Climate Change

Index

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Foreword

The notion of water sustainability underpins the key messages that we want to convey to the readers through the Water Resources Information Portal. In order to help spotlight the significance of achieving water sustainability goals in our city, we would need to refer to, briefly, two inter-connected conceptual-cum-policy frameworks that are perched, respectively, at the global and the national levels.

The essence of the global agenda on water sustainability has been crystallized in Sustainable Development Goal #6 (SDG #6). Asides from highlighting the centrality of ensuring access to clean water and sanitation for all, the multiple sub-goals of SDG #6 remind us that managing the world's water resources in a sustainable manner will yield substantial cross-sectoral benefits. Conserving water at the city and the country scale, through policy measures and behavioural changes, could help protect global biodiversity as well as mitigate greenhouse gases emissions' impact on the global climate system.

The country's national agenda on water sustainability, on the other hand, has been articulated in the 14th Five-Year Plan for Water Security, promulgated in 2021 by the National Development and Reform Commission (NDRC). One of the NDRC Plan's guiding principles accords a higher degree of preference to demand management measures (i.e., water conservation) than the conventional supply augmentation approach. The NDRC Plan also, for instance, prioritizes, for municipal water managers' attention, the reduction of water losses emanating from the water supply networks under their charge. Moreover, in line with the spirit and the letter of the national goal of building an ecological civilization, the Plan accentuates the importance of incorporating the safeguarding of freshwater biodiversity into sustainable water resources management practices at the national, provincial and municipal scale.

Translating the aforementioned goals of the global and national agendas on water sustainability into impactful local actions is a challenging task. The difficulty stems from a relatively low degree of water literacy detected among the general public. Water literacy goes beyond people's knowledge of water issues; it also entails their attitudes toward water conservation ethics and their ability to appreciate and enact meaningful changes in their own water usage behaviour. Early empirical evidence, however, suggests that the mastery of water literacy amongst our community's diverse social groups is wanting. Against this backdrop, the Water Resources Information Portal has thus been created by the Centre for Water Technology and Policy to help nurture a water-literate community in our city.

Our efforts in assembling the Information Portal are guided by one fundamental belief: Embracing a river basin-oriented perspective is essential for us to comprehend the challenges in, and opportunities for, managing water resources sustainably in the 21st century. Through imparting individuals with essential water knowledge and encouraging them to consider water resources management matters from a river basin angle, we aim at broadening our community's collective understanding and sharpening their vision for managing water resources in a sustainable manner. This approach, fully aligned with the global and national water sustainability agendas, aspires to foster an active participation of Hong Kong people from all walks of life in the global water stewardship project.

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1. Water-energy-climate nexus

The importance of sustainable management of water resources in advancing the climate agenda was officially recognized and included in the agenda of the United Nations Climate Change Conference in 2022 (COP27). This acknowledgment highlights the linkages between water use, energy, and carbon emissions.

Greenhouse gases emissions

1.1 What are greenhouse gases?

Greenhouse gases are gaseous matters that trap heat near the earth's surface, contributing to the greenhouse effect. Major greenhouse gases include carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and fluorinated gases.

1.2 What are the main sources of greenhouse gases emissions?

Some major contributors to greenhouse gases emissions include:

i. Burning of fossil fuels, such as coal, oil and natural gas for energy.
ii. Industrial processes, such as the production of steel and aluminium.
iii. Agriculture practices, including livestock farming and commercial cultivation.

Deforestation also reduces the planet's capacity to naturally remove CO_2 from the atmosphere, thus resulting in an increase in the concentration of CO_2.

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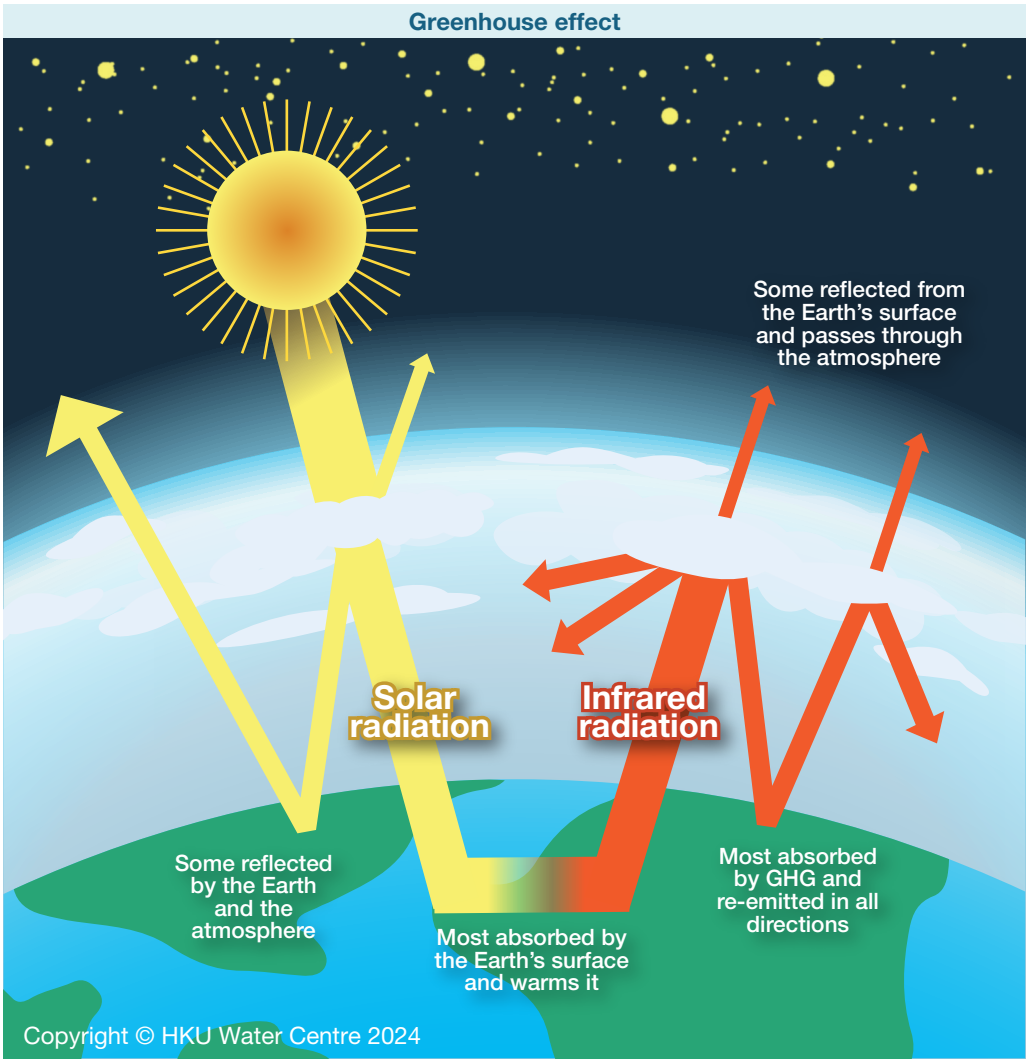
1.3 What is the “greenhouse effect”?

The greenhouse effect is a natural process where greenhouse gases in the Earth’s atmosphere trap the heat emitted by the sun, thus keeping the planet warm and habitable.

However, human activities, particularly the burning of fossil fuels, have led to the release of substantial amount of greenhouse gases, which has exacerbated the greenhouse effect and led to climate change.



1.4 What is climate change?

Climate change refers to the long-term alterations of global or regional climate patterns. Its manifestations include rising earth surface temperatures, changing precipitation patterns, sea-level rise and an increased frequency of extreme weather events.

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1.5 What are the impacts of climate change?

Climate change can lead to a range of impacts on both human and the environment, including:

i. Changes in precipitation patterns, leading to droughts in some regions and increased precipitation in others.
ii. Changes in weather conditions, which affect plant and animal species, migration patterns and overall biodiversity.
iii. Increased frequency and intensity of extreme weather events.
iv. Shrinking icesheets and rising sea-levels, which pose threats to coastal areas and low-lying islands.

Impacts of climate change

1.6 In what ways is water associated with climate change?

Electricity is used to fuel the various aspects of tap water production, including water treatment, distribution, pumping, and sewage treatment.

However, an increased consumption of electricity, which is often generated by the burning of fossil fuels, would intensify the greenhouse effect.

At the same time, climate change would disrupt the normal processes of the natural water cycle, which then leads to adverse impacts on freshwater ecosystem health.

These interconnectednesses underscore the imperative for us to embrace sustainable water resources management practices so that we can mitigate the adverse impacts of climate change on the water cycle.

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Water use and energy consumption

1.7 Does water use produce greenhouse gases?

Water use by itself does not directly produce greenhouse gases. However, the processes associated with tap water production and consumption—such as water treatment, distribution, pumping, and sewage treatment—often require electricity.

The generation of electricity, especially if it is derived from burning fossil fuels, would produce greenhouse gases emissions.

Therefore, while water use per se is not a direct emitter of greenhouse gases, it is crucial for us to consider the energy implications of using water.

1.8 How much greenhouse gases emissions are associated with tap-water production in Hong Kong?

Tap-water production refers to the process of turning raw water into potable water. In 2022/23, greenhouse gases emissions associated with tap-water production was equivalent to 0.437 kg CO_2/m^3.

Considering that total freshwater consumption in Hong Kong in 2022/23 reached 1,066,000,000 m^3, the amount of greenhouse gases emissions associated with water use was estimated to hit 465,842 tonnes of CO_2 equivalent (CO_2 e).

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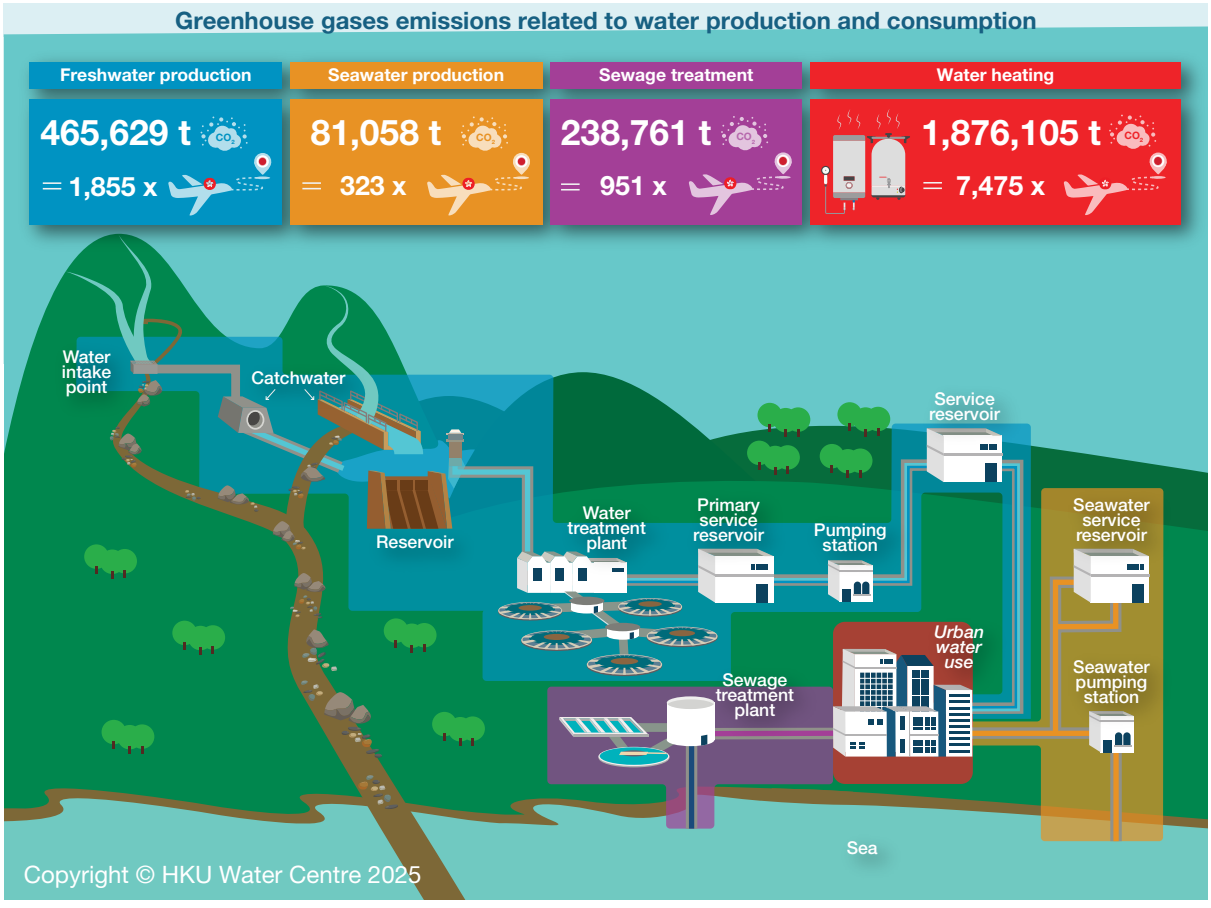
1.9 How much greenhouse gases emissions are associated with water production and consumption in Hong Kong?

Water production and consumption have indirectly generated greenhouse gases emissions in three ways: Potable water production, seawater production, and sewage treatment.

Potable water production:
In 2022/23, 465,629 tonnes of CO_2 e of greenhouse gases emissions were generated. This amount is equivalent to the emissions produced by 1,855 return flights from Hong Kong to Tokyo.

Seawater production:
In 2022/23, 81,058 tonnes of CO_2 e of greenhouse gases emissions were recorded. This figure is equivalent to the emissions produced by 323 return flights from Hong Kong to Tokyo.

Sewage treatment:
In 2022/23, 238,761 tonnes of CO_2 e of greenhouse gases emissions were registered. This amount is , equivalent to the emissions produced by 951 return flights from Hong Kong to Tokyo.



1.10 How much greenhouse gases emissions are generated by domestic water heating?

In 2022/23, domestic water heating generated 1,876,105 tonnes of CO_2 e of greenhouse gases emissions. This figure is equivalent to the emissions produced by 7,475 roundtrip flights from Hong Kong to Tokyo.

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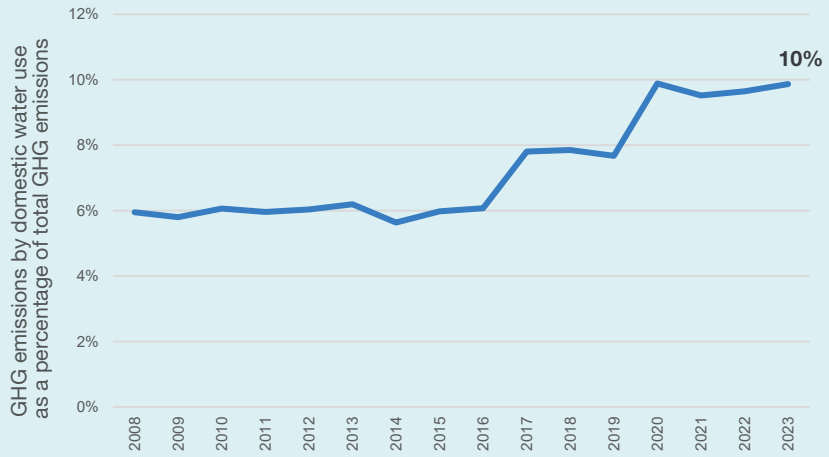
1.11 What proportion of Hong Kong's total greenhouse gases emissions is attributed to domestic freshwater consumption?

In 2022/23, 3,464,950 tonnes of CO_2 e of greenhouse gases emissions are associated with domestic water consumption. Domestic freshwater consumption accounted for 10% of the city's total greenhouse gases emissions in that year.

Greenhouse gases emissions by domestic water use as a percentage of total GHG emissions, 2008-2023



Source: Census and Statistics Department, 2025; Drainage Services Department, 2013-2024; Electrical and Mechanical Services Department, 2008-2024; Environmental Protection Department and Electrical and Mechanical Services Department, 2010; and Water Supplies Department, 2008-2024

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Water and energy consumption

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