

ebmpapst

engineering a better life

ebm-papst @ 2024 AIVC-ASC Technical Conference.

Unlocking Active Sustainable Design with Energy-Efficient Ventilation Strategies

19th April 2024

Agenda

- 1** Reducing energy consumption in buildings effectively
- 2** Success stories utilizing active sustainable design
- 3** The Next Generation of Air Technology
- 4** Unlocking Digital Sustainability with ebm-papst
- 5** Achieving shared success with ebm-papst SEA

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Reducing energy consumption in buildings effectively

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Source: sustainable.to

Passive Design Strategies

Passive strategies are integrated into the design of a building to work with natural elements on a site (including sun and wind patterns) to provide natural heating and cooling of spaces through different seasons.

Examples

- ✓ Natural ventilation
- ✓ Natural shade
- ✓ Daylighting
- ✓ Off-grid (e.g. rainwater as water source)

... and many more!

Active Building Strategies

Active design strategies use purchased energy (including electricity and natural gas) to keep buildings comfortable.

Examples

- ✓ High efficiency HVAC/ACMV systems
- ✓ Solar-Electrical / Photovoltaic
- ✓ Building Automation
- ✓ Wind Power

... and many more!



Energy consumption in a typical office building

Situated near the equator, **Singapore is hot and humid throughout the year**, making it almost necessary for Singaporeans to have an air-conditioning system.

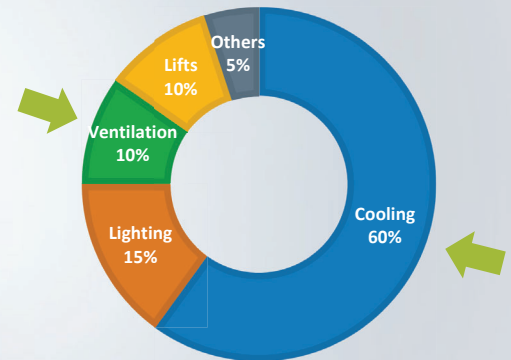
The number of air-con installations is expected to rise with the **increase in number of residential and commercial building developments, growing by 73 per cent from 2010 to 2030**, according to NUS Professor Lee Poh Seng, then deputy director at the Centre for Energy Research and Technology, who spoke to Eco-Business in 2018.

Source: CNA



ENERGY USAGE

■ Cooling ■ Lighting ■ Ventilation ■ Lifts ■ Others



Source: BCA

ecobusiness

enr.com.sg



Therefore, reducing overall ACMV energy consumption will be effective in reducing overall energy consumption of the building.

2

Success stories utilizing active sustainable design

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Cases - Singapore

Aerospace Manufacturing Facility

Energy used by ACMV systems can account for up to 70% of energy consumed in a building

By replacing 7 AC belt-driven centrifugal fans with 14 of our EC centrifugal fans in buildings such as manufacturing facilities

...we were able to go down from 31,890 kWh/month to 16,610 kWh/month!

Energy savings: 48%

Singapore's average OM GEF in 2022 is 0.4168 kg CO₂/kWh. Hence, the retrofit reduced CO₂ emissions by 6,369 kg per month!



~~31,890 kWh/month~~

- 16,610 kWh/month

15,280 kWh/month

Savings

48%



6,369 kg per month



Data Center

Energy used by ACMV systems can account for up to 37% of energy consumed in data centers.

We replaced 54 AC axial fans with 400 our EC axial fans in cooling towers.

Presuming full load operation, we were able to go down from **580,608 kWh/month** to **313,632 kWh/month**.

Energy savings: **46%**

Singapore's average OM GEF in 2022 is 0.4168 kg CO₂/kWh. Hence, the retrofit reduced CO₂ emissions by **111,276 kg per month**.



~~580,608 kWh/month~~

~~313,632 kWh/month~~

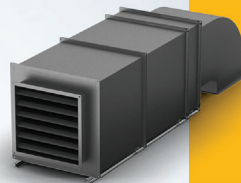
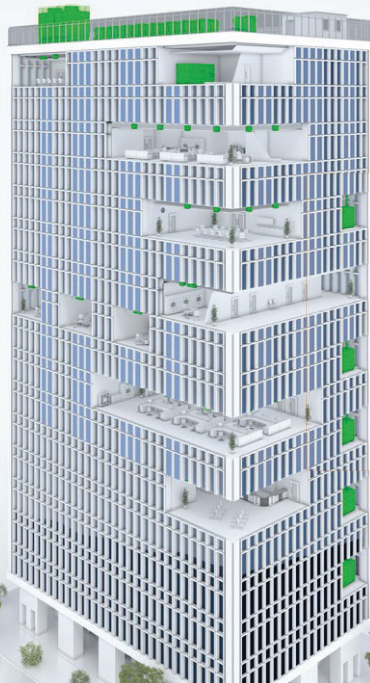
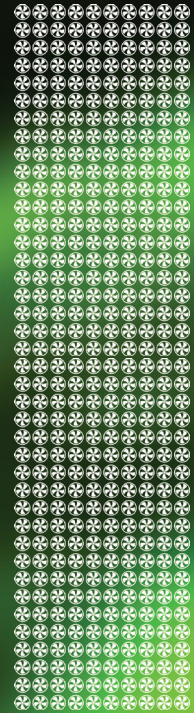
266,976 kWh/month

Savings

46%



111,276 kg per month



- Air Handling Units
- Cooling Towers
- Exhaust/Supply Fans
- Condensers
- Evaporators
- Fan Coil Units *for hotels & commercial*
- Fan Filter Units *for cleanrooms*
- CRAC Units *for data centres*

Our fans are ideal for a wide range of ACMV applications

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The Next Generation of Air Technology

EC technology by ebm-papst

EC technology then

ebm-papst was one of the **first manufacturers** to recognise the economic and ecological advantages offered by EC technology and was **instrumental in promoting its development**.



1975
ebm developed the first EC motor – three decades before official policy makes energy saving a major issue.

1998
The first energy-saving centrifugal and axial fans with **integrated electronics** were developed.



EC technology now



Expenditure for R&D
€ 140.2 million (2022/2023)

above IES

EC Generation 3 motor
was rolled out to customers in 2020/2021



IES is a rating for the energy efficiency of electric motors. Previously, it is the highest rating possible.

“Each new product must surpass its predecessor economically and ecologically.”
- Gerhard Sturm, founder of ebm-papst

The ebm-papst EC fan & its benefits

Compared to conventional tech

Impeller & Periphery

- All optimized together
- Less noise
- Improved airflow

Integrated Components

- Improved efficiency
- Do not require many external components
 - **VSD not required**
 - **No additional losses**
- Less components to maintain
- Lower capital investment
- All components are optimised together



One full solution - all designed, produced and measured by ebm-papst resulting in the **highest possible fan static efficiency**

→ No calculation – Instead, we provide measured and proven values

Compared to conventional tech

Motor

- Energy efficiency above IE5 standard
- High power density
- Very low structural motor noise

Not found in conventional tech

Electronics – the ‘brain’ of the motor

- Converts AC supply to DC voltage
- Same performance on wide voltage range
- Increased reliability (electrical and mechanical engineering)
- Enables fan to ‘talk’ to building management systems

Unlike conventional tech

The future of ebm-papst is already here.

We are moving towards digitalization.

What does an ‘intelligent fan’ look like?



It enables data-driven facilities management.

But how?

It should incorporate ‘smart’ features such as vibration sensors and also optimize itself in its use case.

Why integrate a vibration sensor?

Vibration can lead to fan failure. At ebm-papst, we have equipped a selection of our EC fans with a vibration sensor, allowing users to mitigate and avoid such issues. Vibration occurs because of:

Improper fan mounting or installation

Damaged/imbalanced impeller

Wear & tear

With the vibration sensor, it enables...

Fan health monitoring & predictive maintenance

Optimisation of fan performance

Extension of fan lifespan

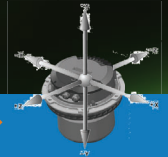
Servicing and exchange on demand

100% safe operation

Avoidance of harmful operation conditions



Integrated in motor



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Unlocking Digital Sustainability with ebm-papst

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Unlocking Digital Sustainability with Intelligate Mesh

Intelligate Mesh

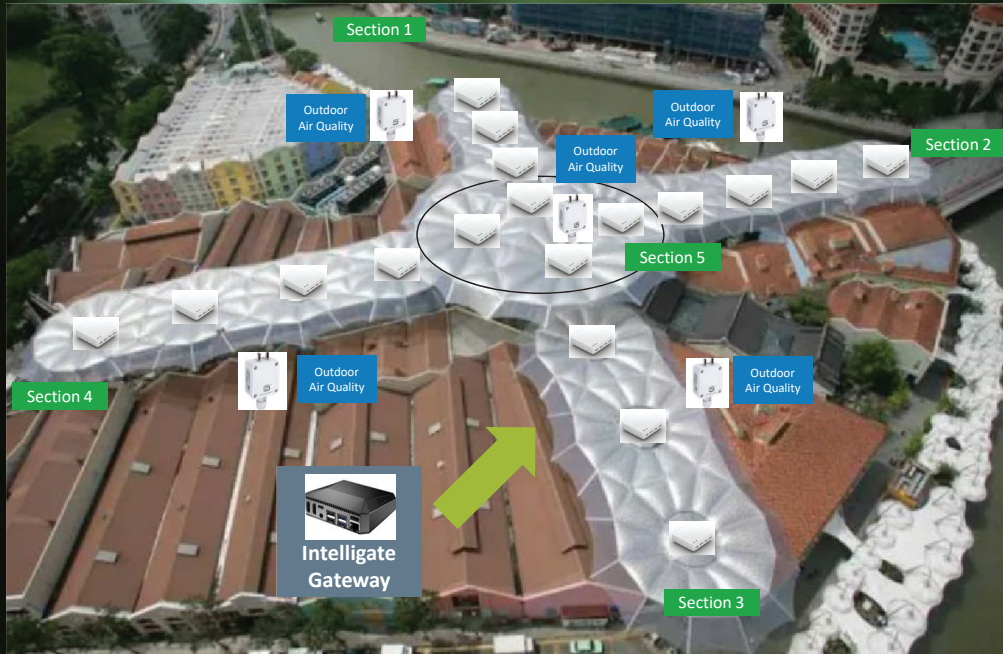
- Essential for obtaining information from ebm papst's EC Fans.
- Connect devices within a 20-50 meter line of sight range via WIFI Mesh.
- Ensure a stable input of different types of data from our EC Fans.
- Allows for a daisy chain of multiple fans to a single device.
- High-level Modbus sensors and devices can be seamlessly integrated via quick connections.

Device Specifications:

- Temperature (°C) sensor
 - Humidity (%RH) sensor
 - Carbon Dioxide (CO²) sensor
 - WiFi Interface with mesh capabilities
 - Fully integrated IoT processor
 - MQTT client (fully enabled IoT integration)
 - ModBUS RTU connection
 - 0-10V output controls
 - 5V-24V DC Power Supply
- * 4-20 mA analogue input (upon request)



WiFi Mesh Project Implementation



Proposed Solutions

- 18 Nos of EC Fan (W3GZ50)
- 5 Nos of Outdoor Air Quality Sensor
- 18 Nos of Mist Relay (DIO)
- 18 Nos of Intelligate Mesh
- 1 Mesh Gateway

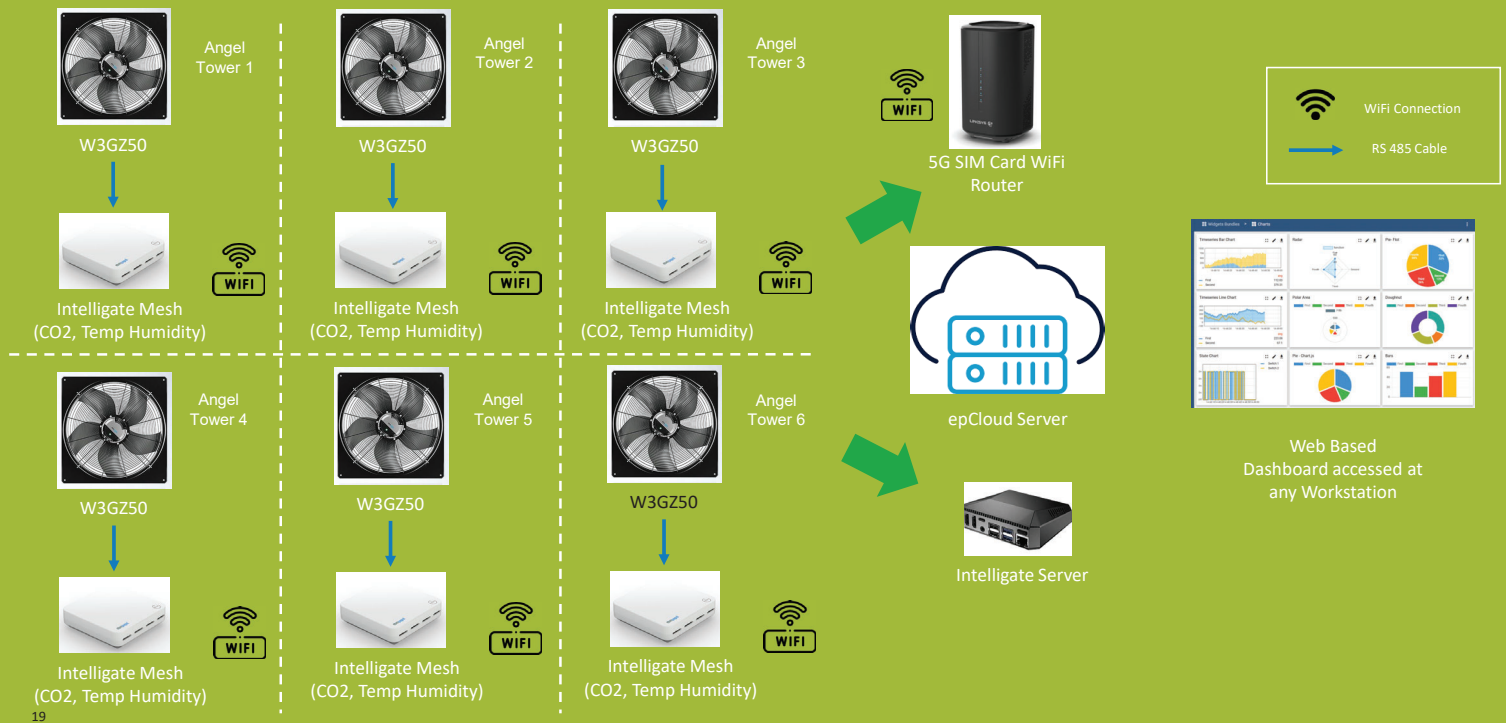
WiFi Mesh Project Implementation



Proposed Solutions

- 18 Nos of EC Fan (W3GZ50)
- 5 Nos of Outdoor Air Quality Sensor
- 18 Nos of Mist Relay (DIO)
- 18 Nos of Intelligate Mesh
- 1 Mesh Gateway

Proposed System Integration



Transport Facility (Singapore) – Demand Controlled Toilet Ventilation

Pain points

- Facility/toilets operate 24/7 → Significant energy is consumed
- Insufficient ventilation → Increased humidity & foul smells

Solution

- 1st Stage: Retrofit of AC centrifugal fans to EC RadiCube fan solution
- 2nd Stage: Implementation of IoT solution → Enables demand-controlled ventilation

Results

- Estimated energy savings of > 60%
- Humidity and foul smells are reduced due to the frequent air changes

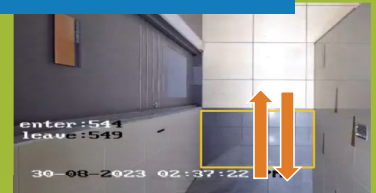


Controls



Analytics

+1 enter/leave count depending on direction of access



Intelligate Mesh:
Measures CO₂, Temp & Humidity



Control Logic
ACH = air change per hour

- 20 ACH at 30% speed for less than 5 people
- 25 ACH at 40% speed for 5 to 10 people
- 30 ACH at 50% speed for more than 10 people

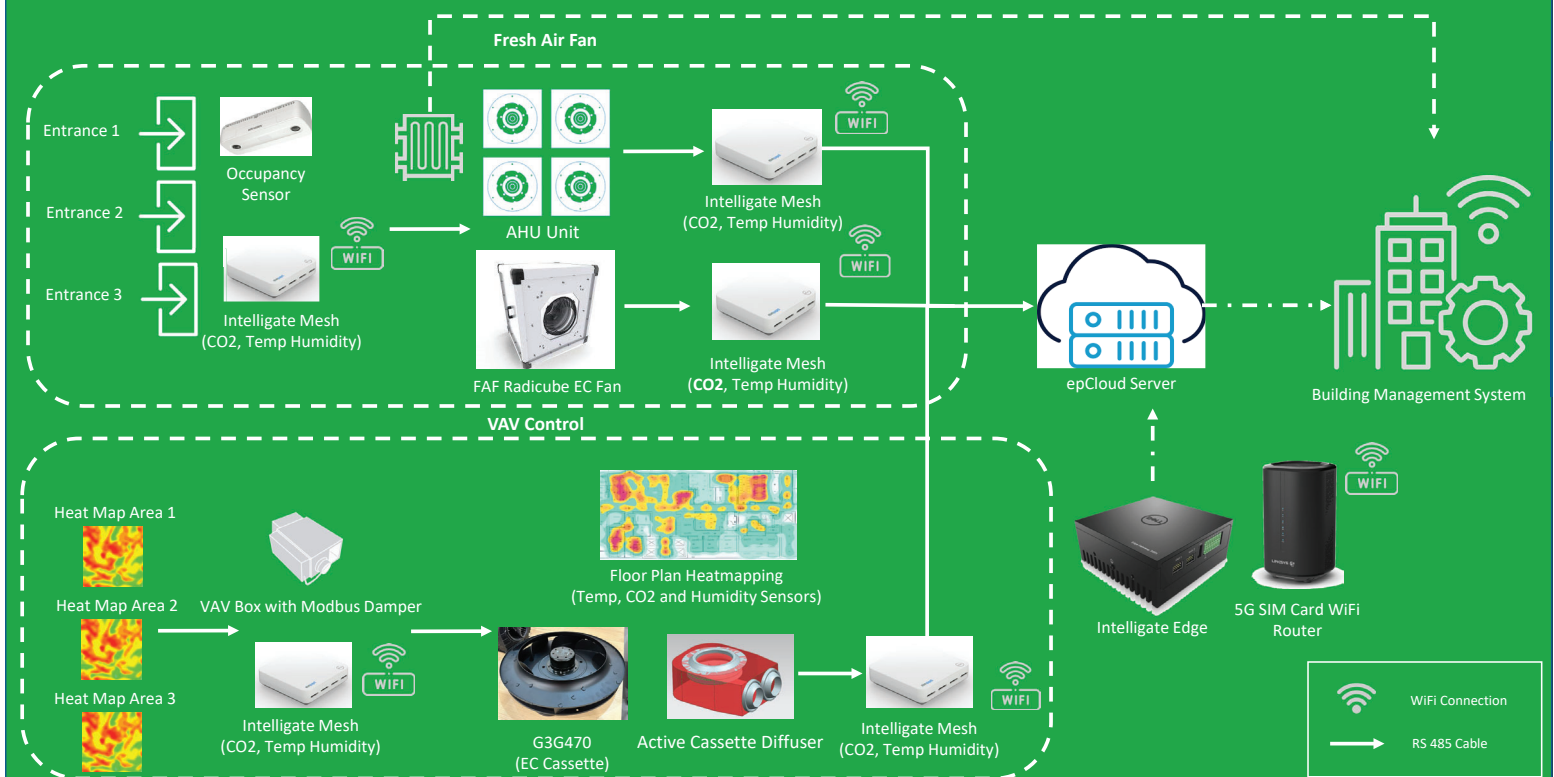


RadiCube fan speed is modulated based on control logic

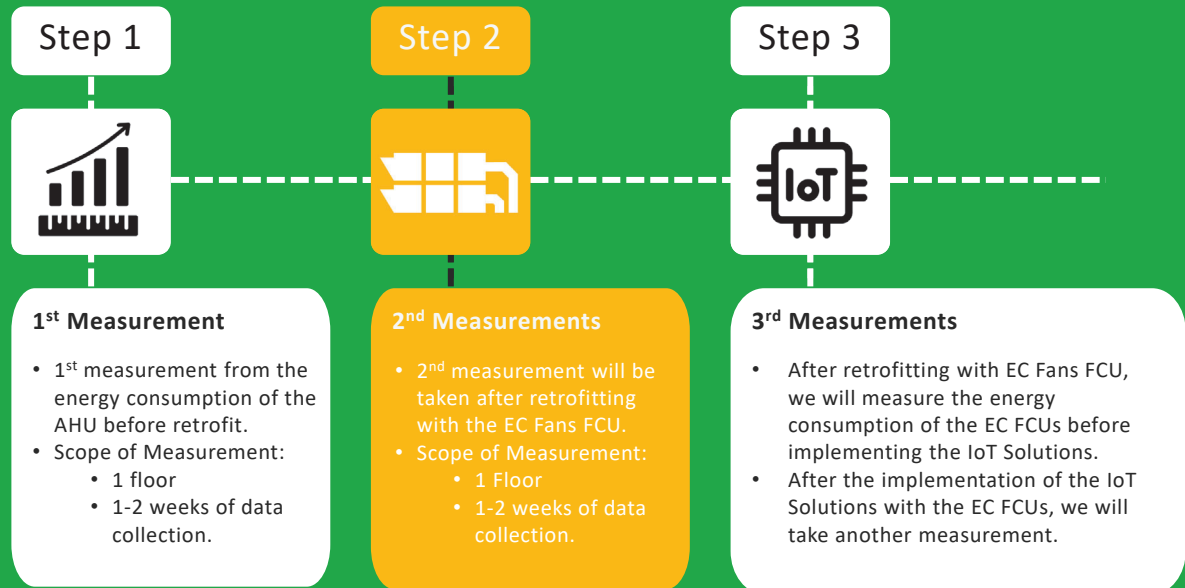
Proposed System Integration



Proposed Solution: On-Demand AHU Control System



Retrofit 1-2-3



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Achieving shared success with ebm-papst SEA

Benefits when working with ebm-papst

What advantages do we offer?



Advisors & Planners (Consultants)

Worldwide Support Network

Biggest EC Fan Portfolio

Shared Data is Verified by Third-Parties

Additional Support for Simulations



Installers (Contractors)

Speedy Lead Time

Hassle-free Installation

Special Equipment is not Required

Onsite & Remote Support

Trainings for Installation Staff



Property Owners

Top-tier Reliability

Impressive Energy Savings

SGBP-Certified

Rapid Return of Investment



Facility Management & Service Providers

IoT-ready

Predictive Maintenance

Fan Data is Accessible Remotely

Enable and Support Data Analysis

Continuous Optimization of System Efficiency

Thank you for your kind attention!

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