



Daikin Green Building Solutions
VRV System

Green Building Solutions



DAIKIN INDUSTRIES, LTD.

VRV is a trade mark of Daikin Industries, Ltd.
VRV Air Conditioning System is the world's first individual air conditioning system with variable refrigerant flow control and was commercialised by Daikin in 1982.
VRV is the trade mark of Daikin Industries, Ltd., which is derived from the technology we call "variable refrigerant volume."



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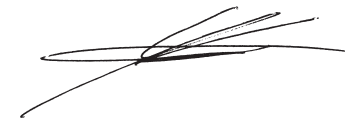
DAIKIN INDUSTRIES, LTD.

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Daikin and Our Commitment to Green Buildings



Yoshihiro Mineno

Senior Executive Officer
General Manager of the
Global Operations Division
Daikin Industries, Ltd.

Let me begin by thanking you for your interest in Daikin products. Air conditioners are now used in most countries, helping to make people's lives more comfortable and productive. However, we also cannot overlook the influence on climate change of their hydrofluorocarbon (HFC) refrigerants and energy consumption.

In October 2016, the Parties to the Montreal Protocol reached an historic agreement in Kigali, Rwanda at the 28th Meeting of the Parties. It provides for a phase down of global HFC consumption, in CO₂ equivalents, and is expected to significantly mitigate climate change. The agreement places importance on reducing CO₂ emissions by equipment from both a refrigerant and energy efficiency aspect.

As the only company producing both air conditioners and their refrigerants, Daikin is committed to mitigating the effects of climate change from both perspectives. We have, for example, been attempting to increase the ratio of highly energy efficient inverter products in countries where there is still relatively low penetration.

Many countries have also been working to address the issue by establishing rating systems such as LEED, BREEAM and Singapore's Green Mark. Air conditioning is just one factor in awarding certification. However, Daikin has consistently supported building owners, consultants and others by developing some of the world's leading air conditioning and control systems.

In this case book, you will find numerous examples of projects which have achieved high scores for green building labeling. As you will also see, these ratings would not have been possible without Daikin's assistance. We hope the cases provide inspiration for your future projects and look forward to offering the support you need.



What Is a Green Building?

Green buildings are carefully designed, built and operated to both reduce negative and increase positive impacts on our surroundings and environment. They deliver many benefits ranging from the preservation of precious natural resources to improvements in the quality of life of their occupants.

These buildings also incorporate various features which allow them to adapt to a changing environment over the course of their long lives. There are a number of specific characteristics which can make a building sustainable, including:



Efficient use of energy, water and other resources



Use of renewable energy, such as solar energy



Pollution and waste reduction measures, and the enabling of re-use and recycling



Good indoor environmental air quality



Use of materials that are non-toxic, ethical and sustainable



Consideration of the environment in design, construction and operation



Consideration of the quality of life of occupants in design, construction and operation



A design that enables adaptation to a changing environment

Notes: This description has been created with reference to information provided by the World Green Building Council (www.worldgbc.org).
Daikin has been a member of the council since 2015.

Main Green Building Rating Systems around the World

Green building rating system	Organisation	Location of headquarters
		URL
BEAM	Beam Society Limited	Hong Kong
		www.beamsociety.org.hk
BREEAM	BRE Global	Watford, U.K.
		www.breeam.com
CASBEE	The Japan Sustainable Building Consortium	Tokyo
		www.ibec.or.jp/CASBEE/english
DGNB	German Sustainable Building Council	Stuttgart
		www.dgnb.de/en
EEWH 綠建築標章	Taiwan Architecture & Building Center	Taipei
		www.tabc.org.tw
Green Building Design Label 绿色建筑评价标识	China's Ministry of Construction, MOHURD (Ministry of Housing and Urban-Rural Development)	Beijing
		www.mohurd.gov.cn
Green Mark	Singapore's Building and Construction Authority	Singapore
		www.bca.gov.sg
GRIHA	GRIHA Council	India
		grihaindia.org
Greenship	Green Building Council Indonesia	Jakarta
		gbcindonesia.org
Green Star	Green Building Council Australia	Sydney
		new.gbca.org.au/green-star
HQC	Alliance HQE-GBC France	Paris
		www.hqegbc.org/batiments/certifications
LEED	U.S. Green Building Council	Washington, D.C
		www.usgbc.org
LEED India	Indian Green Building Council	Hyderabad
		igbc.in/igbc
LOTUS	Vietnam Green Building Council	Hanoi
		vgbc.org.vn/en
NABERS	NSW Office of Environment and Heritage	Sydney
		nabers.gov.au
TREES	Thai Green Building Institute	Bangkok
		www.tgbi.or.th



Helping Sustainability-Conscious Facilities

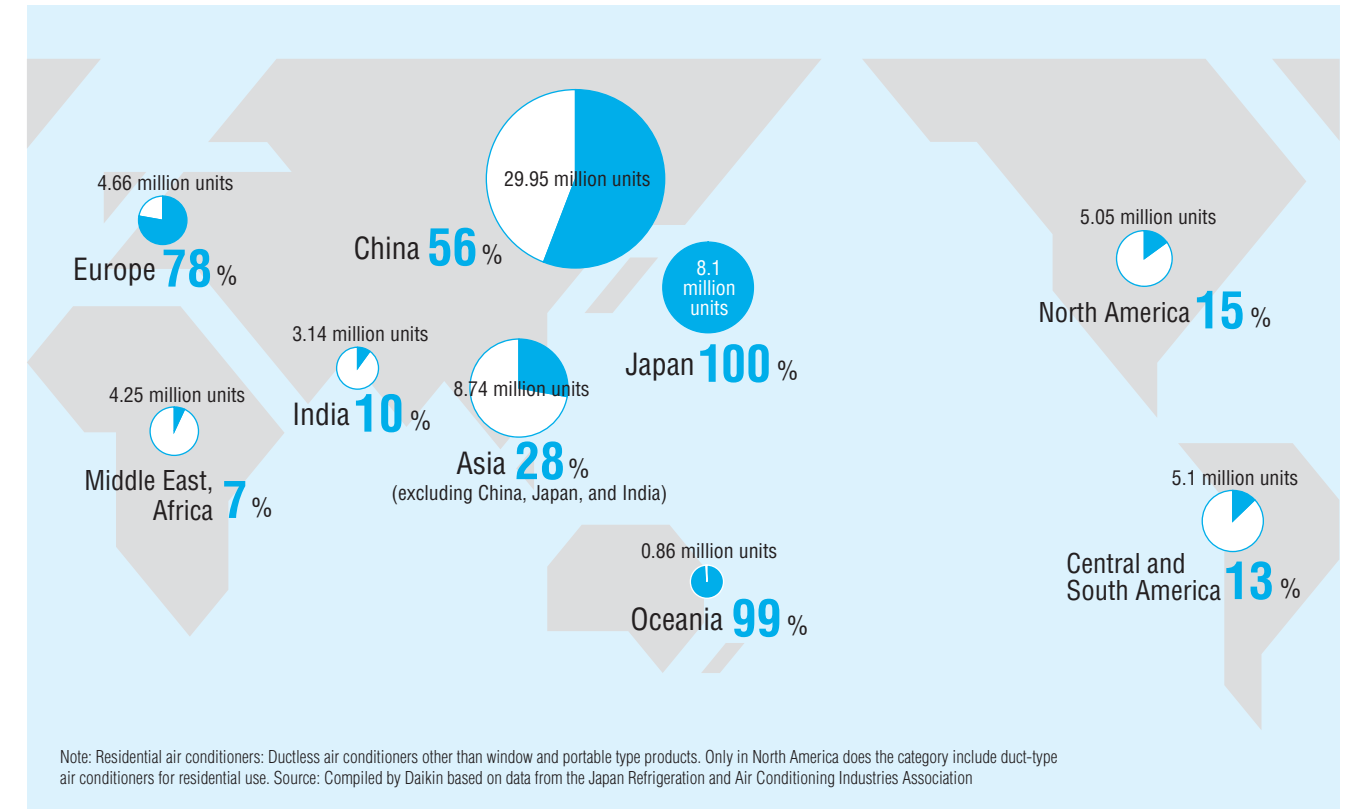
All **VRV** systems deliver significant energy savings and precise control. To maximise these benefits, Daikin provides highly efficient models for laboratories, educational institutions and other facilities which value sustainability.



Distribution of Inverter Technology

Inverter Products as Percentage of All Residential Air Conditioners Worldwide (2015)

■ Inverter models □ Non-inverter models
(The size of the circle is proportional to the demand for residential air conditioners.)



Prompt Counter Measures for Global Warming

Highly energy-efficient inverter air conditioners are ideal for emerging countries, which face problems such as severe energy shortages due to rapid economic growth and which must take prompt measures to deal with global warming. An inverter air conditioner is a product using inverter technology for controlling the voltage, current, and frequency of the air conditioning mechanisms. It consumes about 30% less electricity than a non-inverter air conditioner.

VRV System with Inverters

In 1982, Daikin incorporated inverters into **VRV** multi-split air conditioning system for buildings to achieve capacity control from 0 to 100%. This resulted in operation that was neither excessive nor insufficient during partial load operation, which occupies the greater part of operation time. Consequently, both comfort and energy savings increased significantly.

Your Best Partner for Green HVAC Solutions

Daikin has consistently supported the growth of the green building industry by developing some of the world's leading air conditioning and control systems.

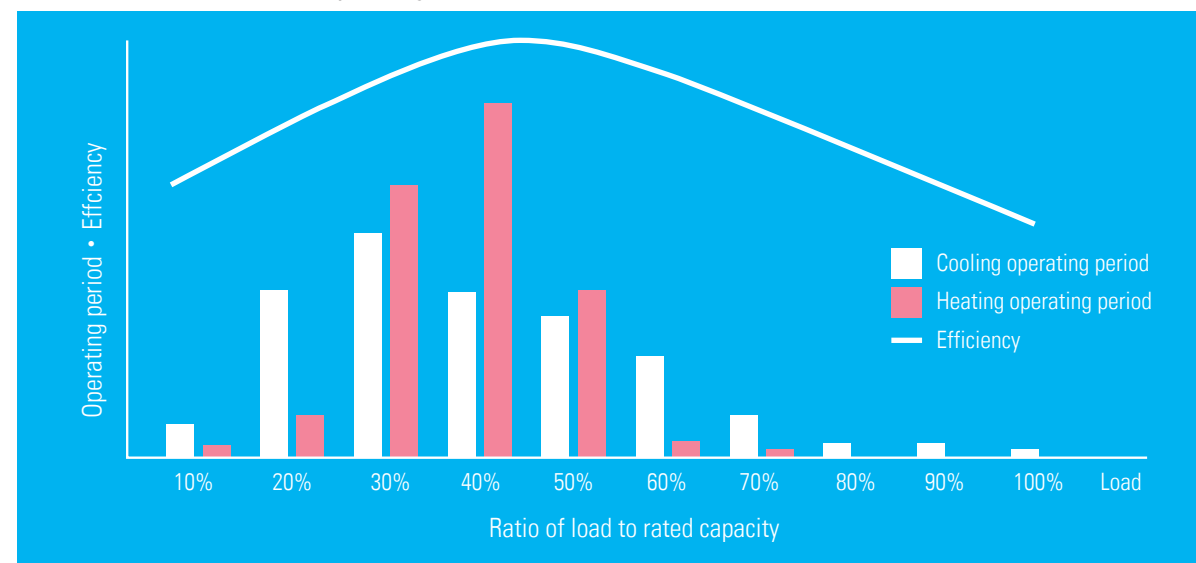


High Efficiency during Partial Load Operation

Partial load operation refers to operation with a load of less than 100%. It usually occurs when there is only a small difference between the outdoor temperature and air conditioner's set temperature. This type of operation accounts for approximately 90% of the annual running time of air conditioning units¹.

To boost efficiency during these periods, **VRV** systems feature DC Inverter technology such as our Reluctance DC motor. We were the first to use this type of motor with a scroll compressor in commercial systems². Compressors are core components and their performance is directly linked to the motor.

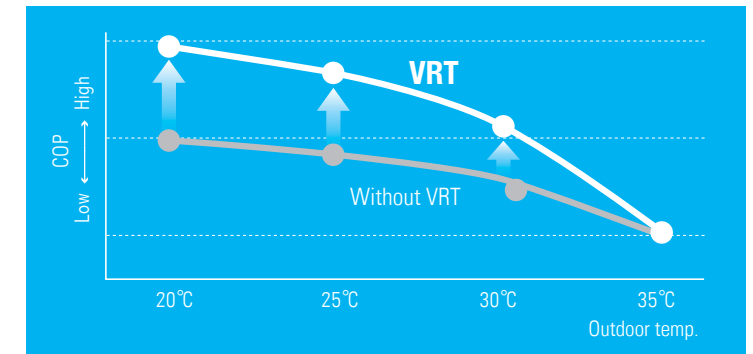
Relation between Load and Operating Periods¹



Notes: 1. This is an in-house analysis created using mass operating data from Japanese office buildings equipped with Daikin systems.
2. Daikin's achievement was recognised by the Institute of Electrical Engineers of Japan at the 54th Academic Promotion and Technical Development Awards in 1998.

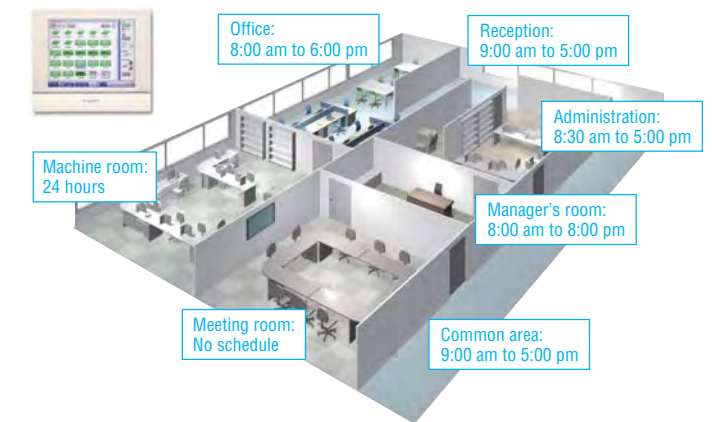
Variable Refrigerant Temperature (VRT)

Daikin's VRT technology automatically adjusts refrigerant temperatures to individual environmental requirements, improving both energy efficiency and comfort. During cooling, the evaporating temperature is raised as close as possible to the condensing temperature. During heating, the opposite occurs. This means the compressors work less, reducing power consumption.



Automatic Control Systems

Automatic control refers to the ability to customise and schedule operations such as startup and shutdown based on how users actually apply air conditioning. This technology helps to optimise operation and cut wastage while maintaining comfort. It is particularly useful for further increasing efficiency during already highly efficient periods of partial load operation.

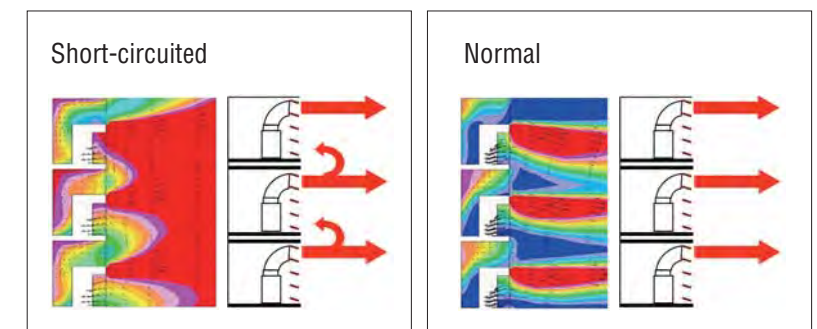


Engineering Support

VRV Xpress This software enables engineers to optimise equipment selections so they can design the most effective, low cost systems possible. It also allows them to choose outdoor units based on peak loads, rather than the sum of the required capacities for each indoor unit. This fine-tuning helps to reduce system sizes and increase efficiency.





DT-FLOW II Heat tends to accumulate on the upper levels of high rise buildings when outdoor units are installed on each floor. As well as tripping circuit breakers, this can decrease capacity and even damage units. With DT-FLOW II, engineers can perform precise airflow simulations which allow them to optimise outdoor unit layouts during the design stage.







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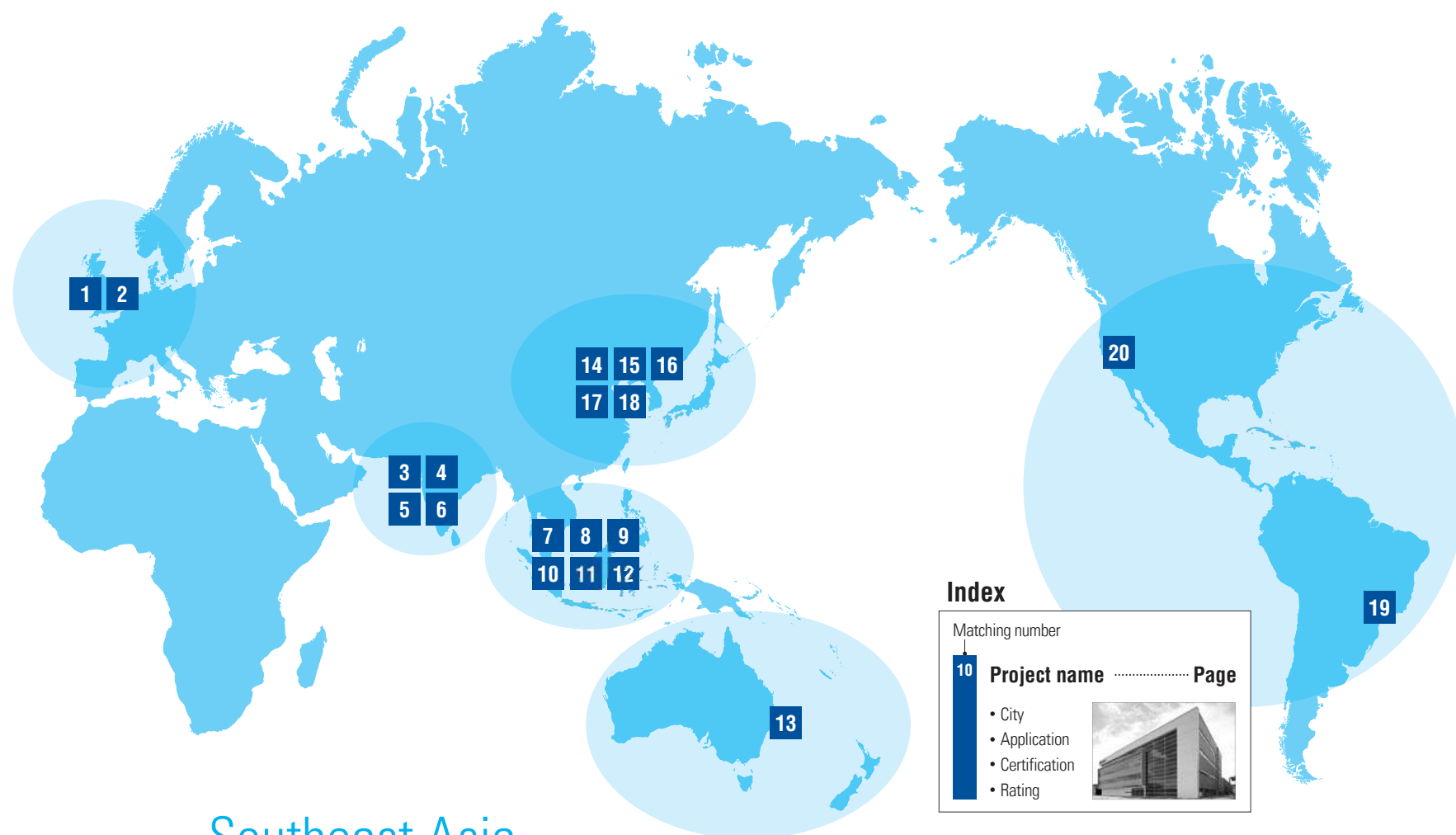
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TREES

Platinum	61 and above
Gold	46 to 60
Silver	38 to 45
Certified	30 to 37

Project Outline

Location	Nonthaburi, Thailand
Number of floors	16
Total floor space	25,350 m ²
Construction	2014
Application	University
Further details	www.cpall.co.th www.tgbi.or.th

Daikin Systems Installed

- Air conditioning systems
VRV III cooling only type outdoor units x 84
- Control systems
intelligent Manager
Power Proportional Distribution (PPD)

Project Overview

CP All Public Company Limited holds an exclusive licence to operate Seven Eleven convenience stores in Thailand. Its Bangkok training centre, CP All Academy, incorporates a wide variety of meeting rooms as well as an auditorium which can accommodate large numbers of management and employees of the convenience stores.

All parts of the facility have been carefully designed for enhanced energy efficiency and sustainable use. A high priority has also been placed on creating a comfortable environment for users. This includes the construction of a lounge area specifically for trainees.



Why VRV?

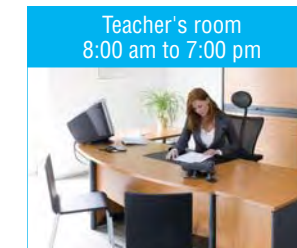
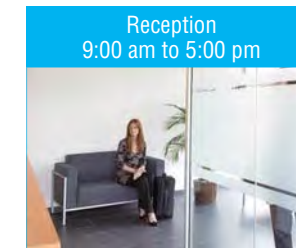
Centralised Control for Energy Savings

Daikin's intelligent Manager is an advanced multi-zone controller which provides a highly cost-effective solution to managing VRV systems. Its operational scheduling helps to significantly reduce energy wastage while maintaining user comfort.

- Daily operation based on start/stop times in individual zones
- Holiday setting
- Automatic switching to cooling, heating, fan operations



Individual Scheduling of Operations

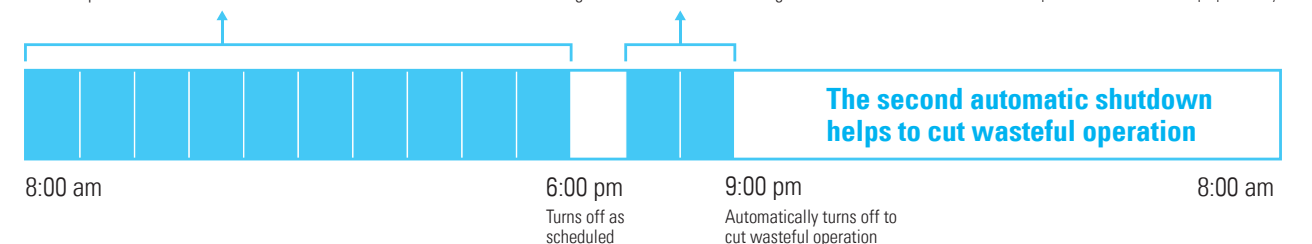


These pictures are for illustrative purposes only.

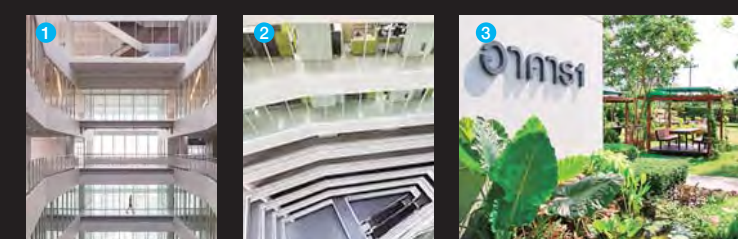
Automatic Shutdown of Units



These pictures are for illustrative purposes only.



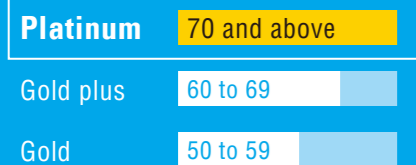
Contribution of Landscape and Indoor Environment to TREES Score



- 1 Skylight admits abundant natural light in corridor area. Low emissivity windows control temperatures.
- 2 Atrium promotes cooling and natural ventilation. CO₂ sensors help to maintain air quality.
- 3 Green area beautifies over 50% of open space. Rainwater use and flush saving conserve water.



Green Mark



Certification Document



Project Outline

Location	Singapore
Number of floors	2
Total floor space	1,002 m ²
Construction	2016
Application	Offices and laboratories
Further details	www.ies.org.sg

Daikin Systems Installed

- Air conditioning systems
 - Outdoor units (total capacity of 50 HP)
 - VRV** IV cooling only type x 5,
 - VRV** III cooling only type x 2
 - Indoor units
 - Ceiling-mounted cassette type round flow x 29,
 - Ceiling-mounted cassette type compact multi flow x 5
- Control system
 - intelligent Touch Manager

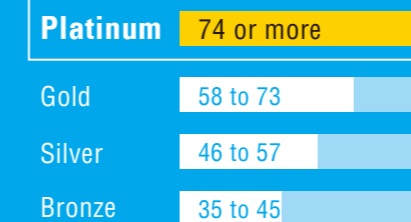
Project Overview

The Institution of Engineers, Singapore (IES) was formally established in 1966 as the country's national society for professionals in the field. It is Singapore's premier engineering body and is often called upon by the government and other organisations to provide feedback on related matters.

IES is actively involved in promoting zero-energy buildings via its Prestigious Engineering Achievement Awards. The prizes recognise accomplishments which demonstrate outstanding engineering skills and have made a significant contribution to progress and quality of life in Singapore.



Greenship



Certification Document



Project Outline

Location	Jakarta
Number of floors	3
Total floor space	2,600 m ²
Construction	2015
Application	Offices
Further details	www.dusaspun.com

Daikin Systems Installed

- Air conditioning systems
 - VRV** III cooling only high COP type outdoor units x 12,
 - indoor units x 46
- Control systems
 - intelligent Touch Controller

Project Overview

PT. Duta Sarana Perkasa (DUSASPUN) is one of Indonesia's leading manufacturers of steel reinforced concrete pipes and associated precast concrete products. The DUSASPUN office emphasises the group's commitment to building for a sustainable future. It is one of only two buildings to be awarded the prestigious platinum rating by Green Building Council (GBC) Indonesia as of May 2017.

Why **VRV**?

High COP Type

VRV III with the high COP type outdoor units were an important factor in meeting the requirements of the Greenship Energy Efficiency and Conservation category and also in achieving GBC Indonesia's platinum rating.

Why **VRV**?

Showcase Near-Zero Energy Building

IES's near-zero energy building showcases a state of the art structure and the latest sustainable construction technologies. Its **VRV** IV air conditioning system operates at a partial load efficiency of approximately 0.74 kW/RT or below.



Project Outline

Location	Manila
Number of floors	30
Total floor space	67,188 m ²
Construction	2016
Application	Offices

Daikin Systems Installed

- Air conditioning systems
 - Outdoor units (total 2,200 HP)
 - VRV IV** cooling only type x 184
 - Indoor units
 - Ceiling-mounted cassette type double flow x 56,
 - Ceiling-mounted cassette type round flow x 835,
 - Ceiling-suspended type x 5,
 - Ceiling-mounted duct type x 21
- Ventilation
 - Heat reclaim ventilation units x 77

LEED

Ore Central still holds the pre-certified gold rating as of February 2017.

Platinum	80 or more
Gold	60 to 79
Silver	50 to 59
Certified	40 to 49

Project Overview

Ore Central has been designed with green building concepts at its core in an effort to minimise its environmental impact. This work has focused on implementing advanced energy conservation strategies to achieve highly energy efficient and cost effective operation. These measures have also significantly reduced greenhouse gas emissions, helping to protect the environment.



Why **VRV**?

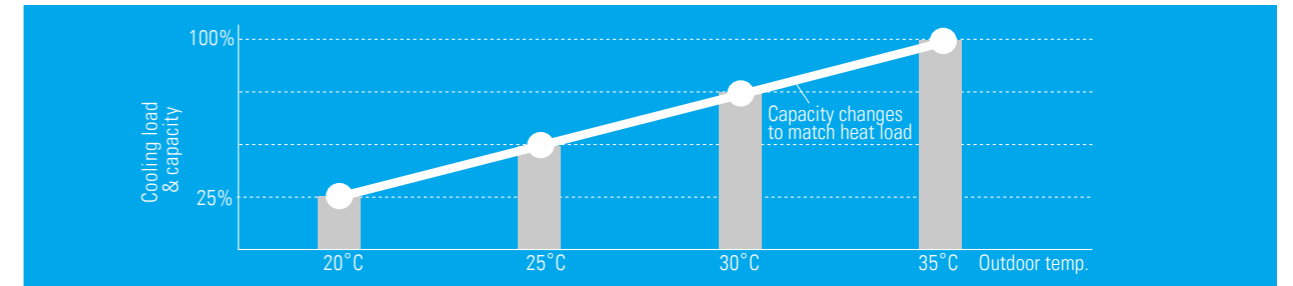
High COP during Partial Load

Partial load operation accounts for approximately 90% of the annual running time of air conditioning units. This type of operation usually occurs when there is only a small difference between the outdoor temperature and air conditioner's set temperature. **VRV IV** features high COPs even for a partial load of less than 50%.

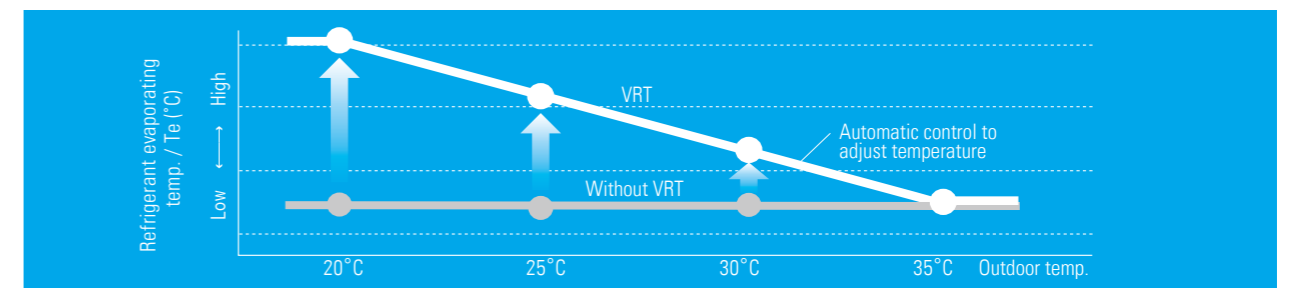
VRT Technology

VRV IV plays an integral role in improving energy efficiency thanks to features such as its variable refrigerant temperature (VRT) technology. VRT automatically adjusts refrigerant temperatures to individual building and climate requirements, helping to improve annual energy efficiency and maintain comfort.

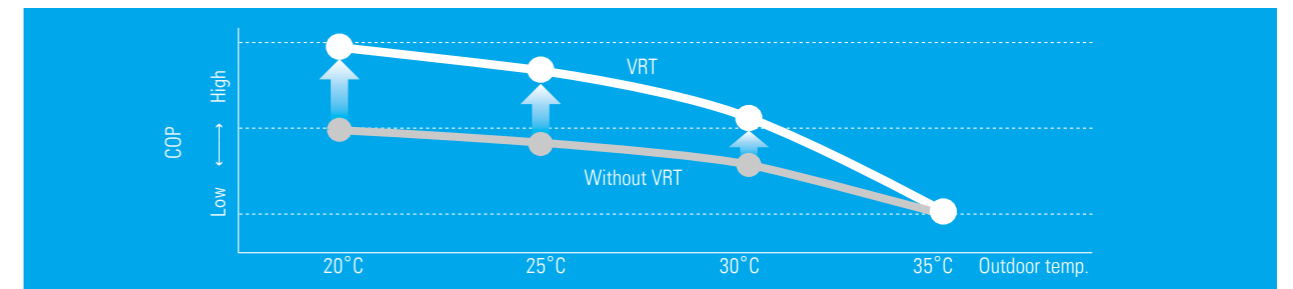
Changes in Evaporating Temperature and COP Depending on Indoor Load



The required capacity changes as the air conditioning load changes based on the outdoor temperature.



If the evaporating temperature is fixed (without VRT), excessive cooling, thermo on/off loss and other inefficiencies occur for partial loads (medium to low loads).



Automatic control adjusts the evaporating temperature as the heat load changes. Energy efficiency is improved without sacrificing comfort for partial loads (medium to low loads).

Indian Railways Institute of Civil Engineering (IRICEN)



LEED India

Platinum	52 to 69
Gold	39 to 51
Silver	33 to 38
Certified	26 to 32

Certification Document



IRICEN obtained 61 points.

Project Outline

Location	Pune
Number of floors	4
Total floor space	2,746 m ²
Construction	2013
Application	Training centre

Daikin Systems Installed

- Air conditioning systems
VRV III heat pump type outdoor units x 23 (total 204 HP)
- Control systems
intelligent Manager and BACnet interface

Project Overview

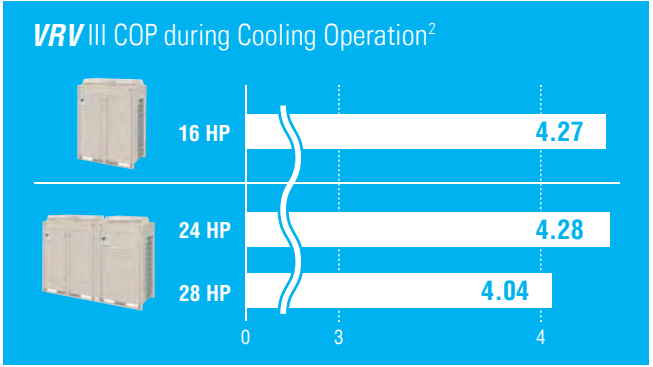
The Indian Railways Institute of Civil Engineering (IRICEN) designed its administrative headquarters as a green building to reduce energy demand and optimise resource usage. The facility is also intended to spread awareness of environmental issues among Indian Railways engineers.

The building is actually utilised in the curriculum for trainee officers at IRICEN. Trainees gain an in-depth understanding of the showcase facility during their studies, helping them to promote green concepts throughout the country.

Why VRV?

High COP with Air-Cooled Systems

IRICEN's design called for a 93.74% reduction in energy consumption from the GRIHA¹ benchmark of 140 kWh/m²/year. Only Daikin VRV could deliver the average COP of 4.2 required for this target. To achieve the best results with an air-cooled system, Daikin recommended VRV III high COP models.

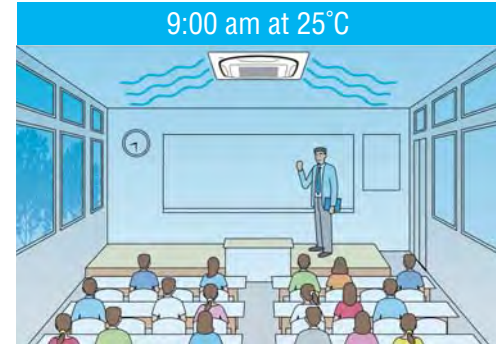


Notes: 1. Green Rating for Integrated Habitat Assessment, www.grihaindia.org
2. Values are based on indoor temperatures of 27.0°CDB and 19.0°CWB, an outdoor temperature of 35.0°CDB, an equivalent length of 7.5 m and a level difference of 0 m.

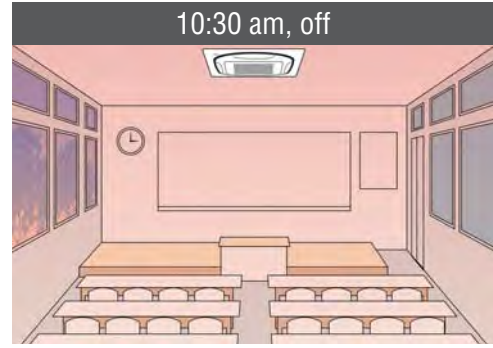
Reduction of Operational Wastage

Control systems play a key role in cutting operational wastage. Functions such as weekly scheduling and automatic shutdown help to prevent excessive cooling and promote energy savings.

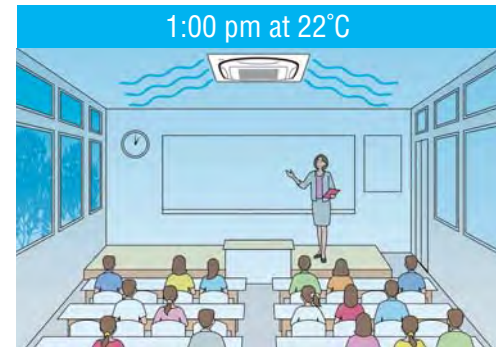
Example of Training Centre



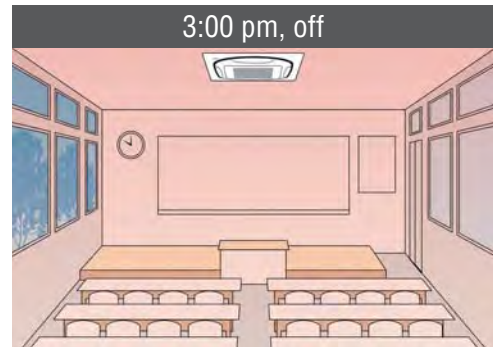
As the first period starts, the air conditioner begins cooling operation.



The classroom is unoccupied in the second period and the air conditioner stops.



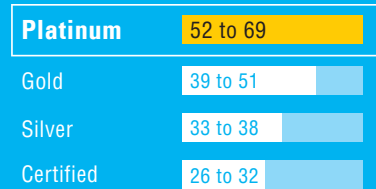
As the third period starts, the air conditioner begins operation again.



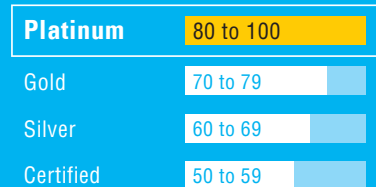
The classroom becomes vacant again after the third period and the air conditioner stops.



LEED India Green New Buildings



LEED India Green Existing Buildings



Certification Document



Project Outline

Location	Mumbai
Number of floors	10
Total floor space	19,573 m ²
Construction	2008
Application	Office
Further details	www.crisil.com

Daikin Systems Installed

- Air conditioning systems
 - VRV III heat pump type outdoor units x 38 (total 1,066 HP)
- Ventilation
 - Heat reclaim ventilation units x 25
- Control systems
 - intelligent Touch Controller and BACnet interface

Project Overview

Crisil House is designed to use recyclable, renewable and locally available materials to reduce its carbon footprint. It also has a large green cover and roof garden to minimise CO₂ emissions. The structure allows in sunlight while keeping out heat, thus sharply reducing electricity consumption.

At the operations level, Crisil House has consolidated its data centres through the use of virtualisation technologies. This has allowed it to reduce the number of physical servers by 75%. It has also provided an enclosed space and focused cooling dedicated to the servers.

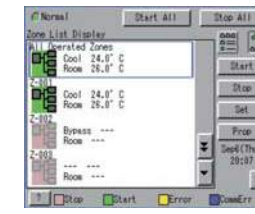


Why VRV?

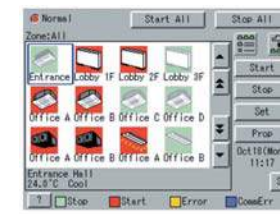
intelligent Touch Controller

Crisil House selected VRV III due to the building's limited installation space and use of zone cooling. intelligent Touch Controller provides total management of the system. It is able to centrally control up to 128 indoor units, making it ideal for small buildings.

intelligent Touch Controller can be operated without a computer by touching coloured LCDs and icons on its touch panel. This feature makes it as straightforward to use as a standard wireless remote controller.



Group (zone) setting is easy and allows users to start/stop individual or all units in a group.



Users can start/stop HRV and lights as well as air conditioners.

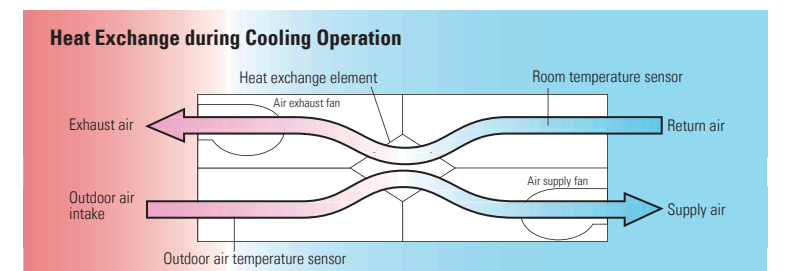


intelligent Touch Controller also offers yearly scheduling, error history and auto heating/cooling changeover functions, plus limits on set temperatures.

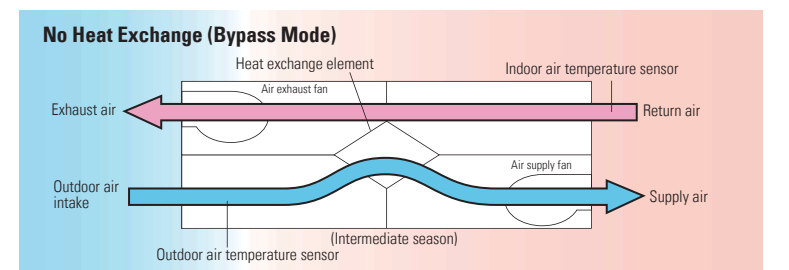
Heat Reclaim Ventilation

A standard ventilation system simply delivers hot and cold outdoor air into a building in summer and winter. However, heat reclaim ventilation (HRV) also recovers heat energy losses and minimises temperature changes caused by ventilation.

The technology decreases air conditioning load by around 23% compared to a ventilation system. Adoption of HRV has helped Crisil House to significantly reduce the energy demand required to lower the temperature of fresh air.



An HRV unit's heat exchanger element removes any heat from the cool air returned from a room. At the same time, it also removes the heat from the hot outdoor air and transfers it to the cooled air. This enables hot air to be discharged to the outside environment and cool air to be supplied into the room.



An HRV unit can also operate as a ventilator. In this case, it does not recover heat.

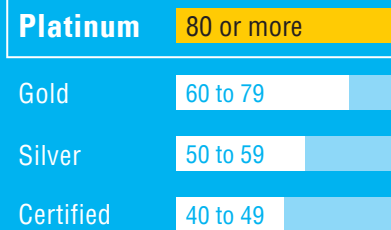
Natural Light and Seven Gardens

Photovoltaic panels have been installed to generate solar energy and all floors have a central atrium overlooking the green area. The atriums supply about 60% of the light for workstations. Each workstation also has energy efficient task lights while motion sensors optimise overall usage. Crisil House also includes a total of seven gardens to absorb heat and CO₂ and provide a visually pleasing environment for employees.





LEED



Certification Document



Project Outline

Location	Delhi
Number of floors	2
Total floor space	1,858 m ²
Construction	2011
Application	Retail store
Further details	global.marksandspencer.com/in/

Project Overview

Marks and Spencer is a major British multinational retailer specialising in clothing, home products and luxury food items. Its Delhi store boasts a host of sustainable features, including heat transmitting glass which cuts UV ray penetration by 90%, helping to stabilise temperatures.

It is also equipped with solar reflective tiles which work with its Energy Star certified equipment to keep the interior cool. Additional green features include rain water harvesting, dedicated recycling bins and the use of rapidly renewable raw materials such as engineered wood.

Daikin Systems Installed

- Air conditioning systems
VRV III heat pump type outdoor units x 7 (total 96 HP)
- Ventilation
Heat reclaim ventilation units x 2
- Control systems
intelligent Touch Controller x 1

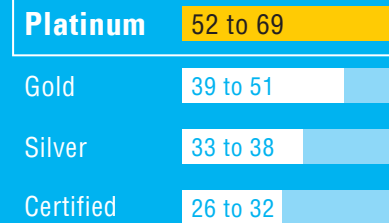
Why VRV?

Water-Cooled Package Vs. Air-Cooled

This project called for a comparison of water-cooled package and air-cooled systems. Water-cooled units can effectively control individual zones if centralised controllers are installed. However, they require a compressor pump and power source plus a cooling tower and boiler. Air-cooled systems can also easily turn on and off to control zones and have fewer additional requirements.



LEED India



Certification Document



Project Outline

Location	Pune
Number of floors	4
Total floor space	4,430 m ²
Construction	2009
Application	Offices
	www.kirloskar.com/greeninitiatives.html

Daikin Systems Installed

- Air conditioning systems
Outside units (total 660 HP)
Water-cooled VRV III x 66
Indoor units
Ceiling-mounted cassette type round flow x 202,
Duct type x 44,
Wall-mounted type x 10,
Floor standing duct type x 2
- Control systems
intelligent Touch Controller and BACnet interface

Project Overview

Yamuna is a corporate office facility owned by the Kirloskar Brothers Limited. The company has endeavoured to create one of Pune's most sustainable buildings, even including a zero discharge water system. The building is designed to achieve the lowest possible power consumption and CO₂ emissions while allowing the maximum amount of natural sunlight to enter.



Why VRV?

Water-Cooled VRV

Yamuna received 13 LEED points for its air conditioning and refrigerant system. It was able to achieve the required EER, thanks to its selection of water-cooled VRV. Daikin inverter technology maintains high efficiency during the partial load conditions in which air conditioners usually operate.



Green Building Design Label 绿色建筑评价标识

Three star ★★★★★

Two star ★★★★★

One star ★★★★★

Certification Document

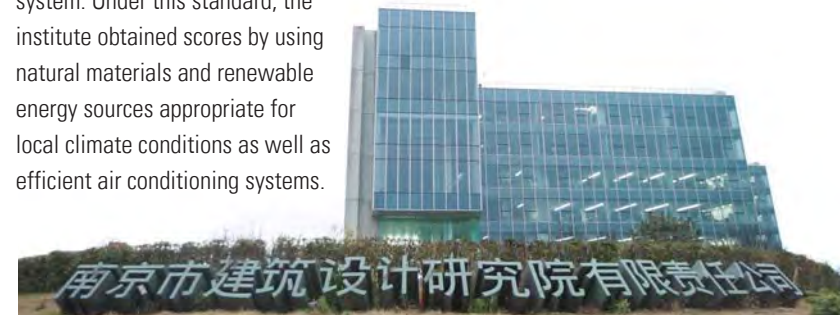


Project Outline

Location	Nanjing
Number of floors	6
Total floor space	34,400 m ²
Construction	2014
Application	Offices and laboratories

Project Overview

Since 2015, Jiangsu province has required all new buildings to attain at least a one star rating in the China Green Building Design Label system. Under this standard, the institute obtained scores by using natural materials and renewable energy sources appropriate for local climate conditions as well as efficient air conditioning systems.



Daikin Systems Installed

- Air conditioning systems
 - Outdoor units (total 776 HP)
 - Air-cooled **VRV** heat pump type x 41
 - Indoor units
 - Ceiling-mounted cassette type round flow x 205,
 - Slim ceiling-mounted duct type x 59,
 - Ceiling-mounted duct type (free ESP) x 15,
 - Ceiling-mounted duct type x 1
 - Outside units (total 176 HP)
 - Water-cooled **VRV** heat pump type x 19
 - Indoor units
 - Slim ceiling-mounted duct type x 41,
 - Ceiling-mounted duct type x 6,
 - Concealed floor standing type x 4

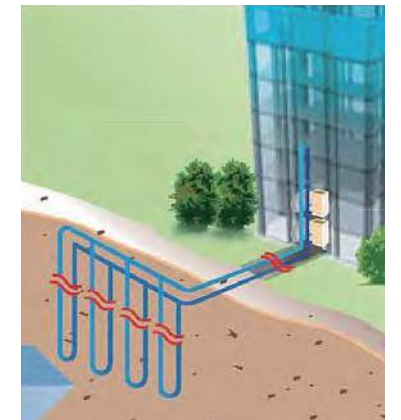
Why **VRV**?

Use of Geothermal Heat Source

VRV can be installed with both air- and water-heat sources, giving it the flexibility to handle a wide range of applications and conditions. Heat pump type systems perform operation by transporting heat between indoor and outdoor units. With air-to-air systems, this heat is discharged to the outdoor air while with water-to-air systems, it is discharged to cooling towers, ponds, rivers and the ground.

The institute has adopted water-cooled **VRV** with a geothermal heat source for its public corridors. The heat load difference between heating and cooling for these public corridors is low, requiring only a small capacity cooling tower to cover any shortfalls in geothermal heat.

The air conditioning capacity for the corridors, which are not used outside of work periods, can also be shared with other spaces. This helps to reduce the energy required for water transportation. In addition, ground source tubes are buried in the building foundations, meaning no extra piping is needed.



Reduced Piping Lengths

The standard also requires air conditioning efficiency to be improved by reducing long piping lengths. The institute was able to satisfy this criterion by installing separate air-cooled **VRV** outdoor units on the roofs of its main and secondary buildings. This produced a maximum piping length of 75.8 m with a coefficient of 0.88, successfully passing the standard value of 0.85.



Elimination of Auxiliary Electric Heaters

The institute has also opted not to use auxiliary electric heaters for its indoor units. These auxiliary heaters are often installed to compensate for a lack of indoor unit capacity during winter. However, Daikin **VRV** units can minimise capacity reductions even when the ambient temperature drops thanks to the advanced design of their compressors and heat exchangers, as well as effective refrigerant control. These key technologies provide sufficient heating capacity without the installation of auxiliary heaters.





Project Outline

Location	Shanghai
Number of floors	22
Total floor space	30,000 m ²
Construction	2014
Application	Offices

Daikin Systems Installed

- Air conditioning systems
 - Outside units (total 1,730 HP)
 - Water-cooled **VRV** heat pump type x 196
 - Indoor units
 - Duct type x 1,043
- Control systems
 - intelligent Touch Manager

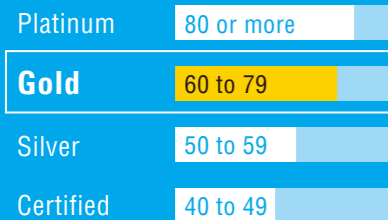


Project Overview

100 Bund Square is located in one of Shanghai's core financial districts. The high-rise has been carefully designed and developed as a sustainable building and has quickly become a local landmark. Along with its imposing structure, the building is known for its use of energy saving, low carbon technologies and attention to user comfort.



LEED



Certification Document



Why **VRV**?

Elimination of Capacity Losses

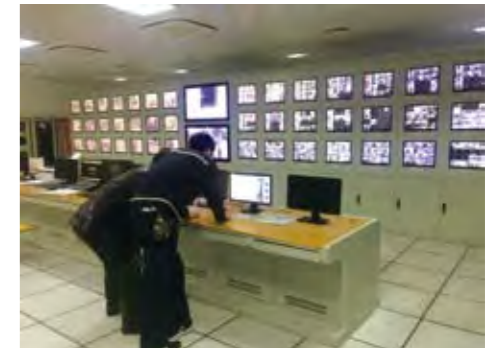
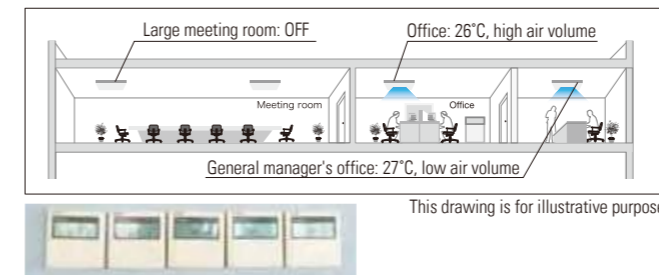
The outside units of water-cooled **VRV** systems eliminate the need for direct heat exchange with the outdoor air. Thanks to this feature, the units can be safely installed inside buildings or other enclosed spaces. This helps to minimise the piping length and any potential decrease in air conditioning capacity.



Both Individual and Centralised Controls

Users require 24/7 individual control of air conditioning via wired remote controllers. This helps to promote energy savings by allowing them to precisely turn on/off individual units.

All air conditioning units can also be controlled with Daikin's intelligent Touch Manager. This centralised controller manages scheduled operations for corridor zones and prevents energy wastage.

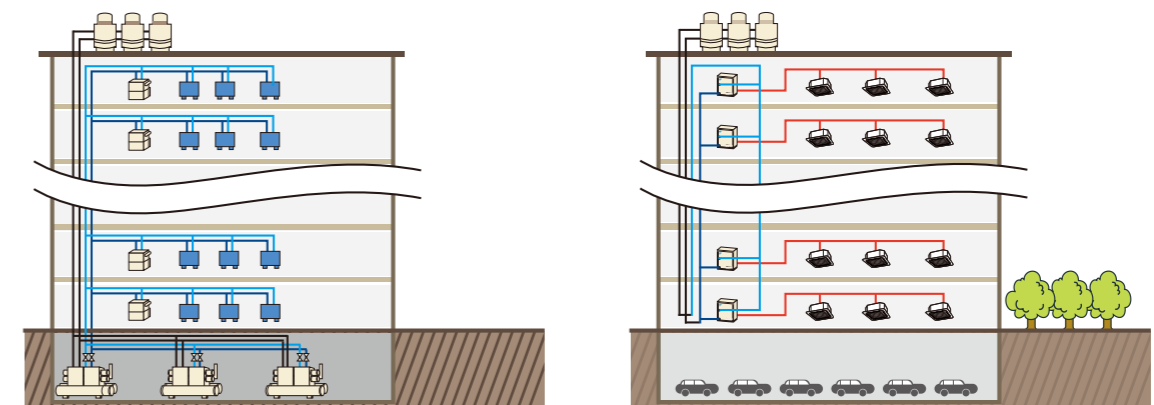


intelligent Touch Manager

Greening to Offset Heat Island Effect

100 Bund Square has green areas which help to prevent the urban heat island effect. These areas have been created by shifting 50% of the required parking space to the building's basement.

With applied air conditioning systems, the basement would normally be taken up by the large machine room required for the chillers. However, with water-cooled **VRV**, compact outside units can be installed on each floor.



Chillers require a large machine room.

Parking space could be provided in the basement thanks to water-cooled **VRV**.



EEWH 綠建築標章

Platinum	53 and above
Gold	42 to 52
Silver	34 to 41
Bronze	26 to 33
Qualified	12 to 25

Certification Document



Project Outline

Location	Taipei
Number of floors	8
Total floor space	54,018 m ²
Construction	2012
Application	University
Further details	www.coss.ntu.edu.tw

Daikin Systems Installed

- Air conditioning systems
VRF III heat pump type outdoor units x 52
 The installed systems also include some residential-use air conditioners.
- Control systems
 Connected to building management systems via Daikin's BACnet interface

Project Overview

After attracting many world-class architects, the selection committee of National Taiwan University chose Japanese Toyo Ito to design its new College of Social Sciences. The building will become the face of the future university.

The facility is fully integrated with the landscape in front of it and the surrounding natural environment as a whole. Its structure also incorporates inherently dynamic spiral lines, setting it apart from standard grid designs.



Why **VRF**?

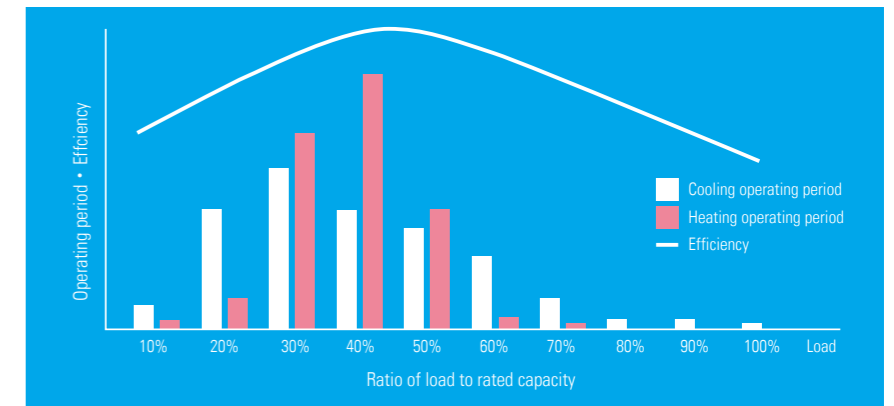
High Efficiency during Partial Load Operation

Partial load operation accounts for approximately 90% of the annual running time of air conditioning units. This type of operation usually occurs when there is only a small difference between the outdoor temperature and air conditioner's set temperature. Unfortunately, the efficiency of conventional air conditioning systems drops significantly during these periods.

To boost efficiency during partial load operation, **VRF** is equipped with Daikin's DC Inverter technology. The compressor is one of an air conditioner's core components and its performance is directly linked to the motor. Daikin was the first to successfully use a Reluctance DC motor with a scroll compressor in commercial-use air conditioners¹.

During rapid cooling, for example, the motor for the compressor increases the rotation speed to rapidly warm the refrigerant by condensing it and allows heat to be discharged outdoors. The motor accounts for 90% of the power consumption of an air conditioner. This makes high efficiency motors a critical point for energy savings.

Relation between Load and Operating Periods²



Notes: 1. Daikin's achievement was recognised by the Institute of Electrical Engineers of Japan at the 54th Academic Promotion and Technical Development Awards in 1998.
 2. This is an in-house analysis created using mass operating data from Japanese office buildings equipped with Daikin systems.

Independent Control and Set Point Restriction

As required by the college, users can individually operate units from local wired remote controllers. At the same time, centralised control functions allow them to be operated from the college's building management systems via Daikin's BACnet interface. The right three control logics are effective for school facility management, particularly the reduction of electricity wastage.

Control (example)	Details
Set point restriction	22 to 28°C during cooling
Daily set point resetting	24°C during cooling
Scheduled shutdown	6:00 pm and 9:00 pm

Set Point Restriction

If a user tries to reduce the set temperature to 16°C using a wired remote controller, the control system restricts the set point range to 22 to 28°C.

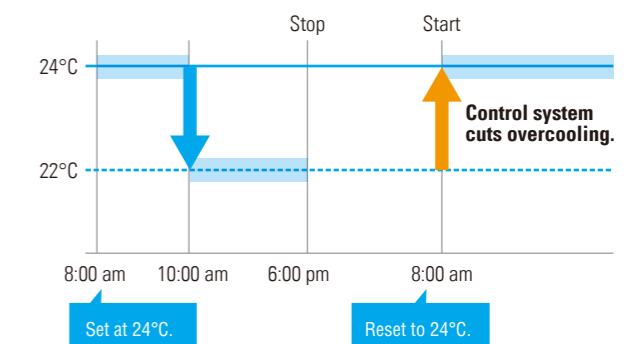


16°C can not be set. 22°C can be set.

These pictures are for illustrative purposes only.

Daily Set Point Resetting

If a user reduces the set temperature to 22°C using a remote controller, the control system returns to a set point of 24°C the next morning.





Project Outline

Location	Osaka
Number of floors	41
Total floor space	254,000 m ² (office area: 103,000 m ²)
Construction	2010
Application	Department store and offices

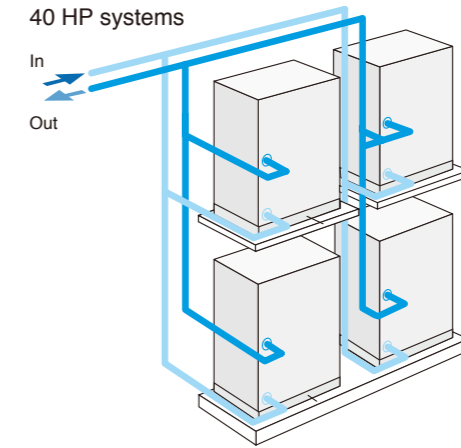
Daikin Systems Installed

- Air conditioning systems
 - Outside units (total 4,839 HP)
 - Water-cooled **VRV** III heat recovery type x 400
 - Indoor units
 - Ceiling-mounted built-in type x 994
 - Outdoor units
 - Air-cooled **VRV** III heat pump type x 12
 - Indoor units
 - Ceiling-mounted cassette type x 32,
 - Ceiling-concealed built-in type x 2,
 - Ceiling-concealed duct type x 6
- Ventilation
 - Heat reclaim ventilation units
- Control systems
 - intelligent Manager

Why **VRV**?

Compact Outside Units

Water-cooled **VRV** III outside units feature a weight of approximately 150 kg and height of 1,000 mm. Their compact, lightweight design allows them to be easily installed in buildings with limited space or in underground malls. The units can also be double-stacked for installation on individual floors.



Comprehensive Assessment System for Built Environment Efficiency (CASBEE)



CASBEE is a method for evaluating and rating the environmental performance of buildings and the built environment. The system was developed by a research committee established in 2001 through a collaboration between academia, industry and Japanese government departments associated with representative green buildings with CASBEE evaluations. CASBEE has been designed to both enhance the quality of people's lives and to reduce the life-cycle resource use and environmental loads associated with the built environment, from a single home to a whole city.

BEE (built environment efficiency) values are calculated by:
$$BEE = \frac{Q \text{ (environmental building quality)}}{L \text{ (environmental building load)}}$$

CASBEE

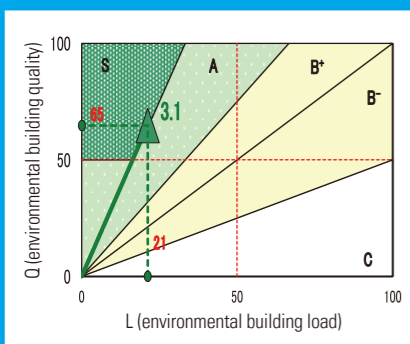
S rank ★★★★★★

A rank ★★★★★★

B+ rank ★★★★★★

B rank ★★★★★★

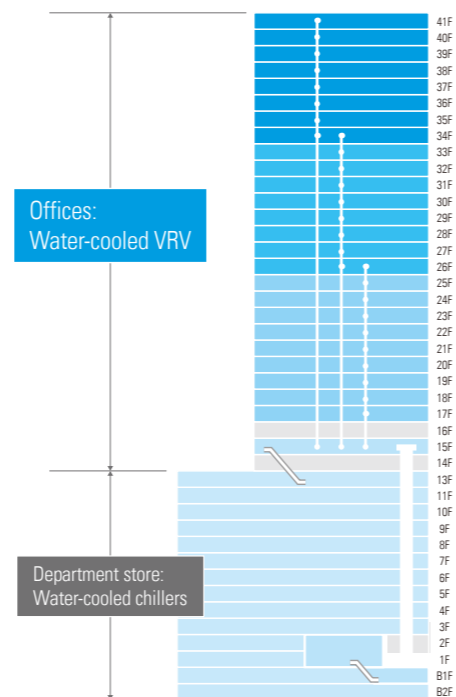
Certification Document



Project Overview

The Umeda Hankyu building consists of the main department store and office tower. The department store occupies the sub-basement to 13th floor while the offices are located on the 17th to 41st floors. Hankyu department store became one of central Japan's largest retail spaces following renovations in 2010.

The new structure has been designed to promote modular operation, space saving, energy saving and easy maintenance. This has included the use of inverter controlled pumps and elevators as well as advanced, high efficiency air conditioning systems to save energy.



Office floor



Air discharge outlet from **VRV** indoor unit
Air suction inlet



Sky lobby



Elevator hall



intelligent Manager is installed in the building's control room. Maintenance personnel have welcomed the system's straightforward setup and operation.



Project Outline

Location	Sao Paulo
Number of floors	32
Total floor space	67,650 m ²
Construction	2006
Application	Offices and shops

Daikin Systems Installed

- Air conditioning systems
 - Outdoor units (total 3,516 HP)
 - VRV III** heat pump type x 196
 - Indoor units
 - Ceiling-mounted built-in type x 960
 - Ceiling-mounted duct type x 8
- Control systems
 - intelligent Manager

Project Overview

Eldorado Business Tower is an office building which also includes boutiques, restaurants and a fitness gym on its lower floors. It is located in a newly developed urban business area facing Sao Paulo's busy Marginal Highway.

The high-profile tower was built by Gafisa, one of Brazil's leading construction companies. The structure's green credentials were firmly established in 2010 when it became South America's first recipient of LEED Platinum certification.



LEED

Platinum	80 or more
Gold	60 to 79
Silver	50 to 59
Certified	40 to 49

Certification Document



Why **VRV**?

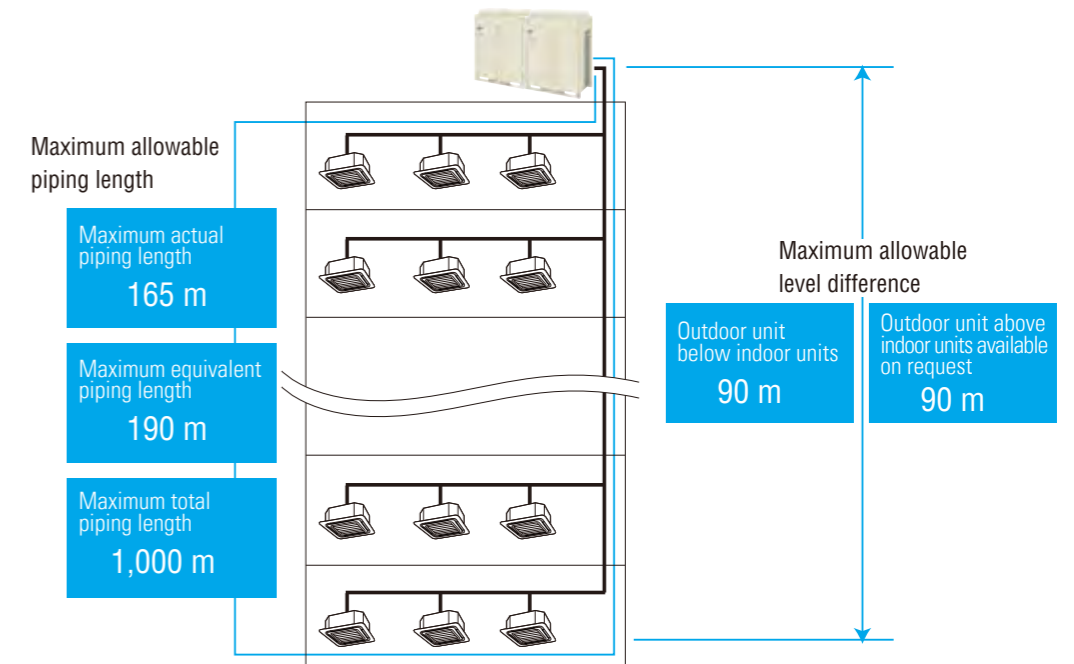
45% Energy Savings Compared to Chillers

Eldorado tower was carefully designed to achieve high environmental performance. Due to its size, Gafisa had originally intended to install a chiller air conditioning system. However, it reconsidered this approach after reviewing electricity costs as well as maintenance and technical requirements.

Fortunately, Daikin was able to demonstrate the many advantages provided by **VRV III**, including enormous energy savings of more than 45% compared to chiller systems. **VRV III** also offered major space savings, faster installation and expert after-sales service courtesy of Daikin McQuay Brazil.

VRV Advantages in Large-Scale Buildings

- Energy savings: Over 45% higher than chillers
- Space savings: Around 1,500 m² for tenants
- Installation period: Far shorter than chillers



Efficient Partial Load Operation

The system's high efficiency, particularly during partial load operation, has helped to dramatically reduce the electricity used by air conditioners. Three years after installation, Gafisa calculated power consumption was actually more than 30% below that contracted for LEED certification.





LEED

Platinum	80 or more
Gold	60 to 79
Silver	50 to 59
Certified	40 to 49

Project Outline

Location	Portland, USA
Number of floors	1
Total floor space	400 m ²
Construction	2012
Application	Shop
Further details	www.stollerfamilyestate.com

Project Overview

Stoller Winery was established in 1995 in Portland, Oregon and currently spans around 1.5 km². The winery prides itself on its efficient use of sustainable farming practices. This low impact philosophy extends to the property's new tasting room. The structure maintains a year-round net positive energy¹ balance using self-generated power from grid-tied solar panels.

Daikin Systems Installed

- Air conditioning systems
 - Outdoor units
 - VRV III S** heat pump type x 4
 - Indoor units
 - Wall-mounted type x 1
 - Ceiling-suspended type x 1
 - Ceiling-mounted duct type x 2
 - Vertical air handling unit x 3
- Control systems
 - Navigation remote controller x 6



Note: 1. Net positive energy structures are so efficient they produce more energy than they consume. The creation of this type of building starts in the planning stage when efficiency is maximised to produce a zero energy design. Once this has been achieved, the solar panels can be oversized to generate an energy surplus. Refer to <http://zeroenergyproject.org/buy/positive-energy-homes/>

Why VRV?

Low Starting Current

Stoller Winery enjoys a warm climate which is ideal for grapes. However, with temperatures approaching 40°C in summer, it can be challenging for people. **VRV** provides maximum comfort under these conditions while maintaining extremely low energy consumption. Its low starting current is also a key advantage due to the use of a solar energy system.



Smooth System Integration

VRV III S integrated easily with a separate fresh air "economizer" mode, helping to provide effective yet highly economical cooling during low demand periods. The units' compact footprint also allowed them to be installed in a small green roof area out of sight of visitors. Their low sound levels have proved to be ideal for maintaining the winery's serene environment.



Sustainable Energy Use

The winery's new tasting room features a net positive energy design that uses over 400 m² of solar panels to provide 100%, and often more, of the facility's power requirements. The structure also incorporates a large amount of wood reclaimed after a forest fire. Its ambience is enhanced by ample use of natural lighting and passive ventilation.

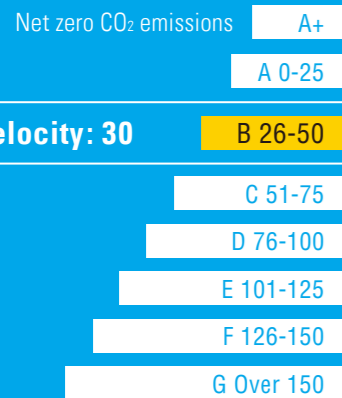




BREEAM



Energy Performance Certificate B



Project Outline

Location	London
Number of floors	Ground and 4
Total floor space	9,885 m ²
Construction	2012
Application	Offices

Daikin Systems Installed

- Air conditioning systems
 - Outdoor units (total 358 HP)
 - VRV** III heat recovery type x 28,
 - VRV** III heat pump type x 2
 - Indoor units
 - Duct type x 256
- Control systems
 - intelligent Touch Controller x 10

Project Overview

The Velocity buildings were named to evoke memories of the aviation and motor racing history of their surrounding area. The structures symbolise streamlined speed and their systems reflect the best in cutting-edge technology.

The project was originally intended to achieve a "Very good" BREEAM rating. However, this was raised to "Excellent" when points for better building practices were added to those for active and passive energy management.



Why **VRV**?

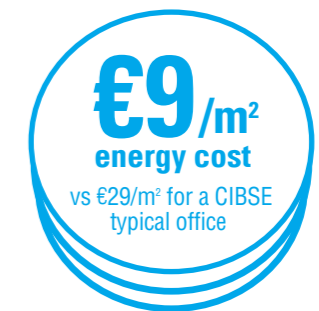
VRV Heat Recovery

Daikin **VRV** systems were specified for Velocity due to their outstanding reliability. Daikin has continued to lead the **VRV** field with successive advances since it first developed the technology. The facility uses heat recovery in its simplest form by directing waste energy from warm areas to cold areas.

The buildings have solar shading on their south-facing aspects to reduce solar gain. Rooftop photovoltaic and solar thermal arrays also provide renewable alternatives for some energy needs. The entire air conditioning system is automatically controlled to keep indoor temperatures at 22 to 23°C all year.

Cost Effective Occupation

Velocity's strong eco-credentials provide it with significant occupation cost savings compared to standard UK office buildings. The graph below shows the difference in annual energy consumption between Velocity and the CIBSE¹ "Typical Office" and "Typical Office Good Practice" benchmarks. The Typical Office Good Practice benchmark applies to facilities built between 2006 and 2010.

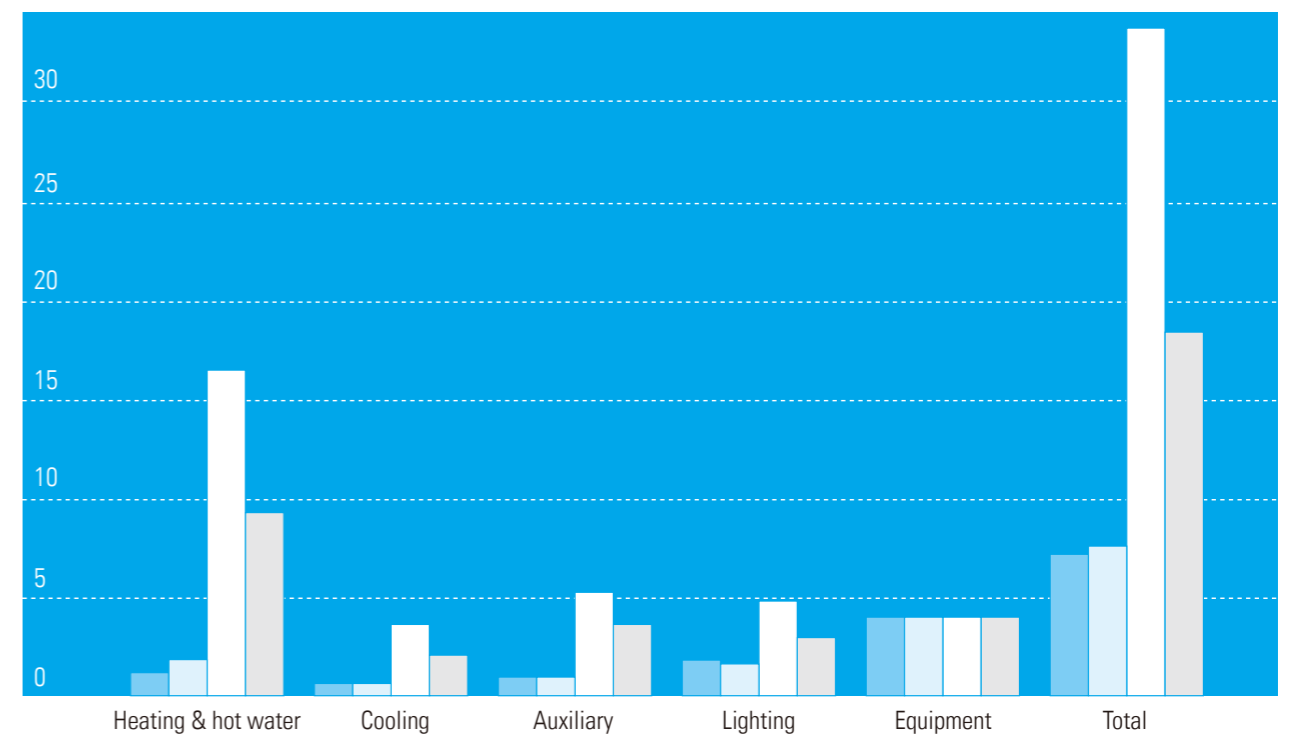


Note 1: Chartered Institution of Building Services Engineers

Energy Use Per ft² Per Year

kWh/ft²/year

Velocity office block 1 (dark blue)
Velocity office block 2 (light blue)
Typical office (white)
Typical office good practice (grey)

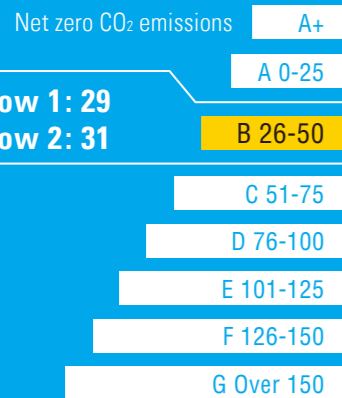




BREEAM



Energy Performance Certificate B



Project Outline

Location	London
Number of floors	Flow 1: 4 Flow 2: 3
Total floor space	6,709 m ²
Construction	2013
Application	Offices
Further details	www.extonestates.com

Project Overview

The flow buildings were designed as a structural extension for a tenant moving into a new office development beside the Thames. The structures were classified as category A and fitted for occupation by up to seven individual tenants. While they were originally intended to achieve "Very good" BREEAM ratings, increased on-site efficiency saw both buildings receive "Excellent" scores.

Daikin Systems Installed

- Air conditioning systems
 - Outdoor units
 - VRV III heat recovery type x 18,
 - VRV IV heat recovery type x 1
 - Indoor units
 - Duct type x 159
- Control systems
 - intelligent Touch Controller



Why VRV?

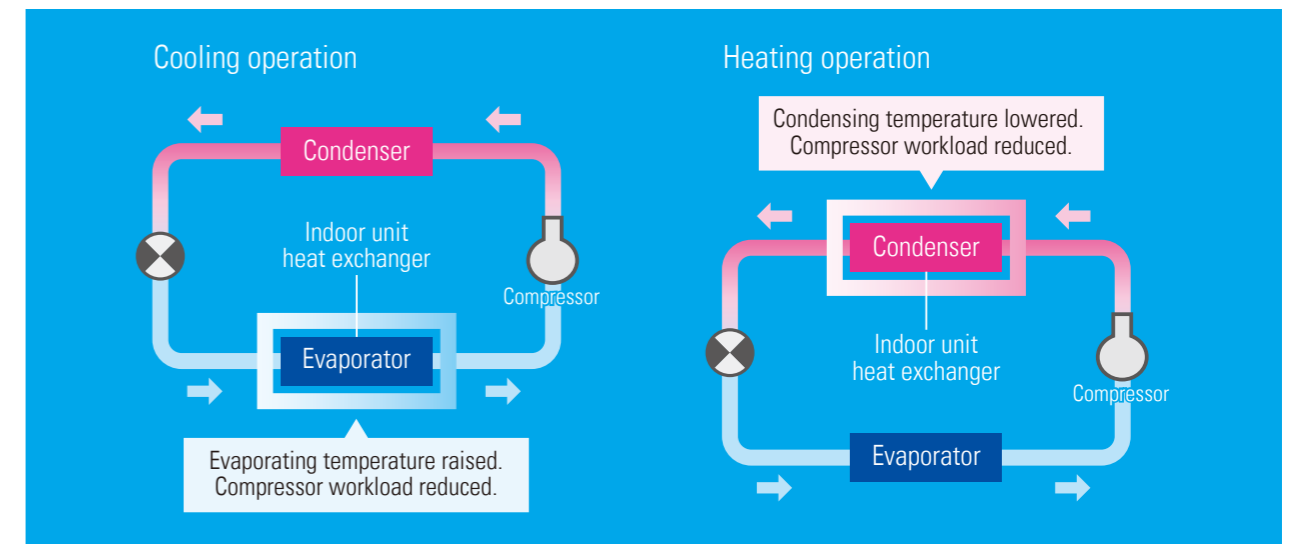
Customised Seasonal Efficiency

The Flow buildings are equipped with both VRV III and the newer VRV IV, providing a clear comparison between the systems. VRV IV introduces the concept of variable refrigerant temperature (VRT) for customised seasonal efficiency and makes heat recovery the centre of its operation.

The project is also significant as one of the first installations of VRV IV in a recent building. Before VRV IV could be installed, it was necessary to partially remove the existing system. Once the new unit was in place, the previous hardware was reinstalled and the two systems were recommissioned.

The VRV systems are remotely monitored by Air Conditioning Network Service System, Daikin's remote monitoring/control system via Internet. The service provides accurate data analysis and facilitates fault prediction. It helps to minimise downtime, control costs and prolong equipment life, without sacrificing comfort levels.

Variable Refrigerant Temperature (VRT)



VRT automatically adjusts refrigerant temperature to individual building and climate conditions. This helps to improve energy efficiency, reduce running costs and maintain comfort. During cooling, the refrigerant evaporating temperature is raised to minimise the difference with the condensing temperature. During heating, the opposite occurs. The compressors work less and this reduces power consumption.

Compact System with Large Capacity

A bridge was later added to provide access between the first and second floors of the Flow buildings. This created an extra 173 m² of space. Various alternatives were considered for air conditioning, including an outdoor unit for each storey and the connection of new indoor units to existing systems.

However, with an existing diversity factor of around 150%, there was no extra capacity. Space for outdoor units was also limited. The solution was to install two 4.9 kW indoor units on each storey with a single 8 HP VRV IV heat recovery outdoor unit on one of the rooftops. The system resulted in a diversity factor of 126%.





Green Mark

Platinum	70 and above
Gold plus	60 to 69
Gold	50 to 59

Certification Document



Project Outline

Location	Singapore
Number of floors	Office: 8; Factory: 2
Total floor space	11,969 m ²
Construction	1995
Renovation	2014
Application	Office

Daikin Systems Installed

- Air conditioning systems
 - VRV** IV cooling only outdoor units x 33 (total 250 HP)
 - VRV** III cooling only outdoor units x 22 (total 168 HP)
- Control systems
 - intelligent Touch Manager
 - Remote Monitoring System
 - Air Conditioning Network
 - Service System

Project Overview

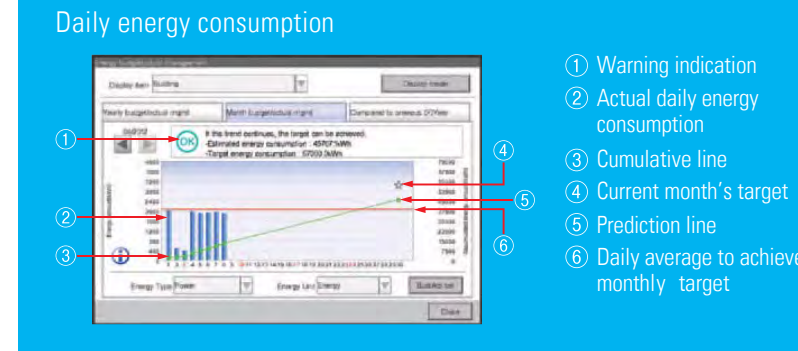
Daikin Air-conditioning (Singapore) Pte. Ltd. seeks to provide a safe, comfortable and high quality working environment to the employees, together with adequate supplies and reliable sources of energy and water to sustain its activities. Energy management will play a key role in the business. Efforts to reduce energy use and prevent pollution will also support the commitment to employees, environment, and communities in which everyone plays a part. To implement this policy, the company renovated its head office to a sustainable building.

Why **VRV**?

Achieving Further Energy Savings with Energy Navigator

Daikin's intelligent Touch Manager is an advanced multi-zone controller that provides the most cost-effective way to control and monitor **VRV** systems. It covers building equipment including lighting, pump, keycard switch and sensors. Daikin Singapore monitors energy consumption trends for all equipment.

Energy consumption trends can be easily understood by using the Energy Navigator feature. Users can identify air conditioning units which are suspected of overcooling or operating in unoccupied rooms. The Energy Navigator feature also provide support in formulation and verification of energy-saving measures to ensure advanced energy management.



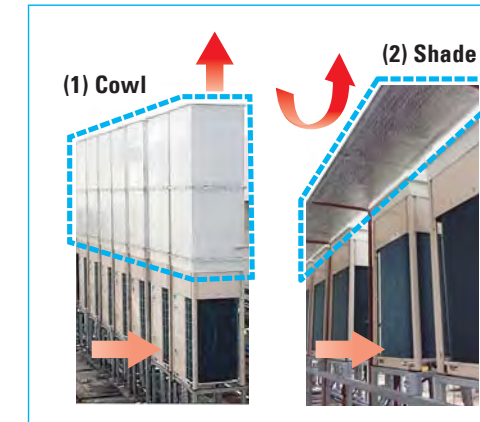
Hourly energy consumption is measured and data is recorded.

Installation for Better Heat Discharge

Daikin Singapore replaced its old systems with the high COP type of **VRV** III and IV throughout its office area. Efficiency of the air conditioning systems achieved approximately 0.74 kW/RT and below with a proper installation method. In addition, this improved efficiency with better heat discharge and lower air intake temperature.

Roof floor heated up by sunlight; hot air from heated floor goes into outdoor units. Daikin Singapore implemented an improved installation to prevent a short circuit including:

- (1) Cowls for better heat discharge and minimising hot air recirculation. Elevate outdoor units' away from hot roof floor surface to improve the air flow circulation and lower the intake air flow temperature for outdoor units..
- (2) Overhang shade keeps out sunlight and lowers the condense coil surface air entry temperature.



Green Roof and Walls

Rooftop garden can help to mitigate urban heat, which also means decrease the energy needed for air-conditioning systems to cool down the building. Daikin Singapore implement green roof and green walls.



Remote Monitoring System

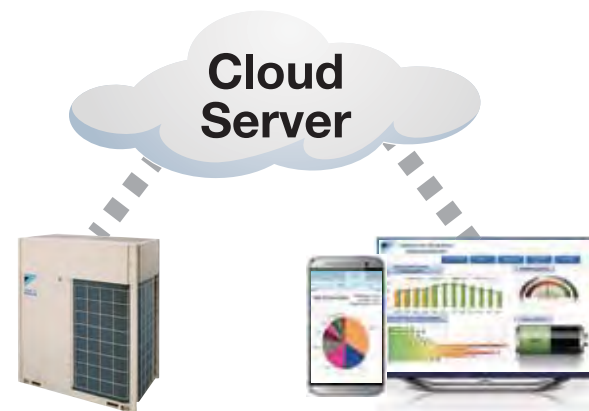
Key Benefits

- (1) Easy deployment
- (2) 24 hours monitoring
- (3) Cloud server
- (4) Smart maintenance
- (5) Breakdown prediction
- (6) Extend equipment lifeperiod
- (7) Breakdown alert
- (8) Mobile application and online web

Requirements for Green Mark

The remote monitoring system is an application which Daikin Singapore developed to display building's **VRV** system efficiency (COP). This is one of the requirements for getting Green Mark. Building owners obtain scores for Green Mark by monitoring energy consumptions for building equipment.

Daikin Singapore unique online diagnosis (failure prediction) system analyses the pattern of operation to respond to the results of analysis before the date value reaches an abnormal level, preventing the equipment from abnormal stop or requiring an emergency repair. Consequently, maintenance quality and reliability are drastically upgraded. This is Daikin Singapore unique way towards "smart building maintenance".



Various Choice of Breakdown Alert

1. Text Message

Clients can choose to be notified during any time of the day (24 hours) or certain time of the day (e.g. 0800 to 1700 hrs). This is only available in Singapore.



2. Email

An email notification will be sent automatically when a malfunction has been triggered. This is available worldwide.



3. Notification via App New App

Remote Monitoring System App available for download on Android / IOS platform.



Application for Smartphone



Smart Building Management (Online Access)

Continuous monitoring of the air-conditioning system data enables us to tune the airconditioner to control automatically leading to energy reduction without affecting user's comfort. This service provides customers with a suite of features. It enables building owners and facilities managers to manage their offices and buildings airconditioning equipment at their desk. Thus, reduce labour cost of collecting the data of equipment condition manually and the need of installing expensive measuring instruments.



Energy savings is automatically adjusted from the following views:

<p>Weather: The system monitors changes in weather and air conditioning conditions.</p>	<p>Indoor Heat Load: The system monitors actual air conditioning load.</p>	<p>Outdoor Unit Location: The system customises energy saving operation of air conditioning to customer specific conditions such as outdoor unit installed location.</p>	<p>Piping Length: The system monitors actual installation and operating conditions and calculates divergence from design conditions.</p>

Key Features

- (1) Instant overview by day, month and year.
- (2) Visualisation of malfunction alert.
- (3) Provide details on date and time of error activation.
- (4) Overview of airconditioning system malfunction history.
- (5) Ability to monitor multi-sites.
- (6) Quick view of equipment list schedule.
- (7) Track airconditioning system malfunction status.

Key Features

- (1) Monitor energy consumption and performance remotely via web access.
- (2) View individual airconditioning system power consumption.
- (3) Track individual airconditioning system efficiency.
- (4) Reduce energy consumption automatically.
- (5) Monitor power consumption threshold.
- (6) Management of power consumption
 - View airconditioning system which fail to turn off after office hour.
 - View airconditioning system operating hours.
 - Refrigerant shortage in the system
- (7) Maintenance and Operational report
 - Generate airconditioning system efficiency report



TREES

Platinum	61 and above
Gold	46 to 60
Silver	38 to 45
Certified	30 to 37

Certification Document



Project Outline

Location	Chonburi, Thailand
Number of floors	4
Total floor space	6,960 m ²
Construction	2016
Application	Offices and laboratories

Daikin Systems Installed

- **Air conditioning systems**
 - Outdoor units (total 412 HP)
 - VRV IV** cooling only type x 29
 - Indoor units
 - Ceiling-mounted cassette type round flow x 95,
 - Duct type indoor units x 4,
 - Ceiling-suspended type x 1
- **Ventilation**
 - Heat reclaim ventilation units x 13
- **Control systems**
 - intelligent Touch Manager

Project Overview

Daikin Industries (Thailand), Ltd. designed its R&D centre to be the leading facility of its type in the Asia and Oceania regions. The construction incorporated many green features, including the use of materials and directionality which maximise natural light. This is complemented by an all LED lighting system.

The centre's energy saving credentials were also enhanced by the use of high efficiency air conditioning, a 30 kW solar energy system and an expansive green roof measuring 278 m². The company's commitment to sustainable development saw the facility receive platinum level TREES certification.



Why **VRV**?

Full Scores for Energy Conservation

Daikin Thailand's efforts to create a sustainable facility were rewarded when it received perfect scores for all TREES energy conservation criteria. The selection of both high COP and space saving **VRV IV** models played a key role in attaining these scores. The COP for the overall system shows it delivers significantly higher energy efficiency than TREES' base-line building.

COP for 20 HP model during cooling¹

4.39

VRV IV high COP model

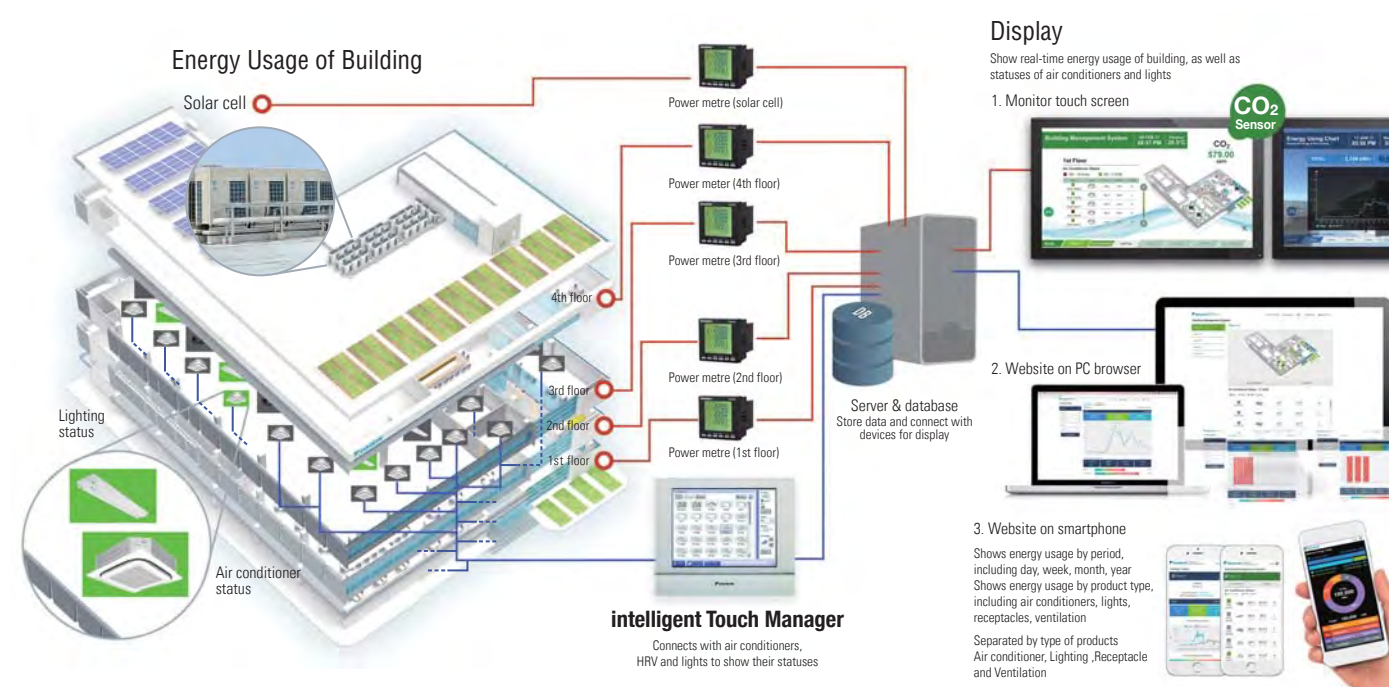
Note: 1. This value is the highest COP in the series.



Building Energy Management System

A building management system ensures the centre maintains the highest possible energy efficiency. Daikin's intelligent Touch Manager provides precise control of all equipment, including the air conditioning, ventilation and lighting systems. Monitoring software is also used to independently verify results.

intelligent Touch Manager helps to effectively cut energy wastage by allowing scheduled shutdowns to be set for different parts of the facility. It also provides additional energy savings by enabling advanced control of the ventilation system based on outdoor temperatures and CO₂ levels inside the building.



Display

Show real-time energy usage of building, as well as statuses of air conditioners and lights

1. Monitor touch screen



2. Website on PC browser



3. Website on smartphone

Shows energy usage by period, including day, week, month, year
Shows energy usage by product type, including air conditioners, lights, receptacles, ventilation
Separated by type of products
Air conditioner, Lighting, Receptacle and Ventilation



intelligent Touch Manager

Connects with air conditioners, HRV and lights to show their statuses



NABERS

6 stars Market leading performance

5 stars Excellent performance

4 stars Good performance

3 stars Average performance

Certification Document



Project Outline

Location	Sydney
Number of floors	2
Total floor space	2,200 m ²
Construction	2008
Application	Offices

Daikin Systems Installed

- Air conditioning systems
 - Outdoor units
 - VRV III heat recovery type x 8
 - Indoor units
 - Duct type x 42
- Air to water heat pump for hot water supply
 - Altherma x 1
- Control systems
 - intelligent Manager

Project Overview

Daikin Australia Pty., Ltd. is the Oceania regional headquarters of the Daikin Group. Daikin Australia immediately understood building design would be a major factor in achieving a 5 star NABERS rating for this project. It made key decisions early on, selecting a north/south orientation and extended reveals to minimise solar heat.

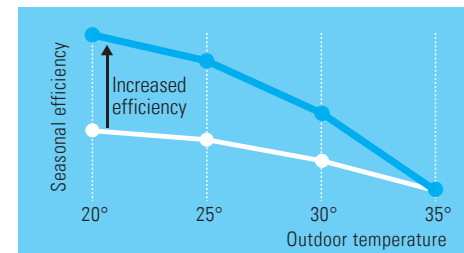


Why VRV?

VRV Heat Recovery

One of the benefits of Daikin's VRV heat recovery system is the ability to transfer energy between contrasting zones. With Sydney's climate remaining mild almost year-round, the south zone usually operates in heating mode while the north is in cooling.

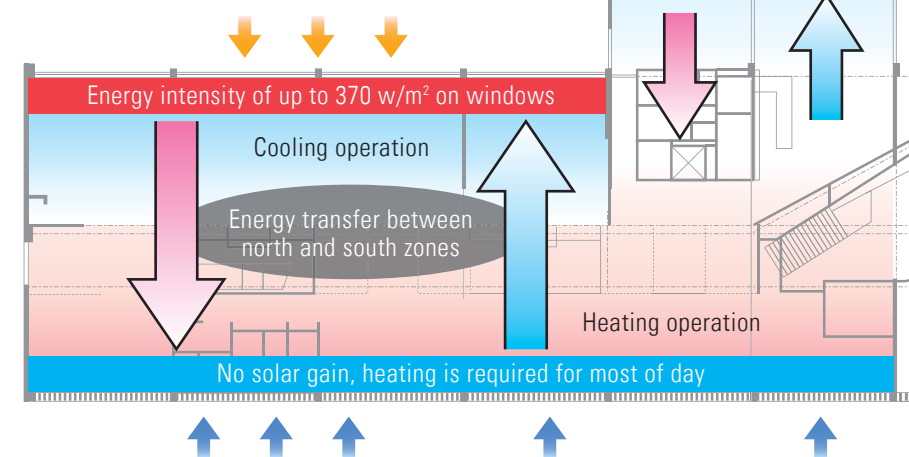
In addition, Daikin Australia also increased evaporation temperature to 9°C to compensate for lower than designed heat load. The VRV component represents 45% of total building electrical load thanks to its high efficiency during partial load and heat recovery.



Higher refrigerant temperature results in higher seasonal efficiency and comfort.

Zone Plan for Energy Transfer

After 10 am, solar load in north zone is high.



intelligent Manager and Air Conditioning Network Service System

The building is divided into 18 zones which can all be controlled at different temperatures by Daikin's intelligent Manager. Individual preferences can be set locally to optimise start times and temperatures, reduce operating times with split schedules, and enable on-demand air conditioning of meeting rooms.

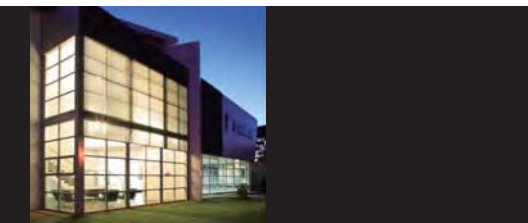
The system maintains outstanding comfort with precise control of individual set points within predetermined ranges as well as airflow adjustment. It also supports zoned lighting, with light detection in perimeter zones. Daikin's Air Conditioning Network Service System, for remote monitoring/control via Internet, also enhances energy management.



intelligent Manager

Natural Light and Ventilation

Daikin Australia. opted for a high window to wall ratio to maximise light. Heat gains were offset with Pilkington Low E glass.



The building is north facing with a significant glass area. The windows can be opened for natural ventilation when conditions allow.



LEED

Platinum 80 or more

Gold 60 to 79

Silver 50 to 59

Certified 40 to 49

CASBEE

S rank ★★★★★

A rank ★★★★★

B+ rank ★★★★★

B rank ★★★★★

Certification Document

LEED FACTS	SUSTAINABLE SITES	INDOOR ENVIRONMENTAL QUALITY
LEED for New Construction Certification awarded 22/07/2016	24/26	11/15
Platinum 85/110	WATER EFFICIENCY 10/10	INNOVATION IN DESIGN 6/6
	ENERGY AND ATMOSPHERE 23/35	REGIONAL PRIORITY CREDITS 4/4
	MATERIALS AND RESOURCES 7/14	



Project Outline

Location Osaka
 Number of floors 6
 Total floor space 47,911 m²
 office area: Approx. 19,800 m²,
 laboratory area: Approx. 28,000 m²
 Construction 2015
 Application Offices and laboratories



Daikin Systems Installed

Office area

- Air conditioning systems
 - VRV** high sensible heat type outdoor units x 88, **VRV** heat recovery type outdoor units x 29, Water-cooled **VRV** x 3 systems (total 60 HP)
- Ventilation
 - DESICA (heat-pump desiccant humidity control OA units) x 118

Laboratory area

- Air conditioning systems
 - VRV** high efficiency type outdoor units x 99, **VRV** heat recovery type outdoor units x 21, Air-cooled high efficiency modular chillers x 18 (total 540 HP), Water-cooled centrifugal inverter chiller x 1 (total 400 USRT)
- Ventilation
 - Heat reclaim ventilation units x 6

Control systems

Central monitoring systems (total control of **VRV**, chiller, ventilation, lighting and shade)

Project Overview

The Technology and Innovation Center (TIC) is a new core base for the Daikin Group's research and development program. The facility's buildings and equipment incorporate advanced environmental technologies, primarily in the air conditioning field. These applications serve as models for solutions which achieve both unrivalled energy efficiency and comfortable indoor environments.

Why **VRV**?

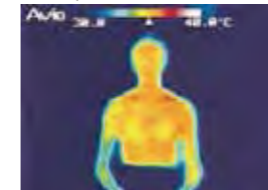
VRV and DESICA

The heat load in TIC's office area varies substantially depending on personnel numbers and fluctuations created by its many glass windows. These factors led to the adoption of **VRV**, which has an advanced ability to handle variable refrigerant temperatures.

Sensible and latent heat are controlled with a combination of high efficiency **VRV** and DESICA. This enhances thermal comfort by individually controlling temperature and humidity. Dramatic energy savings are also realised by reducing excessive heating or cooling and other wasteful usage.

Humans release body heat by evaporating moisture on our skin, meaning we feel cooler with lower humidity. Daikin has used this knowledge to create a more comfortable balance between temperature and humidity.

Temp.: 25°C
Humidity: 80%

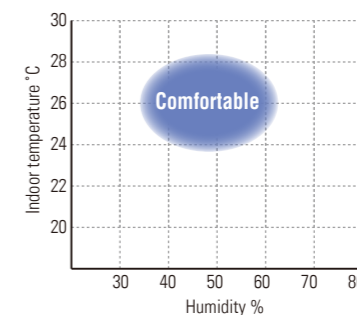


Hot and humid

Temp.: 25°C
Humidity: 50%



Comfortable



People can experience the same comfort with an indoor humidity of 40 to 60% even at 2°C above the set temperature.



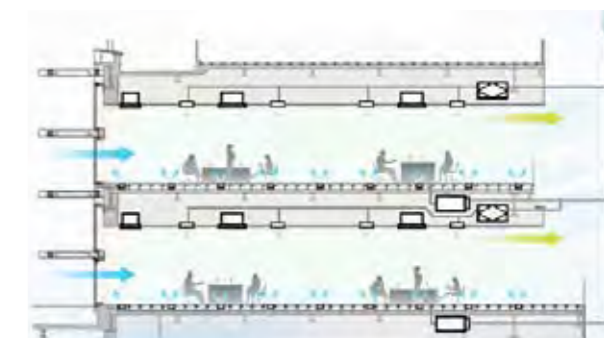
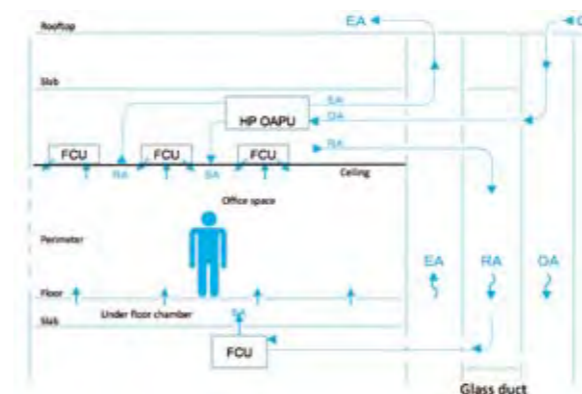
High efficiency **VRV** reduces the compressor workload and performs cooling operation by evaporating at higher refrigerant temperatures.



DESICA is a heat-pump desiccant humidity control OA unit which combines Daikin's heat pump technology with a desiccant element. The unit efficiently adsorbs and releases water vapour into the air without supply and drain pipings.

Optimum Air Conditioning

In office areas, indoor units are installed inside both the floor and ceiling. The indoor and DESICA units are used in combination with natural air to achieve even greater efficiency. This airflow is utilised in Natural Cooling Mode according to the indoor and outdoor temperatures, providing TIC with optimum air conditioning.



With Natural Cooling Mode, the windows are opened manually to promote the intake of natural air at appropriate outdoor temperatures. Concealed underfloor and DESICA units can also supply fresh outdoor air.

Renewable Energy

TIC makes comprehensive use of renewable energy and natural ventilation. The entrance area, for example, is serviced by a prototype water-cooled **VRV** system which utilises highly efficient geothermal and solar heat.

