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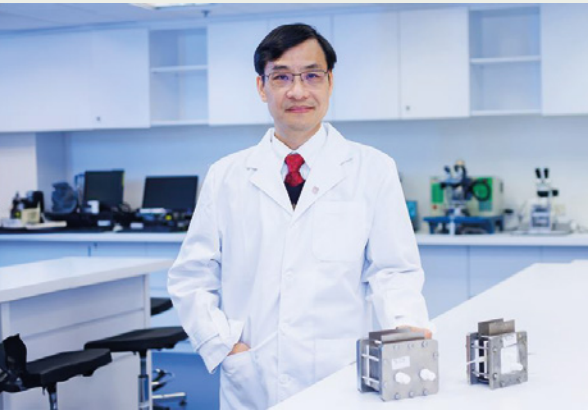
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Research & Innovation



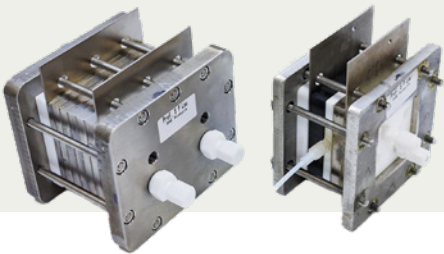
Harnessing Electrochemical Technologies for Carbon Neutrality

PolyU has developed a durable, highly selective, and energy-efficient carbon dioxide electroreduction system that converts carbon dioxide into ethylene, a key ingredient in plastics and chemical fibres. This innovative technology offers a sustainable alternative to conventional ethylene production, which generates significant carbon emissions. It therefore contributes to closing the carbon loop while supporting carbon neutrality goals. Using green electricity, the system increases its lifespan significantly and enhances industrial scalability, offering a practical solution for reducing carbon dioxide emissions in manufacturing and chemical industries.

The system's advanced design, denoted as the APMA cell, employs a metal-free anolyte and a specialised copper electrocatalyst with nanoscale features that increase reaction efficiency and selectivity. This APMA design enables continuous operation at industrial-level currents, suppressing carbonate formation, salt deposition, and unwanted hydrogen

generation, thereby ensures stable ethylene production over extended periods, making it suitable for large-scale industrial adoption.

By transforming carbon dioxide into industrially valuable chemicals, the system supports sustainable industrial practices, reduces environmental impact, and strengthens infrastructure resilience. It received a **Gold Medal at the 48th International Exhibition of Inventions Geneva**, highlighting its global recognition and industrial relevance. The technology also contributes to Industry, Innovation and Infrastructure (SDG9) and Sustainable Cities and Communities (SDG11), promoting greener production methods and a lower-carbon industrial landscape.



Revolutionising Urban Heat Mitigation with Innovative Infrastructure

Mitigating urban heat is a pressing challenge due to rapid urbanisation and global warming. With cities like Hong Kong experiencing record-breaking high temperatures, PolyU researchers from the Department of Civil and Environmental Engineering collaborated with global experts to conduct a first-of-its-kind study on the effectiveness of green-blue-grey infrastructure (GBGI) in cooling urban environments. GBGI encompasses green infrastructures such as trees, grass, and hedges; blue infrastructures including pools, lakes, and rivers; and grey infrastructures like roof gardens, pergolas, and green walls.

The study revealed regional and city-specific variations in the cooling efficiency of GBGI. Globally, GBGI reduced air temperatures by up to 18.9°C in Europe, 17.7°C in Asia, 12°C in North America, and 9.6°C in Australia. Interestingly, botanical gardens, wetlands, green walls, and attenuation ponds were

particularly effective, with reductions of up to 10°C in certain regions. In Asia, grey infrastructures achieved significant cooling, with temperature reductions; in Hong Kong specifically, parks and green roofs reduced temperatures by nearly 5°C.

To guide practical implementation, the research team proposed a nine-stage framework encompassing stakeholder engagement, feasibility studies, design, policy development, implementation, monitoring, evaluation, and upscaling. This framework provides policymakers with a strategic roadmap to optimise GBGI deployment, by decreasing energy consumption, reducing climate change impact, improving urban resilience, enhancing biodiversity, and mitigating the urban heat island effect, which also contributes to the development of sustainable, inclusive, and resilient cities (SDG11).



Teaching & Learning

Driving Sustainable Innovation for a Carbon-Neutral Campus

Organised by the Department of Civil and Environmental Engineering, the Carbon-Neutral PolyU 48 Hours Hackathon gathered students from various disciplines to tackle the global challenge of climate change and generate green solutions that aimed at advancing sustainability on campus through creativity, collaboration, and innovation.

Throughout the event, participating teams received invaluable mentorship and guidance from departmental experts and representatives from the Campus Facilities and Sustainability Office whilst engaging in climate-conscious problem solving. With creativity and determination, students refined their ideas and translated complex climate concepts into impactful proposals to promote carbon neutrality, showcasing strong critical thinking and collaboration skills throughout the process.

The teams unveiled their visionary proposals in a dynamic project showcase and prize presentation, where outstanding teams were awarded cash prizes and PolyU GreenCoins, recognising their problem-solving excellence, commitment to environmental stewardship, and contributions towards a greener campus.

This hands-on initiative not only enriched students' understanding of carbon neutrality but also inspired them to lead with purpose in sustainability-focused innovation, fostering a carbon-neutral mindset among students.



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External Engagement

Uniting Chinese Experts Worldwide for Carbon Neutrality and Sustainability

With the aim to foster international collaboration among Chinese environmental experts from Hong Kong, Chinese Mainland, Taiwan, and overseas, the Global Chinese Environmental Protection Conference was co-organised by PolyU, the Chinese Institute of Environmental Engineering, City University of Hong Kong, the Environment and Conservation Fund, the Global Chinese Environmental Protection Conference, the Environmental Science and Ecotechnology Journal, the Hong Kong University of Science and Technology (Guangzhou), National Cheng Kung University, National Taiwan University, and the Overseas Chinese Environmental Engineers & Scientists Association.

Under the theme "Towards Carbon Neutrality and Sustainable Ecological and Environmental Development", the Conference served as a dynamic platform for dialogue, field visits, and solution-driven discussions. **Around 200 international participants**

engaged in knowledge exchange and explored pressing issues such as air pollution prevention, air quality control, circular economy practices, and the challenges posed by climate change.

The Conference emphasised the shared responsibility of the Chinese community worldwide in addressing global environmental challenges and shaping a more resilient and sustainable future through cross-strait cooperation. By co-creating a sustainable pathway to environmental protection with sustainable economic development, meaningful progress can then be made towards carbon neutrality and ecological harmony.



External Engagement

Achieving Carbon Neutrality Goals through Innovative Catalysis

The 2nd Carbon-Strategic Catalysis International Conference was hosted by the Research Centre for Carbon-Strategic Catalysis, the first carbon-strategic catalysis centre in Hong Kong, and was attended by **over 400 participants and nearly 30 distinguished plenary and keynote speakers** from Australia, Chinese Mainland, and Hong Kong. The main focus of the Conference was on the development of high-efficiency catalysts within the global framework of carbon strategy. It included topics such as advanced material design for energy conversion, carbon-related electrocatalysis and photocatalysis, and energy harvesting and storage technologies.

Participating experts shared groundbreaking research and innovative approaches to catalysis and energy science, offering valuable insights and suggestions for developing strategies to accelerate carbon-neutral solutions. In addition, the Conference strengthened global research collaborations and communication between PolyU and frontier international scientists. This foundation for driving sustainable energy innovation truly reaffirms the University's commitment to contributing to Hong Kong's goal of carbon neutrality by improving research and the prospects for its practical application, as well as to addressing climate challenges through scientific excellence and collaborative innovation.

Governance & Operations

Uniting Universities for a Carbon-Neutral Future

Leading efforts for carbon neutrality by 2050 as set out by the Government of the HKSAR, PolyU co-chairs the Sustainability Performance Working Group, which submitted a joint proposal to the Heads of Universities Committee. This initiative is part of the Hong Kong Sustainable Campus Consortium, a platform established in 2010 by the HKSAR Heads of Universities Committee. The Consortium brings together local higher education institutions to collaborate on climate action and sustainable development.

Accelerating Ongoing Green Campus Efforts

To advance its goal of achieving carbon neutrality by 2045, which is five years ahead of the local official timeline, PolyU has established the Campus Carbon Neutrality Committee. Tasked with developing and monitoring a comprehensive roadmap, the committee ensures that the University's decarbonisation strategies are regularly refined and effectively implemented.

One of the key projects under the committee's responsibility is the Carbon Neutrality Funding Scheme, which supported almost ten projects that demonstrate how research-driven solutions can be integrated into everyday campus operations. Working with the Campus



Facilities and Sustainability Office and the Campus Development Office, highlights include using recycled plastic beverage bottles to decarbonise roadways, adopting precision hydroponics to reduce emissions in agriculture, and introducing sustainable methods for window cleaning.

With the campus and its development projects serving as active testbeds, PolyU continues to translate research into real-world climate solutions. These actions not only mitigate environmental impact but also contribute to a healthier, more sustainable environment for the University and the wider community.

