

# NUS dons' green pitch in Davos

Three researchers from the National University of Singapore (NUS) made their way to the World Economic Forum Annual Meeting in Davos last month where they spoke about how to deal with pressing issues of the day, particularly climate change. Here is what they said.

## Scientific factors interrelated



**PROFESSOR LAM KHEE POH**  
Dean, School of Design and Environment

Every aspect of our lives as individuals and as a society on planet earth is impacted by the physical sciences. The critical point to note is that these scientific factors are all intricately interrelated.

Take the example of the relationship between energy and environmental performance.

While the distribution of energy does vary tremendously across different locations, the way we plan our cities and design our buildings will affect the energy balance and influence the resulting thermal environmental conditions.

Poorly designed and constructed buildings can have significant impact on the energy use for heating and cooling. We must adopt a user-centric design process, apply a life-cycle approach and pay critical attention to implementation details to achieve real and sustained performance outcomes in terms of energy conservation and human comfort.

Sophisticated computational tools are now available that can model and simulate multi-scale energy and environmental performance in terms of airflow patterns and temperature distribution. We should capitalise on these powerful tools and strive for net-zero energy buildings, which are technologically achievable today.

The next frontier is to pursue the twin goals of "Well and Green" developments, which address sustainability issues and the health and well-being of the occupants of buildings. This necessitates broadening the engagement of traditional building professionals to include collaboration with medical, public-health and social-science experts in the new and challenging task ahead.

## Green energy technology



**PROFESSOR LIU BIN**  
Head, Chemical and Biomolecular Engineering

The dominant role played by fossil fuels in industrialisation has caused tremendous growth of carbon dioxide (CO<sub>2</sub>) in the atmosphere, putting humanity's existence at risk. While Asia's CO<sub>2</sub> emission per capita is modest, its rapid growth and heavy reliance on coal and imported oil pose serious challenges to energy security and the environment.

To address this issue, NUS has built the Flagship Green Energy Programme to capture sunlight, CO<sub>2</sub> and water, and convert them into energy-dense chemical fuels, such as green methanol, which can be stored in barrels for transportation and distribution to end-users. The production of green alcohol fuels from sunshine can help meet our energy needs while maintaining an ecological balance that is critical to sustainability.

As green fuels are renewable, they are vital to decouple industrialisation from fossil fuel while protecting the environment. NUS has turned the CO<sub>2</sub> threat into a golden opportunity. With continued research and development, Singapore can be a green energy hub and a green technology centre globally.

We focus on developing scalable, affordable and practical energy solutions for Asia and the world. In the longer term, we aim to collaborate with global research institutions and industry to market these technologies worldwide.

## Water-based air-conditioner



**ASSOCIATE PROFESSOR  
ERNEST CHUA KIAN JON**  
Department of Mechanical Engineering

Present day air-conditioners, invented in 1902, face a number of challenges. They consume huge amounts of energy and cause significant environmental detriment due to the use of chemical refrigerants. And while they cool the desired location, they dissipate large amounts of heat to the environment, thereby creating undesirable heat zones.

In 2017, after three years of intensive R&D, NUS tested the first hybrid membrane water-based air-conditioner, labelled NUScool, which is capable of cooling any desired space without producing heat as a byproduct. In addition, this disruptive air-conditioner is able to harvest water from humid air for tropical countries experiencing a water shortage.

As far as cost is concerned, compared with the conventional, state-of-the-art air-conditioners, it is about 20 to 40 per cent less expensive. The operational cost is also 30 per cent less because of lower energy consumed to provide cooled and dry air.

NUScool is a disruptive technology at the heart of the water, energy and environment/sustainability nexus. It will help to lessen global warming, reduce death rates and help cities become distinctive global green cities.