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Best Practices of Sustainability Benchmarking of Energy and Carbon

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Abstract: *Benchmarking can be a lengthy and complex process but results in numerous benefits including a greater understanding of how a building portfolio operates, allowing comparisons of buildings to be made, identifying areas of improvement and helping preparation for new legislation .Tools and approaches to assess the sustainability and energy performance of buildings are currently available, such as BREEAM and LEED for new buildings, and LES-TER and BREEAM in use for existing buildings. A number of organisations also offer sustainability benchmarking services. Such initiatives have enabled a greater understanding of sustainability measurement, reporting and benchmarking processes. In addition, a growing number of mandatory mechanisms require property organisations to start collecting sustainability data, though the data requirement vary with each scheme, such as the Energy Performance Certificates (EPCs) and Display Energy Certificates (DECs) and the Carbon Reduction Commitment (CRC).Furthermore, a number of international initiatives on sustainability measurement and reporting are underway, such as the GRI, Construction and Real Estate Sector Supplement (CRESS), the UNEP Global Guide for Building Performance under the Sustainable Buildings and Climate Initiative (SBCI).The purpose of this discussion paper is to present an overview of current practices in sustainability benchmarking and identify principles for best practice to support the development of this important process in the future. While focus here is on measuring and benchmarking energy and carbon of s building, the findings can be transferred to other indicators such as water, waste, and transport.*

Keywords: *Environment, Sustainable buildings and climate Initiative*

1. INTRODUCTION

1.1 SUSTAINABILITY BENCHMARKING

Sustainability benchmarking is a process that assesses and compares the sustainability performance of a building against other properties or pre-defined targets and benchmarks. The process covers a wide range of property characteristics as well as operational performance, including building fabric, energy, waste, water and transport. It also allows comparisons to be made at a unit, building or portfolio level as well as over time. The sustainability performance of a building can be viewed from two basic perspectives, viz.

1.1.1 DESIGN

The sustainability performance which the physical fabric and components of the building has been designed to achieve, e.g., the performance specification of the insulation, heating and cooling systems, or lighting systems. Refurbishment or significant maintenance programmes present opportunities for the owner to improve systems such as heating/cooling or lighting and upgrade the sustainability performance of the physical fabric of the building and its plant.

In-Use

The measured operational sustainability performance of the building when it is in use by occupiers. Operational performance is affected by both how occupiers utilise a building and how the owner runs shared services. The interface between the two parties is important in determining how efficiently the overall building is operated.

1.1.2 CHALLENGES IN BENCHMARKING

The benchmarking exercise is identified with many challenges associated with the process. These include:

- the availability and capacity to collect data
- the need to properly identify and use the most appropriate metrics and indicators for measuring environmental performance
- learning to compare like with like in terms of buildings and portfolios; recognising that some characteristics or factors (such as the particular use to which a building is put) can need special consideration.

In meeting these challenges, best practice, is to keep the process simple at the outset and only build up complexity as

understanding of buildings' and portfolios' environmental performance grows. This approach is termed a "graduated approach". Tools and services follow methodologies based on an agreed set of metrics and indicators. It would improve the overall efficiency of sustainability benchmarking by avoiding the duplication of data collection and ensuring that the data is compatible, comparable and portable between various tools and services. Industry standards could also lead to the formation of a central database which could hold national or even international data sets to allow for comparisons and for setting sector-wide benchmarks.

1.1.3 BENEFITS OF SUSTAINABILITY BENCHMARKING

Sustainability benchmarking of a property or property portfolio brings a number of benefits to its users, as it:

- Enables an organisation to assess its impact on the environment at both an individual building and portfolio level: This may be in terms of CO_2 emissions, fuel consumption, waste generation or water consumption, etc., of individual buildings or portfolios, and can be reported in absolute and/or normalised terms.
- Facilitates a greater understanding of how a portfolio is operating: The benchmarking process will identify high impact and low impact buildings, leading to a greater understanding of why certain buildings may consume more than others. For example, a highly intensive building within a portfolio may simply house energy intensive activities, such as a server room. The key question is whether the building is performing optimally.
- Identifies where action is appropriate and where greatest savings can be made: A greater understanding of the sustainability profile of a building or portfolio will highlight poor-performing and well-performing buildings, identifying the areas where action is required and where the greatest improvements/cost-savings can be made.
- Enables an organisation to set and monitor realistic targets: Once an organisation understands how a specific building or portfolio is operating, appropriate targets can be set and the performance against these targets monitored. Sustainability benchmarking will also identify where performance improvement programmes have been successful and what changes have been achieved, thereby helping plan the most appropriate allocation of resources for improvements.
- Enables for the comparison of buildings and portfolios between peer groups: Commercial property owners will be able to compare assets within their portfolios, as well as against other owners' properties/portfolios. Sustainability benchmarking would also enable fund managers or potential investors to compare across funds or property portfolios.
- Assists legislative and regulatory compliance: Benchmarking also creates a robust framework that can help facilitate preparation for compliance with emerging legislation,
- Helps improve asset value: There seems to be an increasing trend among investors to take sustainability factors into account in their decision-making processes. Furthermore, the increasing volume of legislation and mandatory standards for the environmental performance of buildings, as well as occupiers' rising aspirations for greener buildings, would seem to indicate that green factors will play a greater role in the way buildings are valued in years to come. Sustainability benchmarking should therefore assist valuation as well as investment processes and decision-making in the future.

From an owner's perspective, there is some early emerging evidence to suggest that sustainable properties may limit the risk of depreciation to an asset's value over time.

1.1.4 ISSUES AND CHALLENGES IN OPERATIONAL SUSTAINABILITY BENCHMARKING

- Data collection
- Measuring and assessing performance
- Comparing and benchmarking performance

The process of sustainability benchmarking will vary according to its specific purpose and data availability, however, the key steps and associated challenges involved are likely to include, data collection, measuring and assessing performance, comparing and benchmarking performance, and acting upon results.

2. DATA COLLECTION

Collecting accurate, consistently measured and verifiable data is the first step to develop an appropriate and robust benchmarking process that will enable performance and progress to be measured, monitored and managed and, most importantly, help focus behavioural changes to achieve the best results in terms of sustainability performance. Unfortunately, a lack of data may lead to situations whereby it is not possible to employ the most effective metrics to improve and incentivise changes in operational performance. However, organisations can start by using available data, however limited it may be, and increase and improve the sophistication and robustness of the process over time.

It is important, at the outset, to clearly define the scope and purpose of the benchmarking exercise and the intended areas for incentivising behaviour. Following this, organisations should carefully consider the indicators they wish to report (e.g., annual $kgCO_2$ per m^2) and accordingly identify the type of metrics and associated data that needs to

be collected. However, deciding which indicators to employ will be influenced by the nature of data available for metrics to be measured, e.g., gross, or net lettable area for floor space; full time employees equivalent (FTEs) or workstations for number of employees; or sub-metered data, if available, for 'special-uses'. Indeed, data is often inaccessible or not readily available. For example, measuring energy consumption of individual occupiers in a multi-let building would require the installation of sub-meters. Over a large portfolio, such installations can involve significant expense and time. Moreover, care must be taken when benchmarking a property to clearly state the scope of the data collected, for example whether whole building data is collected, including both owner-provided services and occupier consumption. The way in which data is collected can also vary, greatly affecting the robustness of the benchmarking results. There is no current standard business practice in this field, with, for example, some organisations relying on estimates from utility bills for collecting energy data and others measuring actual energy consumption through half-hourly automatic meters and smart meters. While it is possible to collection allows for a more active environmental property management approach through frequent monitoring and targeting techniques.

2.1 MEASURING PERFORMANCE

A number of critical aspects must be accounted for when measuring performance. The operational performance of a building can be represented in both absolute and normalised terms. While both types of indicators have their own benefits and problems when measuring and assessing performance, it is important to note that both absolute and normalised indicators are complementary and necessary to provide a complete picture of an asset's performance and to support active property management. It is also important to select the appropriate driving metric to normalise the sustainability performance indicator in order to influence the right behaviour and deliver improved performances. However, the following issues currently prevent using the most effective metrics: lack of agreed metrics definitions and limited availability of accurate and replicable data.

2.2 ABSOLUTE PERFORMANCE

Absolute performance can be an important means of understanding the overall impact of a portfolio/organisation, e.g., total CO_2 emissions per year or comparing a consistent portfolio over time. Most real estate organisations collect the necessary data to measure and report absolute environmental performance. However, given the characteristics of the property sector, there are concerns about the effectiveness of absolute measures of performance in influencing the right behaviour that will deliver improvements to the sustainable operation of a building. The concern with absolute measures of performance is that care has to be taken to take account for the dynamic nature of the real estate market and the potentially rapid changes of portfolio size and asset ownership. For example, if the total size of the portfolio reduces significantly, absolute emissions would also be reduced, even if no direct actions to cut CO_2 emissions have actually been taken. The opposite is also true, whereby significant reductions in CO_2 emissions of an owner's property portfolio can be outstripped by an increase in their portfolio size over time. By comparing a consistent, like-for-like set of properties it is possible to compare absolutes over time, but the longer the time span being analysed, the more properties may have to be excluded from the like-for-like set.

2.3 NORMALISED PERFORMANCE

Normalised indicators take into account the dynamic nature of the real estate market and allow comparisons of portfolios and buildings' performance over time. Normalised measures have the further advantage of allowing for comparisons against near-peer groups at both the building and portfolio level. This is important in setting a sector wide benchmark and identifying industry leaders. Finally, by providing a more detailed assessment of how assets are performing, they allow organisations to set more appropriate targets.

Normalisation is achieved by relating the impact of a performance metric (e.g., CO_2, or litres of water) to another driving variable, such as floor area or density of occupation of a building. For example, emissions could be presented for an office building in terms of CO_2 per m^2, or CO_2 per full time equivalent employee (FTE) or per workplaces. Deciding which normalisation metric to use for assessing sustainability performance and developing benchmarking tools can be challenging, as the results ultimately can have an influence on the appropriate behaviour to improve building performance. The most common approaches are to assess performance relative to floor area and to occupational density, with each having specific advantages and issues. Moreover, benchmarking usually adjusts data for weather conditions, and in some cases for special uses.

2.4 NORMALISING RELATIVE TO FLOOR AREA

Measuring performance relative to floor area (m^2) is the most widely used and simplest normalised indicator in sustainability benchmarking. This indicator was originally chosen because it has a long history of being recorded for all types of property for other property management purposes, such as rents and insurance, and the relevant data is available, relatively accurate, replicable and verifiable. Furthermore, it has more recently become compatible with legislation on Display Energy Certificates (DECs) required for government-occupied buildings.

2.5 NORMALISING RELATIVE TO OCCUPATIONAL DENSITY

In the past years, organisations have started to increase the occupational density of buildings they occupy, e.g. across the government estate. This strategy may improve overall

organisational carbon and environmental footprint, but results in a higher emissions per unit of floor area, as more people occupy a given space, and these improvements are not captured by a per-floor-area indicator. This situation can be addressed by measuring performance relative to occupational density. Whilst less common, it is an approach that is increasingly being discussed and researched. Measuring density of occupation requires the measurement of the number of 'persons 'that occupy the building and use its facilities during a given period of time. Such an approach has its own issues related to how occupancy is defined and measured, the types of activities carried out by occupiers, and the risks of unintended consequences due to increased density.

The first concern is that there is no clear set of industry definitions for occupational density and the notion of 'persons' is not universal and differs per property type. The issue of industry definitions needs to be clarified for this form of normalisation to be developed further. The varying definitions for the office and retail sectors illustrate the point. In offices, a person is defined either by some notion of a 'worker', such as full time employee (FTE), or some description of a workstation. Managed retail properties have 'visits' measured by footfall, but their energy consumption is less driven by numbers of visitors than in the office sector, and there are questions as to how comparable footfall measurements are for different types of retail properties. Definitions should also indicate how often measurements are taken to account for changes in occupancy levels, e.g. annual average, or based on monthly or quarterly assessments. The issue of type and frequency of data is complicated by the practical matter of data collection.

The second concern is the type of occupier business activities which will influence the appropriate metrics to use. For example, a consultancy may have a large workforce (i.e., large number of FTEs) but the very nature of its business may mean that most employees are often out of the building and may have a high ratio of persons to workspaces. Therefore, reporting performance against either FTEs or workstations would produce significantly different results. Unintended consequences pose the third concern when using occupational density, as higher density does not automatically equate with improved sustainable performance.

There are certainly cost and energy gains to be made though greater utilisation of floor space. However, there are likely to be ceilings to such gains and beyond a certain threshold of people-density the design and operation of a building can be compromised, especially to meet peak demand. Energy demand is driven not only by the number of users, such as lighting and ventilation which are evidence that a more sustainable working environment can improve employee productivity.' There is a point at which high density will impact occupier productivity and by doing so reduce the attractiveness of a building to potential occupiers.

2.6 COMPARING AND BENCHMARKING PERFORMANCE

In order to compare performance across properties on a like-for-like basis, buildings need to be categorised into similar peer groups and special uses should be considered.

2.6.1 CATEGORISATION OF BUILDINGS

In defining the parameters for benchmarking, it is fundamental to establish categories of buildings in order to enable comparison between assets of similar characteristics. Typically, categorisation in the UK has been based on the type of HVAC systems in place, technical specifications and level of servicing.

However, there is a debate, particularly in the office sector, whether incentivising more 'sustainable' behaviours requires a move beyond this type of characterisation to take into account the usage of the buildings and how intensively they are being used. For instance, an alternative option within the office sector would be to categorise offices by density of occupation rather than the type of HVAC system in place. A benchmarking assessment based on a CO_2 emissions per floor area indicator can then be carried out for various bands of density of occupation. However, whilst there are undoubted benefits, there needs to be an agreement on

a standardised indicator for density of occupation before it can become a robust and accepted approach. Until further work has been carried out in this area, the density of occupation approach can only be complementary to the existing categorisation of a buildings based on HVAC systems.

Such an approach is not suitable in the retail sector, as energy consumption is less driven by numbers of people than by floor area and even volume (though customer visits can be a suitable way to normalise water consumption.

2.6.2 SPECIAL USES

In addition to the above, special uses, such as server rooms, trading floors, catering areas and car parks are important characteristics of properties that impact on their sustainability and carbon performance. The option of itemising and separating the consumption of such uses for benchmarking is of benefit when comparing buildings with different 'special uses'. However, ignoring these special consumption areas when reporting would not support the objective of influencing the right behaviour. A better approach to promote improved property management would be to utilise 'special uses' categories to differentiate peer groups and compare assets that have similar areas, in particular server rooms and catering. Whilst this would involve significant effort to obtain the data set to develop and refine such an approach, it may prove of significant benefit for improving performance of the buildings.

3. BEST PRACTICE PRINCIPLES FOR SUSTAINABILITY BENCHMARKING

- Key data collection principles
- Accounting for Change
- Incentivising the right behaviour
- Partnership between occupiers and owners
- Sharing knowledge and experience

Sustainability benchmarking can be a challenging exercise, and it is not usually possible to implement a detailed and wholly comprehensible system immediately from the outset. There is always much to learn and the BBP (Best Benchmarking Practice) would suggest that a Graduated Approach is best employed. This approach is presented below, along with other complementary and supporting principles for best practice.

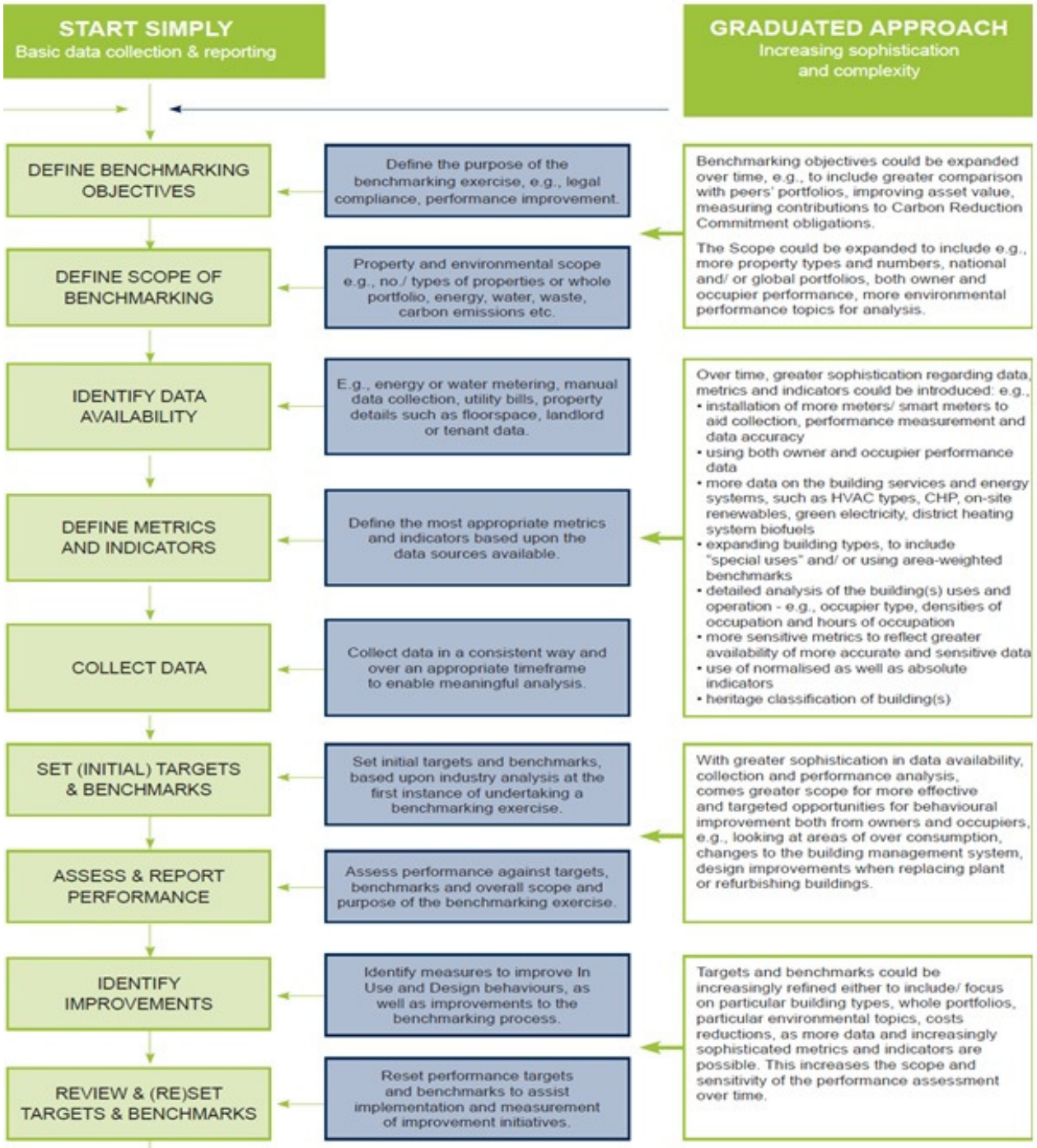

Fig. 1. Principal of Best Practices

A 'Graduated Approach', advocates that the benchmarking process should start off simple and build in complexity over time. This allows for further sophistication to be introduced as a greater understanding of how a building operates and the key factors influencing occupier behaviour develops. Essentially, as data collection becomes more accurate, reliable and routine, the process can be refined to collect further data which gives a greater understanding of how a building functions. This data may be at a greater level of granularity or of additional building characteristics.

For example, once it has become standard for a building's energy consumption to be monitored on a half-hourly basis, greater granularity can be introduced by collecting half-hourly data at the level of each individual tenant. Additional aspects to incorporate within the benchmarking process over time may include:

- Data collection regarding the physical description of the building.
    - Additional sustainability characteristics e.g., waste, water, transport etc.
    - Increasing levels of detail e.g. different fuel and energy supplies for energy consumption; or the collection of information for individual floors.
    - Increased frequency of measurement e.g., moves to the use of smart metering.
- Different or additional normalisation metrics:
    - Floor area
    - Hours of occupation
    - Density of occupation
    - Building use and operation.
- Accounting for changes in portfolios and intensification of buildings operation.
- 'Special uses', e.g., server rooms, trading floors, catering equipment, car parks.
- Employing a graduated approach to sustainability benchmarking has a number of advantages:
- It enables existing relevant data and data collection mechanisms to be utilised from the outset, whilst bearing in mind requirements to improve the scope and quality of data over time.
- It enables and promotes the introduction of necessary increasing sophistication in tandem with improved understanding of detailed particulars of buildings' performance.
- It provides a framework for the progressive adoption of absolute and normalised indicators and near-peer categories, to encourage improved performance and more meaningful comparison with peer performance.
- It facilitates the collection of more sensitive and sophisticated data, such as density of occupation and 'special uses' in order to provide more accurate information about building performance.
- As sophistication increases, it helps inform both owners and occupiers about where best to focus effective changes in behaviour and performance.

4. KEY DATA COLLECTION PRINCIPLES

The success of the benchmarking process will be dependent upon collecting data which is accurate, consistent, replicable, verifiable, and comparable and gathered over a sufficient time period to be able to discern trends. It is also important to ensure that data is collected over consistent time periods to enable the benchmarking process to take account of aspects such as seasonal variations in weather, which may influence the sustainability performance of a building. To ensure successful data collection, it is important that owners and occupiers engage and co-operate. Finally, the data collection requirements should be realistic, achievable and practical.

4.1 ACCOUNTING FOR CHANGE

Benchmarking needs to account for changes in portfolio size and composition (whether increasing or decreasing) to ensure that positive progress in sustainability performance at building level is properly reflected in the reporting process, and not masked by such portfolio changes. For example, the acquisition of further buildings, or increase in the number of occupiers may lead to an increase in an organisation's overall carbon emissions footprint and mask existing improvements in performance at individual building level already present in the portfolio. In addition, some organisations may rationalise their occupation levels from several buildings into one or two, which may improve their overall carbon footprint, but result in a higher emissions ratio per unit of floor area, as more people occupy fewer buildings. Absolute metrics or emissions relative to floor area will not reflect this overall strategic improvement. Careful selection of indicators will be important to ensure that changes in portfolio and building occupation levels are appropriately accounted for in the benchmarking process.

4.2 INCENTIVISING THE RIGHT BEHAVIOUR

Care needs to be exercised in the development and employment of metrics, indicators, targets and benchmarks to ensure that they drive the desired behaviour to achieve improvements in the sustainability performance of buildings while minimising unintended consequences. It will, therefore, be important at the outset to have absolute clarity about the intended purpose, whether that is to influence behaviour in terms of design or use, or a combination of the

two. Organisations should use the benchmarking process and its results to identify those properties that are underperforming and inform their property management strategy to improve them.

4.3 PARTNERSHIP BETWEEN OCCUPIERS AND OWNERS

For benchmarking to succeed in assessing performance and incentivising behaviour and improvements, data collection should ideally cover the whole building, i.e. both owner and occupier consumption data. It is therefore important that owners and occupiers engage and co-operate on data collection and on the implementation of performance efficiency measures. Measuring and reporting on the owner services alone will not give a full picture of how the building is being operated and potential improvements will therefore be limited to Common areas and services, such as energy-efficient lighting, running air-conditioning Systems more efficiently, and reducing the number of hours lift banks are operated at lower-use periods. Measuring occupier areas will give a more complete picture, clarifying where efficiency savings and improvements can be made and providing an opportunity for owners and occupiers to work together, share knowledge on how the building functions, and set sustainability improvements plans for the whole building rather than for specific areas only.

5. CONCLUSIONS

Sustainability benchmarking for property can be a complex undertaking and requires time and patience to implement successfully. There are many challenges to be overcome and detailed decisions to be made. Not all in the property sector will be embracing performance measurement and benchmarking at similar speeds, though the forthcoming CRC Energy Efficiency Scheme may speed-up its uptake. Those in the property sector who are undertaking this process, or who are about to, are encouraged to share the knowledge and experience they gain so that the property sector can collectively make a significant contribution to both the goals of reducing our

Industry's impact upon climate change and the environment, and of preserving and enhancing the value of property assets.

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