

## Evaporative-Cooled Condenser Rooftop Unit:

*Effective Alternative to a Chilled Water System, Water-Source Heat Pump System, or Traditional Air-Cooled Packaged Rooftop Units (RTUs)*

For buildings greater than 100,000 square feet, the capacity, configuration and overall efficiency of HVAC systems take on new importance. These buildings, which typically require 100,000 cfm or more of air handling capacity, are generally configured with chilled water/cooling tower applications. Many view this to be a technically efficient option, but tend to be costly and difficult to incorporate into building designs. Water-source heat pumps (WSHPs), are the lowest “first-cost” option, but can be noisy and prone to frequent maintenance issues.

A technically advanced, large packaged evaporative-cooled condenser rooftop unit (RTU) is a third approach, worthy of consideration, that provides lower overall installed cost than chilled water or WSHP systems. Large rooftop units of between 45 to 240 tons can be configured in evaporative condensing, water-cooled or high efficiency air-cooled modes, offering energy efficiency ratios (EERs) that rival chilled-water/cooling tower systems (see **Figure 1**).

**Figure 1:** Energy Comparison—  
Evaporative Condensing vs.  
Air-Cooled Packaged RTUs

150 Ton AAON RL Air-Cooled RTU	9.8 EER
150 Ton AAON RL Evaporative-Cooled Condenser RTU	14.1 EER

Source: Trumbull Campbell Associates, Inc., based on ARI conditions.

*In the Northeast, where water is readily available and utility rates are high, an evaporative-cooled system can be less expensive to operate than a traditional air-cooled packaged rooftop unit.*

It also frees up leasable area by not requiring a mechanical room; complex, elaborate ductwork; or placing several smaller RTUs across the roof requiring multiple roof penetrations. Furthermore, in the Northeast, where water is readily available and utility rates are high, an evaporative-cooled system can be less expensive to operate than a traditional air-cooled packaged RTU.

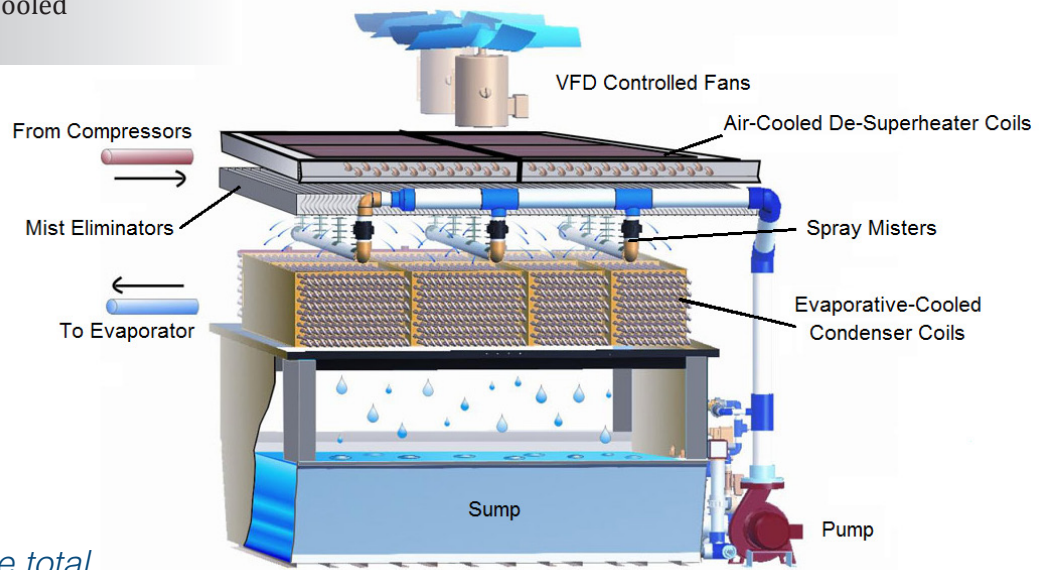
### Innovation in the evaporative-cooled condensing process

In conventional evaporative-cooled condensing, water is sprayed over the condenser coil as the condenser fans draw air across the coil to evaporate the spray and cool the refrigerant tubes toward the ambient wet-bulb temperature.

Sprayers are directed to tubes containing superheated refrigerant, which creates evaporation and scaling that, left unchecked, can foul the coil and dramatically reduce the effectiveness of heat transfer.

To address this issue, we recommend using an AAON®-patented condenser that employs an airside de-superheater coil above the wetted section. This engineering innovation reduces the potential for scale formation and cuts water and chemical usage by at least 22%, two important LEED-submission items. It also limits the risk of condensation damage to the fan motors and extends motor life by delivering considerably drier air to the fans (see **Figure 2**).

**Figure 2:**  
AAON's Patented  
Evaporative-Cooled  
Condenser



*With large RTUs, the total cost of ownership — including energy usage, water consumption, maintenance and the impact of sound on occupant comfort — cannot be overestimated.*

### First cost not the only consideration

While the first cost is certainly a top factor when evaluating an HVAC equipment purchase, the total cost of ownership including energy usage, potential for utility rebates, water consumption, maintenance and the impact of sound on occupant comfort cannot be overestimated. When these considerations are baked into the equation, a packaged rooftop unit offers significant advantages over a chiller water or WSHP system (see **Figure 3**).

**Figure 3:**  
Side-by-Side  
Life-Cycle Cost  
Comparison

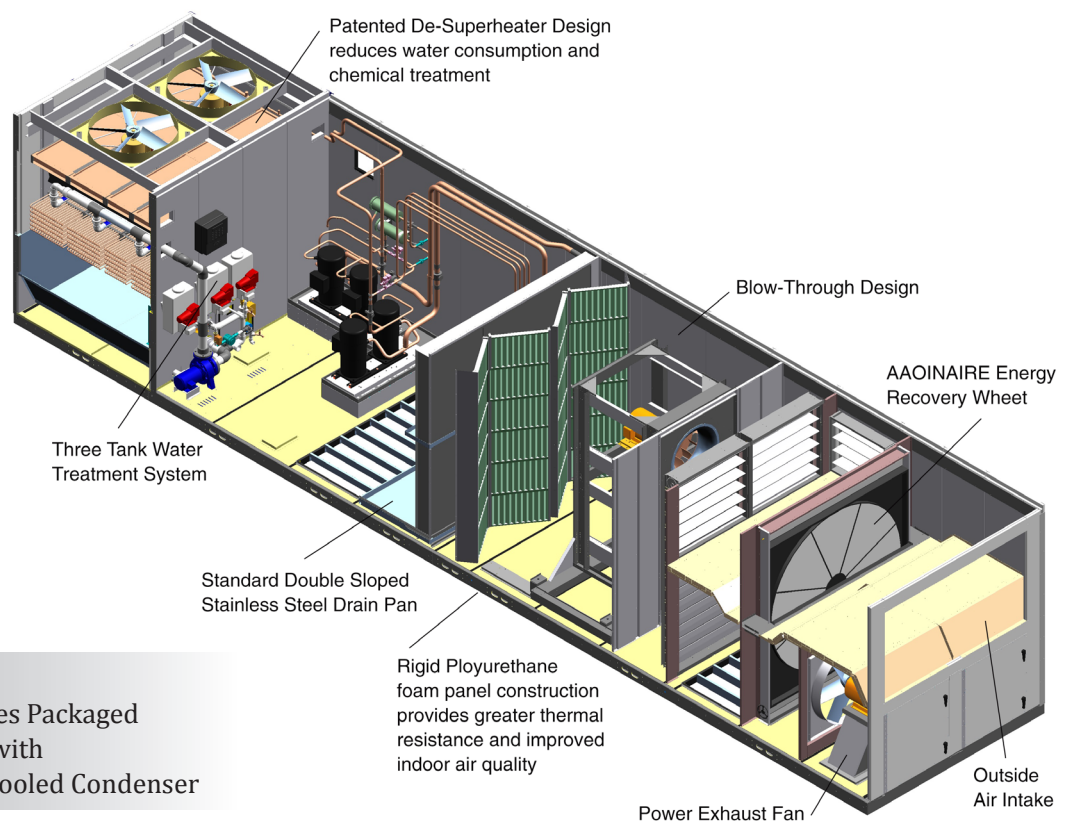
Cost of Ownership	Chilled Water/Cooling Tower	Water-Source Heat Pump	Evaporative-Cooled Condenser RTU
First cost	Higher	Lower	Moderate
Installed/Fitout Cost	Higher	Lowest	Moderate
Operating Cost	Moderate	Highest	Moderate
Maintenance Cost	Higher	Higher	Lowest
Sound Attenuation	Lowest (attenuable)	Highest	Lowest (attenuable)

Note: This information provided for general illustration purposes only. Costs will vary depending on the program specification, load factors, utility costs, climate and other factors.

As Figure 3 shows, the economic benefits of an evaporative-cooled condenser system are not necessarily realized at initial cost but over a much longer life cycle. For that reason, owners, property managers and HVAC specialists should carefully evaluate their HVAC equipment and service suppliers, not only for the equipment purchase itself but also the nature of the third-party engagement — and relationship. Specifically, the HVAC supplier must demonstrate that it has the internal processes, people and systems in place to mitigate operational risk for the building owner over the complete equipment life cycle.

### Selection factors for high-efficiency RTUs

In addition to the total cost of ownership considerations enumerated above, there are a number of design/build factors that inform the selection of a large RTU (see **Figure 4**).



**Figure 4:**  
AAON RL Series Packaged Rooftop Unit with Evaporative-Cooled Condenser

- **Cabinet construction:** Sound-attenuating, double-wall, foam-insulated cabinets add to unit durability, while exterior walls are rated to the 2500-hour salt-spray tests under ASTM B 117-5.
- **Compressor options:** Variable-frequency drive (VFD) scroll, AAON Digital Scroll™ or Turbocor compressors can be selected to adjust capacity to match the required load of sensible or latent cooling.
- **Quiet, efficient fan arrays:** The AAON RL Series uses spring-isolated, direct-drive, backward-curved plenum fans that recover the 7% tension-loss factor of belt-driven fans. AAON's condenser fans are, on average, 40% quieter than comparable air-cooled condensers at full load. Each fan is equipped with a VFD that turns down the motor speed during periods of reduced load, decreasing radiated sound.
- **Heating options:** AAON's RL Series can be configured for gas, hot water, electric or steam heating.
- **Ease of maintenance:** An easily accessed, well-lighted walk-in vestibule containing the compressors, electrical components and water treatment tanks greatly facilitates service and maintenance. Each refrigeration circuit features an independent slide-out condenser coil that is easier to service than a single, large coil that needs to be completely replaced.
- **Next generation Tridium controllers:** Trumbull Campbell Associates is pleased to offer the AAON RL Series of RTUs equipped the industry-leading JACE® series of programmable controllers. JACE offers remote sensing and control of the HVAC system through a pure Web interface with HTML 5 views; charting and data visualization; better reporting; and robust security.

### For more information

To explore the benefits of specifying an evaporative-cooled condenser rooftop unit for your next project, or to request a detailed energy or sound comparison analysis, please contact your Trumbull Campbell Sales Engineer.

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