

URBAN & GREEN TECHNOLOGY (UGTO)

ORGANIZING FOR SUCCESS

A/Prof Karthik Kumar

Director

Science and Engineering Research Council
(SERC), A*STAR

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Enhancing Living Environment to Create Smart Sustainable Cities



UGTO Video

<https://www.youtube.com/watch?v=28VvsBzG5ME>



Mitigating Climate Change and ensuring Built Environment remains competitive



By PM Lee, NDR 2019: “**Climate change one of the 'gravest challenges facing mankind', impact on Singapore to worsen**”

- **Build advanced technologies towards a low-carbon future** to achieve Singapore's emission pledge of halving 2030 peak emissions to 33 million tonnes CO₂ by 2050 *(Singapore's LEDS announced in Feb 2020 & submitted to UNFCCC on 31 Mar 2020; <https://www.straittimes.com/singapore/environment/spores-2050-target-halve-emissions-from-2030-peak>)*



COVID-19 has led to severe disruption to global economy leading to both **demand-** and **supply-side shocks to Singapore economy** *(Economic survey of Singapore First Quarter 2020)*



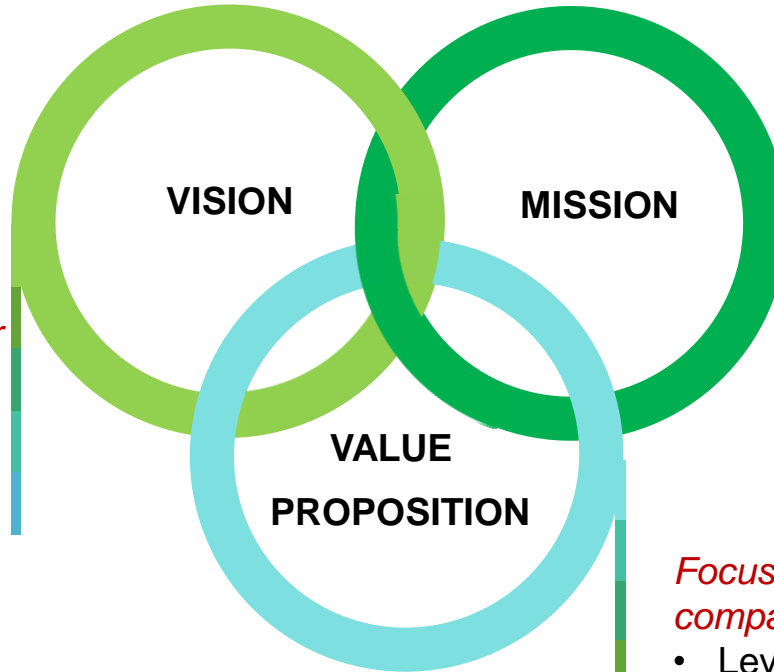
USS RIE 2025

- Vision: **City of Tomorrow**
- Mission: **Resilient, sustainable**, liveable and vibrant city



Urban and GreenTech Office (UGTO; Aug '19)

To be an *active and value-adding partner* in Singapore for research in Urban and Green Technologies.



To *coordinate and direct* the development of A*STAR Urban and Green Technologies

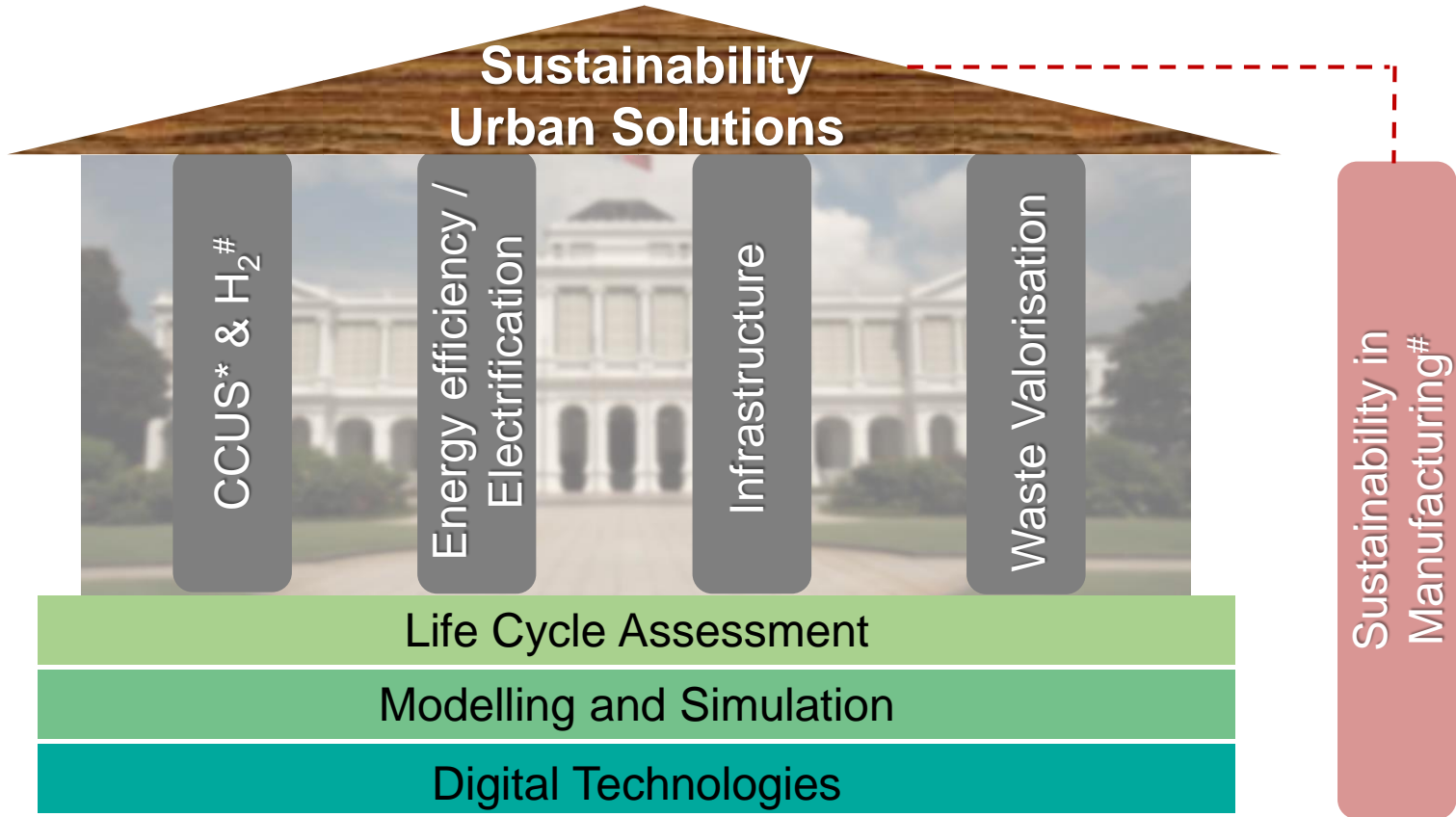
To provide *technology consultancy* to local stakeholders (Public sector agencies, LLEs, SMEs and Startups).

Focus on niche areas, based on comparative advantage

- Leverage capabilities built in AME
- Applied and Translational R&D
- Catalyse Industry Engagement



UGTO's Key Areas of Focus



*CCUS – Carbon Capture Utilisation & Storage

New areas



Top 5 priorities

1. CCUS¹ & H₂

- Modular testbed to accelerate CCUS and H2 tech translation
- Sustainable building materials through mineralisation tech
- Sustainable fuels/polymers/plastics through catalysts development

2. Energy efficiency / electrification

- Plan for EV charging stations to support Singapore in achieving 28000 charging stations by 2030

3. Infrastructure

- To develop a city of tomorrow through development of the following areas:
 - Intelligent traffic control system
 - In construction through robotics and automation, inspection and monitoring systems

4. Waste valorisation

- Plastic recycling and waste sorting initiatives to help address the plastic waste issue in Singapore

5. Sustainability in Manufacturing²

- Material substitution
- Material/process/system re-design
- Industrial symbiosis

¹ CCUS – Carbon Capture Utilisation & Storage

² New area

³ LCA – Life Cycle Assessment

Leveraging LCA³, modelling and simulation, and digital technologies

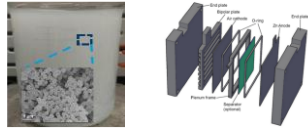
Energy Efficiency / Electrification

Battery Tech



Battery Materials

- Advanced Li-ion
- Open-system Zn-Air
- Solid State Battery
- High performance cathode and anode



Physics-based Battery Modelling + AI/ML



Battery Management System (BMS)

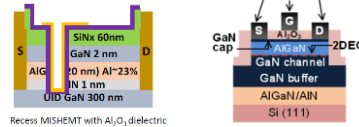


Power Conversion



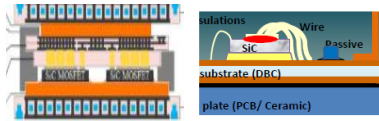
Power Devices

- GaN on Si (200mm)
- SiC (150 & 200mm)
- Device & Applications
- HEMT



Power Module

- Packaging consortium
- Thermal management
- Parasitic cap/EMI reduction
- Novel package design
- Reliability of interconnects



Grid Tech



- Management of Energy Storage and Micro-Grid
- Smart energy analytics



- Solar Photovoltaic Energy Storage System (PVES)



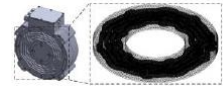
- Integrated Micro-grid Demo System



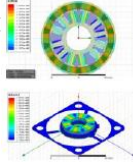
E-motors



- Magnetic materials
- Rapid materials prototyping



- Motor design
- Topological optimization
- EM, thermal modelling and simulation



- Motor control
- Firmware development
- Data-driven intelligent control





Sustainability

Improve resource efficiency and achieve science-based targets through resource management

Life Cycle Assessment

- Environmental impact indicators:
 - Carbon footprint
 - Energy consumption
 - Water consumption
 - Ecotoxicity
- Plastic products, food, water, packaging, etc
- Examples based on carbon footprint:
 - 300g steak = 34 showers
 - 1 glass cup has to be used 85 times to break even against single-use paper cups





Sharing insights into battery-related works

- **Recycling of E-Waste & Lithium-Ion Batteries**

Sharing of NTU Singapore –CEA Alliance for Research in Circular Economy (SCARCE) research thrust in recycling of advanced lithium ion batteries

Presented by Prof. Alex Yan, Nanyang Technological University (NTU)

- **Launch of “Battery Repurposing Whitepaper” by Singapore Battery Consortium, IPI & NTU SCARCE**

Technology and market insights into battery-related technologies including second life batteries, battery repurposing

Presented by Dr. Chiam Sing Yang, Director, Singapore Battery Consortium

- **Understanding the Environmental Impacts of Products & Systems Through Life Cycle Assessment**

Importance of Life Cycle Assessment (LCA) to support evidence-based decisions and planning to achieve our sustainable development goals and sharing of case studies

Presented by: Dr. Yeo Zhiquan, Deputy Group Manager, Sustainability and Life Cycle Engineering, SIMTech, A*STAR



CREATING GROWTH, ENHANCING LIVES



THANK YOU

Video & Website

<https://www.youtube.com/watch?v=28VvsBzG5ME>

<https://www.a-star.edu.sg/About-A-STAR/horizontal-technology-centres/urban-and-green-technology>.

UGTO@hq.a-star.edu.sg