

GreenPulse

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Kampung Admiralty

Singapore's Flagship Vertical Village

INSIDE

GreenPulse

VOLUME: 3

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4

COVER STORY



KAMPUNG
ADMIRALTY
SINGAPORE'S
FLAGSHIP
VERTICAL VILLAGE

8

FACE TO FACE



Interview
with
Mr Rick
Heikoop

16

SPECIAL FEATURE



BEX and MCE Asia
2018 accelerate action
towards common goal
of combating
climate action and
more sustainable living
across Asia

20

PRODUCT



IRRIGATION
REDEFINED –
DESIGNING
SOLUTIONS FOR
A SUSTAINABLE
FUTURE

14

EVENTS

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Kampung Admiralty

Singapore's Flagship Vertical Village

Kampung Admiralty is Singapore's flagship "vertical village" which has transformed a compact 2.2 acre site into a dynamic community heart where integrated social and ecological spaces enable an aging population to live actively. The landscape is designed as layers of green and blue infrastructure woven into the building to connects residents and the greater Admiralty neighborhood to the historical "Kampung" village spirit within today's highly densified urban context. This unique space is meant to serve as a model development for community well-being, nurturing the youth, and graceful aging.

The "Kampung Spirit": Village Farms, Nature Play, and Tight-knit Community

Prior to the 1960s resettlement of Singaporeans from rural villages to today's public high rise housing, wooden attap dwellings, dirt roads and gregarious neighbors were common elements of life. Huge undesignated plots of land were available for residents to grow fruits, rear chickens, and even pigs. Children would often play amongst the surrounding lush tropical forest, catch butterflies, and during rainy weather, find a pet frog. Gates

would often be left unlocked as the communities were built on trust. Neighbors would normally be close friends, and if any basic necessity ran out, the family next door would happily lend a helping hand. These are the memories the older generation recalls of Singapore's past "Kampung Spirit", a term referring to a co-existing cohesive community. The attap houses are now gone and the bright orange dirt roads are now paved. Neighbors only give simple greetings as narrow public corridors leave very little space for community life outside homes.

The idea to build the first integrated public development model that intuitively response to the well-being and spatial needs for graceful aging and nurturing of the youth is showcased at Kampung Admiralty. The development was conceived as an opportunity to bring the "Kampung Spirit" essence back to urbanized Singapore.

A New Concept for an Aging Population

In Singapore, it is projected that the number of citizens 65 years old and above will more than double between 2017 and 2030, while the number of working citizens between the age of 20 and 64



will decline. As part of the planning preparation for an aging population, Kampung Admiralty was conceived to offer a sense of independence amongst the elderly. The central concept was to provide quick access to medical facilities, spaces to bond with grandchildren and old friends, lead an active lifestyle, and all with the convenience of being located right outside of their doorstep.

A One-Stop Integrated Community Development

This flagship project that brings together a multitude of programmes under one roof. It was commissioned on a tight 2.2 acre (0.9 hectares) site with an imposed 200 foot (61 meters) height limit above mean sea level. The development sought to provide inter-community dynamics and urban density in land-scarce Singapore, where the increased stress on the ground level demands creative ways of intensifying land use. The scheme builds upon a layered “Vertical Village” approach. A People’s Plaza at the lower stratum gives a fully porous and uninterrupted ground floor which is now a popular shortcut to the existing wet market and train station. A Medical Centre is located in the mid stratum and a terraced community park with studio apartments for seniors and child care is found along the upper stratum. These three distinct strata which allow close proximity to healthcare, social, commercial and other amenities, generate opportunities for a diversity of cross-programming and support for inter-generational bonding.

Green Infrastructure: Biophilic Benefits, Increased Biodiversity and Reduced Heat Island Effect

Studies have shown that when the elderly are isolated for prolonged periods it may lead to poor



mental health. The landscape seeks to address this issue by creating a diverse and dynamic planting palette to serve as an inviting public environment for active living. On the topmost stratum, the community garden displays a set of 18 species of local fruit trees that were once in abundance at kampungs, reminding the old of familiar memories of the past and the young of their history. As colorful seasonal plants are rarely seen in a tropical setting, the ever-changing landscape of flowering, fruiting and color-changing foliage can create intrigue and be a conversational piece that leads to social bonding among the community.

With a total count of 610 trees and 80,000 shrubs on top a roof area of 38,750 square feet, a wide palette of native plants (55% of total species) that responds to soil depth, light levels, and water requirements were adopted to create a resilient, low maintenance landscape. Designing with characteristics of the natural environment, the landscape attracts wildlife such as butterflies, dragonflies, and small birds. This forms a lush vertical diversity and contiguous horizontal canopy creating cooling microclimates, dissipating urban heat island effect. The middle stratum focuses on an immersive therapeutic landscape for patients of the medical center. It features a rain garden that purifies urban run-off. These close proximities of green outdoor features help elderly feel comfortable and at ease, encourage outdoor physical activities and help develop a sense of belonging in the natural environment.

Blue Infrastructure: Water Sensitive Urban Design Features & Water conservation

Kampung Admiralty stands out as an excellent example of urbanized developments that strive

to harvest, cleanse and recycle rainwater for non-domestic use such as irrigation and water features. A major part of rainfall run-off from the upper strata (level 9,8,6 & 3) are collected and filtered through downstream Water Sensitive Urban Design (WSUD) treatment features such as vegetated filters (at level 8,7,6) and bio-retention basin located at the central courtyard. The cleansed water together with the direct run-off from the two tower roofs is conveyed directly to the two harvesting tanks at the second level, which are sufficiently sized for three consecutive days of irrigation and eco-pond refill. In case these tanks are full, the west tower tank will discharge directly to the external drain while the east tower tank will overflow to the eco-pond in level one which helps to top-up this water body.

Other than the water's aesthetic and therapeutic values, the presence of the eco-pond in the first level also helps to promote biodiversity and natural cooling effects in this urban context. To maintain an output of high water quality for the eco-pond and to minimize the risk of algae blooms in tropical Singapore, a cleansing biotope was introduced to recirculate and cleanse the eco-pond's water. Rainfall run-off from the adjacent areas is cleansed and conveyed into the eco-pond via the vegetated filter which removes sediments and nutrient amounts from the incoming stormwater run-off.



The average annual rainfall in Singapore is 92 inches (2340mm). This means over a million gallons of tap water can be conserved each year if the stormwater run-off is stored in the rainwater harvesting tank and reused for irrigation. This translates to approximately the average water consumption amount of 200 public housing (5-room flats) in one month, a huge saving figure for such a multi-functional urban development located in the heart of a dense residential area.

Harmonious Outlook: An Educational Model and Reference for the Future

As Singapore positions itself as a model garden city, the progressive integration of green and blue infrastructures becomes an imperative climate adaptation gesture to cushion the impact of intensive urbanization through sustainable and biophilic developments. This village is more than just a revitalization of "Kampung Spirit" for Singaporeans. It is a shift in the way we envision the built environment, dense liveability and proximity to green & blue infrastructure. Continuous layered vegetation and climate adaptation design features are woven into the building at all levels. Before development, the site was simply a set of unassuming and unembellished residential pathways. Now it offers a rich social connection to the urban landscape and greater built environment. The finished project offers opportunities to address the contemporary challenges of resource management, environmental protection and quality of life.



RICK HEIKOOP

Senior lecturer Water Management at Rotterdam University of Applied Sciences.

Rick has a 15+ years record of achievement and demonstrated success in initiating, managing and leading (international) collaborations and partnerships in the water sector in triple helix set-up. He is senior lecturer Water Management at Rotterdam University of Applied Sciences (RUAS) and project manager at RDM Centre of Expertise. He was involved in the development of the courses Water Management and Real Estate Management at RUAS.

He co-initiated Wetskills.com in 2010, which organized up to date 31 water challenges in 19 different countries with 617 international young professionals. He is currently managing different international projects such as the DUTEP project in which more than 30 officers from the Jakarta city government participated since 2014 in a ten weeks exposure programme in Rotterdam to learn and experience Dutch Urban Water Management. And several Erasmus Plus projects in collaboration with partners in Indonesia and the Philippines.

Rick is passionate about International collaboration and setting up new projects and initiatives to make better cities. 'It's fun to visit other places and work together with people from other countries to work on today's challenges and make better cities, cleaner rivers and improve water management'. Rick is currently working on two of his passions: the Sani-embankment Philippines, which integrates a helophyte filter system in a river embankment, to provide sanitation facilities along river banks in Davao City and City scan method which aims to gather in a short period of time (1-2 weeks) essential data by young professionals and practitioners that enable them to assess the 'level of resilience' of a specific street, neighborhood or city with low-cost and low-tech tools and instruments with the aim to create awareness and formulate concrete actions to make resilient cities which were organized in Manila, Cebu City and Rotterdam. This approach was presented at conferences and South Africa and Singapore. Rick is actively involved as programme manager in Wetskills for which he organized Wetskills challenges since 2010 in China, Egypt, Indonesia, Morocco, South Africa, Netherlands, Philippines and other countries. He organized in collaboration with a Swiss partner and 150 Swiss students to Sketch city events in Rotterdam.

Interview with Mr Rick Heikoop

Could you tell us about your professional background and how it led you to work in Climate Change and urban resilience?

The Netherlands is a low-lying country, located in the Rhine–Meuse–Scheldt delta. The Netherlands is an example of a country highly susceptible to both sea-level rise and river flooding because 55% of its territory is prone to flooding. 26% per cent of the country is below sea level and 29% is prone to riverine flooding by the river systems of Meuse, Rhine and Scheldt. The Netherlands has a long history of living with water. The first waterboards were established around 1200. The Rotterdam region, where I work and live, is located in the lowest part of the Netherlands. A few kilometers away from Rotterdam is The Zuidplaspolder. It reaches a depth of 6.76 meters (22.2 ft) below average sea level. This makes it one of the lowest point of Western Europe and the European Union. Water management is a necessity in the Netherlands to survive. Pumping stations pump the water from the lowest level to the higher levels. Originally pumping was done by windmills, then by steam engines and now with electrical pumping stations.

I studied Land and Water Management in the Netherlands, then I did a Master's study Urban and Regional Planning at University of the Philippines in Cebu City. Fascinated by the urban challenges of today, I finished a Master's degree Urban Management of The European Metropolitan Region at Erasmus University Rotterdam.

Because of climate change delta cities around

the world are becoming more and more vulnerable for climate change. In the Netherlands we are very much aware of that, since we are already partly below sea level. Flooding takes place of large urban metropolitan cities around the world, like Manila, Jakarta, Bangkok, but also cities at New York, Houston, Melbourne and many more cities around the world. Because of ground water extraction many cities are sinking cities, while at the same time sea water level rises. At the same time these cities also have the deal with drought and longer periods of heat as we experienced this summer in Europe.

It is a big challenge to prepare our cities around the world for the effects of climate change, and how to adapt and make our cities resilient.

Could you share about current research or project you are working on?

I am working on the development of a the City Scan methodology. Cities and local governments cannot adapt alone. They are depending on the efforts of communities and citizens to take measures at the household level and street level. Cities formulate ambitions and visions at the city level, but this is often not translated to the neighborhood level. We can tick if a certain project is implemented, but we don't know when a city or street is 'climate proof', so to say. In Rotterdam citizens and business are urged to take adaptive measures, like creating green roofs and to take out concrete from private gardens to increase infiltration capacity. But city governments don't have specific data to track progress on street level that enable us to say if a certain street is 'climate proof'. It would be great if we could collect data at street level about a range of variables at street level, like shadow, temperature, infiltration capacity, water quality, plastic waste, etc. At the building level we could also identify a range of variables. With these variables we can compare streets and cities and we know what measures could or should be taken to become more resilient.

Could you explain why Climate Change and Resilience is important to architects and urban planners to understand and apply in their own field

Urban Resilience is defined by the 100 resilient cities as "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience." We should look at a city holistically, and understand the city system. If we have better understanding of the potential shocks that our cities might face, we can improve the development trajectory of our cities, and improve the wellbeing of its

citizens. The challenges cities face often aren't a single shock or stress. Most cities face a combination of these challenges, which can contribute to further threatening a city's resilience. Resilience is the capacity to 'bounce back'. We should make our cities and our citizens better able to bounce back after a calamity strikes.

More than half of the world's population lives in coastal areas. A large portion of the coastal population lives in deltas and delta cities. These cities continue to urbanize and impact the natural dynamics and river systems. Because of climate change these cities are confronted with an increase of periods of intense rainfall, which leads to floods in our urbanized concrete jungles, as many of our cities are today. These cities also tend to become hotter in periods of heat waves and cities become 'urban heat islands'. It should be the task of urban planners and architects to make our cities and residences more comfortable, increase infiltration and water storage capacity and make our housing units more comfortable.

Major cities are creating climate adaptation action plans. In your opinion what do cities need to focus more as they develop these kind of action plans?

Talking about resilience, the 100 resilient cities framework distinguishes four dimensions of resilience. Each dimension contains three "drivers," which reflect the actions cities can take to improve their resilience. The driver Infrastructure & Environment entails the man-made and natural systems that provide critical services, protect, and connect urban assets enabling the flow of goods and services. It aims to protect natural and man-made assets that reduce the physical vulnerability of city systems. This includes natural systems like wetlands, mangroves and sand dunes or built infrastructure like sea walls or levees.

The urban development and water issues in South East Asian countries are very diverse. In terms of water management there is either too much water (flood), water shortage (draught and sinking cities) or the water is extremely polluted. One of the biggest challenges in South East Asia's coastal cities is proper water management. Because of urban sprawl and urbanization the natural water catchment areas have become urban, causing flash floods and lack of infiltration capacity. Because of the fact that the natural catchment areas have disappeared, many cities rely on ground water for their water supply. Because of over extraction, the ground water table becomes depleted. Several cities are already so called 'sinking cities'. These cities are becoming extremely vulnerable for the effects of climate

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change such as more extreme rainfall in urban areas, sea level rise and increased river discharges. In addition to this the natural urban floodplains have been occupied with squatter communities and urban development projects. A chronic lack of sanitation facilities pollutes the existing water bodies in most South East Asian cities.

Talking about floods, there is often a lack of collaboration between different stakeholders upstream and downstream. Upstream destruction of natural catchment areas leads to flooding downstream. There should be more focus on collaboration between upstream and downstream stakeholders.

In addition to this more water storage capacity should be created upstream and downstream. Urban floodplains or urban water squares could help alleviate the impacts of flood downstream, although this will not be enough during extreme rainfall. Root cause of sinking cities is over extraction of groundwater. Ground water extraction should be stopped and water supply upstream and protection of catchment areas should be enforced. Structural measures like levees, pumping stations and barriers might not be enough in the long run, and given the speed of land subsidence (up to 20 centimeters a year in Jakarta). A combination of structural and non-structural solutions is badly needed to protect the coastline and cities in South East Asian cities.

A massive transformation of South East Asian cities should take place to better prepare them for the effects of climate change. New policies should be created to create more green roofs for example or other green measures that absorb the water during rainfall and that catch, store and slow discharge the water. Alternative more hard measures could be taken like underground basins or flood tunnels to store the water during heavy rainfall. Urban polders could be created with pumping systems to pump the excess water out.

Could you share some details on Rotterdam's initiative to design the city to withstand climate change?

The Climate Change Adaptation Strategy for the City of Rotterdam is based on a holistic approach by taking into account both the challenges and the opportunities for the city. The strategy gives insight in challenges and solutions on all scales: city, districts and buildings. In 2008, the City of Rotterdam ratified the Rotterdam Climate Proof (RCP) program. The aim of this program – which forms part of the Rotterdam Climate Initiative – is to start working towards a climate proof city and to create the maximum possible economic spin-off in the process. By implementing innovative measures the City of Rotterdam transforms to a sustainable city with

a prosperous socio-economic, where people happily and healthy live, work and recreate.

This strategy provides the framework and the starting point for a future proof development of Rotterdam and ensures that, in the future, topics such as water safety, accessibility and the robustness of the city are included as the basis for each (spatial) development right from the start of the process. The Rotterdam adaptation strategy is one of the results of the Rotterdam climate proof programme.

The core of the Rotterdam adaptation strategy

1. Robust system: maintain and strengthen

For a climate-resilient city, we can continue to rely on our system of flood barriers and dykes, canals and lakes, polder outlets, sewers and pumping stations. In the future, we will also continue to maintain and improve this essential infrastructure; in order to do this, we use the accumulated knowledge about the vulnerable parts of the city to optimise this commitment. Preventing the loss of vital public utilities and facilities in the area outside the dykes, in the city and the port, is of particular concern. This is the robust basis for a climate proof Rotterdam.

In concrete terms, this means:

- Maintaining and optimising the Maeslantkering [storm surge barrier] as effective protection against the effects of a rise in sea level in consultation with the administrator in charge.
- Linking the strengthening of the flood defences to the urban specifications at the relevant locations. Dyke reinforcements are seamlessly incorporated into the city and are multifunctional, serving, for example, as recreational trails, natural embankments, or are combined with area development.
- Working with the other responsible parties to maintain and optimise the current urban water system. We continue to utilise the quality of the existing water infrastructure.

2. Adaptation: use of urban space

But we need to do more. The existing system will reach its limits if the water levels in the river rise, if periods of heavy precipitation intensify or if periods of drought and high temperatures continue for longer. We are already seeing this in some parts of the city. That's why we need to take additional adaptive measures. Adaptation means that we look for solutions throughout the entire urban area that will relieve the system and create resilience. The 'sponge function' of the city is restored with measures which keep rainwater where it falls, store it and drain it away slowly. These include water squares which relieve the sewage system, infiltration zones along infrastructure and the integration of trees and greenery in outdoor

areas (both public and private), which benefits the city environment. By frequently applying these small-scale measures to the 'capillaries of the city', we are able to reduce Rotterdam's vulnerability.

In this adaptive approach, we are opting to:

- Build and furnish adaptively equipping in the outer dyke areas, to seek clever combinations of protection (dykes), spatial planning (e.g. elevating some sections, floating buildings) and damage control (such as evacuation routes, water-resistant design of homes and external spaces, etc.). This is the so-called multi-layered approach.
- Harness the outdoor space and buildings for water storage and 'smart' water drainage, linked to the urban task at the specific locations; this creates more flexibility in the potential solutions and provides the opportunity to add quality to the environment. This could include, for example, an underground water storage facility linked to car parks or blue-green networks in the city.
- Actively encourage heat resistance as part of the design, renovation and maintenance of buildings, outdoor spaces and the road and public utility infrastructure. This could be achieved by, for example, incorporating trees and greenery and creating shade and adequate insulation in homes and offices.

3. Working together and linking in with other projects in the city

Maintaining the current robust system, such as dykes, canals and drains will also be the duty and responsibility of government bodies in the future. Alongside the municipality, water boards and the national government also play an important role. An example is the national Delta Programme which, at a national level, determines the necessary choices for water safety and the supply of fresh water. But climate adaptation in the city requires more than this. The maintenance of many vital public utilities is in the hands of our urban partners. It is therefore essential that energy, the supply of (drinking) water and ICT networks do not break down for long periods of time and it is imperative that these remain robust in extreme weather conditions. Most of the buildings and land are private property. Implementing adaptation measures in both the public and private urban spaces therefore also requires cooperation with other parties.

In addition to governments, residents, businesses, housing associations, developers, knowledge institutions and interest groups are also contributing to Rotterdam's climate resilience. As well as developing the network, the municipality has a predominantly supporting and encouraging role. An example of this is the "Tile out, Green in' initiative, which encourages the residents of

Rotterdam to make their gardens greener. Collaborating at all levels with the parties working in Rotterdam is necessary if we are to achieve our goal of a climate proof city.

There is plenty of time to adapt to the changing climate. This means that it is possible to link the adaptive measures to other spatial development projects in the city and to intelligently combine them with existing management and maintenance programmes. This is known as 'moving to the rhythm of the city'. A climate proof approach to projects will be the subject of discussions between the municipality and the initiators. A shared ambition for a climate proof urban development is essential here. For the municipality, this means, at the very least:

- Actively gathering information and providing residents and businesses with actions to take to protect against river water, excessive and insufficient rainfall and periods with extremely high temperatures.
- Working towards a shared responsibility of public and private land owners for the collection of excess rainfall.

4. Added value for the environment, society, economy and ecology

In this way, climate adaptation offers ample opportunities to strengthen the economy of the city and the port, to improve the quality of life in neighbourhoods and districts, to increase biodiversity in the city and to foster committed and active participation by Rotterdam residents in society. Working together for a climate proof city pays off!

Introducing more trees and plants into the city, for example, makes it less vulnerable to extreme rainfall, drought and heat stress. At the same time, this 'green adaptation' will make the living environment more attractive, become the motor for other investments and inspire the residents of Rotterdam to play an active role. Companies are already benefitting from the increased focus on climate adaptation and sustainable urban development, as well as the international profile Rotterdam enjoys in this field. At present, there are approximately 3600 jobs in the region which are directly linked to climate adaptation. The many businesses in the maritime, engineering and delta technology sectors in the Rotterdam region all have excellent growth prospects. These examples show that climate adaptation contributes to the city's physical, economic and social ambitions. The municipality, in any case, substantiates this by:

- Actively offering scope for pilot projects and innovations within climate adaptation measures (Rotterdam as a testing ground and portfolio for the business community).
- Connecting Delta Cities as a strong international network of cities to be used as the connection with the international market.

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- Launching the further greening of the city as a 'no regrets measure' to create an attractive city environment.

In this way, Rotterdam is working to become a future proof city that provides safety and is attractive to its residents, visitors and businesses, both now and in the future. It is a safe, habitable city in the Dutch delta and it is a pleasure for people to work and live there.

Share some details on city scan app?

The City Climate Scan method gathers essential data in a short period of time (1-2 weeks) with young professionals and practitioners that enable them to assess the 'level of resilience' of a specific neighborhood or city. The City Climate Scan method aims to use low-cost and low-tech tools and instruments that stimulate interaction with stakeholders.

Relatively little is known about resilience at street and neighborhood level. With the City Climate Scan method it is possible to collect relevant information in a short time about the level of resilience in streets and neighborhoods. The objective of the scan is to develop a set of cost-effective measuring methods that can be used worldwide to gain insight into the degree of resilience in a neighborhood. The measurement results of the selected parameters provide insight into the degree of resilience of a particular street, neighborhood or city. This knowledge will raise awareness among citizens and other stakeholders about vulnerability, and will thus contribute to capacity building among stakeholders and


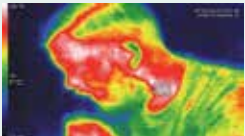


will increase support for the implementation of climate adaptive measures at the local level. A very important aspect of the method is the selection of 'the wicked problems' or challenges in the city where the City Climate Scan will take place.

The City Climate Scan methodology provides insight into certain predetermined parameters in a short time. These parameters can vary per neighborhood or city. The decision to pick or focus on a certain set of parameters can be tailored to the wishes of the user in a particular country or neighborhood. After consulting various partners in the city of Rotterdam, various challenges were selected for the City Climate Scan in Rotterdam: flood risk, heat stress, water quality (surface water and plastic waste) and air quality.

Results City Climate Scan Rotterdam

The objective of collecting a lot of data and interpreting climate adaptation in a short period of time during the City Climate Scan Rotterdam has been achieved. During the data collection with students and practitioners awareness was raised among the participants. The interaction between various stakeholders resulted in the collection of valuable data. The method and research results are stated in table 1. Parameters that were assessed in Rotterdam are: urban heat (temperature), urban water quality (several parameters such as: nutrients, ph, conductivity, temperature, turbidity, oxygen), urban air quality (several parameters), urban floods (infiltration capacity) and waste pollution (plastic waste).

Table 1 challenges and results of the City Climate Scan Rotterdam.

Challenge	Method	Results
Urban floods 	<ul style="list-style-type: none"> • Mapping floodings and infiltration capacity measurements with infiltrometer test 	<ul style="list-style-type: none"> • Measurements on infiltration capacity (see next paragraph) • map with measurements www.climatescan.nl, figure 1 and 2
Heat stress 	<ul style="list-style-type: none"> • Dynamic and static measurements of temperature on several surfaces in the urban dense area with heat cameras and sensors 	<ul style="list-style-type: none"> • Map with heat stress in the urban dense and green areas in the city
urban water quality micro pollutants 	<ul style="list-style-type: none"> • apps and test strips and under-water drones with camera's and sensors 	<ul style="list-style-type: none"> • maps with results of grab samples of nutrients in urban water • 3D-scans of water quality with continuous sensors with indication of pollutant sources
urban water quality macro pollutants; plastic waste 	<ul style="list-style-type: none"> • square method' the type and amount of plastic waste is determined at 1m² 	<ul style="list-style-type: none"> • detailed insight in waste per m² • optimized method to be used at projects in Ambon (Indonesia) and Cebu City (Philippines)

The various experiences gained during the measurements have contributed to a stronger development of the city climatic scans methodology.

FINDINGS

The first results from the City Climate Scan Rotterdam show that the method gathers valuable multidisciplinary data that is currently not collected. The method is currently being developed and number of parameters is being expanded. The parameter Water Quality was measured and mapped using free apps that give insight in the water quality at street or neighborhood level. The parameter Urban Heat was measured at the street level and gave new insights in how heat differs in different neighborhoods and streets. The parameter Plastic Waste was measured at the riverbanks of Maas river and can now be systematically measured. The data gives detailed insight and awareness in the contribution of Plastic waste pollution in our river systems. The parameter Infiltration Capacity of open spaces and the contribution to reduce floods was measured at multiple locations in the city. The open green spaces show a 3-6 higher infiltration rate than paved areas. From detailed flood maps and flood models, locations have been selected to implement green and blue measures.

More than 25 Best management practices (BMPs) in

climate adaptation are mapped on an open source web based international knowledge exchange tool www.climatescan.nl. Some of the BMP's have been tested during the City Climate Scan: e.g. the infiltration rates of permeable pavements have been considered very low after being in service a couple of years. The discussion of this and other results in the triple helix consortium has led to a detailed strategy for the city to be more resilient.

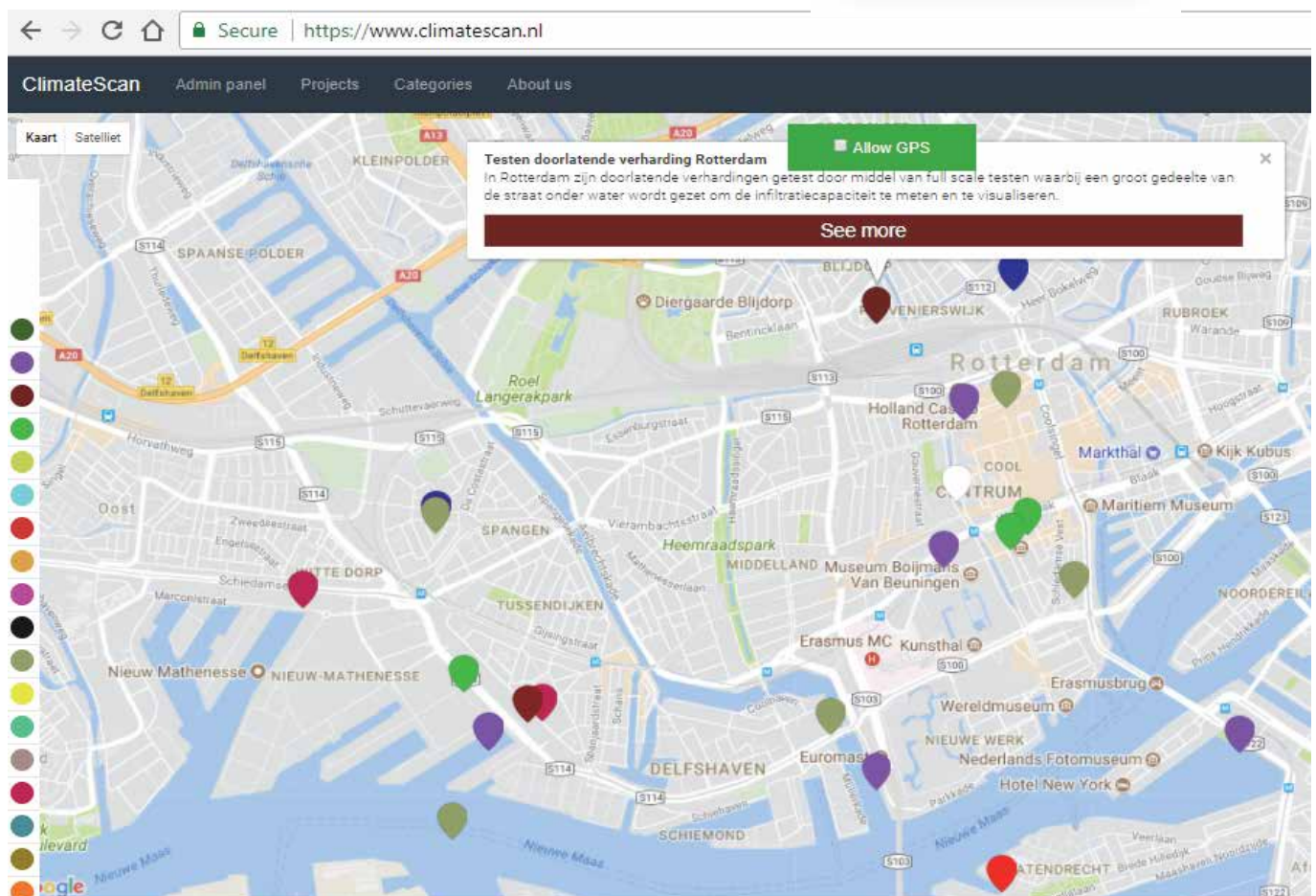
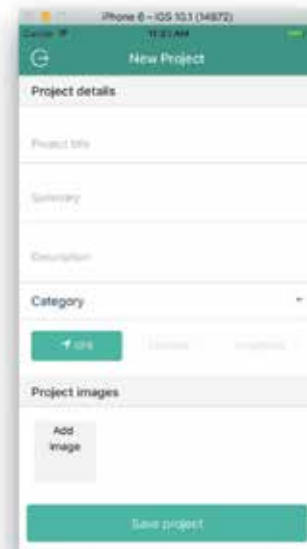


Figure 1. Web-based mapping climate adaptive examples with app from www.climatescan.nl

Upcoming GREEN Events:

Bex Asia 2018

5-7 September 2018

Marina Bay Sands, Singapore

• www.bex-asia.com

16th Annual Cities Alive Green
Roof & Wall Conference

24-28 September 2018

New York, United States of America

• <https://citiesalive.org>

World Class Sustainable
Cities 2018

28 September 2018

Kuala Lumpur, Malaysia

• <http://wscsl.com/v1>

ArchXpo 2018: The International
Exhibition for Architecture &
The Built Environment

02-03 October 2018

Marina Bay Sands, Singapore

• www.archxpo.com.sg/en/page/2/archxpo-2018.html

United Architect of Philippines (UAP)
Singapore Chapter Lecture Series 2018

04 October 2018

Marina Bay Sands, Singapore

• www.archxpo.com.sg/en/page/127/uap-lecture-series.html

Gardex 2018 (12th Int'l Garden Expo Tokyo)

10-12 October 2018

Tokyo, Japan

Singapore International Energy Week

29 October - 2 November 2018

Marina Bay Sands, Singapore

• www.siew.sg/#

The Big 5 Solar Exhibition

26-29 November 2018

Za'abeel Hall 6 Dubai World Trade Centre

Dubai, United Arab Emirates

• www.thebig5solar.ae

Intersolar India 2018

11-13 December 2018

Bangalore International Exhibition Centre

Bangalore, India

• www.intersolar.in

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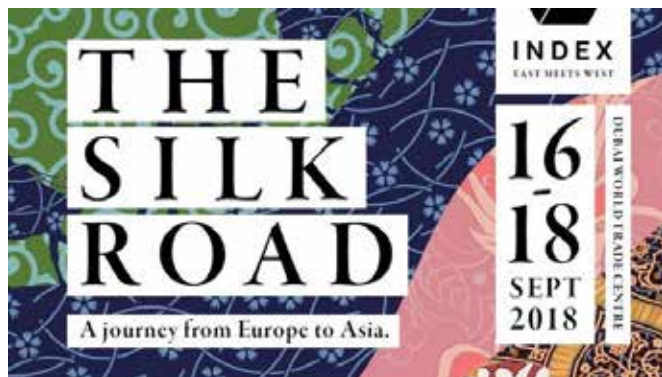
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BEX and MCE Asia 2018 accelerate action towards common goal of combating climate action and more sustainable living across Asia



The Singapore Green Building Week with its two flagship trade platforms Build Eco Expo (BEX) Asia, Southeast Asia's leading trade exhibition for the region's green building market, and Mostra Convegno Expocomfort (MCE) Asia, a regional HVAC-R, water and energy exhibition, offered visitors a glimpse into the array of innovations that will soon become the norm in buildings and spaces of the future.

This took place from 5th to 7th September, along with the annual International Green Building Conference (IGBC), offered a strategic platform for key stakeholders to deliberate on the future of green buildings and sustainable development in the region and globally.

Over 12,000 international visitors, including green building industry professionals, thought leaders, policy makers and end-users attended the events and discussed and exchanged ideas on the latest innovations that will

shape the future of sustainable cities.

Diverse solutions to cater to Asia's diverse needs

Capturing attention on the show floor this year was Surbana Jurong's curated showcase, Depicting the possibilities that technology can bring to future cities, the setup brings to life an environment that integrates sustainable, smart and productive technologies to transform how humans interact with their surroundings. The life-sized urban mock-up allowed the visitors to visualise how spaces associated with living, work and play can be re-imagined to bring about an improvement in quality of life.

Walking through the simulated city grid, visitors witnessed first-hand the benefits offered by DVUCA's city management system, which enables better traffic



monitoring and optimised energy usage. This curated exhibit also showcases how innovative technologies such as (these) ability's key-guard will level the playing field at the workplace between the able-bodied and people with disabilities. Aesthetics and functionality are seamlessly weaved into sustainable building practices as showcased by

Thinkphi's solar panel-equipped outdoor umbrellas.

Making innovation in green buildings and energy efficiency the gold standard

Visitors at BEX and MCE Asia 2018 had a chance of getting the first look at several innovations to be launched. From industrial applications to commercial buildings and even homes, over 400 exhibitors from 31 countries provided a comprehensive look into innovations that are continuously advancing the building sector.

Delta Technology introduced the Insulated Fire Rated Curtain (IFRC), a fail-safe double layer curtain that can seal off even the toughest fire outbreaks. Providing up to four hours of fire integrity and insulation, the curtain could potentially save lives in industrial emergencies.

Advancing its 'Quality Air for Life' message, Panasonic showcased the latest integrated air solutions, which combines air-conditioning and ventilation to improve overall indoor air quality, an important but often overlooked aspect of sustainable living.

To improve hygiene and enhance convenience for users, Dyson's Airblade Wash+Dry combines a tap and hand dryer. The smart innovation saves space in the wash room while reducing the problem of water dripping on the floor as users move from a handwashing area to a separate hand drying station.

In the home setting, Kruger's Secomat dehumidifiers help enhance indoor air quality in living spaces by

maintaining a constant 40 to 60 per cent relative humidity. In spaces with limited air circulation such as basements and storage rooms, dehumidifiers help to inhibit the growth of mould and bacteria, brought about by the region's humid and tropical climate.

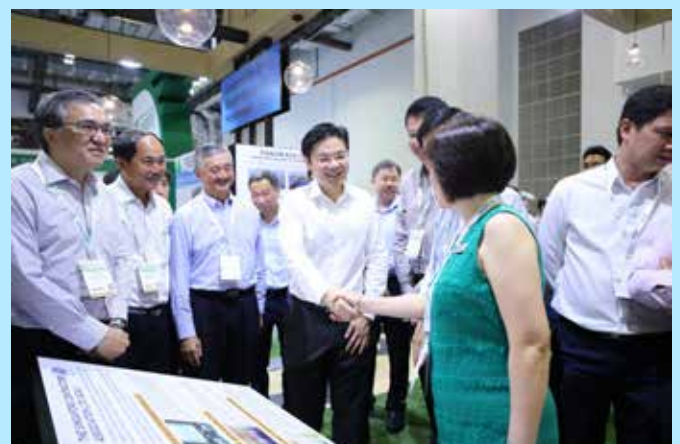
David Yim, Marketing Manager, AGC Asia Pacific, one of the key exhibitors at BEX 2018, said, "BEX Asia is the ideal platform to nurture interest in green building innovations and an opportunity for us to raise awareness among visitors on technologies that are transforming the built sector. For example, AGC is excited to demonstrate how next-generation electrochromic technology combats glare and solar heat in commercial and residential buildings."

Aside from the latest in glass products for buildings, AGC will continue to showcase its popular Halio smart-tinting technology that can tint uniformly in less than three minutes when exposed to light. Unlike other smart glass products, Halio looks like conventional glass, but begins tinting within 20 seconds to provide glare protection and block unwanted heat.

Other well-known names in the built environment sector present on the trade floor include Big Ass Fans, Daikin and ebm-papst. In all, BEX and MCE Asia feature pavilions from China, Germany, Indonesia, Japan and Taiwan, and is expected to draw over 12,000 visitors this year over its three-day event.

Seeding future conversations

BEX and MCE Asia feature complimentary seminars, Green View and Mostra Xchange, featuring an exciting line-up of close to 40 industry experts who will lead conversations on various topics that will impact the future direction of the built environment sector. In partnership with supporting industry organisations such as Institute Engineers of Singapore, The American



Society of Heating, Refrigerating and Air-Conditioning Engineers, and the Indoor Air Quality Association, the seminars showcase a selection of highly curated and qualified sessions on sustainable building solutions, and energy efficiency.

Key sessions and speakers were :

- Lionel Steinitz, CEO, LYS Energy, who will present research on catalysts of green initiatives and the movement toward a low-carbon economy in Southeast Asia
- Anna Kerr, Director at White Arkitekter, the largest architectural firm in Scandinavia, who will discuss diversity and gender equality in urban planning
- Michael Chin, Principal and the Façade and Sustainability Leader from Arup Singapore, who will share successful case studies of green building envelopes and sustainable façade design in tropical regions around the world
- Keith Brewis, Managing Partner, International Operations at Grimshaw, who will share on the emerging use of data in architecture and how it can be creatively used to build iconic structures

BEX Asia and MCE Asia took place at the Sands Expo and Convention Centre, and also co-located with the annual International Green Building Conference (IGBC). With the theme, "Build Green: Build Smart. Build Communities", IGBC 2018 attracted participants from across the entire building and construction value-chain, committed to understanding and putting into action real-world, tangible and leading green building solutions.

In its next edition, BEX and MCE Asia will be complemented by two new flagship events - Innobuild (IB) Asia and Smart Cities & Buildings (SCB) Asia. Following the successful run of BEX Asia for over a decade and MCE Asia since the last four years, the two events will provide attendees with a richer, more well-rounded experience and further catalyse the innovation and adoption of

technology currently available to drive productivity and efficiencies at every stage of the construction cycle.

SCB Asia, which will focus on digital convergence of solutions and technology into the built environment, is a timely addition as nations across the region intensify their efforts on building technologically advanced liveable cities of tomorrow. The role of technology in transforming the building and construction industry will be further underlined with IB Asia, which will look at how companies can tap on productive technologies, equipment and systems to build more efficiently.

"Clearly, as technology advancements disrupt industries across the world, the built environment sector in Asia will not be spared. Nations are also accelerating their journeys to become smart cities, proving that technology is already playing a crucial role in helping to solve today's urban challenges and securing a sustainable future for generations to come," commented Michelle Lim, Managing Director, Singapore, Indonesia and Malaysia, Reed Exhibitions. Lim adds, "These events will be an important accelerator of the industry's transformation, helping stakeholders keep abreast of change and facilitating their evolution as the industry shifts towards smarter and more sustainable living spaces of tomorrow."





IRRIGATION REDEFINED — DESIGNING SOLUTIONS FOR A SUSTAINABLE FUTURE



Our product — Retentsol™ is a 2-in-1 formulation that has dual functions: firstly as a wetting agent, and secondly, as a mini smart 'water bank', drastically reducing the chances of plant dehydration as well as reducing water wastage through run-offs and drainage. The formulation is capable of storing a substantial amount of water during irrigation, 'locking' the water to minimise evaporation and releasing water in times of need. The formulation contains highly water absorbent, non-toxic nanosize gel particles that swell remarkably to retain water molecules under wet conditions. However, when drier conditions resume, the water is returned to the ground under passive controlled release through osmosis and the slight change in pH level in soil.

We have designed this to be compatible with sprinklers and other automated systems with no worries of trapping large amounts of water locally. Importantly, the nanosize water capsules are able to penetrate to the root zone and will not be stuck on soil surfaces. There



should be no soggy ground patches due to localized water trapping issues as the nanosize water banks are well dispersed and the physical property of the nanogel is such that it holds on to the water molecules until triggered by environmental conditions to activate release. This completely soluble agent that uniquely combines wetting capability with water absorption and passive release desorption, makes Retentsol™ suitable for use in both new planting and for watering plants in situ. Also, this unique combination ensures that the plant available water in the soil is increased beyond using any one type of agent alone.

Starting with our pioneer formulations, we have developed a solution that fits for almost every green. The product is formulated to be safe and designed to lower system costs. Our formulations were tested using a wide variety of plant species and were proven to boost plant growth and plant health.

Retentsol™ is first applied during watering by simply mixing it with water and added into the soil as in normal watering where it remains and acts like a 'water bank'. During dry periods, the plants may be able to draw on the material until the water in it is released. Subsequent rains, or intentional watering, will replenish the 'water bank'. You can expect

savings from reduced amount of water used, or less watering frequency and these may also translate into savings in labour and other ancillary costs. Watering frequency can be reduced by up to half, i.e., to say if watering has to be done twice a day, now only one watering is needed. This formulation should also help to circumvent fluctuations in weather conditions and allows more flexibility in adjustment of watering schedule.

A good example of the advantage of the use of our formulation can be seen in the water sensitive plant – *Alternanthera* shown here. This plant species needs frequent watering but with our formulation, the test plants showed good growth despite lack of watering for 2 days.

This is a product for the times in a world faced with climate change. The formulation widens the watering window and reduces the severity of plant stress during dry conditions, ensuring higher plant survivability. Our product will find multiple applications within horticulture, agriculture, and post-fire forest regeneration as well as in high water usage areas such as golf courses.

FytoSol Pte Ltd

Enquiries: Chan.KokPun@FytoSol.com



26th – 27th November, 2018

**Event location: Rosh Rayhaan by Rotana in
Riyadh, Saudi Arabia**

Saudi Arabia Renewable Energy - Solar & Wind 2018 is a 2-day conference that is being hosted on 26th – 27th November, 2018 at Rosh Rayhaan by Rotana in Riyadh, Saudi Arabia. This conference focuses on the future of Renewable Energy in Saudi Arabia with further discussions about Technological Enhancements, NEOM City, Oman's Miraah Project, Masdar Initiative, Prospective Development Sites, Electric Vehicle Market, Dubai Clean Strategy 2050. It also discusses the potential for growth of the Kingdom in regards to reducing Carbon Footprints. It's a platform to discuss and debate best practices which can be instrumental in maximizing the power sourcing in the region.

To get further details kindly send us an email to aditi@bricsaconsulting.com or contact Ms. Aditi Jain on +91 22 4880 3419. To download the conference agenda, kindly click on the below given link:

<https://bricsaconsulting.com/event/saudi-arabia-renewable-energy-2018/>

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