The Patent Trail: Who Finally Connected the Dots

Six patents connect plant science, thermal mass, and comfort into one system. [16]

At a Glance

For over a century, plant transpiration, thermal mass, air filtration, and occupant comfort were studied separately. Bio-inspired cooling research documented the potential but noted that plant mechanisms remain underexploited in building systems. [16] Six patents pending across Thermopod, Terrapod, and related systems connect these disciplines into Biothermal Microconditioning: a managed indoor plant system engineered for measurable thermal comfort.

Deep Dive

Scientific knowledge about plant cooling has existed for over a century. Stephen Hales measured sap flow in 1727. The latent heat of vaporisation (2,260 kJ per kg) was quantified in the 18th century. Transpiration measurement was refined through the 1890s. The knowledge base is old and well established.

NASA's Clean Air Study (1989) by Wolverton, Johnson, and Bounds demonstrated that interior plants remove VOCs from sealed chambers. [4] The study was designed for space stations, never engineered for occupied commercial buildings. ASHRAE Standard 55, first published in 1966 and updated through 2023, defines six thermal comfort factors with an adaptive model recognising that occupants interact with their environments. [7] ASHRAE treats plants as decoration, not as comfort devices. No ASHRAE committee has evaluated managed plant clusters as personal thermal systems.

He, Yu, Ozaki, Dong, and Zheng (2020) reviewed bio-inspired cooling technologies for buildings in Energy and Buildings. They catalogued heat transfer mechanisms used by plants and animals: evaporative cooling, radiative cooling, convective cooling, and hybrid combinations. Their conclusion: these mechanisms create harmony between buildings and nature and enhance indoor environmental quality while achieving energy efficiency. Yet they remain underexploited in building practice. The gap between biology research and building engineering is wide. [16]

This gap is what the patent trail fills. Six patents pending (three for Thermopod and Terrapod, three covering system integration) address interfaces no single discipline had engineered:

First, plant-to-air heat exchange at the occupied zone. Transpiration cools air around the leaf surface. The patents specify cluster geometry and species selection (areca palms: high LAI, vigorous transpiration, indoor light tolerance) to concentrate cooling at desk height, 0.5 to 2 metres above floor level where the person actually sits.

Second, substrate moisture control. Managed irrigation maintains the soil moisture level that maximises both thermal mass buffering and transpiration rate without waterlogging or mould risk. The irrigation cycle is engineered, not left to manual watering.

Third, canopy management for LAI optimisation. Research shows LAI ceases to be a significant thermal parameter beyond 2.5. The system designs cluster density to reach the effective LAI threshold at the target zone without overshoot.

Fourth, integration with existing HVAC. The system supplements mechanical cooling at person level, enabling setpoint relaxation. When the person is comfortable at their desk, the building thermostat can run warmer.

A 2024 review of 74 biophilic design studies confirmed significant psychological, physiological, and cognitive benefits from plants in workplaces. [14] The patent trail adds thermal engineering to the biophilic evidence base. [16] The result is Biothermal Microconditioning: known science connected across four disciplines into one deployable system. Easy Retrofit. 1 day.

Summary

Evapotranspiration science dates to the 1890s. NASA demonstrated plant air filtration in 1989. [4] ASHRAE Standard 55 defined thermal comfort in 1966 and updated through 2023 with adaptive models for naturally conditioned spaces. [7] Each discipline advanced independently for decades.

He et al. (2020) reviewed bio-inspired cooling for buildings in Energy and Buildings. Biological heat transfer mechanisms are documented but remain underexploited in building design practice. [16] The knowledge existed. The integration did not.

Six patents pending connect the dots. Thermopod and Terrapod systems combine areca palm transpiration, substrate thermal mass, canopy leaf area, and managed irrigation into deployable units for the occupied breathing zone. Each patent addresses a specific interface between disciplines.

Biophilic research confirmed measurable cognitive and wellbeing benefits: a 2024 review of 74 studies showed significant improvements. [14] The patent trail adds engineering to that evidence: managed systems delivering thermal comfort as repeatable output.

Biothermal Microconditioning reads across four disciplines. The category was hidden in plain sight.