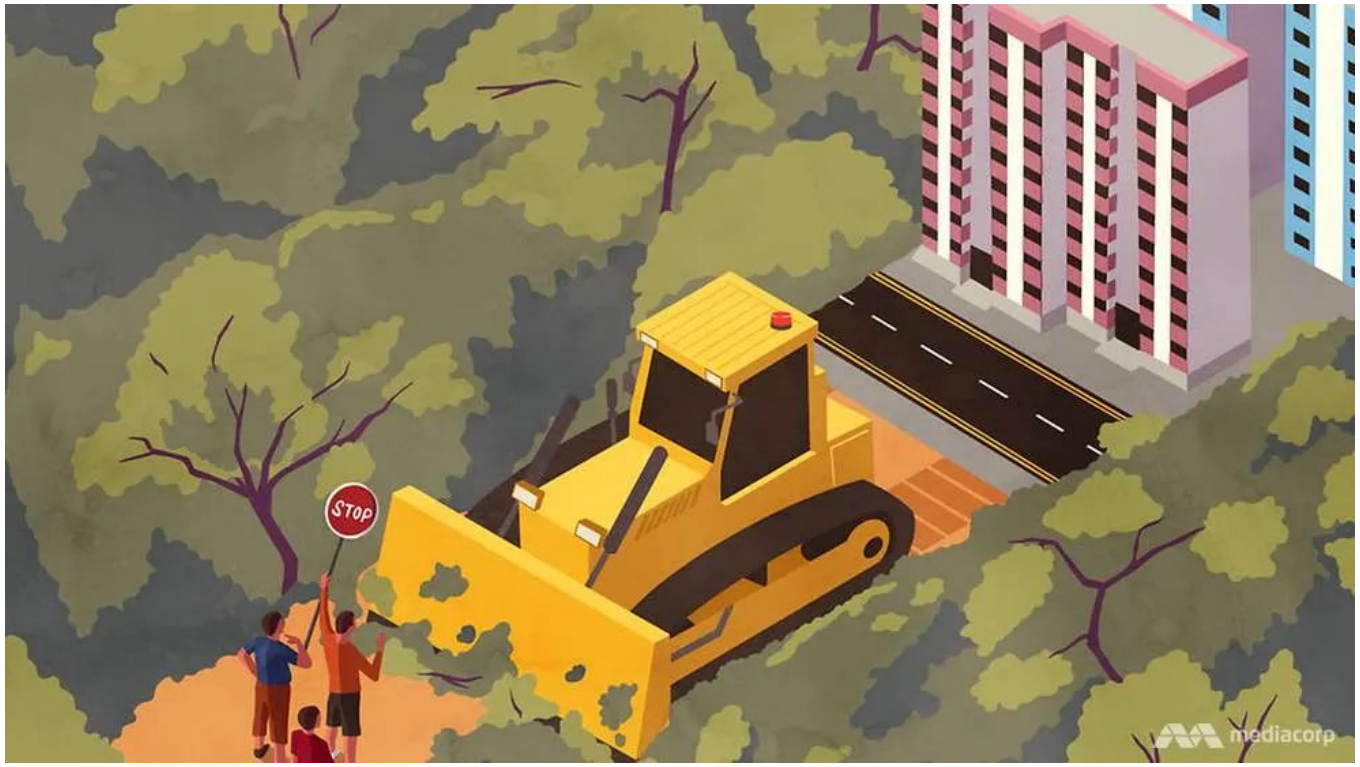
# Deforestation

- **In land-scarce and densely populated Singapore, the Government will have to continue balancing the needs of <u>development</u> and <u>conservation</u>.**

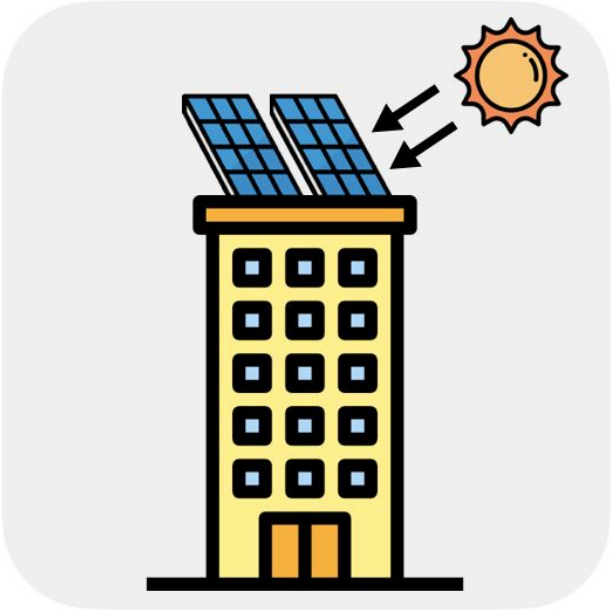


# Deforestation

**Recent cases of deforestation in Singapore:**

- **Tengah Forest (2020)**
  - Parts of a forest corridor meant to provide safe passage for wildlife will be felled to make way for two viaducts that will connect the upcoming Tengah town with the Kranji Expressway (KJE).

# SOLAR PANELS



Solar panels use light energy from the Sun to generate electricity. This results in clean, renewable electricity.

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# Solar Panels

- **Singapore faces challenges to the use of solar energy on a large scale.**
    - We have limited available land for the large scale deployment of solar panels.
    - The presence of high cloud cover across Singapore and urban shading poses challenges such as intermittency.
- **Singapore intends to meet 4% of its electricity needs through solar energy by 2030.**


*Cloudy skies over HarbourFront in Singapore.*

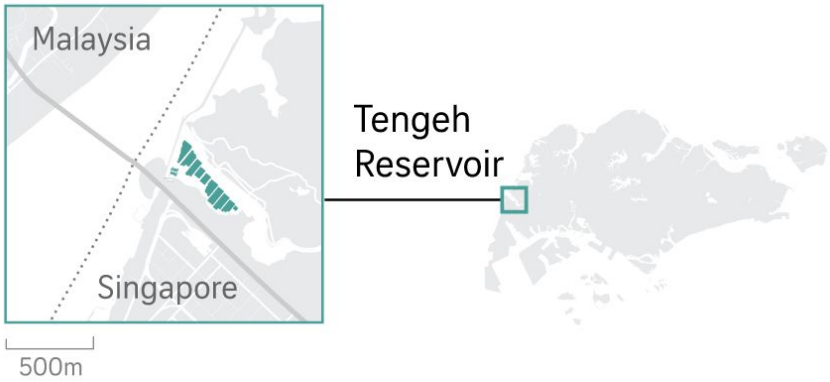
# Solar Panels

- **The Housing & Development Board (HDB) plans to more than double its capacity for solar power by 2030.**
    - Over the next 10 years, it will have a solar capacity that is equivalent to powering about 135,000 four-room flats with clean energy.

*Solar panels on the rooftop of an HDB block in Ang Mo Kio.*

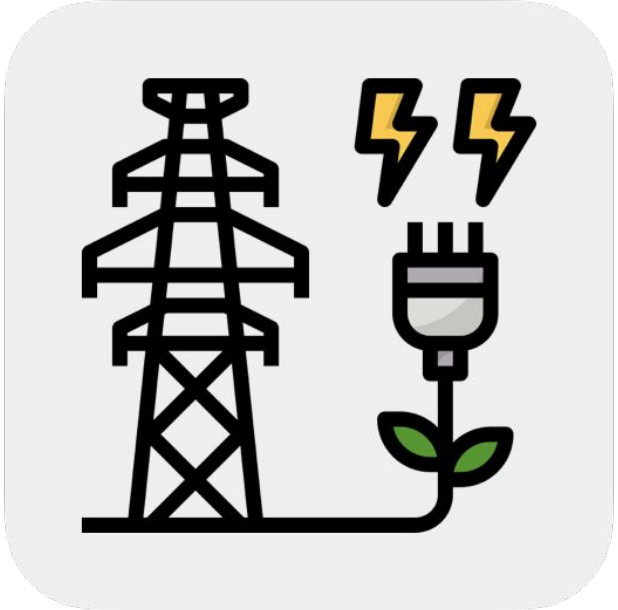
# Solar Panels

- **To overcome land constraints, Singapore built one of the world's largest floating solar farms.**
    - This floating solar farm on the surface of Tengeh Reservoir, covers 45 ha -- or the size of 45 football fields.
    - The 122,000 solar panels will start powering national water agency PUB's water treatment plants in the second half of 2021.




*Floating solar farm on the surface of Tengeh Reservoir.*

# ASEAN POWER GRID



The ASEAN Power Grid allows Singapore to buy green electricity such as hydropower from other ASEAN countries.

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# ASEAN Power Grid

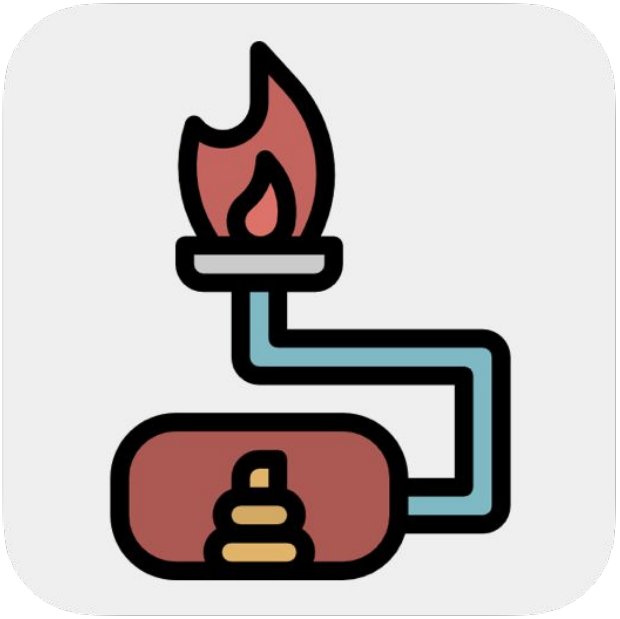
- **The ASEAN Power Grid allows Singapore to buy green electricity such as hydropower from other ASEAN countries.**
    - Singapore, as a small island developing state (SIDS), cannot meet its electricity needs through renewable energy installations in Singapore.
    - A regional power grid allows us to tap on renewable energy efforts such as solar farms in Vietnam, wind farms in Thailand, and hydropower in Laos.

*Solar Farm*

*Wind Farm*

*Hydropower Dam*

# BIOGAS



Food waste slurry and sewerage are combined to produce biogas, which can be used to replace fossil fuel for electricity generation.

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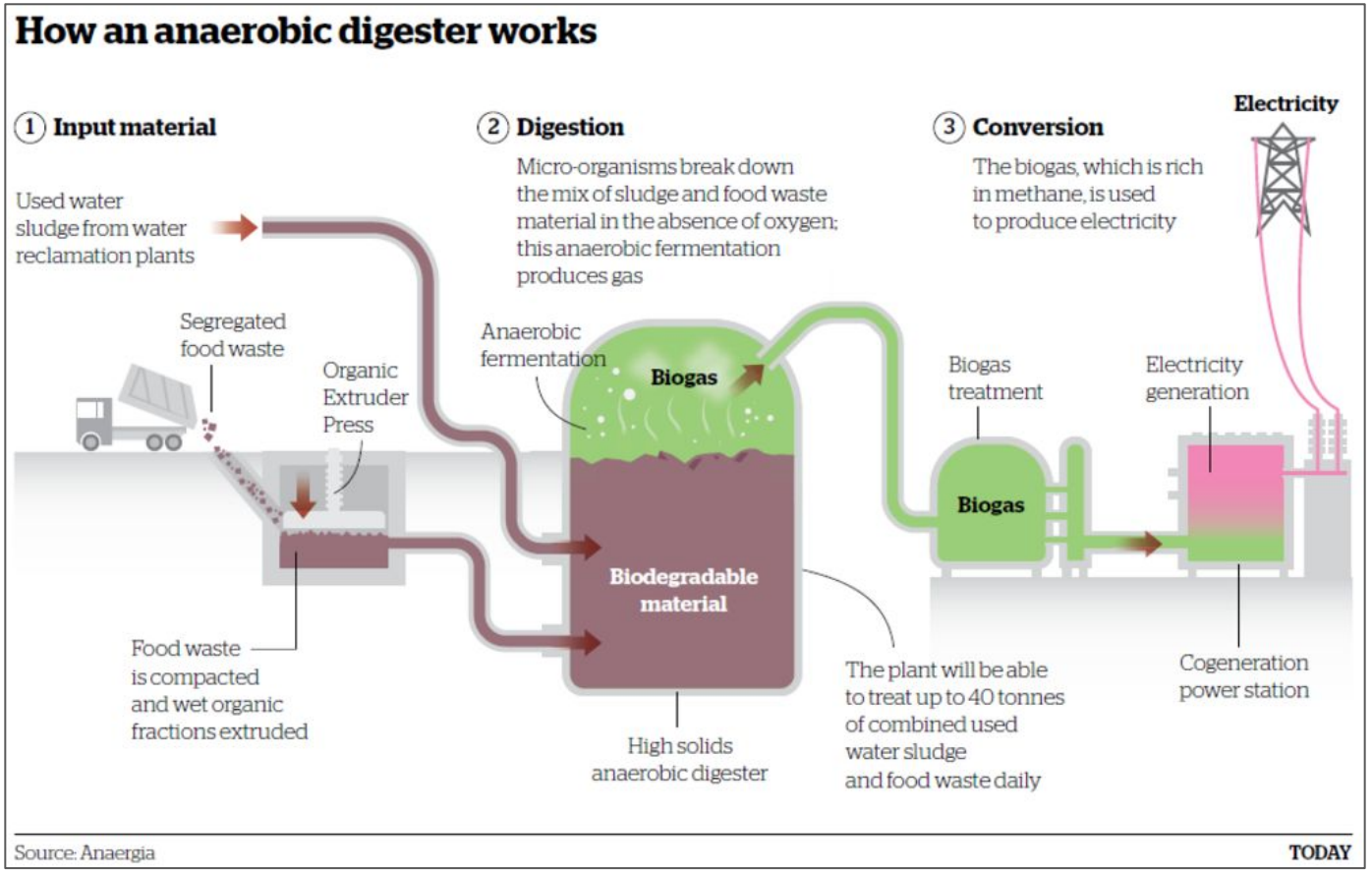
# Biogas

- **A pilot co-digestor at Tuas combines food waste slurry and used water sludge from sewer systems and the residues from reclaimed water to produce biogas.**
    - This biogas can be used to replace fossil fuel for electricity generation.



# COASTAL RESTORATION

The seas are a carbon sink, absorbing carbon emissions. Restoring the coasts allow the seas to do this better, and protect Singapore from floods due to rising sea levels.

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# Coastal Restoration

- The seas are a carbon sink, absorbing the carbon emissions that humans put out.
- At the same time, restoring sea grasses, mangroves, and salt marshes to our coasts will also increase the amount of carbon dioxide absorbed by sequestering the carbon in the seabed.
- Restoring the coasts also protect Singapore from floods due to rising sea levels. This is particularly true of mangroves, which can absorb storm surges and rising tides.


*Sungei Buloh Wetland Reserve, the largest patch of mangrove area in mainland Singapore.*

# REFORESTATION

Reforestation removes substantial amounts of additional carbon dioxide from the atmosphere, and is seen as a way to help cool the climate.

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# Reforestation

- **Launched in April 2020, the OneMillionTrees movement aims to restore nature back into our city through the planting of more than a million trees across Singapore over the next 10 years.**
    - At the heart of the movement is the engagement and involvement of community. Beyond physically planting trees, members of the community can also be involved in designing planting plans, propagating native tree saplings, forest restoration works, outreach and education efforts.

ONE MILLION TREES MOVEMENT

# RETROFIT BUILDINGS

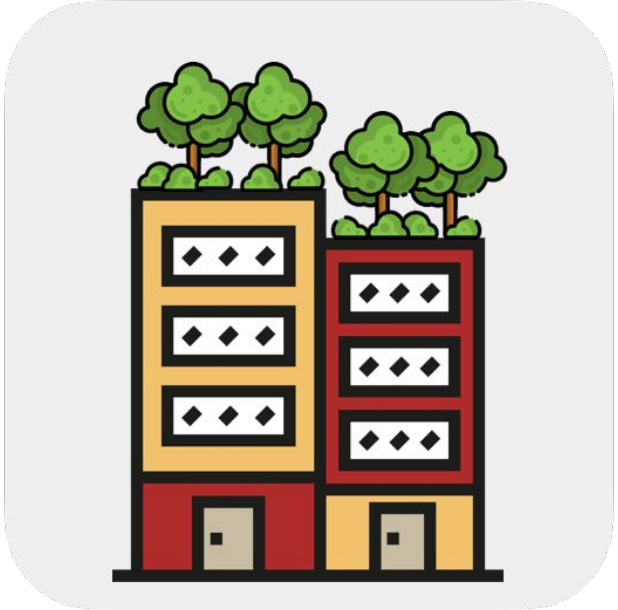
**Retrofitting* makes homes and buildings more climate-friendly with energy-saving and efficient equipment.**

*adding new technology or features to improve existing buildings


# Retrofit Buildings

- **Retrofitting makes homes and building more climate-friendly with energy-saving and efficient equipment. The net effect is lower greenhouse gas emissions.**
- **E.g. National Institute of Education, Singapore**
    - Facilities booking via BMS (Building Management System) to control lighting and air-conditioning so they are ‘on’ only when a specific space is booked.
    - Installed efficient lighting and motion sensors in all corridors and toilets.
    - Installed rainwater harvesting system to irrigate the hockey pitch to offset potable water use.

# GREEN ROOF



**Green roofs* can be installed on buildings to cool them, as well as foster the growth and return of urban biodiversity.**

*roofs partially or completely covered with vegetation

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# Green Roof

- Green roofs can be installed on buildings to both reduce the cooling load required, as well as foster the growth and return of urban biodiversity.



**These plants are succulents and grasses that have been specially selected to withstand warm conditions on top of the buses.*

# GLOBAL COOPERATION

A climate change law creates an obligation on the government to meet certain emission reduction targets.

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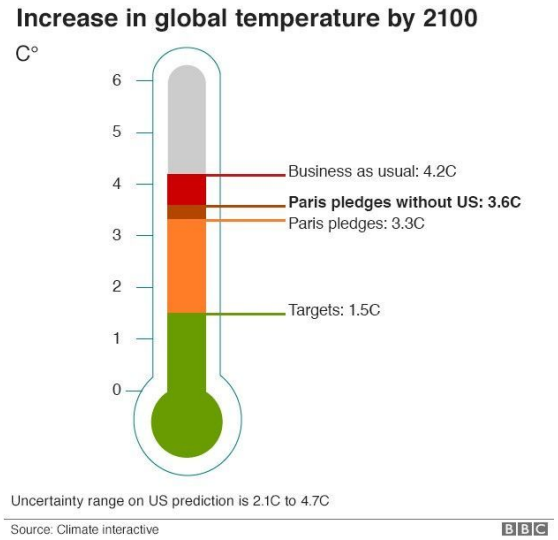
# Global Cooperation

- **The Paris Agreement is legally-binding global climate deal was adopted to limit global warming to below 2ºC**
    - The agreement was signed by 197 countries, including Singapore, and member states submitted national climate change action plans (“Nationally Determined Contributions” - NDC) they will implement to reduce emissions.
    - The agreement entered into force on November 4, 2016.

# CAR-FREE DAYS

Car-Free Sunday SG is an initiative organised by the URA, where some streets in the Civic District are closed off to vehicles and opened up to cultural events and roadside stalls.

*URA: Urban Redevelopment Authority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# Car-Free Days

- **The Urban Redevelopment Authority organises Car-Free Weekends, where some streets in the Civic District are closed off to vehicles and opened up to cultural events and roadside stalls.**
    - Introducing Car-Free Days to the public is meant to allow the public to experience parts of the city centre unclogged by traffic, and inspire the public to imagine a future without pollutive traffic.

# CARBON TAX


A higher carbon price will motivate large polluters to find ways to reduce their carbon emissions.


# Carbon Tax

- **Singapore is the first country in Southeast Asia to introduce a carbon price.**
- **The carbon tax, at S$5 per tonne of greenhouse gas emissions (tCO2e), was introduced in 2019.**
- **The carbon tax will incentivise emissions reductions across all sectors and support the transition to a low-carbon economy.**