Research & Innovation

Driving Innovation in Cooling Technologies for Sustainable Infrastructure

The scholar from the Department of Mechanical Engineering has redefined heat transfer science by overcoming the Leidenfrost effect, a centuries-old challenge that had long hindered efficient cooling in extremely high-temperature environments. By developing structured thermal armour, the team successfully inhibited the effect above 1,000°C, enabling sustained liquid cooling and extending the temperature range of superwettability. This breakthrough provides a foundation for next-generation technological advancements across industries reliant on thermal management.

The impact of this pioneering work has been recognised internationally: the scholar received the **2023 Falling Walls Science Breakthroughs of the Year Award in Engineering and Technology category**, and the **2024 Nukiyama Memorial Award** for his significant contribution to thermal science and engineering. These accolades affirm the innovation's potential in critical applications ranging from electronics cooling and data centres to nuclear energy and aerospace technologies.

Building on these achievements, the team will commercialise the Energy-Efficient Liquid Cooling System (ELCS), with the support of the "Research, Academic and Industry Sectors One-Plus Scheme" (RAISe+) of the Government of the HKSAR. ELCS integrates nano-engineered surfaces, phase-change cooling, and AI-optimised monitoring to drastically reduce the energy demand of data centres, where cooling alone used to consume 40% of total energy use. By delivering scalable, energy-efficient solutions, this research advances industry innovation and sustainable infrastructure, while contributing to Affordable and Clean Energy (SDG7).

Advancing Infrastructure Resilience through Composite Column Innovation

A novel structural solution, the Fibre-Reinforced Polymer (FRP) - Engineered Cementitious Composite (ECC) - High-Strength Concrete (HSC) composite column, has been developed to enhance the safety and resilience of infrastructure. This column is uniquely designed with three layers: an outer FRP tube, a middle ECC ring, and an inner HSC core. Unlike conventional FRP-confined HSC columns, which are prone to cracking and premature failure due to the brittleness of HSC, the addition of the ECC ring redistributes hoop stress and strain more effectively from the core to the FRP tube. This results in uniform confinement, improved efficiency, and greater deformability.

The research demonstrates that the composite column possesses excellent compressive performance, combining high loading capacity with superior ductility. These qualities make it especially suitable for large-scale infrastructure in marine environments and coastal regions, where durability and resilience are critical.

The significance of this innovation has been recognised with a **Gold Medal at the 49th International Exhibition of Inventions Geneva**, underscoring its potential to transform structural engineering practice and contribute to the development of safer, longer-lasting infrastructure.

Teaching & Learning

Strengthening Next-Generation Entrepreneurship through Cross-Institutional Partnership

PolyU has entered into a strategic agreement with Guangdong University of Technology to jointly nurture a new generation of innovative and entrepreneurial talent. As part of this collaboration, the "Guangdong-Hong Kong-Macao Greater Bay Area Immersive Experience Project" was launched to strengthen talent exchange and support entrepreneurial initiatives through a shared credit system.

Leveraging the educational and professional resources of both institutions, the initiative fosters a high-quality talent ecosystem that supports innovation, entrepreneurship, and knowledge transfer across the region. In particular, students are encouraged to co-develop and launch start-up projects, which will be supported for further incubation and implementation in Hong Kong, Macao, and Guangdong.

This cross-border partnership offers students a wealth of opportunities to develop their innovative and entrepreneurial skills through initiatives such as establishing a service consultation hub for talents from both institutions, co-organising international exchange activities, and promoting entrepreneurial cooperation projects. By jointly cultivating high-quality innovative and entrepreneurial talent across various fields, the collaboration provides valuable experiential learning and support networks that prepare students to succeed in dynamic and competitive environments.

Unleashing Artificial Intelligence Skills in Future-Ready Talent

To respond to the growing demand for an aptitude for AI, the Department of Data Science and Artificial Intelligence was established to offer provident programmes, aiming to equip students with interdisciplinary knowledge in areas such as big data, blockchain, and metaverse, thereby cultivating future leaders who can think critically, solve complex problems, and stay relevant and competitive in the fast-changing job market and ever evolving society.

Complementing the academic training, the PolyU Library organised a seminar designed to broaden students' understanding and hands-on experience with generative AI. Through case studies, demonstrations of AI tools, and discussions on ethical considerations, participants explored both the opportunities and challenges of AI-generated content, gaining insights into how AI technologies can be responsibly applied across various industries.

By bridging theory and practice, the University is committed to nurturing technically competent and ethically grounded future-ready change-makers in the AI-driven era, who are capable of harnessing the power of AI responsibly to drive technological advancement and contribute to society.

External Engagement

Sustainable Solutions for Land Reclamation and Nature-Based Urban Development

To facilitate experience sharing and knowledge exchange on viable and more sustainable approaches to land reclamation in Hong Kong, the Department of Civil and Environmental Engineering and the Geotechnical Division of the Hong Kong Institution of Engineers co-hosted the "International Symposium on Reclamations Using Local Dredged Sediments" to provide a platform for **over 260 Hong Kong, Chinese Mainland, and international practitioners and experts in reclamation technologies** to engage in discussions on practical, eco-friendly, and sustainable solutions to land scarcity and soft ground issues. Through talks, technical visits, and case studies, participants identified that locally dredged marine sediments can effectively mitigate problems such as limited supply and rising costs of conventional fill materials, thus helping provide a constructive answer to land scarcity.

International Symposium on Reclamations Using Local Dredged Sediments

Meanwhile, the Research Institute for Land and Space convened **almost 40 global experts and scholars** to discuss integrating nature into the lifecycle management of urban infrastructure at the "International Conference on Nature-Based Solutions for Urban Infrastructure". **Over 200 international participants** engaged in keynote speeches, technical sessions, a poster exhibition, and a hands-on workshop, exploring how nature-based strategies can enhance urban resilience, environmental quality, and liveability. It is hoped that such applied knowledge will help promote a sustainable, research-backed blueprint for future urban and land development in Hong Kong and beyond.

Promoting Geotechnical Innovations for Sustainable Development

The "International Symposium on Innovations in Geotechnical Engineering towards Sustainability" brought together global experts to explore the critical role of geotechnical engineering in advancing sustainable development. Organised by the Department of Civil and Environmental Engineering, the Symposium was attended by **around 400 international participants** and featured **almost 70 speakers and nearly 200 emerging researchers** from around the world, serving as a vibrant platform for sharing cutting-edge research and fostering collaboration between academia and industry.

Presentations and discussions focused on energy-efficient, environmentally friendly, resilient, and sustainable geotechnical systems, showcasing breakthrough technologies and highlighting innovations in geomechanics that support the transition to a more sustainable society. Moreover, by connecting researchers and professionals from diverse backgrounds, the Symposium facilitated knowledge exchange and interdisciplinary cooperation, reinforcing the role of geotechnical engineering as a dynamic interface between human society and the earth system, which is paramount to making significant contributions to developing innovative solutions for sustainable development.

Governance & Operations

Accelerating Innovation through Strategic Entrepreneurial Support

PolyU continues to nurture an innovation-driven entrepreneurial ecosystem through the comprehensive PolyVentures platform, supporting students, alumni, and researchers from ideation to acceleration. The Micro Fund Scheme backed a record number of **over 100 startups**, around 60% of which progressing into Hong Kong Science & Technology Parks Corporation (HKSTP)'s Ideation and Incubation Programmes. Concurrently, the Greater Bay Area Startup Postdoc Programme, the first of its kind among local universities, further encouraged tech-based entrepreneurship, supporting **over 20 postdoctoral fellows** to date and earning **more than 20 awards with nearly HK$30 million in follow-on funding**.

The University also offered the Proof-of-Concept Funding Scheme to accelerate development, which engaged **nearly 90 students** and led to more than 40 projects, around half of which entered HKSTP's Ideation Programme. Meanwhile, **over 20 high-potential technology ventures** received financial support ranging from HK$1 to 3 million through the Two-Tier Angel Fund Scheme.

Complementing funding with infrastructure, the PolyU Industrial Centre provides innovators with over 160 advanced facilities, equipment, and technologies to transform concepts into prototypes, while just **over 50 startup teams** were admitted to the PolyU InnoHub Hong Kong, most of whom were previously funded by PolyU entrepreneurship programmes.

PolyU Industrial Centre

Through these targeted efforts, the University has supported **over 500 active startups** and trained **more than 7,600 entrepreneurs** to date, translating research into impact and contributing to regional innovation in Hong Kong and the Greater Bay Area.

Micro Fund Scheme

Proof-of-Concept Funding Scheme

Empowering Innovative Early-Career Researchers

PolyU champions innovative, interdisciplinary research by recognising outstanding young faculty members, who have demonstrated exceptional originality and impact in addressing global challenges, with the Young Innovative Researcher Award. The exceptional researchers were selected from a competitive pool of submissions for their impactful contributions across a wide range of disciplines, including materials science, green energy, advanced manufacturing, intelligent construction, textile technology, and medical technology.

Their pioneering projects involve developing nano-porous materials to enhance hydrogen storage, designing novel computing devices to reduce energy consumption in Artificial Intelligence of Things, and establishing recycling certification systems to promote a sustainable circular economy. Other notable efforts include creating biocompatible smart wearable materials for health monitoring, advancing high-performance swept lasers for industrial and medical applications, and innovating four-dimensional real-time tumour tracking technology to improve cancer treatment.

Importantly, while each recipient receives research funding of HK$500,000 and a personal cash prize to encourage continued pursuit of innovative and impactful research, the award reflects PolyU's dedication to nurturing ambitious young scientific talents who contribute meaningful solutions to societal challenges, supporting national objectives to foster new quality productive forces and strengthen the research and innovation landscape, further solidifying Hong Kong's position as a hub for world-class research excellence.