Industry Perspective

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Less is more with energy efficiency

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Executive Summary

September 2021

Demand side management needed to meet green targets. In order to meet ambitious global targets for reducing CO_2 emissions, there needs to be a renewed focus on energy efficiency (EE) to reduce energy wastage. Under the Paris Agreement, Asian countries have pledged to reduce emission intensity by up to 65 per cent in 2030 (using 2005 as a baseline line).

What is energy efficiency (EE)? EE is the concept of using less energy to perform the same task, thus eliminating energy wastage. The benefits of EE are significant. Adopters will: (a) reduce carbon footprint, (b) enjoy cost savings; and (c) enjoy non financial benefits such as improved image and branding by being Environmental, Social and Governance (ESG) friendly.

Buildings are a key contributor to CO_2 emissions. Buildings and construction projects are significant contributors to global CO_2 emissions, accounting for 39 per cent of total emissions. Given this and to address issues of sustainability and meet government targets to reduce pollution, we believe there needs to be a refocus on buildings' EE.

Compelling investment opportunities. We see significant opportunities for EE. Using a conservative bottoms up approach, we estimate investment opportunities of \$\$9.6bn by 2030 in key Asian markets including Singapore, Malaysia, Indonesia, Thailand, Hong Kong SAR and Mainland China. Our estimates are conservative as we assume an adoption rate of only 20 per cent for commercial buildings and 30 per cent for industrial buildings.

UOB's role to support EE. UOB is committed to playing its part to improve the environment. Through UOB's Smart City Sustainable Finance Framework (UOBSCSFF), we are making EE and other sustainable city solutions more accessible to large and small companies to help them embark on their sustainable journey.

For more information on the insights and banking solutions, please email: SG.C&I@ UOBgroup.com

Companies keen to participate on the exciting opportunities from the expected pick-up in the adoption of EE or related sustainable city solutions can email us at <u>SG.C&I@UOBgroup.com</u>.

Ambitious global green targets

Countries remain committed to the Paris Agreement despite COVID-19

Trends such as sustainability, digitalisation and automation accelerated post COVID-19

Green agenda at the forefront post COVID-19

Under the Paris Agreement in December 2015, 197 countries, including countries in Asia, have committed to reducing emission intensity by up to 65 per cent in 2030. In order to achieve these ambitious targets, various Asian governments have announced incentives and plans including green finance funds, tax exemptions, investment subsidies and regulations aimed at promoting sustainable practices. As a recap of the commitments under the Paris Agreement on climate change, over 190 countries pledged to take action to keep temperature rise to below two degrees Celsius and limit global warming to 1.5 degrees.

Despite the outbreak of COVID-19, most of the countries that ratified the Paris Agreement remain committed to meet the targets. In fact, the urgency to meet green targets has intensified as countries are striving for a sustainable economic recovery. To do so, there have been additional investments in the development of smart cities and green practices, particularly energy efficiency and renewable energy. Some of these trends favour the development of smart cities and green practices such as energy efficiency and renewable energy. Post the pandemic outbreak, several trends have been accelerated, including the drive for sustainable living, better quality of life, digitalisation and automation.

In terms of recent developments, Japan and Republic of Korea announced their commitment to be carbon neutral by 2050. This is a significant development since Japan is the world's third largest economy and fifth biggest carbon emitter. Fortunately, US reversed its earlier decision to withdraw from the Paris Agreement after the change in administration. US' new President Joe Biden also plans to implement a US\$2tn clean energy and infrastructure plan and a goal of net-zero emissions by 2050. Also noteworthy is that China, the second largest economy, has committed to be carbon neutral by 2060. This is significant as China accounts for circa 28 per cent of global emissions. Steps that China will take to meet this target include: (i) transition to renewable energy, (ii) industrial decarbonisation in electricity and heat generation, (iii) switch to electric vehicle; and (iv) energy efficiency targets for its buildings.

Figure 1: Country commitments to reduce CO₂ under the Paris Agreement



- United Nations Framework Convention on Climate Change

By 2030, these markets pledge to reduce emission intensity from 2005 levels by		Policy push to achieve goals for sustainability…
	36% Monetary Authority of Singapore (MAS) announced US\$2bn green finance investment program to drive sustainable finance growth.	
	45%	Total financing of up to RM5bn for the Green Technology Financing Scheme up to 2022.
	20-25%	Clean Technology Fund Investment Plan aims for US\$300mn to support goal of increasing share of alternative energy to 20 per cent, up to 2022.
	29-41%	US\$400bn worth of new public-works projects in transportation, energy, water, waste sectors focusing on sustainable growth.
*	26-36%	Hong Kong Government has earmarked US\$127mn for small-scale renewable energy installations in government buildings and community facilities.
*	60-65%	Reuse 79% of solid industrial waste as part of environmental protection initiative for "Made in China 2025".

Source: Climate Watch, UOB Analysis

Annual improvement in energy intensity will have to rise to meet sustainable goals

Catch-up needed to meet sustainable targets

Sustainable Development Goal (SDG) 7 adopted by United Nations Members commit the world to ensuring universal access to affordable, reliable and sustainable modern energy and is aligned to commitments under the Paris Agreement. Achieving SDG target 7.3 (doubling the global rate of energy intensity improvement by 2030) is key to meeting SDG7 targets.

Initially, an annual improvement rate of 2.6 per cent per year was recommended by the United Nations (UN) to achieve the target, but since global progress has been slower than necessary in recent years, the **annual average improvement rate now needed to meet SDG target 7.3 by 2030 is 3.0 per cent.** Therefore, governments that are committed to meet their SDG Targets will have to accelerate investments into EE.

High labour intensity of EE makes it an attractive investment for jobs creation Interestingly, the **high labor intensity of EE investments makes it a particularly attractive investment for job creation.** An analysis by the International Energy Agency (IEA) suggests that US\$1mn spent on building EE can create 15 jobs, one the highest factors in the energy sector. Comparatively, for the same investments in new grids, coal or other traditionally-fired power plants, the job creation is circa 2 to 6 jobs.

Figure 2: Global growth rate of energy intensity



Source: IEA, UN and World Bank, UOB Analysis

Government tools to drive EE

Governments have several policy tools for increasing energy efficiency, including:

- 1) Regulatory actions that mandate minimum efficiency levels in buildings
- 2) Labelling of appliances, vehicles, etc to indicate the level of energy consumption to better inform consumers or end-users.
- Fiscal or financial incentives to increase the financial viability of adopting EE equipment;
- 4) Awareness programs to help energy users make informed decisions.

What is Energy Efficiency (EE)?

EE simply means using less energy to perform the same tasks

Concept of energy efficiency

Energy efficiency simply means using less energy to perform the same task, which equates to eliminating energy waste.

Energy efficiency brings a variety of benefits: reducing CO_2 emissions and lowering costs for households and at an economy-wide level. In addition, there are also other benefits, which are discussed below.



Multiple benefits from EE including:

- Cost savings
- ESG goals
- Capital value
 enhancement
- Improve branding

Why EE? Returns include financial and non-financial benefits

EE looks at the demand side management of energy and offers tangible and non-tangible benefits including:

- Helping companies meet its ESG objectives and to be a more responsible corporate citizen.
- Cost savings from lower energy consumption.
- For selected assets, the capital value of energy efficient assets such as green buildings could be enhanced.
- Meeting its sustainability targets could also improve the company's branding and corporate image.
- Please see the next page for more details on the benefits of EE.



Figure 3: Benefits of adopting EE



Lower energy usage



Initial steps to being a green building and starting ESG journey



Cost savings

EE can lower energy usage, deliver positive social impact, cost savings and potentially higher capital value for buildings

Benefits of EE

The benefits of adopting energy efficiency are significant and can range from positive environmental impact to direct positive financial contributions. The key benefits of EE include:

Lower energy usage

Based on research by Singapore's Building Construction Authority (BCA) covering a nine year period, BCA observed that the overall energy use intensity (EUI) for green buildings has been steadily improving. The average EUI has improved by 14 per cent since 2008. This could be attributed to energy efficiency improvements as more commercial buildings in Singapore attain BCA Green Mark certification and non-BCA Green Mark buildings have undergone upgrading and retro-fitting of their air-conditioning (chillers; split-units) and lighting systems. Some of the upgrades have also included the use of solar energy equipment to improve energy consumption.

Initial steps to being a green building and starting ESG journey

By adopting EE, building owners could take the initial steps to convert their building to be a Green building. This could be the start of their journey towards being recognised as an Environmental, Social and Governance (ESG) company that would improve its branding image and perception.

Cost savings

Building owners can cut their operating expenses meaningfully by undertaking energy efficiency retrofits. For retail properties, the savings can range from about 9 per cent to 17 per cent of the total annual operating expenses, based on 15 per cent of the gross rental income. A 13.5 per cent saving in operating expenses translates to about 2.7 per cent higher net income. As for office properties, the savings could range from 7 per cent to 37 per cent.

Prospects for energy efficiency look promising given government incentives, cost savings and potential capital value upside After a building upgrade where operating expenses were lowered (assuming rental growth remains constant), **based on the capitalisation rate of 6.75 per cent, the real estate valuation could increase by 1.7 per cent.**

When measuring the return on retrofit based on the ratio of the change in valuation to the total retrofit cost, the ratio ranges from two to seven times for office buildings and one to nine times for retail properties. This demonstrates that the increase in the value of green properties far exceeds their total retrofit cost.

The green building landscape in Singapore continues to evolve and grow, underpinned by a supportive regulatory framework and government incentives. The incentives include a S\$50mn Green Mark incentive scheme for existing buildings and premises (GMIS-EBP). The government will co-fund up to 50 per cent of the retrofitting cost for energy improvements, or up to S\$3mn for building owners (up to S\$20,000 for tenants) who are existing small and medium enterprises.

Another government incentive is the building retrofit energy efficiency financing (BREEF) scheme. This will help building owners to fund the upfront costs of energy efficiency retrofits and in adopting Green Mark standards for existing buildings. Furthermore, the authorities will also offer an increased risk share of 60 per cent for any loan default with participating financial institutions.

Under Singapore's latest Green Building Masterplan (SGBMP) by Building and Construction Authority (BCA) and Singapore Green Building Council, the target is to increase Singapore's number of green building to 80 per cent (gross floor area) by 2030 from the current 43 per cent. In order to meet this objective, EE will be a key area of focus under SGBMP. In summary, prospects for energy efficiency in Singapore looks promising and we expect the growth of the green building trend to be mirrored in the other geographies in Asia.

Regional EE Incentives and Grants

To encourage developers and building owners to adopt green practices or energy efficiency, selected ASIAN governments offer a range of incentives for EE adoption, ranging from grants, tax breaks as well as subsidies. A summary of these regional incentives are highlighted below.

Energy Efficiency	<u>(;)</u>			*
Lineichey	Singapore	Malaysia	Thailand	Hong Kong SAR
Financing	BCA BREEF Scheme. Funding for energy efficient retrofit works Financing: up to S\$4mn or 90 per cent of equipment cost	Green Technology Financing Scheme 2.0. Rebate of 2% p.a. on interest (limited to 7 years) for Producer of Green Technology; User of Green Technology and ESCOs	NA	NA
Government Funding	NEA: Energy Efficiency Funds (E2F). Grant of up to 50 per cent of the qualifying costs, capped at S\$600,000	Green Technology Financing Scheme and Green Investment Tax Allowance. Free energy audits for building owners who shall accept to invest in energy saving measures	Energy Conservation Promotion Fund (ENCON Fund)	CLP Eco Building Fund to subsidise residential buildings' EE enhancement works, while HK Electric has setup the HK Electric Smart Power Fund to subsidise residential buildings or composite buildings
Government Grants	EDB: Resource Efficiency Grant for Energy (REG(E)) BCA: Grant for Low- GWP (Global Warming Potential) Refrigerant Chillers	SEDA: Energy Audit Conditional Grant for Commercial (2021) Energy Audit Conditional Grant for Commercial (2021)	NA	Green Item subsidy for maintenance works in building common areas. The subsidy is applicable to buildings >30 years with an average annual rateable value of less than HK\$162,000 in urban areas or HK\$124,000 in New Territories
Tax Incentive	NA	Tax exemption of 100 per cent of additional capex incurred to obtain the Green Building Index (GBI) certificate	Thailand's Board of Investment. Exemption of import duty on machinery for EE	Deduction period for capex on renewable energy-efficient building installations has been shortened from 25 years to 5 years

EE is critical to meet green targets

Buildings and construction projects account for 39% of CO₂ emissions worldwide

Energy efficiency for buildings is increasingly becoming more important to reduce carbon footprint as buildings and construction projects account for 39 per cent of global CO_2 emissions.

Other than ESG considerations, building owners may also enjoy financial benefits in terms of energy cost savings and potential uplift in capital values by improving the energy efficiency of their buildings. The regulatory outlook is favourable with incentives in selected Asian countries.

Energy efficient buildings to reduce CO₂ footprint

Buildings and construction are responsible for a significant portion of energyrelated carbon dioxide (CO_2) emissions worldwide. This is because all buildings release CO_2 when they use equipment that relies on combustion energy sources such as boilers, furnaces and onsite power generation. The Global Alliance for Buildings and Construction highlights that global building sector CO_2 emissions have been rising three per cent since 2010.



Source: Global Alliance for Buildings and Construction, UOB Analysis

Buildings can also generate renewable energy

60% of EE investments are skewed toward buildings

Hence, the reduction in CO_2 from buildings is seen as a potential solution to the climate crisis. Rather than being a major contributor to greenhouse gas emissions by relying on fossil fuels, buildings could not only cut their energy demand but could also generate clean, renewable energy (such as rooftop solar) that could be sold back to the national grid.

With energy consumption expected to rise with increasing population and growing economies, the need for energy-efficient buildings is essential and the focus of green initiatives in many countries. As a result, it should not be surprising that global EE investments (US\$249bn in 2019) are skewed toward buildings since this segment accounts for a significant share of carbon emissions. At a distant second is the transport sector with 25 per cent share of global EE investments followed by industry at 14 per cent.

Figure 5: Global EE investments by sector (2019)



"All of the core imperatives of energy policy – reducing energy bills, decarbonisation, air pollution, energy security, and energy access – are made more attainable if led by strong energy efficiency policy." – IEA (2016)

EE investment opportunities

Based on research by UN Environmental Program, Green Finance opportunities in ASEAN for EE (in building retrofit) is US\$152bn over the period 2016-2030. Annualising this for the period 2021-2030 suggest a potential investment opportunity of US\$91.2bn (S\$118.6bn).

We have conducted our own research on the potential investment opportunities in key ASIAN markets (Singapore, Indonesia, Malaysia, Thailand, Hong Kong SAR and Mainland China) and have **estimated an investment opportunity or addressable market of S\$9.6bn for EE building retrofit for the period 2021-2030.** Our figure is based on a conservative estimate of 20 per cent adoption of EE by commercial properties and 30 per cent by industrial property owners. In addition, for markets such as Mainland China, we have excluded segments such as industrial property due to limited data. Our EE investment opportunities by country, is highlighted below.

Assuming **100 per cent adoption would suggest opportunities of S\$44.0bn by 2030.** Our conservative adoption rates are due to perceived barriers and pain points by the building owners. This is conservative as rising awareness of the benefits could eventually drive adoption, particularly as the ecosystem matures. Also, due to limited data on Mainland China's industrial property, we have excluded this segment from our estimates.

Market		Current	Market (2030)	CAGR (2021-2030)
		S\$mn	S\$mn	(%)
	Singapore	1,274.7	1,850.1	3.8
	Malaysia	744.9	1,357.9	6.2
	Thailand	521.8	758.9	3.8
	Indonesia	580.0	1,058.7	6.2
\$	Hong Kong SAR	473.0	568.4	1.9
*	Mainland China	2,405.0	4,008.4	5.2
Total EE	retrofit opportunities in selected ASIAN countries	5,999.5	9,602.3	4.8

Source: UOB estimates, various websites

Key Pain Points in EE Adoption

Despite the benefits of EE, overall adoption has been moderate due to numerous pain points that could have impacted the pace of adoption by building owners. The key pain points are highlighted below but they can be categorised into access to funding, limited awareness of benefits, limited awareness of the operational performance of the EE as well as limited industry-wide data for benchmarking or comparison purposes.



UOB's regional survey indicates strong interest in EE if there is a zero capital outlay Strong interest in EE from our sample survey

We conducted a sample survey across the region in April 2021 with owners of buildings that are more than 8 years old to gauge the potential interest and opportunities in EE retrofitting works in the region.

Some of the key highlights include:

80 per cent of the respondents were keen on EE if there was 1 a zero outlay financing package offered. Respondents that were **not interested** cited **uncertainties on** system performance, upfront capital outlay and disruptions 2 to business operations as key pain points. Out of the sample survey, 72 per cent of the respondents have adopted EE, with most citing cost savings and reduction in 3 carbon footprint as the key reasons to adopt EE. Interestingly, out of the respondents who have experience with EE projects, 29 per cent managed to achieve over 30 per cent energy savings with 37 per cent achieving between 10 to 30 4 per cent energy savings. The remaining still managed to achieve 10 per cent or lower savings

Figure 6: Regional sample survey*

29%

of EE adopters

enjoyed cost

>30% to 50%

savings of

Figure 7: Savings from EE adoption



Respondents

Keen if zero outlay

* Regional survey skewed by Malaysia, Thailand and Singapore. ** Percentage of total survey respondents

Source: UOB Analysis



HHUOB

Expert interviews indicate government push is key and financiers will play a critical role to advance the growth of the sector

Key highlights from expert interviews

Over the past 12 months, we have conducted interviews with experts and stakeholders across the region. Companies we engaged and interviewed include energy service companies (ESCOs), property and facility management companies, multinational end-users of EE and energy management consultants. Some of the key takeaways and highlights from our engagement are:

> Government regulation, incentives and push is key to promote the growth of EE adoption.

> Banks and financiers play a critical part to accelerate the sector's growth due to the limited capital of ESCOs, particularly the local companies.

Accelerating the adoption of EE by building owners is challenging and there is a need to build awareness and to have a supportive eco-system.

Shared savings model for EE is popular as building owners do not have to come out with capital expenditure but this will mean ESCOs will need to be well capitalised.

"Its not easy to convince internal stakeholders. Benefits have to be highlighted upfront. First thing is potential savings".



- Facility Management Executive

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"You need to have the proper tool for measurement & verification in order to maximise your potential savings when adopting EE."



- Facility Management Executive

"In ASEAN, Thailand is an EE market leader in terms of Ecosystem, Government policy and Banks with knowledge and experience. Indonesia and Vietnam is on the rise"

- Energy Consultant

Key highlights from expert interviews



"For non-holistic/piecemeal EE enhancement, a coy can just engage with manufacturer or equipment supplier directly. For a holistic and more comprehensive project, a coy will usually look for ESCO to manage project. Hence, ESCO is key to the successful implementation of EE ".

- Regional: Managing Director of International F&B company that embarked on EE "Areas for EE enhancement include AC, cooling systems, lighting, heating and water usage. Contract period is for lighting 3 to 5 years and AC/cooling systems is 8 to 10 years"



"Shared Savings model is the more popular model. This model requires no upfront cost and ESCO will pay for the investments. Savings are split between the ESCO and the building owner. In terms of business segmentation and opportunities, Industrial is the most popular, followed by commercial".



- Building Energy Management Consultant

Energy Efficiency success cases

There are numerous EE success cases and the exact financial savings will depend of the respective countries' electricity tariff and scope of EE enhancement works. In addition, the existing condition and age of the building and its equipment also plays a part in determining the exact financial savings. We highlight success cases below from Singapore and Malaysia across various property segments that enjoyed significant annual energy savings and payback period of 1.8 to 6.8 years for the initial EE investment.

Commercial: Great World City				
	Project specification	Retrofit of chiller plant and pre-cool coils		
	System cost (SGD)	8.0mn		
	Annual savings (SGD)	1.17mn		
	Payback period	6.8 years		
Commercial: TUNE He	otel KLIA2			
	Project specification	Lighting, window glaze and HVAC		
	System cost (MYR)	3.1mn		
	Annual savings (MYR)	0.52mn		
	Payback period	6.0 years		
Industrial: Molex Singapore Ltd				
Moler	Project specification	Optimisation of chiller, pumps, cooling tower and lighting		
	System cost (SGD)	1.11mn		
	Annual savings (SGD)	0.6mn		
	Payback period	1.8 years		
Residential: Caribbea	n @ Keppel Bay			
	Project specification	Optimisation of water pumps and lighting		
	System cost (SGD)	217,700		
	Annual savings (SGD)	100,000		
	Payback period	2.2 years		

Source: Energy Efficient Singapore, UOB Analysis

Areas to improve EE in a building

Some of the equipment or areas in a building that could benefit from EE retrofitting include:



Lighting control

Lighting accounts for circa 18 per cent of energy used in commercial buildings. New lighting technologies such as light-emitting diode (LEDs) are many times more efficient than traditional technologies such as incandescent bulbs, and switching to newer technologies can result in substantial net energy use reduction, and associated reductions in greenhouse gas emissions. The use of LEDs saves energy by circa 80 per cent as compared to traditional commercial technologies such as halogen lamps. At the same time LED prices have been tumbling, declining 20 per cent for three consecutive years. Lighting products that were quite expensive are now much more affordable.

Figure 9: Rating systems for efficiency in kW/RT for chilled water plants.



Source: UOB Analysis, various websites

Furthermore, since an LED light bulb can last from 20,000 to 50,000 hours i.e. 5 to 8 times longer than any other bulb, its cost of operation is lower than other bulb types. The global energy-efficient lighting market is projected to expand at a CAGR of 3.5 per cent during the forecast period and reach value of US\$29.7bn by 2026.



Source: Shutterstock

Air-Conditioning System

The Air Conditioning and Mechanical Ventilation (ACMV) system can account for more than 50 per cent of total building energy consumption. Incorporating energy efficient measures into a building's heating and cooling systems are essential to creating an energy efficient structure.

An example of savings from improving the efficiency of air-conditioning systems is Shangri-La Hotel in Singapore. It had operated an air-conditioning system of 3,252 refrigeration tonnes (RT) capacity at an average efficiency of 1.22 kW/RT. After the retrofit, the installed capacity reduced to 2,600 RT with an average system efficiency of 0.68 kW/RT. The project has resulted in savings of 14,400 kWh of electricity per day. Without energy efficiency improvements to cooling equipment, electricity demand for cooling in buildings could increase by as much as 60 per cent globally by 2030.

Another example is the Singapore Post Centre that undertook a retrofit of its chiller plant. This helped to improve the efficiency from 1.1kW/RT to 0.6kW/RT. The resultant annual energy savings amounted to 5,000MWh and a 45 per cent reduction in annual energy cost usage to S\$1.44mn. The payback period was 1.7 years.

3 Solar Photovoltaics (PV) System

The use of renewable energy is an area to consider when improving a building's energy efficiency. This involves the use of solar PV systems for buildings. There are two kinds of solar PV for buildings.

Building-integrated photovoltaics (BIPV)

BIPV is one of the most promising and visually attractive ways of producing on-site electricity directly from the sun. In BIPV, the PV modules are integrated within the building structures mainly into roof or façade. The BIPV is installed considering the local weather conditions and the building architecture.

The BIPV system will have some impact on the building structure and its functionality. The PV modules serve a dual purpose: they replace conventional building envelope materials and generate power. BIPV systems can provide savings in materials and electricity costs, reduce use of fossil fuels and emission of ozone depleting gases, and add architectural interest to the building.

The initial cost of BIPV is offset by reducing the amount spent on conventional building materials and labour that would normally be used to construct that part of the building. Once the building is in operation, there are additional savings as the sunlight generates electricity energy. These advantages make BIPV one of the fastest growing segments of the solar PV industry.



Figure 10: Use of BIPV for a commercial building

Source: Shutterstock

Building-applied photovoltaic (BAPV)

BAPV is a photovoltaic technology retrofitted on different building structures primarily during the construction stage. It is fairly less detrimental to the environment and enables energy generation at a lower cost than conventional power generating sources. In BAPV, the PV modules are directly attached to the buildings using additional mounting structure and moving rails. The PV modules do not have any direct effect on the building structures and the way they function. The PV modules are installed at tilted angles either on roof or façade based on local weather conditions. BAPV can also be installed on either a horizontal roof or a vertical wall. BAPV is gaining popularity, as they help in reducing the uncontrollable use of fossil fuels and, offers weather protection, without affecting building aesthetics where they are installed.



Figure 11: Use of BAPV for a commercial building

Source: Shutterstock

While the upfront costs of making a building energy efficient may seem high, building owners could recoup the extra cost through reduced utility and maintenance expenses. Also, incorporating energy efficient features into a building could improve the capital value of buildings and attract tenants due to the potential savings on utility bills.

The global cool roof market size is expected to reach US\$27.1bn by 2025

4 Chiller

With proper design, appropriate chiller features and targeted maintenance, it is possible to establish an efficient chiller system. Up to 30 per cent of energy associated with chillers is loss due to inefficiency. Fortunately, not all cooling systems have to consume such high levels of energy. Simply being conscious of energy considerations and incorporating them into the design can significantly reduce the energy consumption of a chiller system.

5 Façade, cool roof and glazing system

An energy efficient roof (cool roof) is designed to reflect sunlight and absorb less heat than a standard roof. Cool roofs can be made using highly reflective paint, a sheet covering, or highly reflective tiles or shingles. Cool roofs reduce energy bills, improve indoor comfort, and may extend the service life of the roof. The warmer the climate, the greater the number of cooling days and the higher cost savings. A cool roof can benefit a building by reducing energy bills by decreasing air conditioning needs and improving indoor comfort for spaces that are not air conditioned.

For commercial buildings, the estimated net annual savings of a cool roof varies between US\$0.10 and \$0.20 per square foot of roof area, depending on domestic electricity tariffs and other localised factors. The global cool roof market size is expected to reach US\$27.1bn by 2025, accelerating at a CAGR of 5.7 per cent.

Energy efficient glazing is a term used to describe glazing consisting of two or more glass panes within a sealed unit. Unlike the original single glazing or old double glazing, energy-efficient glazing incorporates lowemissivity coated glass to prevent heat escaping through the windows. It helps keep the office warmer in winter and cooler in summer, thereby increasing the overall energy efficiency of the entire building.

Other benefits include reduced carbon footprint and noise reduction. The air or gas gap between the panes of glass in a sealed unit provides an extra layer of insulation. Installing energy efficient windows can save money over the long term by reducing the amount of energy required to heat/cool the offices. It is possible to lower the energy demand of a total glazed building up to 15 per cent compared to a normal building.

6 Elevator

By modernising an elevator, users or building owners can enjoy energy savings of over 50 per cent. Some enhancement or solutions range from retrofitting LED lights to a completely new elevator with energy-regeneration technology. The latest generation of energy efficient elevators could include features such as:

- i. Software- and microprocessor-based controls;
- In-cab sensors and software that automatically enter an idle or sleep mode, turning off lights, ventilation, music, and video screens when unoccupied;
- Destination dispatch control software that batches elevator stop requests, making fewer stops and minimising wait time that will reduce the number of elevators required; and
- iv. Personalised elevator calls used with destination dispatch controls that eliminate the need for in-cab controls.

Energy and power management system

A power management system (PMS) is essentially a digitised power distribution network, including connected devices and sensors that collect data from key points across the users' electrical infrastructure, from the facility's service entrance, across all feeders, down to final distribution and loads. PMS helps to deliver safe, reliable, efficient, and compliant operation of electrical distribution systems, including assets connected to it.

Some key benefits include avoiding electrical fires, quicker recovery from outages, improving uptime by avoiding unplanned outages, reducing energy costs as well as the maintenance of electrical assets.

Key features of PMS are track electrical system health and efficiency, capacity management, equipment monitoring as well as power event analysis. Depending on the project scope and equipment, the potential energy savings from the use of PMS could amount to 20 to 30 per cent.

1

Adopting EE is a step towards being a green building

Improving the energy efficiency of a building is also a gradual move towards becoming a green building. The classification of a green building will require certification from a recognised body (such as Singapore's Building and Construction Authority, BCA) and will have characteristics and features such as:

Energy efficiency (powered by renewable energy such as solar power, energy efficient air-condition and lighting system, etc). 2

Water efficiency (system to harvest rainwater for irrigation, recycled condensate water for cooling tower system). 3 Green innovations. These could include sustainable operations and maintenance, advocating a healthy indoor environment (good lighting, air quality, etc) and other green features (integrated paper recycling).

Figure 12: BCA Green Mark (Ratings and Criteria)

Groups	Components	Total Max Points	Intent
Energy Efficiency	Part 1 – Building Energy Performance (EE)	40	Usage of energy efficient system (for e.g. Air Conditioning, Ventilation, Usage of Renewable Energy and other energy efficient features)
	Part 2 – Resource Stewardship	30	Usage of water efficient fittings and features (reduction of water for building operations). Promotion of Waste Reduction and monitoring.
Other Green Requirements	Part 3 – Sustainable Management	35	Usage of sustainable and environmentally friendly product in the daily building operation and maintenance
-	Part 4 – Smart and Healthy Building	40	Advocates healthy and comfortable indoor environment (e.g. good air quality, thermal comfort, minimal noise level, good lighting).
	Part 5 – Advance Green Effort	20	Other green initiatives such as adoption of Smart Facilities Management.

Green Mark Rating	GM Platinum	GM Gold (Plus)	GM Gold	GM Certified
Green Mark Score	70 and above	60 - 70	50 - 60	Comply with all pre-requisite requirements

Source: BCA, UOB Analysis

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Green buildings for sustainability

Regulations and industry trends favour green buildings.

80%

of buildings in

Singapore are

BCA Green Mark

targeted for

certification

by 2030

Regulations and industry-led initiatives have been put in place over the past few years to drive the development or the repurposing of existing buildings into green standard buildings ("green buildings"). Recent research from the Global Commission on the Economy and Climate finds that bold climate action could deliver at least S\$26tn in economic benefits through 2030.

Renewable energy has the potential to reduce the impact of fossil fuel on the environment while providing a range of economic opportunities for businesses and communities to thrive. The strong push for sustainability has not only become a part of many businesses' corporate social responsibility but is also an aspect of remaining relevant in the future business environment as various stakeholders and other relevant partners in the company's eco-system push for higher sustainability.

Singapore, together with most countries, has committed to the Paris Climate Agreement which was ratified on 21 September 2016. Since the Paris Agreement came into force on 4 November 2016, Singapore has implemented a range of mitigation measures across various sectors, including industrials and real estate.

In terms of targets for green buildings, Singapore plans to have at least 80 per cent of buildings to be Building and Construction Authority (BCA) Green Mark certified by 2030. Complementing this effort is also the target to reduce carbon emissions by 36 per cent from 2005 levels by 2030 and have a renewable energy capacity of 2 gigawatt-peak by 2030.

Figure 13: Snapshot of Singapore's green building and related targets



Green Buildings At least 80% of buildings to be BCA Green Mark certified by 2030



Carbon Emissions Reduce emissions by 36% from 2005 levels by 2030



Renewable Energy Target 2GWp by 2030 that can power 350k households p.a.

Source: Straits Times, Business Times, UOB Analysis

UOB's sustainability initiatives

UOB is committed to a sustainable future and has a framework aligned with the UN Sustainable Development Goals (SDGs).

SUSTAINABLE

UOB recognises the importance of a sustainable future, and is committed to driving the change for a better environment. In order to support this initiative, we have introduced the UOB's Smart City Sustainable Finance Framework (UOBSCSFF), which is a finance framework for green sustainability-linked loans, deposits and trade facilities. This framework revolves around 7 key areas which are deemed essential for smart cities to be effective and efficient.

Companies that are keen to embark on this journey can tap on opportunities available from the development of smart cities can contact us to see how UOB can simplify your journey with UOB's Sustainable Financing.

Figure 14: UOB's Smart City Sustainable Finance Framework



Focus areas in UOB's SCSFF

UOB's key focus areas would meet selected UN SDGs

Figure 15: Seven key focus areas

1	7 stimment 13 Enui	Renewable energy refers to the energy generation, components manufacturing and expansion of associated distribution networks, including Solar Energy, Wind Energy, Small-hydro Power, and Geothermal. By promoting investment into renewable energy and transiting away from fossil fuels, greenhouse gases (GHG) emission levels can be reduced.
2		Green building construction refers broadly to those that are able to utilise highly efficient technologies that are able to reduce energy consumption, and better manage waste, surpassing regulatory requirements. Through this, a smart city will see reduced energy usage, water consumption, and waste.
3	9 NOTESTICS 9 NOTESTICS 14 III 14 III 14 III 15 III 10 IIII 10 III 10 III 10 III 10 III 10 III 10 III 10	Energy efficiency refers to improvement and retrofitting works, to reduce energy use. The concept is to make use of relevant technology and efficient designs to optimise the usage of electricity for buildings, agricultural/aquaculture processes and even transportation infrastructure.
4	11 menowaren ▲ Marcia	Green transport refers to the development, enhancement and operation of mass urban transportation systems, cleaner vehicles and low carbon shipping. This aims to reduce demand of fossil based fuels and associated emissions.
5		Sustainable water management and treatment refers to the development and improvement to water efficiency processes and wastewater treatment as well as the associated distribution infrastructure.
6		Waste management refers to the development and enhancement of waste management systems and waste to energy plants.
7		Climate change adaptation refers to activities which increase the resilience of eco-systems, pollution control and climate adaptation infrastructure.

Conclusion

Sustainability trends are here to stay. Building owners should consider going green to reduce carbon footprint and to save costs. The trend towards sustainability and the green movement will pick up momentum. Given that globally, buildings and construction projects account for 39 per cent of global CO_2 emissions, we believe that the focus on energy efficiency of buildings will intensify. Other than reducing CO_2 emissions, an energy efficient building will also yield cost savings and is a move towards being classified a green building.

Looking ahead, we expect the development of green buildings will accelerate. In addition, building owners may consider retrofitting existing buildings or assets to reap the benefits that include lower CO_2 emissions and financial uplift in terms of lower operating expenses and potential higher capital values. Other than energy efficiency initiatives, building owners can also consider the switch to solar energy that is economically viable due to the accelerated decline in the cost of solar energy systems and savings from lower energy costs.

Environmental Benefits Economic Benefits Social Benefits Green buildings are built The operating cost of a green Research indicates green to leverage on the best use buildings is generally lower buildings enhance health and of natural resources and to compared to a normal building wellbeing of those living and be environmentally friendly due to lower consumption of working in them. and sustainable. energy and water. This could increase the value of the building.

Figure 16: Benefits of green buildings

Source: UOB Analysis

Summary - Energy Efficiency Incentives and Grants

To encourage developers and building owners to adopt green practices or energy efficiency, selected Asian governments offer a range of incentives, ranging from grants, tax breaks as well as subsidies. A summary of these regional incentives are highlighted below.

Energy Efficiency	<u>()</u>			\$
Lineiency	Singapore	Malaysia	Thailand	Hong Kong SAR
Financing	BCA BREEF Scheme. Funding for energy efficient retrofit works. Financing: up to S\$4mn or 90% of equipment cost	Green Technology Financing Scheme 2.0. Rebate of 2% p.a. on interest (limited to 7 years) for Producer of Green Technology; User of Green Technology and ESCOs	NA	NA
Government Funding	NEA: Energy Efficiency Funds (E2F). Grant of up to 50% of the qualifying costs, capped at \$600,000.	Green Technology Financing Scheme and Green Investment Tax Allowance. Free energy audits for building owners who shall accept to invest in energy saving measures	Energy Conservation Promotion Fund (ENCON Fund)	CLP Eco Building Fund to subsidise residential buildings' EE enhancement works, while HK Electric has setup the HK Electric Smart Power Fund to subsidise residential buildings or composite buildings
Government Grants	EDB: Resource Efficiency Grant for Energy (REG(E)). BCA: Grant for Low- GWP (Global Warming Potential) Refrigerant Chillers	SEDA: Energy Audit Conditional Grant for Commercial (2021) Energy Audit Conditional Grant for Commercial (2021)	NA	Green Item Subsidy for maintenance works in building common areas. The subsidy is applicable to buildings >30 years with an average annual rateable value of less than HK\$162,000 in urban areas or HK\$124,000 in New Territories
Tax Incentive	NA	Tax exemption of 100% of additional capex incurred to obtain the Green Building Index (GBI) certificate	Thailand's Board of Investment. Exemption of import duty on machinery	Deduction period for capex on renewable energy-efficient building installations has been shortened from 25 years to 5 years

Key Incentives for Energy Efficiency (Singapore)

Energy	
Efficiency	Singapore
Financing	BCA: BREEF Scheme Target building owners, management corporations, energy services companies (ESCOs) and SPVs who require funding for energy efficient retrofit works.
	Financing: up to S\$4mn or 90 per cent of equipment cost/ cost of installation, whoever is lower <u>https://www1.bca.gov.sg/buildsg/sustainability/green-mark-incentive-schemes/building-retrofit-</u> <u>energy-efficiency-financing-breef-scheme</u>
Government Funding	 NEA: Energy Efficiency Funds (E2F) Aim to encourage investors of new industrial facilities or major expansions in Singapore to integrate resource efficiency improvements into manufacturing facility development plans early in the design stage. With grant of up to 50 per cent of the qualifying costs, capped at \$600,000. https://www.e2singapore.gov.sg/programmes-and-grants/incentives/energy-efficiency-fund
Government Grants	EDB: Resource Efficiency Grant for Energy (REG(E)) Aim to supports industrial facilities in the manufacturing sector to be more energy efficient and improve competitiveness. Grant support for REG(E) will correspond to the amount of carbon abatement, up to the maximum cap of 50 per cent of qualifying costs. https://www.edb.gov.sg/en/how-we-help/incentives-and-schemes.html
	BCA: Grant for Low-GWP (Global Warming Potential) Refrigerant Chillers Aim to encourage owners and operators of existing buildings to adopt water-cooled chillers using refrigerants with low global warming potential (GWP) early, before the ban on sales of water-cooled chillers using high-GWP hydrofluorocarbons (HFC) refrigerants takes effect in 2022. https://www1.bca.gov.sg/buildsg/sustainability/green-mark-incentive-schemes/grant-for-low-gwp- refrigerant-chillers-logr
Tax Incentive	-

Key Incentives for Energy Efficiency (Malaysia)

Energy Efficiency	
	Malaysia
	Ministry of Environment and Water, Credit Guarantee Corporation Malaysia Berhad (CGC) and MGTC
	<i>Green Technology Financing Scheme 2.0</i> Rebate of 2% p.a. on interest/profit rate (limited to first seven years only) for each loan and financing for Producer of Green Technology; User of Green Technology and ESCOs
Financing	Malaysian Debt Ventures (MDV), corporation under Minister of Finance IncEnergy Performance Contracting (EPC)
	Aim to help ESCOs implement energy-efficiency projects in the building sector. It will be supported by credit guarantee fund of RM15.8mn from Ministry of Energy, Green Technology & Water along with RM2mn contribution from JKR Building Sector Energy Efficiency Project, to reduce facility financing rate on loans to enhance financing package attractiveness.
	Green Technology Financing Scheme and Green Investment Tax Allowance under MESTECC
Government Funding	Target Energy Audit and Management in Large Commercial Building/ Large & Medium sized industries/ Large government facilities
	The campaign will offer free energy audits to the targeted building owners who shall accept to invest in energy saving measures with an amount equal to the cost of the audit. Conducted over period of 2016-2025.
	SEDA: Energy Audit Conditional Grant for Commercial (2021)
Government Grants	Energy Audit Conditional Grant for Commercial (2021) Funding for similar project expected to be implemented for year 2020-2021. Open to any existing building with commercial electricity tariff listed under the Efficient Management of Electricity Energy Regulation (EMEER) 2008 by Energy Commission and has valid appointed Registered Electrical Energy Manager
	Ministry of Energy, Green Technology and Water Malaysia
Tax Incentive	<i>Tax incentives</i> Tax exemption equivalent to 100% of additional capital expenditure incurred for building owners to obtain the Green Building Index (GBI) certificate. Tax incentives include investment tax allowance, accelerated capital allowance, import duty exemption, sales tax exemption and energy efficient products



Key Incentives for Energy Efficiency (Thailand)

Energy Efficiency	
Enciency	Thailand
Financing	-
Government	Energy Conservation Promotion Fund (ENCON Fund)
Funding	Support operation of ESCO companies through funding to increase credit lines given by ESCO fund
Government Grants	-
Tax Incentive	 Thailand's Board of Investment Activity based incentives: 8 years corporate income tax exemption for waste-to-energy projects: the amount of tax exemption is not subject to any cap. Exemption of import duty on machinery Exemption of import duty of raw or essential materials use in manufacturing export products for 1 year which can be extended as deemed appropriate.

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