Inspired by Nature. For Climate. For Our Future.

Low-Cost Cooling Systems for Sustainable Homes

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The Climate Challenge: The Vicious Cycle of Cooling

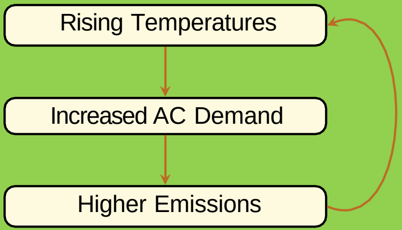
The Dilemma

- Global warming drives up indoor temperatures across regions.
- Traditional Air Conditioning (AC) consumes massive electricity.
- AC refrigerants further accelerate global warming.

The Objective

Break the cycle using low-cost, zero-refrigerant, nature-inspired systems for everyday homes.

The Energy-Warming Spiral



Biomimicry: Nature’s 3.8 Billion-Year Development

What is Biomimicry?

An approach to innovation that seeks sustainable solutions to human challenges by emulating nature’s time-tested patterns and strategies.

Human Approach (Active) ↔ **Nature’s Approach (Passive)**

Human Approach (Active)

- Resource-heavy infrastructure
- High mechanical energy input
- Extractive and disruptive design

Nature’s Approach (Passive)

- Form-based and structural adaptation
- Driven by solar and wind currents
- Regenerative and zero-waste

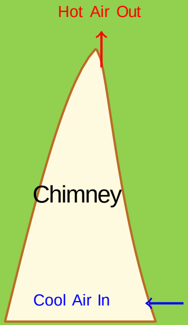
Lessons from Termites: Structural Architecture

The Macrotermes Mastery

Despite external fluctuations from 1.5C to 40C, the interior of a termite mound remains remarkably stable at around 30C.

Key Mechanical Principles:

- **Stack Effect:** Warm indoor air rises and escapes through a porous central chimney.
- **Buoyancy Currents:** Cool air is drawn in continuously via low subterranean vents.
- **Thermal Mass:** Thick clay walls absorb heat during peak sunshine.



Lessons from Bees: Geometric Evaporative Cooling

The Honeycomb Matrix

Beehives maximize surface area interaction through hexagonal geometries. When overheating occurs, bees use micro-droplets of water combined with wing fanning to initiate localized rapid cooling.

Physics of Evaporative Cooling:

- Latent heat of vaporization handles heat absorption.
- Highly porous structures maximize water retention and transition surface.

Application to Architecture:

- Modular clay geometries.
- Structural surface area packing to maximize wind exposure.
- Natural capillary action replacing mechanical water distribution pumps.

The Terracotta Clay Tube Cooling Model

System Blueprint (Bilingual Concept)

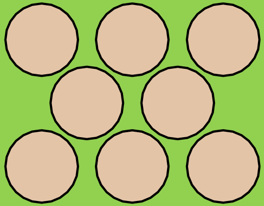
Low-Cost Clay Tube Cooling System

A low-cost arrangement of porous terracotta conical cylinders arranged in a compact honeycomb configuration.

Operational Process:

1. Water drips over the earthenware tubes.
2. Clay absorbs water through capillary pores.
3. Ambient hot wind enters the tubes, evaporates the moisture, and emerges cooled (6C to 10C drop).

Honeycomb Layout Optimization



Porous Earthenware Cylinders

Affordable Adaptations for Housing

Table: Comparison of Residential Cooling Modalities

Metric	**Conventional AC**	**Commercial Cooler**	**Nature-Inspired Clay Grid**
Capital Cost	High	Medium	Very Low
Operating Power	1500W – 2500W	150W – 300W	0W – 15W
Refrigerant Harm	High	None	None
Community Source	Global Corporates	Domestic Factories	Local Potters

Social Empowerment Aspect

Generates local employment for traditional clay craftsmen while cutting electricity reliance during extreme heatwave spells.

Virtual Exhibition Showcase: Explaining the Prototypes

Model A: The Window-Insert Hive

[redacted]

- Designed for dense urban clusters or small village windows.
- Uses a modular bamboo frame to securely support custom clay cones.
- Water reservoir on top utilizes standard drip tubes for uniform gravity distribution.

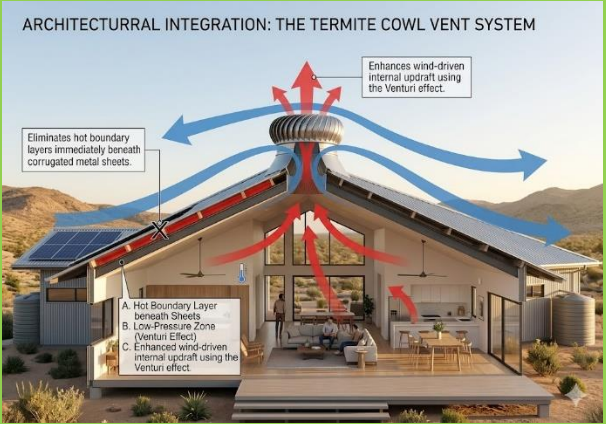
Model B: The Termite Cowl Vent

[redacted]

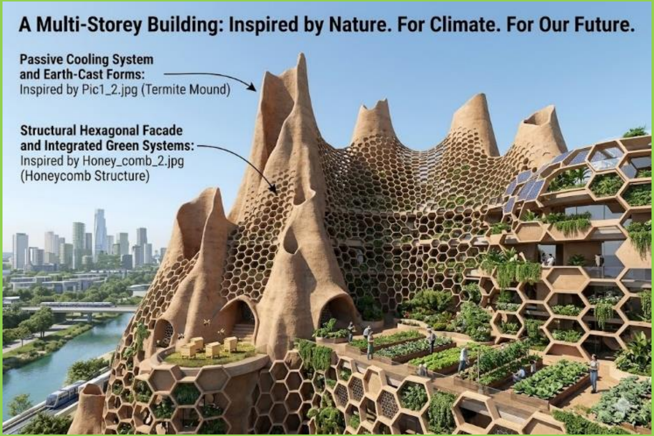
- Roof-mounted low-cost structural cap.
- Enhances wind-driven internal updraft using the Venturi effect.
- Eliminates hot boundary layers immediately beneath corrugated metal sheets.

Model A: The Window-Insert Hive

The Termite Cowl Vent



AI Generate Picture



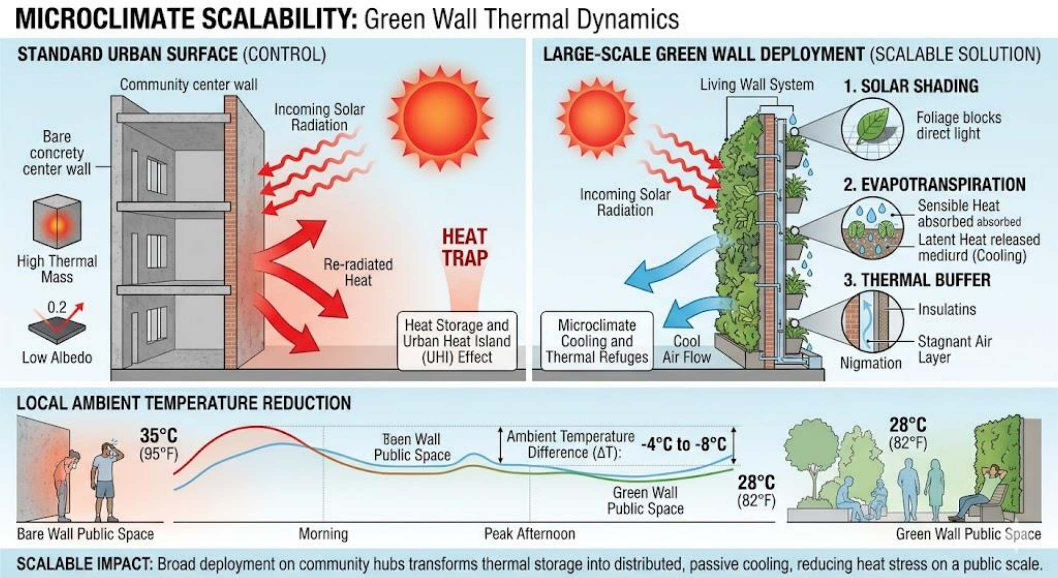
Empirical Advantages: For Climate. For Our Future.

- **Carbon Footprint Suppression:** Reduces localized peak household energy footprint by up to 85 percent.
- **Acoustic Comfort:** Completely silent operations compared to heavy vibrating mechanical fans.
- **Microclimate Scalability:** Large scale deployment on community center walls can bring down ambient local temperatures in public spaces.

World Environment Day Call to Action

Shifting from an era of engineered control over nature to an era of humble structural alignment with ecological laws.

Community centre walls



Key Academic References

Selected Architectural & Material Science Research

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Conclusion and Open Discussion

“Cool Ideas for a Hot Planet”

Thank You