

Minister for National Development's R&D Award 2015

The biennial Minister's R&D Award was launched in 2011 to recognise and encourage outstanding R&D efforts among MND Family and its external partner agencies for contributing towards the vision of making Singapore "an endearing home and a distinctive global city".

2 This year, 19 nominations from MND Family agencies, partner agencies and Institutes of Higher Learning (IHLs) were received. Projects were evaluated by an evaluation panel, chaired by Prof Lui Pao Chuen, Advisor of MND. The evaluation criteria were:

- a) Contribution to MND's Vision & Mission
 - i. Significance in addressing key national challenges faced by MND; and
 - ii. Strategic Impact of implementation to a significant population and/or proportion of the related industry in Singapore.
- b) Technological Innovation
 - i. Technological Merit of research that is original, creative and novel, and represents a significant breakthrough or game-changer in associated fields.

3 Details on the winning projects of the Minister for National Development's R&D Award are:

a) **Distinguished Award –**

NUS' project – "A Novel Nano-Woven Membrane Air Dehumidification to Enhance Building Energy Efficiency"

In hot and humid tropical climates, air conditioners require more energy to remove water from the moisture-rich air. Conventional compressor-driven air conditioning systems have approached their performance limit due to component level limitations. More energy efficient cooling methods are necessary to reduce building energy consumption and environmental impact. This project presents a revolutionary membrane air dehumidification system to remove moisture from air entering a building to make air conditioning significantly more energy efficient. The system uses nano-polymeric materials to sieve out moisture from air without the need for thermal regeneration. The membrane high selectivity translates into reduced energy consumption for air conditioning. It will also produce cleaner air than existing systems, which has a side-effect of deteriorating air quality due to potential contamination.

This game-changing technology is strategically poised to enable Singapore to greatly improve energy efficiency in all buildings including residential, commercial and industries sectors. In addition, the membrane dehumidifier has great potential for confined spaces where removing moisture from moist air is critical for human comfort and continuous operation of delicate equipment such as field hospitals, armoured personnel carriers and operation decks of navy ships and aircrafts etc.

b) **Merit Award –**

HDB's project - Development of Urban Environmental and System Modeling tool (UESM) to drive Greater Sustainability and Liveability in HDB Towns

Singapore's tropical climate is characterised by hot and humid weather conditions with high rainfall all year round. In a high rise high density living environment, thermal comfort and aural comfort are key considerations in the planning and design of HDB towns and buildings. HDB adopts passive design strategies to achieve high density living that is optimised for tropical climate. The guiding design principles are always to harness the elements of nature, as much as possible, to promote sustainable green living and to capitalise on green building technologies. Greenery is also introduced extensively to soften the urban environment and mitigate the urban heat-island effect to improve the quality of the living environment.

As part of the efforts to drive greater sustainability and liveability in residential towns, HDB carried out extensive research and developed UESM techniques in the town planning process. Through these simulation platforms, HDB is able to better understand the climatic conditions and the trade-offs of sustainability initiatives in urban plans. On a broader level, what HDB is trying to achieve, through the use of this tool, is to provide residents with a more comfortable living environment.

c) **Merit Award –**

HDB's project - Development of Solar PV Projects

In 2009, HDB embarked on the Solar Capability Building Programme (SCBP) to explore an alternative energy source that was sustainable and innovative, allowing Singapore to harness solar energy on an impactful scale, despite the limited land space. Solar photovoltaic (PV) systems installed on HDB rooftops can generate clean energy to power the common facilities, including lightings, lifts and pumps in the HDB blocks. Furthermore, with more than 9,000 HDB blocks in Singapore, the available rooftop spaces signifies the potential to generate around 350 GWh¹ of energy annually – equivalent to powering 73,000 4-room flats, with carbon emissions of CO₂ reduced by 175,000 tons.

As part of SCBP, HDB came up with a Solar Leasing model that allowed for a large scale rollout of solar PV, involving leasing solar PV systems from private companies which design, finance, install, operate and maintain the entire system. As an incentive, HDB may provide a percentage of the initial start-up costs whilst the remaining costs will be recovered from the solar energy sold at a lower cost to the Town Councils (TCs). The solar PV installations can be easily installed, replicated, integrated, and removed if necessary. This makes it cost effective and easily scalable to more installations across Singapore. The Solar Leasing model has been extended to other Government agencies, thus promoting greater adoption of solar energy.

d) **Special Mention –**

NParks' project - Using Agent-Based Modeling to predict habitat and species connectivity within Singapore's coastal waters

In collaboration with DHI Water & Environment (S) Pte Ltd, NParks developed the probabilistic Agent-Based Model (ABM) for coral larvae dispersal using the modelling toolbox, ECOLab. The first of its kind to be developed for use in the study of corals in the region, this modelling package supports a framework that allows simulation of coral larvae dispersal patterns, its mortality rate, habitat quality and settlement success, based on varying hydrodynamics and water quality conditions, including water temperature, suspended sediments and flow velocities. Besides monitoring broad trends of coral larvae dispersal within a spatially complex system, it also tracks the organisms down to the minute, individual level.

Tapping on this modelling tool, NParks is able to identify the Sisters' Islands as the ideal location for development of Singapore's first Marine Park. The model indicated that the Sisters' Islands were a good source of reefs that could populate other reefs areas in Singapore. It can be further enriched as a nursery by relocating corals from other areas. Through propagation, it can become a tremendous source of coral progeny for the recruitment and enhancement of the coral diversity elsewhere in the southern islands.