Master Planning of Punggol Eco-Town

Award Scheme	**Guangzhou Award**
Sustainable Development Goals	**Goal 11 - Make cities and human settlements inclusive, safe, resilient and sustainable**

Summary

Punggol is a coastal town located in the North-East region of Singapore. Formerly known as “Kampung Punggol”, this area used to be a rural village better known for fishing, poultry farming and pig rearing, as well as its seafood restaurants and boating facilities and services.

Background and Objective

Today, Punggol has been transformed into Singapore’s first eco-town, and will eventually house 96,000 homes, making it one of the largest new towns in Singapore. Since its inception in 1996, the master plan for Punggol has gone through several major iterations. In 1996, the blueprint for Punggol was unveiled, setting out the vision of Punggol as a “Waterfront town of the 21st Century”. Subsequently, in 2010, Punggol was selected as Singapore’s first Eco-Town with the vision to be a “Sustainable Waterfront Town of the Tropics”. In 2007, Punggol was selected as a pilot Remaking Our Heartland (ROH) town, and one of the key plans was to dam up Sungei Serangoon and Sungei Punggol to introduce a 4.2km long manmade waterway through the town to connect these two freshwater reservoirs. The next phase of development for the town in 2012 saw the launch of new signature waterfront housing districts, and the expansion of the town centre to create a new Punggol Downtown. Over the years, the master plan for Punggol has evolved and the physical environment has been transformed, with many new initiatives developed for sustainable living through effective energy, water, and waste management and developments to serve its residents. BACKGROUND INFORMATION The Housing & Development Board (HDB) is Singapore’s public housing authority. Established on 1 Feb 1960, HDB provides housing for the majority of Singaporeans. As the master planner and developer of our towns and estates, HDB plans, designs and develops vibrant and sustainable towns with quality homes and living environments for all. HDB towns are comprehensively planned to ensure that the different infrastructural needs and land uses are planned for holistically and safeguarded upfront (see Graphic 1 of supporting docs, detailing HDB’s Comprehensive Town Planning principles). Today, more than 1 million flats have been completed in 23 towns and 3 estates across the island, housing over 80% of Singapore’s resident population. ORIGINS HDB new towns house a large proportion of Singapore’s residents. When the plans for Punggol were unveiled in 1996, the aim was to develop a pioneer town of the new millennium, incorporating new planning concepts and quality housing to meet the rising aspirations of Singaporeans. The Remaking Our Heartland (ROH) initiative was developed as a new comprehensive blueprint to renew and further develop the HDB towns and estates, to ensure the sustainability and vibrancy of the HDB heartlands and to make Singapore a distinctive and endearing home for Singaporeans.Unveiled in 2007, Punggol was selected as a pilot young town to be realized under ROH, with new plans and strategies drawn up to reinforce the vision of Punggol as a waterfront town. One of the key plans was to introduce a 4.2km long manmade waterway through the town to connect two freshwater reservoirs, and open up new opportunities for waterfront living and water-based activities. In 2010, Punggol was selected as Singapore’s first Eco-Town to enhance the living environment in its estates and encourage residents to do their part for the environment. Punggol serves as a ‘living laboratory’ to test new ideas and technologies in sustainable development, integrating urban solutions to create a green living environment. To date, multiple initiatives have been developed for sustainable living through effective energy, water, and waste management. HDB also developed its first eco-precinct, Treelodge@Punggol, which harnesses the elements of nature to promote sustainable green living. Green building technologies are adopted to help promote energy conservation, efficient use of resources, and recycling efforts. This project has also won Singapore’s first Green Mark Platinum Award. In 2012, the next phase of development for Punggol was launched, with the following key ideas: Punggol Downtown – a new destination for the North-East Region An Even Greener Punggol Ways of Moving around Punggol – i.e. new transport-related infrastructure Signature Waterfront Housing Districts Great Places for the Community – i.e. new sports and recreational facilities, commercial nodes etc. To guide HDB’s sustainability efforts, a comprehensive and holistic framework for sustainable development that covers the three sustainability dimensions was developed. The framework sets out the 10 key desired outcomes and broad strategies to achieve these outcomes. The environmental strategies are wide-ranging and focus on reducing carbon emissions, optimising resource usage, encouraging greener forms of transport, enhancing biodiversity and greenery, achieving effective water and waste management and providing clean, safe, healthy and comfortable living environment. To ensure social sustainability, whilst meeting the evolving and diverse needs of a wide spectrum of residents, the social strategies seek to encourage more social integration, ownership and identity in HDB towns. Economic sustainability involves offering various housing schemes and policies to ensure HDB flats remain affordable to Singaporeans. In addition, the strategies focus on creating sustainable and inclusive growth to drive economic vibrancy in HDB towns and at national level. In developing the plans for Punggol, many parties and partners are involved. Here are some key examples: To mark a milestone of public housing in Singapore with the introduction of the Punggol Waterway, HDB also launched the Punggol Waterway Landscape Masterplan Design Competition (May 2008), to invite the private sector (professionals) to give their views and draw up the best landscape masterplan design for the waterway. HDB hoped to integrate the different elements of live, play and enjoy along the new waterway and create a design that excites

public imagination as well as meets the aspirations and expectations of current and future Punggol residents. HDB also actively consulted the public in a "Call for Ideas" exercise (Jun 2008), designed to hear from Singaporeans, especially Punggol residents, to seek feedback on the lifestyle along the waterway that Singaporeans will like. HDB wanted to know what type of waterfront housing Singaporeans aspire to live in and what facilities and amenities they want to enjoy along the waterway promenade. This subsequently led to the Waterfront Housing Design Competition (Dec 2008), where good and feasible ideas obtained from the Call for Ideas exercise were showcased by HDB and incorporated into the design brief for the first 2 housing parcels along the waterway. The winning design (Waterway Terraces I & II) set the benchmark for the rest of the developments along the waterway. The planning of Punggol is led by HDB, in collaboration with the various government agencies, as a 'Whole-of-Government' effort. This is evident in the formation of the Punggol Eco-Town Inter-Agency Committees, which aims to Spearhead and set strategic directions on the framework in developing Punggol Eco Town; and Provide guidance and expert advice in the area of planning, architecture, sustainability, energy and maintenance optimisation. For community engagement, HDB engages other public agencies to develop community engagement strategies. One example is partnering Peoples Association to organize Welcome Parties for all precincts in Punggol. At Welcome Parties for new home owners/residents, various public agencies will also participate to bond the residents and messages on sustainable living & eco-lifestyle are also shared. Since 2006, 26 Welcome Parties have been held for about 5,000 Punggol residents. Since 2016, HDB also led in organising the MyNiceHome Roadshows, which are public roadshows held prior to the completion of the first block in each new precinct to provide a platform for residents to learn more about their future home, familiarise themselves with their new living environment, and pick up renovation tips. Partnering various public agencies as a 'Whole-of-Government' approach allowed us to synergise efforts and leverage on resources to ensure that the 'Whole-of-Government' messaging towards good social behavior and eco living are being incorporated into the programme collaterals. As part of the continuous efforts to increase awareness of the many green innovations in Punggol that support eco-friendly high-rise living, HDB has since 2011 rolled out the Eco-Learning Journey (ELJ) programme for students and residents. The ELJ is a half-day guided tour to eco-destinations in Punggol Town (e.g. Treelodge@Punggol, My Waterway@Punggol, Punggol Town Square) to create awareness and educate the school children and residents on the eco-features and influence them to embrace a more eco-friendly lifestyle. These programmes are effective in disseminating information such that participants would be bringing back with them eco-messages and sharing these messages with their family members. School children are nurtured from young to shape their lifelong attitudes towards environmental sustainability and in turn share these information and knowledge with their family members. Since its launch, HDB has reached out to more than 7,500 students and residents. HDB also works closely with like-minded agencies to raise awareness and nudge residents to make behavourial changes. HDB's work is fully supported by the Singapore Government, and HDB is under the Ministry of National Development (MND). The government places a strong emphasis on home ownership and comprehensive town planning. This strong support has led to strong coordination between the various government agencies, with policies to ensure that there is continuous estate renewal and rejuvenation.

Outcomes and Impacts

As master planner, developer and builder of HDB towns, HDB is in a position to drive for greater sustainability in Punggol. Guided by the SD Framework, HDB has implemented a suite of initiatives to achieve the outcomes we set out. As the town develops, new SD initiatives can also be introduced to stretch our sustainability goals. In line with Singapore's Smart Nation Vision to improve the quality of lives of Singaporeans through the use of digital technology and Big Data, HDB has been leveraging on a suite of smart technologies to improve planning, development and management of public housing. HDB formulated the Smart HDB Town Framework which maps out how smart initiatives will be introduced to create a more liveable, efficient, sustainable and safe living environment for HDB residents. Guided by HDB Smart Town Framework, several Smart initiatives were implemented for new public housing developments in Punggol to further stretch sustainability targets. Some examples include Smart Enabled Homes, EV Ready Carpark lots, Smart Irrigation, Smart Urban Rainwater Harvesting, Smart Indoor/Outdoor LED Lighting and Smart Pneumatic Conveyance System. HDB adopts the following to attain the desired outcomes: Adopt a collaborative approach in our community engagement efforts. By partnering other public agencies, private sectors and the Punggol community, we are able to synergise and reach out to the community more effectively. Consult the community & stakeholders to find out their preferences and to co-create programmes and initiatives that best suit the local needs. Nurture volunteers under HDB "Friends of Our Heartlands Network" to grow the movement on encouraging adoption of eco-lifestyle. For example, HDB trained student volunteers as Heartland Ambassadors who internalised eco living tips before outreaching and sharing these tips with fellow residents. They also organised activities such as terrarium workshops, upcycling workshops, to engage fellow residents. Since 2010, some 700 students have been trained from Punggol Schools. To date, 26 outreach projects have been conducted, outreaching some 7,000 Punggol residents. Having fellow residents, especially young residents to do the sharing allows the eco messages to be better accepted. Facilitate & enable the community to lead, own and do more for the community. HDB's Friendly Faces, Lively Places (FFLP) Fundallowsresidents to initiate ground up projects to activate spaces in the town and bring neighbours together. This helps to develop a stronger place identity amongst the residents. So far, 6 FFLP activities have been conducted, engaging more than 680residents. Enhance communication through digital means – including PET website, Green Living e-Guide on eco tips available on HDB InfoWEB. City Application Visual Interface (CAVI) – a modelling tool which can simulate various built environments and recommend an optimal scenario to create the desired living environment with optimum sustainability performance. The tool will also allow HDB to simulate the various new urban solutions to drive energy efficiency, effective waste management, water recycling, rainwater collection, thermal comfort and efficient transportation networks. With this, planners and architects can choose the optimal combination of solutions to achieve the desired sustainability targets and its cost implications. The tool will reduce the risk of physical trial and error by providing a virtual platform for testing a planned environment before developments are actually implemented. Integrated Environmental Modeller (IEM) – an integrated software platform uses 3D city models to simulate the interaction of urban

microclimatic conditions such as wind flow, temperature fluctuations, and solar irradiance with each other, as well as their combined effects on the surrounding urban landscape (i.e. buildings, water bodies, vegetation etc.). Using IEM, HDB's planners, architects and engineers will be able to analyse key wind channels, and the solar heat gained by different urban features (e.g. concrete, vegetation, water bodies). This will help them to design open spaces, as well as optimise the building layouts and orientation to enhance the intensity of wind flow and promote natural ventilation within the town. More greenery can also be introduced in areas that receive more heat from the sun to mitigate heat gain and lower the ambient temperatures, bringing maximum thermal comfort and creating a more pleasant living environment for residents. Floating Wetlands System – inspired by the organic form of honeycomb, this system is made out of hexagonal cells that bind to one another to create a light-weight structure with high strength and rigidity. It allows wetland plants to be cultivated, transforming plain water surface into pockets of greenery that beautifies the environment, cleanses the water and improves biodiversity. The honeycomb pattern also allows flexible configuration in any size and shape, which can be easily assembled and deployed. HDB also invented and patented a unique interlocking solution that enhanced the rigidity and stability of the modules. HDB also invented and patented a unique interlocking solution that enhanced the rigidity and stability of the modules. Dual Bicycle Rack Parking System (DBR)– to promote cycling, providing sufficient parking infrastructure is critical. The DBR parking system developed and patented by HDB maximizes the number of bicycle lots provided within a small footprint size, and safeguard spaces for social communal activities. Designed with an enhanced security feature to minimise theft, it also encourages residents to park their bicycles in a more organised manner. About 2000 DBR was implemented in existing development in Punggol, increasing the parking provision by 60%. HDB's community engagement efforts in encouraging neighbourliness and eco-living complement the hardware development. Our community efforts encourage residents to live the eco way and make their Town truly eco. For example, the ELJs allow participants to see and experience the many green innovations in Punggol that support eco-friendly high-rise living. They learn about the ways to lead an eco-friendly lifestyle and could share and encourage their family and friends to apply the eco-friendly tips that were shared during the ELJ.

Innovative Initiative

The innovation is both evolutionary and revolutionary. Evolutionary – The planning of Punggol hasevolved, learning from HDB's 50+years of experience in town planning. Revolutionary–As an Eco-Town, Punggol is positioned as a living laboratory to test bed new ideas and urban solutions. Some examples include: My Waterway@Punggol- At 4.2km, it is the first and longest man-made waterway in Singapore that meanders through the entire town. The design of the waterway and the landscape promenade embraces the area's rich coastal heritage, providing more opportunities for water-based recreational activities and sports right next to the heartlands. The waterway and the new communal spaces along the promenade provide a vibrant living environment, transforming Punggol into a sustainable waterfront town of the 21st century. A digital twin was created for the entire town for virtual simulation. Extensive environmental modelling of microclimatic conditions was carried out to assess the impact of the plans formulated for Punggol to guide design. Detailed simulations were carried out to identify wind flow, hotspots and noise at the township, district and precinct levels. Complex Systems modelling tools have been used to model the complex interdependencies between systems like water, waste, transportation, energy, building forms and urban ecology. This helps the planners and architects better understand the trade-offs involved when introducing various green features to optimise the combination of sustainability initiatives in the most cost effective manner. Implementation of an extensive cycling network (33km), complimented by dual-tier bicycle parking system in estates to promote active mobility Cultivation of freshwater tolerant mangrove and implementation of floating wetlands along Punggol Waterway to enhance greenery, biodiversity and improve water quality Guided by HDB's Smart Town Framework, several Smart initiatives were implemented for new public housing developments in Punggol to further stretch sustainability targets. Some examples include Smart Enabled Homes,EV Ready Car park lots Smart Irrigation, Smart Urban Rainwater Harvesting Smart Indoor/Outdoor LED Lighting and Smart Pneumatic Conveyance System. The innovation has been applied in Research process Planning and design is a closed loop – HDB always takes feedback via our research arm and applies these lessons learnt into our planning of town. The research arm in HDB conducts surveys on a regular basis. These surveys serve as an evaluation of our products and services, and also provides a channel for residents' feedback to be incorporated into future planning and design. The findings obtained from these surveys are disseminated to the relevant stakeholders within HDB for immediate rectification or future planning and design purposes. R&D process HDB adopts a structured process that guides research to implementation. Right upstream, we collaborate with Research Centres, Institutes of Higher Learning and the Private sector on both Fundamental and applied research to develop new innovations and technology. New concepts will be prototyped and tested in our Master laboratory, the Centre of Building Research. This is to ensure that the solutions are workable. Thereafter, we will bring these solutions to our living laboratories such as Punggol. Once the solutions are proven to be feasible, cost-effective and acceptable by residents/ relevant stake holders, we will then deploy to all our towns. This also helps to build up capabilities within Singapore and position Singapore as an Urban Solutions Hub. Sample Household Survey (SHS) HDB conducts the Sample Household Survey (SHS), which is a 5-yearly large scale survey on households living in HDB flats, covering more than 8,000 households across all towns and estates. This survey enables HDB to remain up-to-date with changing housing requirements and aspirations, as well as to ensure that housing design and policies remain relevant and effects. It also seeks to monitor residents' level of satisfaction with various aspects of public housing and identify areas where efforts can be made to further improve on the physical and social environment in HDB towns. To date, HDB has completed ten such surveys, with the first survey conducted in 1968 and the latest carried out in 2013. Survey on Residents of Newly Completed Precincts Since 2006, HDB has been conducting surveys on residents living in newly completed flats as part of a continuous process to enhance the design and quality of our flats. The findings from these surveys serve as impetus to improve the physical living environment of our HDB estates. Solar Leasing Model One key criterion for implementation of new sustainable initiatives is cost-effectiveness and maintenance requirement over the entire life-cycle. To ensure the economic sustainability of our initiatives and efforts to make the deployment of sustainability technologies possible in the long run, HDB works closely with the industry to develop sustainable business models, such as

the Solar Leasing Model. Under the solar leasing model, private solar PV system developers would design, finance, install, operate and maintain the solar PV systems. This model was subsequently developed on a wider and more sustainable scale. Town Councils managing the HDB blocks with solar panels will enter into a service agreement with the developer to pay for the solar power generated and consumed, at a preferential rate not higher than the retail electricity tariff rate. This helps the Town Councils to mitigate the rising cost of energy. The expertise of private enterprises is harnessed to maximise solar generation without additional cost to the Town Councils. HDB's challenge is to innovate while providing cost-effective housing for the masses. To do this, we have to constantly innovate in our planning concepts, building technology, maintenance etc.

Conclusion

Other cities can learn from Singapore's strong Government support, and the 'Whole-of-Government' approach in which all government agencies work together as one to achieve common goals. RELEVANCE TO SUSTAINABLE DEVELOPMENT GOALS Goal 3: Ensure healthy lives and promote well-being for all ages Goal 4: Ensure inclusive and equitable education and promote life-long learning opportunities for all Goal 6: Ensure availability and sustainable management of water and sanitation for all Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation Goal 10: Reduce inequality within and among countries Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable Target 1: Access for all to adequate, safe and affordable housing and basic services and upgrade slums Target 2: Access to safe, affordable, accessible and sustainable transport systems for all Target 3: Participatory, integrated and sustainable human settlement planning and management Target 4: Safeguard cultural and natural heritage Target 7: Universal access to safe, inclusive and accessible green and public spaces, in particular of women, children older persons and persons with disabilities Target 8: Support positive economic, social and environmental links between urban, peri-urban and rural areas Target 9: Improving resource efficiency, mitigation and adaptation to climate change, resilience to disasters and implement holistic disaster risk management Goal 12: Ensure sustainable consumption and production patterns Goal 13: Take urgent action to combat climate change and its impacts