SEED PROJECT WEBINAR ON PASSIVE COOLING, DIRECT TO CHIP COOLING AND LIQUID COOLING

Date: 25 October 2022, Tuesday
Time: 3pm-550pm
Venue: Zoom

The event is open to CoolestSG Consortium industry and IHL/RI members, its invited guests and government agencies. A Zoom link will be sent to registered attendees no later than two days from the event. For registration click here or scan the below QR Code no later than two days from the event.

Speakers: Dr Han Wei
Dr Matthew Law
Dr Muhammad Haiqal Bin Mahbod

Event Organizer: Cooling Energy Science and Technology Singapore - CoolestSG Consortium

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INTRODUCTION

Air-conditioning and mechanical ventilation (ACMV) systems have their fair share of high initial capital investment and high recurring operating costs. Dr. Han Wei will give an overview of the operation of vertical farms, the optimal environment for plant growth and challenges to build and operate an efficient ACMV system for vertical farms, which he is trying to address as part of the seed project **"Passive cooling for vertical farms in the tropics"** that he is working on. Cooling load calculations based on plant evapotranspiration modelling will be presented and key parameters driving these loads will be discussed.

Dr Matthew Law's seed project **"Direct to chip on demand two phase cooling using additively manufactured oblique fins"** focuses on managing the cooling needs of High Performance Computing servers in data centres by introducing on-demand two-phase cooling. This on-demand system will run based on the computational work of the server by operating in single-phase liquid cooling during low loading periods and automatically switch to high-efficiency two-phase cooling during high loading periods. This change in cooling mode can occur instantaneously without the need of additional/external inputs.

Dr Muhammad Haiqal Bin Mahbod aims to improve thermal management by using digital twins and AI in his seed project **"Digital twin for liquid cooled data centres"**. In this webinar, Dr Haiqal will give an overview of digital twins and explore how its extension into data centre applications can contribute to reducing energy consumption.

Each presentation will take 45 minutes including a 15 minute Q&A session.

PROGRAM OUTLINE

2.50pm **Admittance of attendees**

3pm **Welcome remarks and introduction - Mr Peter Lindgren, CoolestSG Consortium Office & NUS**

3.05pm **Opening remarks - Professor Chou Siaw Kiang, Chair of CoolestSG Technical Committee (TC) & Department of Mechanical Engineering, NUS**

3.15pm **Seed project: "Passive cooling for vertical farming in the tropics" - Dr Han Wei, Department of Mechanical Engineering, NUS**

4pm **Seed project: "Direct to chip on demand two phase cooling using additively manufactured oblique fins" - Dr Matthew Law, Department of Mechanical Engineering, NUS**

4.45pm **Seed project: "Digital twin for liquid-cooled data centres" - Dr Muhammed Haiqal Bin Mahbod, Department of Mechanical Engineering, NUS**

5.30pm **Closing remarks - Associate Professor Lee Poh Seng, CoolestSG Programme Director & Department of Mechanical Engineering, NUS**

5.45pm **Event feedback, link to presentations and recording - Mr Peter Lindgren, CoolestSG Consortium Office & NUS**

5.50pm **End of event**

ABOUT THE COOLESTSG CONSORTIUM

CoolestSG is a national consortium set up by NRF in 2018. The task of the CoolestSG Consortium is to bring stakeholders together to catalyse co-development between researchers and industry of novel low-energy cooling technologies and/or passive/integrated designs and to translate research into deployment and commercialisation with the aim to promote Singapore as a frontrunner in cooling technologies.

Screenshots may be taken during this webinar which will be recorded.

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ABOUT THE SPEAKERS

Dr Wei Han, Department of Mechanical Engineering, NUS
E-mail: hanwei@nus.edu.sg

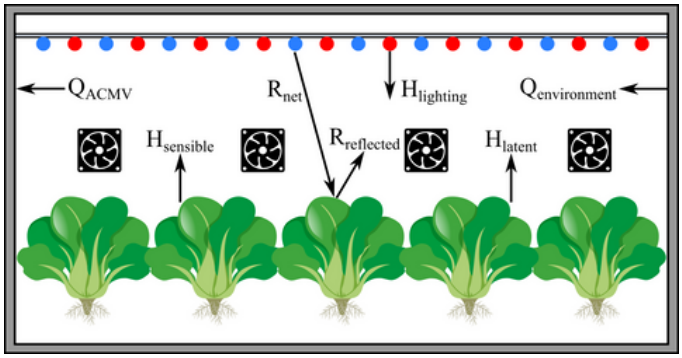
Han is a Postdoctoral Research Fellow at the Department of Mechanical Engineering, NUS. He joined Prof. Lee Poh Seng's group earlier this year and has been seeking solutions to sustainable urban farm cooling. Prior to his venture into this area, he worked on aerodynamics as a research scientist at Temasek Laboratories at NUS after receiving a PhD in aerospace engineering from the University of Queensland. Dr. WEI is an experimentalist and expert at characterising highly transient flow phenomena through non-intrusive optical diagnostics.

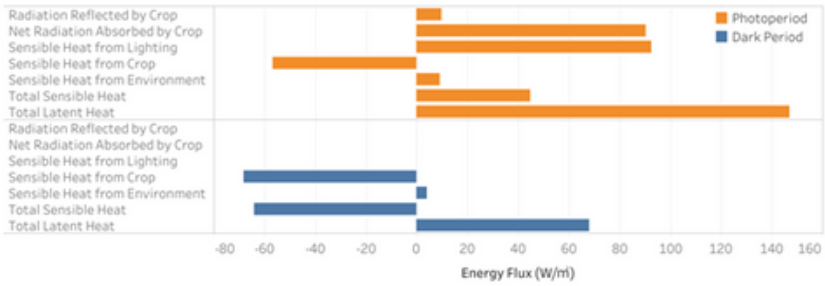
Dr Matthew Law, Department of Mechanical Engineering, NUS
E-mail: mlllaw@nus.edu.sg

Matthew is a Senior Postdoctoral Research Fellow in the Department of Mechanical Engineering, National University of Singapore. He received his Ph.D. in Mechanical Engineering from NUS in 2016 under the supervision of Prof Lee Poh Seng. He specialises in single-phase and two-phase cooling using novel fin structures.

Dr Muhammad Haiqal Bin Mahbod, Department of Mechanical Engineering, NUS
E-mail: haiqalbm@nus.edu.sg

Haiqal is a Postdoctoral Research Fellow in the Department of Mechanical Engineering, National University of Singapore. He specialises in thermal managemnet of data centres.Dr Muhammad Haiqal Bin Mahbod is a Research Fellow at the National University of Singapore's (NUS) Department of Mechanical Engineering. He received his PhD in Mechanical Engineering from NUS in 2022 under the supervision of A/Prof Lee Poh Seng of the Cooling Energy Science and Technology Laboratory. His work involves the use of Machine Learning on a Data Center Cooling System model to improve energy efficiency in the tropics.

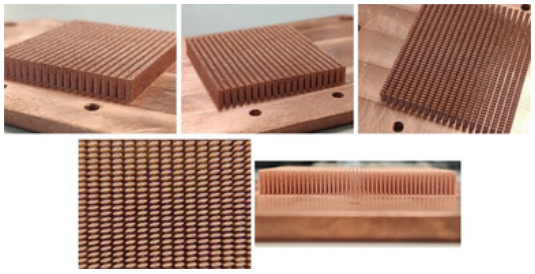




LEFT ABOVE: Energy balance inside an airtight vertical farm climate cell. RIGHT ABOVE: Cooling loads inside a vertical farm climate cell with Leaf Area Index (LAI) = 3, Photosynthetic Photon Flux Density (PPFD) = 500 μmol/ m²s, T = 23 ºC and RH = 65%

Image Credit: Dr Han Wei

RIGHT: Dr Matthew Law has conducted lab-based investigations of the oblique-fin structure in both single-phase and two-phase modes of cooling. The oblique fins offered significant heat transfer augmentation compared to the conventional straight fins, owing to the secondary oblique channels which promote boundary layer regeneration and flow mixing. Photo Credit: Dr Matthew Law



RIGHT: Digital Twins are virtual models that accurately reflect the current state of a physical entity which include the entity's infrastructure, system, and processes. Such models are embedded with sensor data to form the digital copy of the system. Bringing together data from every stage of a project, a digital twin creates a single source of truth that improves collaboration while providing deeper insights for everyone involved, from design team to asset owner. Photo Credit: AutoDesk