

DAIKIN

VRV

Green Breath of Air-conditioning

DAIKIN INDUSTRIES, LTD.

High Efficiency Building Air Conditioning System



VRV



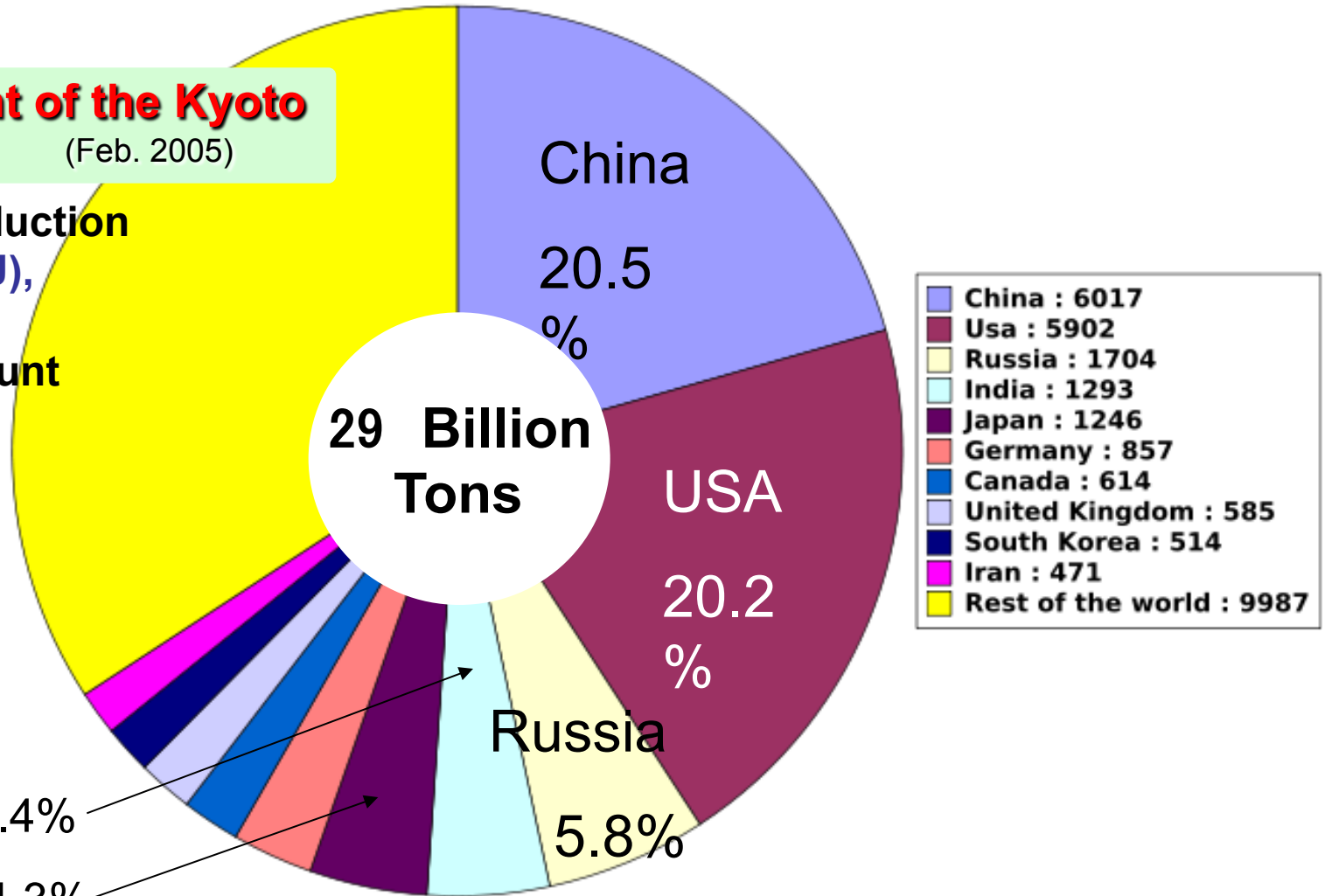
Energy Saving Approach

To stop Global Warming

Global Total CO2 Emission

Enforcement of the Kyoto Protocol (Feb. 2005)

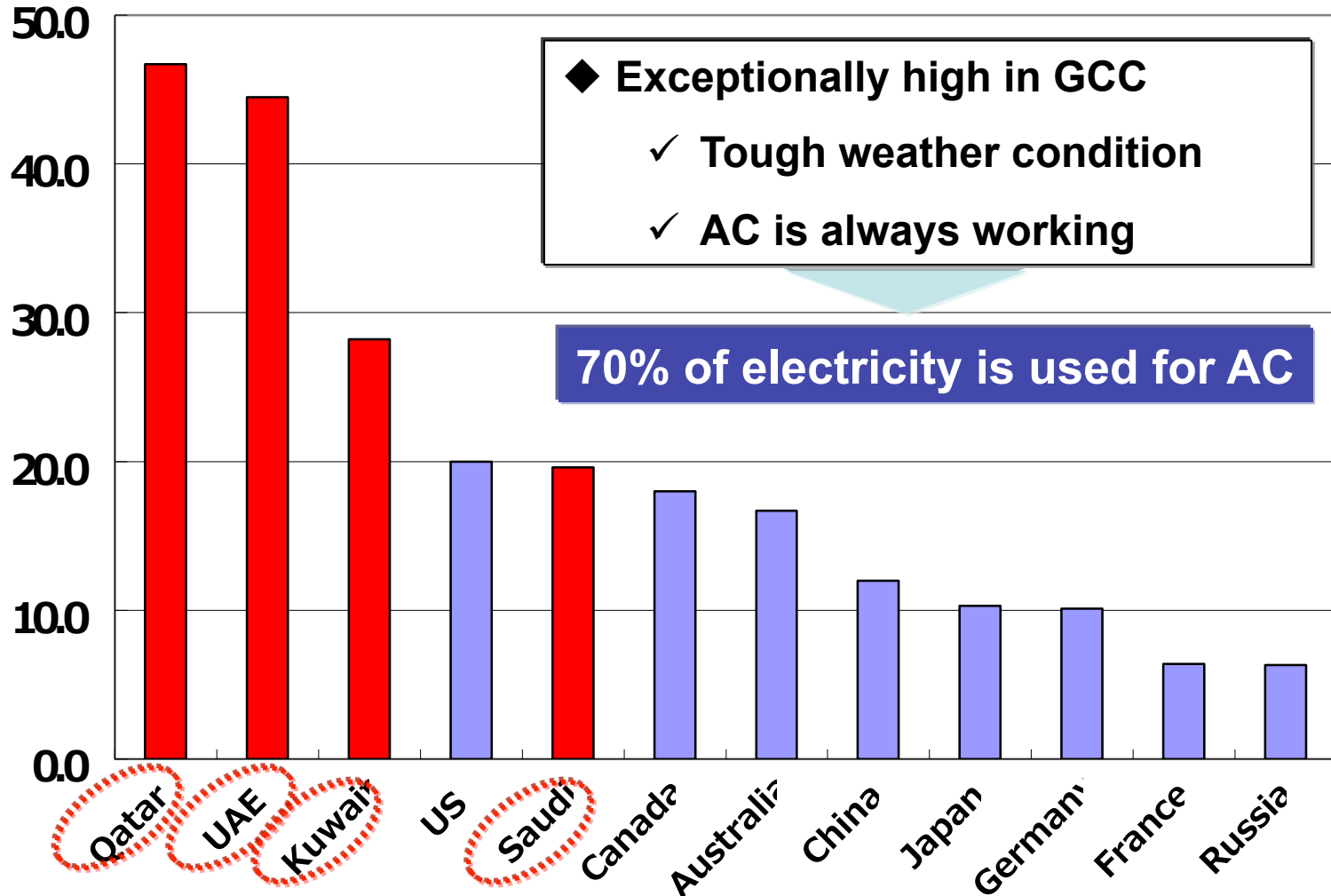
Required reduction
EU: 92% (EU),
Japan: 94%
Of 1990 amount
before 2012.



Source : Energy Emission Administration 2006

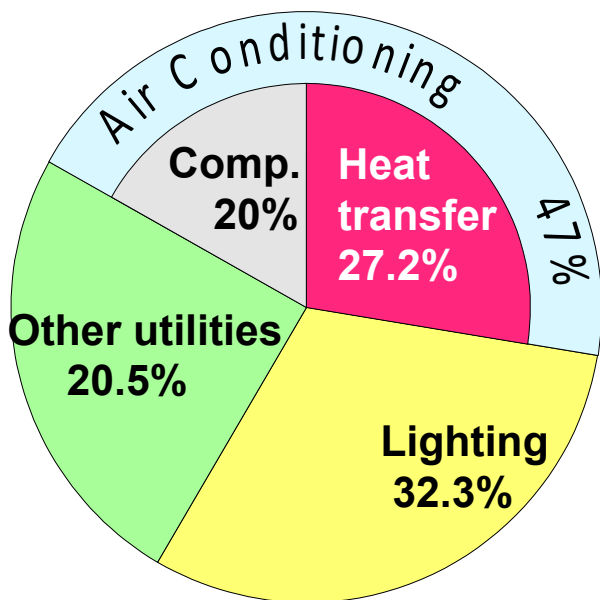
CO2 Emission per capita

Tons / capita



Energy saving approach

Energy consumption in office buildings in Japan



47% of electricity is consumed by AC

AC consumption reduction is prime target of energy saving

How does it possible to achieve energy saving and comfort simultaneously?



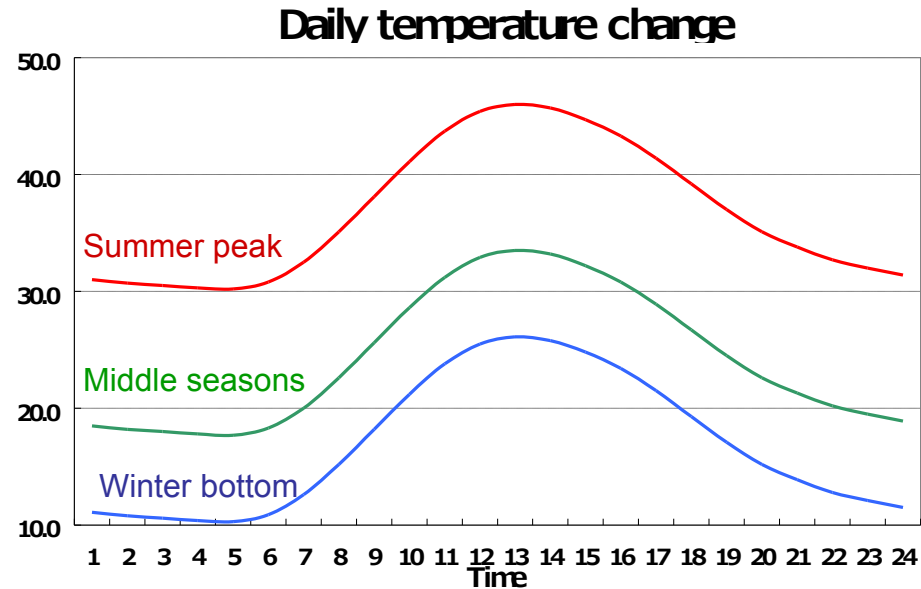
Minimizing Energy Losses !

Character of Cooling Load

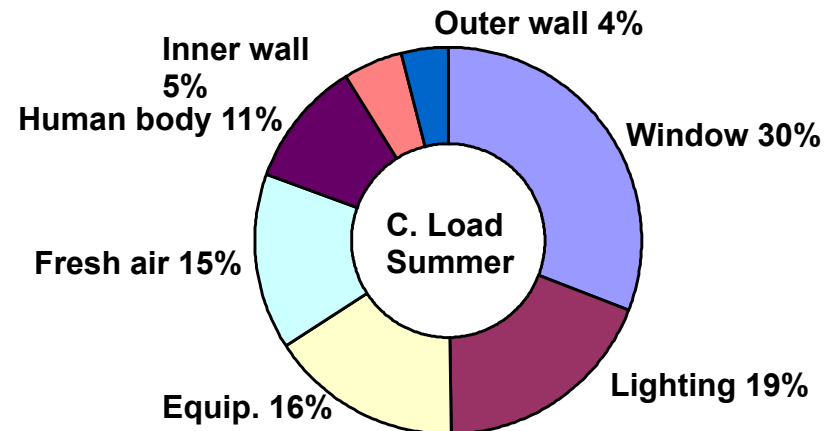


Changing continuously

Seasonality

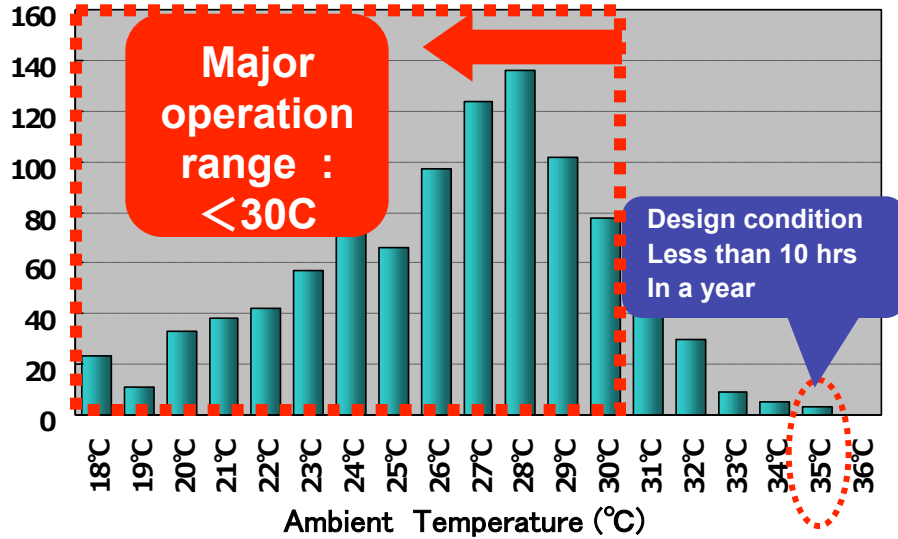


Diversity

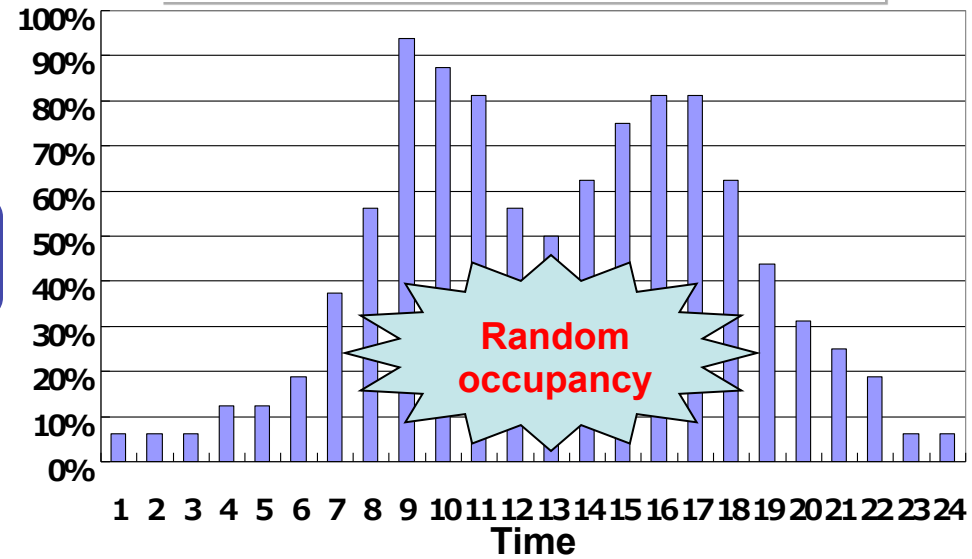


Part Load Performance (1)

Yearly Cooling hours



Daily occupancy ratio



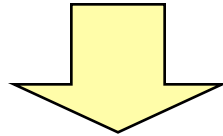
AC is selected for maximum load but operated under fluctuating part load almost all time

- **Quick capacity adjustment for changing load**

Adjusting refrigerant flow

Part Load Performance (2)

What is the best way for quick and accurate refrigerant flow control ?



Inverter Driven compressor

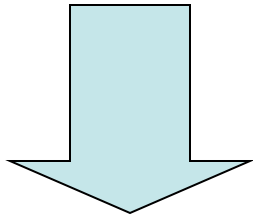
- **Motor speed direct control**
- **Quick response by electronics control**
- **Simple mechanism**

VRV Key Technologies

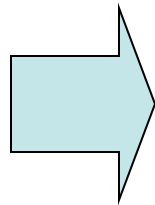
Inverter driven compressor : Outdoor unit

Motorized expansion valve : Indoor unit

CPU : Integrated control system



**Quick & Flexible
Capacity Control**

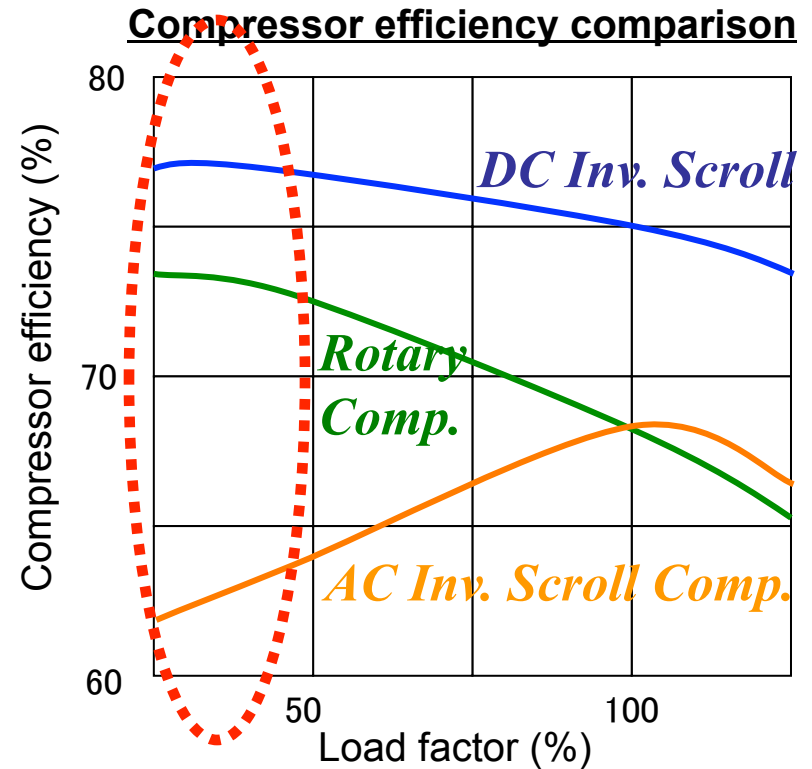
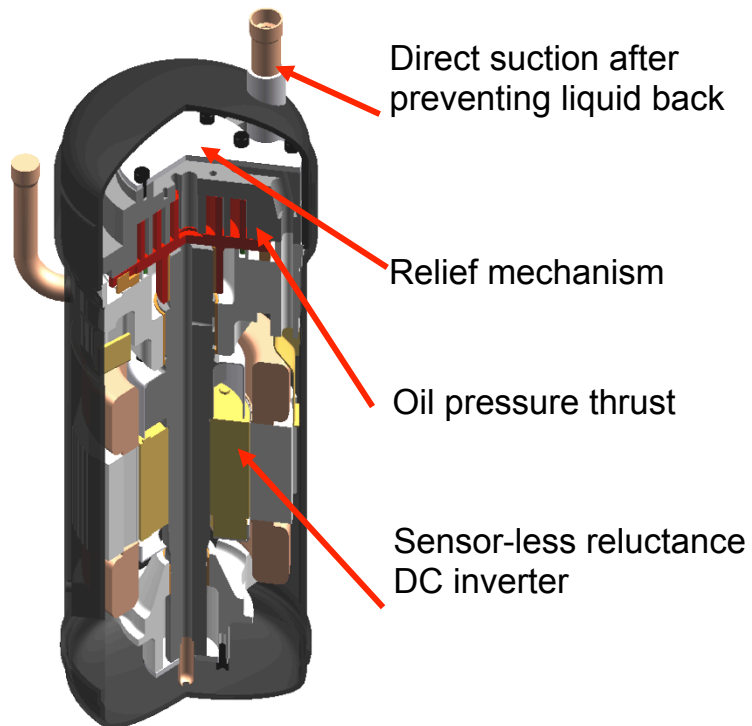


- **Energy saving**
- **Comfort condition**

Major Components (1)

DC Inverter Scroll compressor

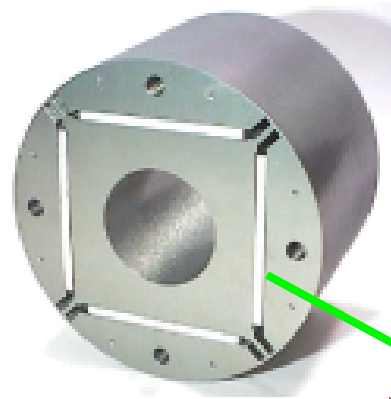
High performance, especially in part load



Major Components (2)



Stator



Rotor



Neodymium magnet
(High torque)

Strong magnetic power



Neodymium magnet

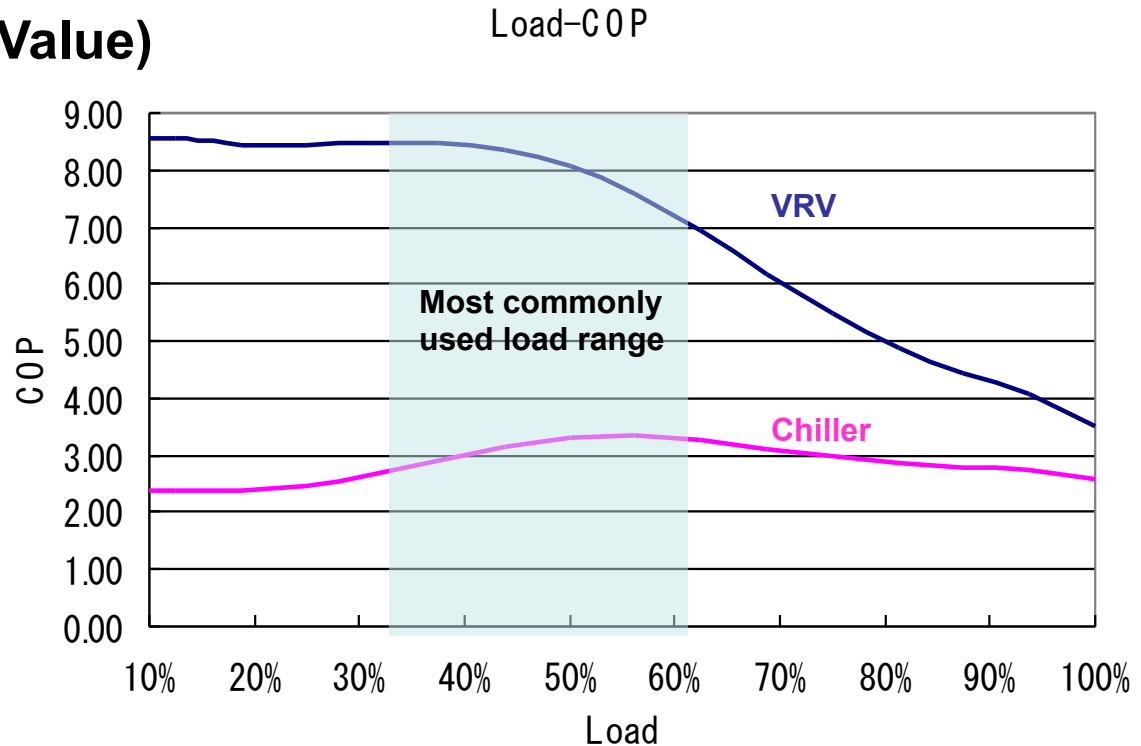
Ferrite magnet

Performance Evaluation VRV v.s Chiller

IPLV (Integrated Part Load Value)

IPLV shows more realistic performance of AC system.

It shows seasonal coefficient of performance which is calculated by using 4 different COP under different conditions.



IPLV comparison according to ARI 550/590-98

VRV : 10HP air cooled model, Chiller performance is cited from Japan Refrigeration Institute air cooled chiller data.

VRV has excellent performance in part load condition because of its inverter driven compressor.

Other Benefits

Short model change interval



Offering Packaged Solution

Chiller System



Water

Water Volume?

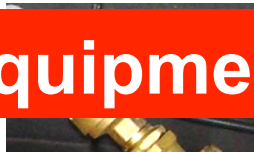
Water Quality?

Pipe Corrosion?

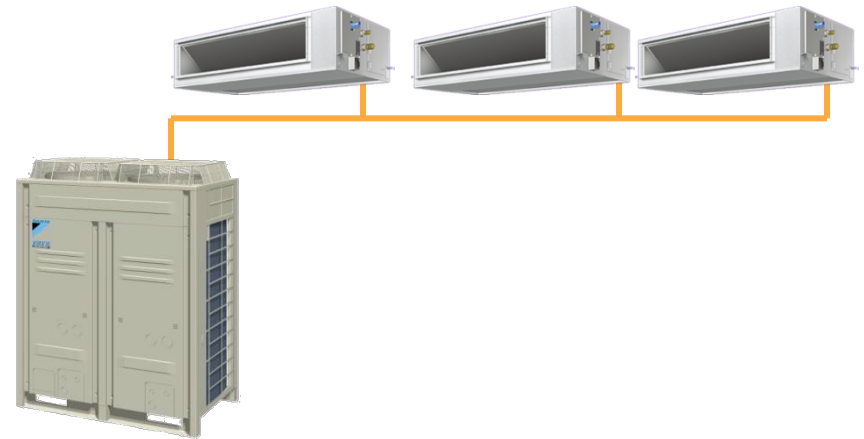


Many Equipments

Manual Integration



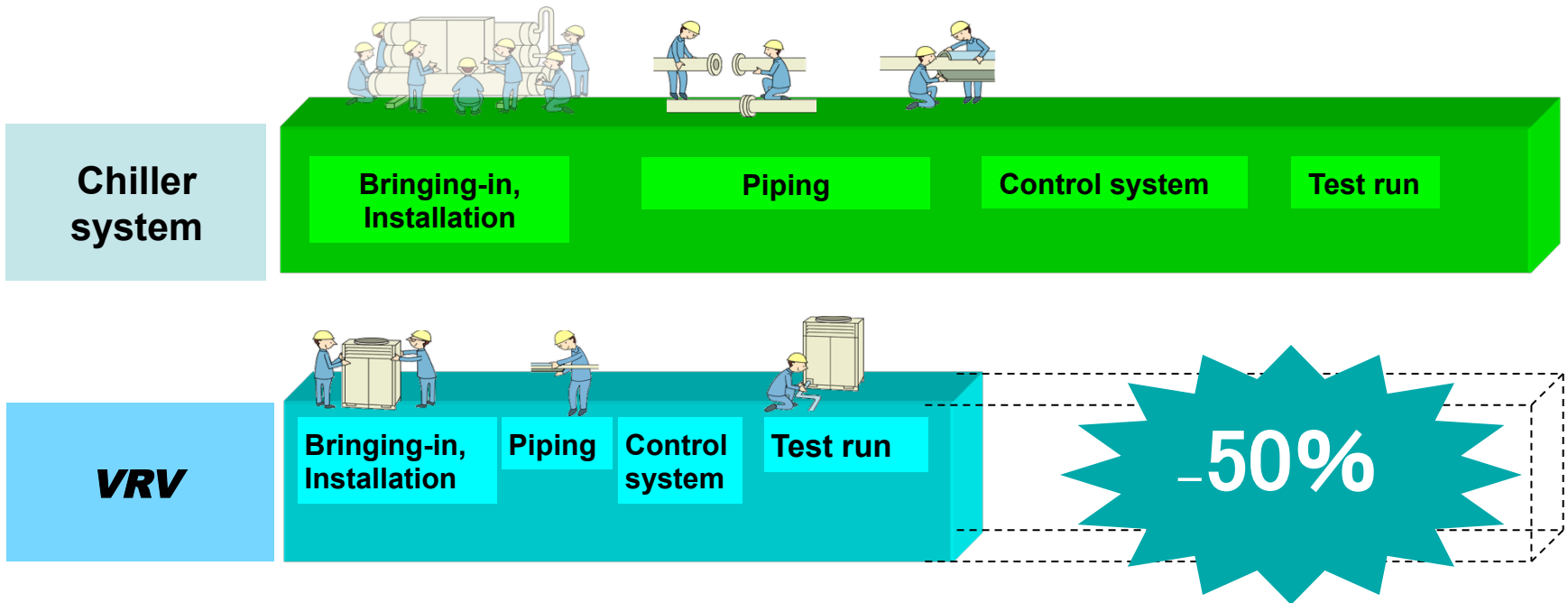
VRV



Simple system

One stop shopping

Easy to install in short time



<Condition>

Application of the building:

Office

Total floor area:

8,000m²

Number of people for installation:

5 persons/day

Central system:

100HP air cooled chiller x 4 + 250kW boiler
+ Ceiling mounted cassette type FCUs

VRV system:

44HP outdoor unit x 10
+ Ceiling mounted cassette type indoor units

Shortest installation time example



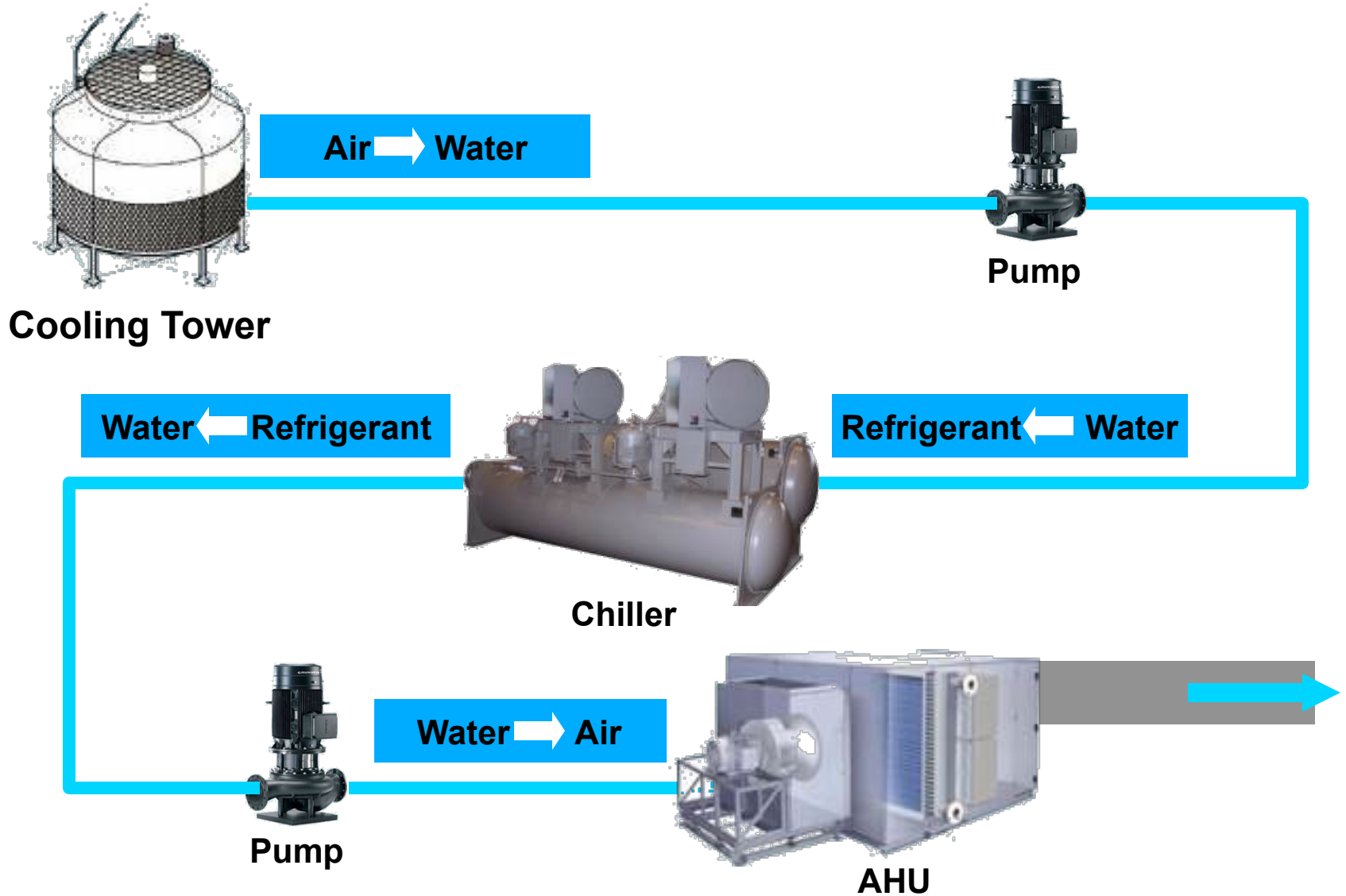
A super market in Japan

Total floor area = 20,000m² (10,000m²/F x2)

Installed VRV = 700HP (10HP x 70)

Installation term = 20days only!

Minimum Energy Losses



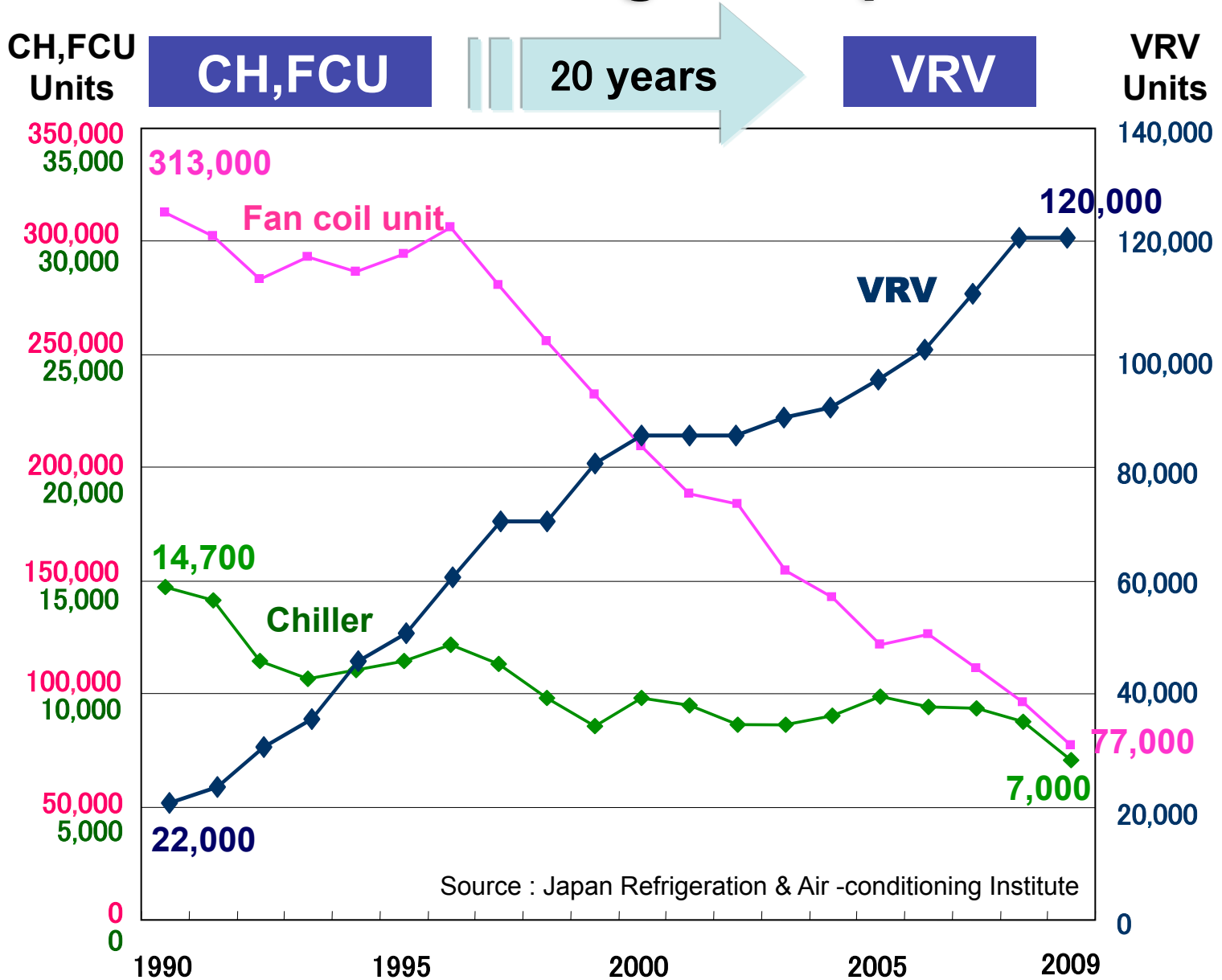
The background of the entire image is a soft, light pink color, densely populated with various stages of pink cherry blossoms. Some flowers are in full bloom, showing five petals and a central yellow stamen, while others are buds or partially open. The blossoms are scattered across the frame, creating a delicate and celebratory atmosphere.

2011

*The 30th year
for*

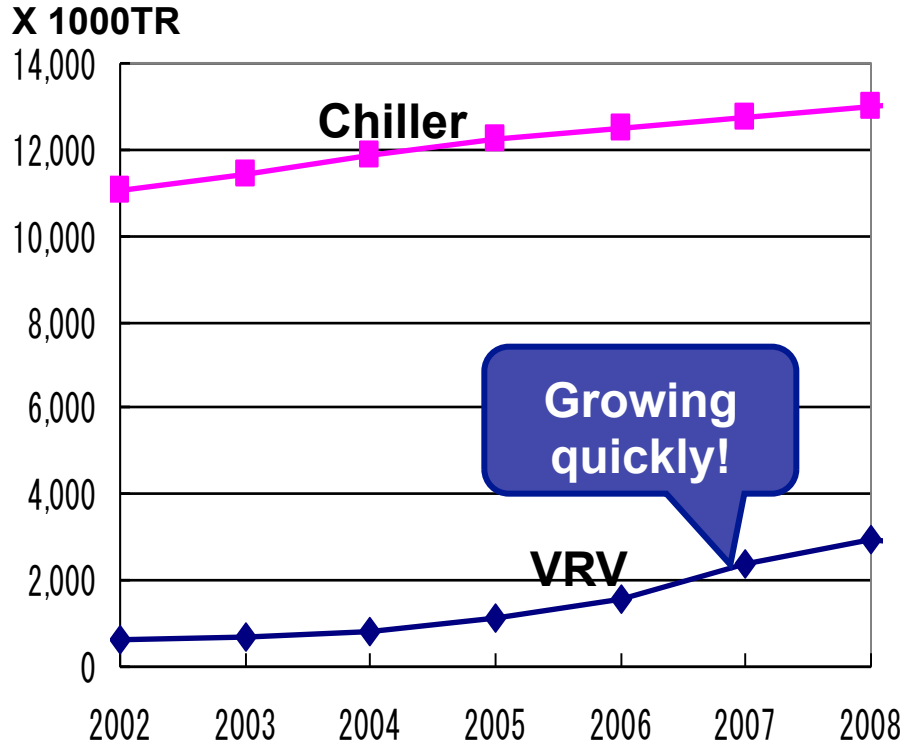
WRV

Drastic Change in Japan

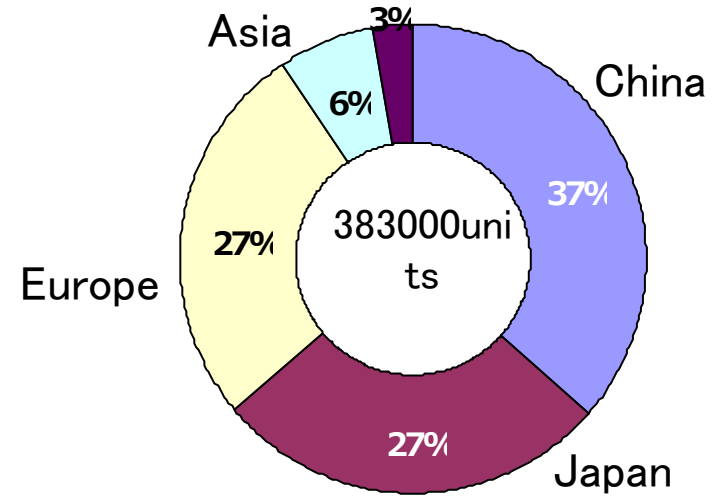


World HVAC Market 2008

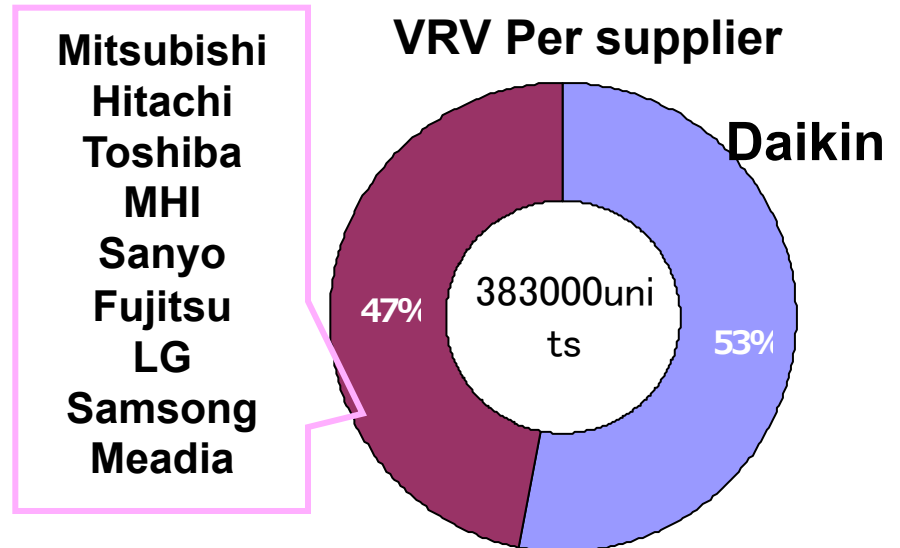
VRV vs. Chiller



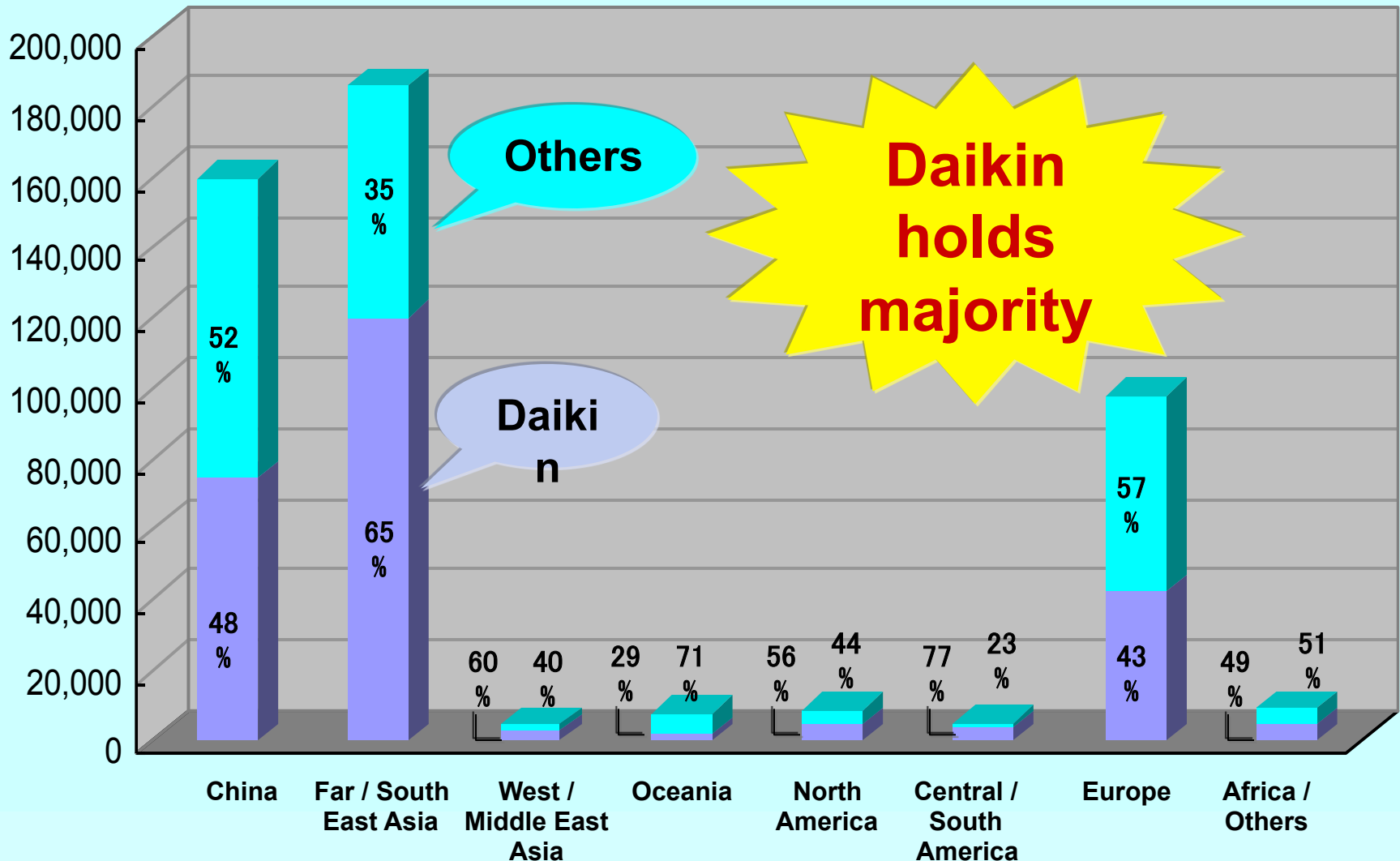
VRV per region



VRV Per supplier



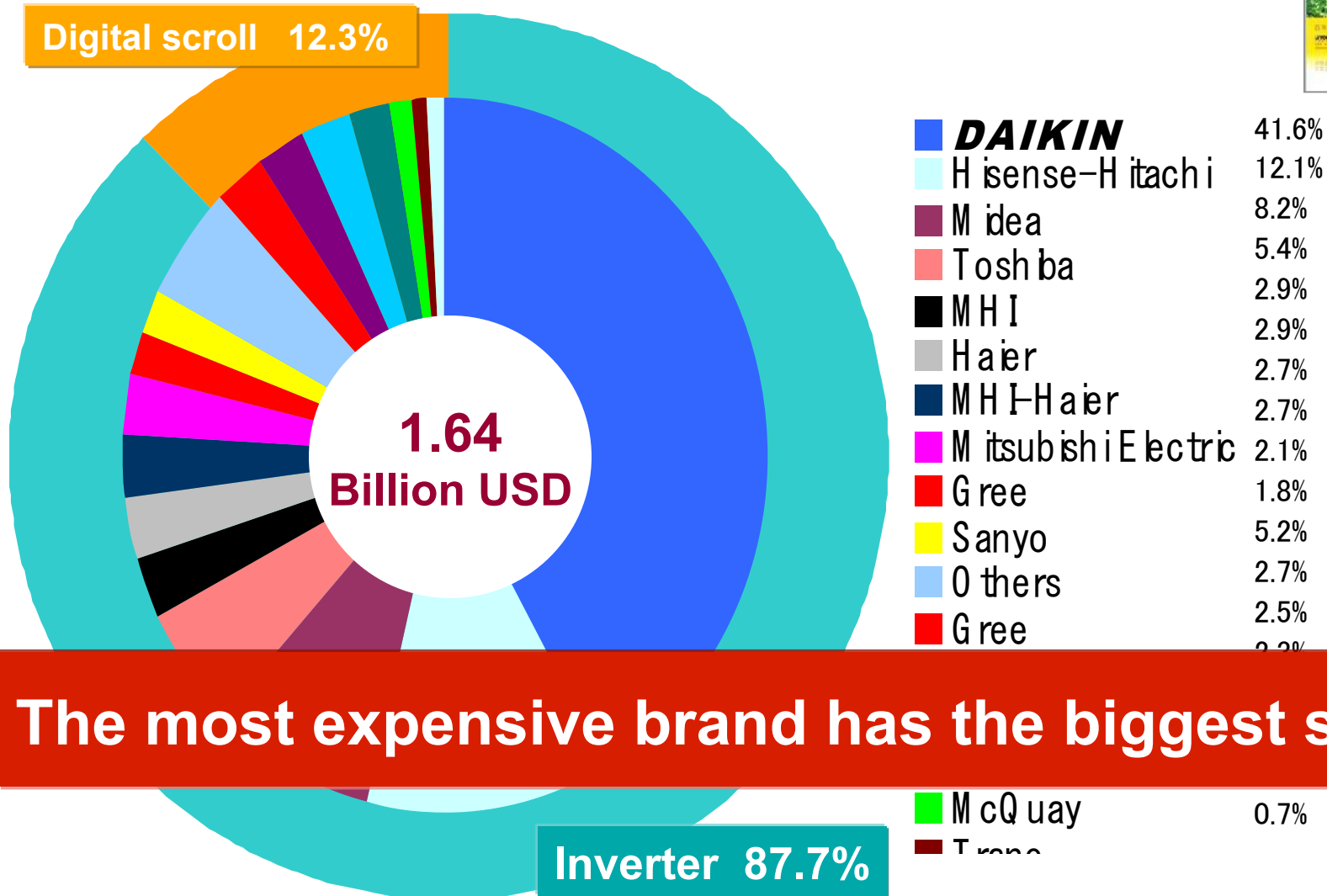
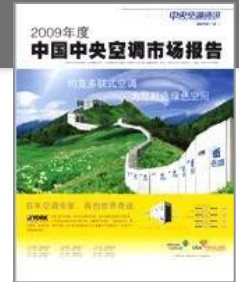
Global VRV Market (2008)



Estimated by Daikin

Situation in China (VRV + Multi split)

[Resource]
Chinese Central Airconditioning Report, Feb., 2010



The most expensive brand has the biggest share!

VRV Global Penetration

**1990 – 1999 : Small & Medium Sized
Building**

**2000 – 2011 : Medium & Large Sized
Building**

1992 France



Holiday Inn Dijon, Dijon

- VRV were installed in 1 year later from opening

1993, Portugal



Quinta dos Palhas Hotel

- **Equipment**

- 51 x RSXY5, RSXY8 and RSXY10 VRV heat pump inverter outdoor units
- 334 x FXYC20, FXYC25, FXYC32, FXYC40 and FXYC63 double flow ceiling mounted cassette indoor units
- 10 x FXYS25, FXYS40 and FXYS63 ceiling mounted built-in indoor units





1994, Spain

Palacio de Justicia, Vitoria - Gasteiz



1995, Italy



Grand Hotel Excelsior Vittoria, Sorrento,

● Equipment

- 3 x RSXY8 and 6 x RSXY10 VRV heat pump inverter outdoor units
- 104 x FXYS ceiling mounted built in indoor units



1996, Germany



Renault Bank, Köln,

● Equipment

- 8 x RSXY10 VRV heat pump inverter outdoor units
- 1 x FXYH63 ceiling suspended indoor unit
- 62 x FXYA25 and 20 x FXYA40 wall mounted indoor units





2000–2010, Days of large projects

- ***System Scale up : 10 → 30 → 54HP***
- **Ref. Piping Extension : 100 → 150 → 165m**

Penetration into large scale projects

Accumulated sales 1 million units in 2007

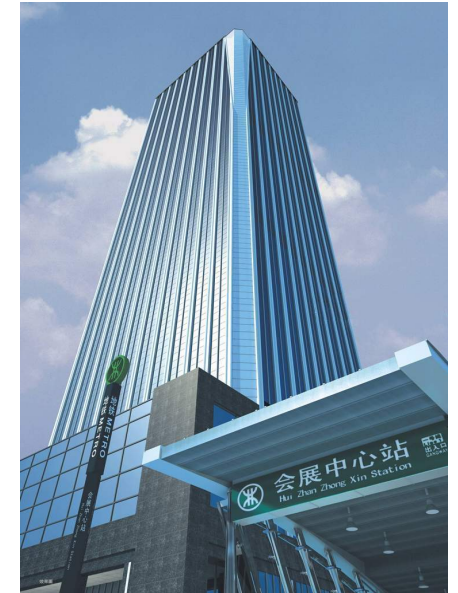
'00-'08 Examples

● Towards to large scale buildings

Condominium



**Airport terminal
Bldg.**

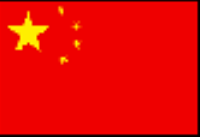


High-rise Bldg.



**Large Office
Complex**

2000, China

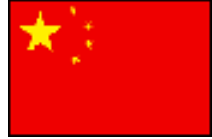


Jiansu Plaza Shenzhen,



**53F, 150m Office Tower
Break through
into High-raised Building Market**





➤ System summary

VRV + Chiller

Developer: Jiansu Province Gov.

Completion: 2000-12

Project scale:

Floor number: 53F

Building height: 150m

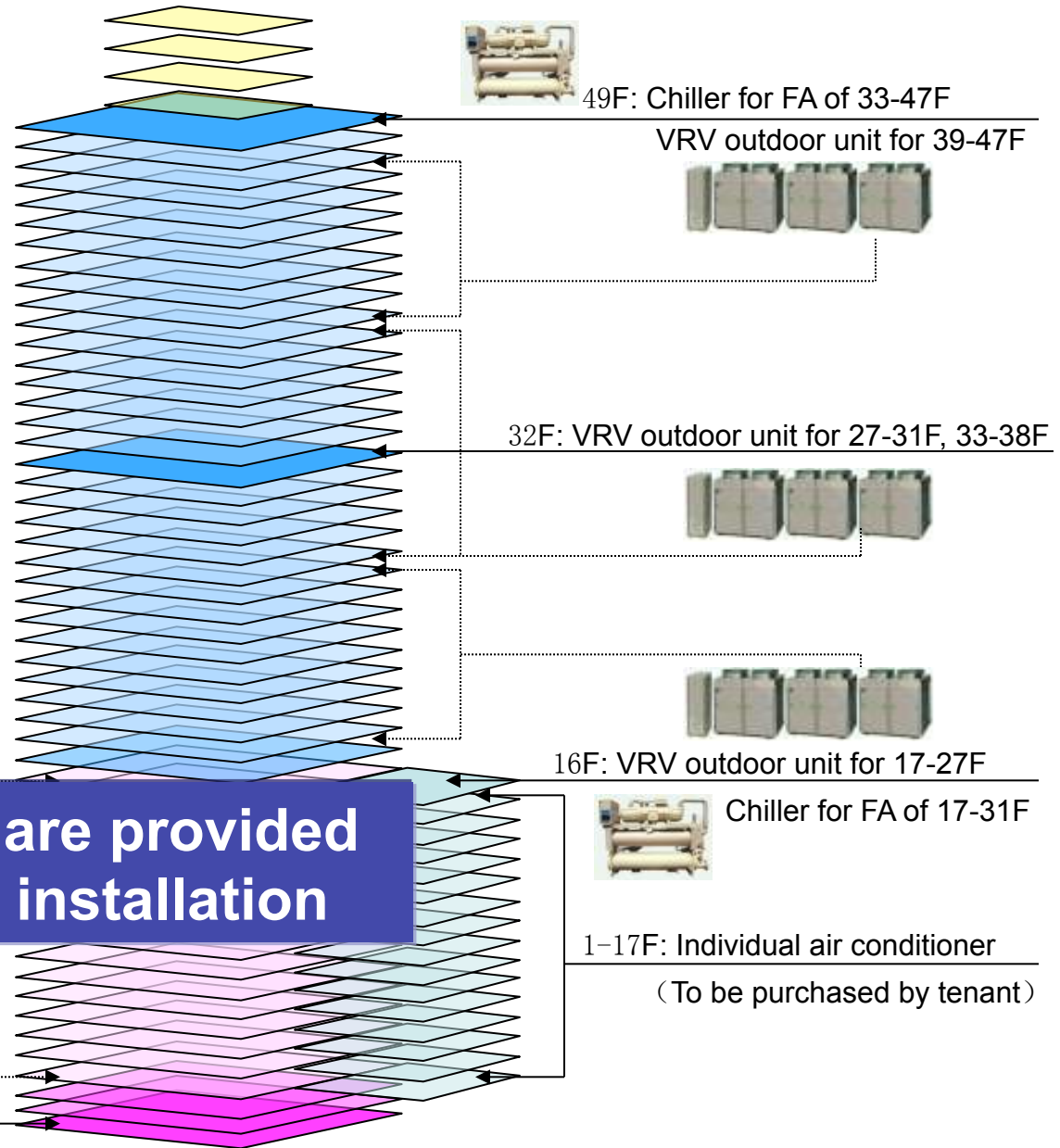
Floor area: 90,000m²

Air conditioning area: 60,000m²

Control system: Centralized controller*16
i-Manager*4

AC system: VRV-K+water cooled chiller

Model: VRV: VRV-K*2
VRV-Plus*115
Chiller: CUW120B5Y*5
CUW360B5Y*3



2 Mechanical floors are provided for Air Cooled VRV installation

2004, Spain

Telefonica HQ in Madrid



Approx. 200,000m² Office Compound

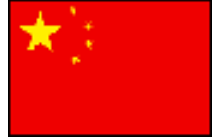
Usage: Offices, retail, com. rooms, etc...
Air conditioned Surface : 200,000 m²
AC system : VRV-K + Water cooled & Air cooled chiller

VRV : 1,420USRT



Chiller : 5,800USRT





2006, China

Thomson Riviera, Shanghai



地址： 浦东区花园石桥路28弄

用途： 公寓

均价： 130,000元/m²

建筑面积： 115,000m²

层数： 2幢40层+2幢44层的超高层

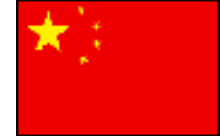
VRV : 1,998 HP

High Class condominium



2007, China

Nanjing City Financial Center



■ 1, 2办公区

室外机总配置: **VRVIII*P 4,748HP**

RHXYQ8P 186套

RHXYQ10P 50套

RHXYQ14P 92套

RHXYQ16P 92套

室内机形式:

FXDP56M FXDP71MPVC

■ 商业区

室外机总配置: **VRVIII*1,088HP**

RHXYQ8P 7套

RHXYQ10P 7套

RHXYQ12P 1套

RHXYQ14P 1套

RHXYQ16P 8套

RHXYQ20P 1套

RHXYQ24P 3套

RHXYQ26P 4套

RHXYQ30P 2套

RHXYQ32P 5套

RHXYQ36P 1套

RHXYQ40P 2套

RHXYQ42P 1套

RHXYQ44P 1套

RHXYQ46P 1套

RHXYQ48P 3套

室内机形式:

FXFP71M FXFP100M FXFP125M

控制系统: i-Manager



28F

Office: 48,000m²

Shop: 4,500m²

2006, Japan



Osaka Ekimae the 4th Building

Renovation Project

Offices, Shops : 24F + B4F

Air cooled
VRV



Water cooled
VRV

Before renewal : Central system

- Centrifugal chiller (Shop) 650USRT*2
- Absorption chiller (Shop) 560USRT*2
- Centrifugal chiller (Office) 560USRT*2



After renewal VRV+Central system

Air-conditioner for interior

- Existing central system

Air-conditioner for exterior

- Upper floor: Air cooled VRV*440HP
- Lower floor: Water cooled RV*440HP



2007, Brazil

Eldorado Tower, San Paulo

- Height : 33F + B3
- Total Floor area : 67,650m²
- Typical floor area: 1600 m²
- Completion : 2007
- Air cooled VRV 196 units

All condenser units on the roof
No machine space on tenant floors
Long Ref. piping

LEED “Platinum”



2011, Qatar

Samrya Tower, Doha

Total floor area : 68, 658 m²

Height: 42F + B3

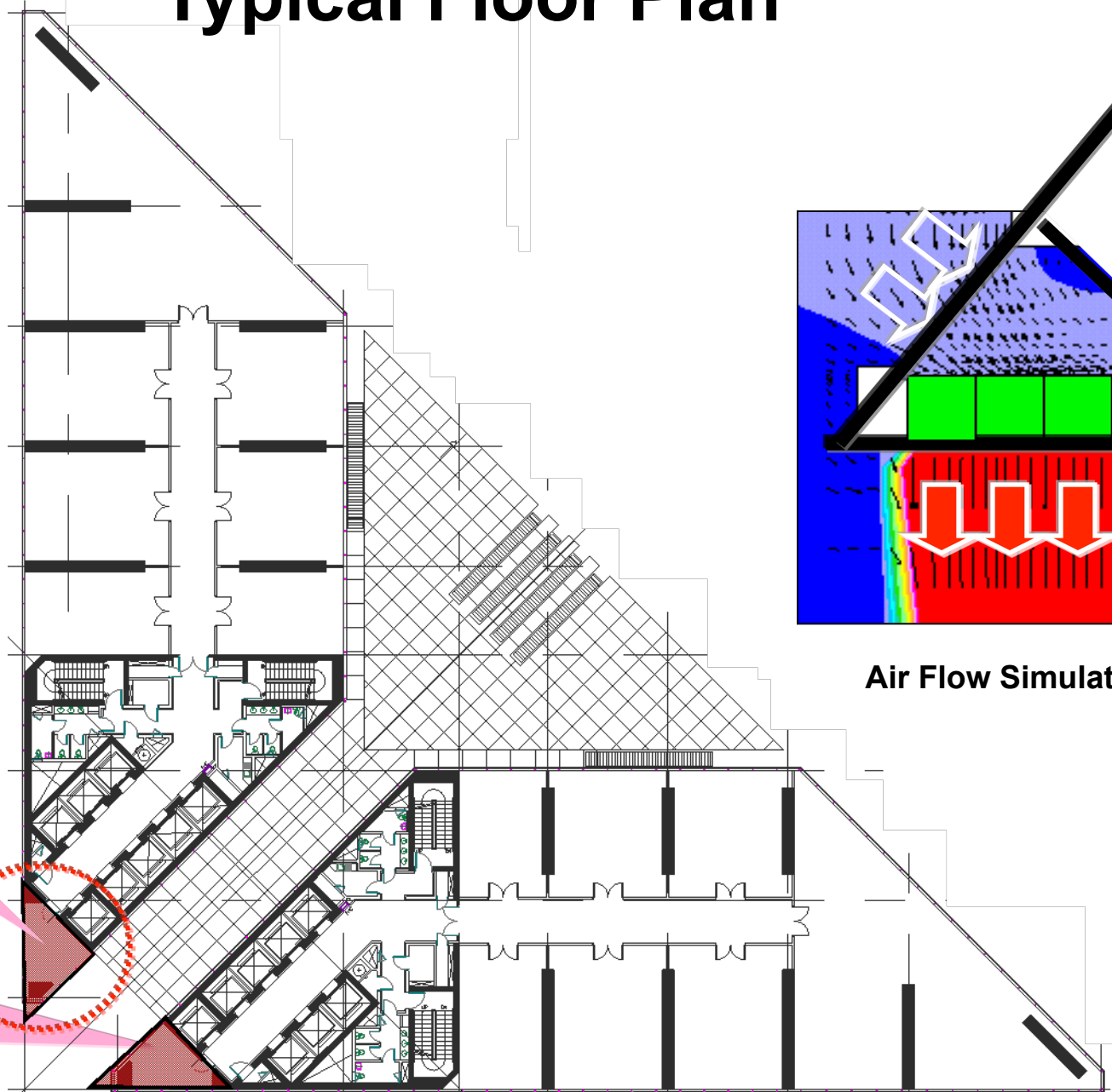
Air cooled VRV : 12 HP x 439 units

High Ambient temp. Model

Operative up to 50C

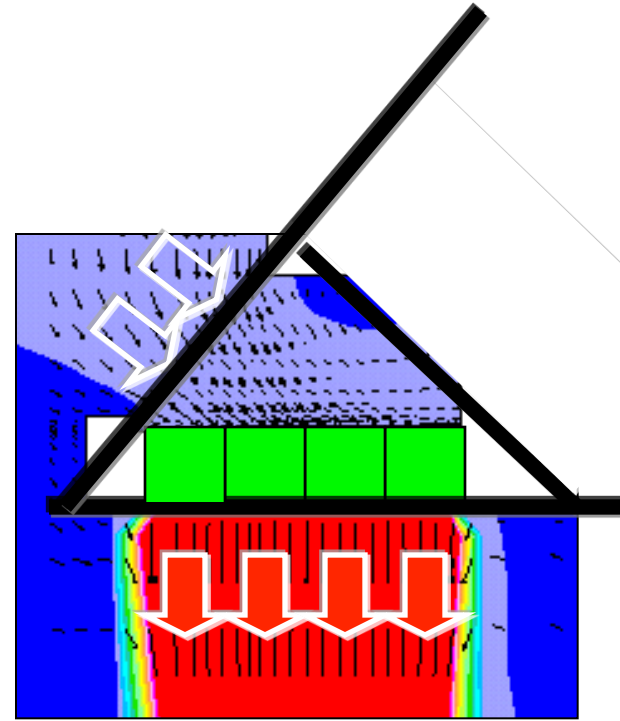


Typical Floor Plan



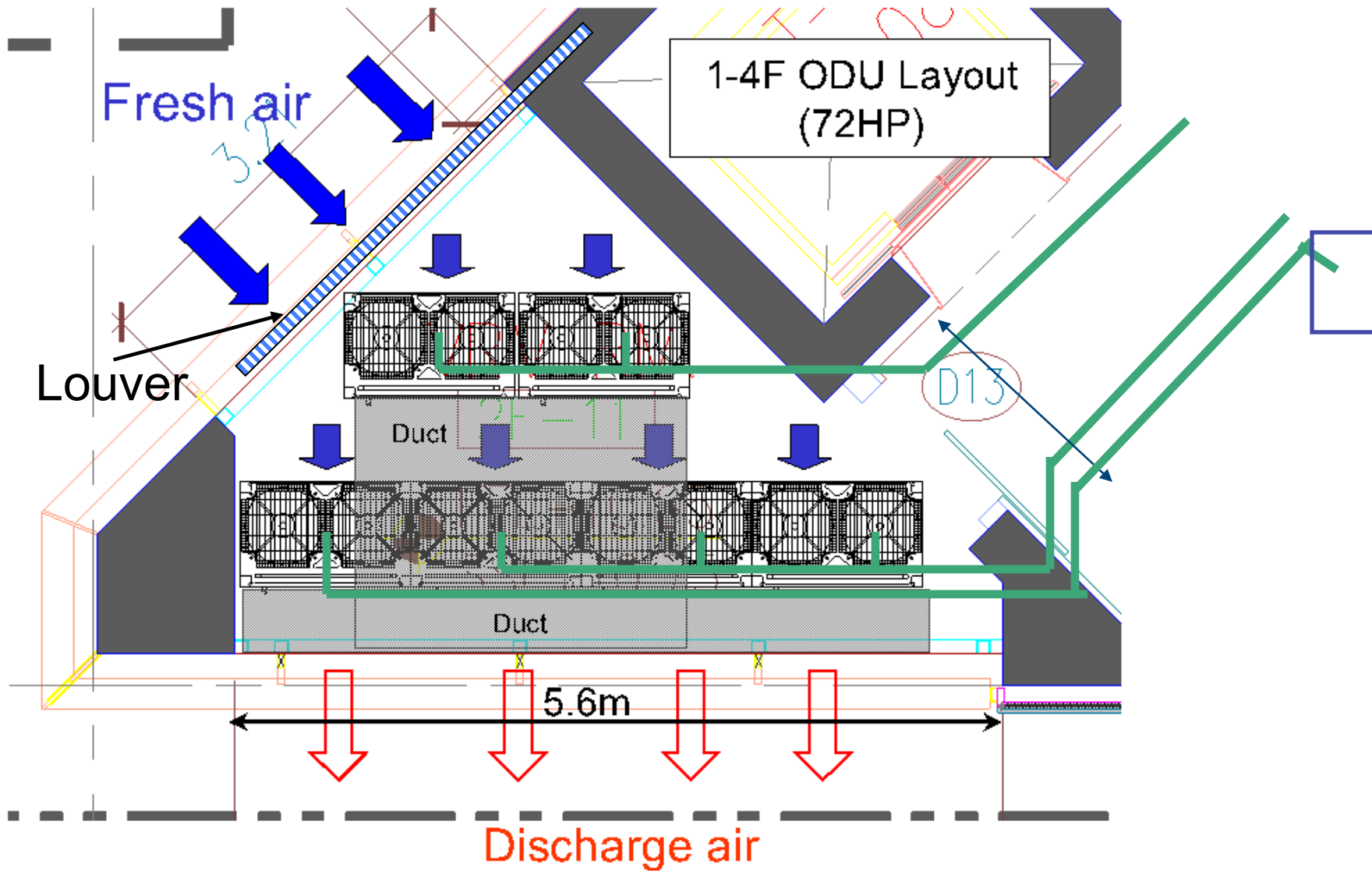
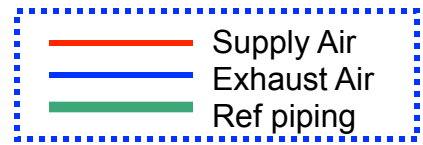
ODU
Machine
room

ODU
Machine
room

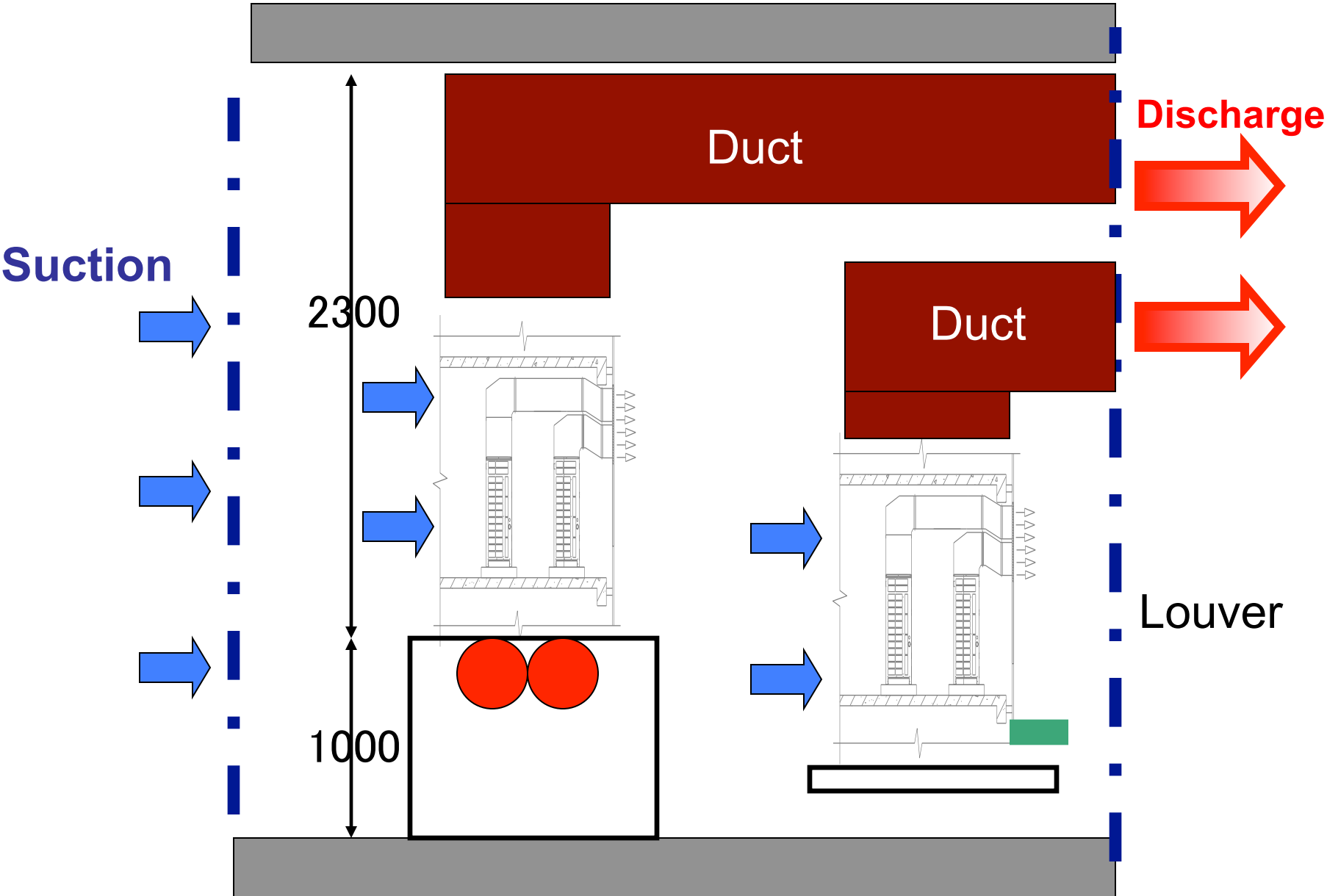


Air Flow Simulation result

Machine room detail



Exhaust Duct Layout

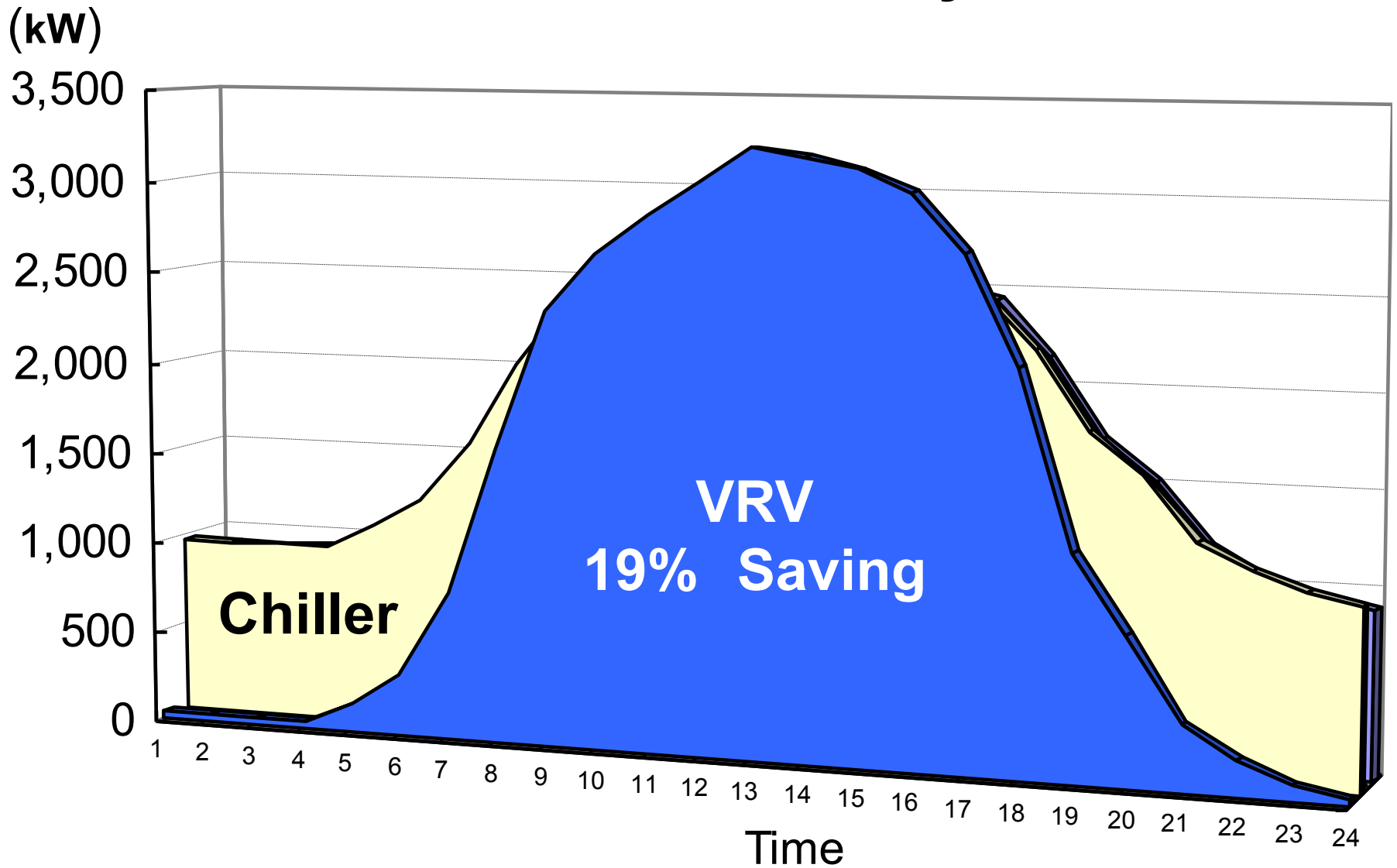


Electricity Consumption Simulation

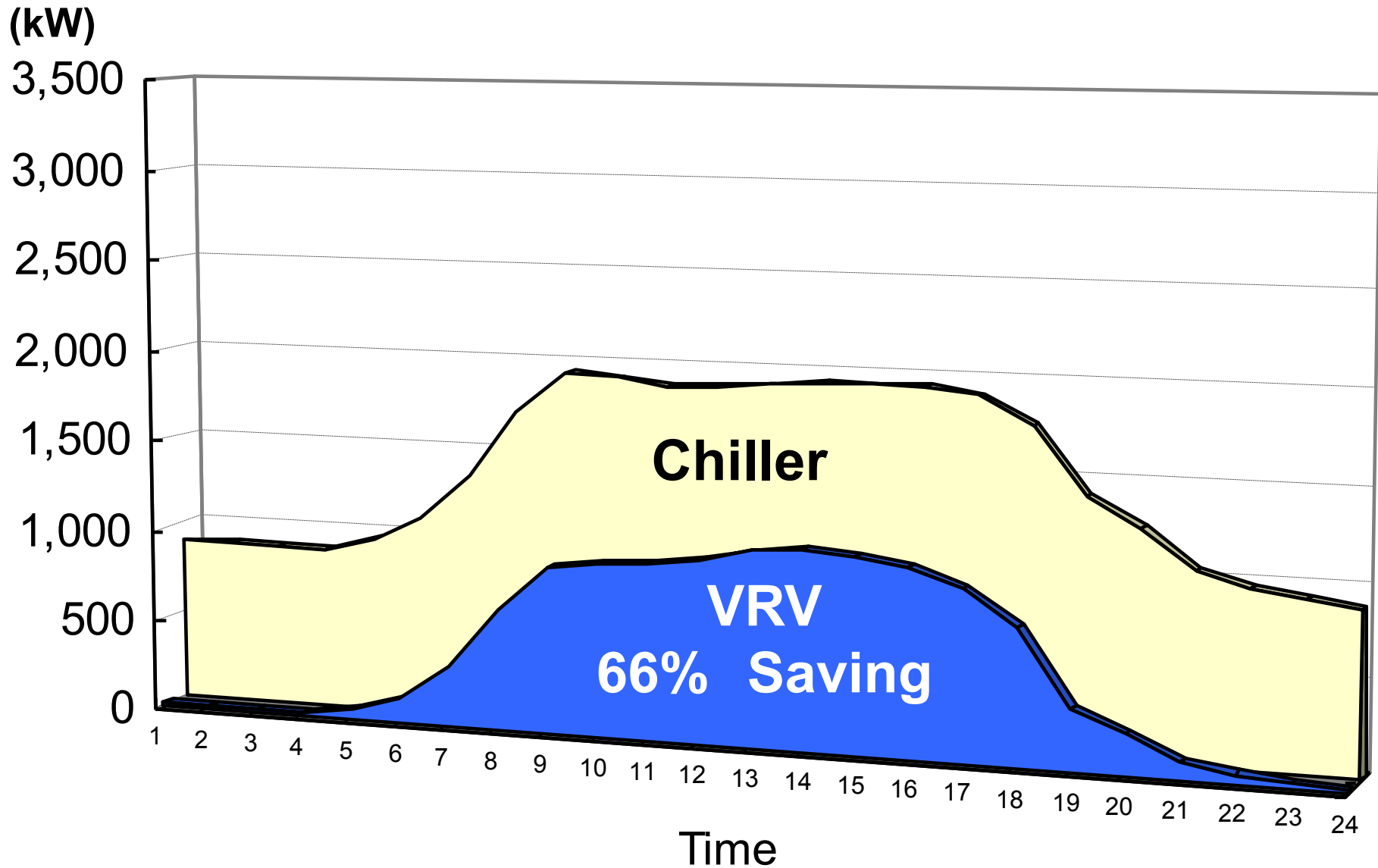
Samrya Tower

VRV System vs. Chiller System

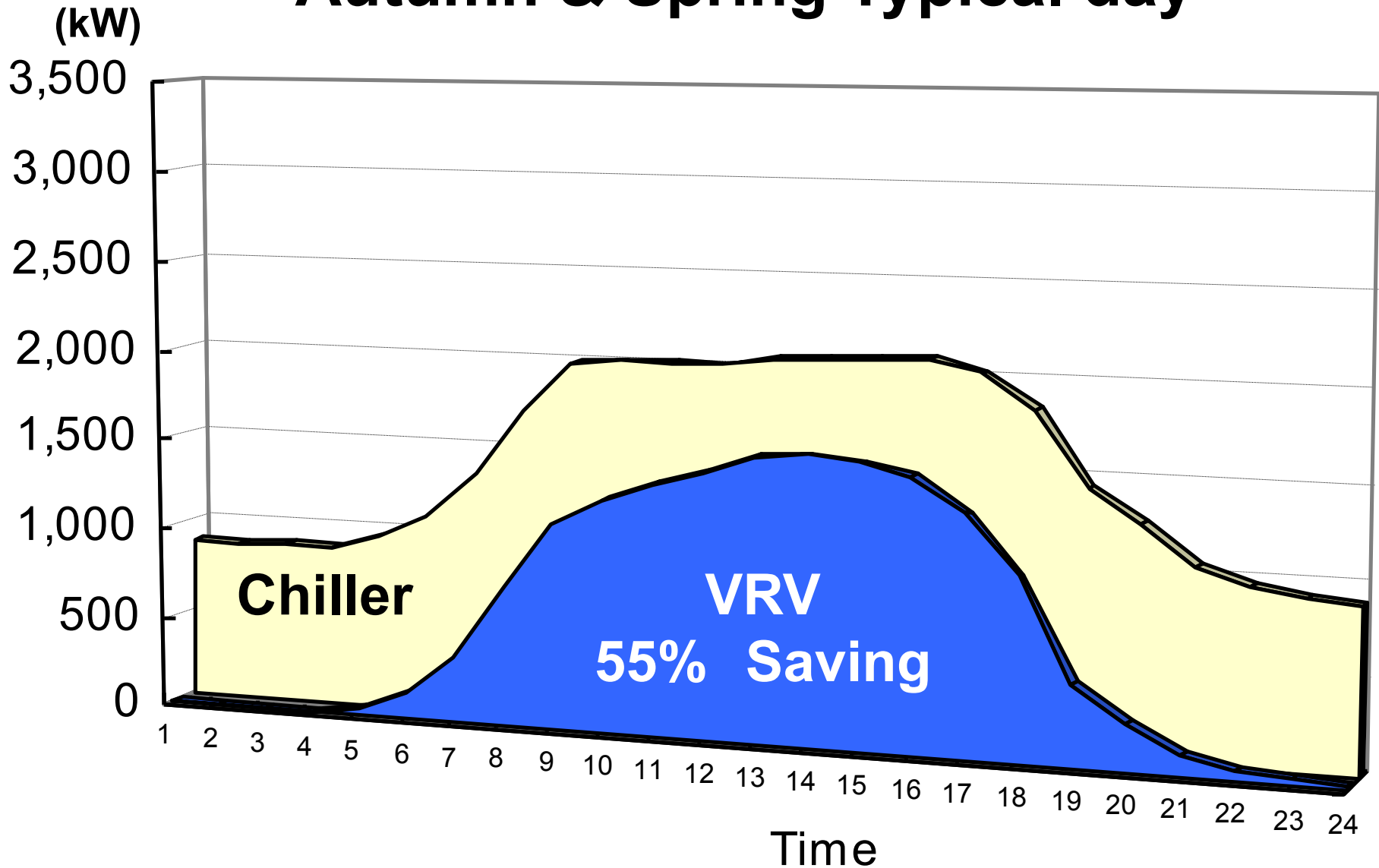
Summer Peak Day



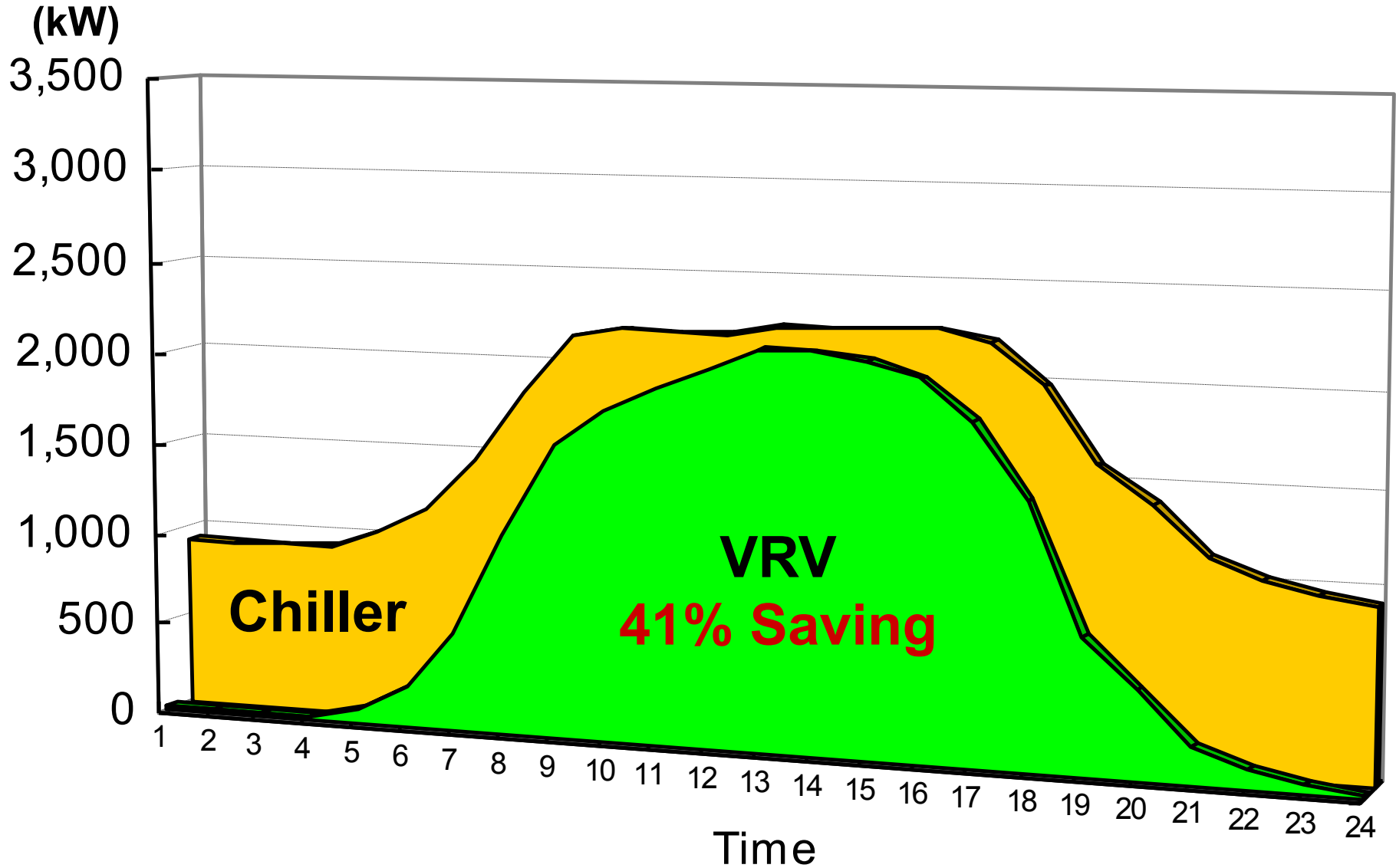
Winter Bottom Day



Autumn & Spring Typical day



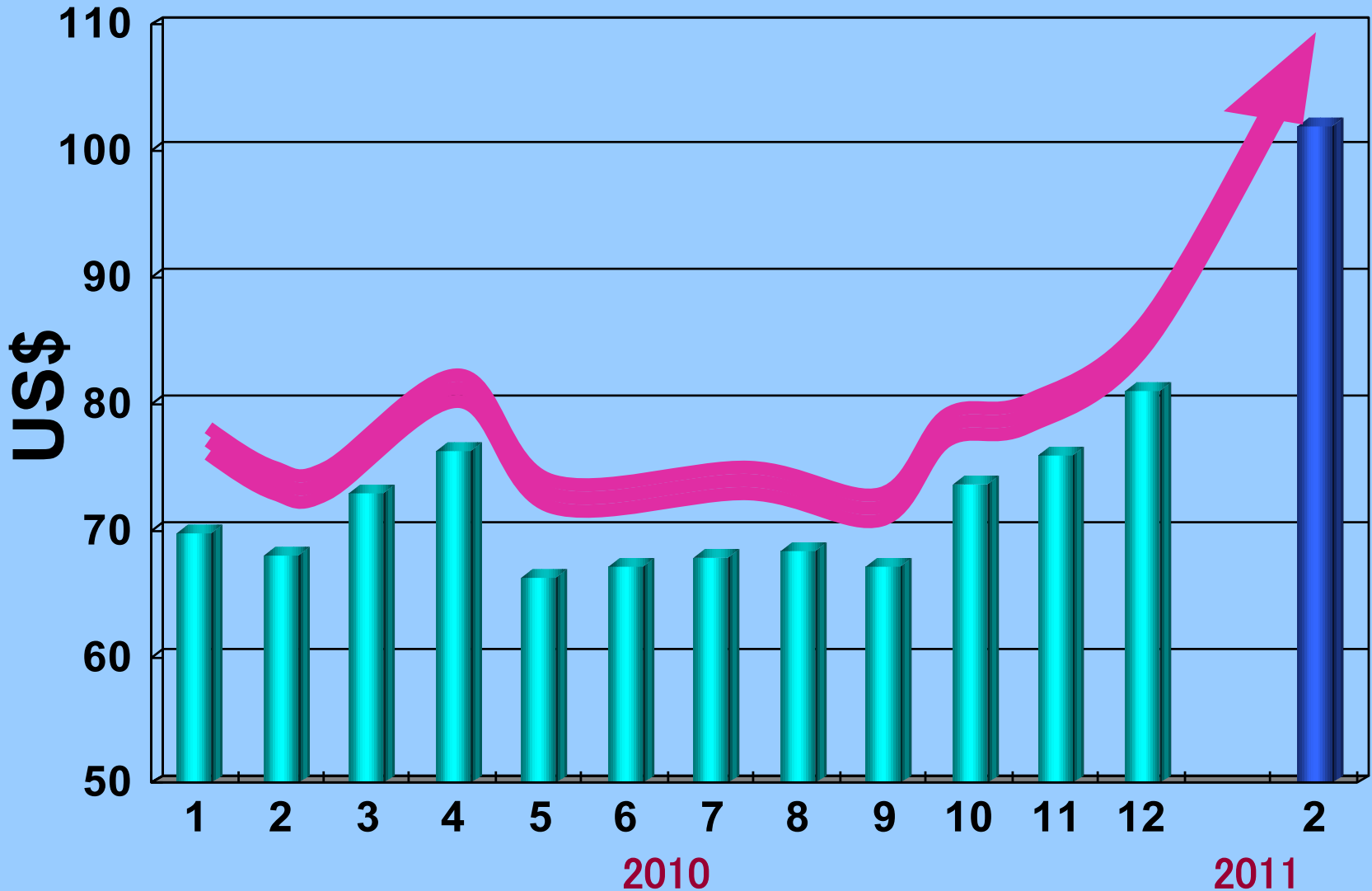
Annual Accumulated Result



For the next decade

Higher Energy Cost

Crude oil Price



Solution?

Yes !





*Thank you
for
your attention !*