NEWS ARTICLE

Credit: EmTech Asia 2018

EXCLUSIVE - Making Singapore cool again: A conversation with Professor Gerhard Schmitt

BY: NICKY LUNG PRIYANKAR BHUNIA

GEOGRAPHY: **SINGAPORE**

PUBLISHED:

14 MAR 2018

OpenGov his insights on how to combat UHI in Singapore and the role of Cooling Singapore in this effort.

Cities already house over 50% of the world's population, and the number is expected to increase to 60% by 2030. Rapidly growing cities are bringing with them a host of challenges. One of them is the Urban Heat Island (UHI) Effect.

An UHI is an urban area or metropolitan area that is significantly warmer than its surrounding rural areas due to human activities. The temperature difference usually is larger at night than during the day.

In general, cities consume a large amount of energy, have less vegetation to provide shade and cooling, and are built of materials that absorb and store heat.

The UHI effect occurs due to a combination of factors, including: (1) heat-trapping buildings and infrastructure, (2) reduced vegetation, (3) urban geometry, and (4) increased anthropogenic heat from human activities including traffic, industrial activities, lighting, air-conditioning (AC) etc.

It is a global problem affecting cities around the world, particularly in the tropics. The increased temperature reduces thermal comfort, discourages people from walking or cycling, and increases the energy used for air conditioning. It impacts comfort, liveability, as well as the economy.

According to a study by Verisk Maplecroft, heat stress threatens to cut labour productivity in south-east Asia by up to 25% by 2030, by limiting human ability to undertake activity. UHI is also responsible for more intense storms, which sometimes lead to flooding.

Singapore is also susceptible to the effects of UHI. In tropical Singapore, dense urban structure causes heat to be trapped while anthropogenic heat caused by human activities worsens the situation. Studies by Matthias Roth and Winston T.L. Chow found that the UHI effect over the urbanised Singapore averages about 4°C, though it can exceed 7°C at certain times of the day.

global climate change.

In Singapore, a research project called Cooling Singapore was launched in 2017. Funded by the National Research Foundation of Singapore (NRF), Cooling Singapore is the first multi-institutional initiative led by the Singapore-ETH Centre, together with National University of Singapore (NUS), Singapore-MIT Alliance for Research and Technology (SMART), and TUM CREATE (established by the Technical University of Munich).

With the aim of improving outdoor thermal comfort of tropical Singapore, the research initiative hopes to add to actionable knowledge for policymakers with a roadmap in tackling the problem of UHI.

At EmTech Asia 2018, OpenGov spoke to Professor Gerhard Schmitt who is the Lead Principal Investigator of Cooling Singapore. Professor Schmitt is also a Professor of Information Architecture at ETH Zürich and Director of the Singapore-ETH Centre.

With research focus and expertise on responsive, sustainable and liveable future cities, specifically in the rapidly-urbanising regions across the world, Professor Schmitt shared with us his insights on how to combat UHI in Singapore and the role of Cooling Singapore in this effort.

Prof Schmitt urged the city-state to "take more mitigation measures because the acceleration of temperature increase is real." The increase in temperature is a result of both global climate change and the increase in anthropogenic heat in Singapore.

> "The increase of the urban temperature in Singapore, resulting from a combination of global and local effects, is accelerating. The key thing is to deal with the sources of heat as soon as possible. We simply cannot afford to add more heat to our environment," Prof Schmitt emphasised.

In his presentation at EmTech Asia, Prof Schmitt presented the key objectives and multi-stakeholder approach of the Cooling Singapore project.

With strong emphasis on science and data, the project aims at mapping the UHI effect and outdoor thermal comfort in Singapore to identify the areas that are most affected.

The team uses a numerical weather prediction model coupled with an urban canopy model to compare the temperature in Singapore as it exists today with a hypothetical Singapore without any buildings and with only vegetation and thereby, estimate the UHI effect. Similar simulations can be performed for all anthropogenic factors, such as transportation.

Outdoor thermal comfort, as experienced and perceived by people, is modelled with sensation, perception and behavioural models incorporated. To understand people's behaviour, the researchers conduct measurement campaigns, online surveys and interviews.

(2) Evaluating options

The team then identifies viable mitigation strategies and evaluates their expected effectiveness in reducing the UHI effect in the hotspot areas. In the process, the team also systematically identifies knowledge and technology gaps and will develop a roadmap to guide future UHI-related research and development (R&D) activities in Singapore.

A catalogue of eighty-six different mitigation strategies have been identified for Singapore across 7 clusters: Shading, Transportation, Energy, Materials and Surfaces, Urban geometry, Water bodies and Vegetation.

(3) Developing a roadmap

Research findings will be consolidated into reports to develop a policy roadmap on how Singapore can tackle UHI. As the roadmap is catered to policymakers and other stakeholders, a 14-member UHI task force has been set up, comprising stakeholders from local agencies and universities including Nanyang Technological University (NTU) and Singapore University of Technology and Design (SUTD).

The draft Roadmap will be presented during the Cooling Singapore Symposium at the World Cities Summit on 11 July 2018.

A prototype, in the form of a web-based tool, will be developed to support the research and mapping activities. The digital model will also help citizens identify cooler parts of Singapore.

Credit: Cooling Singapore

In our subsequent discussion, Prof Schmitt explained, "The ultimate objective is to make Singapore a liveable city in the long run. If we do not act now, together with the population increase, the problem of urban heat island is only going to worsen. With a deteriorating environment caused by increasing temperatures, citizens will be less productive and suffer detrimental health effects."

When asked about at what stage is Singapore currently in, in terms of tackling the UHI effect, Prof Schmitt said the project represents a first step, but the initiatives are running in parallel.

strategies have been developed and the tool development is underway," he continued to share.

Acknowledging the fact that both research and urban climate design to alleviate the UHI effect will take time, Singapore must take a holistic approach that balances between urban climate design to change our physical environment and our interaction with it, in implementing mitigation measures.

On mitigation, Prof Schmitt suggested that new developments in Singapore should be designed in a way such that they are cooler than existing ones by increasing air flow, be it artificial or natural air flow into and around the building. They should also be powered by renewable energy resources. This will eventually change the mindset of people, their behaviour, as well as their physical comfort.

While designing new buildings with more liveable features is possible, improving existing buildings in built-up areas is a much more daunting task. This is particularly true in highly urbanised cities in Southeast Asia.

Prof Schmitt suggested a few ways. For example, old buildings can be refurbished to improve air flow. Technology can be applied to existing buildings to increase air flow, or even lift the ceiling to increase usable space.

> Technology, including the use of artificial intelligence (AI) and sensors for data collection, is a key backbone for the project's research and development of urban solutions.

At the moment, the Cooling Singapore team is developing an interactive web-based application tool to help map and visualise the UHI effect. With real-time data and simulation, the app will provide information on noise, pollution, heat and humidity.

According to Prof Schmitt, the idea is based on the observation that people intrinsically like to enjoy the outdoor environment. Noting that rising temperature has detrimental implications on people's health, technology can help to map the most pleasant route, in

Instead of the currently available static maps, the use of AI can assist the simulation to show the dynamic movement of the population and their activities throughout the day. Accurate data also increases the stability and accuracy in temperature predictions.

The team behind the Cooling Singapore project believes that the interactive map detailing the outdoor thermal comfort of Singapore would be important for policy-makers to understand the actual situation in order to effectively tackle the problem.

According to Prof Schmitt, the map can help policy-makers in better urban planning, such as in deciding where to locate schools and other community facilities. It can also be used to predict which are the most visited places, so authorities can plan accordingly.

In planning the urban landscape of Singapore, Prof Schmitt believed that there should be more clusters of mixed-use living and working development across the island and cited the positive example of the recently announced Punggol Digital District (PDD) development plan.

“The latest plan to develop it into Punggol Digital District is exactly the right thing to do. People learn and work in the same district they live, avoiding traffic, pollution and time lost in daily commute. Creating more self-contained communities and ecosystems is how part of Singapore could be developed. The key is to bring together the places where people live and work to reduce unnecessary daily commute and travel,” he said.

Prof Schmitt also emphasised that planning ahead is a better way to improve the environment and its sustainability. However, citizen engagement is equally important as government-led initiatives.

When asked about how a city can balance between citizens’ desire for more liveable environment and the city’s development need due to land scarcity, Prof Schmitt pointed out that there are always natural limits to a city or country’s development before it becomes unbearable to live. But even in built-up areas of the city, we could do more to make it more walkable, liveable, and open up more public spaces.

Through this project, the team hopes to help planners, stakeholders and residents visualise a liveable environment through the interactive map and the easy-to-

"When people start to see the change in temperature and how it positively affects their lives, they will change their mindset, behaviour and support these initiatives to make Singapore an even more liveable city," he concluded.

ARTICLE CHANNELS:

TECHNOLOGY

SMART CITIES

GEOSPATIAL

BIG DATA ANALYTICS

EDUCATION

RESEARCH

RENEWABLE ENERGY

SUSTAINABILITY

ARTIFICIAL INTELLIGENCE

PREVIOUS ARTICLE

Technology used in fighting wildlife crime in Indonesia

NEXT ARTICLE

MIT study finds humans are responsible for spread of false news, not bots

ENJOYED THIS ARTICLE?