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Next Generation Direct Air Cooling: Maximizing Thermal Management in Tower Sites



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Maximizing Thermal Management in Tower Sites

Reducing the use of electricity at tower sites is high priority for wireless carriers these days. One way of doing this is by reducing HVAC use, which generally accounts for a good deal of the electricity use of a cell site. Reducing electricity use also helps carriers meet commitments they have made to be carbon neutral.

To lower those costs and meet sustainability goals, wireless carriers are turning to RF Industries' (RFI) Next Generation Direct Air Cooling (DAC), a fan-based direct air cooling system that provides low-maintenance, energy-efficient, and



Left – exhaust cover, slim design; Right – exhaust damper

environmentally friendly cooling options for equipment cabinets and shelter enclosures. It works by bringing fresh, outside air to the equipment in an energy-efficient, controlled and clean manner.

Telecom equipment is designed to operate at high temperatures. Carriers that have adopted the RFI DAC technology are generally comfortable operating sites at 104°F, according to David Therrien, President at Schroff Technologies International, Inc. Schroff, which is owned by RFI, invented Direct Air Cooling.

"If we think about it, by leveraging low temperature differential (delta T) as long as the outside temperature is below 104°F, the RFI Shelter DAC would operate as the primary means of cooling the majority of the year in many geographies," Therrien said.

RFI DAC systems are proven to reduce cooling electricity by over 75 percent compared to traditional HVAC systems, according to Pedro Yarahuan, RFI Corporate Accounts Manager.

"The equipment required for an RFI DAC system is significantly smaller, more cost effective, and significantly lighter than existing HVAC systems," Yarahuan said. "The shelter DAC solution is the perfect option to coexist with traditional solutions, reducing HVAC maintenance, fuel expenses and site visits."

RFI DAC systems qualify for energy rebates and green initiative programs. The DAC solution is eligible for utility cash incentives (utility rebates) which reduce the need for CAPEX investment when considering this migration.

"Additionally, when rebates are paired with a lease agreement, DAC solutions can be implemented at little to no initial costs, taking advantage of the OPEX already intended to pay for the electric bill," Yarahuan said. "RFI DAC technology incorporates advanced remote monitoring capabilities to ensure optimal thermal management at the site, allowing for data analytic reports at the carrier's backend at the network operating center," Yarahuan said.



Lowering HVAC Maintenance

Wireless carriers have to oversize the HVAC system, because of variations in temperatures based on location, climate, the time of day, the time of year, and the amount of data traffic, according to Therrien.

"The site's HVAC might have three times the capacity required 85 percent of the time, because, most of the time, it's not the hottest day of the year, or the hottest time of the day, or it might not be your maximum load site," Therrien said. "An oversized HVAC cools the site very quickly and cycles on and off sometimes as many as 10 to 15 times an hour. Those starts and stops not only use a lot of electricity, they are what damages compressors and fan systems."

As the HVAC systems age, they break down as they cycle. "HVAC maintenance, especially near the end of life, can be expensive, with repair parts that may not be available immediately," Yarahuan said.

Reducing Excessive Cycling

The RFI DAC system is prioritized as the primary cooling solution, so the HVAC is relegated to operating only during the time when the ambient temperature is above the desired temperature inside the enclosure as set by the customer.

"In an average market in the middle of the country, we can stop the HVAC from running as much as 90 percent of the time. Only on the hottest days when the RFI DAC can't provide the cooling, our controller then releases the HVAC to perform," Therrien said. "Everything we do is focused not just on the energy saving aspects, but also making massive reductions in cycling, so that you extend the life of the HVAC equipment, and really make maintenance an afterthought as opposed to a regular event."

Keeping the Shelter Cool During Power Outages

The RFI DAC is DC-powered, which eliminates interruptions during power outages, reducing the need for generator use. It also consumes 1/10th the energy of a typical HVAC system. This benefit translates to less fuel consumption and less generator capacity as it would only turn on to recharge the batteries or to operate HVACs on a lead-lag basis (one at a time). As a result, the technology reduces the site visits to refuel generators and fuel costs during extended outages.

"Once a generator reaches its end of life and it's time to replace it, sites that already incorporate an RFI Shelter DAC will require a smaller generator. This translates to less CAPEX cost to replace it and increased fuel efficiency," Yarahuan explained.

Multiple Deployment Options

Wireless carriers typically have redundant HVAC systems on one wall of their shelters. One option they have is to leave both HVACs in place and install the RFI DAC on the shelter door. Or they can maintain a single HVAC unit and add the RFI DAC next to it on the wall. Additionally, RFI DAC units can replace the HVACs altogether.

"If they require redundancy, and they have two good HVAC units, then they probably will choose the door-mounted RFI DAC and leave all three systems available to them. That's really a customer choice," Therrien said.



Left – the full site after the main HVAC was pulled out but one still remains in the back.
Right – black filter easily installs into the enclosure.

Smart Control of the Telecom Shelter

A patented Smart Controller is used to regulate the temperature, which can control up to three RFI DAC systems and two HVAC units. Using either Ethernet or wireless connectivity, the controller provides site alarms for high and low temperatures, and in the case of a failure of the RFI DAC, HVAC or the controller.

“The intelligence built into the controller provides the carrier with an integral way to maximize the thermal management of the site,” Yarahuan said. “What makes this technology special is the intelligence of using all the elements at the site to maximize the thermal management capabilities.”

Conclusion

As the industry moved from passively to actively cooling its tower sites, it turned to HVAC systems. But an air conditioner is not scalable enough to meet the variable cooling needs of a telecom site in an efficient manner.

“Today, the tower site equipment purchases of wireless carriers are driven by the need to increase energy efficiency. This serves the dual outcomes of reducing costs and increasing sustainability,” Yarahuan said.

One major carrier recognized this in 2017 when it went from air conditioning-only solutions to air conditioning plus an RFI DAC as its standard for deploying new telecom shelters.

“I think that speaks a lot towards the effectiveness of this type of technology,” Therrien said. “There’s no doubt that it saves electricity, how much depends on the workload of the site. A well designed RFI DAC system is going to consume 1/10 of the energy roughly of a similar HVAC plan, and it’s going to be far more reliable.”

Additional Source Materials

- Direct Air Cooling Video & Landing Page:
<https://rfindustries.com/thermal-cooling-solutions/>



ABOUT RF INDUSTRIES

RF Industries designs and manufactures a broad range of interconnect products across diversified, growing markets including wireless/wireline telecom, data communications and industrial. Our products include RF connectors, coaxial cables, data cables, wire harnesses, fiber optic cables, custom cabling, energy-efficient cooling systems and integrated small cell enclosures.

Our high-touch customer approach allows us to be responsive, accessible and hands-on when needed, every step of the way. Unlike large organizations, you will always be our number one priority. Our end-to-end support promises personal attention, guidance, and partnership all the way through site deployment.

RFI's unique flexibility also gives us a competitive advantage. As an agile business, we are able to identify and react to challenges quickly and easily, resulting in a smoother overall customer experience.