

## 7.5 How can we respond to the impacts of climate change?

### 7.5.1 International cooperation

### 7.5.2 Government actions

### 7.5.3 Individual actions

## 7.5 Our responses – How can we respond to the impacts of climate change?

### Summary

This section first introduces the international cooperation in tackling climate change, including two international agreements, the Kyoto Protocol and the Paris Agreement. It will then discuss actions in respect of mitigation, adaptation and resilience, as well as individual actions to combat climate change.

### 7.5.1 International cooperation

The **Intergovernmental Panel on Climate Change (IPCC)** was established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in 1988. On a regular basis, IPCC reviews most up-to-date scientific literature on climate change and prepare assessment reports, providing clear scientific perspectives and objective information to the world, including the scientific bases and causes of climate change, its potential environmental and socio-economic consequences, and the adaptation and mitigation options to respond to the impacts.

The United Nations Framework Convention on Climate Change (UNFCCC) was adopted during the Rio de Janeiro Earth Summit in 1992. It is an international environmental agreement which aims at stabilising the level of atmospheric greenhouse gases in order to prevent dangerous interference to the climate system due to human activities. To achieve this goal, two important international agreements were adopted by the United Nations, namely, **the Kyoto Protocol** in 1997 and **the Paris Agreement** in 2015.

#### **The Kyoto Protocol**

In 1997, the 3<sup>rd</sup> session of the Conference of the Parties (COP 3) of UNFCCC took place in Kyoto, Japan and adopted the Kyoto Protocol. But the Protocol did not enter into force until 2005.

The Kyoto Protocol recognizes **the principle of “common but differentiated responsibilities”**, meaning that combating climate change is a responsibility commonly shared by all nations. However, since more developed countries<sup>1</sup> are principally responsible for the current high levels of atmospheric greenhouse gases as a result of more than a hundred years of industrial activity, the Protocol places a heavier burden on more developed countries than less developed countries<sup>2</sup> in emission reduction.

A **top-down approach** was adopted in negotiating the emission reduction targets among the more developed countries. It is difficult to implement the agreement because each country has to consider its own circumstances and economic interests.

The emission reduction commitment period of the Kyoto Protocol was 2008 - 2012. The European Union and 37 more developed countries<sup>3</sup> **pledged to reduce at least 5% greenhouse gas emissions against 1990 levels.**

In 2012, the Doha Amendment to Kyoto Protocol was adopted at the 18<sup>th</sup> session of the Conference of the Parties (COP 18) of UNFCCC. **The 2<sup>nd</sup> commitment period of 2013 - 2020 was adopted. Relevant Parties pledged to reduce their greenhouse gas emissions by at least 18% against 1990 levels.**

### Effectiveness of the Kyoto Protocol

There are criticisms of the effectiveness of the Kyoto Protocol, citing **the lack of participation of some more developed countries.** For example, the United States in 2001 declared that it had no intention of implementing the Kyoto Protocol, and Canada formally withdrew in 2012.

During the 1<sup>st</sup> commitment period from 2008 to 2012, **some more developed countries achieved the emission reduction targets while some did not.**

Party	Committed emission reduction <sup>i</sup> (relative to 1990 levels)	Actual emissions <sup>ii</sup> (average value from 2008 to 2012)	Target achieved
European Union (15 countries)	-8%	-18%	√
Japan	-6%	4%	X
Canada	-6%	24%	X
Croatia	-5%	-15%	√
New Zealand	0%	38%	X
Russia	0%	-50%	√

**Table 5.1** Emission reduction pledges for the 1<sup>st</sup> commitment period and actual emissions of some countries

Other criticisms are directed towards the principle of “common but differentiated responsibilities”. Under this principle, **less developed countries are not required to share the responsibility of emission reduction.** However, **increased emissions from less developed countries have offset the reductions made by more developed countries.**

1 Teachers reference: Referred as Developed Countries by UNFCCC

2 Teachers reference: Referred as Developing Countries by UNFCCC

3 Teachers reference: Referred as Industrialized Countries by UNFCCC

## The Paris Agreement<sup>iii</sup>

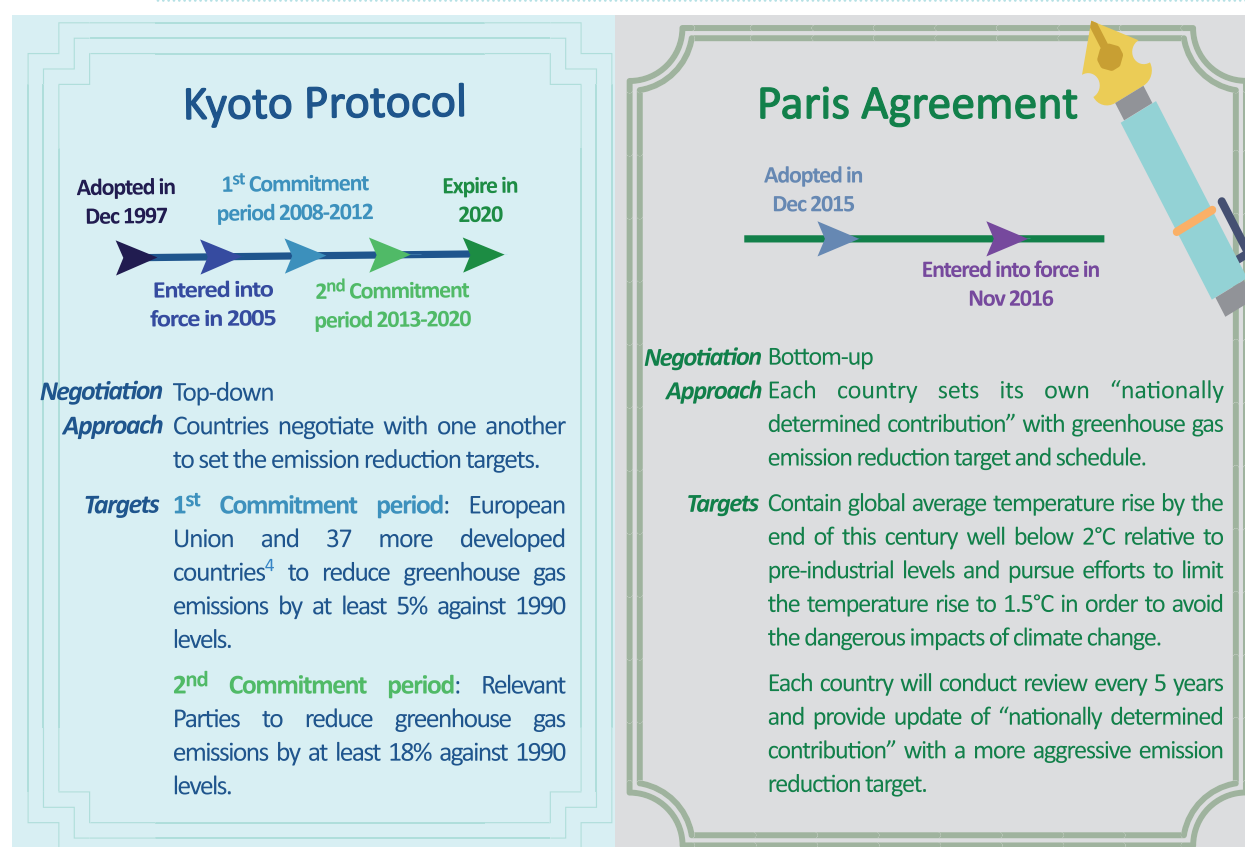
In 2015, the 21<sup>st</sup> session of the Conference of the Parties (COP21) of UNFCCC took place in Paris, France and adopted the Paris Agreement.

The main goal of the Paris Agreement is to **contain global average temperature rise by the end of this century well below 2°C relative to pre-industrial levels and to pursue efforts to limit the temperature rise to 1.5°C** in order to avoid the dangerous impacts of climate change. The Paris Agreement entered into force in November 2016 and was later ratified by 181<sup>iv</sup> Parties as of September 2018.

Unlike the Kyoto Protocol, the negotiation in the Paris Agreement was based on **a bottom-up approach**. Each country compiles its own **“nationally determined contribution”** with greenhouse gas emission reduction target and schedule according to its national circumstances. Each country will conduct review every 5 years and provide update of “nationally determined contribution” with **a more aggressive emission reduction target**. Since the countries determine their own emission reduction targets, it is easier to implement the agreement.

Party	Emission reduction target
China	Peak of carbon dioxide emissions at around 2030. Pursue to advance the peak. Carbon intensity in 2030 lower than the 2005 level by 60-65%.
Japan	Carbon emissions in 2030 lower than the 2013 level by 26%.
European Union	Carbon emissions in 2030 lower than the 1990 level by at least 40%.
India	Carbon intensity in 2030 lower than the 2005 level by 33-35%.

**Table 5.2** Emission reduction targets of some Parties<sup>v</sup>



**Fig 5.1** Comparison of the Kyoto Protocol and the Paris Agreement

<sup>4</sup> Teachers reference: Referred as Industrialized Countries by UNFCCC



### Special Report on Global Warming of 1.5°C

In response to one of the decisions made at COP21, the IPCC published the Special Report on Global Warming of 1.5°C in October 2018. The Special Report makes an urgent call for policymakers that limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society. The Special Report clearly presents the multiple benefits of limiting global warming to 1.5°C compared to 2°C, for example,

1. a slower rate of sea level rise which enables greater opportunities for adaptation in the human and ecological systems of small islands, low-lying coastal areas and deltas;
2. lower impact on terrestrial, freshwater and coastal ecosystems which helps retain more of their services to human;
3. lower ocean warming and acidification and hence lower risks to marine biodiversity and ecosystems;
4. lower climate-related risks to health, food security, water supply, human security and economic growth; and
5. lower adaptation needs.

Human activities have already caused approximately 1°C of global warming above pre-industrial levels and we are already seeing the consequences of global warming through more extreme weather, rising sea levels and diminishing Arctic sea ice. To contain global warming to 1.5°C, human-caused carbon emissions have to decline by about 40% from 2010 levels by 2030, reaching net zero around 2050. Current national pledges of emission reductions under the Paris Agreement would not suffice to achieve the goal. The goal can only be achieved if global carbon emissions start to decline well before 2030. Based on the “nationally determined contributions” for reductions in greenhouse gas emissions made by the countries at the Paris Agreement, a global warming of around 3°C would be more likely by the end of this century.

#### 7.5.2 Government actions

Each country has to implement emission reduction measures according to its “nationally determined contribution” in order to **mitigate** climate change. At the same time, the country also has to be prepared to **adapt** to impacts of climate change and to strengthen **resilience**.

Mitigation	Adaptation	Resilience
Reduce greenhouse gas emissions or remove greenhouse gases from the atmosphere.	Reduce the impacts of climate change.	Cope with and absorb climate change related stresses. Maintain public services and socio-economic functions.

**Fig 5.2** Three key aspects in responses to climate change

## Mitigation

### (a) Replace fossil fuels with renewable energy

Reduce the use of fossil fuels. Increase the share of solar power, wind power and hydro-electric power in the energy mix.



**Fig 5.3a Solar panels**

Source: American Public Power Association<sup>vi</sup>



**Fig 5.3b Hydroelectric dams**

Source: American Public Power Association<sup>vii</sup>

### (b) Improve energy efficiency

Improve energy efficiency. For example, use energy efficient electrical appliances and fuel-efficient vehicles, install intelligent energy saving systems in buildings.

### (c) Improve transportation systems

Encourage the public to use public transportation, cycle or walk. Promote the use of electric or hybrid vehicles.

### (d) Improve waste management

Develop waste-to-energy technologies, which can manage urban waste efficiently and reduce reliance on fossil fuels.

### (e) Afforestation and urban greening

Afforestation increases carbon sinks<sup>5</sup>. Roof greening or vertical greening on buildings have cooling effects and therefore can reduce energy consumption of air conditioners. They can also alleviate the urban heat island effect by reducing heat absorbed by building surfaces.



**Fig 5.4 Building with vertical greening<sup>viii</sup>**

### (f) Carbon capture and storage

Scientists have been developing technology to capture atmospheric carbon dioxide and store it underground or in deep ocean for long term, or store it in biomass. Most of the technologies are still at their infancy and not ready for large-scale deployment.

<sup>5</sup> Any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere


 **Adaptation****(a) Coastal and drainage projects**

Coastal protection structures: **Raise the height of seawalls** or **build sluices** (flood gates) to guard against extreme water level caused by storms.

River channel improvement: **Enhance the drainage capacity of channels.**


Drainage system planning: Design **new drainage systems** according to flood prevention strategies and **improve existing systems**; keep the drainage systems in good shape and perform preventative maintenance.

Sluice in Holland:  
Maeslant Barrier

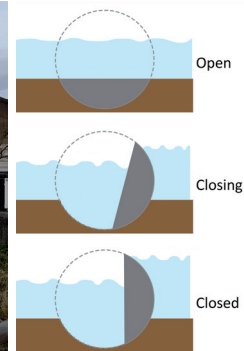


More information

Video of  
Maeslant Barrier



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**Fig 5.5 Coastal protections in Japan**Source: Pekachu<sup>ix</sup>**Fig 5.6a Thames Barrier, sluice in River Thames, England**Source: Kleon3<sup>xi</sup>**Fig 5.6b Operation of Thames Barrier<sup>x</sup>****(b) Building design**

**Highly reflective materials** can reflect more sunlight, reducing the energy absorbed by buildings. **Flood resilient houses or floating houses** can reduce the losses of life and property.

**Fig 5.7 Flood resilient house**Source: Infrogmat<sup>xii</sup>

An architectural firm in Holland designed floating facilities such as floating house, restaurant, hotel and golf course to adapt to climate change

**(c) Land use planning**

A better land use planning can **avoid building important infrastructure** like hospitals in high-risk areas such as coastal areas and slopes.

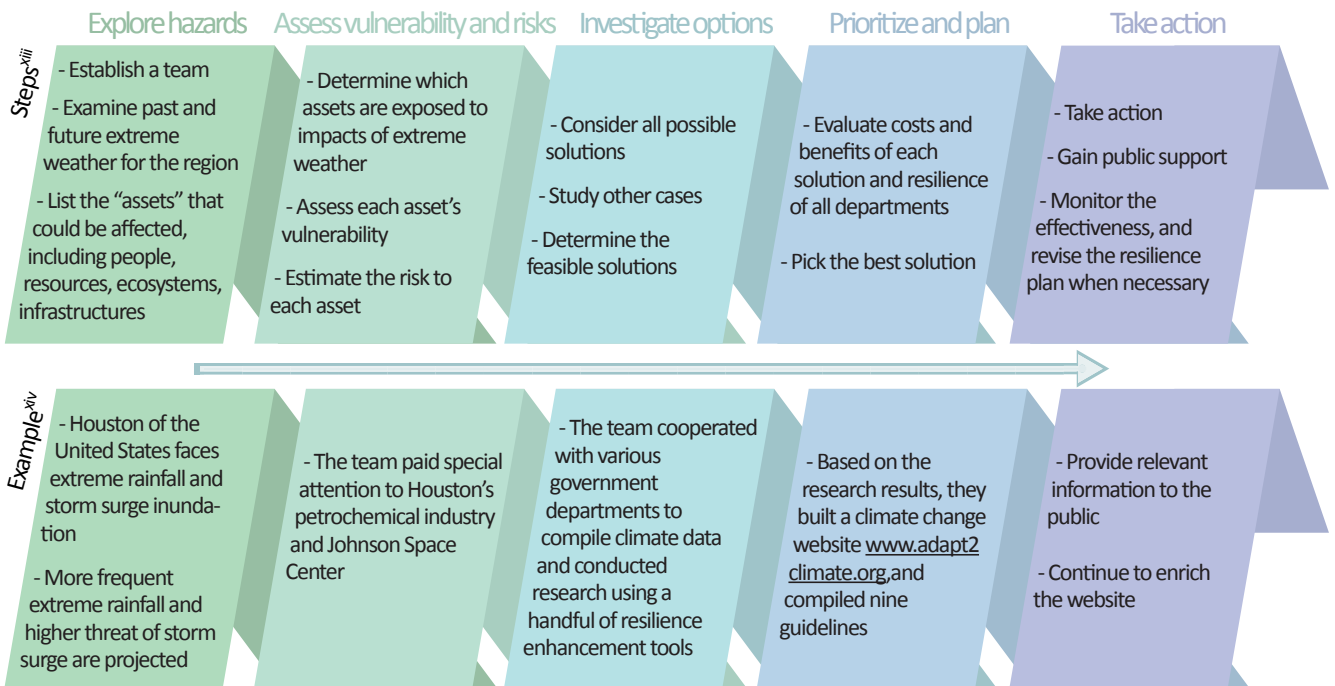
**Buffer zones** like parks, waterfront promenade should be constructed in high-risk areas to **replace high-density development**. River revitalization and roof greening can alleviate the urban heat island effect effectively.

**(d) Food supplies**

Breeding new crops which are more **resistant to high temperature and drought.**

**Resilience**

By strengthening climate resilience, we can cope with the stress brought by climate change. Table 5.3 shows the steps of strengthening climate resilience suggested by the US National Oceanic and Atmospheric Administration.



**Table 5.3 Five steps and an example of resilience enhancement**



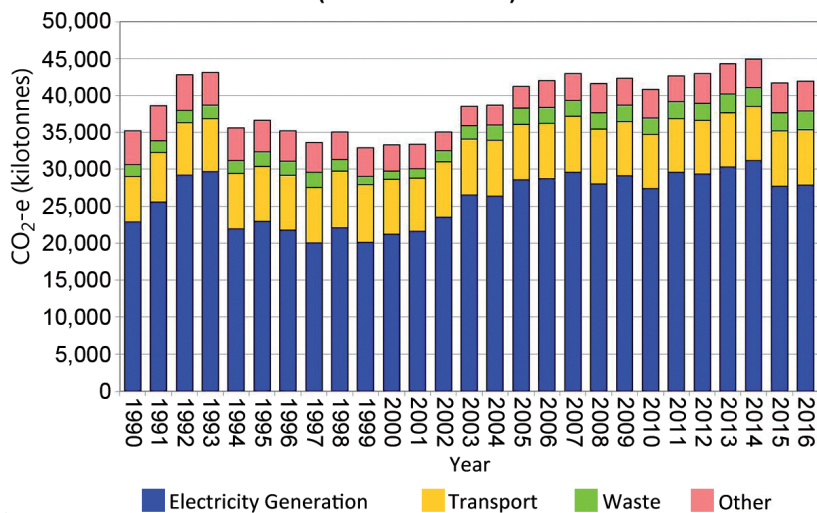
**Fig 5.8 Houston, U.S. faces extreme rainfall and storm surge inundation**

Source: Michael Slaten<sup>xv</sup>

### Case study: Hong Kong (City level)

As Fig 5.9 shows, Hong Kong's total greenhouse gas emissions in 2014 amounted to about 45,000 kilotonnes<sup>xvi</sup> of carbon dioxide equivalent (CO<sub>2</sub>-e)<sup>6</sup>, accounting for less than one thousandth of global emissions. However, **per capita greenhouse gas emissions in Hong Kong were about 6.2 tonnes<sup>xvii</sup> CO<sub>2</sub>-e**, close to the global per capita emissions of 7.3 tonnes<sup>xviii,xix</sup>CO<sub>2</sub>-e.

**Trend of greenhouse gas emissions in Hong Kong (1990 to 2016)**



**Fig 5.9 Trend of greenhouse gas emissions in Hong Kong<sup>xx</sup>**

Source: Hong Kong Environmental Protection Department<sup>xx</sup>

Hong Kong government released “Hong Kong’s Climate Action Plan 2030+<sup>xxi</sup>” in 2017. It sets a target to reduce carbon intensity by 65 - 70% by 2030 against the 2005 level. To achieve this goal and combat climate change, Hong Kong also takes actions in the three aspects: **mitigation**, **adaptation** and **resilience**.

### Mitigation

#### (a) Manage energy demand

Reduce energy intensity<sup>7</sup> by 40% by 2025 using 2005 as the base.

#### (b) Adopt renewable energy

Use more renewable energy. It is estimated that between now and 2030, about 3 - 4% of energy required by Hong Kong can be generated from wind, solar and waste-to-energy technologies.

#### (c) Improve transport system

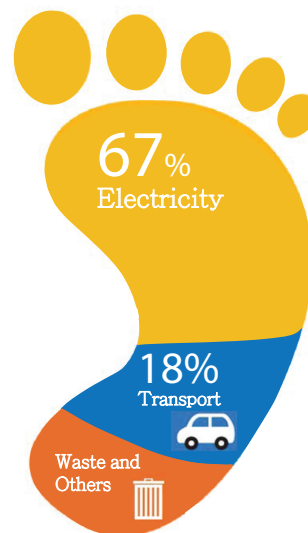
Railway serving as the backbone of low-carbon public transport.

Control the growth of private cars.

Promote walking and cycling to reduce carbon emissions from road transport.

<sup>6</sup> Carbon dioxide equivalent: Commonly adopted in carbon audits to evaluate the warming effect of various greenhouse gases with reference to carbon dioxide

<sup>7</sup> Energy demand per unit of economic output



**Fig 5.10 Greenhouse gas emissions in Hong Kong**

Source: Environmental Bureau

Greenhouse Gas Emissions and Carbon Intensity in Hong Kong



More information

Emissions Gap Report 2015



More information

Concise Report on the World Population in 2014



More information



## Adaptation

### (a) Improve infrastructure

Strengthen slope safety.

Integrate drainage and flood management plans. Intercept, store and discharge stormwater more efficiently.

Carry out coastal protection works to reduce the impacts of sea level rise.

### (b) Improve town planning

Improve urban thermal comfort and ventilation.

Strengthen urban fabric and develop smart city to better prepare for climate change.

### (c) Increase water resources

Conduct study on increasing water resources, including desalinated water, reclaimed water, recycled grey water and harvested rainwater.

### (d) Protect ecosystems

Promote sustainable agriculture and fisheries.

Enhance country parks.

Enhance biodiversity in urban environment.

Hong Kong West  
Drainage Tunnel



More information



#### What is reclaimed water?

Reclaimed water is highly treated wastewater.



#### What is grey water?

Water collected from baths, showers, wash basins, kitchen sinks and laundry machines etc. is known as grey water. Along with harvested rainwater, the grey water can be treated and reused for non-potable purposes such as toilet flushing.

## Resilience

### (a) Be prepared for emergencies

Enhance emergency information sharing and support mechanism for dealing with hazards.

Improve mechanisms of decision-making and coordination in emergency response.

### (b) Raise community awareness of climate change

The government collaborates with commercial, professional, academic and community bodies to organise workshops and activities pertaining to climate change.

The Hong Kong Observatory (HKO) studies and makes long-term projections about climate change impacts in Hong Kong, and provides such information through its website. HKO also organises regular school and public talks, as well as other public education activities to promote the understanding of climate change.

### 7.5.3 Individual actions

Just as mankind has played an undeniable role in bringing about climate change, every one of us has an inescapable responsibility in mitigating the impact so caused. Whatever the governments of this world pledged in the Paris Agreement, **ultimately it is down to us as citizens of the planet to achieve the targets set through a change in mindset, lifestyle and consumption behaviour.**

To achieve the low-carbon target, we can start from daily life and develop habits to reduce carbon emissions.



#### Clothing

- Choose energy efficient washing machine.
- Run washing machines or dishwashers with a full load.
- Choose a washing machine that meets your household's needs.
- Hang-dry washed clothes in an outdoor area, whenever possible.
- Line dry clothes, dry with cold air, or remove clothes promptly from the dryer to keep wrinkles to a minimum.
- Wash clothes in cold water.



#### Food

- Prepare a shopping list before buying so as to avoid purchasing more than needed.
- Buy family-sized product with less packaging if possible.
- Allow hot/ warm food to cool down to room temperature before putting it in the refrigerator.
- Avoid setting the refrigerator temperature unnecessarily low.
- Leave enough space between refrigerators and the walls or cabinets so air can circulate around the condenser coils. Trapped heat increases energy consumption.
- Bring your own container for drinks and food.
- Cut down on take-away food which usually uses non-recyclable materials.
- Use durable tableware instead of disposable ones such as foam container, plastic cutlery, paper cup and wooden chopsticks.
- Buy drinks contained in plastic or glass bottles which can be recycled.
- Avoid buying tetra pack drinks which do not have recyclable outlets locally cannot be recycled.
- Buy fresh local food which consumes less energy and hence less pollution.
- Bring the items purchased earlier to the front (first-in-first-out system).
- Consume food close to expiry date first.
- Store food in accordance with the instructions on the packaging.
- Reuse food trimmings/ surplus portions for second dish recipe.
- Separate food waste to facilitate recycling.
- Eat what you can consume comfortably by ordering the right portion and number of dishes.
- Donate surplus festive food or gift packs to the needy.



### Living

- Purchase energy-efficient electrical appliances (with energy labels).
- Use energy efficient light bulbs (such as compact fluorescent lamps (CFLs)).
- Set your air-conditioners at 24-26°C.
- Turn off electrical appliances when they are not in use.
- Avoid leaving electrical appliances on standby mode.
- Install a low-flow shower-head and take a quick shower.
- Turn off the lights in any room which are not using.
- Use fans instead of room coolers as far as possible.
- Clean the filters of room coolers regularly.
- Keep the windows and doors closed when the room cooler is turned on and use curtains or blinds to shade against sunlight.
- Avoid putting the refrigerator near a heat source - an oven, the dishwasher or direct sunlight from a window.
- Bring your own bags to reduce consumption of plastic shopping bags.
- Adopt simple packaging and minimise gift wrapping to avoid wastage of resources.
- Choose more durable products. Think twice before shopping to avoid purchasing unnecessary items and cause wastage.
- Donate unwanted gifts to the needy through charitable organisations.
- Separate all recyclable materials, such as metals, plastics, waste paper and other recyclables from waste stream and put them in recycling bins to facilitate recycling.



### Travelling

- Use public transportation.
- Drive less.
- Plan and schedule the route wisely.
- Switch off idling engines.
- Drive at proper speed.
- Keep your vehicle well maintained.
- Maintain proper tire pressure.
- Buy fuel-efficient vehicle (such as electric or hybrids vehicles).
- Share your car with others.
- Use stairways instead of lift.

**Fig 5.11** Ways to reduce carbon emissions<sup>xxii</sup>