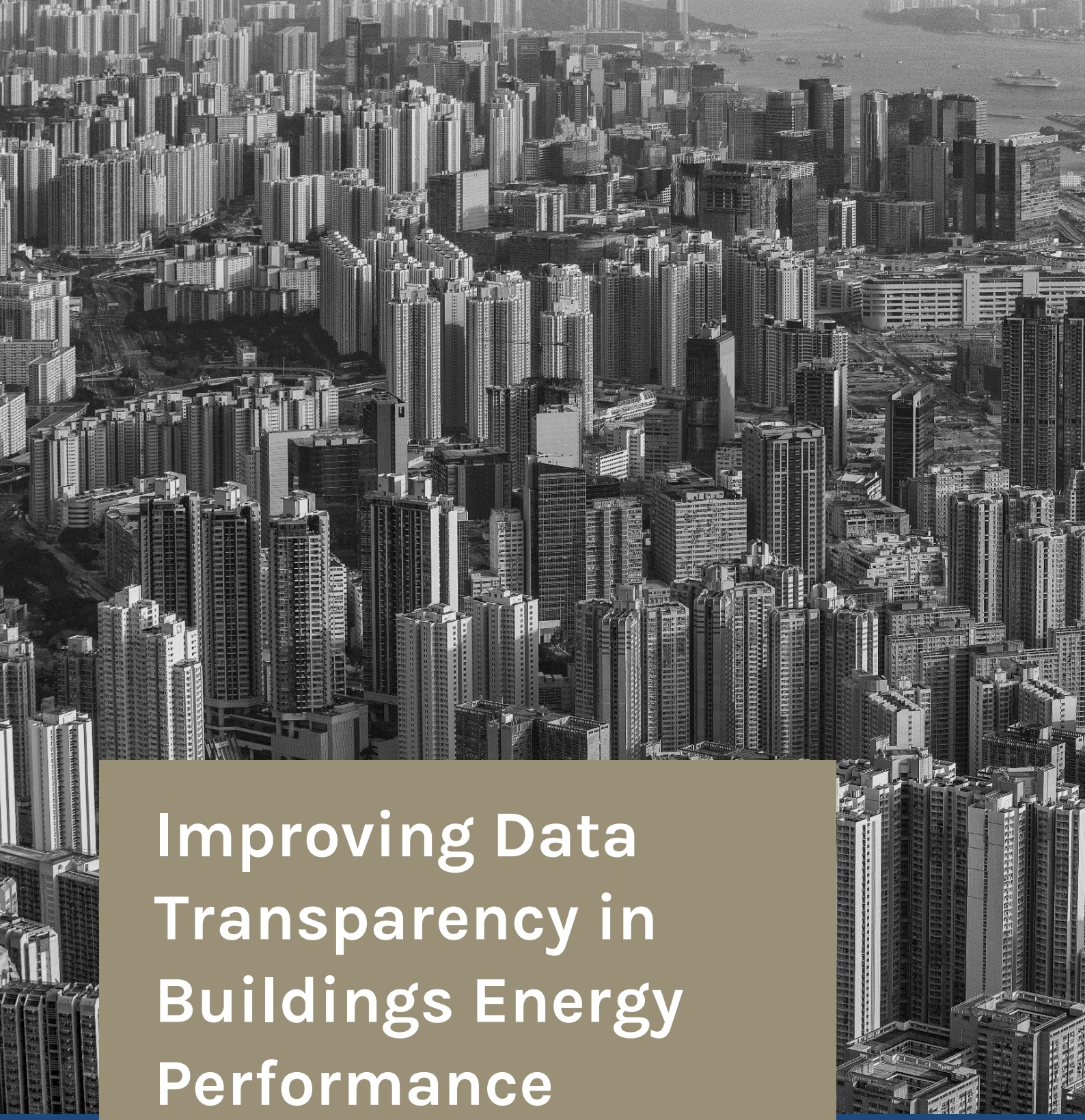

Improving Data Transparency in Buildings Energy Performance

March 2020

BUSINESS ENVIRONMENT COUNCIL
商界環保協會

Table of Contents

About BEC

Business Environment Council Limited ("BEC") is an independent, charitable membership organisation, established by the business sector in Hong Kong. Since its establishment in 1992, BEC has been at the forefront of promoting environmental excellence by advocating the uptake of clean technologies and practices which reduce waste, conserve resources, prevent pollution and improve corporate environmental and social responsibility. BEC offers sustainable solutions and professional services covering advisory, research, assessment, training and award programs for government, business and the community, thus enabling environmental protection and contributing to the transition to a low carbon economy.

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EXECUTIVE SUMMARY

Commercial and residential buildings in Hong Kong accounted for **60% of the city's total greenhouse gas emissions** in 2017. While energy consumption data are available at a sector-wide level, there is a **significant lack of data to understand and track the energy performance** of individual buildings or groups of buildings with similar characteristics.

What Benefits Can Data Transparency Bring?

To Policymakers:

- Generate insights from raw data and study the common factors leading to fundamental differences in buildings' energy usage
- Enable performance tracking to evaluate the effectiveness of energy efficiency policies
- Identify and prioritise actions within the buildings sector
- Lay the groundwork for future building energy efficiency related policies

To Others:

- Enable prospective investors to evaluate the environmental performance of buildings
- Enable performance tracking to determine the effectiveness of energy efficiency investments
- Provide robust and reliable information for research purposes
- Understand their relative energy performance compared to a similar group of premises

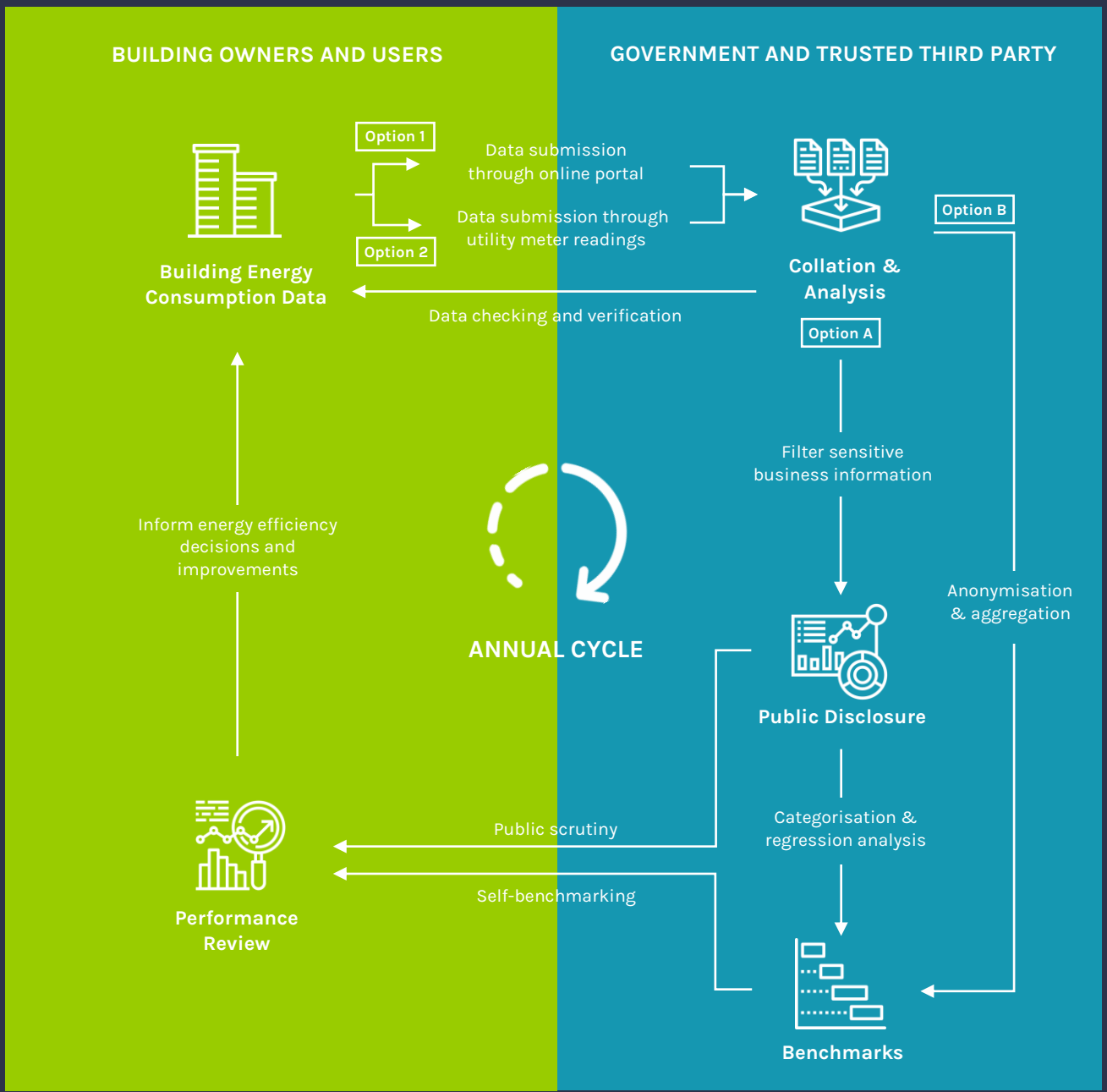
To Building Owners and Managers:

- Enable performance tracking of energy efficiency measures
- Understand their relative energy performance compared to a similar group of buildings
- Encourage business action and build business cases through benchmarking

What Are We Proposing?

A data collection, analysis, benchmarking, and reporting system. The figure below highlights important elements of the system and alternative pathways to implement the system.

The intention of this report is not to recommend a definite pathway, but to highlight possible routes that could be adopted by key stakeholders for further discussion.



Background

WHY BUILDINGS?

In Hong Kong, around 93% of electricity[1] and 94% of towngas[2] were consumed by commercial and residential buildings in 2017, translating to around 60% of the city's total greenhouse gas (GHG) emissions[3]. Therefore, reducing emissions from buildings will be crucial to reduce the city's impact on climate change, and an important step in achieving Hong Kong's decarbonisation targets.

Fig. 1 Hong Kong's electricity consumption in 2017
(terajoules)

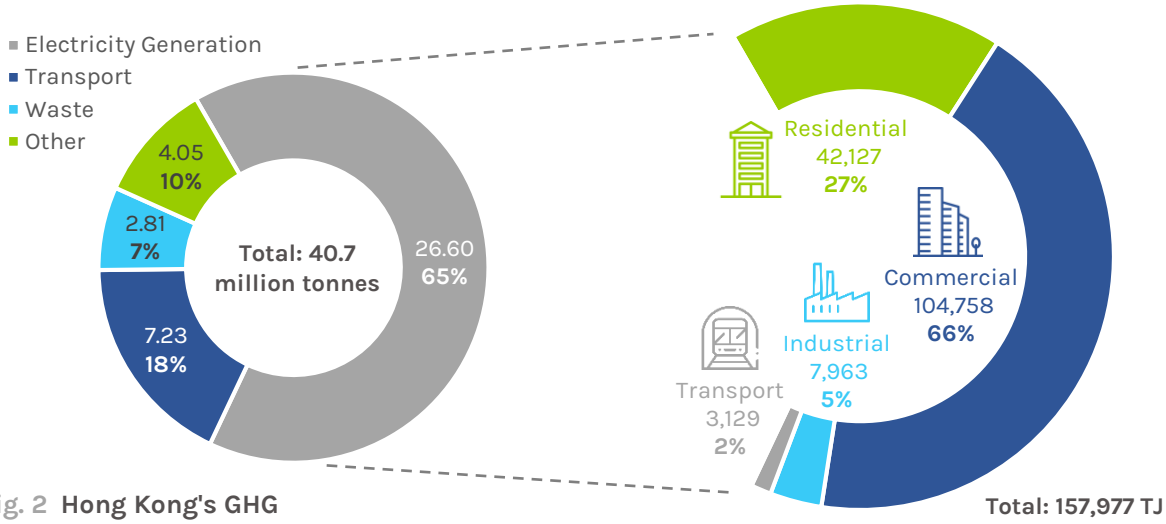


Fig. 2 Hong Kong's GHG emissions by sector in 2017
(million tonnes of CO_2-e)

Data source: Hong Kong Energy End-use Data, Greenhouse Gas Inventory for Hong Kong

In January 2019, Business Environment Council (BEC) published the "Investing in Buildings Energy Efficiency: How to Enhance Hong Kong's Policy Framework"[4] report. It is a comparative study on buildings energy efficiency policies across various cities, and one of the main goals is to identify possible policy recommendations for Hong Kong to further improve the energy efficiency of buildings.

One of the most important gaps identified in the research[5] is the lack of a set of open and comprehensive benchmarks on the energy consumption intensity of buildings. This finding was supported by BEC members and other key stakeholders from Hong Kong's property development and management sector. Among the report's 20 policy recommendations, one that aims to address this problem is to set up a mandatory reporting system for buildings energy performance, followed by benchmark development.

[1] https://www.emsd.gov.hk/filemanager/en/content_762/HKEEUD2019.pdf
[2] https://www.statistics.gov.hk/pub/B11000022018AN18B0100.pdf
[3] In 2017, 65.4% of Hong Kong's total GHG emissions was from electricity generation (including towngas production), from: https://www.climateready.gov.hk/files/pdf/2017_GHG_by_sector.pdf
[4] https://bec.org.hk/files/images/Resource_Centre/Publications/Investing_in_Buildings_Energy_Efficiency.pdf
[5] https://bec.org.hk/newsroom/InvestingEnergyEfficiencyReport_Eng

Key industry stakeholders highlighted that due to limited data availability, it is difficult to understand their building portfolio's relative energy performance in Hong Kong, making it hard to build a business case for energy efficiency measures and investments.

WHAT TYPES OF EXISTING POLICIES AND PUBLIC DATA ARE AVAILABLE?

There are sectoral-level energy consumption data available from the Government, as well as a few benchmarking tools available in the market. However, most data and tools are either not granular enough to provide any insight on building-level performances, have a limited sample size, or simply are not regularly updated.

DATA FROM THE GOVERNMENT

The Electrical and Mechanical Services Department (EMSD) provides aggregated sector-level data on an annual basis through its publication of the **Hong Kong Energy End-use Data**[6]. This dataset provides a comprehensive overview of the overall energy consumption of four sectors – residential, commercial, industrial, and transportation – but the data is not sufficiently granular for analysis and comparison for individual buildings.

EMSD also developed a set of **Energy Utilisation Indexes**[7] (EUIs) for residential, commercial and transport sectors. Online benchmarking tools, one for each sector, are available for users to input their energy consumption data and calculate their relative energy performance in percentiles. Published in 2011, these benchmarks were the first-of-its-kind in Hong Kong and divided into a wide range of buildings categories, but were not considered transparent and reliable by many stakeholders and potential users[8]. Near the time of publication, the benchmarks and EUIs have been updated on 12 March 2020, and the coverage of commercial sector categories has been expanded considerably.

In terms of statutory measures, the **Buildings Energy Efficiency Ordinance**[9] (BEEO) mandates existing commercial building owners to carry out an energy audit every 10 years with guidelines provided in the energy audit code. The EUIs of central building services installations from the mandatory energy audit reports are publicly disclosed on BEEO's website[10], which has 2,577 building EUI records as at November 2019. As the EUIs show only energy consumption from central building services installations – in other words energy consumed in common areas or solely by the building owner – the energy usage of tenants is completely left out of the picture. In addition, essential building specifications such as gross floor area (GFA), occupancy rate, building type and function are also not disclosed to the public, hampering the opportunity to understand and compare EUIs across buildings. With the limited amount of information available, it is hard to compare energy performance among individual buildings solely based on the disclosed EUIs.

PUBLICLY AVAILABLE TOOLS

In 2017, the Hong Kong Green Building Council (HKGBC) developed a **Benchmarking and Energy Saving Tool (HK BEST)** for commercial buildings and office occupants[11]. It is a recognition scheme

[6] https://data.gov.hk/en-datasets/search/energy%20end-use%20data?order=name&file-content=no
[7] https://ecib.emsd.gov.hk/index.php/en/
[8] It was a common view expressed by major stakeholders who had attended workshops organised by BEC under the previous research project "Investing in Buildings Energy Efficiency: How to enhance Hong Kong's Policy Framework"
[9] https://www.emsd.gov.hk/beeo/
[10] https://www.emsd.gov.hk/beeo/en/register/search_eaf.php
[11] http://hkbest.hkgbc.org.hk/index.html

that awards both commercial building owners and tenants who achieve certain energy performance classes. Along with the recognition scheme, HK BEST also provides a free benchmarking tool to let building owners and occupants understand whether their energy performances are below average, average, or good. The recognition scheme and benchmarking tool currently cover commercial buildings (office/retail) and office occupants only.

Apart from HK BEST, there is also an interactive **building energy intensity map**[12] developed by a local NGO using disclosed EUIs of buildings that are required to conduct energy audits under the BEEO. Similar to the EUIs disclosed on BEEO's website, the data displayed on the map face the same issue of incomparability as the building system boundaries are not well defined.

ENVIRONMENTAL, SOCIAL, AND GOVERNANCE (ESG) REPORTING

Companies listed on the Hong Kong Stock Exchange are required to annually disclose ESG related information under a "comply or explain" framework. Listed companies have to report against a set of provisions and key performance indicators (KPIs) in the environmental and social subject areas; if companies choose not to report any required provisions or KPIs, they must provide reasons in the report[13]. Companies can also adopt international reporting standards, such as the Global Reporting Initiative's Sustainability Reporting Standards[14], to disclose additional information.

Regardless of reporting standards, one of the core disclosures is the company's direct and/or indirect energy consumption and the resulting greenhouse gas emissions. This means building energy consumption information of listed companies – be it the entire building portfolio of a real estate developer, or the office space rented by a bank – will be publicly available.

The main limitation, in terms of using ESG disclosures to assess building energy performance, is that the data available are company-based due to the nature of ESG reporting. Reporting entities are not intended to be building-based and have the flexibility to set their operational boundaries and categories differently. Some companies may report the energy consumption of entire buildings or even the aggregated energy consumption across their building portfolios, while some may only report the energy consumed in common areas. This makes it hard to compare building energy consumption directly between different companies using data from ESG disclosures alone.

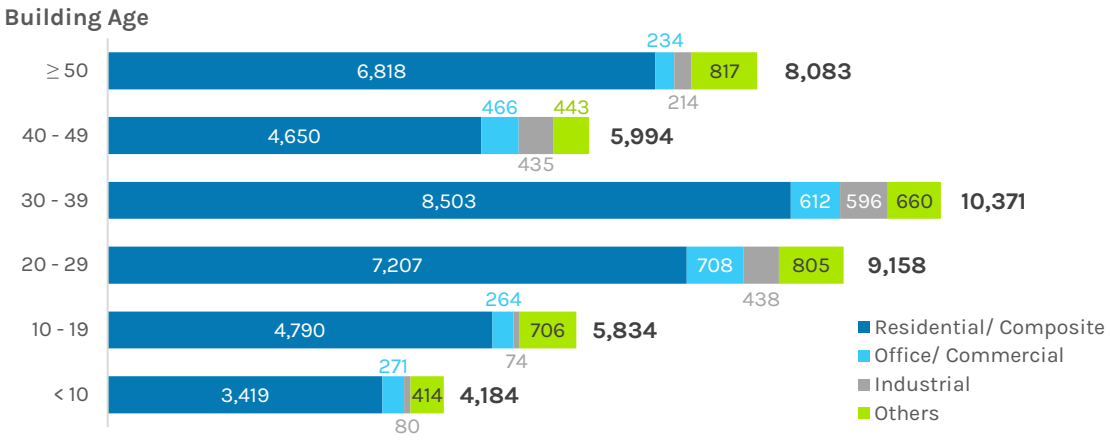
Company coverage is another issue. As buildings owned or leased by listed companies and non-listed companies who voluntarily release ESG information only represent a portion of the Hong Kong building stock, creating benchmarks solely from publicly available data will be under-representative and likely subjected to selection bias.

[12] https://www.arcgis.com/home/item.html?id=db1e2fa512b048a0a8cc3016efc61597
[13] https://en-rules.hkex.com.hk/node/3841
[14] https://www.globalreporting.org/standards

WHY IMPROVE ENERGY-RELATED DATA TRANSPARENCY OF BUILDINGS?

As explained earlier, **buildings are the single largest GHG emitter in Hong Kong**. There are close to 44,000 existing private buildings in Hong Kong and more than half of those were built over 30 years ago (Fig. 3), and these tend to be less energy efficient with system deterioration and the possibility of insufficient upkeep. On top of that, there are also around 8,000 government buildings and facilities. These indicators all point towards a major opportunity to significantly improve building energy efficiency and reduce GHG emissions; however, **there is little data available to track the performance of buildings**. Currently available data are either fragmented, underrepresented, or not granular enough to allow any meaningful analyses.

Fig. 3 Number of private buildings in Hong Kong
(as at 31 December 2018)

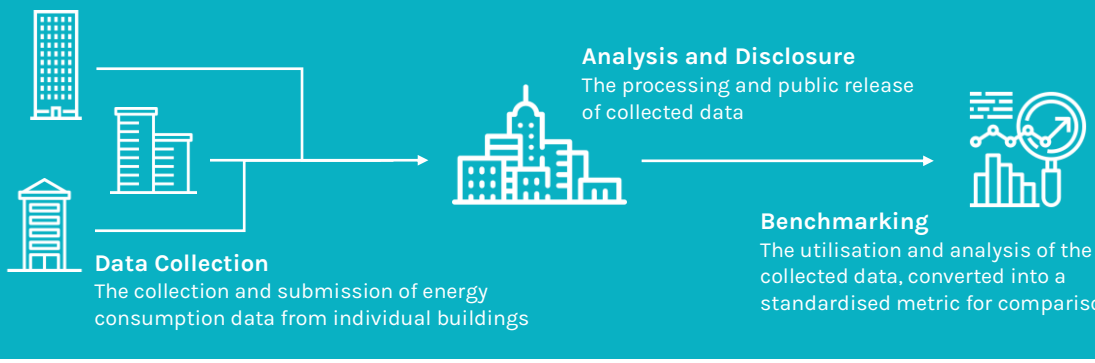


Total number of private buildings: 43,624

Data source: Buildings Department

You cannot manage what you do not measure. The need to set up a data collection and reporting system for building-level data was highlighted in BEC's "Investing in Buildings Energy Efficiency" report. Collecting data should be the first step in understanding how individual buildings perform in terms of energy use and hence how much they contribute to Hong Kong's GHG emissions. It is equally important for the collected data to be open, transparent, and available for public use. Conceptually, the system or framework should include four essential components, namely data collection, data analysis, disclosure and benchmarking, as shown in Fig. 4 below:

Fig. 4 Essential elements of a data collection and reporting system



With improved availability of data and benchmarking tools, the potential for a wide range of applications will be unlocked, as highlighted below:

FOR POLICYMAKERS

The immediate benefit is the **ability to generate insights from the raw data** – energy performance of each and every building (ideally; but depends on the coverage of the scheme) in Hong Kong in a given year. Combining energy performance data with the existing building specifications in Government databases, policymakers will be able to study the common factors leading to fundamental differences in the energy usage of Hong Kong's buildings, for example, how building age, occupancy rate, and building services systems correlate to the actual energy performance of buildings in their operational stage. These insights are crucial in assisting the formulation of policies that precisely target the most inefficient groups of buildings.

The added benefit of collecting and reporting data at regular intervals is the **enablement of performance tracking**. This will allow policymakers to measure the effectiveness of building energy efficiency policies, and provide them with the opportunity to identify, improve, and prioritise actions within the buildings sector.

Box 1

Tokyo's Cap and Trade Programme

Started in 2010, the Cap and Trade Programme is an emissions trading scheme targeting large buildings in Tokyo with an annual energy consumption of more than 1,500 kilolitres of crude oil equivalent (roughly equal to 6 million kWh per annum).

Covered buildings are required to achieve a 6% to 8% carbon emission reduction over 5 years from 2010 to 2014, and a 15% to 17% reduction over 5 years from 2015 to 2019, using 2010 as a baseline; **the actual reduction achieved in 2017 was 27%**. The reduction can be achieved through energy efficiency improvements or buying emission credits from buildings that have achieved beyond the required reduction target.

Notably, a voluntary reduction scheme was launched in 2002 to mandate large buildings to submit their GHG emissions data and reduction plans, but reductions were voluntary. **Through this scheme, building owners started to build their emission inventories and gained capacity on reduction measures**, which were key precursors to the success of the Cap and Trade Programme.

Thinking in the longer term, this **lays the groundwork for future climate and building energy efficiency related policies**. With building-level energy consumption data available, the GHG emission of individual buildings in Hong Kong can be calculated as a baseline for future target-setting policies, or even more ambitiously, carbon pricing/trading schemes for buildings, such as Tokyo's Cap and Trade Programme (Box 1).

FOR BUILDING OWNERS AND MANAGERS

Similar to the case for policymakers, collecting and analysing data allow building owners and facility managers to **understand and track their own energy performances**, and with the help of benchmarks, their relative energy performance compared to buildings with a similar profile.

This can also be used as an **encouragement to reduce building-related emissions** through peer-pressure (if the data released can be traced back to individual buildings) or self-benchmarking (if the data released are anonymised). For instance, if a building is found to have very poor performance compared to its peers in the same category, the building manager and/or owner is more likely to be incentivised to improve; vice versa, a well-performed building will be able to justify its investment in energy efficiency measures using benchmarking results as a **proof of performance**.

Box 2

Tokyo's Carbon Reduction Reporting Programme & Low Carbon Benchmarks

Building operators using or owning small and medium facilities (SMFs) with a combined total annual energy consumption larger than 3,000 kilolitres of crude oil equivalent are required to report, inter alia, their carbon emissions and intensity, and progress of energy saving measures to the Tokyo Metropolitan Government (TMG).

To encourage SMFs to save energy, TMG offers a comprehensive "menu" of 255 energy saving measures, and allows the public display of "Programme Participation Certificates" to show the commitment to reduce carbon emissions by SMFs who participate in the reporting scheme voluntarily.

TMG also provides carbon intensity benchmarks for 30 types of buildings ranging from offices to restaurants to public facilities. The benchmarks, along with the carbon intensity of SMFs reported in the Carbon Reduction Reporting Program, are publicly available on the TMG website.

"Carbon Report Cards" are provided for building owners to display their carbon intensity and benchmarked performance: ranks B or C indicate a building's carbon intensity is higher than average. These report cards **bring visibility of energy efficient buildings to tenants and real estate investors, to improve their occupancy rates and encourage more building owners to work on retrofits**. Tenants can also estimate their energy bills based on this information to compare electricity costs in different buildings.

In 2014, out of all 630,000 facilities, there were 34,242 reporting SMFs and around one-third of those were voluntary submissions. **TMG reported an 11% carbon emission reduction** (baseline 2010) from the 25,579 facilities that submitted the report in 4 consecutive years.

FOR TENANTS, HOMEOWNERS, AND OTHER ENERGY END-USERS

With benchmarks, electricity end-users can compare their energy performance with their peers – whether it is a group of office tenants in Grade B office buildings, retail storefronts of similar size and nature, or four-person households in private housing estates. Together with the mass roll out of smart meters by the power companies[15], end-users will be able to analyse and breakdown their own energy performance in greater detail, spatially and temporally, and recognise energy-saving opportunities tailored to the users' consumption patterns.

An added advantage for homeowners is the possible synergy with the time-of-use tariff and other energy saving rebate schemes linked with real-time electricity consumption. However, details of such arrangements would need to ensure the practicality, fairness and equity for customers.

For listed companies, assessing their buildings' energy efficiency using benchmarks can be a key performance indicator to prospective investors. Building energy performance benchmarks provide a standardised and systematic way for **investors to evaluate the environmental performance of buildings** owned by companies, and to track the cost-effectiveness of energy efficiency investments.

It is also anticipated that having this system in place can provide a significant amount of robust and reliable information for research purposes that would in turn benefit Hong Kong's society as a whole.

[15] https://www.info.gov.hk/gia/general/201807/03/P2018070300449.htm

Identified Barriers

Despite the apparent benefits from improved data transparency in buildings, there is still a lack of information that drives actions or investments in better energy efficiency in buildings. In this study, BEC engaged key stakeholders in Hong Kong's property sector through workshops and interviews to solicit their views on the reasons behind. Their comments and concerns are categorised and summarised into three main barriers: data availability and granularity, data privacy, and variations in building characteristics.

DATA AVAILABILITY AND GRANULARITY

Perhaps the most fundamental challenge is **how energy consumption data at the building level can be effectively collected?**

OPTION 1: RELY ON REPORTING BY BUILDING OWNERS AND MANAGERS

One option is to require building owners and managers to collect and report their buildings' energy consumption through an online data collection portal on an annual basis. This narrows the data gaps as building owners and managers also have access to building specifications and operational data. This option, however, faces several issues. Building owners and managers do not have access to their tenants' or residents' energy consumption data, which are measured by separate electricity meters and accounts. This increases the administrative burden on building owners, as they would need to negotiate and liaise with building users to collect and collate data.

Another barrier is their willingness to disclose. From our conversations with property owners and managers, most are unwilling to voluntarily disclose such information without incentives or government regulations. They have also encountered similar difficulties when attempting to obtain energy consumption data from their tenants.

Additionally, out of the 40,000+ buildings (Fig. 3) in Hong Kong, more than 5,000 are "three-nil" buildings that do not have property management companies, owners' corporations, or any form of residents' organisations[16]. It would be a strenuous task to obtain data from these types of buildings without a coordinating party.

OPTION 2: OBTAIN INFORMATION DIRECTLY FROM UTILITY COMPANIES

Utility companies such as CLP Power Hong Kong Limited (CLP), The Hongkong Electric Company Limited (Hongkong Electric), and The Hong Kong and China Gas Company Limited (Towngas) hold the energy consumption data of all their customers' accounts through electricity and gas metering. As long as the locations of meters are known, data can be attributed to individual buildings to construct a building-level energy consumption database. However, under current practices, the data are owned by individual customers and cannot be arbitrarily disclosed (see data privacy section below for more).

The lack of submetering also poses a hurdle towards further breaking down energy consumption by building units or building systems, hampering the usefulness of energy analysis for buildings.

In addition, to be able to categorise energy performance benchmarks into different building groups, both the energy consumption and the usage/specifications of a building have to be obtained – and utility companies do not have access to the latter.

[16] https://www.legco.gov.hk/yr18-19/english/panels/rmab/papers/rmab20190624cb2-1669-3-e.pdf

DATA PRIVACY

From our engagement with stakeholders, data privacy is a major concern on two levels.

TO UTILITY COMPANIES AND ENERGY END-USERS

Utility companies hold the energy consumption data, but data ownership belongs to individual customers; they do not have the authority to disclose such personal data unless required by law, regulations or rules, or without explicit informed consent from account holders[17]. Requesting consent from all their existing accounts one by one – 2.6 million for CLP[18], 0.58 million for Hongkong Electric[19] and 1.9 million for Towngas[20] – would certainly face challenges administratively and financially.

The handling of personal data, defined as "any data relating directly or indirectly to a living individual; from which it is practicable for the identity of the individual to be directly or indirectly ascertained; and in a form which access or processing of that data is practicable", is regulated in Hong Kong under the Personal Data (Privacy) Ordinance (PDPO)[21] Cap. 486. The PDPO is based on six data protection principles (DPPs), as shown in Box 3. DPP3 relates directly to the use of data, and states that the collected data must be used for the purpose for which it is collected or for a directly related purpose, unless voluntary and explicit consent with a new purpose is obtained from the individual.

Box 3

Data Protection Principles (DPPs)

1. Purpose and manner of collection of personal data

2. Accuracy and duration of retention of personal data

3. Use of personal data

4. Security of personal data

5. Information to be generally available

6. Access to personal data

TO BUILDING OWNERS AND MANAGERS

In the case that energy performance data of buildings are disclosed without anonymisation, also known as the public disclosure approach, individual buildings can be identified and have their performance rated against other buildings. Building owners and managers have expressed concerns about the risk of being penalised internally (by management) and externally (by green/pressure groups) if the buildings they manage are consuming more energy than the average building, whereas the actual energy consumption of a building depends on a wide range of factors – not just energy efficiency – including building characteristics and specifications (see next section).

Another aspect of concern is that commercially sensitive business information may be revealed by associating a building's energy consumption with its business functions, for instance the occupancy rate of a hotel, or whether a building holds data centres. Such kinds of information could be used against companies by their competitors or those with malicious intent.

[17] Summarised from the privacy policy statements of utility companies. See more details below:
- CLP Power Hong Kong Limited: https://www.clp.com.hk/en/privacy-policy
- The Hongkong Electric Company: https://www.hkelectric.com/en/privacy-policy
- The Hong Kong and China Gas Company Limited: https://www.towngas.com/en/Info/Privacy

[18] https://www.clpgroup.com/en/Media-Resources-site/Publications%20Documents/e_2018%20Annual%20Report.pdf
[19] https://www.hkelectric.com/en/CorporateSocialResponsibility/CorporateSocialResponsibility_CDD/Documents/SR2018E.pdf
[20] https://www.towngas.com/getmedia/32d64b10-3678-4e11-b338-56ea2753e4c5/Towngas_SR_2018_EN.pdf.aspx?ext=.pdf
[21] https://www.elegislation.gov.hk/hk/cap486

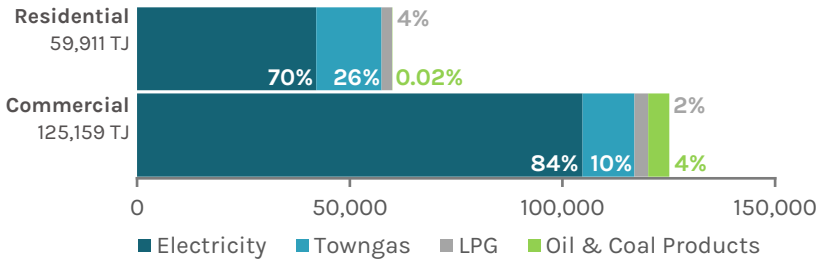
VARIATIONS IN BUILDING CHARACTERISTICS

There is a diverse range of factors affecting the energy consumption of buildings – such as gross floor area (GFA), location, building function, occupancy rate, building age, and building systems. Using EUIs, typically expressed in kilowatt-hour per square metre (kWh/m^2) per year in Hong Kong, as the sole metric for comparison would be too general to determine the energy performance of buildings. To illustrate this argument using examples suggested by our workshop participants: two residential buildings but one has enabled electric vehicle charging, or two commercial buildings but one has data centres, will have very different EUIs even if their building specifications are very similar.

In other words, EUI indicates energy use but not necessary energy efficiency, as it only considers a single variable: floor area. A low EUI does not always mean a building is energy-efficient while a high EUI does not directly equate to poor performance[22], although how EUIs change over time may provide some insight.

Fuel type is also another important variable to be considered. While electricity is the major type of energy consumed in residential and commercial sectors (Fig. 5), the use of fossil fuels also contributes to GHG emissions in buildings.

Fig. 5 Energy consumption by fuel type in 2017
(terajoules)



Data source: Hong Kong Energy End-use Data, Hong Kong Energy Statistics

[22] https://aceee.org/files/proceedings/2016/data/papers/9_421.pdf

The Way Forward

This section explains the possible actions that can be taken up by the Government and the private sector, with examples from overseas cases, to address barriers detailed in the previous section.

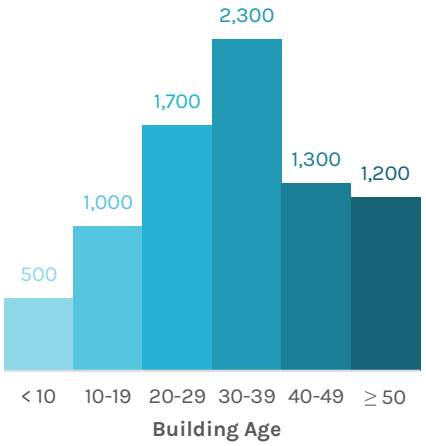
GOVERNMENT AS AN INITIATOR AND ENABLER

To substantially improve the transparency of building energy performance-related data, BEC foresees that the Government can play two key roles, as an initiator and enabler.

ROLES AS AN INITIATOR

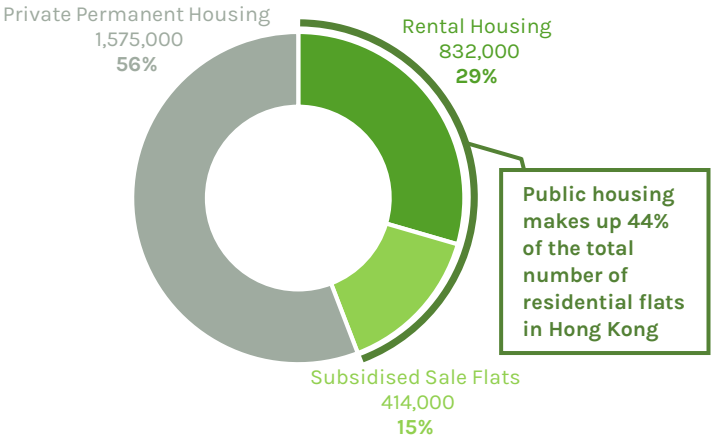
Currently, there are around 8,000 government buildings and facilities[23] (Fig. 6) maintained by the Architectural Services Department (ArchSD). Given the sizable building stock owned and operated by ArchSD, and the vast number of public residential flats (Fig. 7), the Government is well-placed to take the lead with public buildings to trial energy performance data collection, analysis, disclosure and benchmarking. Valuable learning can be captured through testing and trialling to help build capacity for the future application of the data collection and reporting system.

Fig. 6 Number of government buildings and facilities maintained by ArchSD
(as of November 2019)



Data source: Architectural Services Department

Fig. 7 Number of flats by type of permanent housing
(as of March 2019)



Data source: Housing in Figures 2019

The collected data across government buildings and facilities can also be used to study the relationship between building specifications and building energy performance. For instance, understanding the correlation between building age or size and actual energy performance of existing buildings, would narrow the knowledge gap in factors leading to energy reduction in buildings.

Through the disclosure of data from government buildings and facilities, preliminary benchmarks can also be developed for public use at the outset to enable the comparison of energy performance across various groups of buildings.

In parallel with the above, EMSD can also consider classifying publicly disclosed EUIs in the BEEO website according to specific building types/specifications, preferably in a standardised or consistent format[24], to facilitate an apple-to-apple comparison between EUI records.

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[23] As of 30 November 2019. This number excludes facilities not managed by the Architectural Services Department such as government hospitals, public housing estates and aided schools.

[24] For example, categorise using common building types like single owner, multi-tenant, office building with centralised air conditioning, or refer to the commercial sector energy-consuming groups used for EUI benchmarks (Table 1).

ROLES AS AN ENABLER

The other crucial role for the Government is to enable the collection and disclosure of data through policy incentives and ultimately through legislation; and at the same time, collate and publish data in a useful format in collaboration with a third party trusted by the business community (e.g. an academic institution or NGO). As pointed out by stakeholders, most building owners will not voluntarily disclose their building energy consumption without any form of incentives or regulations. The same applies to utility companies as the PDPO prevents them from disclosing customer data unless required by law or regulations. Therefore, to realise data disclosures, government support is necessary.

Box 4

Singapore's Building Energy Benchmarking Report (BEBR)

BEBR is an annual report that provides energy performance trends and benchmarks for different types of buildings in Singapore. The first BEBR was published by Singapore's Building and Construction Authority (BCA) in 2014.

The types of buildings covered by BEBR are expanded in a phased approach. In 2013, commercial buildings such as hotels, offices, retail and mixed developments were required to participate in the annual mandatory submission exercise. This expanded to healthcare and educational facilities in 2016; and to large buildings of civic, community, and cultural institutions in 2018.

BCA also adopts a phased approach in the disclosure exercise for building energy performances. Since 2014, the top 10 commercial buildings for each building type have been named, with permission from the building owners, in the BEBR. However, their corresponding Energy Use Intensity (EUI) were not released. In 2016, BCA released anonymised building energy performance data of all commercial buildings publicly. Disclosed data include building type and size (large/small), green mark rating (yes/no) and the corresponding EUIs. In 2017, BCA took voluntary disclosures for commercial buildings, with data made available via BCA's Building Energy Submission System website. Voluntary disclosure for healthcare facilities and education institutions followed in 2018.

The overall EUI of more than 1,600 buildings has decreased by 11% over ten years from 2008 to 2018. Commercial buildings saw a larger decrease of 14%.

Data collection

To collect data through reporting by building owners and managers, the Government will have to establish incentives for building owners to report their energy consumption, and empower building owners with the authority to collect data from tenants/residents, or alternatively, request tenants/residents to report directly. This approach, however, requires laborious effort on data entry and verification.

Singapore follows a similar method to mandate the collection of data, in a phased approach, to the Building and Construction Authority (BCA) by building owners through legislation[25], and discloses data through its annual publication: Building Energy Benchmarking Report[26] (Box 4).

Alternatively, collecting data from utility companies reduces the administrative burden of collecting and reviewing data entries on both building owners/managers and data reviewers/auditors, especially in the case of "three-nil" buildings, as the data will be collected directly through electricity and gas meters[27]. Yet, this will

[25] Part IIIB, Section 22FJ of the Building Control Act, https://www.bca.gov.sg/BuildingControlAct/others/building_control_act.pdf
[26] https://www.bca.gov.sg/GreenMark/building_energy_benchmarking_reports.html
[27] The gradual replacement of smart electricity and gas meters will further enhance the accuracy and granularity of data analyses. However, we are also aware that gas meter readings must be manually recorded by inspectors or end-users. We therefore also recommend enabling automatic gas meter reading in the next generation of gas meters.

have to rely on the Government's agreement with utility companies, how customer data from individual accounts can best be protected, and costs recovered from electricity and gas ratepayers.

In addition, the Government has access to building specifications and systems through a number of departments such as EMSD, Buildings Department, and Home Affairs Department. Combining these with the energy consumption data collected through utility companies, the Government can categorise data and develop benchmarks by building type (for example by energy-consuming groups, see Table 1 for more).

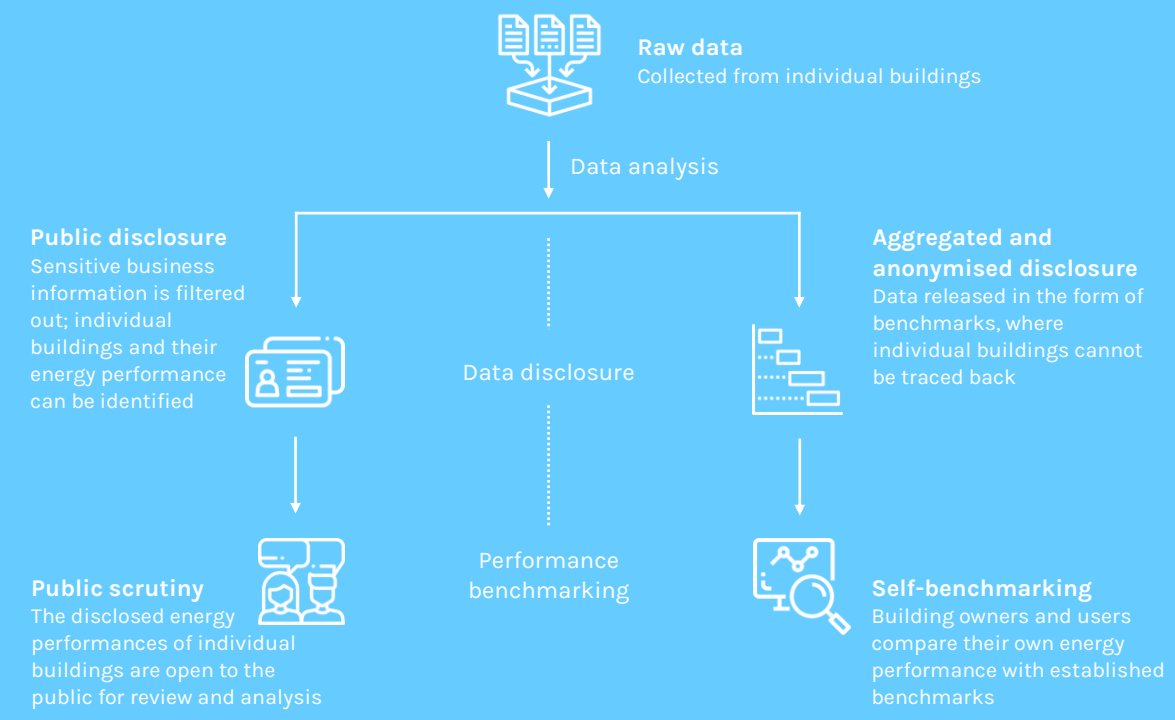
Data analysis, disclosure, and benchmarking

After the collection of raw data, the next step will be to collate and analyse data (similar to the process mentioned in the subsection roles of an Initiator). To protect sensitive business information, the types of data to be disclosed must be carefully selected, for instance, the occupancy rate of hotels or the energy consumed by data centres should not be part of the disclosure.

Alternatively, an anonymised approach can be considered as an early stage implementation to reduce the perceived risks from a public disclosure approach (see Fig. 8 below) and enhance public acceptance. To begin with, instead of listing out data by individual buildings, the data can be anonymised, aggregated, and disclosed in the form of benchmarks. Such benchmarks will be immediately useful for building owners and users to compare their own energy performance to their peers, while also addressing data privacy and public disclosure concerns.

BEC notes that some energy end-users do not prefer submitting energy consumption data to the Government, and therefore recommends the involvement of a third party trusted by the business community to enhance the credibility of the data analysis and benchmarking process. The entire process should also be made transparent, in line with DPP5 of the PDPO (see Box 3), clearly stating the intention and objectives, types of data collected, how they will be used, processed, and disclosed. Transparency of the entire process is crucial to gaining the trust of energy end-users, as further discussed in the next section.

Fig. 8 Data disclosure and benchmarking: two examples



BUILDING TRUST AND CAPACITY AMONG THE BUSINESS COMMUNITY

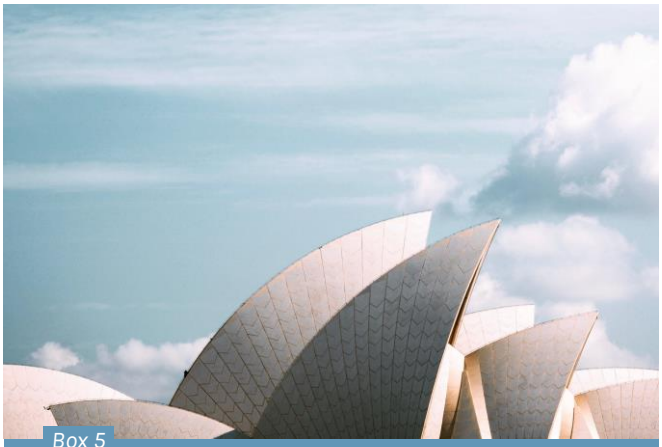
While the Government, with the help of a trusted third party, is recommended to take on the role of a central data coordinator, building capacity and the correct mindset in the business sector (and to a greater extent, the civil society) will facilitate the data collection and disclosure processes. To alleviate the perceived fear around data transparency, it is imperative to build trust between data owners and data users – between building owners and managers, the Government, tenants, residents, and the wider public.

SENDING THE RIGHT MESSAGE

Data collectors and users must communicate clearly the reason behind the collection of data, how the data will be used and processed, and the importance of data transparency, to avoid miscommunication. In the case of buildings energy performance, communicating and emphasising that data disclosure is about helping building owners and users understand their own performance, how they perform against their peers, bring potential cost savings, and to move forward on energy efficiency; but not about penalisation.

...TO THE RIGHT AUDIENCES

Tenants and residents make up the majority of the energy consumed in buildings. Building owners and managers can only do so much to improve the efficiency of central building services systems. Therefore, to further reduce emissions from buildings, it is also necessary to raise awareness on building energy performance by engaging building users. This can be initiated through setting up smart sub-meters to enable data sharing among building owners and users to understand the consumption distribution and pattern of different building users, holding education and capacity building sessions, creating a safe environment for energy-saving collaborations, and to strengthen trust between all parties. Once trust is established, future green partnerships and engagements will be much more effective and impactful.



Box 5

Sydney's Better Buildings Partnership

Launched in 2011, the Better Buildings Partnerships (BBP) of Sydney is a collaboration of property owners and industry influencers providing green leadership and sustainable innovation for Sydney's commercial and public buildings.

BPP represents 54% of all commercial office space in Sydney's central business district and has reduced its energy consumption by 43% and energy intensity by 51% in 2017 (2006 baseline).

The partnership produces resources and tools, builds capacity, and embeds and creates sustainability best-practice standards in the sector, with solution-oriented initiatives to tackle intractable and systemic industry issues.

For example, its "tenants and communities" initiative launched green leasing standards, toolkits and template clauses to foster green collaborations between landlord and tenants. Reports like "The Tenants & Landlords Guide to Happiness" and "Tenant Engagement Foundation Report" were also published.

Another ongoing initiative, "benchmarking and engagement", was launched to address the lack of access to consistent and meaningful data within commercial office buildings. BBP has been developing a report to summarise the obstacles and opportunities of improved data management in buildings, and to generate sustainability insights using data from BBP members' assets. The report was still in development at the time of writing.

OTHER CONSIDERATIONS

In this section, other factors that are also relevant to the fairness and success of a data collection, analysis, disclosure, and benchmarking system will be discussed.

INCLUSION OF NON-ELECTRICAL ENERGY

As briefly mentioned in the variations in building characteristics section, while building energy consumption is largely due to electricity use (Fig. 5), the building energy performance disclosure and benchmarking processes should also cover other types of energy, such as towngas, diesel and LPG, to provide a complete picture of both energy usage and GHG emissions.

The inclusion of non-electrical energy is also a way to prevent potential gaming of the system. Focusing only on electricity consumption may induce a perverse incentive that encourages building owners and managers to switch to less clean fuels to reduce electricity consumption.

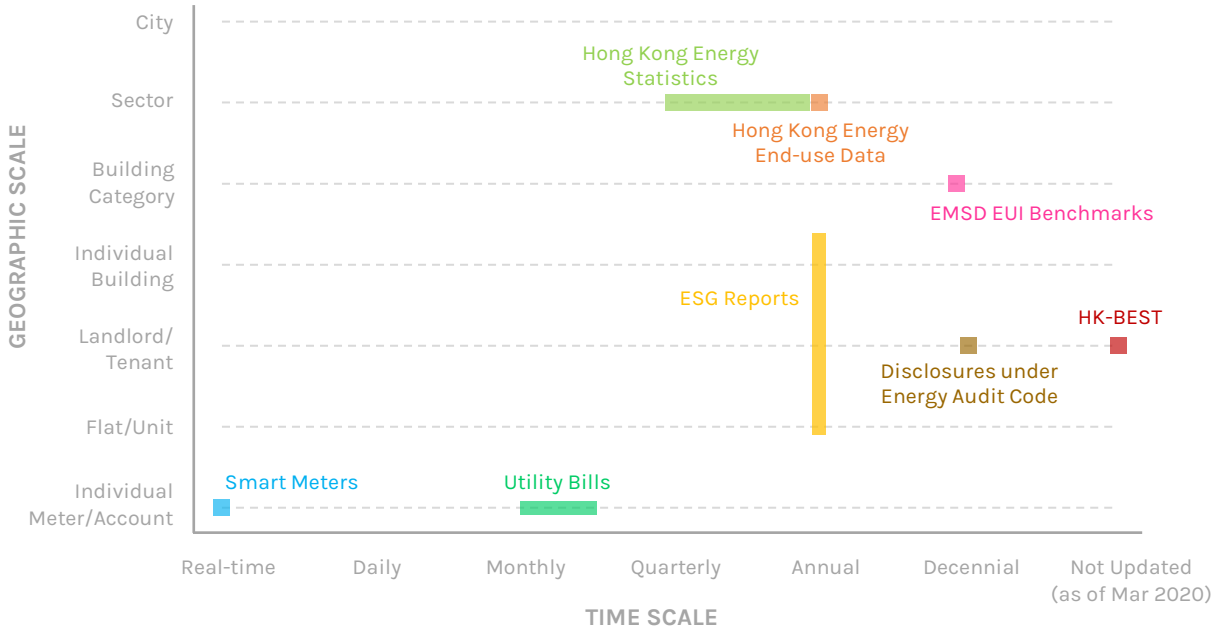
UPDATING DATA ON A REGULAR BASIS

Another important factor to consider is how often the data and benchmarks are to be updated. The issue with existing benchmarks is that most of them are not updated regularly. The graph below (Fig. 9) shows the granularity – geographically and temporally – of existing building energy-related data in Hong Kong.

Without regular updates, it will be difficult to track progress in buildings energy efficiency and provide an accurate representation of buildings energy performance in a particular year for building owners to benchmark themselves against.

Therefore, we suggest conducting the data collection, reporting and benchmarking cycle on an annual basis for the effective use of data. For a fair comparison, different buildings should be benchmarked over the same period of time to reduce the influence of uncontrollable factors, such as the yearly variation of temperature and unexpected events like a flu or disease outbreak, which can drastically increase energy consumption for ventilation and cleaning.

Fig. 9 Granularity of existing building energy related data in Hong Kong



DATA METRIC

This is a continuation of the discussion in variations in building characteristics on choosing the right metric to represent the energy efficiency and performance of buildings.

Efficient benchmarks will involve the development of a metric that will fairly and accurately account for the factors leading to energy efficiency, in order to prevent false accusations of energy-intensive buildings as poorly performing buildings.

To avoid reinventing the wheel on the categorisation of buildings, the benchmarks can start with referencing EMSD's existing energy consumption indicators[28].

In the process of developing Energy Utilisation Indexes and the benchmarking tools (as mentioned in our data from the Government sub-section), EMSD classified residential and commercial buildings into numerous principal groups and subgroups, according to operational and physical characteristics. There are also primary and secondary indicators of energy consumption. Table 1 below lists a few examples.

Box 6

New York City (NYC)'s Local Law 84 & ENERGY STAR scores

In NYC, owners of buildings larger than 25,000 ft^2 (~2,320 m^2) and public buildings larger than 10,000 ft^2 (~930 m^2) are required to submit their energy and water consumption data online through the ENERGY STAR Portfolio Manager for benchmarking. Data of individual buildings are publicly disclosed, analysed by a report and visualised in a map.

ENERGY STAR is a national scheme launched by the United States Environmental Protection Agency, and its Portfolio Manager calculates an ENERGY STAR score for individual buildings, on a scale of 1 – 100, to measure their energy performance. The score is calculated by normalising energy intensity (EUI) with activities such as weather, operating hours, number of units through regression models, and comparing the adjusted energy intensity with buildings in the same property type. A score of 50 means the building performs better than 50% of its peers.

Table 1 **Selected energy consumption groups and indicators from EMSD's EUI benchmarks**

	RESIDENTIAL	COMMERCIAL
Principal Groups	Public Housing, Private Housing, Housing Authority Subsidized Flats	Restaurant, Retail, Accommodation, Educational Services, Private Office, Hospitals and Clinics
Subgroups	Public Rental Flat, Private Residential Flat, Traditional Village House, Villas	Chinese Restaurant, Bar, Hotel, Kindergarten, Domestic Banking, Common Ares of Shopping Arcades
Primary Indicator	Annual Energy Consumption (kWh/Annum)	Annual Energy Consumption (kWh/Annum)
Secondary Indicators	Building Age, Total Number of Rooms, Number of Persons, Monthly Household Income	Operation Schedule, Occupancy, Temperature Set Point, Year of Operation, Hotel Rating

Click to view the full list

[28] https://ecib.emsd.gov.hk/images/files/glossary_en.pdf

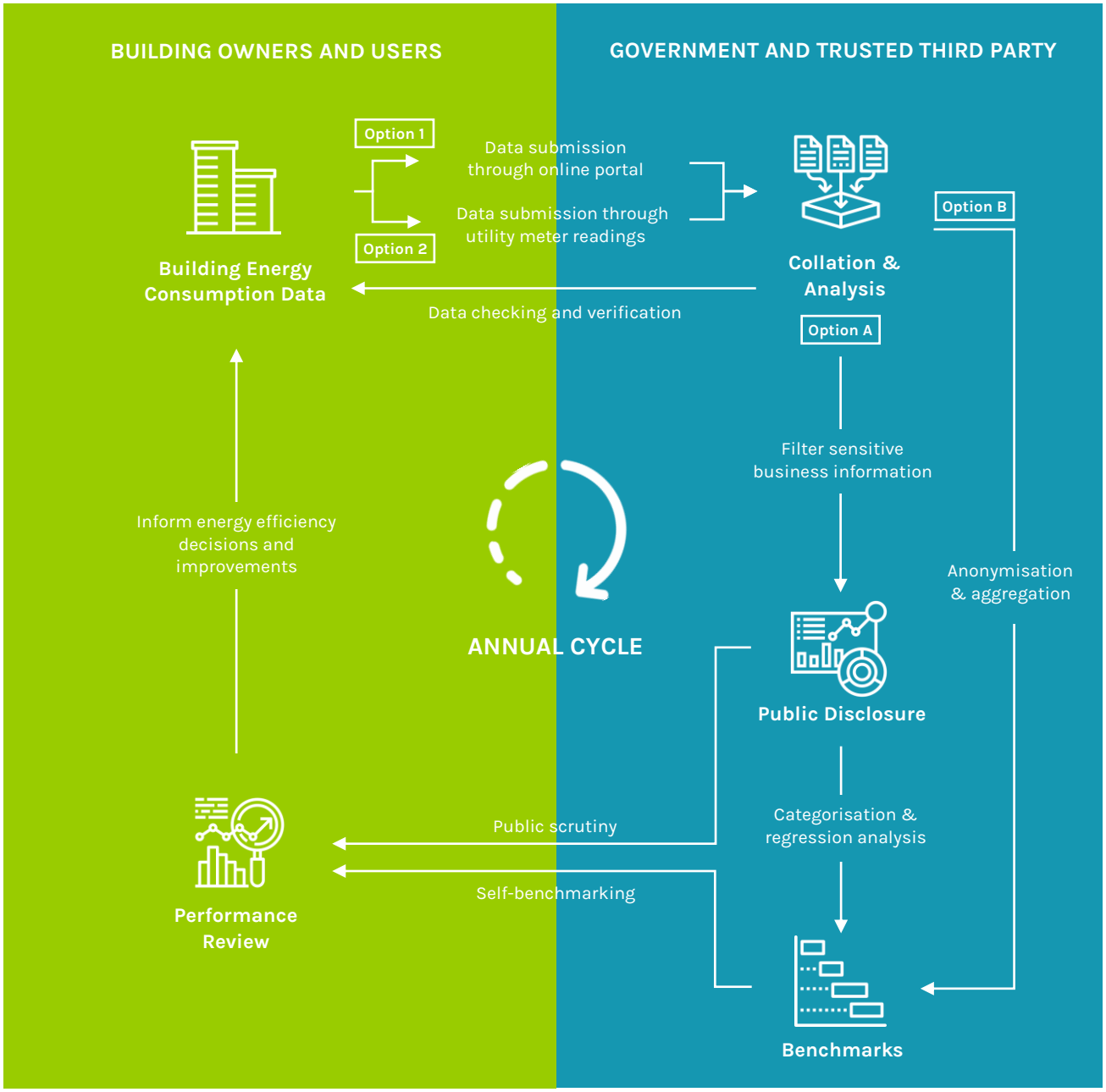
DATA VERIFICATION

To get meaningful analyses and results, the data collected from the reporting system needs to be accurate. In the case of EUIs of central building services installations disclosed on EMSD's website, the energy consumption data are verified through energy audits conducted by registered energy auditors. However, doing regular (annual) energy audits for the sake of data verification would be impractical, especially among SMEs and individual building owners.

For electricity and towngas consumption, copies of electricity bills and meter readings should be sufficiently accurate to qualify as verified data for reporting and benchmarking. But for other on-site fossil fuel consumption, regular checking and auditing of purchase orders and receipts may be needed to confirm the veracity of data collected.

NEXT STEPS

The flowchart below summarises the data reporting, analysis, disclosure and benchmarking process, with alternative routes to address the various considerations illustrated in the previous sections. The intention of this report is to recommend a definite pathway, but to highlight possible routes that could be adopted by key stakeholders for further discussion.



BEC recognises the challenges ahead for key stakeholders – utility companies, building owners and building users – to materialise the findings outlined by this report. We believe the options and considerations suggested in the report can act as alternative pathways for the data reporting and benchmarking process, which can allow built-in flexibility for a more gradual and smoother implementation.

Looking forward, data transparency and energy performance benchmarking will be a crucial enabler to further improve energy efficiency and decarbonise Hong Kong's building sector – by informing public policy, incentivising private investment in energy-saving design and technology, and driving behavioural change among building users.

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Interviewees and Workshop Participants (by company name, listed alphabetically)

Active Energy Management Limited
AECOM Asia Company Limited
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BEC Staff

Mr Simon Ng	Director – Policy & Research
Mr Wayne Wong	Senior Officer – Policy & Research
Ms Shirmai Chung	Intern