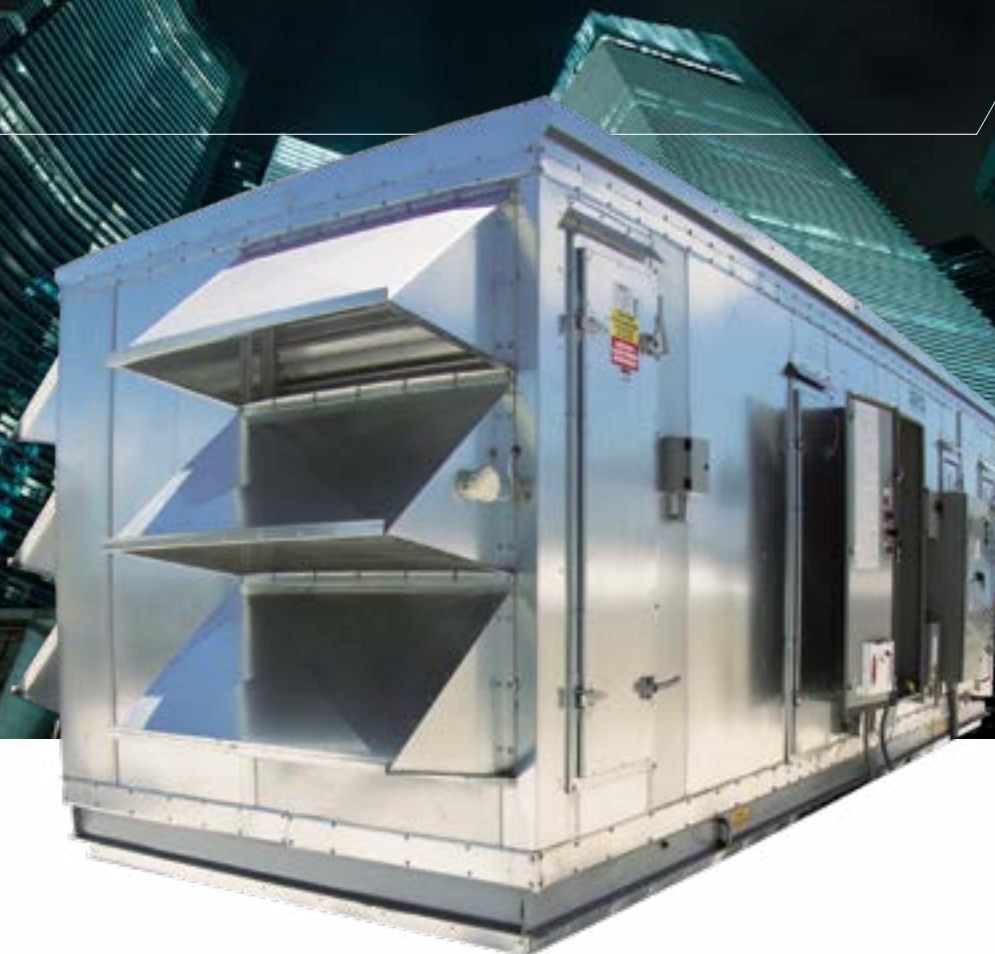


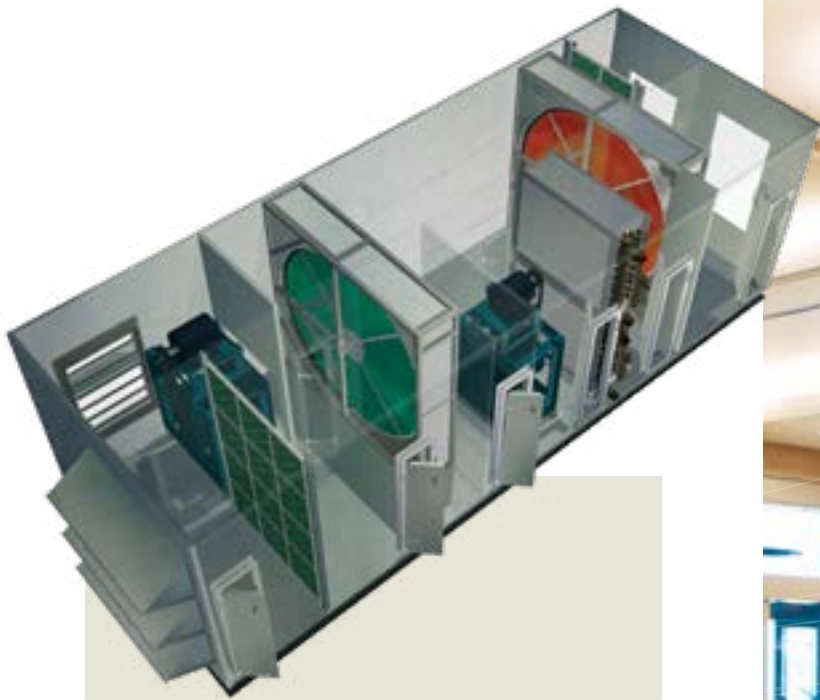
ENERGY EFFICIENT

DEHUMIDIFICATION

# PINNACLE SERIES

DEDICATED OUTDOOR AIR SYSTEM





Provides a very high degree of latent cooling using only a minimal amount of conventional cooling input



Substantial energy savings over traditional over-cooling and reheat systems



Constant stream of optimally conditioned ventilation air comes into the space while stale polluted air is exhausted out

Pinnacle® manages 100% of a building's humidity, temperature and ventilation in a single package. One minute it's an air conditioner. The next, it's a dehumidifier. It's the only ventilation system you will ever need.

#### How does it work?

Pinnacle combines the strengths of passive total energy recovery, conventional cooling technology and a new class of desiccant product -- the passive dehumidification wheel -- to supply perfect ventilation.

Pinnacle is comprised of a supply fan, exhaust fan, total energy wheel, cooling coil, and passive dehumidification wheel. The total energy wheel is used to precondition fresh air using the exhausted building air. The cooling coil and passive dehumidification wheel then work in concert to further treat this fresh air stream to produce room temperature air at a much reduced humidity level.

The key to this system is the passive dehumidification wheel.

# VERY DRY OUTDOOR AIR IN A SIMPLE, ENERGY-EFFICIENT INTEGRATED PACKAGE

## The True 3Å Advantage

Inside every Pinnacle unit is the True 3Å energy recovery wheel which has saved an estimated 565 trillion BTUs and reduced carbon emissions by more than 32-million tons over the past 30 years. The True 3Å desiccant is a key contributor to a building's IAQ, allowing less than .045% contaminant transfer into the supply airstream according to independent testing.



It is optimized to remove moisture from a saturated air stream, without an active regeneration source.

## Unprecedented efficiency

Pinnacle responds to various combinations of temperature and humidity by modulating the passive dehumidification wheel and the cooling coil. Thus, Pinnacle can provide a constant stream of optimally conditioned ventilation air while exhausting your building's stale, polluted air. It does so in a highly efficient manner, providing substantial operating savings by eliminating the need for traditional over-cooling and reheat systems. Equally important, by optimizing the condition of your building's supply air, Pinnacle reduces the demand for overall heating and cooling capacity. That can mean substantial savings in installation costs.

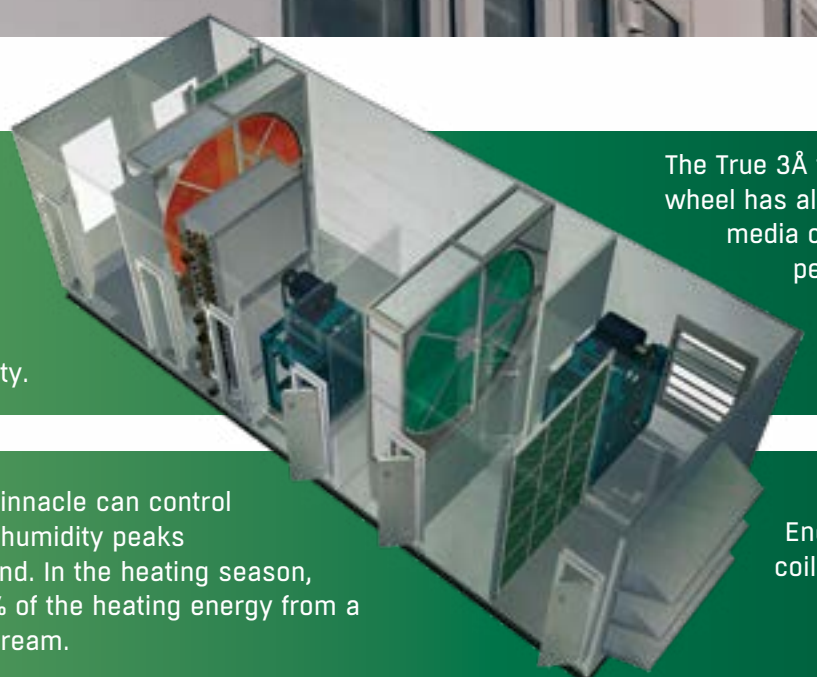
## 3fficiency

When Pinnacle is utilized together with active chilled beams and NEUTON™ chilled beam pump modules, a whole-building efficient hydronic system is achieved. Read more about the advantages of the 3fficiency system on pages 10-11 and discover why the cost savings and superior indoor air quality make it a better alternative to variable refrigerant flow (VRF).





# THE ONLY VENTILATION SYSTEM YOU WILL EVER NEED



The passive dehumidification wheel's performance can be modulated on demand to respond to various conditions of temperature and humidity.

The True 3Å total energy recovery wheel has aluminum, "honeycombed" media coated with a high performance, 3Å (angstrom) molecular sieve desiccant.

In the cooling season, Pinnacle can control temperature peaks and humidity peaks independently, on demand. In the heating season, it can recover up to 90% of the heating energy from a building's exhaust air stream.

Energy input to the cooling coil is adjusted on demand.

At any given time, your building could be faced with one of the following conditions:

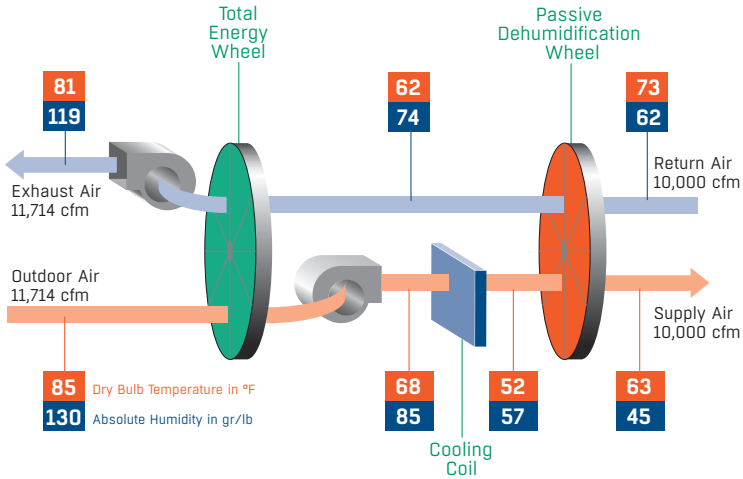
- The building is too hot, although humidity is acceptable.
- The building is too hot and too humid.
- The building is too cool and too humid.
- The building is too cold, although humidity is acceptable.

The Pinnacle system responds to these varying conditions on demand. It cools, heats, or dehumidifies as required, providing a steady stream of optimally pre-conditioned air to your building. It will allow constant ventilation of your work space for superior air quality. And it provides maximum comfort level at minimal energy cost.

That's intelligent.

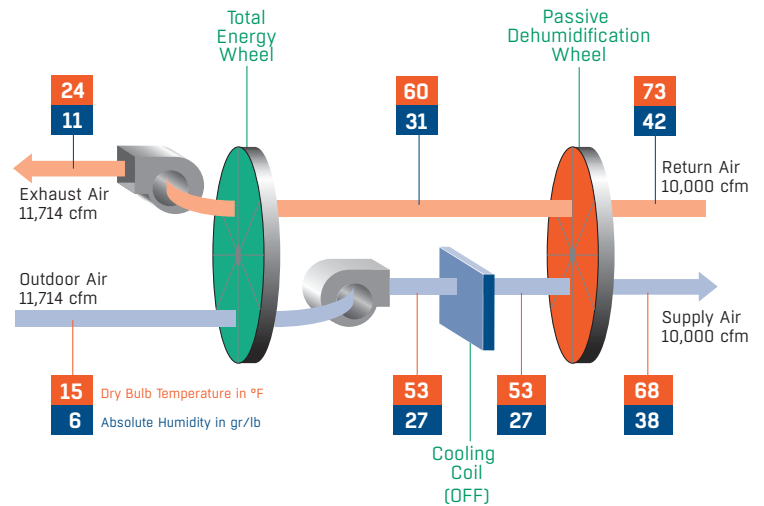
Pinnacle offers several advantages over other systems:

- Dehumidification of the air supply can be greatly increased.
- Energy efficiency is greatly increased.
- It controls humidity in unoccupied spaces.
- During the heating season, it can recover up to 90% of the energy from the building's exhaust air stream.

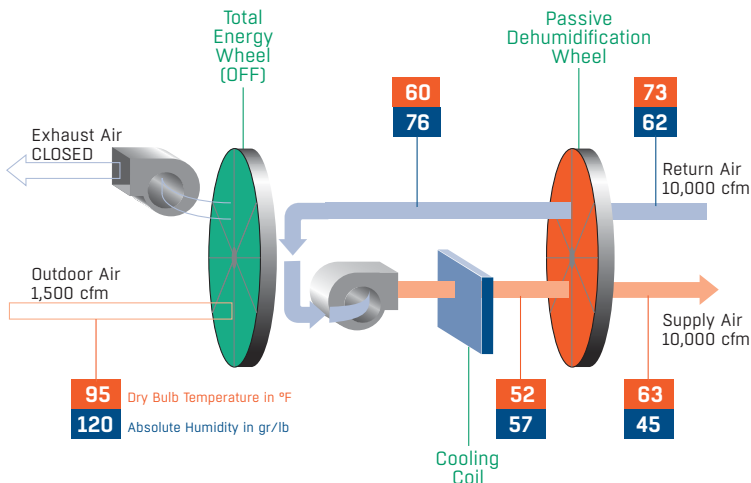


« Schematic of the Pinnacle system operating at peak space latent load providing 70.1 tons of total cooling at a Sensible Heat Ratio (SHR) of 0.27 using only 33.8 tons of refrigeration input. The dew point delivered to space is 44.8°F. A conventional system with the same leaving coil temperature will NOT deliver the same dewpoint. It would require 81.1 tons of refrigeration and 156 MBtuh to achieve the same leaving coil condition.

Schematic of the Pinnacle system operating in heating mode providing 156 MBtuh of energy and 41 MBtuh of humidification. »



« Schematic of the Pinnacle system operating in unoccupied mode. The system can operate in 100% recirculation mode and with very little refrigeration input effectively controlling the indoor humidity.



# FEATURES & BENEFITS

## EFFICIENCY STANDARD WITH OPTIONAL UPGRADES

### The True 3Å Total Energy Wheel



- Certified total energy recovery performance (sensible and latent) up to 90% efficient
- Patented 3Å molecular sieve-desiccant coating to avoid cross-contamination
- Wheel faces are coated to ensure long lasting corrosion protection
- All aluminum, structural spoke system eliminates mechanical fatigue and allows media replacement (sizes 13 and up)
- Non-wearing labyrinth seals (sizes 13 and up)
- Passive dehumidification wheel is polymer coated to avoid oxidation and future transferring of moisture.

### SEMCO Panel System

- Double-wall panel construction (2 or 4 inches thick with 18-gauge outer skin) eliminates exposed insulation and the associated risk of bacterial growth
- Double-wall removable panels provided for large internal components
- Gasketed double-wall access doors for all compartments
- Sloped secondary roof of continuous standing-seam panels standard on units designed for outdoor installation
- Welded cabinet floor with insulated drain pan

### Supply and Exhaust Air Fans

- AMCA rated plenum fans sized for quiet and efficient operation
- Mounted, balanced, tested and internally isolated for vibration
- Motors are NEMA frame, high-efficiency with a 1.15 service factor

### Filter Sections

- Filters that are 30% (MERV 8) efficient are provided for the outdoor air and return airstreams
- Optional 65, 85 or 95% (MERV 11, 13, 14) cartridge filters can be provided in addition to standard 30% filters
- Optional HEPA filters for hospital applications

### Hoods and Dampers

- Low-leakage motorized fresh air damper and gravity exhaust air damper
- Outdoor units provided with an intake and exhaust hood with bird screen
- Optional motorized exhaust damper available
- Optional recirculation damper available

### Electrical Package with Single Point Connection

- Power distribution panel with non-fused disconnect and branch circuit protection for each motor and transformer. Motors are wired to starters or VFDs.
- Custom control packages available
- 208 or 480V single-point connections available.
- Optional 575V single-point connection available.

### Optional Variable Speed Wheel Control

- Digital reading of temperatures
- Proportional heating control
- Automatic summer/winter changeover

### Reheat Options

- Hot water coil
- Steam coil, non-freeze type
- Electric coil (requires separate electrical connection point)

### Cooling Options

- Chilled water
- Direct expansion (DX) coil

## Key Benefits

- Able to dehumidify outdoor air as low as 40 grains, dew points unattainable with conventional systems
- Significantly reduces the required cooling input
- Most efficient “Latent Air Conditioner” with best humidity control under all conditions
- Competitive first cost, lowest cost per ton of latent load
- Lowest operating cost, best life cycle cost
- Unoccupied mode (evenings/weekends/summer)
- Standard, cataloged energy wheel products and wheel systems
- Independently certified wheel performance in accordance with ASHRAE and ARI Standards with regard to:
  - latent heat transfer efficiency
  - sensible heat transfer efficiency
  - pressure loss across wheel
- Equal latent and sensible heat transfer enthalpy wheel
- Highest performing wheel on the market
- Field-adjustable purge section
- Wheel media independently certified to pass NFPA 90A requirements for flame spread and smoke generation based upon ASTM E84 fire test
- Minimal maintenance
- Suitable for new construction and can be retrofitted to most existing facilities.
- Precools and dehumidifies outdoor air during the cooling season.
- Preheats and pre-humidifies the outdoor air during the heating season.
- Supplies preconditioned outdoor air to conventional HVAC systems, allowing them to effectively increase outdoor air percentages.
- Preconditioned outdoor air can be introduced to the return air plenum serving a central HVAC system.
- Can be supplied directly to the conditioned space since the system’s recovery efficiency ranges between 74 and 85% (in balanced flow operation).

## System Airflow Capacities

Model	PVS-03	PVS-05	PVS-09	PVS-13	PVS-18	PVS-24	PVS-28	PVS-34	PVS-43	
Air Capacity	Low	2,000	3,000	4,500	6,000	8,000	11,000	15,000	18,000	26,000
	Mid	2,250	3,500	6,000	7,500	10,000	13,000	18,500	21,000	30,000
	High	2,500	4,000	7,300	8,800	14,000	15,000	21,000	24,000	37,000

# COMPARISONS

## SIDE-BY-SIDE TECHNOLOGY COMPARISON

The two most significant advantages offered by the Pinnacle system, when compared with the traditional over-cooling and reheat systems, are that (1) the dehumidification or latent capacity (e.g., dryness of the air provided to the controlled space) is significantly increased and (2) the energy efficiency is greatly improved. The Pinnacle system has more latent capacity and higher energy efficiency than a desiccant-based cooling (DBC) or a dual-wheel energy recovery system (DWERS).

For example, a DBC system processing outdoor air on a latent design day (85°F and 130 gr/lb) is limited to a supply air condition of approximately 60 grains with technology currently available. To reach this condition requires the equipment to be operated at very low face velocities (resulting in very large system space requirements) and regenerated at very high regeneration temperatures (large energy inputs.)

The DWERS and other conventional over-cooling reheat systems are limited by the humidity level of the air leaving the cooling coil. Since most conventional cooling systems have a practical limit of approximately 48°F leaving air temperature, the absolute humidity level obtainable from most conventional systems is about 50 grains per pound of moisture (gr/lb.)

As a result, the only commercially available way to dehumidify outdoor air below approximately 50 grains of moisture involves cooling the outdoor air below approximately 48°F, and requires expensive, non-standard cooling equipment with very deep cooling coils, complex controls with defrost cycles and significantly elevated kW/ton energy consumption (i.e. poor energy efficiency.)

### Comparing First Cost, Operating Cost and Life Cycle Cost at Like Dewpoints

Equipment Options	Latent Capacity Delivered	Equipment Cost	Annual Cost of Operation	Life Cycle Cost
Packaged Rooftop Gas Reheat	42.5 Tons	\$56,500	\$24,045	\$610,020
Chilled Water/Hot Water Reheat	42.5 Tons	\$63,000	\$20,130	\$514,960
Customized Package DX with Condensor Reheat	42.5 Tons	\$66,000	\$21,920	\$556,370
Active Desiccant Based Cooling	36.8 Tons	\$87,000	\$12,240	\$332,250
Total Energy Recovery, Chilled Water with Hot Water Reheat	42.5 Tons	\$60,500	\$11,290	\$300,490
Dual Wheel Energy Recovery System	42.5 Tons	\$61,500	\$4,465	\$146,330
<b>Pinnacle "Passive" Dehumidification System</b>	<b>42.5 Tons</b>	<b>\$65,300</b>	<b>\$3,420</b>	<b>\$119,050</b>

**Lowest annual operating cost (only 14% of the baseline system)**

**Lowest life cycle cost (\$490,000 less than the baseline system)**

**Lowest first cost per ton of latent load provided**



## Comparing Latent Capacity Provided at Attainable Dewpoints

Equipment Options	Lowest Practical Dewpoint Delivered	Humidity Level Delivered	Latent Capacity (Outdoor Load)	Latent Capacity (Room Load)
Packaged Rooftop Gas Reheat	51° F	55 grains	43 Tons	6 Tons
Chilled Water/Hot Water Reheat	51° F	55 grains	44 Tons	7 Tons
Customized Package DX with Condensor Reheat	51° F	54 grains	43 Tons	6 Tons
Active Desiccant Based Cooling	49° F	65 grains	37 Tons	0 Tons
Total Energy Recovery, Chilled Water with Hot Water Reheat	49° F	52 grains	44 Tons	7 Tons
Dual Wheel Energy Recovery System	42° F	52 grains	44 Tons	7 Tons
<b>Pinnacle "Passive" Dehumidification System</b>	<b>51° F</b>	<b>40 grains</b>	<b>51 Tons</b>	<b>14 Tons</b>

**100% more latent capacity available to handle space loads**

## Comparing Energy Consumption and Cooling Requirements at Like Dewpoints

Equipment Options	Dewpoint Delivered	Latent Capacity Delivered	Conventional Cooling Capacity Required	Reheat Required	Energy % Baseline
Packaged Rooftop Gas Reheat	51° F	42.5 Tons	75.8 Tons	166,100 btu/hr	100%
Chilled Water/Hot Water Reheat	51° F	42.5 Tons	75.8 Tons	166,100 btu/hr	100%
Customized Package DX with Condensor Reheat	51° F	42.5 Tons	75.8 Tons	0 btu/hr	85%
Active Desiccant Based Cooling	55° F	36.8 Tons	18.9 Tons	489,000 btu/hr	70%
Total Energy Recovery, Chilled Water with Hot Water Reheat	51° F	42.5 Tons	37.5 Tons	166,100 btu/hr	57%
Dual Wheel Energy Recovery System	51° F	42.5 Tons	29.5 Tons	0 btu/hr	33%
<b>Pinnacle "Passive" Dehumidification System</b>	<b>51° F</b>	<b>42.5 Tons</b>	<b>24 Tons</b>	<b>0 btu/hr</b>	<b>27%</b>

**Lowest cooling input to produce 42.5 tons of latent load**

**Lowest dewpoint and 20% more total latent capacity than the other options**

# 3FFICIENCY

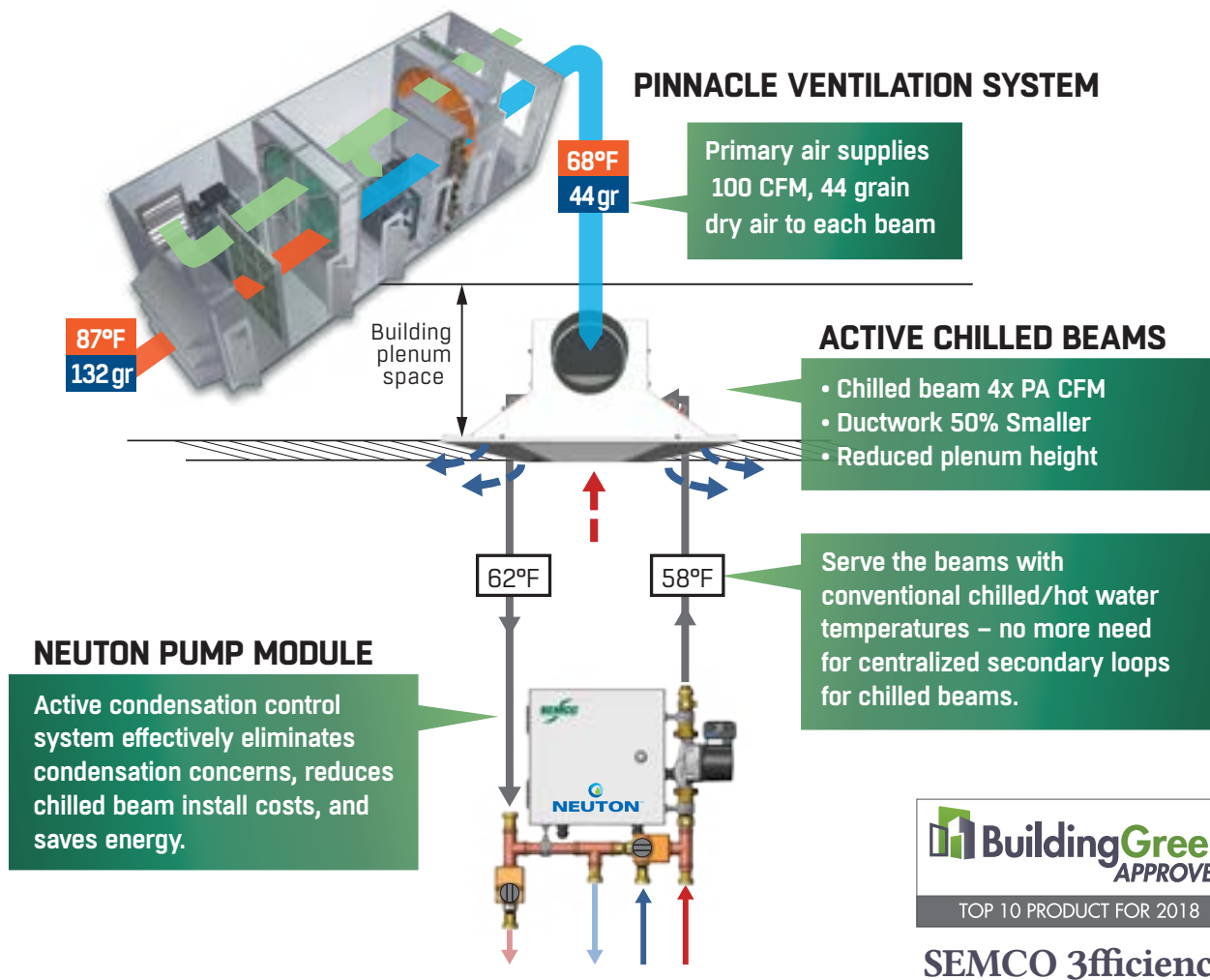
## EFFICIENT HYDRONIC SYSTEM

At SEMCO, we design products that fit together to maximize indoor air quality and energy efficiency. When specified with a SEMCO active chilled beam system and efficient NEUTON pump modules, the Pinnacle series can produce even greater savings.

Acknowledged as one of the **Top 10 Green Building Products** for 2018 by Building Green, 3fficiency has been receiving industry recognition for providing an energy-efficient, easy-to-specify integrated system. 3fficiency improves upon a traditional chilled beam design by reducing piping and simplifying building controls.

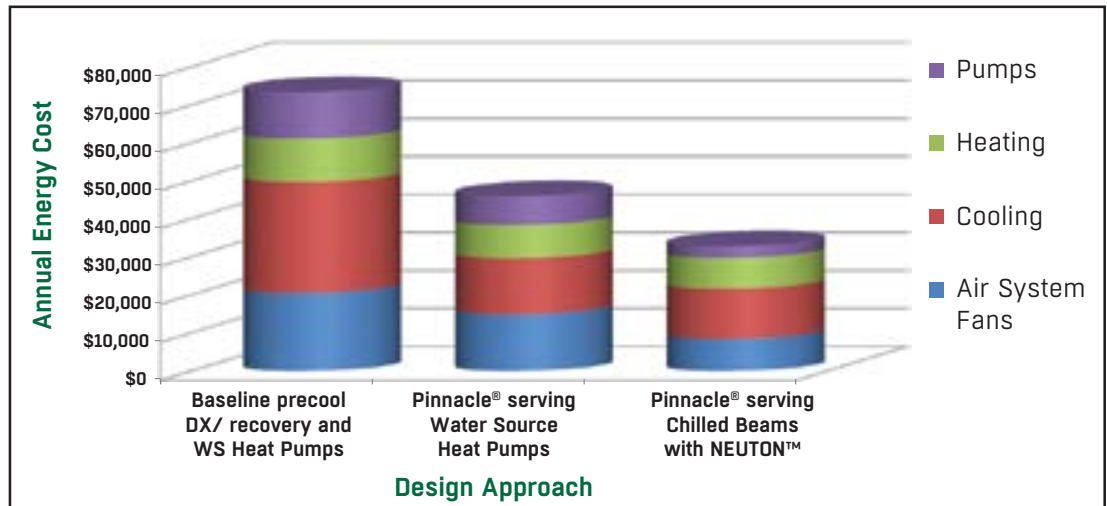


**3fficiency**<sup>TM</sup>  
PINNACLE + NEUTON + CHILLED BEAMS

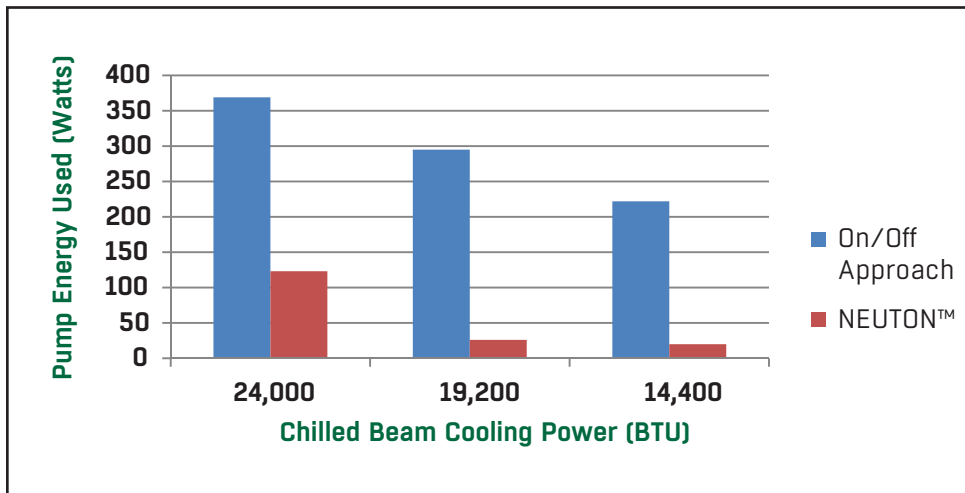


## 3FFICIENCY ENERGY SAVINGS

Energy modeling completed for an actual High School project comparing three design approaches which highlights the energy savings offered by the 3fficiency system, even over the efficient Pinnacle serving water source heat pumps.



### Standard efficiency pump (on/off) vs. high efficiency ECM variable speed pump served by the NEUTON pump module control logic



Variable flow using high efficiency pump vs. conventional approach shown graphically

A high-efficiency ECM motor combined with substantial power reduction offered by the NEUTON variable flow pump results in significant energy savings over a traditional, constant flow – on/off design approach.

- Three cooling conditions are analyzed above: peak coil cooling power (24,000 BTUs), 80% of peak (19,200 BTUs) and 60% of peak (14,400 BTUs).

- The constant speed pump operates to deliver a constant flow of 6 gpm at a 13 foot pressure head – cycled on and off during part load.
- The NEUTON ECM variable flow pump runs continuously, but varies the flow from 6 gpm down to 3 gpm, greatly reducing the pump energy used.

## EXCELLENCE IN SOLUTIONS

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FläktGroup SEMCO delivers smart and energy efficient Air Distribution and Air Quality solutions to support every application area. We offer our customers innovative technologies, high quality and outstanding performance supported by more than fifty years of accumulated industry experience. The widest product range in the market, and strong market presence in 65 countries worldwide, guarantee that we are always by your side, ready to deliver Excellence in Solutions.

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