



AFFORDABLE AND CLEAN ENERGY

Research

Otto Poon Charitable Foundation Research Institute for Smart Energy

The Institute is dedicated to developing innovative and sustainable energy technologies and solutions. With about 50 faculty members from 12 departments, its research focus areas include district energy systems and smart grid, smart buildings and smart energy systems, advanced energy storage technologies, advanced and renewable energy conversion technologies, and advanced energy materials.

Optimal Control Strategy for Use of Building Heating, Ventilation and Air-Conditioning (HVAC) Systems

The instantaneous balance and reliability of power grids is conventionally guaranteed through frequency regulation provided at the supply side. Due to the

increasing involvement of intermittent renewable power generations, more frequency regulation capacity will be needed. A research conducted by Ir Professor Wang Shengwei, Director of Otto Poon Charitable Foundation Research Institute for Smart Energy, Chair Professor of Building Energy and Automation, and Otto Poon Charitable Foundation Professor in Smart Buildings at the Department of Building Environment and Energy Engineering, has proposed a hierarchical optimal control strategy consisting of a regulation bidding controller and a power use following controller. It is validated on a simulation test platform and its value proved in maximising the use of regulation capacity provided by HVAC systems while ensuring the indoor environment control quality under a given guarantee rate. It does not involve complex optimisation technologies, which is very convenient and valuable in actual use.

Efficient and Scalable Moisture-Electric Generators from Ionic Hydrogel

Moisture-electric generators (MEGs) use chemical energy from atmospheric moisture to generate electricity without causing pollutions and harmful gas emissions, but most suffer from intermittent electrical signals and low currents. A team led by Professor Tao Xiaoming, Director of the Research Institute for Intelligent Wearable Systems, Chair Professor of Textile Technology at the School of Fashion and Textiles, has developed an efficient ionic hydrogel moisture-electric generator (IHMEG) with flexible, lightweight and all-weather adaptable features.

The IHMEG operates in a stable manner in a wide range of environmental conditions from 10% to 85% relative humidity (RH) and is thus a promising green power source for Hong Kong, where RH fluctuates between 40% and 90% throughout the year.



Education

Habitat Green in East Africa

Habitat Green is a PolyU service-learning and leadership programme focusing on nurturing students' global leadership and cultural sensitivity in the context of interdisciplinary green engineering, appropriate technology and sustainable living. Students are trained to work with local students in Rwanda to design solar energy panels and develop green energy solutions for families in remote villages.

In the process, they learn about the concepts of socially responsible leadership, intercultural competences, racial tolerance and global citizenship, and demonstrate these in practice. They also learn about green engineering, sustainable development and appropriate technology, adopting the concepts into the service projects.

Subject: Renewable Energy for a Sustainable World

This subject aims to foster students a sense of wonder and curiosity about science and energy, providing them with an introduction to important renewable energy resources and technologies used for harnessing these, within a framework of a range of simple to state-of-the-art advanced energy systems. It helps students understand present energy needs and future demand by examining conventional and renewable energy technologies, which help them analyse problems relating to renewable energy production and use, and evaluate the feasibility of possible solutions.



Engagement

Rural Electrification in Africa

Having started by assessing the needs of Rwanda's local communities in 2013, PolyU students began installing household-based solar panels since 2015. The current focus is on large-scale green engineering solutions to help rural households. In addition to installing standalone solar energy systems which provide electricity for light, students have successfully set up stations to provide charging capacity for households. Furthermore, they have trained local youth and nurtured their ability to maintain the systems, aiming to make these effective and sustainable.

In 2021/22, they have served **200 rural households** in Rwanda.

Public Sustainability Lecture and Seminar

Co-hosted by the Consulate General of France in Hong Kong and Macao, the PolyU Research Institute for Sustainable Urban Development and the Research Innovation Office, the Sustainability Lecture Series: The Decarbonisation Challenge – Energise The Future: Potential & Challenges – From Smart Buildings to Waste-to-Energy brought together speakers from the academic and business communities to share their views, experiences and good practices related to energy sustainability. **88 participants** were engaged.

A research seminar related to advanced and renewable energy conversion technologies was also hosted by the Otto Poon Charitable Foundation Research Institute for Smart Energy.

Policies and Operations

Energy and Greenhouse Gas Policy

The Policy was established in 2014, committing the University to responsible energy management and carbon emission reduction. It aims to meet this commitment through energy-efficient design and practices in all its development initiatives and in respect of its premises, plant and equipment, and other activities entailing environmental considerations. The University also pledges to comply with relevant energy legislation, standards, regulations and code of practices, while striving to attain energy efficiency and reduce carbon emission through proper maintenance and monitoring of campus operations and practices.

PolyU Building-Integrated Photovoltaics Applications

In order to promote clean, eco-friendly and renewable energy, PolyU has installed building-integrated photovoltaics applications in various parts of the campus. By applying 'nanocomposite paste for self-cleaning photovoltaic panels' on photovoltaic panels, organic compounds and pollutants are decomposed and washed away by rainwater, increasing the photovoltaic system's generation by **about 5 to 10%**. Furthermore, through academic collaboration, the University has also replaced and recommissioned the central air-conditioning plants to reduce energy consumption.

With regard to the enhancement work of the university main entrance, photovoltaic panels have also been installed along the top of its new canopy.

PolyU Air Conditioning (A/C) On-Demand Services

By applying a 'non-auto restart function' to thermostats in staff offices, developing an A/C on-demand control strategy and engaging departments to participate in the A/C on-demand service with an incentive scheme, electricity wastage on campus has been reduced and departments are encouraged to maintain energy savings.

Sustainability Awards in Smart Energy Use

PolyU has been granted the title of Hong Kong Green Organisation (HKGO) by the Environmental Campaign Committee and the Environmental Protection Department since 2016. This sustainability recognition affirms PolyU's efforts and commitments to the environment. PolyU has also been repeatedly awarded with the **Excellent Level for Energywise** Certificate for its commitments in energy efficiency.

