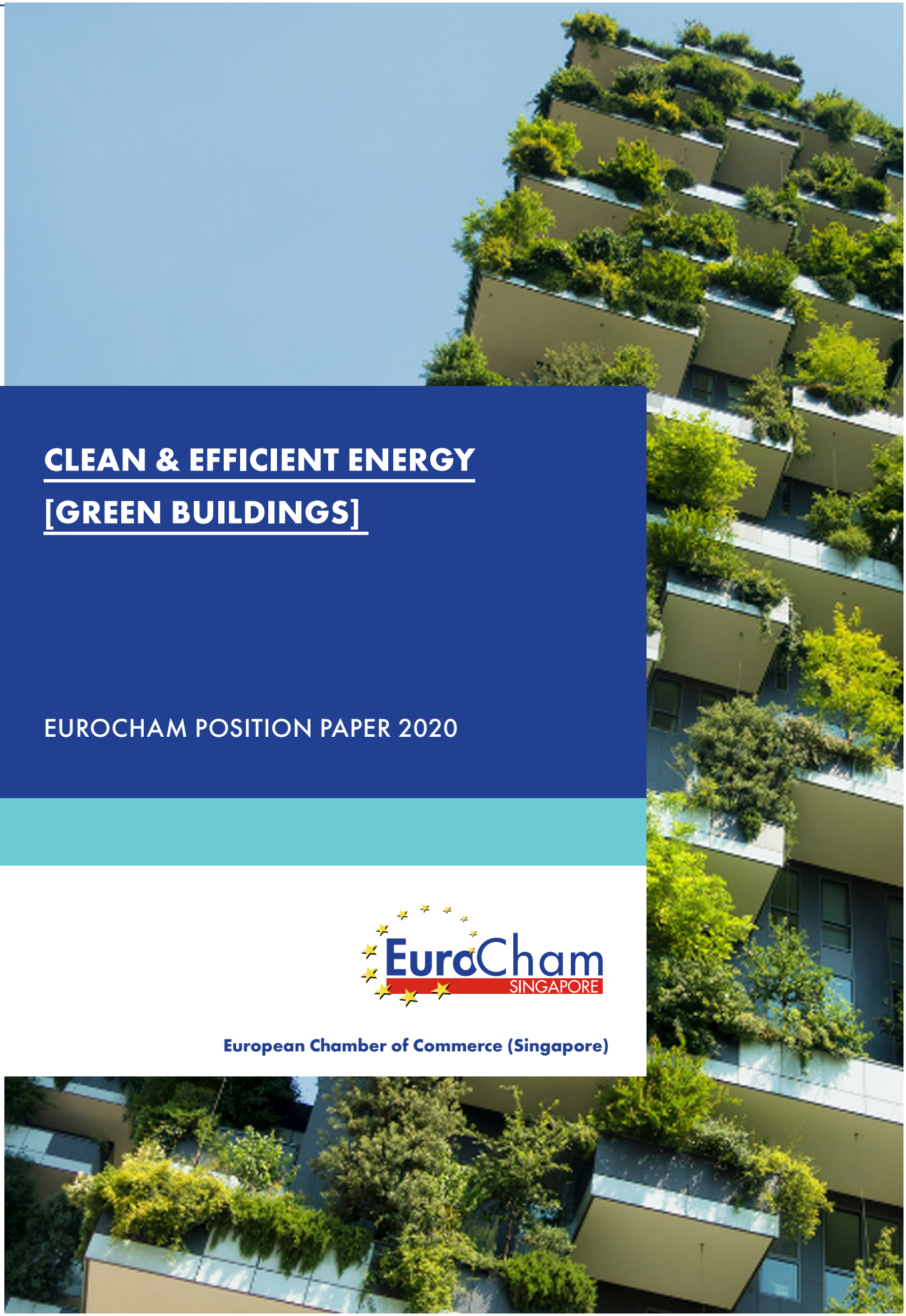

CLEAN & EFFICIENT ENERGY [GREEN BUILDINGS]

EUROCHAM POSITION PAPER 2020

EuroCham SINGAPORE

European Chamber of Commerce (Singapore)

TABLE OF CONTENTS

INTRODUCTION

BACKGROUND

This position paper assesses the developments towards green buildings and utilization of clean and efficient energy in Singapore on the one hand and in the European Union (EU) on the other. Globally, the call for sustainable development is emphasized by the United Nations (UN). The Brundtland Commission formed at the UN Assembly with the resolution 38/161 of 19 December 1983, highlighted in 1987 that sustainable development meant attaining today's needs without compromising future generations' capability to sustain their own necessities[1]. In 2018, the UN Framework Convention on Climate Change underlined that meeting the 1.5°C limit required "rapid, far-reaching and unprecedented" changes in land, energy usage, industry, buildings, transport and cities[2].

Emissions from buildings and their construction are approximately 40% of total carbon emissions, where operational emissions constitute 28%[3]. Green buildings, being more energy efficient, can aid in efforts by both Singapore and the EU towards sustainable development. The World Green Building Council (WGBC) is committed towards the promotion of efforts for buildings to reach net-zero carbon operating emission by 2030, and to advocate for all buildings to be net-zero carbon in operation by 2050. They have defined net-zero carbon buildings as buildings that "are highly energy efficient and fully powered from on-site and/or off-site renewable energy sources"[4]. As net-zero buildings are currently not feasible in a large-scale implementation, green buildings and nearly-zero energy buildings (NZEB) are the midway goal.

SCOPE & OBJECTIVES

This paper will focus on current developments towards green buildings and clean and efficient sources of energy for both Singapore and the EU and in particular in the areas of:

- Energy Demand

1 *Khan, Jam Shahzaib, Rozana Zakaria, Siti Mazzuana Shamsudin, Nur Izie Adiana Abidin, Shaza Rina Sahamir, Darul Nafis Abbas, and Eeydzah Aminudin. "Evolution to emergence of green buildings: A review." Administrative Sciences 9, no. 1 (2019): 6.*
2 *https://www.reuters.com/article/climatechange-ipcc/temperatures-to-rise-1-5-degrees-celsius-by-2030-2052-without-rapid-steps-u-n-report-idUSL8N1WM0JJ#:~:text=LONDON%2FSEOUL%2C%20Oct%208%20(,The%20U.N.*
3 *https://www.worldgbc.org/news-media/WorldGBC-embodied-carbon-report-published*
4 *Ibid.*

- Energy Supply
  – Conventional and renewable energy
- Measurement, Reporting and Verification (MRV) of greenhouse gas (GHG)

The analysis of both Singapore and the EU is crucial as it will allow stakeholders and private companies to understand their respective areas of improvement, establishing an avenue for a development of green buildings in Singapore. A combined effort of multiple stakeholders is imperative for ensuring the best possible progress towards sustainability.

The primary objective of this position paper is to assist stakeholders in both Singapore and in the EU to understand the current developments and issues to be tackled. Constructive recommendations will be provided, which will present opportunities for creating an attractive business environment in Singapore.

METHODOLOGY

This position paper has been developed by engaging the Singapore government's statutory boards and having extensive interviews with members of the European Chamber of Commerce (S) operating in the relevant industries, pertaining to the issue of energy and green buildings.

This paper is written by Lesley Nair S/O Dahrma Raj Nair. Special acknowledgements go to Total Solar Singapore Pte Ltd, Shell Eastern Petroleum Pte Ltd, KPMG Services Pte Ltd and Lys Energy Solutions Pte Ltd for their contributions and assistance in the expert panel.

STRUCTURE OF THE PAPER

This paper will be streamlined into two chapters, the first focusing on addressing energy conservation, comprising innovations by both Singapore and the EU towards increasing the energy efficiency of buildings and their methods of MRV. Second, the paper will focus on energy supply, assessing the access to cleaner, renewable energies that are being utilized by both Singapore and the EU. The efforts of both parties will be analysed, and constructive recommendations will be provided.

The following chapter will then provide an overall recommendation towards the progress of efforts for green buildings, before concluding on the future prospects for stakeholders in both Singapore and the EU.

The structure of the paper:

Chapter 1: Energy Conservation

- Addressing the energy efficiency of buildings
- Assessing the MRVs of Singapore and EU

Chapter 2: Energy Supply

- Access and utilization of renewable sources of energies

Chapter 3: Looking ahead

Conclusion

CHAPTER 1

ENERGY CONSERVATION

Both Singapore and the EU have strong environmental ambitions and have similar goals of achieving nearly-zero buildings towards their decarbonisation efforts, where Singapore aims to halve its emissions by 2050 and where the EU goes beyond and aims to be climate-neutral by 2050.

This chapter focuses on energy conservation efforts by both the Singapore and the EU. This is achieved through energy efficient technologies construction materials as well as digital technologies and legislations for measurement, reporting and verification (MRV), working towards green buildings and NZEBs.

ADDRESSING THE ENERGY EFFICIENCY OF BUILDINGS

SINGAPORE

The Building Construction Authority (BCA) in Singapore works with key industry players and academia towards progressing efforts of developing Green Buildings in Singapore. Within the umbrella term of Green Buildings, Singapore has been working towards Super Low Energy (SLE) Buildings as well. Key initiatives taken by these Singapore authorities are:

- The SLEB Technology Roadmap
  This roadmap was developed to identify and prioritize more than 60 key technologies and strategies towards helping the industry to design and develop cost-effective SLE Buildings. The availability of options allow building owners and developers to select suitable technologies that best enable them to meet their desired building performance and outcomes.

- The SLEB Smart Hub
  This hub was created to facilitate the exchange of knowledge on energy efficient technologies amongst industry stakeholders. This open database of green building technologies is supported by building energy data and analytic tools. The Smart Hub also has an online advisory function to recommend customised retrofitting plans for building owners and developers to green their buildings.

- Green Buildings Innovation Cluster (GBIC)
  BCA and the National Research Foundation (NRF) also established the Green Buildings Innovation Cluster (GBIC) in 2014, which funds collaborative research on environmentally sustainable buildings between the Built Environment sector and the research community. This programme enables collaboration between building owners, developers and research partners to develop innovative green technologies and conduct large-scale demonstrations to assess feasibility of energy-efficient technologies for green buildings.

- Singapore Green Building Master Plan (SGBMP)
  From 2020 onwards, BCA and the Singapore Green Building Council (SGBC) are working together with various industry stakeholders to co-create the Singapore Green Building Master Plan (SGBMP). BCA also engages wider stakeholder groups, comprising financial institutions and end-users such as tenants, homebuyers and youths.

- Building Retrofit Energy Financing (BREEF) Scheme
  This scheme aims to reduce upfront capital cost for energy bills and financing upfront costs for energy efficiency for the retrofitting of buildings. Within this scheme, chiller plants – centralized cooling systems – that provide a portion of the air-conditioning systems, have had their operating efficiency improved by 38%. Along with other retrofits, there was an average total annual electricity savings of 16%, which contributed to 120 GWh per annum. This has been cited to amount to an estimated $30 million in savings per annum.

Within the recently announced Housing Development Board (HDB) Green Towns Programme, HDB has outlined a 10-year plan to make HDB towns more sustainable and liveable by 2030. A key initiative is towards the utilization of Smart LED lighting to increase the energy efficiency of buildings for both common property areas and for homes as well. Smart motion sensors and analytics capabilities are installed within residential buildings, that can automatically adjust the luminosity of the LED lights depending on the motion detected. Using smart sensing control, the LED lights progressively dim and brighten according to whether motion is detected. This usage of Smart LED lighting can reduce energy used for lighting by up to 60% compared with conventional LED lighting.

The Singapore government also plans to continue working with various stakeholders to improve district cooling solutions and explore the feasibility of new areas for implementations. Users of the current Marina Bay District Cooling System enjoy efficiency and energy savings of more than 40%. This higher operational efficiency is being planned for expansion, where upcoming district cooling projects include Jurong Innovation District, Punggol Digital District and Jurong Lake District.

EUROPEAN UNION

At the EU level, the EU directives play an essential role towards promoting the implementation of energy efficient technologies to progress towards a greener building stock. "Energy efficiency first" is a key element as well within the EU directives. Initiatives towards encouraging the implementation of such technologies are:

- The compliance to EU directive 2018/844 of 30 May 2018, amending directives 2010/31/EU on energy performance of buildings and 2012/27/EU on promoting implementation of energy efficiency in buildings has increased the adoption rate of technologies to improve building stock. Member states have been increasing the installation of building insulation and windows with high energy efficiency ratings. In addition, Energy Performance Certificates (EPCs) are proving to be profitable for building owners. In states such as Belgium and Germany, the NZEB standards have been exceeded, where the Passivhaus standard is being implemented for both new and

existing buildings, pushing buildings to be net positive for energy.

- The EU also improved upon the ventilation, space heating/cooling, and water heating/cooling. The EU published its first plan in 2016 to tackle the massive amount of energy used for heating and cooling in the building sector. A major strategy of the plan is to improve integration of the power grid with district heating and cooling systems. Energy efficient technologies in boilers, along with design improvements in vent dampers and Heating, Ventilation and Air-conditioning (HVAC) systems are being developed and implemented to contribute energy savings for residential and commercial buildings.
- EU member states are also required by the 2010 EU Energy Labelling Directive (2010/30/EU) and the Ecodesign Directive to ensure that household appliances, lighting and electronics to meet minimum energy efficiency standards and to carry energy labels, to quantify the expected energy consumption. The role of member states is to promote the awareness of such directives and programmes, which could have more penetration within member states. These energy efficiency requirements also need stringent enforcement by member states. Policymakers at both the EU and member state levels, use legal constraints and information awareness programmes to drive improvements in energy efficiency.

ANALYSIS

In the past decade, both Singapore and the EU have made significant progress towards green buildings. The creation of technologies for HVAC systems increase the efficiency of energy consumption for buildings and this has reduced the energy demand as a result.

However, in both the EU and Singapore, the persistence of the perception that there is no urgency to implement energy efficient technologies is an area which needs to be taken into consideration. Building owners need to understand the benefits, which are often cost savings over long-term, for replacing conventional technologies with more sustainable ones. This mindset results in a fragmented adoption of technologies, highlighted within the report by the United Nations Economic Commission for Europe (UNECE). Within the EU, the adoption of technologies is not a combined effort by member states and this needs to be addressed.

Within Singapore, the government's initiatives thus far have been coalesced around the public sector and the HDB's implementations, which should be expanded as well. Furthermore, additional technologies employed within the EU, such as smart metering, can be considered towards implementation for buildings in Singapore as well.

RECOMMENDATIONS

- The benefits of energy efficient technologies have to be effectively communicated to building owners and users. Despite both Singapore and the EU making inroads towards the development and implementation of technologies that can increase the energy efficiency of buildings, individuals have to be educated on them as well.
- Both the EU and Singapore should consider the awareness of individuals to be included in their respective roadmaps and building masterplans. This will enable the individuals to understand the perspectives of the government and of companies as well, ensuring an effective ecosystem for the promotion of energy efficiency in buildings, where sustainable, resilient and inclusive cities for both parties can be created.
- The commitment towards green buildings, has to see efforts taken by both public and private sectors. Both sectors have to work together to ensure that praiseworthy initiatives in their respective sectors can be coalesced to accelerate their progress.

The Singapore government has been in communication with private companies, yet there is further need for clarity in this communication, to ensure that clear and detailed roadmaps are drawn to constantly update interests, agendas and plans for progression.

ASSESSING THE MEASUREMENT, REPORTING AND VERIFICATION (MRV) OF SINGAPORE AND THE EU

The MRVs are key towards enforcing the effectiveness of efforts towards increasing the energy efficiency of buildings. Both Singapore and the European Union have implemented policies towards ensuring that all buildings adhere to standards set out by the government and union, respectively. These standards will be analysed and assessed subsequently.

SINGAPORE

The Building and Construction Authority (BCA) launched the Green Mark Scheme in 2005, which formed the backbone of Singapore's first Green Building Masterplan (SGBMP). This Scheme mandated stakeholders to adopt technologies for attain green buildings respective to standards of Gold, GoldPlus and Platinum. As the built environment sector began to embrace the idea of sustainable buildings, BCA expanded its target to have "at least 80% of buildings (by floor area) in Singapore to be green by 2030".

Subsequently, the second and third SGBMP were rolled out, allowing BCA to ensure that its plans were updated with the advent of newer technologies for green buildings. In 2018, BCA also launched the Super Low Energy (SLE) Building programme that pushed firms to exceed the Green Mark Platinum standard and attain a higher level of sustainability for their buildings.

BCA also launched the Super Low Energy (SLE) Building programme in 2018 to encourage firms to go beyond the existing Green Mark Platinum standards and push the envelope of environmental sustainability in Singapore. From the Building Energy Benchmarking Report 2017, the proportion of tenant's electricity consumption was observed to be around 50% of total buildings' electricity consumption. Furthermore, it is important to consider the user/occupant behaviour as building's plug loads have been identified to consume about 25% of the total building energy consumption. As the Built Environment sector began to embrace the idea of sustainable buildings, BCA expanded its ambition to green the larger stock of existing buildings and engage buildings occupants to change their energy consumption behaviour. Furthermore, as of March 2020, more than 42% of Singapore's Gross Floor Area (GFA) has been greened. As buildings account for over 20% of Singapore's emissions, greening of buildings is key to Singapore's effort to continue developing sustainably and to mitigate its emissions.

To further the progress towards efficiency in green buildings, BCA is co-creating the next SGBMP with the Singapore Green Building Council (SGBC) and various industry stakeholders this year. The co-creation process will encourage stakeholders to co-own and co-deliver the SGBMP, recognising the shared responsibility to raise building performance and sustain it over the lifecycle of the building. The SGBMP 2020 will thus be a combined effort with stakeholders from the public, private and people sectors, including Trade Associations and Chambers (TACs). One of the key initiatives under the SGBMP 2020 is to review the mandatory minimum environmental sustainability standards for buildings. To support the push towards more energy efficient buildings, BCA plans to raise the minimum energy performance standards for both new and existing buildings in the coming years.

To facilitate building owners to benchmark their electricity consumption against other buildings, BCA has been publishing energy performance data and will aim to continue to cover more types of buildings, from commercial to educational, healthcare and transport as well. This will allow building owners to know how they perform compared to similar types of buildings and spur them to upgrade and benefit from savings for improved energy efficiency of their buildings. The formation of an effective ecosystem is also a key priority for the BCA, where they are working with industry partners, such as the Singapore Green Building Council (SGBC), to develop a suite of programmes to strengthen the industry ecosystem.

In addition, under the current Green Mark scheme, all buildings with footprint of more than 1000m2 will need to conduct a solar feasibility study. Additional Green Mark points are also awarded for solar ready roof and solar deployment. The use of renewable energy is also one of the four main areas of cost-effective features to adopt towards achieving SLEB status, in addition to passive design, active strategies and smart energy management.

EUROPEAN UNION

Within the EU, the Green Deal has been established as a roadmap for making the EU's economy more sustainable. Amongst the various areas, building and renovating is one of the focuses, with overall targets set out at the union level for 2020, 2030 and 2050.

The European Commission (EC) highlights that currently about 35% of the EU's buildings are over 50 years old and approximately 75% of them are energy inefficient. The present rate of progress is slow, where an estimated 1% of building stock is renovated per year. Therefore, there needs to be more done for attaining green buildings.

Therefore, the EU has established a legislative framework that includes the Energy Performance of Buildings Directive 2010/31/EU (EPBD) and the Energy Efficiency Directive 2012/27/EU. Both directives promote policies for the progress

towards "achieving a highly energy efficiency and decarbonised building stock by 2050". These directives were further amended as part of the Clean energy for all Europeans package in 2018 and 2019. These new rules had to be transposed into national law by member states by 10 March 2020.

Within the EPBD, there are a broad range of policies and supportive measures that are summarized below:

- Member states are required to establish long-term renovation strategies to decarbonise national building stocks by 2050, with dedicated milestones for 2030, 2040 and 2050. These should be in line with the National Energy and Climate plans (NECPs) energy efficiency targets. In addition, they must mandate cost-optimal minimum energy performance requirements for new buildings, existing buildings undergoing major renovation, and for the replacement or retrofit of building elements such as heating and cooling systems, roofs and walls.
- In the EU it is defined by the EPBD that requires all new buildings to be nearly zero-energy by the end of 2020. All new public buildings should have been nearly zero-energy already by 2018. Member states had to draw up and submit nearly zero-energy buildings national plans, describing how they intended to increase the number of NZEBs in their respective country to comply with the directive. This is to be combined with Energy performance certificates to be issued when a building is sold or rented, and inspection schemes for systems such as air-conditioning to be established.
- Under the Energy Efficiency Directive (2012/27/EU), member states must undertake energy efficient renovations to at least 3% of the total floor area of buildings and are recommended to only purchase buildings that are highly energy efficient.
- The EU also utilizes the Energy Performance Certificates (EPCs). Within Article 20 (2) of the EPBD, member states are asked to provide their respective objectives towards improving the energy performance of buildings for owners and tenants of the buildings. From these objectives, essential information on the EPCs, inspection reports and financial instruments employed to progress towards greener buildings are communicated. For monitoring, the EPBD requires member states to establish an independent control system to verify a statistically significant portion of EPCs annually. The compliance of the EPCs have its highest levels for newly constructed and sold buildings, with its lowest levels for rented out buildings.

ANALYSIS

The Green Mark Scheme in Singapore and the EU Directives set the precedents for manufacturers within the Built Environment Sector to progress towards greener practices in construction and maintenance. There has been progress on both sides towards MRV for greener buildings. The EU employs more mandates towards having energy efficiency measured, reported and verified in buildings, where Singapore employs more incentives to have companies continue practicing more greener efforts.

On both ends, the direction is positive towards sustainable development. However, the rate at which buildings are currently measured and enforced for their emissions to be reduced, has to be quickened. Despite agencies and member states respectively in Singapore and the EU implementing initiatives to improve their MRV, the potential for improvement should be harnessed effectively.

RECOMMENDATIONS

- The current Green Mark Scheme in Singapore is exemplary, but it can be improved through better MRV. The Singapore government can also consider the implementation of technologies employed within the EU, such as smart metering, towards improving the MRV of buildings, similar to that in the Punggol Digital District (PDD).
- The ability to employ data analytics for both parties should be better utilized. This can increase the pace of MRV for buildings' emissions. Furthermore, strategies drawn up by both the EU and Singapore should ensure that enforcement of the buildings' emissions is effective, and that data should be weaved into their strategies as well.

CHAPTER 2

ENERGY SUPPLY

The conservation of energy to ensure that buildings are more energy efficient is combined with the supply of renewable sources of energies, where the generation of cleaner energy produce less GHG emissions, reducing types of pollution as well. This diversification of energy supply, reducing the dependence on conventional fuels is paramount for sustainable development, and is a key priority for both Singapore and the European Union.

ACCESS AND UTILIZATION OF RENEWABLE SOURCES OF ENERGIES

SINGAPORE

As a "High Rise High Density Urban Tropics" country, Singapore faces limitations in having access to renewable sources of energy. In light of this, solar energy is currently the most viable renewable energy resource.

The government aims to deploy at least 2-Gigawatt peak (GWp) of solar by 2030, and given Singapore's space constraints, various areas and initiatives to facilitate the large-scale deployment of solar in Singapore is being considered, such as in rooftops, reservoirs, and vacant land, to achieve its solar goals. Key initiatives are listed below:

- Rooftop solar deployments on public buildings are outlined through the recently announced SolarNova programme. The programme promotes and aggregates solar demand across government agencies to drive the adoption of solar PV, allowing them to provide lead demand and build up the solar ecosystem in Singapore. HDB aims to commit 70% of High-rise flats in Singapore for solar panel installation on rooftops by 2030, which amounts to a further 320-Megawatt peak (MWp), furthering its aim of generation to a total 540 MWp, to support the new 2GWp solar target.
- The government is also working closely with JTC Corporation to develop new initiatives to encourage the adoption of solar. BCA organized a workshop in February 2020 with JTC, the Energy Market Authority (EMA) and the Sustainable Energy Association of Singapore (SEAS) and received key feedbacks towards improvements of the solar industry. Thus, the government plans to develop a suite of market levers, recognition and research initiatives to stimulate the increase of solar photovoltaic (PV) cells onto private sector buildings. Potential market levers include demand aggregation by developers to improve the business case of smaller rooftops, and government policies to mandate solar deployment on lessee's roof.
- Apart from rooftops, the government is also looking to increase solar deployment in new areas such as reservoirs, vacant land, and Building Integrated PVs (BIPVs). The Public Utilities Board (PUB) will also be increasing the deployment of floating solar panels on reservoirs. Earlier in February, PUB awarded a 60 MWp floating solar deployment on Tengeh Reservoir, to be completed in 2021. JTC will also be expanding its SolarLand initiative to install solar panels on vacant land plots not required for development in the near future. The project will see the development and deployment of mobile solar systems for easy re-deployment when the land is needed for other sues. The government is also devoting R&D efforts to develop and reduce costs of such applications to improve its feasibility of implementation in Singapore, where in the longer term, Singapore could be plugged into a regional power grid to trade electricity with its neighbours to bolster energy security.
- The government also engages in solar research, having built up capabilities in institutes such as the Solar Energy Research Institute of Singapore (SERIS), which conducts industry-oriented R&D and trains manpower for the solar energy sector; and the Energy Research Institute @ the Nanyang Technological University (NTU), which conducts research in a range of energy sectors such as fuel cells, smart grids and green buildings. Beyond the research efforts, BCA is also collaborating with agencies such as NParks, JTC and the Urban Redevelopment Authority (URA) to develop solutions for the co-location of solar panels and green roofs. The government encourages companies to take the lead in adopting innovative technologies, to help collectively increase solar deployment and achieve solar targets.

EUROPEAN UNION

The EU had set a target in 2018 for 32% share of EU energy consumption coming from renewable energy sources by 2030. The revised Renewable Energy Directive (Directive EU 2018/2001), as part of the "Clean energy for all Europeans' package, was aimed at keeping the EU a global leader in renewables and to help the EU meet its emissions reduction commitments under the Paris Agreement. Key renewable technologies in areas of solar and offshore wind have been expanded in the EU. Biomass remains as the key renewable energy source in the EU, where overall deployment of bioenergy is expected to be 55% in 2030. Within the building industry, the following points have been highlighted:

- The current contribution of renewable energy towards energy demand in buildings stands at 22% in 2015. Approximately half of this was biomass and the other half was renewable electricity and district heat derived from renewable sources. The contribution of solar thermal was relatively small, where it was only 2% of renewable consumption. The Energy Performance of Buildings Directive (EPBD 2010/31/EU) mandates both residential and tertiary sector buildings to increasingly utilize renewable sources of energy.
- The European Parliament Committee on Industry, Research and Energy (ITRE) adopted the Maximizing Energy

Efficiency in Buildings' report. As part of the EU's upcoming Renovation Wave initiative in September 2020, the massive roll-out of solar power is encouraged, including the launch of a pan-European solar rooftop programme. However, large scale implementation is required as more than 90% of buildings in the EU go unused. This pushes the need for large-scale implementation of solar PV in the EU, and together with offshore wind and hydro, more opportunities for job growth can be achieved as well.

- Biomass products, such as pellets are used as fuel for space heating installations. Geo and aero thermal energy heat pumps are employed in buildings for ground coupled and air to air heat exchange. This conversion technology offers the possibility of efficient energy used both for space heating and cooling.

ANALYSIS

Singapore's key source of renewable energy is solar, due to its limitations mentioned above. Its efforts towards solar have made progress towards identified targets. In comparison, the EU has greater access to renewable sources of energies, prioritised differently due to member states having different energy mixes based on their natural resources. Northern countries have more resources for wind, hydropower and geothermal, where southern countries have more solar and biomass. The EU's directives towards increased employment of renewable energy is positive; aligns with EU's Renovation wave, solar is currently being prioritised as well.

Despite the EU having more sources of renewable energies, this paper chooses to focus on solar as it the analysis for Singapore, where both parties' direction to solar can elicit key insights. Therefore, with both parties prioritising solar, there are key opportunities for collaboration. Information on technologies can be gathered and shared to develop cost-efficient methods.

RECOMMENDATIONS

- Although both the EU and Singapore have on their own set targets towards attaining solar energy, both parties have to establish clear roadmaps develop the public and private sectors for the implementation of solar technologies. These roadmaps will also need to include the views, interests and agendas of private companies, where effective communication is once again key here, as aforementioned in the earlier chapter of Energy Conservation.
- The rate of implementation of solar in both the EU and Singapore has to be increased to meet their own goals for utilizing solar energy. For this, the authorities will have to work together with private companies. Research and Innovation attain cost-efficient technologies for the employment can be shared amongst the various stakeholders in both the EU and Singapore. The sharing of information through consultations will be crucial to a combined effort for the employment of renewable energy in both the EU and Singapore.

CHAPTER 3

LOOKING AHEAD

This position paper has limited its focus to commercial and residential buildings, as initiatives by both the EU and Singapore have been geared towards these two areas. However, this should not take away the importance of such initiatives – for increasing energy efficiency of buildings and the employment of renewable sources of energies – eventually being implemented into the industrial sector as well.

Looking ahead, both the EU and Singapore will have to consider the industrial sector buildings in expanding their vision of green buildings. Although both parties' efforts are commendable, the impact of the industrial sector on GHG emissions is more than the buildings sector – comprising of both commercial and residential buildings. Therefore, the focus should expand to establishing roadmaps which consider similar recommendations to do set out in this paper.

CONCLUSION

The EU and Singapore are in prime position to achieve their targets for attaining green buildings. Their efforts have been assessed in this position paper, for readers to understand the respective landscapes and to begin the facilitation of a discussion that is imperative towards the improvement of initiatives taken by both parties. The key theme that is raised in this position clearly points to communication and education. Building owners and residents need to understand the importance of green buildings, the technologies being employed and their benefits. Without this crucial understanding, it will be difficult for EU and Singapore to accelerate their initiatives and attain their targets.

This has to be in tandem with effective communication with private companies. Ministries, Statutory boards and agencies at the governmental level can implement actions towards actualising policies, but they will be incomplete without the cooperation of private companies. Companies within the built environment and renewable energy sectors have to be consulted. Their views are of paramount importance towards having effective operations of technologies and maintenance of green buildings.

Ultimately, the path to green buildings for the EU and Singapore has to be a meaningful one. This requires constant movement by all stakeholders, where communication and education have been re-emphasized in this paper. Even with robust initiatives and technological innovations, the road towards sustainability will not be complete if not for a combined effort. We believe that the recommendations in this paper can help the EU and Singapore towards achieving a coordinated ecosystem for the attainment of clean, efficient energy and for greener buildings.

CONTRIBUTORS

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LIST OF ACRONYMS

BCA	Building Construction Authority
BREEF	Building Retrofit Energy Financing
ECP	Energy Performance Certificates
EMA	Energy Market Authority
EPBD	Energy Performance of Buildings Directive
EPBD	Energy Performance of Buildings Directive
EU	European Union
GBIC	Green Buildings Innovation Cluster
GBIC	Green Buildings Innovation Cluster
GHG	Greenhouse gas
GWp	Gigawatt peak
HDB	Housing Development Board
ITRE	Industry, Research and Energy
MRV	Measurement, Reporting and Verification
MWp	Megawatt peak
NRF	National Research Foundation
NTU	Nanyang Technological University
NZEB	Nearly-zero energy buildings
PDD	Punggol Digital District
SEAS	Sustainable Energy Association of Singapore
SEAS	Sustainable Energy Association of Singapore
SERIS	Energy Research Institute of
SGBC	Singapore Green Building Council
SGBMP	Singapore Green Building Master Plan
SGBMP	Singapore Green Building Master Plan
SLE	Super Low Energy
UN	United Nations
WGBC	World Green Building Council