

NUS team develops water-based air-conditioner

Samantha Boh

A “green” air-conditioning system that harnesses water to cool the surrounding air could, in a couple of years, replace those that use chemical compounds which also deplete the ozone in the atmosphere.

This alternative also does not require a compressor. Together, the features make it a world first.

Researchers at the National University of Singapore (NUS) have developed a bulky prototype. But they believe a compact version no larger than a conventional air-con will be ready in two to three years’ time.

Most notable about the system is that it does not use harmful chemical refrigerants such as chlorofluorocarbon and halogenated chlorofluorocarbon, part of the greenhouse gases that trap heat and lead to depletion of the ozone layer.

Tests done on the NUS campus, both indoors and outdoors, also show it consumes 40 per cent less energy. This is largely because it does not need a compressor, said Associate Professor Ernest Chua, who led the research.

Conventional air-cons have a compressor, often placed on a balcony or a building’s external ledge, to expel the heat that has been absorbed by the chemical refrigerants. The process requires high pressure and this is the reason for the high consumption of energy, said Prof Chua from the NUS Department of Mechanical Engineering.

Without the compressor, the system will not emit hot air which can adversely affect the microclimate of surrounding areas, he said.

The NUS system involves a two-step process. First, hot and humid air is blown into a dehumidifier, where paper-like membrane sheets absorb its moisture.

Next, the remaining air moves into an “evaporative cooler” where water absorbs the heat from it. The resulting cool and dry air is then released into the surrounding area.

Explaining the concept of evaporative cooling, Prof Chua said it is similar to what happens when one steps out of a swimming pool.

“You feel cool when you step out because of evaporative cooling. The layer of water on your skin changes from liquid to vapour, taking heat away from your skin, causing you to experience a cooling effect.”

While some residual air from the evaporation process will have to be purged to the environment, it is cool and moist, though still dryer than air in the environment. Hence, Prof Chua believes it will not have adverse effects on the microclimate.

He said the NUS system is also 20 to 30 per cent cheaper to manufacture than conventional air-cons.

It requires one litre of water to run a 12,000 British Thermal Unit (BTU) unit, normally used to cool a master bedroom in an HDB flat, for 20 hours.

But the NUS system can harvest 12 to 15 litres of water from the air, through the membrane dehumidifier, in the same amount of time.

Unlike conventional air-con, which can go lower, the lowest temperature the NUS system can reach is 18 deg C.

It was developed in the last four years with the help of more than \$1 million in government funds.

“Singapore and countries in the region rely a lot on air-cons, so we thought why not spend our research efforts on something that can impact many lives,” said Prof Chua.

Senior lecturer Md Raisul Islam, a member of the research team, said: “In commercial buildings, about 60 per cent of energy consumed is by the air-con systems.”

The team hopes the size can be reduced eventually for use in cars too.

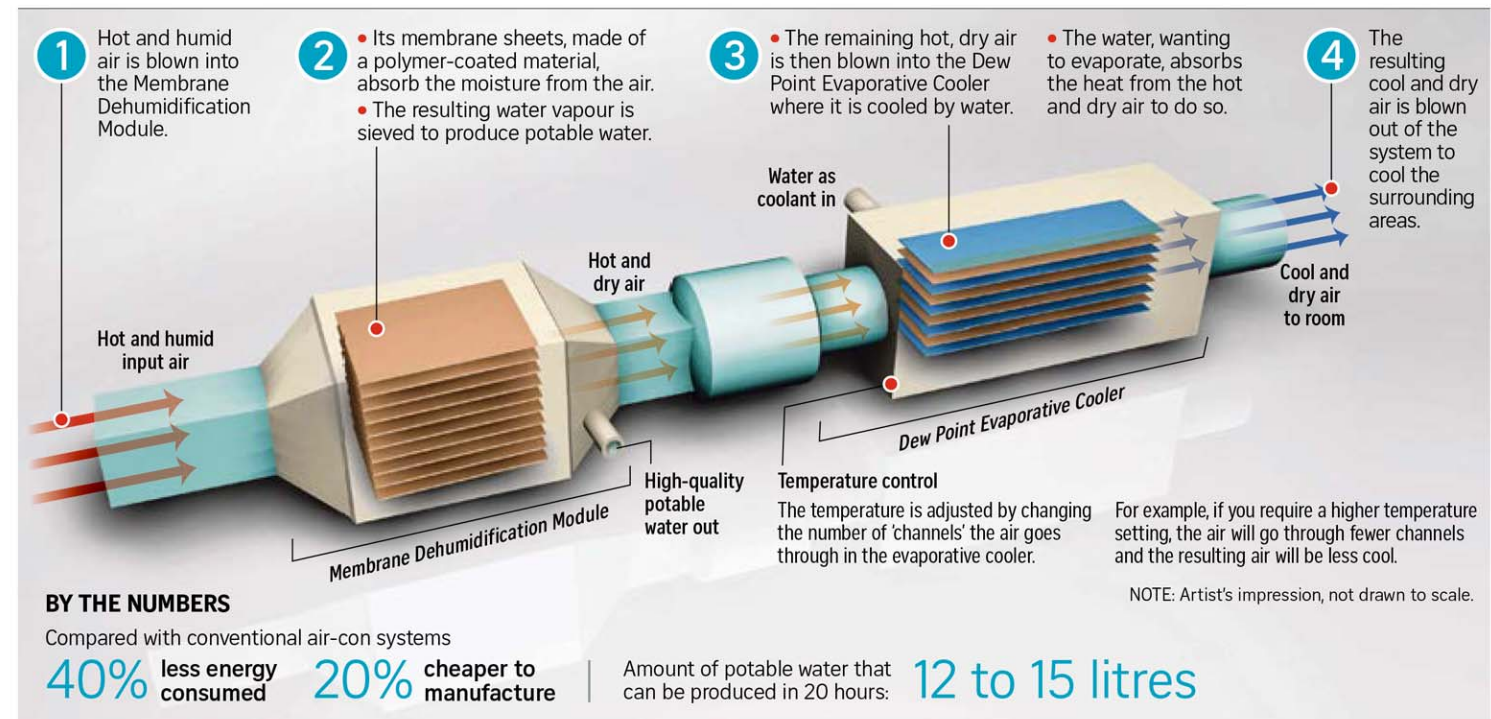
Professor Ng Kim Choon of King Abdullah University of Science and Technology in Saudi Arabia, who initiated the project but is no longer involved in its development, said the system will form the new global standard for cooling efficiency. The technology used now in air-conditioning was developed in 1902.

Said Prof Ng: “Building owners would save millions in capital and operating costs as well as valuable space in the buildings.”

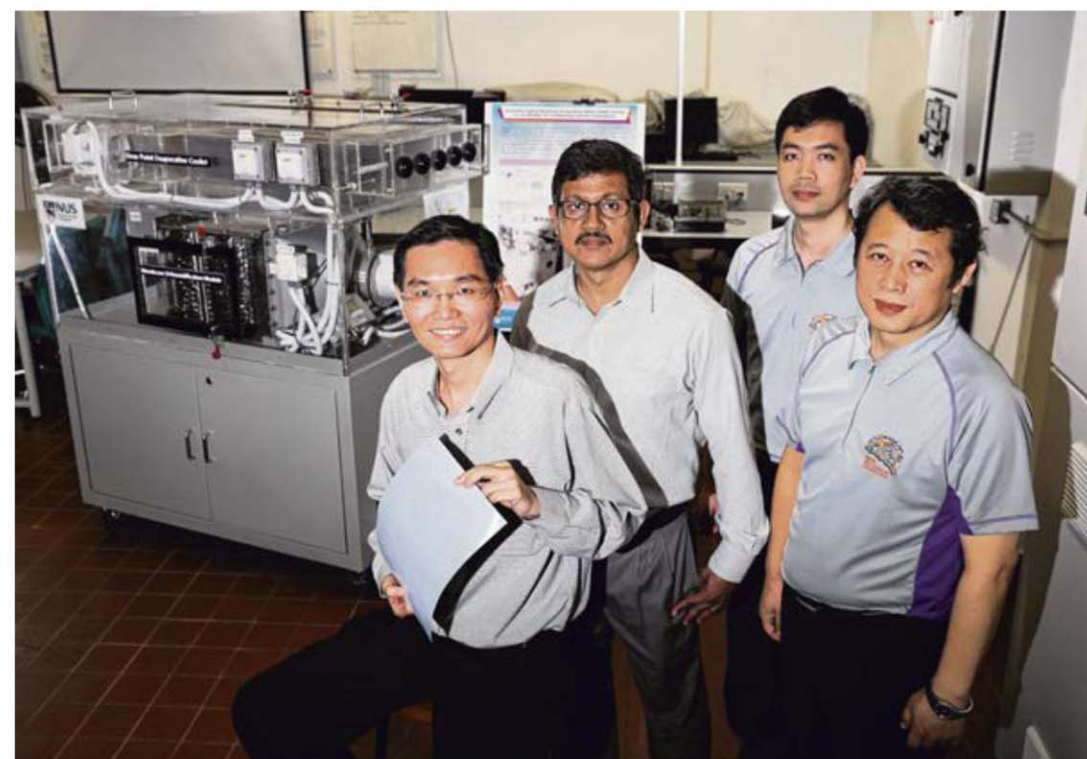
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A greener, leaner air-con system

Developed by researchers from the National University of Singapore, this air-conditioning system cools hot air using water instead of chemical refrigerants like chlorofluorocarbon, which depletes the ozone layer. It does not need a compressor, hence it does not emit hot air like conventional air-con systems, which can adversely affect the microclimate of surrounding areas.



Source: NATIONAL UNIVERSITY OF SINGAPORE STRAITS TIMES GRAPHICS



(From far left) Associate Professor Ernest Chua, 48, holding a membrane sheet used in the Membrane Dehumidification Module; Dr Md Raisul Islam, 52, senior lecturer; Dr Bui Duc Thuan, 37, research fellow; and Dr M Kum Ja, 47, senior research fellow beside the world's first air-conditioner which does not use a compressor or chemical refrigerants. ST PHOTO: KELVIN CHNG

ST WATCH
How the system works
<http://str.sg/oJsy>