COLD
TUBE
Singapore

THE BIG IDEAS

In tropical climates, the human body cools down mainly in two ways: by perspiration as a natural means to regulate the body's temperature; and by convection, whereby the body loses heat to the relatively cooler air chilled by air-conditioners.

Heat always flows from hotter to cooler bodies, and radiant heat transfer is no different. Radiant cooling, where the skin emits thermal radiation and loses heat to cooler surfaces, is an unfamiliar concept to many. This is in part due to the ubiquity of air conditioning, but also due to the technical challenge of creating an environment for radiant cooling without the issue of condensation.

The Cold Tube project introduces radiant cooling as a more energy-efficient alternative to air-conditioning. It is the world's first demonstration of an environment cooled entirely by radiant cooling for thermal comfort.

THE GOAL

The project aims to demonstrate how new energy-efficient technology based on radiant cooling can improve thermal comfort without air-conditioning in tropical climates such as in Singapore. If radiant cooling is feasible outdoors in Singapore and could make people feel comfortable outdoors, the technology could help curb our dependence on air conditioning.

WHY IT MATTERS?

As our reliance on air conditioning continues to grow, particularly in the developing world, we need to critically think of ways to overcome the shortcomings of air-based thermal comfort systems, such as its relatively poorer efficiency.

Radiant cooling allows higher energy efficiency, converting more of the energy input to improve human comfort. With proper controls, radiant systems such as the Cold Tube could save up to 72% of the HVAC (heating, ventilation, air conditioning) energy demand for cooling.

The Cold Tube demonstrator not only showcases technological advances in thermal comfort, but shows how radiant cooling can be applicable in some of the most daunting environments.

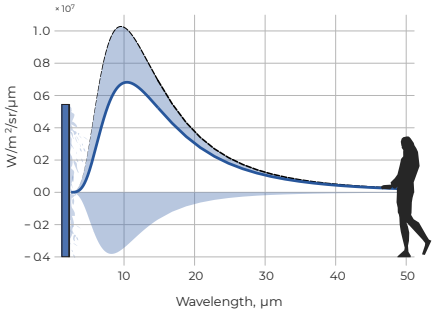
The Cold Tube can be applied to ventilated outdoor spaces such as bus stops, open-air food centres, and sheltered walkways connecting residential areas and/or public transport stations. It can also be adapted for indoor environments, where energy savings over conventional air conditioning can be realized.

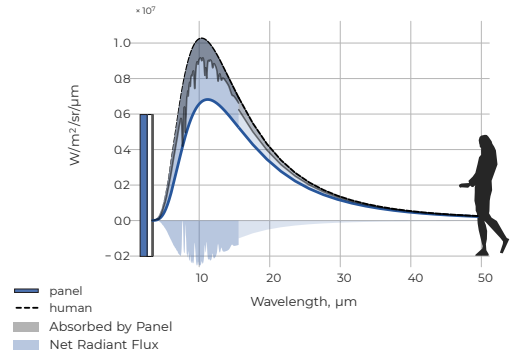
HOW IT WORKS?

During radiant cooling, heat radiating from your body hits cold surfaces that emit less powerful radiation than your body. This net loss of heat from your body cools your body and makes you feel comfortable. If enough surface area around you is sufficiently cold, thermal comfort can be managed entirely with radiant cooling—no need for air conditioning!

The Cold Tube radiant cooling panels are made up of mini tubes carrying water of 10 ˚C that actively chill the panels. Chilled to below dew point, condensation will take place if the chilled panels are exposed to the outdoor tropical air. Hence the panels are encased with infrared-transparent membranes that still allow thermal energy to be transmitted from one's body to the chilled panel through the membrane, while preventing air contact and condensation on these panels.

As shown in the diagram, some of the radiation from the body is absorbed by the membrane, but the majority is transmitted to the chilled panels.





TEAM
Prof. Adam Rysanek
Prof. Jovan Pantelic
Prof. Forrest Meggers
Prof. Arno Schlueter
Eric Teitelbaum (Project Manager)
Lea A. Ruefenacht
Dr Kian Wee Chen
Kipp Bradford
Dorit Aviv
Denon Shepard
Dietmar Leyk

CONTACT
Eric Teitelbaum, teitelbaum@arch.ethz.ch

PARTNERS
Singapore-ETH Centre
Berkeley Education Alliance for Research in Singapore
University of British Columbia
University of California Berkeley
Princeton University
ETH Zurich

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