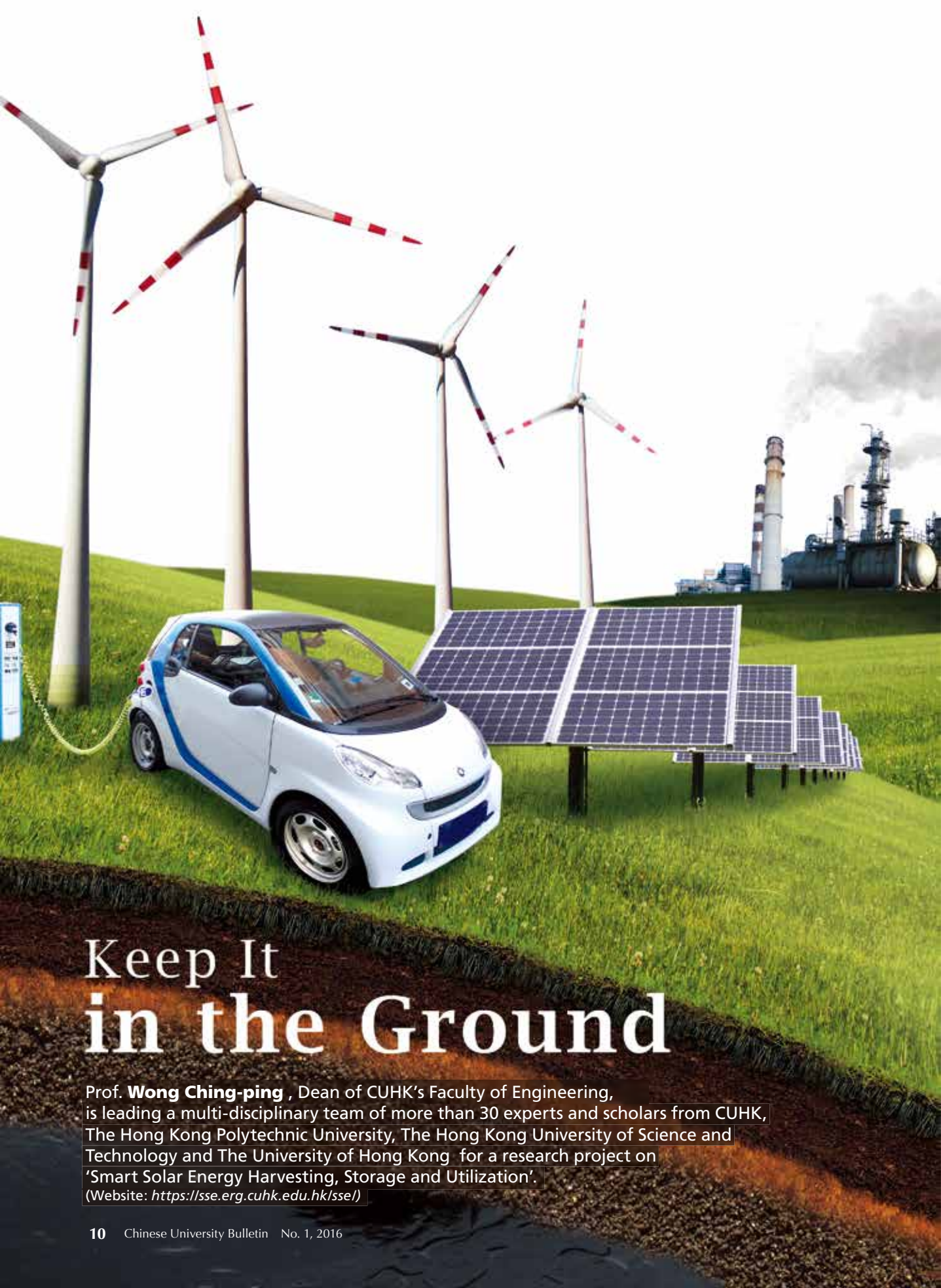

Keep It in the Ground

Prof. **Wong Ching-ping** , Dean of CUHK's Faculty of Engineering, is leading a multi-disciplinary team of more than 30 experts and scholars from CUHK, The Hong Kong Polytechnic University, The Hong Kong University of Science and Technology and The University of Hong Kong for a research project on 'Smart Solar Energy Harvesting, Storage and Utilization'. (Website: *https://sse.erg.cuhk.edu.hk/sse/)*


Prof. Wong Ching-ping

Keeping fossil fuel in the ground is a means of reducing greenhouse gas emissions and limiting global temperature increase by the end of the century. For this, scientists all over the world are racing against time to work on the development of cutting edge technology for a shift of power supply from the burning of fossil fuels to efficient utilization of emission-free and inexhaustible energy from nature.

CUHK's Faculty of Engineering has taken up this challenge by starting a project on clean energy. The five-year research, entitled 'Smart Solar Energy Harvesting, Storage and Utilization' has received a grant of HK$60.33 million (US $7.8 million), funded by the Research Grants Council of the Hong Kong Government. With Professor Wong as the leader, the project covers the development of thin film PV devices and modules to enhance the performance of solar harvesting, the design of smart electricity storage and the establishment of distributed grid systems to increase the penetration of solar energy utilization.


Prof. Zhao Ni

Supercapacitors with High Energy and Power Densities

Professor Wong has been working with Prof. **Zhao Ni** from the Department of Electronic Engineering, together with a team of post-doctoral researchers and students, to develop nanostructured metal oxide-carbon composites for asymmetric supercapacitors.

One of the major problems for renewable energy is that power output is variable and therefore unable to provide sufficient energy when electricity demand peaks. 'Supercapacitors are important for the storage and transmission of green energy, especially when the power is needed in the evening,' said Professor Wong. For him, the development of clean energy technology is an exciting project as 'renewables are the way forward—we can save the environment and breathe better.'

Batteries have high energy density but low power density—they can store large amount of power but take a long time to charge up. Capacitors charge almost instantly but only store a small amount of power. The CUHK team is working to combine the two. With energy density of 98.0 W h kg^{-1} and power density of 22,826 W kg^{-1}, the supercapacitors developed by Professor Wong's team have demonstrated the highest efficiency recorded to date.

High-Energy-Density Redox Flow Batteries

Another key breakthrough of the research project has been achieved by Prof. **Lu Yi-Chun**'s team from the Department of Mechanical and Automation Engineering. They have developed a technology for high-energy-density flow batteries by exploiting highly concentrated sulphur-impregnated carbon composite to achieve the highest catholyte volumetric capacity reported to date—294 ampere-hours per liter—which is five times that of vanadium catholyte.

Recently, their team further attained the highest catholyte capacity to date (550 ampere-hours per liter) by successfully combining liquid phase, lithium iodide and solid phase sulphur flow cathodes. 'The technology could be used for electrical cars. It is being patented and some of our industrial partners would also like to license it,' Professor Lu remarked.

The final stage of this research project features a field demonstration of microgrids at a student hostel at CUHK. This will be the first project focusing on rooftop solar panel and building-integrated-PV (BIPV) powered urban level microgrid systems. A full-scale solution of urban microgrids will also be provided, offering a significant reference for PV development in a modern metropolis like Hong Kong.


Prof. Lu Yi-Chun