Buildings and Cooling Pavilion

Global Alliance for Buildings and Construction | Cool Coalition

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Passive Design, Construction, and Cooling for a Hotter Planet

19 November 2025, 11:00-12:30 Belém local time

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Opening Remarks

Hubert Nsoh Zan

Assistant Manager on Energy Efficiency Regulation,
Energy Commission of Ghana

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Special Remarks

H.E. Dr. Chuop Paris

Secretary of State,
Ministry of Environment of Cambodia

Buildings and Cooling Pavilion

Keynote Speech

Kazunao SHIBATA

Deputy Director-General / Group Director for Environmental Management and Climate Change, Global Environmental Department, Japan International Cooperation Agency (JICA)

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Special Address

Dr. Luong Quang Huy

Head of Division of GHG Emission Management & Ozone Layer Protection, Department of Climate Change, Ministry of Agriculture & Environment, Viet Nam

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Article 25

Niger College Passive Cooling Project

Inspiration presentation (recording)

Toby Pear

Associate,
Article 25

Click here for the recording video

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Collège Hampaté Bâ - Article 25

19 November 2025

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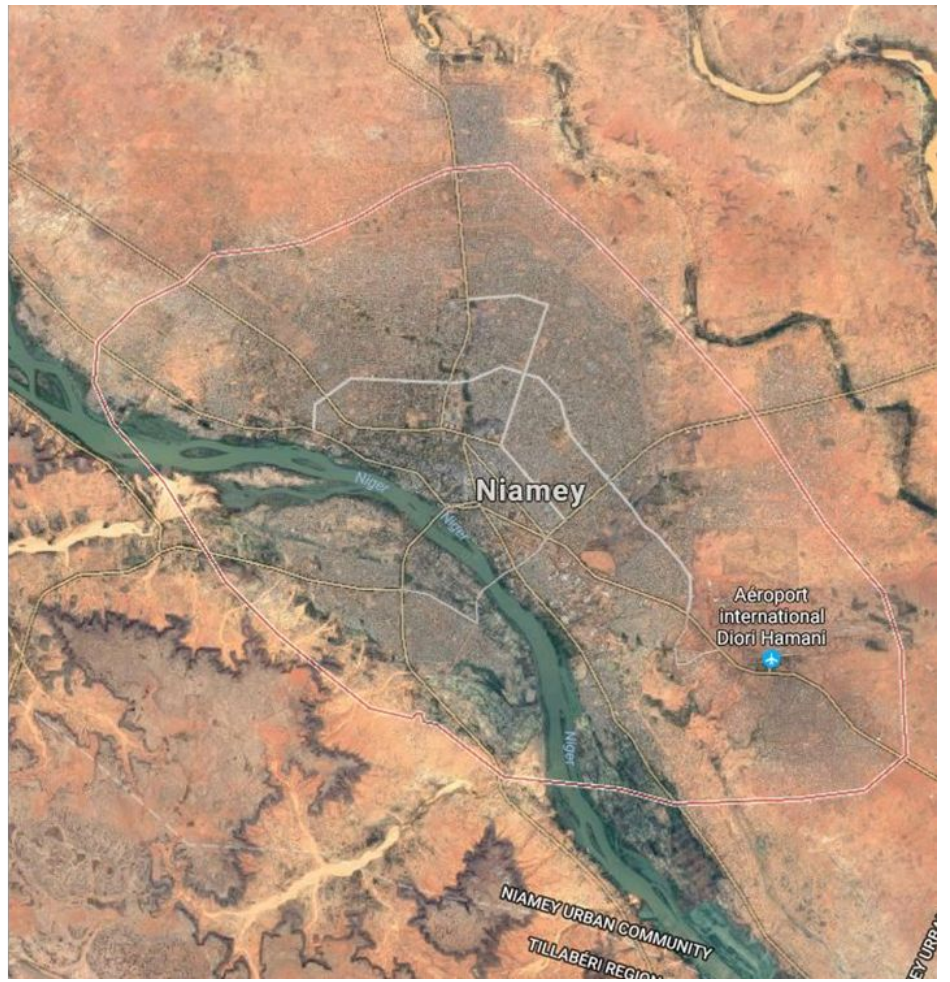
Collège Hampaté Bâ, Niger
An exemplar school for the Sahel
Article 25


ATLANTIC
OCEAN
Rabat
Alger
Tunis
MOROCCO
TUNISIA
Mediterranean Sea
Tripoli
El Aaiún
Western Sahara
ALGERIA
SAHARA DESERT
LIBYA
EGYPT
Cairo
Nile
Red
Tropic of Cancer
MAURITANIA
Nouakchott
MALI
Dakar
SENEGAL
Banjul
THE GAMBIA
Bissau
GUINEA BISSAU
NIGER
SAHEL
Bamako
Niger
Niamey
CHAD
SUDAN
Khartoum
GUINEA
BURKINA FASO
Ouagadougou
Conakry
Freetown
SIERRA LEONE
BENIN
TOGO
NIGERIA
N'Djamena
Monrovia
LIBERIA
Yamoussoukro
COTE D'IVOIRE
GHANA
Abuja
Porto Novo
Accra
Lomé
SOUTH SUDAN
CENTRAL AFRICAN REPUBLIC
CAMEROON
Juba
Bangui
Malabo
EQUATORIAL GUINEA
Yaoundé
D.R. CONGO
UGANDA


Niamey
Niger
Aéroport international Diori Hamani
NIAMEY URBAN COMMUNITY
TILLABÉRI REGION


CSP
AMADOU HAMPATÉ BÂ
Unité dans la diversité
CSP
AMADOU HAMPATÉ BÂ

An exemplar project...

Use of local, laterite stone


Laterite

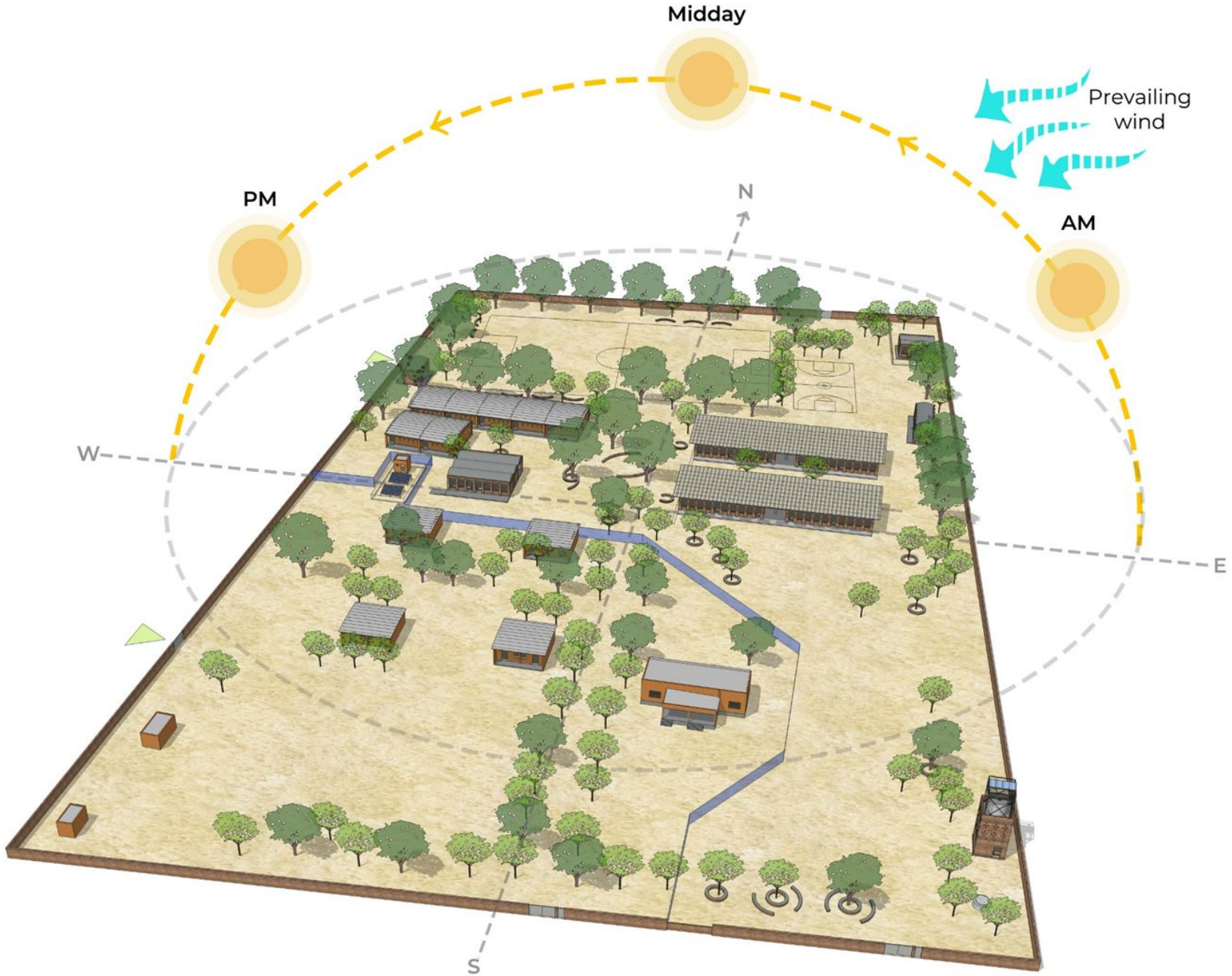
An exemplar project...

Passive Design

Orientation & Form

Natural Ventilation

Thermal Mass

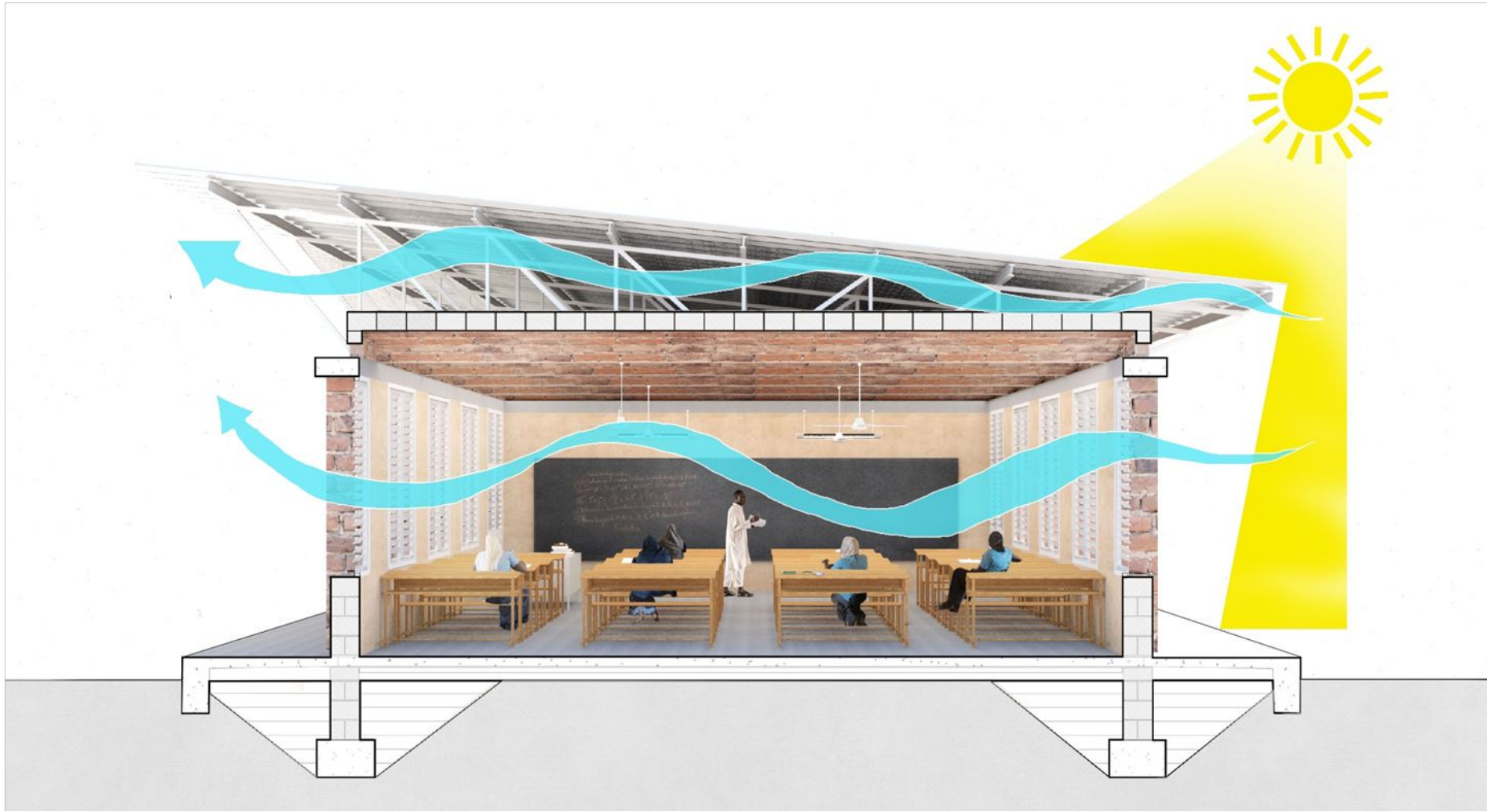


Passive Design

Orientation & Form

Natural Ventilation

Thermal Mass



Passive Design

Orientation & Form

Natural Ventilation

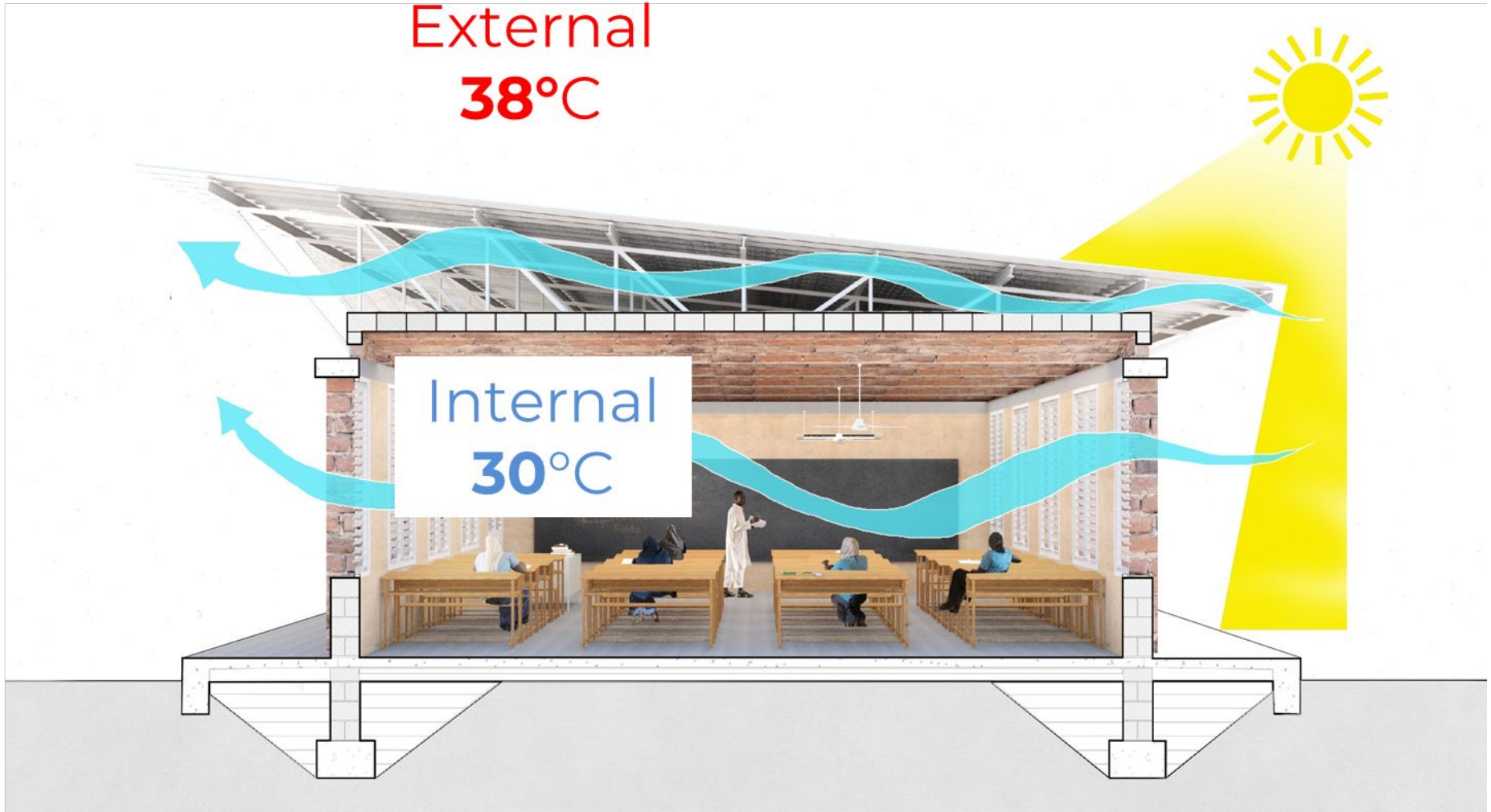
Thermal Mass

Passive Design

Orientation & Form

Natural Ventilation

Thermal Mass



Article 25

Toby Pear
www.article-25.org
toby-pear@article-25.org

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[Click here for the recording video]

Passive Cooling Working Group Activities Highlight

(recording)

Gennai Kamata
Associate Programme Officer,
UNEP GlobalABC & Cool Coalition

Dr. Sanyogita Manu
Passive Cooling Specialist
UNEP

Dr. Lorenzo Pagliano
Full Professor, Building Physics,
Politecnico di Milano

Dr. Zahra Jandaghian
Research Officer,
National Research Council of Canada
& Co-chair CIB TG97

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Passive Cooling Webinars

https://globalabc.org/presentations

Natural Ventilation

Fan Design Strategies

Passive Cooling Cambodia

Cool Surfaces

Nature-based Solutions

Lock-in Effect

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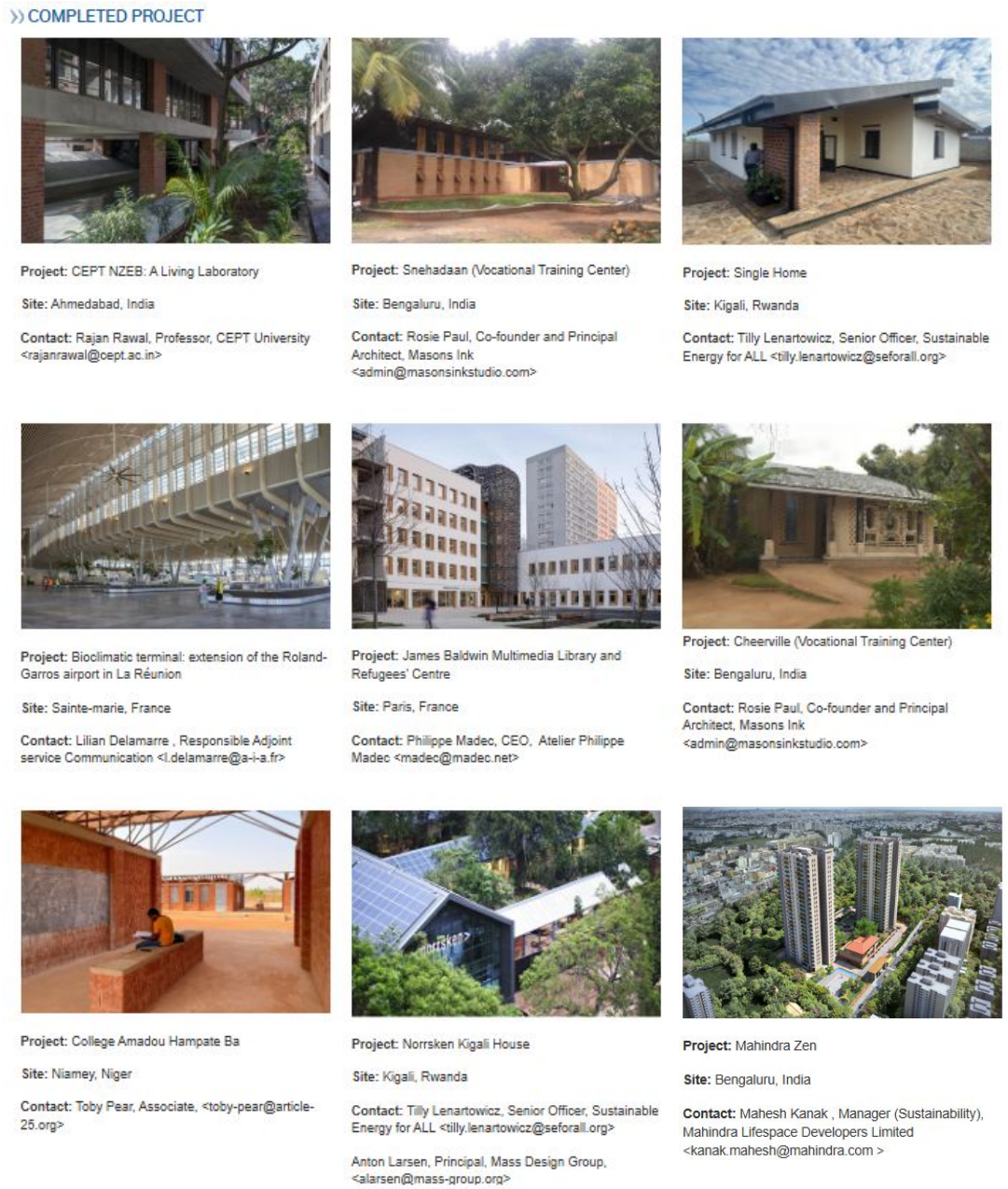
Passive Cooling Repository

https://globalabc.org/passive-cooling-global-case-studies

Special Thanks:

- CEPT University (India)
- Masons Ink (India)
- SEforALL (Rwanda)
- French Government (France)
- Article 25 (Niger)
- Mahindra Lifespaces (India)
- LOD (China)
- SPACECOOL (Japan)
- GBPN (India)



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Passive Cooling Repository

https://globalabc.org/passive-cooling-global-case-studies

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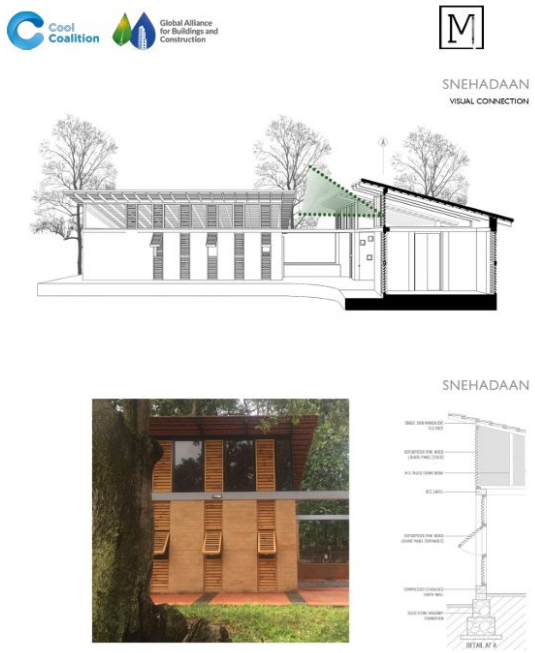

- Case Study Title: Vocational training centre - *Snehadaan*

Project Name	Snehadaan
Location	Carmelaram, Bengaluru, Karnataka, India
Climate Zone	Tropical Savanna Climate/ @RGQ@D: Zone 3A (Warm-Humid)
Latitude/Longitude	12°54'06.3"N 77°43'00.5"E
Building Type	Public/ educational - vocational training centre
Floor Area [sqm]	168 square metres
Building Height [m]	5.40 M
Number of Storeys	1
Completion Year	2018
Project Team	Architects: Rosie Paul, Sridevi Changali and Shubha B A

*mock-up experiments and other research-based experiments could be included as case study, aside from actual building construction projects if similar information could be provided.

1. Project Description

Project Overview

The project was built to promote an inclusive workshop space for imparting training and mentoring for People Living with HIV (PLHIV). Located in the suburbs of Bengaluru, the project comprises a candle-making workshop with ancillary spaces, including a display unit, a shop, and a seminar hall, envisioned as an inclusive space to showcase the charitable trust's various activities. The building was designed to sit nestled in between the existing trees on the site. A plot of approximately 180 square meters was demarcated within the 40468.6 square

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CEPT UNIVERSITY

Passive Cooling Guidelines (ongoing)

The guidelines aim to

1) **policy-makers** wishing to develop or update their building energy code to incorporate passive cooling

2) **design practitioners** working on building design, construction and operation on the ground

The guidelines are aimed for **tropical regions whose cooling demand is dominant**.

Chapter 1
Design and Operation of Passive Cooling Strategies

Chapter 2
Performance Indicators for Energy and Comfort, Climate Analysis Tools

Chapter 3
Building and Cities Codes, Policy Perspective, Guidance

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International Council for Research and Innovation in Building and Construction

Passive Cooling & NbS Workshop

https://cibworld.org/nbs-passive-cooling-workshop-recap/

Together with CIB, Passive Cooling WG organised a workshop to discuss the potentials and way-forward of passive cooling and Nature-based Solutions in Purdue University, USA.

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Passive Cooling: A First Line of Defence

- Heat risk rising across tropical regions
- Cooling demand outpacing access, affordability & grid capacity
- Mechanical cooling alone is insufficient & inequitable
- Passive cooling enables resilience, equity & lower emissions
- But it does not occur automatically
- Regulations shape layout, orientation, shading & airflow at scale

Traditional cooling wisdom meets a new era of extreme heat: Passive cooling remains the first line of defence

(Image Source: Prabhu B Doss, Flickr Commons: CC-By-NC-ND-2.0)

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Chapter 1 at a Glance: Scope of Strategies

- Strategies arranged across four thematic categories and two spatial scales — connecting city form and building detail
- Over twenty strategies addressing solar control, natural ventilation & material response in warm-humid climates
- Provides design guidance applicable to neighbourhoods, buildings & façade-level interventions

	Neighborhood/ City	Building
Orientation	Orienting Streets to Reduce Heat Gain Orienting Streets to Enhance Ventilation Locating and Orienting Public Spaces for Comfort	Orienting Buildings for Solar and Wind Optimization Designing Fenestration to Minimize Solar Gain and Maximize Daylighting and Air Movement
Shading and Surface Treatments	Designing Setbacks and Overhangs for Mutual Shading Applying Cool and Smart Surfaces in Public Spaces Shading Streets with Vegetation and Built Structures Providing Street Shading with Temporary or Fabric Structures Integrating Water Bodies for Microclimate Cooling Incorporating Parks and Urban Forests for Shading and Cooling	Installing Green, Cool, or Smart Roofs and Walls Providing External Shading for Windows Shading Buildings with Strategically Placed Trees Ensuring Daylight Access While Minimizing Solar Heat Gain
Urban and Built Form	Promoting Low-Rise, High-Density Urban Fabric Designing Public Squares and Gardens for Cooling Integrating Blue–Green Infrastructure for Urban Heat Mitigation	Shaping Building Massing to Reduce Heat Gain and Enhance Ventilation Zoning Interior Spaces Based on Thermal Needs Designing Semi-Outdoor Thermal Buffer Spaces Enabling Cross Ventilation Through Building Layout Using Stack Ventilation for Vertical Air Movement Facilitating Night Cooling Through Operable Openings Enhancing Comfort with Passive Evaporative Cooling
Material and Construction		Insulating Walls and Roofs to Reduce Heat Transfer Using Thermal Mass to Moderate Indoor Temperatures Designing High-Performance Windows and Glazing

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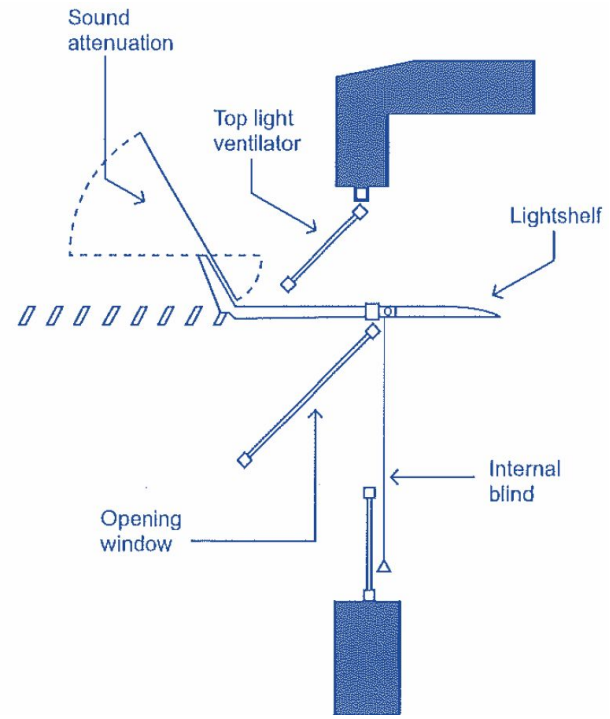
Inside a Strategy: Linking Design and Policy

Framework applied to every strategy

- What the strategy is
- How it works
- Common variations
- Implementation guidance
- Pitfalls to avoid
- Climate zone suitability
- Microclimatic considerations
- Synergies with other strategies
- Retrofit applicability
- **Performance-oriented note for policy-makers**



A contemporary example of a single opening designed to serve several functions: sun protection, ventilation, reflection of light for better distribution of daylight, and the reduction of noise transmission (Koch-Nielsen, 2013).

Example: External Shading for Windows

DESIGN SUMMARY

- Fixed or adjustable devices – overhangs, fins, louvers, or vegetation – block direct solar radiation.
- Reduces cooling loads & glare while maintaining daylight and ventilation.
- Key design points:
  - Size for solar geometry
  - Use durable, reflective materials
  - Integrate with window system
- Climate focus: Essential in hot-humid & hot-dry regions; combine with natural ventilation.

Policy Guidance

- Mandate solar-control metrics in codes, e.g., SHGC ≤ 0.25–0.62; U-factor 1.8–3.0 W/m²·K, (BEE, 2024).
- Provide credits/incentives for adaptive or dynamic shading.
- Integrate façade & urban-design provisions in planning rules.
- Support training and compliance programmes for inspectors & practitioners.

Koch-Nielsen, H. (2013) *Stay Cool: A Design Guide for the Built Environment in Hot Climates*. London: Routledge.

BEE (2024a) *Energy Conservation and Sustainable Building Code (for Commercial and Office Buildings)*. New Delhi, India: Bureau of Energy Efficiency, p. 227.

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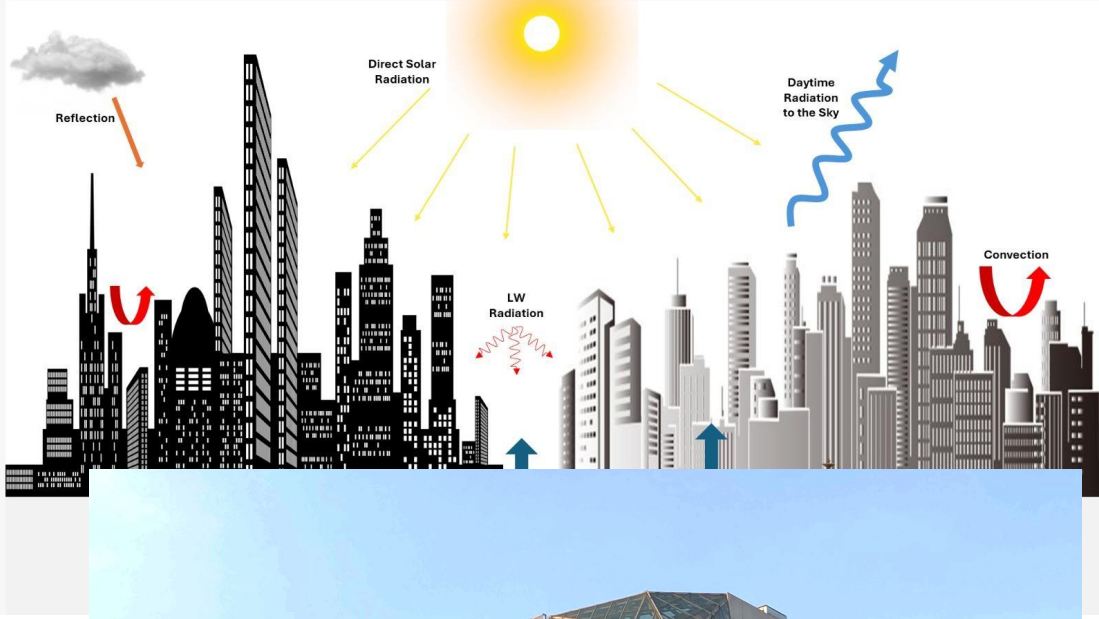
eERG
end-use Efficiency Research Group
30 YEARS OF EXPERIENCE
eerg.it

Passive Cooling Guidelines



Chapter 2, Indicators
Chapter 3, Codes and policies

We need a **precise common language**, to translate successful technical and legislation examples from one jurisdiction to another

Such common **"translation language" exists, in international standards (e.g. ISO 52000)**.

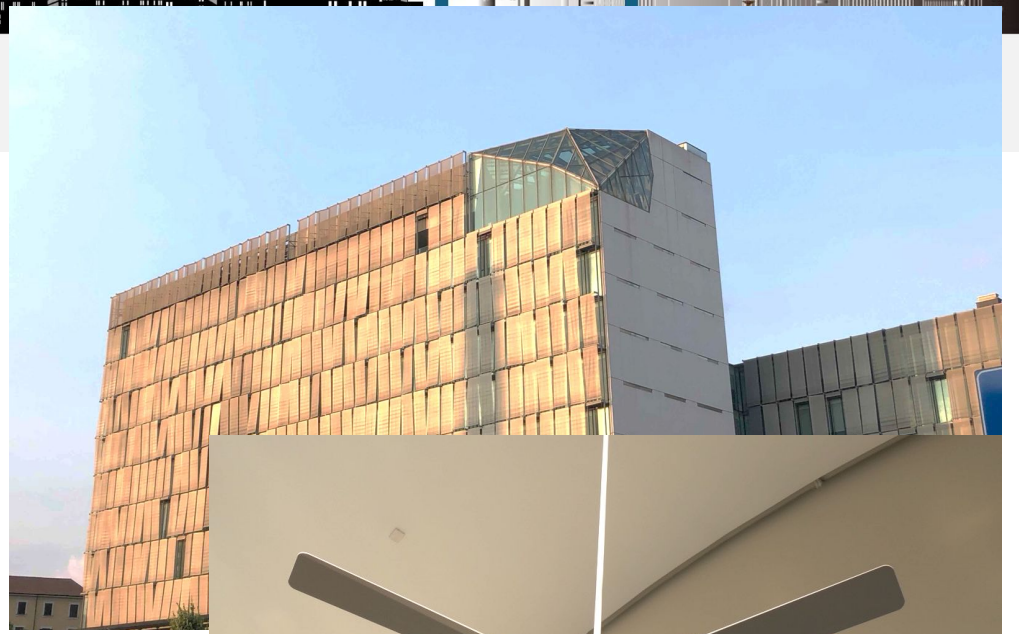
It allows to **transfer lessons learned**, leaving at same time **each country free to choose its own speed** in improving performance levels

In the guidelines we present examples of codes at 3 levels:

Urban (not discussed in this presentation)

building

personal



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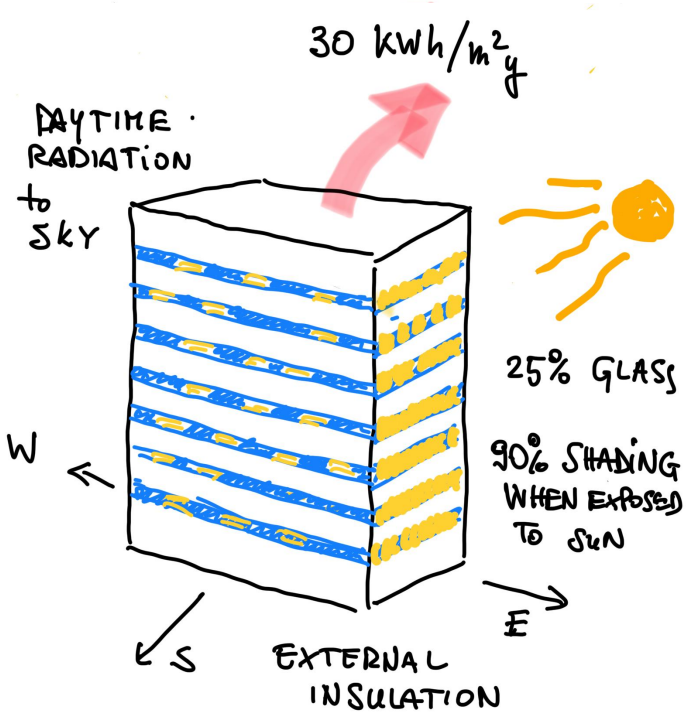
Energy need for *(heating or)* ***cooling*** = heat to be extracted from a thermally conditioned space to maintain the intended space temperature conditions (standard ISO 52000)

Performance of the building envelope in avoiding heat penetration into the space. Under different names, in building codes of Morocco, Serbia, British Columbia, Vancouver, Toronto,…



~~200~~ 30 kWh/m²y

« *energy needs* » Can be further reduced by passive systems such as *Nocturnal ventilative cooling* or *Earth to air heat exhangers* or *eveporative cooling*

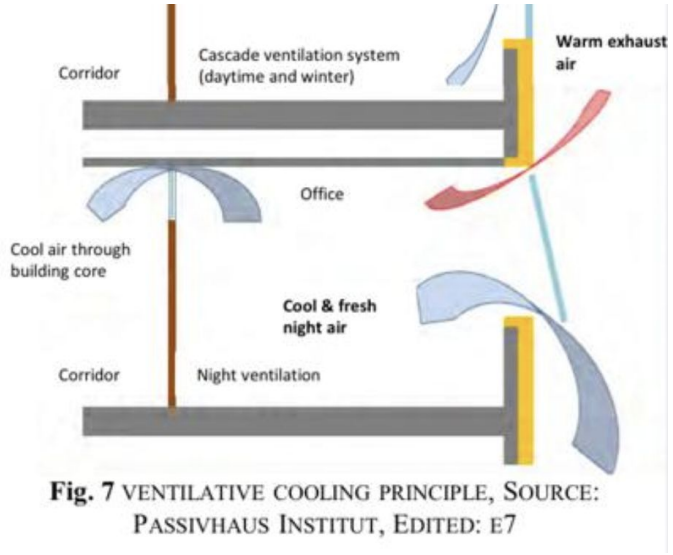
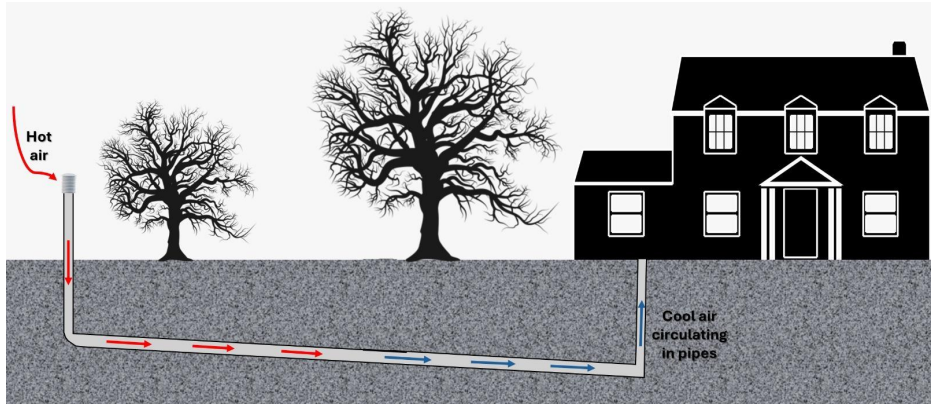


Fig. 7 VENTILATIVE COOLING PRINCIPLE, SOURCE: PASSIVHAUS INSTITUT, EDITED: E7



15 kWh/m²y

Remaining low « *energy needs* », if any, can be supplied by efficient active systems such as heat pumps, thus reducing ***total*** *primary energy*

10 kWh/m²y

By increasing the % of renewables in the national energy mix the ***non renewable*** *primary energy* used at the source can be lowered

6 kWh/m²y

Standard EN ISO 52000: "**The use of**

only one requirement,

e.g., the numeric indicator of *primary energy* **use**,

can be misleading.

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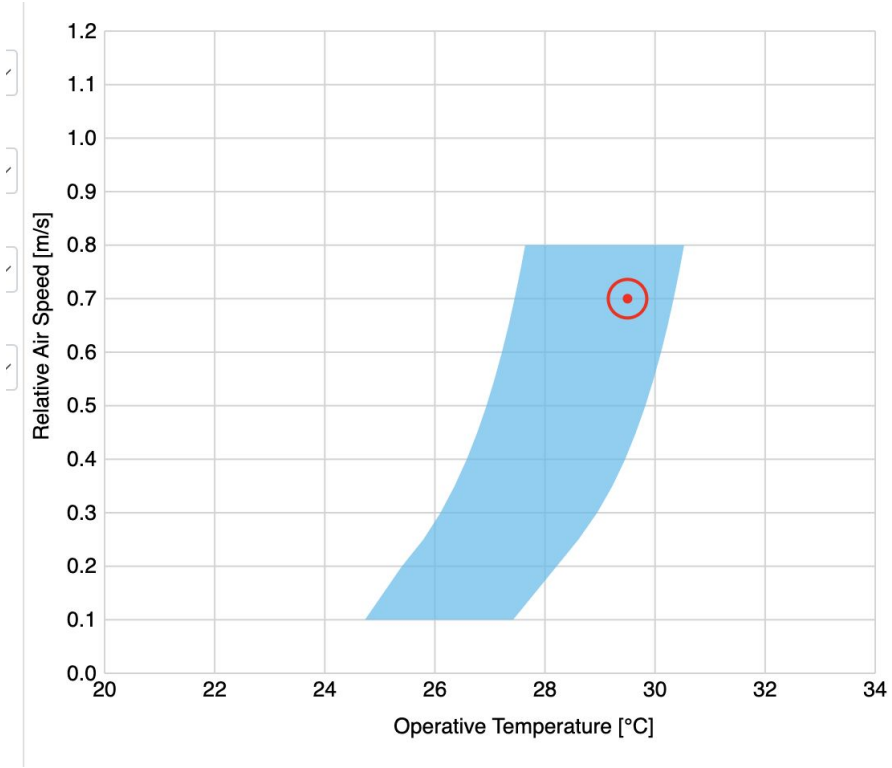
MUSA MULTILAYERED URBAN SUSTAINABILITY ACTION

The choice of the **comfort scenarios** determines the comfort temperature felt by people and in turn the "*energy needs for cooling*"

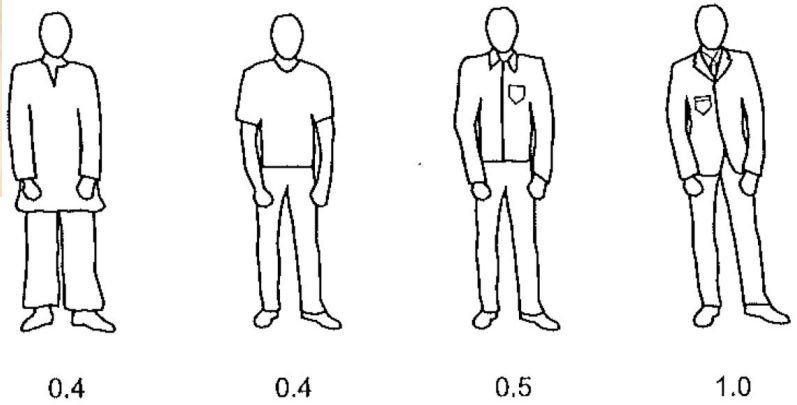
Clothing and chairs with low insulation values

and air speed on skin (from natural ventilation and fans)

can offer full comfort even raising the set point to 28 °C and beyond, according to the « ***elevated air speed comfort zone method*** » of Standard ASHRAE 55.



Practiced e.g. by Cool Biz campaign by Japan Government and corporations since 2005



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Panel Discussion

Moderator

Hubert Nsoh Zan
Assistant Manager on Energy Efficiency Regulation, Energy Commission of Ghana

Calvin Chong
Divisional Director for Energy & Climate Policy,
Ministry of Sustainability & Environment, Singapore

Monserrat Bodadilla
Leader of Resilience in the Built Environment
EBP - CEELA Project

Zulfikar Yurnaidi
Head of the Energy Modeling, Policy and Planning Department,
ASEAN Centre for Energy

A/Prof HY William Chan
Special Advisor
ICLEI, & former Sydney City Councillor and Chair of Environment, Planning, Heritage and Transport, Australia

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Ministry of Sust and the Envir SINGAPO

Singapore's Passive Cooling Strategies

Mr Calvin Chong
Divisional Director (Energy & Climate Policy)
Ministry of Sustainability and the Environment, Singapore

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Ministry of Sust and the Envir SINGAPO

Singapore is an island, a city, and a country

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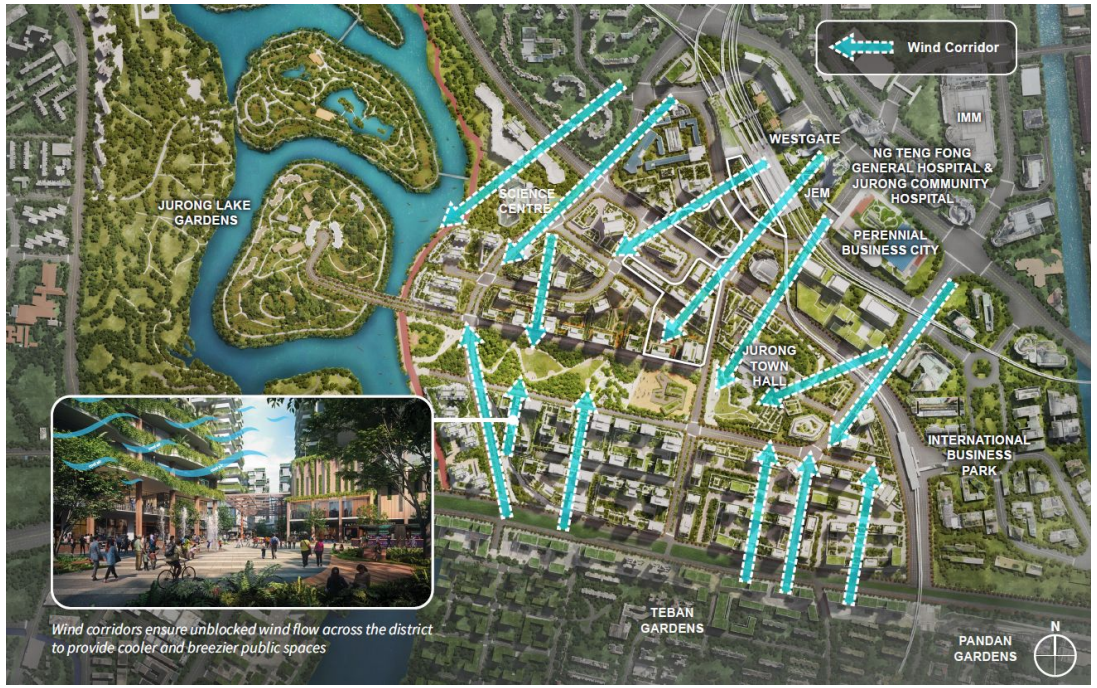
Ministry of Sust and the Envir SINGAPO

We use urban design to maximise wind corridors and allow for natural ventilation

Marina South's climate-sensitive design



Wind corridors in Jurong Lake District

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We intensify greenery and use cool materials

Integration of greenery into our urban landscape

Use of cool materials

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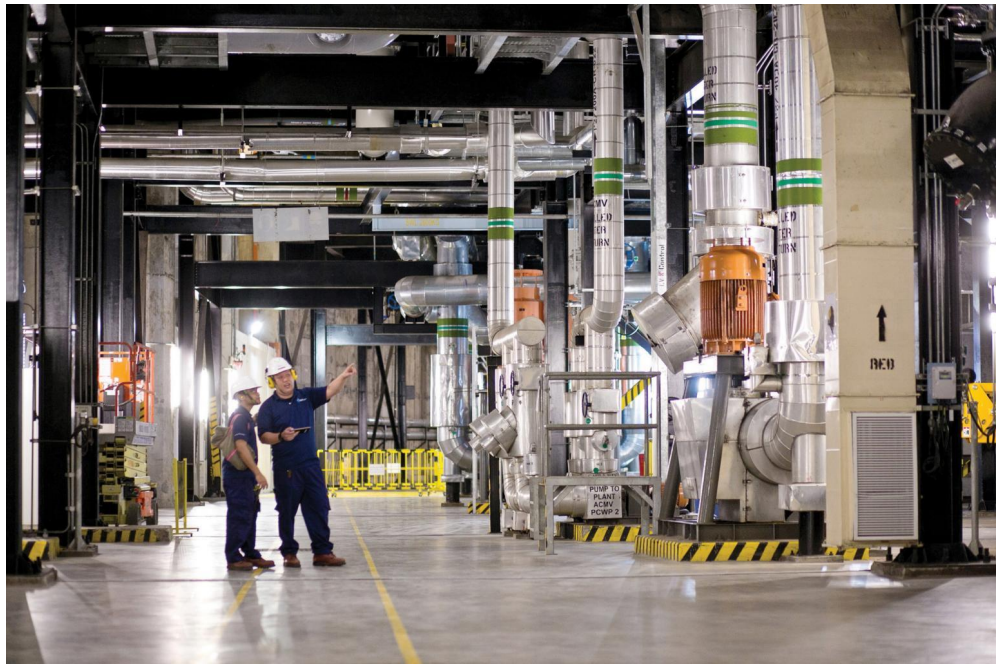
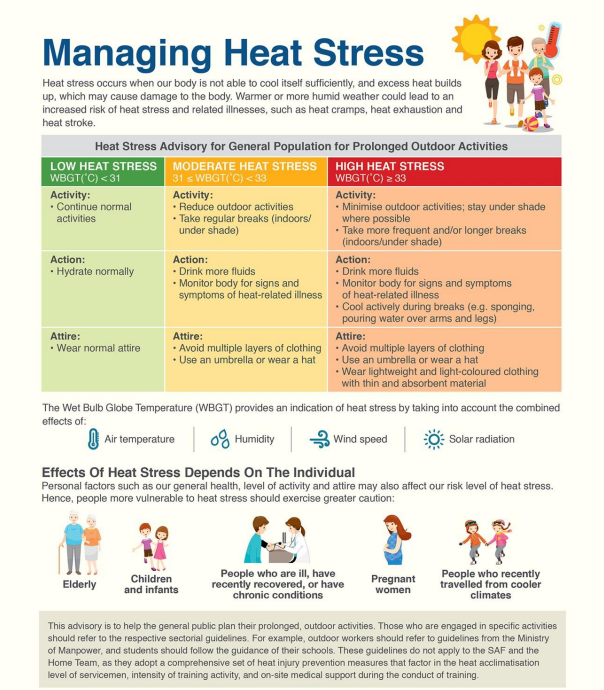
SINGAPO

We optimise active cooling in our buildings and increase community resilience



World's largest underground district cooling system at Marina Bay



Managing Heat Stress

Heat stress occurs when our body is not able to cool itself sufficiently, and excess heat builds up, which may cause damage to the body. Warmer or more humid weather could lead to an increased risk of heat stress and related illnesses, such as heat cramps, heat exhaustion and heat stroke.

Heat Stress Advisory for General Population for Prolonged Outdoor Activities

LOW HEAT STRESS WBGT(°C) < 31	MODERATE HEAT STRESS 31 ≤ WBGT(°C) < 33	HIGH HEAT STRESS WBGT(°C) ≥ 33
Activity: • Continue normal activities	**Activity:** • Reduce outdoor activities • Take regular breaks (indoors/ under shade)	**Activity:** • Minimise outdoor activities; stay under shade where possible • Take more frequent and/or longer breaks (indoors/under shade)
Action: • Hydrate normally	**Action:** • Drink more fluids • Monitor body for signs and symptoms of heat-related illness	**Action:** • Drink more fluids • Monitor body for signs and symptoms of heat-related illness • Cool actively during breaks (e.g. sponging, pouring water over arms and legs)
Attire: • Wear normal attire	**Attire:** • Avoid multiple layers of clothing • Use an umbrella or wear a hat	**Attire:** • Avoid multiple layers of clothing • Use an umbrella or wear a hat • Wear lightweight and light-coloured clothing with thin and absorbent material

The Wet Bulb Globe Temperature (WBGT) provides an indication of heat stress by taking into account the combined effects of:

Air temperature | Humidity | Wind speed | Solar radiation

Effects Of Heat Stress Depends On The Individual

Personal factors such as our general health, level of activity and attire may also affect our risk level of heat stress. Hence, people more vulnerable to heat stress should exercise greater caution:

Elderly | Children and infants | People who are ill, have recently recovered, or have chronic conditions | Pregnant women | People who recently travelled from cooler climates

This advisory is to help the general public plan their prolonged, outdoor activities. Those who are engaged in specific activities should refer to the respective sectorial guidelines. For example, outdoor workers should refer to guidelines from the Ministry of Manpower, and students should follow the guidance of their schools. These guidelines do not apply to the SAF and the Home Team, as they adopt a comprehensive set of heat injury prevention measures that factor in the heat acclimatisation level of servicemen, intensity of training activity, and on-site medical support during the conduct of training.

Heat Stress Advisory for the general population undertaking prolonged outdoor activities

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Ministry of Sust and the Envir SINGAPO

Thank you!

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Panel Discussion

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Hubert Nsoh Zan
Assistant Manager on Energy Efficiency Regulation, Energy Commission of Ghana

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Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Embajada de Suiza en el Perú

Cooperación Internacional - COSUDE
Hub Regional Lima

PROYECTO CEELA

EBP

Panelist

Monserrat Bobadilla
Leader of Resilience in the Built Environment
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Confederazione Svizzera
Confederaziun svizra

Embajada de Suiza en el Perú

Cooperación Internacional - COSUDE
Hub Regional Lima

PROYECTO CEELA

EBP

The average temperature in Latin American and Caribbean cities has risen by **1.5°C since 1950**.

70% of workers in Latin America and the Caribbean are exposed to extreme heat.

48,000 people over the age of 65 died prematurely from heat-related causes in the region, in 2023.

How do we face this?

1 Integrated design in practice

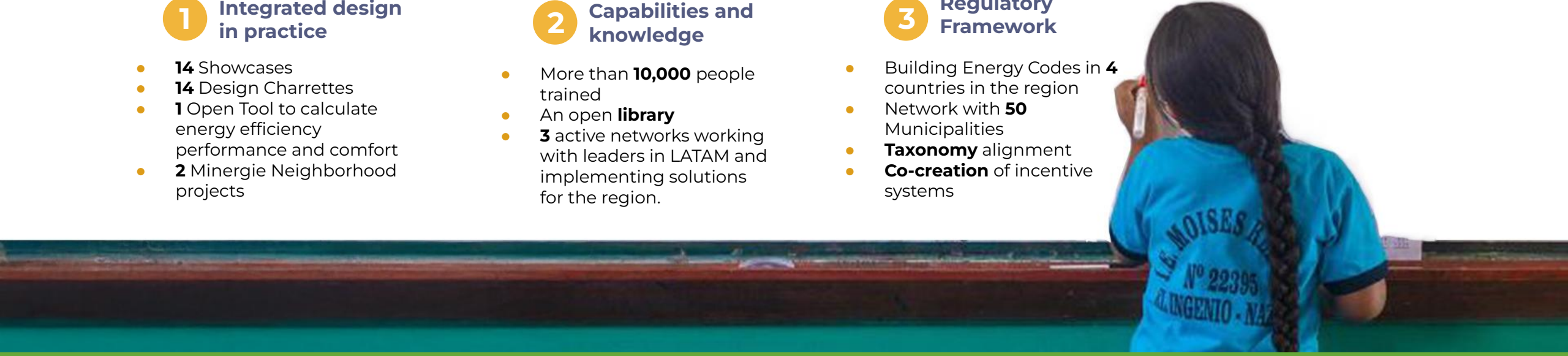
- **14** Showcases
- **14** Design Charrettes
- **1** Open Tool to calculate energy efficiency performance and comfort
- **2** Minergie Neighborhood projects

2 Capabilities and knowledge

- More than **10,000** people trained
- An open **library**
- **3** active networks working with leaders in LATAM and implementing solutions for the region.

3 Regulatory Framework

- Building Energy Codes in **4** countries in the region
- Network with **50** Municipalities
- **Taxonomy** alignment
- **Co-creation** of incentive systems



#BuildingsCoolingPavilion #BuildForClimate #ActOnCooling

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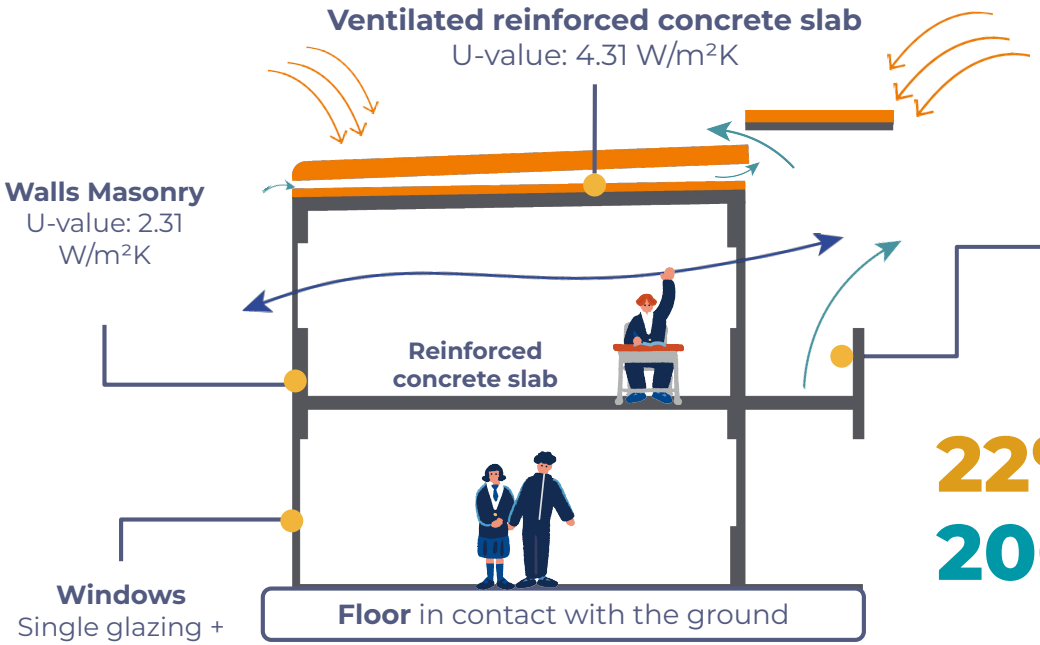

22% less discomfort

200 students and teachers benefited

"At times it got **so hot** that it made us **sleepy**, and we'd either **fall asleep** in class or **stop paying attention.**"

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Thank you!

Learn more at

#BuildingsCoolingPavilion #BuildForClimate #ActOnCooling

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Panel Discussion

Moderator

Hubert Nsoh Zan
Assistant Manager on Energy Efficiency Regulation,
Energy Commission of Ghana

Calvin Chong
Divisional Director for Energy & Climate Policy,
Ministry of Sustainability & Environment, Singapore

Montserrat Bodadilla
Leader of Resilience in the Built Environment
EBP - CEELA Project

Zulfikar Yurnaidi
Head of the Energy Modeling, Policy and Planning Department,
ASEAN Centre for Energy

A/Prof HY William Chan
Special Advisor
ICLEI, & former Sydney City Councillor and Chair of Environment, Planning, Heritage and Transport, Australia

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Q&A

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SPACECOOL

Closing Remarks

Takayuki Hosyuyama

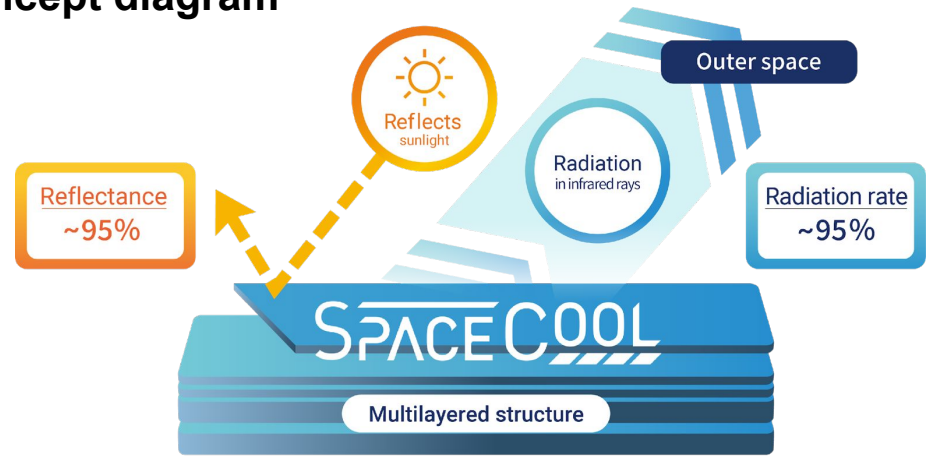
Co-founder, Board Director and CSO,
SPACECOOL INC.

hoshu@spacecool.jp

Radiative cooling materials already exist

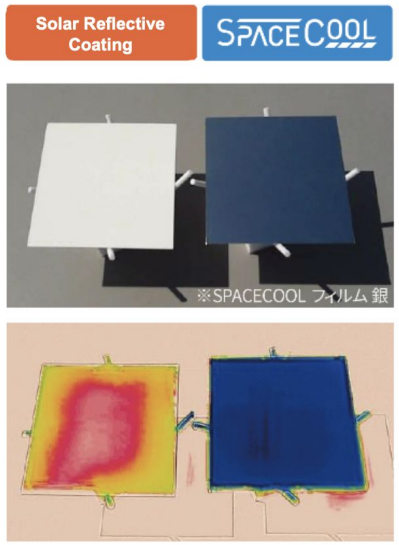
SPACECOOL Products have a higher solar reflectance than conventional solar reflective paints or glaciers. As a material that readily undergoes radiative cooling, it nearly eliminates solar heat gain.

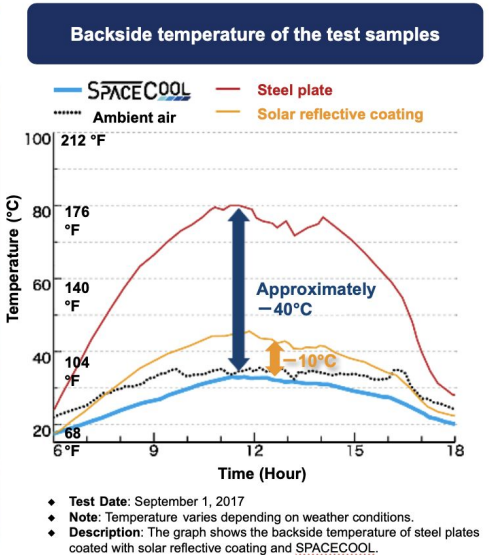
Concept diagram



Zero energy cooling is achieved

Basic test result





- **Test Date**: September 1, 2017
- **Note**: Temperature varies depending on weather conditions.
- **Description**: The graph shows the backside temperature of steel plates coated with solar reflective coating and SPACECOOL.

Daytime radiative cooling material

SPACECOOL Products
- **Self-Adhesive Film**
- **Magnet Sheet**
- **Membranes**

=Higher solar reflectance + High radiation

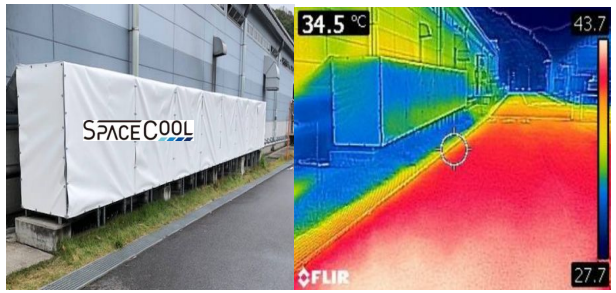
>

reflectance

Installation examples and Effect categories

Installation of SPACECOOL, you can combat heat stress.
As a result, user will get the benefits of four effect categories.

Power & Cost Savings, CO2 Reduction

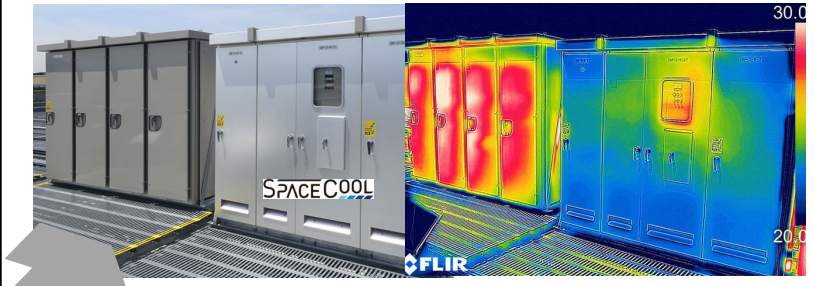


AC/HVAC Outdoor Units

Telecom Station

Prevent Equipment Failure

Increase Reliability &Reduce OPEX

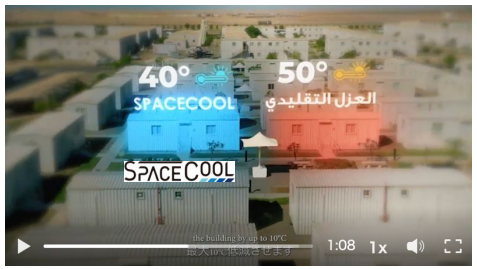


Power Distribution Board & Cubicle

Gas Supply Control Panel

Heat Mitigation

Improve Working Environment
Power & Cost Savings, CO2 Reduction

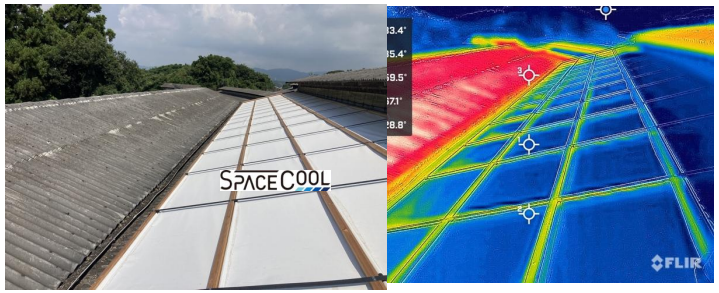


Simple Container Workers House

Corrugated Metal Roof

Enhance Productivity

PCS for Solar Panel



Livestock Facility

Passive radiative cooling is more useful for heat problem.

SPACECOOL

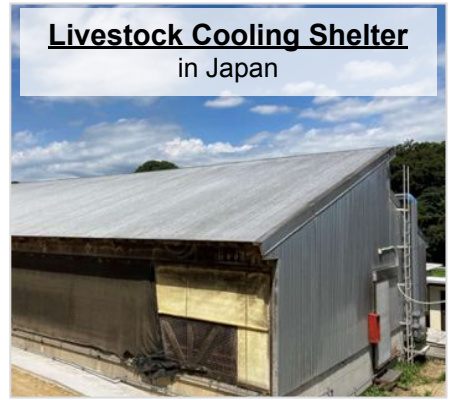
Radiative cooling materials are particularly useful among passive cooling methods.

- **For those living in simple containers, they get a comfortable living space.**
- **Medical tents gain enhanced cooling performance and increased comfort.**
- **For athletes, they get good sports facilities and help lower core body temperature.**
- **Sun umbrellas make walking easier.**
- **Not only humans, but livestock like pigs also thrive more easily.**

Container Workers House
Red Sea Global in Saudi Arabia

Sunshade for Tennis Court
at Emirates Palace Hotel in Abu Dhabi

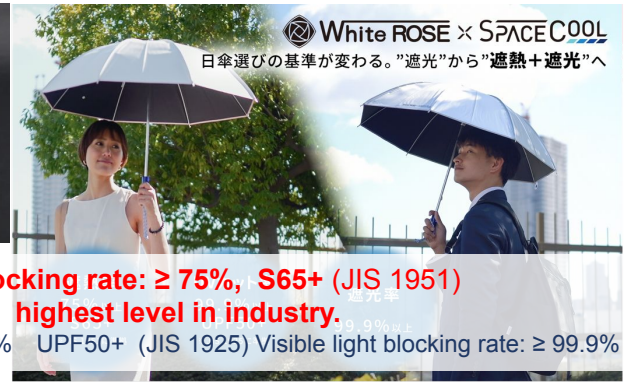
Red Cross Tent
Emergency aid tent at EXPO2025



Livestock Cooling Shelter
in Japan

Rest tent for Athlete
World Athletics Championship in Tokyo 2025

Pavillion Tent
at EXPO2025



Heat blocking rate: ≥ 75%, S65+ (JIS 1951)
highest level in industry.
UV blocking rate: ≥ 99.9%　UPF50+ (JIS 1925) Visible light blocking rate: ≥ 99.9%

Adaptation to Mitigation

Power savings and CO2 reduction effects from individual adaptation for each HVAC are limited.
Radiative cooling materials can enhance the thermal performance of roofs and rooftop.
Large-scale installation could make it a viable mitigation strategy.
SPACECOOL can provide adaptation , Policy makers can upgrade adaptation to mitigation.

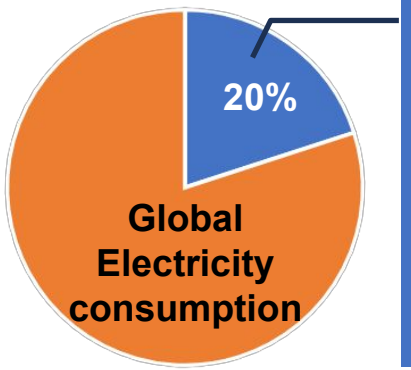
Radiative Cooling Solution

Result on metal roof, Rooftops
Simulation→Set Policy

warehouses, schools, hospitals,
buildings, commercial facilities

Result & Simulation

Improving Air Conditioning Efficiency on Business
→3 to 18% reduction in power consumption in Japan
→Ave16% reduction in power consumption in Thailand



20% Air conditioning use for of global electricity consumption.

↓

2% Improving efficiency by ave10% by SPACECOOL=2% Reducing

↓

270 million tons=0.7% (Y2024：37.8 Gt)
global energy-related CO_2 emissions

Strategic Options / Policy

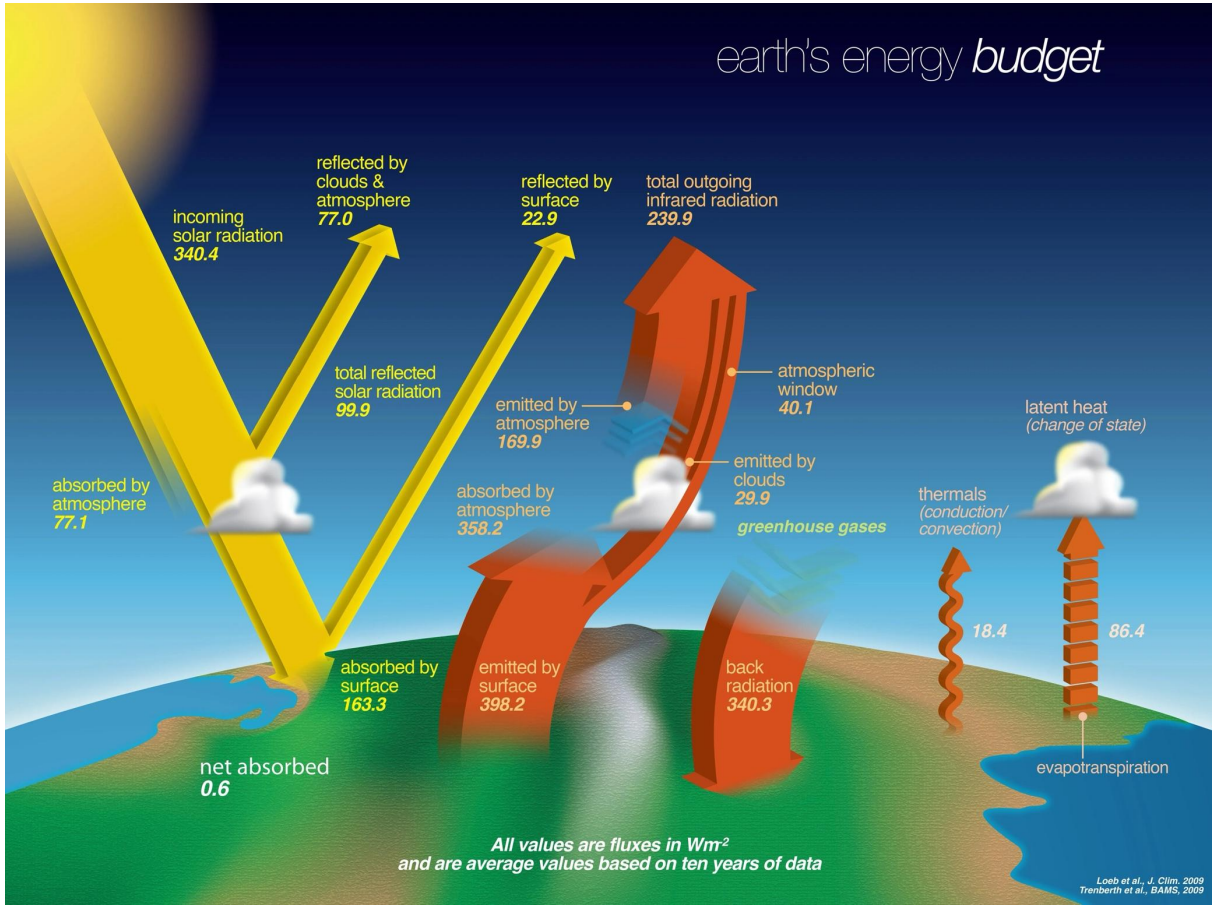
- Certification of Materials within the Economic Zone
- Establishment of Installation Standards
- Joint Demonstration in Large-Scale Implementation Areas
- Establishment of Implementation Subsidies for Private Companies

Etc…

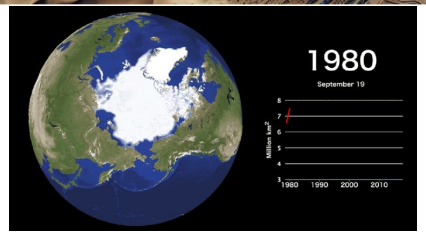
Potential for Controlled SRM

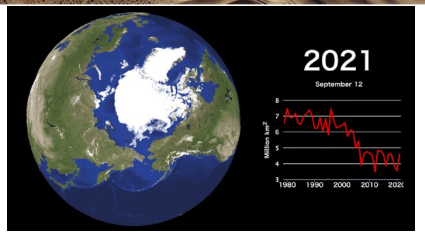
SPACECOOL

SRM（Solar radiation management）, which falls outside both adaptation and mitigation.
Achieving the 1.5°C target is becoming increasingly difficult, with tipping points looming.
Distinct from conventional solutions, Increasing albedo(Earth's reflectivity) is also necessary.
Controlled SRM may be worth considering. *not include with un-controlled SRM like aerosol.



Earth's energy budget describes the balance between the radiant energy that reaches Earth from the sun and the energy that flows from Earth back out to space. **Credits: NASA**





Arctic sea ice extent has decreased by 2.8 million km².
Snow absorbs only 10-20% of sunlight, while water absorbs 90%.
Increase albedo (Earth's reflectivity) to compensate for the loss of Arctic sea ice.

Let's move mountain together !

The public and private sectors can collaborate.
We can respond to climate change with adaptation and mitigation.
SPACECOOL member believes for THE FUTURE.

SPACECOOL INC. CEO & CTO Masahiro Suemitsu

When you want to get sample, sample of sun-umbrella, discussion. Please contact us.

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Thank you!