

Portal To Profitability

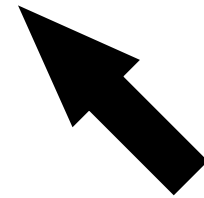
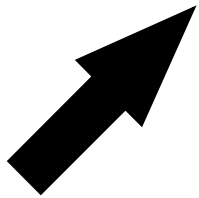
Variable Refrigerant Volume
HVAC Systems

Exploiting Each Kilowatt

Jim Dale 28 June 2010



V R F / V



Variable Refrigerant

Flow

Volume

History

- VRV was developed in response to the 1970's oil crisis and the resulting strict energy efficiency laws in Japan
- **VRV/V Concept**
 - 1- System Simplicity
 - 2- Low Energy consumption
 - 3- Individual Operation
 - 4- Design Flexibility
 - 5- Easy Installation
 - 6- Advanced Control
 - 7- User Comfort
 - 8- Versatile
- Introduced in Japan 1982
- Introduced in Europe 1987
- Introduced in North America 2001

Available VRF/V Suppliers Worldwide

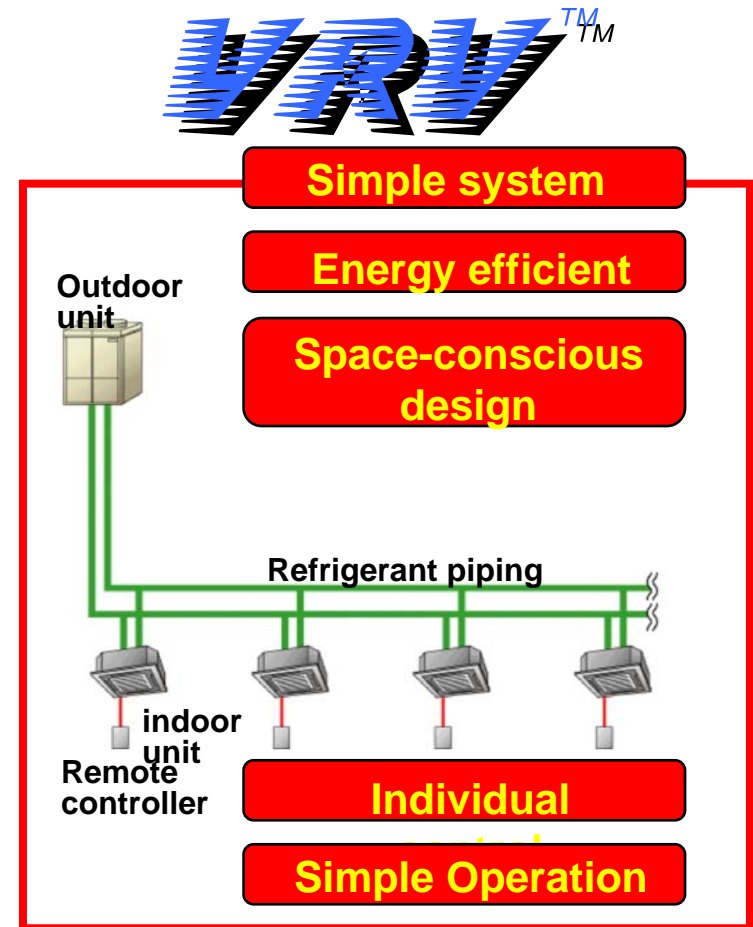
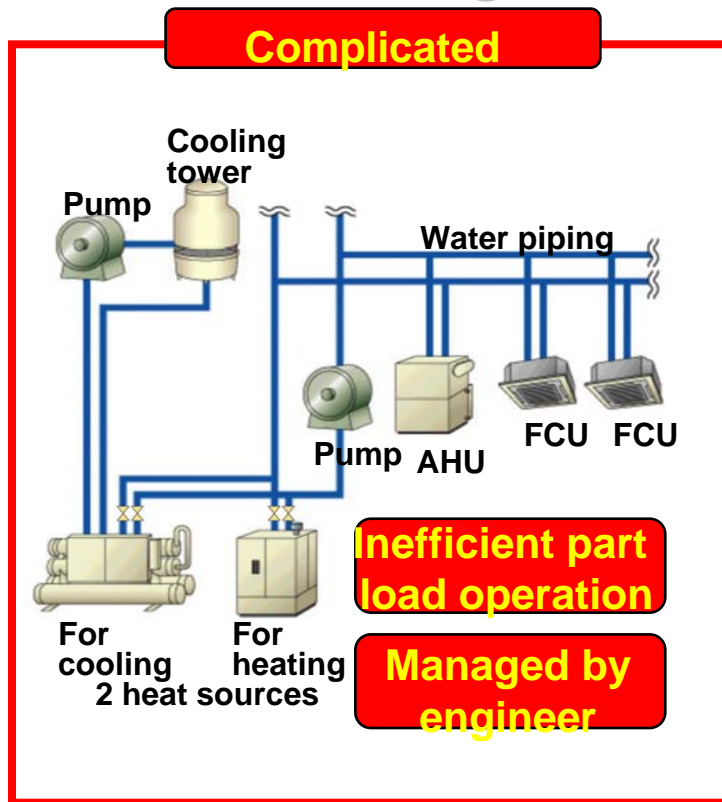
Existing Suppliers

- Daikin, VRV and VRV-S, VRV-W
- Mitsubishi Electric , City Multi
- Hitachi ,Set free
- Sanyo , Eco Multi
- Fujitsu , Airstage
- Panasonic
- Toshiba MM-S Modular Multi
- LG , Multi V

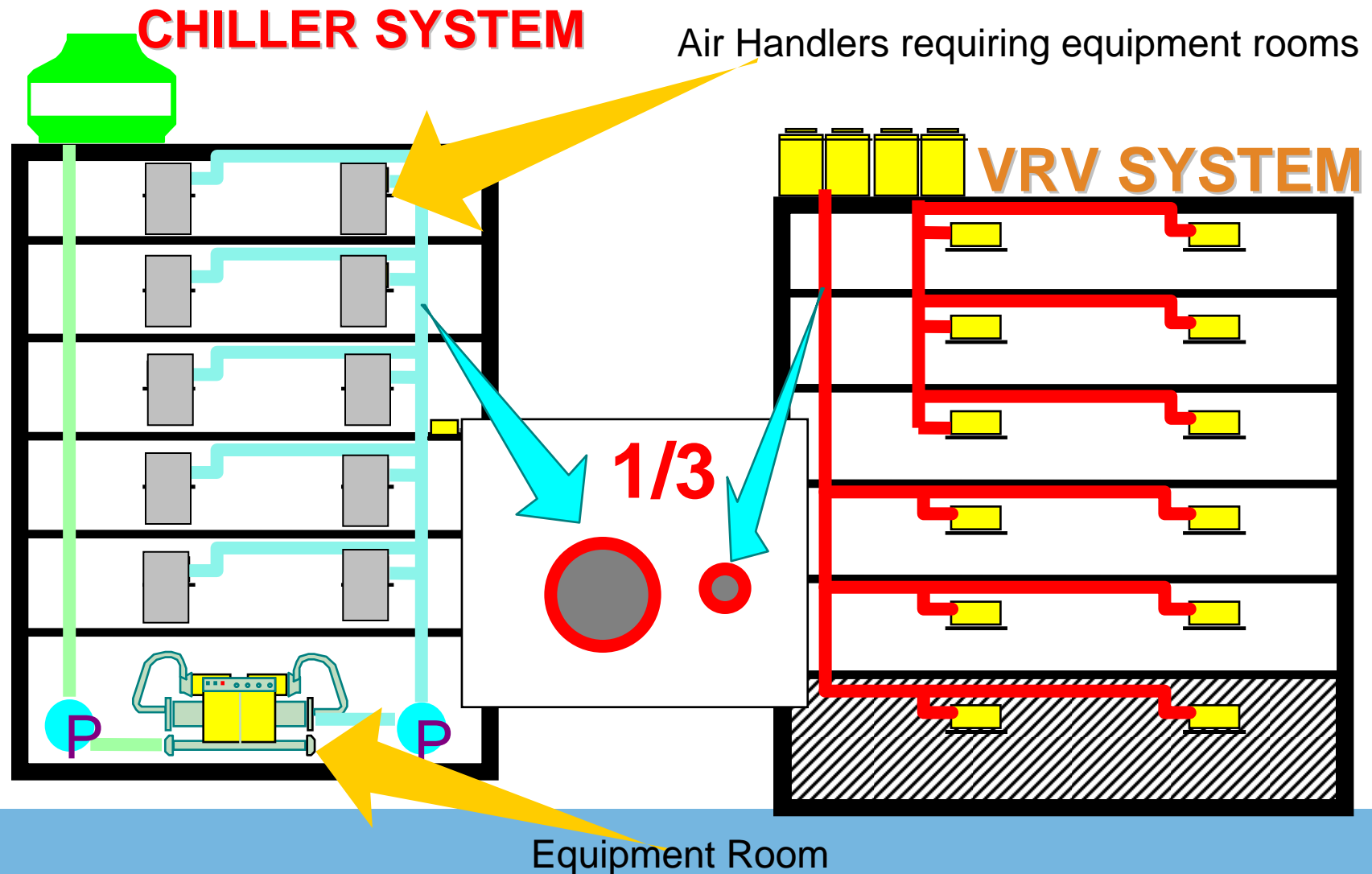
Some manufacturers do not have the VR technology, but have a multi zone system with an un-loader compressor: Samsung DVM, Midea, Haier

Let's think of the VRV system as a hot / chilled water system that employs refrigerant instead of water

Central System



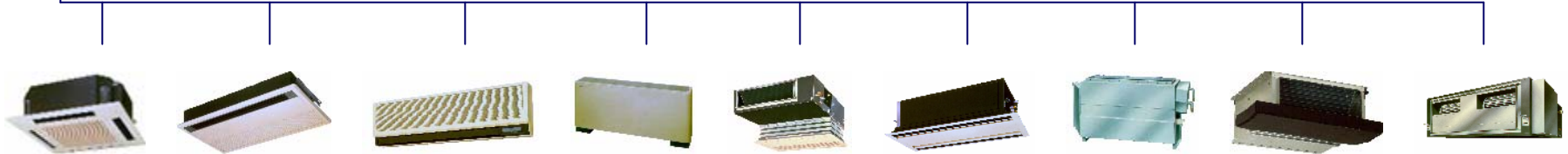
Efficient use of space



System Design



- Factory set suction temperature.
- PID (Proportional, Integral & Derivative) - control in every indoor unit
- Complete variable capacity modulation.



- Multiple Indoor Units
- Individual Control
- Modular Build-up
- Energy Saving @ full and part-load
- Cost Effective
- Low Noise

VRV Concept

1- System Simplicity – Typical Layout

Air cooled shown, also available
in water cooled



Outdoor Unit

Indoor Unit

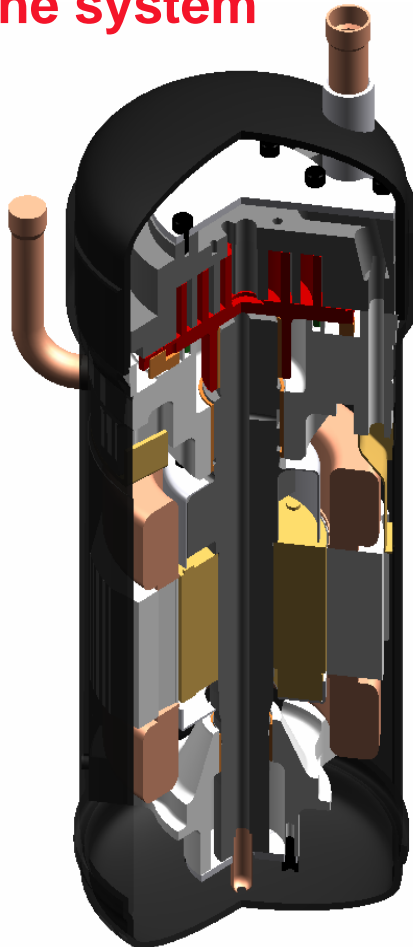
Main features:-

- Energy Saving
- Individual control
- Long refrigerant Piping
- Wide range of units
- Low Noise Level
- Less interior space used



High Performance Scroll Compressor

The Heart of the system

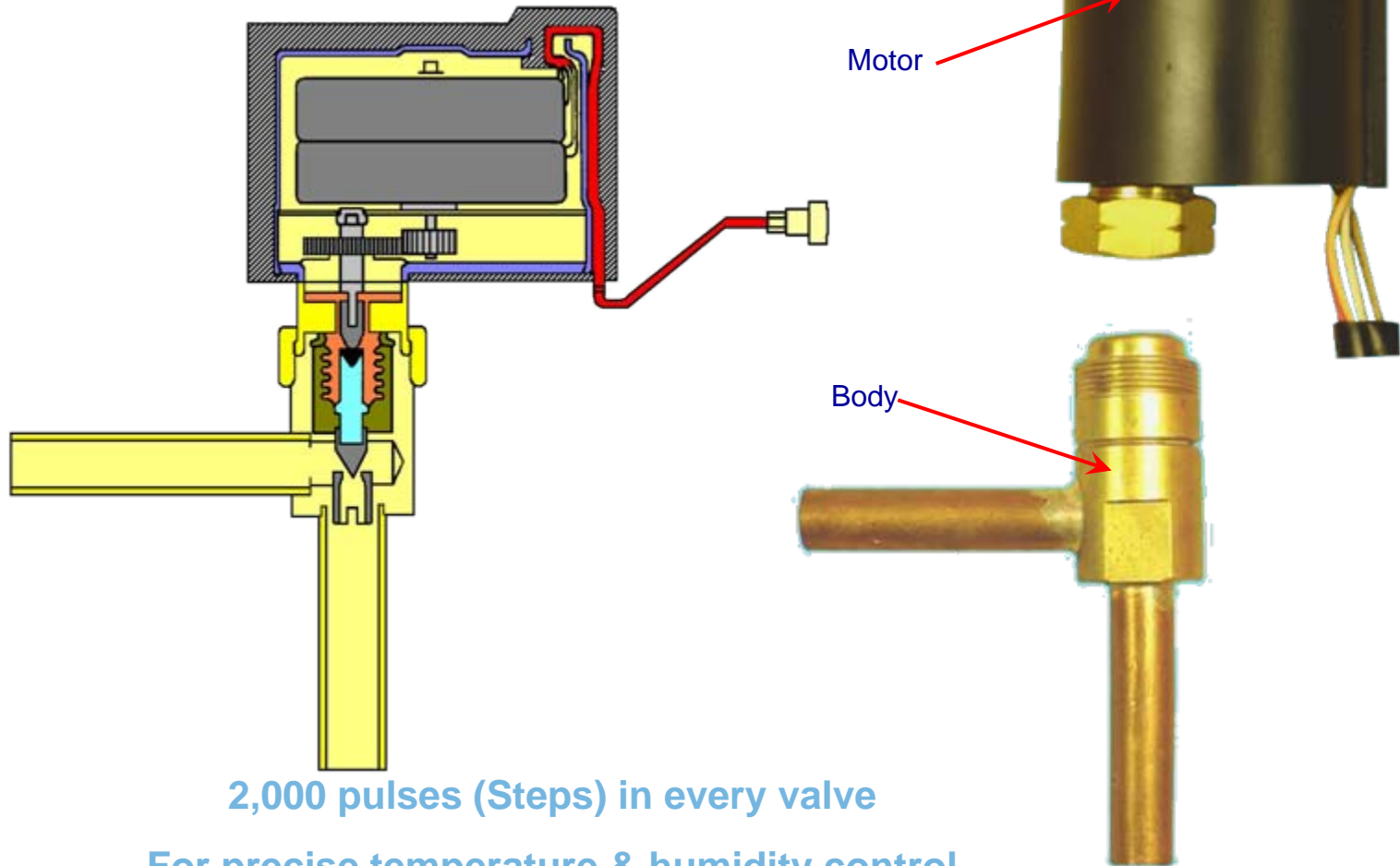


- Reluctance DC Motor
- Inverter driven
- Optimized Scroll (R-410A)
- High Pressure Shell
- Stronger Shell material
- Improved Sealing
- Stable oil temperature
- Improved efficiency
- Improved Reliability



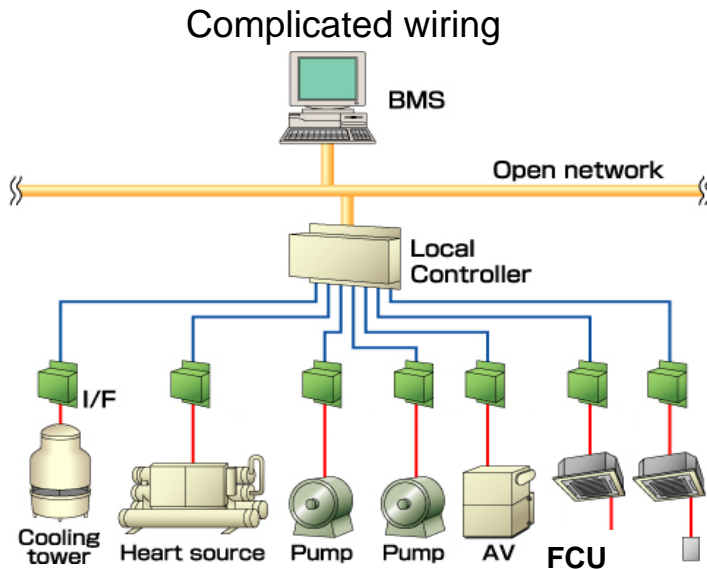
Electronic Expansion Valve

In Every Indoor Unit



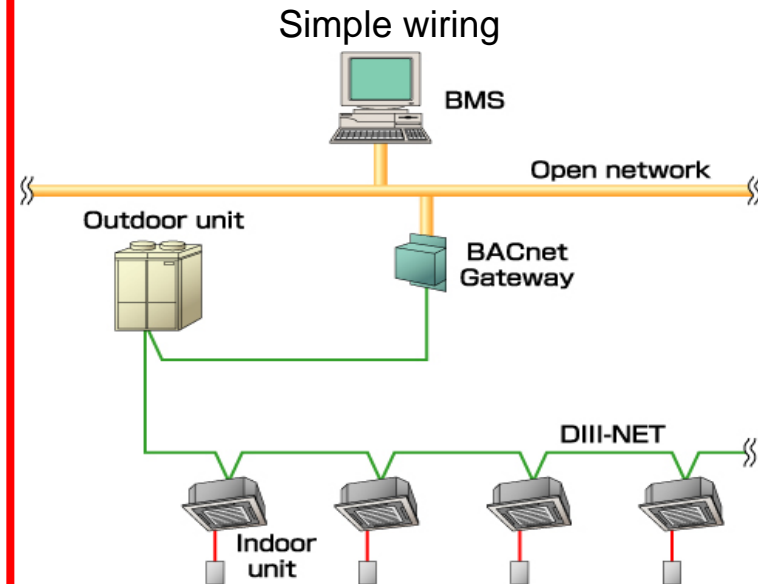
Unlike the standard systems the VRV systems comes complete with Direct Digital controls factory installed w/o additional costs other than installation of the communication network

Central A/C System



\$ 600 / point
2-6 points / piece of equipment

VRV System



All monitoring points
included at no cost

VRV Operation -(electric power research institute)

VRV consumed 40-48% less energy and provided a more comfortable environment compared with conventional Ducted System.

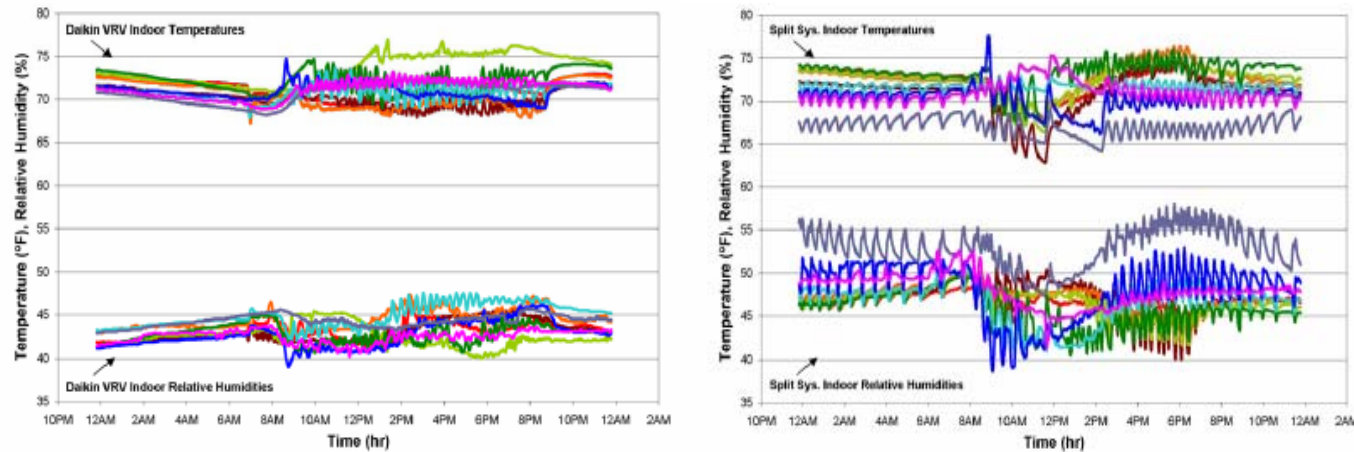


Figure 5-8
Daikin VRV Daily Indoor Conditions Profile (October 5, 2008)

-7
Split System Daily Indoor Conditions Profile (October 11, 2008)

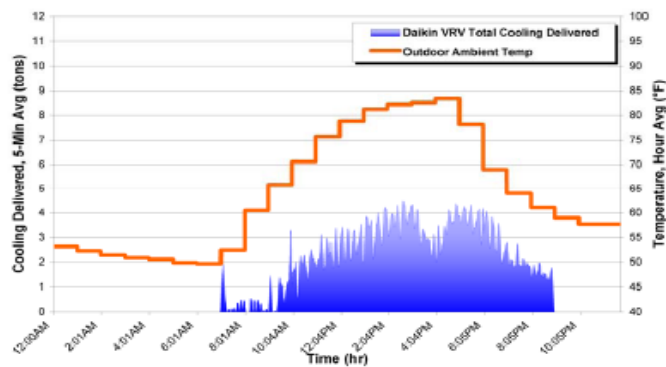
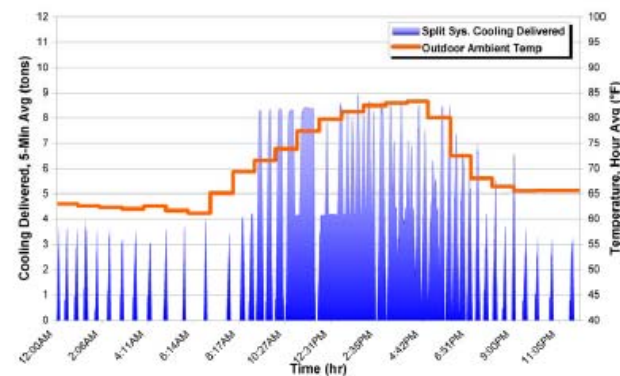


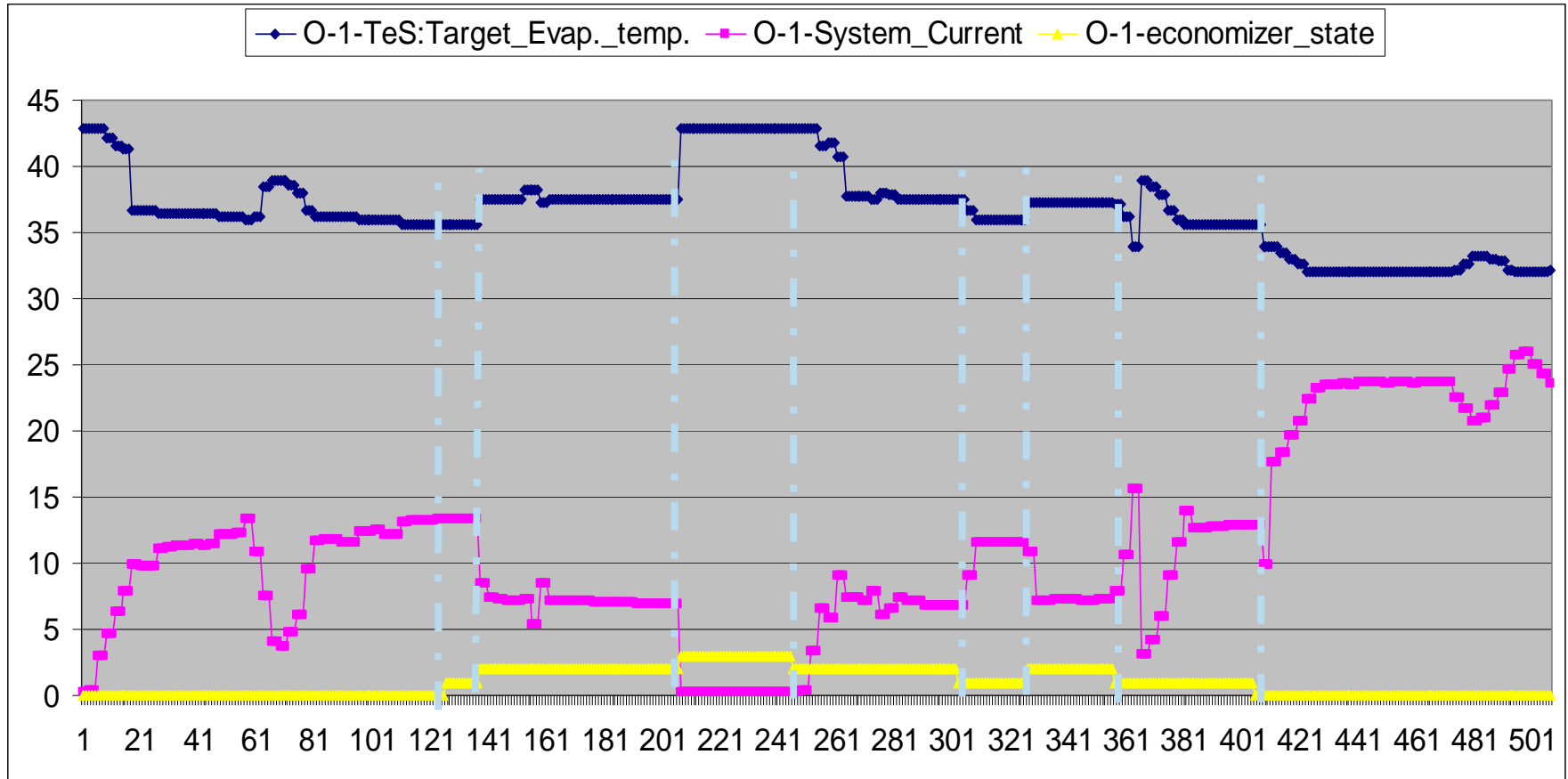
Figure 5-6
Daikin VRV Daily Cooling Delivered Profile (October 5, 2008)



5
Split System Daily Cooling Delivered Profile (October 11, 2008)

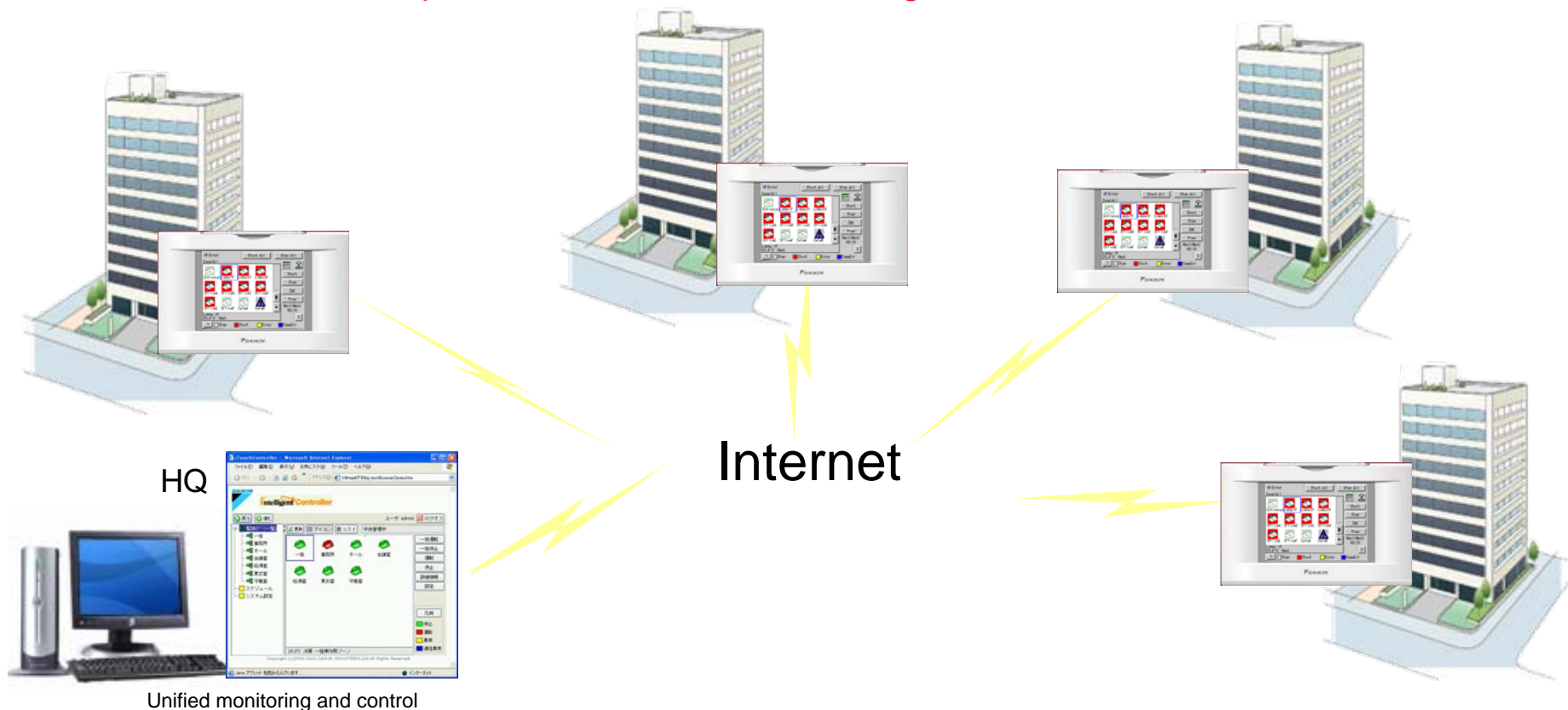
Multiple stage Mechanical Economizer

example of 6 ton HR with 4 indoor units totaling 6 tons



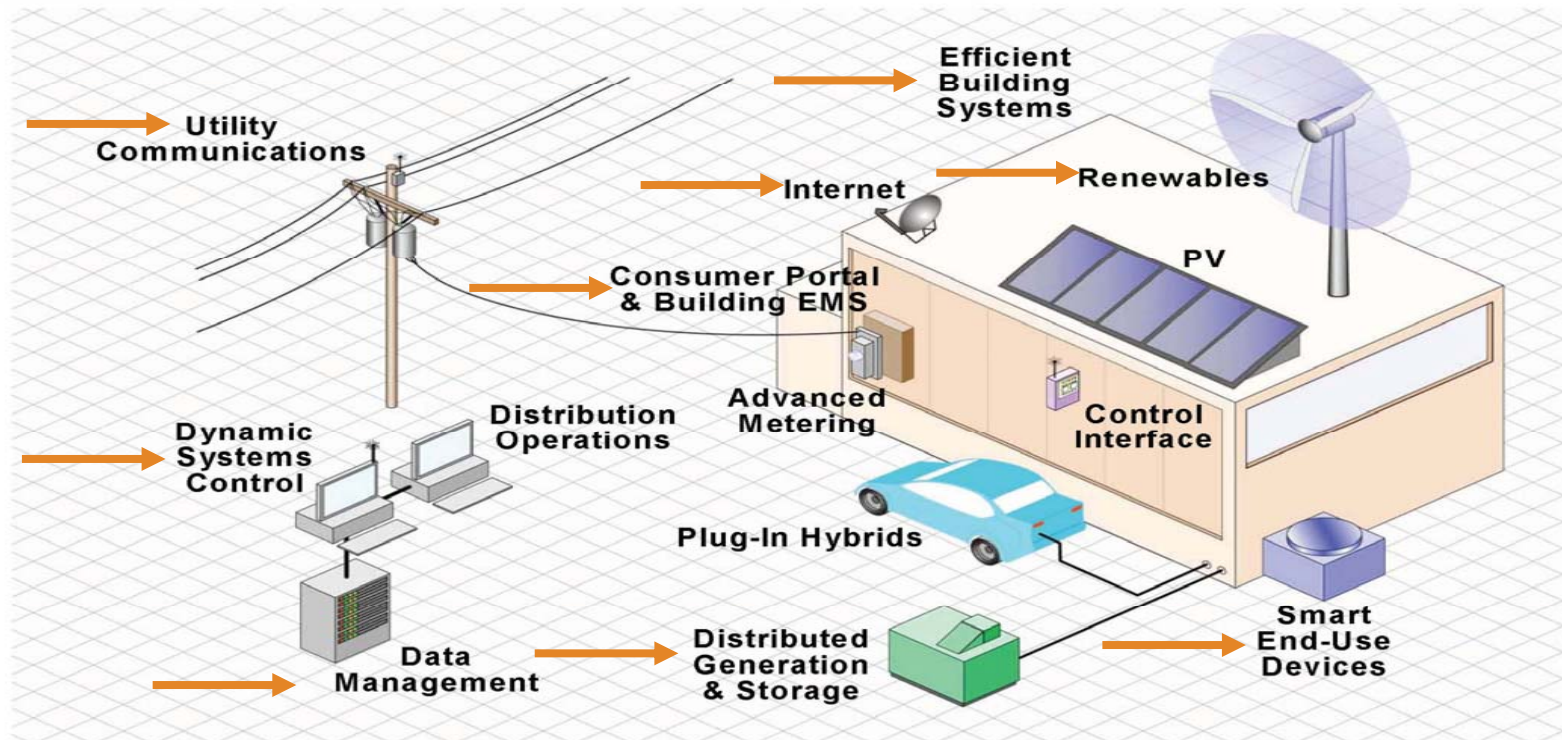
Centralized Monitoring and Control via Web Browser

- Remote monitoring of more than one building
- Allows each tenant or department to access and manage, via internet, their environment



Creating an Intelligent Grid: *Consumer Opportunities*

How VRV systems can contribute to
The success of the “Smart Grid”



Energy efficiency and demand response is a driver that will greatly accelerate the creation of a smart grid