NUS National University of Singapore

Lloyd's Register Foundation Institute for the Public Understanding of Risk

GETTING TO NET ZERO

A Guide for Singaporeans to get started on reducing their carbon footprint

Net Zero is **balancing the amount of carbon dioxide and other greenhouse gases that we release into the atmosphere with the amount that we remove from the atmosphere.** By achieving Net Zero, we can mitigate the risk of climate change.

Singapore has committed to achieve net zero carbon emissions by 2050. Alongside the public and private sectors, individuals and communities have a key role to play in achieving this goal. This Guide is about what individuals can do to contribute.

IS INDIVIDUAL ACTION IMPORTANT?

Any individual's carbon emissions make up a tiny part of national, let alone global emissions. It may feel like there is no point in trying to reduce your own emissions when governments, firms and other people aren't taking action.

Don't get discouraged! Here are 4 reasons why it is worth taking individual action:

Pave the way.

Each step you take helps to make climate action more familiar to others, gradually changing what people think of as normal.

Signal to governments and firms that people want change.

Decision-makers hold back from making major changes on the grounds that the public will not support them. Changing consumption and behaviours voluntarily sends a powerful signal to public and private decision-makers.

Live in harmony with your values.

For people who treasure the environment, it is natural to make lifestyle choices that help to protect the earth.

Small actions add up.

Changing individual purchasing habits and behaviours makes it easier and cheaper for every sector to reduce emissions.

3 TYPES OF ACTION TO REACH NET ZERO

REDUCE
Reduce our carbon footprint as much as possible. **Individual action focuses on REDUCE**

INNOVATE
Innovate to replace fossil fuels with low-carbon or no-carbon products and services

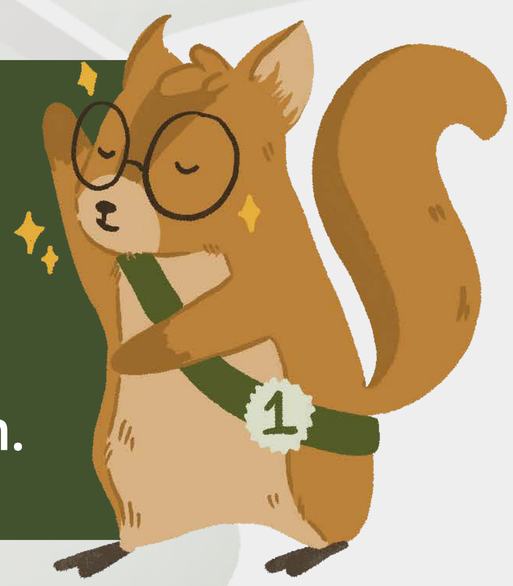
REMOVE
Remove carbon dioxide from the atmosphere to offset remaining emissions that are hard to reduce or replace

MEASURE YOUR CARBON FOOTPRINT

Everyone's carbon footprint is different depending on what services and products you consume, the place you live, and how you get around. This means that the most effective actions to reduce emissions will not be the same for everyone.

So the best place to start is by calculating your own carbon footprint.

Is there a priority list?
Yes, but it won't be the same for everyone! Start by calculating where your emissions are coming from.

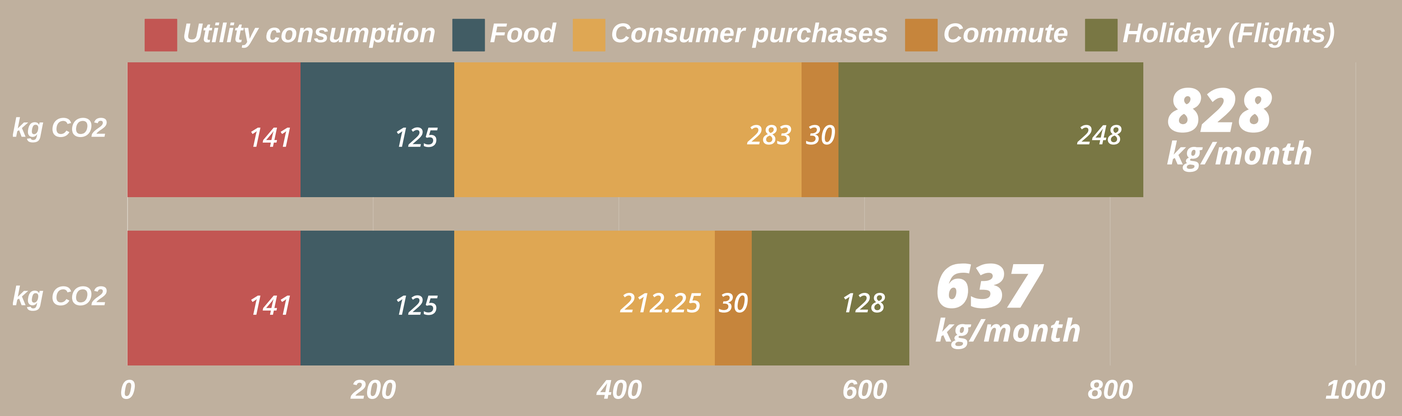


Try out the SP calculator below!

https://mycarbonfootprint.spgroup.com.sg/

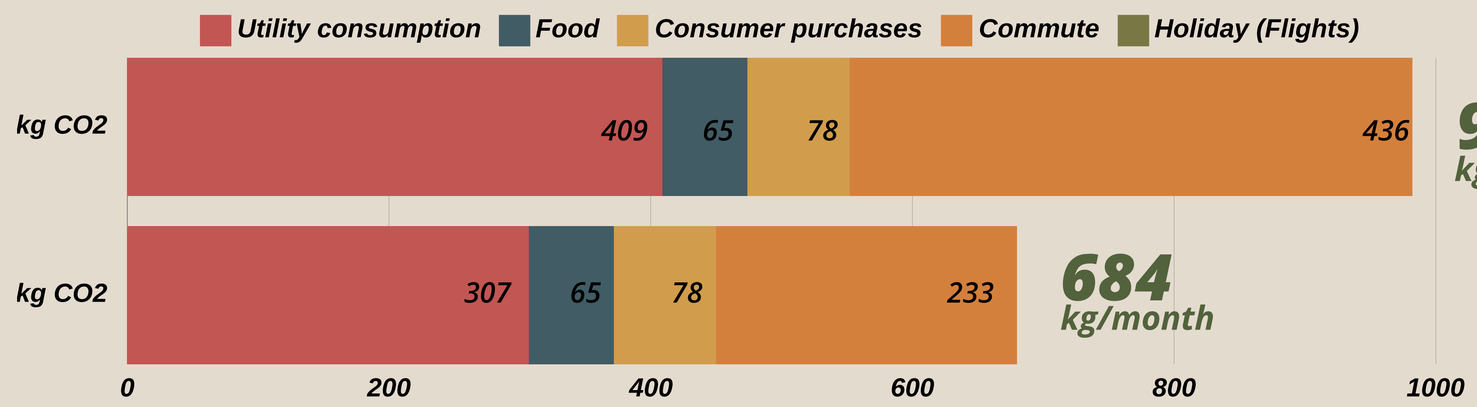
FOOTPRINT PROFILE EXAMPLES

Yi Ling is 25. She lives in a 2-room HDB and always conserves energy and water at home. She takes the MRT to get around. Her diet includes meat and dairy. She spends $150 - $200 a month on clothes, electronics or other items. She usually takes two holidays a year to different parts of Asia, travelling by plane.

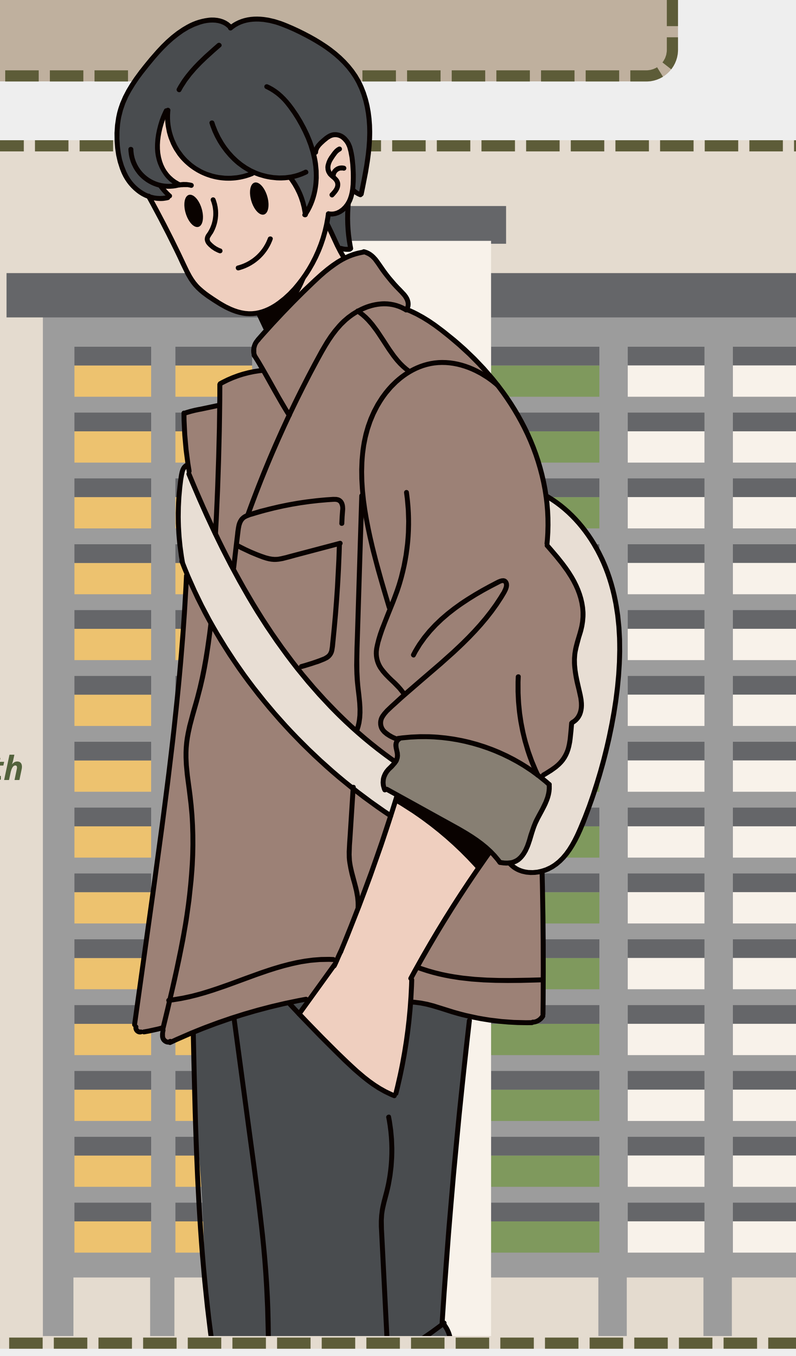


If Yi Ling can cut back her monthly purchases of consumer goods by 25% and can swap one of her holidays by air to a staycation or destination accessible by ferry, Yi Ling can reduce her carbon footprint by over 20%.

Deliang is 35, owns a car, and generally uses this to get to work and to drop his family members. He lives in a 5-room HDB and utility consumption is high. He is a vegetarian and tends not to buy new clothes, electronics or household items. He makes one trip a year to a nearby destination, either Malaysia or Indonesia.



If Deliang can replace half his car journeys with MRT journeys, and reduce utility use by 25% at home, he can cut back his total footprint by more than 30%.



WHAT ACTIONS SHOULD I TAKE?

Working towards Net Zero doesn't mean you have to give up the things that you most value. Use a carbon footprint calculator to work out which actions will be most effective in reducing your carbon emissions, and then ask yourself these questions:

1

Which actions am I ***most willing*** to take? In some cases you might be willing to make a big change in your lifestyle because it brings other benefits, like better health.

2

Which actions seem ***easy to take?*** There may be practical barriers to taking actions we would be otherwise be willing to take, like having to take a private hire vehicle home after work to look after family.

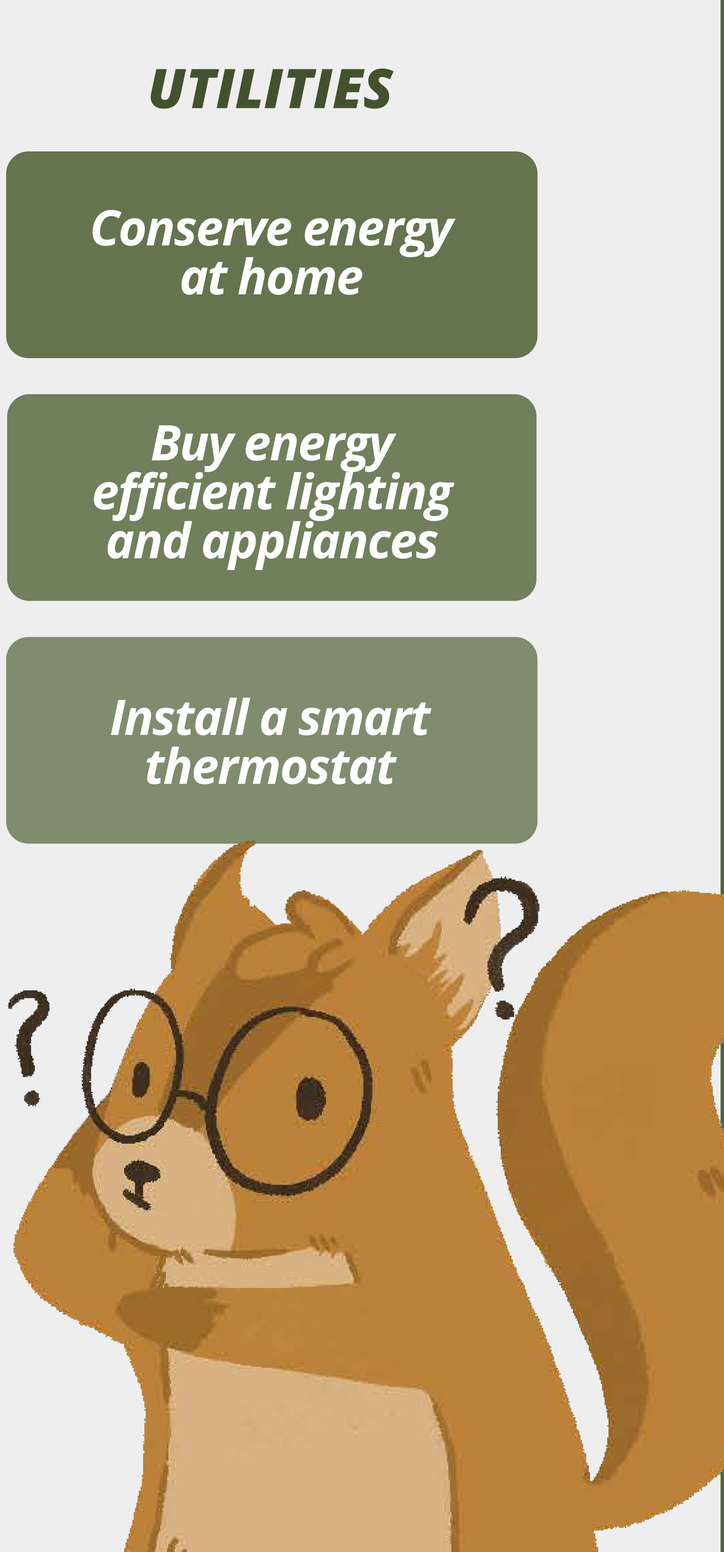
3

Which actions seem ***normal*** and can fit in with what my family, friends and colleagues do? While you may feel fine standing out from the crowd, insisting on a different diet, for example, can put a strain on relations with family.

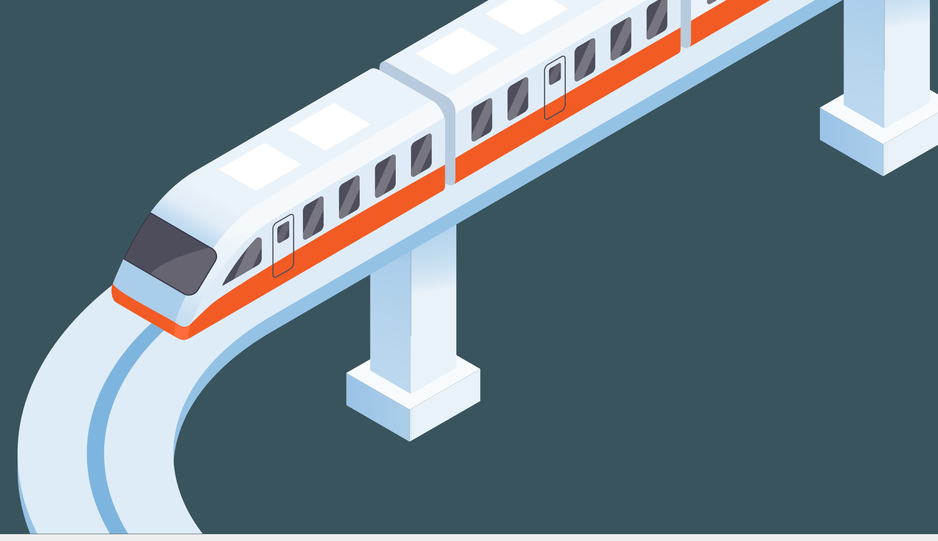
WHAT ACTIONS COULD I TAKE?

FOOD	CONSUMPTION AND WASTE	TRANSPORT AND TRAVEL	UTILITIES
Reduce food waste	*Don't buy new - repair, reuse, rent, borrow*	*Reduce air travel*	*Conserve energy at home*
Reduce consumption of meat and dairy	*Refuse unneeded consumer products*	*Reduce commute - work from home if possible*	*Buy energy efficient lighting and appliances*
Switch to a plant-based diet	*Reduce consumption of carbon-intensive products*	*Switch to public transport such as MRT or bus*	*Install a smart thermostat*
Switch to locally produced food	*Reduce use of plastics*	*Switch to walking or biking*	
		Switch to electric or hybrid vehicles	

Find out more in the next few sections!



TRANSPORT CHOICES



The daily commute to work or study can add a lot to your individual carbon footprint. Two things matter: ***how far you go*** and ***what kind of transport you use***.

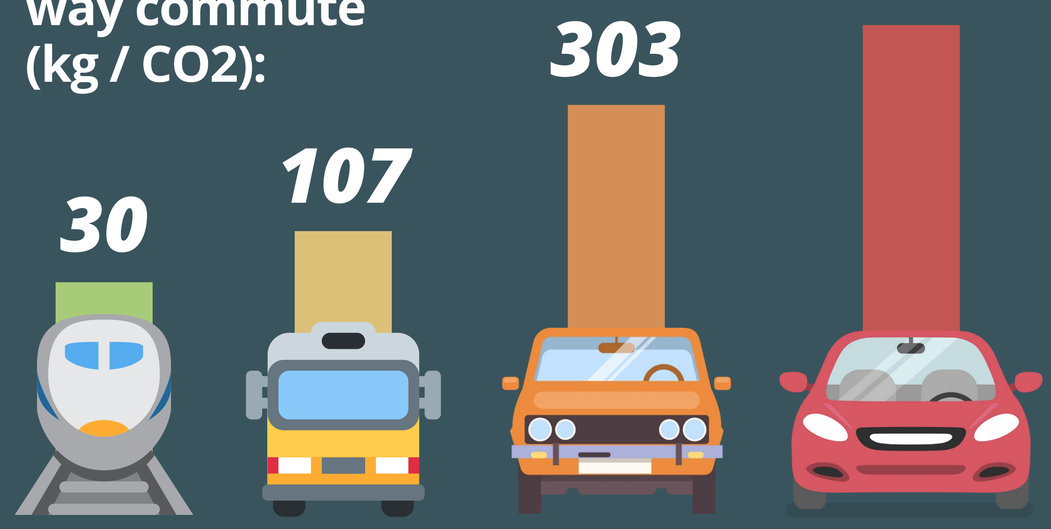
Some people are lucky enough to live close enough to their workplace to walk. Others may be able to work from home all or some of the time. For most people though, they will need to commute to work everyday.

On average, Singaporeans spend

45 mins

getting to work

For a 45 min one - way commute (kg / CO2):



MRT is by far the ***most carbon-friendly*** form of transport. For a 45 minute commute, MRT generates about 30 kg of carbon emissions, compared to 107 kg for bus and 436 kg for a mid-size car.

ACTIONS

For individuals:

1. TAKE PUBLIC TRANSPORT
Swapping private for public transport once a week will significantly decrease your carbon footprint in the medium / long run.

2. SHARE RIDES
Carpooling reduces the number of vehicles on the road, lowering emissions and reducing congestion.

3. WORK FROM HOME
Doing so once a week cuts commute footprint by 20%. Where feasible, work from home or negotiate remote work options with your employer.

What others need to do:

1. FLEXIBLE SCHEDULES
Employers should establish and maintain flexible work schedules which allow people to work from home whenever possible.

2. REDUCE BARRIERS
Showers and lockers at workplaces will reduce some barriers to walking or cycling into work.

3. IMPROVE INFRSTRUCTURE
The government should invest in complementary infrastructure, such as pedestrian-friendly road design and cycle lanes.

ELECTRIC VEHICLES VS. PETROL CARS

Singapore has set a target of ***100% cleaner energy vehicles by 2040.*** Half the taxi fleet, private hire fleet and bus fleet will be electric by 2030.

Given Singapore 's current energy mix with most power generated from natural gas, switching all light vehicles to electricity would reduce carbon emissions by *1.5 to 2 million tonnes a year*, according to Land Transport Authority estimates.

As of mid-2023, there were about **8,900** electric vehicles on the road accounting for < 2% of passenger cars in Singapore.

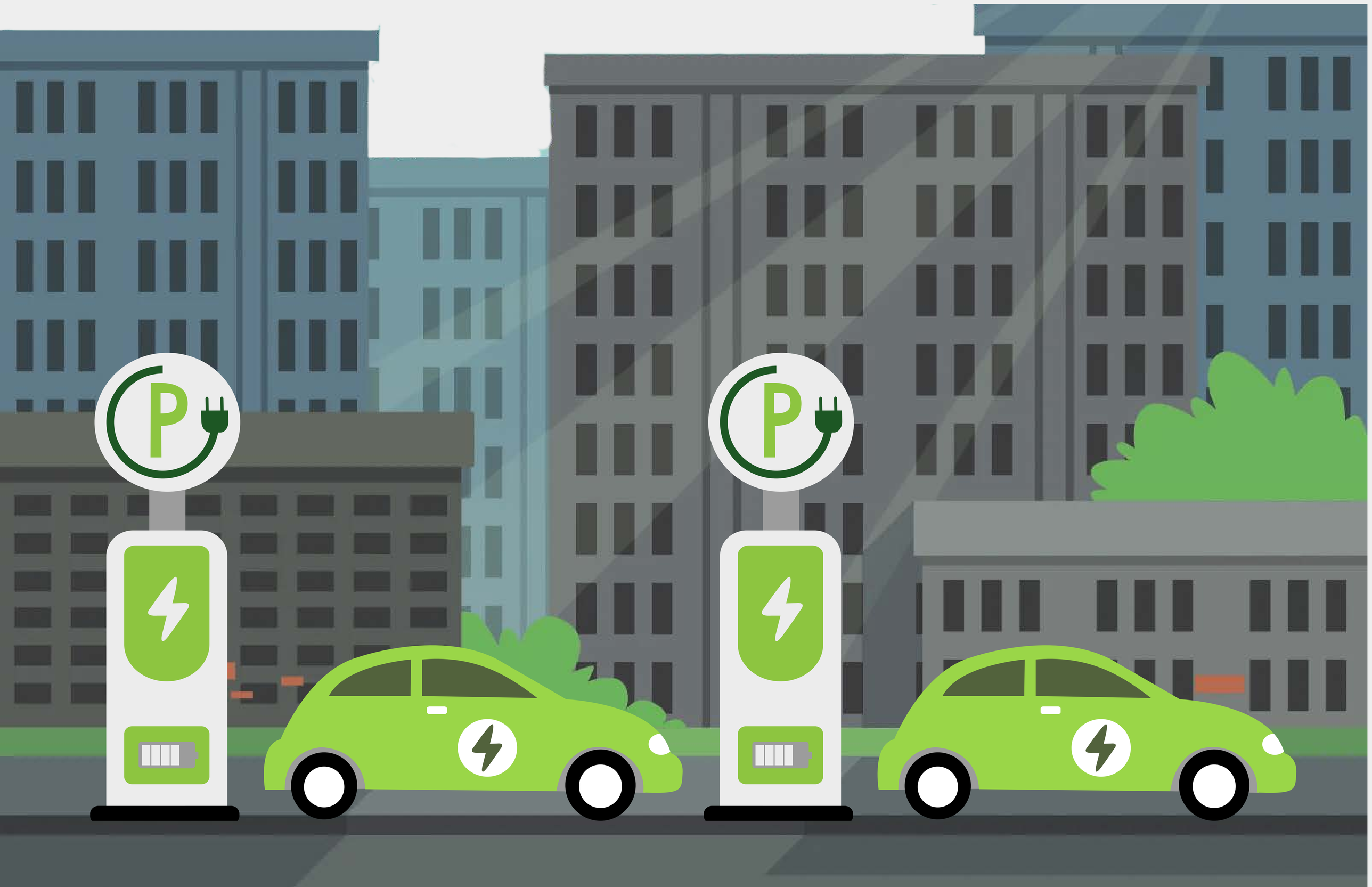
BENEFITS OF ELECTRIC VEHICLES:

CO_2 ***EMITS HALF THE AMOUNT OF CO2/KM DRIVEN COMPARED TO A SIMILAR VEHICLE***

REDUCES AIR POLLUTION

REDUCES NOISE

Although batteries are carbon-intensive to produce, EVs generate ***much lower emissions over the lifecycle of the vehicle*** than conventional petrol cars.



ACTIONS

For individuals:

1. CHOOSE SHORT-HAUL FLIGHTS

Make fewer, longer trips. Choose destinations closer to home.

2. REDUCE WORK AIR TRAVEL WHERE FEASIBLE

Engage with your employer about how work air travel can be reduced, such as replacing travel with virtual meetings.

3. CHOOSE DIRECT FLIGHTS

Most carbon emissions from air travel come from takeoff and landing, so reducing the number of flights can lower your overall footprint.

4. FLY ECONOMY

Flying economy has a lower carbon footprint per passenger compared to business or first class as it accommodates more people per flight.

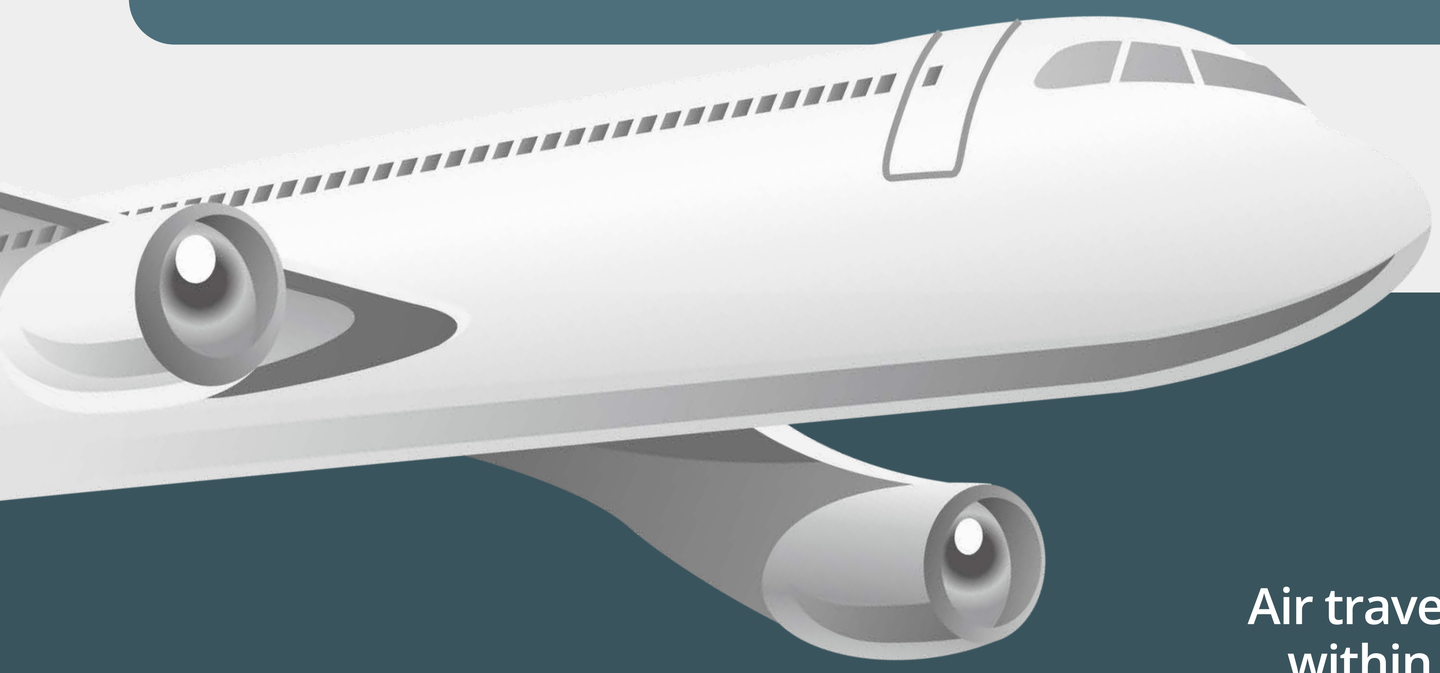
What others need to do:

1. ACKNOWLEDGE RESPONSIBILITY

Airlines need to take responsibility for their carbon footprints, and demonstrate that they are investing in R&D around sustainable aviation fuel and innovation to reduce their carbon footprint.

2. BE RESPONSIVE

Companies across sectors need to be responsive to calls for changes in work travel practices from their employees.



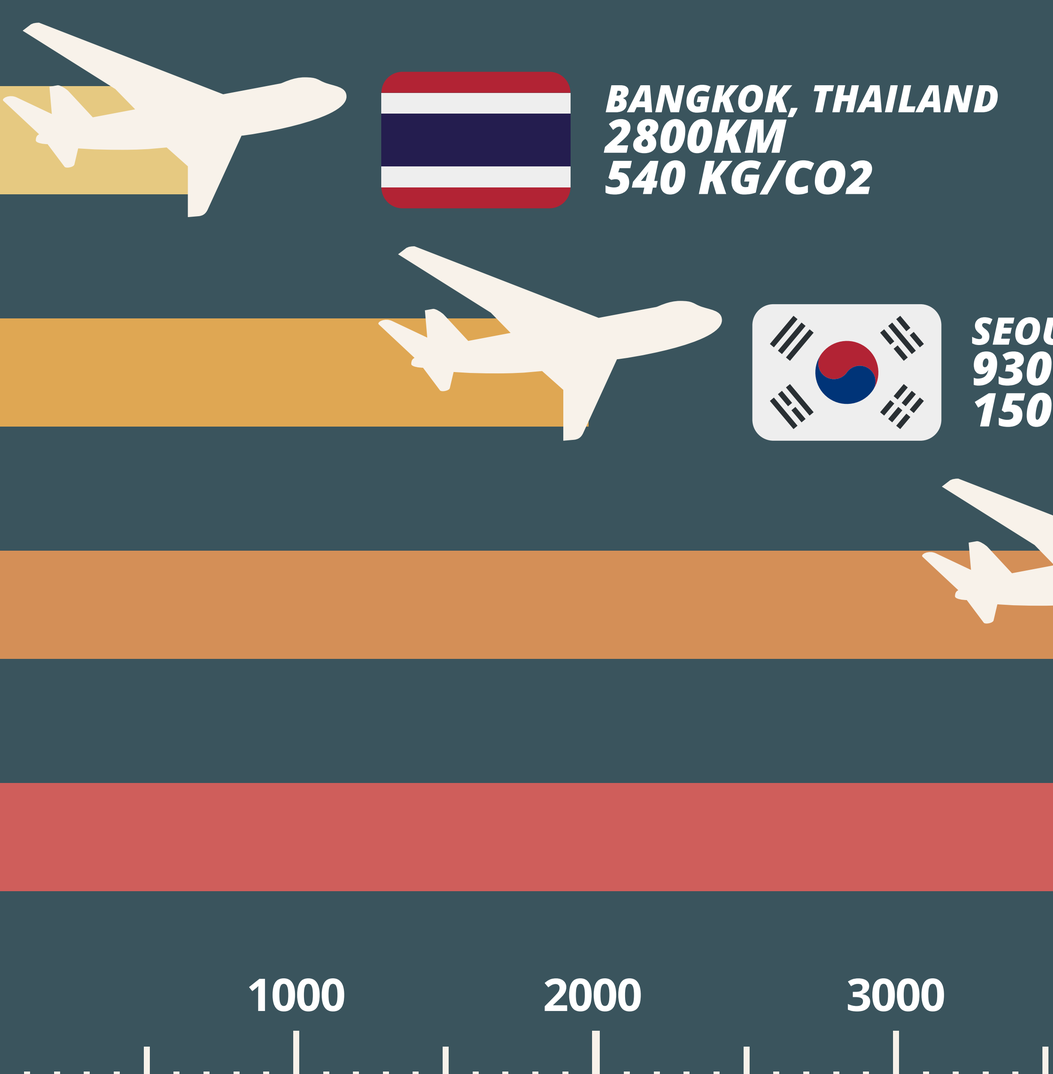
FLYING

Air travel is extremely carbon intensive. Just one trip within SE Asia adds more than half a tonne (540kg) to a person's carbon footprint.

On the other hand, holidays are a major source of well-being for most of us, and there are few destinations that can be reached from Singapore without flying. With limited leave, people want to make the most of their time off and want to reach their destination as quickly as possible, meaning that air travel is the only option.

What is more, some people have to fly frequently for their job. But there are still actions we can take.

ROUND TRIP FROM SINGAPORE IN ECONOMY:



ENERGY USE AT HOME

TRANSPORT RELATED
5%

HOUSEHOLDS
14%

COMMERCE & SERVICES RELATED
39%

INDUSTRIAL RELATED
41%

SG ELECTRICITY DISTRIBUTION

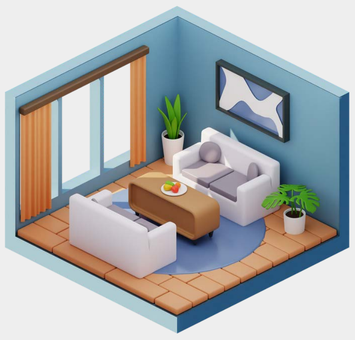
Households make up about 14% of overall electricity consumption. Commerce and service-related and industrial-related electricity consumption is rising much faster than household electricity consumption.

HOW MUCH CARBON IS EMITTED FROM ELECTRICITY USE AT HOME?

Singapore uses natural gas for almost all of its electricity generation. This generates lower carbon emissions than coal, but is much higher than renewables. In 2022, average emissions per unit of electricity generated in Singapore was 0.42 kg CO2/kWh. This is known as the ***Grid Emission Factor or GEF.***

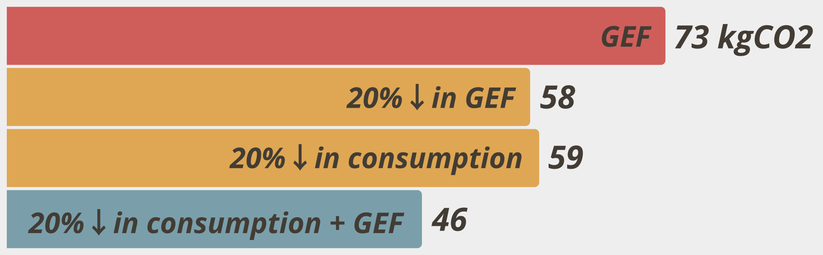
Household emissions from home energy use can therefore be reduced in two ways:

1. REDUCING THE GRID EMISSION FACTOR
2. REDUCING THE AMOUNT OF ELECTRICITY USED.



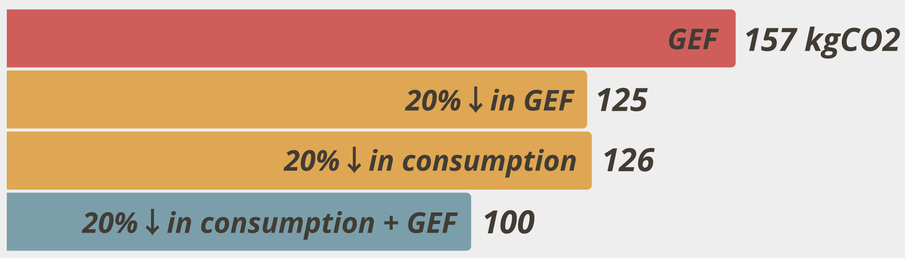
EG. 1-2 ROOM FLAT

Electricity consumption: 175.6 KwH



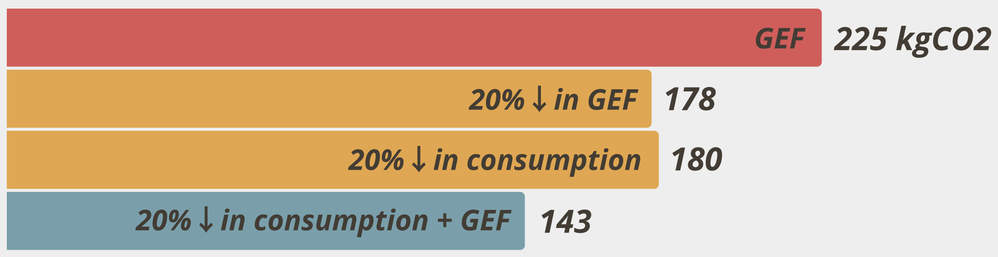
EG. 4 ROOM FLAT

Electricity consumption: 377.8 KwH

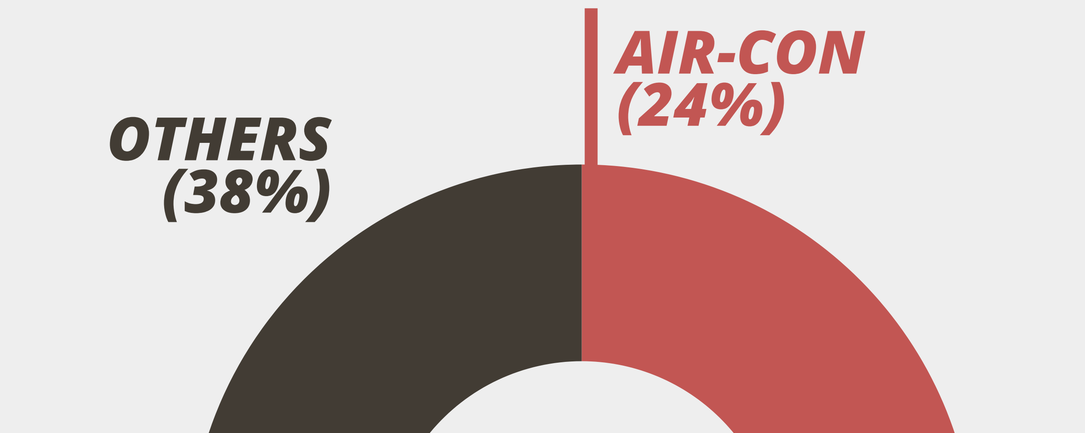


EG. CONDOMINIUM

Electricity consumption: 540.8 KwH

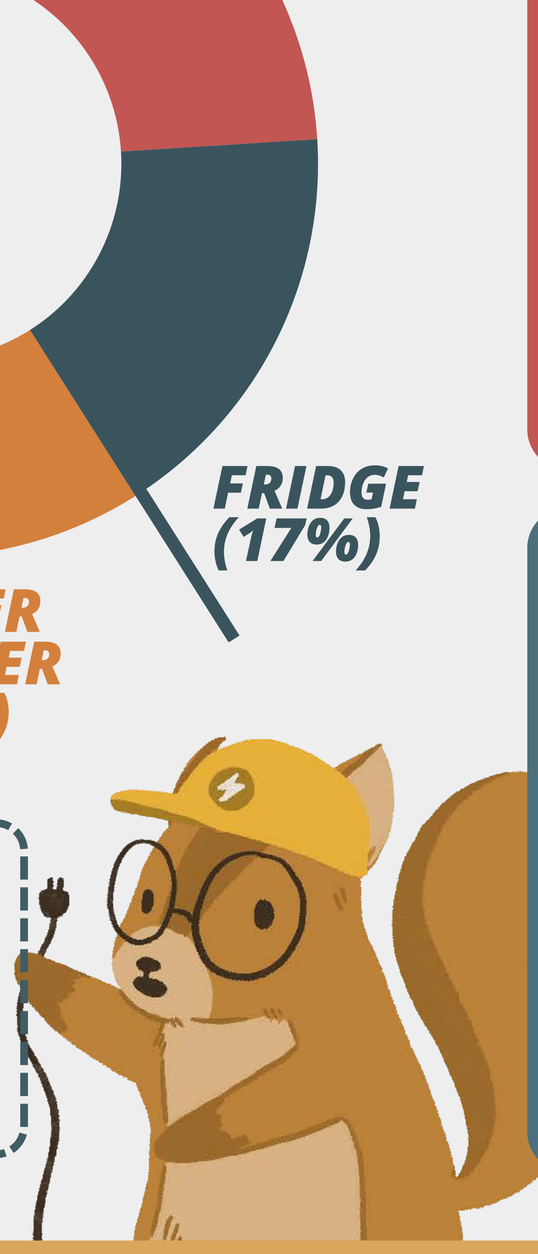


WHAT DO WE USE ELECTRICITY FOR?



2020 AVERAGE MONTHLY ELECTRICITY CONSUMPTION

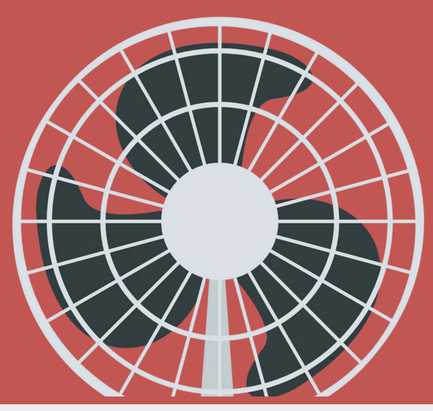
HDB flats: 376 kWh
Condominiums: 569 kWh
Landed properties: 1,257 kWh



HOW COULD I REDUCE MY ELECTRICITY CONSUMPTION AT HOME BY 20% (AND SAVE MONEY ON BILLS)?

1. USE A FAN INSTEAD OF AN AIR-CON

Energy used by 1 air-con is equivalent to 11 fans. Save up to $441 a year!



2. USE A THERMOS FLASK INSTEAD OF AN ELECTRIC AIR POT

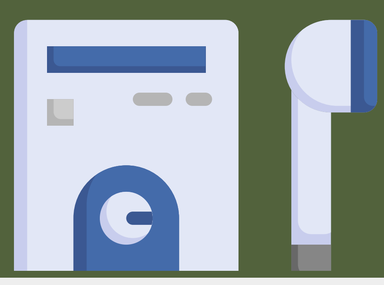
Don't let your electricity bills boil over. Save around $348 a year!

3. THE MORE TICKS, THE BETTER

Save around $303 / year if you buy a 5-tick instead of a 2-tick air-con, and $59 / year for buying a 5-tick instead of a 2-tick refrigerator!

4. SWITCH OFF THE STORAGE WATER HEATER

Leaving the storage water heater on can land you in hot water. Save an additional $124 / year by switching it off after use!



HOW TO READ ENERGY LABELS

Energy labels provide valuable information to consumers about the efficiency of products and appliances when they are considering a purchase.

1 **2**

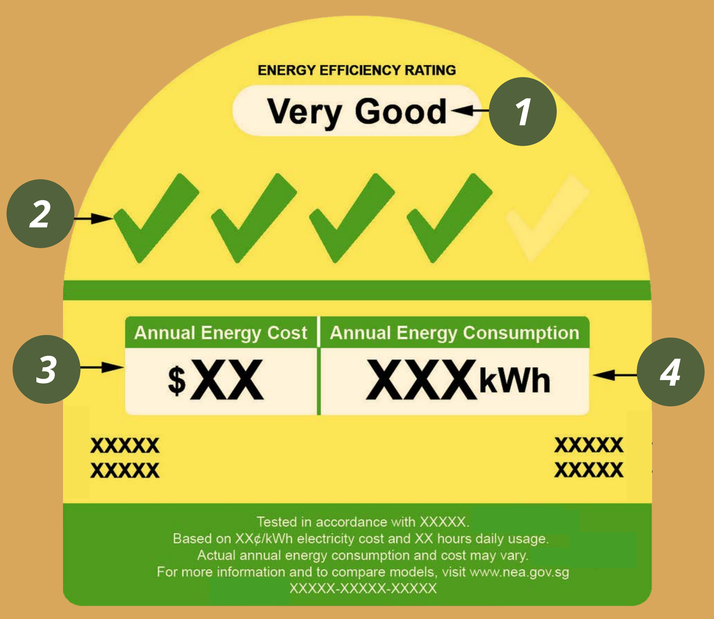
The model's relative energy efficiency is expressed in ticks and words:

✓ ✓ ✓ ✓ ✓

Low *Fair* *Good* *Very Good* *Excellent*

3

Annual energy cost, computed based on typical appliance usage, energy consumption of product, and cost of electricity ($0.27 / kWh)



4

Type of appliance and its capacity:

Air Con: Full load cooling capacity (in kW)
Clothes dryer: Related capacity (in kg)
Refrigerator: Total storage volume (in litres)
Television: Diagonal screen size (In inches)

ACTIONS

1. SWITCH TO ENERGY-EFFICIENT APPLIANCES

They consume less electricity and can significantly reduce your overall energy usage.

2. MAINTAIN YOUR APPLIANCES

Dirty or poorly maintained appliances can consume more energy than necessary to operate efficiently.

3. TURN OFF APPLIANCES AND SWITCHES WHEN NOT IN USE

What others need to do:

1. MANUFACTURE ENERGY EFFICIENT APPLIANCES

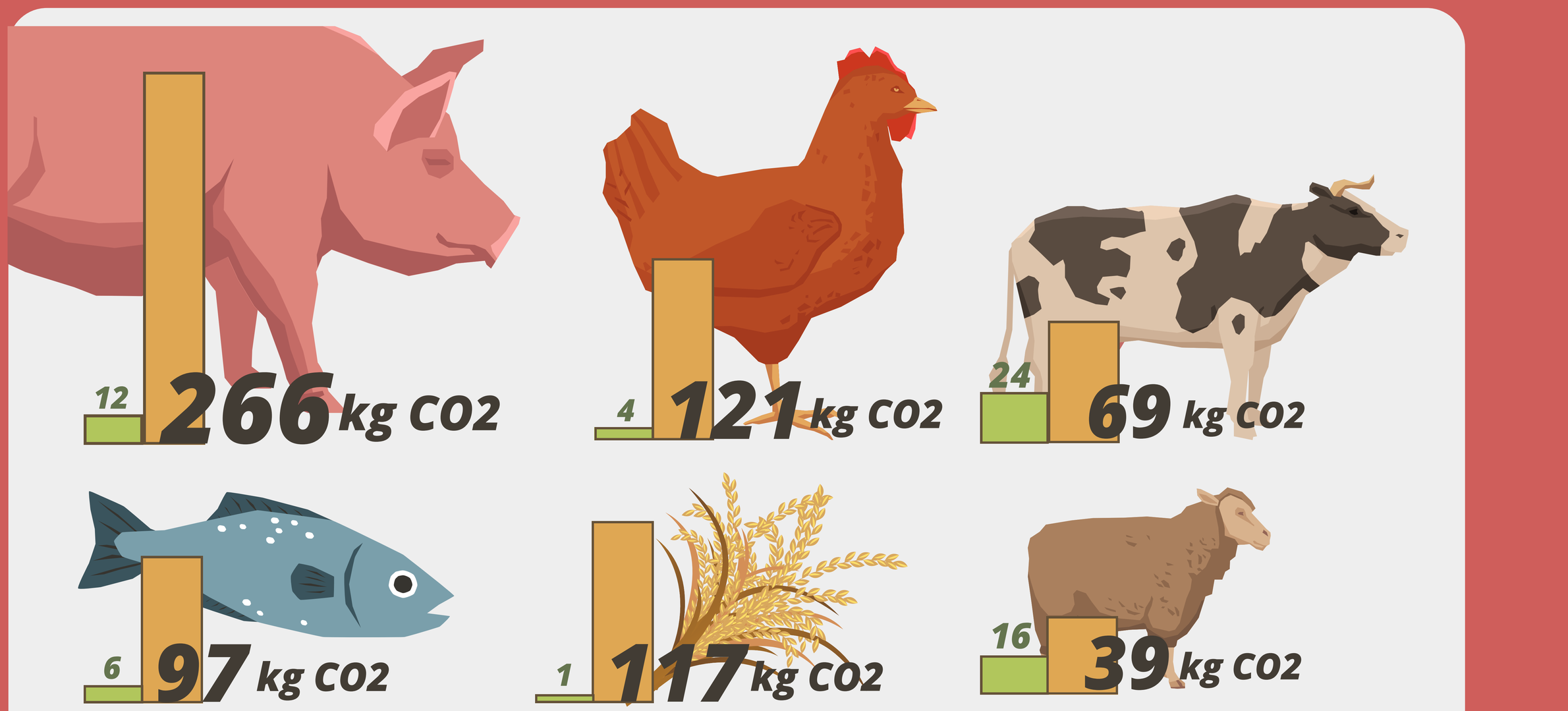
2. STRICTER ENFORCEMENTS

This can include regulations on energy consumption levels for various devices sold in the market.

FOOD CHOICES

Food decisions are important in determining the size of your carbon footprint.

Singapore is a bit different from other countries as we rely heavily on imported food. This means that the distance and type of transportation adds to the carbon footprint of producing the food.



A detailed analysis of the carbon footprint in 2019 showed that red meat – beef, mutton and pork – were the most carbon intensive foods by kilo. However, Singaporeans eat very little mutton and beef. Looking at the annual emissions by food type, pork generates the most emissions. It's useful to note that a significant proportion of those emissions are due to air transportation.

ACTIONS

For individuals:

1. REDUCE FOOD WASTE

When food is wasted, not only are the resources used in its production wasted, but the greenhouse gas emissions from the decomposing food contribute to climate change.

2. CONSIDER A PLANT-BASED DIET OR REDUCING MEAT CONSUMPTION

3. SUPPORT LOCAL AND SUSTAINABLE FOOD SOURCES

Doing so can help reduce the carbon footprint associated with transportation and support local economies.

What others need to do:

1. IMPROVE TRANSPARENCY

Companies need to provide transparent information about the environmental impact of products. This helps consumers make informed choices and encourage more sustainable consumption habits.

2. ENHANCE INDUSTRY PRACTICES

Industry practices need to prioritise sourcing from sustainable and environmentally responsible suppliers, such as those that use ethical and sustainable farming practices and minimise water and energy usage.

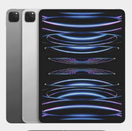
CONSUMER CHOICES

CARBON FOOTPRINT OF PRODUCING ELECTRONIC DEVICES (KG CO2)

544KG
Studio Display

381KG
Thinkpad E15 2nd Gen

300KG
16-inch Macbook Pro



135KG
12.9 inch iPad Pro, 6th Gen

73KG
iPhone 14 Pro Max

59KG
Samsung Galaxy S23+

56KG
Apple Watch Ultra

43KG
Apple TV 4K, 3rd Gen

Monitors, laptops, tablets and phones generate carbon emissions throughout their lifecycle from pre-manufacture to manufacture, transportation, use and end-of-life.

Size and type of device matters more for footprints than the brand you choose. Larger devices have a larger carbon footprint.

Consumer electronics are not required to display an energy efficiency label. Consumers may find it difficult to compare the carbon footprint of items.

Choosing a smaller display, skipping a phone upgrade, and repairing rather than replacing devices will all contribute to reducing your carbon footprint.

CLOTHES

Many overlook the impact clothes have on our carbon footprint. Many small purchases add up quickly.

The fashion industry generates **2-8%** of global total emissions, hence our choice of clothing has an enormous impact!

Approximately half of fast-fashion is produced with synthetic materials derived from fossil fuels. Even natural materials have major carbon footprints. Cotton production alone uses *3.3 million acres of land* and *16 billion cubic meters of water* every year.

Buying fewer items of clothing, wearing them for longer, renting and exchanging clothes all help to reduce emissions as well as save some money.

Some brands have started to report the carbon footprint of their products. Buying brands that are making an effort to reduce emissions sends a signal to companies that consumers care.

Average Trainers
14KG
in materials and manufacturing

Adidas x AllBirds
2.94KG
in materials and manufacturing

Levi's 501 Jeans
14.5KG
in materials and manufacturing

Nudie Jeans
7.1KG
in materials and manufacturing

HOW MUCH DOES RECYCLING HELP?

Recycling should be thought of in terms of the ***whole lifecycle of the material***. Recycling materials such as aluminium reduces more carbon emissions, as producing recycled aluminium emits far less carbon emissions than producing new aluminium. In Singapore, waste is incinerated. Recycling also helps to ***reduce the amount of emissions produced by incineration***.

Material	*GHG from new production*	*GHG from recycled production*	*Difference (%)*
Steel	*2.4*	*0.3*	*97*
Aluminium	*11.0*	*0.4*	*96*
Glass	*0.9*	*0.5*	*41*
Plastic	*2.1*	*1.3*	*37*
Paper	*1.1*	*0.7*	*37*
Organic Waste	*0.07*	*0.05*	*27*

HOW MUCH DOES RECYCLING REDUCE EMISSIONS?

ALUMINIUM CANS ●●●●●

TEXTILES & FOOTWEAR ●●●○○

CAR TIRES ●●○○○

PAPER ●●○○○

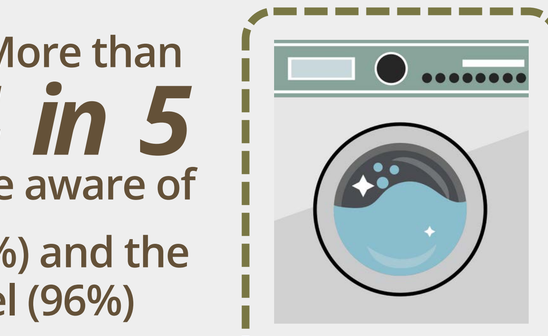
GLASS ●○○○○

Recycling is good for the environment but you might want to take some other actions such as reducing consumption or choosing products made of recycled materials to reduce your carbon footprint.

DO PEOPLE PAY ATTENTION TO ECO-LABELS?

More than ***4 in 5*** are aware of the NEA Energy Label (95%) and the PUB Water Efficiency Label (96%)

However, less than one-third recall seeing the EPEAT (29%) and UL GREENGUARD (22%) labels



49% purchase eco-labelled washing machines

In general, most consumers are willing to accept higher prices of 30% or less for eco-labelled versions of the products:

10% willing to accept prices *80% higher*

51% willing to accept prices *10% higher*

37% willing to accept prices *50-80% higher*

23% willing to accept prices *10-30% higher*

CAN LABELS GUIDE US?

Here are the five most common eco-labels found in Singapore certified by external parties. Many consumer brands also label their own products with sustainability information. In some cases they may work with respected NGOs to increase consumer trust.

Singapore Green Label

UL GREENGUARD

PUB Water Efficiency Label

NEA Energy Label

EPEAT (Electronic Product Environmental Assessment Tool)

What are these labels, and what do they do?

GREEN LABELS IN SINGAPORE

Other common eco-labels found on consumer products indicate that manufacturers are meeting certain environmental standards in production processes. However, they do not indicate low carbon emissions. Hence, consumers are unable to use these as a guide to lower their carbon footprint.

SINGAPORE GREEN LABEL

Type I ecolabel
Verified by third parties based on life cycle considerations

Covers paper products:
Ensures that clearing land for trees is done through sustainable methods such as controlled burning

This label marks products which meet minimum standards for environmental sustainability. There is a special certification process for paper products because of the high environmental impacts of the industry.

UL GREENGUARD

Covers low chemical emission products:

Helps demonstrate compliance with key chemical emission standards and commitment to healthier indoor environments. The Gold Certification means products emit even lower levels, and incorporate a really low level of formaldehyde emissions.

EPEAT (ELECTRONIC PRODUCT ENVIRONMENTAL ASSESSMENT TOOL)

Type I ecolabel
Verified by third parties based on life cycle considerations

Covers products from the technology sector:

Ensures veracity of EPEAT-registered products through a surveillance process known as Continuous Monitoring, which tests the ability of Participating Manufacturers to prove conformance with EPEAT criteria on an ongoing basis

This label has a ***bronze / silver / gold rating*** system, where 23 required environmental criteria must be met to qualify as bronze. Some criteria include the identification and removal of parts containing hazardous materials, and the use of at least 65% reusable or recyclable materials.

EPEAT is primarily overseen by an unpaid board of advisors consisting of environmental advocates, manufacturers, institutional purchasers, researchers, government policy staff members and electronics recyclers.

INFO BITE: GREEN LABELLING / MARK SCHEME

The Green Mark certification scheme was launched in Singapore in January 2005. It is a green building rating system designed to evaluate a building's environmental impact and performance.

Who can apply? Developers, building owners and government agencies for new and existing buildings, districts, parks, infrastructure and building interiors.

What are the key criteria? Climatic responsive design, building energy performance, resources stewardship, smart and healthy building, advance green efforts.

What are the benefits? Meaningful differentiation of buildings in the market, positive effect on corporate image, reduction in energy, water and material resource usage, reduction in potential environmental impact

ACTIONS

For individuals:

1. BE INFORMED
Understand the metrics and measurements used of carbon labels.

2. LOOK FOR LABELS WITH AN EXTERNAL CERTIFICATION PROCESS

3. SUPPORT COMPANIES WHO TRY
Support companies that transparently display carbon labels. Buy from companies committed to reducing the carbon footprint of all their products and processes.

What the government could do:

1. INCENTIVISE
Offer tax incentives, grants, or subsidies to businesses that adopt environmentally friendly practices and achieve lower carbon emissions.

2. INFORM
Run public awareness campaigns to educate consumers about carbon labels and their significance.

What companies could do:

1. INVEST IN R&D
Invest in research and development to innovate and create low-carbon products and processes.

2. IMPROVE TRANSPARENCY
Track and disclose carbon emissions across a company's supply chain, adopting consistent and transparent accounting practices.

ACKNOWLEDGEMENTS & REFERENCES

1. Department of Statistics - Commuting to work
2. Electric vehicles vs. petrol cars
3. Flight emissions calculator
4. Energy Market Authority Grid Emission Factor - Household electricity use
5. National Environment Agency - Energy saving tips
6. Environmental impact of key food items in Singapore
7. Carbon footprint of electronic devices:
   - Samsung
   - Apple
   - Lenovo
8. How does recycling help the environment
9. Carbon footprint and recycling
10. National Environment Agency - The energy label

RESEARCH AND CONTENT

Dr. Olivia Jensen, Deputy Director, LRF Institute for the Public Understanding of Risk (IPUR)

Dr. Tra Thi Trinh, Research Fellow, IPUR

Jared Ng, Manager, IPUR

Research Assistants
Liang Jun Kang
Huang Taizhe
Neel Rahul Obordo Karve

DESIGN AND COPYEDITING

Jared Ng, Manager, IPUR

Nur Ameera Bte Azman, Research Assistant, IPUR

ipur.nus.edu.sg

Innovation 4.0 3 Research Link, #02-07 National University of Singapore
Singapore 117602

NUS National University of Singapore

Lloyd's Register Foundation Institute for the Public Understanding of Risk