ZERO-ENERGY THERMAL COMFORT SOLUTION, AN ENGINEERING SOLUTION BY DERATEC

Thermal Comfort:

ASHRAE 55 defines thermal comfort as "**that condition of mind that expresses satisfaction with the thermal environment**".

This comfort condition applies to residential apartments and commercial spaces. However, the most critical thermal discomfort happens in industries with high heat loads machinery processes. The combination of this kind of heat load and humidity is a high risk for human health & safety and production efficiency. These heat loads can be exhausted using proper cross-flow ventilation to achieve better thermal comfort.

Zero-Energy Thermal Comfort?

It is so expensive to achieve thermal comfort using air-conditioning or mechanical ventilation systems due to the high energy consumption. Fortunately, nature and physics help us use natural ventilation on the internal heat loads convection. The ambient airflow enters the building through lower positions openings (louvres). Then, it warms up by heat loads with convection heat transfer. The hot air moves up to exit from the upper exhaust (ridge vents or upper louvres).

Natural ventilation is a zero-energy, sustainable solution and a cost-effective method to exhaust the generated heat based on Australian Standards.

Our calculations show the zero-energy thermal comfort solution can save significant system running costs for our clients. The following table is summary results of 10 years' benefit for one of our recent projects:

Ventilation Type	Mechanical Ventilation (Roof Fans)	Natural Ventilation (Roof Vents)
10 Years Benefits	-$607,743.29	+$254.993.00

How it Works:

Step 1: Primary Thermal Comfort Evaluations:

- Project brief
- Full site audit & thermal images captures
- In-house Engineering & Compliance

Step 2: Existing Thermal Comfort Analysis

- 3D modelling of building & equipment geometries
- Analysing the thermal comfort aiding Computational Fluid Dynamics (CFD) to simulate convection airflow & temperature inside the building & wind effect around the building
- Thermal, humidity & velocity outcomes to identify problematic & critical hot spots.

Step 3: Zero-Energy Thermal Comfort Solution:

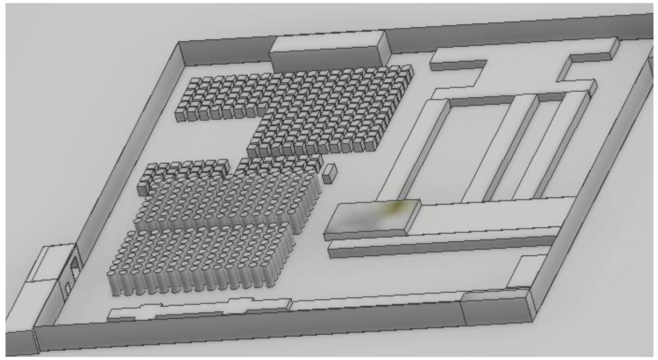
- Initial identifying & calculation the Louvre & roof vents type, size, quantity and location.
- Re- simulate convection airflow & temperature inside the building to find the optimal design of sustainable solution & environmental conditions for human occupancy (ASHRAE 55 Thermal Comfort) and fire safety.
- Thermal, humidity & velocity outcomes of new design vs existing system

Step 4: Final Report

- Cost-effective plan for implementation the zero-energy thermal comfort solution
- Simulation results of current systems vs. proposed sustainable solution.
- Concept design & drawings

Thermal Imaging Scan

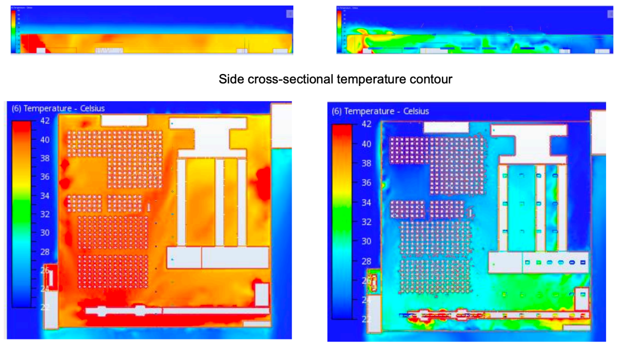
3D Modelling of Building



Temperature Contours

Before

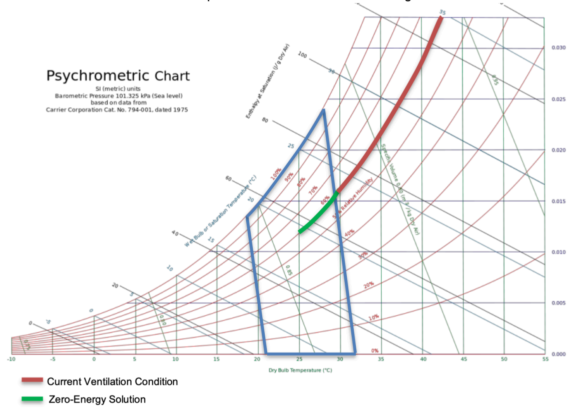
After



Side cross-sectional temperature contour

Plan View- Temperature contour- 1.7 m above the ground

ASHRAE 55 Thermal Comfort Analysis



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