MEDIA RELEASE

BCA DRIVES THE NEXT GENERATION OF GREEN BUILDINGS - THE SUPER LOW ENERGY BUILDINGS

- *More than 10 developers to pledge their commitment to achieve the new Green Mark for Super Low Energy buildings*

5 September 2018, Singapore – The Building and Construction Authority has launched the Super Low Energy (SLE) Programme to push the envelope of environmental sustainability in Singapore. It includes a suite of initiatives such as the SLE Buildings Technology Roadmap and the SLE Challenge to encourage the adoption and design of cost-efficient SLE buildings. These were announced by Guest-of-Honour, Mr Lawrence Wong, Minister for National Development and Second Minister for Finance, at the opening of the Singapore Green Building Week (SGBW) 2018.

2 Since the beginning of Singapore's green building journey in 2005 with the introduction of BCA Green Mark and the three Green Building Masterplans, we have 'greened' more than 3,400 buildings, covering more than 100 million m^2 of gross floor area. There has been growing acceptance that green buildings make economic sense from the building life cycle perspective. The strong business case for green buildings is clearly demonstrated in BCA's latest Building Energy Benchmarking Report 2018 (refer to Annex A). Commercial buildings continued to show commendable improvement at 14% in energy performance since 2008. This improvement from over 1,000 commercial buildings translates to about 1,000 GWh in energy savings per annum, which is equivalent to about S$200 million savings in a year.

3 Over the years, with the advancement of technologies and the industry professionals becoming more competent in green building design, we are better positioned to spearhead ***the next lap in Singapore's green building movement to push for more energy-efficient solutions in a cost-effective manner.*** Globally, there is growing support for the movement towards zero energy buildings. In Singapore, BCA retrofitted an existing building at the BCA Academy into a zero energy building in 2009.

4 Mr Hugh Lim, BCA CEO, said: "We have come a long way in our environmental sustainability journey. To kick-start the next wave of our green building movement, BCA is working with the industry professionals to deliver cost-effective Super Low Energy buildings which can achieve a minimum of 60% energy efficiency improvement over the 2005 building codes, when the BCA Green Mark was first introduced. Beyond this, we are embarking on more rigorous research and innovation to further push the frontier for

green buildings to achieve up to 80% energy efficiency improvement. By setting such new performance benchmarks, Singapore can play an important role in mitigating climate change and doing our part as a responsible global citizen. We hope more building owners and developers will join us as we work towards the common goal to shape a greener built environment that benefits Singaporeans."

SLE Programme: creating a SLE ecosystem

5 The SLE Programme is aimed at making SLE buildings (refer to Annex B) the next generation of green buildings. It consists of two key aspects:

1) **SLE Challenge** to invite progressive developers to take the lead in developing SLE buildings through good designs and cost-effective technologies. To recognise these SLE projects, BCA has introduced the **new Green Mark for SLE**.
2) **SLE Buildings Technology Roadmap** to develop cost-effective solutions to push the limits of energy-efficiency

SLE Challenge

6 BCA is inviting industry and government agencies to take on the SLE Challenge voluntarily. So far, more than 10 developers and building owners have pledged their commitment to achieve at least one SLE project in the next five years.

7 For instance, the Defence Science and Technology Agency (DSTA) has worked with the Army to achieve a high standard of energy efficiency for building facilities in Kranji Camp and Seletar Camp[1], while still meeting operational requirements. For Kranji Camp building, DSTA adopted computational fluid dynamics to simulate wind flow and design the buildings for optimal natural ventilation. Solar light pipes are used to channel sunlight into the building interior, while sensors are introduced to automatically lower artificial lighting levels when there is sufficient sunlight, thus conserving energy. Solar panels are installed on the roofs of both buildings to convert sunlight to electricity, generating sufficient energy to meet all their requirements. The two Army buildings will save close to 540 MWh of electricity a year – which is equivalent to the annual electricity consumption of about 116 4-room HDB flats. DSTA also introduced the use of Mass Engineered Timber, a sustainable material which also serves as a carbon sink, for the Kranji building, which is a first for SAF facilities.

8 To recognise exemplary building owners and developers, BCA introduced the **new BCA Green Mark for SLE** (GM SLE) (refer to Annex C). This voluntary certification framework for SLE buildings, adds on to the BCA Green Mark (GM) scheme, to support the net zero energy aspiration in the tropical and sub-tropical region. GM for SLE will provide recognition for best-in-class energy efficient buildings in addition to their Green Mark ratings. For example, a building that achieves GM Platinum and GM SLE would be

[1] Both developments are on track to achieve Zero Energy Building status under the new BCA Green Mark for SLE, as the framework provides pathways to meet either Super Low Energy or Zero Energy Building.

awarded Green Mark Platinum (Super Low Energy). It encourages building owners to push the boundaries in terms of passive and active strategies, smart energy management, and use of renewable energy to achieve best-in-class building energy performance. Public and private developers have agreed to strive for the GM SLE in close to 20 projects.

SLE Buildings Technology Roadmap

9 BCA is also launching the ***SLE Buildings Technology Roadmap*** to help achieve the ambitious target of up to 80% energy efficiency improvement over 2005 levels (refer to Annex D). Jointly developed in partnership with industry and academia, the Roadmap outlines the broad strategies to help the industry design and develop cost-effective SLE buildings.

10 An SLE building with 60% energy efficiency improvement is technically feasible with best-in-class technologies today, but more research, development and demonstration (RD&D) is needed to push the boundaries to 80% energy efficiency improvement, and to do so in a cost effective way. Keppel Land is one such developer who has committed to pilot various emerging technologies at its BCA Green Mark Platinum certified development, Keppel Bay Tower, with a view to replicate the implementation of these technologies to rejuvenate its other commercial buildings. In 2017, BCA and Keppel Land launched a Joint Challenge Call for test-bedding of SLE technologies at Keppel Bay Tower. This project is supported by an innovation fund of $1.28 mil from BCA's Green Buildings Innovation Cluster (GBIC) programme. Keppel Land will be demonstrating five technologies within Keppel Bay Tower, namely:

a) **Smart lighting system**
The smart lighting system utilises occupancy sensors which will allow seamless transition in lighting levels according to building occupancy. The fully-autonomous system will be implemented in seven levels of the building.

b) **Air conditioning based on indoor activity analytics**
Integrated sensors are used to capture occupants' activities and comfort levels based on which an analytical model will be derived to predict and optimise air-conditioning operation to improve energy efficiency.

c) **Intelligent building control system**
The smart building management system, which will be implemented throughout the entire building, uses a simulation model together with available building data for energy optimisation, predictive maintenance and fault detection. This technology employs a high precision physics-based simulation engine that utilises high computing capability, coupled with machine learning and artificial intelligence ability, to improve data analytics and control. This will reduce the downtime and resources required for Keppel Land to maintain and operate the development.

d) **High efficiency air distribution system**

This air handling unit fan, which is about 25% more energy efficient than best-in-class technology, is expected to run at a lower noise level, resulting in better indoor environment quality for building occupants.

e) **Cooling tower water management system**
This system, which will be implemented throughout the entire building, incorporates a patented solution which dissolves existing scales (build-up of solids/sediment) and prevents further scale formation. It also removes dissolved oxygen, creating an alkaline environment for better corrosion control. The system will also automatically disinfect water to prevent algae and bacteria, thereby eliminating the need for chemical treatment. The amount of blow-down water (water that is drained to remove mineral build-up) discharged is hence substantially reduced, resulting in significant water savings.

Issued by the Building and Construction Authority on 5 September 2018

Enclosed:
Annex A: Factsheet on Building Energy Benchmarking Report 2018
Annex B: Infographic on characteristics of a SLE building
Annex C: Factsheet on Green Mark for SLE
Annex D: Factsheet on SLE Buildings Technology Roadmap

About BCA

The Building and Construction Authority (BCA) of Singapore champions the development of an excellent built environment for Singapore. BCA's mission is to shape a safe, high quality, sustainable and friendly built environment, as these are four key elements where BCA has significant influence. In doing so, it aims to differentiate Singapore's built environment from those of other cities and contribute to a better quality of life for everyone in Singapore. Hence, its vision is to have "a future-ready built environment for Singapore". Together with its education arm, the BCA Academy, BCA works closely with its industry partners to develop skills and expertise that help shape a future-ready built environment for Singapore. For more information, visit www.bca.gov.sg.

ANNEX A: FACTSHEET ON BCA BUILDING ENERGY BENCHMARKING REPORT (BEBR) 2018

Background

BCA took a momentous first step towards greater transparency in building energy performance information through the release of the annual BCA Building Energy Benchmarking Report (BEBR) in 2014.

Objective

With the release of the BEBR annually, BCA hopes to raise awareness among stakeholders of the performance of our buildings, spur positive action at all levels to initiate and implement improvements in building energy efficiency, drive change to energy consumption behaviour and embrace sustainable best practices as we move forward. This will further encourage the growth of green economy through driving demand for green buildings, thereby opening up market opportunities for green solutions and services.

Other than bridging the information gap for the industry, the data is also used to review the standards for BCA's Green Mark scheme and green building policies. This year, BEBR would be streamlined to be ***e-BEBR which is an online technical report that focuses on statistics and figures drawn from data collected through the Annual Mandatory Submission***[2]***.*** This year's statistics and figures include that of commercial buildings, healthcare facilities, and educational institutions as well as 3 new building types, namely: large-sized buildings of civic, community and cultural institutions, sports and recreation centres, and transport facilities.

Target Audience

The national building energy benchmarks are set yearly and the report benefits stakeholders at all levels:

- Building Owners, Facilities Managers, and Tenants. Raise awareness of energy performance of their buildings and drive action to improve performance standards

- Consultants and Designers. Generate or refine new ideas, designs and best practices in designing/ retrofitting a green building

- The Government. Monitor energy consumption and efficiency of buildings and provide insights to support formulation of appropriate measures

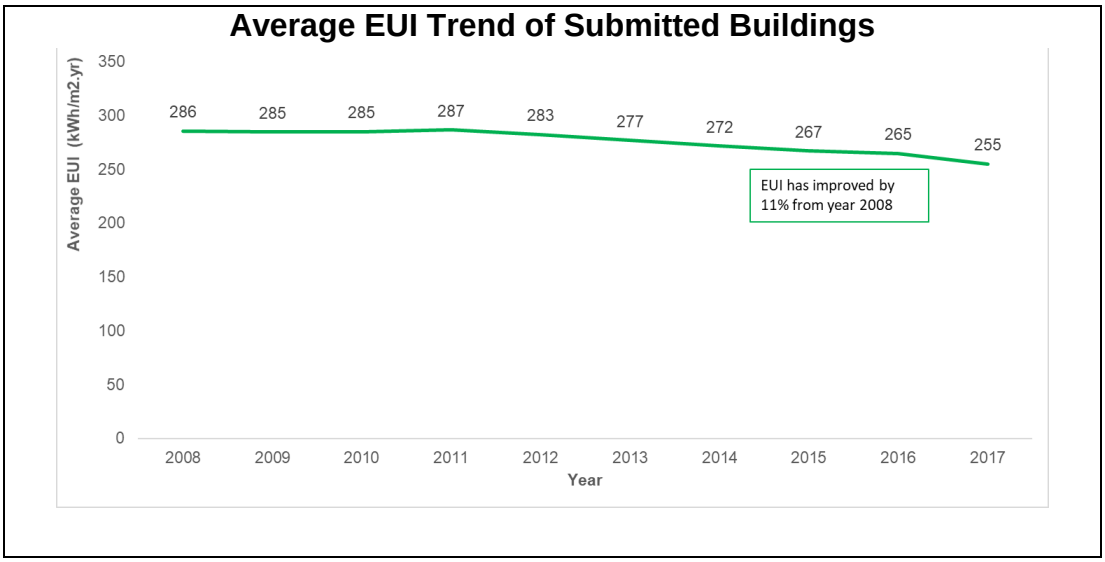
- Research and Education Communities. Spur further research and studies to advance green building technologies and solutions for the future

Overall Performance of Submitted Buildings in 2017

Key Findings

[2] The annual mandatory submission is a requirement under Section 22FJ of the Building Control Act that has been implemented since 2013, requiring building owners to submit building information and energy consumption data to BCA annually.

- Based on the submitted data from 1,566 buildings, BCA observed that the ***total electricity use of buildings has not increased even as the building stock continued to grow, corresponding to overall less electricity used per floor area.***



- ***Commercial buildings continued to lead energy efficiency efforts with commendable improvement of 14% in energy use intensity (EUI) since 2008.***

The e-BEBR is available at BCA's corporate website from 5 September 2018 onwards: (https://www.bca.gov.sg/BESS/BenchmarkingReport/BenchmarkingReport.aspx or https://www.bca.gov.sg/Sustain/sustain.html).

Next Steps

Disclosure of Building Energy Performance Data

In 2017, the first set of energy performance data for commercial buildings was released, on a voluntary basis, through BESS and Singapore's Open Data Portal, data.gov.sg. This year, ***additional parameters would be disclosed for the commercial buildings that had been volunteered. The first set of anonymised data for healthcare facilities and educational institutions would also be released.*** In addition, BCA is considering mandatory disclosure in the future to allow more data to be shared in the public domain. The disclosed data would be available at BCA's website or Singapore's open data portal from 5 September 2018 onwards: (https://www.bca.gov.sg/BESS/BenchmarkingReport/BenchmarkingReport.aspx or http://www.data.gov.sg).

Targeted and Customised Engagement of Building Owners

Besides the streamlined e-BEBR and the possibility of mandatory disclosure in future, ***BCA seeks to instil behavioural change through (a) conducting regular and customised engagements; and (b) introducing a stronger element of social norming.*** The enhanced engagement of building owners through personalised emails and automated SMS, aims to further spur the industry towards energy efficiency improvements. The outreach messages to building owners would be customised according to the performance of the buildings. In turn, such information would be passed on to the facilities management teams responsible for the buildings' operations.

ANNEX B: INFOGRAPHIC ON CHARACTERISTICS OF SUPER LOW ENERGY BUILDING

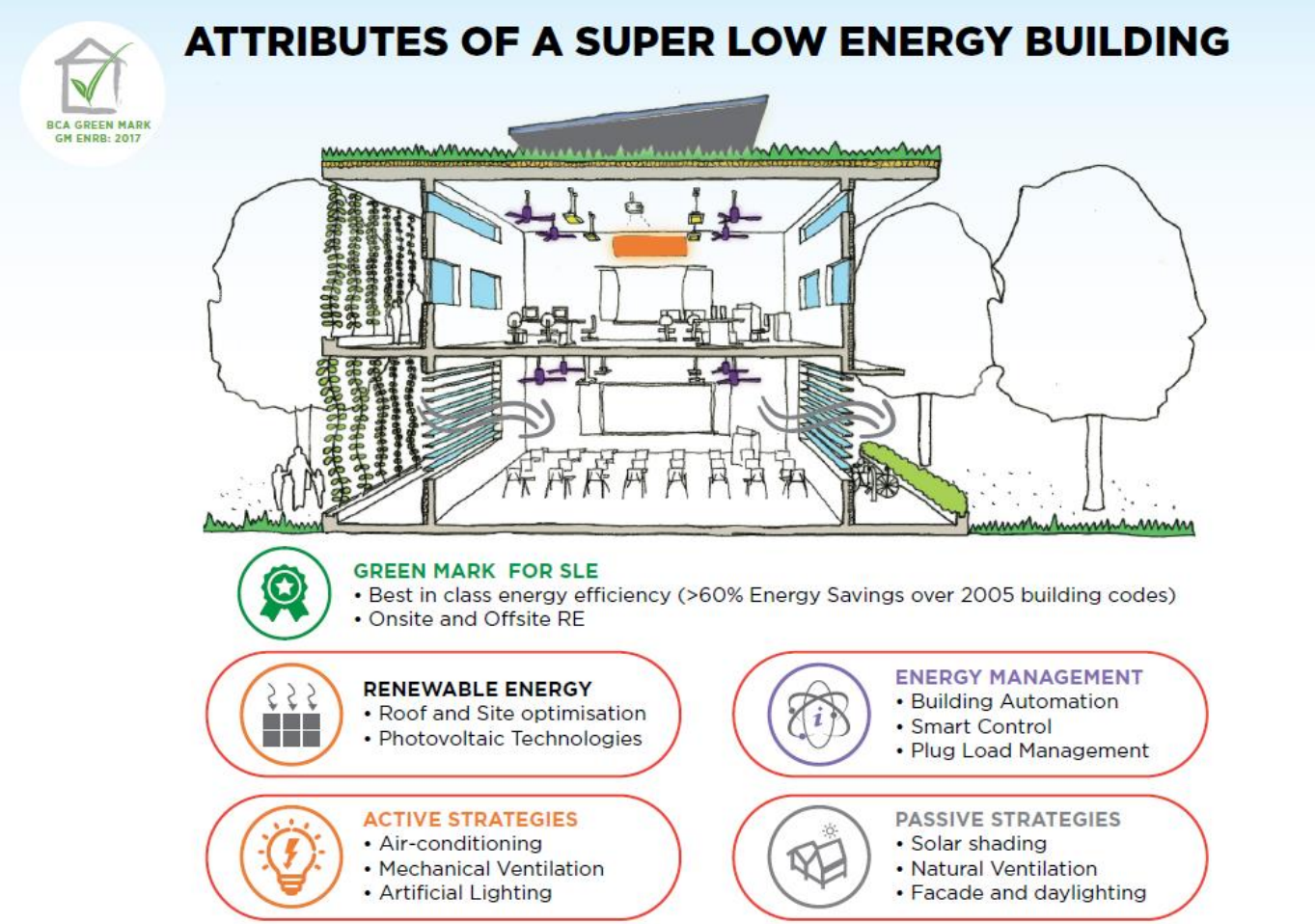


Figure 1: Characteristics of a SLE building

ANNEX C: FACTSHEET ON GREEN MARK FOR SUPER LOW ENERGY

Background

Following the review of 3rd Green Building Master Plan in consultation with local and international panel of experts, BCA has set out a long term aspiration for the built environment sector to push boundaries of green building performance in the tropics.

As part of the Super Low Energy Programme, a voluntary certification framework for SLE buildings, based on the BCA Green Mark (GM) scheme, has been rolled out. BCA has consulted various industry associations, government agencies and stakeholders to gather feedback and recommendations to develop this new framework for the industry.

Objective

BCA Green Mark for SLE targets new and existing non-residential buildings such as offices, commercial/retail, industrial, institutions and schools, including demonstration projects from Research & Innovation efforts. The new scheme aims to encourage industry to push boundaries on energy efficiency to achieve best-in-class building energy performance in a cost effective manner.

Building Categories:

Under BCA Green Mark for SLE, there are two building categories: (a) Super Low Energy buildings and (b) Zero Energy Buildings (refer to *Table 1*)

Table 1. GM SLE Building Categories

SLE/ZE certification	Requirement
Super Low Energy	To achieve at least 60% energy savings through adopting energy efficient measures and onsite renewable energy based on 2005 building code level.
Zero Energy	Use of onsite and off-site renewable energy to generate more than 100% of energy needed for building operation including plug load.

Key Highlights:

(a) The Need for SLE as Our Next Lap in Singapore's Green Building Movement. SLE aims to raise energy efficiency standards in a cost-effective manner to bring about a new best-in-class energy efficient buildings that can achieve energy savings of at least 60% energy savings over the 2005 building codes (refer to *Figure 1).*

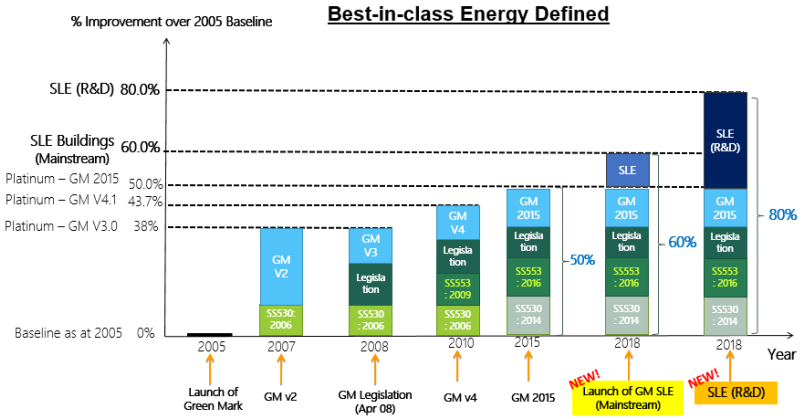


Figure 1. Comparison of SLE against Green Mark Platinum Standard

(b) Minimum Green Mark Requirements. Green Mark Gold rating is the minimum requirement for SLE and ZE buildings in order to meet the holistic environmental sustainability indicators, such as greenery, indoor environmental quality and other non-energy aspects. This ensures the overall environmental sustainability performance indicators are being looked at holistically, while pushing the boundaries in terms of building energy performance.

(c) Alternative Pathways for Existing Developments. Project teams may choose to attain SLE by having (a) Energy Use Intensity (EUI) of the building less than the benchmark EUI (refer to *Table 2*) or (b) at least 60% energy savings based on 2005 building code level (refer to *Figure 1).* For example, industrial buildings could be using pathway (b) as there is no benchmark EUI for industrial buildings in accordance to the BCA Building Energy Benchmarking Report.

Table 2. Benchmark EUI of selected building types[3]

Building Type	Benchmark EUI* (kWh/m^{2}yr)
Schools	25
Office	100
Hotel, retail & other mixed commercial development	160

(d) Comparable Payback Period to Green Mark Platinum. BCA encourages projects teams to adopt cost-effective solutions to develop SLE buildings. With higher energy savings over the life cycle, SLE buildings could actually enjoy comparable payback periods to Green Mark Platinum buildings. We foresee the energy efficiency level continuously improving with research and technology development going forward.

Conclusion

Green Mark for SLE is attainable using the latest green building technologies and practices today. From a life cycle cost perspective, building owners will reap net benefits from the energy savings over time to offset the initial cost premium of SLE buildings.

[3] The Benchmark EUI follows the BCA Building Energy Benchmarking Report 2017

ANNEX D: FACTSHEET ON SUPER LOW ENERGY BUILDINGS TECHONOLOGY ROADMAP

Background

Singapore has committed to reducing its greenhouse gas emissions intensity by 36% from 2005 levels by 2030. The building sector, which is responsible for more than one-third of the country's total electricity consumption, could play a significant role in reducing the carbon footprint and mitigating climate change. To drive the energy efficiency of buildings, BCA has been working closely with the built environment industry and its stakeholders to achieve the national target of greening 80% of Singapore's building stock by 2030.

The past decade has seen rapid technological advances and intensified national efforts that have shaped the landscape of Singapore's built environment. Greater opportunities arise in developing, deploying and mainstreaming technological innovations to push the boundaries of building energy efficiency. BCA has a long-term aspiration for all buildings in Singapore to be able to achieve Super Low Energy and to accelerate the development of zero energy buildings in the tropics.

Development of the SLE Buildings Technology Roadmap

To address the challenges and seize opportunities provided by SLE, BCA has been working with the industry and academia closely to develop a ***Super Low Energy Buildings Technology Roadmap*** that charts the pathways towards SLE via development, demonstration and application of technologies. The Roadmap examines a wide spectrum of emerging building energy technologies, analyses their interaction and integration, and explores their feasibilities in our tropical and urban context. Through technology trending and foresighting, the Roadmap outlines broad strategies of technology development towards mainstream adoption of SLE by 2030.

The Roadmap was developed in collaboration with the industry and academia, including the Energy Research Institute @NTU (ERI@N) and Solar Energy Research Institute of Singapore (SERIS), from June 2016 to July 2018. The Roadmap adopted a consultative approach involving extensive expert consultation sessions, stakeholders' roundtable workshops and industry surveys, in addition to intensive technology scan, data mining, modelling and simulation.

Key Findings from the Roadmap

The key findings from the Roadmap can be summarised as below:
1) More than 60 potential solutions from enhanced existing technologies and emerging R&D innovations have been identified and grouped under four broad categories, namely Passive Strategies, Active Strategies, Smart Energy Management and Renewable Energy (Figure 1).
2) Achieving SLE with 60% energy efficiency improvement (over 2005 codes) is technically feasible with best-in-class technologies today.

3) Further technological advancements and R&D will be needed to reach 80% energy efficiency improvement, to make SLE both technically feasible and economically viable for mainstream adoption by 2030.
4) Lower rise institutional buildings and schools have the potential to achieve zero or positive energy target first.

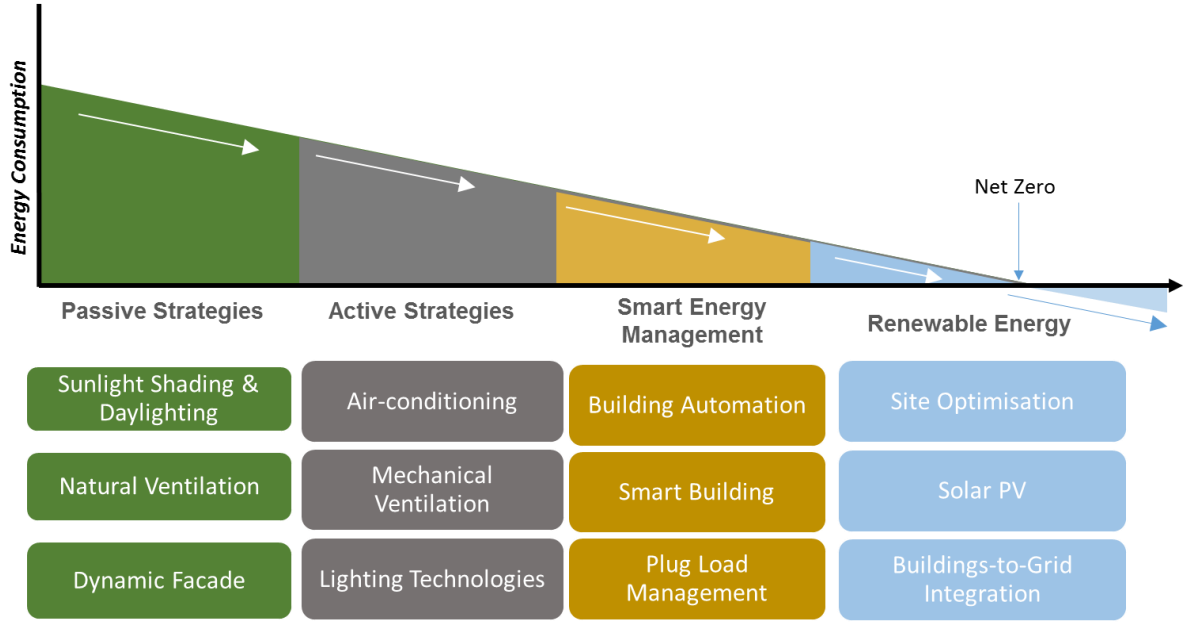


Figure 1. Broad Strategies for SLE

The Roadmap makes recommendations for future research and technology development directions to maximise the benefits of innovations, including greater focus on technology translation and co-innovation. It also provides insights into cost-effective solutioning for implementation, and recommends driving wide adoption of SLE through the BCA Green Mark scheme.