WHITE PAPER

REDUCING COSTS AND ACHIEVING VALUE: VRF SYSTEMS FOR HOTELS AND HOSPITALITY

INTRODUCTION

Variable Refrigerant Flow (VRF) zoning systems solve many challenges associated with commercial construction and facility management.

VRF zoning systems contribute to sustainable buildings as they rely solely on electricity to deliver energy-efficient performance. This benefits cities, states and building owners looking to reduce carbon emissions and deal with rising energy costs.

VRF systems maintain set points specific to occupant usage and individual zone requirements. This reduces the likelihood of hot and cold "trouble" spots.

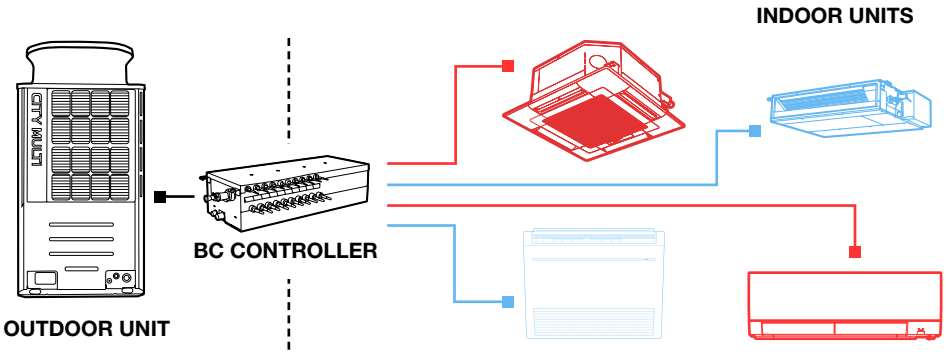
VRF systems are more compact and require less ductwork than conventional equipment. Additionally, they require fewer alterations to building facades, which is beneficial in cities where grilles on facades are prohibited or considered unsightly. This smaller footprint makes them ideal for owners and developers looking to maintain the integrity of historical buildings or create rooftop entertainment spaces. The low operating sound levels mean the equipment will not disturb guests as they enjoy rooftop amenities.

These benefits drive the growing popularity of VRF systems. Lesser-known, however, are the benefits related to cost reduction or avoidance with VRF systems versus conventional systems. This White Paper addresses the mislabeling of VRF systems as "expensive" and explains how building owners can realize cost savings and create competitive advantages throughout the system's lifecycle.

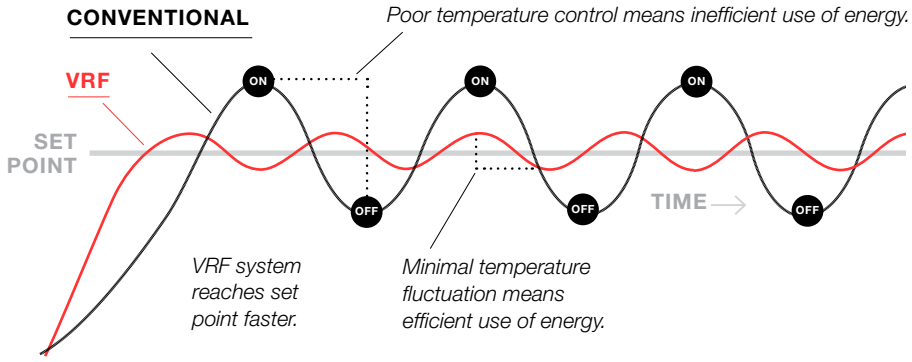
LET'S START WITH AN OVERVIEW

VRF systems provide personalized heating and cooling to **multiple zones in a building by cycling refrigerant between an outdoor unit (air-source or water-source) and indoor units in each zone via refrigerant lines.** Indoor units are available in ductless or ducted styles to match the zone's requirements or limitations. Hospitality applications typically require heat-recovery VRF systems due to diverse thermal profiles. In essence, some zones require heating while others require cooling. VRF systems capable of heat recovery use a branch circuit (BC) controller to provide simultaneous heating and cooling in those zones.

SIMULTANEOUS HEATING AND COOLING



While sized to meet design temperatures, each VRF outdoor unit has an INVERTER-driven compressor enabling the system to vary capacity to match the current load. The majority of operation is during partial-load conditions, saving money by reducing **energy consumption by up to 40%** compared to conventional, fixed-capacity systems. Variable capacity enables VRF systems to precisely maintain set points without the noisy and energy-intensive start/stop cycles of conventional systems.



ADDITIONAL INSIGHT

For more information on VRF system basics, watch our webinar, Getting Started with VRF.

STREAMLINED MAINTENANCE

Once per quarter, clean coils, check electrical connections, check the refrigerant charge, inspect refrigerant lines and wash reusable filters, which last up to 10 years.

ELIMINATE COMPLEXITY

VRF systems reduce or eliminate requirements for belt changes, boiler analysis, chiller maintenance, cooling towers, filter replacements, pump seals, strainer cleaning, water treatment and 10-year overhauls.

COST AVOIDANCE WITH VRF SYSTEMS

The first opportunities to reduce costs with VRF systems emerge during mechanical design. HVAC specifiers can help developers and building owners look beyond the mechanical bid to demonstrate how VRF systems allow them to avoid costs associated with alternatives such as PTACs (commonly used in hospitality applications). The complexities of HVAC systems dictate requirements that impact the developer's first cost and total cost. For example, VRF systems allow developers to eliminate PTAC sleeves and limit wall penetrations and louver openings. VRF Systems are modular, typically requiring less design time and are also easier to install than conventional systems. These benefits contribute to a more efficient process providing labor cost savings.

MAXIMIZE SPACE: SMALLER PLENUMS

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While conventional systems require large duct runs to move conditioned air, VRF systems utilize small-diameter piping to move conditioned refrigerant. This allows for smaller plenums with reduction of space between floors. Rooms appear more spacious and **architects can demonstrate how to reduce construction costs** by, for example, designing shorter buildings with the same amount of usable space. In some applications, smaller plenums will allow developers to **increase usable space** with additional floors. Taller spaces may also provide opportunities to add windows for increased natural lighting. With more usable space, owners and developers can enhance the guest experience with income-producing amenities such as rooftop bars.

MINIMIZE MECHANICAL ROOMS

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VRF equipment is compact compared to conventional HVAC units and is distributed rather than centralized. **This reduces space requirements for mechanical rooms.**

SPEND LESS ON STRUCTURAL SUPPORT

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At an average weight of 70 pounds per ton for an outdoor unit, **VRF equipment is up to 30% lighter than alternatives** such as chilled water systems. This reduces requirements for structural steel and lintel beams.

DEFER COSTS UNTIL LEASES ARE SIGNED

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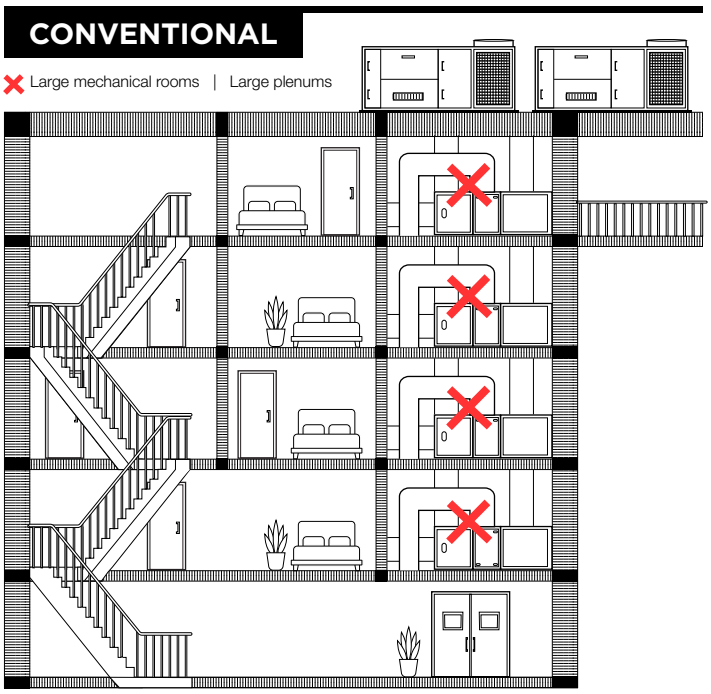
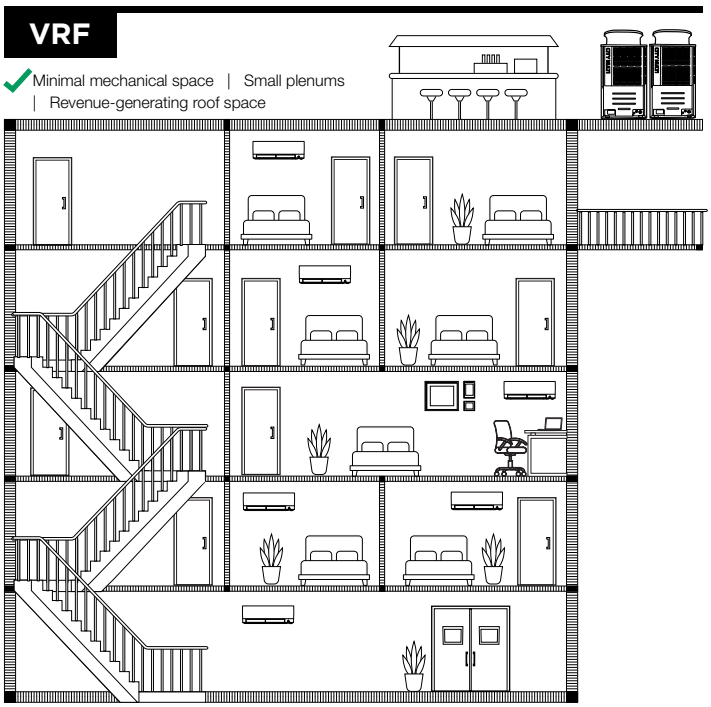
The design flexibility of a VRF system's modular components **mean contractors can finish out a system floor-by-floor based on tenant needs.** Whether developing a multifamily building or a multi-use commercial space with a hotel, restaurant and retail tenants, this benefit allows owners to defer part of the installation costs until leases are signed.





CASE STUDY: MOXY COLUMBUS SHORT NORTH

"Another advantage of the Mitsubishi Electric VRF system and its energy efficiency is that we were able to qualify for energy rebates. This helped offset our initial upfront costs so we were able to realize the long-term savings that came with the system without having to pay quite as much on the front end."

— Nelson Yoder, Crawford Hoying

Columbus, OH | 150,000-square-foot multi-use building | 116 guest rooms | Rooftop amenities

READ CASE STUDY

WATCH OUR VIDEO

For more information about the Moxy Case Study and the benefits of VRF technology, watch our video overview on YouTube.

PTAC VERSUS VRF SYSTEMS IN A NEW CONSTRUCTION HOTEL

The following comparison based upon a 47,800-square-foot hotel located in Chicago, Illinois illustrates how the developer's **lifecycle and operating expenses for a conventional PTAC system can be higher than those for a VRF system**. This is despite the apparent premium paid for high-efficiency VRF technology if only the mechanical bid is considered.

VRF SYSTEM: 25-YEAR LIFECYCLE COST

Building Type: Hotel
Building Square Footage: 47,813 SF (137 guest rooms)
City: Chicago, Illinois
Analysis excludes public areas and outside air requirements.

HVAC SYSTEM	TOTAL LIFE CYCLE COST	FIRST COST	FIRST COST/SF	LIFETIME MAINTENTANCE COST	HVAC LIFETIME UTILITY
VRF System	$2,774,519	$986,660	$20.64	$69,893	$730,412
PTAC System	$4,318,450	$721,795	$15.10	$509,249	$1,429,446

VRF SYSTEM: ANNUAL ENERGY COST

HVAC SYSTEM	ANNUAL ENERGY COST ($)	$/SF	SAVINGS	SAVINGS %
VRF System	20,034	0.42	19,173	48.9%
PTAC System	39,207	0.82	-	0%

CASE STUDY: NOMAD HOTEL

"Many of the existing city properties we develop are built lot line to lot line. There's no space to build a centralized plant that has cooling towers, boilers and chillers. VRF was ideal for us because we can put units on the roof that have a small footprint."

— Ryan Bean, Sydell Group

Los Angeles, CA | 14-story luxury hotel | 241 guest rooms | National Historic Landmark

READ CASE STUDY

REAL WORLD IMPACT

In New York City, Local Law 97 sets limits for the metric tons of CO_2 a building over 25,000-square-feet can produce per square foot. Building owners will be fined if CO_2 emissions for their facilities exceed the limits established for their category of building.

SUSTAINABILITY AND COMPETITIVE ADVANTAGES

Not all developers and building owners will immediately recognize the benefits of lower bills and overall reduced energy usage. If tenants are responsible for utility bills, some will look at the capital costs associated with VRF systems and decide there is little value in paying for an HVAC system known for its efficiency if systems with lower mechanical bids are available. Building owners will look past the mechanical bid once they comprehend the benefits of VRF systems over conventional systems. If they're still unsure of the comparative advantages relative to first cost, they should consider the indirect benefits of certified sustainable buildings. According to recent studies, potential benefits include increased rental rates, higher occupancy rates and greater tenant/guest satisfaction and retention.

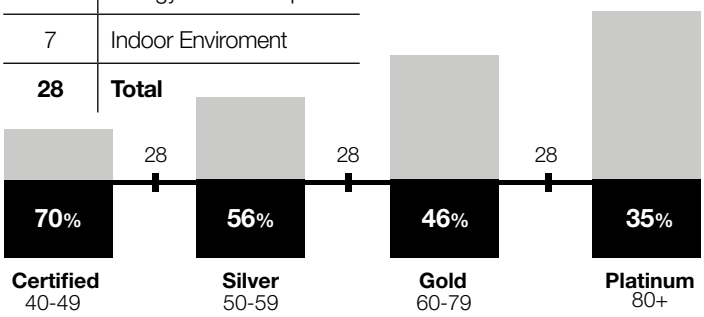
Based on 10 years of financial performance data for the **Bentall Kennedy** office building portfolio, which includes 34 million-square-feet of commercial space in the United States, a study published in the September 2015 issue of the *Journal of Portfolio Management*, showed the following:

- Higher net-effective rents: **3.7% higher** for LEED-certified properties compared to similar non-certified buildings
- Higher occupancy rates: **9.7% higher** for buildings with **ENERGY STAR®** certification compared to non-certified buildings

VRF systems contribute to the certification and marketability of high-performance buildings as "sustainable." Application of VRF technology can contribute up to 21 points in the Energy and Atmosphere category and up to 7 points in the Indoor Environment category when a building is evaluated for LEED certification. As presented earlier, VRF systems can vary capacity, reducing energy consumption and costs. This ability is especially applicable for tightly-constructed facilities certified as zero-net energy (ZNE) or passive house. Fixed-capacity systems are prone to short cycling in low-load environments.

VRF AND LEED POINTS

Points	Category
21	Energy and Atmosphere
7	Indoor Enviroment
28	**Total**



COST SAVINGS THROUGH DECARBONIZATION

In addition, the reduction in carbon dioxide (CO_2) emissions that comes with electric-powered VRF systems can help building owners keep their facilities attractive to tenants, prospective buyers and guests interested in "green tourism". Public and private initatives toward decarbonization coupled with the cost of energy **are driving more stringent building codes and legislation.** VRF systems are uniquely positioned to help building owners meet CO_2 reduction goals while lowering utility costs. They're designed for extended lifecycles providing sustainable performance well into the future.

CONCLUSION

Modern construction requirements, decarbonization efforts and rising energy costs position VRF technology as the primary heating and cooling method of the future. Total-installed-cost advantages plus the comfort and performance benefits should help developers and building owners choose VRF systems as the preferred HVAC technology of today. With more complete consideration for how VRF systems compare to conventional systems in terms of overall requirements and impact on a building, HVAC specifiers can easily explain the opportunities VRF systems create for reducing costs, avoiding costs and creating competitive advantages.