

# Cooling and Heating Without Ductwork

Split-ductless Technology Offers Energy Efficiency,  
Zoned Control and Design Flexibility for Homes



White Paper

December 2012



A home comfort study conducted by Decision Analyst found that 67 percent of U.S. houses have at least one room that is too hot in the summer or too cold in the winter. One cost-effective way to solve that problem is with the installation of a split-ductless cooling and heating system. A proven technology worldwide, split-ductless is poised for dramatic growth in residential construction because it provides highly energy-efficient, precisely zoned control to one room or the entire house. Plus, because the system has no ductwork, installation is fast and easy, and doesn't require messy demolition work.

This white paper describes the major features and benefits of split-ductless technology and how it is a solution ideally suited for single rooms, whole-house systems, renovations or additions. Likewise, this white paper provides a case study of a home renovated with a split-ductless system (also known as a mini-split system).



**Bella Mira Estates, Issaquah, Wash.**

environment and reduces power consumption. Because split-ductless systems have minimal or no ductwork, they avoid the energy loss associated with ducted central forced-air systems.

**Design flexibility.** The compact outdoor equipment can be installed in small spaces (like patios and landscapes), while the indoor units can be tucked above doorways and windows or into the ceiling.

## **SPLIT-DUCTLESS SYSTEM FEATURES**

Split-ductless systems take advantage of innovative technology, which provides superior control of room comfort and energy efficiency. With a variety of configurations available, split-ductless systems provide precise comfort control by moving refrigerant through piping to the zone to be cooled or heated. Regardless of time of day, sun or shade, season of the year or special requirements, they offer personalized comfort to each room or space. The systems have many unique features and benefits, including the following:

**Year-Round Comfort.** Split-ductless zoning provides year-round comfort throughout the home, eliminating hot and cold spots.

**Energy efficiency.** Unlike a conventional compressor that starts and stops constantly, the inverter-driven compressor motor varies its rotation speed to ramp up and down, like the cruise control on a car. This smooth frequency variation delivers the precise capacity needed to maintain a constant temperature set point, which creates a more comfortable

CONTINUED ON NEXT PAGE >

**Installation ease.** The indoor units easily connect to the outdoor unit via two refrigerant lines, plus power and control wiring, through a three-inch opening in the wall or ceiling. This system design works especially well for older buildings with solid walls and minimal ceiling clearance.

**Quiet operation.** The indoor unit can operate at 30 dB(A) — about the sound level of a whisper — and as low as 19 dB(A). The outdoor unit hums at about the level of normal conversation, 55 to 60 dB(A). The amazingly quiet operation is possible because of the system's noise dampening features, including the motor that ramps up and down smoothly and the insulated compartment that it's housed in. Typical outdoor units do not offer these features. They turn on with a bang and run at 65 to 70 dB(A), which is equivalent to heavy traffic.

**Discreet indoor units.** A variety of indoor units are available — wall-mounted, ceiling-recessed cassette, horizontal-ducted and floor-mounted — providing more design options than other types of residential HVAC systems.

**Advanced Filtration.** Indoor units feature a multi-part filtration system to reduce contaminants such as allergens, viruses and bacteria from the air as it circulates. The standard filter system contains two filters; the enhanced system has three filters. With proper maintenance, the washable filters can last more than 10 years.

**Remote controllers.** Various control options are available. Remote controllers operate individual units in each room, and they come in wireless handheld (infrared) or wall-mounted (radio frequency) designs. The remote controllers can be networked together through a single central controller or through an internet gateway.



**Phillip Waggoner House, Washington, D.C.**  
**Wall-mounted Unit**

## EXCLUSIVE BENEFITS FOR HOMES

Professionals and homeowners say that split-ductless systems are ideal HVAC solutions for single-family and multi-family dwellings. Here are some reasons why:

### Fast, No-mess Installation

“It was the easiest and quickest system to install. Our lives were not turned upside down, and the installation was completed in less than five days. There was no drywall mess and very little interruption to our daily routine.” — Philip Waggoner, homeowner, Washington, D.C.

“Installing ductwork was a last resort,” but installing a ductless system was “a no-brainer. It saved a significant amount of labor and materials expense.” — Shawn Montague, president, Breezin HVAC, Inc., Staten Island, N.Y., of the installation in four five-story 130-year-old brownstones in New York City

CONTINUED ON NEXT PAGE >

### Superior Comfort

"Except for a few days in the spring when we throw open the windows, we keep the system running 24/7. With glass on three sides, our back porch is now our favorite room." — Herb Craddock, homeowner, Charlottesville, Va., about his enclosed screen porch

### Energy Savings

"The inverter compressor technology allows us to cool only the spaces in the house we desire. This is a great energy saver." — John Gluszak, homeowner, Queens, N.Y.



"With this system, we can show the homeowner the most effective and cost-efficient way to cool and heat their homes." — David Lee, student, Appalachian State University, Boone, N.C., of the school's award-winning model home entry in the 2011 Solar Decathlon

### Quiet Operation

"You cannot hear whether it's on or off, but we can still hear the neighbor's compressor." — Sara Ross, homeowner, Amherst, Mass.

### Low Maintenance

"This is an amazing product. It not only maintained the architectural integrity of our house, it introduced us to a technology that is quiet, reliable and efficient, providing us years of worry-free operation." — Herbert Ment, homeowner, Hewlett Harbor, N.Y.

### Green Home Certifications

Split-ductless systems are sustainable, cost-effective HVAC solutions that can contribute points toward green home program certifications, including ENERGY STAR for Homes, LEED for Homes, the National Green Building Standard and many local and regional green building programs. Refer to the websites of these national programs for more details.



**Novogratz House, New York City, N.Y.**  
**Ceiling-cassette Unit**  
**Controller**

## CASE STUDY: O'NEILL PASSIVE HOUSE

### Renovated California Home Reduces Energy Usage by 80 Percent

When bank manager Catherine O'Neill retired in 2009, she wanted to create a comfortable home with a distinct energy-efficiency statement. In a cul-de-sac of ranch houses near downtown Sonoma, Calif., she purchased a run-down 1962 farmhouse that had not been lived in for years, but that had "good bones."



**O'Neill Passive House, Sonoma, Calif.**

To transform the neglected house into a showcase for energy efficiency, O'Neill turned to Rick Milburn, founder of PassivWorks, Inc., Vineberg, Calif., a master builder and green building activist. After conducting extensive research, Milburn and O'Neill decided to rebuild the home to the Passive House (Passivhaus) Standard developed in Germany in 1988. Compared to traditional dwellings, a Passive House reduces the home's overall energy usage by 60 to 70 percent and heat usage by 90 percent.

Energy modeling that accounted for climate, square footage, orientation of the building, windows, materials and other factors was performed on the home. Using the data, Milburn

employed a number of innovative construction techniques and products to make the home extremely airtight. Because Passive House buildings have little tolerance for air leakage, the O'Neill house was wrapped in earth-friendly plywood sheathing and another barrier, and the walls were stuffed with fiberglass insulation. Plus, all joints were tightly sealed with building tape.

The O'Neill house also was dressed with a premium insulated metal roof and triple-pane windows. Once the windows were installed, an air-tightness test found that the house performed 30 percent better than Passive House Standard requirements.

### Split-Ductless System an Ideal Choice

The home's electricity would be supplied by solar panels, but for backup cooling and heating, Milburn recommended a residential system without ductwork. "I have found the technology to be the most well-matched system for meeting [Passive House] energy-efficiency goals," he explained. "Mini-split systems are unique for meeting small cooling and heating loads. Plus, the indoor and outdoor units are so quiet you can't tell they are in operation."

CONTINUED ON NEXT PAGE >

## CASE STUDY: O'NEILL PASSIVE HOUSE

There were other reasons the split-ductless system was the ideal choice. Besides superior efficiency, the single indoor wall-mounted unit is connected with two small pipes to the outdoor unit, so walls did not have to be torn up to add ducts. "Also, we liked the fact that the units are so compact — the outdoor unit's the size of a suitcase," said Jarrod M. Denton, AIA, Signum Architecture, St. Helena, Calif.

The O'Neill house achieved an 80 percent reduction in energy use when compared to a typical California home, and the retiree's combined gas and electric bills average less than \$20 a month. (The farmhouse was unoccupied for years before the renovation, so no historical energy data is available for comparison.)

O'Neill is thrilled with the renovation, especially the cooling and heating system without ducts. "It is incredibly quiet, and because I am skinny, keeps me toasty warm," the homeowner said. "My favorite thing about my house is that ... it doesn't look like one of those geeky, architectural experiments. It is not only highly energy efficient, but it's also beautiful, inviting and comfortable."



**Outdoor Unit**



**O'Neill Passive House, Wall-mounted Unit**

Recently, the O'Neill Passive House was selected by the U.S. Department of Energy as a prototype home to building professionals. "These homes are truly the future of energy-efficient building and the most practical, cost-effective way for us to reduce our daily energy consumption," Milburn said. "On the coldest day of the year, Passive Homes can be powered with the same amount of energy it takes to run a hair dryer."

Visit this and other case studies at [www.mehvaccasestudies.com](http://www.mehvaccasestudies.com).

**For more information** about Mitsubishi Electric HVAC products, visit [www.mitsubishipro.com](http://www.mitsubishipro.com).



**Mitsubishi Electric US Cooling & Heating Division**  
3400 Lawrenceville Suwanee Road  
Suwanee, Ga. 30024  
800-433-4822

