

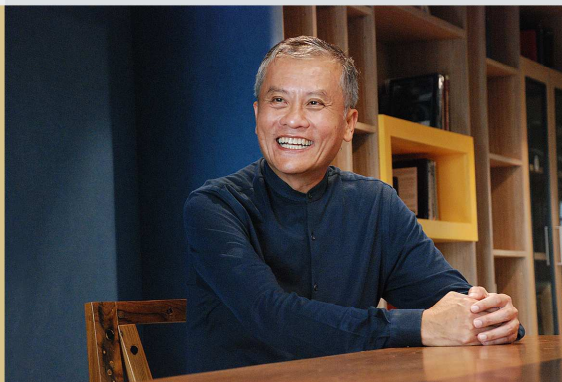
Air-conditioning 4.0



KECHA THIRAKOMEN

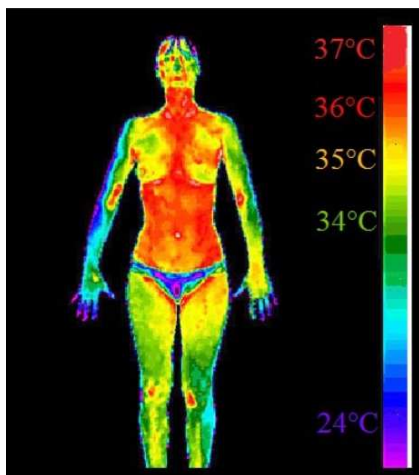
TGBI Smart city and Clean energy program manager, president of EEC, a group of Thai mechanical and engineering consulting engineering company.

He is a Fellow ASHRAE and Distinguished Lecturer. He has received Exceptional Air-conditioning Engineer Award from Air-conditioning Association of Thailand.

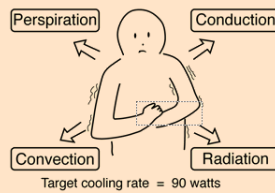




Body temperature



Convection Cooling of Body

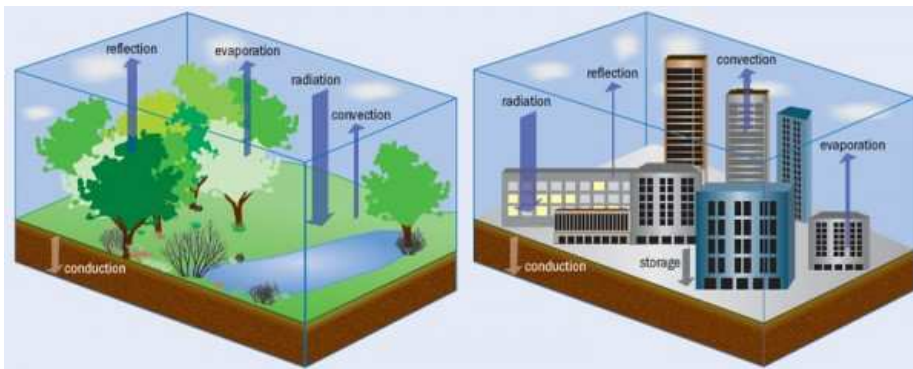


As one of the basic [heat transfer](#) mechanisms, [convection](#) involves the transport of energy by means of the motion of the heat transfer medium, in this case the air surrounding the body. The best approach to an estimate of heat loss by this mechanism may be to calculate the [heat loss by conduction](#) and to adjust the effective [wall thickness](#) used in the conduction calculation to take in to account the fact that air motion will strip away the heated layer surrounding the skin and increase the transfer of heat to the air.

[Modeling the cooling of the human body](#)

In estimating the effect of convection on the cooling of the body, it is lumped in with conduction. Together, they are not generally adequate for cooling.

1. Ambient micro-climate



2. Indoor climate



3. AC technology

Conventional Cooling

Conventional air conditioner

RADIANT COOLING

SKY SERIES

210µS vs 206µS 98%

100% Comfortable / Slightly comfortable

RADIANT COOLING FOR USERS' COMFORT COOLING

Conventional air conditioners are built to blow cold air downwards and directly at people to cool them instantly. However, when in direct contact with cold air for too long, some people experience discomfort and dry skin.

THE PRINCIPLE OF RADIANT COOLING

RADIANT COOLING: Heat is absorbed by the cool surrounding walls and ceiling, resulting in a cool feeling.

CONVENTIONAL COOLING: Heat is absorbed by the breeze on the skin, resulting in a cool feeling.

4. Ventilation

MDCC Fully-Integrated HOME INTELLIGENCE for Better Health

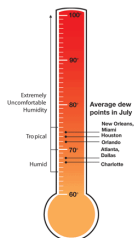
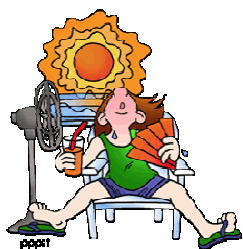
at 80% invisible danger BUT NOT AS MUCH AS CO₂ I AM DANGEROUS BUT NOT AS MUCH AS CO₂

Oxygen

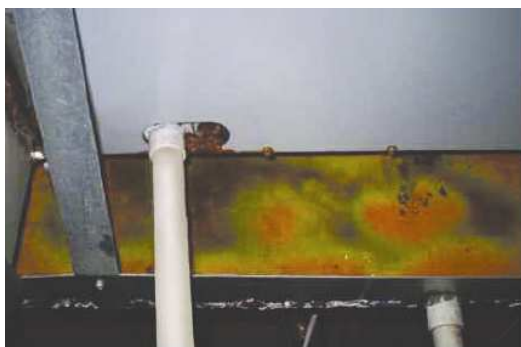
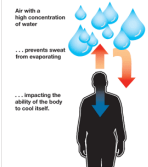
เพิ่มออกซิเจนในห้อง ด้วยเครื่องเติมอากาศ ERV

เพื่อนใหม่เป็นไปตามบริษัทกำหนด

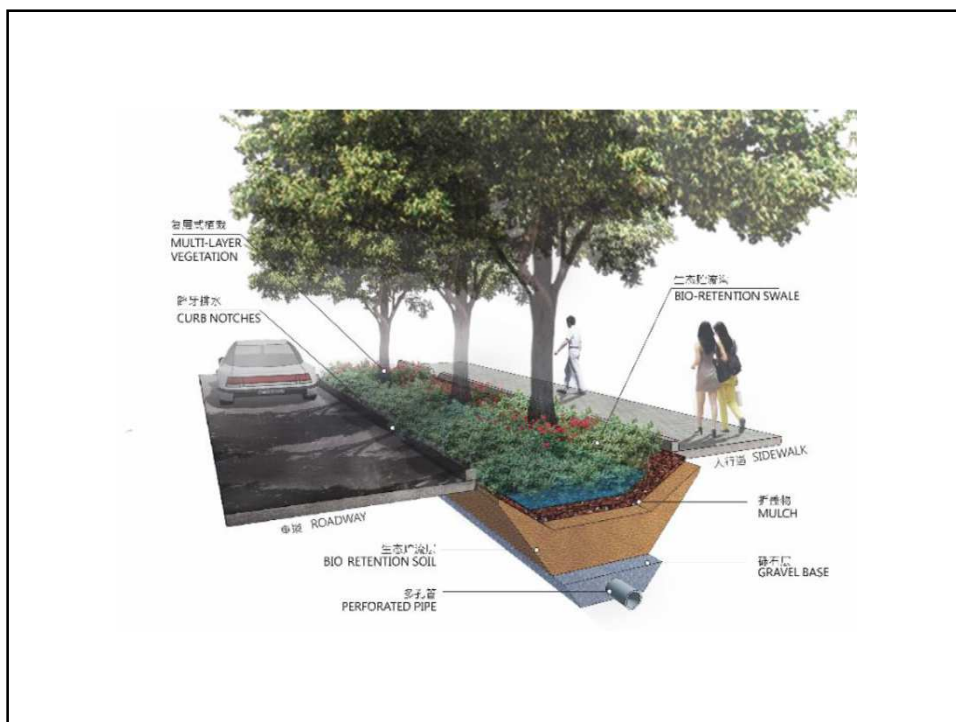
5. Humidity



Dew points and relative humidity (RH) affect the way your body perceives heat. Higher humidity levels can cause the atmosphere to feel much hotter than the actual temperature. So when the humidity is at its all, the thermometer can turn up the heat record and may feel cooler at a higher temperature. Even the outdoor thermometer can jump up to 6% on cooling coils for every degree the thermostat is turned up.



1. Ambient micro-climate



ต้นไม้ช่วยลด ปัญหาโลกร้อนได้อย่างไร??

คุณรู้หรือไม่ ?

ต้นไม้ใหญ่ 1 ต้น ดูดซับ คาร์บอนไดออกไซด์ได้ 11 กิโลกรัมต่อวัน นั่นคือลด คาร์บอนไดออกไซด์ CO2 เพิ่ม ออกซิเจน (O2) ได้ประมาณ 11 กิโลกรัมทุกวัน

ต้นไม้ที่ปลูกสูง 18-20 เมตร จะให้ร่มเงาและช่วยเย็นพื้นที่กับเครื่องปรับอากาศ 5 เครื่องทำงานคิดต่อวัน เป็นเวลา 20 ชม. ไม้ใหญ่ 1 ต้นลดและช่วยประหยัด ได้เงินมากกว่าค่าเครื่องปรับอากาศ 1 เครื่องเลยทีเดียว

ต้นไม้ที่มีประสิทธิภาพสูง ที่การสร้าง ออกซิเจน ลดอุณหภูมิ พืชธรรมชาติได้ดี จะมีลักษณะดังนี้

มีร่มเงาสูงชันในการแผ่ ร่มเงาในพื้นที่บริเวณกว้าง เป็นลักษณะใบดกและตั้งมุม ในอากาศได้ดี และมีพื้นที่ แลกเปลี่ยนก๊าซออกซิเจนมาก ตามไปด้วย

ต้นไม้ที่ชนะเลิศ ด้านการช่วยปรับปรุงสิ่งแวดล้อมโลก คือ ต้นจามร เพราะสร้างปริมาณก๊าซออกซิเจนสูงที่สุด ช่วยพอกก๊าซ CO2 ได้มากที่สุด สามารถช่วยกักน้ำใน (ใบที่หนาที่สุด) และทำได้ดีในสิ่งแวดล้อมที่ร้อนชื้น การปรับปรุงสิ่งแวดล้อมเช่นนี้เอง จากพื้นที่ในเมือง มีปริมาณไนโตรเจนสูง อีกด้วย

ต้นไม้ / ไม้ประดับ

CO2 11 กิโลกรัม ต่อวัน
O2 11 กิโลกรัม ต่อวัน

www.eec-academy.com สถาบันการเสริมรู้

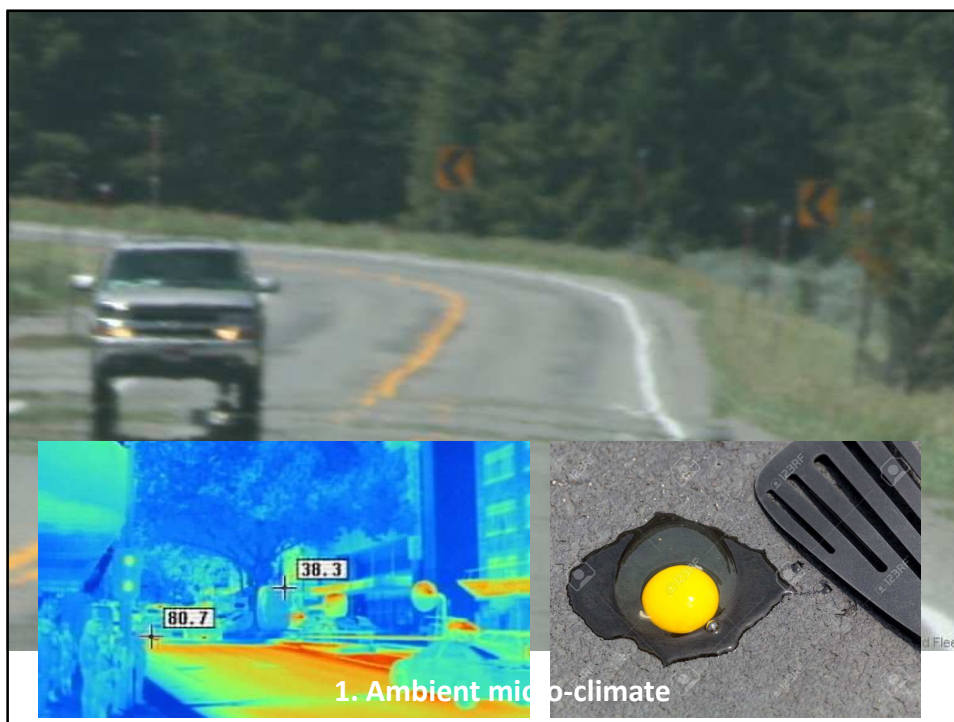
โทร 096-271-219, 02-026-9100-0
www.facebook.com/EECAcademy

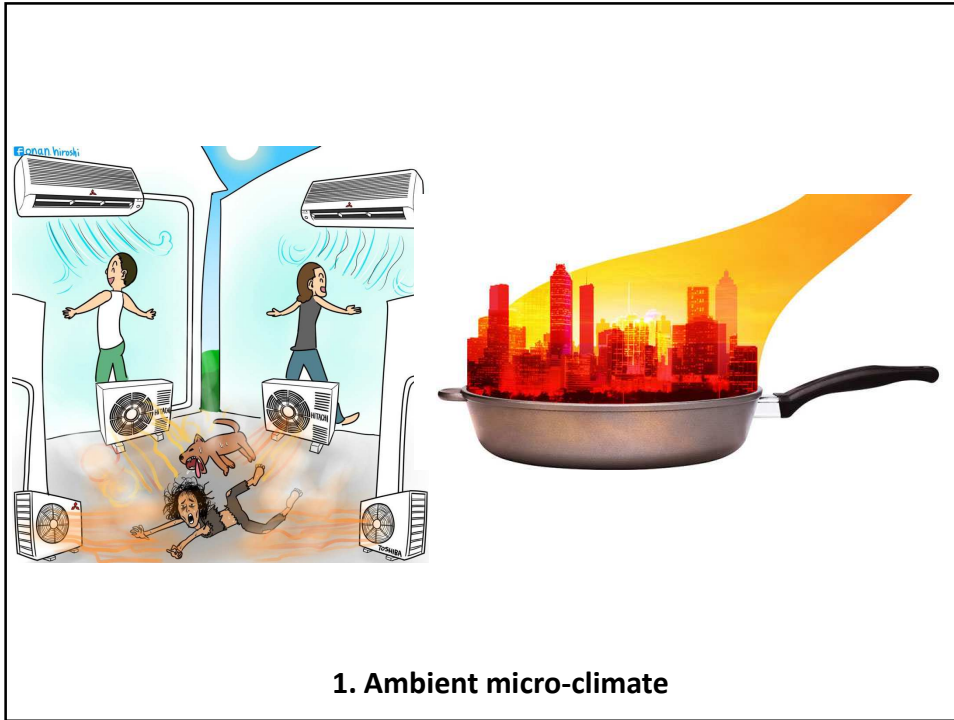
August 2010

October 2010


© All designs are copyright of Green over Grey™

1. Ambient micro-climate

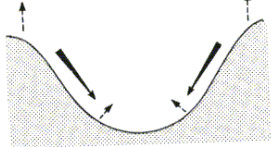




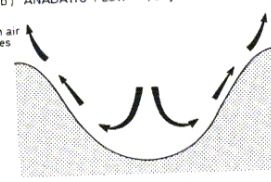
Advantages of Microclimatization



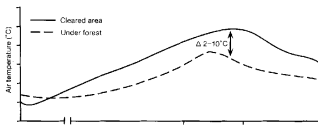
(a) KATABATIC FLOW (Clear night)



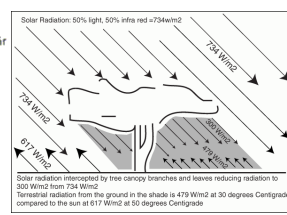
(b) ANABATIC FLOW (Day time)



→ Airflow - - -> Longwave cooling



— Cleared area
- - - Under forest
4.2-10°C

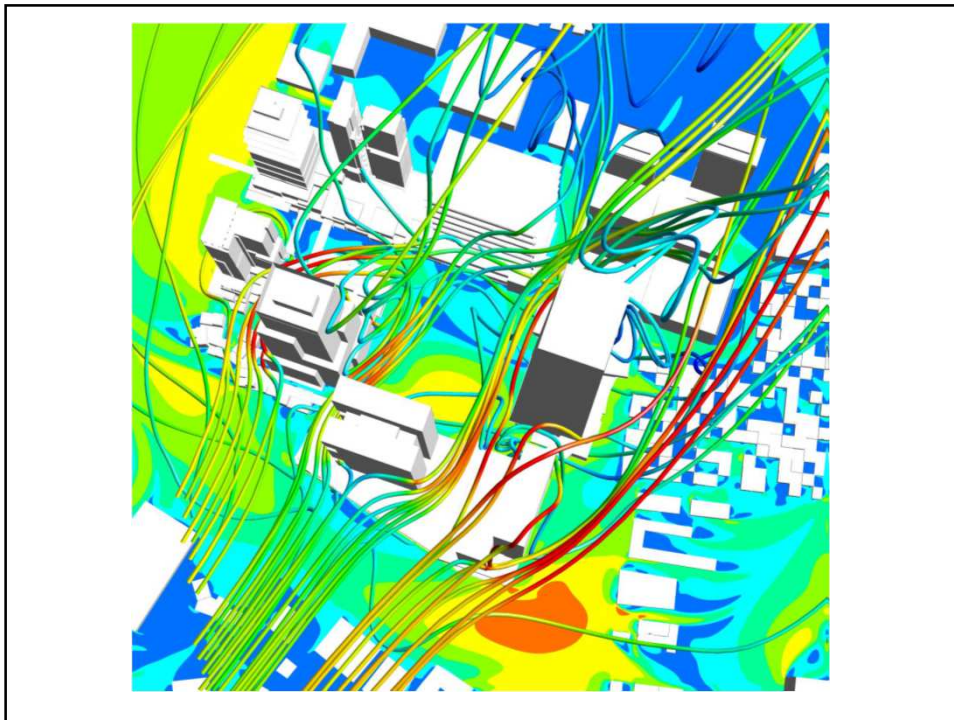


Solar Radiation: 50% light, 50% infra red = 724W/m²

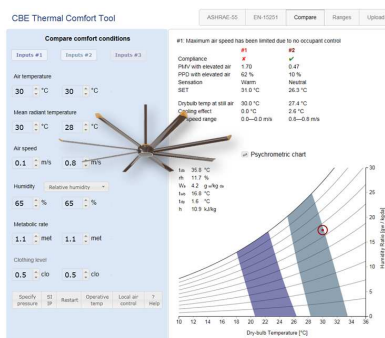
724 W/m² 724 W/m² 724 W/m²

617 W/m² 300 W/m² 479 W/m²

Solar radiation intercepted by tree canopy branches and leaves reducing radiation to 300 W/m² from 724 W/m²
Terrestrial radiation from the ground in the shade is 479 W/m² at 30 degrees Centigrade compared to the sun at 617 W/m² at 50 degrees Centigrade



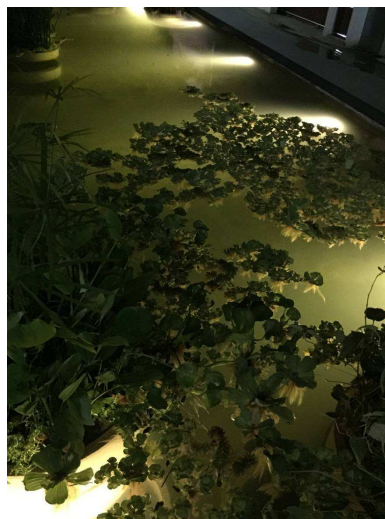
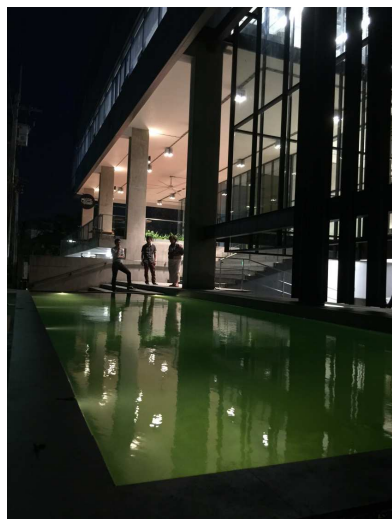
Natural comfort





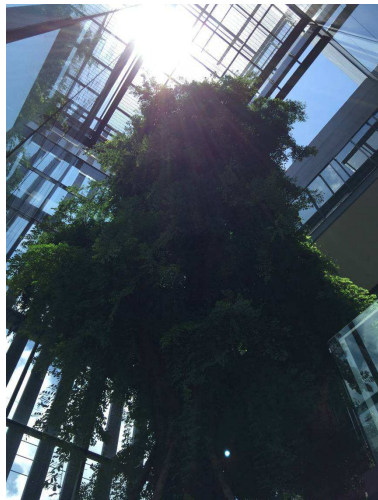


Night cooling storage & cool surrounding





Technology: natural ventilation



- Building cooling tower

Thermal comfort

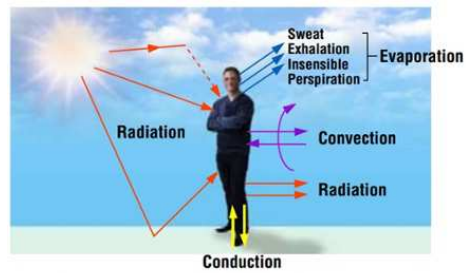
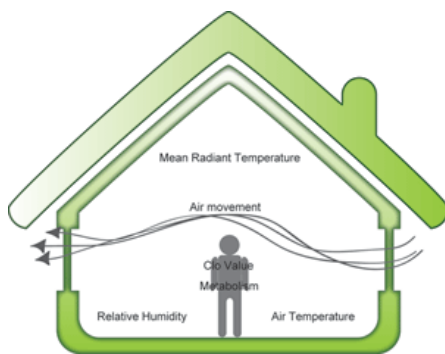
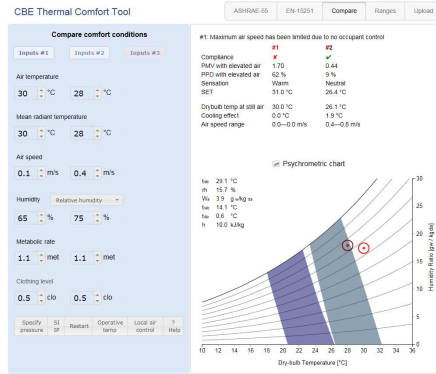


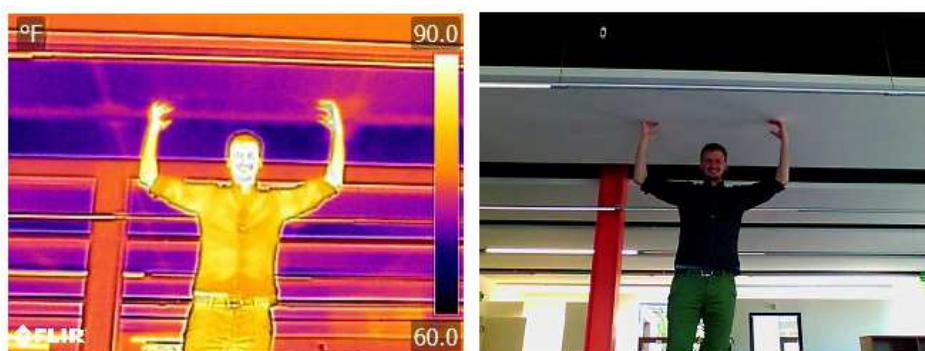
Figure 1: Components contributing to thermal comfort
Source: UC Berkeley Center for the Built Environment

2. Indoor climate

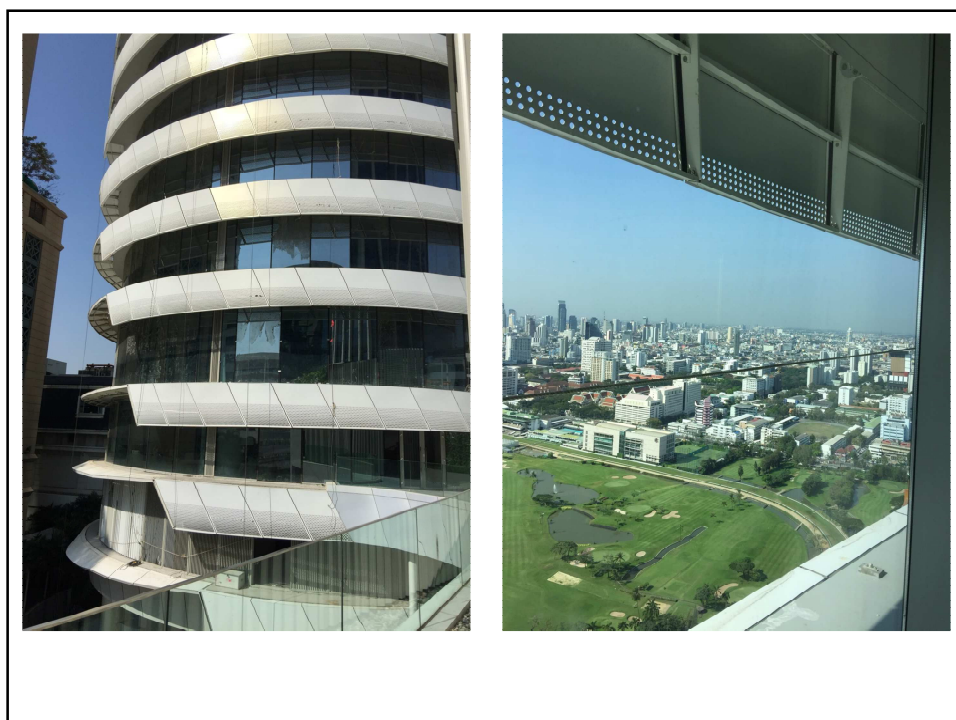
Heat capacity 500-700 watt-hour/m²

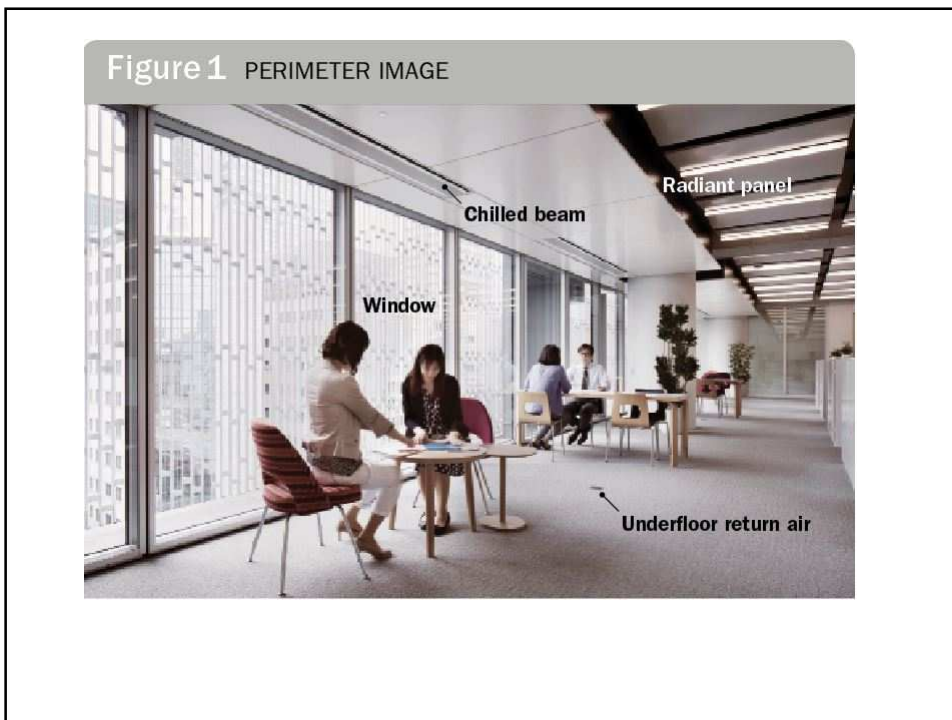
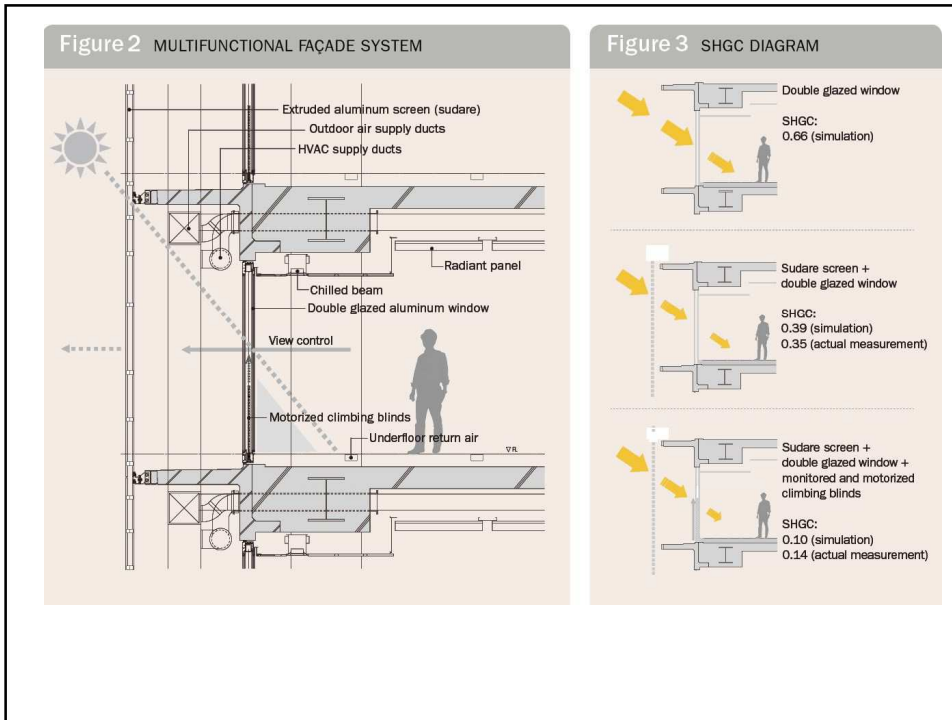


2. Indoor climate



2. Indoor climate







EEC ENGINEERING NETWORK
Value Creation

EEC –NEW OFFICE BUILDING 2

Moisture Resistance

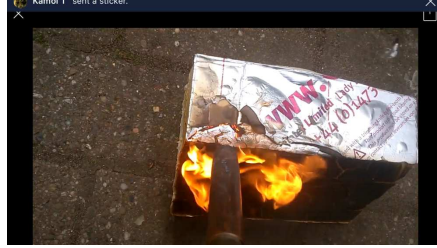
The insulation core of Kingspan KoolDuc® panels has 90% (or greater) closed-cell structure and is highly resistant to moisture penetration. In addition, the risk of moisture ingress is further reduced by the factory applied aluminium foil facings provide a high performance and impermeable barrier.

Thermal Performance

The thermal conductivity of Kingspan KoolDuc® panels is 0.021 W/m·K / 0.152 imperial units. A low thermal conductivity allows thinner insulation to achieve the same thermal performance as thicker insulation. The installed material thermal resistances (R-values) for the range of panel thicknesses are:

Thickness	R-value
22 mm / 7/8"	1.047 m ² ·K/W / 6.0 ft ² ·hr ² ·F/Btu
30 mm / 1 1/8"	1.428 m ² ·K/W / 8.1 ft ² ·hr ² ·F/Btu
33 mm / 1 1/4"	1.571 m ² ·K/W / 8.8 ft ² ·hr ² ·F/Btu

R=6



Product Description

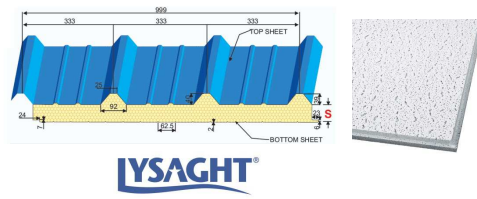
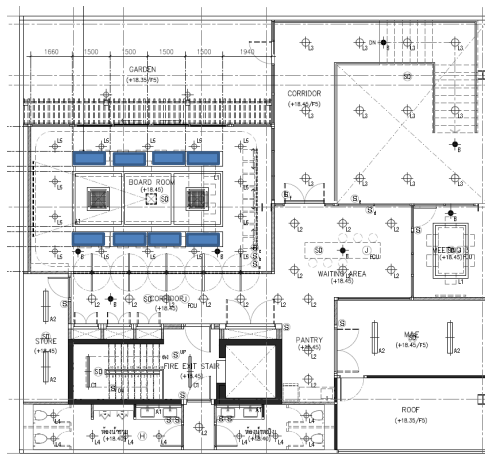
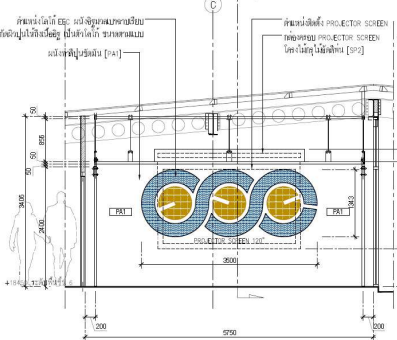
The Kingspan **KoolDuct**® System is an advanced and innovative high performance pre-insulated ductwork system comprising up to 4m long ductwork sections fabricated from CFC/HCFC-free rigid phenolic insulation panels with aluminium surfaces available in silver or black. It is particularly suitable for high specification projects that require durable materials to perform in moisture and hygiene controlled environments.

Kingspan KoolDuct® System vs. PIR

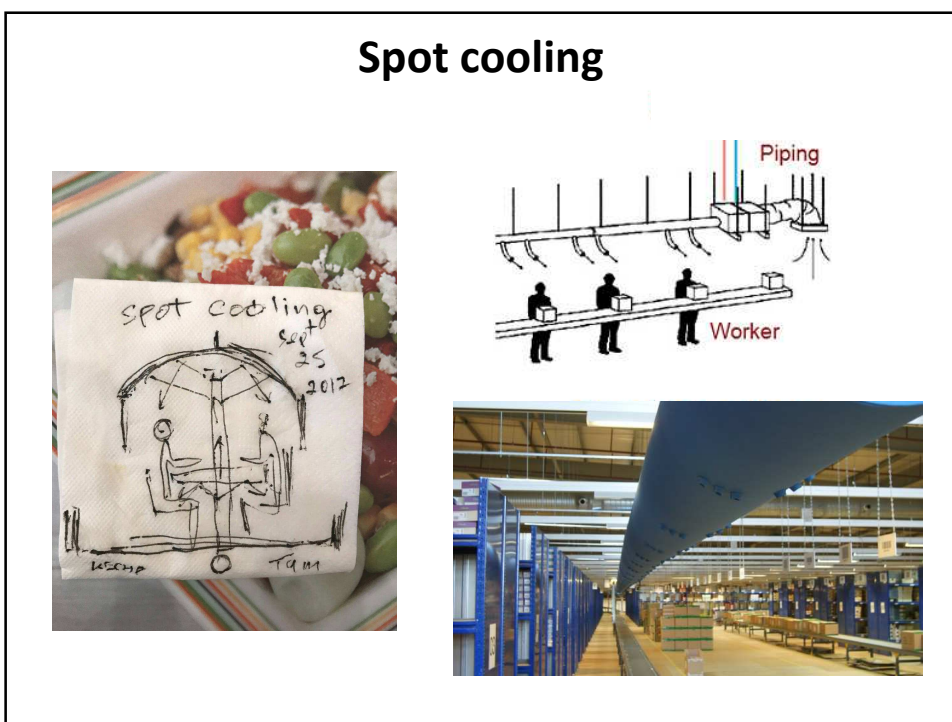
The Australian HVAC industry has been introduced to a number of PIR (polyisocyanurate) insulated ductwork products from both Asia and Europe that claim to deliver all the same benefits as the Kingspan KoolDuct® System. The reality is that in addition to key differences in the insulation core, there are some critical differences to consider when comparing the Kingspan KoolDuct® System to a PIR alternative.

Are you really comparing apples with apples?

PRODUCT PERFORMANCE		Kingspan KoolDuct®	PIR Alternative
Four Zero Fire Performance	AS 1530.3	✓	?
Fire Test Certification	UL 723	✓	✗
Fire Test Certification	UL 181 – Class 1	✓	✗
Fire Test Certification	AS 4254: 2002	✓	✗
Smoke Obscuration	<5%	✓	?
System Working Pressure (Continuous)	Max 1000pa	✓	?
Compressive Strength at 10% compression	200kpa	✓	?
Mean Air Velocity (Max)	20 m/s / 4000fpm	✓	?
Air Leakage Rating (System to SMACNA – Class 3)	<1%	✓	✗
Product Life Span	25+ years	✓	✗



YSAGHT



CUP : Natural power

SUSTAINABILITY

- Reduce electricity demand
- On-peak/off peak management
- District cooling/heating
- Chilled water storage
- On-site CHP
- Reclaim heat for hot water
- Central waste water treatment
- Recycle water plant
- Smart system
- CO₂ reduction/ GHG reduction
- Central laundry system
- Solid waste management

REDUNDANCY

- Engineering utility supplies
- On-site power generation
- 24/7 services

SAFETY

- Central fire water supply station
- Ring road fire hydrant
- Flood protection
- Central site security control
- Central site fire monitoring

COOL BASIN

- Eliminate heat dissipation in south plot
- Elevated Ring road as basin
- Tall buildings as ventilation tower





Less machines and equipment and O&M cost

How district cooling works



COOLING SOURCES
Free cooling from e.g. sea, lake, river or ground water etc. or renewables from e.g. wind farm

DISTRICT COOLING UTILITY
Combines cooling sources and produces chilled water.

COLD TOWER
Stores cooling to balance peak demand.

DISTRIBUTION NETWORK
Underground, insulated pipes carry the chilled water.

DELIVERY
District energy substations deliver the chilled water to a network of buildings.

APPLICATION
Commercial, retail and residential.

Temperatures: 7-10 °C (supply), 17-20 °C (return)



Residential & VRF Air-conditioning solutions



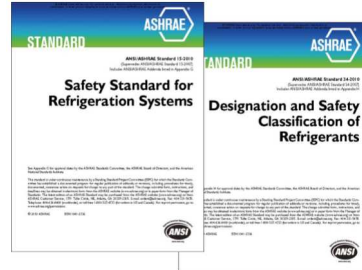
From water to space conditioning, VRF systems offer a wide range of options for air conditioning in residential and commercial buildings. They are designed to provide efficient and flexible cooling and heating solutions for multi-story buildings.

The flexibility of our products can already start at the design stage. Offering a wide range of capacities and configurations, we can offer a VRF system that perfectly fits your specific requirements.

According to the market requirements for commercial buildings, we have developed our VRF systems with a wide range of capacities and configurations, ensuring the highest level of efficiency and reliability.



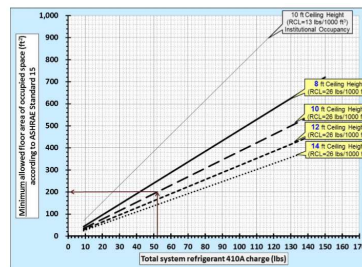

Variable Refrigerant Flow - VRF



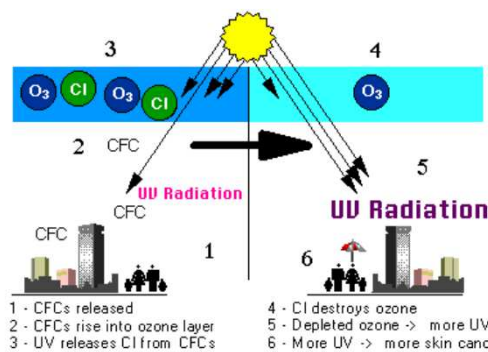
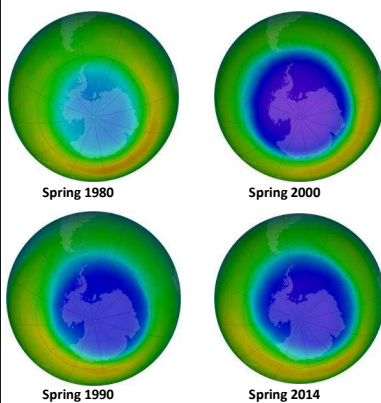
ASHRAE Standards 15 and 34 – Considerations for VRV/VRF Systems



RESIDENTIAL | LIGHT COMMERCIAL | COMMERCIAL



CFCs & HCFCs are Ozone Depleting Substances (ODS) leading to more UV-B dangerous radiation reaching earth



- The **Montreal Protocol** was signed in September 1987 for the phase-out of CFCs & HCFCs
- A return to the 1960s levels might take up to 2070

Image source: Ozonewatch - Nasa

VRF & Chillers Have Strengths in different segments



VRF Focus

Systems < 200kW
New but especially Retrofit
Mainly Installer / HVAC designer

Installer Value Preference

- Strong support from supplier
- Ease of installation
- Installation cost



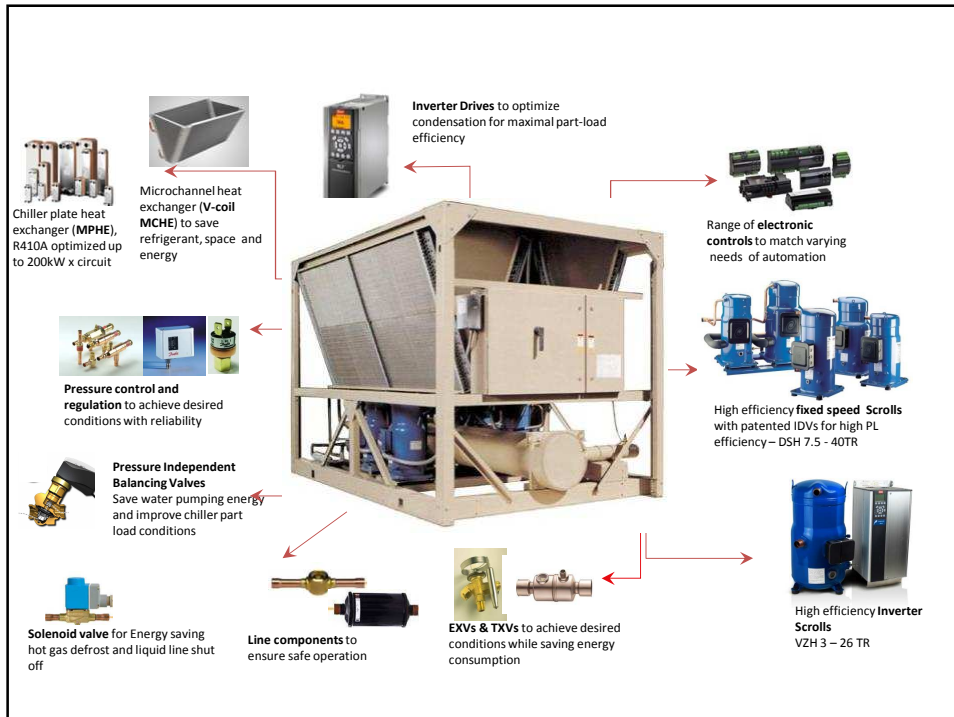
Chiller Focus

Systems up to several MW
New & Replacement
Consultants / HVAC designer

Consultant Value Preference

- Comfort (air quality)
- Ease of maintenance
- Open system architecture
- Operating costs

- VRF WW foreseen CAGR around **10%** (still regions with low penetration)
 - But serious challenges arising from focus on GWP / flammability of alt. refrigerants
- Chillers WW foreseen CAGR around **3%** (a more mature application)
 - But better positioned to be seen as „greener“ systems



Technology: modular chiller

A/C area 1750 m²



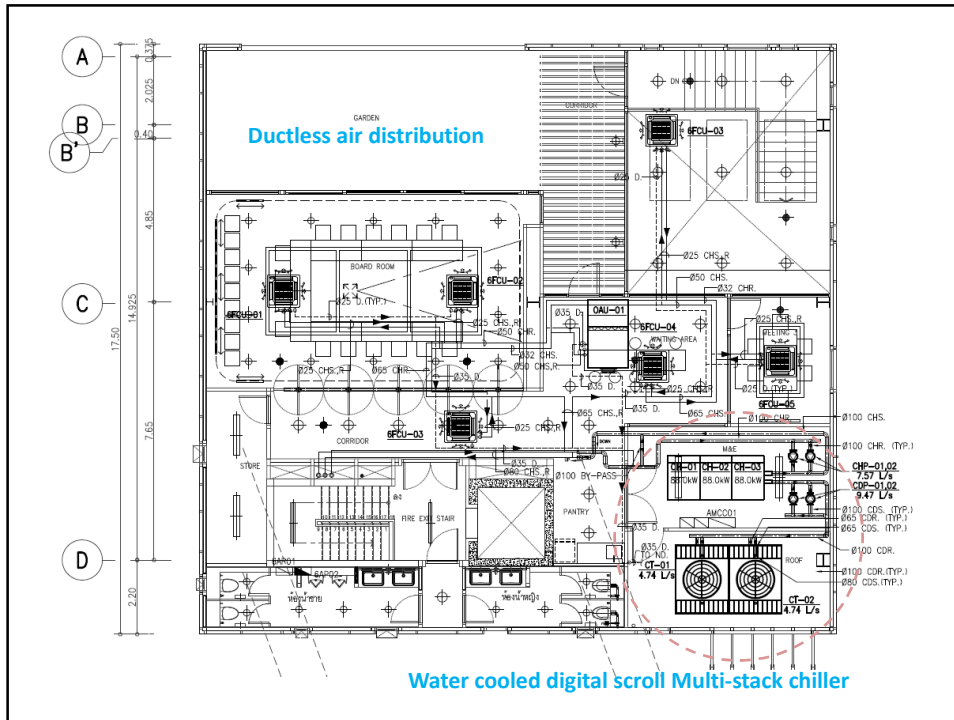
- Smart water cooled modular chiller
- COP = 6
- Limit environmental friendly refrigerant 410 a content
- FCU add on flexibility



Technology: fan less cooling tower



- Reduce heat island effect
- Avoid airborne pollution
- Non chemical water treatment



Water meter Digital Electricity meter BTU/h meter

Energy meter list

EEC 1st & 2nd floor, Green Companion, Stitch & Hammer

Electric meter list

MDB, DB 1st to 5th floor, Chiller plant, CBP pumps, Lift, Lighting/Outlet/HVAC for EEC office (3rd & 4th floor) WWTP

Water meter list

EEC 1st & 2nd floor, Green Companion, Stitch & Hammer, 1st WC, Rain water meter for irrigation and urinals



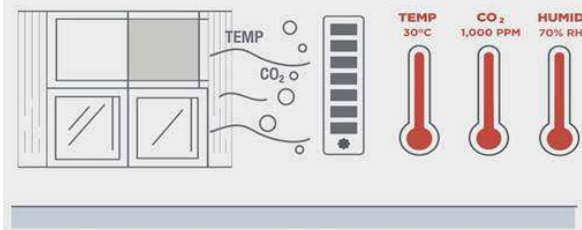
Technology: smart A/C system

CMS/FMS

EC ACADEMY

HEALTH & WELL-BEING

หากค่า CO₂ เกิน 1000 PPM หรือ อุณหภูมิเกิน 30°C หรือความชื้นสูงกว่า 70% ขึ้นไป ระบบระบายอากาศจะทำงานโดยอัตโนมัติ



ENERGY MEASUREMENT UNIT

ระบบ Energy Measurement Unit หรือ EMU จะแสดงการใช้พลังงานไฟฟ้า รายวัน รายเดือน รายปี และแสดงผลอัตโนมัติผ่าน Smart Devices

Expansion joints

RADIANT SYSTEMS

Underfloor heating and cooling systems

valsir
QUALITÀ PER L'IDRAULICA

125184 2123 Building_014_01

Working system

Press. max. 10 bar

CE/05/0817

1.2%

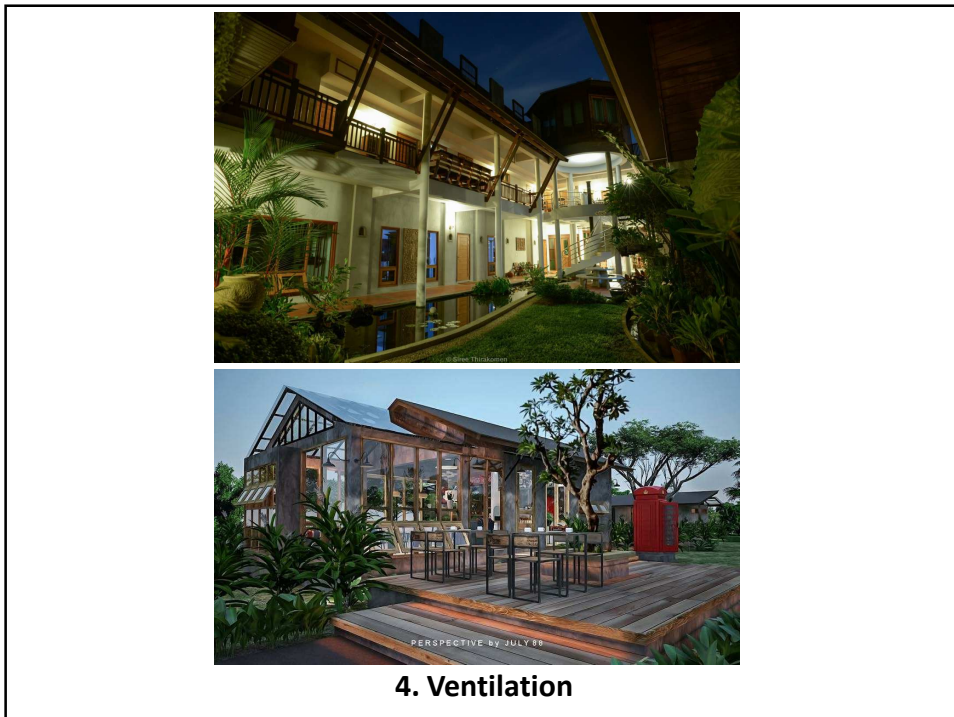
La progettazione è stata eseguita in conformità alle norme UNI EN 12663-2:2010 e UNI EN 12663-3:4-5:2010. Non è garantita la completezza funzionale dell'impianto nel caso in cui non siano rispettate scrupolosamente le specifiche tecniche e le istruzioni per l'installazione. Il Marchio Valsir è un marchio registrato Valsir.

Spessore	Pressione	Temperatura	Velocità	Spessore	Pressione	Temperatura	Velocità
10	10	10	10	10	10	10	10
15	15	15	15	15	15	15	15
20	20	20	20	20	20	20	20
25	25	25	25	25	25	25	25
30	30	30	30	30	30	30	30
35	35	35	35	35	35	35	35
40	40	40	40	40	40	40	40
45	45	45	45	45	45	45	45
50	50	50	50	50	50	50	50
55	55	55	55	55	55	55	55
60	60	60	60	60	60	60	60
65	65	65	65	65	65	65	65
70	70	70	70	70	70	70	70
75	75	75	75	75	75	75	75
80	80	80	80	80	80	80	80
85	85	85	85	85	85	85	85
90	90	90	90	90	90	90	90
95	95	95	95	95	95	95	95
100	100	100	100	100	100	100	100

1.2 What is radiant cooling?

It is a technology to cool buildings based on the sensible heat absorption through cold surfaces (radiant panels)

BATH EMPIRE



4. Ventilation

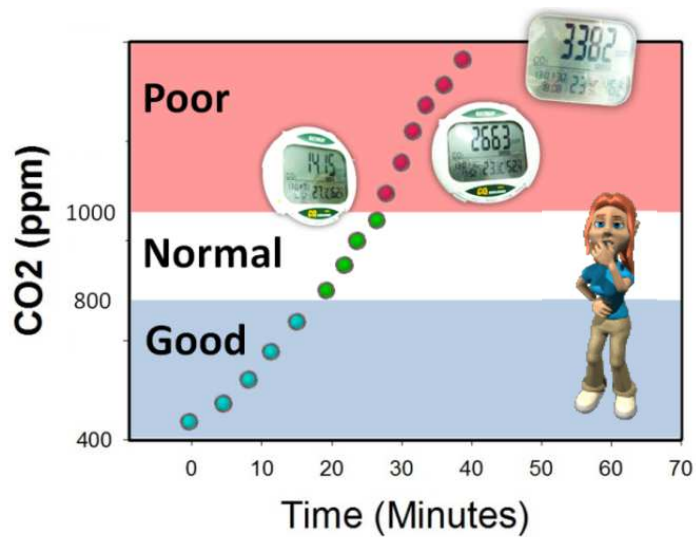
1st floor ventilation system

ERV heat recovery efficiency 70%



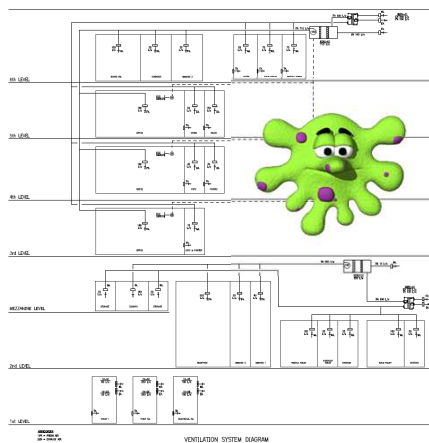
4. Ventilation

Green Building Guidelines

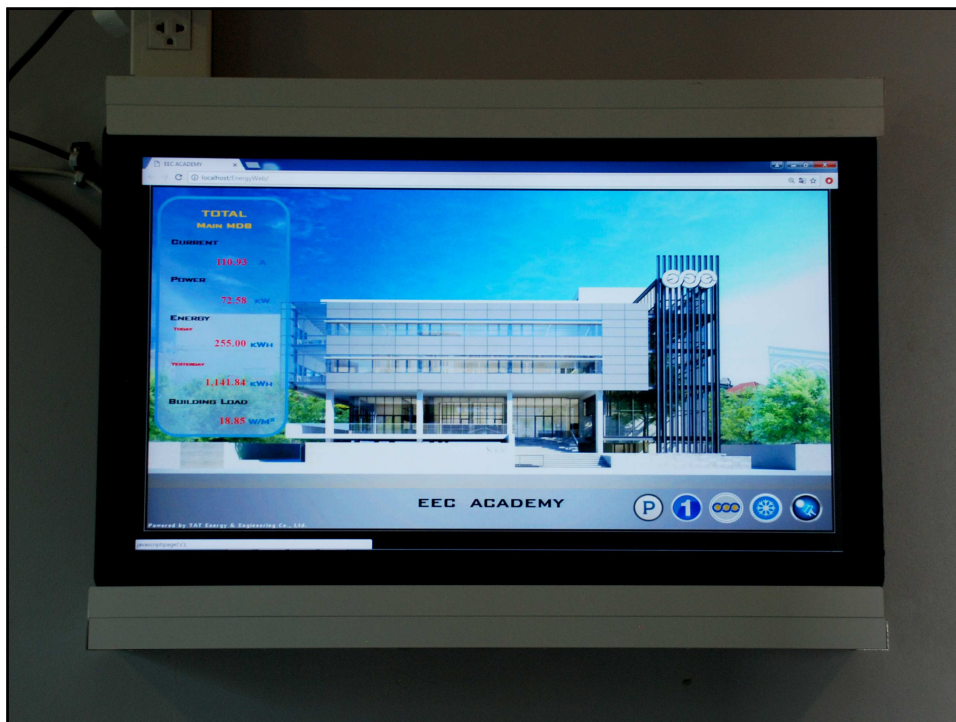


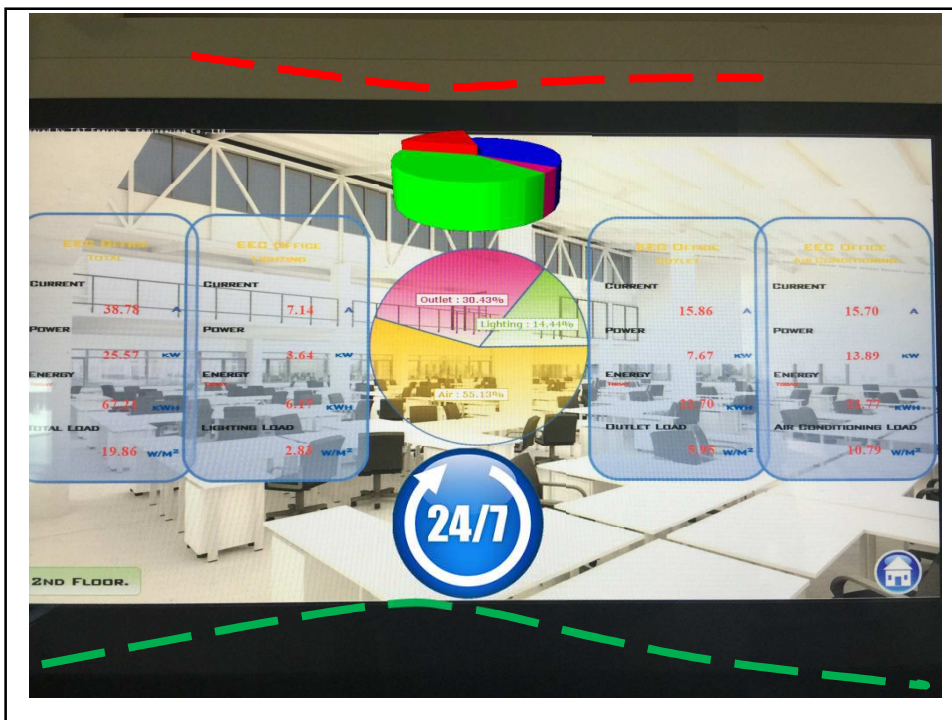
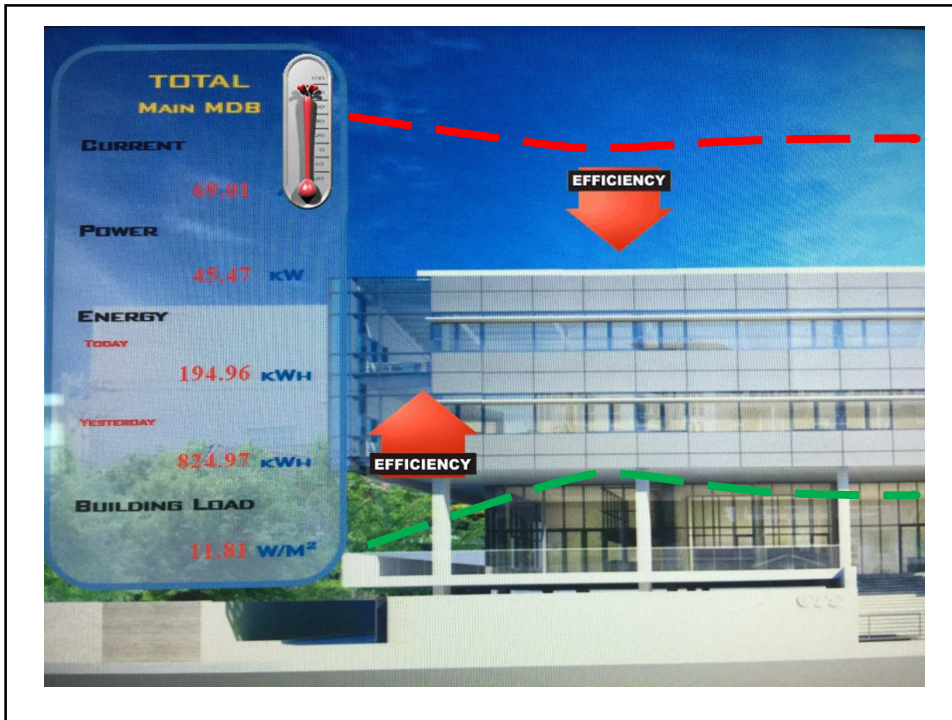


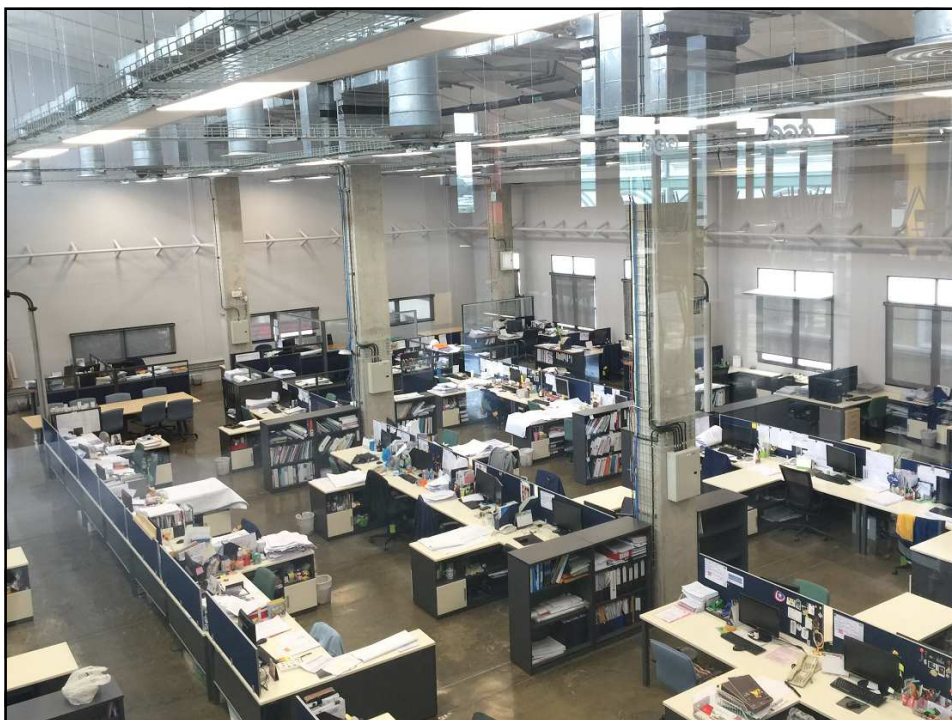
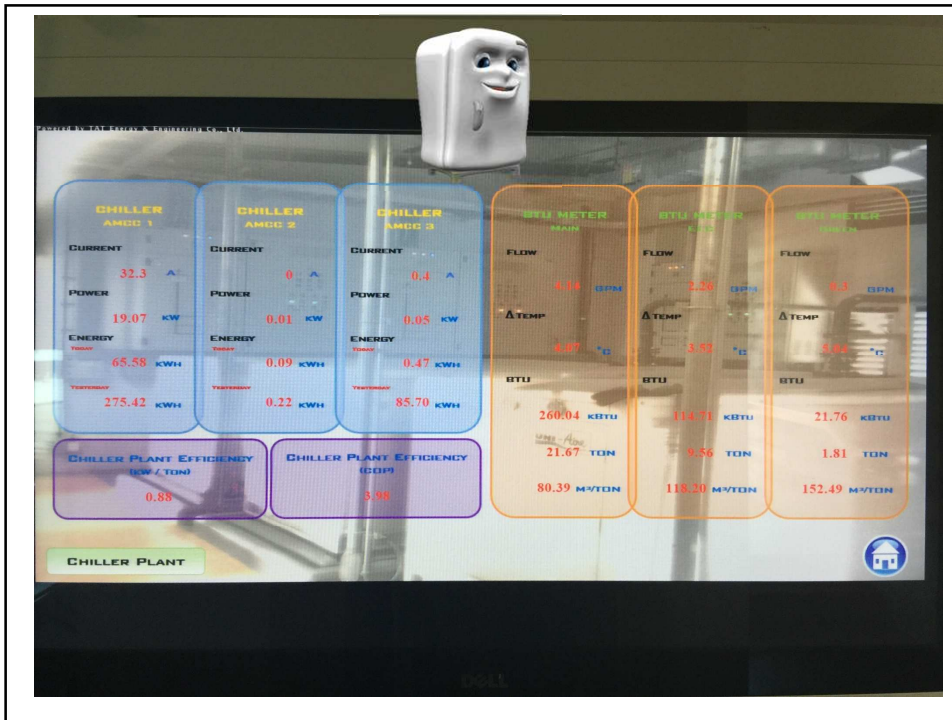
Background AC



5. Humidity







Technology: terminal AC unit



- Fan coil unit
- Cassette type unit
- Chilled beam unit

24/7

Indoor individual environmental control

