

Variable Refrigerant Flow: ***A Benefit to Your Facility***

An introduction to VRF technology and exploration of its impact on energy, maintenance and operating costs



<https://www.mitsubishipro.com>



VRF Technology Overview

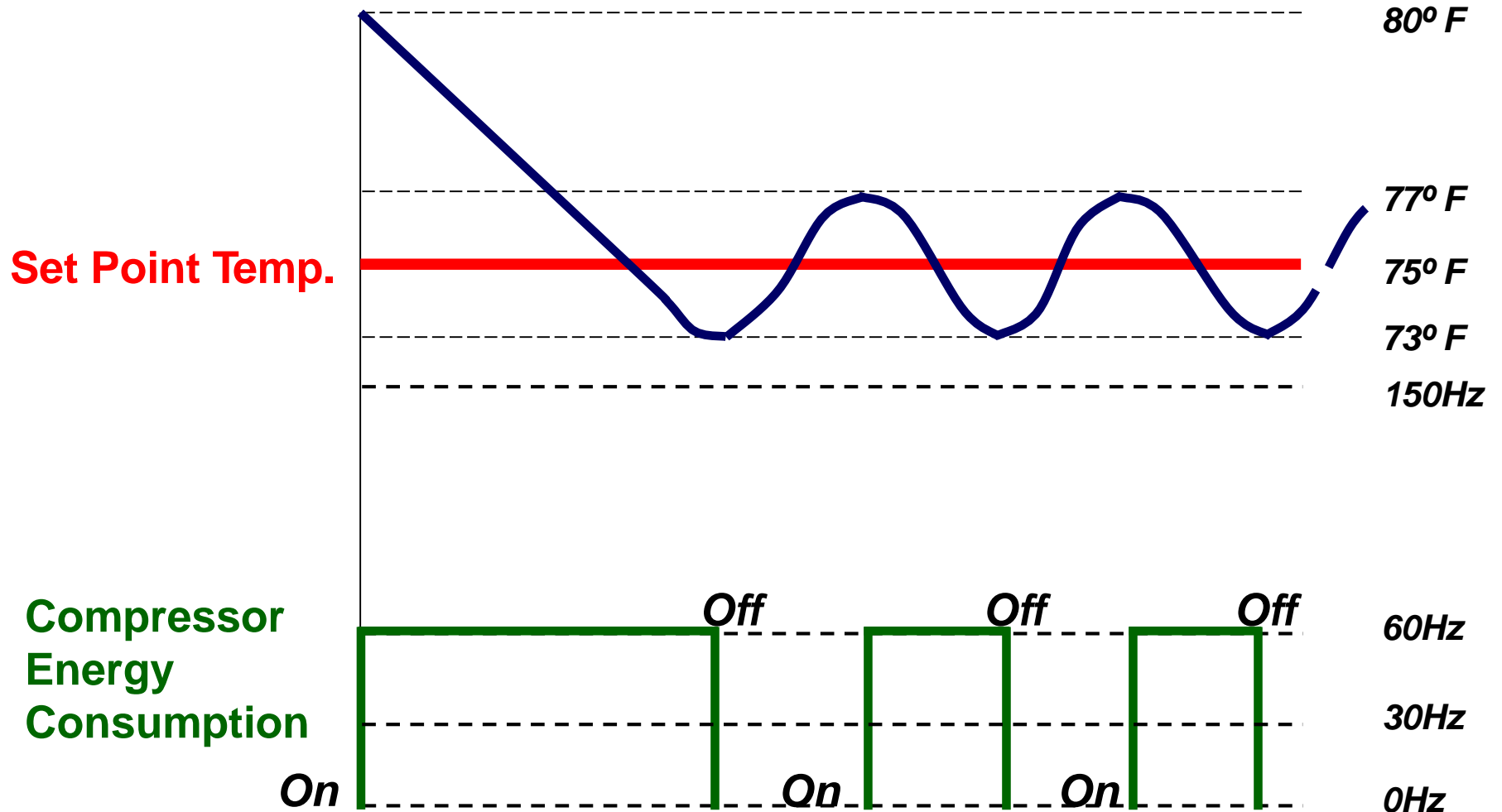
What is VRF Technology?



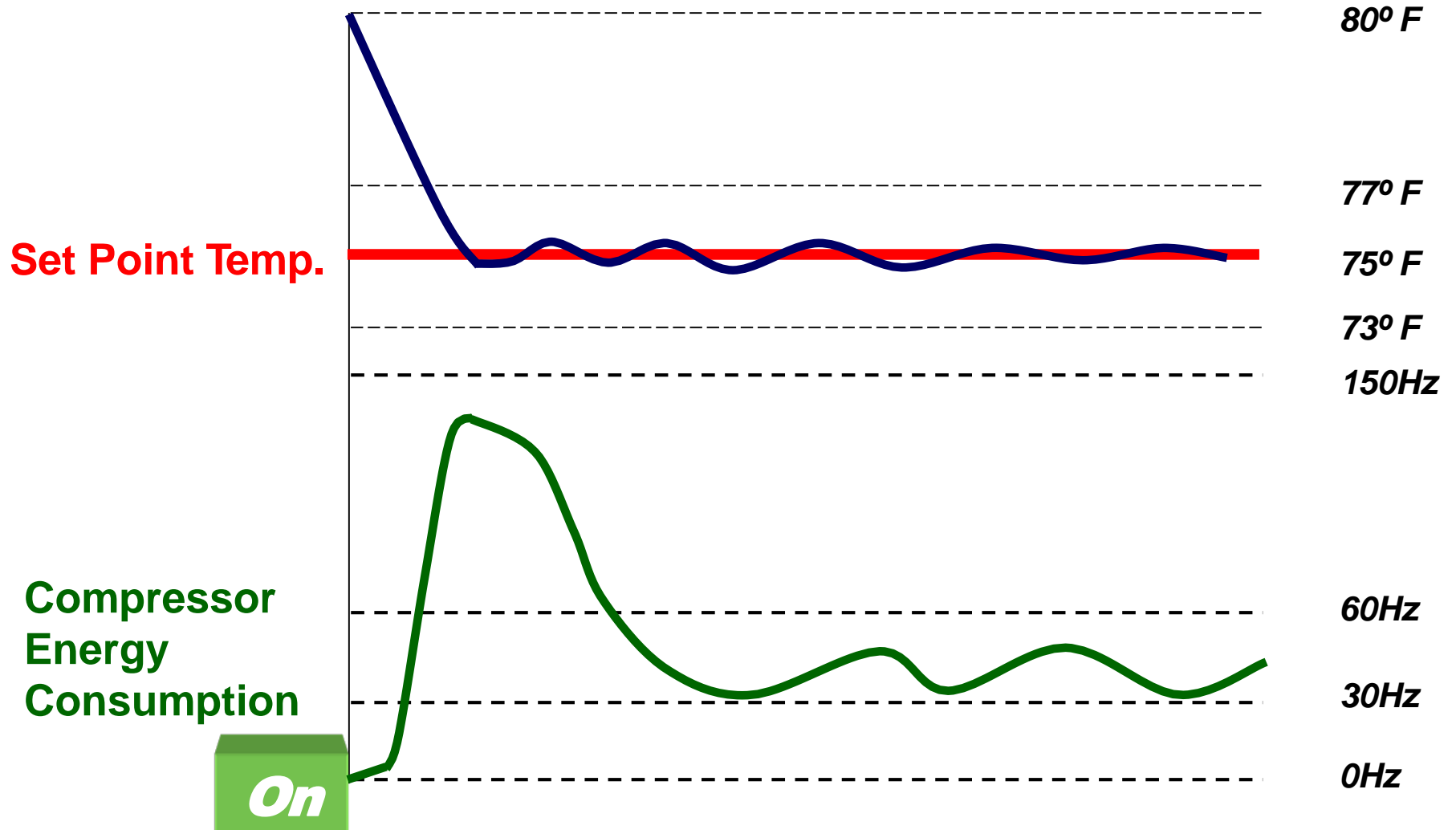
What is VRF Technology?

- **Zoning - Moving refrigerant rather than air:**
 - Variable capacity outdoor unit connected to multiple variable capacity indoor units (of differing capacities & configurations)
 - Up to 50 indoor units per system
 - From 50 to 150% connected capacity
- **Inverter-driven compressors:**
 - Modulate to match building load - down to 4% capacity)
- **Heat pump technology:**
 - Cooling and heating only to rooms that require it

Traditional Compressor



INVERTER-driven Compressor



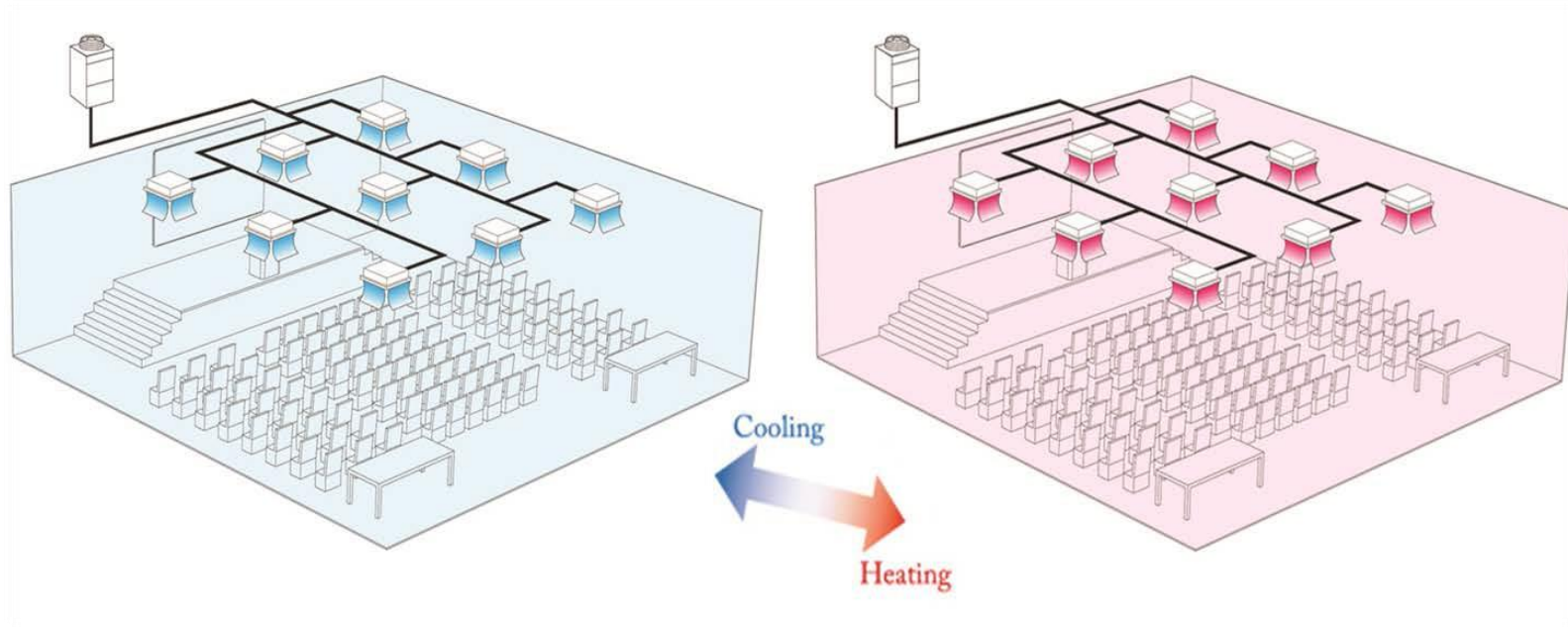
Inverter Compressor Advantage

| Features | Benefits |
|--|---|
| Accelerated cooling, heating performance | -Temperature setpoint reached faster |
| Smooth, modulated frequency for temperature maintenance | -Comfortable indoor climate consistently maintained -Sizing flexibility |
| Low rotation speed at start-up keeps power current minimal | -No inrush current typical of conventional HVAC -Eliminates power spikes that can affect appliances, cause energy spikes |
| Higher rotation speed during cold ambient conditions generates higher head pressure, discharge gas temperature | -Generates greater heating performance |
| No ON/OFF as in conventional systems | -Reduces compressor cycling -Longer run times - energy used more effectively, greater life expectancy |



VRF System Components

VRF Technology – Heat Pump System



VRF Technology – Heat Pump System



*Outdoor
Unit*

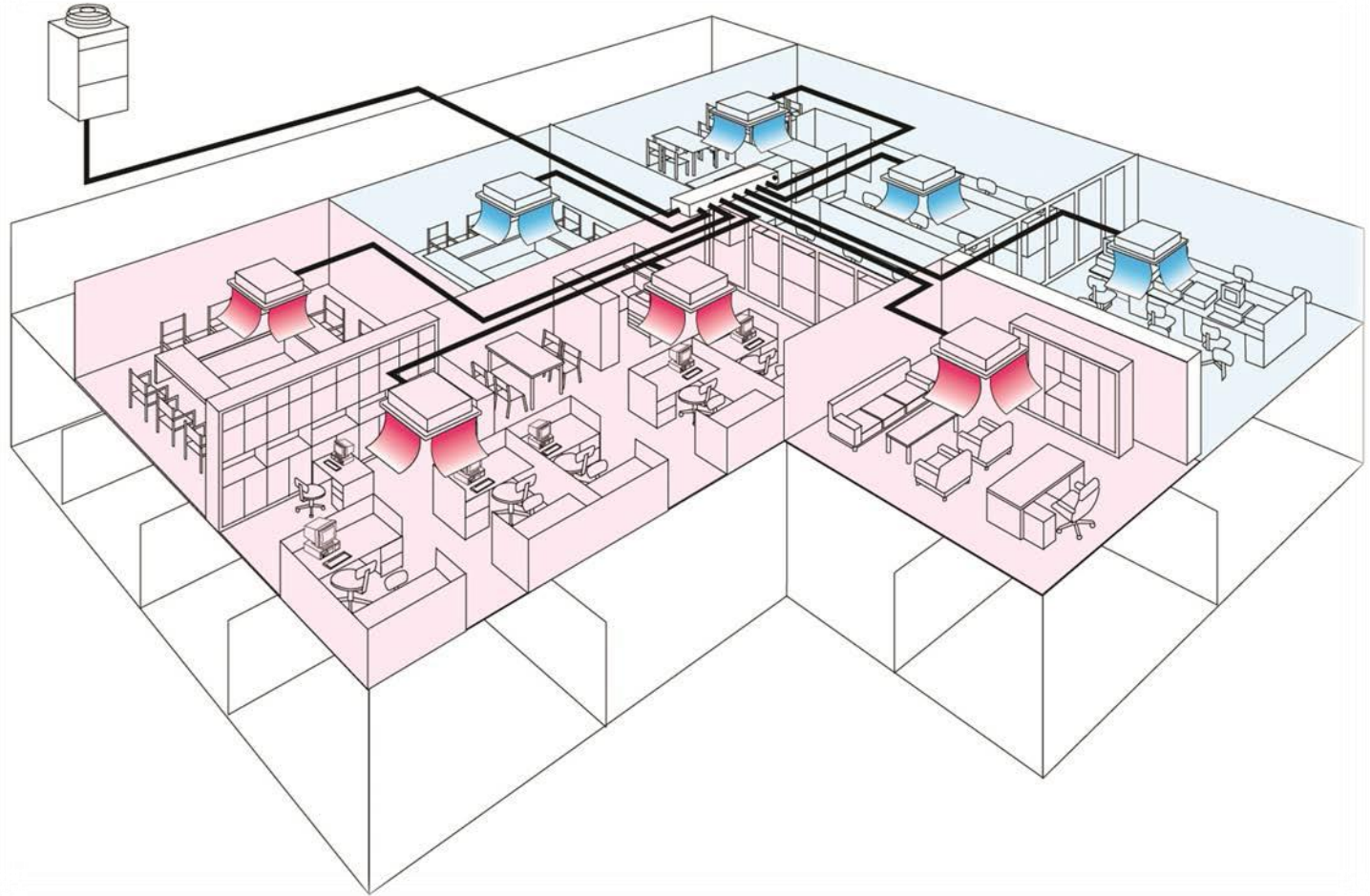


*Indoor
Units*



*Controls
System*

VRF Technology – Heat Recovery System



Simultaneous cooling and heating

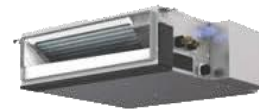
Typical Heat Recovery System



*Outdoor
Units*



*Branch
Circuit
Controller*



*Indoor
Units*



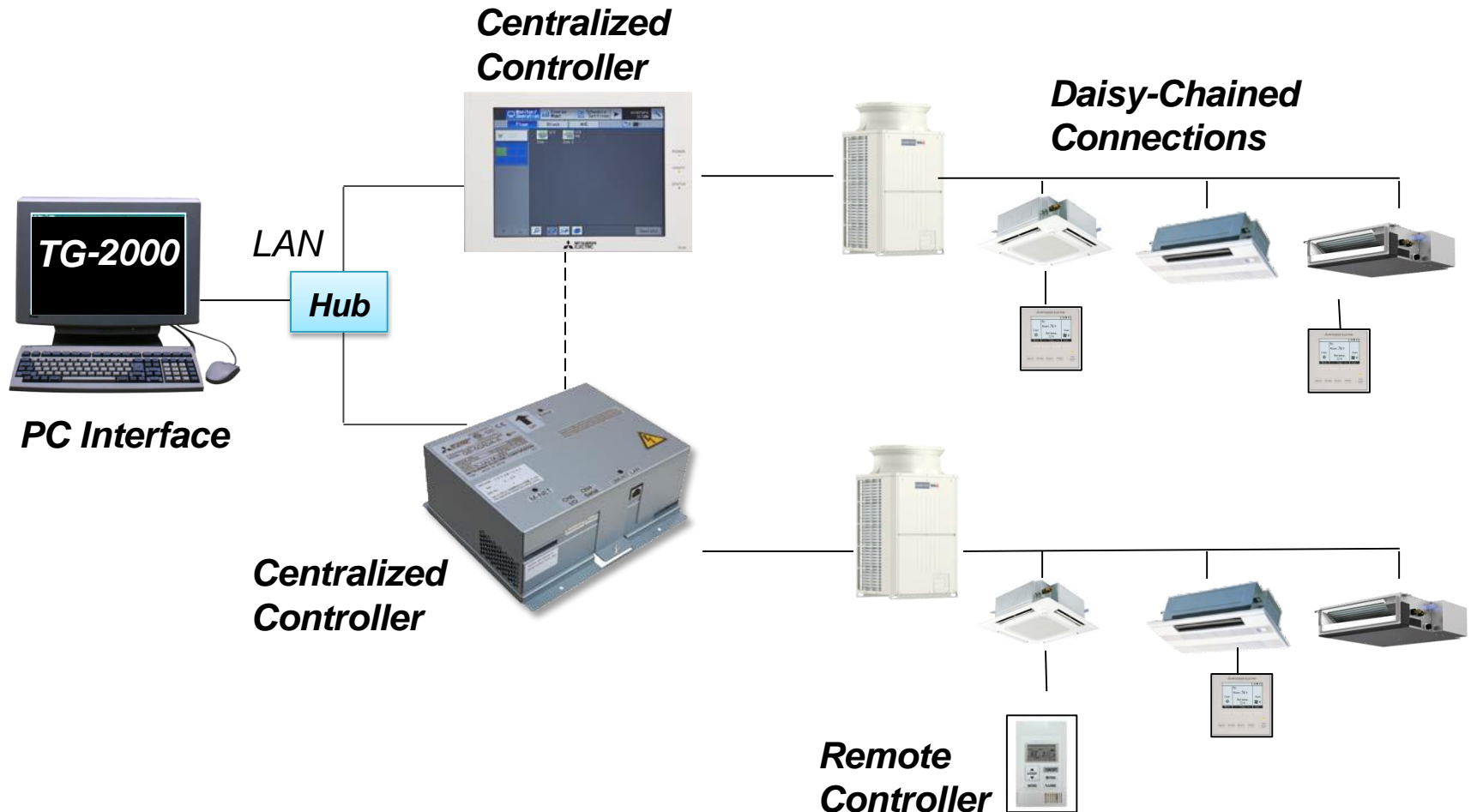
*Controls
System*

VRF Integrated Controls



- Manufactured by Mitsubishi
- Easy to install and operate
- 2-wire DDC (Direct Control) system
 - 16 ga. stranded and shielded, non-polar
 - Daisy-chain connection
- Customizable control scheme with web access
- Individual room controls
- Color touch screen centralized control
- Integration into building management system via BACnet® and Lonworks®
- Third-party equipment control
- Tenant billing capability
- Front end capability w/ full graphics

VRF Integrated Controls



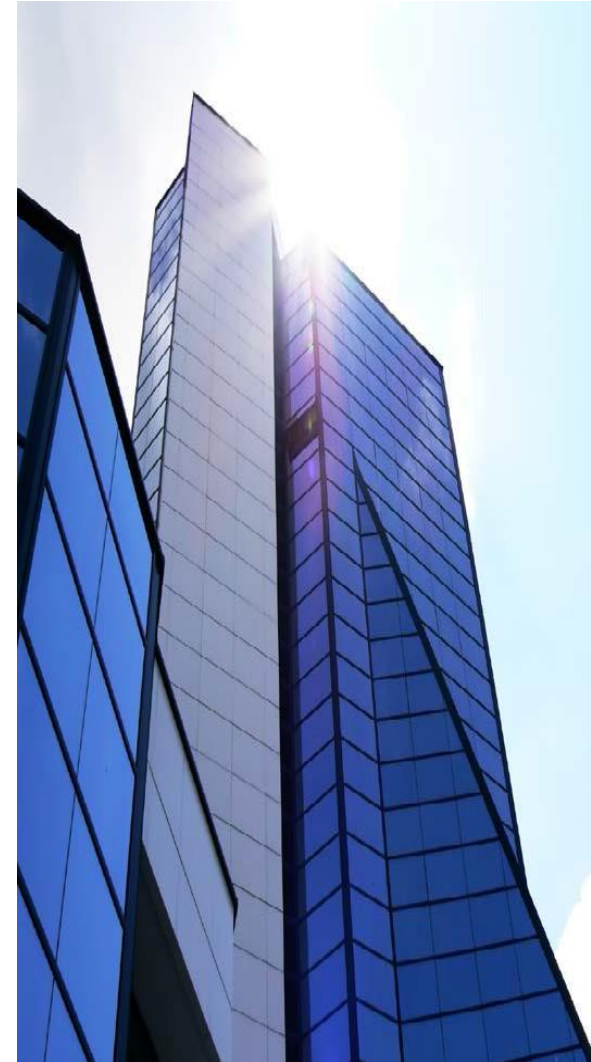
- Centralized Control of up to 50 Indoor Units
- Campus software controls up to 40 Centralized Controllers = 2,000 Indoor Units



VRF Design Considerations & System Advantages

Diversity

- **Time of Day**
 - *VRF can distribute cooling and heating capacity to keep up with changing solar loads*
- **Occupancy**
 - *As people move throughout a building, VRF can always keep them comfortable*
 - Adapts to various building uses
- **Cooling and Heating**
 - *VRF can cool and heat simultaneously*

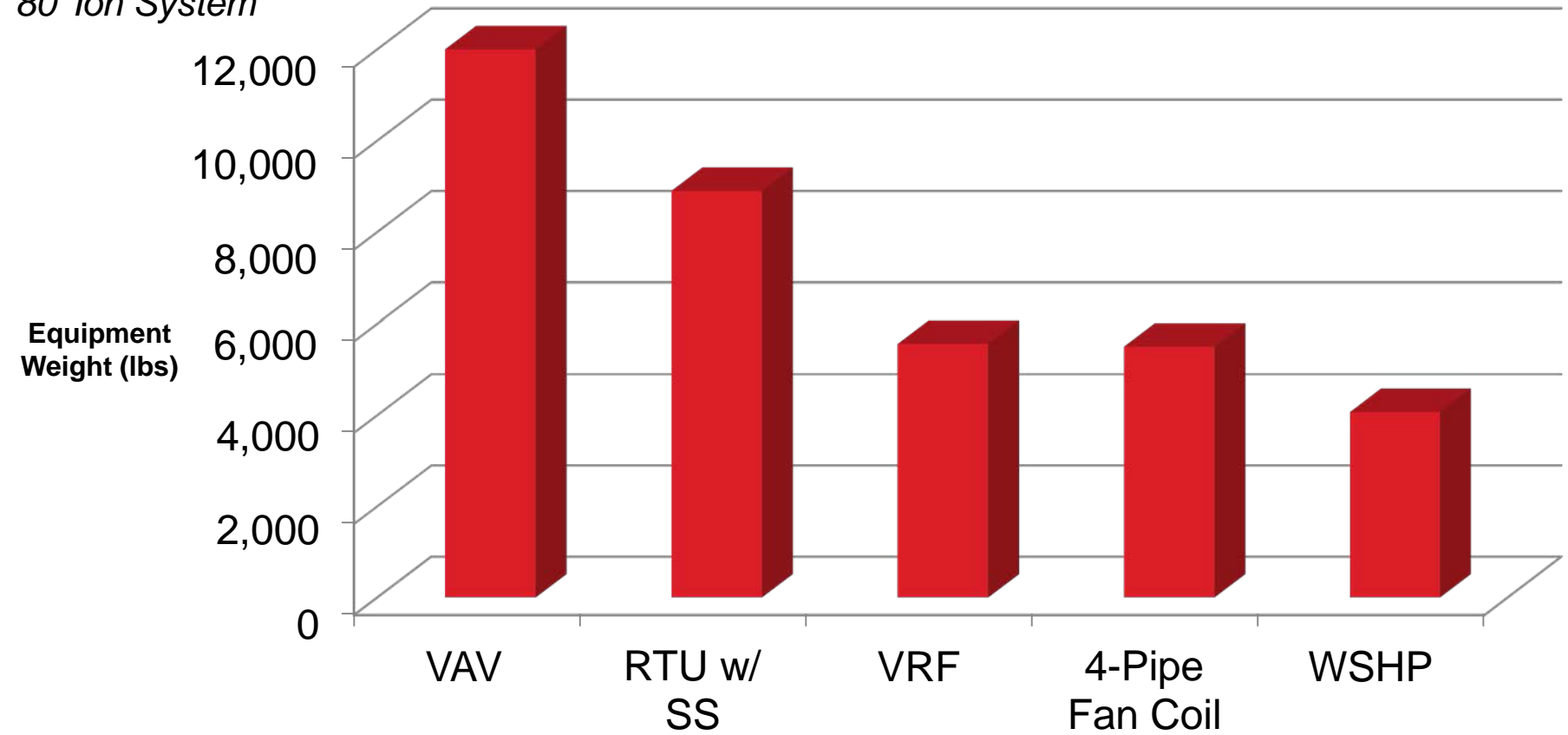


Weight Reduction = Structural Reduction



Rooftop Equipment Weight

80 Ton System



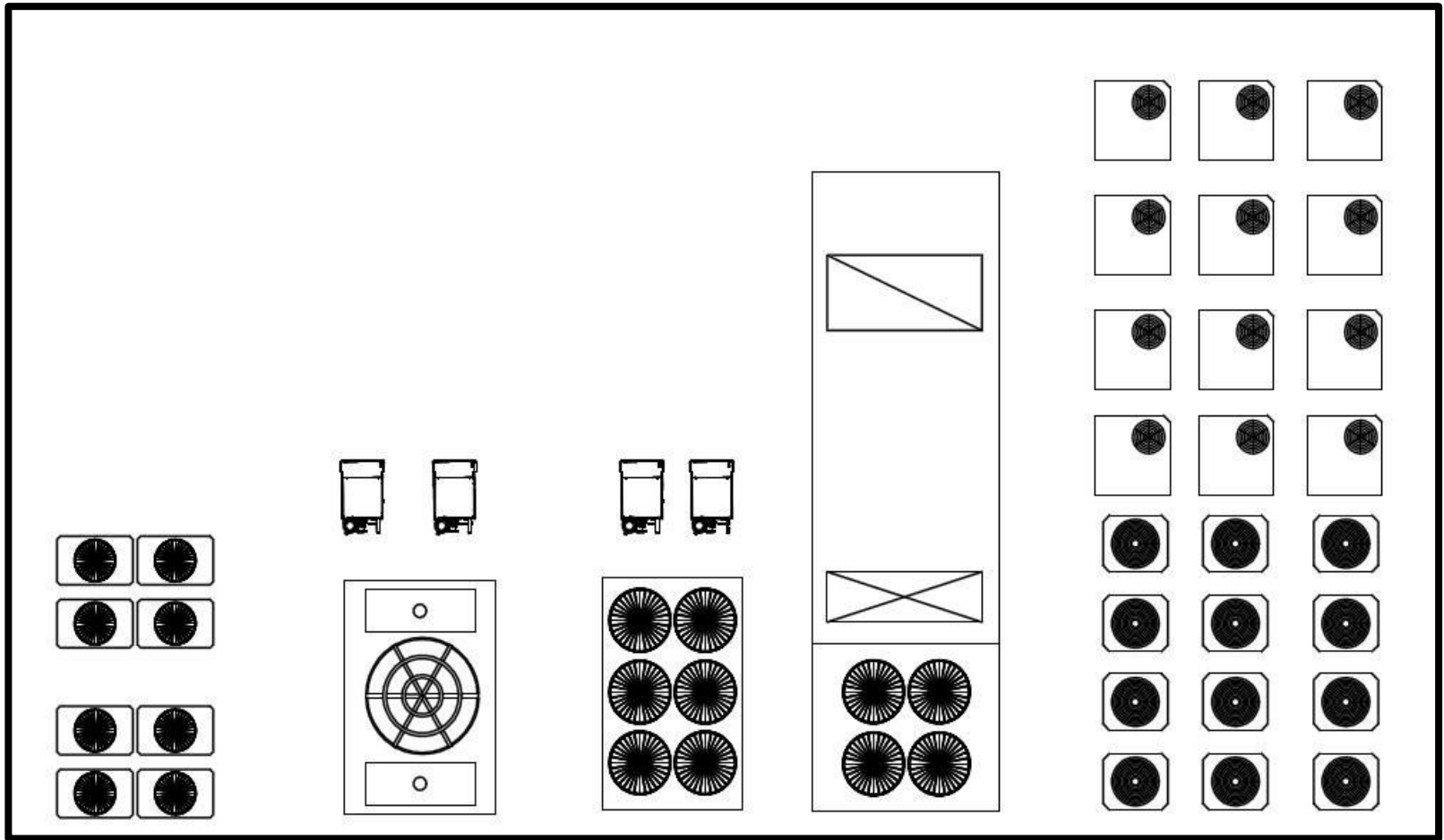
VRF Equipment Weight Savings

- Average equipment weight per ton for VRF is 70 lbs per ton (outdoor unit only)
- Average equipment weight per ton for water-cooled chiller is 101 lbs./ton

31% reduction in equipment weight

Reduced Roof Space

80 Ton System



VRF

WSHP

4-Pipe/AC

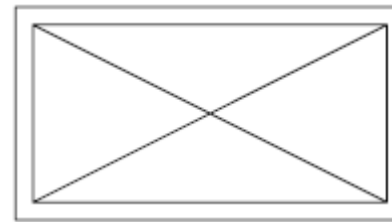
VAV RTU

RTU's / SS's

Ceiling/Wall/Chase Space Savings

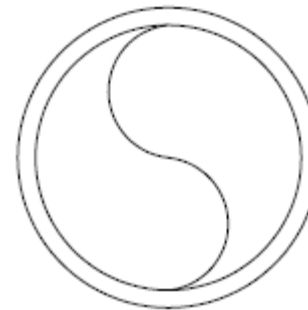
Space Required to Deliver 20 tons of Cooling

Rectangular Ductwork (DX System)



40" x 20"

Round Ductwork (DX System)



30" Round

Piping (4-Pipe System)



3" CHWS&R, 3" HWS&R

Piping (VRF)



1³/₈" Gas 1¹/₈" Liquid

VRF Frees Up Plenum Space



Reduced Mechanical Space



- Traditional systems require space for pumps, boilers, chillers, ducts, piping, heat exchangers
- VRF offers efficiency without requiring the space

VRF Installation Flexibility



VRF Installation Flexibility



VRF Installation Flexibility



Efficiency

| System Type | Roof Top Units | Air-Cooled Chiller | Mitsubishi Electric Air Source VRF | Mitsubishi Electric Water-Source VRF |
|-------------|----------------|--------------------|------------------------------------|--------------------------------------|
| IEER | 12.4 | - | 27.4 | 25.7 |
| EER | 11.0 | 10.3 | 12.2 | 13.8 |
| IPLV | - | 14.2 | - | - |
| SCHE | - | - | 26.8 | 20 |

Indoor Comfort Flexibility



Wall-mounted Unit

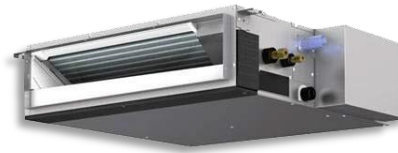


Ceiling-suspended Unit



Floor-standing Unit

Indoor Comfort Flexibility



***Medium Static
Ducted Unit***



***Low Profile
Ducted Unit***



***High Static
Ducted Unit***



***Vertical
Ducted Unit***

Indoor Comfort Flexibility



1-way Cassette



4-way Small Cassette



4-way Large Cassette

Outside Air Considerations



PremiSys

- Designed to handle 100% outdoor air with optional energy recovery
- Offer premium features ideal for handling ventilation air in variable refrigerant flow (VRF) applications.
- Models MP and MPE (with energy recovery) are pre-engineered to provide semi-custom flexibility while maintaining the quality, consistency, and value of a standardized product.
- MPF models offer a split system version of this rooftop ventilation product and are connected to CITY MULTI Y-Series outdoor units.



PEFY-OA/CFMR



Ducted fan coil for 100% outside air applications

- Discharge air temperature control
- Compatible with Y and R2-Series outdoor units
- Can be used in conjunction with standard indoor units
- Three modes of operation: cooling, heating, and fan only
- Three fan speed settings
- Dual set point functionality*
- Built-in condensate lift; lifts to 27-9/16" (700 mm)



sample image for reference

Lossnay ERV

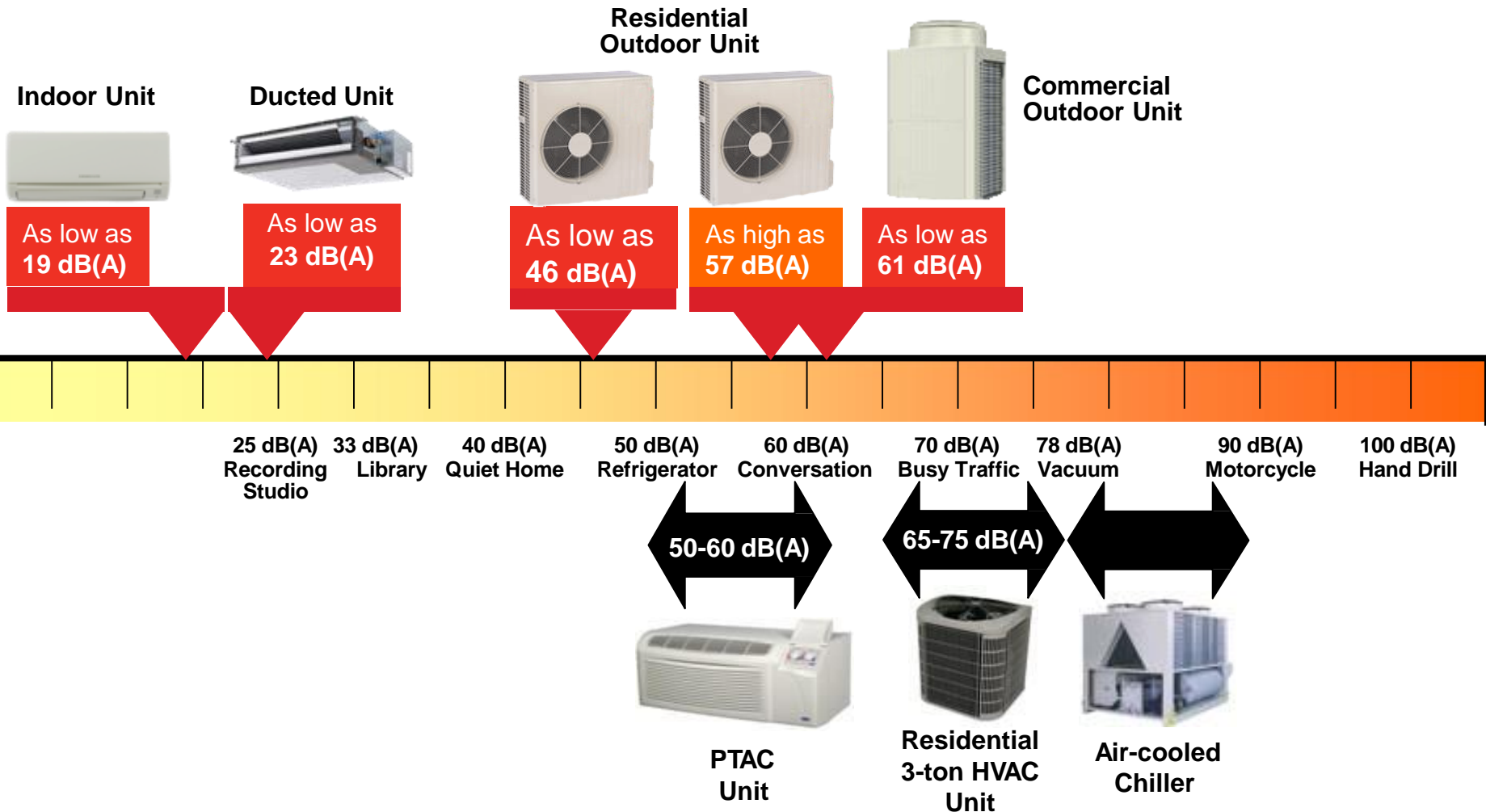
- Lossnay® cross-flow energy recovery core
- Minimal cross contamination (<1% overall) between entering and leaving air streams
- Stand-alone control
- M-NET
- External input bypass damper control
- Stand alone or interlocks with all Mitsubishi product.

Coastal Considerations



What Does QUIET Sound Like?

How QUIET are VRF Systems?



Re-Cap: Benefits of VRF Systems

- Space Utilization
 - Installation flexibility to meet building space requirements
 - Minimal impact to existing building architecture and structure
 - Reduced ceiling, roof & equipment room space
 - Smaller electrical service
- Ease of installation
 - Unitary equipment – applied system
 - Integral controls
 - Factory contractor training
- Energy Savings
 - Inverter compressor - Meets building load
 - Minimal/no waste heat
- Occupant Comfort
 - Individual comfort control - flexibility to meet the needs of any space
 - Quiet operation
- Factory Software
 - Reduces design time (sizes refrigerant lines, calculates needed refrigerant)
 - Detailed schematic – aides in installation
 - Maintenance software – ease of troubleshooting/reduces downtime
- Reduced Maintenance Time












METUS Training Classes

City Multi Courses













CITY MULTI® Courses

| | |
|---|--|
| COMMERCIAL PRODUCT OVERVIEW ELEARNING |  COURSE DESCRIPTION |
| DIAMOND DESIGNER SEMINAR |  COURSE DESCRIPTION |
| COMMERCIAL APPLICATIONS |  COURSE DESCRIPTION |
| INSTALLATION ESSENTIALS (DAY 1) |  COURSE DESCRIPTION |
| CONTROL & SYSTEM SETUP (DAY 2) |  COURSE DESCRIPTION |
| SERVICE ESSENTIALS (DAY 3) |  COURSE DESCRIPTION |
| INSTALLATION, STARTUP AND SERVICE ESSENTIALS <i>Includes Day 1, Day 2 and Day 3</i> | |
| S-SERIES INSTALLATION ESSENTIALS |  COURSE DESCRIPTION |
| DIAGNOSING PROBLEMS USING MAINTENANCE TOOL |  COURSE DESCRIPTION |
| ADVANCED CITY MULTI SERVICE |  COURSE DESCRIPTION |


M&P Courses



M- & P-Series Courses

| | | |
|---|---|--------------------|
| RESIDENTIAL PRODUCT OVERVIEW ELEARNING (PRE-REQUISITE) |  | COURSE DESCRIPTION |
| APPLICATIONS |  | COURSE DESCRIPTION |
| RESIDENTIAL COMFORT SOLUTIONS TRAINING |  | COURSE DESCRIPTION |
| INSTALLATION ESSENTIALS (DAY 1) |  | COURSE DESCRIPTION |
| SERVICE ESSENTIALS (DAY 2) |  | COURSE DESCRIPTION |
| INSTALLATION & SERVICE ESSENTIALS <i>Includes Day 1 and Day 2</i> | | |
| ADVANCED RESIDENTIAL CONTROLS |  | COURSE DESCRIPTION |
| ADVANCED SERVICE |  | COURSE DESCRIPTION |
| DSB FOR RESIDENTIAL ELEARNING |  | COURSE DESCRIPTION |
| RESIDENTIAL SELLING SKILLS ELEARNING |  | COURSE DESCRIPTION |
| OVERCOMING OBSTACLES - CONTRACTOR OBJECTIONS ELEARNING |  | COURSE DESCRIPTION |

Controls Courses

|  Controls Courses  | |
|--|--|
| ADVANCED RESIDENTIAL CONTROLS |  COURSE DESCRIPTION |
| COMMERCIAL CONTROLS |  COURSE DESCRIPTION |

Sign up for our courses at:
<https://www.mitsubishipro.com/training>

<http://www.mylinkdrive.com>



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Local Trane Support

Primary Contact

Mitsubishi Electric Trane HVAC US provides innovative products, systems, and solutions capable of cooling and heating any school building application small or large.

Trane's experienced sales staff, in-house design capability, and full-service factory-certified technicians (**Ductless Technical Specialist**) and installers allow them to exceed the expectations of clients and their demanding applications.

Ductless Technical Specialist (DTS)

DTS's are highly trained technical service professionals that provide support on METUS equipment. DTS's are the first line of support for technical, service and product application needs. When DTS members call Mitsubishi Electric, their calls get priority access to METUS' technical support department. It is highly recommended that contractors or maintenance personnel contact their DTS's before contacting Mitsubishi Electric.

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METUS On-Campus

SCHOOLS THAT ARE USING CITY MULTI EQUIPMENT



ARKANSAS

Little Rock Christian Academy
Helena-West Helena School District
Sheridan School District
Bryant Public Schools
Malvern School District

KANSAS

Lawrence Public Schools
Seaman School District
Ellinwood Public Schools
Dodge City Public Schools
Argonia Public Schools
Auburn Washburn School District

OKLAHOMA

Chouteau-Mazie Public Schools
Watonga Public Schools
Norman Public Schools
Tulsa Public Schools
Cheyenne Arapaho Education

MISSOURI

Smithton R-VI School District
St. Joseph School District
St. Louis Public Schools
Lincoln County R-III School District
Eldon School District
Sedalia School District 200

NEW MEXICO

Los Lunas Public Schools
Albuquerque Public Schools
Alamogordo Public Schools
Santa Fe Public Schools
Las Cruces Public Schools
Socorro Consolidated Schools

LOUISIANA

St. Charles Parish Public Schools
Calcasieu Parish Public Schools
Lafourche Parish School District
Lafayette Parish School District
Rapides Parish School District
Evangeline Parish School District
Assumption Parish School District

TEXAS

Houston ISD
Goose Creek ISD
Cy Fair ISD
Elgin ISD
Pflugerville ISD
Temple ISD
San Marcos ISD
El Paso ISD
Socorro ISD
Garland ISD
Birdville ISD
Dallas ISD
Carrollton/Farmers Branch ISD
Episcopal School of Dallas
Abemathy ISD
Post ISD
Frenship ISD
Merkel ISD

Thank you for your time!

Questions?



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